The National Disaster Medical System

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A national system has been developed to respond to medical care needs in disasters of great magnitude primarily in the United States and its territories. The National Disaster Medical System (NDMS) is based on a concept in which hospitals voluntarily commit a portion of their staffed beds for care of disaster casualties. These hospital beds will be augmented by medical teams and logistical support to enable the system to respond to a large civilian disaster. The system is a cooperative effort of the Department of Health and Human Services, the Department of Defense, the Federal Emergency Management Agency, the Veterans Administration, state and local governments and the private sector.

When fully implemented, the NDMS will comprise up to 150 disaster medical response units to clear and triage casualties, an evacuation system and 100,000 committed beds in hospitals throughout the United States. The system will serve national needs in the event of a massive peacetime disaster and as a backup for military casualties resulting from a conventional military conflict overseas.

Anesthesia professionals are encouraged to familiarize themselves with the program and continue their active involvement in the clinical training of emergency response personnel and their hospitals' disaster response teams.

Background
Military health care planners are taught to plan for and handle large numbers of medical casualties. Today's medical care costs have made construction of facilities and storage of sizeable amounts of medical supplies impractical. Because of its current peacetime posture, it is estimated that the U.S. military medical system has only approximately 18,000 fully staffed hospital beds, 2,000 of which are overseas. These facilities are scaled for a relatively healthy active duty population and are clearly inadequate to care for the numbers of casualties that might result from a conventional armed conflict overseas. Although Public Law 97-1741 directs the Veterans Administration (VA) to serve as the primary support agency to the Department of Defense (DoD), military medical needs would undoubtedly exceed its acute care capabilities.

DoD medical planners were aware that, of approximately 1.1 million nonfederal acute care hospital beds in the United States, a minimum of 15% were unoccupied at any given time. They concluded that the recruitment of a portion of these nonfederal beds could result in significant support capability for care of military medical casualties at considerable cost savings. Because it recognized that augmenting this capacity in a period of military mobilization would take considerable time, in 1980 the DoD established the Civilian-Military Contingency Hospital System (CMCHS).1

The CMCHS was a cooperative effort of the DoD and the VA in partnership with civilian hospitals throughout the nation. Private sector hospitals voluntarily committed staffed beds to support the
DoD-VA hospital system to care for military casualties which might result from a conventional conflict overseas. The CMCHS was locally coordinated by major federal hospitals (military or VA) in the larger urban areas. Each such "Federal Coordinating Center" was responsible for recruiting local accredited hospitals with 100 beds or more to participate in the system.

Upon activation, the Federal Coordinating Center would be responsible for receiving, triaging and local administrative management of patients transferred into its area. In the event of a military emergency, CMCHS participating hospitals agreed to admit patients (up to 10% of their licensed bed capacity) from the DoD. While initially targeted to identify 50,000 beds, by 1981 more than 770 hospitals in 48 urban areas had responded with a commitment of more than 63,000 beds.1

Although the CMCHS provided extensive education and casualty drill programs, it had no deployable medical resources; it was solely a source of beds. The development of CMCHS did, however, awaken strong interest in emergency preparedness throughout the national health care community.

**Need for a National Disaster Medical System**

Inherent in technological advances is the potential risk of disaster. Fires, explosions, release of toxic substances, air and rail accidents and dam failures are but a few of the myriad of possible mishaps. Although the United States has experienced numerous natural, industrial and other disasters, none has approached the magnitude or resulted in the massive number of casualties as did the earthquake in Armenia (1988), the release of toxic gas in Bhopal (1984), the earthquake in Tangshan, China (1976), the eruption of Mt. Pelee on Martinique (1904) or the ship explosion in Halifax, Nova Scotia (1917).

It is perhaps inevitable that the United States will some day experience a similar massive natural or technological disaster. The nation's health care system must be ready to deal with the significant number of casualties that would accompany such an eventuality. Fortunately, the major disasters that have occurred in the United States to date, such as the industrial explosions in Port Chicago, California (1944), the Alaskan earthquake (1964) and the eruption of Mt. St. Helens (1980), have all occurred in relatively unpopulated areas. The same was true for the Fort Tejon, California, earthquake (1857). Because of the low density of population at Fort Tejon at the time, the number of casualties was minimal. Today, this area is so densely populated authorities estimate that a present day recurrence could result in 20,000 deaths and 100,000 major injuries requiring hospitalization.1

No single community or state can be adequately prepared for such a catastrophic event. While most communities have adequate health care resources and emergency medical services for their normal local needs, none is prepared to deal with a sudden surge of disaster injuries proportional to its population. Indeed, the state of California has only 67,000 operating beds, mostly in large metropolitan areas. Many of these beds would themselves be rendered unusable by any sizable disaster. Thus, any system for addressing disaster casualties must provide for mutual aid, must be able to handle large numbers of patients and must be able to provide definitive care far removed from the disaster area.

For 24 hours following the October 17, 1989 earthquake in San Francisco, the NDMS was placed on alert status and was prepared to implement the program if needed. Since all of the local medical facilities were in operation, many using emergency power, they were able to handle the approximately 24,000 people injured, and the NDMS was not called into action. Throughout this emergency situation, CRNAs in and around the earthquake site were instrumental in providing care to the victims.

Prior to the early 1980s, the United States lacked any plans or organizational arrangements for a medical response to a catastrophic disaster. In August 1980, medical planners representing the DoD, Department of Health and Human Services (HHS), Federal Emergency Management Agency (FEMA) and the VA formed an interagency working group which reviewed numerous disaster plans, all of which seemed to lack an adequate medical response.1

Discussions between civilian and military medical planners resulted in the concept of a single national system that could continue to provide backup support to the DoD medical system and organize resources to care for civilian victims of a major domestic disaster. An initial concept paper relating to such a system and modeled after the highly successful CMCHS program previously discussed was prepared in August 1981.2

On December 17, 1981, the U.S. president directed a series of initiatives aimed at improving national capabilities to respond to both major peacetime disasters and national security emergencies. He established the Emergency Mobilization Preparedness Board and charged it with developing improved policies and programs for national emergency preparedness.1 These policies and programs were to utilize existing resources to the greatest extent possible.
The NDMS System Design was presented in late 1982. HHS, DoD, FEMA and the VA were directed to develop and maintain the NDMS, with HHS serving as the lead administrative agency. An interagency NDMS Implementation Task Force was established in February 1984, and the initial public announcement of the system was made in June 1984. The goal of the NDMS is to have a minimum of 100,000 fully staffed beds nationwide, located in 72 of the nation's largest metropolitan areas.

National Disaster Medical System Concept

The NDMS is designed to fulfill three primary objectives (Table I):^3

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<tr>
<td>Objectives of the National Disaster Medical System</td>
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<tr>
<td>1. <strong>Rapid medical response</strong></td>
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<td>2. <strong>Provide evacuation of casualties</strong> from the scene to designated areas of care.</td>
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<tr>
<td>3. <strong>Provide definitive medical care</strong> away from scene.</td>
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1. **Rapid medical response**

The general elements of the NDMS—medical assistance teams and medical supplies and equipment—are available to supplement local and state resources, upon request. The NDMS response consists of deployment of mobile teams which are preorganized, trained and equipped units capable of providing austere medical care (patient clearing) on site and/or at transportation nodes during evacuation (patient staging). Military active duty or reserve medical units, if available, may provide similar services. In a national security emergency involving a conventional conflict overseas, the medical response element will provide aeromedical reception and staging service at stateside entry points and receptor airports. Figure 1 demonstrates patient flow through this system.

**Field rescue/first aid.** All rescue efforts, triage and first aid of casualties will be rendered by any available local or state resources.

**Casualty triage/clearing.** This is the first point at which a patient would encounter formal elements of the NDMS. Participating hospitals, volunteer agencies and health departments have been encouraged to form Disaster Medical Assistance Teams (DMAT). Each 29-person DMAT would be capable of conducting around-the-clock casualty clearing in a disaster area or medical staging for the evacuation system. Table II illustrates the suggested composition of a DMAT, which closely resembles a military medical clearing platoon. With external support, each team can operate an 80-patient triage site at an airport receiving site or a clearing operation in a remote disaster area. This concept has already been successfully tested during large-scale national exercises involving DMATs from at least nine states.

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<td>Personnel composition of a Disaster Medical Assistance Team (DMAT)</td>
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<td>2 Medical Officers</td>
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<tr>
<td>1 Head Nurse—Clinician</td>
</tr>
<tr>
<td>2 Staff Nurses (RN)</td>
</tr>
<tr>
<td>4 Licensed Vocational Nurses</td>
</tr>
<tr>
<td>2 Surgical Technicians</td>
</tr>
<tr>
<td>1 Laboratory Technician</td>
</tr>
<tr>
<td>1 Pharmacy Technician</td>
</tr>
<tr>
<td>3 Emergency Medical Technician (EMT)—basic</td>
</tr>
<tr>
<td>1 Pharmacy Clerk</td>
</tr>
<tr>
<td>1 Supply Clerk</td>
</tr>
<tr>
<td>2 Medical Records Clerks</td>
</tr>
<tr>
<td>9 Ward Attendants (litterbearers)</td>
</tr>
<tr>
<td>29 Total personnel</td>
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The emergency and critical care specialists on a DMAT frequently train together to develop the special skills necessary for triage, medical regulating and patient care under austere medical conditions. While the majority of teams thus far have been developed in large metropolitan cities, one northeastern Arkansas town of approximately...
15,000 people has organized a complete team, including two CRNAs. Major medical centers and agencies have been asked to provide 15-person administrative headquarters units that will facilitate combining three DMATs into a large Clearing-Staging Unit (CSU) that would be capable of deploying aid directly to a disaster scene (Figure 2). The headquarters unit would provide limited internal logistical support such as supply, communications and feeding of personnel and patients.

When combined, an entire 102-person CSU would be capable of operating a large clearing station in a disaster area, a standard 250-patient airport staging unit or (if augmented) a fixed refugee care site providing screening, ambulatory medical care and intermediate nursing care for a population of 10,000 refugees. Medical planners indicate that the "worst case" 100,000-casualty scenario would require up to 150 CSUs, half to remain at home to receive patients and half to be deployed to the disaster area to provide on-site aid.

Each NDMS receiving area is forming at least one CSU to enable it to receive casualties at its airport. The larger metropolitan areas will form more than one, thereby allowing extra teams to travel to the disaster site, if needed.

Deployment of these teams should have minimum impact on the sponsoring hospitals' operating ability. It is estimated that the volunteer personnel required to develop one unit for each of 4,300 beds in an NDMS area comprise less than 1% of available personnel in that area.

HHS will activate, mobilize and deploy DMATs to the disaster area upon request. Active duty and reserve military units may also be activated and deployed by DoD to provide clearing and triage services, subject to availability.

Surgical stabilization. In an extreme disaster, field surgical services should be available to treat unstable, but salvageable, patients fit for evacuation. Such services can be most effectively provided by a highly mobile and surgically intensive field unit. NDMS has designed a 201-person Mobile Emergency Surgical Hospital (MESH) similar to a Mobile Army Surgical Hospital (MASH). Table III illustrates the personnel composition of these planned units. A MESH would be capable of performing up to 96 major surgical procedures per day and would contain the equipment necessary to manage a 60-bed intensive care unit. Although CRNAs have not been allocated a fixed position in the MESH team, they would play an integral role in these units.

When considering the "worst case" situation, 10-15 MESHs are desirable and feasible from the standpoint of available manpower. However, equipment for such a unit is expensive to procure and difficult to move as rapidly as may be necessary for a timely response. Further development of these units awaits resolution of cost and deployability issues. Interestingly, planners working on this model have recently discovered that a great deal of the medical equipment that was stored throughout the country by the U.S. Public Health Service in the late 1960s is still quite functional and could be modified for current use.

2. Evacuation of casualties

DoD will provide an aeromedical evacuation system to transport patients who cannot be cared for in the disaster area to other locations within the continental United States. Once casualties have been transported to a staging site by local authorities, the NDMS will coordinate their air or long-distance ground transportation and disposition. This element involves the use of aeromedical evacuation aircraft and flight medical crews under the control of the U.S. Air Force's Military Airlift Command, and possibly those aeromedical assets which...
are part of the Civil Reserve Air Fleet coordinated by DoD and the Department of Transportation. Patient movement by air will be coordinated by the Armed Services Medical Regulating Office, located at Scott Air Force Base, Missouri. Local NDMS Coordinating Centers will activate area Patient Reception Plans and may request activation of the system's disaster medical assistance teams to provide emergency stabilization treatment allowing casualties to be moved so they could receive more definitive treatment elsewhere.

Upon arrival in a casualty clearing area, patients will be triaged, transported and tracked to local participating NDMS hospitals. Patient tracking during evacuation will be accomplished through the use of DoD's computerized Defense Medical Regulating Information System. Patient transportation will be conducted following local area NDMS Patient Reception Plans. NDMS DMATs may be activated to provide patient staging and reception services at their home locations, if their region has been designated to receive casualties from the disaster area.

3. Definitive medical care

The DoD and VA will coordinate the provision of hospital care in a national network of permitted nonfederal acute care hospital beds. The NDMS has determined that accredited hospitals may participate voluntarily by agreeing to adhere to a specified training and casualty drill program and to accept NDMS patients in proportion to their available bed capacity at the time of system activation. Currently, more than 108,000 beds in more than 1,600 hospitals are enrolled, and recruitment of additional bed capacity is continuing.

The local NDMS Federal Coordinating Center will provide periodic patient status reports which will serve as the basis for providing information to the American National Red Cross (ARC) and other agencies involved in patient welfare services. Participating NDMS hospitals will receive and admit patients and provide definitive care. Such care will include use of the services of attending private physicians and ancillary services such as laboratory, radiology, blood bank, commercial ambulance, etc. The hospitals will determine when patients can be discharged and returned home. Upon such a determination, the local NDMS Federal Coordinating Center will be notified, and arrangements for return travel will be made through participating hospital social service departments or designated patient welfare agencies.

In support of each of the above functions, pre-designated arrangements and resources relating to command and control, logistical support and financing provide for the full operational capability of the system.

Activation and coordination

In the event of a major disaster, the governor of an affected state may request federal assistance under the authority of the Disaster Relief Act of 1974 (Public Law 93-288, as amended). Upon receipt of a FEMA recommendation, the president may declare a major disaster or an emergency. This presidential declaration triggers a series of federal responses coordinated by the FEMA, including the activation of NDMS when appropriate. The NDMS may also be activated upon request of a state health officer in situations not involving a presidential declaration, under authority provided by the Public Health Service Act. Generally, NDMS will only be called on in conditions of major disaster, as defined in Public Law 93-288. In the event of a national security emergency, the secretary of defense has authority to activate the system.

Upon system activation, a National Disaster Medical Operations Support Center (NDMOSC) will become operational to coordinate federal health responses to the disaster. NDMOSC will include representatives of the U.S. Public Health Service, HHS, DoD, FEMA and ARC, as well as other federal and private agencies concerned with medical services or medical logistics. NDMOSC will work in cooperation with state emergency medical authorities and the federal coordinating officer responsible for overall management of federal response to the disaster.

Although the NDMS is organized to respond to a major national disaster, there will be immediate benefits to the states and local communities that participate in the system. Once organized and trained, DMATs and other elements of the NDMS may be activated in response to local mass casualty incidents or on an intrastate basis. Thus, the NDMS will not only enhance nationwide medical response capability, it will also improve the ability of participating states and localities to respond to disasters within their jurisdictions.

As a result of Hurricane Hugo in October, 1989, the NDMS was formally activated for the first time. This included activation, federalization and deployment of two DMATs from New Mexico which staffed a temporary emergency room, clinic and inpatient care facility on the island of St. Croix for the first week of its operation. This temporary facility consisted of several Deployable Medical System (DEPMEDS) units provided by the 109th Evacuation Hospital, Alabama National Guard. Utilization of the DEPMEDS as temporary facilities became necessary because of extreme water damage.
to the St. Croix Hospital, rendering that facility unusable.

Through NDMS coordination, arrangements were made for establishing an aeromedical evacuation system to provide transportation for patients requiring specialty care. This operation included deployment of a U.S. Air Force Aeromedical Evacuation Liaison Team (AELT) on St. Croix. A second AELT was deployed to McDiill Air Force Base, Florida.

In addition, the Tampa/St. Petersburg NDMS Patient Reception Area was activated for the purpose of receiving and providing care for evacuated patients. The DoD Office of Civilian Health and Medical Programs (OCHAMPUS) was also activated and provided guidance on submission and payment of claims for patients evacuated to Tampa/St. Petersburg NDMS-participating hospitals.

Financing

The NDMS has developed a system for compensation of participating hospitals and health professionals. Hospitals will be compensated for bills as charged for all NDMS patients. NDMS will recover its hospital service expenses from third-party payers to the extent required by federal law. Members of DMATS will be recruited and trained as volunteers, but appointed to temporary federal status upon activation in a major emergency. This federal status will eliminate licensure and certification problems, provide for federal protection against personal legal liability and permit compensation of team members for their federal service.

If activation of the NDMS is accompanied by a presidential declaration and a task order providing for reimbursement, financing of NDMS operations will be reimbursed by FEMA through the mechanisms established by Public Law 93-28B.

In the event that the NDMS is activated by HHS, financing of the response and reimbursement of other participating federal departments and agencies will be the responsibility of HHS.

All participating federal agencies will fund their own forces that participate in the NDMS response and the activities of outside suppliers of goods and/or services they engage. Extraordinary expenses will be reimbursed by the activating agency (FEMA or HHS).

OCHAMPUS will provide for the processing and payment of claims from participating NDMS hospitals, attending private physicians and purveyors of ancillary services (e.g., laboratory, radiology, blood bank and private ambulance transportation).

All organizations will be responsible for keeping records of expenditures made in connection with the NDMS response and for submitting such records to the activating agency in support of claims for reimbursement.

National Disaster Medical System areas

The NDMS will include virtually all major metropolitan areas of the nation. There are three criteria for NDMS patient reception areas:

Available beds. Each area should have a minimum of 2,500 acute care hospital beds in facilities offering a full range of general medical and surgical services.

Coordinating center. The area must have a federal or nonfederal institution capable of acting as a coordinating center to link hospital beds with transportation, communication and other resources, as well as to establish patient administration procedures.

Air access. The area must possess an airport capable of accommodating aeromedical evacuation aircraft.

Figure 3 illustrates the 72 urban areas which currently meet these criteria and are participating in the NDMS. The filled circles indicate the areas that were formerly CMCHS participants and have converted to NDMS. Other metropolitan areas may be added as conditions warrant.

Endorsement

A number of major national organizations have endorsed the NDMS. These organizations include:

- American Medical Association
- American Hospital Association
- American College of Healthcare Executives
- American College of Emergency Physicians
- National Association of State Emergency Medical Services Directors

As professionals skilled in the art of trauma care, CRNAs are encouraged to inquire about their own hospitals' participation in the NDMS and to take part directly or become involved in the training of deployable personnel.

Individuals interested in obtaining additional information regarding the NDMS may contact: Thomas P. Reutershan, Emergency Coordinator, National Disaster Medical System, Parklawn Building, Room 16A-54, 5600 Fishers Lane, Rockville, MD 20857, (301) 443-1167.

REFERENCES

Figure 3
Proposed areas for the National Disaster Medical System

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Charles A. Reese, CRNA, PhD, is a commander in the Nurse Corps, US Navy. He is currently assigned as head of Anesthesia Programs, F Edward Hébert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland. He first became active in planning for mass casualties while assigned as the sole anesthetist aboard the aircraft carrier USS Nimitz where a flight deck aircraft accident killed 14 and injured more than 100 others.

This article was prepared while Commander Reese was serving as the Assistant Chief of Staff for Plans and Operations at the Naval Medical Command Northeast Region in Great Lakes, Illinois. In this capacity, his office provided direct oversight to four NDMS Federal Coordinating Centers which have identified more than 13,000 beds in 198 NDMS-participating hospitals.

He has served on the AANA Continuing Education Committee, the AANA Education Committee and the AANA Journal Editorial Review Board. In the latter capacity, he conceived the original AANA Continuing Education "Journal Course." He has published numerous articles and is an internationally recognized speaker.

All opinions or assertions are those of the author and are not to be construed as official or reflecting the views of the United States Navy.