Prepared for:

Assistant Secretary for Preparedness and Response

Joint Review of National Disaster Medical System (NDMS), Consolidated Report of Recommendations

STAKEHOLDER REVIEW DRAFT

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1. Introduction

1.1 Background

"All disasters are local," is a common saying among those engaged in preparing and responding to emergencies. However, this does not mean that a locality, once overwhelmed, is on its own. Rather, there are many agreements, processes and procedures in place and emerging that attempt to ensure that an appropriate amount of resources, at appropriate levels, can be brought to bear in order to lessen the impact and consequences of a given disaster. Once a local jurisdiction is unable to respond effectively, it can look to the state to assist; once a state begins to be overwhelmed, it can look to other states; if necessary, federal resources can also be accessed. This holds true across response disciplines and functional areas.

A key concern in preparing and responding to an emergency is making sure that steps are taken to minimize the number of casualties and minimize the adverse health consequences to those who are affected. This requires a healthcare system and healthcare response that are resilient, flexible, interoperable and able to surge appropriately to meet the needs of those affected. The landscape is complex in the number and scope of functions as well as in the number and types of organizations involved, and any of the pieces, if not well-coordinated and integrated, could do something that might result in a negative impact despite the best intentions of all concerned.

MITRE was asked to support the Joint Review of the National Disaster Medical System (NDMS) under Title III – All-Hazards Medical Surge Capability of the Pandemic and All-Hazards Preparedness Act. Section 2803 requires, as part of the joint review, that the Secretary of the Department of Health and Human Services (HHS) evaluate the benefits and feasibility of improving the capacity of HHS to provide additional medical surge capacity to local communities in the event of a public health emergency. This mandate implicitly poses the question: Is the Nation well prepared to surge its medical capabilities to meet healthcare and public health needs in the event of a catastrophic incident or other major public health emergency?

From MITRE's interviews with people involved in medical response from both the private and public sectors, it was clear that the community strongly desires to "do the right thing." The aftermath of the hurricanes of 2005 and the emergence of avian flu as a threat have spawned a great deal of planning and preparedness activity. However, these plans may not fit together and may be relying on common resources that are inadequate to serve all plans. Many jurisdictions, as well as private sector organizations, are building capacity from response teams to pharmaceutical caches to mobile medical units. But how will these resources come together if needed during a crisis?

Although most medical response professionals feel the Nation is better prepared than in 2001 or 2005, there remains a sense that the Nation is not well prepared. The consensus among the professional community is that while there are challenges around the number of resources, another important challenge is the ability to mobilize and coordinate those resources.

1.2 Vision for Medical Surge

In the future, a seamless transition of control and resources will occur across tiers of response. Local communities, with regional and federal support, will have the capability and capacity to

respond to any and all surge in demand for emergent or disaster healthcare. Local jurisdictions will act first, with support from the private sector as appropriate. Local hospitals will have agreements in place to share the patient load, as will other types of facilities (nursing homes, clinics, etc.). These plans will be coordinated with the local government's plans for deploying local public resources. The plans will be exercised regularly. When an event becomes too large for the locality, then agreements with entities farther afield will be leveraged. Private sector facilities will engage partner facilities and/or other facilities within their networks. Suppliers will be flexible enough to shift inventory as appropriate. Local governments will leverage assistance compacts and other agreements signed with neighboring jurisdictions. Similarly, states will engage when needed, adding resources, including the National Guard, and within a region, support will be given according to a regional plan that includes agreements on resource sharing and appropriate compensation. When requested, the Federal Government will bring still more resources to bear.

This process can not be purely sequential. In fact, David Paulison, FEMA Administrator recently stated, "What we've done in this country in the past is to set up a system of what I call 'sequential failure'. We would wait for communities to become overwhelmed before the state would step in, and then the state would become overwhelmed before the federal government would step in. This process does not work; we saw that with Katrina." The process, therefore, must be based on partnerships and facilitated by planners with the ability to analyze the situation and preposition resources in anticipation of projected needs.

Before the event, the status of all candidate support resources and their current readiness will be known. This will apply to response teams, supplies, transportation resources, and medical care capacity. At each tier of response, decision-makers will have situational awareness of resources with access appropriate to their role and prior agreement for the sharing of information. This knowledge will be used, as the effects of the incident spread, to best apply the resources available at the state level, then regionally and, finally, nationally, or even internationally, to best mitigate the adverse consequences on the community immediately affected as well as the communities that are asked to assist. With this type of knowledge, resources will be used in the most efficient manner: qualified personnel will be efficiently deployed, employed and rotated; transportation assets will be used most efficiently; patients will be treated with the most medically-appropriate and cost-effective care; and, the supply chain will be able to support just-in-time delivery.

Finally, decision-makers will have access to predictive tools (e.g. models and simulations) that allow them to make the best decisions about what preparedness strategies to pursue and what additional resources to acquire. These tools will provide useful information (e.g., casualty estimates, resource gaps, etc.), based on historical data, situational awareness, intelligence, and other evidence (such as a clear understanding of current resources).

1.3 What Would This Require?

In order to realize this vision, there must first be consensus on what needs to be done. This requires an ordered way of defining the problem space, and it leads to a high-level recommendation: The Office of the Assistant Secretary for Preparedness and Response (ASPR) must play a key role in providing the "glue" to help leaders from the broader community to understand and fully appreciate medical surge requirements and to participate in shaping a

National Medical Surge Strategy. ASPR must also find ways to address concerns around proprietary information and other issues that have prevented private sector stakeholders from fully engaging in planning activities. It is essential for a wide range of stakeholders from all levels of government and the private sector to participate in planning activities and in exercises to simulate the consequences of major catastrophic incidents. This will allow the community to measure the adequacy of existing plans and resources. Such activities are an essential awareness-building step, but participation in these kinds of exercises has largely been the province of a small subset of the public health and community healthcare professions (along with military planners).

When the broader community understands the implications brought to light by these activities, various stakeholders will naturally step forward with their concerns and potential contributions to meeting medical surge requirements. At this point the problem-solving process can shift from defining the problem to identifying elements of the solution.

One method of defining the problem space is to take a systems engineering approach, beginning with the definition and decomposition of the functions that must be performed and the capabilities and resources necessary to execute those functions. The Department of Defense (DoD) has been using this method for many years to define what needs to be done, assign responsibility and measure readiness. In its report on Disaster Medical Assistance Teams (DMAT) in 2002, the Center for Naval Analyses (CNA) suggested a similar framework (at a lower level) as a starting point for managing DMATs more effectively. There have already been attempts at a similar structure for response. The Department of Homeland Security (DHS) developed a Universal Task List that became the basis for the Target Capabilities List. However, these lists are a mixture of functions, tasks and checklist items, rather than a true list of capabilities. HHS undertook a similar process through the work of its Mission Fulfillment Working Group, but that effort focused solely on HHS resources. United States Northern Command (NORTHCOM) is also in the process of developing a similar construct as it defines the DoD medical response support mission in greater detail.

At the highest functional level, ASPR and its partners could create a breakdown of the Emergency Support Function (ESF) #8 missions and capabilities. Once the capabilities are defined, and common definitions agreed upon, responsibility can be assigned for each to the level of detail that makes sense. Then, using tools and planning assumptions, resource requirements can be agreed upon. The next step would be to conduct an inventory of available resources, across government and the private sector and match resources to the missions, capabilities and requirements.

The federal system complicates, but does not invalidate, the use of such an approach. The Federal Government does not have legal authority, or even the technical ability, to dictate to states, localities, and private sector entities their most appropriate roles and responsibilities in disaster management. Instead, the Federal Government must create a partnership framework in which the partners voluntarily take responsibility and then, where necessary, the federal government supplies the missing resources or creates incentives for others to address essential needs. With proper leadership, such a model gives the Nation the advantage of having resources and leadership at all levels of government and in the private sector aligned appropriately.

Funding constraints are unlikely to vanish – healthcare already makes up a large portion of the economy and continues to grow as the population ages and medical technology advances.

Therefore, in planning for all but a few truly national scenarios (e.g. pandemic avian influenza), a National Medical Surge Strategy must focus first on temporarily reallocating and mobilizing resources efficiently, rather than creating new resources. When new resource needs are identified, these needs should be analyzed to determine the most cost-effective solution (e.g., is the need something that can be filled by volunteers vice new employees). Each participant in medical surge planning and operations has at least some freedom to reallocate their own resources and to reshape relationships in ways that will maximize flexibility and responsiveness in responding to public health emergencies.

Lack of sufficient qualified and/or licensed personnel was one of the key concerns of many stakeholders that MITRE engaged. From the private sector perspective, the biggest gap noted was that of trained staff. The Nation is already experiencing shortages of doctors, nurses, and other staff. If there are shortages during "normal operation," then the system will be further stressed under surge conditions. The second area of concern centered on facilities and infrastructure. Currently, there are not many incentives to build excess capacity into the system. Emphasis is placed on using capacity efficiently, rather than on having a reserve in place. What one might consider a "surge bed" is considered by another to be "wasted space." Third is a concern about the supplies needed to support the process. Most private sector healthcare providers do not maintain large inventories of supplies. Instead they rely on suppliers who must understand demand well enough to get equipment and consumables to where they need to be just in time. There is little incentive to maintain large stocks in reserve. Governmental organizations stockpile materiel to help bridge the gap, but this must be done carefully to make the best use of monetary resources.

Private and public organizations realize that it is in their economic and political best interests to be able to continue operations during a crisis. Entities in the private sector and across levels of government are investing in initiatives that mitigate risk: acquiring assets, training personnel, etc. However, from a national perspective, these efforts are not well coordinated. Issues include rules and regulations that make it difficult to share resources, plans developed in isolation, and personnel training issues based on the acquisition of many different types of equipment.

Individuals from the private sector expressed frustration that government moved slowly and that they were not allowed to be part of the process (or worse yet, that they were invited and subsequently ignored). State and local entities feel a similar frustration in that federal initiatives are not always planned collaboratively. This is ironic in that it is apparent that the Federal Government cannot solve the problems or provide enough resources on its own. Rather the federal role must be to act as a facilitator and supplement capabilities where it makes sense to do so from the national perspective; augmenting its own capabilities by putting incentives in place where it makes sense for partners to assist.

A systems engineering approach with an associated inventory of available resources would be a valuable tool in coordinating the process nationally. Such a process would not be without some challenges. For example, it is sometimes not seen in the best interests of some players to come forward with their inventory of resources. This might put their capabilities at the risk of being "federalized." Worse yet, admitting to having a capability might make one less likely to get more money for something else. However, if there is truly to be an efficient national approach, it is important to understand the national capability. So forming strong, trusting relationships with all partners in all functional areas is crucial.

ASPR's strategy reflects this type of approach. The organization is undertaking efforts to push the planning and resourcing farther out into the field. ASPR should continue in this direction and continue to pursue its desire to have more of a regional presence. In addition, ASPR should act as a focal point for discussions, sponsoring research and conversations around important issues. Despite fears to the contrary, this should not be seen as an attempt by ASPR to "pass the buck," rather it should be an attempt to act in a facilitative and supportive role, encouraging the development of local capabilities and encouraging collaborative planning. NDMS now finds itself within this framework. By exercising appropriate leadership, ASPR can create a cooperative environment in which all participants have a commitment to the medical surge process, have confidence that other participants will meet their obligations, collaborate as needed with governmental and private sector partners, and communicate effectively before, during, and after catastrophic incidents.

To recap, at a high level MITRE recommends the following:

Recommendation 1.1: ASPR must play a key role in bringing together leaders from the broader community to shape a National Medical Surge Strategy.

Recommendation 1.2: ASPR must find ways to address concerns around proprietary information and other issues that have prevented private sector stakeholders from fully engaging in planning activities.

Recommendation 1.3: ASPR and its partners should take a systems engineering approach to addressing medical surge.

1.4 NDMS

NDMS was originally created in 1984 as a partnership between HHS, the Department of Defense (DoD), and the Federal Emergency Management Agency (FEMA). The Department of Veterans Affairs (VA) was added as a partner two years later. The partnership memorandum of agreement (MOA), revised periodically, provides a framework for medical and ancillary services when a disaster overwhelms local emergency response capabilities. The three-part mission of NDMS has remained: **medical response** to supplement state and local healthcare resources, **evacuation of patients** from the disaster area, and the **provision of definitive care** for DoD contingencies and national emergencies through a pre-identified network of hospitals.

NDMS initially focused on natural disasters and overseas conflicts. The terrorist attacks of September 11, 2001 and subsequent anthrax incidents raised concerns about the need for a federal response to a large-scale terrorist incident. The attacks prompted passage of the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (Public Law 107-188) which statutorily authorized NDMS under the new position of Assistant Secretary for Public Health Emergency Preparedness at HHS.

In March 2003, the NDMS medical response teams were transferred to the newly created Department of Homeland Security (DHS) by the Homeland Security Act of 2002 (Public Law 107-296). After the massive destruction caused by Hurricane Katrina and related flooding, the NDMS teams were transferred back to HHS by the Pandemic and All Hazards Preparedness Act (PAHPA) (Public Law 109-417), effective January 1, 2007 and were positioned, organizationally, within ASPR's Office of Preparedness and Emergency Operations (OPEO).

The NDMS partnership is currently governed by a senior level committee known as the Senior Policy Group (SPG). The members include ASPR, the DoD Assistant Secretary for Health Affairs, the DHS Chief Medical Officer (CMO) and the VA Undersecretary for Health. This group is supported by an Executive Secretariat that is charged with the day to day aspects of managing the partnership. Currently, only the response team (HHS) portion of NDMS receives direct program funding (approximately $34 million per year). DoD does not receive, through the annual budget process, explicit funding for managing the patient evacuation component or their portion of the definitive care component. VA does not receive explicit funding for NDMS support per se, but does have funded billets for Area Emergency Managers, that do have, as one of their primary responsibilities, managing the FCC function of VA hospitals.

1.5 Approach and Assumptions

During this four-month effort the MITRE team spoke with many stakeholders within and outside of the current system. MITRE also analyzed information obtained from HHS, DoD, VA, and other organizations. The 15 National Planning Scenarios, as well as input from stakeholders, were used to get an approximation of potential gaps in capability. From this analysis, MITRE arrived at several recommendations for ASPR and its partners to consider. MITRE was tasked to investigate a wide spectrum of issues starting with NDMS and related to medical surge capacity. The recommendations vary in level depending on the tasking MITRE received and where the analysis and information led. For example, in some cases MITRE was asked to look at specific issues relating to the organizational elements transferred from FEMA to HHS, in others MITRE was asked to look at larger issues. Some recommendations are relatively straightforward; others are more complicated and less concrete, suggesting a direction rather than a solution. Most recommendations are specific to the NDMS partnership, but some sections do discuss national capacity and medical surge issues and hence some recommendations address issues outside the federal partnership. MITRE assumed that there was a likelihood that during review the document might be distributed in sections based on subject matter expertise or that reviewers might only read a certain section. Thus, sections have, in many cases, been prepared to stand alone and there may be some overlap. While reviewing this document, the reader should recognize the following:

- This report makes reference throughout to use of the National Guard, or to a specific Service-component, e.g., Air National Guard, where it is understood they may be called upon to provide support. It is recognized that any National Guard forces, to include references to Army or Air National Guard, will likely be operating under state control. However, because of the dual federal/state role of the National Guard, MITRE included National Guard capabilities as part of the analysis of federal capacity.
- Within HHS and in the community at large, the term “NDMS” is used to describe both the federal partnership (encompassing medical response, patient evacuation and definitive care) and the organizational unit of dedicated personnel transferred from FEMA to HHS (that is chiefly responsible for managing the NDMS teams). MITRE was asked to specifically address issues relating to both and we attempted to make the context clear when necessary.
- The recommendations are at present provided “unfiltered” with no attempt to prioritize them based on importance to the overall system, potential for funding, policy changes or

partner coordination that may be required. This review was written with the implicit assumption that the next step in the process would be the development of national or NDMS plans to address gaps identified here and in subsequent analyses.

- All information is current, to the extent MITRE was able to determine, when this review was first submitted to ASPR at the end of August 2007.

1.6 Document Organization

The remainder of this document is organized sections that correspond to specific areas of MITRE's tasking, with sections 3-5 mapped to the three parts of the NDMS mission. Each section and/or subsection first discusses the current state, then discusses a potential end state, and finally makes some recommendations for consideration. The sections appear in the following order:

Section 2 –Organizational Structure and Performance offers recommendations that address the following themes: achieving greater clarity and understanding of the mission and role of NDMS across the organization and the federal partners; fostering greater integration and coordination with the larger ASPR organization as well as the federal partners; enhancing governance regarding organizational policies, procedures, and expectations; developing and communicating operational policies and procedures, roles and responsibilities of individuals within NDMS, and the federal partners. Addressing these topics will rectify issues identified by NDMS staff and federal partners and will contribute to enhancing performance. As the organization plans changes in the areas of Medical Response, Definitive Care, and Patient Evacuation, it will be important to ensure that factors that contribute to organizational structure and performance are addressed as part of the planning and execution efforts.

Section 3 - Medical Response identifies new challenges posed by the catastrophic incidents described in the National Planning Scenarios that will demand a faster, better coordinated, and more capable national medical response. Within an overall medical surge strategy coordinated regionally by ASPR with its federal, state, and local partners, NDMS medical response teams will continue to provide emergency medical care as part of the first wave of the federal response. Achieving the required level of capability and responsiveness will require enhanced logistics, better processes and systems for coordinating with partners, the possible acquisition of additional mobile medical assets, adoption of telemedicine capabilities, and research and development to improve disaster medicine practices and protocols.

Section 4 - Patient Evacuation discusses recommendations to plan, manage, and execute patient evacuation. This section includes recommendations that HHS assume responsibility for coordinating patient movement operations, with appropriate support from other federal partners and the public/private sector. The recommendations provide a structure that: enables day-to-day staff support, supports high-level decision-making and mission coordination in emergency situations by promoting national centralized coordination with decentralized operations and execution, and provides a core cadre to support patient movement operations and management in emergency situations with improved situational awareness.

Section 5 - Definitive Medical Care presents the recommendations for the definitive medical care component of NDMS. The two key recommendations are that NDMS (1) increase surge capacity by considering availability of beds in all hospitals and alternate care facilities; and (2) revise the definition of an NDMS patient to ensure that hospitals and alternative facilities are

compensated for treatment. Supporting recommendations address broader NDMS considerations:

- Reviewing FCC structure to ensure consistency with current concepts
- Reviewing policies to promote and increase participation
- Establishing an integrated and interoperable information system for tracking patients, patient health information, staff, beds and other assets
- Clarifying roles and responsibilities
- Creating performance measures for Federal Coordinating Centers (FCCs), and training to those standards.

Section 6 – Asset Assessment Methodologies examines technologies required to support NDMS under pre-deployment, deployment, and post-deployment conditions. Establishing and maintaining teams and their specialized equipment caches requires use of specialized acquisition methods to assure timely procurements meeting the decentralized specialized team needs. Inventory and warehouse management of team assets can be improved with access to state-of-the-art asset management tools. Timely and accurate budget projections and ongoing financial management require improved access to enterprise procurement and financial systems, preferably via data exchanges between NDMS management databases and the HHS systems. Adaptation of standard travel policies and related purchase card management are key to flexible and rapid deployment of teams and team caches during major disasters.

Section 7 –Training describes approaches for adopting a centrally-driven, systematic and phased approach to developing the NDMS training strategy and associated curriculum that will lead to: establishing and achieving minimum training standards/core competencies; utilizing adult learning theory and a blend of training approaches; leveraging other national and regional training opportunities; and continually monitoring and evaluating training effectiveness. The desired end-state is to have a broad training curriculum that is cost-effective to administer, and which is designed to equip NDMS teams and federal partners with the skills and knowledge to effectively respond to national disasters.

Section 8 –Telemedicine portrays a "to-be" picture of telemedicine efforts in. These recommendations include the field response and patient movement components of NDMS, but do not extend to the definitive care, per MITRE's tasking. As part of this assessment, MITRE conducted research and interviews with NDMS staff and a broad range of subject matter experts (SMEs) engaged in telemedicine activities in order to identify opportunities to expand telemedicine capabilities that would increase efficiency of field operations. This included potential efficiencies gained through integration with mobile medical capabilities.

Section 9 - Review of Policies and Directives provides an analysis of DHS policies and procedures that were applicable to NDMS and makes recommendations about the realignment of those policies now that NDMS has been transferred to HHS.

Appendix A - Modeling and Simulation (M&S) Capability for Medical Surge Response attempts to identify how modeling and simulation (M&S) can support the vision of a medical surge capability that is flexible and able to respond to all hazards, scalable to both small and large events, integrated across organizational boundaries (local, state, tribal and private sectors) and predictable. As we performed our analysis, this capability was deemed to be a gap that

should be addressed and this appendix is intended as informational. The scope of this section was limited to medical surge response; therefore, equally important aspects of disaster modeling such as disaster effect analysis or recovery are not included in the analysis.

Appendix B – NDMS Program Manager and Regional Emergency Coordinator Matrix of Program Functions is a table summarizing the roles of the Regional Emergency Coordinators and the NDMS Program Managers.

Appendix C – State Mobile Medical Assets is a table of the state mobile medical assets that MITRE identified during the course of this analysis.

References – provides a listing of documents reviewed and persons formally interviewed to support report preparation.

2. Organizational Structure & Performance

2.1 Introduction

This section provides recommendations for improving NDMS organizational structure and performance related to the following areas:

- Coordination and funding mechanisms for the NDMS federal partner agencies
- Current organizational structure of NDMS headquarters and field personnel
- Effectiveness of the current structure for interacting with and soliciting NDMS response team input on program issues
- Respective roles of HHS Regional Emergency Coordinators and NDMS Program Managers
- Adequacy of current program resources, given program requirements/objectives
- Overlapping and potentially duplicative functions resulting from the move of NDMS from DHS/FEMA to HHS
- Process improvements.

2.2 Approach

MITRE reviewed each of the task areas in terms of its current state, the desired end state, gaps that exist between the current and end states, recommendations to address the gaps and achieve the desired end state, and any constraints that may affect achievement. To gather data, MITRE conducted interviews with key stakeholders and reviewed a number of key documents and reports. To support analysis, MITRE used an organizational performance model to identify common areas of concern in all the task areas.

The majority of MITRE's tasking in this area focused on issues related to the move of the NDMS response teams from FEMA to HHS/ASPR; however some issues within the larger NDMS partnership were also identified. Given that the overall partnership and the response operations portion of ASPR are both referred to generically as "NDMS", some confusion is inevitable. However, the discussion and recommendations are structured to first discuss (in section 2.3) organizational issues that overall NDMS partnership. Section 2.4 then focuses on issues related to portion of NDMS (response operations) that is managed within HHS/ASPR.

2.3 NDMS Partner Resource and Organization Discussion

This section addresses the coordination and funding mechanisms for the NDMS federal partner agencies and discusses the adequacy of current program resources, given program requirements/objectives. .

Current State

The NDMS Executive Secretariat identified insufficient resources and funding mechanisms among the top five challenges that must be addressed by the NDMS Senior Policy Group over the next two years. As noted by the Executive Secretariat in a March 1, 2007 letter to the NDMS

Senior Policy Group (SPG), there is not a standardized patient movement or definitive care budget or funding mechanism provided for DoD or VA. Currently, only the response team (HHS) portion of NDMS receives direct funding (approximately $34 million per year).

At this time, NDMS and its federal partners lack the resources to mount an effective, coordinated federal response to the worst potential public health emergencies. Among the resources lacking are sufficient trained staff, standardized processes, new technology systems and an integrated system that can quickly take advantage of response resources, staff (providers), transportation resources, regulating and tracking systems and recipient beds.

The most critical need is funding and equipment for training and exercises for the NDMS partnership. The Departments of Defense and Veterans Affairs have significant roles in an emergency, including patient evacuation and operation of the Federal Coordinating Centers, yet neither department has received training funds in the last several years. Without ongoing training and participation in realistic exercises, NDMS and its partners cannot respond effectively to future emergencies.

Despite Memoranda of Understanding (MOU), there is still organizational confusion regarding roles and responsibilities of the federal partners. The SPG is a forum used more for discussion than decision-making, and the same topics continue to be discussed over a period of years. Clear guidance from the SPG is required regarding the scope of the NDMS partnership and how the partnership will integrate with an evolving ESF #8.

Desired End State

The SPG will meet more frequently to resolve issues and make decisions, and will have greater accountability for its activities. The federal partners will receive funding for the full range of resources required for a rapid and effective response to a broad range of potential public health disasters. This will include funding to maintain patient evacuation and definitive care components as well as any associated medical regulating and tracking components. The federal partners will agree upon a mechanism for annually requesting, managing, and allocating inter-departmental funding.

Recommendations to Achieve Desired End State

- **Recommendation 2.1**: **Establish a high-level working group** of all response partners to develop and agree on the mechanism **for requesting and allocating inter-departmental funding** for NDMS.
- **Recommendation 2.2**: Assess training needs and **develop curricula for a full range of training programs and exercises**, from self-paced study courses and classroom training to comprehensive exercises and participation in real-time events. A number of more specific recommendations to enhance training are included in section 7.
- **Recommendation 2.3**: **Conduct SPG meetings more frequently** to address the key issues identified by the NDMS Executive Secretariat, make decisions, and hold federal partners accountable for their responsibilities in the context of the NDMS partnership. Smaller groups would work together between meetings to identify issues and prepare recommendations to be decided during the meetings.

2.4 NDMS Response Operations Organization and Performance Discussion

The following subsections discuss the organizational structure and performance of the NDMS response operations organization and provide recommendations to reach the desired end state. Within HHS, the response operations component transferred from FEMA is known simply as "NDMS", but so is the larger partnership, and this is the basis for potential confusion. So, in this section, we attempt to use "OPEO/NDMS" to correspond to the response operations portion of NDMS that was moved from FEMA to the Office of Preparedness and Emergency Operations within HHS/ASPR.

2.4.1 Overarching Themes

MITRE identified four dominant areas in which changes could substantially improve NDMS response teams performance. Recommendations addressing the tasks in this report focus primarily on these overarching themes.

Integration: coordinating with the larger ASPR organization, federal partners, and other stakeholders to share knowledge, leverage lessons learned, and streamline approaches to support disaster response.

Governance: ensuring that NDMS's organizational policies and procedures establish expectations, boundaries, and accountability among OPEO/NDMS elements as well as federal partners.

Alignment with mission: identifying clear roles and responsibilities required to carry out the NDMS mission, and then building staff capabilities to perform those roles, with performance measures and accountability for each role.

Operational details: developing, detailing, and communicating policies and procedures to ensure that NDMS operations are up to date and, where appropriate, aligned with the operations of ASPR, HHS, and federal partners.

2.4.2 Framework for Organizational Change

In assessing the OPEO/NDMS organizational structure, MITRE used the Burke-Litwin Model of Organizational Performance and Change[1] as a framework. As shown in Figure 2-1, this model displays twelve interrelated variables that affect change within an organization. One or more of these variables applies to the recommendations proposed here for improving NDMS organizational structure and performance.

[1] *A Causal Model of Organizational Performance and Change*, W.Warner Burke & George H. Litwin, Journal of Management, 1992, vol. 18.

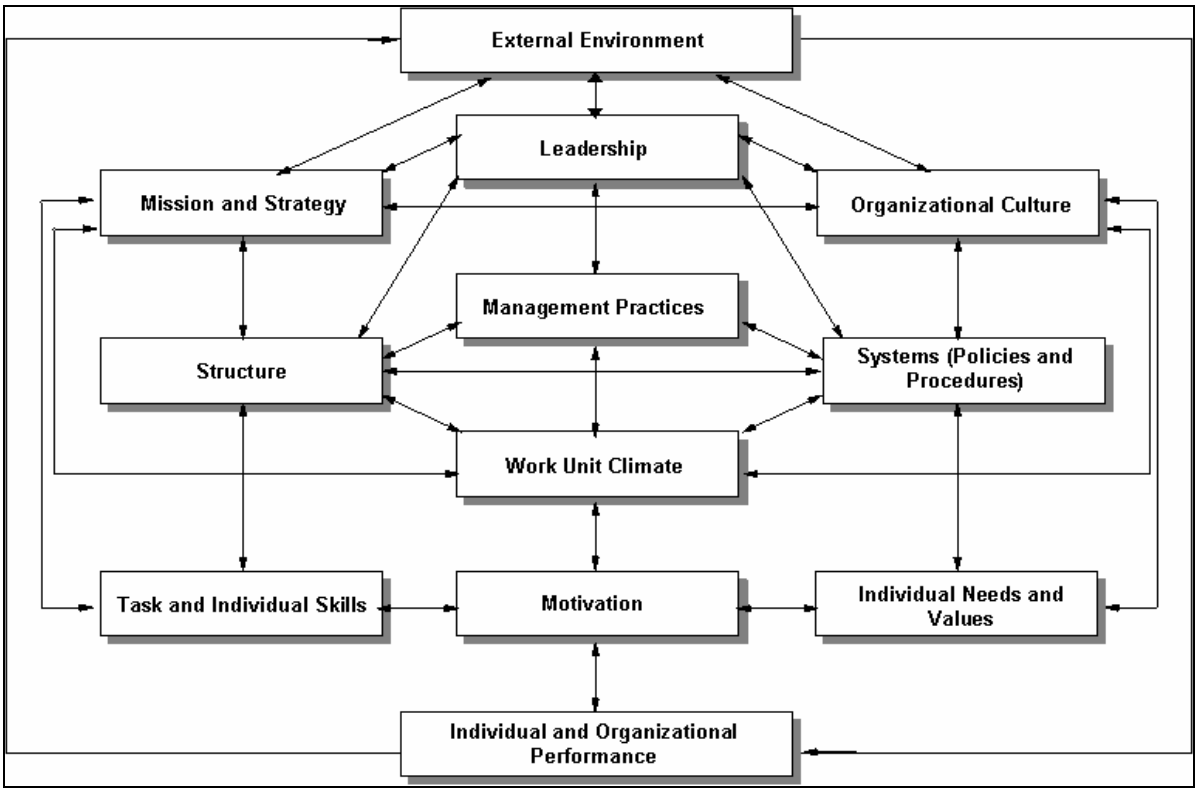

Figure 2-1. Burke-Litwin Model of Organizational Performance and Change

2.4.3 ASPR/NDMS Organization Findings, Recommendations, and Constraints

The findings, recommendations, and constraints discussed in this section are based on MITRE's ongoing review of NDMS and on multiple studies and reports commissioned by NDMS and conducted by government agencies and independent external organizations since 1994. Many of the observations and recommendations made in those reports are still relevant today and are referenced in this document.

During the past several months, MITRE worked with ASPR to develop a Current State Assessment and Organizational Development Work Plan (ODWP). This effort consisted of documenting ASPR's current state and developing recommendations for organizational improvement in the areas of people, processes, and program resource allocation. The findings and recommendations described in that work plan are also relevant for OPEO/NDMS. Therefore, it is appropriate for ASPR to include OPEO/NDMS when it adopts recommendations contained in the ODWP. This approach will lead to the development of an integrated and consistent approach across ASPR and will contribute to enhancing OPEO/NDMS's organizational performance and effectiveness. Specifically, the ASPR Current State Assessment identified the following issues which were also identified during the NDMS review:

- Strategic outcomes are unclear, and success is not clearly defined
- Current ASPR resource allocations may not support achievement of ASPR strategy
- Management does not spend adequate time on strategic work efforts
- Operational processes and measurements are not uniformly documented and reported

- The emergency response nature of ASPR's work translates into a highly reactive culture
- Trust issues continue to impede organizational efficiency.

As ASPR adopts recommendations and actions to address these issues, efforts should extend to ASPR's NDMS response operations component.

Constraints: Funding constraints are a serious issue for OPEO/NDMS and pose a serious threat to OPEO/NDMS's ability to organize effectively to accomplish its mission. Since large-scale disasters are not frequent, preparedness initiatives tend to be forgotten during periods of relative calm. Though public and political interest increases after unforeseen disasters, OPEO/NDMS's budget, like that of other emergency response organizations, has remained the same for several years. If funding is not increased substantially to provide additional resources and trained staff, NDMS may find it difficult to respond effectively to the new threat environment.

2.4.3.1 Organizational Structure

This section addresses the organizational structure of NDMS headquarters staff and field personnel and discusses the effectiveness of current structure for interacting with and soliciting NDMS response team input on program issues. It relates to the resources that would be directly responsible and organic to the specific OPEO/NDMS organizational activity within HHS and ASPR.

Current State

As the NDMS response operations component transitions from DHS back to HHS, its leaders are deciding on the optimal structure for its functions and staff. In determining the structure, leaders want to maintain the integrity and identity of the NDMS response component, to preclude any degradation in response capabilities, while simultaneously integrating key NDMS functions and structure with the larger ASPR organization. With the transition still underway, the lack of integration is evident even in the nomenclature used by the organizations. While OPEO/NDMS is part of ASPR, members of OPEO/NDMS and the larger ASPR organization often refer to each other as if they were separate organizations.

While the transition is a key driver, there are other external factors affecting the decision-making process:

- The new threat environment:
  - An increase in both natural and man-made disasters, as well as the danger of unknown threats
  - The potential for larger disasters that affect more people over a wider geographic area and occur with less warning
  - A need for earlier response, e.g., alerting and reporting to team collection points for movement within 12 hours post activation decision and notification; operational on scene within 24 to 36 hours instead of the current 72 hour concept.
- Increasing political and public scrutiny, with more congressional interest in disaster preparedness, new and changing legislation, and rising expectations by the public for fast and effective response to emergencies. At the same time, funding is lacking for the staff and other resources required to ensure effective disaster response.

- The need to coordinate multiple stakeholders on whom OPEO/NDMS is dependent (e.g., federal partners, hospitals, state and local first responder agencies, and other organizations responsible for performing critical functions). Each stakeholder group has a different constituency (e.g., the VA is focused on veterans) and culture (DoD's command and control approach), and they often have different meanings for key terms.

In addition to these external factors, there are leadership and strategy issues that affect NDMS performance.

- OPEO/NDMS staff does not have a clear understanding of how the ASPR vision and strategy affects NDMS. With the organizational structure in flux during the transition, staff also lack a clear understanding of their roles and responsibilities. These challenges are exacerbated by the fact that the larger ASPR organization is a new and quickly growing organization with many processes and procedures still emerging.
- Competing priorities within ASPR restrict senior leadership's involvement with NDMS issues. This – combined with NDMS response operations staff's physical location apart from ASPR – has led to the perception that OPEO/NDMS is less important and less involved in decision-making and implementation plans. The NDMS Director is perceived as open and responsive to staff as well as teams, but is not seen as having a large influence on ASPR decisions.
- Many of the staff within OPEO/NDMS HQ have long tenure with the organization and served on teams prior to coming to headquarters, which contributes to the strong esprit de corps and pride in being part of NDMS. There is an atmosphere of trust and camaraderie as a result of shared experience in the field. They have significant institutional knowledge, deep experience, and good relationships with regional and local teams.
- OPEO/NDMS has strong competence in medical response and operational support, but it is one asset in a larger spectrum of HHS response assets. The NDMS response operations staff needs to have the right interfaces with ASPR strategic planning and operations to strengthen NDMS integration with the overall ASPR response capability.

Desired End State

When the transition is complete, OPEO/NDMS should have an organizational structure aligned with the ASPR mission, focused on coordinating an improved federal response to disasters. The structure will promote collaboration with federal partners as well as internal elements, integrating lessons learned from field personnel and best practices from the emergency preparedness community. It will provide clarity about the roles, responsibilities, and requisite capabilities of organizational elements and individuals. The NDMS focus within the broader ESF #8 will be clear, and OPEO/NDMS will be appropriately integrated with the broader ASPR planning and operational functions to improve emergency medical response.

Recommendations to Achieve Desired End State

- **Recommendation 2.4: Expand efforts to increase funding and public support**: Continue to monitor the external environment for emerging threats; educate Congress and the public about the need to build the nation's capabilities to respond to these threats, and the risks to the nation's public and economic health if we are not adequately prepared;

support ASPR in helping shape federal legislation and funding for emergency preparedness.

- **Recommendation 2.5: Strengthen relationships with stakeholders**: Clarify roles, responsibilities, and accountability to maintain and build close relationships with federal partners, response teams, and other entities (including Regional Emergency Coordinators) involved in responding to public disasters. Check communication channels to be sure they are effective in disseminating messages and receiving feedback among the organizations. Ensure that there is shared understanding of NDMS procedures and terms of reference to facilitate and hasten coordination during an emergency.
- **Recommendation 2.6: Expand OPEO/NDMS role in decision-making**: Increase OPEO/NDMS leadership's participation with ASPR leadership in key meetings, ensuring that NDMS needs and interests are represented in planning and decision-making, e.g., playbook development, ESF #8 Standard Operating Procedures, etc. Ensure they are viewed as an integral component of ASPR leadership with equal participation, expectations, and responsibilities. Seek opportunities for OPEO/NDMS staff to develop recommendations and brief ASPR leadership. Compensate for the physical distance from ASPR HQ by ensuring that 1) OPEO/NDMS staff attend key meetings at ASPR HQ, 2) ASPR leadership attend key meetings at OPEO/NDMS and participate in NDMS governance and planning meetings, and 3) OPEO/NDMS and other ASPR staff members work together on integrated project teams.
- **Recommendation 2.7: Finalize the organizational structure of ASPR's NDMS component**: Ensure that it is consistent with the NDMS mission, aligned with the ASPR mission and strategy, has clear roles and responsibilities, and is flexible enough to adapt to evolving situations. The new structure should remain in place for an extended period, with only minor adjustments, to bring stability to the organization and reduce "change fatigue." The NDMS Director should focus on increasing his role on the ASPR leadership team, while delegating day-to-day decisions to his staff.
- **Recommendation 2.8: Communicate**: Cascade the new structure throughout OPEO/NDMS, ASPR, and federal partners to ensure clarity on reporting relationships, roles and responsibilities, expectations and boundaries, performance measures and accountability. Establish a communications process that focuses on the mission and provides frequent updates to OPEO/NDMS staff on priorities, issues, and the status of major initiatives, as well as information about ASPR issues and decisions.
- **Recommendation 2.9: Integrate**: Identify opportunities for OPEO/NDMS and ASPR staff to work on strategic and operational issues, developing stronger working relationships and cross-pollinating ideas. OPEO/NDMS personnel should be included in ASPR work groups and committees so that they not only have a seat at the table, but also provide valuable on-the-ground experience in ASPR planning and decision-making processes. Consider merging all of ASPR's response operations (to include operations of NDMS teams, U.S. Public Health Service teams, Incident Response Command Teams, etc.) under one entity. Integrate the diverse capabilities and experience of federal partners, the National Guard and other experts who bring knowledge of new medical procedures or research that can improve response capabilities.

- **Recommendation 2.10**: **Prepare a budget request** that **includes model for future staffing** for OPEO/NDMS, as well as funds for **training current staff** to improve skills; funding for **training and exercises**, including comprehensive exercises with multiple organizations; equipment and supplies for caches, training, and real-world events; and **technology systems** to share information and track resources. Senior leadership at NDMS should include a medical professional with expertise in disaster planning and response.
- **Recommendation 2.11**: **Recruit experienced, capable staff** with expertise in strategic planning, disaster response, training, recruitment, and evaluation. Rotate people in and out of OPEO/NDMS to and from other parts of ASPR to introduce new ideas and methods. Ensure that personnel decisions are driven by skills and experience rather than personalities. Maintain OPEO/NDMS's esprit de corps with ongoing presentations on the mission and vision for new and existing employees. Recognize staff accomplishments and communicate the organization's success in responding to emergencies.
- **Recommendation 2.12: Designate staff and resources to develop standardized processes, performance measures, and readiness assessments.**
- **Recommendation 2.13**: **Develop or identify existing state-of-the-art technology systems** to manage finance and budget, track credentialing and participation in training, conduct team readiness assessments, and provide online training.

2.4.3.2 Program Manager and Regional Emergency Coordinator Roles

Because both FEMA/NDMS and ASPR had regional personnel in addition to the NDMS program managers (PMs), there was some concern that there was duplication of roles between the NDMS program managers and the regional emergency coordinators (RECs). Hence, MITRE was asked to specifically include an analysis of the two job positions and compare their roles and responsibilities.

Current State:

The REC and PM roles have both been in existence since the NDMS response component was originally established as part of HHS. At that time, RECs were referred to as Emergency Coordinators (ECs). Program Managers have always been referred to as PMs. In 2002, when NDMS was transferred to DHS, there were 2-3 ECs for each of the 10 FEMA regions. At DHS, the role of the ECs focused on planning activities and providing support to the NDMS teams.

When the NDMS teams were transferred back to HHS in 2007, there were 10 RECs at HHS focused on public health planning with the states. Additionally, 23 ECs at NDMS were working at the state and local level while also addressing NDMS team maintenance issues. The two groups, HHS RECs and NDMS ECs, were combined under a Program Manager within the ASPR Regional Emergency Coordination Program (RECP). This resulting organization has 4-5 RECs in each FEMA region devoted to emergency preparedness and response.

The Program Managers have remained with OPEO/NDMS. During the past few years, the role of the PM has become less structured, and there are fewer responsibilities (e.g., PMs do not go to the field during disasters, they no longer assess team readiness or secure equipment for the cache). While not formally documented, it is generally agreed that the role of the PM is to serve as a liaison or facilitator between NDMS teams and headquarters. Their responsibilities include

everything from assisting in the selection, purchasing approvals, maintenance and use of cache to reviewing training and purchasing requests for the teams and making recommendations to Finance on whether to purchase items. All the PMs have other responsibilities in addition to their primary role as Program Manager. The management structure of the PM organization is not as clear as the REC's and position descriptions do not currently exist.

MITRE reviewed the REC and PM roles and concluded that there appears to be little or no overlap between them. The RECP comprises both a headquarters office (within ASPR) and 10 regional offices throughout the U.S. for a total of 37 people. The RECs support the development, maintenance, and execution of a regional HHS and ESF #8 public health emergency preparedness and response activities which includes state, local, and federal partners. The 10 PMs are based at NDMS HQ and serve as liaisons or facilitators between NDMS teams and headquarters, in addition to performing other responsibilities at headquarters. The roles and responsibilities of the respective organizations are not well understood by the other; therefore, there is limited coordination between the two functions.

Desired End State

The PMs and RECs will have a clear understanding of their roles and responsibilities as well as the connection points between their roles. The PMs and RECs will work in a coordinated and integrated manner to ensure that consistent, timely, and accurate information is conveyed to all responders and opportunities for coordination are identified and fully leveraged.

Recommendations to Achieve Desired End State

- **Recommendation 2.14**: **Further study should be undertaken to identify methods, benefits, and costs with strengthening the role of the regions** to increase standardization and the level of service to the teams while creating greater efficiencies. For example,
  - **Recommendation 2.14.1**: Regionally **locate OPEO/NDMS HQ staff for specific functions** (e.g., Human Resources, Operations, Program Management). These functions will be cross-matrixed with HQ to reduce the administrative burden on the teams and ensure consistent application of standards and the dissemination of best practices. Ensure there is a HQ contact for resolution of issues requiring face-to-face interaction.
  - **Recommendation 2.14.2**: Build regional equipment caches. Providing the minimum essential core equipment and materiel resources with the team and pre-positioning additional stocks regionally could facilitate deployment. In a national disaster, transportation availability is likely to be a constraint given the myriad competing requirements that will exist. While providing regional caches will require the purchase of additional resources, it may enhance the ability to get the teams on-scene quicker and thus justify any added costs.
- **Recommendation 2.15**: **Develop and clearly communicate the roles and responsibilities of the PMs** (or individuals performing these functions, if not maintained in pending reorganization), and **align with the ASPR and NDMS mission and approach** to working with the teams.

  - The RECP is undertaking a strategic planning initiative which includes the development of regional processes and procedures that are documented, communicated and monitored. Information developed during the strategic planning process will be shared with the PMs.

- **Recommendation 2.16**: **Create working relationships between the RECs and PMs** to share information and best practices, and enhance the coordination between HQ, the regional offices, and the teams.
- **Recommendation 2.17: Increase communications** among OPEO/NDMS HQ, regional representatives, response teams, and state and local agencies to increase understanding of NDMS responsibilities and capabilities.

2.4.3.3 Overlapping Functions

In addition to the overlaps that were feared to exist between the PM and REC role, MITRE was asked to address other overlapping and potentially duplicative functions resulting from the move of the NDMS response component from DHS/FEMA to HHS.

Current State

While the review shows no significant overlapping or duplicative functions as a result of the transition, the move from DHS/FEMA to HHS has created an environment of uncertainty, including unfamiliarity with reporting relationships, organizational structure, and policies. As is typical of organizational mergers and reorganization, significant time is required to adapt to the new structure and policies, distracting staff from developing and executing strategies focused on the organization's primary mission to respond during emergencies. There have been several different organizational structures/charts discussed for OPEO/NDMS. That the organization continues to be in a state of flux creates uncertainty and stress for employees.

In the current organizational structure, many NDMS staff members have multiple roles that report to different functions and people within the organization. Although ASPR considers the transition complete, OPEO/NDMS is still working through strategic, operational, and tactical issues.

There is limited coordination between OPEO/NDMS and ASPR across selected functional areas (financial management, human resources.) As a result, NDMS is not fully benefiting from ASPR's efficiencies, and ASPR is not taking full advantage of NDMS's expertise. These factors adversely impact the organization's effectiveness.

Desired End State: NDMS will have a stable, well-established organizational structure, with clear roles and responsibilities, as well as expectations and boundaries for the various stakeholders.

Recommendations to Achieve Desired End State

- **Recommendation 2.18**: **Revisit, clarify, and communicate OPEO/NDMS's mission and strategy** to reflect the current environment and risk of threats, and to align with ASPR's mission.
- **Recommendation 2.19**: **Finalize OPEO/NDMS's organizational structure**, ensuring that it identifies and leverages opportunities for coordination across the organization, to

reduce duplication of effort and to make sure that key areas of responsibilities are not overlooked.

- **Recommendation 2.20**: **Develop and communicate roles and responsibilities** to all staff.
- **Recommendation 2.21**: **Increase coordination between OPEO/NDMS and ASPR functions**; **promote working relationships** among the individuals performing those functions.

2.4.3.4 Process Improvements

MITRE was also asked to make recommendations to the current processes that OPEO/NDMS has in place.

Current State

Management responsibilities are not consistently aligned with OPEO/NDMS's scope of responsibility: processes are unclear, documentation is poor, travel and reimbursement processes are unclear and appear to be slow, and command and control issues are inconsistently interpreted by federal partners. The response operations portion of NDMS has been an informal organization, but as its responsibilities have grown, there is a need for more formal and standardized policies and processes.

Currently, there are few standards for ensuring capabilities are adequately resourced to meet requirements, assessing readiness, and determining accountability. For example, medical response teams have great flexibility in how they manage themselves and conduct training. While this has its benefits, it also limits standardization that could increase effectiveness and cost efficiency.

Desired End State

There will be clarity regarding OPEO/NDMS's scope internally and among the federal partners, with clearly defined NDMS processes and procedures that are understood by stakeholders. Where coordination across stakeholders is required, there will be agreement about processes and procedures, ensuring smooth hand-offs from one organization to another. Standards for readiness will be established and understood, with regular assessments to determine readiness and identify need for training and revisiting processes. All response teams will be consistently managed.

Recommendations to Achieve Desired End State

- **Recommendation 2.22**: **Adopt and document HHS processes** that address areas of concern (budget process, employee reimbursement, HR procedures, performance evaluation, etc.).
- **Recommendation 2.23**: **Adopt a standardized method to formalize policies and procedures** within OPEO/NDMS for finance, information systems, human resources, and resource management (e.g., warehouse contracts, cache replenishment, and equipment maintenance).

- **Recommendation 2.24**: **Review management responsibilities and align decision-making and financial approvals** with the appropriate level of OPEO/NDMS management.
- **Recommendation 2.25**: **Streamline processes** to increase internal efficiencies, e.g., joint purchases, combined training for teams with similar needs.
- **Recommendation 2.26**: **Review human resources within OPEO/NDMS to confirm the appropriate set of skills and number of resources** to attain NDMS staffing and talent needs. Conduct training (formal and on-the-job) to ensure that staff have the requisite skills to perform their jobs and can continue to grow professionally and personally.
- **Recommendation 2.27**: **Establish clear expectations for the teams and provide guidance on how general guidelines can be adapted for their specific needs**. Balance the need for standardization across the system with the teams' need for flexibility and autonomy. Conduct regular assessments to ensure that guidelines are followed. Institute awards and penalties to motivate the desired behaviors.
- **Recommendation 2.28: Consolidate/streamline processes to increase internal efficiencies** for such tasks as reimbursement, human resources, etc. Foster greater collaboration between OPEO functions to leverage the breadth and experience across the organization to generate new ideas and policies.
- **Recommendation 2.29: Conduct regular assessments to ensure readiness and adherence to documented processes**. Hold individuals and organizations accountable for their performance.

3. Medical Response

3.1 NDMS Mission

The mission of the National Disaster Medical System (NDMS) is defined in the 2007 NDMS Concept of Operations as follows:

> "In accordance with Public Law 109-417, the statutory mission of the National Disaster Medical System (NDMS) is to organize a coordinated effort by the NDMS federal partners, working in collaboration with the states and other appropriate public or private entities to provide health services, health-related social services, other appropriate human services, and appropriate auxiliary services to respond to the needs of victims of a public health emergency, and to be present at locations, for limited periods of time, when such locations are at risk of a public health emergency. NDMS also provides resources and assets to support national emergency response activities under Emergency Support Function #8, *Public Health and Medical Services* (ESF #8), of the National Response Plan (NRP). Further, the federal partners agree that NDMS also continues the availability of the NDMS hospital network as backup to military and veterans' hospitals in a military health emergency.
>
> "The NDMS serves the federal response by providing disaster medical care to the nation. NDMS will temporarily supplement federal, tribal, state, and local capabilities by funding, organizing, training, equipping, deploying, and sustaining a specialized and focused range of public health and medical capabilities."

The terms "National Disaster Medical System" and "NDMS" as used throughout this report refer to the complete set of functions stated or implied by the NDMS statutory mission – whether performed by the interagency partnership or any of the HHS organizations that support the NDMS mission.

The NDMS statutory mission goes beyond the functions performed by the organization within HHS/ASPR/OPEO currently known as NDMS. Many of the planning, resource management, and logistical elements of the NDMS mission are performed by the Office of the Assistant Secretary for Preparedness and Response (ASPR) and additional functions are performed by other HHS operational divisions and staff divisions under the administrative concept of ESF #8, which is similar to the legislative concept of NDMS.

3.2 Background

NDMS was originally created in 1984 as a partnership between HHS, the Department of Defense (DoD), and the Federal Emergency Management Agency (FEMA). The Department of Veterans Affairs (VA) was added as a partner two years later. The partnership memorandum of agreement (MOA), revised periodically, provides a framework for medical and ancillary services when a disaster overwhelms local emergency response capabilities. The three-part mission of NDMS has remained: **medical response** to supplement state and local healthcare resources, **evacuation of patients** from the disaster area, and the **provision of definitive care** through a network of pre-identified hospitals to care for disaster victims (international or domestic) or for large numbers of military casualties from an overseas war.

As noted, NDMS initially focused on natural disasters and overseas conflicts. The terrorist attacks of September 11, 2001 and subsequent anthrax incidents in the nation's capital raised concerns about the need for a federal response to a large-scale terrorist incident. The attacks prompted passage of the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (Public Law 107-188) which placed NDMS under the new position of Assistant Secretary for Public Health Emergency Preparedness at HHS.

In March 2003, NDMS was transferred to the Federal Emergency Management Agency (FEMA) within the newly created Department of Homeland Security (DHS) by the Homeland Security Act of 2002 (Public Law 107-296). After the massive destruction caused by hurricane Katrina and related flooding, NDMS was transferred back to HHS by the Pandemic and All Hazards Preparedness Act (PAHPA) (Public Law 109-417) effective January 1, 2007.

While a part of FEMA, the NDMS organization largely continued to structure its capabilities to respond to natural disasters. Its medical response teams had a concept of operations based on a set of standard disaster response planning assumptions common among emergency response professionals, including the following:

- Local leadership using a standardized incident management system
- Initial response provided by local and state authorities for the first 72 hours following an incident, except that NDMS teams were expected to be deployed within 24 to 36 hours of a request for assistance
- Surge capacity provided by other levels of government in concentric circles (city, county/metro, state, regional, federal) when requested by the next lower level of government.

3.3 Requirements Analysis

In April 2005, the Department of Homeland Security released the *National Planning Scenarios Created for Use in National, Federal, State and Local Homeland Security Preparedness Activities* (NPS). This document outlines 15 disaster scenarios, including 5 catastrophic incidents capable of generating mass casualties. In contrast to the traditional pattern of medical response requirements created by natural disasters, several of the scenarios envisioned high energy incidents that would almost immediately generate mass casualties and overwhelm local emergency response capabilities. These scenarios differ from the traditional threats in several important ways including the following:

- Chemical, biological, radiological, and nuclear (CBRN) threats that require specialized equipment, supplies, and response protocols
- Massive casualties requiring medical attention exceeding local capabilities within the first hours of an incident (with casualties an order of magnitude higher than the worst historical domestic disasters)
- Little or no warning prior to the incident
- Significant potential for degradation of local medical resources
- Significant potential for degradation or loss of local emergency management capability
- Loss of critical infrastructure including power and water supply under some scenarios
- Substantial risk of mass panic or civil disorder.

The complexity and potential severity of these scenarios strongly suggest that the national response capability for incidents of national significance must be substantially upgraded to meet the current threats to public health. In the future, the national medical response must be:

- Faster, to cope with catastrophic incidents with limited or no early warning
- More massive, to provide help for an order of magnitude more casualties under some scenarios
- Fully coordinated with all responses from agencies at all levels of government, whether directed by local, state, or federal authorities
- Prepared to leverage private sector resources at all levels
- Directed at the entire spectrum of care
- Designed to ensure that delivery of services occurs in a safe and secure environment
- Flexible, to meet the gaps in local/regional emergency response.

These scenarios also make high demands on local, metropolitan area/county, state and regional authorities. At a minimum, the scenarios suggest that the local/state/regional response must be:

- Prepared to surge without little or no advance warning
- Ready to coordinate a massive national response when needed
- Fully integrated from a control perspective
- Prepared to implement continuity of control plans in case of emergency management infrastructure loss.

MITRE analyzed the NPS to estimate medical response team requirements. The analytical process is depicted in Figure 3-1. Essentially MITRE determined which NDMS capabilities likely would be required for each of the planning scenarios, estimated the capacity required for the "worst case scenarios" for each capability, and then examined the capacity provided by state and local resources and other federal elements, including the National Guard and regular military forces.

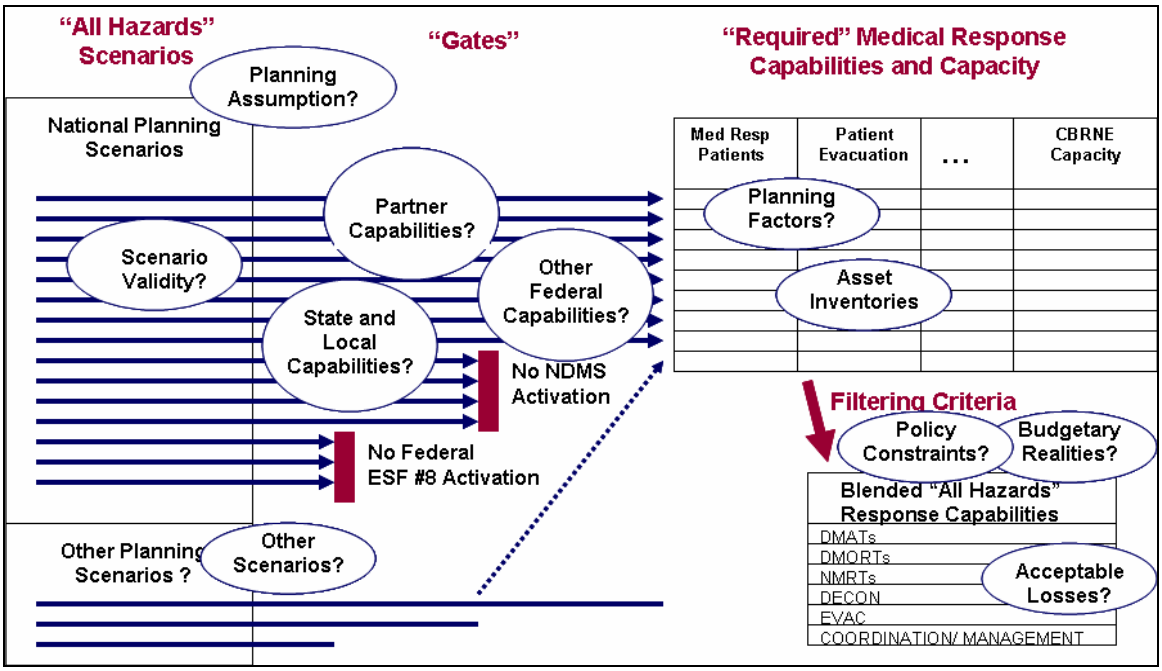

Figure 3-1. Analytical Process for Arriving at Blended "All Hazards" Response Capacity Requirements

An integrated strategy is especially important because of the severe challenges of meeting medical needs in the first minutes and hours after a catastrophic incident (which require a local response), and the need to identify appropriate roles for different private sector, local, metropolitan area, state and federal resources that maximize the overall effectiveness of the national response. Ideally, a large share of the gap should be filled by improving state and local surge capacity, rather than expanding the number of federal medical response teams. The integrated planning approach needed is discussed further under the topic of NDMS headquarters support for medical response teams. The more robust proposed national response capabilities also point toward a requirement for significant joint training across federal agencies and across levels of government. (See section 3.4.4 and the supporting sub-sections and section 7, Training, for additional discussion and recommendations on integrated planning and training.)

In evaluating the required capabilities, MITRE reviewed and analyzed a large body of literature and conducted interviews to determine the views of experts in government, academia, and the healthcare industry. The literature reviewed included government plans and reports, academic research, and consulting work products created for federal agencies. MITRE has attempted to use capability definitions consistent with existing guidance documents, including both civilian and defense policies, plans, and procedures. MITRE encourages the use of common terms and definitions across agencies that must work together to meet medical surge requirements.

In estimating the required capacity, MITRE relied upon planning factors supplied by federal agencies, academic experts, and professional societies to estimate the gross requirements for medical treatment for each scenario. These gross requirements would be addressed first by local, metropolitan area, and state medical resources, and next by regional resources under interstate emergency medical assistance compacts. MITRE estimated local response capabilities based on planning factors from the Department of Homeland Security (DHS). MITRE concluded that the

medical requirements (if any) for 6 of the 15 scenarios would likely be addressed without mobilizing medical response teams from outside the affected area. The medical response requirements for the remaining 9 scenarios would likely overwhelm local resources in most cities and states, and would require assistance from outside medical response teams.

The following sections present estimates of the net requirements for assistance from medical response teams after local, metropolitan area, state, and regional resources are taken into account. These requirements could vary widely from the estimates depending on factors including the severity of the incident, the preparedness and capabilities of local public health and medical care agencies, the behavior of the affected population, and the speed with which patients can be evacuated outside the affected geographical area. In some cases the medical response requirements may also be affected by how rapidly the nature of the incident has been diagnosed and appropriate disaster management procedures implemented.

For all these reasons the capacity estimates presented in this report are inherently imprecise. However, MITRE believes that the estimates can and should be used as one factor in planning to achieve disaster preparedness. These estimates should be subject to continual refinement as more planning scenarios are created, as planning factors and models are refined, and as local, metropolitan area and state medical response capabilities evolve.

3.3.1 Projected Capability Requirements for Medical Response Teams

MITRE examined the NPS in light of expressed policy objectives for national medical surge capability as described in the Stafford Act and subsequently expanded in PAHPA. For the purposes of examining the NDMS required medical response team capabilities and tasks, the NPS are more than adequate, and provide consistency with HHS's interagency partners. The 15 scenarios are:

- **Scenario 1: Nuclear Detonation – 10-Kiloton Improvised Nuclear Device**
- **Scenario 2: Biological Attack – Aerosol Anthrax**
- **Scenario 3: Biological Disease Outbreak – Pandemic Influenza**
- **Scenario 4: Biological Attack – Plague**
- **Scenario 5: Chemical Attack – Blister Agent**
- **Scenario 6: Chemical Attack – Toxic Industrial Chemicals**
- Scenario 7: Chemical Attack – Nerve Agent
- **Scenario 8: Chemical Attack – Chlorine Tank Explosion**
- **Scenario 9: Natural Disaster – Major Earthquake**
- **Scenario 10: Natural Disaster – Major Hurricane**
- **Scenario 11: Radiological Attack – Radiological Dispersal Devices**
- Scenario 12: Explosives Attack – Bombing Using Improvised Explosive Devices
- Scenario 13: Biological Attack – Food Contamination
- Scenario 14: Biological Attack – Foreign Animal Disease (Foot and Mouth Disease)

- Scenario 15: Cyber Attack

MITRE selected the nine scenarios in bold text (1, 2, 3, 4, 5, 6, 8, 9, 10, and 11) because they span the range of incidents of national significance from responding to natural events through major terrorist/nation-state attacks. Each of these scenarios would likely overwhelm local, metropolitan area, state, and regional resources, require a significant commitment of NDMS resources, and thus present challenges that may exceed current NDMS capacity. In Scenarios 1, 3, and 9, significant degradation of local health services capabilities should be expected because healthcare personnel and facilities would be affected by the incidents. In addition, in Scenario 1, it is likely that local emergency management capabilities would be seriously degraded (and if Washington, DC is the targeted city, some federal emergency response management capabilities would also be degraded).

The conditions that may be created by the scenarios include:

- Casualty numbers in excess of local and state capacity
- Destruction of infrastructure supporting essential services
- Incapacitation of personnel performing essential services
- Scale sufficiently large to require massive interagency and international effort
- Uncharacterized contaminated environments posing risk to response forces
- Movement of asymptomatic contaminated/infected personnel
- Difficulty restoring essential services due to magnified public perception of health risks.

Drawing upon the literature review and interview process, MITRE identified 10 general medical response team capabilities that are critical to mitigating the health impacts of the scenarios. Mitigation as used here includes: (1) minimizing the number of fatalities among survivors of the initial event, (2) preventing secondary health consequences such as opportunistic infections, (3) providing appropriate levels of care for initial treatment, triage, and evacuation of casualties, and (4) restoring the local healthcare system to a level sufficient to support the population after the event. The required response capabilities are:

- **Triage/Pre-Hospital Care.** The evaluation and classification of casualties for purposes of treatment and evacuation or quarantine. It consists of the immediate sorting of patients according to type and seriousness of injury, and likelihood of survival, and the establishment of priority for treatment and evacuation to ensure the most efficient and effective utilization of limited medical resources. It includes those pre-hospital treatment and tasks necessary to increase the survivability of casualties prior to receiving more definitive care.
- **Mass Prophylaxis.** The capability to protect the health of the public through administration of critical interventions in response to a public health emergency in order to prevent the development of disease among those who are exposed or are potentially exposed to public health threats. This capability includes the provision of appropriate follow-up and monitoring of adverse events, as well as risk communication messages to address the concerns of the public.
- **Patient Decontamination.** The capability of making a sick or injured person requiring medical and/or dental care or treatment safe through the process of absorbing, destroying, neutralizing, making harmless, or removing chemical or biological agents or removing radioactive materials clinging to or around them. Patient decontamination also includes

the subsequent decontamination of medical personnel and equipment involved in the decontamination process or otherwise exposed through the process of moving or decontaminating patients.

- **General Emergency Medical Care.** The capability to receive mass casualties and provide appropriate clinical care equivalent to the services of a hospital emergency department. Care expectations would be based on the location and type of facility throughout the continuum of care, e.g., forward mobile facilities at the incident site would not have the same expectation as would a fixed trauma center at a Patient Reception Area that receives evacuated patients.
- **Specialty Emergency Medical Care.** The capability to receive mass casualties and provide appropriate clinical care equivalent to a specialized emergency medicine center (such as a trauma center, burn center, pulmonary care center, or pediatric care center). Care expectations would be similarly based on the status of the facility throughout the continuum of care, e.g., facilities at the incident site may be operationally degraded.
- **Patient Evacuation Preparation.** The activities required to stabilize patients and prepare them for transportation via the most appropriate mode of transport available (e.g., ambulances, helicopters, etc.). This capability includes transferring patients to local, in-state, or regional facilities, even if the NDMS Patient Evacuation function is not activated. (Initial preparations may be done by NDMS medical response teams but enroute and post-arrival care is provided through the NDMS Patient Evacuation function.)
- **Psychological Support.** The provision of psychological/mental health services within a medical response operation. The capability includes caring for or coordinating the care for patients presenting with both physical and psychological symptoms, providing appropriate psychological/behavioral interventions for responders and casualties, and coordinating follow-up for those exposed.
- **Medical Shelter.** The provision of medically supervised shelter for special needs patients and other patients requiring minimal levels of ongoing care and/or quarantine. This capability also aligns with the need to provide service akin to primary care.
- **Mortuary/Victim Identification Support.** The provision of fatality management activities as directed in support of other mortuary services agencies
- **Veterinary Medical Care.** The provision of veterinary care for animals affected by incidents of national significance, including service animals, pets, and livestock, as directed by ESF #8 and/or ESF #17 (Animal Protection) authorities.

Table 3-1 provides a cross-walk of the potentially required federal medical response capabilities for each scenario. At this stage of the analysis, a capability is listed when it appears that the number of fatalities and/or casualties might overwhelm local, metropolitan, state, and regional medical response capacity.

Table 3-1 –Capability Requirements for Medical Response Teams

National Planning Scenarios	Triage/Pre-Hospital Care	Mass Prophylaxis	Patient Decontamination	General Emergency Medical Care	Specialty Emergency Medical Care	Patient Evacuation Preparation[a]	Psychological Support	Medical Shelter	Mortuary Operational Support	Veterinary Medical Care
1. Nuclear Detonation – 10-Kiloton Improvised Nuclear Device	●		●	●	●	●	●	●	●	●
2. Biological Attach – Aerosol Anthrax	●	●	●	●	●	●	●			●
3. Biological Disease Outbreak – Pandemic Influenza	●	●	●	●	●		●	●	●	●
4. Biological Attack – Plague	●	●	●	●	●	●	●	●	●	●
5. Chemical Attack – Blister Agent	●		●	●	●	●	●	●	●	●
6. Chemical Attack – Toxic Industrial Chemicals	●		●	●	●	●	●	●	●	●
7. Chemical Attack – Nerve Agent									●	
8. Chemical Attack – Chlorine Tank Explosion	●	●	●	●	●	●	●	●	●	●
9. Natural Disaster – Major Earthquake	●			●		●		●	●	●
10. Natural Disaster – Major Hurricane				●		●			●	●
11. Radiological Attack – Radiological Dispersal Devices			●		●	●	●		●	
12. Explosives Attack – Bombing Using Improvised Explosive Devices										
13. Biological – Food Contamination										
14. Biological Attack – Foreign Animal Disease										●
15. Cyber Attack										

a – Patient movement preparation does not necessarily imply activation of the NDMS Patient Movement function, as patients may be moved by local, metropolitan area, regional, or National Guard resources.

Table 3-2 presents MITRE's estimates of the gross capacity requirements for medical response capabilities associated with the NPS (in the aggregate). The estimated capacity requirement for each capability is determined by the worst cases among the 15 scenarios. These gross estimates include patients who are cared for by local, metropolitan, state, and regional medical care resources.

Table 3-2 – Estimated Gross Capacity Requirements for Medical Response

Capability	Worst Case Scenarios	Estimated Gross Medical Response Capacity Requirements[a]
1. Triage / Pre-Hospital Care	#1 – Improvised Nuclear Device #3 – Pandemic Influenza #8 – Chlorine Tank Explosion	IND: 300,000 – 400,000 patients PANDEMIC: 200,000 – 1,000,000 hospital admissions; 18,000,000 – 44,000,000 outpatient visits[b] CHLORINE: 122,500 seriously injured patients; 350,000 with minor injuries; 450,000 seek medical care without serious symptoms
2. Mass Prophylaxis	#3 – Pandemic Influenza #2 – Anthrax	PANDEMIC: millions of doses of influenza vaccine ANTHRAX: tens of thousands of courses of antibiotics
3. Patient Decontamination	#11 – Radiological Dispersal Device #1 – Improvised Nuclear Device #5 – Chemical Blister Agent	RDD: 300,000 people requiring decontamination IND : 110,000 patients requiring decontamination BLISTER AGENT: 70,000 people requiring decontamination
4. General Emergency Medical Care	#1 – Improvised Nuclear Device #3 – Pandemic Influenza #9 - Major Earthquake	IND: 138,000 ambulatory patients; 95,000 patients requiring special care PANDEMIC: 18-44 million outpatient visits[b] HURRICANE: 100,000 patients
5. Specialty Emergency Medical Care	#1 – Improvised Nuclear Device #9 – Major Earthquake #8 – Chlorine Tank Explosion	IND: 1,700 burn cases; 1,100 blunt trauma; 700 prompt radiation; 3,500 flash blindness or retinal burns EARTHQUAKE: thousands of crush patients; hundreds of burn patients CHLORINE: 140,000 pulmonary cases, many requiring ventilators and/or oxygen
6. Patient Evacuation Preparation	#1 – Improvised Nuclear Device #8 – Chlorine Tank Explosion #5 – Blister Agent	IND: 90,000 patients moved out of state CHLORINE: 87,500 patients moved out of state BLISTER AGENT: 57,500 patients moved out of state
7. Psychological Support	#1 – Improvised Nuclear Device #3 – Pandemic Influenza #11 – Radiological Dispersal Device	IND: 4,000+ responders requiring psychological support PANDEMIC: tens of thousands of medical responders under intense stress RDD: significant potential for exaggerated fears on the part of responders and the public

Capability	Worst Case Scenarios	Estimated Gross Medical Response Capacity Requirements[a]
8. Medical Shelter	#1 – Improvised Nuclear Device #9 – Major Earthquake	IND: about 100,000 patients requiring medical shelter EARTHQUAKE: tens of thousands of patients requiring medical shelter
9. Mortuary Operational Support	#1 – Improvised Nuclear Device #3 – Pandemic Influenza #8 – Chlorine Tank Explosion	IND: 90,000 – 100,000 fatalities 1st hour; 400,000 – 500,000 fatalities within 8 weeks PANDEMIC: 55,000 – 285,000 fatalities over a 1 year period[b]
10. Veterinary Medical Care	#14 – Foreign Animal Disease #1 – Improvised Nuclear Device #10 – Major Hurricane	FAD: "Massive" amount of livestock euthanized IND: No projection available HURRICANE: Thousands of affected livestock and pets

a – IND estimates based on DHS NPS, Table 1-15; other estimates based on NPS and ASPR playbooks.
b – Pandemic casualties will not have a specific geographic focus and it is unclear to what extent NDMS could or would be deployed for this scenario except for potential mass immunization efforts. According to the National Strategy for Pandemic Influenza: Implementation Plan, "The distributed nature of a pandemic, as well as the sheer burden of disease across the Nation over a period of months or longer, means that the Federal Government's support to any particular State, Tribal Nation, or community will be limited in comparison to the aid it mobilizes for disasters such as earthquakes or hurricanes, which strike a more confined geographic area over a shorter period of time. Local communities will have to address the medical and non-medical effects of the pandemic with available resources."

To arrive at net medical response requirements for federal personnel and materiel, it is necessary to estimate local, metropolitan area, state, and regional capabilities and capacity. Surge capacity benchmarks developed by HRSA and published on the AHRQ website[2] are the basis for the local capacity estimates, which assume that localities will reach these benchmarks in the near future. Actual capabilities and capacity vary widely by metropolitan area and state, and in some scenarios these capabilities are adversely impacted by the incident. Table 3-3 presents a representative estimate for local medical surge capacity for each capability area, with an indication of the degradation in capacity (if any) expected for the worst-case scenarios.

Table 3-3 – Estimated Non-Federal Capacity for Disaster Medical Response (for top ten metropolitan areas under NPS scenarios)

Capability	Local / Metro / State / Regional Medical Surge Capacity[a]	Degradation (if any) in Response Capacity Caused by Scenarios
1. Triage / Pre-Hospital Care	IND: 20,000 - 95,000 patient encounters (median 30,000) PANDEMIC: No net surge capacity (absences exceed surge personnel available) CHLORINE: 40,000 – 190,000 patient encounters	IND: core urban hospitals destroyed or rendered inoperative; estimated ~50% degradation overall PANDEMIC: ~40% of medical personnel unavailable due to illness or caring for family CHLORINE: Significant percentage of first responders incapacitated
2. Mass Prophylaxis	~50,000 doses / courses distributed per day	PANDEMIC: ~40% of medical personnel unavailable due to illness or caring for family ANTHRAX: negligible degradation
3. Patient Decontamination	2,500 – 9,000 patients and workers	RDD: highly site-specific

[2] AHRQ, "*Optimizing Surge Capacity: Regional Efforts in Bioterrorism Readiness*", Bioterrorism and Health System Preparedness Issue Brief No. 4, Table 2: HRSA Surge Capacity Benchmarks.

Capability	Local / Metro / State / Regional Medical Surge Capacity[a]	Degradation (if any) in Response Capacity Caused by Scenarios
	decontaminated / day	IND: core urban hospitals and fire stations destroyed; no water available in inner city; ~50% degradation overall BLISTER AGENT: negligible degradation
4. General Emergency Medical Care	IND: 2,000 – 9,000 encounters / day PANDEMIC: 1,000 – 5,000 encounters/day EARTHQUAKE: 1,000 – 3,000 encounters/day	IND: core urban hospitals and urgent care centers destroyed; ~50% degradation overall PANDEMIC: ~40% of medical personnel unavailable due to illness or caring for family EARTHQUAKE: nearly 90% of hospital capacity degraded in the region
5. Specialty Emergency Medical Care	IND: 500 – 2,500 encounters / day PANDEMIC: 500 – 2,000 encounters / day	IND: core urban hospitals and urgent care centers destroyed; ~50% degradation overall EARTHQUAKE: nearly 90% of hospital capacity degraded in the region CHLORINE: Significant percentage of hospital personnel incapacitated
6. Patient Evacuation Preparation	IND: ~1,000 patients/day CHLORINE: ~1,500 patients/day BLISTER AGENT: ~2,000 patients per day	IND: core urban hospitals and urgent care centers destroyed; significant losses of ambulance and EMT capacity; ~50% degradation overall CHLORINE: Some losses of hospital, ambulance, and EMT capacity; assumed to be ~25% degradation overall
7. Psychological Support	No data identified	No projections identified
8. Medical Shelter	No HRSA surge capacity benchmark	IND: about 100,000 patients requiring medical shelter EARTHQUAKE: tens of thousands of patients requiring medical shelter
9. Mortuary Operational Support[b]	~300 human remains processed / day ~100 human remains identified / day No local capacity for decontaminating human remains (IND, RDD)	IND: Urban morgue(s) incapacitated PANDEMIC: 40% of mortuary workers absent due to infection or caring for family members
10. Veterinary Medical Care	No data identified	FAD: "Massive" amount of livestock euthanized IND: No projection available HURRICANE: Thousands of affected livestock and pets

a – Surge capacity estimates are generally based on HRSA surge capacity benchmarks, for available categories, assuming metropolitan area populations of 4-19 million consistent with the top ten US metropolitan statistical areas. Cities with very large populations not subject to particular hazards (e.g., hurricanes, earthquakes) were excluded in estimated the surge capacity ranges for those hazard scenarios.

b – Mortuary services surge capacity assumed to be 3 times the average death rate for median "top ten" metropolitan statistical area. For the IND and RDD scenarios, decontamination issues could effectively eliminate local surge capacity.

3.3.2 Net Federal Medical Response Teams Capacity Requirements

MITRE estimated net federal medical response requirements by subtracting local, metropolitan area and state response capacity from the total estimated gross response requirements. This is shown in Table 3-4. The resulting net federal medical response requirements do not translate directly into NDMS requirements, because they do not take into account potential contributions

by other federal agencies including the military services, various agencies of the Department of Health and Human Services (HHS), and the National Guard.

Table 3-4. Estimated Net Federal Medical Response Teams Capacity Requirements

Capability	Estimated Net Federal Medical Response Teams Capacity Requirements[a]
1. Triage / Pre-Hospital Care	IND: 200,000 – 370,000 patients PANDEMIC: 200,000 – 1,000,000 hospital admissions; 18,000,000 – 44,000,000 outpatient visits[b] CHLORINE: 100,000+ seriously injured patients; 250,000+ with minor injuries; 350,000+ seeking medical care without serious symptoms
2. Mass Prophylaxis	PANDEMIC: millions of doses of influenza vaccine ANTHRAX: thousands of courses of antibiotics (federal personnel may not be required in many metro areas depending on local resources and plans)
3. Patient Decontamination	RDD: 300,000 people requiring decontamination IND : 110,000 patients requiring decontamination BLISTER AGENT: 70,000 people requiring decontamination
4. General Emergency Medical Care	IND: ~130,000 ambulatory patients; ~75,000 patients requiring special care PANDEMIC: 18-44 million outpatient visits[b] HURRICANE: 20,000 - 80,000 patients
5. Specialty Emergency Medical Care	IND: ~1,600 burn cases; 800+ blunt trauma; 700+ prompt radiation; 3,500 flash blindness or retinal burns EARTHQUAKE: thousands of crush patients; hundreds of burn patients CHLORINE: 140,000 pulmonary cases, many requiring ventilators and/or oxygen
6. Patient Evacuation Preparation	SEE Chapter 4 – Patient Evacuation
7. Psychological Support	IND: 4,000+ responders requiring psychological support PANDEMIC: tens of thousands of medical responders under intense stress RDD: significant potential for exaggerated fears on the part of responders and the public
8. Medical Shelter	IND: about 100,000 patients requiring medical shelter EARTHQUAKE: tens of thousands of patients requiring medical shelter
9. Mortuary Operational Support	IND: Mass disposition of ~90,000+ fatalities within 1 week Mass disposition of ~400,000+ fatalities within 8 weeks PANDEMIC: ~100,000+ fatalities over a 1 year period[b]
10. Veterinary Medical Care	FAD: “Massive” amount of livestock euthanized IND: No projection available HURRICANE: Thousands of affected livestock and pets

a – IND estimates based on DHS NPS, Table 1-15; other estimates based on NPS and ASPR playbooks.

b –This net requirement represents the “gap” between existing mortuary resources and the magnitude of mortuary resources needed for the pandemic scenario. Because of the geographic dispersion of the fatalities, a primarily federal response is not feasible; however, the federal government should provide leadership for addressing the mortuary needs under this scenario since uniform standards for identifying and disposing of human remains will be a nationwide problem with significant implications for numerous federal programs.

3.3.3 Crosswalk of Current NDMS Response Team Types with Similar Teams of Other Organizations

In addition to NDMS medical response teams, there are other federally funded teams that have similar capabilities from three sources: DoD, the National Guard (support provided to states with federal sponsored Title 32 funding with forces under state control), and other federal agencies (based on providing a deployable capability, e.g., VA may have some crisis incident response teams but their purpose is to support locally and not deploy):

- **DoD.** Numerous types of DoD assets provide capabilities very similar to DMATs. These assets are dedicated to DoD missions and DoD force protection. The capabilities of these DoD assets are well documented and readily available (unclassified), but for national security reasons DoD does not release the current inventory or locations of these assets. However, DoD has a homeland defense and civil support mission (HD/CS) through Defense Support to Civil Authorities (DSCA).
- **National Guard.** The Air National Guard (ANG) has Expeditionary Medical Support (EMEDS) resources that can be rapidly deployed in response to medical emergencies and are similar to DMATs. The ANG has announced plans to maintain at least one deployment-ready EMEDS in each of the ten FEMA regions. These assets can be mobilized on the orders of state governors, can be shared through EMACs, or can be deployed as federal resources by Presidential order. Although these assets are normally regarded as a state resource as previously discussed, MITRE recommends that they should at least be integrated for federal coordination/situational awareness and their availability/use monitored during Incidents of National Significance under the federal ESF #8 command and control structure.
- **HHS**. OPEO/NDMS is the only HHS component with readily deployable, pre-equipped teams of medical response personnel. However, various HHS agencies can supply significant numbers of medical professionals to meet surge capacity requirements for incidents of national significance. These agencies are the Unites States Public Health Service (USPHS), the National Institutes of Health (NIH), the Indian Health Service (IHS), the Centers for Disease Control and Prevention (CDC), and the Substance Abuse and Mental Health Services Agency (SAMHSA).
- **Other Federal Agencies.** Other federal agencies have small numbers of response teams that may play specialized roles in disaster medical response. For example, the VA has one Medical Emergency Radiological Response Team (MERRT) that can provide technical advice, decontamination expertise, and medical care as a supplement to an institutional health care provider. DHS has limited Coast Guard resources for environmental assessment and cleanup of hazardous materials in waterways. The EPA, NRC, and DOE have various teams for environmental and radiological surveillance. In general, medical response resources of these agencies are dwarfed by the NDMS, DoD, National Guard, and local resources.

Table 3-5 lists the federal assets that are similar to each NDMS team type and provides basic comparative information. The DoD and National Guard assets are designed for mobility and provide capabilities inherently similar to those of NDMS response teams. The other agencies

can provide supplemental personnel for longer time periods than NDMS but with generally slower response times to become fully operational.

Table 3-5. Federal Assets with Capabilities Similar to NDMS Teams

NDMS Team Type	Similar Federal Assets	Comparative Capability / Overlap
Disaster Medical Assistance Teams (DMATs)	• Expeditionary Medical Support (EMEDS) – Air National Guard and US Air Force • Support Medical Company (SMC) – US Army • Medical Battalion (Evacuation) – US Army • Mobile Aeromedical Staging Facility – US Air Force • USPHS Rapid Deployment Force (RDF) Teams	EMEDS and SMCs provide deployable forward medical units comparable to DMATs Evacuation Battalions and Mobile Aeromedical Staging Facilities provide specialized services for stabilizing and transporting patients, comparable to a DMAT supporting the NDMS Patient Movement function but with enhanced logistical and transportation resources. The USPHS RDF teams are designed with the goal of staffing Federal Medical Stations during an event. – this is different from DMATs in that DMATs provide more emergency care, while FMSs are designed with a primary care focus
Specialty Teams	MEDCOM SMART Teams – US Army: • SMART-AIT: Aero-Medical Isolation Team • SMART-B: Burn Team • SMART-EMR: Emergency Medical Response Team • SMART-HS Health Systems Team • SMART-LOG: Logistics Team • SMART-MC3T Medical Command, Control, Communications and Telemedicine • SMART-PC: Pastoral Care Team • SMART-PM: Preventive Medicine Team • SMART-SM: Stress Management Team • Medical Company – Combat Stress Control – US Army USPHS/SAMHSA Mental Health Teams	The US Army Medical Command's SMART teams are configurable to provide subject matter expertise for various event types and are comparable to NDMS Specialty Teams; deployability is contingent on readiness status, which may vary USPHS and SAMHSA are forming Mental Health Teams, which are designed to provide mental health services in the field.

NDMS Team Type	Similar Federal Assets	Comparative Capability / Overlap
National Medical Response Teams	• SMART-NBC: Nuclear / Biological / Chemical Team – US Army • Chemical / Biological Incident Response Force (CBIRF) – US Marine Corps • CBRNE Consequence Management Response Force (CCMRF) – DoD • Weapons of Mass Destruction Civil Support Team – National Guard • CBRNE Enhanced Response Force Package (CERF-P) – National Guard	DoD has various team types for CBRNE Consequence Management; in addition, all DoD combat units have decontamination and personnel protection capabilities
IMSURTs	• Fleet Surgical Team – US Navy • Mobile Field Surgical Team – US Air Force	Military surgical teams roughly correspond to IMSURTs in capabilities
Disaster Mortuary Operational Response Teams (DMORTs)	• Quartermaster Company (Mortuary Affairs) – US Army • Quartermaster Company (Mortuary Affairs) – US Army Reserve • Personnel Retrieval and Processing (PRP) Units – USMC	DoD has a small number of units with up to 200 personnel each providing mortuary services
National Veterinary Response Teams	• SMART-V: Veterinary Team – US Army • Medical Detachment – Veterinary Services – US Army	SMART-V and MD-V units provide capabilities similar to NDMS Veterinary Teams
Mobile Intensive Care Units	• Hospital Ships: Mercy Class – US Navy • Expeditionary Medical Facility – US Navy • Clinical Operations Equipment Set (COES) – US Army • Air Force Theater Hospital	DoD assets generally have greater capacity than NDMS MICUs in terms of both operating theaters and ICU beds
Strike Teams	• Air Force Radiation Assessment Teams (AFRAT) • Radiation Assistance Program Teams (RAP) – DOE • CDC • VA MERRT • DOE, NRC, strike teams	RAPs and AFRATs are configured for nuclear and radiological incidents CDC teams are configured for infectious disease outbreaks VA, DOE, NRC teams were formed for nuclear power plant accidents

3.3.4 Gap Analysis Comparing Known / Anticipated Requirements to Currently Available Response Teams

MITRE used the net federal medical response capacity requirements for the worst case scenario (IND) from the preceding stage of the analysis and evaluated the potential force packages that DoD could provide, as documented in *JTF-CS CONPLAN 0500 Nuclear Playbook Surgeon* (28

July 2005), along with existing NDMS medical response team resources. The shortfall constitutes the gap between known/anticipated requirements versus currently available response teams.

While this gap analysis is useful for planning purposes, it does not take into account the possibility of multiple concurrent events (*e.g.*, a simultaneous attack on two cities such as occurred on September 11, 2001). It also does not consider the risk that DoD assets may be committed to defense missions.

Table 3-6 lists the net federal medical response requirements, the share of resources that may be provided by DoD and National Guard (when federalized or operating under state-controlled Title 32/State Active Duty with coordination with federal authorities for integrated use) components, and the gap that remains to be filled by HHS/NDMS teams. The DoD contribution totals over 3,400 personnel and 5,400 tons of materials.

Based on this worst case analysis, one could surmise that the gap that remains to be filled is more than 100 additional DMAT-equivalents (above and beyond the ~50 DMATs that can be fielded simultaneously today), plus additional specialty and fatality management resources. However, further analysis is needed to recommend an appropriate integrated response strategy that includes capability and capacity enhancements at the local, metropolitan area, state, and regional levels. An integrated strategy is especially important because of the severe challenges of meeting medical needs in the first minutes and hours after a catastrophic incident (which require a local response), and the need to identify appropriate roles for different federal resources that maximize the overall effectiveness of the federal response.

Table 3-6 Gap Analysis

Estimated Worst Case Net Federal Medical Response Capacity Requirements[a]	Estimated DoD Contributions Based on CONPLAN 0500 (if available and with Secretary of Defense approval)	Gap Remaining to Be Filled by HHS (including but not limited to NDMS)
1. Triage / Pre-Hospital Care IND: 200,000 – 370,000 patients PANDEMIC: 200,000 – 1,000,000 hospital admissions; 18,000,000 – 44,000,000 outpatient visits CHLORINE: 100,000+ seriously injured patients; 250,000+ with minor injuries; 350,000+ seeking medical care without serious symptoms	200 physicians, 800 nurses, 1,600 medics and med techs (2,600 medical professionals total) (Equivalent to about 65 DMATs)	750 physicians, 1,500 nurses, 3,000 EMTs (5,250 medical professionals total) (Equivalent to about 200 DMATs)
2. Mass Prophylaxis PANDEMIC: millions of doses of influenza vaccine ANTHRAX: thousands of courses of antibiotics (Federal personnel may not be required in many metro areas depending on local resources and plans)	Not applicable	Mass prophylaxis may not require NDMS activation – most cost effective approach is to use local resources
3. Patient Decontamination RDD: 300,000 people requiring decontamination IND : 110,000 patients requiring	Sufficient capacity to meet mass decontamination requirements	For personnel safety reasons, each team must possess decontamination capabilities to decontaminate arriving patients prior to treatment

Estimated Worst Case Net Federal Medical Response Capacity Requirements[a]	Estimated DoD Contributions Based on CONPLAN 0500 (if available and with Secretary of Defense approval)	Gap Remaining to Be Filled by HHS (including but not limited to NDMS)
decontamination BLISTER AGENT: 70,000 people requiring decontamination		
4. General Emergency Medical Care IND: ~130,000 ambulatory patients; ~75,000 patients requiring special care PANDEMIC: 18-44 million outpatient visits[b] HURRICANE: 20,000 - 80,000 patients	200 physicians, 800 nurses, 1,600 medics and med techs (2,600 medical professionals total) (Equivalent to about 65 DMATs) *Note: same personnel as providing triage / pre-hospital care*	750 physicians, 1,500 nurses, 3,000 EMTs (5,250 medical professionals total) (Equivalent to about 200 DMATs) *Note: same personnel as providing triage / pre-hospital care*
5. Specialty Emergency Medical Care IND: ~1,600 burn cases; 800+ blunt trauma; 700+ prompt radiation; 3,500 flash blindness or retinal burns EARTHQUAKE: thousands of crush patients; hundreds of burn patients CHLORINE: 140,000 pulmonary cases, many requiring ventilators and/or oxygen	Section 5 outlines definitive care capability changes that could impact local specialty care requirements.	Insufficient data
6. Patient Evacuation Preparation	See Chapter 4 – Patient Evacuation	Insufficient data
7. Psychological Support IND: 4,000+ responders requiring psychological support PANDEMIC: tens of thousands of medical responders under intense stress RDD: significant potential for exaggerated fears on the part of responders and the public	Insufficient data	Insufficient data
8. Medical Shelter IND: about 100,000 patients requiring medical shelter EARTHQUAKE: tens of thousands of patients requiring medical shelter	Insufficient data	Medical shelter staffed by PHS or MRC personnel
9. Mortuary Operational Support IND: Mass disposition of ~90,000+ fatalities within 1 week Mass disposition of ~400,000+ fatalities within 8 weeks PANDEMIC: ~100,000+ fatalities over a 1 year period[b]	200 skilled mortuary affairs personnel augmented by 400-600 additional personnel	The gap is highly dependent on the standard of post-mortem care and on decontamination capability. A viable approach would be to take DNA samples prior to mass burials. Probable requirement for several additional DMORT-WMDs.
10. Veterinary Medical Care FAD: "Massive" amount of livestock euthanized IND: No projection available HURRICANE: Thousands of affected livestock and pets	Insufficient data	Insufficient data

3.3.5 Summary and Additional Considerations

The "gap" remaining after existing local surge capacity is exhausted and other federal resources are taken into account is estimated at about 750 physicians, 1,500 nurses, and 3,000 emergency medical technicians and other paramedical and technical staff (or about 5,250 medical professionals total). This gap is approximately three times the size of the force that NDMS can currently deploy at one time.

The gap in capability includes not only the number of trained personnel, but the types of equipment, training, and personnel protection available to them. The following additional considerations should be taken into account in preparing NDMS teams to face the new threats suggested by the NPS and other threats like them:

- **CBRNE Training.** The NPS IND scenario requires essentially all NDMS resources, suggesting that most or all teams need to be familiar with nuclear incident procedures and treatments. To be prepared for this scenario NDMS teams (including DMORTs) would need to be trained for nuclear events. Detailed analysis is needed to determine what proportion of teams require CBRNE training and equipment, including further discussions with OASD(HD&ASA) on commitments by DoD regarding CBRNE consequence management.
- **Personnel Protection for CBRNE.** CBRNE scenarios pose hazards to NDMS responders who will need additional personal protective devices. These include radiation and chemical hazard detection equipment, decontamination capability (for both team members and arriving patients), and other protective devices (e.g., masks, isolation equipment). Again, further analysis is needed to determine what proportion of teams requires this equipment, in the context of an overall integrated medical response strategy and clarification of the role to be played by DoD.
- **CBRNE Specialized Equipment and Supplies.** In order to treat patients for CBRNE exposure, more NDMS teams will require access to additional pharmaceutical products and nuclear, chemical, and biological diagnostic equipment.
- **Rapid Deployment Requirements for Catastrophic Incidents.** The CBRNE scenarios in the NPS, and other scenarios that may be identified by DHS, FBI, the Defense Threat Reduction Agency (DTRA), Biomedical Advanced Research and Developmental Authority (BARDA), or intelligence agencies in the future, require that teams arrive on the scene rapidly to reduce suffering and loss of life. NDMS should strive for a reaction time for catastrophic events to enable alerting and reporting to team collection points for movement within 12 hours after the decision is made to activate the teams with the teams operational on scene within 24 to 36 hours.
- **Logistics Requirements for Catastrophic Incidents.** Tighter reaction time requirements may necessitate forward staging of equipment and pharmaceutical cache on the outskirts of cities perceived to be at the highest risk of CBRNE events. In addition, the chaos created by some scenarios may substantially impede resupply efforts.
- **Command and Control Requirements for Catastrophic Incidents.** Catastrophic incidents will demand vastly improved situation awareness, command, control and communications. Several hundred teams of local, metropolitan area, regional, National

Guard, regular military, NDMS, and other federal medical professionals will be setting up and operating within overlapping areas on short notice. There will be significant contention for security, transportation, logistical, and patient movement resources that will require central coordination. The importance of a unified chain of command and a robust incident management system cannot be overstressed.

- **Security Considerations for Catastrophic Incidents.** Catastrophic incidents can cause significant breakdowns in societal order and corresponding increases in lawless behavior. The physical security of NDMS teams and their supplies and equipment cannot be taken for granted. Accordingly, physical security plans should be coordinated in advance with public safety and military leadership, and practiced as part of comprehensive catastrophic incident planning and exercises.
- **Psychological Considerations for WMD Events.** WMD events may induce panic among members of the public as well as medical responders, who may be unwilling to perform their duties because of exaggerated fears of radiation, chemical, or biological exposure. The best antidote is information, provided in advance through training and awareness building activities. In addition, psychological support for managing stress and grief may need to be increased for WMD events compared to the natural disasters that NDMS teams are accustomed to dealing with.

3.4 Medical Response Recommendations

The following sections outline recommendations for upgrading the NDMS and associated ESF #8 capabilities to meet the new threats as envisioned by the NPS, or other threats that may be identified by the Department of Homeland Security and the Federal Bureau of Investigation, who are responsible for domestic intelligence related activities. Close coordination is required across all levels of government to build a truly national response capability that leverages the distinct advantages of each level of government.

A major component of the NDMS mission, as envisioned by Congress, is working in collaboration with the states and other appropriate public or private entities to provide health-related services to respond to the needs of victims of a public health emergency. This includes working with local and state authorities to evaluate and, where needed, expand local medical surge capacity. HHS is making significant efforts to encourage local public health and emergency management officials to plan for increased surge capacity to address the scenarios outlined in the NPS, particularly in the areas of pandemic influenza and other biological incidents.

As local surge capacity grows, NDMS medical response teams are likely to be activated less frequently for small scale disasters (except to the extent that they are perceived as a heavily subsidized resource that can be used at low cost to the states). However, NDMS medical response teams will be required to respond to any major catastrophic incidents that overwhelm local surge capacity, which may include CBRN events. The mission of the NDMS medical response teams will gradually evolve toward supporting the largest mass casualty incidents. This evolution will challenge NDMS in terms of the scale and level of coordination required for medical response.

3.4.1 Vision for National Medical Response

The national medical response to disasters and catastrophic incidents is intended to supplement state and local resources and can be activated in several ways under different statutory authorities. The federal medical response is coordinated by ESF #8 under the leadership of the Secretary of HHS, assisted by ASPR. The National Response Plan (NRP) identifies 15 supporting federal agencies that may assist with the ESF #8 national response, including DoD, DHS, and VA (the NDMS federal partners). ESF #8 uses resources primarily available from HHS, including the NDMS response teams, all Operating Divisions (OpDiv), Staff Divisions (StaffDiv), Regional Offices, and other ESF #8 support agencies, organizations, and civilian volunteers.

According to the NRP, the Secretary of HHS assumes operational control of emergency public health and medical response assets, as necessary, in the event of a public health emergency, except for members of the armed forces, who remain under the authority and control of the Secretary of Defense. NDMS is one component of the larger federal medical response, which in turn is only part of the national capability that includes local, metropolitan area, state, regional, and private sector capabilities and assets. NDMS performs a limited number of functions, within the context of the overall national response, as illustrated in Figure 3-2.

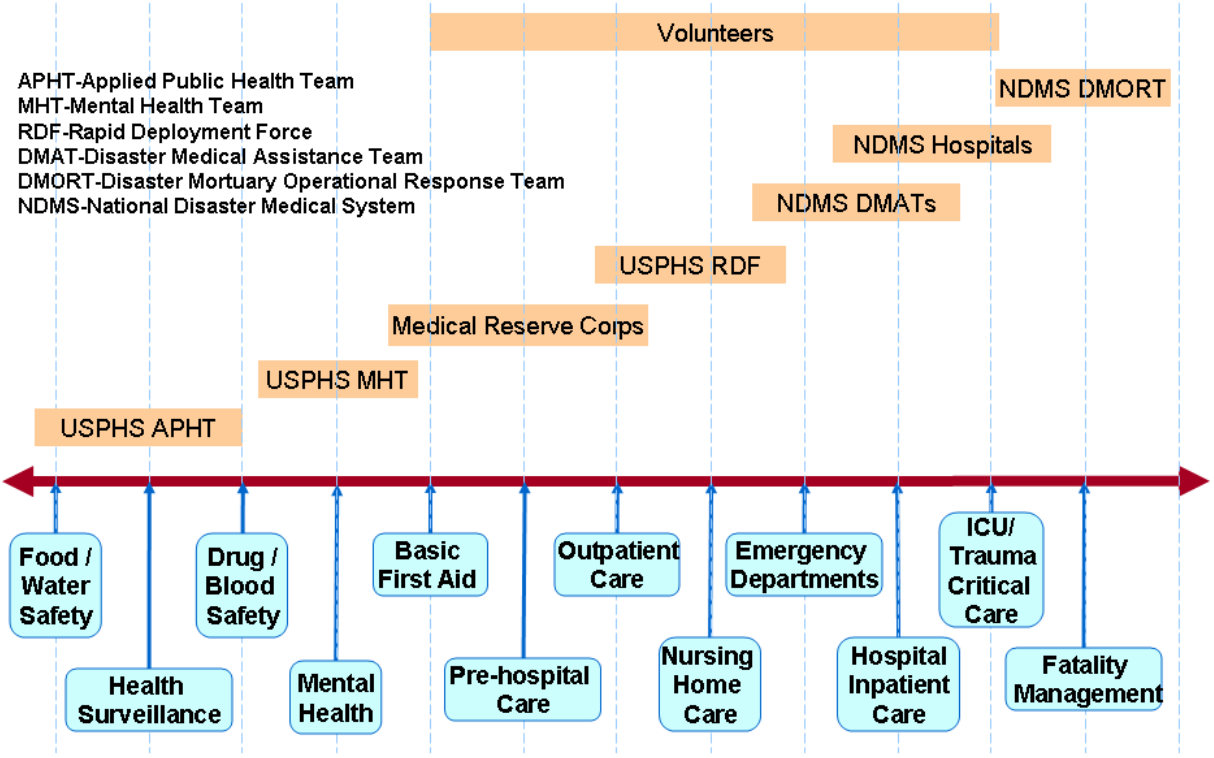

Figure 3-2. NDMS Role Within the Spectrum of Care Provided by HHS as part of the National Medical Response

The ASPR/NDMS organization plays a specific role in the overall national medical response, which is to mobilize teams of highly skilled emergency care professionals equipped with a full complement of shelters, medical equipment and supplies to assist state and local disaster medical

response efforts for short periods of time. This specialized role takes on new importance in the light of the evolving public health threats identified in the NPS.

NDMS teams must be equipped to deal with a broad array of disasters, including certain CBRN incidents. A significant percentage of NDMS teams must be capable of arriving on the scene and beginning to function within 24 to 36 hours of notification, and of operating without logistical support, power, or water for a minimum of 72 hours.

NDMS medical response teams will provide the first wave of federal medical assistance. As such the teams will provide crucial life-saving medical assistance during the initial 7 to 10 days following an incident, and may assist for longer periods if required while local medical capabilities are restored.

Medical elements of the National Guard (NG), whether mobilized under state or federal authority, may perform a parallel role in close coordination with ESF #8. For the largest scale catastrophic incidents, ESF #8 may also request and coordinate assistance from DoD through the Joint Staff.

3.4.2 Team Staffing Model

Active practitioners of emergency medicine and related healthcare specialties are the ideal members of NDMS medical response teams. By definition, these active practitioners are already currently employed in emergency medicine or other relevant disciplines, whether in private, nonprofit, or public health facilities. The existing NDMS model of enrolling team members as intermittent federal employees (IFE) leverages existing professionals' employment experience (and their training and credentialing by existing healthcare organizations) to produce a large roster of highly qualified personnel available for deployment. The IFE model is very cost-effective in maintaining a workforce that is well-prepared and well qualified to provide disaster medical assistance.

Some observers have suggested that full-time employment would be a preferable model, given the additional complexities posed by the recognized CBRN threats. Full-time employment would provide more time for training and exercises, but in MITRE's view this benefit would be more than offset by the lack of everyday exposure to emergency and/or trauma patient encounters. In addition, full-time employment may be cost-prohibitive. (Retaining 1,500 qualified medical professionals on a full-time roster would cost at least $125 million annually, on top of NDMS's existing budget of $35 million annually.) Hence, MITRE supports the continued use of the IFE model for NDMS medical response teams.

Other observers have recommended a model similar to the National Guard for NDMS medical response teams. Under this model, a small core full-time staff would anchor each medical response team, overseeing such matters as roster management, logistics, and coordination for training exercises. Other team members would be activated periodically for training with a week of active duty and several weekend drills. MITRE concurs with the view that core team members will need to devote more time to team management in the future due to the complexity of preparing for CBRN incidents. Whether paid team training time is needed should be evaluated further by NDMS.

Another possible model is dual state-federal deployment, similar to the National Guard. Such a model would enable states to utilize NDMS medical response teams at their own expense for local

emergencies, leveraging the federal investment in training, credentialing, equipment and logistics. Under this model, NDMS medical response teams would become part of the local surge capacity during a local emergency but would be federalized at other times. However, in practice the local DMATs might not mobilize for local emergencies because the team members are already employed in providing emergency medical services in the local area. This offers other potential application of the resources (e.g., making their cache available to an incoming DMAT to allow them to deploy more rapidly). The idea of dual federal-state status warrants further discussions with other stakeholders (including the states, DMAT commanders and team members, regional emergency coordinators, and local jurisdictions) to evaluate its merit.

3.4.3 Response Team Recommendations by Functional Area

The recommendations in this section are largely centered on preparing NDMS for the broader spectrum of medical response challenges posed by the NPS. NDMS offers an excellent foundation for meeting these challenges. Its IFE model has proven capable of delivering highly qualified staff who work effectively as teams in disaster situations under austere conditions. State officials who evaluated federal response assets in the Katrina/Rita response gave NDMS the highest marks of any federal entity and recommended that all other federal medical assistance be packaged in teams similar to NDMS DMATs.

These recommendations are intended to build on NDMS's strengths and the proven excellence of the DMATs model. Following the Katrina/Rita response the White House recommended that "HHS should organize, train, equip, and roster medical and public health professionals in preconfigured and deployable teams" for federal disaster response. NDMS is HHS's center of excellence for forming, training, equipping, and managing deployable medical response teams.

3.4.3.1 General Capability

Recommendation 3.1. NDMS headquarters, together with ASPR logistics, should become HHS's center of excellence for the management of pre-packaged civilian federal medical response team capabilities. NDMS headquarters must be capable of developing response doctrine and training, acquiring and managing equipment and supplies, providing logistical and travel support for deployed personnel, recruiting and mobilizing intermittent federal employees and other HHS staff resources, maintaining certification records and status information for medical professionals, and providing all required resources management support.

Recommendation 3.2: A significant percentage of DMATs and NDMS strike teams should be prepared to deploy and commence operations within 24-36 hours of notification. Historically DMATs have taken about 36 or more hours to deploy and commence operations for short-notice events. The NPS catastrophic incidents will require a much faster national response, which will require new logistical concepts for NDMS medical response teams as discussed in Section 3.9.9, Medical Logistics. Teams should be provided a mission capability to alert and report to team collection points for movement within 12 hours post activation decision and notification; with operational capability established on scene within 24 to 36 hours.

Recommendation 3.3: DMATs should be trained and equipped to operate in close coordination with Expeditionary Medical Support units (EMEDS). Consideration should be given to standardizing shelters, logistical systems, storage, and transportation to maximize coordination between NDMS teams and EMEDS. These units operate under standard USAF

protocols and doctrine, and combined training and cooperation will be helpful in preparing for any truly large-scale disasters in which extensive DoD medical support is required. In addition, EMEDS assets and capability should be considered in planning to meet the goal of deploying DMATs within 12 hours of notification.

Recommendation 3.4: DMATs should conduct joint exercises with potential supporting DoD components, to include NG. Joint exercises will help pinpoint any deficiencies in command, control, transportation, logistics and coordination between civilian and DoD medical assets.

Recommendation 3.5. Pursue the feasibility of dual federal-state status with stakeholders; determine impact for local, state, and NDMS capabilities.

3.4.3.2 Triage/Pre-Hospital Care

Under some NPS scenarios, NDMS medical response teams may face significantly increased numbers of patients requiring triage and pre-hospital care. One approach to meeting this demand is simply to increase the number of teams. However, there is some potential for automation to increase labor productivity in triage and thereby reduce the requirements for on-site medical personnel.

Recommendation 3.6: NDMS should consider conducting a pilot project to evaluate the feasibility of using telemedicine to assist in patient triage and movement planning. Remote screening could be in the form of videoconferencing or the patient interacting directly with the computer to provide information. With assistance from a minimally trained NDMS team member, physiologic monitoring devices such as blood pressure cuffs, pulse oximeters and e-stethoscopes and e-otoscopes could provide the remote screener with information. The teleconsultant could decide remotely on the next step for the patient. The patient's EMR could be initiated by either the local or remote person.

Recommendation 3.7: NDMS should consider a pilot to test self-service triage concepts. Another type of remote screening has only the patient interacting with a computer. The patient is led through a series of screening questions. Based on the patient's responses, the patient's status is prioritized.

It is important to conduct small pilot studies first as this is an area where technology exists, but the efficacy has not been conclusively proven. Before investing heavily in such technology, further study needs to be done to investigate how patients will respond during stressful situations.

3.4.3.3 Mass Prophylaxis

Recommendation 3.8: ASPR should continue to plan for the provision of prophylaxis as part of delivering disaster medical care. However, MITRE recommends that mass prophylaxis not be considered a primary mission for NDMS medical response teams. DMATs immunized over 70,000 patients during their encounters following hurricanes Katrina and Rita and immunizations such as these do have the potential to contribute to the avoidance of post-disaster disease outbreaks that could be reasonably expected. However, NDMS medical staff are largely overqualified to deliver mass prophylaxis, and transporting NDMS staff long distances to provide prophylaxis at remote sites is not economically efficient. Accordingly, MITRE recommends that ASPR work with communities to plan their mass prophylaxis

campaigns based on the use of local resources to provide immunizations, inoculations, or other forms of pharmaceutical dosing. In the same vein, NPRTs, and to a lesser extent NNRTs, currently have roles associated with mass prophylaxis. MITRE suggests that ASPR re-evaluate these roles and determine whether NDMS is the appropriate home for mass prophylaxis programs; however, regardless of the programs' organizational affiliation within HHS, NDMS would be the appropriate entity to maintain rosters and manage mobilization for NPRTs and NNRTs to support such a program if required.

3.4.3.4 Patient Decontamination

Recommendation 3.9: NDMS should re-evaluate the appropriate role for NDMS response teams in patient decontamination. When deployed for CBRN events, NDMS response teams must be able to address issues regarding the definitive decontamination for patients at DMAT sites, and NDMS should ensure that training and supplies are adequate to address this need**.** However, there are currently a handful of response teams, the National Medical Response Teams (NMRT) that are trained and equipped to conduct gross field decontamination. These teams are much more expensive to maintain than the standard DMATs due to their specialized cache and training requirements. In addition, the NMRT rosters often overlap with those of co-located DMATs and this has caused some to question whether the co-located NRMTs and DMATs can exist as independent resources if needed simultaneously. Finally, the NMRTs take longer to prepare for deployment than DMATs and many people interviewed felt that they worked best when used as a pre-deployed asset. During our analysis, it was determined that DoD (through its mission to provide CBRN consequence management in support of civil authorities), as well as many states and local governments, have resources for conducting gross field decontamination. NDMS may not need to invest in this capability if it is determined, after a more thorough inventory of state and local resources and after discussions and joint exercises with DoD elements, that others can provide this capability.

3.4.3.5 General Emergency Medical Care

Recommendation 3.10: NDMS may need to support a higher volume of general emergency medical care under the catastrophic incident scenarios in the NPS. DMATs excel at this function, so any increase in capacity would require either expanding the number or size of DMATs. The considerations to be weighed in deciding whether to expand the number or size of DMATs are discussed further in the context of the medical response planning function. ASPR needs to consider the tradeoffs between increasing local surge capacity versus federal surge capacity in determining whether to invest in forming and equipping additional DMATs.

3.4.3.6 Specialty Emergency Medical Care

Various NPS scenarios create intense peak demands for specialty emergency care. Some examples of specialty emergency medical care include emergency (trauma) surgery, burn care, crush (orthopedic, vascular) injury care, pediatric medical and surgical intervention, and eye care. Ordinarily specialized treatment is best provided at specialized units within hospitals, or by specialty hospitals. However, MITRE has found that specialty bed availability and patient evacuation throughput may be insufficient in some scenarios.

Recommendation 3.11: ASPR should address the need for additional specialty capabilities for trauma surgery, respiratory therapy, and eye care. Various medical planning exercises

have pointed to significant shortages of specialists for some of the catastrophic incident scenarios for these specialties. The shortfalls should be analyzed in joint exercises, and each organization should coordinate with the others in planning an overall national response. The first priority should be to stabilize patients and transport them away from the disaster site. However, if patient evacuation resources might be overwhelmed, it may be necessary to create and equip new teams or provide specialist augmentation to provide this specialty care near the incident sites. Because this could be costly, these capabilities should only be acquired if exercises and simulations confirm a need that cannot be met using state or local facilities or through patient evacuation.

Recommendation 3.12: NDMS should assess the need for additional mobile medical assets to support specialty emergency medical care teams consistent with overall ASPR plans for national medical surge capacity. As outlined further in Section 3.9.9.4, Mobile Medical Assets, specialty teams may be required to come to disaster areas to provide specialized emergency care. These teams need access to appropriate facilities which may need to be provided in the form of mobile medical assets. These include additional surgical units with operating theaters, mobile intensive care units, step-down units, burn beds, and respiratory care units. Again, these capabilities should only be acquired if exercises and simulations confirm a need that cannot be met using state or local facilities or through patient evacuation.

3.4.3.7 Patient Evacuation Preparation

Recommendation 3.13: NDMS should consider creating specialized teams to coordinate and facilitate patient movement. NDMS needs to improve its capability for processing patients into the patient evacuation function. This topic is addressed in detail in Section 4, Patient Evacuation.

3.4.3.8 Psychological Support

Recommendation 3.14: NDMS should pilot the use of telemedicine for psychological support for responders and patients. Psychological support for responders, patients, and their families will take on new importance given the likely significant psychological component of catastrophic incidents resulting from terrorism. Using videoconferencing and diagnostic tools adopted for telemedicine, mental health professionals can provide treatment remotely without consuming valuable space, food, and water at facilities near disaster sites.

3.4.3.9 Medical Shelter

Recommendation 3.15: ASPR should enhance its ability to provide medical shelter through the Federal Medical Station (FMS) program. Shelter as used here includes primary care and basic medical support for special needs patients and other patients requiring minimal levels of ongoing care and/or quarantine. FMSs should ordinarily be staffed by PHS Commissioned Corps members, local members of the Medical Reserve Corps, or other state and local healthcare staff resources. MITRE recommends that FMS teams be identified and mobilized using the same management processes and protocols as NDMS teams.

Recommendation 3.16: The FMSs should have full-scale logistical support capabilities attached to each unit. Each FMS should be readily deployable with all required supplies to operate self sufficiently for at least 72 hours, including sufficient food, water and supplies for

both staff and patients. These capabilities may be provided by contract resources at ASPR's discretion.

Recommendation 3.17: One FMS should be designated and specially configured to provide palliative care. In several scenarios, thousands of patients will be fatally injured with no chance of recovery. There is no need for these patients to compete with others for limited transportation resources to move them out of the area, and there is a real need for compassionate care and pain management for these patients, as well as for assistance to their families. ASPR should consult with experts in palliative care and the hospice function to devise the concept of operations for this specialized shelter.

3.4.4 Headquarters and Regional Functions in Support of Medical Response Teams

The ability of response teams to execute the response capabilities discussed so far in turn depends on planning and management capabilities resident in headquarters or regional support structures, including the following:

- **Medical Planning.** The process which encompasses all aspects of federal medical support for Incidents of National Significance and Presidentially declared disasters. Medical planning provides guidance to medical support personnel operating at all levels with the primary focus of timely provision of medical capabilities to respond to any homeland defense, emergency preparedness, or civil support contingencies.
- **Medical Intelligence.** That category of intelligence resulting from collection, evaluation, analysis, and interpretation of medical, bio-scientific, and environmental information that is of interest to strategic planning and to medical planning and operations for the protection of public health.
- **Medical Incident Management.** The exercise of authority and direction by a properly designated medical coordinator in the accomplishment of the mission and development of a common operating picture. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities and procedures employed by the medical coordinator in planning, directing, coordinating, and controlling medical operations.
- **Medical Surge Management.** In response to notification of mass casualty incident, the ability to provide management and coordination of federally-owned medical surge operations and assist other agencies as directed.
- **Medical Information Management.** The capability to manage public health and patient care data to meet management needs including providing appropriate patient care, ensuring continuity of care, and rapidly identifying emerging public health threats.
- **Medical Responder Recruiting, Training, and Certification.** The activities required to maintain a sufficiently large pool of appropriately certified medical professionals available to meet medical surge requirements.
- **Medical Response Research and Development.** Health sciences basic and applied research (conducted by universities, "think tanks," academic centers, and HHS agencies such as the Administration for Healthcare Research and Quality (AHRQ), the Centers for Disease Control (CDC), and the Biomedical Advanced Research and Development

Authority (BARDA) leading to the fielding of new or improved capabilities by NDMS and its partners.

- **Medical Resources Management.** The ability to manage funds and other resources necessary to provide the professional services, materials, travel services, and other ancillary services needed to support medical surge requirements.
- **Medical Logistics.** The science of planning and carrying out the movement and maintenance of medical forces. In the NDMS arena this is primarily in the provision of, movement, distribution and disposition of materiel, vehicles, and mobile medical assets.

3.4.4.1 Medical Intelligence

Recommendation 3.18: HHS (including CDC), and DoD (including the National Guard) should assure the interoperability of their medical intelligence systems for public health protection and force protection. Best practices should be shared across agencies and adopted more widely, as appropriate.

3.4.4.2 Medical Planning

Recommendation 3.19: ASPR should systematically plan to augment local medical surge capability in the most appropriate manner given the particular disaster scenario. To accomplish this, ASPR must develop regional response plans through its Regional Emergency Coordinators working with state and local public health and emergency management officials, as well as private sector representatives – especially medical providers. For the high energy events, these plans shall include templates for Requests for Federal Assistance (RFA) for DMATs and other NDMS response teams, including probable deployment locations and missions. These RFA templates should take into account available local, state and regional medical surge capacity and surge plans. For the largest scale incidents, RFA templates should also be available to identify potential DoD civil support that may be desired. RFA templates can then be updated to provide incident specific language, submitted, and acted on appropriately by the supporting Partner.

Recommendation 3.20: Regional medical response plans should be tested and refined in joint exercises involving local, state, federal, and private sector entities. Federal participants should include NORTHCOM and NG, as well as ESF #8 (ASPR) including NDMS. Lessons learned should be incorporated into the plans of all parties and shared across agencies and regions.

Recommendation 3.21: To support this planning, ASPR must acquire, create, or adopt more sophisticated planning and modeling tools. ASPR needs to equip state, local, and regional planners with sophisticated models and templates for medical planning. Such tools may be adapted from DoD, DHS, academic sources, or possibly other countries. Some tools may need to be built specifically to meet ASPR's unusual intergovernmental requirements. The planning and simulation tools should include enhanced models that enable, but are not limited to:

- Casualty estimation
- Medical staff planning
- Medical materials planning
- Analysis of alternative response strategies

- Human responses to public announcements/directions.

Recommendations regarding modeling and simulation are addressed further in Appendix A.

3.4.4.3 Medical Incident Management

Catastrophic incidents will demand vastly improved situation awareness, command, control, and communications. Many teams of local, metropolitan area, regional, National Guard (normally operating under state control), regular military, NDMS, and other federal medical professionals will be setting up and operating within overlapping areas on short notice following a catastrophic event. There will be significant competition for security, transportation, logistics, and patient movement resources that will require central coordination. The importance of unified reporting, coordination, integrated procedures, and a robust incident management system cannot be overstressed.

Recommendation 3.22: ASPR should continue to define the concept of operations for ESF #8, to include more detailed responsibilities, and develop a concept for information sharing and how coordination with partners will be addressed. The process for HHS oversight, command and control, and coordination must be developed and documented so that all partners are aware of their responsibilities and how information will flow.

For example, DoD assets are so capable and potentially vital, and the cost of duplicating them so high, that they cannot be ignored or discounted in planning for catastrophic incidents. ASPR should use the aforementioned planning and other tools to provide DoD with estimates of what may be requested to support ESF #8. These estimates should include both the capabilities and capacity envisioned, with appropriate timelines. DoD and HHS must negotiate interagency agreements that result in firm commitments to mutually conduct the planning, training, system development, and operational exercises needed to achieve integrated federal planning and operational responses under ESF #8, including both non-DoD assets such as NDMS medical response teams and DoD assets such as EMEDS.

Similarly, the capabilities and capacity of NG forces should be factored into regional plans for ESF #8 with consideration given to integrating and using them based on the operational support status – e.g., Title 32, State Active Status, Emergency Medical Assistance Compact (EMAC), or when federalized under Title 10. Finally, all partners should fully participate in joint planning, exercises, and system interoperability activities with other elements of the ESF #8 community.

Recommendation 3.23: ASPR should conduct exercises involving all the ESF #8 supporting agencies and local jurisdictions to test and refine medical command and control processes and systems. HHS is required to exercise command authority over all the federal partners except DoD, and in the case of DoD, HHS must provide overall coordination. The processes and systems for providing HHS oversight, command, control, and coordination should be tested in comprehensive exercises which will provide the additional benefit of testing medical response plans and doctrine (including the NDMS medical response). Lessons learned should be used to strengthen the ESF #8 processes and systems at HHS and the supporting agencies, and to refine the federal-state-local coordination process.

Recommendation 3.24: HHS and its partners should implement standard systems and processes for readiness reporting, situation reporting, and public health risk assessment. These systems should contribute seamlessly to developing a common operating picture to guide

the decision-making process by the incident command structure. Any HHS Incident Management COP should be coordinated with DHS to ensure consistency with their COP guidance and direction.

3.4.4.4 Medical Surge Management

Medical surge management consists of two phases: mobilization and deployment. Mobilization of NDMS assets is managed by the NDMS Operations Support Center (OSC), which maintains team rosters and manages team mobilization through a process that includes alerts, activation, and deployment orders. Operations during deployment are managed through the Incident Response Coordination Team (IRCT) that is mobilized by ASPR. The entire process is monitored and directed from HHS Headquarters and the Secretary's Operations Center (SOC), which has overall responsibility for HHS operational execution.

Recommendation 3.25: MITRE recommends that ASPR develop a strategy and concept of operations for the deployment of HHS (especially ASPR-owned) assets and more robust and integrated internal operations management capabilities.

ASPR has grown substantially in size and responsibility in a short period of time. As such, work must continue to integrate the "puzzle pieces" into a more cohesive whole. For example, the OSC has the systems, processes, and staff needed to maintain team rosters and credentialing information and manage the mobilization process, under the direction of the SOC. To clarify the reporting relationship, ASPR should consider the NDMS OSC an extension of the SOC, but this does not imply a need to co-locate the OSC with the SOC unless current space challenges can be overcome.

Recommendation 3.26: Another example of an opportunity to better integrate NDMS capabilities into ASPR is in the management of "other health professionals" and volunteers. Historically, public health agencies are deluged with offers of help from volunteers who include many qualified healthcare professionals. Volunteers are much less effective in rapid mobilization situations compared to pre-configured and trained teams ready to commence operations as a unit. Some states have already established volunteer lists and credentialing processes, but even these states would have difficulty rapidly integrating out-of-state volunteers into their response due to credentialing and licensing issues. ASPR has begun to develop a national process for using volunteers and this should continue. However, volunteers in categories such as nurses, respiratory therapists, physical therapists, and other specialties may be in sufficient demand as to warrant consideration for hiring as intermittent federal employees in advance of emergencies. In fact, ASPR has already begun to recruit respiratory therapists. NDMS already has a core capability in hiring, managing and deploying intermittent federal employees. ASPR should consider allowing NDMS to manage this function. In this same vein, ASPR and NDMS should revisit the concept of specialty teams like the National Nurses Response Teams. In many cases, though deemed a "team", the members are deployed as individuals to augment other teams. NDMS should review whether the team model is best for all people deployed as individuals, including nurses, respiratory therapists, etc.

3.4.4.5 Medical Information Management

Recommendation 3.27: NDMS should continue to pursue adoption of an Electronic Patient Record system for all NDMS response teams. Additional recommendations for medical

information management are included in Section 8, Integrating Information Technology Support to Response Operations.

Recommendation 3.28: NDMS should begin a pilot program to test Telemedicine concepts for disaster medicine, as discussed in Section 8, Telemedicine.

3.4.4.6 Medical Responder Recruiting, Training, and Certifications

As noted earlier, NDMS is a very cost effective program because it leverages the training and credentials of healthcare practitioners in emergency medical care. NDMS's reputation is based on the high level of professional competence of its team members, as well as their formation in teams. These strengths need to be maintained at NDMS, and extended to other team-based medical response activities across HHS.

Recommendation 3.29: MITRE recommends that HHS standardize emergency medical care certification requirements across all of HHS, and develop model standards for states and localities. Certification should include professional accreditations as appropriate, plus training in incident management practices.

Recommendation 3.30: NDMS training should include joint exercises with Partner provided teams. NDMS staff at all levels, including headquarters, regions, team commanders, and team members, should be comfortable interacting with DoD, NG , state/local staff to perform their respective roles. Joint exercises will contribute immeasurably to readiness for major CBRN incidents.

Recommendation 3.31: NDMS should intensify the focus on CBRN training for NDMS medical response teams. Although DoD may provide the bulk of the capability and capacity for chemical, radiological, and nuclear incidents, NDMS teams must be prepared to play their role in the responses to these incidents. Training programs should leverage existing training resources developed by the military health services and other agencies, as appropriate. The scope of this training will depend on the role defined for the teams that emerge from joint planning and exercise and may require additional funding.

3.4.4.7 Medical Response Research and Development

Recommendation 3.32: ASPR should strive to become a center of excellence for the practice of disaster medicine. ASPR should leverage other HHS programs (e.g., NIH, AHRQ, HRSA, CDC) to stimulate research and development on emergency medicine and disaster response. The establishment of the new Center for Emergency Care in ASPR is a promising start in this direction. Areas for research in disaster medicine should include risk mitigation and casualty avoidance strategies, triage techniques, community planning, treatment protocols, telemedicine, and related fields.

Recommendation 3.33: To maximize the effectiveness of its R&D program, ASPR should strive to involve a broad array of partners. These should include academic institutions, other government agencies, think tanks, healthcare facilities, and corporate R&D partners. ASPR should also make a concerted effort to leverage the R&D programs at DoD, in areas such as medical planning, command and control, and modeling and simulation. ASPR's recent moves to place liaison staff at key partner agencies should help stimulate the flow of ideas across agencies.

3.4.4.8 Medical Resource Management

This section discusses resource management in the context of requirements to provide the organizational infrastructure and provide administrative, financial, and other operational resources and tools that enable medical response capabilities of the NDMS teams.

As a new organization within HHS, OPEO/NDMS and its parent ASPR have faced challenges in adapting HHS standard procedures to NDMS requirements. OPEO/NDMS is a transaction-heavy organization. FEMA recorded nearly 50,000 financial transactions associated with NDMS during the period 2003-2006. Its need to maintain a "readiness" state and be able to deploy and manage under unknowable circumstances requires maximum precision and flexibility. Its geographically disbursed team structure, predominant reliance on intermittent federal employees, and specialized cache equipment and inventory requirements are fundamental to the NDMS business model.

Flexibility, advance planning and adaptation are required in order to support NDMS's business model. It is evident that some HHS's policies and standard procedures, especially when coupled with short staff and high workloads, make it difficult for the Office of the Assistant Secretary for Administration and Management (ASAM) to meet NDMS requirements. More importantly, strict adherence to "standard" procurement procedures in times of emergency is impractical. HHS must adhere to the Federal Acquisition Regulations (FAR), which are intended to assure provision of quality products, compliant with federal and industry standards, at "best price" with fair access by suppliers capable of meeting federal requirements. Competitive bidding and detailed purchasing justifications are fundamental underpinnings for federal procurements, except under exceptional circumstances. As such, acquisitions take time to complete through the documentation and approval process. But some federal procurement standards adopted by HHS may not be directly applicable to the NDMS and ASPR missions. An example is the Section 508 standards, many of which may not apply to NDMS, due to the stringent team "fitness for duty" standards. Waivers to these standards might simplify some procurement procedures. During emergencies, rapid support for emergency procurement actions is critically important.

HHS has begun to make some important accommodations to NDMS's business requirements. Development, promulgation, and maintenance of standardized logistics lists has facilitated purchasing processes since purchasing against standard items lists is more readily authorized. Similarly, use of standing order agreements and outsourced equipment purchasing and maintenance to contractors supports NDMS's business model. Information systems tied to these purchasing agreements can streamline acquisition processes.

It is also recognized that NDMS staff and teams require additional training to ensure acceptable levels of knowledge about departmental purchasing and financial management protocols. Where documentation and justifications are required, NDMS must ensure that they provide documentation that is understandable by those not familiar with NDMS and its process.

NDMS is conscientious about managing the resources for which they are responsible. Teams pay strict attention to the management and maintenance of their equipment and medical supply caches, because they are aware that lives depend on them during emergencies. HHS could reinforce this responsible valuation of resource caches by supporting NDMS with the accurate data they request from purchasing and financial systems, especially from Purchase Request Information System (PRISM) and Unified Financial Management System (UFMS).

Since team travel is an essential business function of NDMS, it is essential that the travel support contractors provide services appropriate to the needs of NDMS medical teams. Concerns regarding information systems, hours of access, types of payment options and other related capabilities expressed by NDMS teams should receive close scrutiny to assess how these could be resolved.

3.4.4.8.1 General Recommendations

OPEO/NDMS operates within the overall operational context of ASPR. Its specific logistics and operational support requirements are provided by OPEO, but approval for many of its purchasing and budgetary functions rest within ASPR and other agencies within the Office of the HHS Secretary, specifically with ASAM. Thus, collaboration among all of these organizations and operational units is essential to meet NDMS needs. ASPR should ensure that OEPO/NDMS is actively and continually represented on "business owner" requirements teams and user groups associated with planning and development of HHS-wide systems supporting:

- Human Resources/Personnel Management
- Travel Management
- Acquisition/Purchasing Management
- Budget and Financial Management.

Administrative Management capabilities designated for use by OPEO/NDMS should ensure cross-integration of financial management data with related HR, salary, travel, acquisition data, and associated documentation to minimize rework or manual entry.

3.4.4.8.2 Travel Management

Transporting a team presents unique travel arrangement requirements that differ from those that meet individual travel requirements. Under FEMA, NDMS used *National Travel* as their prime travel contractor. Under FEMA's travel contractor, the process for planning and managing travel was efficient and supported team travel effectively. The system allowed for direct interaction with the group travel contractor. Team travel expenses were charged against a government travel authority (GTA) card. Funds were placed on the card as needed to enable charges against the card. This travel management process and the related expense management system optimally supported NDMS teams' unique requirements for rapid individual and group travel in emergencies.

HHS has implemented an eTravel solution through contracts with Omega Travel and Northrop Grumman. Omega Worldwide Travel provides Travel Management Center services for the entire department. Their services include arranging and booking travel for individuals and groups; providing travel policy support; providing customer service; reconciling centrally billed accounts; and providing management reports.

Northrop Grumman provides travel voucher and authorization support through its eTravel solution, GovTrip.com. According to the GovTrip website, "GovTrip is a web-based, self-service online travel reservation with an automated booking process. GovTrip can interface with accounting and disbursing systems, giving GovTrip the capacity to determine real-time funds availability". Reportedly the system has the capability to obligate and de-obligate funds

electronically. The system also has the ability to route reimbursement payment electronically to the traveler's personal savings or checking account.

Though GovTrip reportedly supports group travel, its predominant model supports individual travel. Reportedly, the authorization work flow of the system has severe limitations in that the chain of approvals *stops* if one of the approval authorities is unavailable. This causes backups when trying to manage a group travel setup. Under time-sensitive travel situations, some travelers have by-passed the system and booked travel directly through Omega. They have then submitted the "premium rate" travel with their travel voucher expense close-out.

HHS used ESI, a contractor specializing in Event Management, to manage travel arrangements for the Spring 2007 NDMS Conference. ESI served as an intermediary between the travelers and the HHS travel contractor, Omega Travel. ESI serves as a medium to pick up most expenses (all except meals and incidental expenses) for travelers during an incident or event. For group travel, the ESI process relies on the NDMS team to develop and submit a spreadsheet with the required travel details for each team member. This spreadsheet is then submitted to ESI → ESI sends the spreadsheet to Omega → Omega develops the itineraries and sends them to ESI → ESI sends them to NDMS → NDMS sends them to the team. Each travel booking is arranged individually, and the associated expenses are charged against individual government credit cards assigned to team members and staff (see further discussion below).

The Spring 2007 NDMS Conference, for which ESI provided traveler support, was attended by 1,400 participants. After the event, many travelers and NDMS staff expressed concern that their expenses were higher and travel arrangements less efficient than under previous travel management services. Instances of higher cost and multiple stopover travel plans were cited. The service was described as cumbersome and inefficient. Payment was still incomplete in mid-summer for some travel arrangements for the event.

HHS plans to use ESI to provide surge support for travel management during the 2007 hurricane season. Based on their experience with ESI, OPEO/NDMS staff are concerned that the poor performance of ESI may compromise critical travel services in an emergency. Users who have used the ESI travel support complain that ESI appears to have minimal staffing, especially after mid-day on Friday and on weekends. While they represent their ability to staff up for emergencies, this "as needed" staff is not likely to have ongoing knowledge of the NDMS team's "standing" requirements, special site situation requirements, and special adaptation necessary to get the team "out the door". Thus, there is concern within OPEO/NDMS that this travel system will collapse under the travel demands of a major disaster.

NDMS team members are required to have a government travel credit card. This is a condition on the deployment checklist -- a person is not deployable if that person does not have a government travel card. (Reportedly, there have been limited exemptions granted in an emergency, wherein use of a personal card was authorized and the government reimbursed the traveler through the travel voucher reconciliation process.) Some NDMS team members resist use of the cards because they have to pay the expenses on the card personally and then secure federal reimbursement. But federal reimbursement is frequently delayed, resulting in additional burden and cost to the traveler. NDMS teams have also reported that the use of personal travel cards has disadvantages during group travel situations. Examples include:

- Loss of team-oriented travel coordination -- Team members may need to convene at a specific location for transport to a site but some members may have encountered

problems reaching the convening site. This information is not known by the team coordinators under individualized booking arrangements.

- More complex site registration - A single person registering a team against a single credit card can be faster than having each member individually register with a personal travel card.
- Managing hotel room block bookings: A booking for a block of rooms may need to be held or extended in order to reserve the rooms for an incoming team. A single point of contact for a block of rooms can more easily manage reservations of blocks of rooms. (It was noted that the Incident Response Coordination Team [IRCT] can rent a block of rooms at a hotel. IRCTs now include purchase card holders.)
- Less direct billing oversight: On-the-spot oversight of a single bill by a team official makes it easier to challenge unapproved charges than is possible through retroactive checking of many separate reimbursement requests.

Recommended Improvements in Travel Management

- **Recommendation 3.34**: **ASPR should work with OPEO/NDMS and the Department's travel management office to review efficacy of the travel contractors in meeting the emergency deployment needs of NDMS teams**. A key focus should be on the capability to manage the many aspects of efficient group travel under emergency conditions with very short notice at any time of the day. Contractor capability should include experienced, knowledgeable staff capable of meeting high volume travel planning at night and on weekends as well as during regular business hours. This is especially important since most NDMS team members are intermittent federal employees who are likely to be making travel arrangements outside of normal business hours.
- **Recommendation 3.35: Information technology support for online travel management** should enable:
  - Authorization workflow that has alternate flows and alert capabilities for non-available authorizers. Management users of the systems should be mandated to list alternate authorizers for all approval processes assigned to them;
  - Management of group orders and oversight by a group leader. This is especially important where hotel room bookings are being managed by a team Logistics Officer.
- **Recommendation 3.36: Consideration should be given to the use of GTA cards which are funded at the time of an incident**. Such a card could be controlled by the team Logistics Officer. Oversight of hotel bills and related team purchases could more easily be managed using such a payment system.

3.4.4.8.3 Procurement

Effective maintenance and operation of NDMS medical response teams require procurement management capability that addresses three phases of team operation:

- Pre-Deployment: Resource establishment and maintenance -- ongoing/"standing" team
- Deployment: Event support including materiel replenishment
- Post Deployment: Post event support including cache restabilization.

Before transferring back to the Department of Health and Human Services (HHS), FEMA's Response Services Branch managed NDMS's purchasing requirements and fiscal matters. NDMS initiated purchase requests using the FEMA Form 40-1, which is a paper-based multi-part form. Purchasing delays were frequent. Documentation of procurements and actual costs were often incomplete, since it was not uncommon for these forms to be lost, requiring repeated orders or reconstruction of procurement documentation. To address these problems, NDMS proposed to install Oracle's Supply Chain software to manage its procurement activities. FEMA rejected this plan, but authorized NDMS to contract out the design and development of a document management workflow system. The resulting Resource Management System (RMS), enabled NDMS headquarters to manage their financial and supply data and related documentation. The NDMS RMS system was transferred to HHS as part of the operational transfer from FEMA in January, 2007.

Initial acquisition requests, whether from headquarters staff or NDMS teams at remote locations, are entered into required electronic forms through the RMS online system. The designated NDMS reviewer(s) checks the request against available funds, budgets, and spending priorities and enters results in RMS. The request is printed and manually submitted to OPEO. OPEO validates the request against ASPR, HHS and GSA standards, budgetary priorities and spending policies. Purchases below $3,000 may be made by NDMS staff and team members issued approved government purchase cards. Requests from $3,000 to $49,000 require OPEO approval. ASPR approval is required for requests above $50,000. HHS should verify whether or not cards need to be issued to replace those previously provided by FEMA.

Once approved, the purchase request is processed by the Program Support Center (PSC) within the Office of the Assistant Secretary for Administration and Management (ASAM). OPEO/NDMS staff expressed concern that ASPR-approved purchase orders lose their identity and are hard to track when they reach ASAM. Until the order is completed, OPEO/NDMS has little information about its status. To ensure completion of purchase requests, OPEO/NDMS has set up a system to monitor procurement actions within RMS. Their flagging/alerts process begins at a 3 day point after submission of a purchase request. ASPR's OPEO initially tracked the purchase-related data via spreadsheets, and flagged follow-up after one week. RMS has recently been enhanced to support OPEO's purchase documentation tracking needs. Once a contract is awarded, ASAM notifies the NDMS Project Officer (PO) of the procurement action. The PO enters the information into RMS.

There appear to be no standards for completion of purchasing action above the ASPR level. Agreement on timelines and processes for monitoring progress on completion of purchases is vital to maintaining ongoing the readiness stance for NDMS teams. Use of automated workflow and tracking alert systems within the acquisition process would be helpful

OPEO/NDMS relies on HHS to provide receiving, trans-shipping and warehousing services for NDMS initial team administrative inventory. New purchases received at the Department's warehouse in Gaithersburg, Maryland are tagged and placed in the accountable property inventory. This is a key benefit of using the Gaithersburg center. The center also packages and reships supply items to teams. While it has never been used this way, it could also serve as a major asset deployment depot during emergencies.

Although RMS is designed to track orders and spending, it is not tied to HHS databases that manage actual financial transactions. As a result, it is not uncommon for the recorded balance in

RMS to be different from actual available funds. The existence of multiple spending authorities against NDMS accounts results in gaps in documentation of purchases within the RMS system. When officials sign form 393s that commits funds, they do not have visibility into the actual available funds, and thus may approve spending above account limits. Approval of spending against the OPEO/NDMS budget by the NDMS Director is inconsistently managed. In some instances, an order to fill out an NDMS team cache might be approved by ASPR/OPEO without approval by the NDMS Director. Purchases can be made by ASPR/OPEO Logistics on behalf of the team without going directly to the team for authorization to spend against their budget. Other organizations within ASPR can make purchases against the NDMS Common Accounting Number (CAN) without making entries directly into the RMS system. Sometimes costs for large purchases are taken out of the NDMS headquarters program budget; other times costs may be debited against team accounts; or costs may be shared by team and program budgets.

Recommended Improvements for Procurement

- **Recommendation 3.37: NDMS emergency preparedness and response processes may present unique requirements to existing purchasing and financial tracking rule-sets built into PRISM and UFMS**. ASPR should arrange with ASAM to meet managers of PRISM and UFMS to evaluate NDMS business requirements related to these two enterprise systems. A key consideration should be how a minimum set of data can most efficiently be transmitted to and from the NDMS RMS system to maintain accurate budget and account balances.
- **Recommendation 3.38: OPEO/NDMS logistics and operations staff should be trained on PRISM and UFMS to assure understanding of the capabilities and limits of these systems in relation to the NDMS operational processes and needs**.
- **Recommendation 3.39: Budget and capital investment planning requests submitted to the HHS by ASPR should include short and long-term information system requirements for OPEO/NDMS and its teams**. Such requests should include projected future changes in the scope and focus of NDMS and its teams in support of broader functions of ASPR and the Department under changing disaster major health management scenarios.
- **Recommendation 3.40: IT systems supporting OPEO/NDMS should incorporate work flow capabilities to facilitate rapid approval, authorization, tracking, receiving, payment processing**. NDMS should be actively involved in developing the work flow to assure that they work with the decentralized, intermittent federal staffing structure and processes of the NDMS teams. The 24/7 support needs of NDMS teams should be incorporated into Service Level Agreements (SLA) with ITSC.
- **Recommendation 3.41: The RMS system developed to support NDMS has served as an effective management tool for tracking documentation and budget records of NDMS teams and central office**. If HHS determines that NDMS and ASPR should be incorporated into departmental "enterprise applications" supporting related administrative functions, consideration should be given to how RMS and the enterprise systems could interoperate in order to enable the team-level requirements of NDMS.

3.4.4.8.4 Budget Development

When the NDMS operations component was transferred to HHS, a recommended 2007 budget was developed by FEMA and transferred to HHS, with associated resources. The budget was based on historic spending patterns of NDMS. The line-item structure of FEMA and the NDMS program structure were adapted by HHS to create the Fiscal Year (FY) 07 budget and spend plan. The budget team used a combination of the FEMA data, available historic documentation, team and program budget projections, and "expert knowledge" of NDMS management staff to develop the FY2007 spending plan and out-year budget projections. The FY2008 budget included some projections for additional expenses. Based on HHS budget guidance, the FY2009 budget was projected at "no increase" level. An alternative budget at a 2% decrease in spending was also developed, in accordance with HHS budget guidelines.

Teams submit their proposed spend plans annually through NDMS's RMS system, which includes a web-based interface. Each team budget is reviewed by a headquarters administrative review team. Individual team requests are incorporated into an overall NDMS spend plan, which is then adjusted based on expected funding levels for the fiscal year. Once OPEO/NDMS receives approval for its spending plan, approved funding levels are then allocated to the teams, which, in turn distribute the funds to their various budget categories consistent with their original spend plan. Some adjustment to projected team budgets is always expected since individual budget proposals are adjusted by ASPR and Departmental budget planning and final Congressional budget appropriation. OPEO is working with NDMS to ensure that allocated budgets will be established based on an approved spend plan.

OPEO/NDMS closely monitors budget, staff time management (see below), and spending by the NDMS teams. Teams submit projected monthly budget requests, one month in advance. The budgets must align with their annual budget projections, with some accommodation for unique spending requirements. These requests are reviewed by the NDMS administrative review team associated with that team. Once approved by the review team, requests are submitted for authorization. While team spending is closely managed, there are variable policies regarding other authorized spending against the teams' budgets.

Recommended Improvements of Budget Development

- **Recommendation 3.42: ASPR procurement processes and controls should be modified to assure that OPEO/NDMS has review and approval authority over procurements made on its behalf and that the information is transferred to RMS in a timely manner**.
- **Recommendation 3.43: Training: NDMS staff responsible for purchasing, budget, and or financial functions should be trained** on:
  - HHS policies and procedures for purchasing management including required adherence to Federal Acquisition Regulations (FAR) standards
  - Standard budget planning and funding cycles of HHS
  - NDMS should revise its spending cycles to align to the expectable purchasing authorization and execution timelines of the department.
- **Recommendation 3.44: ASPR should work with OPEO/NDMS and ASAM to ensure** that:

- Expedited purchasing processes appropriate to the emergency readiness and response requirements of NDMS
- Execution of purchase requests is completed in a timely and accurate manner
- Established agreements on timelines and processes for monitoring progress on executing purchases orders are in place since consistent and persistent status tracking and monitoring is essential to national health in an emergency
- Standardization of appropriate NDMS purchasing processes. (ASPR should support NDMS in examining options for Service Level Agreements (SLAs) with third party companies to manage some of its vital supplies and services. Where cache standardization is possible, a single supplier agreement might be feasible. ASPR should facilitate ASAM review of budget and contracting options appropriate to NDMS. Mechanisms for funding and scheduling of large-scale purchases, replacements due to inventory obsolescence, durable life replacement of event-purchased equipment. Special contracting mechanisms may be required to distribute spending across multiple fiscal years and balance operating vs. event funding).

- **Recommendation 3.45: ASPR and ASAM should examine the relative size and complexity of NDMS purchasing and financial transaction requirements and determine appropriate priority, staffing allocation, and other support functions commensurate with the scale of its operations**.

3.4.4.8.5 Time and Attendance

OPEO/NDMS manages projected payroll expenses by requiring teams to submit a projected payroll time and expenses one month in advance, as part of their monthly budget projections. Actual attendance is reported through the HHS Integrated Time and Attendance System (ITAS), which is a web-accessible system. Time and attendance for NDMS employees is managed through the ITAS. ITAS provides employees full capability to manage and report leave requests, actual hours worked. Supervisors view and approve leave requests and timecards for each employee. Supervisors may set up alternate reviewers in the system. The Timekeeper role enables entry of new employees or modifications to existing employee records, establishment of supervisory relationships, and entry of new or modified organizational units. The system provides reports appropriate to the user type.

The ITAS system presents a user-friendly interface to a logical set of time and attendance functions. The ITAS website provides download capability for training and information documents and presentations for all levels of users. It also includes access to the HHS "Guide to Timekeeping." All personnel (and associated classes of ITAS users) are required to adhere to documented departmental policies and procedures. The "HHS Guide to Timekeeping" encourages organizations to file documentation of their specific organizational policies and procedures along with the HHS guidelines. The ASAM PSC manages ITAS for the Department. NDMS reports that ITAS works well for their Time and Attendance purposes.

3.4.4.8.6 Information Technology Support for NDMS Medical Response Team Procurement, Budget Development and Financial Management

Information system (IT) support for procurement and financial management must enable an efficient, orderly, and timely management and traceability of purchases and related financial transactions. The IT systems supporting OPEO/NDMS must:

- Serve the needs of NDMS and be consistent with federal and departmental procurement systems, procedures, and purchasing standards
- Support NDMS and ASPR operational requirements under different deployment conditions
- Enable rapid response and scaling to accommodate event support in emergency conditions
- Enable tracking of event-related and post-event replenishment procurement
- Be capable of exchanging information with existing Department of Health and Human Services procurement and financial management systems
- Support the headquarters and decentralized team management structure of NDMS.

When the NDMS response component was part of FEMA, it funded the development of the RMS to support management of documentation related to purchases against budgeted funds for the NDMS teams. It enabled NDMS to maintain spending control within the larger FEMA and DHS purchasing and financial management systems. When the NDMS response component transferred to HHS, the RMS developer, Apprio Inc, entered into a small business sub-contractor agreement with Unisys, ASAM's prime contractor for information technology services. Thus, Apprio is continuing to manage ongoing maintenance and enhancement to the RMS application, enabling its adaptation to the changing administrative requirements of NDMS. The present agreement extends through 2008 with a potential for two one-year renewals.

RMS was built as an electronic document management system to scan, index, and track the status of purchase requests. RMS is a custom-built Java application with an Oracle back end. It is a web-based application that manages documentation of budget requests and authorizations, team account status, purchase requests, expenditures documentation including time sheet submissions. It assures web-accessible records and documentation of the budget, purchasing and basic financial information of NDMS. It has built-in validation rules that prevent completion of a purchase request that exceeds balance listed for the specified CAN amount. Each request must be associated with a specific budget line item. The requested purchase amount is automatically deducted from the account balance.

At HHS, OPEO/NDMS receives key information technology support through the office of the Assistant Secretary for Administration and Management (ASAM). ASAM/PSC has implemented the PRISM enterprise-wide to support purchasing for the Office of the Secretary and the HHS Operating Divisions. PSC also built and implemented the UFMS enterprise-wide, with fielding scheduled in October 2007. UFMS provides electronic financial management capabilities for the Office of the Secretary and other Operating Divisions of HHS. UFMS is built on Oracle Financials, an industry "best" commercial-off-the-shelf (COTS) application. The UFMS is the official source for transaction records against ASPR accounts.

RMS itself lacks some capabilities. For example, in the area of authorization sign-off, if no alternate signatory authorization has been set up, an order can be delayed. RMS has capability to manage delegation of authority in absence of primary authority, but it is not always used. For example, a key user has the option of setting up email alerts to multiple alternates to alert them to complete back up authorizations. Staff are being provided additional training on new and existing capabilities. Other limitations exist; some are being addressed under a schedule of ongoing maintenance enhancements. Most importantly, as noted above, presently there is no

direct information system interface between RMS and the key HHS enterprise data sources, PRISM and UFMS. Obligation numbers and amounts are transmitted from PRISM to NDMS. However, PRISM is unable to transmit the vendor and order details which NDMS requires for its full procurement tracking. Inability to access full and timely documentation from PRISM and UFMS results in RMS being out of synch with actual expenditures. The limited acquisition-related data received from PRISM requires manual record matching and data entry into RMS by NDMS staff. Salary costs are separately reported to OPEO/NDMS; the data must be manually entered into RMS. During staffing overload, data entry can lag significantly. While initially focused on the documentation management needs of NDMS, the RMS system was recently modified to enable OPEO to use RMS. Presently it lacks ad hoc reporting capability but a future improvement may include Crystal Reports capability.

Since OPEO/NDMS does not have direct access to UFMS data to reconcile its RMS financial data, the organization is unable to maintain current knowledge of its spending and available budget. RMS is being enhanced to show a record of the source of all funds deletions against the team budgets, including headquarters-originated transactions. Effectiveness of this capability will depend on provision of timely and accurate documentation to NDMS and on staff capacity to make the manual entries. RMS developers have proposed that NDMS receive a direct feed from UFMS in order to keep its own expenditure information current.

3.4.4.9 Medical Logistics

Recommendation 3.46: ASPR must intensify its focus on medical response team logistics, with an emphasis on rapid response capability. Logistical support is a crucial element of successful response team performance, and as such deserves special attention. Overall, MITRE's recommendations in this area include:

- Integration of ASPR/NDMS logistical plans with local medical surge planning, including pre-positioning of assets at trauma centers and potentially, acquisition of additional mobile medical assets
- Greater standardization and interchangeability of response team caches
- Adoption of appropriate life cycle management processes, consistent with the integrated logistics concept of operations, for all team assets
- Standardization of comparable logistics processes across all HHS medical response assets
- Enhanced procedures for retrograde movement and replenishment of caches.

Recommendation 3.47: ASPR should develop an Integrated National Medical Logistics Concept of Operations (ConOps) that takes into account the various elements of the national response. ASPR should consult with all ESF #8 supporting agencies, state and local partners, and relevant private sector organizations to formulate a comprehensive national medical logistics ConOps that is consistent with the national medical surge strategy.

This ConOps will need to take into account the primary role of local resources in responding to the immediate aftermath of a catastrophic incident, and the inherent difficulties of moving materials into a disaster area in less than 24 hours after the occurrence of the disaster. Accordingly, any material needed by federal teams within the first 24 hours would need to be pre-positioned within the disaster area.

In working with its partners to build the integrated national medical logistics ConOps, ASPR should work to:

- Establish templates for medical response logistics based on collective experience and best practices from which state and local authorities can build their own capabilities
- Assist state, local, tribal, territorial, and regional entities in tailoring templates to fit differing geographic sizes and population densities and to meet the specific local needs
- Ensure testing and evaluation of plans and templates in accordance with the National Exercise Program
- On a regular basis, establish a process to capture the needs and collect appropriate data from state and local participants necessary to assess readiness
- Leverage other medical logistics programs (such as the Strategic National Stockpile managed by CDC, and private sector pharmaceutical distribution assets)
- Work to embed requirements for collecting and using performance data and metrics as conditions for future public health preparedness grant funding.

Recommendation 3.48: ASPR logistics should formulate a NDMS Logistics ConOps that should be aligned to the National ConOps. The NDMS logistics ConOps should specifically address the unique requirements of NDMS for rapidly deploying its teams and, in particular, providing logistics resources within 24 hours following a disaster or catastrophic incident.

Numerous requirements must be considered in developing, testing, and refining the NDMS logistics ConOps. At least six *competing* goals must be balanced in optimizing the distribution of NDMS medical response teams and their caches of vehicles, equipment, and supplies. These goals are:

- **Rapid response capability.** For teams to arrive at a disaster site in time to provide urgently needed care, teams and their caches should be located as close to likely disaster sites as possible.
- **Safety of personnel and materials.** To prevent the destruction or degradation of capabilities when disasters strike, teams and their material should be located at a safe distance from potential disaster areas.
- **Unit preparedness**. To maintain a high state of readiness, teams should train with and maintain their own caches, which should be located near the team.
- **Cost effective storage and cache replenishment.** To reduce storage costs and promote efficient maintenance of perishable items, caches should be stored in central locations.
- **Flexibility.** To provide flexibility in assigning teams and materials, caches should be standardized so that any team can use any cache.
- **Adaptation to local conditions.** To respond to specific regional hazards (e.g., earthquakes versus hurricanes) caches should be regionally or locally tailored.

The exact balance to be struck among these competing goals needs to be determined based on the integrated strategy for medical response that includes local, metropolitan area, state, regional, and federal elements. MITRE's suggestions for balancing these goals in the context of

equipment cache management, pharmaceutical cache management, and fleet management are provided later in this section.

Recommendation 3.49: ASPR should develop robust internal logistics management capabilities. ASPR and NDMS logistics should be consolidated, with special care taken to assure that the unique competencies required for NDMS logistical support are retained or strengthened. Key ASPR/NDMS logistics capabilities include the ability to:

- Meet stringent NDMS response time requirements that exceed those of other federal disaster response programs or commercial logistics systems
- Support a nationally distributed network of response teams each with its own cache
- Support the lifecycles of pharmaceuticals with expiration dates and equipment with inspection, maintenance, and/or certification schedules
- Maintain vehicles and rechargeable supplies in a state of readiness
- Maintain visibility over all assets in the logistics system
- Maintain accountability for controlled substances.

Recommendation 3.50: To meet these challenges, ASPR must maintain staff capability to perform logistical planning, coordinate logistical plans with other agencies and private sector organizations, contract for logistics services where appropriate (including contracts with corporate entities, interagency agreements, and memoranda of understanding with other government entities), manage logistical operations, and consistently deliver rapid and high quality logistics services to the NDMS medical response teams, and other HHS teams as needed.

In addition to the above general recommendations, the following sections provide more detailed recommendations for logistics sub-functions.

3.4.4.9.1 Pharmaceutical Cache Management

Pharmacy logistics is managed through a blanket purchase agreement with McKesson except for the NMRT pharmacy caches, which are managed through an interagency agreement (IAA) with the Department of Veterans Affairs. ASPR Logistics is also in the process of developing an IAA with DoD in order to leverage their prime vendor contracts. In addition, an IAA between FEMA and the Defense Logistics Agency is still current and could be used by NDMS, especially in the area of veterinary pharmaceuticals. Pharmacy logistics received funding in August 2007 and began replenishing the DMAT caches. As of mid-September 2007, 25 of the 40 DMAT pharmacy caches were ready to be deployed; the final 15 were projected to be ready by the end of September 2007.

- Formulary Considerations: Pharmaceutical caches require licensure and special training to maintain. They must be kept under proper security and temperature controls. In order for a facility or an area to be allowed to house pharmaceuticals it must obtain authorization from the Drug Enforcement Administration (DEA), which takes up to six months to one year to become registered. Pharmaceuticals are a time sensitive item, since they have expiration dates. Inventories need to be rotated an average of twice a year.
- Response Time Considerations: Pre-positioned pharmacy assets located throughout the nation cut response times from days to hours. The pharmacy cache locations have been picked based on response time to areas where the NDMS missions are most likely to

happen. Pharmaceutical storage location is currently considered by NDMS to be near optimal now that these facilities are properly registered. With the pharmacy caches located in five different logistic centers throughout the United States, pharmaceuticals can be shipped forward in less than 12 hours. Planning for arrival of pharmaceutical logistic inventories on the disaster site within 24 hours can be done with very high confidence.

- Management Considerations: NDMS and ASPR are having internal discussions about how best to manage the pharmacy logistics function in the future. Options include continuing the current arrangements, outsourcing more of the effort (e.g., the NMRT cache management), and partnering with CDC (which stocks many of the same items in the SNS). These discussions are appropriate and should continue.

3.4.4.9.2 Equipment and Cache Procurement Management

There is no standard equipment and materiel life cycle management regarding caches. While under FEMA, NDMS benefited from FEMA-negotiated contracts with vendors for biomedical equipment and maintenance. Under the DoD Medical Readiness program, medical commodity maintenance is also contracted out. ASPR is beginning to address bulk purchasing agreements and other asset management approaches to supporting team logistical and cache requirements. In developing these agreements, ASPR is assuring adherence to Federal Acquisition Regulations and HHS purchasing standards and guidelines.

NDMS equipment must be maintained at maximum modernization levels in order to meet preparedness standards. Many NDMS team caches include medical hardware requiring regular testing and recalibration, along with general maintenance. In some cases, hardware standards have changed, requiring replacement of obsolete units. For example, presently each cache contains two defibrillators. Advanced Cardiac Life Support (ACLS) protocols have now changed, rendering some units obsolete and in need of replacement. Each unit reportedly costs $40,000. Funds for these replacements are not presently budgeted.

Similarly, NDMS recognizes that its IT equipment must be maintained at maximum modernization levels in order to meet preparedness standards. When it was transferred to HHS, NDMS had 325 laptops that had been purchased with FEMA funds six years ago. The laptops had outdated operating systems (OS); printers were also out of date. ASAM's Information Technology Service Center (ITSC) provides IT support to the Office of the Secretary of HHS. It has established a prime contractor agreement with Unisys to provide contractor owned and operated IT assets for the Office of the Secretary, HHS, including the operation of a data center in Reston, Virginia. ASPR solved NDMS's IT equipment capability by incorporating its IT equipment under the Unisys contractor-owned equipment program. Unisys issued NDMS 400 new laptops at a cost of $2.5 million ($4,500 per year per laptop) – this cost that was not originally budgeted for. The contract also covers Blackberries and other assets.

However, some aspects of the standard Unisys Service Level Agreement (SLA) may not be compatible with NDMS's requirements. The Unisys agreement is intended for the standard office environment. But NDMS supports 100 non-campus, non-office, geographically dispersed sites. The Unisys Help Desk is designed for weekday high volume demand, but NDMS usually needs after hours and weekend help plus surge event coverage.

Recommended Improvements of Equipment and Cache Management

MITRE's review of equipment cache management found that in general, management of equipment caches in the field by the response teams has been satisfactory. However, lifecycle management processes that were formerly managed by FEMA require renewed attention from ASPR. MITRE recommends the following improvements:

- **Recommendation 3.51: NDMS should implement a process to determine, on a periodic basis, what items belong in team caches.** In doing this, NDMS should also:
  - Establish an alert system to monitor the industry for changes in equipment standards or maintenance schedules and enact any mid-cycle changes as required
  - Assure that after-action procedures include a re-inventory of system resources against *newest standards* to insure that replacement acquisitions meet newest standards.
- **Recommendation 3.52: Core medical response team caches should be standardized so that any team can use any comparable team's cache.** Medical response teams that are in a ready to deploy status should continue to have a standard "all-hazards" cache assigned to them and available for training or use when needed. This allows core caches to be truly interchangeable. For example, local caches could be reassigned to incoming out-of-town teams when local teams are not activated. This practice would facilitate the incoming team's ability to deploy rapidly to be operational on scene within 24 to 36 hours. In the event that caches are augmented locally, the locally-adapted portions of cache, should be stored in different containers and not transported with the core cache unless the adaptations are appropriate for the disaster situation.
- **Recommendation 3.53: ASPR should maintain safety stock to allow for retrogade movement and replenishment of used caches.** The amount of safety stock required should be determined by qualified logisticians based on the replenishment throughput available.
- **Recommendation 3.54: Caches should generally be pre-positioned near trauma centers where the public will expect to receive medical care in the aftermath of a catastrophic incident,** and where incoming NDMS medical response teams would be expected to deploy. Pre-positioning should be coordinated with state and local partners as part of integrated surge capacity planning and integrated national medical logistics planning.

- **Recommendation 3.55 ASPR should consider developing a centrally-managed biomedical maintenance program using national contracts**. ASPR Logistics is currently in the process of conducting the related analysis and providing findings and recommendations for review and comment.

Other opportunities to improve equipment lifecycle management include the following:

- **Recommendation 3.56: ASPR should work with NDMS and ASAM to develop contracts for maintenance and replacement of priority medical and administrative/operational equipment that are standard across the teams**. Service level agreements and contract terms should meet NDMS requirements relative to adhering to industry standards, such as minimum maintenance and testing schedules.

- **Recommendation 3.57: ASPR and ASAM should work with NDMS to establish an alert system** to monitor the industry for changes in equipment standards or maintenance schedules and enact any mid-cycle changes as required.
- **Recommendation 3.58: ASPR and ASAM should work with NDMS to review existing purchasing agreements to ensure accommodation to change in standards**. Action should be taken to terminate standing contracts for obsolete equipment and implement processes to re-compete acquisitions against new standards.
- **Recommendation 3.59**: **NDMS should continue to work with ASAM to identify and execute bulk-purchasing agreements and to establish and manage life-cycle-based equipment lease-purchasing agreements** such as the ones being put in place for the pharmacy caches

3.4.4.9.3 Facility Management

NDMS teams typically rent facilities for office and storage purposes. Team specific leases are gradually being converted to GSA-managed leases. The leases will be "all-inclusive" with "wrap around services" including utilities in the lease. While this process simplifies management responsibilities at the local level, it is not evident that GSA has sufficient experience with the type of widely dispersed, small-facility leasing that NDMS teams need. When a local utility company contracts directly with GSA for an NDMS team site, the team's Local Commander is unable to intervene when problems arise. Losses of lighting, heating, and air-conditioning have jeopardized the condition of some stored caches. Anecdotal evidence indicates that one facility went without electricity for several months. Others reported being locked out of their facilities due to delayed lease payments. A review of procedures between HHS PSC and GSA is indicated.

There is no automated process to expedite notification and resolution of problems at GSA-contracted sites. A complex chain of calls is necessary to resolve the situation. The onsite Commander contacts NDMS headquarters staff, who call GSA. GSA contacts the local utility company. Notification regarding the problem resolution follows a similar multi-level chain of contacts. The onsite Commander is the last person in the chain of contacts and has no direct control over monitoring completion of the service repair request.

Recommended Improvements in Facility Management

- **Recommendation 3.60: Designated representatives (at headquarters and/or regionally) should collaborate with teams and GSA to establish leased space set-up process and standards** including development of a "model" set-up process, minimum standards for each leased facility, process for handling special requirements, and processes for evaluating and approving requests for adding new standards or granting exemptions from standards. The role of HHS PSC in resolving issues in the short-term, should receive immediate attention.
- **Recommendation 3.61: NDMS (or ASPR or other appropriate representatives) should work with GSA to formally establish the Team Commander or designee as the GSA Point of Contact (e.g., user) in any "problem ticket" management workflow software** and ensure that they are included in the notification workflow to assure timely notification of problems and their resolution. .

3.4.4.9.4 Fleet Management

Fleet management presents special challenges in planning, scheduling, and budgeting for ongoing maintenance and replacement cycles. A recent NDMS inventory team inspection of all fleet resources found all 206 NDMS vehicles to be in excellent or very good condition and ready to perform their missions. However, it is important to note that many vehicles were purchased with special disaster assistance funding. Consequently, they tended to be purchased in large groups when funds were available. Presently 99 NDMS vehicles purchased with these funds are reaching the end of their useful life (estimated at 7 years) and there are no funds set aside for replacements in the NDMS or ASPR budget. Normally, the phase out and replacement of the fleet should be staggered over several years in order to spread out the budget impacts.

Another potential concern is that the major portion (160 of 206 vehicles, 80%) of fleet vehicles is co-located at the MD warehouse site. ASPR should determine the appropriate deployment and training model for NDMS teams and determine whether having vehicles co-located with all teams enables teams allows for the most effective system as teams would not need to wait for vehicles post-arrival at the deployment site. Vehicles should also be used regularly to remain ready to deploy. Co-location with teams better ensures this is accomplished. However, centralized management does provide for better control over vehicle condition and usage and this should be taken into account as well.

The team Commander and Logistics Chief are responsible for overseeing the procurement and completion of required maintenance. In instances where the fleet is housed at a Logistics Center, the fleet is maintained by the full-time government center staff. NDMS uses the Voyager Fleet system for maintenance of its vehicles. This program has a large established network of gas stations and repair shops across the country that provides services to "members" who pay for the services with a Voyager Fleet Card. The list of participating shops is accessible via the Internet. The Voyager Fleet Card can be used to pay for services at any approved shop. Every piece of NDMS rolling stock has an assigned Voyager Fleet Card. NDMS has set and promulgated to the teams specific parameters associated with use of the cards. Parameters include limits on level of pre-approved maintenance and repair. Requirements above this level require headquarters approval. As with other special issue card systems (i.e., GSA cards) there are some places where Voyager cards are not accepted. This limitation would be difficult to over come without some accommodation for using more universally accepted cards such as Visa or MasterCard

Recommended Improvements in Fleet Management

NDMS should collaborate with ASPR and ASAM to:

- **Recommendation 3.62: Conduct an assessment of fleet requirements**, including types, numbers, and locations. This will allow NDMS to better define the needs for the vehicles and address any gaps that are found.
- **Recommendation 3.63: Establish a phased replacement plan for fleet vehicles**; budget projections should be adjusted to support the replacement plan; phasing of replacements and budgeting should be planned forward to at least 2012 in order to incorporate the present fleet asset replacement needs.
- **Recommendation 3.64: Assess availability and applicability of "industry standard" Asset Planning and Management tools** to assist NDMS' tracking and budgeting for its fleet and other major assets.

3.4.4.10 Mobile Medical Assets

In the event of pandemic disease, large-scale terrorist attack, extreme natural disaster, or other catastrophic incident, the surge of tens of thousands of traumatized, sick and/or contaminated patients would quickly exceed local and regional hospital capacity. Mobile medical assets are portable medical facilities that can be rapidly deployed to the scene of a disaster or other more appropriate locations near the affected area. These facilities can provide a self-contained, climate-controlled, clean environment for practicing advanced-level medical care at the point of need. Mobile medical assets can also be effective in limiting the risk of infecting or contaminating hospital buildings and equipment, staff, and patients.

Currently there are mobile medical assets of varying capabilities available at all levels of government, with the largest and most capable facilities currently owned by the federal government (mainly the Department of Defense). Figure 3-3 illustrates a representative sample of available mobile medical assets and indicates their suitability for supporting various roles across the spectrum of disaster medical care. The number of mobile medical assets has been increasing, particularly at the state and local levels (including the National Guard at the state level).

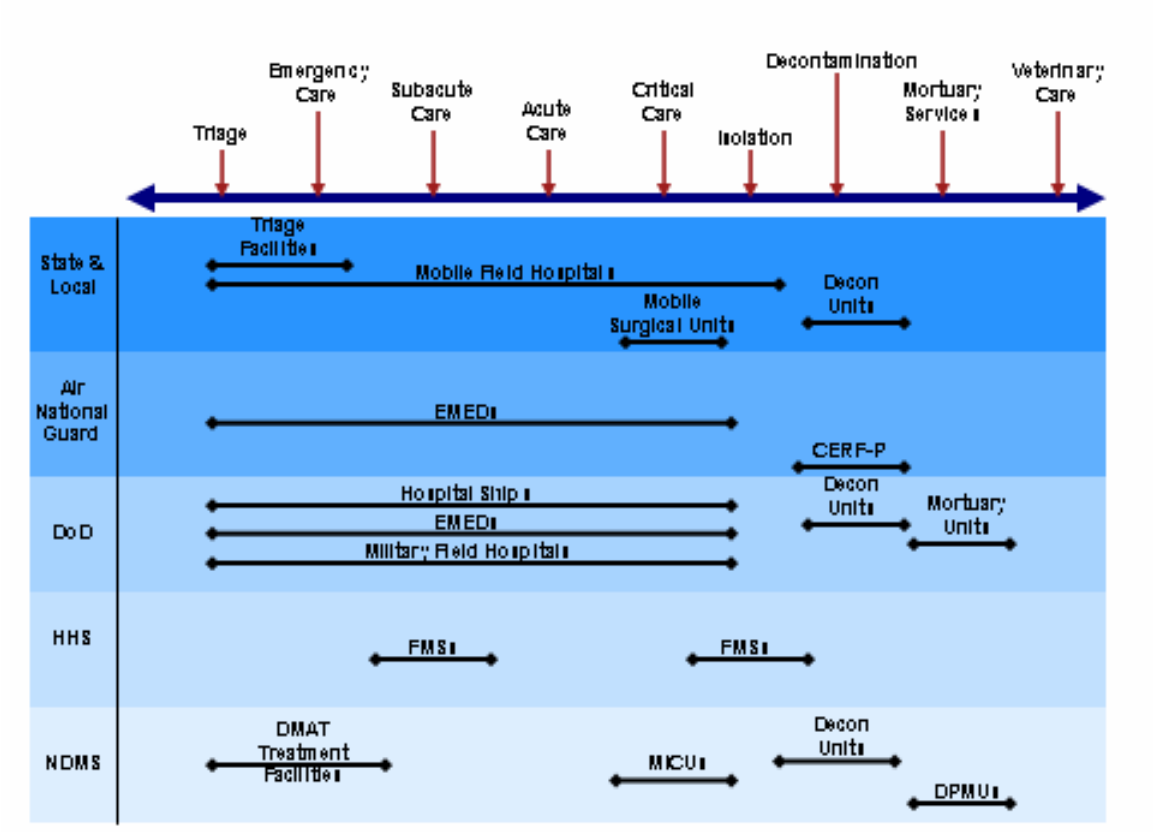

Figure 3-3. Mobile Medical Assets Address the Spectrum of Disaster Medical Care

ASPR currently does not have a definitive listing of mobile medical assets that may be available from other sources for disaster medical response. Private, local, and state mobile medical asset capability varies throughout the country. Some states have developed field hospitals for surge

capacity, while others have not developed any mobile facilities. Many state funeral and mortuary associations have purchased portable morgues to process remains during a disaster, but the capability is not available in every state and not standardized. Very few mobile critical care facilities have been developed by private organizations, local governments, or state governments. Federal assets are generally more readily identified, but these are managed by separate entities and availability depends on other priorities (e.g., DoD has assets but cannot provide concrete availability information because they must take into account the need to meet potentially unpredictable mission requirements).

Recommendation 3.65: MITRE recommends that ASPR inventory and type mobile medical assets at all levels of government, in consultation with federal, state, and local partners, and maintain resource typing data at the SOC. While challenges around access to information exist, it is imperative that HHS attempt to identify candidate resources for use by type and capability provided, e.g., the unit type code available (even if only be name) and the extent of capabilities it can provide. The number that can be provided for an incident can be identified through the requirements-based requests that were previously discussed. MITRE has furnished a partial list of mobile medical assets as a starting point for this effort (see Appendix C). Among the mobile medical assets that MITRE identified were the following:

- Emergency care shelters (tents) such as those used by DMATs
- Mobile surgical hospitals such as those acquired by North Carolina, Nevada, Connecticut and California
- Air Force and Air National Guard Expeditionary Medical Support (EMEDS)
- Army, Navy, and Air Force (Military) Field Hospitals
- National Guard CBRNE Enhanced Force Package (CERF-P) units
- Federal Medical Stations (FMSs)
- Portable Morgue Units

Recommendation 3.66: Given that states in particular are acquiring new capability, ASPR must work with its partners to develop an integrated mobile medical assets strategy as a supporting element of a national medical surge strategy. The availability of facilities to meet surge requirements must be analyzed locally and regionally, with gaps identified and responsibilities for filling them accepted by either partners or HHS. It was not possible for MITRE to conduct a detailed analysis of existing inventory versus requirements, because the existing inventory is not fully understood and the number of assets that may be available from the Department of Defense is dynamic based on operational exigencies and not publicly available. Preliminary estimates suggest that a gap does exist and that ASPR should coordinate planning to address this gap.

The most obvious gaps appear to be in the areas of emergency (trauma) surgery, burn care, crush (orthopedic, vascular) injury care, pulmonary care (respiratory therapy), pediatric medical and surgical intervention, and eye care. In addition to these gaps, which address the possible direct consequences of an event on citizens, events that destroy a large amount of local infrastructure also affect the ability to provide primary care and pharmacy services. The extent of the gaps varies by region and locality and must be addressed as part of comprehensive, integrated medical

surge planning. A possible outcome of this planning would be the identification of requirements for specialized NDMS teams and mobile medical assets to address these medical specialties.

Other recommendations for mobile medical assets include the following:

- **Recommendation 3.67: Encourage an accreditation process for mobile medical assets.** Currently, The Joint Commission is the accrediting body for hospitals, laboratories, and other healthcare organizations. It may be appropriate to pursue using them to accredit mobile medical assets.
- **Recommendation 3.68: Fund a facilitated expert panel to develop recommendations for procurement, upkeep, maintenance, and exercising of mobile medical assets.** In April, 2005 the Agency for Healthcare Research and Quality (AHRQ) conducted an expert panel to examine altered standards of care in mass casualty events. It may be appropriate to convene such a panel to facilitate knowledge transfer about mobile medical assets.
- **Recommendation 3.69: Investigate ways the federal government can further facilitate the EMAC process.** Although EMACs are state compacts, there may be situations where the federal government may be able to encourage EMAC use to to cover gaps, etc., and pre-coordinate access to EMAC resources to expedite the process.
- **Recommendation 3.70: Adopt an EMAC-like framework to permit government entities to quickly acquire support from private sector resources.** Provisions surrounding liability, privacy, insurance and other legal issues should be adapted from the EMAC framework and embedded in model contracts for acquiring private sector mobile medical resources.

3.4.4.11 Network Access

A separate but related IT support issue relates to network access for NDMS teams. Presently NDMS users have access to Verizon Air Cards, to supplement low speed satellite access. Under non-deployment conditions, the NDMS sites use FEMA's DSL access. FEMA has 100 high speed connectors in its Frederick, Maryland warehouse that are intended for NDMS. It has been reported that transfer of the FEMA satellite bandwidth was included in the signed Interagency Agreement (IAA), but confirmation of this is not available. To date, these assets have not been transferred to HHS. These network connections are critical to assure vital data exchange during disaster incidents.

- **Recommendation 3.71**: ASPR Logistics and NDMS should **assure availability of required high speed network access for NDMS teams** by completing the agreed-upon transfer of network access cards and related assets and establishing new DSL access contracts for NDMS staff and teams.

3.4.5 Human Remains Support, Reporting, and Tracking

The major catastrophic incidents in the NPS will cause mass fatalities in numbers that will immediately overwhelm state and local resources and severely challenge NDMS DMORTs. In addition, some of the scenarios call for the ability to handle large quantities of contaminated remains. NDMS should develop joint plans with DoD and state, local and private sector organizations for mass casualty processing, and these plans should include a realistic standard of

postmortem care given the disaster situation. For example, following an improvised nuclear device (IND) explosion, it may be necessary to perform temporary interments to forestall a secondary public health disaster.

During Hurricanes Katrina and Rita a great deal of confusion resulted in local, state, and federal officials being uncertain as to whose responsibility it was to collect the remains for processing. To make matters worse, in addition to the people who perished during or as a result of the hurricanes, caskets were dislodged exposing previously deceased bodies to the elements and in some cases, resulting in unidentified remains. At one point a contractor was hired to remove the bodies for processing.

The removal of remains is generally a local responsibility. However, in a mass casualty situation it would be unrealistic to expect local medical examiners and coroners to be able to handle the extra workload. If it were a pandemic situation, it is unlikely the DMORT members would be able to depart their hometowns. Aside from having sufficient medical examiners and coroners, obtaining enough body bags and caskets would be nearly impossible, especially if the disaster resulted in quarantine or a prohibition against movement of trucks or trains. Most funeral homes use a just-in-time method of re-supplying their homes so they do not carry large inventories. Additionally, in a mass casualty event, enormous refrigeration space would be needed to hold the remains both before and after processing. This could be in a building but would more likely be in refrigerated trucks.

Disaster Mortuary Operational Response Teams (DMORTs) respond to disasters where assistance is requested to recover, identify, and process deceased victims. DMORT members use an automated Victim Identification Program (VIP) to identify remains. An eight-page form is used to collect ante mortem information about a victim. It includes a physical description as well as a description of the clothes, jewelry, prior accidents or surgeries, military service, and biological relatives. A 14-page site recovery/post-mortem form is also completed. The information from those two forms is entered into the WinID database, which attempts to match the victim identification profile with the post-mortem information.

WinID is a software program that makes use of dental and anthropometric characteristics to rank possible matches looking for similarities between pre and post-death dental records, in order to facilitate victim identification. One source interviewed said that he began developing the WinID in 1988, and utilized the third version of it when he was deployed to the World Trade Center site in New York following the tragedy on September 11, 2001. He donates the program to dental communities that can use it, and it is also available in multiple languages. Discussions with DMORTs indicate this system is the only one used by most medical examiners.

The WinID program is used extensively for victim identification and is provided free. There is no indication that a better program needs to be developed for this purpose.

Recommendation 3.72: ASPR (including OPEO/NDMS) should work in the context of the national framework with state medical examiners, private funeral directors, DoD mortuary affairs staff, and other experts to devise regional mass fatality management plans.

- A structure needs to be created whereby a single manager is responsible for coordinating efforts in conjunction with federal, state, and local officials. It would need to cover contingencies for mass casualties, refrigeration, appropriate body bags and caskets for mass casualties, decontamination of mass casualties, possible lack of support by

DMORTs in the case of a pandemic flu, and resources available to supply hardest hit casualty areas. Thinking these issues through prior to a disaster will greatly enhance the efficiency of processing remains in a respectful manner.

- The creation of an effective plan will require gathering appropriate federal, state, and local officials and private entities to provide the expertise and background required. It will require resources that HHS may not yet have funded.

3.4.6 Conclusion

NDMS medical response teams have served the nation with distinction, providing life-saving care following natural and other disasters. Now the country faces a wide range of additional hazards identified in the NPS that place new demands on NDMS. To meet these demands, NDMS must expand the functional capabilities and capacity of its teams to respond capably to a variety of catastrophic events.

Fortunately, NDMS has a large and highly qualified pool of personnel who are available to serve as intermittent federal employees and trained to operate as teams when the need arises. Hence, NDMS has a solid base on which to build to higher levels of capability and capacity. Properly prepared to respond to a whole new class of potential catastrophic incidents, NDMS will remain an important component of the national response to disasters and catastrophic incidents.

4. Patient Evacuation

4.1 Introduction / Purpose

This section provides recommendations regarding proposed enhancements to patient movement capability, medical regulating, and patient tracking. Recommendations are based on research and interviews with NDMS federal partner agency officials and other stakeholders, both inside and outside of the Federal Government. Use of federal organic resources as well as contract and other non-traditional resources are considered and discussed.

The section is organized to provide a discussion of the current state and the desired end state to frame a context for the recommendations. Discussion, findings, and recommendations for the integral and related element – Definitive Care – is provided at Section 5; Section 6 provides a related discussion of the technologies used and required and will incorporate some of the information provided in this section.

4.2 Description of Current State

4.2.1 Patient Evacuation

The process of preparing for and responding to a disaster starts at the local level. Most local officials have emergency response plans and are familiar with locally available assets. When a disaster strikes that destroys the infrastructure of the local agencies or is beyond their capabilities, the state can be called upon for assistance. State assets, capabilities, and experiences vary widely and, depending on the nature of the disaster and their capabilities, state officials can request assistance from the federal government.

Patient evacuation in any large-scale disaster or national emergency situation requires an integrated effort by local, state, and federal officials and supporting agencies. Historically, medical officials prefer to retain patients in a safe haven as close as possible to their home, shelter-in-place, or evacuate patients without federal assistance[3]. State or local officials may elect to shelter-in-place or evacuate patients without federal assistance. NDMS employs its organic capabilities (see Medical Response Section) and relies on other federal partners for support as outlined in ESF #8 and the NDMS Partners' Memorandum of Agreement (MOA), dated 24 October 2005, when federal assistance is required.

- Per extracted information from the MOA, DoD:
  - Has primary responsibility for coordinating the patient evacuation function of NDMS
  - Coordinates with the Department of Transportation, the primary federal agency for ESF #1, to provide support for the evacuation of patients to definitive medical care under the NRP

[3] However, post-Katrina/Rita there is increased importance and lower threshold for evacuation of hospitals and nursing homes in certain high-risk areas, including southern Louisiana, the Rio Grande Valley, and the Texas gulf coast. In addition, there seemingly is an increased expectation that state and local officials will request federal assistance for medical facility evacuation, potentially due to the need to demonstrate (following a disaster) that all possible assistance was requested or because inadequate medical transportation and other resources may be available locally to accommodate simultaneous evacuation of multiple facilities.

  - At the request of DHS or HHS, DoD may use available DoD transportation resources to evacuate patients from designated staging sites to NDMS patient reception areas.

In the current environment, federal movement assistance will not generally be requested unless requirements are so large that they overwhelm the local and regional capabilities to transport using ground ambulance or helicopter, for example, or distance to be moved would not make it prudent to permit maximum use of locally/regionally available transportation. This DoD evacuation has traditionally been accomplished using Air Force fixed-wing assets.

- As outlined in ESF #8, December 2004 and a July, 2007 NRF ESF #8 draft, DoD:
  - At the request of HHS, coordinates with ESF #1 to provide support for the evacuation of seriously ill or injured patients to locations where hospital care or outpatient services are available
  - Using available DoD transportation resources, in coordination with the NDMS Medical Inter-Agency Coordination Group (MIACG)[4], evacuates and manages victims/patients from the patient collection point in or near the incident site to NDMS patient reception areas
  - Provides available medical personnel for casualty clearing/staging and other missions as needed including aeromedical evacuation and medical treatment. Mobilizes and deploys available Reserve and National Guard medical units, when authorized and necessary to provide support
  - Coordinates patient reception, tracking, and management to nearby NDMS (non-federal) hospitals, VA hospitals, and DoD military treatment facilities that are available and can provide appropriate care

DoD resources are coordinated through the U.S. Transportation Command (USTRANSCOM). These resources generally would include C-130 and C-17 aircraft which can be configured for and routinely provide patient support, with other USTRANSCOM patient transport capable resources used at USTRANSCOM discretion and tasking. However, patient carrying capacities are reduced when required to transport critical patients with special equipment needs as there are limited spaces to connect oxygen, ventilators, and so forth. It is also appropriate to note that all these airframes have primary DoD airlift, combat support, and air refueling mission responsibilities. Thus, they are available for medical support only if they are not otherwise required for a primary DoD support mission. USTRANSCOM also has access, through a contract managed by the Air Mobility Command, to pre-approved civilian air ambulance services. DoD augments crew and aircraft capabilities with additional resources as described below.

- Critical Care Air Transportation Teams (CCATT) are used to support the movement of critical patients. This team concept provides three specialized staff and advanced specialty medical equipment. Each CCATT team can support up to 3 high-acuity or 6 lower-acuity patients.
- Patient Support Pallets provide seats and litter stanchions to support patients on airframes with cargo rollers; pallets provide capability for either 8 ambulatory, 3 ambulatory and 3

[4] MIACG is composed of NDMS partner representatives (DHS, DoD, VA, HHS) to support placement of victims/patients in NDMS hospitals for care; MIACG assesses national capabilities to accept casualties into definitive, hospital-based care and per the Catastrophic Incident Supplement to the National Response Plan, Annex 1 recommends which FCCs to activate

litter, or 6 to 8 litter patients. The C-130 has organic capabilities and does not require use of the support pallet.

Additionally, the Air National Guard (ANG) has 10 Aeromedical Evacuation Squadrons which each have deployable team components that provide: command and control; aeromedical evacuation (AE) operations; crew management; patient staging; 7-11 AE crews; liaison teams to locate with the activities (e.g., medical facility, headquarters element) providing the patients to coordinate movement requirements; communications team; and Logistics/Biomed team. Appropriate resources from the various ANG units frequently deploy in support of natural disasters and other national emergencies under state-to-state Emergency Management Assistance Compacts (EMAC) absent, or before, a request for federal patient evacuation assistance. When activated under Title 32, the ANG is considered a state asset and will likely be available prior to federal assets being activated to support area/regional patient movement. However, when not operating under federal control they do not have any requirements to report status, availability, and workload.

Finally, as detailed in section 4.4.1 - Recommendation 4.6, additional capability is potentially available through a FEMA established (late summer 2007) ambulance support contract to support operations in Zones 2 and 4. The contract provides access to ground and air ambulances and special needs transport vehicles.

FCC patient reception plans identify local government and private ambulances to respond to the airport and transport patients to NDMS hospitals. Usually, the arrangement is made by contacting the local emergency management agency or the local Emergency Medical Services (EMS). Contracted support is generally not acquired through the hospitals or FCC but rather through local authorities. Many, but not all, jurisdictions have some capability for helicopter transports. Approximately 15 percent of the FCCs also have arrangements for bus transportation. Many have reciprocal agreements with nearby jurisdictions for EMS support if their own capacity is overwhelmed.

The Department of Veterans Affairs operates approximately two-thirds of the 66 FCCs that have been established within the Continental United States (CONUS). DoD operates the remaining FCCs. Their daily throughput to receive patients ranges from eight at Ft Jackson, SC, to 1,054 at Bedford, MA, with a median throughput of 100 people per day. FCCs are located in 40 states. These numbers are shown to demonstrate the broad range of capacity that exists and must be considered when planning evacuation. The numbers reported are representative of the day they are reported and could vary from reporting period to reporting period.

Based on information received from FCC Coordinators, approximately 90% (59) of the FCCs report that they have a patient reception plan. Of the other seven, three do not have a plan in place at the moment or personnel turnover has resulted in an inability to locate the plan, one has a draft plan (which could be used if needed in a disaster), two have not reported, and one (New Orleans) reports that their mission capability is significantly degraded as a result of Hurricane Katrina.

FCCs that received patients during Hurricanes Katrina and Rita said they received more patients per day than they had identified in their planning. However, local community assets supported the FCCs, and they were able to process all patients to local hospitals.

4.2.2 Patient Tracking

According to the National Center for Missing and Exploited Children, more than 5,000 children were separated from their immediate families or guardians following Hurricanes Katrina and Rita. This followed a massive evacuation of over 400,000 people to 48 states.

During Katrina, a confluence of worst-case scenarios created the conclusion that patient evacuation was dysfunctional, perhaps poorly coordinated, and was unable to provide visibility for evacuees. In fact, less than half of the patients evacuated through the New Orleans airport were actually placed on DoD-coordinated aircraft. Those that were did not routinely have patient movement requests entered into the DoD patient movement tracking system known as TRAC^{2}ES (TRANSCOM Regulating and Command and Control Evacuation System) due to many constraints. Patients not evacuated on DoD coordinated aircraft were moved on available conveyances (coordinated and uncoordinated) to include National Guard (non-USTRANSCOM tasked), private aircraft, helicopter, and ground transports (medical and non-medical). In addition, aircraft – even when "committed" for a medical mission – moved with a mix of patients and non-patients, thereby further exacerbating the ability to maintain effective, or any, visibility.

The National Response Plan includes scenarios which estimate that up to 100,000 casualties may require transportation from the scene of a disaster to healthcare facilities for definitive care (See Table 5-1). Tracking where patients come from and go to with certain minimal essential demographic and medical information such as name, age, gender, diagnosis, medical specialty code, and specialized equipment requirements is essential in any disaster situation. A number of commercially available and government developed patient tracking systems (outlined below) are in use by some states and FCCs.

- The WIISARD program was developed by the University of California, San Diego under a contract from the National Library of Medicine. It uses a wireless internet information system to coordinate and enhance care of mass casualties in a terrorist attack or natural disaster.
- EMSystem is in use in several states. According to company literature, "the company provides emergency department status tracking, patient tracking, mass casualty incident support, syndromic surveillance, hospital bed tracking, and public health alerting solutions."
- Puerto Rico uses Disaster Management Systems triage tags. Their literature states that the product was "developed by fire fighters and designed for ease of use with minimal training in the event of disaster requiring triage of patients."
- The Hospital Emergency Resource Database System (HERDS) was developed by New York State Department of Health and is a statewide electronic web-based data collection system linked to health care facilities (all NY State hospitals) through a secure internet site that allows hospitals to relay resources or needs to the Department of Health during emergencies, or respond immediately to rapid request surveys in preparedness planning efforts. HERDS includes a patient locator and tracking system that lets the general public inquire about missing persons or for EMS, fire, and police to track individuals moved from the scene.

- Raytheon developed the Emergency Patient Tracking System. According to their literature it is "a technical solution that increases mass casualty incident survival rates by facilitating triage, treatment, and transport of victims."
- Web-Medis is a hand-held wireless patient tracking system developed by the Oak Ridge Institute for Science and Education and used in Utah.
- MobileIRIS is a Mobile Incident Response Information System used in New Jersey. Their literature says "it tracks and monitors information for thousands of evacuees and emergency workers."
- ReddiNet (Rapid Emergency Digital Data Information Network) is used in California. It provides "Mass Casualty Incident Management through special screens that allow for data input on patient capacity, victim identification, and dispatch information to evenly and accurately distribute patients to waiting hospitals."
- WebEOC is used in Texas. It is a tool that helps build html forms that can be used to track any type of data, including hospital bed availability and patient tracking. (Note: WebEOC is currently also used by ASPR for incident management purposes.)
- Image Trend has developed an internet based patient tracking system for the State of Wisconsin for Tracking Resources, Alerts, and Communications (WITrac).
- TRAC^{2}ES was developed by the U. S. Transportation Command and is used exclusively by DoD to track patients being transported to and from evacuation points. TRAC^{2}ES is currently the only nationally accepted and utilized patient tracking and medical regulating system. It provides in-transit visibility from the point of embarkation to debarkation for patients moved on a DoD aircraft who have been submitted for movement with a patient movement request (PMR) and moved by USTRANSCOM or USTRANSCOM incorporated assets. The information tracked includes patient identity, service affiliation and grade or status, gender, medical diagnosis, medical condition, special procedures or other needs, medical specialties required, administrative considerations, personal considerations, home address of patient and/or duty station, and other information having an impact on the transfer. A mass casualty, or contingency, patient movement request is also available; it collects less required data than the full PMR to expedite input and enable more PMRs to be prepared in a reduced time.
- The Joint Patient Tracking Application (JPTA) is a web-based system that is used by military medical facilities in theaters of operations and in the United States. It can identify the criticality of the patient and whether the patient is in a Medical/Surgical, Psychiatric, Burn, Pediatric, or Critical Care category (the standard bed reporting categories for NDMS). The JPTA was designed for military use, and an agreement has been signed by HHS and DoD to develop application modifications to provide an NDMS version, but as of this report preparation, no changes have been made to the JPTA.
- The U.S. Coast Guard tracks patient data using their aviation database – ALMIS (Automated Logistics Management Information System); which can provide names and destinations.
- Many states and FCC's use pencil and paper on-site and later enter the information into Excel spreadsheets.

Other patient tracking systems may be available and in use, but we were not able to discover them in our analysis.

4.2.3 Patient Reporting and Tracking Process Flow

Figure 4-1 shows the patient reporting and tracking process from the incident site through to Patient Reception Area. The figure identifies which parties are responsible for patient movement and tracking along with other high-level information exchanges.

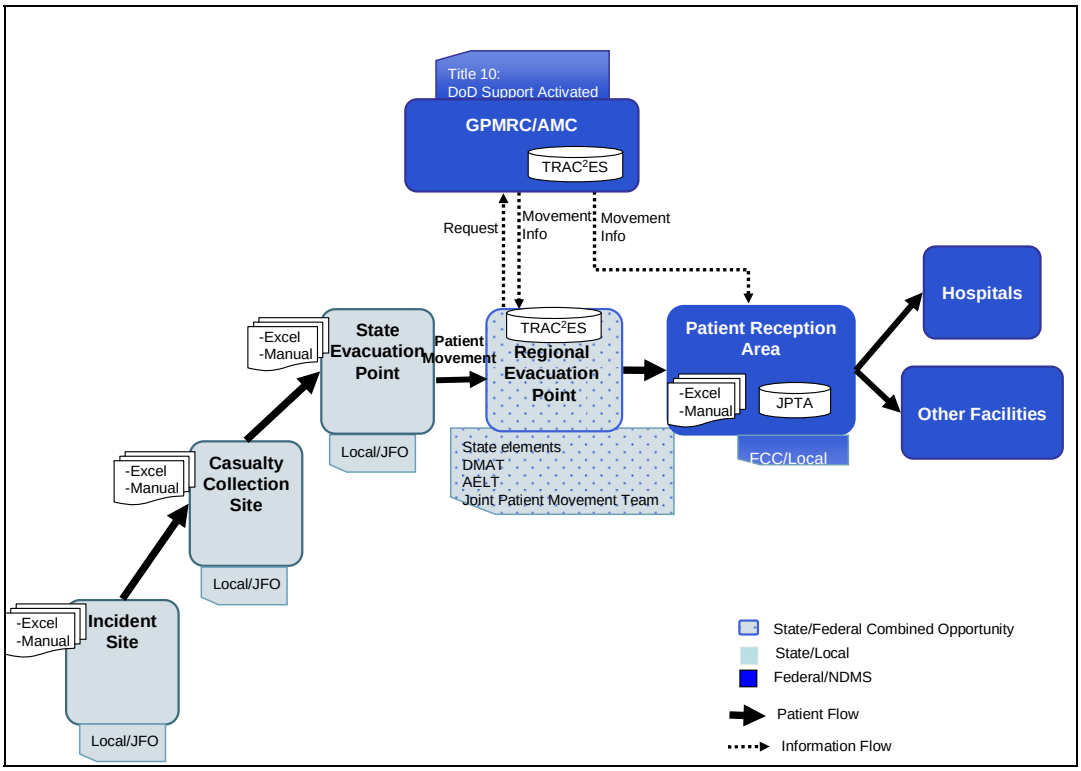

Figure 4-1: Patient Reporting and Tracking Process Flow with DoD Participation

General Process Description

The evacuation process begins at the Incident Site. Persons identified as requiring medical care are moved to a Casualty Collection Site. At the Casualty Collection Site, patients are treated and released or re-triaged to definitive care. Injured or ill persons who require further treatment are transported to local hospitals. Those who cannot be treated and released and are in need of more intensive or specialized care beyond the current local capabilities are further evacuated to a State Evacuation Point. From the State Evacuation Point, those injured or ill patients who cannot be treated and released are moved to a state-operated Regional Evacuation Point[5] (REP). The

[5] Figure depicts what would likely be the "worst case" regarding the number of interface/transfer locations as outlined by ASPR/Operations. In reality, Casualty Collection Site, State Evacuation Point, Regional Evacuation Point do not necessarily need to be separate locations; depending on the operations concept one or more could be combined. The addition of moves and locations increases the likelihood that tracking systems will fail, increases the number of transportation assets required, and further stresses sick and injured patients.

hospitals providing care are expected to stabilize the patient for evacuation and report them for federal movement, within their current operational capabilities and constraints.

Under current NDMS provisions, only patients admitted to a hospital are evacuated to a NDMS participating hospital. Reporting and tracking from the Incident Site to the Regional Evacuation Point is the responsibility of the local and state officials and presents a current capability gap for the overall system. NDMS is normally not yet engaged at this level and has no responsibility or method to track or regulate patients locally when not involved. This is normally accomplished using local methods, e.g., locally produced or manual systems.

Depending on the level of federal activation and assistance, the REP is the first likely opportunity for federal regulating and tracking to occur. However, federal tracking responsibility will be assumed at whatever is the point at which federal evacuation begins. Federal forces (such as Disaster Medical Assistance Teams, USTRANSCOM/Air Mobility Command (AMC) Aeromedical Evacuation Support elements and Joint Patient Movement Teams) may be deployed to a REP if required. When deployed, they can assist with reporting patients for movement through the federal system. When a patient movement request is received, TRAC^{2}ES enables medical regulating and tracking of patients from the point of embarkation to the point of debarkation at the PRA. As outlined earlier, the ability to support tracking is dependent on the ability to create the PMR. If the volume, communications, or other constraints preclude data entry, automated regulating and tracking likely cannot occur.

The remainder of this section describes the support provided by the responsible NDMS components.

- GPMRC: When a request for aeromedical patient movement is received, the GPMRC identifies a suitable reception hospital based on MIACG guidance concerning which FCCs will be activated[6]. The request is coordinated with the Tanker Airlift Control Center (TACC), which identifies support, transportation, and evacuation resources. Once resources are identified and mission(s) finalized, the information is provided to both the Aerial Port of Embarkation REP onload and Aerial Port of Debarkation PRA offload sites. GPMRC is able to regulate the patients and establish tracking based on the PMR from origin to destination PRA using TRAC^{2}ES. GPMRC provides both the sending and receiving locations with the respective movement information regarding arrival, patient count for their location, and other related details.
- Patient Reception Area. TRAC^{2}ES enables tracking to the offload PRA. Once patients are received, the PRA is responsible for tracking patients to NDMS hospitals.
  - Eight percent of the VA-sponsored FCCs have tested automated tracking systems. Only one FCC (Newark, NJ) is consistently using an automated system (IRIS). The remainder use pencil and paper methods, often using Excel spreadsheets to organize the data. During Katrina, patients sometimes arrived at the PRA without significant medical information and sometimes without identification. This precipitated the rudimentary tracking until identification and triage of incoming patients could be accomplished. Local NDMS hospitals assisted in the identification and tracking of patients.

[6] MIACG would recommend which FCCs and PRAs to use; GPMRC would then use that information as the basis to make individual patient assignments and coordinate reception with the FCCs/PRAs

– The DoD FCCs have indicated they use a number of manual, local, Red Cross, or military (JPTA) systems to support tracking.

Automated patient tracking is limited by the availability of communications connectivity and the ability of the human interface to enter information. If the information is not available or cannot be entered into the system due to volume, communications, or other constraints, adequate tracking may be impossible to achieve.

4.3 Description of Desired End State

4.3.1 Patient Movement

The evacuation system can be viewed as a system-of-systems composed of medical care facilities, local agencies, state agencies, disaster response, non-governmental organizations (e.g., contract transportation providers), and federal departments. Each of these organizations or systems has its own command and control structures, processes, and procedures. As emergency events become more severe, the overall evacuation system involves more and more of these systems and resources. The hand-off from one evacuation mode or provider to another as the system progresses represents not only a potential bottleneck but also a point where critical data can be lost.

To help a smooth transition through the system, the desired end state should provide:

- Clear descriptions of what a federal (NDMS) acceptable resource is to enable collection of capabilities information from various medical care facilities — hospitals, nursing homes, assisted-living homes, mental health facilities. Patients could then be regulated to a facility appropriate for their level of care.
- Single focal point to manage patient movement requirements management and coordination.
- Situational awareness of patient-medical facility-transportation requirements and capabilities as well as supporting resources available from state and federal assets.
- Access to traditional and non-traditional transportation resources which can provide safe and appropriate movement.
- End-to-end visibility of patient movement and treatment throughout the entire process.
- Once patients are discharged from the NDMS system, repatriation back to their homes and families. For individuals previously moved as patients, much of this movement could be coordinated with and provided by commercial common carriers as the individuals likely may have recovered sufficiently that they no longer require specialized patient transport.
- Understanding and acceptance of roles and responsibilities by all parties involved in the process. System execution is exacerbated by the complexity and number of organizations and players involved and thus a concerted effort to ensure all participants understand their roles and necessary interfaces is critical.

System enhancements to achieve this end-state are detailed in the Recommendations section.

Hospital Evacuation

A draft Federal Patient Movement Concept of Operations, which was developed by ASPR and has not been officially coordinated with the NDMS Partners, outlines the process for evacuating individual hospitals. The concept of operations is described below as extracted and modified from that document and is depicted in Figure 4-2, also extracted from the draft concept. Similar to the general process outlined above, the REP remains the customary federal interface point.

In the event that hospitals request assistance for evacuation and state and/or federal assets are required, the evacuating hospital patients will first be transported from the medical institution to an REP/APOE and then from the REP/APOE to a NDMS destination hospital. Upon first alert of circumstances that could necessitate hospital evacuations, NDMS will initiate a nationwide bed count within NDMS hospitals

Patients will be transported to a REP/APOE by any available means to include ground ambulances, air ambulance, wheel chair vans, and buses. Travel from the REP/APOE (aerial port of embarkation) to NDMS sites will use resources coordinated by the designated NDMS Patient Movement Coordination Center and tasked by the responsible assigned transportation execution agent, e.g., USTRANSCOM and Tanker Airlift Control Center in the case of military aircraft. Once the patients arrive at the destination reception point, they will be assigned to participating NDMS hospitals by the supporting FCC.

Private hospitals that have contracted for private air and ground ambulance assets and can execute their plan without state and/or federal assistance will use designated airports. These hospitals will not use REP/APOEs for their evacuation operations. At the designated airport, patients from these hospitals will be transported via commercial aircraft to pre-identified hospital locations.

State hospitals must plan for patient evacuation in the event that Shelter-in-Place (SIP) is not possible. Early in the response phase, hospitals evacuate their OB, NICU, and Nursery units. This evacuation will be accomplished using private and contracted transportation resources to bring patients to pre-designated receiving facilities.

Figure 4-2 provides a graphic extracted from the draft CONOPS.

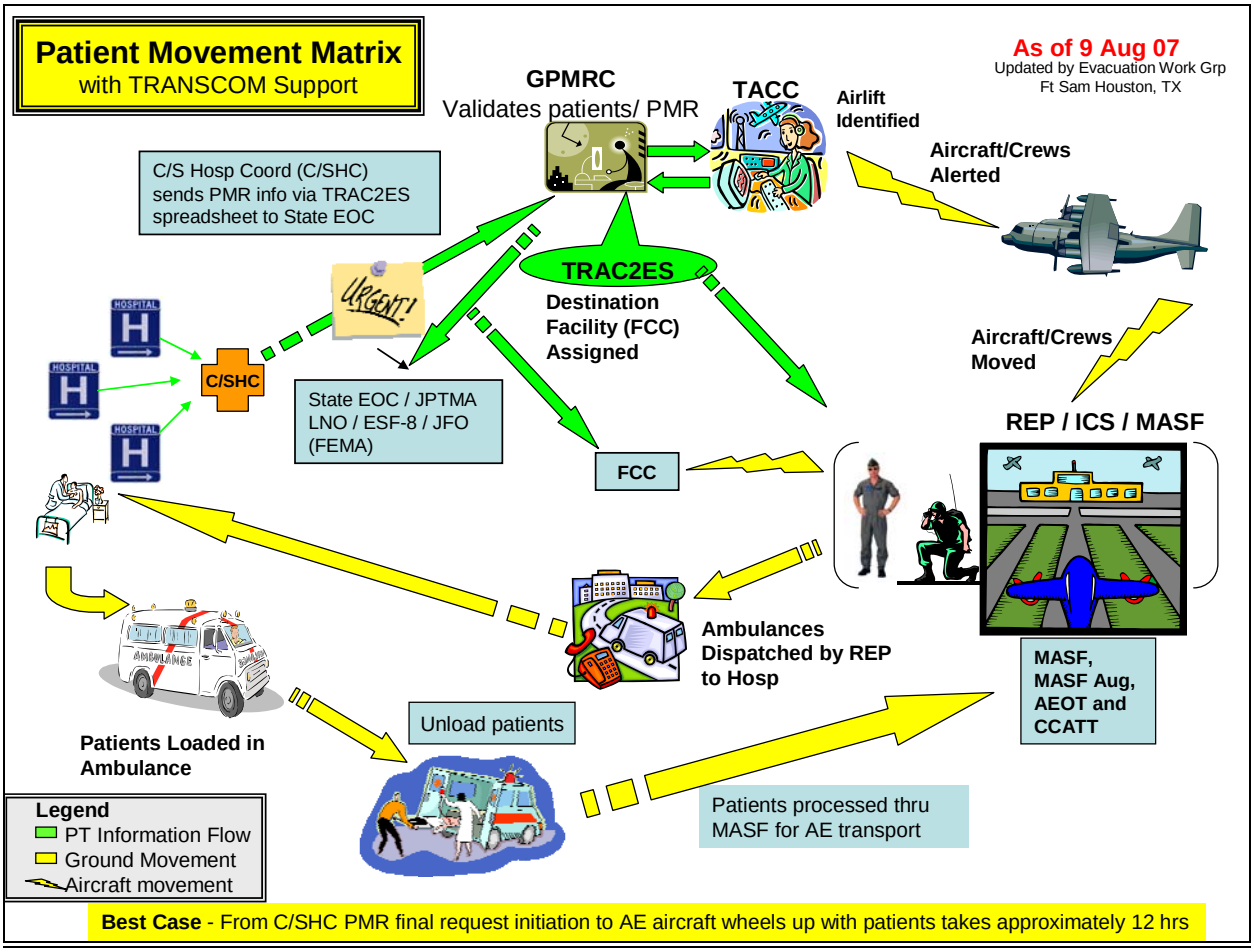

Figure 4-2. Operational Steps for Medical Institution Evacuation Plan (Extract)

4.3.2 Patient Tracking

As discussed previously, the ability to track patients end-to-end through the system has been problematic at all levels. Ideally, a national patient tracking system or data repository for individual systems should be identified. Components of an effective national patient tracking system might include:

- Standardized tracking method(s) with common data systems linked into larger national system
  - A secure, internet-based software tool for patient data visibility. However, data entry should not be dependent on internet access.
  - Ability to integrate with the disparate systems that exist at the local, state, and federal level.
- Hand-held devices for ease of data-entry.
- Unique identifiers to protect privacy of patients.
- Health Insurance Portability and Accountability Act (HIPAA) compliance.
- Wrist tags with bar codes or other methods to facilitate identification.

- Basic relevant patient identification and clinical data such as name, gender, date of birth, general health status, when and where the patient was picked up and taken to.
- Scanners to read driver's licenses, passports, etc.
- Scalable system that can be easily modified to the scope of the incident and to incorporate additional information if required.
- Appropriate interface(s) with electronic medical information that is based on accepted standards for medical information exchange.
- Immediate accessibility to pertinent information by emergency managers, hospitals, NDMS staff members and other appropriate responders in different locations including different states.

4.4 Recommendations to Achieve End State

This section discusses the proposed recommendations that have been identified, or validated, to support enhancing the patient evacuation system.

4.4.1 Patient Evacuation Management and Operations

This section discusses recommendations for HHS to manage and coordinate overall patient evacuation. It is based on the premise that HHS should assume responsibility for coordinating federal patient movement operations, with appropriate support from other federal partners and the public/private sector. The normal responsibilities associated with internal operational coordination, planning, and execution would remain a partner responsibility. The recommendations seek to promote the principle to provide unity of effort while respecting the chain of command of participating organizations. If implemented, the recommendations will provide a structure that enables:

- Day-to-day staff support
- High-level decision-making and coordination in emergency situations; provides national centralized coordination with decentralized operations and execution to enable each partner to maintain its own authority, responsibility, and accountability
- Core cadre to support patient movement operations and management in emergency situations
  - Patient movement regulating and movement coordination
  - Patient holding
  - Patient movement reporting and liaison support
  - Augmentation for transportation resources to enhance critical movement capacity

Implementing the structure will require a methodology and commitment from federal officials within HHS, the partners, and the executive and legislative branches to provide required funding for the additional resources:

- Full-time staff (final number to be determined) for day-to-day staff support

- Approximately 90 additional personnel (federal intermittent employees similar to other teams) to staff the three recommended teams and to provide HHS command center augmentation
- Staff for Critical Care augmentation teams (number TBD)
- Materiel and equipment
  - Communications, automation and other equipment to support the patient movement teams
  - Patient movement items
  - Critical care equipment

Recommendation 4.1: Establish a patient movement function that could support daily planning and coordination for patient movement operations

Information provided to MITRE indicated that NDMS plans to have an organizational unit for Patient Movement and Definitive Care that will enable NDMS to increase its emphasis on patient transportation planning and execution. Stated functions included, but were not limited to:

- Coordinating with VA and DoD regarding FCC establishment, funding and activation issues
- Providing input on development of policy for federal patient evacuation
- Supporting patient movement activities during disasters through representation on the MIACG (or other group established for headquarters decision-making)
- Overseeing development and implementation of Patient Reception Area operations
- Participating in the development, improvement, maintenance, and evaluation of tracking systems for patients moved during national emergencies
- Compiling and reporting on data, to include identifying available resources
- Interpreting federal law and policy as it impacts ESF #8 implementation and state and local requirements
- Developing materials in response to congressional and other official inquiries
- Managing funds directed toward national patient movement, reception and tracking initiatives
- Coordinating and monitoring national bed counting activities
- Coordinating with VA and DoD regarding national hospital registration issues
- Providing input on reimbursement and other definitive care related policy
- Managing and coordinating funding allocated for definitive care
- Coordinating with RECs and FCCs (through identified VA/DoD coordination protocols) to obtain routine readiness status reporting to ensure requirements and candidate regional resource availability are known for planning
- Reviewing FCC definitive care reception plans.

The study team supports the validity and the need for this organizational element, or at the very least an entity tasked with patient movement as one of its responsibilities. However, the MITRE team suggests the proper positioning of the function within the organization should be revisited, and a decision made regarding where it might best properly integrate to provide the pre-disaster planning and coordination HHS, ASPR, NDMS, and ESF #8 requires to ensure optimal readiness. This is a potential item for further study as part of the previously mentioned Phase 3, Implementation Planning.

A final consideration is devoting adequate staffing resources for these functions. The most recent NDMS organizational proposal MITRE was provided identified 2 full-time equivalents to these functions. The needed composition to support day-to-day operations and concept to provide a core capability to initiate operations should be reviewed to ensure adequate staff is readily available to support patient movement planning and coordinating functions.

Recommendation 4.2: Establish through policy a Headquarters-level patient evacuation decision-recommendations body

Using centralized command and control with decentralized operations and execution, HHS needs a headquarters-level entity to have oversight and situational awareness for patient evacuation and definitive care emergency operations activities.

The NRP, ESF #8, and the NRP Catastrophic Incident Supplement-Appendix 8 all reference the MIACG and indicate that among other things it will assess national capabilities to accept casualties into definitive, hospital-based care and will determine which FCCs to activate. However, it was identified during interviews that the role and responsibilities of the MIACG are not universally understood. HHS needs an organization at the ESF #8 execution level to make patient movement recommendations; e.g., when to activate federal support and what resources might be appropriate to employ. Once its recommendations are approved and appropriate mission tasking provided, this group would then support the HHS Secretary's Operations Center (SOC) by providing situational awareness for patient movement activities through reporting received from the various supporting operational activities.

The group membership should include a representative from the Patient Movement and Definitive Care function and representatives from all of the primary supporting partners (e.g., VA, DoD, FEMA ambulance contract Contracting Officer's Technical Representative (COTR), DHS). As noted above, the Partner representatives would function similar to a functional cell in a command center to provide "decision recommendations" and situational awareness to decision-makers and would liaise with their Partner agencies. In addition, the team could be assisted by advisory personnel from civilian agencies such as the American Ambulance Association and Association of Air Medical Services who could be engaged as the situation and requirements warrant. The partner representatives would also be responsible for any routine situational awareness reporting to their respective agencies. If for some unforeseen reason partner entities cannot support the HHS SOC in the capacity envisioned, then HHS should identify positions from within HHS to serve this function.

A written charter should clearly delineate their roles and responsibilities. Written procedures and processes would provide efficiencies in decision-making, especially if members are newly assigned to the group or are filling-in for someone who is missing.

Benefits

A newly established cross-organizational group that has information gathering responsibility and makes recommendations regarding major evacuation related decisions gives partner organizations an entity to look to for information and guidance during a disaster. Further, it places responsibility for decision-making with one entity. With a charter in place, each agency partner should clearly understand and accept responsibility for the group's success at providing appropriate guidance and decisions during a crisis period.

Constraints

Several areas of potential concern are funding, operational/organizational mismatches, logistical support, and policies and procedures. All these issues must be addressed in advance via mutually agreed to policies and procedures. Absent consensus during an actual crisis, a single authority must make a binding decision on the group. While this is a natural process for some individual departments, it must become a core competency of the group.

Recommendation 4.3: Develop organic capability within HHS to provide medical regulating and patient movement coordination

Background

DoD has historically been assigned the responsibility to coordinate patient movement for the NDMS through DoD Directives/Instructions, the ESF #8, previous and existing Memoranda of Agreement, and other documentation. However, in interviews conducted for this study, DoD representatives universally noted that DoD cannot commit to a specific, established resource support level because of ongoing DoD priority mission requirements and the subsequent availability of total force resources. Additionally, DoD personnel interviewed suggested a requirements-based rather than capabilities-based approach to planning. In this approach, the requirements for either/both planning or/and operations (e.g., projected workload) would be identified (through modeling, other forecasting methods, or through actual requests from real-world events) and the supporting activities would then identify their support capabilities to meet the projected requirements.

This support issue is further exacerbated by current funding process questions. DoD has provided, and the NDMS Executive Secretariat has endorsed, a proposal to the Senior Policy Group (SPG) that identifies approximately $15M of initiatives to support definitive care and patient evacuation. The initiative was developed to correct the long-standing issue that there has not been a standardized budget or funding mechanism for DoD and VA support. A coordinated position and decision regarding the process for funding other than NDMS response teams (e.g., can this be included in the HHS budget or is it more appropriate for the partner components to seek the funding through their organic budgets?) is a needed first-step.

Revisions to the ESF #8 Concept of Operations, interviews conducted for this study, and other documents that have been reviewed suggest to the MITRE team that DoD desires wording to reflect that DoD will coordinate patient movement only when DoD resources are being utilized. While this suggested doctrinal change is counter to previous plans (e.g., responsibilities identified for the Armed Services Medical Regulating Office and its successor organization — the GPMRC, DoDD 6010.22 (Jan 21, 2003), and the Oct 2005 MOA which suggest DoD will

coordinate NDMS patient evacuation [uncaveated]), it likely reflects the reality of today's DoD operating constraints. However, it also worth pointing out that previously the Air Mobility Command had significantly more resources at its disposal with the C-9 fleet which has since been retired, and a greater number of Air National Guard and Air Force Reserve deployable AE assets than exists in today's inventory. Thus, resource availability was seldom an issue.

Finally, the notional National Planning Scenario (NPS) requirements suggest that many of the scenarios do not require significant out-of-area/region movement. In these scenarios, the use of DoD resources is likely not warranted as the anticipated requirements could potentially be handled by alternative resources. Having the DoD and USTRANSCOM retain the primary patient evacuation coordination responsibility would require that they be engaged in even these limited scope operations.

- This may not be the best use of critical DoD resources in today's environment, given the potential availability of other resources. In those situations where DoD support would still be required because of the numbers and types of casualties to be moved, the DoD's mission assignment could change to one of executing a transportation request with the capacity for GPMRC support as needed and requirements warrant.
- Under this construct, a HHS patient movement coordination team would determine the desired medical facility location to which the patient(s) would be taken and then pass a "movement requirement" to DoD, similar to what is done with cargo and personnel today. The supporting DoD entity (to include GPMRC) would then perform any additional validation and other responsibilities IAW their procedures to execute the mission.

Discussion

The Executive Secretariat has a current recommendation to the Senior Policy Group proposing a 25-person inter-agency GPMRC augmentation team to support NDMS medical regulating on non-DoD conveyances. This number is consistent with a similar unit type code full manpower composition that was originally developed in 1999 to provide a deployable DoD patient movement coordination center and thus seems a reasonable starting point for identifying staffing requirements. It can be adjusted as needed should further analysis suggest a different mix.

However, this study does not support the assumption that these resources should principally be used for GPMRC augmentation. In MITRE's view, augmentation of a DoD entity does not address the core concern of managing a domestic disaster and normal DoD combat operations simultaneously, both requiring patient movement with limited resources. Accordingly, MITRE recommends a HHS-based team that could train with DoD, but regulate disaster events separately when directed by the HHS executive agent. Or, conversely the team could as outlined by the Executive Secretariat provide selected augmentation to the DoD's GPMRC when USTRANSCOM and GPMRC were responsible for patient evacuation (see employment options outlined later in this section). This team would support all emergency support operations requiring federal patient movement, to include the small-scale operation that may not reach the level of needing DoD support or the large scale operation that required all available patient movement resources. Three non-inclusive options to effectively employ team personnel are discussed later in this section.

This entity would be responsible for orchestrating a coordinated response through interaction with participating partner and private entities executing patient movement operations. In addition, the coordination center needs to be prepared to perform execution related operations as needed, e.g., identify destination hospitals for HHS regulated patients if USTRANSCOM GPMRC is not the responsible activity for any reason. For example, the HHS coordination center would work with state and federal authorities at or near the incident site to identify evacuation requirements and coordinate with a supporting entity, such as USTRANSCOM. The supporting element (USTRANSCOM in this example) would then plan and execute the movement using their existing command and control systems and provide necessary situational awareness information back to the HHS coordination center. This approach provides a single source for overall situational awareness in all cases, e.g., when DoD transportation resources are used and when they are not. Thus, it further recognizes the likelihood that DoD may not be the only provider or single manager of support. Therefore, it assumes that since DoD has indicated they will only monitor and track resources moved on DoD resources it makes sense for HHS to have a single entity responsible for overall situational awareness. As such, further refinement must be accomplished during implementation planning in this area to identify any system redundancies and the desired operational workarounds to obviate them to the maximum extent possible.

Although the team would be considered an HHS ESF #8 support entity, it should be aligned with NDMS for team management and structure. NDMS is best configured and organized within HHS to support response team management, activation, and deployment. Additionally, command and control when employed must be considered in the overall context of the evolving federal patient movement concept of operations, e.g., MIACG (if they could exercise command and control as a staff activity), HHS SOC, Incident Response Coordination Team (IRCT), GPMRC if they assume overall responsibility for patient movement.

Depending on how many staff are ultimately assigned, the team composition could integrate remaining full-time staff from the previously discussed patient movement function who are not already committed, e.g., MIACG, HHS SOC). These individuals could interface within HHS, with the partners, and with the candidate resource providers on a routine basis to conduct requirements and resource planning, work transportation issues, and ensure necessary resource and other readiness information is available when needed. This would also ensure continuity with policies, procedures, and operations and ensure a smoother transition when deployment is required. Other team personnel would be intermittent federal employees similar to current NDMS response teams. Naturally, this creates an additional issue of conducting operations in a no-notice situation that would not be present were the GPMRC, a 24-hour operation, the single point manager. Thus, procedures must be developed to identify alternative strategies to provide support in the immediate period should federal evacuation support be required with little to no notice to get the necessary team components activated.

Once the decision is made regarding which FCCs to use, the HHS patient movement coordination team should be given the responsibility to review the patient movement requests to ensure the patients' suitability for movement on the available conveyance types, regulate the patients to destination reception areas, and identify a desired movement source – e.g., civilian ground or air ambulance through pre-existing contracts, DoD, ANG in Title 32 role, Coast Guard, or other resources identified as available at the time of the emergency. The team would then coordinate with the desired transportation provider to ensure they can accept and complete

the movement mission. The movement mission would then be executed under the control of the assigned transporter with updates provided to this HHS patient movement coordination team to ensure situational awareness.

During active operations, the team could establish a regional presence forward through the Incident IRCT elements co-located with the Joint Field Office (JFO). This would facilitate coordination with state and local entities and enable better forecasting of requirements. Several options exist to accomplish this based on the operations tempo, to include but not limited to:

- Deploy a small liaison presence forward; conduct movement coordination team operations from the HHS SOC, NDMS OSC, or other similar activity
- Deploy and operate movement coordination from the JFO — number of team personnel to be deployed would be sized to support the forecasted requirements and the anticipated scope of evacuation operations
- Deploy a small liaison presence forward to the JFO to ensure interaction with state and local operations; integrate remaining team personnel with GPMRC when DoD will be asked to assume primary movement responsibility.

To ensure HHS situational awareness when deployed in support of a national emergency, the team should provide routine status reporting to the MIACG (or similar entity) at the HHS SOC. Additionally, in those situations when the evacuation requirements are such that they require the larger capacity transportation resources of DoD, team members could be split if needed with some to be determined number deploying to USTRANSCOM to provide support and situational awareness there.

The team will need computer equipment and related supplies to support up to five to six personnel for any given single shift. Additionally, consideration should be given to providing the team with satellite (or other comparable) communications to provide them the ability to independently transmit data should the communications infrastructure be degraded. Additional coordination will also be required to determine if it would be prudent to assume space can be provided within the JFO or other similar command and control element to which the team could attach or if a stand-alone portable shelter/tent should be procured as part of the team's standard equipment.

Finally, there are a number of initiatives underway to identify the future bed reporting and patient tracking systems for HHS. Any solution must consider needed interfaces to reduce the potential for redundancy and allow for the integration of medical capacity, patient, and transportation availability information to support decision-making.

- Until final decisions are made, one interim solution for reporting and tracking could be to explore using TRAC^{2}ES. This would require the establishment of appropriate access so that the HHS patient movement function could access only assets, information, and patients assigned to it. The various FCCs and/or facilities could then be given user accounts for system access. TRAC^{2}ES provides existing capabilities to collect and report medical, demographic, and other patient movement related information and create missions and other resources that could be used to bridge the gap pending implementation of other solutions.

Benefits

- Creates a single patient movement coordination function that can interact with both state and federal entities
- Reduces DoD's planned role so that they will only need to provide support in those events where large-scale evacuation will be required and their larger capacity transportation capability is paramount, or in those situations where the number of critical care patients requires use of every available medical transport capability
- Reduces uncertainty and improves resource requirements and capabilities planning
- Leaves room for synchronization with other efforts and would help reduce the current information void that exists with regard to local/state/federal resource availability that impact planning assumptions and the ability to conduct detailed planning.

Constraints

- Team members must be adequately trained to validate requirements and understand the nuances of the various transportation resource modes to determine suitability for a particular mode. This may require collateral agreements with DoD to periodically enable the team members to work and train with the GPMRC. Additionally, the team members must receive specialized training to ensure they are aware of the impacts associated with moving patients on various transportation modalities and can properly validate their use to ensure safe and appropriate transport.
- The addition of these positions requires funding that may not be approved through the budget appropriation process. Cost factors include equipment, initial and periodic training, and inclusion within the HHS budget submission of a forecasted annual usage budget estimate to support national emergencies. The fallback if the additional staff positions and required communications, automated, and other materiel support resources cannot be approved is to coordinate for continued reliance on DoD.
- Use of non-permanent staff could create operational issues in the immediate period post-incident pending activation. There is also the question of whether personnel with such highly specialized skills and experience would be available to serve only on an intermittent basis.

Recommendation 4.4: Establish patient staging/patient administration team(s)

This recommendation mirrors another Executive Secretariat recommendation to the SPG that this study supports. That suggestion recommends a team of 33 staff. There is no reason to dispute that number as being a good starting point for discussion and preparation of related resource documents to seek approval.

Currently, DoD has the only available deployable patient staging assets. As discussed earlier, it no longer seems prudent to solely rely on and plan for DoD to have the primary responsibility for patient evacuation. Rather, DoD should be viewed as another asset that can be considered by the patient movement coordination team for use based on appropriateness and availability.

Similarly, the creation of one team seems to be an acceptable risk since the patient staging capability likely would not be deployed in those scenarios where the evacuation numbers are

expected to be minimal. In these situations, at most a small cadre of patient movement subject matter experts might be warranted at the Regional Evacuation Point/Casualty Collection Point to orchestrate patient evacuation.

Should a situation arise where there will likely be patient staging requirements from more than one site, DoD support can be requested.

Inherent in this recommendation is the requirement for portable shelters/tents to house the unit and for the related medical, communications, and other equipment to outfit the unit to support patient staging operations. Consideration should also be given to separately including in the equipment cache a stockpile of movement support items (e.g., litters, straps, pillows, medical supplies) to support approximately 250 patients in the event the emergency situation is such that the sending facilities cannot provide them for all the patients to be evacuated.

Benefits

- Provides organic capabilities; reduces uncertainty and improves resource requirements and capabilities planning.

Constraints

- The establishment of one team limits the support capability to one site; should the national emergency(ies) require patient staging from multiple evacuation points support from DoD must be requested
- The addition of these positions requires significant funding that may not be approved through the budget appropriation process. Cost factors include equipment, initial and periodic training, and inclusion within the HHS budget submission of a forecasted annual usage budget estimate to support this elements employment in national emergencies.

Recommendation 4.5: Establish deployable patient movement liaison teams

Currently, DoD is relied on to provide patient movement teams and aeromedical evacuation liaison. As discussed earlier, it no longer seems prudent to solely rely on and plan for DoD to have the primary responsibility. Rather, DoD should be considered as another candidate resource provider to be used based on appropriateness and availability.

This recommendation supports, but modifies, another Executive Secretariat recommendation to the SPG. That suggestion recommends a team of 26 staff to comprise a deployable medical regulating team(s) to provide additional capability or even to replace DoD joint patient movement teams. Similarly, there appears to be no reason to dispute that number as being a good starting point for discussion and preparation of related resource documents to seek approval. However, this study team suggests the personnel can be used, depending on the operational tempo, to employ as a group or as sub-teams of 3 to 6 cross-functional clinical, communications, and administrative staff to interface at optimum points with the elements providing and/or receiving the patients. As a result, this report suggests the terminology “patient movement team” vice “medical regulating team” to infer a broader context. This is also consistent with terminology used by USTRANSCOM in development of GPMRC support teams. Functions and proposed sub-team composition need to be developed as part of Implementation planning with acceptance of specific recommendations. However, the recommendation considers that this integrated team could be configured to provide several functional “sub-teams”

to complete tasks similar to those performed by several existing DoD teams – e.g., Joint Patient Movement Teams and Aeromedical Evacuation Liaison Teams.

These personnel would complement the staging/administration team suggested in Recommendation 4.4 that would be located at the interface onload point (traditionally, but not restricted to, an airfield) and provide a cadre of patient movement trained personnel who could be positioned at or near the patient source. This could include local/state casualty collection points, individual medical facilities, local/state headquarters elements with direct interaction with the facilities providing the patients, or even selected patient reception areas. These personnel could support patient reporting to the coordination center and provide advice and other information to support patient preparation before they reach the onload point.

This element requires communications and other equipment to support their operations. Similar to the patient movement coordination team, they should also be provided with satellite (or other comparable) communications to provide them the ability to independently transmit data should the communications infrastructure be degraded.

Benefits

- Provides organic capabilities; reduces uncertainty and improves resource requirements and capabilities planning
- Helps obviate Hurricane Katrina/Rita after action items that patient movement was poorly coordinated.

Constraints

- The addition of these positions requires funding that may not be approved through the budget appropriation process. Cost factors include equipment, initial and periodic training, and inclusion within the HHS budget submission of a forecasted annual usage budget estimate to support this elements employment in national emergencies. The backup position is continued reliance on DoD to perform this function.

Recommendation 4.6: **Continue pursuing feasibility of alternative transportation means to increase capacity**

Nearly every interviewee in the patient evacuation domain stated that there is insufficient capability to move critical patients. The majority of existing commercial capabilities are limited to 1 to 3 patients per aircraft. One broker, SoS International, indicated a capability to access a variety of wide-body airframes to include Airbus 310, Boeing 737, and others. But even they reported a maximum capacity of four to six litters. While DoD has larger overall capacity, they estimate they can only provide four percent of that capacity to support critical care patients. Further, significant shortfalls exist in multiple patient categories for the nuclear, chlorine, and blister scenarios, should they occur.

Recently, FEMA established an ambulance support contract to support operations in Zones 2 and 4 (Atlantic and Gulf coast)[7]. These contracts were established to provide a capability of a minimum of 25 aircraft (helicopter and fixed wing), 100–300 ground ambulances, and movement of up to 3,500 special needs people per zone. The primary intent of the contract according to the

[7] Zones do not equate to the 10 Regions; this contracting action breaks the CONUS up into four zones

HHS COTR is for FEMA to be able to provide these assets to a state for their command and control, and not as part of the federal patient movement capability inventory. However, their use likely could reduce the overall out-of-region requirements that the federal support would be asked to move. Additionally, the resources identified to support this contract likely could include some of the same resources. Thus, the potential exists for the double counting of resources.

Therefore, it is imperative that HHS pursue expansion of the ambulance contracts to improve resource availability and provide committed federal support. Coordination and identification of resources could become a role for an adequately staffed Patient Movement function within NDMS.

Further analysis and coordination should also be made to identify support capabilities using commercial (non-patient specific) buses and trains and determine the feasibility of configuring others commercial assets to support patient evacuation. However, use of resources that are not routinely used to provide medical support will also require a plan to provide medical crews during transit. The dedicated medical resources (e.g., air and ground ambulances) will routinely have organic medical crews.

Research conducted for this report did not identify any existing, pre-positioned conversion kits that are available to readily reconfigure buses and trains for patients, similar to what can be done with DoD aircraft. However, there are companies who are able to configure ambulance buses from regular rectangular school buses. One company representative interviewed for this study identified a capability to provide a bus with seating for 42 people that can be converted in approximately one hour to carry 12 litter patients.

- It is likely impractical for HHS to purchase buses to support federal operations. Thus, a national effort would need to be undertaken to establish guidelines and incentives for local communities and states to procure these assets so they could be reconfigured during emergencies.
- The stated cost of the ambulance bus is $100K plus or minus $10K with a six-month lead time currently required to build it. A regular bus costs between $75K and 80K.
- However, the buses as currently built do not have hook-ups for oxygen or ventilators so they would be unable to support critical patient transport. And, even if they could, they would be limited to short-haul movement. The cost for incorporating this additional capability was estimated to be about $10K more with a potential reduction of six litter spaces.

Discussion with VA indicated that AMTRAK uses mail cars because they are the only car type that holds litters. Since they run on "special" tracks, they are only used on the Eastern corridor of the U.S. However, few of these cars exist in the current inventory, they take several days to get ready, and they have no electrical outlets to plug in medical equipment. They also are not heated or air conditioned. So, current alternatives would restrict use to tying down litters to seats in the cabin or transporting ambulatory patients.

The Air Force has procured conversion kits that enable Boeing 767 aircraft to be reconfigured for patient movement. However, the kits are only compatible for the B-767 fleet and would require the USTRANSCOM/CC, with the approval of the Secretary of Defense, to activate the AECRAF program phase to support a Presidential declared national emergency or other crisis.

AMC initially purchased 44 of the kits at a cost of $1.1M for each of the first 10, and $310K for each of the next 34 (in mid-1990s dollars). The contract also permits the airlines a designated period of time to remove the aircraft from commercial operations and deliver them to the configuration site. It then takes 24 hours to install the conversion kit. Thus, for planning purposes it is likely this resource would not be available for at least 72 hours. By current contract, the aircraft also must be kept in service with DoD for 30 days at an approximate cost of $1M per day. These constraints may not make this particular asset a viable alternative. The feasibility of developing similar sets for other, perhaps less expensive and more readily available, aircraft should be pursued. Recognition also must be made, however, that the lack of requirements to use a larger capacity patient movement resource on a recurring basis may make this cost prohibitive.

Many of the established alternative patient conveyance providers could have agreements with state and local officials. Thus, it is imperative that HHS attempt to reach agreement with FCCs, the RECs, and State Emergency Planners to obtain copies of support plans and related transportation appendices to deconflict resource overlap.

There are a number of associations and other groups that could be initial conduits to help identify candidate evacuation resources for mutual assistance agreements or for contracting to support local, state, and federal movement. Representatives from these groups could become candidate partners to assist with identifying and coordinating alternative resources as they have already established relationships with many of the service providers. They are also familiar with the need for standards to ensure safe and appropriate transportation and are cognizant that any carrier should not be approved to transport patients. These include, but are not limited to:

- American Ambulance Association. This association indicates 45,000 ground ambulances are available in the United States. Ambulances are categorized as basic life support or advanced life support.
- Association of Air Medical Services. The Atlas & Database of Air Medical Services[8] which was developed by the Center for Transportation Injury Research in alliance with the AAMS and with support from USDOT (NHTSA and FHWA), identifies 792 rotary wing aircraft in the 50 states which are capable of performing trauma “life flight” type transport and at least 227 fixed-wing aircraft used for medical transport. The fixed-wing assets are routinely limited to 1 to 2 patients per aircraft. Figures 4-3 and 4-4 show the rotary wing and fixed-wing coverage. The “blue star” in Figure 4-4 shows a Corporate Headquarters, the “red square” represents an airport base.

[8] downloaded Jan 3, 2007

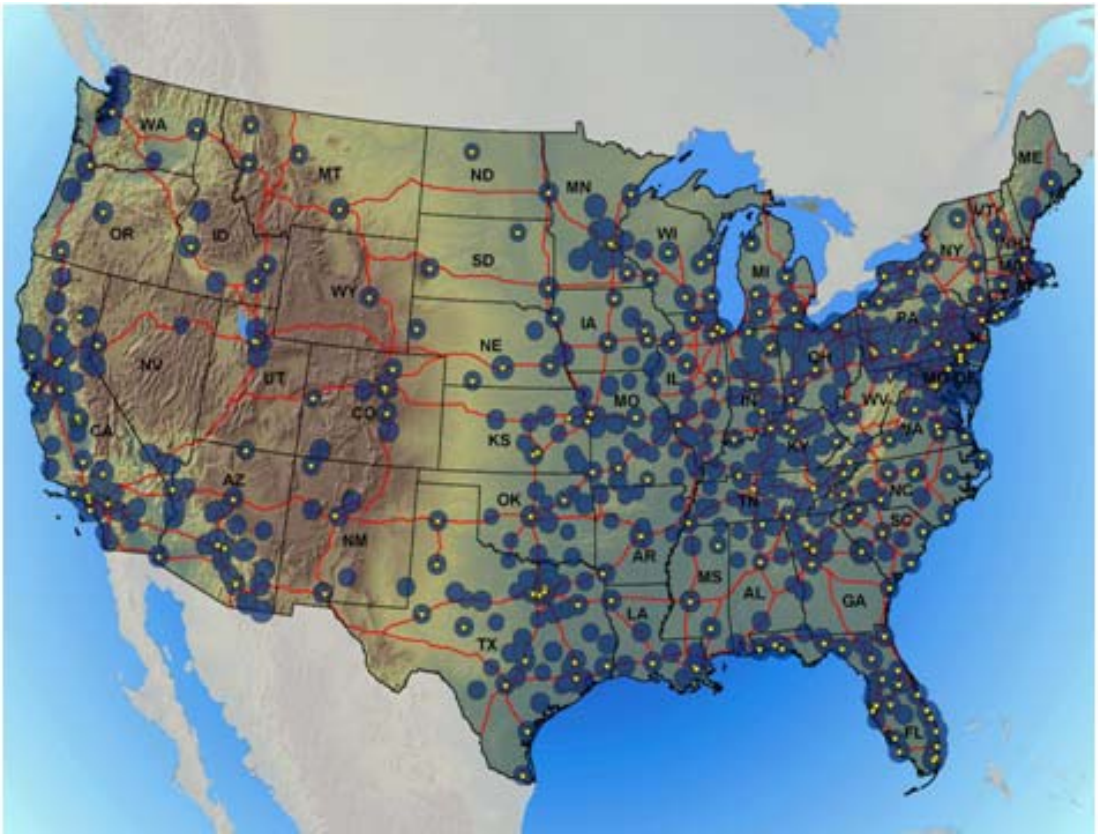

Figure 4-3: Rotary Wing Coverage

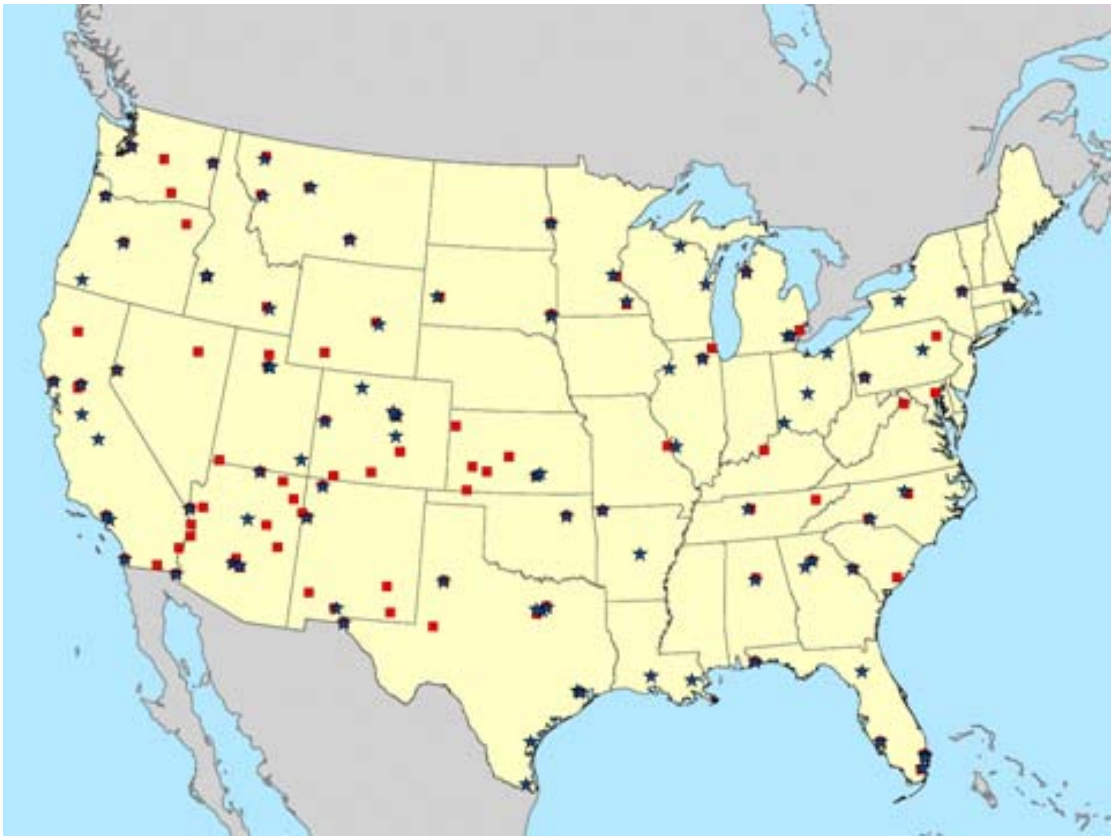

Figure 4-4. Fixed-Wing coverage

Agreements should also be pursued with the other federal providers who could be called in absent, or in conjunction with, DoD mission tasking. These agreements would identify how the patient movement coordination team can receive resource information and access these resources while they are activated under other support provisions. An example of a potential support arrangement is outlined below.

- The ANG provides movement prior to federal activation and during the period the federal support is being mobilized, as previously discussed. Therefore, if each ANG unit has approximately 7-11 medical crews and could fully mobilize, a capacity assumption could be made for their support of 3 missions per day. Using a standard planning factor of 50 patients per mission (with up to 3 critical), 150 patients (with 9 critical) per day could be moved by this one ANG unit for the initial 72 hours before USTRANSCOM is activated and can mobilize the Air Reserve Force augmentation. A planning factor of 3 critical patients per mission is based on the stated capability of an Air Force Critical Care and Trauma Treatment team. Air Mobility Command sources indicate that 2 is preferred, but 3 is the stated capacity. However, as transportation resources would be critical, the maximum capacity is assumed when required.
- The Coast Guard has identified that they have 30 C-130s at five sites with 25 aircraft routinely in operational status. The aircraft are subject to use in certain conditions contingent to disaster relief operations but are always used first for urgent search and

rescue, law enforcement, and homeland security tasking. Coordination with the USCG is necessary both in deliberate and operations execution planning to determine:

- What resources may be available from the Coast Guard for use for patient evacuation in various scenarios
- If the aircraft can accommodate CCATT, patient support pallets, and other related equipment to enhance their capabilities.

Recommendation 4.7: Develop critical care augmentation capability

The ability to support critical care patient movement is a lessons learned shortfall. For example, the Air Mobility Command planning factors for the 2007 hurricane season that MITRE was provided indicated that they were capable of ~4% critical patient movement with proper support using CCATT and other organic resources (e.g., 4 of 100 patients moved could be moved and supported in a critical care status).

HHS, through the Patient Movement and Definitive Care function discussed earlier, should pursue a strategy to develop an organic critical care capability that could augment the transportation resource providers and increase the critical care movement capabilities. Since the individuals would need to be familiar with the nuances of the various transportation modes, these individuals would need to be appropriately trained to meet the standards and criteria established by DoD, or the AAMS, for example. Standards for the appropriate skill mix, required training/orientation, and other criteria could be developed in coordination with DoD, AAMS, and other entities involved in outlining patient transportation policies and procedures. The required number of desired critical care augmentation members could be determined both through determination of an "acceptable risk level" using NPS projections and determination of what might be a "reasonable expected pool" that could be obtained from the private and public health care sector.

In addition, if resources other than USTRANSCOM or established air and ground ambulances resources are use, medical crews may be needed to support transport. HHS should review requirements to augment alternative transportation modes and develop a training/qualification strategy to provide the needed personnel. In extreme situations, this cadre could also complement the organic capability of USTRANSCOM, for example and subject to coordination, to split the crew mix and increase mission capabilities.

Recommendation 4.8: Improve situational awareness

In any situation it is essential that decision-makers have situational awareness of operational activities, to include patient requirements, medical capacity, and transportation availability. This also includes the need to coordinate with the National Guard, the Coast Guard, and other entities like the AAMS to establish procedures for the patient movement function, HHS SOC, MIACG, and patient movement coordination team to have visibility of resources and workload during normal operations and once federal support is needed.

Situational awareness and the establishment of a Common Operational Picture (COP) enable the collection of information from operational resources and sources of information. A well-maintained COP provides the decision-maker with a near real-time source of information and is an enabler of domain awareness by providing decision-makers at all levels with the "right information, at the right time, and to the right level." A well-maintained COP reduces the degree

of operational uncertainty and decision-making time. Any COP plans should be coordinated with DHS as the overall responsible agency for a federal common operating picture to ensure consistency of purpose, information standards, and so forth.

Situational awareness should provide the following abilities to HHS, its deployed assets and components, and other partner agencies and organizations:

- Provide tactical, operational, and strategic decision authorities with the information they need to make sound decisions
- Rapidly inform HHS and partners of strategic implications to mission success
- Rapidly exchange strategic, operational, and tactical information with supporting commands and interagency organizations
- Facilitate the effective planning, execution, and evaluation of multiple mission events
- Enable effective interface with partners to satisfy mission requirements.

The value of enhanced situational awareness is the ability to display information using a standard set of integrated, linked tools and services that provide ready access to operational and intelligence information on a graphical display that is tailored for the operator. An effective COP combines the vast resources of the tactical, operational, and strategic information derived from static and dynamic data sources on a common visual display. A properly managed COP:

- Reduces the degree of operational uncertainty
- Allows leadership to create and control the operational dynamics and not react to them
- Gives leadership more control of the operational tempo
- Reduces decision-making time through shared awareness
- Provides the ability to identify, prioritize, focus, and control operations against the identified threat
- Allows monitoring of the execution phase of an operation and assessment of how well the operation is progressing
- Provides shared situation awareness to coordinate operations.

While the advantages of increased information sharing are great, overcoming organizational roadblocks may be more challenging than technological roadblocks at the implementation stage. Put simply, while the technology already exists to enhance information sharing, the organizational cultures involved in this situation have historically not easily shared information. Therefore, the HHS and partner team will need to pay as much attention to the organizational/cultural dimensions of change as they will to the technical. Understanding the organizational issues and designing and executing a comprehensive change strategy will be critical. This strategy must include more than “end-user training” and communication about the new systems. Resistance to information sharing often comes from cultural assumptions about power, trust, and control; organizational designs; business processes; and organizational incentives that do not always enhance and reward collaboration.

Implementation of many of the recommendations in this and other Sections will lead to improved situational awareness and readiness status reporting.

Benefits

- Improved coordination
- Higher comfort level with decisions due to improved situational awareness

Constraints

- Requires resources from NDMS partners to develop policies and procedures to implement and ensure roles and responsibilities are clear.

4.4.2 Patient Tracking

Recommendation 4.9: Develop a national patient tracking system or system of systems (Note: For recommendations on bed and other medical capabilities reporting which are also inherent to patient evacuation, see Section 5 and Section 6.)

The reasons for developing a mechanism for patient tracking are obvious. Family members want to be able to locate other family members, confirmation of movement is needed to pay the bills for transportation and definitive care, hospitals need to know how many people are coming into their system and their disposition upon release, and emergency managers need to be able to manage what could be a chaotic scene of multiple activities. Initially, a policy clearly defining roles and responsibilities of all partners and supporting members of the NDMS Program and ESF #8 needs to be developed. All members of the partnership need to agree on their responsibilities and have a clear interpretation of the consequences of their participation as fully supportive members. Training and exercises are an important part of integrating these roles and responsibilities in the programs at state and local levels.

On June 26, 2007, HHS published a Notice of a new System of Records (SOR) in the Federal Register. In summary, "In accordance with the requirements of the Privacy Act of 1974, we are proposing to establish a new system titled, "The National Disaster Medical System (NDMS) Patient Treatment and Tracking Records System," System Number 09-90-0040. As stated, the primary purpose of the NDMS Patient Treatment and Tracking Records System is to "collect data from individuals using the medical care capabilities provided by NDMS. NDMS has a need for the collection of information for health care, patient movement, and tracking, as well as for reimbursement of health care rendered."

As noted earlier, there are myriad local, state, and federal systems used to support tracking. If development and implementation of one national system is not feasible, several options exist that could in concert help obviate the existing deficiencies:

- Provide grants to states to purchase automated systems meeting minimal requirements
- Develop a national system composed of individual systems that can report and/or receive data when necessary through feeder systems already in use or in development
- Use a combination of both. The national system middleware methodology may be more appropriate because it allows the states who have systems in place to continue using their current systems albeit possibly with some modifications. Coupling this with grants to states may work to everyone's advantage by giving states flexibility to choose what

works best for their needs while providing a forum for obtaining information required by NDMS.

Mandating use of a national system may be problematic for states and localities that already use automated systems. State laws may preclude use of the system due to legal issues, funding, training, or possibly restrictions that may be incorporated into the system by HHS which would contradict state policies. In addition, any system must comply with federal guidance and state-of-the-market technology regarding the protection of personal and medical information.

HHS has had ongoing discussions with DoD about creating a modified version of JPTA to support emergency operations. The preliminary cost estimate for a JPTA modification was approximately $87,000. Our analysis team understands that agreement has been reached, this initiative is going through both HHS and DoD for approval, and implementation development work can begin shortly. HHS also intends to address HIPAA implications prior to implementation and will develop, in concert with NDMS partners, a supporting CONOPS describing how the system will be deployed and used.

The Agency for Healthcare Research and Quality (AHRQ) recently awarded a contract to Abt Associates to develop recommendations for a National Mass Patient and Evacuee Movement, Regulating, and Tracking System and to build a web-based Mass Evacuation Transportation Planning Model for use before an incident:

- The national tracking system study will provide recommendations regarding system components, suggested implementation phasing, and prototyping. The recommendations report was being drafted concurrent with this report and it is not known at this time what might be implemented.
- The Mass Evacuation Transportation Planning Model describes estimated time to evacuate patients from healthcare facilities. Test sites in New York City and Los Angeles were used to determine elements of the model. The estimates have been given to AHRQ for New York City. The Los Angeles estimates were tested in June 2007 and will be included in a task order due out later this summer.

Each of these initiatives requires an independent assessment by HHS to determine suitability for incorporation into a national emergency management system. It is suggested that it would be prudent to establish a cross-functional, cross-agency team to review and validate the various initiatives and to make recommendations for continued use. Using the same evaluation members ensures continuity to the evaluation process.

Benefits

- The benefits of mandating minimum standards for a patient tracking system are continuity and uniformity of data. Providing middleware for patient tracking systems offers flexibility and some universality in the case of disasters that cross state lines. Providing grants to states gives everyone an opportunity to become technologically advanced in the tracking or regulating of patients.

Constraints

- Time and money are the biggest constraints. It will take time and resources to develop and publish requirements for the state grant programs and the data warehouse. It will also

require a significant investment of taxpayer dollars. Ideally the programs used are ones that can be used on a day-to-day basis to track routine EMS runs. This would result in familiarity with the program. Using one estimate of $100,000 to $250,000 per state, it could result in an outlay of $10 million. Preliminary estimates using other development efforts suggest a national data warehouse could cost in the $1-3 million dollar range depending on services desired. Additional research will be required to further refine this estimate.

- Mandating a system without also providing requisite funding to the states or others who will be required to purchase/use it could lead to sporadic implementation.

4.4.3 Requirements Planning and Forecasting

Recommendation 4.10: **Requirements definition through modeling and other means is needed to improve resource planning**

The ability to identify potential support requirements is paramount to planning and resourcing emergency assistance operations. There have been several recent efforts to conduct modeling and simulation for the national planning scenarios. However, these have been limited to a few scenarios. Additionally, because this was not traditionally accomplished within HHS planning, DoD and other partners have set out to develop their own requirements modeling analysis. Modeling needs to become a standard part of operations planning. Output should outline the projected requirements by categories and, based on input parameters, enable planners to make an initial assessment of patient evacuation requirements and the ability to retain the patients regionally.

Finally, HHS and NDMS should make a concerted effort to reach agreement with states and FCCs to get copies of plan appendices and other information that would provide anticipated resource levels.

Additional discussion on modeling and simulation is included in Appendix A.

Benefits

- Enhanced HHS ability to understand evacuation requirements and resources available from point of injury to definitive care

Constraints

- Requesting additional information from states may require approval from OMB for the additional paperwork burden and may meet resistance from the states

4.4.4 Policy and Procedures

Recommendation 4.11: Develop operational and logistical procedures for patient evacuation

The apparent lack or understanding of a specific step-by-step process and identified roles for coordinating appropriate resources to move patients could exacerbate resource identification and impact command, control, communications, and reporting when support is identified. Therefore, there is a need to clearly define roles, responsibilities, and interdependencies for all supporting components in MOAs, ESF #8, National Incident Management System (NIMS), CONOPS, and other related documents.

The resulting operational procedures should also force a reevaluation of policies for who is authorized movement on dedicated or opportune patient transportation resources. Existing partner policies and procedures, if subscribed to as written could preclude the movement of non-patient family members with patients. This could set up a situation whereby patients could be separated from other family members. In the case of people with special needs, mentally or physically handicapped, blind, infirm, youth, etc., this creates extreme hardship on both the family and the staff assigned to provide patient movement. In most movement situations, the requirements should not overwhelm the system such that family integrity cannot be considered.

Benefits

- Roles and responsibilities buy-in from participating partners
- Common understanding pre-move of policies and procedures
- Family integrity can be maintained.

Constraints

- People who are not categorized as patients may be evacuated with patients, thus creating the likelihood that additional transportation assets will be needed.

Recommendation 4.12: Increase exercise opportunities

Additional exercise participation and training opportunities are essential to ensure cohesive operations, as discussed in multiple sections within this document.

4.4.5 Logistics

Recommendation 4.13: Develop a patient movement item (e.g., litters, litter straps, pillows, and other related material) support concept that is integrated with overall logistics support operations

The Executive Secretariat has recommended to the SPG an initiative to procure patient movement items to support 100 patients at each of the FCC sites. Projected initial cost was $3,350,000. While the study team believes this is a prudent initiative to enhance patient evacuation capabilities, it also believes this should be considered in the context of an integrated logistics system capabilities review before a final decision is made. For example, would it be more prudent to provide the equipment at selected Regional depots and distribute as needed to support emergencies, is the support provided by the staging teams sufficient if the patients arrive on litters, should a combination of options be pursued, should they be positioned with each FCC?

Recommendation 4.14: Develop critical care augmentation equipment sets

HHS should pursue the procurement of materiel and equipment sets to support the critical care augmentation personnel identified in Recommendation 4.7. The existing logistics detail identified to support the Air Force's CCATTs could be used as a baseline to review to identify requirements. The number of sets to be procured would be linked to the number of augmentation teams/personnel determined to be reasonable in the Recommendation 4.7.

5. Definitive Medical Care

5.1 Introduction

This section contains the consolidated recommendations for definitive care in NDMS. In order to frame the recommendations, this introduction includes a description of current operations. The definitive care component of NDMS has been activated only once, in 2005, in response to Hurricane Katrina/Rita. The examples referenced in this section are taken from that event.

The information presented here was gathered from numerous interviews with NDMS staff, NDMS partner agencies, the Agency for Health Care Research and Quality, the Centers for Medicare and Medicaid Services, state and local government partners, the private sector, academia, professional societies, non-governmental organizations, and private citizens, as well as examination of a large number of published and unpublished documents provided by federal, state, and private organizations. The interviewees and documents are included in the listings at the end of this document. Discussion, findings, and recommendations for the integral and related element – Patient Evacuation – is provided at Section 4; Section 6 provides a related discussion of the technologies used and required and will incorporate some of the information provided in this section.

The recommendations presented here are congruent with the recommendations contained in several previous studies:

- *The National Disaster Medical System (NDMS) Strategic Vision* by MAXIMUS (1994)
- *Assessing NDMS Response Team Readiness: Report to DMAT and NMRT Team Commanders* by CNA Corporation (2002)
- The NDMS Senior Policy Group 2007-2009 Issues Paper (2007).

5.1.1 Current Operations

Definitive medical care is defined in the Memorandum of Agreement (MOA) between FCCs and NDMS hospitals as "medical treatment or services beyond emergency medical care, initiated upon inpatient admission to an NDMS hospital and provided for injuries or illnesses resulting directly from a specified public health emergency, or for injuries, illnesses and conditions requiring non-deferrable medical treatment or services to maintain health when such medical treatment or services are temporarily not available as a result of the public health emergency."

Definitive medical care is provided by NDMS hospitals in fulfillment of the third objective of NDMS (as described in the NDMS Federal Coordinating Center Guide of July 2006):

> *to provide a nationwide network of voluntary, pre-identified, non-federal acute care hospitals capable of providing definitive care for the victims of domestic disaster or military contingency that exceeds the medical care capabilities of the affected local, state, or federal medical system.*

Per the most recent version of a working, uncoordinated draft Appendix to the Federal Patient Movement Concept of Operations, the HHS SOC would convene the MIACG to communicate mission requirements and establish an integrated concept of NDMS operations. In this role and consistent with other planning documents (e.g., Incident Management annexes/appendices, ESF

#8, etc.) the MIACG would recommend activation and de-activation of selected FCCs that would then form the basis for patient regulating decisions.

According to the FCC Guide, "the definitive medical care portion of the NDMS begins upon [patient] admission to the participating NDMS hospital." FCCs then monitor the status of NDMS patients and "may be called upon to help coordinate the discharge and transportation of patients returning to their point of origin or other destinations, as authorized."

This description of current operation is divided into four subsections that parallel the topics of recommendations in the sections that follow this introduction:

- Scope
- Capacity
- Reimbursement
- Asset Reporting

A fifth subsection briefly describes the definitive care experience in the one activation of NDMS definitive care: Hurricane Katrina/Rita in 2005.

5.1.1.1 Scope

Each civilian hospital that volunteers to be part of NDMS becomes affiliated with an FCC. An FCC is defined in the *NDMS FCC Guide (2006)* as a facility located in a metropolitan area of the United States responsible for day-to-day coordination of planning and operations in one or more assigned geographic NDMS Patient Reception Areas (PRAs). A PRA is defined as a geographic locale containing one or more airfields, adequate patient staging facilities, and adequate local patient transport assets to support patient reception and transport to local voluntary, pre-identified, non-federal, acute care hospitals capable of providing definitive care for victims of a domestic disaster, emergency, or military contingency.

Although all of the NDMS hospitals are civilian, the 66 CONUS FCCs are managed by the VA DoD. Approximately two-thirds of the FCCs are managed by the VA; the other third are divided among three DoD services (Army, Navy, and Air Force). Each FCC recruits civilian hospitals in its geographic area to accept NDMS patients after they arrive at a PRA.

More than 1,800 civilian hospitals are currently affiliated with FCCs (out of about 5,000 civilian hospitals nationally). Nearly 1,300 hospitals are affiliated with FCCs operated by the VA; 540 hospitals are affiliated with FCCs operated by DoD.

Each hospital that participates in NDMS signs an MOA with the FCC with which it is affiliated. In the MOA, the government agrees to reimburse the hospital for taking NDMS patients – 110% of Medicare payment for patients without insurance or covered only by Medicaid – and the hospital specifies the minimum and maximum number of beds it can make available for patients to be admitted as a consequence of a catastrophic public health emergency. The minimum is the number of beds that could be staffed and available within 24 hours (minus average daily patient census), and the maximum is the number that could be made available within 72 hours (with overtime, deferrals of elective surgery, and other actions, such as early discharge, to increase capacity).

Under the 15 National Planning Scenarios (NPS) of the National Response Plan (NRP), hospitalizations may be as high as 100,000. Table 5-1 shows MITRE's estimates of the hospital bed requirements for the NPS. The capacity to respond to that demand is the topic of the next subsection.

5.1.2 Capacity

NDMS hospitals have committed a minimum of about 34,000 beds and a maximum of about 80,000 beds through current MOAs. Although the MOAs specify only total number of beds to be made available within 24 and 72 hours, actual bed availability at any point in time may vary from the MOA.

In the current process, when NDMS is activated, the MIACG recommends which FCCs to use and alerts them to obtain bed availability reports from participating NDMS hospitals and report bed status to the DoD's USTRANSCOM. USTRANSCOM provides bed reporting instructions and begins collecting daily bed availability information by five specialty areas:

- Critical Care
- Medical/Surgical
- Psychiatric
- Burn
- Pediatric

USTRANSCOM then uses the information about bed availability to assign NDMS patients who require movement from the emergency area to hospitals with available beds to meet their medical needs. USTRANSCOM tracks bed availability through its patient movement system, the TRANSCOM Regulating and Command and Control Evacuation System ($TRAC^2ES$).

Table 5-1. Estimated Bed Requirements by Scenario

#	Scenario Title[9]	Description Summary	Hospitalizations						Primary Medical Condition
			Scenario Total	NDMS Bed Type					
				CC	MC	M/S	MP	SBN	
1	**Nuclear Detonation**	Terrorists detonate a 10-kiloton nuclear device in a large city	100,000	**60,000**	**20,000**	**18,000**	**0**	**2,000**	Burns, Blunt Trauma, Radiation Exposure, Orthopedic Injuries, Ophthalmologic Injuries - Eye Damage, Flash Blindness, Retinal Burns.
2	**Biological Attack -- Aerosol Anthrax**	Terrorists spray anthrax spores in a city using a concealed spray device	13,000	**650**	**2,600**	**9,750**	**0**	**0**	Respiratory Problems, Inhalation Anthrax, Exposure
3	**Biological Disease Outbreak -- Pandemic Influenza**	Natural outbreak of pandemic influenza that begins in China and spreads to other countries	300,000						
4	**Biological Attack -- Plague**	Terrorists release pneumonic plague into three areas of a large city	7,348						
5	**Chemical Attack -- Blister Agent**	Terrorists spray a combination of blister agents into a crowded football stadium	70,000	**3,500**	**3,500**	**54,250**	**250**	**8,500**	Ophthalmologic - Blindness, Skin Conditions, Respiratory - Lung Damage Orthopedic
6	**Chemical Attack -- Toxic Industrial Chemicals**	Terrorists use grenades and explosive devices at petroleum facilities	1,000	**49**	**49**	**800**	**2**	**120**	Orthopedic Respiratory and Skin Conditions - Burns Skin and Ophthalmologic Conditions Ophthalmogic and Respiratory Problems

[9] Shaded rows represent the scenarios that the MITRE team assumed would likely not require federal evacuation support – either because number of hospitalizations was projected to be minimal or because everyone was affected (e.g., pandemic) and there was no place unaffected

#	Scenario Title[9]	Description Summary	Hospitalizations						Primary Medical Condition
			Scenario Total	NDMS Bed Type					
				CC	MC	M/S	MP	SBN	
7	**Chemical Attack -- Nerve Agent**	Terrorists spray Sarin into the ventilation system of three commercial buildings in a city	350						
8	**Chemical Attack -- Chlorine Tank Explosion**	Terrorists use explosives to release a large quantity of chlorine gas	100,000	**5,000**	**5,000**	**85,000**	**0**	**5,000**	Ophthalmogic and Respiratory Problems
9	**Natural Disaster -- Major Earthquake**	7.2 magnitude earthquake occurs in a major metropolitan area	18,000	**2,700**	**1,800**	**12,600**	**0**	**900**	Trauma Injuries - Orthopedic (various) and Burns
10	**Natural Disaster -- Major Hurricane**	Category 5 hurricanes strikes a major city	5,000	**250**	**1,000**	**3,250**	**0**	**0**	Dehydration, Injuries, Mental Health Problems
11	**Radiological Attack -- Radiological Dispersal Devices**	Terrorists detonate "dirty bombs" in three cities in close proximity	390	**98**	**20**	**98**	**0**	**176**	Radiation, Burns, Blunt Trauma
12	**Explosives Attack -- Bombing Using Improvised Explosive Devices**	Terrorists detonate IEDs in a sports arena, use suicide bombers in a public transit concourse, and in a parking facility	450						
13	**Biological Attack -- Food Contamination**	Terrorists contaminate food with anthrax in processing facilities	650						
14	**Biological Attack -- Foreign Animal Disease (Foot and Mouth Disease)**	Terrorists infect livestock at specific locations	None						
15	**Cyber Attack**	Terrorists conduct cyber attacks on US financial infrastructure	None						

Bed counts are often requested in periods of heightened readiness. Heightened readiness has been declared for every major event since 9/11/2001, and now includes such events as the State of the Union address, Independence Day, and the Super Bowl. The number of beds reported varies only slightly from one count to the next. Table 5-2 shows bed capacity reported in three recent bed count reports.

Table 5-2. Bed Capacity

Item	Bed Category					Total
	Critical Care	Pediatric	Medical/ Surgical	Psychiatric	Burn	
June 28, 2007	5,791	3,849	18,679	4,588	200	**33,107**
May 3, 2007	4,996	3,933	17,161	4,017	470	**30,577**
Nov 2, 2006	5,198	3,988	18,642	4,454	231	**32,513**
Average of three counts	5,328	3,923	18,161	4,353	300	**32,066**
Percent of Total	16.6	12.2	56.6	13.6	0.9	**100**

In comparing NDMS maximum capacity (80,000) with the bed requirements described in the NPS, it is clear that the current NDMS bed capacity is sufficient for all but the two scenarios that have an estimated 100,000 hospitalizations each (nuclear detonation and chlorine tank explosion). NDMS bed capacity is shown in Table 5-3 on the next page.

There are two major shortcomings in the current NDMS bed capacity:

- **Shortage of some specialty beds.** Although the total number of beds may be sufficient, there are gaps between needs and availability for some of the bed types, particularly critical care beds (nuclear scenario), medical/surgical beds (chlorine tank explosion scenario), and burn beds (blister agent and chlorine tank explosion scenarios)
- **Distance to NDMS hospitals.** The distance from a disaster to NDMS beds could require an inordinately large numbers of patients be transported over great distances. Although the capacity of NDMS hospitals is nearly enough to handle all but the most severe of the NPS, the capacity is widely scattered, and it is not practical logistically to move so many patients such a distance. Patient movement requires large amounts of specialized medical resources that are likely to be in high demand (and short supply) during an emergency. Also, movement for critical patients may not be safe or in their best interest and is best avoided when possible.

Table 5-3. NDMS Federal Coordinating Center Bed Capacity

HHS Region	FCC Parent Agency	FCC Facility Name	Location		Bed Capacity by NDMS Bed Category Maximum					
			Identified Service Area	State	CC 17.0%	MC 12.0%	M/S 56.5%	MP 13.5%	SBN 1.0%	Total
1	Navy	Groton USN	New Haven/Hartford	CT	163	115	543	130	10	**961**
1	VA	Bedford VAH	Bedford	MA	681	480	2,262	540	40	**4,003**
1	VA	Northampton VAMC	Northampton	MA	132	93	440	105	8	**779**
1	Navy	Newport USN	Providence	RI	70	49	233	56	4	**412**
1 Total					**1,046**	**739**	**3,478**	**831**	**62**	**6,155**
2	VA	Lyons VAMC	Lyons	NJ	639	451	2,123	507	38	**3,758**
2	VA	Albany VAMC	Albany	NY	145	102	480	115	9	**850**
2	VA	Buffalo VAMC	Buffalo	NY	243	172	809	193	14	**1,431**
2	VA	Castle Pt VAMC	Castle Point	NY	246	174	818	195	14	**1,447**
2	VA	New York VAMC	New York	NY	184	130	610	146	11	**1,080**
2	VA	Northport VAMC	Long Island	NY	192	136	640	153	11	**1,132**
2	VA	Syracuse VAMC	Syracuse	NY	190	134	631	151	11	**1,117**
2	VA	San Juan VAMC	San Juan	PR	65	46	216	52	4	**383**
2 Total					**1,904**	**1,344**	**6,327**	**1,512**	**112**	**11,198**
3	Navy	Bethesda	Washington DC/Maryland	DC	35	25	118	28	2	**208**
3	Air Force	Dover USAF	Wilmington/Dover	DE	83	58	275	66	5	**486**
3	Army	Walter Reed USA	Greater Baltimore area	MD	282	199	937	224	17	**1,658**
3	VA	Philadelphia VAMC	Philadelphia	PA	467	330	1,552	371	27	**2,747**
3	VA	Pittsburgh VAMC	Pittsburgh	PA	443	312	1,471	351	26	**2,603**
3	Air Force	Andrews USAF	Northern Virginia Suburbs	VA	67	47	222	53	4	**393**
3	Navy	Portsmouth USN	Norfolk/Virginia Beach	VA	95	67	315	75	6	**557**
3	VA	Richmond VAMC	Richmond	VA	225	159	749	179	13	**1,325**
3 Total					**1,696**	**1,197**	**5,637**	**1,347**	**100**	**9,977**
4	VA	Birmingham VAMC	Birmingham	AL	137	97	456	109	8	**807**

HHS Region	FCC Parent Agency	FCC Facility Name	Location		Bed Capacity by NDMS Bed Category Maximum					
			Identified Service Area	State	CC 17.0%	MC 12.0%	M/S 56.5%	MP 13.5%	SBN 1.0%	Total Total
4	VA	Bay Pines VAMC	Tampa	FL	258	182	857	205	15	**1,516**
4	Navy	Jacksonville USN	Jacksonville	FL	78	55	259	62	5	**458**
4	VA	Miami VAMC	Miami	FL	243	171	807	193	14	**1,428**
4	VA	Atlanta VAMC	Atlanta	GA	188	133	624	149	11	**1,105**
4	Army	Ft Gordon USA	Augusta	GA	108	76	359	86	6	**636**
4	VA	Lexington VAMC	Lexington	KY	72	51	239	57	4	**423**
4	VA	Louisville VAMC	Louisville	KY	68	48	226	54	4	**400**
4	VA	Jackson VAMC	Jackson	MS	77	54	255	61	5	**452**
4	Air Force	Keesler USAF - Mississippi	Biloxi/Gulfport/Mobile, AL	MS	209	148	696	166	12	**1,232**
4	VA	Salisbury VAMC	Salisbury	NC	779	550	2,590	619	46	**4,584**
4	Navy	Charleston USN	Charleston	SC	25	17	82	20	1	**145**
4	Army	Ft Jackson USA	Columbia/Greenville/Spartanburg	SC	134	94	445	106	8	**787**
4	VA	Nashville VAMC	Nashville	TN	263	185	873	209	15	**1,545**
4 Total					**2,638**	**1,862**	**8,768**	**2,095**	**155**	**15,518**
5	Navy	Great Lakes USN	Chicago/Gary/Hammond	IL	422	298	1,404	335	25	**2,485**
5	VA	Indianapolis VAMC	Indianapolis	IN	142	100	473	113	8	**837**
5	VA	Detroit VAMC	Detroit	MI	506	357	1,681	402	30	**2,976**
5	VA	Minneapolis VAMC	Minneapolis	MN	146	103	486	116	9	**860**
5	VA	Cleveland VAMC	Cleveland	OH	325	230	1,081	258	19	**1,913**
5	Air Force	Wright Patterson USAF	Cincinnati/Columbus/Dayton/Toledo	OH	238	168	792	189	14	**1,401**
5	VA	Milwaukee VAMC	Milwaukee	WI	129	91	427	102	8	**756**
5 Total					**1,909**	**1,347**	**6,344**	**1,516**	**112**	**11,228**
6	VA	Central Arkansas HCS	Little Rock	AR	62	44	207	50	4	**367**
6	VA	New Orleans VAMC	New Orleans	LA	224	158	744	178	13	**1,317**

HHS Region	FCC Parent Agency	FCC Facility Name	Location		Bed Capacity by NDMS Bed Category Maximum					
			Identified Service Area	State	CC 17.0%	MC 12.0%	M/S 56.5%	MP 13.5%	SBN 1.0%	Total Total
6	VA	Shreveport VAMC	Shreveport	LA	73	51	242	58	4	**428**
6	VA	New Mexico HCS	Albuquerque	NM	75	53	250	60	4	**442**
6	VA	Oklahoma City VAMC	Oklahoma City	OK	128	90	424	101	8	**751**
6	VA	Dallas VAMC	Dallas	TX	423	298	1,405	336	25	**2,486**
6	VA	Houston VAMC	Houston	TX	430	304	1,429	342	25	**2,530**
6	VA	San Antonio HCS	San Antonio	TX	230	162	764	183	14	**1,353**
6	Army	William Beaumont USA	El Paso/Las Cruces NM	TX	121	85	402	96	7	**712**
6 Total					**1,766**	**1,246**	**5,868**	**1,402**	**104**	**10,386**
7	VA	Des Moines VAMC	Des Moines	IA	85	60	283	68	5	**500**
7	VA	Wichita VAMC	Wichita	KS	96	68	319	76	6	**565**
7	VA	Kansas City VAMC	Kansas City	MO	88	62	294	70	5	**520**
7	Air Force	Scott USAF	St. Louis	MOIL	189	134	629	150	11	**1,114**
7	Air Force	Offutt USAF	Omaha/Lincoln	NE	113	80	377	90	7	**667**
7 Total					**572**	**404**	**1,902**	**454**	**34**	**3,366**
8	Army	Ft Carson USA	Denver/Boulder	CO	242	171	803	192	14	**1,422**
8	VA	Salt Lake City HCS	Salt Lake City	UT	143	101	474	113	8	**839**
8 Total					**384**	**271**	**1,277**	**305**	**23**	**2,261**
9	Air Force	Luke USAF	Phoenix	AZ	193	136	642	153	11	**1,136**
9	VA	Southern Arizona HCS	Tucson	AZ	51	36	168	40	3	**298**
9	Navy	Camp Pendleton USN	Orange County	CA	178	126	592	141	10	**1,048**
9	VA	Long Beach VAMC	Long Beach	CA	312	221	1,038	248	18	**1,838**
9	Navy	San Diego USN	San Diego	CA	139	98	462	110	8	**817**
9	VA	San Francisco VAMC	San Francisco	CA	299	211	994	237	18	**1,759**
9	Air Force	Travis USAF	Sacramento/Travis	CA	183	129	609	146	11	**1,078**
9 Total					**1,356**	**957**	**4,505**	**1,076**	**80**	**7,974**

HHS Region	FCC Parent Agency	FCC Facility Name	Location		Bed Capacity by NDMS Bed Category Maximum					
			Identified Service Area	State	CC 17.0%	MC 12.0%	M/S 56.5%	MP 13.5%	SBN 1.0%	Total Total
10	VA	Portland VAMC	Portland	OR	182	129	606	145	11	**1,072**
10	Army	Madigan USA	Seattle/Everett/Tacoma	WA	239	168	793	189	14	**1,403**
10 Total					**421**	**297**	**1,398**	**334**	**25**	**2,475**
Grand Total					**13,692**	**9,665**	**45,505**	**10,873**	**805**	**80,538**

5.1.3 Reimbursement

At the time of Hurricanes Katrina and Rita, the previous mechanism put in place by NDMS to reimburse NDMS definitive care claims had been allowed to lapse and no mechanism remained in place. In addition, the federal agencies involved knew that many states would require financial assistance to compensate healthcare providers for care provided to evacuees who had relocated throughout the country. Consequently, FEMA and the Centers for Medicare and Medicaid Services (CMS), entered into an interagency agreement that helped address both issues. According to this FEMA-CMS agreement, executed on November 30, 2005 and remaining in effect through September 30, 2007, FEMA provided $70 million to CMS for the purpose of reimbursing claims stemming from Hurricanes Katrina and Rita. Under the agreement, CMS was to provide reimbursement for two types of definitive care:

- **NDMS Definitive Medical Care.** Payment to health care providers for NDMS evacuees who received medical services in NDMS hospitals.
- **Uncompensated Definitive Care.** Grants to states as reimbursement for medical services provided to the massive number of patients who were evacuees but who did not meet the specific criteria for NDMS patients (or who could not be identified as NDMS evacuees). This category was created in recognition of the substantial burden placed on states for medical care to Katrina/Rita victims who were not evacuated through formal NDMS channels.

Of the $70 million allocated for reimbursement following Hurricanes Katrina and Rita, $3.5 million was ultimately allocated towards NDMS definitive medical care, including payments to hospitals and practitioners furnishing services within such hospitals and administrative services, and $66.5 million was allocated to states for definitive uncompensated medical care. Congress later appropriated additional funds to meet a variety of Katrina-related health care needs, including uncompensated medical care.

From a total of nearly 5,000 claims filed for NDMS definitive care reimbursement, 773 were paid (238 to hospitals and 535 to practitioners) for a total of $1.83 million in medical payments. Of the remaining $1.7 million allocated towards NDMS definitive care, CMS obligated about $0.7 million to cover claims processing-related costs (some remains unexpended) and nearly $1 million remained available for expenditure as of the end of August 2007.

CMS used an existing relationship with a Medicare fiscal intermediary to handle the NDMS definitive care claims processing. The contractor handled the claims efficiently; the longest delays resulted from getting the NDMS-CMS agreement in place.

Consistent with the NDMS MOA, the NDMS hospital agreements, the FEMA-CMS agreement, internal NDMS FCC planning documents, and statutes governing other federal health care programs, the NDMS definitive care reimbursement policy used for the Katrina/Rita event had the following components:

- **Determination of NDMS coverage.** A patient had to be evacuated by NDMS and placed into an acute care hospital (or inpatient rehabilitation or psychiatric facility) by the FCC for inpatient care.

- **Coordination of payments with other payers.** NDMS does not reimburse if the NDMS patient has coverage from Medicare, TRICARE, or the VA, and pays secondarily if the NDMS patient has private health insurance.
- **Appropriateness of care.** The claim is also evaluated according to guidelines for appropriateness of care and allowable level of payment. The NDMS definitive care hospital admissions were deemed medically appropriate when the patient transfer/admission was reflected on records provided by the involved NDMS FCCs.
- **Reimbursement at 110 percent.** NDMS reimburses at 110 percent of the Medicare rate if the NDMS patient has no health insurance or if the NDMS patient only has coverage through Medicaid.

This policy was in effect for the Katrina/Rita emergency only, but could well serve as a template for NDMS definitive care reimbursement policy in the event future public health emergencies trigger activation of the NDMS patient movement and definitive medical care functions.

5.1.4 Asset Reporting

NDMS Asset Reporting System: TRAC²ES

DoD's TRAC^{2}ES is used to report patients for movement; it has been used effectively by DoD since 2001. TRAC^{2}ES has multiple screens intended to capture medical and demographic information that is needed to validate and schedule patients for movement to ensure safe and appropriate transport. It also provides a capability to support situations with mass casualties or other mass patient movement by facilitating the rapid data entry of available demographic and medical information.

While TRAC^{2}ES serves as the primary method for tracking NDMS bed capacity, other bed tracking systems are used outside of NDMS. In addition, the Assistant Secretary for Preparedness and Response (ASPR) is in the process of developing, refining, and fielding the HavBED system to enable centralized bed tracking to support ESF #8 (see detailed discussion at the end of this section).

Existing Non-NDMS Systems

There are numerous local, state, and regional systems in addition to TRAC^{2}ES. Some of the major systems are described briefly below.

- **Denver Health Medical Center.** This medical center administers a system to track real-time hospital bed availability for the City and County of Denver. Emergency medical services use the real-time system to facilitate transport of patient from the field to area hospitals.
- **New York's Hospital Emergency Response Data System (HERDS).** At the direction of New York's governor, HERDS was developed to serve the State Health Department after the 9/11 World Trade Center attacks. Operational since July 2002, HERDS combines Geographic Information Systems and a comprehensive, interactive database to provide health officials with online, real time data describing available hospital beds, medical supplies, personnel, numbers, status and immediate care needs of ill or injured

persons, along with other urgent information to facilitate a rapid and effective emergency response.

- **EMSystem®.** Originally similar in purpose to the Denver Health system, EMSystem® is currently widely used by about a third of the hospitals in the U.S. to track availability of medical resources within a geographic region. The system includes emergency resource management and patient tracking, as well as credentialing for health care professionals. At least four states use this system on a statewide basis (Arkansas, Louisiana, Texas, under review in Florida).
- **Rapid Emergency Digital Data Information Network (ReddiNet®).** Primarily serving agencies in California, ReddiNet® provides real-time information for coordination of hospitals, agencies, and service providers within regional and inter-regional healthcare systems.
- **State Hospital Capacity Web System.** Developed by Harborview Medical Center and the University of Washington, this system supports medical resource management at a regional and statewide level. Hospitals report beds by the NDMS bed categories, and also count beds for operating rooms and emergency departments. The system is in use in three states (Washington, Oregon, and South Carolina), and is under consideration for use in additional states.
- **Burn Bed Availability Reporting System.** HHS/ASPR manages this system, which was developed in collaboration with the American Burn Association in response to the terrorist attacks in September 2001 and the Rhode Island nightclub fire in February 2003. Operational since October 2005, this system looks at bed capacity as well as surge capacity and staffing.

Non-NDMS Systems under Development: HAvBED

The National Hospital Available Beds for Emergencies and Disasters (HAvBED) is under development to be a federal standards-based "system-of-systems" for reporting available hospital beds. Starting in FY 2006 and continuing through FY2007, HHS included language in the National Bioterrorism Hospital Program cooperative agreements requiring grantee states to either start the development of bed tracking systems or enhance current capabilities at the state and local levels. HAvBED is due for delivery to HHS in September 2007.

The goal of HAvBED is similar to the goal of DoD's TRAC^{2}ES: to provide planners and regulators with information they can use to move patients in a time of national need. HAvBED is owned by HHS and may include all civilian acute care hospitals, although policy will determine the extent/scope of hospital reporting to HAvBED (through the states). HAvBED counts beds in eight categories (versus the five used by TRAC^{2}ES), and tracks other information (e.g., projected number of beds available within 24 and 72 hours, Emergency Room (ER) status, mass decontamination facility availability, and number of available ventilators).

5.1.4.1 Activation of NDMS Definitive Care: Katrina/Rita

The definitive medical care component of NDMS was activated for the first (and only) time in 2005 for Hurricanes Katrina/Rita. DoD is the NDMS partner agency charged with moving patients, and reported that DoD moved more than 6,000 passengers, including 2,900 patients, in response to Hurricane Katrina.

Some patients and other evacuees were moved by other, non-NDMS methods, such as Air National Guard (ANG), civilian air ambulances, and private aircraft. Those patients were not processed by FCCs, and are not considered to be NDMS evacuees.

The FCCs managed by the VA (which received the vast majority of patients from Katrina/Rita) received and processed 2,829 people during Hurricanes Katrina and Rita (1,911 from Katrina and 918 from Rita). This total includes both patients and non-patients. The VA FCC rosters indicate that the initial destinations for these 2,829 people were as follows:

- Medical facilities: about 1,950 people (~69%)
- Shelters: about 250 (~9%)
- Nursing homes: about 125 (~4%)
- Miscellaneous (e.g., family, friends, hotels): about 100 (~4%)
- Uncertain or Unknown: about 400 (~14%).

The medical severity of the patients moved was not recorded in any formal fashion at the time they were moved. At the time of evacuation, much of the medical information available about a patient evacuated was hand-written on paper sent with the patient. There were no automated systems established at the disaster sites to track who was being moved or their condition. At the receiving hospitals, records were kept of patients admitted, and later claims were filed by hospitals for reimbursement of patients sent by NDMS. Those later claims included patients' primary diagnosis and diagnosis-related group. The diagnoses included a wide range of medical conditions.

Of the approximately 2,000 people sent to hospitals after evacuation, hospitals were later reimbursed for 228 patients determined eligible to receive NDMS reimbursement. (Ten of these patients were treated in two facilities; hence 238 facility payments were made). In many cases, the NDMS hospitals were able to obtain reimbursement from other sources for the majority of their NDMS evacuees. The NDMS makes payment for care only if there is no other insurance coverage available to the patient (other than Medicaid), and only makes partial payment (in some situations) when such other coverage has been exhausted.

The reimbursement mechanisms and procedures, as well as results from Katrina and Rita claims, are described in more detail in the next section.

5.1.5 Future Operations

When a disaster occurs and the definitive care portion of NDMS is activated, FCC coordinators can work with local officials to assign NDMS patients to the most appropriate hospitals or alternate care facilities. The NDMS patient has been defined more broadly to include those who require a wider range of medical care due to conditions that have been caused or aggravated by the emergency.

- Criteria are developed and promulgated outlining the parameters that must be met to be considered an NDMS patient, what reimbursement can be expected and from whom, when NDMS responsibility for care and payment ceases, and so forth
- A hospital or alternate care facility can expect to be compensated for every NDMS patient who does not have other coverage.

- Claims procedures are available online, and FCC and medical administrative staff have been educated in reimbursement processes and regulations.
- FCCs are activated in some capacity based on surviving operational status at the Regional Evacuation Point as well as at the PRAs. Triage teams are operational for patient evacuation and patient reception.
- Information about patients, staff, beds, and other assets is available electronically and in real time, so that when a patient arrives at a PRA, the FCC coordinator knows where the patient can be sent, and the receiving facility has at least the minimum NDMS data about the patient.
- Potential receiving facilities for NDMS patients include not only hospitals, but possibly alternate care facilities such as nursing homes, urgent care centers, outpatient surgery facilities, and federal medical stations.
- FCCs Coordinators collaborate and plan with state and local officials as well as with other FCC Coordinators to facilitate communication and coordination
- FCC readiness standards are developed; FCC coordinators train with state, local, and federal components of disaster response, and every FCC has achieved a "green" readiness rating
- FCCs are located near most major metropolitan areas.

5.1.6 Findings and Recommendations

The purpose of the previous description is to present current NDMS operations and future state to frame the findings and recommendations that follow. The findings and recommendations are organized under four main topics specified in the Statement of Work for this task:

Scope: Extent of definitive care activity and range of operation, including temporal and geographic boundaries. Findings and recommendations are summarized under three headings:

- Mission
- Governance
- Communication.

Capacity: Capability of staff and equipment to treat patients. This is measured in numbers of patients that can be accommodated. Findings are grouped into three categories; recommendations cross all categories:

- Current NDMS capacity
- Potential hospital/staff capacity
- Alternative care facilities.

Reimbursement: The process by which health care providers receive payment for their services. All findings and recommendations apply to policies and procedures.

Asset Counting: Method of reporting non-consumable clinical assets, such as staffed beds and ventilators, and may include essential non-clinical assets such as generators. Consumable assets are considered supplies and are not generally reported here. Findings are grouped into two categories; recommendations cross both categories:

- Current methods
- Potential methods.

5.2 Scope

Recommendations

Mission	Governance	Communication
• Review FCC mission, roles, and distribution • Train, train, train • Consider the feasibility of activating FCC(s) at the disaster site as well as reception sites • Develop readiness and performance measures	• Review the existing division of DoD and VA FCCs; determine feasibility of standardizing with VA as lead for all FCCs • Clarify roles and responsibilities • Establish regulating guidelines	• Establish NDMS information clearinghouse • Develop integrated systems for patient, asset, staff, and movement tracking

5.2.1 Findings

Mission

The definitive care support methodology for DoD contingencies has evolved since NDMS was created, but the NDMS mission has not been reviewed for consistency with the process DoD uses for current operations.

- The original mission for the NDMS predecessor, the Civilian-Military Contingency Hospital System, was to provide backup to military and VA hospitals in times of overseas conflict with massive military casualties; the creation of NDMS changed the mission to support for both military conflicts and national disasters.
- DoD currently utilizes a combination of DoD facilities, TRICARE contracted entities, and VA for healthcare of large combat or non-combat surges. Also, the military often uses civilian hospitals for specialized care near military bases, for both active duty personnel and dependents (e.g., TRICARE). This process is similar to the NDMS process and uses many, if not all, of the same hospitals for distributing military patients. Several interviewees suggested that the TRICARE process may suit DoD needs better in a military contingency.
- DoD and the VA agreed in November 2006 to create a Primary Receiving Center in each metropolitan area to coordinate arriving military patient admissions to DoD, VA, or NDMS facilities. The agreement states that the Primary Receiving Centers (PRCs) may be designated as FCCs for NDMS. That agreement lists 86 PRCs, though there are currently only 66 CONUS NDMS FCCs (see Figure 5-1.)

Federa			Memorandum of Agreement between the VA and DOD							
Memora			VA-DOD Contingency Plan							
2007			Nov. 16, 2006							
Region	**Agency**	**FCC Facility Name**	**Location**		**Beds**		**Region**	**Primary Receiving Center**	**Patient Reception Area**	
			City	**State**	**Minimum**	**Maximum**		**Name**	**Official PRA(s)**	***PRA for mapping***	**State**
1	Navy	Groton USN	New Haven/Hartford	CT	251	961					
1	VA	Bedford VAH	Bedford	MA	1294	4003					
							1	VA Boston HCS (W. Roxbury)	Boston	Boston	MA
							1	VA CT HCS (W. Haven)	West Haven	West Haven	CT
1	VA	Northampton VAMC	Northampton	MA	254	779	1	VAMC Northhampton	Northhampton	Northhampton	MA
1	Navy	Newport USN	Providence	RI	128	412	1	VAMC Providence	Providence, Newport NS	Providence	RI
2	VA	Lyons VAMC	Lyons	NJ	2090	3758	2	VA NJ NCS (East Orange/Lyons)	East Orange, Lyons	East Orange	NJ
2	VA	Albany VAMC	Albany	NY	500	850	2	VAMC Stratton (Albany)	Albany	Albany	NY
2	VA	Buffalo VAMC	Buffalo	NY	683	1431	2	VA West NY HCS (Buffalo)	Buffalo	Buffalo	NY
2	VA	Castle Pt VAMC	Castle Point	NY	705	1447	2	VA Hudson Valley HCS (Castle Point)	Castle Point	Castle Point	NY
2	VA	New York VAMC	New York	NY	743	1080	2	VA NY Harbor HCS (Brooklyn)	NYC minus Bronx, Long Island	New York City	NY
2	VA	Northport VAMC	Long Island	NY	659	1132					
2	VA	Syracuse VAMC	Syracuse	NY	617	1117	2	VAMC Syracuse	Syracuse, Ft. Drum	Syracuse	NY
2	VA	San Juan VAMC	San Juan	PR	193	383		VAMC San Juan	San Juan, Roosevelt Roads, Ft. Buchanan	San Juan	PR
3	Navy	Bethesda	Washington DC/Maryland	DC	120	208	3	National Naval Medical Center (Bethesda)	NNMC, DC & Maryland environs	Bethesda	MD
3	Air Force	Dover USAF	Wilmington/Dover	DE	191	486	3	VAM&ROC Wilmington	Wilmington	Wilmington	DE
3	Army	Walter Reed USA	Baltimore	MD	617	1,658	3	Walter Reed Army Med Ctr (DC)	Walter Reed AMC DC & Maryland environs	Washington	DC
3	VA	Philadelphia VAMC	Philadelphia	PA	1251	2747	3	VAMC Philadelphhia	Philadelphia	Philadelphia	PA
3	VA	Pittsburgh VAMC	Pittsburgh	PA	666	2603	3	VAMC Pittsburgh (UD) (Pittsburgh HCS)	Pittsburgh	Pittsburgh	PA
3	Air Force	Andrews USAF	Northern Virginia Suburbs	VA	223	393	3	79 Med Wing Andrews AFB (Maryland)	N. Virginia, Andrews AFB	Arlington	VA
3	Navy	Portsmouth USN	Norfolk/Virginia Beach	VA	257	557	3	Naval Med Center Portsmouth (Norfolk)	Norfolk, NMC Portsmouth, Langley AFB, Ft.	Norfolk	MD
3	VA	Richmond VAMC	Richmond	VA	743	1325	3	VAMC McGuire (Richmond)	Richmond, Ft. Lee	Richmond	VA
							3	VA Maryland HCS (Baltimore)	Baltimore	Baltimore	MD
4	VA	Birmingham VAMC	Birmingham	AL	495	807	4	VAMC Birmingham	Birmingham, Redstone Arsenal	Birmingham	AL
4	VA	Bay Pines VAMC	Tampa	FL	597	1516	4	VAMC Bay Pines	Tampa, MacDill AFB	Tampa	FL
4	Navy	Jacksonville USN	Jacksonville	FL	141	458	4	Naval Hosp Jacksonville (Jacksonville FL)	Jacksonville, NH Jacksonville	Jacksonville	FL
4	VA	Miami VAMC	Miami	FL	699	1428	4	VAMC Miami	Miami	Miami	FL
4	VA	Atlanta VAMC	Atlanta	GA	615	1105	4	VAMC Atlanta	Atlanta	Atlanta	GA
4	Army	Ft Gordon USA	Augusta	GA	120	636	4	Eisenhower Army Med Ctr (Augusta)	Augusta, Ft. Gordon	Augusta	GA
4	VA	Lexington VAMC	Lexington	KY	121	423	4	VAMC Lexington	Lexington	Lexington	KY
4	VA	Louisville VAMC	Louisville	KY	144	400	4	VAMC Louisville	Louisville, Ft. Knox	Louisville	KY
4	VA	Jackson VAMC	Jackson	MS	221	452	4	VAMC G.V.S. Montgomery (Jackson)	Jackson	Jackson	MS
4	Air Force	Keesler USAF - Mississippi	Biloxi/Gulfport/Mobile,AL	MS	550	1,232	4	81 AMDS Keesler AFB (Mobile)	Mobile, Keesler AFB	Mobile	AL
4	VA	Salisbury VAMC	Salisbury	NC	2085	4584	4	VAMC Salisbury	Salisbury, Charlotte, Winston-Salem	Salisbury	NC
4	Navy	Charleston USN	Charleston	SC	65	145					
4	Army	Ft Jackson USA	Columbia/Greenville/Spartanburg	SC	616	787					
4	VA	Nashville VAMC	Nashville	TN	664	1545	4	VAMC Nashville	Nashville	Nashville	TN
							4	VAMC Asheville	Asheville	Asheville	NC
							4	VAMC Johnson (Charleston)	Charleston	Charleston	SC
							4	Blanchfield Army Hospital (Ft. Campbell)	Clarksville, Ft. Campbell	Clarksville	KY
							4	Moncreif Army Hospital (Ft. Jackson)	Columbia SC, Ft. Jackson	Columbia	SC
							4	Martin Army Hospital (Ft. Benning)	Columbus, Ft. Benning	Columbus	GA
							4	VAMC Durham	Raleigh-Durham	Raleigh	NC
							4	Womack Army Med Ctr (Ft. Bragg)	Fayetteville, Ft. Bragg	Fayetteville	NC
							4	Nav Hosp Cp Lejeune (Jacksonville NC)	Jacksonville NC, Cp Lejeune, cherry pt	Jacksonville	NC
							4	VAMC Memphis	Memphis	Memphis	TN
							4	Naval Hospital Pensacola	Pensacola	Pensacola	FL
							4	Winn Army Hosptial (Ft. Stewart)	Savannah, Ft. Stewart	Savannah	GA
5	Navy	Great Lakes USN	Chicago/Gary/Hammond	IL	1,226	2,485	5	Naval hosp Great Lakes (Chicago)	Chicago, NH Great Lakes	Chicago	IL
5	VA	Indianapolis VAMC	Indianapolis	IN	375	837	5	VAMC Roudebush (Indianapolis)	Indianapolis	Indianapolis	IN
5	VA	Detroit VAMC	Detroit	MI	1212	2976	5	VAMC Dingell (Detroit)	Detroit	Detroit	MI
5	VA	Minneapolis VAMC	Minneapolis	MN	358	860	5	VAMC Minneapolis	Minneaplois	Minneaplois	MN
5	VA	Cleveland VAMC	Cleveland	OH	789	1913	5	VAMC Stokes (Cleveland)	Cleveland	Cleveland	OH
5	Air Force	Wright Patterson USAF	Cincinnati/Columbus/Dayton/Toledo	OH	569	1,401	5	74 Med Gp Wright-Pat AFB (Dayton)	Dayton, Wright-Pat AFB	Dayton	OH
5	VA	Milwaukee VAMC	Milwaukee	WI	358	756	5	VAMC Zablocki (Milwaukee)	Milwaukee	Milwaukee	WI
							5	VAMC Cincinnati	Cincinnati	Cincinnati	OH
							5	*Scott AFB (see Region 7)*			
6	VA	Central Arkansas HCS	Little Rock	AR	168	367	6	VA Central Arkansas HCS	Little Rock, Little Rock AFB	Little Rock	
6	VA	New Orleans VAMC	New Orleans	LA	638	1317	6	VAMC New Orleans	New Orleans, New Orleans NMC	New Orleans	LA
6	VA	Shreveport VAMC	Shreveport	LA	154	428	6	VAMC Brooks	Shreveport, Barksdale AFB	Shreveport	LA
6	VA	New Mexico HCS	Albuquerque	NM	223	442	6	VA New Mexico HCS (Albuquerque)	Albuquerque, Kirkland AFB	Albuquerque	NM
6	VA	Oklahoma City VAMC	Oklahoma City	OK	290	751	6	VAMC Oklahoma City	Oklahoma City, Tinker AFB	Oklahoma City	OK
6	VA	Dallas VAMC	Dallas	TX	831	2486	6	VAMC Dallas (North Texas HCS)	Dallas	Dallas	TX
6	VA	Houston VAMC	Houston	TX	1215	2530	6	VAMC Houston	Houston	Houston	TX
6	VA	San Antonio HCS	San Antonio	TX	503	1353					
6	Army	William Beaumont USA	El Paso/Las Cruces NM	TX	257	712	6	Beaumont Army Med Ctr (Ft. Bliss)	El Paso, Ft. Bliss	El Paso	TX
							6	Reynolds Army Hospital (Ft. Sill)	Lawton, Ft. Sill	Lawton	OK
							6	Brooke Army Med Ctr (ft. Sam Houston)	San Antonio, Lackland AFB, Brooke Army m	San Antonio	TX
							6	Darnall Army Hospital (Ft. Hood)	Temple, Ft. Hood	Temple	TX
7	VA	Des Moines VAMC	Des Moines	IA	145	500	7	VAMC Des Moines	Des Moines	Des Moines	IA
7	VA	Wichita VAMC	Wichita	KS	230	565	7	VAM&ROC Wichita	Wichita, McConnell AFB	Wichita	KS
7	VA	Kansas City VAMC	Kansas City	MO	245	520	7	VAMC Kansas City	Kansas City, Ft. Leavenworth, Whiteman AF	Kansas City	MO
7	Air Force	Scott USAF	St. Louis	MO	322	1,114	7	375 Med Group Scott AFB (St. Louis)	St. Louis, Scott AFB, Ft. Leonard Wood	St. Louis	MO
7	Air Force	Offutt USAF	Omaha/Lincoln	NE	222	667					
8	Army	Ft Carson USA	Denver/Boulder	CO	684	1,422					
8	VA	Salt Lake City HCS	Salt Lake City	UT	294	839	8	VA Salt lake City HCS	Salt Lake City, Hill AFB	Salt Lake City	
							8	Evans Army Hosp (Ft. Carson)	Colorado Springs, USAF Academy	Colorado Springs	CO
							8	VAMC Denver	Denver	Denver	CO
							8	VA E Montana HCS (Montana HCS)	Miles City	Miles City	MT
							8	VAMC Fort Meade (Black Hills HCS)	Rapid City	Rapid City	SD
9	Air Force	Luke USAF	Phoenix	AZ	417	1,136	9				
9	VA	Southern Arizona HCS	Tucson	AZ	109	298	9	VA S Arizona HCS (Tucson)	Tucson, D-M AFB, Ft. Huachuca	Tucson	AZ
9	Navy	Camp Pendleton USN	Orange County	CA	290	1,048	9	Nav Hosp Cp Pendleton (Orange Cty)	Orange County, Camp Pendleton	Orange	CA
9	VA	Long Beach VAMC	Long Beach	CA	408	1838	9	VA Long Beach HCS	Long Beach	Long Beach	CA
9	Navy	San Diego USN	San Diego	CA	232	817	9	Naval Med Ctr San Diego	SanDiego, NMC San Diego	SanDiego	CA
9	VA	San Francisco VAMC	San Francisco	CA	865	1759	9	VAMC San Francisco	San Francisco	San Francisco	CA
9	Air Force	Travis USAF	Sacremento/Travis	CA	61	1,078	9	60 AMDS Travis AFB (Sacramento)	Sacramento, Travis AFB	Sacramento	CA
							9	Michael O'Callahan Fed Hosp	Las Vegas, Nellis AFB	Las Vegas	NV
							9	VA Loma Linda HCS	Loma Linda, USMC 29 Palms	Loma Linda	CA
							9	VA Greater Los Angeles HCS	Los Angeles	Los Angeles	CA
							9	VAMC Hayden (Phoenix)	Phoenix, Luke AFB	Phoenix	AZ
10	VA	Portland VAMC	Portland	OR	512	1072	10	VAMC Portland	Portland	Portland	OR
10	Army	Madigan USA	Seattle/Everett/Tacoma	WA	396	1,403	10	Madigan Army Med Ctr (Ft. Lewis)	Seattle, McChord AFB, Oak Harbor	Seattle	WA
							10	3 Med Gp Elmendorf AFB (Anchorage)	Anchorage, Elmendorf AFB	Anchorage	AK
							10	Naval Hospital Bremerton (Bremerton)	Bremerton	Bremerton	WA
66					33,916	80,538	86				

Figure 5-1. Comparison of PRCs and FCCs

- NDMS and the FCCs now have a primary focus on domestic emergencies and civilian casualties of a quite different nature from military casualties. As Katrina/Rita demonstrated, much of the population served was in poor health even before the disaster occurred; the flooding caused new conditions and exacerbated existing conditions. People evacuated without medications for chronic conditions such as hypertension, diabetes, and psychosis.
- In Katrina/Rita, every attempt was made to send NDMS patients to participating NDMS hospitals, but some were dispositioned to non-NDMS hospitals based on patient need if care was not available in a NDMS hospital. Any non-NDMS patients who may have arrived were assigned based on medical needs without regard to NDMS affiliation of the facility.
- NDMS generally will activate only those FCCs and their associated Patient Reception Areas (PRAs) designated to receive patients in support of the identified casualty producing event.
  - In Katrina/Rita, FCCs were activated only at the PRAs used. It has not been an identified FCC role, nor has it been NDMS policy to activate FCCs at forward patient evacuation sites.
  - Some patients were moved several times before reaching their eventual destinations. Triage facilities were not in place at each of those patient holding and transition areas. This situation was exacerbated, as discussed in section 4, by the fact that many patients were not fully coordinated through USTRANSCOM and the GPMRC as the GPMRC, as a matter of procedure, attempts to notify reception sites of incoming aircraft missions.
  - Several FCC Coordinators reported that it would have helped communication and coordination of patient care to have the FCCs activated at the evacuation sites. Information known at the evacuation site, such as number of patients and their medical conditions, would have been invaluable to medical staff at the PRAs. However, it must be noted that depending on the event supported, the forward FCC/PRA may be operationally degraded and thus their availability may be limited to non-existent.
    - For example, at one PRA, five newborn (day-old) patients arrived and required a nursery level of care not available at the PRA. If this patient information had been available in advance of arrival, the appropriate incubators and other equipment could have been available, as well as transportation directly to local specialized hospitals.
- Currently, there are no measures of FCC readiness for the definitive care mission. Such readiness measures (and related performance measures) would help FCC Coordinators determine where training is needed, and in an emergency, which FCCs are most prepared to handle patient surges.
- Implementation will require, but is not limited to, changes to the MOA, provider agreements customized to each provider type, clear reimbursement policy, clear internal procedures, development of identified criteria for payment, and so forth.

- Opportunities for training have been limited and not all stakeholders have participated. The coordinators of FCCs activated during Katrina/Rita report that the relationships developed during training exercises were essential to the operation of the PRAs. All of the FCC coordinators interviewed identified training with all responding organizations as essential to effective provision of definitive care in an emergency.

Governance

It is unclear who is responsible for managing all of the FCCs, and how the chain of command works in an emergency.

- 43 FCCs are operated by the VA; 23 by DoD
- Due to downsizing and other issues, several DoD facilities have asked to transfer their FCC responsibilities to local VA facilities
- Army FCC leads are generally field grade officers (O-4 and above) with the FCC function as their primary responsibility; Air Force and Navy FCC leads could have multiple job responsibilities with FCC coordination as an ancillary task and are frequently company grade officers (O-1 to O-3). The VA Area Emergency Managers are also not solely dedicated to their NDMS responsibilities; however, they are likely to be more senior, can provide better stability and community links, and are less likely to experience conflicts in their roles and responsibilities.
- In Katrina/Rita, the chain of command was unclear.
- Stakeholders observed that the National Guard was underutilized and could serve a greater role in NDMS.

Communication

Information system and information sharing constraints can impair planning and preparation for patient reception by FCCs and definitive medical care facilities.

- In Katrina/Rita, patients often arrived at hospitals and at PRAs with no records, no identification, and no points of contact. Some arrived with penciled notes pinned to their clothes with notations about their condition or treatment. In summary, information deficiencies included:
  - Minimal information about severity of medical condition
  - No information about type of facility moved from
  - No information about patients moved by non-NDMS methods
- DoD's TRAC^{2}ES is used to report patients for movement; it has been used effectively by DoD since 2001. TRAC^{2}ES has multiple screens intended to capture medical and demographic information that is needed to validate and schedule patients for movement to ensure safe and appropriate transport. It also provides a capability to support situations with mass casualties or other mass patient movement by facilitating the rapid data entry of available demographic and medical information. However, if patient movement requests cannot be prepared, even with minimal information, due to any number of constraints (e.g., degraded communications, insufficient staff for entry, etc.) it is difficult to impossible to maintain visibility

- Coordination among agencies was poor in Katrina/Rita. Medical staff arrived without clear assignments; volunteers were often not able to be used. In other cases, some facilities were overcrowded, while others were staffed but empty.

5.2.2 Recommendations

As with the other areas, implementing the recommendations will require a commitment of resources to include, but not limited to:

- Review of the day-to-day full-time manning needed for the previously discussed Patient Movement and Definitive Care function
- Staff resources to work and coordinate the myriad of issues that would be required to effect the recommendations, develop and promulgate policies and procedures, and so forth
- Additional staff and equipment for mobile definitive care related teams
- Additional intermittent staff that may be required to support augmentation of medical facilities, depending on the selected implementation concept
- Establishment of an information clearinghouse and other automated system enhancements.

Mission

Recommendation 5.1: Review FCC mission, roles, and distribution. Given that DoD has a process for distributing patients to TRICARE network hospitals, the opportunity exists to review the current concept for using NDMS hospitals as military back-up in a contingency. Some DoD representatives interviewed suggested that the existing TRICARE network presents a better future direction. If the partners decide that it remains prudent to keep an identified NDMS infrastructure separate from a model for using TRICARE network hospitals, HHS, DoD, and VA should consider synchronizing the processes to ensure the combination of FCCs and PRAs is consistent with the VA and DoD agreement from November 2006 and the identified PRCs. This would further serve to eliminate the confusion that could exist from having one FCC and hospital listing for a national emergency response with a different listing for NDMS as back-up in a military contingency as exists today. In addition and assuming the FCC mission remains valid, consideration should be given to the following:

- Consider putting policies in place so all hospitals and other medical facilities can be used in an emergency; this could help reduce or eliminate the FCC Coordinator's task of recruiting hospitals to be NDMS hospitals.
- Enhance the current FCC functions of outreach, training, communication, and coordination with local resources and Regional Emergency Coordinators (RECs).
- Continue to maintain relationships and work closely with the federal partners, the state and local authorities, hospitals, and other stakeholders involved in responding to public disasters.
- Augment NDMS staff resources with mental health and clinical social workers, chaplains, case managers, and volunteers. Many FCC Coordinators and others interviewed who had direct experience with Katrina reported that the population who

passed through NDMS hands had major mental health issues (besides not having medications they were accustomed to taking in order to function), as well as other social issues such as lost children, dead or dying relatives, and general fear and high anxiety, grief, and loss and displacement. The ones who did not get out (and perhaps some of those who did get out) tended to need these kinds of services, hence the recommendation that consideration should be given to augment existing capabilities – even on a short-term basis – to manage these situations.

- Consider utilizing all medical facilities (e.g., urgent care, nursing homes, surgical centers), facilities with beds that could be used in an emergency (e.g., hotels and dormitories), and facilities that could accommodate Federal Medical Stations (FMS), such as schools. As noted previously, implementation of this recommendation also infers the need to develop and promulgate established criteria regarding the definition of what constitutes a patient, identification of reimbursement policies and procedures, capability and status reporting, and so forth.
- Create shelter spaces for non-patients who travel with patients.
- Encourage/require all hospitals to report bed status (not just current NDMS hospitals). Reporting requirements could be established through grant criteria, a phased-in Joint Commission accreditation requirement, and/or a requirement for participation in Medicaid/Medicare. Inherent in this is the need to identify the desired reporting system(s) to be used and ensure all facilities have the ability to report the same or otherwise provide interfaces to existing systems to avoid the need for redundant entry into multiple systems, e.g., HavBED and TRAC^{2}ES. Policies and procedures must also be implemented to facilitate reporting and preclude additional data entry for the facilities such as agreement on a national reporting system or a method to extract data from existing databases for use to create a national status and availability report. Finally, coordination must include CMS representatives responsible for survey and certification requirements to facilitate consensus and obviate the appearance that the program is moving toward "required" participation vice voluntary.
- Create "special needs" medical shelters for people on home ventilators and similar specialized durable medical equipment who do not require hospitalization.
- Create and maintain relationships with hospitals and other medical facilities (and potential medical facilities) in the area, and participate collaboratively in training exercises with them.
- Increase communications with the states and local agencies to increase understanding of the NDMS mission, goals, and public health role.
- Consider creating a position for a FCC National Coordinator. Tasks might include the following:
  - Review FCC plans
  - Include state hospital associations and other stakeholders in planning
  - Develop and review FCC readiness measures
  - Address medical requirements during recovery phase
- Consider a greater federal role in local and regional movement of patients, as might be required for massive short-distance movement. For nearly all of the National Planning

Scenarios, most of the needed medical resources are likely to be available within the region, such as within two hours by ground transportation or a reasonable short-haul helicopter distance.

Recommendation 5.2: Train, train, train. Increase the emphasis on training and integrate training for different types of disasters and associated medical conditions. Based on the experience of Katrina/Rita, focus on chronic illnesses with exacerbations due to the disaster (diabetes, hypertension, asthma, heart disease, and others), and those with mental or behavioral conditions. In addition:

- Work with local responders, hospitals, and other resources to train for disaster response
- Train in security, managing non-medical staff, working with translators, and working around transportation assets, including aircraft
- Engage nursing homes in planning and training exercises
- Train all FCC personnel, patient movement teams, and administrative teams on using information systems
- Increase exercise opportunities for all stakeholders, perhaps by training on small incidents that would not normally require activation of federal definitive care components
- Develop comprehensive scenario based exercise plans
- Participate in joint exercises with NORTHCOM and National Guard components
- Strengthen NDMS Headquarters training programs

Recommendation 5.3: Depending on the scenario and operational status, consider the feasibility of activating FCC(s) at the disaster site as well as reception sites. The FCCs, if not operationally degraded, have the experience and contacts within their area of responsibility and could serve as a primary coordination/collection point at the incident site. In addition, the FCC could be a candidate forward base for the additional teams/personnel addressed in section 4. While they may not be operationally capable of providing support if damaged in the disaster event, it seems prudent to include the possibility during planning to capitalize on their inherent capabilities. Other planning and execution considerations for the disaster site include:

- Deploy administrative teams at evacuation sites to create records and track people (see section 4 discussion)
- Position coordinators on the ground at evacuation sites
- Develop a plan for managing triage at each evacuation site and at every stage of patient movement and reception
- Establish a central patient movement coordination center and staff a team at each evacuation site (see section 4 discussion)
- Implement EMR.
- Develop a means to transmit patient Electronic Medical Record (EMR) data to receiving hospital and patient movement crews

Recommendation 5.4: Develop readiness and performance measures. FCCs should develop readiness and performance measures so that planners can gauge overall preparedness and determine where additional resources or training may be needed.

- Develop performance measures and readiness measures for FCCs
- Develop best practices and standards for FCCs
- Develop integrated readiness reporting system
- Develop national, regional, state, and local disaster readiness dashboard with metrics.

Governance

Recommendation 5.5: Review the existing division of DoD and VA FCCs; determine feasibility of standardizing with VA as lead for all FCCs. Most locations where there is a DoD assigned lead FCC also likely have a VA facility in the area/region that could assume the lead FCC responsibility. Under this construct, DoD involvement would remain as a critical component; however the VA facilities could assume the lead role with the DoD facilities in an alternate or supporting role and/or as a PRA. They would still work hand in glove and the DoD facilities would remain integral to support coordination, act as PRAs, and so forth as they do today. However, the VA staff generally offers more stability within the area for relationship building and sustainment, planning continuity and so forth. Collaterally, elevate the qualifications for the position of the FCC Coordinator to ensure placement of senior-level, experienced personnel. Other related considerations include:

- Establish a position within HHS for overall FCC coordination; management, communications, and command and control would remain with the supporting organization (VA or DoD) as part of their planning and execution responsibilities. If the VA is assigned responsibility for all FCCs, this position could be a VA liaison to HHS and/or could be positioned with the Patient Movement and Definitive Care function. Its main purpose would be to ensure a designated individual(s) within HHS remained current with FCC issues, status, constraints, etc. The individual could also support the MIACG or other similar group discussed in Section 4 during planning and execution activities.

Recommendation 5.6: Clarify roles and responsibilities

- Develop and delineate the overall organizational structure, particularly where acceptance and implementation of a recommendation or other lessons learned may change the existing structure
- Delineate the roles and responsibilities of the RECs, the FCCs, and their relationships for planning and operations execution; goal is to identify and eliminate unnecessary functional overlaps
- Create and implement a communication plan and educate all stakeholder groups to promote understanding of their roles and responsibilities.

Recommendation 5.7: Establish regulating guidelines.

- Establish general regulating criteria/guidelines/protocols before an incident occurs

- Tailor general guidelines for a specific incident and allow decisions to vary from the guidelines, as circumstances indicate. Consider standard Emergency Department (ED) response criteria and acuity scales for patient management – disposition, treatment, and transport.

Communication

Recommendation 5.8: Establish an NDMS information clearinghouse. Establish an NDMS information clearinghouse modeled on other successful clearinghouses such as the one HHS developed in the Children's Bureau:

- Define the role of the clearinghouse: key role in information collection and dissemination; more limited role in information development and consolidation
- Create a Web-based resource designed to optimize usability
- Post monthly bulletins with updates about articles, legislation, research, state actions, etc. relevant to NDMS
- Disseminate resources such as pamphlets about best practices and evidence-based practices
- Create and disseminate fact sheets with short, two-page summaries about seminal topics
- Provide lists of relevant conferences, symposia, etc.
- Create a web site with all of this information, including links to other resources
- Evaluate types of information to push rather than simply operate a passive web site
- Develop standardized emergency response models, playbooks, and scenarios for training consistency
- Develop standardized incidence response "grade sheets" for NDMS self-assessments

Recommendation 5.9: Develop integrated systems for patient, asset, staff, and movement tracking. Establish simple, interoperable tracking systems for patients and professional staff; include licenses/certification systems and bed, transportation, and other asset tracking systems.

- Perform gap analysis for existing systems
- Integrate reporting monitoring and oversight to a single entity within HHS for situational awareness (see section 4 discussion)
- Consider comprehensive recommendations presented in a recent study that was completed under a contract for AHRQ (see section 4 discussion)
- Establish minimum data set of patient health data
- Determine best option to integrate NDMS bed counts, burn bed counts, and alternate levels of care for maximum reporting, e.g., HAvBED, TRAC^{2}ES stand-alone, other.
- Work with DoD to establish necessary interfaces to TRAC^{2}ES or any replacement DoD system for those situations in which DoD will be transporting NDMS patients to ensure appropriate patient movement situational awareness information is provided
- Provide access to Health Information Exchange patient data that complies with privacy and personal information protection policies

- Track all medical and clinical personnel, including retired health care professionals who could potentially become part of the available resource pool. Consider utilizing retirees to augment facility staff when hospital personnel are deployed. If credentials have expired, healthcare professionals with experience can fill roles that do not require credentials.

5.3 Capacity

Recommendations

- Utilize all hospitals and alternate care facilities in an emergency
- Increase clinical staff to increase bed capacity

5.3.1 Findings

Current NDMS

- More than 1,800 hospitals recruited by the 66 FCCs have committed a minimum of 34,000 beds and a maximum of 80,000 beds in an emergency.
- NDMS hospitals could significantly increase the number of beds available in an actual emergency by decompression methods.
- The total number of beds in NDMS hospitals is adequate for all but the two NPS that have an estimated 100,000 hospitalizations each (nuclear detonation and chlorine tank explosion). However, the NDMS beds are located across the U.S. and accessing them may be impractical because so many patients would need to be moved. Furthermore, there are some gaps in the types of beds needed, particularly critical care beds and burn beds.
- In Katrina/Rita, patients were sent to hospitals without consideration of whether they were affiliated with NDMS.

U.S. hospital beds and staff

- The approximately 5,000 U.S. civilian hospitals provide nearly 1 million staffed beds; beds in community hospitals total over 800,000, including 1,800 burn beds. The average bed occupancy rate is about 70%; therefore, approximately 250,000 to 300,000 beds are available on the average. The MOAs signed by NDMS hospitals indicate that hospitals can more than double the number of beds available within 72 hours if necessary in an emergency; therefore, it is likely that more than 600,000 beds could be available if necessary
- The total number of beds in hospitals is sufficient for an emergency if surge procedures are followed. However, a large number of patients would still need to be moved and treated at some alternate care facilities. Many patients would self-move.

- In some states, hospitals are partnering with hospitals with similar levels of care in other parts of the state to admit their patients in case one of the hospitals must reduce service due to damage or other causes. Such arrangements do not handle surge from a disaster, but do address the challenges of moving patients as a result of damage to a hospital.
- In Louisiana, hospitals are moving toward having 7 days of supplies on hand, whereas JCAHO only requires 5 days of supplies. In Katrina/Rita, some hospitals had to wait 6 to 7 days before supplies arrived.
- Some state hospital associations report that hospitals may have beds available, but their capacity may be limited because of utilization of all equipment on hand, leaving none available for surge. Hospitals do not keep caches of equipment for emergencies. Some hospitals have MOAs with vendors for surge conditions, especially for catering and equipment.
- State hospital associations reported key issues in Katrina, including:
  - Lack of staff (due to nursing shortage and staff leaving the area)
  - Lack of beds (particularly pediatrics and labor and delivery)
  - Lack of alternative care (patients were reluctant to leave hospitals because they had no adequate shelters to go to)
- After Katrina/Rita and the problems with mass evacuations, the primary directive became to shelter-in-place. A survey of hospitals reported their main concerns with that directive:
  - Employees leave the area, so sufficient staff are not available
  - Generators were insufficient
  - Fuel for generators was scarce
  - Security was inadequate
- Staffing shortage is the critical limiting factor on medical surge capacity.

Alternate care facilities

- Hospital capacity could be sufficient for any scenario if facilities for alternate levels of care were used to decompress hospitals and treat patients who require a lower level of care.
- Consider utilizing alternate care facilities, including urgent care centers, outpatient clinics, sub-acute care facilities, nursing homes, and mobile medical facilities.
- Dormitories and hotels would provide sufficient numbers of beds to supplement hospital beds, although staffing could become the critical limitation. Implementation would also require coordination to identify and resolve any potential legal and liability issues that could result from using these for medical purposes, even for minimal care patients.
- Facilities without beds, such as schools and stadiums, could be used if mobile medical facilities are available.
- Some states are prevented from using non-hospital facilities because state regulations require offsite facilities to meet current hospital standards. If surge capacity in such

states is to be increased by use of alternate care facilities, then the restrictions will need to be revised.

- Finally, criteria must be developed that outlines items such as (but not limited to): use of these facilities, accreditation, inspection, or certification requirements, reimbursement policies and procedures, definition of an "eligible" patient to use the facilities, and so forth.

5.3.2 Recommendations

Recommendation 5.10: Utilize all civilian hospitals and alternate care facilities in an emergency. The number of beds available can be greatly increased by using all available medical facilities and staff:

- Use all civilian hospitals[10] in an emergency, and plan to use all types of medical facilities to treat patients (e.g., urgent care centers, nursing homes, outpatient surgical centers); this will also require a review of the existing MOA guidelines with a determination regarding the best way to implement, e.g., federal policy, individual MOAs
- Expand specialized beds in a surge condition – especially critical care and burn beds:
  - Increase burn capacity; as this is an expensive, highly specialized, and resource-intensive capability to develop and maintain, options need to be researched to include (but not limited to) the viability of training select health care professionals to augment established burn units, feasibility of providing burn teams and other mobile capabilities, and so forth
  - Work with state, local, and regional planners to identify what mobile surgical units or mobile ICUs may be available; make decisions regarding the need for additional assets and associated staffing by NDMS as a result of the review of available capabilities vs. projected requirements
- Assist coordination between hospitals, shelters, and alternate care facilities so that patients can be discharged from hospitals to create capacity for those needing hospital care
- Evaluate the impact of multiple/simultaneous events on response requirements and definitive care
- Use models to predict bed and facility requirements by disaster type
- Develop capacity to analyze implications of scenarios for FCC doctrine, training, and preparation
- Develop detailed scenario-based casualty forecasts by state, region, and city and train to those scenarios.

Recommendation 5.11: Increase clinical staff to increase bed capacity. Staff augmentation is needed to for medical facilities in disaster areas and in areas that receive disaster patients. HHS should work with state, local, and regional planners to identify what local/area resources may be available; HHS can then make informed decisions regarding the need for additional

[10] Use of DoD or VA poses potential legal issues that would first need to be addressed

augmentation as a result of this review of available capabilities vs. projected requirements. Consideration should be given to:

- ED and emergency response capabilities. The large number of patients in a disaster is likely to overwhelm EDs.
- Maximizing effective use of skilled staff to supervise less experienced staff to serve the greatest number of patients in an emergency
- Developing decision support models for reallocating medical teams dynamically
- Recruiting telemedicine providers for telemedicine pilot programs
- Recruiting CBRNE trained medical professionals.

5.4 Reimbursements

Recommendations

- Create policies and procedures for claims and reimbursements
- Establish an MOA between NDMS and CMS to handle claims and reimbursements
- Define an NDMS patient more broadly, and revisit the reimbursement model

5.4.1 Findings

There were no claims and reimbursement policies or procedures in place when NDMS was activated for Katrina/Rita. There is no permanent apparatus in place now for NDMS reimbursement.

- The reimbursement contract adopted in response to Katrina/Rita has expired.
- The claims and reimbursement method used for Katrina/Rita worked well after it was agreed by both parties; the main delay was to get an agreement between FEMA and CMS so that CMS could process the claims.
  - $70 million in special funds was transferred from FEMA to CMS for hospital and provider reimbursement for NDMS Katrina/Rita patients
  - $66.5 million of the $70 million was granted to states as payment for general uncompensated definitive care that resulted from treating patients from Katrina/Rita.
  - Of the other $3.5 million, about half was paid to hospitals and providers. Nearly 5,000 claims were filed for $10.8 million; 773 claims were paid for $1.83 million.
  - Main reasons for claim denials:
    - Not NDMS patient (80% of denials)
    - Not NDMS covered service (12% of denials)
    - Not NDMS facility (5% of denials)

  - In Katrina/Rita, hospitals were reimbursed through the uncompensated definitive care pool for treating patients who were not NDMS patients.
- During the response to Katrina/Rita, an NDMS patient was carefully defined to avoid improper payment of claims unrelated to the disaster.
- The MOA that is signed by each FCC and its affiliated NDMS hospital states that the government will compensate the hospital at 110% of the Medicare rate for inpatient services for NDMS patients if such funds are available and if the patient does not have private insurance.
- Hospital association representatives said that 110% reimbursement is not usually an incentive to affiliate with NDMS or to treat patients. They reported that they believe most hospitals are quite willing to be part of NDMS. Hospital administrators stated they would be satisfied to be reimbursed at 100% of the Medicare rate if they could be assured of payment for all patients they received due to a disaster. In Katrina/Rita, hospitals treated patients regardless of insurance or "NDMS" patient status and received no payment for most of the uninsured patients they treated.
- The cost of processing claims and reimbursement increases if compensation needs to be at differing rates and for patients with extensive restrictive criteria. More straightforward processing combined with the establishment of clearly defined criteria should result in less cost for system development and maintenance.

5.4.2 Recommendations

Recommendation 5.12: Create policies and procedures for claims and reimbursements. Based on approved changes to the concept of operations, establish written policies and procedures for claims processing, including how hospitals and providers file claims for reimbursement.

- Make information about reimbursement processing publicly available, and proactively notify medical facilities with this information when a disaster occurs
- Develop detailed procedures for claims processing
- Include all hospitals and other appropriate facilities such as nursing homes and urgent care centers in the reimbursement for NDMS patients in an emergency
- Update information in the FCC guide to reflect changes; regularly train FCC coordinators and provider agencies on reimbursement procedures – who is covered, how to file a claim, etc.
- When FCCs are activated, reissue instructions to hospital administrators and other stakeholders in the reimbursement process
- Establish a senior-level working group within HHS to address issues and develop policies and procedures related to development and submission of the supplemental appropriations required to fund NDMS definitive care reimbursements. Membership could include ASPR, OPEO, NDMS, CMS, ASL, ASRT, and ASAM.

Recommendation 5.13: Establish a Memorandum of Agreement (MOA) between NDMS and CMS to handle claims and reimbursements.

- Complete an Interagency Agreement (IA) as soon as possible, before another disaster occurs, so that CMS can process the claims for NDMS
- Conduct a study to determine whether it is more cost effective and timely to keep a claims office operating at a maintenance level in case it is needed, or to have an MOA and plans in place to activate an office when needed.

Recommendation 5.14: Define an NDMS patient more broadly, and revisit the reimbursement model. In policies and procedures, broaden the definition of an NDMS patient so an NDMS patient is not only someone treated in a hospital, but also includes patients treated in other facilities and Emergency Departments.

- Develop and promulgate criteria, e.g., who is an NDMS patient?; what facilities can be reimbursed?; how do they bill?; how do they get paid?
- Retain NDMS as payer of last resort, but consider broadening reimbursement policy to include evacuees from the disaster area who seek assistance at medical/alternate facilities for treatment of conditions directly resulting from the disaster
- Survey facilities to determine the appropriate reimbursement model to support a broadened system.
- Reimburse regardless of level of care (inpatient, outpatient skilled, subacute, observation, etc.) or type of facility (hospital, nursing home, ED, shelter, etc.) treating an NDMS patient

5.5 Asset Reporting

Recommendations

- Develop integrated systems for patient, asset, staff, and movement tracking
- Conduct feasibility analysis to determine HavBED's capability to support asset reporting

5.5.1 Findings

Current asset counting. NDMS receives routine reports of available beds at NDMS hospitals through TRAC^{2}ES in five categories: Critical Care, Pediatric, Medical/Surgical, Psychiatric, and Burn.

- NDMS bed counts are also completed upon request in preparation for periods of heightened readiness or following actual events.
- In Katrina/Rita, bed types were not the major focus for regulators. FCC Coordinators sent patients to facilities wherever beds were available.
- Several other bed and other asset reporting systems exist and are used for emergency response in state and local areas.

- NDMS currently has no system that integrates bed counts with patient movement or patient needs.
- AHRQ conducted a study to look into creating a system to integrate tracking beds and other assets, patients, staff, and movement.

Proposed asset counting. AHRQ is developing HAvBED, which is a set of data reporting standards for states to report bed availability at hospitals that receive HRSA grants.

- HAvBED has eight categories of beds, plus other asset categories: Adult intensive care, Medical/surgical, Burn, Pediatric ICU, Pediatric, Psychiatric, Negative pressure/isolation, and operating rooms, plus ED status, decontamination facilities, and ventilators.
- HAvBED is scheduled to be delivered to HHS in September 2007.
- HAvBED is flexible and can be augmented to accommodate additional types of facilities and assets.
- Nursing homes are the most often mentioned types of facilities that should be considered under surge conditions, primarily as resources for hospital decompression.
  - Two state hospital associations reported that in a disaster, hospitals do not look to nursing homes as potential destinations for hospital patients; rather, they see nursing homes as one source of the surge – patients moving from nursing home to hospital.
  - In areas away from disaster, hospitals might look toward nursing homes as places to place some hospital patients, in order to create surge capacity.
  - Consideration would need to be given to nursing home staffing to determine if augmentation may be needed to support the patients they would be given and clear criteria identified regarding the types of patients who can be transported to nursing homes. Nursing home and long-term care facility staffing requirements are normally at the Licensed Practical Nurse, clinical assistant, or nursing assistant level.

5.5.2 Recommendations

Recommendation 5.15: Develop integrated tracking systems for patients, assets, staff, and movement. Establish simple, interoperable tracking systems for people, professional staff and licenses/certifications, beds and other medical assets, and transportation assets. (also see a similar recommendation 5.9 – each was determined to be applicable to the topic area and thus included in both).

- Consider the comprehensive recommendations presented in a recent study for AHRQ
- Establish a *minimum* data set of patient health data
- Integrate NDMS bed counts, burn bed counts, and alternative facilities into HAvBED reporting
- Work with DoD to establish necessary interfaces for those situations in which DoD will be transporting NDMS patients to ensure appropriate patient movement situational awareness information is provided
- Pursue feasibility of modifying TRAC^{2}ES or using TRAC^{2}ES in a stand-alone mode pending agreement on and establishment of a national system

- Provide access to Health Information Exchange patient data
- Track all medical and clinical personnel, including retired health care professionals who could potentially become part of the available resource pool. Consider utilizing retirees when hospital personnel are deployed. If credentials have expired, healthcare professionals with experience can fill roles that do not require credentials.

Recommendation 5.16: Conduct feasibility analysis in coordination with the partners to determine HAvBED's capability to support asset reporting as a "universal" tool, expand facilities included, and identify methodology to collect information from any remaining non-HavBED facilities to preclude redundant data entry into multiple systems, e.g., interface with TRAC^{2}ES or other accepted DoD/VA tool, use of middleware**, .** Consider using HAvBED as the master tracking system for availability of beds, and expand reporting to include nursing homes, sub-acute and skilled nursing care facilities, and assisted living facilities. In addition, maintain a list of locations and capacities of outpatient facilities such as urgent care centers, surgical centers, etc. Finally, the collection of data from any participating Partner facilities that may not use HavBED must be considered to preclude any requirement for them to use multiple systems for data entry.

6. Asset Assessment Methodologies

6.1 Introduction

This section provides recommendations for enhancing national hospital bed and other asset reporting, particularly as it relates to timeliness of reporting, accuracy of results, percentage of all U.S. hospital beds encompassed, ability to include other assets besides hospital beds, and opportunities for automation (e.g., web-based methods). This section complements operational details and related information system recommendations contained in Sections 4 and 5:

MITRE's initial review identified key systems and their responsible owner and assessed the scope of the key systems. A key focus of the "to-be" capability is on opportunities to enhance existing capability in terms of timeliness of reporting, accuracy of results, percentage of all U.S. hospital beds encompassed, ability to include other assets besides hospital beds, and opportunities for automation, including web-based methods.

MITRE was also asked to give preliminary recommendations related to an emergency medical record to support the direct medical treatment responsibilities of NDMS during an actual disaster or other health incident. Though not directly required within the tasking, it became evident that the issue of documentation of patient care and status was an integral element of Patient Movement and Regulation and Definitive Care. Thus, this section also incorporates a summary overview of the status and proposed future direction for NDMS's Emergency Medical Record system.

In completing these tasks, MITRE reviewed government furnished documents and industry and academic studies and conducted interviews to assess opportunities for improved capabilities in bed counting and asset monitoring. At the same time, MITRE reviewed information system support that is essential to current and future management and operational capabilities of NDMS and its parent organization, ASPR.

6.2 Context for NDMS Incident-Based Information Requirements

On the national scale, NDMS has ongoing responsibilities to provide guidance, leadership, and direct support to assure national preparedness for disaster health management. This includes support for essential information technology capacity that enables essential and cross-system information exchange. Thus, NDMS has a major interest in systems solutions that meet the functional requirements in a major disaster, while meeting emergent national interoperability standards. Such flexible capability will enable increasingly effective exchanges of information and data among health care providers, public health organizations, regional health information organizations, and the federal government in the event of major disasters and health pandemics.

The *Medical Surge Capacity and Capability* study completed by The CNA Corporation for HHS in 2004 suggests a multi-tier level as a conceptual means of distinguishing the coordination and

management health-related disasters.[11] The table below is an adaptation from their multi-tier model:

Table 6-1. Disaster Tier Information Requirements

Disaster Management Level	Control locus	Focus	Basic Health-related Info Requirements
Tier 1	Unit-level healthcare asset management	Local incident management capabilities (internal Emergency Management Program and Emergency Operations Plan)	Bed capacity; available assets; patient status; internal movement; continuity of operations; recovery
Tier 2	Healthcare "coalition" collaboration	Information sharing, cooperative planning and mutual aid and resource sharing	Area-wide coordination of assets; Notification; Clearinghouse re asset needs and availability; Asset sharing; Patient transport; Basic medical status. Aggregate information is generally sufficient.
Tier 3	Jurisdiction incident management (EMS)	Emergency Operations Center (EOC); Medical Incident Management System and emergency support; Logistics management.	Command management. Multi-facility asset and need sharing; patient and evacuee management; resource and logistics management. Patients transported and distributed among care sites. Strategic National Stockpile and other asset request and availability notification.
Tier 4	State response and coordination of intrastate jurisdictions	Management coordination and support to jurisdictions. Coordinate mutual aid across regions and statewide	Implementation of state emergency procedures. Extended region support; state and regional resource allocation and distribution; logistics support coordination management and situational control
Tier 5	Interstate/regional coordination	Management coordination and mutual support. Link with federal resources	Cross-government and jurisdictional logistics coordination; resource sharing and allocation;
Tier 6	Federal response	Federal support to state and local jurisdictions	Multi-state and national management of resource allocations, logistics; funding; implementation of federal emergency policies, standards, procedures

Within this broad national context, NDMS and ASPR have four broad interests related to patient and asset tracking during major health disasters:

- National health situation monitoring - HHS requires information to determine level of disaster in order to support stages and collaborate on estimating and scheduling required federal response
- Health asset logistics management - HHS requires information on available health-related assets in the affected region in order to plan deployment of required additional capacity
- Ongoing event-related health services operations management - HHS requires capability to directly manage federal support at the onsite disaster management site and to receive information regarding status and continued needs

[11] *Medical Surge Capacity and Capability: A Management System for Integrating Medical and Health Resources During Large-Scale Emergencies,* The CNA Corporation for Department of Health and Human Services, Contract Number 233-03-0028, August 2004.

- Event-based direct medical care and services management - HHS must ensure that any federally-deployed medical response teams or individuals are able to document a minimum record of medical intervention in behalf of a disaster victim.

At the event/incident level, ASPR has responsibility for ensuring that its federal teams are properly provisioned with IT-related resources to support their work during a major health disaster. NDMS medical teams provide direct services to people in high risk environments. They require basic but state-of-the-art hardware and software to support their direct patient and victim care during a health disaster. Rugged equipment able to withstand harsh environments is needed for disaster information management. Hand-held devices, network and satellite communication capabilities, hardened server and laptop equipment and clinical and administrative software are essential. And, the equipment must have software that enables NDMS teams to manage all aspects of patient care at an incident site and during transit or transfer to alternate care sites.

The Emergency Responder Electronic Health Record (ER-HER) Detailed Use Case, 20 December 2006,[12] includes a graphic depicting the complex data exchanges required during a medical disaster among onsite care givers, emergency care and definitive care sites and the information systems supporting these sites during a mass casualty incident.

[12] *HITSP Emergency Responder Electronic Health Record Interoperability Specification*, Healthcare Information Technology Standards Panel, Care Delivery Technical Committee of the American National Standards Institute, Review Copy Version 1.0, July 20, 2007.

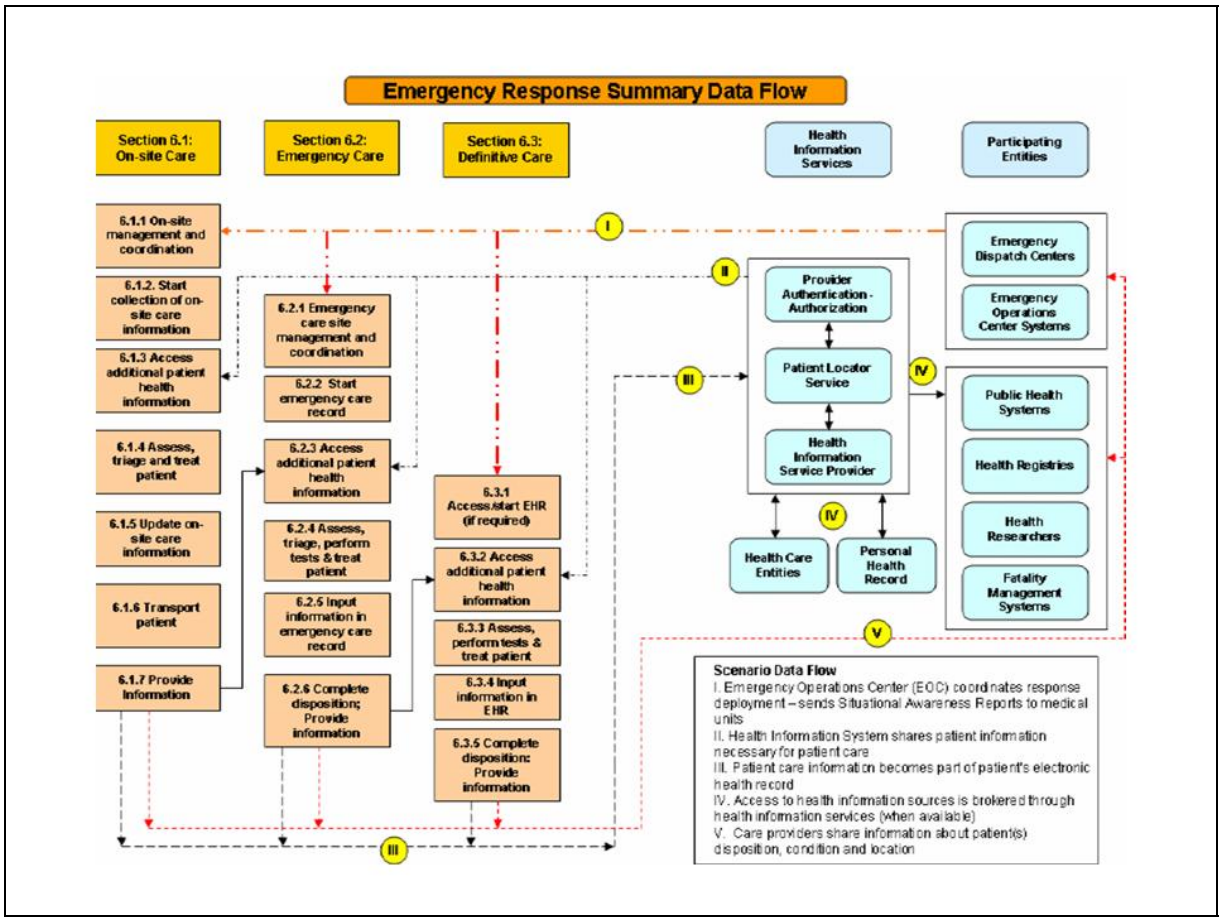

Figure 6-1. Incident-Based Data Exchange

The following capabilities are generally needed at the incident level: (*Note: shaded areas are not addressed in this report, but are included as context*.)

Table 6-2. Incident Based Information Requirements

Primary Functional Capability	Information Technology Support
Management of deployment and setup (See related Logistics and Information Technology Support reports)	• Electronic and telecom capability to notify medical assets (eg NDMS team members) to prepare to deploy; two-way availability and status communication • Deployment operations management - personnel tracking; status; location; personnel asset demand vs met need monitoring • Travel Management - web and telecom based management of ordering, processing, status tracking, change, billing and payment. • Logistics and Cache transport tracking and status data • Onsite IT Set-up and System Management for hand-held and laptop documentation and dashboard device; local data terminal(s) and server; printer; bar-code reader(s); local area network; satellite or other network upload and download data exchange; central server. • Software enabling multi-level and multi-perspective incident views and data management • Security controls including credentialing, management of users and access authentication
Command Structure; Situational Awareness; Resource Tracking	• Online management of and communications among command structure and contacts • Updated incident description and status • Online procedural protocols • Data and analytic support for victim pool status/pattern indicators

Primary Functional Capability	Information Technology Support

	• Assets tracking
	• Personnel (medical and other)
	• Support facility -
	  • Hospital beds by type
	  • Nursing home
	  • Shelter
	  • Other alternate care facility
	• Transport assets
	  • Ground ambulances
	  • Air ambulances
	  • Buses
	  • Fleet vehicles
	  • Trains
	  • Airplanes
	• Other equipment
	• Order tracking
	• Order fulfillment monitoring

Direct Care- Patient Stabilization and Treatment	• (Optional/Optimal) Timely and appropriate electronic data about patient; access to key medical history data
	• Mechanism for documenting emergency medical care - basic patient identity, diagnosis, treatment, medications, status data (hand-held device; direct data entry)
	  – Software embedded in hand-held devices
	  – Assessment and diagnostic tool support
	  – Medical information database re drugs, poisons and illness.
	  – Access to library of medical and emergency protocols
	  – Bar-code forms processing capability
	• Mechanism for transferring documentation to follow-on treatment provider (Print-out; transfer data to/from data store; authorized user access to/view of data)

Direct Service - Patient Transfer and Tracking to manage/"regulate" transport of patients and evacuees	• Collect and enable view of current and timely data re accessible healthcare provider(s), bed capacity and special medical needs • Collect and enable view of data re transport equipment status and location • Enable automated route and schedule planning based on patient-specific required transfer schedule and transport support requirements • Create automated transport plan and transmit notice of transport assignment • Transmit automated notice of "used"/"reserved" bed/space, reserved transport and personnel assets assigned to the transfer • Enable sign-off documentation re transfer • Print Information to accompany patient in transfer to hospital or other facility • Provide capability to monitor completion of transport
Recovery	• Close temporary medical records; complete archive or expungement of record according to policy. • Facilitate family reunification • Facilitate mortality management • Shipping management for restorage of assets • Inventory of assets and restocking management • Debriefing documentation and process management • Enable view and analysis of data re event pattern and management

Presently, although multiple information technology systems are in use for reporting assets and tracking patients during evacuation, no single product or suite of products has established dominance in the industry. The emerging consensus acknowledges that establishing agreement on data standards, core data elements essential to health disaster management, interoperability among systems, and an ability to exchange or view data "near real time" are the fundamental

challenges to be met by all interested parties from the local service provider level to the national disaster coordination centers.

6.3 Current Preparedness Efforts to Assure Availability of Asset Information During Health Disasters

Three core information capabilities are increasingly recognized as fundamental to managing patients in a large-scale disaster:

- Available asset reporting: Bed and other asset availability reporting and use scheduling ("Asset Reporting")
- Patient Movement Management: Patient location, medical status, and support requirements; transport management and movement tracking ("Tracking")
- Patient identity verification and treatment documentation (Electronic Medical Record ("EMR"))

A broad range of federal, state, local, regional, and private sector studies and prototype software have confirmed these priority needs. HHS has taken an assertive role in promoting the development and testing of key elements of the information exchange capabilities that would enhance response to health disasters. The HHS Health Resources and Services Administration (HRSA), Agency for Healthcare Research and Quality (AHRQ), and the Office of the National Coordinator for Health Information Technology (ONCHIT) have funded research and technology prototype development projects related to medical records and health disaster management.

AHRQ is providing key federal leadership in encouraging development of model information technology capabilities to support national health disaster management. AHRQ has contracted for the development of bed and patient tracking software and modeling systems for disaster surge capacity and transport scheduling. AHRQ also conducted a study to look of key processes and information system capabilities in the public and private sector that support patient movement, regulating and tracking. According to AHRQ, the objective of the project is to "evaluate existing models to develop a scenario-based model for movement, regulating, and tracking patients/evacuees using two demonstration cities for planning and responding to a mass casualty event of small, medium, and large (catastrophic) size… (and) … make national recommendations for the development of a national system." Publication of the study is expected in late 2007. These initiatives have advanced national understanding of the need for and basic capabilities required of interoperable systems that can support health-related care during various types of major disasters or health emergencies.

In addition to HHS initiatives, DHS, through its grant and funding mechanisms, is supporting development of capabilities at the national, state, and local levels that impact health emergency management. And, DoD has been extending its war-fighter casualty management systems to support or complement civilian resources for terrorism or major disaster support.

DoD continues to advance the capabilities and interoperability among its core information technology capabilities for managing movement and tracking of battle casualties. Through the VA and NDMS, DoD has been able to build a network of backup healthcare facilities and treatment teams within the civilian medical system to ensure adequate surge capacity in the event

of major military or terrorist event. Conversely, DoD and VA capabilities are also available to support the state and local governments and private sector management in the event of a major health-related disaster. Thus, interoperability among the military tracking systems and private sector and civilian government emergency management systems is important. Presently, the DoD systems for casualty management are more advanced and better funded than comparable civilian capabilities. DoD and VA have unique data and management requirements associated with supporting military and international transport and medical care. Governance, data security and change control priorities must first consider military and national security requirements.

Emergency management organizations, local and state health organizations, private healthcare systems, state governments and regional groups are using a combination of grants, contracts, tax funds and philanthropy resources to fund development and testing of improved approaches to disaster health management. In the civilian governmental and private sector, providers are moving increasingly to electronic records and information sharing capabilities, especially through web-based systems and data exchange capabilities.

Health information technology standardization and harmonization activities, policy development, and related initiatives are focusing disaster emergency health systems capabilities that:

- Are secured and protected by reliable authentication and access authorization
- Use common data definitions and have harmonized data sets
- Define minimum data elements that optimize data exchange while providing acceptable levels of patient and care information
- Support algorithms that optimize unambiguous matching patients and their information
- Verify credentials of clinical care providers and support cross jurisdiction credentialing verification
- Meet certifying standards including Emergency Data Exchange Language (EDXL) protocol overseen by the Organization for the Advancement of Structured Information Standards (OASIS) and ANSI standards developed in collaboration with HHS' ONCHIT. The *HITSP Emergency Responder Electronic Health Record Interoperability Specification*, published in July 2007,[13] is an important document built on the HHS Use Case for Electronic Health Record developed by the HHS Office of the National Coordinator for Health Information Technology.

6.4 Key Health-Related Asset Reporting Applications

State-of-the-art Emergency Medical Services (EMS) at the local and state levels are the primary source for surveillance and status information in health disaster areas. Some EMS systems have been extended to incorporate key health asset and patient tracking information. In some instances, community healthcare organizations have built systems to exchange bed status and emergency room capacity information. For example, NDMS receives routine reports of available beds at NDMS hospitals in five categories through TRAC^{2}ES: Critical care, Pediatric, Medical/surgical, Psychiatric, and Burn. Bed count data is also assembled by NDMS periods of

[13] *Ibid. HITSP Emergency Responder Electronic Health Record Interoperability Specification*

heightened readiness. Some state and local areas produce bed and other asset reports as part of their emergency preparedness exercises.

Below are examples of systems presently under development and/or in use:

- **WebEOC** is a web-based emergency management communications system that enables linking local, state, national, and even worldwide sources to facilitate decision-making in emergency situations or during major events. The tool enables development and posting of electronic forms for data submission and storage. It has been used in some areas for reporting of hospital bed availability and patient tracking. The tool is adaptable to different uses. It is presently in limited use at the HHS SOC.
- **EMTrack** (by EMSystems) is a web-based system to support medical and emergency response teams. It supports a range of capabilities including emergency department status tracking, patient tracking, mass casualty incident support, syndromic surveillance, hospital bed tracking, and public health alerting solutions. It supports recording of patient information and status, patient transfer tracking and data exchange with healthcare facilities. Patients can be tracked using RFID, barcode or data entry.
- **HERDS** (Hospital Emergency Resource Database System) was developed by New York State Department of Health and is a statewide electronic web based data collection system linked to health care facilities (all NY State hospitals) through a secure internet site that allows hospitals to relay resource data and need requests to the Department of Health during emergencies, or to respond immediately to rapid request surveys in preparedness planning efforts. HERDS includes a patient locator and tracking system that lets the general public inquire about missing persons or for EMS, fire, and police to track individuals moved from the scene.
- **HAvBED** (Hospital Available Beds for Emergencies and Disasters) has been built and tested to serve as a core data store and access application for bed and other asset reporting and viewing. The long-term intent of the design is to enable data sharing at all levels from local to national. HAvBED enables recording of eight categories of beds, plus other assets: Adult intensive care, Medical/surgical, Burn, Pediatric ICU, Pediatric, Psychiatric, Negative pressure/isolation, and operating rooms, plus ER status, decontamination facilities, and ventilators. HAvBED is flexible and can accommodate additional types of facilities (not just hospitals) and assets (equipment). Hospitals that receive grants from HRSA are required to report bed availability through HAvBED. HAvBED, which is developed with HHS AHRQ funding, is scheduled to be delivered to HHS in September 2007.
- **ReddiNet** (Rapid Emergency Digital Data Information Network) was built by the Southern California Hospital Association as an open source product to enable regional health providers and EMS staff to track healthcare resources, patient capacity, and surveillance information. ReddiNet (Rapid Emergency Digital Data Information Network) is used in California. According to its website, ReddiNet provides Mass Casualty Incident Management through special screens that allow for data input on patient capacity, victim identification, and dispatch information to evenly and accurately distribute patients to waiting hospitals."

DoD uses several applications to manage and track injured or combat wounded members of the armed forces. DoD's Joint Medical Workstation (JMeWs) enables access to the suite of key DoD medical and patient transport-related applications. (The DoD Joint Medical Workstation [JmeWs] website of DoD's MC4 Medical Communications for Combat Casualty Care at https://www.mc4.army.mil/software.asp shows DoD's technology capabilities supporting management of military healthcare and casualty management.) The key DoD medical casualty systems include:

- **TRAC^{2}ES**, developed by the U. S. Transportation Command, has been used by DoD since 2001 to track patients being transported to and from evacuation points. TRAC^{2}ES is currently the only nationally accepted and utilized patient tracking and medical regulating system. It provides in-transit visibility from the point of embarkation to debarkation for patients moved on a DoD aircraft who have been submitted for movement with a patient movement request (PMR) and moved by USTRANSCOM or USTRANSCOM incorporated assets. TRAC^{2}ES has multiple screens intended to capture medical and demographic information that is needed to validate and schedule patients for movement to ensure safe and appropriate transport. It also provides a capability to support situations with mass casualties or other mass patient movement by facilitating the rapid data entry of available demographic and medical information.

  The information tracked includes patient identity, service affiliation and grade or status, gender, medical diagnosis, medical condition, special procedures or other needs, medical specialties required, administrative considerations, personal considerations, home address of patient and/or duty station, and other information having an impact on the transfer. A mass casualty, or contingency, patient movement request is also available; it collects less required data than the full PMR to expedite input and enable more PMRs to be prepared in a reduced time. The system is focused on management of facility bed availability and transportation assets associated with patient movement. Its design assumes manual data entry by process "handlers" at the transport site and various intervening sites.

- **JPTA** (Joint Patient Tracking Application) is a web-based system that is used by military medical facilities in theaters of operations and in the United States. It tracks the location of military patients throughout the world. It can identify the criticality of the patient and whether the patient is in a Medical/Surgical, Psychiatric, Burn, Pediatric, or Critical Care category (the standard bed reporting categories for NDMS). The JPTA was designed for military use and agreement has been reached between HHS and DoD regarding modifications to provide an NDMS version to support emergency operations but as of this report preparation no changes have been made.

  Presently, data exchanges between JPTA and TRAC^{2}ES are made three times daily via manual loading of exported spreadsheet data. In December 2007, DoD expects to launch the new Theatre Medical Data Store (TMDS) which will enable record views of data from the Composite HealthCare System (CHCSII) and TRAC^{2}ES. In support of patient movement, the system will enable two-way data exchange. The system will only support the military. It is not presently designed to support NDMS or related civilian needs, though it could be modified to do so. Any joint development strategy would require addressing privacy and security issues including compliance with the Healthcare Information and Portability Act (HIPAA) and development of a concept of operations with NDMS and civilian partners before such a capability could be deployed and used.

- **ETAS** (Emergency Tracking Accountability System) tracks evacuees using barcode readers at departure and arrival points. DoD suggests ETAS is useable as a prototype for civilian evacuations in the U.S. However, further development of ETAS is unfunded.

6.4.1 Additional Areas to Consider for Bed Asset Reporting

6.4.1.1 Nursing Homes

The New Orleans disaster made it evident that information on nursing home patients and related supporting assets is vitally important in assessing surge requirements and managing response during major disasters. If the disaster destabilizes the nursing home network, many of their patients may require hospitalization or movement to an alternate chronic care treatment site. Medically compromised or fragile patients require special transport planning and management. Thus, reporting on and tracking nursing home patients is an additional area for both asset reporting and tracking information systems. Basic facility data such as name; location including longitude and latitude as part of address information; management contacts; numbers of patients; diagnoses; and ongoing chronic care requirements are vital response management information.

The Online Survey and Certification, and Reporting (OSCAR) System maintained by the CMS contains vital nursing home data. State and local licensing agencies could also be used to feed state and regional preparedness databases. Since patient populations and facility conditions do not change dramatically over time, periodic data loads would provide sufficient information to establish general conditions for planning purposes. The standard midnight census report maintained by most nursing homes would provide reasonably current patient census information.

6.4.1.2 Home Health Patients

Homebound patients under the care of area Home Health Agencies are another vulnerable population whose needs must be considered during major disasters. If the disaster compromises the patient's home or access for Home Health Aides, then these patients may require transport to and management at an alternate health management site. Basic data on the location and required support for home health patients is contained in the OASIS (Outcome and Assessment Information Set) database maintained by CMS, based on required reporting on all federally supported home health patients.

6.4.1.3 Shelters

Information on location and current and available capacity of area shelters may be needed during major health emergencies. In the event that surge demands necessitate movement of patients out of the disaster area, it may be necessary to know what alternate housing space is available. It may be possible to use available data sources to load preparedness databases. The Department of Housing and Urban Development (HUD) receives quarterly reports from shelters receiving HUD funds through their Homeless Management Information System. The Coordinated Assistance Network (CAN) works with shelters and non-profits that provide support during disasters. The Red Cross National Shelter System maintains basic information on shelters.

6.4.1.4 Other Assets

In a disaster management environment, it may be necessary to know information about a broad range of assets. This would be especially important if the disaster requires movement or relocation of large numbers of medically compromised persons. Data on available airplanes and air ambulances, ground ambulances, buses, fleet vehicles, trains, and water vehicles may be necessary to support evacuation of injured or medically compromised persons. State and local licensing organizations and major system owners are potential sources for this asset inventory information.

6.5 Patient Tracking Applications

Software to enable tracking of patients during health emergencies is essential for many reasons:

- Family members must be able to locate family members
- Emergency managers and transport coordinators need to be able to manage movement of patients
- Hospitals and other treatment facilities need to know how many people are coming into their system, their immediate requirements, and their expected disposition upon release
- HHS needs to account for persons provided transport and care as part of its payment reconciliation process.

Key characteristics of health incident-based tracking and documentation capabilities include:

- Internet-based, but capable of data-entry without access to the Internet
- Immediate accessibility by emergency managers, hospitals, NDMS staff members, and other appropriate responders in different locations
- Ease of use: Hand-held devices for ease of data-entry; use of scanners to read driver's licenses, passports, etc.; ability to use body/wrist tags or bar-coded forms to facilitate identification and status tracking
- Expandable database: Minimally capture the name, gender, date of birth, general health status, when and where the patient was picked up and transferred to; expandable to facilitate adding fields and additional patients
- Patient Identifier: Assign and store unique identifiers to protect privacy of patients
- Ability to integrate with the disparate systems that exist at the local, state, and federal level
- Compliance with HIPAA and other standards
- Possibility of merging into an electronic medical record.

In many states, patient tracking relies on basic pencil and paper notations on-site; the data is entered later into spreadsheets. More recently, new patient tracking technologies have begun to proliferate in the emergency management marketplace. Some of these extend capabilities to address specialized scenarios, including disasters associated with chemical, radioactive, and weapons of mass destruction.

- The **WIISARD** (Wireless Internet Information System for Medical Response in Disasters) system was developed by the University of California, San Diego under a contract from the National Library of Medicine. Their website states "The goal of WIISARD is to provide emergency personnel and disaster command centers with medical data to track and monitor the condition of hundreds to thousands of victims on a moment-to-moment basis, over a period of hours to days at the disaster site. In addition, WIISARD will develop technologies to enhance communication among emergency team members and ensure their safety by tracking the "hot zone," or location and wind drift of the chemical or radioactive matter used as a weapon of mass destruction against civilians."
- Puerto Rico uses the **All Risk Triage Tags,** developed by Disaster Management Systems. Their literature states that the tagging system "provides first responders with a tool to identify, process, and triage contaminated patients… (the product was) developed by fire fighters and designed for ease of use with minimal training in the event of disaster requiring triage of patients." The tag also provides rescue personnel with a means to identify clothing and other personal property.
- **MMRS** (Metropolitan Medical Response System), developed as a contractual program between HHS and approximately 125 metropolitan/city governments, uses bar-coded patient tags which are scanned via wireless devices to transmit patient identity and status, destination, and special conditions to a central database. At the receiving facility, the tag can be scanned and data transmitted from the central server to the facility information system. The system is designed to facilitate triage, treatment, and transport of victims, and was meant to enhance cities preparedness to respond to terrorist CBRNE incidents.
- **Web-Medis** is a hand-held wireless patient tracking system developed by the Oak Ridge Institute for Science and Education and used in Utah.
- **MobileIRIS** is a Mobile Incident Response Information System used in New Jersey. Their literature says "it tracks and monitors information for thousands of evacuees and emergency workers."
- **WITrac** (Wisconsin for Tracking Resources, Alerts, and Communications) was developed for the State of Wisconsin by Image Trend. The application is a database-driven, internet-accessible application that services all areas of the state, whether rural or metropolitan. The system "tracks bed, pharmaceutical and resource availability from all designated facilities within the state as well as providing for allocation of these resources to support surge capacity needs. Hospital bed diversion status, emergency event planning, emergency chat, and alert notifications are supported in real time." (Source: WITrac website)
- **Patient Tracking Locator** system, which is funded by AHRQ, is in prototype stage of development. It is intended to fulfill the key functions in tracking the movement of patients within the healthcare network under emergency conditions. According to AHRQ, "The goal of this project is to develop a system for integrating and managing data pertaining to tracking casualties, victims, and/or individuals affected by large scale events". Potentially, this system could serve as a central data repository for core patient identity and basic status and location information.

6.6 Federal Disaster-Related Electronic Medical Record and Patient Status Applications

The American Health Information Community (AHIC) is an advisory panel to the Secretary of the Department of Health and Human Services. AHIC recommended creation of a standard Emergency Responder – Electronic Health Record (ER-EHR) to support interoperability between first responders, emergency departments, and definitive care facilities. The draft *HITSP Emergency Responder Electronic Health Record Interoperability Specification* was published for comment on July 20, 2007. Congruency with the ER-EHR interoperability specification will be necessary for electronic data sharing with first responders, emergency departments, and definitive care facilities.

From the NDMS perspective, availability of an Electronic Medical Record (EMR) is a core requirement for its medical teams. NDMS teams must provide quality medical care under austere conditions at a disaster site, in transit from the impacted area, and into participating definitive care facilities. The ability to accurately and effectively document direct medical care delivered to disaster victims is critical to the successful completion of the NDMS team mission.

HHS is aware of the importance of enabling NDMS to record patient treatment and tracking data. On June 26, 2007, HHS published a Notice of a new System of Records (SOR) in the Federal Register. The notice stated that "The primary purpose of the NDMS Patient Treatment and Tracking Records System is to collect data from individuals using the medical care capabilities provided by NDMS…NDMS has a need for the collection of information for health care, patient movement, and tracking, as well as for reimbursement of health care rendered."

NDMS is developing a "lite" EMR application to provide a record of diagnoses and interventions, location, treatment administered, medications, transfers of patients during medical disasters. The NDMS EMR is being built based on requirements defined by its team specialists. The EMR enables disaster-site recording of data, using hand-held devices to collect and record data related to direct treatment provided by the team. The EMR data provides patients and definitive care or follow-up medical professionals with documentation of emergency treatment provided. This record serves as a protection for the patients, for documentation of medical claims, to inform follow-up treatment, and for NDMS's performance records, effectiveness assessments and strategic planning purposes. The system could be adapted for use by free-standing specialty medical teams or temporary triage and treatment facilities lacking access to a full electronic medical record capability.

The NDMS EMR system is a standalone client-server application. The client application runs on touch screen enabled wireless laptop computers. This application is a thick client Java application which allows for some local processing and data validation. On site data storage enables immediate data access; satellite and wireless network connectivity enables uploading of data to offsite data stores and data exchange services. User access is restricted to credentialed, authorized users with onsite system administrator management. The EMR server is a hardened laptop computer running an Oracle database. Communications between client and server is accomplished using wireless, encrypted communications.

The NDMS EMR is being built to meet all required data security and confidentiality standards in the industry. The NDMS EMR developers provided input to the initial set of the ER-EHR interoperability specifications. The existing NDMS EMR is in alignment with the initial ER-

EHR interoperability specifications and has an architecture that can be adapted to the consensus interoperability specifications. Before it is deployable, the prototype must be tested for adherence to current and emergent federal and national security standards applicable to emergency medical care. It should also be evaluated for completeness of the proposed data capability in relation to national consensus regarding minimum data sets associated with medical emergency data exchange. The prototype should be modified as necessary to meet these standards.

In the event NDMS adopts telemedicine capabilities in the future, the NDMS EMR could be modified to serve as the data and documentation exchange medium for telemedicine transactions.

Most hospitals and other health treatment facilities use electronic patient registry and use of electronic medical records is gaining momentum. The EMR has been designed to be inter-operable with the DoD Theater Medical Information Protocol (TMIP) suite in order to transfer data with a patient during DoD assisted medical evacuations and patient transfers. It is also being built to enable exchange of data with the medical records in a receiving treatment facility and to enable integration of event-related diagnosis and treatment information into subsequent medical records. Thus, adoption of a standards-compliant EMR and related Patient Tracking capability by NDMS would demonstrate federal leadership to the industry.

6.7 Recommendations for Asset Reporting, Patient Tracking, and Electronic Medical Record

Recommendation 6.1: HHS should consider the technological solutions emerging from the "Services-Oriented Architecture" (SOA) domain. These solutions call for open architectures that enable loose coupling of capabilities to augment or enable data exchanges among independent systems. If properly designed, AHRQ's HAvBED and Patient Tracking Locator software could serve as a regional and national capability for reporting and monitoring assets and tracking patients in mass casualty environments. Basic data could be transmitted to the data store from key data sources to pre-populate the HAvBED database.

In a disaster situation, a pre-approved notification could activate the system and transmit an alert requiring participating facilities and organizations to push a data update to the data store. The national data store could receive data transmissions from "feeder" systems and simultaneously enable manual data entry and submission of data by authorized users who are unable to submit automated data. The national capability could provide data storage and special "views" to be accessed by authorized users at state, regional, and national levels for surge management purposes. Alternate care locations and capacities could be added to the inventory including urgent care centers and surgical centers; location and basic care needs of persons in nursing homes, home health sites, shelters, and other facilities could be maintained in the event of emergency. Policies for system deactivation and record archiving would require policy oversight and monitoring.

Periodic updating of asset data would provide base information in the event of an emergency. The national information exchange capability should enable automated notification of facilities and asset owners to update their information in an emergency. A reasonably current data store could enable automatic messaging by telephone and computer, with instructions on how to access and update the facility's web-based record. Data should be stored in multi-site or at a

federal hardened site to enable situational monitoring and reporting from a "good enough" view even though data may be less-than-current.

ASPR, DoD, and the VA have collaborated extensively on planned extensions of DoD's medical casualty information capabilities. One option that continues to be explored is whether to fund increased extension of military technologies into the civilian sector. This is an attractive option since these systems are already developed and tested and proven to support casualty movement. However, the command structure of the military and the types of casualties they typically manage are not readily adapted to the more diffuse structure of the civilian healthcare and human services resources in the country, which are predominantly privately owned and managed. Refocusing DoD systems to meet civilian needs may conflict with priority requirements for military systems. And, focusing limited federal civilian resources to modify military information systems may constrain private sector momentum. A preferable strategy may be to continue building separate private-sector systems and ensuring interoperable data exchange capability between the civilian and military systems that could be used by the appropriate command and control or coordination activities.

The efforts to develop useable patient tracking systems raise the possibility of a more robust tracking of patients on an ongoing basis. However, supplying data to such a system may prove too burdensome to make it efficacious. A patient locating system associated with a specific health disaster or incident may be easier to successfully implement.

It has been suggested that an optimal test of asset reporting and patient tracking could be built through a collaborative initiative among:

- Federal partners including HHS, DHS, DoD, VA
- A major hospital network serving a vulnerable region (e.g. in hurricane or tornado area), that uses widely recognized industry electronic admission and discharge systems and electronic medical record systems
- Owners of the electronic admission and discharge systems and electronic medical record systems used by the hospital network.

This initiative might test capabilities that enable two-way data exchange whereby the regional hospital system is notified of the identifiers of known victims; the disaster site receives a return list of candidate record names; the onsite data managers accept the most likely record name and submit a query to the hospital database and receive a corresponding data return of key status indicators on the patient regarding recent diagnoses, treatment and current medications.

In a major disaster where vital medical records are destroyed, such as occurred in New Orleans, it may be possible to use existing data stores to reconstruct records. Records from CMS and insurance companies, master patient index of major regional healthcare providers, and nursing homes and home health records could be used to reconstruct basic health history. HHS should examine existing legislative and regulatory authorities to enable such record reconstruction in the event of major disasters.

Recommendation 6.2: It is evident that continued federal leadership with development funding, public-private partnership leadership, and shared governance of support technology initiatives is critically needed to sustain continued building of interoperable

data exchanges that will enable communities to manage major health-related disasters. Federal authorities should:

- 6.2.1: Continue to provide grants to states to purchase or modify automated health-related systems meeting minimal requirements.
- 6.2.2: Establish simple, open source interoperable tracking systems for people, professional staff and licenses/certifications, beds and other medical assets, and transportation assets.
  - 6.2.2.1: Develop a national data store that can receive data through feeder systems already in use
  - Use HAvBED as the master tracking system for availability of beds and other assets, and expand reporting to include nursing homes, sub-acute and skilled nursing care facilities, and assisted living facilities. (Note: HAvBED system should not replace any existing systems, but rather it should acquire and amalgamate data already being gathered by these pre-existing systems.)
  - 6.2.2.2: Require hospitals not participating in a multi-institutional bed capacity system to provide necessary data via the HAvBED manual data entry web interface.
- 6.2.3: Require that local, state, and regional health asset reporting and patient tracking systems for emergency management be able to exchange data with the federal government
- 6.2.4: Require collaboration with "key system" owners to plan, build, and test automatic load scripts to enable transfer of data to a central database during emergencies
- 6.2.5: Require, as a condition of continued funding under HHS and DHS emergency preparedness grants and contracts, periodic transmission of key asset data (facility, bed capacity, etc.) to central data store
- 6.2.6: Build interface between existing credentialing/privileging systems and user authorization interfaces in mass casualty incident management systems
- 6.2.7: Provide funding through CMS for administrative costs associated with building interoperable asset reporting and patient tracking between public health departments and licensed Medicaid and Medicare providers
- 6.2.8: Ensure that administrative and management support for onsite incident management teams includes personnel to enter documentation and track reporting activities.

Governance will continue to be a major challenge in this complex environment. It is recognized that federally-supported emergency medical information capabilities may require an independent assessment by HHS to determine suitability for incorporation into a national emergency management system.

Recommendation 6.3: HHS should continue to engage other federal agencies, state, and regional organizations as partners in planning and development process, to include governance, standards, policy, and funding.

A federal "enterprise-wide" cross-functional, cross-agency team should be established to review and validate the various emergency management and health-related information exchange initiatives and make recommendations for continued use. Additional partners in this effort may

include the American Hospital Association, state hospital associations, state and local public health associations, emergency management professional organizations, and selected medical specialty professional organizations. This approach will offer and provide collaborative efforts at multiple levels as well as the greatest opportunity for acceptance and widespread implementation of such a system. A number of issues will require ongoing attention. Some examples include:

- Governance: How and under whom will a governance structure be established and sustained to ensure the ongoing evolution of this capability? How will the interests of all sectors including federal, state and local governments, the military sector, private sector interests, including major and small businesses, technology vendors, non-profit, research organizations *and* individuals be represented in the evolution of the capabilities?
  - At the system governance level, examples of governance questions include: When, under what circumstances, and with what authorization would the national reporting capability be "turned on?" What would be the "trigger" emergency levels? Who will have required decision authorities?
- Data Standards and Control: What data load standards and frequencies will be required? Will queries be run against a system or will the systems be required to push data to the national data store? How will users be added, credentialed? How will confidentiality be protected?
- Policy: Who will provide sustained leadership and management to support resolution of interoperability requirements?
- Funding: Where will funds come from to cover the costs of this interoperability capability? How will the costs be incorporated into the overall HHS and government-wide budget?

As a core federal resource, ASPR and the NDMS partners have an opportunity to examine their roles in supporting emergency health information management both at the immediate disaster level and at the national preparedness and response level. ASPR and NDMS should continue to work with the Chief Information Officers of the HHS Operating Divisions and other organizations within the Office of the Secretary to develop a capital investment planning budget commensurate with the importance of these information needs for health disaster management. Because NDMS functions at multiple levels, including direct services during a disaster, NDMS has direct expert knowledge on health disaster information capability requirements. Thus, it can fulfill a key "business owner" role in guiding planning, design, development and testing of "cohesion tools" that enable information collection, aggregation, and sharing during emergencies at multiple scales of complexity.

7. Training

7.1 Overview

This section provides recommendations for enhancing NDMS training. The following areas were considered in developing recommendations:

- Curricula
- Establishment of minimum training standards/core competencies
- Types of training
- Most effective training delivery methods
- Cost effectiveness of training provided
- Appropriateness and usefulness of training
- Adequacy of current training curricula and training plans
- Adequacy of current training budget
- Training utilization by NDMS medical response personnel.

MITRE's recommendations are consistent with training programs for other elements of the Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response (ASPR) and the Office of Force Readiness and Deployment (OFRD), and identify joint training opportunities with these entities, as appropriate.

7.2 Approach

To gather data, MITRE conducted interviews with key stakeholders and reviewed numerous key documents and reports. Many of these reports focused on NDMS training and are cited in this document to demonstrate the consistency of recommendations by multiple organizations over the last decade. To support analysis, MITRE reviewed each of the areas in terms of its current state, its desired end state, recommendations to achieve that end state, and any constraints that may affect achievement. MITRE's approach includes the application of best practices in learning concepts and training design, as defined by industry experts.

In its review, MITRE identified 3 overarching areas that need to be addressed in each element of this task.

Alignment of strategy with the mission: The training strategy must be constantly focused on fulfilling NDMS's mission: *Design, develop, and maintain a national capability to deliver quality medical care to the victims of - and responders to - a domestic disaster.*[14] The training strategy must be flexible, evolving to meet the changing threat environment.

A structured, strategic approach: This requires a systems approach to all training activities, through assessment, design, development, implementation, and evaluation. This approach will help ensure that lessons learned in each of those phases are continuously incorporated into training plans and policies.

[14] National Disaster Medical System web site, http://www.hhs.gov/aspr/opeo/ndms, accessed Aug. 8, 2008.

Measurement and accountability: All individuals and units being trained for emergency response must be provided with clear performance standards and held accountable for meeting those standards. Regular evaluations are conducted to ensure continued improvement in the overall level of emergency response.

7.3 Recommendations and Constraints

This document presents recommendations for developing an integrated training strategy, one that is sufficiently agile to ensure that NDMS can respond effectively to the evolving threat environment in the United States.

There are 3 key constraints to the successful development and implementation of an integrated training strategy. A weakness in any of these factors will affect NDMS's ability to accomplish its mission:

- Strong leadership support
- Appropriate funding
- Effective coordination among NDMS, its federal partners, state and local responders, and other organizations with a role in emergency response.

7.3.1 Curricula and Adequacy of Curricula and Training Plans

Current State

In the absence of a comprehensive training strategy, the majority of training programs are developed and conducted at the team level and driven primarily by individual teams' needs and interests. While team-driven development is important, it does not necessarily advance the more strategic objectives of ASPR and NDMS. In addition, funding is not available for NDMS's federal partners to participate in training, which affects the interoperability of the partners in a real emergency.

Desired End State

NDMS's integrated training curricula will incorporate the needs of the entire medical response system, and will advance both bottom-up interests (specific team development) and top-down (NDMS and ASPR) strategic goals. The curricula will align with NDMS's specific ESF #8 responsibilities, support NDMS partner agencies in fulfilling their ESF #8 responsibilities, and enable teams to acquire and maintain the skills needed to respond effectively to emergencies. The training curriculum and learning objectives for the curriculum will be developed by the NDMS Headquarters Training function, and will guide the training of the teams and federal partners.

Recommendations to Achieve Desired End State

- **Recommendation 7.1**: **Develop a training strategy that incorporates best practices** identified by the American Society for Training and Development (ASTD).[15]

[15] American Society for Training & Development, *2004 State of the Industry Report, Characteristics of the Best Learning Organization*, December 1, 2004.

- High level of investment in learning
- Measurement and demonstration of efficiency and effectiveness of the learning function
- Alignment of learning with business needs and individual employee competency needs
- Provision of a broad range of internal and external learning opportunities
- C-level Executive Leadership involvement and support for learning
- Combination of learning with other performance improvement solutions.

- **Recommendation 7.2**: **Apply a systematic, phased approach to developing the NDMS training strategy**, using the ADDIE[16] model (Figure 6-1). In ADDIE (Analysis, Design, Development, Implementation, and Evaluation), outcomes from one phase serve as the basis for the next phase.
  - **Needs Analysis:** Establish the knowledge, skills, and levels of proficiency required of participants in order for them to provide high quality medical care in a safe environment during disasters. Recommendations for conducting a baseline analysis of needs are detailed in Annex A.
  - **Training Design:** Develop a comprehensive curriculum to fill the gaps between the desired and actual levels of proficiency of teams and individuals; establish training standards, policies, and standard operating procedures (SOPs); identify specific training methods and programs to produce a measurable improvement in the knowledge, skills, and behavior of training participants.
  - **Training Development:** Develop content for specific training courses and activities that align with NDMS objectives; determine the most effective delivery methods for each training program; conduct pilot sessions to test training effectiveness.
  - **Implementation:** Create a plan for each training program, train the trainers, and conduct the training.
  - **Evaluation:** Measure the effectiveness and efficiency of the training program; use the results of the evaluation to revise the program as needed.

[16] *Introduction to Instructional Design and the ADDIE Model*, Kevin Kruse, http://www.e-learningguru.com/articles/art2_1.htm, accessed July 23, 2007.

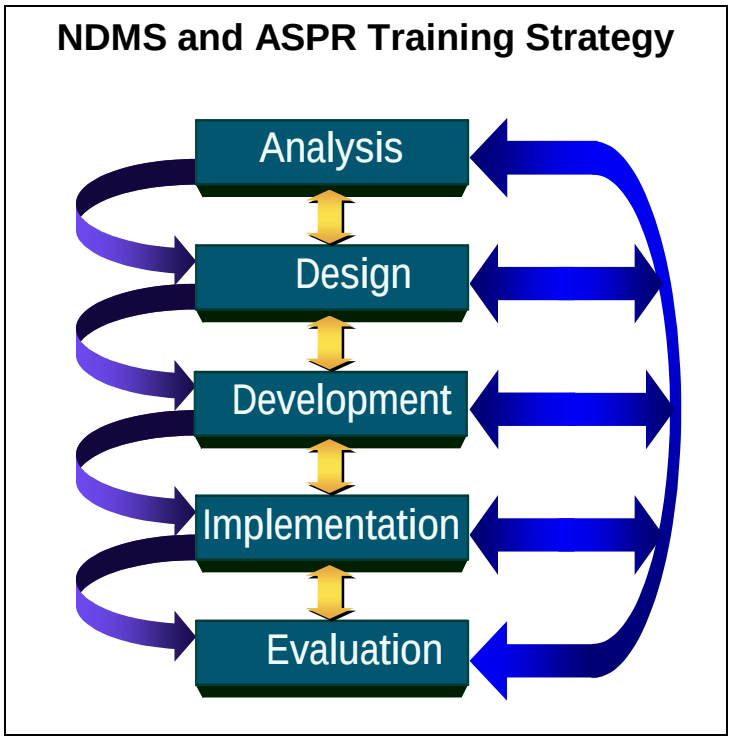

Figure 7-1. ADDIE Model for Training Strategy

- **Recommendation 7.3**: **Ensure that the training strategy provides a comprehensive, role-based curriculum for each training program**, using a consistent development process to move participants in sequenced steps — from awareness of training concepts, to skill in following defined procedures in typical situations, to proficiency in applying underlying principles to solve new problems.
- **Recommendation 7.4**: **Establish working groups of regional and team Training Officers** to work with headquarters staff to ensure an integrated training approach, with plans linked to the scenarios and playbooks as well as to team-specific requirements.
- **Recommendation 7.5**: **Promote training standardization and compliance with more centralized programming and administration**.
- **Recommendation 7.6**: **Align/leverage Training, Exercises, and Lessons Learned (TELL) and other learning entities focused on disaster medical response**.

7.3.2 Establishment of Minimum Training Standards/Core Competencies

Current State

A critical element, largely missing from the current NDMS training program, is a set of common standards to ensure that each team is trained in the core competencies needed to respond to disasters and to operate effectively with multiple teams in larger exercises or real emergencies. Currently, NDMS does capture feedback and training lessons learned in After Action Reports, which can be used to inform the planning and development of future training.

Desired End State

NDMS's integrated training strategy will provide for standardized training that can be rolled out repeatedly and consistently across teams to ensure that all participants in the system have a baseline of knowledge and skills. This is necessary to ensure that when multiple teams are brought together, they have a common understanding of core principles, which will facilitate the delivery of a consistent high level of patient care. Standards will be in place for key tasks and supporting activities performed prior to, during, and after deployment.

Recommendations to Achieve Desired End State

- **Recommendation 7.7**: **Identify the skills, knowledge, and abilities required of individuals, teams, and federal partners**, based on role and area of specialization, as well as general skills in leadership, team work, planning, and working under pressure. NDMS may also want to establish physical abilities/requirements for performing the various roles in austere conditions.
- **Recommendation 7.8**: **Establish minimum standards in the core competencies each team must have**, such as setting up and outfitting temporary facilities to provide medical care, providing medical care under adverse conditions, and maintaining the safety of response personnel while they are deployed.
- **Recommendation 7.9**: **Provide additional standards for specialty teams with specific roles** (e.g., surgical, veterinary, or mortuary).
- **Recommendation 7.10: Identify policies, procedures, and regulations that must be followed in support of these tasks**.
- **Recommendation 7.11**: **Develop a system to track the accomplishment of the minimum standards by each team**.
- **Recommendation 7.12**: **Provide readiness assessment tools for individuals and teams to measure their proficiency levels**. Establish a process and schedule for initial and continuing independent assessments to validate team readiness.
- **Recommendation 7.13**: **Impose restrictions and retraining requirements for teams that have not met minimum standards**.
- **Recommendation 7.14**: **Periodically review training methods to assess their effectiveness in developing the intended skills and knowledge**.
- **Recommendation 7.15**: Because of the urgent need for standards development and the limited training staff at NDMS, **hire experienced temporary personnel** (e.g., retirees or contractors with emergency services expertise) **to support rapid development of the standards and readiness assessment tools**.
- **Recommendation 7.16**: **Review, and incorporate as appropriate, recommendations by previous and current NDMS contractors for the establishment of a readiness system** that defines the mission-essential tasks at all levels, identifies the personnel and equipment needed, sets up a training system to exercise critical skills, and measures the cost effectiveness of each training approach and delivery method.
- **Recommendation 7.17**: **Ensure that all training plans include standards and readiness assessments** to help teams meet those standards.

7.3.3 Training Types, Delivery, and Cost Effectiveness

Current State

NDMS's responsibilities under ESF #8 encompass a broad range of potential disaster scenarios, which requires a training strategy with a wide range of learning opportunities. In addition, NDMS training has become more complex with more learners, participants from a wider geographic area, and field exercises involving equipment and, in some cases, multiple teams. Since most training programs are planned and conducted on the local level, there is currently no centralized strategy for selecting the most effective and efficient training and delivery methods. (Examples of training delivery methods are described in Annex B.) Also lacking are readiness assessment tools that can measure effectiveness.

Desired End State

NDMS training strategy will use a blend of training approaches (internal and external, formal and informal) and learning styles (watching, hearing repeating, doing) to help people move new skills and knowledge into long-term memory. Careful planning and management of all the details of implementation are essential to ensure that training is delivered effectively. Given the depth of knowledge and experience among NDMS participants, the training strategy will incorporate adult learning principles: connecting learning to individuals' accumulated knowledge and experience, ensuring that they understand training goals, and aligning training goals to their personal/professional goals. NDMS will inventory existing resources and leverage them to ensure the most cost-effective training programs.

Recommendations to Achieve Desired End State

- **Recommendation 7.18**: **Align training priorities with the objectives detailed in the NDMS and ASPR vision and mission**. Within those priorities, clearly define the responsibilities of and expectations for all parties. Ensure that training activities are aligned with the planning scenarios and with federal regulations and policies.
- **Recommendation 7.19**: **Provide full range of training for individuals** (skills development, coaching, leadership training), **teams** (working together as a team, with other teams, and in multi-team settings), **regional** (knowledge sharing among and across teams, and within and among regions), **federal partners, and other organizations that work with NDMS in disaster response**. This should encompass a combination of training programs to ensure that all elements of the system work together.
- **Recommendation 7.20**: **Use a blend of delivery methods**, including self-paced study (print and electronic), live training (classroom and conferences), experiential opportunities (exercises), and coaching/mentoring. Recognized by experts as the most effective and cost-efficient way to increase the impact of training, this blended approach "layers" delivery methods to develop and then reinforce knowledge and skills.
- **Recommendation 7.21**: **Since on-the-job training is considered the best way to learn and retain information, include real application of skills**, including:
  - Frequent, brief exercises to test notification of and communication with medical response teams, patient evacuation teams, and definitive care hospitals

  - Field exercises that simulate the conditions of a disaster; these are essential to test personnel in their use of equipment and to establish smooth coordination and working relationships within the teams and with other teams and partners
  - Reconsider the current prohibition on team participation in National Security Special Events and other activities such as air shows.[17] The ban has had a negative effect on the morale of teams, who enjoy these events, and has hurt recruitment. Propose a process whereby participation can be resumed without jeopardizing the health and safety of the public or exposing response team members to liability. As training exercises, the teams' participation in these events should include specific learning objectives. There should also be an instructor present to observe, evaluate the team's performance, and facilitate the discussion of lessons learned. This instructor should also be qualified to step in to assist with the equipment or delivery of patient care, if needed.

- **Recommendation 7.22**: **Determine the most effective delivery method** — online courses and simulation training, classrooms and web-based seminars, field exercises, and live events — for each specific training program.
- **Recommendation 7.23**: **Revisit online training courses and update them to reflect NDMS current priorities**.
- **Recommendation 7.24**: **Create and maintain an online resource library**, with material drawn from teams, federal partners, contractors, and professional associations.
- **Recommendation 7.25**: **Consider centralization, outsourcing, and the use of technology-based delivery methods to increase cost-effectiveness**.
- **Recommendation 7.26**: **Leverage existing resources and expertise** (e.g., current contractors and partners experienced in online and distance learning) **for cost effectiveness** and to further the goal of standardization of required training throughout the system.

7.3.4 Appropriateness and Usefulness of Training

Current State

Currently, NDMS teams and FCC Coordinators schedule training at their discretion and according to their own specific plans. With the exception of a few national events, such as the NDMS annual conference, most NDMS training is initiated and implemented locally. In its 2002 report on response team readiness,[18] CNA recommended that NDMS consider training as a means for linking the NDMS system together by "training the pieces of the system to work together." Other missing elements include a consistent system for evaluating the readiness status of both individuals and teams and a process to ensure that evaluation results are fed back into training plans and programs.

[17] *A Strategic Look at the Federal Medical Response to Disasters*, LTC Vivian T. Hutson, U.S. Army War College Civilian Research Project, March 28, 2007.

[18] *Assessing NDMS Response Team Readiness*, The CNA Corporation, December 2002; *NDMS Plan for Action*, MAXIMUS, March 1994.

Desired End State

The recommended shift in strategy — to include more national and regional training — will have an impact on both the approach to training and the resources required for implementation. More national and regional training helps ensure cost-effective use of funds by combining training programs for teams in need of similar training, promotes development of cross-team skills and working relationships, and provides an opportunity to assess the capabilities and interoperability of multiple organizations in responding to major disasters. After standards have been developed and disseminated to all participants, NDMS leadership will communicate strongly the importance of adhering to these standards, and will support the imposition of restrictions on those individuals or teams that cannot meet the standards.

Recommendations to Achieve Desired End State

- **Recommendation 7.27**: **Develop a series of exercises to train response teams in standard activities that are relevant for all teams in all disaster situations**. This will help ensure a consistent level of proficiency in basic skills and will contribute to the interoperability of multiple teams.
- **Recommendation 7.28**: **Devise training modules based on the 15 National Planning Scenarios**.
- **Recommendation 7.29**: **Support ASPR in development of annual training exercises that include all agencies with responsibilities under ESF #8**. This will help operationalize the way NDMS partners work together and strengthen processes to ensure that questions during emergency responses are routed to correct areas for response.
- **Recommendation 7.30**: **Require that all requests for investment in training demonstrate a link to one or more of the ESF #8 responsibilities**.
- **Recommendation 7.31**: **Provide leadership training to enhance field-based command and control** (e.g., to ensure a clear understanding of how NDMS and ASPR will integrate in the field with regard to management support for the response assets, roles, responsibilities, and overall mission requirements).
- **Recommendation 7.32**: **Require sustained training to ensure continued competence** (e.g., for teams to mobilize and move quickly).
- **Recommendation 7.33**: **Provide cross-training for backfill capacity**.
- **Recommendation 7.34**: **Train participants in the use of multiple communication procedures and equipment** (e.g., if one communication system is inoperable, users will be able to operate other systems without a break in communications).
- **Recommendation 7.35**: **Establish a formal system to determine the quality and effectiveness of training in enhancing the performance of those being trained, and to gather feedback to identify areas for improving the training system**. Training evaluations will help ensure that training standardization does not reduce the usefulness of training, and that training is relevant and of worthwhile value. Identify evaluation approaches used by emergency response organizations and use those as a basis for a model appropriate to NDMS.

- **Recommendation 7.36**: **Establish evaluation criteria of exercises as one determinant of team readiness**. The 2002 CNA Readiness Study[19] recommended that exercise evaluation criteria provide clear objectives linked to observable behaviors and measurements. Field exercises should be observed and assessed by an independent evaluator, and results should be reviewed with the team and NDMS HQ to determine additional or continued training.
- **Recommendation 7.37**: **Identify qualified personnel at all levels who can conduct readiness assessments** that evaluate both the current level of proficiency of participants and the effectiveness of the training program.
- **Recommendation 7.38**: After training events, exercises, and actual emergencies, **utilize Corrective Action Plans (CAP)**, described in the HHS Strategic Readiness Plan for Emergency Response,[20] to identify actions to be taken, the individuals responsible for taking action, and the time frame for implementation. This will help ensure that lessons learned from training exercises and actual events will be continuously incorporated into training plans and policies.

7.3.5 Adequacy of Current Training Budget

Current State

According to the NDMS Executive Secretariat,[21] insufficient resources and funding mechanisms are among the top five challenges to be addressed by the NDMS Senior Policy Group over the next two years. Training at NDMS is not just an optional activity to be funded during good economic times. Training is an investment in national security, an essential function to ensure that NDMS teams and federal partners can respond rapidly and effectively to a disaster. Given the expanding range of potential disasters and the large number of people who could be affected, failure to invest fully in training will affect not just public health, but the nation's security and its economic health.

Desired End State

A robust training budget will ensure that individuals, teams, regional and federal organizations will receive the training required for an effective response. Training needs will be prioritized and expenditures aligned with NDMS's strategic objectives. Priority will be given to:

- Additional training staff: permanent staff to oversee the training strategy; oversee national, regional, and team training programs to ensure consistent training in mandated core competencies; and evaluate training effectiveness. Temporary and contractor staff resources are essential to support development of standards, readiness assessment tools, training handbooks, and other tasks.
- Development of new online courses, funding for multiple team exercises, support for team participation in field exercises and real events, training in redundant communication systems during emergencies.

[19] *Assessing NDMS Response Team Readiness*, ibid.

[20] U.S. Department of Health and Human Services , *Strategic Readiness Plan for Emergency Response - Draft*, April 2007.

[21] National Disaster Medical System Senior Policy Group, *2007-2009 Issues Paper*, March 18, 2007.

- Development of new technology applications and systems to streamline team member applications and reimbursement processes, and to ensure better reporting and tracking of training utilization.
- Striking a balance between centrally mandated training for core competencies and team-directed training to maintain individual and specialty team skills.

Recommendations to Achieve Desired End State

- **Recommendation 7.39**: **Expand training staff** to support a more robust training function and the development of standardized training programs. New staff will have experience in training design and development, state-of-the-art training technologies, and the full range of delivery methods. Current staff will be provided with training opportunities to expand their capabilities.
- **Recommendation 7.40**: **Develop a realistic budget for funds and resources** to fully implement the training strategy required to meet NDMS objectives.
- **Recommendation 7.41**: **Communicate to funding organizations the necessity and value of fully funding the NDMS training strategy**. This includes leadership demonstrating the clear link between NDMS's ability to respond effectively to emergencies and adequate training resources, including expanded staff, a robust training budget, and the equipment required to exercise critical skills.
- **Recommendation 7.42**: **Establish a transparent process for requesting, approving, and tracking expenditure of training funds**, including periodic reviews to measure expenditure of training funds against accomplishment of NDMS objectives.
- **Recommendation 7.43**: **Provide mandatory standardized training**. NDMS teams will continue to identify, develop, and conduct training that reflects the needs and interests of the team. To support the implementation of this approach, team training budgets would be divided into funding for mandatory and discretionary training. Each team would develop and submit a training calendar at the beginning of the fiscal year, allowing NDMS HQ to allocate funds and develop a schedule for HQ staff to attend and observe field training programs. Review of the individual team training calendars will enable NDMS to identify joint training opportunities for multiple teams, based on schedules and topics of interest.

7.3.6 Training Utilization by NDMS Medical Response Personnel

Current State

Currently, NDMS has few formal training requirements, incomplete reporting and tracking of training utilization, limited monitoring or enforcement of requirements, and little accountability for implementing training guidelines. Staff resources and funding are not adequate to fully support participation in existing training opportunities, and there is no consistent system for tracking and reporting the utilization of training by individuals and teams. The NDMS Resource Management System (RMS), an internal system that was developed to track financial transactions and documents, does not report training utilization or comprehensive training costs. The process for travel and expense reimbursement has been identified as a significant issue,

especially since the transition of NDMS to HHS requires adherence to new procedures for travel and training expense reimbursement.

Desired End State

NDMS's integrated training strategy will ensure that appropriate training programs are developed and made available to participants on all levels. Dedicated staff resources will implement the strategy — overseeing the development and implementation of a variety of training programs, maintaining an inventory of all training opportunities, ensuring that funding is available to increase participation in training, and tracking participation to ensure that individuals and teams have the skills and knowledge to respond effectively to emergencies,

Recommendations to Achieve Desired End State

- **Recommendation 7.44**: **Assign dedicated staff members** (e.g., Regional and National Training Coordinators) **to provide oversight** and be accountable for the development, implementation, funding, and participation in training programs.
- **Recommendation 7.45**: **Ensure that budget requests include sufficient funding for training programs required by the training strategy**, including opportunities for joint training with federal partners, and expanded participation of individuals in the annual conference.
- **Recommendation 7.46**: **Develop and maintain a centralized list of training activities conducted by local, state, regional, and federal organizations**; include training opportunities for individuals to develop skills and experience.
- **Recommendation 7.47**: **Coordinate with appropriate representatives within ASPR and HHS the development of a streamlined process to expedite travel and expense reimbursements for both trainers and participants**.
- **Recommendation 7.48**: **Implement a learning management IT system to track training requirements and training participation/utilization**. If possible, integrate the system with current credentialing and privileging systems to ensure that individuals and teams who do not meet standards or have out-of-date credentials are identified, notified, and provided with a remediation process through which they can be retrained to meet the standards or renew their credentials.

7.3.7 Other Identified Training Needs

Current State

MITRE's scope of work did not include a comprehensive training needs analysis, but during the review several other areas were identified for consideration as training priorities.

- Based on the experience of Hurricanes Katrina and Rita, medical teams should train for different types of patients, including the chronically ill (diabetes, hypertension, asthma, and orthopedic) whose conditions may be exacerbated by the disaster, and persons with mental or behavioral conditions.
- Where possible, teams should include mental health and clinical social workers, chaplains, and social service caseworkers.

- Teams should be trained in management of non-medical staff, such as translators, and in working safely around aircraft and other transportation vehicles.
- Where possible, include nursing homes in planning and training exercises.
- All participants — medical teams, FCC personnel, patient movement and administrative personnel — should be trained in the use of multiple communication and IT systems.

Annex A. Needs Analysis

Table 7-A-1. Needs Analysis

Current skills and knowledge	• Self-assessment by team members • Test of basic concepts
Inventory of current clinical experience and training	• Self-assessment • Review of credentials and privileging
Inventory of training resources	• Research training programs offered by state and regional organizations, National Guard, universities and hospitals
Performance	• Input from Administrative Officer, Team Leader, Training Officer or other role
Training Audit	• Review of all current and previously used training vehicles and materials developed by NDMS HQ, teams and federal partners
Training Effectiveness	• Review training evaluations • Solicit feedback regarding training
Processes and Procedures	• Identify what they are • Assess knowledge and understanding of them
Team Composition and Status	• Audit of team types, team initiation date, roster size, number of active members, experience level of members, turnover rate
After-Action Reports (AAR)	• Review to identify key topics, issues
Environmental Scan	• Current priorities and issues
Training Budget	• Allocations for types of training, topics, expense categories
Training Capabilities and Resources	• Identify internal and external resources performing training-related tasks in the area of disaster preparedness and management • Evaluate the skills, knowledge and experience of training staff at HQ, the federal partners, and on the teams
Calendar of Events	• Identify training opportunities conducted by 3rd parties • Identify key events (e.g., hurricane season, start/end of fiscal year, major speeches/addresses/events)

Annex B. Description of Training Delivery Methods[22]

Table 7-B-1. Delivery Methods

Delivery Method	Type of Training	Benefits	Disadvantages	Relative Cost to Develop	Relative Cost to Deploy
On-line Training Classes	Self-paced	• Available 24X7 • Allows for dispersed audience to obtain standardized training • Clearly established learning objectives can guide design and development of content • Good for dissemination of information (e.g., policies, procedures, systems, expectations) • Can be taken in a limited period of time, at convenience of the student • Incremental cost is lower when spread over wide audience • Easy to track who has taken the class • Easy to track performance on test questions • Appeals to students who are self-disciplined • Appeals to students who have a visual learning style	• Does not foster collaboration with others • Does not allow for hands-on application of material • Learner support and feedback may be delayed • Read/Watch only training has the lowest retention rate (10 – 20%) • Requires computer access	High	Low
Web-based Seminars	Live/online	• Allows for dispersed audience to obtain standardized training • Clearly established learning objectives can guide design and development of content • Good for dissemination of information (e.g., policies, procedures, systems, expectations)	• Does not allow for hands-on application of material • Requires all participants have access to technology and high speed access • Requires coordination of schedules	High	Medium

[22] Information contained in this table is based on the following resources: *Blended Learning White Paper: Getting the Recipe Right*, Sparrow InterActive, Tampa, Florida, 2005. Retention rate information provided by National Training Laboratories (NTL), Bethel, ME. Originally developed by Edgar Dale "Audio-Visual Methods in Teaching" 3rd Edition, Holt Rinehart Winston, 1969, and Adapted by Elaine Montambeau, 2000.

Delivery Method	Type of Training	Benefits	Disadvantages	Relative Cost to Develop	Relative Cost to Deploy
		• Opportunity exists for people to ask questions. • Can be conducted in a limited period of time • Incremental cost is lower when spread over wide audience • Easy to track who has taken the class • Methods exist to track performance on test questions • Appeals to students who have a visual learning style • Live session can be saved and made available for people to view at their convenience.			
CD-ROM	Self-paced	• Available 24X7 • Clearly established learning objectives can guide design and development of content • Allows for dispersed audience to obtain standardized training • Good for information dissemination • Can be taken in a limited period of time, at convenience of the student • Incremental cost is lower when spread over wide audience • Appeals to students who are self-disciplined • Appeals to students who have a visual learning style	• Requires that student provide information about completing the class. This information cannot be verified. • Not able to track performance on test questions • Needs to be sent to students with instructions for loading on PC. May require more computer memory than the student has available, etc. • Read/Watch only training has the lowest retention rate (10 – 20%)	High	Medium
Webcasts	Web-based, not live	• Available 24X7 • Clearly established learning objectives can guide design and development of content • Allows for dispersed audience to obtain standardized training • Good for information dissemination	• Requires that student provide information about completing the class. This information cannot be verified. • Not able to track performance on test questions • Requires that students have access to a	High	Low

Delivery Method	Type of Training	Benefits	Disadvantages	Relative Cost to Develop	Relative Cost to Deploy
		• Can be taken in a limited period of time, at convenience of the student • Incremental cost is lower when spread over wide audience • Appeals to students who are self-disciplined • Utilizes audio and visual media; therefore, appeals to different learning styles.	computer with high speed access		
Simulated	Web-based, Interactive	• Available 24X7 • Clearly established learning objectives can guide design and development of content • Allows for dispersed audience to obtain standardized training • Creates opportunity to gain practical experience and make decisions • Can be taken in a limited period of time, at convenience of the student • Incremental cost is lower when spread over wide audience • Appeals to students who are self-disciplined • Utilizes audio and visual media; therefore, appeals to different learning styles	• Relatively new technology, expensive to utilize	High	Low
Conference Calls	Live/Instructor-Led	• Provides interaction with instructor and classmates • Clearly established learning objectives can guide design and development of content • Written/Hardcopy materials can be prepared and distributed to supplement the oral presentation • Good for dissemination of information (e.g., policies, procedures, systems, expectations) • Good for briefing people prior to exercises	• Requires coordinating schedules • Information is provided verbally • Cannot test students on the material • Quality of instructor may impact effectiveness	Low	Low

Delivery Method	Type of Training	Benefits	Disadvantages	Relative Cost to Develop	Relative Cost to Deploy
		or other training events • Effective method for following up on training conducted			
Classroom	Live/Instructor-led	• Provides interaction with instructor and classmates. People are social beings and like interacting with others. • Clearly established learning objectives can guide design and development of content • Opportunities for collaborative exercises to be integrated with lectures; therefore, greater opportunity for retention than read-only material Immediate feedback can be provided by the instructor and other students • Provides opportunity for student to ask questions, real-time • Attendance is verified by instructor • Instructor can gauge level of understanding	• Occurs at a given time and place; therefore, may be challenging to schedule. • Requires more time and expense to conduct (for travel, etc.) • Quality of instructor may impact quality of the classroom experience	Medium	High
Conferences/ Seminars	Live/Instructor-led	• Provides interaction with instructor and other attendees. People are social beings and like interacting with others. • Students can select sessions of greatest interest to them • If opportunities for collaborative exercises are integrated with lectures; there greater opportunity for retention than listen-only material (retention rate can range from 50 – 95%) • Provides opportunity for student to ask questions, real-time • Attendance is verified by instructor • Instructor can gauge level of understanding	• Occurs at a given time and place; therefore, may be challenging to schedule. • Requires more time and expense (for travel, etc.) • Sessions tend to be more passive (instructor talking to students, with minimal hands-on opportunities) • Quality of instructor may impact quality of the classroom experience • Less formal development of learning objectives due to broad audience. Information presented may not be completely aligned with the organization's training needs. • Not geared toward evaluating progress of students	Medium	Low- High
Exercises	Experiential	• Provides interaction with instructor and	• Occurs at a given time and place; therefore,		

Delivery Method	Type of Training	Benefits	Disadvantages	Relative Cost to Develop	Relative Cost to Deploy
		classmates. People are social beings and like interacting with others. • Clearly established learning objectives can guide design and development of exercises • Opportunity to demonstrate desired behavior • Practice by doing in real-world simulated environments creates greatest opportunity for retention (75 - 90%) • Immediate feedback can be provided by the instructor and other students with opportunity to repeat exercise • Provides opportunity for student to ask questions, real-time • Attendance is verified by instructor • Easy for instructor can gauge level of understanding. Allows instructor to modify training to reflect the initial knowledge and the level of learning/understanding during the exercise	may be challenging to schedule. • Requires more time and expense to conduct (for travel, etc.) • Quality of instructor may impact quality of the experience		
Performance Support/ Learning tools	Job aids Reference materials Documentation	• Provides opportunities for students to follow up on what they learned • Accessible 24 X 7 • Effective follow-up method for policies, procedures and other technical information	• Difficult to monitor usage • Learner support may be delayed • Outdated materials difficult to re-tract and replace with new information	Low	Medium
Coaching/ Mentoring	Individualized	• Student can select topics for focus, based on need • Immediate feedback provided • Level of participation easily verified • Level of understanding easy to track • Fosters long-term relationship	• Not efficient method for training large numbers of people • Sessions not based on standardized learning objectives	Medium to High	Medium to High

8. Telemedicine

8.1 Description

This section identifies opportunities to expand the use of telemedicine to facilitate mass casualty response activities, including NDMS medical response and patient movement. As part of this assessment, MITRE conducted research and interviews with NDMS staff and a broad range of subject matter experts (SMEs) engaged in telemedicine activities in order to identify opportunities to expand telemedicine capabilities that would increase efficiency of field operations, to include potential efficiencies gained through integration with mobile medical capabilities. In addition, MITRE interviewed individuals participating in the Health Information Technology Standards Panel ER-EHR Technical Committee to determine the current status of the Emergency Responder – Electronic Health Record.

The objective of this effort was to develop a "to-be" picture of telemedicine efforts in NDMS that minimizes staffing issues for medical response personnel. The scope included the field response and patient movement components of NDMS, but did not extend to the definitive care component.

8.2 Overview

MITRE researched the literature, interviewed NDMS staff and subject matter experts, and reviewed NDMS internal documentation to assess the potential for expansion of telemedicine activities to facilitate mass casualty response and patient movement activities.

8.2.1 Definition of Telemedicine

The American Telemedicine Association (ATA) defines telemedicine as:

> Telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve patients' health status. Closely associated with telemedicine is the term "telehealth," which is often used to encompass a broader definition of remote healthcare that does not always involve clinical services. Videoconferencing, transmission of still images, e-health including patient portals, remote monitoring of vital signs, continuing medical education and nursing call centers are all considered part of telemedicine and telehealth[23].

While this definition mentions telehealth, this report does not addresses NDMS performance of telehealth activities.

8.2.2 General Uses of Telemedicine

The potential uses of telemedicine cross a wide range of activities. The ATA lists five primary telemedicine services: specialist referral services, patient consultations, remote patient

Endnotes

[23] American Telemedicine Association. (2007). ATA defining telemedicine. Retrieved July 13, 2007, from http://www.americantelemed.org/news/definition.html

monitoring, medical education, and consumer medical and health information.[24] The Food and Drug Administration (FDA) list is similar, but more specific in outlining possible telemedicine activities.

- Direct clinical, preventive, diagnostic, and therapeutic services and treatment, including procedures where a provider may be present with the patient, and clinical training and consultative clinical Grand Rounds, if used for decision-making regarding the clinical care of a specific patient.
- Consultative and follow-up services.
- Remote monitoring, including the remote reading and interpretation of results of patient's procedures.
- Rehabilitative services.
- Patient education provided in context of delivering health care to individuals[25].

The FDA is responsible for approving devices used in telemedicine. One noticeable difference is the FDA's list does not include medical education. FDA evaluates devices for safety and effectiveness based on intended use. Verification of FDA approval should be done before the purchase of any device used in a telemedicine activity.

The actual implementation of telemedicine activities is growing. One factor is the increase of insurance payers acknowledging the value of telemedicine and reimbursing providers, albeit widely variable, for telemedicine activities[26,27,28]. More devices are being developed and implemented in the home environment[29] to include assisted living and correctional facilities[30,31]. Cost benefit and efficacy studies are being done, but primarily for non-emergency care[32].

[24] American Telemedicine Association. (2007). ATA defining telemedicine. Retrieved July 13, 2007, from http://www.americantelemed.org/news/definition.html

[25] U.S. Food and Drug Administration, Center for Devices and Radiological Health. (1996). Telemedicine related activities. Retrieved July 13, 2007, from http://www.fda.gov/cdrh/telemed.html

[26] Center for Medicare and Medicaid Services. (2006, January 22). Medicare payment for telemedicine and telehealth services. Retrieved July 13, 2007, from http://www.atmeda.org/news/Medicare%20Payment%20Of%20Services%20Provided%20Via%20Telecommunications.pdf

[27] Whitten, P., Buis, L. (2007). Private payer reimbursement for telemedicine services in the United States, *Telemedicine and e-Health,13*(1), 15-24. Retrieved July 13, 2007, from http://www.americantelemed.org/news/Whitepapers/2006%20Private%20Payer%20Report.pdf

[28] Brown, N. A. (2006). State Medicaid and private payer reimbursement for telemedicine: an overview [Abstract]. *Journal of Telemedicine and Telecare, 12*(2), 32. Retrieved July 13, 2007, from http://www.ingentaconnect.com/content/rsm/jtt/2006/00000012/A00206s2/art00003

[29] Starren, J., Hilliman, C., Weinstock, R. S., Shea, S. (2006). The Informatics for Diabetes Education And Telemedicine (IDEATel) Project. In D. W. Bates, J. H. Holmes, and G. Kupperman (Eds.), *American Medical Informatics Association Annual Symposium* (p. 1185). Bethesda, MD: American Medical Informatics Association.

[30] Brady, J. L. (2005). Telemedicine behind bars: A cost-effective and secure trend. *Biomedical Instrumentation and Technology, 39*(1), 7-8.

[31] Nacci, P. L., Turner, C. A., Waldron, R. J., Broyles, E. (2002). Implementing telemedicine in correctional facilities. Washington, D. C.: National Institute of Justice. Retrieved July 13, 2007, from http://www.ncjrs.gov/txtfiles1/nij/190310.txt

[32] Hersh, W.R., Hickam, D. H., Severance, S. M., Dana, T. L., Krages, K. P., Helfand, M. (2006, February). Telemedicine for the Medicare Population: Update. Evidence Report/Technology Assessment No. 131 (Prepared by the Oregon Evidence-based Practice Center under Contract No. 290-02-0024.) AHRQ Publication No. 06-

Although teleradiology is the most frequent use of telemedicine, teledermatology is the most studied. Bravata et al. (2002, p. 76) suggest teledermatology may be appropriate for NDMS:

> Since few practicing primary care or emergency physicians have ever seen the rashes associated with smallpox or other bioterrorism related illness, the use of teledermatology technologies may increase the likelihood of a timely diagnosis by facilitating access to dermatologic experts. In the event of a widespread epidemic reaching geographically isolated areas, existing telemedicine infrastructures could be used by public health officials to relate public health information and alerts to clinicians.[33]

There are two primary mechanisms for telemedicine - store and forward and real time interactions. Store and forward is the collection of data that is stored and forwarded for review at a later time. Real time interactions can involve clinicians interacting with clinicians, clinicians interacting with patients, patients interacting with computer software, or clinicians interacting with computer software. The key difference between the two is the immediacy or delay of the interaction.

8.3 Existing NDMS Telemedicine Capability

NDMS, with its current computer and telecommunications equipment, is severely limited in its use of telemedicine. There is no video capability and limited audio (satellite phones and field radios only) with internet connectivity twice per day to upload EMR data. The current speed of the satellite internet connectivity is only 64 kilobytes per second (kbps), comparable with dial-up. With the exception of the Mobile Intensive Care Units (MICU's) and Disaster Portable Morgue Units (DPMUs), it does not appear that the NDMS teams have any radiological imaging equipment. Reading radiological images is the most common use of telemedicine. The NDMS teams do have digital cameras, but still, non-radiological photos have limited usefulness. Based on the existing plan for NDMS medical response teams to upload data once or twice a day, the most likely scenario is the store and forward of text records and digital photos. The digital photos could be used for teledermatology, but would be most valuable in real-time rather than store and forward. Only non-emergent consultations can be done with store and forward.

8.4 NDMS Telemedicine Possibilities

8.4.1 Considerations in Selecting and Implementing Telemedicine Options:

1. What is the disaster situation?
2. Will the team be located very close to the disaster site?
3. Are the local first responders victims of the disaster?

E007. Rockville, MD: Agency for Healthcare Research and Quality. Retrieved July 13, 2007, from http://www.ahrq.gov/downloads/pub/evidence/pdf/telemedup/telemedup.pdf

[33] Bravata, D., McDonald, K., Owens, D., et al. (2002, June). Bioterrorism Preparedness and Response: Use of Information Technologies and Decision Support Systems (Evidence Report/Technology Assessment No. 59 (Prepared by University of California San Francisco-Stanford Evidence-based Practice Center under Contract No.

290-97-0013). AHRQ Publication No. 02-E028. Rockville, MD: Agency for Healthcare Research and Quality. Retrieved July 13, 2007, from http://www.ahrq.gov/downloads/pub/evidence/pdf/bioit/bioit.pdf

4. Are the local hospitals functioning?
5. Is the telecommunications infrastructure functioning?
6. Is there warning of the disaster (*e.g.*, hurricane)?
7. Will the NDMS patients be stabilized and transported quickly?
8. What is the average time per encounter?
9. Is the NDMS response expected to be short-term or long-term (surge, recovery, support)?
10. Is the existing communications infrastructure working?
11. Does the NDMS provider want additional patient information, (*e.g.*, current medication list)?
12. Does the NDMS provider want to be able to e-prescribe (*e.g.*, pandemic situation)?

There are many different scenarios and many possible combinations of telemedicine activities. For example, if the local hospitals are not functioning, the types of injuries treated by the NDMS teams may be much more critical than if the local hospitals are functioning. Or, telemedicine could prove helpful in an infectious disease or bio event when sending a team in to the direct incident area could result in the potential loss of the team.

The need for telemedicine may depend on where the disaster occurs. Smaller hospitals may not be able to provide critical care. In that case, NDMS teams may be called upon to provide critical care. Teleconsulting, remote monitoring, and teleradiology might be good options. If the local first responders are victims or if there is warning of the disaster, NDMS teams may be in the role of first responders.

If the critical NDMS patients are stabilized and transported quickly to a local hospital, telemedicine may not be a viable option, especially telesurgery, remote intensivist monitoring, or teleradiology. If the patient must be transported a significant distance, some telemedicine activities may provide value, such as teleconsulting.

In an event such as Katrina where NDMS teams will provide surge, recovery, and support services, all types of telemedicine activities would be valuable. The longer the deployment, the more valuable telemedicine, especially teleconferencing for follow-up visits and mental health. If there is a large number of patients presenting with both physical and psychological problems, telescreening and telemental health would provide the most value. If the average encounter time is 30 minutes and the patients are seen as they arrive, telemedicine activities may not provide any benefit.

If the existing telecommunications infrastructure is functioning and is not overloaded, telemedicine activities can occur without upgrading the existing satellite capability. Patient safety may improve if NDMS teams have access to more patient information such as current medications and allergies. If NDMS teams were to staff telemedicine sites, as may be necessary in a pandemic situation, e-prescribing would be valuable.

8.4.2 Assumptions

1. The NDMS has a well-developed concept of operations (ConOps) for telemedicine, with accompanying policies and procedures and trained personnel.

2. Memoranda of agreement (MOAs) are in place with telemedicine-capable facilities. A network of NDMS telemedicine centers would be created similar to the NDMS hospital network. For example, this could consist of existing hospital or teaching facilities with telemedicine capabilities who would agree to participate in NDMS operations.
3. All provider licensing issues across states are resolved. A mechanism might be to "federalize" telemedicine providers if they are practicing across state lines and not licensed in the disaster jurisdiction, or progress could be made on existing initiatives to streamline credentialing for healthcare professionals providing emergency care for disasters, for example:
   - Federation of State Medical Boards resolution to have a telemedicine licensing model for states by 2008.[34]
   - State Nurses associations in 21 states (soon to be 22) have joined the Nurse Licensure Compact.[35] Nurses licensed in one "Compact" state can practice in another "compact" state, but must follow the Nurse Practice Act of the State where practicing.
   - Three states have adopted the same for advanced practice nurses.[36]
4. A database of providers, especially specialty providers, at participating telemedicine-capable facilities is accessible.

8.4.3 Increasing Telemedicine Capability

The key to telemedicine is to have the appropriate people and equipment on the 'other end'. There are telemedicine networks all over the country. The Telemedicine Information Exchange lists 125 active programs in the United States[37]. Having a significant number of these networks and personnel available in a disaster situation would be extremely beneficial. MOAs and resolution of provider licensure issues must be in place as part of disaster operations preparation and planning. It is likely that many of the facilities participating in telemedicine networks are the same facilities connected with the FCCs. Many VA, DoD, and Indian Health Service facilities have telemedicine programs.

NDMS personnel would need training in use of the telemedicine equipment and when to use which telemedicine modality. Telemedicine has the potential to reduce the number of healthcare professionals required on an NDMS team and/or increase the number of patients a team can treat.

8.4.3.1 Internet Connectivity

While some telemedicine options could be done with voice only, the greatest benefit will come from continuous internet connectivity. Even if the existing infrastructure is in working condition, it may be overloaded. Continuous internet connectivity via satellite may be a better

[34] Federation of State the Bylaws Committee. Resolution 07-2: Telemedicine Model Policy. Retrieved July 9, 2006 from: http://www.fsmb.org/pdf/2007hodbylaws%20and%20resolutions.pdf.

[35] National Council of State Boards of Nursing. (2007). Background Information about the RN and LPN/VN Nurse Licensure Compact. Retrieved July 9, 2007, from https://www.ncsbn.org/156.htm

[36] National Council of State Boards of Nursing. (2007). APRN Compact. Retrieved July 9, 2007, from https://www.ncsbn.org/917.htm

[37] Telemedicine Research Center. (2007). Telemedicine and Telehealth Programs. Retrieved July 13, 2007, from http://telemed.org/programs_t2/browsebylocation_t2.asp?zz=0&browseField=location&submit=Browse&countryFilter=US.

alternative for NDMS teams in all situations. This technology has improved significantly over the last several years, increasing speed and quality of service. Currently, the speeds are faster than dial-up, but slower than digital subscriber line (DSL) or cable services. Some mobile satellite internet services are able to provide private networks and support virtual private network (VPN) connections. The satellite dishes can be mounted on a vehicle or set up on site and the dishes automatically lock on to the satellite.

8.4.3.2 Connect for Patient Information

The Nationwide Health Information Network (NHIN) is still in the planning stages; however, some health information exchanges (HIEs) are online and patient information may be available electronically. After Hurricane Katrina, numerous organizations, including pharmacy chains, Medicaid programs, major health plans, and the Veterans Health Administration contributed to a master database of prescription information providing a 90-day prescription history for more than 860,000 people.[38] The program was such a success that a public/private collaborative has created an online database of prescription histories available to registered providers caring for victims of a disaster. This information in this service, ICERx.org (In Case of Emergency Prescription Database), comes from a variety of sources including community pharmacies and pharmacy benefit managers. Healthcare professionals must be registered with the service and can only access it during an emergency. The database includes more than just prescription history. It also includes the name of the prescriber, the pharmacy that filled the prescription and drug reference information.[39] E-prescribing is also available. Veterans' health information is also available electronically and some health information may be gleaned from insurer's claims data, including treatment codes and diagnosis related groups. As more providers move to electronic records and more HIEs go online, additional patient information will become available to NDMS teams via the internet. HIEs and NDMS medical response teams may want to adopt ICERx.org's model of pre-registering healthcare professionals and limiting access to disaster situations.

8.4.3.3 Videoconferencing

The capability for telemedicine increases dramatically with the addition of continuous broadband internet connectivity, microphones, and video cameras. Videoconferencing can be one-on-one or multiple participants simultaneously from multiple sites. Examples of uses for videoconferencing include:

- Assist with screening of patients presenting with physical and psychological problems
- Link event-type expertise with NDMS providers – single teams or multiple teams concurrently
- Provide other types of clinical expertise, for example:
  - Pediatrics
  - Obstetrics
  - Mental health

[38] IQH. (2005, October). Hurricane relief: Prescription Database Available for Physicians. Quality Update, I(2). Retrieved July 11, 2007, from http://www.iqh.org/docs/katrina2.pdf

[39] SureScripts. (2007, 4 June). ICERx.org to Provide Prescription Medication Information for Evacuees and Other Disaster Victims. Retrieved July 11, 2007, from http://www.surescripts.com/pressrelease-detail.aspx?id=114

  - Surgical specialties
  - Neurology
  - Aerospace medicine, if the patient will be transported via aircraft
- Follow-up 'visits' such as post-op wound checks
- Provide translation services.

The cost of microphones, computer video cameras, and software to support this capability has been dropping dramatically. Some videoconferencing software is available free. All Macintosh computers and some PC laptops have a video camera built in right above the monitor. The remote providers should be able to access the NDMS electronic medical record (EMR) for specific patients both to see existing information and to add information.

8.4.3.4 Remote Screening

Remote screening could be in the form of videoconferencing or the patient interacting directly with the computer to provide information. Patients with physical or psychological problems could be interviewed via teleconferencing. With assistance from a minimally-trained NDMS team member, physiologic monitoring devices such as blood pressure cuffs, pulse oximeters and e-stethoscopes and e-otoscopes could provide the remote screener with information. The patient's EMR could be initiated by either the local or remote person.

Another type of remote screening has only the patient interacting with a computer. The patient is led through a series of screening questions. The software running this decision support could be on the local machine or via the internet. Based on the patient's responses, the patient's status is prioritized. If the patient enters information indicating a potentially serious condition, an NDMS team member is alerted. A system like this has been implemented in the emergency department at Parkland Memorial Hospital in Houston.

8.4.3.5 Teleconsulting

Teleconsulting reduces the need for multiple specialists on the NDMS teams. Via teleconsulting, a single specialist could service multiple NDMS teams. This is especially important with disaster-type specific experts who may have expertise in specific CBRNE incident categories. The interaction could be clinician-to-clinician or remote clinician-to-patient. In addition to audio and video, physiological monitoring devices can be included in the consult, as with remote screening.

8.4.3.6 Remote Monitoring

Remote monitoring becomes possible with the addition of integrated physiologic monitoring devices. Examples of physiological monitoring devices available for remote monitoring are: blood pressure cuffs, pulse oximeters, electrocardiograms (ECGs), electroencephalograms (EEGs), and blood glucose monitors. Ideally, remote monitoring is supplemented with audio and/or video capability. The monitoring could be of an individual patient or several patients concurrently. Remote monitoring of critical care patients, to include neonatal intensive care, by an intensivist has been proven to be an effective modality[40,41,42,43]. The person doing the remote

[40] Moore, S. K. (2002). Extending healthcare's reach. *IEEE Spectrum, 39*(1), 66-71.

[41] Rendina, M. C. (1998). The effect of telemedicine on neonatal intensive care length of stay in very low birthweight infants. *Proceedings of the American Medical Informatics Association Annual Symposium*, 111-115.

monitoring should be able to zoom in the video and adjust the audio volume and must have the ability to alert NDMS personnel.

Remote monitoring can be any of four configurations:

- Single device/single patient
- Multiple devices/single patient
- Single device type/multiple patients
- Multiple device types/multiple patients.

8.4.3.7 Telesurgery

Telesurgery can be as simple as a surgeon monitoring or directing a procedure via videoconferencing or as complex as using robotics. As the complexity of the modality increases, so do the costs. Endoscopic devices can be equipped with video and/or still cameras and the images saved for store and forward and/or sent real-time. The primary issue with telesurgery, especially via satellite is the latency. Numerous studies have been done to identify the maximum acceptable latency to ensure patient safety.[44,45,46,47,48,49] The consensus is that the latency must be less than 600 milliseconds. Satellite bandwidth should ideally be greater than 5 megabytes per second (Mbps). Latency is not just a function of the satellite. Latency is also affected by routers, switches, length of cable, signal processing (such as encryption) and whether the signal is routed by multiple satellite hops.[50] Telesurgery may be the least viable telemedicine option for NDMS teams as it would only apply to on 3 out of the 106 NDMS teams.

8.4.3.8 Teleradiology

Teleradiology is the most frequently used type of telemedicine. It is used in a variety of ways. For example, prior to transferring an acutely ill patient, the referring facility sends radiological images to the tertiary care facility. The tertiary care facility can review the images and offer suggestions for treatment prior to movement, considerations for movement and anticipate needs

[42] Celi, L.A., Hassan, E., Marquardt, C., Breslow, M., & Rosenfeld, B. (2001). The eICU: It's not just telemedicine. *Critical Care Medicine, 29*(8), N183-N189.

[43] Breslow, M. J., Rosenfeld, B. A., Doerfler, M., et al. (2004). Effect of a multiple-site intensive care unit telemedicine program on clinical and economic outcomes: An alternative paradigm for intensivist staffing. *Critical Care Medicine, 32*(1), 31-38.

[44] Rayman, R., Croome, K., Galbraith, N., et al. (2007). Robotic telesurgery: a real-world comparison of ground- and satellite-based internet performance [Abstract]. *International Journal of Medical Robotics, 3*(2), 111-116.

[45] Rayman, R., Croome, K., Galbraith, N., et al. (2006). Long-distance robotic telesurgery: a feasibility study for care in remote environments [Abstract]. *International Journal of Medical Robotics, 2*(3), 216-224.

[46] Rayman, R., Primak, S., Patel, R., et al. (2005). Effects of latency on telesurgery: an experimental study [Abstract]. Medical image computing and computer-assisted intervention : MICCAI ... International Conference on Medical Image Computing and Computer-Assisted Intervention, 8(Pt 2), 57-64.

[47] Rovetta, A., Bejczy, A. K., Sala, R. (1997). Telerobotic surgery: applications on human patients and training with virtual reality [Abstract]. Studies in Health Technology and Informatics, 39, 508-517.

[48] Marescaux, J., Leroy, J., Rubino, F., et al. (2002). Transcontinental robot-assisted remote telesurgery: feasibility and potential applications. Annals of Surgery, 235(4), 487-492.

[49] Marescaux, J., Rubino, F. (2004). Robot-assisted remote surgery: technological advances, potential complications, and solutions [Abstract]. Surgical Technology International, 12, 23-26.

[50] Satellite Signals Limited. (2007). Geostationary satellite latency and time delay ms. Retrieved July 16, 2007, from http://www.satsig.net/latency.htm

upon patient arrival. Because of the size of the radiological images, they would need to be compressed prior to sending.

8.4.4 Equipment Requirements for Telemedicine

Table 8-1 summarizes the types of equipment that would have to be purchased to support telemedicine capabilities for NDMS medical response teams.

Table 8-1. Equipment Requirements for Telemedicine

Equipment / Function	Options	Videoconferencing - NDMS side	Videoconferencing - distant provider side	Remote monitoring - NDMS side	Remote monitoring - distant provider side	Remote screening using software for decision support	Teleradiology
Computer/software		X	X	X	X	X	X
Video camera	Camera embedded in computer	X		Optional	Optional*		
	Camera as a computer peripheral	Optional	X	Optional (Recommended)	Optional (Recommended)		
Audio playback	External speakers	Recommended	Recommended	Recommended	Recommended		
	Headset	Optional	Optional	Optional	Optional		
	Satellite	Recommended	Recommended	Recommended	Recommended		
Power	AC/DC via Existing infrastructure	Optional (if available)	Optional (if available)	Optional (if available)	Optional (if available)	Optional (if available)	Optional (if available)
	AC/DC via Generator	Recommended	Recommended	Recommended	Recommended	Recommended	Recommended
	Battery / Fuel Cells	Optional	Optional	Optional	Optional	Optional	Optional
	Solar	Optional	Optional	Optional	Optional	Optional	Optional
Teleradiology Equipment							X

8.5 Integrating Telemedicine with NDMS EMR

Many telemedicine activities could be captured automatically into the NDMS EMR. Any additional patient data, such as medication history and allergies, could automatically populate the appropriate patient history sections of the EMR. The EMR could be initiated by the patient. An NBC news report described an emergency room check-in kiosk where the patient checks in using a touch screen similar to that used by airlines. The patient is taken through a series of screens and, based on responses, prioritized. Emergency room personnel are alerted when a patient enters information indicating a potentially serious situation. The kiosk has shortened waiting times for all types of patients[51]. Although not mentioned in this news report, once the patient provides identifying information, the system could then search for additional patient information via HIEs which would also populate the EMR, once the patient's identity is confirmed.

Physiological monitors can 'dump' data directly into the EMR. The physiological data could be captured continuously, but capturing physiological data at preset intervals is more common. In order to save memory, radiological images should be compressed. Any images would need to be compressed prior to sending in either a store and forward situation or real-time. All audio and video could be captured, as well. If audio and video are captured and stored, it could be analyzed later to improve processes and/or training.

[51] Williams, B. (Anchor and Managing Editor). (2007, July 16). NBC Nightly News with Brian Williams [Television broadcast]. New York: National Broadcasting Company.

The American Health Information Community (AHIC) is an advisory panel to the Secretary of the Department of Health and Human Services. AHIC recommended creation of a standard Emergency Responder – Electronic Health Record (ER-EHR) to support interoperability between first responders, emergency departments, and definitive care facilities. The ER-EHR is in the process of being defined by the Health Information Technology Standards Panel (HITSP). The NDMS EMR developers have provided input to the initial set of the ER-EHR interoperability specifications. The existing NDMS EMR is in alignment with the initial ER-EHR interoperability specifications and has an architecture that can be adapted as the HITSP ER-EHR technical committee completes the interoperability specification and consensus is achieved. Congruency with the ER-EHR interoperability specification will be necessary for electronic data sharing with first responders, emergency departments and definitive care facilities. This congruency will be essential for effective use of telemedicine for disaster medical response.

8.6 Gradual Implementation and Added Value

Telemedicine capability can be added in a gradual and modular fashion. NDMS teams have laptops, wireless routers, and a satellite dish, although the satellite capability may need to be upgraded. The speed of the current set-up, 64 kbps, is too slow for anything other than storing and forwarding telemedicine applications. The next step would be to add continuous broadband internet connectivity. Once internet connectivity is established, and assuming NDMS team members have registered with ICERx.org, one of the first activities could be obtaining medication histories as patients arrive and are identified. As stated above, the medication histories could automatically be incorporated into the EMR and would provide valuable information and potentially improve patient safety.

Assuming continuous internet connectivity, identification of telemedicine capable facilities and providers, and licensing issues are resolved, then videoconferencing would be a relatively inexpensive addition, mental health visits, as indicated, would provide the most added value. Given the history of the type of patients seen at NDMS facilities, screening for level of acuity and degree of concurrent anxiety, along with mental health visits would provide the most added value. Modern telemedicine has been used successfully in psychiatry since the early 1990's.[52,53] However, telepsychiatry using two-way closed circuit television was initiated between Nebraska Psychiatric Institute and Norfolk State Hospital in Nebraska in 1959[54]. Workflow and facility layout may need to be altered to provide a more private area for videoconferencing.

The addition of physiological monitoring devices that automatically populate the EMR is valuable in that the data is more accurate than when manually entered into the EMR. It also provides efficiencies in that the provider does not need to physically perform the activity or document the result. Audio and visual alarms can alert the provider when there is a change in patient status. Once the physiological monitoring devices are connected to the computer and the computer to the internet, remote monitoring becomes possible. More devices can be added over

[52] Stamm, B. H. (1998). Clinical applications of telehealth in mental health care. *Professional Psychology: Research and Practice, 29*(6), 536-542.

[53] German, H. (2006, February 28). Surviving the storm. Telemedicine and Telehealth Articles. Retrieved July 16, 2007, from http://tie.telemed.org/articles/article.asp?path=articles&article=telepsychAndNaturalDisasters_hg_tie06.xml

[54] Brown, F. W. (1998). Rural telepsychiatry. *Psychiatric Services, 49*(7), 963-964.

time and as the patient population indicates. ECG, EEG, and other physiological waveforms can be sent in a store and forward format or reviewed in real-time.

NDMS MICU units are good candidates for teleradiology and telesurgery applications as well as remote monitoring by intensivists. It is the MICU patients that are the most likely candidates for movement to emergency departments and definitive care facilities. Currently, EMR records are printed and sent with patients. With telemedicine, EMR records could be forwarded to the receiving facility. The providers at the receiving facility could offer suggestions for treatment and movement as well as plan for the patient's arrival. The planned addition of Radio Frequency Identification (RFID) for patient identification will make patient tracking easier and provide the receiving facility with a better idea of arrival time. Table 8-2 summarizes the relative benefits and costs of each telemedicine modality for NDMS.

Table 8-2. Benefit/Cost Comparison for Telemedicine Modalities

Modality	Expected Benefit	Cost[55]
Access to patient information	**High.** Improves access to patient history, prevents adverse events due to allergies and drug interactions.	**Low.** Leverages existing EMR with minor extensions. Requires internet access.
Teleconsulting	**High.** Improves treatment and patient movement decisions. Improves access to specialized experts from the field.	**Low.** Modest additional infrastructure at site. Requires modest additional bandwidth plus access to teleconsultants networks.
Telescreening	**High.** Reduces patient queues using remote providers. Gets urgent cases treated sooner.	**Low.** Requires videoconferencing plus (optionally) basic remote diagnostic tools.
Teleconferencing – provider to provider	**High.** Improves treatment coordination. Improves situation awareness.	**Low.** Leverages videoconferencing capability.
Teleconferencing – provider to patient	**High.** Enables remote clinician to direct or provide care.	**Low.** Leverages videoconferencing capability.
Remote monitoring	**Moderate.** Reduces on-site staffing required for patient monitoring.	**Moderate.** Requires investment in telemedicine capable patient monitoring equipment.
Teleradiology	**Moderate.** Provides access to skilled radiological studies across multiple sites. However, in many cases sufficient radiological capacity may be available locally.	**High.** Requires investment in teleradiology equipment and additional staffing with radiology technicians.
Telesurgery	**Low.** Provides access to specialized surgical capabilities. However, patient movement to specialized centers may be preferred in many cases.	**High.** Requires high definition video conferencing, very low latency communications, and (optionally) robotic telesurgery equipment.

[55] Cost consideration does not include any required satellite communications upgrade

8.7 Conclusion

The existing NDMS set up and equipment is not conducive for telemedicine. Several items are needed to extend the NDMS capability into telemedicine.

Recommendation 8.1. Continuous broadband internet connectivity is needed. Broadband is defined as data transmission rates greater than 200 kbps[56].

Recommendation 8.2. Telemedicine capable facilities and providers need to be identified and MOAs put in place.

Recommendation 8.3. All provider licensing issues must be resolved. In the short term, this may best be accomplished by making telemedicine providers intermittent federal employees. All NDMS healthcare professionals should register with ICERx.org. As new HIEs come online, MOAs need to be completed and NDMS personnel made aware of what information is available and how to access it. In order to automatically capture the online information, enhancements to the NDMS EMR would be required.

Recommendation 8.4. Add teleconferencing capability. This requires the addition of video cameras, audio microphones, and software. The telemedicine providers need appropriate complementary equipment and software; in many cases these will already be available at telemedicine centers. Teleconferencing may require modifications in the NDMS response teams' physical set up to create effective work spaces for this function.

NDMS MICUs would receive the greatest benefit from real time teleradiology, telesurgery, and remote physiological monitoring. Prior to any NDMS-wide implementation of telemedicine, pilot studies should be conducted. Since there are only three MICUs, the MICUs would be a reasonable place to pilot the majority of telemedicine activities. An alternative would be to use one MICU and one regular NDMS response team.

Recommendation 8.5. A pilot study for each type of telemedicine activity is suggested. Pilot testing, in concert with a selected telemedicine provider, such as an academic telemedicine center with an emergency medicine focus, would provide valuable opportunities for reality testing. Before investing in the development of a detailed concept of operations, set of policies and procedures, and training and certification program for NDMS teams and participating telemedicine providers, NDMS should develop a relationship with a trusted partner and work with them on a comprehensive pilot test plan. The lessons learned can then be incorporated into an appropriate full-scale program for the NDMS medical response teams.

Recommendation 8.6. More broadly, an ongoing disaster medicine research and development effort by HHS and coordinated by ASPR is recommended. One authority on telemedicine, Dr. Oscar Boultinghouse, MD, FACEP, is also medical director of the NDMS Texas-3 DMAT. He runs a telemedicine center for the University of Texas and serves as associate director of the American Telemedicine Association. His views are informed by a career in emergency and disaster medicine, plus pioneering work in civilian telemedicine. Dr. Boultinghouse recommends six strategic tasks for the government disaster medical response community, summarized here as follows:

[56] Federal Communications Commission. (2007). What is broadband? Retrieved July 17, 2007, from http://www.fcc.gov/cgb/broadband.html

- Integrate telemedicine into national emergency response plans and corresponding local, state, and federal response plans, templates, playbooks, etc.
- Create a national civilian disaster telemedicine support capability (or a network of networks).
- Conduct basic research to define human and logistical factors that can optimize the work of disaster medical response providers (*e.g.*, rapid processing of patients at the event site, organized presentation of patients to the distant consultants, etc.)
- Develop a telemedicine provider and responder corps and maintain it at a functional level of readiness in regional locations.
- Accelerate the transfer telemedicine technology from DoD and the private sector to the public health community.
- Identify funding to support these tasks.[57]

Any telemedicine initiatives undertaken by NDMS will require careful development and thorough testing to assure the practicality of the approaches, the ruggedness of the devices, the reliability of the software, and the feasibility of using the system in the austere conditions under which DMATs and other medical response teams frequently operate. Pilot testing of new telemedicine capabilities in the field should be the norm to mitigate technological risks. Fortunately, NDMS has repeatedly demonstrated its ability to create effective, field-grade systems and processes that meet the challenges of disaster medical response, and can apply that same expertise to capitalizing on the opportunities presented by telemedicine.

[57] Boultinghouse, O. (2006). "The Telemedicine Response to Homeland Safety and Security: Developing a National Network for Rapid and Effective Response for Emergency Medical Care," University of Texas Medical Branch, Galveston, TX, unpublished monograph.

9. Review of Policies and Directives

9.1 Description

MITRE conducted a comprehensive review of existing DHS directives and policies related to the development and operations of NDMS. MITRE reviewed each document and developed recommendations regarding the continued need for the selected directive or policy, changes that must be made to the document in light of the transfer of NDMS to HHS, and which directives or policies require a legal review within HHS in order to determine whether they are suitable for adoption within the Department. In addition, MITRE identified and included any significant program areas for which there are no existing policies or directives.

9.2 Overview

After reviewing policies, directives, legislation, proposed legislation, key documents from governing groups of the NDMS and conducting one-on-one interviews with ASPR, OPEO and NDMS personnel, MITRE developed recommendations for directive and policy changes or additions along with program areas which currently lack directives or policies. The three DHS directives for which reviews were specifically requested are all from the FEMA Directives Management System and dated April 12, 2006. The areas addressed in the directives are:

- Determination of a Public Health Emergency for NDMS Activation
- NDMS Custody and Use of Federal Property
- NDMS Ongoing Preparedness Activities.

During this Joint Review, the NDMS Senior Policy Group (SPG) submitted a 2007-2009 Issues Paper created by the Executive Secretariat at the request of the SPG. After a series of meetings, the Executive Secretariat identified numerous overlapping issues which are documented in the paper. These issues have been evaluated and included as appropriate.

Finally, after many interviews with ASPR, OPEO, and NDMS personnel and analysis of policies and practice, additional program areas lacking clarity in policy or lacking policy altogether have also been identified. In most cases suggestions on how to proceed in resolving each are provided. In each case, NDMS should update these directives in the HHS/ASPR equivalent of the DHS Directives Management System.

9.3 DHS Directives

Determination of a Public Health Emergency for NDMS, FEMA Directives Management System 6900.11

This FEMA directive brings to policy legislation which specifies the Secretary of DHS (or other appointed delegates) as the individual with authority to activate the NDMS. A series of 11 guideline examples of what constitutes a public health emergency or potential public health

emergency are provided. These guidelines include scenarios from a naturally occurring infectious disease outbreak to a bioterrorism attack. Also included are emergency declarations by state governors, a Presidential declaration of a major disaster, or the Secretary's determination of an Incident of National Significance under the National Response Plan.

Recommendation 9.1: This directive should remain intact and be updated to be consistent with current legislation, which transfers authority for the activation of NDMS from the Secretary of DHS to the Secretary of HHS. This legislation is specified in the Pandemic and All-Hazards Preparedness Act (PAHPA) Section 101.

NDMS Custody and Use of Federal Property, FEMA Directives Management System 6900.9

Activation of NDMS Teams as covered in 6900.11 authorizes federal funding for NDMS activities which may be in response to a disaster or which may be a training activity. Once authorized, 'federal activation' authorizes the expenditure of federal funds for intermittent federal employees pay and benefits, and cache supply replenishment. It also covers NDMS team members by the statutory protections applicable to federal employees.

When activation of NDMS Teams does not occur as described in 6900.11, DHS Directive 6900.9 specifies this as a 'non-federal activity'. While NDMS Teams are free to respond in a non-federal capacity to requests by state or local governments or by private not-for-profit entities, they would not be entitled to federal pay or benefits and would not be covered by the statutory protections applicable to federal employees.

The Directive goes on to specify the requirement criteria of the organizations which the NDMS Teams may elect to support in a non-federal activity situation. For example, the entity must be a state or local government or a not-for-profit entity with adequate insurance to replace lost or damaged federal property. Other criteria include indemnification of the Federal Government and terms for replacing federal supplies used from NDMS Team caches during the activity.

Recommendation 9.2: This directive, while never operationalized, should remain intact. NDMS should confirm that internal processes and procedures are in place to accommodate this directive. Of particular concern is the prompt replacement of cache inventory. NDMS should update this directive and include it in NDMS Policies and Procedures. The HHS Office of General Counsel will need to be involved in the review and updating of this directive to ensure the legal requirements are properly addressed.

NDMS Ongoing Preparedness Activities, FEMA Directives Management System 6900.10

Ongoing preparedness activities are viewed as vital to NDMS Team readiness and efficacy. The need to stay current on best practices, new equipment and working as a team are viewed as essential for the ongoing effectiveness of all types of NDMS Teams. Historically, ongoing preparedness activities have not been funded to the degree many would deem appropriate. This Directive defines ongoing preparedness activities (training and support) and NDMS Team compensation based on whether the activity is a 'federal activity' or a 'non-federal activity' as defined in Directives 6900.9 and 6900.11.

Unlike Directive 6900.9, NDMS Team remuneration and statutory protections are dependent on whether the ongoing preparedness activity has been approved by the Chief of the Operations Branch, Response Division, FEMA upon the recommendation of the Chief of NDMS (or their delegate) rather than activated for a Public Health Emergency by the Secretary. The two types of

ongoing preparedness activities are handled quite differently from a reimbursement standpoint. While both training and support activities are covered by the statutory protections regarding worker's compensation and tort claims, they are handled differently by USERRA which applies only to training activities.

Recommendation 9.3: This directive requires further investigation and alignment with ASPR/NDMS goals and priorities in light of expanded team training, service activities, and the need for prompt cache replacement post-training. Authority for approving training activities to qualify as a 'federal activity' is unclear since the transition of NDMS to HHS, and should be carefully evaluated.

9.4 Program Areas Lacking Directives or Policy

There are several program areas that require additional directives and policy. These are largely in the areas of defining an NDMS patient, integrating NDMS activities in the larger ESF #8 response, retooling NDMS to meet the requirements set forth in the National Planning Scenarios, NDMS governance, and potential operational transition gaps.

Defining an NDMS Patient. The definition of an NDMS patient eligible to receive definitive care or evacuation services may need to be revised. The historical definition of an NDMS patient has changed with the PAHPA legislation and current pending legislation,[58] which expand NDMS patients to include outpatients, nursing home residents, at-risk and special needs patients, including patients requiring mental health services.

Recommendation 9.4: This program area should be refined through policy which clearly defines the attributes of an NDMS patient. This definition should include the traditional NDMS patient receiving emergency care along with an expanded NDMS patient base including outpatients, nursing home residents, at-risk and special needs patients (including patient requiring mental health services). The policy should codify how each of these patient types will be addressed for both definitive care and patient evacuation. Additionally, the policy should state how the needs of patient families will be best met in an evacuation situation, while not delaying transport of other patients in need. This policy should be documented and approved through the appropriate review process and distributed to NDMS partner agencies.

NDMS Reimbursements for Care. In 2005, NDMS was first confronted with activating patient evacuation and massive use of NDMS hospitals as well as non-NDMS hospitals in the care of their patients. Reimbursement procedures and an interagency agreement were not in place for hurricane Katrina. This resulted in significant reimbursement delays while the Department of Health and Human Services (HHS) and the Department of Homeland Security (DHS) established an agreement and processes. Eventually funds were transferred from DHS to HHS.

Recommendation 9.5: While the reimbursement process following Katrina ultimately worked, going forward **HHS should establish policy and develop criteria for reimbursement rates and procedures for providers claiming reimbursement**. These should not only be publicly available, but an educational outreach to FCCs should be undertaken proactively. All facilities should know in advance what reimbursement will be made and the process they must go through to file a reimbursement claim. A long-term agreement between NDMS and CMS should be finalized to define how claims will be processed.

[58] "Public Mental Health Emergency Preparedness Act of 2007", sponsored by Mrs. Clinton and Mr. Domenici.

Recommendation 9.6: Additionally, **the procedures to be used for HHS to obtain supplemental appropriations to pay for medical care should be developed, coordinated, and promulgated**. This would alleviate the need for the crisis coordination that occurred during Hurricane Katrina/Rita to reach agreement on the payment process that would be used since reimbursement for medical care has been ineligible for FEMA Disaster Relief funds.

NDMS Medical Response Capabilities. It is anticipated that the response requirements for NDMS in the future will be substantially different than in the past. With the publication of the 15 National Planning Scenarios, ASPR is charged with a specific set of requirements to plan an ESF #8 response.

Recommendation 9.7: Although difficult, **NDMS's role in the broader ESF #8 response to the 15 scenarios should be defined strategically and documented in the form of a policy or directive**. The role, expectations, and ability for NDMS to respond to the 15 National Planning Scenarios should be further evaluated. This evaluation should include the duration of NDMS team deployment and assure that NDMS has the logistical capacity to support teams for targeted durations.

- The Secretary's Operations Center's (SOC) concept of operations (ConOps) is evolving and strategic priorities need to be established along with NDMS's role in the broader ESF #8 response. As these decisions are finalized, policy should be established and communicated which clarifies NDMS's role in an ESF #8 response. This should include, but certainly not be limited to the future role of the NDMS Operations Support Center (OSC) with the SOC.
- The existing Memorandum of Agreement between the partners, the ESF #8, and other related documents give DoD the responsibility to coordinate NDMS patient evacuation. However, a significant level of DoD patient evacuation support has really only been required during Hurricanes Katrina and Rita. Additionally, recent changes that would transfer responsibility for coordinating commercial transportation resources from DOT to FEMA or that add contracted air and ground ambulance capabilities have not been incorporated in existing policy. Thus, the role of DoD in NDMS patient transportation should be re-evaluated. Once a partner decision is made regarding which FCCs should be activated, HHS may be in a better position to coordinate patient movement and determine to which facilities patients are transported, when they are transported and how they are transported, to include using DoD transportation, when needed. This would put DoD in a more tactical and support role, rather than the lead department for patient evacuation.
- Multiple information technology systems are in use for the reporting of available NDMS hospital beds, patient tracking, and electronic health records. Going forward it is essential that a systems solution is adopted which not only meets the functional requirements set forth by NDMS and partner agencies, but also meets national interoperability standards to assure the highest degree of integration possible among NDMS partners as well as other health care providers, public health organizations, and regional health information organizations. The ability to seamlessly communicate electronically should eliminate duplicate reporting, integrate patient and bed reporting and tracking, enhance patient care, and improve the quality, timeliness, and accessibility of patient related information.

NDMS Governance. As an organizational division within HHS, NDMS is governed by:

- HHS Secretary
- HHS Assistant Secretary for Preparedness and Response
- ASPR Director for the Office of Preparedness and Emergency Operations
- NDMS Director.

As a federal partnership, NDMS is governed by:

- Senior Policy Group (SPG), which 1) sets policy and goals for national preparedness, and 2) oversees the NDMS Executive Secretariat
- Executive Secretariat, which implements policy made by the SPG
- Medical Inter-Agency Coordination Group (MIACG) which assesses national capabilities to accept casualties into definitive, hospital-based care and recommends which FCCs to activate.

The NDMS Federal Partner roles and responsibilities are outlined in a Memorandum of Understanding. However, the PAHPA legislation has given the HHS Assistant Secretary for Planning and Preparedness increased authority over the NDMS system.

It should be noted that the Executive Secretariat identified unclear command and control as one of NDMS's most pressing strategic problems, particularly as it relates to patient evacuation and regulating.

MITRE recommends that the following changes be made to NDMS Governance.

> **Recommendation 9.8: Maintain the NDMS Executive Secretariat and SPG, but conduct SPG meetings more frequently to address the key issues**. The HHS Assistant Secretary for Preparedness and Response (Chair of the SPG) should ensure that appropriate issues are addressed, decisions made, and federal partners held accountable. Smaller groups should continue to work together between meetings to identify issues and prepare recommendations to be decided during the meetings.
>
> **Recommendation 9.9: Implement key changes to patient evacuation and regulating entities, requiring new policies and directives**. *These recommendations are further detailed in Sections 4 and 5 of this report.*
>
> - Establish through policy a Headquarters-level patient evacuation decision-recommendations body
> - Develop organic capability within HHS to provide medical regulating and patient movement coordination
> - Review the existing division of FCCs, determine feasibility of standardizing with VA as lead.

Appendix A. Modeling and Simulation

A.1 Task Description

A vision of the future NDMS is one that is flexible and able to respond to all hazards, scalable to both small and large events, coordinated with the public health system, integrated across organizational boundaries (local, state, tribal and private sectors) and predictable. The objective of this task is to identify how modeling and simulation (M&S) can support this vision and what steps can be taken to mature the existing M&S capability. The scope of this task was limited to medical surge response and therefore equally important aspects of disaster modeling such as disaster effect analysis or recovery are not included in this analysis.

The following activities were performed in support of this task:

- Generated a taxonomy of relevant modeling approaches and provided examples of medical surge response areas that could be modeled with each approach
- Conducted an initial survey of existing medical surge response models. The results are provided in Appendix A.
- Analyzed the output of MITRE project team interviews with NDMS staff to determine M&S needs in the areas of disaster response teams, patient movement, definitive care, and organizational change. Feedback was used to identify examples of surge models in the taxonomy section and as input for recommendations.
- Identified logical next steps for advancing the medical surge community's M&S capability.

A.2 Modeling Medical Surge Response

A model is a representation of reality. A model can be either a physical mock-up as in the construction of a small scale prototype of a physical entity such as a building or a ship, or it can be a mathematical model/algorithm that describes the behavior of an entity under study as in the case of predicting the dispersion pattern of a chemical plume. A model abstracts away what is unnecessary to answer a specific question and focuses on the details associated with a particular study question. Therefore, a model is typically an approximation of reality. It is as much an art as a science to know how best to represent the reality and what level of detail to use to answer a given question. For instance, if one wanted to study the mechanics of an automobile engine to determine its efficiency under various road conditions, it would not be necessary to model the entire car in detail; the focus would be on the engine mechanics with the other components abstracted to a level that allows for studying the mechanics in the context of the automobile. Similarly, in a medical surge response situation it is probably not necessary to represent every person in a population affected by a disaster to determine the effects of the disaster on mass evacuation.

The purpose of a model drives its development. Answers to the following key questions shape a modeling effort:

- What question needs to be answered?

- What must be represented (e.g., medical supply availability over time, human/group behaviors)?
- What data is needed and available to support the study?
- What type of outputs must be derived to answer the question?
- What is known/unknown and must therefore be parameterized in the model to allow for variation?
- What are the usage scenarios that will be used to exercise the model?
- What are the constraints to be imposed (e.g., local resource availability is dependent on the location of the disaster)?
- How can the model be validated?
- What type of execution time is needed for the model (i.e., real-time response planning) vs. accuracy of the results (i.e., the decision has life or death consequences)?

Some examples of the types of analysis needed in this community for which modeling could be used include the following:

- Evaluation of alternative response strategies under a spectrum of disaster scenarios
- Sensitivity analysis to determine if there are critical resources that if not made available or not provided within a certain time period of time will significantly influence the outcome of the disaster
- Decision support that might include: 1) what is the appropriate composition of medical resources needed to handle a given type of disaster 2) where should these resources be located to best assist in the response 3) when should the resources be allocated 4) what is the probability of multiple events and how should resources be allocated under such a scenario 4) when should the federal response teams get engaged in a particular event and what resources should they provide?
- Cost/benefit trade-offs. For instance, a study could compare the cost of stockpiling medical supplies vs. the cost of replacement of those supplies due to expiration vs. the cost/risk of acquiring needed resources on demand
- Dependency analysis of non-medical factors that affect medical surge response to include coordination across multiple tiers/layers of government and other disaster response organizations, state of communication infrastructure, local medical resource availability, etc.

A.3 Relevant Modeling Approaches and Their Application to this Domain

A wide variety of modeling approaches and techniques exist for representing and studying a spectrum of problems. To provide some perspective on a very broad subject area a high level discourse of selected modeling approaches thought to be relevant to the medical surge response problem space is included here. It is not the intent of this section provide a tutorial on modeling techniques; such information can be found in other publications. Rather, several broad categories of modeling approaches are introduced along with medical surge response application areas. This

categorization is also used to profile existing capabilities in the model survey included in an Annex to this Appendix.

A.3.1 Mainstream Simulation based Approaches

The qualifier – mainstream - is included here because other approaches described in this section are simulation-based but are called out in a more specialized category. The approaches presented here are standard approaches with a large suite of available commercial tools and broad industrial base.

A.3.1.1 Discrete Event Simulation

A discrete event simulation (DES) represents a system that can be described as a set of interacting entities and a sequence of timed events that trigger those entities to take action. Each time an event occurs, the system changes state based on what component of the system is responding to the event. A simulation tool will provide the infrastructure to manage the clock and event list. Randomness is introduced through the use of stochastic processes/distributions to represent probabilistic actions such as arrival rates of events. A classic example of a system modeled as a DES is the queue of customers at a bank. In a similar vein a model could be constructed to simulate the queue of patients waiting admission into a hospital. Several models included in the survey use a DES approach.

A.3.1.2 System Dynamics

System dynamics is a methodology for studying and managing complex feedback systems, such as one finds in business and other social systems [http://www.systemdynamics.org]. Systems are represented through a set of interconnected causal relationships that create feedback loops. A causal relationship is one in which an action taken by an entity affects (positively or negatively) the state of another entity. An example of such a relationship in this domain would be that medical supplies are depleted (negative effect) when requests are made for them in a disaster situation. A positive effect would be seen when new supplies replenish the cache. A system dynamics model could be very effective at providing support for real-time / dynamic planning of a disaster scenario. By representing the current state of entities in the disaster and updating the model dynamically with situational awareness data, the effects of the situation could be evaluated in real-time and alternative strategies explored.

A.3.2 Complex Systems Modeling

Many definitions of a complex system exist. For purposes of this investigation a complex system is defined as one with the following characteristics:

- Consists of a large number of interacting entities
- Exhibits emergence – the collective behavior cannot be predicted from individual behavior patterns
- There is no central control present

A typical medical surge response scenario exhibits all of the attributes of a complex system:

- Many types of individuals and organizations are interacting during a medical crisis situation to include victims, response specialists (e.g., medical, police, fire), media, onlookers, etc.
- Each of these individuals and logical groups (e.g., doctors, mass evacuation) have differing agendas, responsibilities, and priorities. Their individual and collective behaviors will differ and the interactions they have will influence the overall unfolding of the scenario. Each disaster is often considered unique because of this.
- A disaster situation can be chaotic with very little centralized control.

Examples of complex system modeling approaches include the following:

- Agent-based Modeling (ABM) – interacting entities are represented as independent actors with their own unique behaviors. When these actors interact the result is emergent group behavior that cannot be predicted. This approach is typically used to study complex systems where human behavior needs to be represented. This approach is already being explored in this domain as evidenced in the survey findings. Additional medical surge response applications might include:
  - Mass movement analysis to aid in determining movement patterns so that optimal medical surge response locations can be anticipated.
  - Exploration of different disaster scenarios to discover emergent behaviors that may occur for purposes of planning/responding to similar situations
- Cellular automata – the representation of entities in a grid of cells where the state of any given entity (cell) is determined by a simple rule based on the state of selected neighbors. Possible medical surge response applications include:
  - Mass movement analysis – for studying movement patterns where each cell represents an individual and their next move is dependent on the behavior of nearby evacuees
  - Disease propagation – for studying how different behavior rules associated with an infected individual can lead to certain propagation patterns and hence where medical response will be needed
- Multi-paradigm modeling –an emerging approach for creating a complex system model when there are important features to be represented at varying scales (e.g., fidelity/abstraction level) or where different parts of the overall model are best represented by different underlying formalisms/approaches. For instance, in this domain it is important to have detailed patient profile information in order to accurately identify patient transport requirements such as type of transport and response agent skill while mass movement of individuals could be modeled at an aggregate/group level. As another example, a disaster cast as a multi-paradigm model might include a system dynamics model for resource management at a high level, a discrete-event simulation for medical personnel scheduling and coordination, and a detailed system model for representing the infrastructure to include communication links. In general, the community has a wide spectrum of specific models that could be integrated together for a more complete understanding of disaster response through multi-paradigm modeling. [HHS2007] identifies the need to conduct interdependency analysis with other non-medical sectors (agriculture, water, energy) to determine the full impact of the disaster on response

efforts. This type of complex model could be created through an ensemble of sector-specific models.

A.3.3 Gaming Technology

Gaming technology is a simulation-based model that provides the infrastructure (gaming engine) to support the construction of games that can range in scope from single user to massive multi-player online games (MMOG) with thousands of players distributed across the Internet. The serious games movement is focused on applying gaming technology to real world problems particularly in the area of training. Other application areas include policy exploration, visualization, education, and health and therapy. Examples of the use of gaming for incident management training include triage role playing developed by NIST in collaboration with the Institute of Security Technology Studies at Dartmouth College and incident management strategy gaming developed by NIST. [Jain2006].

A.3.4 Other Modeling Approaches

Several other modeling approaches are summarized here because they are considered relevant to this domain.

- Markov chain – A Markov chain describes a process with a finite number of states and an associated probability of moving from state to state. Movement is strictly based on the current state with no knowledge of previous states required to make a decision. It is usually represented by a directed graph where the nodes represent states and the edges represent probability of moving from one state to the other. A Markov chain was used to represent patient movement in a hospital from one specialty area (e.g., emergency room, surgery, ICU) to another in the AHRQ surge model (See Annex 1 to this Appendix).
- Real options analysis - A real option is the right, but not the obligation, to undertake some business decision, typically the option to make a capital investment. With real options analysis, uncertainty inherent in investment projects is usually accounted for by risk-adjusting probabilities [Wikepedia]. Because of the dynamics and uncertainty associated with any given disaster scenario this type of analysis could be effective in deciding on an investment strategy for NDMS. For instance, it might be useful to determine the best investment strategy for DMAT cache medical supplies with limited shelf-life where there are risks with overstocking and having to throw out expired medicines as well as under-stocking and being faced with a disaster that demands them.
- Decision support/Optimization models– A large class of model techniques exist in the Operations Research (OR) area of expertise for creating decision support tools and optimization models. These models are typically closed form, mathematically defined models and are generally referred to as analytical models. For instance, in a linear programming model the objective is to optimize a linear objective function that is constrained by a set of linear equations. Another example would be a cost/benefit model where an organization is trying to maximize benefits and minimize costs. In the area of medical response this type of model could be used to determine optimal resource allocation schemes or evaluate different investment strategies in terms of benefits and risks.

- Business process models – The industry is maturing business process modeling notations, semantics and tool support to represent and simulate the execution of business process models[http://www.bpmi.org/]. Such models could be developed for the medical response surge community to study how changes to current business processes might affect (negatively or positively) the outcome of a disaster response based on both interactions among participants and delays incurred in performing an activity. These models could range in scope from a single group within an agency to a multi-agency spanning structure to determine effectiveness of interactions across the community at many levels. [HHS2007] calls out the need for studying the process of managing supplies from the production to tracking to transporting. Process modeling could help the community "understand how well we conduct these activities today, how well the infrastructure supports these activities, and finally, it will identify gaps in processes that must be further examined for remediation strategies" [HHS2007]. It may also be useful to consider the use of supply chain management /enterprise resource planning models as a way to study this area.

A.3.5 Proposed Next Steps

The medical surge response community has clearly recognized the need for a modeling and simulation capability as evidenced by the wealth of existing models. To identify some logical next steps that build on that base, this section reiterates the key objectives identified in the NDMS vision and uses these as the basis for making M&S recommendations.

A.3.5.1 Respond to All Hazards

To develop response strategies for all hazards requires that 1) models exist for each hazard type and 2) that each model analyzes all the response requirements. Based on the initial survey, there appears to be a predominance of support for bioterrorism scenarios. In terms of response needs analysis, a large number of models identify response needs for definitive care but there is very little in the way of support for patient movement/transport. It is recommended that the community clarify which disaster scenarios are sufficiently addressed by existing models, perhaps down select to a 'best of breed' where redundancy exists, and devote future resources to develop an analysis capability for uncovered hazard types.

As to the second point – analyzing all the response requirements – there is also a recognized need to understand the consequences of IED attacks on the medical infrastructure, creating a disaster area with degraded medical response capability. In addition the impact of cyber attacks on the infrastructure can affect the ability of the surge response teams to effectively communicate [HHS2007]. Understanding the full scope of requirements for effective medical surge response demands a broad view of a hazard situation and may require broadening the scope of response modeling beyond the medical surge requirements to determine the best response strategy.

A.3.5.2 Scaleable to Both Large and Small Events

The ability to scale a medical surge response to the scale of the event requires an adaptable resource allocation scheme as well as flexible organizational structure and processes.

Given the uniqueness of any given event, an M&S capability could help the community explore effective resource allocation strategies under different disaster scenarios to identify key flex points that correlate with disasters of different scales. Previous disaster response data could be used to validate the model.

Assuming a broad spectrum of disaster events, the organizational roles, responsibilities, types of demands on the medical surge response community, and duration of response are likely to also span a broad range. In addition, interfaces among government organizations are likely to vary based on the event parameters, its location, and regional resources available. Therefore, it is recommended that modeling & simulation (perhaps gaming technology) be explored as the basis for analyzing different roles, individual behaviors and collective organizational effectiveness under events of different scales. Such models could aid in determining ahead of time the ideal processes and organizational structure to use given the scale of an event and/or to validate the adequacy of existing organizational structures and processes.

The presence of simultaneous or multiple/staggered events will add another dimension to responding to events with different scales. A few models have been identified in the survey that represent simultaneous events. From a resource allocation perspective there is a need to develop a strategy for how to allocate across the multiple events to optimize medical response for all. Development of models that assist planners in exploring these optimization strategies prior to their actual occurrence will position NDMS for effective response should such a multi-event scenario unfolds. The dynamics of multiple events may require that the organizational structure and processes change over time as events unfold. Exploration of these options could also be conducted as part of a modeling and analysis capability either in real-time to play out a strategy or in offline mode to evaluate the feasibility of alternatives.

A.3.5.3 Coordinated with the Public Health System

It is unclear how M&S can support this objective except from the perspective of representing the public health system as part of a grander complex systems model of medical surge response. It is noted that the public health system has responsibility for coordination with the private health sector which may be an important interaction to study at a time when government assets may not be sufficient to respond to a disaster event.

A.3.5.4 Integrated Across Organizational Boundaries

There are two dimensions to consider here: community-wide integration of people/organization and integration of the medical surge response models. Each of these is addressed in the following sections.

Community Integration

While there are many integration/information sharing challenges within this multi-layered response community, the focus of this discussion is limited to the integration of the modeling community with itself, with its medical response operational counterparts, and with other medical response modeling communities.

[HHS2007] identifies the need for tools & mechanisms to support information sharing across the M&S community. The recommendation is to stand up a community-wide portal for retaining and accessing information about available models, data, and analysis results. A reference

implementation for such a capability would be Wikepedia [http://en.wikipedia.org/wiki/Main_Page]. The basic infrastructure mechanisms exist, are available as open source software, and could be stood up quickly allowing the community itself to start populating the resource and refining its content in a self-managing manner. This will provide some basic mechanisms for community members to populate the portal with available assets and other community members to leverage those assets. The capability can serve as a community-wide resource that has been vetted by the community itself. The capability will serve as living resource, updated and refined by its members. It is recognized that this solution does not fully address the need to protect information. However, as a first step control of assets can be retained locally while exposed globally.

DoD has a wealth of knowledge and capability in the medical response area. The 'community' portal would ideally include members of this community as well allowing information sharing and knowledge capture across a broader medical surge response modeling community. An example of the type of models available from this community is the Tactical Medical Logistics Planning Tool (TLM+) profiled in the survey. It was developed for the Navy & Marine Corps and is being adapted for disaster scenarios [Konoske2007].

It is also important to share information between the modelers and their operational counterparts. This integration is two-way as illustrated in Figure A-1 and expanded on here:

- Access to modeling results - By making the results accessible to the operational side, they become a part of the input to response planning by providing insight into how an event might unfold, what type of resource allocation strategy is likely to be most effective for a particular type of scenario, etc.
- End user access to models – The operational user needs to have a streamlined interface to models. Model development should emphasize the creation of end user GUIs that hide the details of the model while providing flexibility of execution. This will facilitate the use of the models by operations staff to conduct 'what if' analysis as part of their decision-making activities.
- Integration of models with operational planning & execution tools – This community can go one step further by integrating the modeling tools with operational capabilities. This will allow the operational staff to oscillate seamlessly between decision-making models and disaster response planning & management tools. By having this enhanced capability the operational team can leverage 'what if' analysis in real-time.
- Disaster data collection / retention for refining and validating the models – The models are only as good as the data that drives them. By having mechanisms in place for collecting data in a consistent manner that supports the modeling activity, the models can be refined over time and validated against real disasters. This will lend credibility to the models and allow for new modelers to quickly get access to needed data.

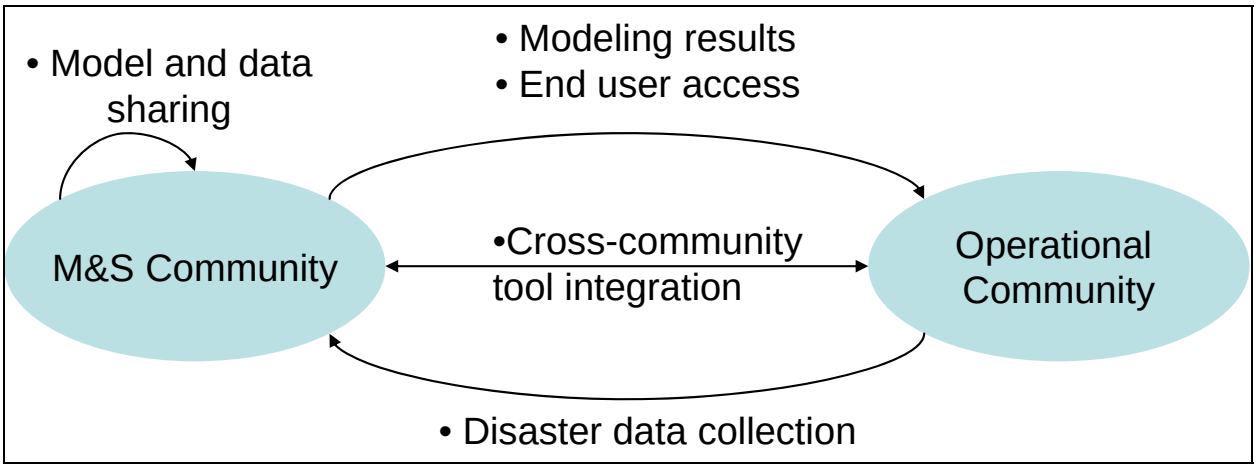

Figure A-1. Community Integration

Model Integration

Model integration addresses the infrastructure needed to compose models together to support broader, end-to-end analysis. For instance, the community could explore the emerging trend toward web-based simulation as a way to combine simulation models with World Wide Web (WWW) technology to yield more complex and complete capabilities. Or it could investigate the use of multi-scale/multi-paradigm modeling techniques to integrate different models built with different approaches at different levels of abstraction focused on different aspects of medical surge response. Model integration is also intended to address the need to evaluate how models could be composed for broader response analysis. For instance, patient movement response needs are actually driven by the patient profiles derived from the definitive care models. Therefore, transport models could potentially leverage the output of those models. A review of models and their composition potential could be a good first step. For examples of model composition see [Albores2005] and [AHRQ2006].

A.3.5.5 Predictable

Due to the complex nature of a disaster situation, there is a high degree of uncertainty that exists for any given event. Therefore, a predictable response is a noble but probably not achievable goal. That said, the M&S community could begin to mature complex system models that would allow for the study of different scenarios as they unfold to understand the emergent behaviors and how to respond. The New York University Center for Catastrophe Preparedness and Response (CCPR) has initiated development of such models using ABM and optimization techniques (See Annex 1 to Appendix A.) This work could possibly be leveraged and broadened to cover other levels of government/disaster locations. By simulating the unfolding of various complex disaster events the community may discover recurring patterns of needs, use the model to evaluate effectiveness of different response strategies, and hence make the community prepared as opposed to predictable.

Annex 1 to Appendix A: Initial Medical Surge Model Survey

This annex contains a partial compendium of existing medical surge response models. It is not intended to represent a comprehensive list but is just meant to illustrate the variety and depth of capability that is already in place for the community. Each model is summarized in terms of the medical surge response area supported (e.g., Definitive Care), type of response needs determined by the model, scenarios represented, modeling approach used, sponsoring organization, availability of model, and associated references.

Table A-1. Medical Surge Model Survey

Response Area	Surge Response Needs Determined	Scenario(s) Represented	Modeling Approach	Sponsoring Organization	Availability of Model	Reference
Definitive Care	1. # of beds (medical/surgical, ICU) over a daily time period 2. average daily arrival of plague victims 3. cumulative mortality (with and w/o early intervention) 4. Ventilator utilization	Bioterrorist attack	Simulation		Unknown	[Miller2004]
Definitive Care	1. Number of doctors 2. Number of nurses 3. Number of beds	-	Simulation		Unknown	[Schenk2005]
Definitive Care	1. Number of patients 2. Number of beds	1) Single event bioterrorist attack 2)Multiple bomb attacks	Agent-based Modeling		Unknown	[Narzisi]
Definitive Care	1. Number of patients 2. Number of beds 3. Cumulative mortality rates	Pandemic	Differential equations, deterministic model		http://www.influsim.de	[Eichner2007]
Patient Movement	1. Patient wait time for an ambulance	Air crash in residential area	Simulation		Unknown	[Christie1998]
All (Response teams, Definitive Care, Patient Movement)	Resources (staff, supplies) needed in various tasks: • Medical Command Centers • Neighborhood Emergency Health Centers • Acute Care Centers • Community Outreach Unit • Patient Transport • Community Security • Logistics (Mobility) Support	Biological warfare	Analytical (Spreadsheet-based)		http://www.dartmouth.edu/~engs05/md/appendix.html	[Dartmouth2003]

Response Area	Surge Response Needs Determined	Scenario(s) Represented	Modeling Approach	Sponsoring Organization	Availability of Model	Reference
Definitive Care	1) Number of beds (medical/surgical, convalescent, ICU, hospice) over time 2) Nursing hours	Bioterrorism attack (smallpox)	Discrete-event simulation	AHRQ		[Miller2006]
Definitive Care	1) Casualty arrival pattern 2) Number of patients in the hospital 3) Number of dead and discharged patients 4) Resource availability and daily requirements 5) Prophylaxis requirements	Weapons of Mass Destruction	Markov Chain	AHRQ	www.surgemodel.org (restricted access)	[AHRQ2006]] + demonstration by R. Cassagrande, Gryphon Scientific
Definitive Care	1) Mortality rates and how they are affected by (number of hospitals, hospital resources, communication, triage, grid-size, size of original population affected) 2) Time traces of people and hospital response.	1) Food poisoning outbreak 2) Sarin outbreak	Complex System Modeling / ABM + OR-based optimization	New York Center for Catastrophe Preparedness & Response(CCPR)	Unknown	[PLAN-C -1] , [PLAN-C-2], [PLAN-C-3]
All areas	Given a resource allocation strategy the model determines an efficiency index for actual usage in the scenario	Earthquake based on data available from Romania	ABM using the HLA* to federate multiple simulations	German Science Foundation	Unknown	[Fiedrich2006], [Fiedrich2007]
DMAT Response Team	1. Specific medication types, and estimated doses for 3 days 2. Prescribed medications prescribed including number of prescriptions	-	Empirical analysis based on community emergency room statistics		Unknown	[Rosenthal2005]]
DMAT Response Team	1. Resource requirements (vehicles, equipment, manpower) for mass decontamination 2. Effect of geographic spread of available resources on response time	Biological or Chemical Attack (simultaneous/ staggered events)	Simulation	Unknown	Unknown	[Albores2005]
Definitive Care + Patient Movement	1. Patient estimates (type, disposition,…) 2. Care providing estimates (patient time in system, equipment utilization,…_ 3. Transportation estimates (usage by pool, details by level of care, utilization)	Military Scenarios; plans exist for supporting disaster scenarios	Discrete event simulation (TML+)	Bureau of Medicine and Surgery and the Office of Naval Research	http://www.nhrc.navy.mil/programs/TML/download.html	[Konoske2007]; http://www.nhrc.navy.mil/programs/TML/index.html

* HLA (High Level Architecture) is a distributed simulation integration infrastructure originally developed for the military training community and now specified as an IEEE standard

Appendix B. Program Manager and Regional Emergency Coordinator Matrix of Program Functions

B.1 Description

This Appendix provides a matrix that arrays program functions that are performed by NDMS Program Managers (PMs) and HHS Regional Emergency Coordinators (RECs). The matrix highlights those functions that involve interaction with and coordination of NDMS response team activities, as well as those involving Federal Coordinating Center (FCC) activities. An objective of the matrix is to identify duplication of effort among these two staff types, as well as program functions that do not currently appear to be adequately covered by either group.

B.2 Background

The REC and PM roles have both been in existence since NDMS was originally established as part of the Department of Health and Human Services (HHS). At that time, RECs were referred to as Emergency Coordinators (ECs). Program Managers have always been referred to as PMs. In 2002, when NDMS was transferred to the Department of Homeland Security (DHS), there were 2-3 ECs for each of the 10 FEMA regions. At DHS, the role of the ECs focused on planning activities, liaison with state and local public health officials, and providing support to the NDMS teams.

When NDMS transferred back to HHS in 2007, there were 10 RECs at HHS focused on public health planning with the states. Additionally, 23 ECs at NDMS were working at the regional, state and local level while also addressing NDMS team maintenance issues. The two groups, HHS RECs and NDMS ECs, were combined under a Program Manager within the Assistant Secretary for Preparedness and Response (ASPR) Operations (OPEO) section. The resulting organization has 2-5 RECs in each FEMA region devoted to emergency preparedness and response. A new role, the REC Field Supervisor, has been added to each of the 10 FEMA regions. (This does not represent an additional 10 positions, but rather the Team Lead selection is from the existing 33 REC positions.) Enhancement of the REC program is viewed as an opportunity to substantially increase the planning, coordination and execution capabilities of public health emergency preparedness and response at the regional, state and local levels.

The Program Managers have remained at NDMS headquarters. During the past few years, the role of the PM has become less structured, and there are fewer operational responsibilities (e.g., PMs do not go to the field during disasters, they no longer assess team readiness or secure equipment for the cache). There are many more administrative and finance responsibilities. Currently, the PM role is not defined and documented consistently from one PM to another. This is due to differences in the needs of varying team types, levels of team maturity as well as differences in style among PMs.

While not formally documented, it is generally agreed that the role of the PM is to serve as a liaison or facilitator between NDMS teams and headquarters. Their responsibilities include everything from assisting in the selection, purchasing approvals, maintenance and use of the equipment cache to reviewing training and purchasing requests for the teams and making recommendations to Finance on whether to purchase items. All the PMs have other

responsibilities in addition to their primary role as Program Manager. The management structure of the PM organization is not as clear as the REC's and updated position descriptions do not currently exist.

B.3 Overview

The development and analysis of a matrix reflecting the program functions currently performed by RECs and NDMS PMs illustrates little to no overlap between the two areas of responsibility. PMs support the NDMS Teams as collateral responsibility and largely serve as liaisons with the agency supporting both administrative and subject matter expert type issues. The REC's role, in contrast, is one which supports the development, maintenance and execution of a regional HHS and ESF #8 public health emergency preparedness and response activities which includes state, local and federal partners. Their interface with NDMS response teams owes in a large degree to proximity.

B.4 Program Functions Performed by NDMS Program Managers and Regional Emergency Coordinators

Table B-1. Program Manager and REC Functions

	Program Manager	Regional Emergency Coordinator
Team Support		
Cache development	Yes	No
Cache inventory management	Yes, to a degree *	No
Purchase approval recommendation for cache equipment & supplies	Yes	No
Questions regarding use, appropriateness of use of supplies	Yes	No
Overall preparedness for emergency deployment	Yes	No
Telephone support for miscellaneous inquiries not handled by other areas within NDMS or ASPR	Yes	Yes (for issues related to interactions with local/state/federal governments
Administrative		
Liaison with HQ for most matters	Yes	No
Budget development	No *	No
Budget approval	Recommendation to Finance	No
Budget execution	Yes	No
Expense reimbursement (personal)	Yes	No
Order tracking (undelivered purchases)	Yes	No
Lease assistance (e.g., warehouse)	Yes	No
Government process support (e.g., procurement, travel)	Yes	No
Purchasing assistance for non-standard items, business case development with or for the Teams	Yes	No

	Program Manager	Regional Emergency Coordinator
Training		
Required courses and certifications defined	No	No
Compliance tracked and monitored	No	No
Request approvals	Recommendation to NDMS Finance	No
Participation in exercise or class with teams	Occasionally	Yes, state & metro
Team Development		
Member recruitment	No *	No, not actively
Professional development plans for team members	No	No
Determining Team readiness	Yes, evolving **	No
Communications		
Regularly scheduled contact with Teams	Monthly calls with Team Leads	No **
Site visits	Yes, infrequent	Yes, periodic
Local and Regional Outreach		
Contacting 'NDMS hospitals'	No	Some, indirectly
Working directly with local teams	Yes	Yes, some
FCC activities	No	No **
Regional Planning and Preparedness		
Identify, address, coordinate and oversee HHS regional public health and medical resource capabilities	No	Yes
Coordinate with local, states, regional and federal authorities to integrate all tiers of response; assist with federal aspects of the plan	No	Yes
Create and maintain regional emergency preparedness profiles	No	Yes
Identify regional issues that could impede rapid and effective medical response (i.e., economic, geopolitical, etc.)	No	Yes
Develop and maintain internal regional response team capability for disasters as part of the Secretary's IRCT	No	Yes
Participate in the planning, development and evaluation of regional preparedness exercises	No	Yes
Conduct semi-annual regional ESF #8 meeting	No	Yes
FCC coordination Look for multi-state , multi-team training opportunities and coordinate with NDMS HQ	No No **	No ** Yes
Participation with Internal Groups, Committees		
Management Working Group	No	No
Medical Needs Assessment Teams (MNATS)	No	Yes
IRCT Quality Management Board (QMB)	No	Yes
Regional Operations Steering Committee (ROSC) Regional Advisory Committee (RAC)	No No	Yes Yes
Other Duties As Assigned		
Make recommendations to higher-level HHS regional officials regarding proposals, actions and reports related to emergency	No	Yes

	Program Manager	Regional Emergency Coordinator
preparedness		
Congressional requests	Yes	No
After Action Report Development	No *	No
Roles During an Emergency Deployment		
Serve as NRP ESF #8 health & medical area coordinator & IRCT leader in the affected region for all HHS assets	No	Yes
ESF #8 federal asset management responsibilities (including NDMS Teams)	No	Yes
ESF #8 operational responsibilities for deployed federal health and medical assets (including NDMS Teams)	No	Yes
Field deployment	No *	Yes
Communicate with the Secretary's SOC as necessary	No	Yes
Deploy from home region to support the REC in the affected region in ESF #8 planning, operations chief, or key liaison capacity to a state EOC	No	Yes

* Once performed by Program Managers, recently changed

** Planned for the future

B.5 Analysis

The program functions of the RECs and the PMs do not represent materially duplicative tasks or efforts. RECs serve in a Departmental level capacity with broad responsibilities at the regional level for the planning, preparation, situational awareness, response and recovery of ESF #8 public health emergency and emergency response. These include clear missions and directives, including:

- Serving as the designated HHS resource on all matters affecting regional public health emergency preparedness and maintaining operational responsibility for deployed federal health and medical assets.
- Serving as the National Response Plan – ESF #8 health and medical area coordinator and Incident Response Coordination Team (IRCT) Leader in the affected region during an emergency (REC Field Supervisor).
- Communicating with the HHS Operations Support Center (OSC) and Secretary's Operations Center (SOC) to support emergency operations.
- Identifying regional public health and medical resources and capacities.
- Planning ESF #8 regional emergency response, in coordination with local, state, federal, and tribal authorities to integrate all tiers of response to natural disasters, terrorist incidents, and other public health or medical emergencies into seamless, comprehensive plans.
- Identifying geopolitical, economic, or other issues in the region that could impede a rapid and effective health and medical response.

- Deploying from home regions to support the REC in an affected region in roles such as the ESF #8 planning, or operations chief, or in a key liaison capacity to a state EOC.

PMs serve in a resource management and administrative support role including:

- Cache management assistance including the selection of equipment, medical supplies and the use, maintenance, support of cache items.
- Administrative support, including financial assistance such as liaison with headquarters on budget development, approval, expense reimbursement, order tracking, procurement assistance, facilities contracting.
- Subject matter expert on miscellaneous issues which arise during routine team maintenance, training or during emergency deployments.
- Telephone trouble shooting support from headquarters across virtually any domain which falls into emergency response and administration.

B.6 Discussion

While there is little to no overlap between the program functions of PMs and RECs, as the ASPR organization continues to grow, and changes to responsibilities are implemented, there are areas which warrant further investigation and discussion.

Interviews with staff reveal a perception that 'swim lanes' or areas of responsibility are not clearly defined. This lack of clarity is not an unexpected result of an organization in transition. At the same time, future responsibilities are not consistently understood or consistently communicated by RECs and PMs. For example, the ongoing 'care and feeding' of the NDMS teams has been represented as the future responsibility of both the RECs and the PMs.

It has been suggested that RECs could assume more FCC Coordinator responsibilities, particularly in the area of hospital recruitment. This suggestion is partly based on the fact that RECs are responsible for planning and building partnerships at the local and regional level, and FCC coordination, especially NDMS hospital recruitment, could be considered within this purview. In addition, it has been pointed out that RECs are generally more senior personnel with longer-standing community ties than some of the DoD FCC coordinators, who are junior officers, typically rotate every 2-3 years, and perform FCC coordinator responsibilities as a collateral duty. While the idea of having RECs perform FCC responsibilities is conceivable from the perspective of REC mission and skills, the concept would need to be evaluated more fully in the context of REC priorities and workload, and implications for the NDMS federal partnership.

With the transition of NDMS to HHS, ASPR leadership has indicated that NDMS headquarters staff will support the response of NDMS teams during a disaster, but will no longer be deployed to the field as part of the response. Many of the Program Managers, who have participated in past response efforts, are disappointed by this narrowing of their role. They believe their knowledge and experience can be and has been well-utilized in the field during a disaster. They also advocate the benefits of PMs having direct field response experience in order to later make process improvements at headquarters. These concerns should be further evaluated.

Appendix C. State Mobile Medical Assets

State	Triage and General Emergency	Acute Care	Critical Care	Subacute Care	Decontamination	Mortuary Services	Veterinary Care
Region 1							
Connecticut		Ottilie W. Lundgren Memorial Field Hospital: 100 bed					
Maine							
Massachusetts							
New Hampshire		Acute Care Center: 1000 beds built by NH, RI, VT					
Rhode Island		Acute Care Center: 1000 beds built by NH, RI, VT					
Vermont		Acute Care Center: 1000 beds built by NH, RI, VT					
Region 2							
New Jersey						Somerset County: Deployable Morgue	
New York					New York Presbyterian: Mobile Decon Unit		
Puerto Rico		Western Shelters(10): 100 beds					
Virgin Islands							
Region 3							
Delaware							

State	Triage and General Emergency	Acute Care	Critical Care	Subacute Care	Decontamination	Mortuary Services	Veterinary Care
District of Columbia							
Maryland							
Pennsylvania							
Virginia							
West Virginia							
Region 4							
Alabama							
Florida						Florida Emergency Mortuary Operation Response System: Portable Morgue	
Georgia							
Kentucky	Louisville: 20 emergency beds				Boone County: Decontamination Unit		
Mississippi							
North Carolina		SMAT I: 100 bed field hospital SMAT II: 8-50 bed units, configurable to 400 bed field hospital					
South Carolina							
Tennessee							
Region 5							
Illinois	4 IMERT Triage Tents					State Portable Morgue Unit: Housed at O'Hare Airport can process hundreds	

State	Triage and General Emergency	Acute Care	Critical Care	Subacute Care	Decontamination	Mortuary Services	Veterinary Care
						of remains	
Indiana						Indiana SEMA: Portable Morgue Unit, capacity unavailable	
Michigan		MI-TESA: 100 beds				MI-MORT Portable Morgue, capacity unavailable	
Minnesota						Minnesota Department of Health: DPMU, capacity unavailable	
Ohio	Hamilton County: Triage Available, throughput unavailable	Hamilton County: 210 beds			6-8 Portable Decontamination Units	Ohio Funeral Directors Association: A DPMU and refrigeration truck, capacity unavailable	
Wisconsin							
Region 6							
Arkansas							
Louisiana							
New Mexico							
Oklahoma							
Texas							
Region 7							
Iowa							
Kansas							
Missouri							
Nebraska							

State	Triage and General Emergency	Acute Care	Critical Care	Subacute Care	Decontamination	Mortuary Services	Veterinary Care
Region 8							
Colorado					4 Decontamination Units		
Montana							
North Dakota							
South Dakota							
Utah						DPMU	
Wyoming							
Region 9							
Arizona							
California		Emergency Medical Services Authority: 180 ward beds in 200 bed facility	Emergency Medical Services Authority: 20 ICU beds in 200 bed facility				
Hawaii	Healthcare Association of Hawaii: Triage/12 emergency hospital beds						
Nevada		Nevada One Medical: Hospital capacity unknown					
Guam							
Region 10							
Alaska		Juneau: GateKeepr System, capacity unknown			Bartlett Hospital: Mobile Decontamination		
Idaho							
Oregon	McKenzie-						

State	Triage and General Emergency	Acute Care	Critical Care	Subacute Care	Decontamination	Mortuary Services	Veterinary Care
	Willamette Medical Center: Triage/Emergency Response Shelters Sacred Heart Medical Center: Triage/Emergency Response Shelters Lane County: Triage/Emergency Response Shelters						
Washington							

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List of Interviewees

The list of interviewees does not include persons who may have provided the information through email and other similar exchanges.

1. Mr. Steve Allen, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
2. ANG Readiness Center staff (Col Kenneth Franklin, Lt Col Kathy Groce, Lt Col Heidi Rothschild, SMSgt Kelly Gunson, Mr. Steve Larson)
3. CDR Brad Austin, Office of Preparedness and Emergency Operations (HHS/ASPR/OPEO)
4. CAPT Ana Marie Balingit-Wines, USPHS, Chief Nurse, National Disaster Management System (HHS/ASPR/OPEO/NDMS)
5. Mark Barnes, CTR USTRANSCOM J6 (DoD)
6. Robert Bishop, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
7. Mr. Jack Beall, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
8. Ms. Janet Belisle , Office of Seamless Transition, Department of Veterans Affairs
9. Mr. Buddy Bell, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
10. Mr. Darryl Britt, CEO, Apprio, Inc.
11. Ms. Sandy Boguchi, Office of the Assistant Secretary for Preparedness and Response (HHS/ASPR)
12. Mr. Oscar Boultinghouse, MD, FACEP, Chief Medical Officer, University of Texas Medical Branch (UTMB) Electronic Health Network; Associate Director and Chief Medical Officer, American Telemedicine Association; Chief Medical Officer, NDMS Texas-3 DMAT
13. Ms. Teresa Brown-Jesus, Health Resources and Services Administration (HHS/HRSA)
14. Mr. Tom Bowman, Regional Emergency Coordinator, Region IV, ASPR
15. LTC Leslie Burton, Headquarters, U.S. Army Medical Command, NDMS FCC Program Director
16. CAPT David Canton, MD, USPHS, Chief Medical Officer, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
17. Dr. Steve Cantrill, Principal Investigator, HAvBED System
18. Mr. Rocco Casagrande, Gryphon Scientific
19. Mr. Robert Cornish, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
20. Mr. Mick Cote, Regional Emergency Coordinator, Region VI, ASPR
21. Mr. Jim Craig, Director of Health Protection, Mississippi Department of Health
22. Mr. Jim Czarzasty, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
23. Mr. Robert Daley, Management Work Group (HHS/ASPR/OPEO/NDMS)

24. Bill Devir, Team Commander, Disaster Medical Assistance Team, Ohio 5 (HHS/ASPR/OPEO/NDMS)
25. Ms. Ellen Embrey, Deputy Assistant Secretary of Defense for Force Health Protection and Readiness, Office of the Assistant Secretary of Defense for Health Affairs (OSD[HA])
26. LTC Myron Fay, Chief, Global Patient Movement Requirements Center
27. Mr. Michael Feeser, CEM, Chief of Plans, Department of Veterans' Affairs (VHA/EMSHG)
28. Mr. John Fitch, National Funeral Directors Association
29. Mr. Gordon Flint, Medical Planner, Joint Task Force – Civil Support, USNORTHCOM
30. Maj Michael Foutch, Office of the Surgeon General, U.S. Air Force NDMS FCC Program Director
31. Mr. Joseph Forsha, , Office of Preparedness and Emergency Operations (HHS/ASPR/OPEO)
32. COL Mark Gaul, MD, MPH, USAF (ANG), Deputy Command Surgeon and ANG Advisor to Command Surgeon, NORAD-USNORTHCOM
33. CPT Michael Giles, US Army Reserve, Medical Planner, Joint Task Force – Civil Support, USNORTHCOM
34. Mr. Ben Goldhaber, Office of Preparedness and Emergency Operations (HHS/ASPR/OPEO)
35. Maj Lorraine Gravley, USAF, NC, Patient Movement, Joint Staff Logistics Directorate, J4, Health Service Support Division, Department of Defense (Joint Staff/J-4/ HSSD/DoD)
36. Dr. Jimmy Guidry, MD, Medical Director and State Health Officer, Louisiana Department of Health and Hospitals
37. Dr. Peter Highnam, NIH Fellow, Biological Advanced Research and Development Authority (HHS/ASPR/BARDA)
38. Mr. Keith Holterman, Office of the Assistant Secretary for Preparedness and Response (HHS/ASPR)
39. Mr. Cotton Howell, Region IV Commander, Director of Emergency Management, York Count SC
40. LT Thomas Janisko, USPHS, Office of Assistant Secretary for Preparedness and Response (HHS/ASPR)
41. Mr. Robert Jevec, Operations Support Center, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
42. Ms. Amy Kircher, Epidemiologist, Force Health Protection, USNORTHCOM
43. Mr. Christopher Klots, Medicare Contractor Management Group, Center for Medicare Management, Centers for Medicare and Medicaid Services
44. Mr. Harry Koerner, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)

45. Lt Col William Kormos, NDMS DoD Executive Secretariat Member, Office of the Assistant Secretary of Defense for Health Affairs (DoD/OSD[HA])
46. CAPT Ann Knebel, USPHS, Deputy Director for Preparedness Preparedness, Office of Preparedness and Emergency Operations (HHS/ASPR/OPEO)
47. Mr. Christopher Lake, PhD, Vice-President of Special Projects, Blu-Med Response Systems
48. Mr. Mark Lauda (HHS/ASPR/OPEO)
49. LTC Keith Lostroh, USTRANSCOM J6 (DoD)
50. Ms. Maribeth Love, Deputy Director for Logistics (HHS/ASPR/OPEO/NDMS)
51. Mr. William Macchi, Medical Operations, USNORTHCOM
52. Mr. Mark Mahar, Global Patient Movement Requirements Center
53. Mr. David Marcozzi, Office of Preparedness and Emergency Operations (HHS/ASPR/OPEO)
54. Ms. Caitlyn Miller, Office of Preparedness and Emergency Operations (HHS/ASPR/OPEO)
55. Mr. Adam Munn, Force Health Protection, USNORTHCOM
56. Ms. Francesca (Christi) Music, Senior Advisor for Health and Medical Civil Support Policy; Office of the Assistant Secretary of Defense for Homeland Defense
57. Dr. Anne Norwood, HHS/ASPR
58. Mr. Vince Pearce, National Response Program Manager, U.S. Department of Transportation
59. Mr. Jay Petillo, Director of Resource Preparedness and Evaluation, (HHS/ASPR/OPEO)
60. Ms. Sally Phillips, Agency for Healthcare Quality and Research (HHS/AHRQ)
61. Maj Tammy Pokorney, Office of Command Surgeon, Air Mobility Command
62. Ms. Rosanne Prats, MHA, ScD, Emergency Preparedness Director, Louisiana Department of Health and Hospitals
63. CAPT Corley Puckett, Deputy Command Surgeon, U.S. Transportation Command
64. Mr. George Rathkamp, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
65. Ms. Mimi Reilly, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
66. Mr. Mark Russo, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
67. Ms. Melissa Sanders, Team Leader, Senior Public Health Advisor, Assistant Secretary of Preparedness and Response (HHS/ASPR)
68. Ms. Helga Scharf-Bell, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
69. LCDR Spencer Schoen, Navy Medicine Office of Homeland Security, U. S. Navy NDMS FCC Program Director
70. Mr. Ed Siekierski, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)

71. Dr. Thomas Sizemore, Office of Preparedness and Emergency Operations (HHS/ASPR/OPEO)
72. Mr. Mike Sonnier, Acadian Air Ambulance
73. Mr. Mark Snyder, FEMA Logistics
74. Lt Col Wayne Surratt II, USTRANSCOM J6 (DoD)
75. Tachett, Timothy, Disaster Medical Assistance Team, Arkansas 1, MWG (HHS/ASPR/OPEO/NDMS)
76. CAPT Jeffrey Timby, MC, USN, Surgeon, Joint Task Force - Civil Support, USNORTHCOM
77. CDR Meta Timmons, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
78. Mr. Brian Trent, Office of the Assistant Secretary of Preparedness and Response (HHS/ASPR)
79. RADM W. Craig Vanderwagen, Assistant Secretary of Preparedness and Response (HHS/ASPR)
80. Veitch, MaryAnn, Logistics National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
81. Mr. Mike Vineyard, Office of Preparedness and Emergency Operations (HHS/ASPR/OPEO)
82. Lt Col Anthony Voirin, USNORTHCOM Liaison to USTRANSCOM
83. Mr. John Welch, Public Health Service, Medical, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
84. Ms. Dianne Whittington, Division of Emergency Preparedness, Security & Emergency Management Group, Centers for Medicare and Medicaid Services (HHS/CMS)
85. Mr. Jim Woods, Contracting Specialist, (HHS/ASPR)
86. Mr. Jody Wireman, PhD, MSPH, MPA, CIH, Force Health Protection, USNORTHCOM
87. Mr. Vernon Wright, Manager, Contract Administration, Blue Bird Body Co., Fort Valley, GA
88. Dr. Kevin Yeskey, Office of Preparedness and Emergency Operations (HHS/ASPR/OPEO)
89. Mr. H. James Young, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
90. Ms. Kristy Young, National Disaster Medical System (HHS/ASPR/OPEO/NDMS)
91. Dr. Michael Zanker, MD, Senior Medical Advisor for Operations and Response to the Chief Medical Officer, U.S. Department of Homeland Security

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2. Marcia Fries, Louisiana Hospital Association
3. Kathy Heilig, North Carolina Hospital Association

4. Paul Richter, South Carolina Hospital Association
5. Rosilyn Schulman, American Hospital Association
6. Doris Varlese, Greater New York Hospital Association
7. John Wilgis, BS, RRT, Florida Hospital Association

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7. Mr. Harry Mayer, Regional Emergency Coordinator, Region III
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10. Ms. Ann Taylor, Regional Emergency Coordinator, Region VI

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6. Mr. Paul Christoph, Nashville and Knoxville, TN
7. Mr. Joe Copes, Philadelphia, PA
8. Mr. Brian Crowder, Houston, TX
9. Ms. Paulette Demattao, Kansas City, MO
10. Mr. Jack Flynn, Castle Point, NY
11. Mr. Theodore Gegoux, Long Beach, CA
12. Mr. Bradley Harris, San Antonio, TX
13. Mr. Dan Johnston, Tucson, AZ
14. Mr. Ron Kirkpatrick, Jackson, MS
15. Ms. Diane Kroll, Minneapolis, MN

16. Mr. Francisco Maldonado, Miami, FL
17. Mr. Paul Malool, Newark, NJ
18. Mr. Rex Oxner, Little Rock, AR
19. Mr. Michael Peters, Des Moines, IA
20. Mr. Jeff Quinn, Albany, Buffalo, and Syracuse NY
21. Mr. David Rossi, Pittsburgh, PA
22. Mr. Cosme Torres-Sabater, San Juan, PR
23. Ms. Sarah Salk, San Francisco, CA
24. Mr. Zane Shaw, Salt Lake City, UT
25. Mr. Richard Smith, Oklahoma City, OK
26. Mr. Joe Stevens, New York City, NY
27. Mr. Cosme Torres, San Juan, PR
28. Ms. Sharon Tyree, Indianapolis, IN and Detroit, MI
29. Mr. James Vorrell, Cleveland, OH
30. Mr. Dennison Waterman, Albuquerque, NM
31. Mr. Gregory Watts, Tampa, FL
32. Ms. Darlene Weisman, Milwaukee, WI