

Role of Regional Healthcare Coalitions in Managing and Coordinating Disaster Response

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The cars come crawling towards the District. The backup from the West on Route 66 inside the beltway (7 miles to GZ) contains the usual mix of single commuters and 'slugs' looking to settle in to another day of work in the city. From the South comes the line of cars slowly making its way past the Occoquan (20 miles to GZ), transitioning from the outer suburbs into Fairfax County. Interstate 95 is full of cars and trucks headed south from Baltimore towards DC, and as it meets the Beltway (12 miles from GZ), cars can either head East or West around the road that rings the city. There is no quick and easy way into the city during rush hour.

On this beautiful, crisp, clear winter morning, life around the city is shaping up much like any other day in the Nation's Capital. Kids are off to school. Congressional hearings are an hour or so from starting. Offices are coming to life, and talk inevitably, turns back to the successes and failures of the Redskins.

First comes the intensely bright flash. It is brighter than the flash of a million flashbulbs all going off at the very same time. Many of those on the highways headed into town are blinded, their retinas seared by the intense light. Cars driving at speed plow into others that are already slowing because of the start again -- stop again rush hour traffic. The highways are instantly made impassable, with hundreds of mangled cars littering the roadways. Where the flash is not seen, close in to the city, there is an eerie howl, followed immediately by breaking glass and flying debris. Closer to ground zero, there is utter devastation. Buildings are collapsed in the immediate vicinity of the explosion. Many of those that are standing are on fire. An ill-defined plume of smoke, ash and dust begins to rise over the city. 1600 Pennsylvania Avenue is no more.

There have been a number of significant planning efforts focused on response to and recovery from the terrorist use of an improvised nuclear device (IND). The White House Office of Science Technology Policy led the creation of a first and second national planning guidance for IND response [1,2]. The National Labs contributed key inputs related to important mitigation steps that could save thousands of lives – a

message so simple it may be easy to deliver but hard to convince [3]. HHS/ASPR brought together subject matter experts to help describe many of the key health and medical response elements that will need to be implemented [4], illustrated the basic approach to the spontaneous formation of triage and treatment areas [5], and has continued to promote the development of crisis standards of care as part of a systems approach to catastrophic disaster response [6,7]. The intent of this paper is to highlight the role that healthcare coalitions will play in an event of this magnitude. “A primary purpose for any healthcare coalition is to promote optimal situational awareness for its member organizations through the collection, aggregation, and dissemination of incident information [8].”

This paper will explore a number of issues related to catastrophic disaster event planning and response. The IND detonation scenario represents one of the most compelling examples of a sudden onset, no notice catastrophic event. The public health and healthcare issues and challenges that are forced upon the “collar communities”, those areas that are located outside of the blast zone but are geographically adjacent to the affected region, will require close coordination and prioritization of available resources within the emergency response system. The decade long history of coalition development in the National Capital Region (NCR), with different efforts and approaches in each of the 3 jurisdictions, Maryland, DC and Northern Virginia will be reviewed. Description of the optimal framework for coordinating response between existing healthcare coalitions and emergency management infrastructure, including emergency operations centers and community reception centers, will be detailed. Finally, the paper will explore how coalitions that organize to form regional networks can improve communications of resource needs and provide situational awareness. The goal of such networks will be to enhance the response regarding management of the unstructured intake of arriving patients as well as providing for the intensive medical support irradiated patients will need under such circumstances. How can the “collar community” outlying healthcare coalitions coordinate with each other across jurisdictional lines in order to relieve the sudden surge in demand for care while helping those communities most severely impacted by the attack to begin the important process of recovery?

Creating the Coalition Model – Developing Coalitions in DC, Maryland and Virginia

In the immediate aftermath of the 9-11 and anthrax attacks, the need for better coordination and cooperation amongst hospitals, EMS agencies and public health departments across the Washington, DC metro region was quickly recognized. Prior to the 2001 attacks, planning efforts related to disaster preparedness and response within the three distinct jurisdictions was occurring at a varied pace. In the few years preceding that fateful fall, planning efforts focused on regional response were promoted in part by some of the initial Nunn-Luger-Domenici WMD grant funding. These efforts were encouraged by strong personalities and leaders whose vision for improved processes and procedures for hospital disaster response were being slowly heeded. Front and foremost were the efforts of the DC Hospital Association (DCHA) which was responsible for developing and implementing a city wide hospital mutual aid radio system (HMARS), developed what became the prototypical hospital mutual aid agreement that linked DC hospitals as response partners in event of an overwhelming crisis [9] and commissioned one of the first municipal bioterrorism response plans in the Nation, completed in August 2001 [10].

The events of 2001 changed everything. Hospitals across the region recognized the importance of planning for disaster. The anthrax attacks proved that large scale disaster could essentially present as a public health and healthcare delivery event, with significantly less response actions required of the traditional first response agencies. And from this, the notion of developing a “coalition” of response agencies was born. How would public health, healthcare institutions, and the traditional first responder agencies, police, fire and EMS, coordinate their efforts to enact a uniform and unified response to such events?

In the immediate aftermath of the events of the fall of 2001, an effort to promote these interdisciplinary linkages in northern Virginia was initiated. The Northern Virginia Emergency Response Coalition (NVERC) was created in October 2001, driven by the need to unify response efforts amongst the many hospitals and public health agencies affected by the surge in demand for screening and care related to inhalational anthrax cases. In addition, there was great interest in and concern regarding the need for specific training and expertise required for the response to future disaster events. It was developed under the auspices of the existing regional EMS council. Efforts that took hold in northern Virginia were indeed modeled directly upon the very successful planning and coordination efforts spearheaded by the DCHA. Three foundational elements of the DC effort can be seen in hospital coalitions that have developed across the country in the ensuing 10 plus years since the Northern Virginia effort crafted its own approach to coordinating hospital planning and response for disaster events. DCHA involved each of the District hospitals in their effort, including participation of the Veterans Hospital (VAMC) and the flagship Army military treatment facility (Walter Reed Medical Center) with the private institutions and public hospital (DC General) located across the city. They pursued the development of HMARS in the mid 1990s, a radio system that linked all of the DC hospitals in real time, and developed a protocol for daily testing and information exchange. And in the context of intense healthcare business competition, DCHA developed and implemented a Hospital Memorandum of Understanding that governed the exchange of resources in times of crisis – it went so far as to assign “buddy” hospitals across the city so that no single institution was left unpaired. This DC hospital MOU became the prototype for the MOU shared across the nation by the American Hospital Association. The coordination of planning efforts across private and public institutions, the development of an MOU, and the establishment of a linked radio system were some of the first efforts in the United States to coordinate hospitals in the context of disaster planning and response, and were the foundations for the efforts that followed in northern Virginia.

Northern Virginia

The Northern Virginia Hospital Alliance (NVHA) was formed in October 2002, an effort initiated by two of the three recognized leaders of the NVERC. Although the NVERC ‘coalition’ focus was deemed vitally important, and was very successful during its relatively brief duration, it became clear that specific needs of the northern Virginia hospitals regarding planning and response required a different approach than that required by their municipal public health, law enforcement, fire and EMS partners. NVHA is comprised of 14 member hospitals and 6 free-standing fully functional emergency departments in the northern Virginia suburbs of Washington DC. It includes facilities that serve a population of over 2.5 million residents over 3,000 square miles – ranging from suburban to exurban to rural communities. The

hospitals have over 3,500 acute care beds, and provide more than 700,000 ED visits and over 170,000 hospital admissions (2009 data). As a conglomerate, the NVHA member hospitals have over 40,000 employees, making them the largest private sector employer in northern Virginia [11].

The organization was conceived as both a planning and response entity, with an initial focus placed on creating the sort of real time information sharing and management system that was noted to be sorely lacking during the 2001 attacks. A regional hospital coordinating center (RHCC) was developed, and an 800 MHz radio system was put in place as the result of a public private partnership entered into with northern Virginia's largest municipality, Fairfax County. Other key efforts included development of a regional focus on chemical event preparedness, with coordinated purchasing of a regional cache of personal protective equipment (PPE), development of an integrated approach to surge capacity and capability that has included an element of telemedicine to assure immediate availability of medical expertise and oversight, and a robust pharmaceutical and materials acquisition, storage and logistics plan, including the development of a warehouse capacity, to ensure availability of key resources separate from state or federal stockpiles. The NVHA remains a robust and vital planning and response organization to the present time, led by an Executive Director and governed by an active Board of Directors comprised of the CEOs or senior most administrators of each of the region's 14 hospitals.

In the aftermath of the 9-11 and anthrax attacks, Arlington County, Virginia, which was one of the last of the original 120 MMRS funded "cities", brought forward the recommendation to expand its MMRS program to include some of its northern Virginia neighboring jurisdictions. In 2005, the Northern Virginia Emergency Response System (NVERS) was created, representing 25 towns, cities and counties with approximately 2 million residents. NVERS supports "a regional approach to coordinated preparedness, response, mitigation and recovery across jurisdiction and discipline boundaries during day-to-day emergencies and multi-jurisdictional and/or multi-disciplinary incidents through strategic planning, priority-setting, information sharing, training, exercises, equipment acquisition and policy-making." [12] It provides for coordination on planning and integration of response capabilities across law enforcement, fire and rescue, emergency medical services, hazardous materials, emergency management, hospitals, public health, public information and information technology. It coordinates closely with its State partners in the Commonwealth of Virginia, as well as with its regional partners in the State of Maryland, and the District of Columbia, and partners closely with many of those same entities who help to comprise the Metropolitan Washington Council of Governments.

Suburban Maryland

The focus on planning and response to disaster events in the State of Maryland preceded those outlined for the District of Columbia and the Commonwealth of Virginia. The Maryland Institute for Emergency Medical Services System (MIEMSS), founded by the Governor of Maryland in 1973, placed emphasis on the development of a 'system' that coordinates the delivery of emergency pre-hospital and hospital based care. The central role played by MIEMSS in organizing out-of-hospital and hospital emergency capabilities has led to a different approach to the development of regional hospital coalitions. In the years prior to the 9-11 attacks, these efforts developed in parallel with the hospital specific planning efforts of the DCHA and EMS focused disaster planning occurring in northern VA. MIEMSS created a

seamless statewide radio network linking the state's hospitals that has been in operation for nearly three decades. The state Emergency Medical Resource Center (EMRC) was founded in 1974, representing one of the first systems in the nation to emphasize and develop coordination of EMS and hospital communications, for use both day-to-day, as well as during disaster events. In the aftermath of the region's experience with the 9-11 attacks, an information management platform focused on facility resources data collection and information sharing system was put into place.

Given the strong State influence on planning, efforts at coalition building has been somewhat limited compared with the DC and VA efforts. In 2004, the Bethesda Hospitals' Emergency Preparedness Partnership (BHEPP) was established, creating a planning and response link amongst the local community hospital which is an accredited Level 2 trauma center, and the federal medical facilities at the National Institutes of Health (NIH) and the National Naval Medical Center (formerly Bethesda Naval Medical Center, now renamed the Walter Reed National Military Medical Center) [13]. In addition, the National Library of Medicine, co-located on the NIH campus, is an active member of the partnership. This geographically concentrated effort has conducted and participated in numerous exercise events focused on coordinating municipal, regional and federal emergency response agencies. By coordinating their response capabilities, they have effectively developed a significant capacity to manage a sudden influx in patient care needs. They have been an active and engaged partner in planning efforts occurring across the National Capital Region.

More recently, the Suburban Maryland Hospital Coalition has been established, comprised of the 10 hospitals located in the close in Maryland suburbs of Washington, DC, located in Montgomery and Prince George's Counties (and incorporating the three aforementioned hospitals comprising the BHEPP). This entity is a planning group only, focused on the coordination of ASPR/HPP related funding opportunities. However, the central Maryland area hospitals signed a regional sharing agreement for the first time in 2012, including four hospital signatories from the suburban Maryland region, in order to support a disaster event affecting Baltimore hospitals. The voluntary Baltimore Healthcare Facilities Regional Mutual Aid System's Memorandum of Understanding (MOU) agreement has formalized the process of collaborating in the event that one hospital becomes overwhelmed during a disaster. This agreement allows all participating hospitals to work together during an emergency to share staff, beds, equipment, and supplies [14].

District of Columbia

As previously described, the DCHA played a crucial role with regards to coordinating the DC hospitals for disaster planning and response. However, five years after the 2001 attacks, the leadership provided by DCHA in the emergency preparedness efforts of the DC hospitals transitioned to the DC Emergency Healthcare Coalition (DCEHC), which was funded by an ASPR grant in 2007. Membership includes seven acute care hospitals, and a combination of 40 skilled nursing facilities and community health centers. DCEHC was developed along the parameters established in the Medical Surge Capacity and Capability Healthcare Coalition in Emergency Response and Recovery handbook [15]. It is staffed by a Healthcare Coalition Response Team (HCRT), Senior Policy Group, and has created a Coalition Notification Center (CNC) which utilizes an on call Duty Officer. The CNC rotates location amongst three DC hospitals facilitates information exchange to Coalition members and external partners by use of the HMARS radio

system and a health information management platform. By doing so, the DCEHC has come into sync with the NVHA and its Regional Hospital Coordination Center (RHCC) and the State of Maryland’s EMRC, in being able to communicate in real time amongst and between the three regional healthcare partners of the NCR during day-to-day alerts, and in support of response to disaster events (see Table 1).

Table 1. NCR Healthcare Coalition Communications Network

COALITION	OPERATIONAL COORDINATION CENTER	COMMUNICATIONS CAPABILITIES	ON-CALL	LINKAGES
DCEHC (regional)	Coalition Notification Center (CNC)	Hospital Mutual Aid Radio System (HMARS); Health Information System	Duty Officer	Coordinates with DC Dept. of Health, DC Fire/EMS, Emergency Management (EOC)
NVHA (regional)	Regional Hospital Coordination Center (RHCC)	MEDCOMM Radio Network; Virginia Healthcare Alerting and Status System (VHASS)	Incident Commander and Operations Chief	Coordinates with Virginia Dept. of Health Communications Centers, Local jurisdictional emergency management (EOCs)
MIEMSS (state)	Emergency Medical Resource Center (EMRC)	Radio and Microwave linkages; HC Standard platform	Field Operations Support Team	Coordinates with EMS, Hospitals, 911 centers, Maryland Joint Operations Center (MJOC) Serves as contact point for CNC and RHCC

Note: An HMARS Radio unit and antennae is located and monitored at both Inova Fairfax Hospital Medical Campus and the Northern Virginia RHCC, ensuring additional redundancy to the communications networks which link the three DC regional healthcare coalitions.

Coordinating across the NCR

Because so many planned events occur in the Nation’s Capital -- the presidential inauguration every four years, and the yearly State of the Union presidential address, and July 4th celebration -- and because Washington DC’s buildings and their occupants remain high threat targets for terrorists seeking to inflict damage, coordinating communications and response activities across the NCR is of critical importance. FEMA’s after action report detailing the planning and response activities related to the 2009 Presidential Inauguration of Barack H. Obama highlighted, among other items, the unprecedented degree of planning coordination and cooperation that occurred in support of this historic event, particularly in the public health and medical sectors.

Hospital coalitions and individual institutions took a wide range of steps to plan and prepare for the Inauguration. The DC Emergency Healthcare Coalition (DCEHC), the DC

Hospital Association (DCHA), and the Northern Virginia Hospital Alliance (NVHA) developed plans and worked with their members to prepare for the Inauguration. These entities developed emergency operation plans, incident action plans and other documents to coordinate their members' response activities. Northern Virginia hospitals integrated their planning activities to a degree that exceeded their previous efforts. Further, the DCEHC led efforts to create a NCR hospital incident information sharing procedure for the Inauguration. [16]

In addition to coordinating the planning efforts, the operational elements required to ensure close synchronization of response efforts were also put into place. The DC Department of Health Health Emergency Coordination Center (HECC) was utilized during the Inauguration weekend to serve as a coordinating point for information relevant to the NCR hospitals and public health agencies, and was staffed by members comprising the DC, MD and northern VA hospital coalitions, health departments and EMS agencies. The recommendation from the FEMA report was that “NCR hospital and EMS partners should identify opportunities to institutionalize these processes in order to prepare the region for large-scale, no-notice events”. [17] Similar efforts will have been used in coordinating planning and response to this year’s 2013 Presidential Inauguration.

One area in which the FEMA report noted a need for improvement was in developing consistency amongst NCR hospitals with regards to sharing a common set of terms and definitions to describe their ability to accept patients. The three different jurisdictions each utilized words and phrases that were not in use by the other jurisdictions: “Open, Special Diversion, and Closed;” “Green, Yellow, and Red;” and “Baseline, Stressed, and Overwhelmed” were all used to describe hospital surge capacity status. As a result, “...during the Inauguration, officials unfamiliar with the terminology disseminated an announcement predicated on an erroneous understanding of hospital status....This incident illustrates how officials unfamiliar with the differing terminology may make erroneous assumptions and conclusions about hospital status.” [18]

As a direct result of this experience, the NCR coalition partners have undertaken efforts to standardize hospital terminology throughout the region, and have drafted a ‘NCR Hospital Event Information Sharing Procedure’. It is intended to provide guidance to the hospital coordination centers located in DC, suburban Maryland and northern Virginia in the procedures required to facilitate effective information sharing during planned events and major incidents. This draft policy establishes the notification criteria that would warrant region wide information sharing (see Box 1). [19]

Box 1. Notification Criteria for National Capitol Region Hospital Information Sharing, from ‘NCR Hospital Event Information Sharing Procedure’, Draft document, June 19, 2012

<i>Judgment by Healthcare Coordinating Center leadership that notification of the other NCR Coordinating Centers (VA -- RHCC, MD -- EMRC, DC -- CNC) is warranted.</i>
<i>A single, mass casualty event that involves 40 or more patients that will require transportation to specialty hospitals (pediatrics, trauma) throughout the NCR and/or where hospitals outside of the host jurisdiction will receive patients.</i>
<i>A single HAZMAT event involving 30 or more patients that will/may require decontamination.</i>
<i>An event involving a suspected or confirmed Category A biological agent.</i>
<i>A Fire/EMS agency has activated a Mass Casualty Unit, Task Force or equivalent, for an event occurring in the NCR.</i>

An agency or healthcare facility has accessed and/or requested a CHEMPACK or MMRS pharmaceutical cache.

Building the Emergency Response System – A Framework for Catastrophic Disaster Response

The examples of healthcare and hospital coalition development in the NCR over the past two decades serve as useful illustrations of how the emergency response system has evolved over time. The progress represented by these concrete efforts has been purposefully orchestrated by leaders in the NCR who recognize the importance of implementing a ‘systems approach’ to emergency preparedness and response. Indeed, these efforts are the substrate necessary for developing the optimal framework required for coordinating response between existing healthcare coalitions and the emergency management infrastructure. A large scale event, especially a no-notice event such as that posed by an IND detonation, will require coordination amongst local, regional and state emergency operations centers (EOC). Furthermore, specific to the IND event, the utilization of community reception centers, where evacuating patients will be initially assessed or reassessed, re-triaged and if needed, referred for more definitive medical assessment and care, will require an entire community’s emergency response system to be able to implement. While the health and medical functions will be of paramount importance in helping to manage the expected casualties resulting from such an attack, the overarching coordination of such events will be managed through respective emergency management agencies, and the exchange of critical information is going to occur in EOCs. In addition, the establishment of community reception centers, or “assembly centers”, for those patients who are ambulatory and evacuating from the site of the detonation or its fallout, will require significant logistical support, spearheaded by emergency management authorities.

Including Health as Part of the Emergency Response System

As described in the IOM report detailing the development of crisis standards of care, coordination of the entire emergency response system is required in order to best mitigate the consequences arising from a catastrophic disaster event [20]. This “system” includes those elements traditionally considered to be a part of emergency response – police, fire and EMS agencies, but must also include other partners, as well. Hospitals, public health agencies, and the private practice medical community are also key components. Early planning efforts funded under the Metropolitan Medical Response System grants of the late 1990s, followed by the weaknesses exposed by the 9-11 and anthrax attacks of 2001, highlighted the importance of bringing health and medical entities to the table as full partners in planning and response. Thus, the emergency response system is now intended to be inclusive of public health agencies and strives to include those elements involved in the delivery of acute medical care – hospitals, clinics, and the private practice community. However, inclusion of the private practice healthcare practitioners in the emergency planning and response process remains mostly elusive [21,22]. Nonetheless, as exemplified by the NCR coalition development experience, the transition to a comprehensive systems approach to preparedness and response is slowly occurring in communities across the nation.

Healthcare coalitions may be in the best position to help broker such change. The intent of federal grant funding, particularly that coming from the ASPR/Hospital Preparedness Program is focused to ensure that such connectivity continues to be developed and planned for. The enhancement and maturation of such connections are vitally important to the success of any response to a catastrophic event. As the National Guidance for Healthcare System Preparedness document highlights, “healthcare coalitions, in coordination with healthcare organizations, emergency management, ESF (emergency support function) # 8, relevant response partners and stakeholders (must) develop a plan to ensure healthcare organizations are represented in incident management decisions during an incident.” [23].

The healthcare coalition may be uniquely able to plan for disaster response needs irrespective of the jurisdictional issues that can often hamper planning within many of the municipal based emergency response agencies. Coalition membership is often comprised of healthcare systems that have its facilities located in more than one jurisdiction. As a result, these are often organizations that are used to routinely coordinating basic public health, EMS and related public safety issues amongst multiple jurisdictional agency partners. Given that the healthcare coalitions also chiefly represent private sector entities, more latitude in the procurement process can often hasten acquisition of key planning resources. Many times such resources may be provided by ‘in-kind’ contributions, of both personnel and resources, which further helps to promote the planning effort. For example, the RHCC in Northern Virginia is co-located within Inova Health System’s eICU telemedicine nerve center, providing a location for a command center that takes advantage of additional functionality provided by the broadband connectivity needed for this critical care service.

Given this potential benefit, the healthcare coalition can help to serve as a convener of emergency response entities, much the way the DCHA and the original NVERC, and later the NVHA, did in the National Capitol Region. Planning must be based upon known or perceived hazards, and must focus on the steps needed to ensure safe, timely and evidenced based responses to the identified risks. Such planning must take into account the ability to surge in demand for healthcare services, and must include plans that recognize the potential shift in care delivery across the surge spectrum from conventional to contingency to crisis surge response [24]. Across the varied risks that might be planned for, the healthcare coalition must be prepared to help manage and promote not only communications, information sharing and situational awareness, as previously described, but other key issues, as well. Key attributes and functions of a robust healthcare coalition are described in Table 2.

Table 2. Core Functions and Capabilities for Healthcare Coalition Development

Core Mission Areas	Examples
Regional planning and collaboration	Serves as multi-agency coordinating center focused on acute care hospitals and healthcare organizations
Communication and information management	Interoperable voice and data communications systems to share situational awareness; Bed status board; Resource tracking board; Mass notification and alerting; Patient tracking
Training, education and exercises	Focus areas: incident command; media and crisis

	communications; active shooter; decontamination procedures; burn and trauma care; radiological response, others
Personal protective equipment (PPE)	Regional acquisition of biological (N-95 masks, elastomeric masks, gowns, gloves) and chemical (powered air purifying respirators (PAPR), chemical protective clothing, boots) PPE; interchangeable across coalition
Critical infrastructure protection	Water system resiliency including emergency water pumping and potable water storage systems; Electrical power system resiliency including installation of emergency generator transfer panels ('quick connect'), ensure adequate back-up generator power and fuel to support generators
Decontamination and detection	Decontamination showers (fixed facilities represent preferred approach, when possible); radiation detection portals
Surge capacity and capabilities	Development of "immediate bed availability" surge plans, utilizing strategies including implementation of reverse triage protocols, establishment of "discharge lounges" and implementation of telemedicine solutions; exploration of regional staffing models
Pharmaceuticals and materials management	Acquisition of key equipment, supplies and pharmaceuticals used to support surge response efforts including: temporary beds, EMS/transport ventilators, portable vacuum suction units, IV pumps, "crash" carts, HEPA air 'scrubbers'; co-location of CHEMPACK cache
Security	Augmentation of security protocols and information sharing among coalition members
Mass fatality management	Procurement of materiel and equipment to support mass fatality management, coordinated planning to help mitigate placement of decedents in setting of large numbers of casualties
Organization and leadership	Leadership, both administrative and clinical (with incorporation of subject matter experts to help lead policy development); focus on fiduciary goals and fiscally prudent and defensible decisions

Development of a regional healthcare operations policy, one that details the allocation and sharing of key resources, and plans for their utilization across the rainbow of potential scenarios, will be an important step taken in the direction of codifying the basic procedures that will govern a response to mass casualty, mass exposure and public health emergency. The purpose of such a plan ought to be to

describe the systems, tools and organizational structure by which the healthcare coalition will execute its basic responsibilities. As noted previously, these include facilitating communications, information sharing and response between coalition partners and other relevant response partners at the local, regional and state level (i.e., law enforcement, Fire/EMS, Public Health, Emergency Management and others); coordinating the management and distribution of patients from a mass casualty incident to receiving hospitals with the public safety and EMS agencies, both municipal and private; promoting coordinated and consistent strategies and tactics across the responding coalition members; and facilitating resource support to the coalition members, to include mutual aid/cooperative assistance, deployment of regional stockpiles (see Table 3), governmental assistance, and the management of spontaneous volunteers or donations.

Table 3. Example of Healthcare Coalition Resource Stockpiling (from NVHA Regional EOP)

Personal Protective Equipment: N95 respirators, procedural masks [adult and pediatric], replacement filters for elastomeric respirators, protective gowns
Temporary Hospital Beds: Portable hospital beds that can be deployed and used to augment surge capacity at hospitals or alternate care sites managed by local authorities.
Linen & Staff Scrubs: disposable linen to include blankets, pillows, hospital sheets, patient gowns [adult & pediatric sizes], diapers and staff scrubs.
Basic Medical Supplies: suture kits, splints, bandages, dressings; divided into 5 identical “caches” that are each sub-divided into rolling hospital carts for improved mobility and deployment.
Ventilators Supplies: ventilator circuits that can be used to support the disaster EMS/transport ventilators deployed to coalition member hospitals
Hydration Fluid & Supplies: 12,000 1 liter bags of normal saline and IV starter kits / catheters [in a variety of gauge sizes].
Drinking Water: 25,000 individual 1 gallon bottles of drinking water
Decontamination Supplies: filters, breathing hoses for PAPRs and spare Level-C DECON suits

The role of Regional Healthcare Coalitions in IND Response

As the region begins to take account of what has happened – buildings in downtown DC collapsed and on fire, glass from high-rise offices and apartments blown out for miles around, roads and highways made impassable by the twisted steel of multiple car crashes, large snow-like dust particles beginning to settle back down to the ground – public safety radios may begin to crackle, text messages may begin to flow, WTOP may or may not be on the air. Most people will have no idea what has occurred, nor what is in store. Many thousands are dead; many more thousands are critically injured. Tens of thousands are at risk for radioactive exposure, and if they are not directed to shelter immediately, the number of casualties from this explosive event will be significantly larger. Patients will begin to come to hospitals, clinics and other acute care facilities. The ability to deliver stabilizing care will become quickly overwhelmed. Many more will begin to attempt to evacuate the city and close in suburbs seeking care elsewhere. The exodus has begun.

Building healthcare coalitions into the matrix of emergency response ‘systems’ is critically important, particularly in helping to mitigate the health and medical consequences arising from a catastrophic event such as that caused by a nuclear detonation. Those coalitions that are in the immediate impact zone will have particular challenges as they begin to mount a response to the sudden disaster. In the context of an attack in downtown DC, it is likely that the DCEHC may simply cease to function. The NVHA and Maryland coalitions are more likely to be able to respond immediately, and their ability to respond will also likely trigger the activation of protocols by healthcare coalitions adjacent or otherwise virtually connected to them (i.e. the other 5 healthcare coalitions located across the Commonwealth of Virginia, and the notification of the entire emergency response system in the State of Maryland). Coalitions will need to focus on key functions related to their role as a member of the emergency response system, although these implementation priorities may not all be easily accomplished, given the circumstances at hand (see Table 4). The key functions that are described will be required of those coalitions both close to the impact zone, as well as those located farther away from ground zero. Given the sudden onset, no-notice circumstances under which such efforts must be mounted, it is likely that the farther away from the impact zone, the better organized the health and medical response will be, given mostly to the opportunity to implement established protocols and the distance that separates those outlying communities from the chaos and confusion wrought by the terrorist attack.

Table 4. Healthcare Coalition Functions, Roles and Challenges in IND Response (Located at end of paper)

In their description of the RTR system for spontaneous coordination of an improvised response to an IND detonation or other acute radiological emergency, Hrdina, et. al. note the importance of establishing not only spontaneously located triage and treatment sites, but based upon their location, utilize pre-determined assembly sites based on geographical proximity to render more definitive stabilizing care and initiate transport to definitive medical facilities [25]. This conceptual approach to developing a spontaneous response to events as disruptive as an IND detonation can only be implemented with coordination of all of the emergency response system elements described previously. Emergency management agencies will need to help coordinate the ‘reception’ of incoming casualties, most of whom are evacuating under their own power, some of whom will require medical attention, treatment, diagnosis, and management. Law enforcement presence will be important to coordinate people movement and to keep order. EMS transport units will be necessary to help move more severely affected patients to definitive care sites. Medical personnel will be required to initiate life stabilizing and sustaining care. Public health authorities will be needed to help track patient exposures, get contact information for sharing of further public health information, particularly information related to potential exposure concerns. Emergency management leadership will likely be needed to help coordinate the co-location of such services, helping to identify the sites, and the resources required to manage the delivery of care under such circumstances. This is particularly important, as one of the key early actions required of emergency management will be coordination of messaging regarding the importance of shelter-in-place strategies that are anticipated to be able to save thousands of lives, and contribute to limiting the absolute number of patients who may ultimately require health and medical evaluation and treatment.

By being linked into this emergency response system, the healthcare coalition will be able to take advantage of the information management and communications tools utilized by emergency

management. In addition to using these platforms to share actionable information with the affected population, direct coordination with the EOC will also be important in helping to procure the additional resources needed to respond to the catastrophic event. It is important to emphasize that by coordinating such messaging, the EOC, which will already be overwhelmed with information and data input, can better prioritize the request for resources that come as “bundled” requests from healthcare coalitions, and not as disparate requests for the same types of resource needs repeated by hospital after hospital in any given region. Linkages to the EOC, where there will also be public health participation and representation, can be used to broadcast early information regarding special medical considerations, such as describing the specific needs of suspected or confirmed irradiated patients. Such information would be particularly important to share with outlying communities who are likely to see the migration of patients away from the epicenter of the event, and towards those communities, and could begin to prepare for the arrival of irradiated patients.

It would also serve as the opportunity to begin to mobilize other “specialty network coalitions”, coalitions of response organizations that can provide specific surge capability, for example those related to burn care and radiation injury management. Two regional burn consortia that could provide assistance to the NCR include the Eastern Regional Burn Disaster Consortium, based at the Burn Center at St. Barnabas Hospital (New Jersey), which includes 27 burn centers along the east coast located from Maine to DC/Maryland [26] and the Southern Burn Disaster Program, operationally based in Birmingham, Alabama and incorporating burn facilities located from Virginia to Texas [27]. In addition, the Radiation Injury Treatment Network [RITN], which provides comprehensive evaluation and treatment of radiation injured patients, and has been extensively engaged in IND planning and response efforts, would also be activated [28].

Whereas the close-in healthcare coalitions would likely be overwhelmed with patient care delivery, acquisition of needed resources, and protection of existing infrastructure, the ability to relay this situational awareness to the State EOC would help to facilitate activation of the aforementioned coalitions, and would likely trigger the request for activation of the National Disaster Medical System (NDMS), and invoke the participation of the Federal Coordinating Center (FCC) to assist in the receipt, triage, staging, tracking and transport of victims of this large scale catastrophic event [29].

Assisting Response and Recovery – ‘Network Centric’ Coalitions

The IND detonation scenario will result in infrastructure damage limited to a circumscribed geographical area, and depending on prevailing weather conditions, creation of a dangerous fallout zone that will extend for a much larger distance, posing danger to many more citizens who will quickly be at risk for radiation exposure. Given that the characteristics of such an event will change rapidly over time, and in light of the importance of public messaging described earlier, a very important aspect of the response, and recovery, will be how effectively critical information will be authenticated, broadcast and updated. The progression of healthcare coalition development and cross jurisdictional coordination, as exemplified in the progress being made by the DC, suburban Maryland and northern Virginia healthcare coalitions, demonstrates the importance of pursuing the concept of “networks of networks” in achieving the capabilities required for robust and resilient community response to catastrophic disaster.

Network centric, or “netcentric” refers to the development of a “continuously-evolving, complex community of people, devices, information and services interconnected by a communications network to optimize resource management and provide superior information on events and conditions needed to empower decision makers.” [30] A concept of network centric warfare was introduced to the Department of Defense in the mid to late 1990s [31] There are four distinct components of this approach: (1) A robustly networked force improves information sharing; (2) information sharing and collaboration enhance the quality of information and shared situational awareness; (3) shared situational awareness enables self-synchronization; and, (4) the above dramatically increase mission effectiveness. The de-emphasizing of traditional hierarchical command and control approaches to incident management, and the recognition that spontaneous decision making will be effective in the setting of horizontal information flow, matches well with the potential role that healthcare coalitions could and should play in response to an IND event.

Healthcare coalitions that organize to form regional networks can improve communications of resource needs and provide situational awareness. The goal of such networks will be to enhance the response regarding management of the unstructured intake of arriving patients as well as providing for the intensive medical support irradiated patients will need under such circumstances. In the first hour to hours, during which time event characterization will be important, effort will be focused on projecting the location and direction of the fallout plume, and sharing this information with the public. Hours after the detonation, to the first day or days, information provided to those who require radiation screening, or more definitive medical attention, will become most important. While this information will be of significant importance in the close in communities affected by the blast, because of the forecast population movement anticipated as occurring as a result of such an attack, the surrounding communities will play an increasingly important role in supporting the needs of this migrating population.

Those close-in communities that are geographically adjacent to the ground zero impact zone will struggle to accomplish the emergency response functions related to security, fire suppression, search and rescue, patient care delivery and other fundamental response efforts. Those communities that are farther away from ground zero, the unaffected ‘collar communities’, will have an enormous responsibility to support command and control functions, both hierarchical and vertical, and to support the lost infrastructure in the affected communities. This may include not only the communications infrastructure, but much of the emergency response mechanism that may either be directly impacted by the event, or consumed by the enormous response that is likely to be required. Collar community healthcare coalitions may be able to broaden their network of communications capabilities, coordinating communication and allocation requests that accommodate the needs of the impact communities. Perhaps most importantly, collar community coalitions will be required to ramp up procedures for managing the influx of surge patients (trauma, radiation, combined, non-affected but requiring ‘routine’ emergency care, etc) that are certain to present seeking medical care and attention. As patients care needs become better defined, and the stratification of care is conducted along the surge capacity framework ranging from conventional surge to contingency and crisis surge responses, the outlying healthcare coalitions will be able to prioritize information shared with the State EOC and

Federal government regarding resource allocation needs. This coalition to coalition networking and coordinated response, as well as coalition to state coordination, is only possible with the development of robust, mature healthcare coalitions that are fully integrated partners in their community emergency response system.

Conclusion

A catastrophic emergency, of which an IND detonation may be the prototypical example, demonstrates the importance of developing robust emergency response systems that have the capacity and capability to manage a complex set of response requirements. In this type of event, the impact area affected by the detonation will be surrounded by an intact infrastructure. The role of the healthcare coalitions will be particularly important in helping to coordinate information flow supporting real-time situational awareness, and interpreting data pertaining to resource utilization and initiating the request for resource needs. Acquiring and sharing such data will need to occur with the support of affiliated emergency management agencies. Such efforts will be critically important to the public health and healthcare response faced by communities that are geographically situated immediately outside of the blast zone following an IND attack.

Lessons learned from the decade long maturation of healthcare coalition development in and around the National Capital Region – in the District of Columbia, northern Virginia and the close in suburbs of Maryland – highlights the attributes of such coalitions, and establishes some of the benchmarks that may be useful to other communities seeking to develop the same level of capability and coordination. In the event of catastrophic attack or natural disaster that disrupts civil society, the priority to return to normalcy, or at least a “new normalcy” will be of utmost importance. And the attempt to minimize the adverse healthcare consequences related to such an event will make the difference between whether or not a response is viewed as successful. Strong, robust, and well managed healthcare coalitions will play an important role in enhancing the response to any catastrophic event, and may be uniquely positioned to be able to coordinate key response actions that cross jurisdictional lines. By doing so, they will be immensely useful in assisting to relieve the burden on those areas most severely impacted.

Table 4. Healthcare Coalition Functions, Roles and Challenges in IND Response

Core Coalition Functions	Implementation Priorities in IND response	Potential Challenges
Regional planning and collaboration	Establish situational awareness amongst coalition members, and across regional boundaries to include neighboring coalitions; coordinate strategic and tactical health/medical response plans	Early priorities will include participation of emergency response system partners in assisting coalition members -- assistance from public safety agencies to manage surge response and security needs; assistance from Public Health authorities to establish patient registry and contact tracing mechanism; emergency management for assistance in resource procurement via coordination with local/regional/State EOCs; local/regional/State government leadership in establishing key crisis messaging regarding life saving and sustaining actions
Communication and information management	Report bed, staff and resource availabilities; coordinate with local, regional and State EOCs	Communications networks for both voice and data may be significantly impaired
Personal protective equipment (PPE)	Establish uniform protocols for staff protection from radiological hazards; coordinate with other members of emergency response system (public safety agencies)	Relatively limited supplies of PPE may be rapidly exhausted; tactical decisions regarding greatest need for PPE may occur amongst emergency response system partners, possibly resulting in re-assignment of available resources
Critical infrastructure protection	Ensure safety of drinking water sources; implement back-up power support; assess structural integrity of healthcare facilities located closest to impact area	Water pressures likely to be low; widespread power outages expected, requiring sustained operations with limited water and requirement for back-up power generation; re-supply of water and fuel not likely; lack of fuel will significantly hamper responder relief efforts, including the need to transport patients to outlying facilities
Decontamination and detection	Decontaminate incoming patients per established protocols; implement radiation detector capabilities at healthcare institutions (portal or hand-held); ensure that staff are appropriately decontaminated, and prioritize public safety staff decontamination, if needed	Water may not be available for decontamination; healthcare facilities have limited capability to provide dry decontamination; few healthcare facilities have portal radiation detectors, hand held survey monitoring will be time consuming
Surge capacity and capabilities	Implement surge response strategies accounting for 'crisis standards of care' response – transition to contingency and crisis surge response protocols	Healthcare facilities will face unprecedented demands for service care delivery, yet must also maintain services to existing patients, and those who present with other emergencies unrelated to the immediate effects of the detonation event
Pharmaceuticals and materials	Access and distribute available local/regional equipment,	Transportation infrastructure may impede physical movement of materiel from central warehouse to

management	supplies and pharmaceuticals; initiate requests for additional materiel based on actual and projected patient care needs	healthcare facilities; ability to develop 'demand forecasting' based on projected needs limited
Security	Need to establish security of healthcare facilities; need to promote passage of hospital staff, both direct healthcare providers and non-healthcare support service employees, across police lines to be able to report to work	Limited personnel will not be able to be augmented by law enforcement agencies, which will be otherwise engaged in the response; staff without proper credentialing may have difficulty crossing police lines; spontaneous volunteers will require management and coordination, including credentialing (numbers of volunteers may be limited due to concern regarding potential exposure to radiation)
Mass fatality management	Prepare for mass fatalities that result from IND attack	May be overwhelming demand for external service support; healthcare facilities will have to be prepared to store and catalogue decedents from an event, including those that may have radiological contamination, on site

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