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The Role of Information Technology in Hospital
Emergency Management

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September 11th, Katrina, SARS and the threat of pandemic flu have all raised the public's awareness of emergency management. While always an integral part of the community, hospitals tend to become even more important in a disaster as people rely on these institutions to not only care for the ill and injured, but also to provide shelter, food, information and leadership in relief and recovery operations. Over the past few years the importance of hospitals as members of the emergency response community has come to the forefront, including hospitals being viewed as 'First Receivers' by local, state, and federal officials¹.

There are also regulatory standards that cement the hospital's pivotal role in emergency preparedness. Both the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the Occupational Safety and Health Administration (OSHA) require compliance with emergency preparedness guidelines. Several sources of federal funds are also only available to those institutions who can demonstrate compliance.

Despite both the need and the federal mandates for hospitals to play a leading role in emergency management, most hospitals cannot yet answer the question – Are you ready? – with a resounding yes. Add to this the already stretched resources of the healthcare system - 62% of all hospitals and 79% of urban ones are at or over ED load, an estimated shortage of 400,000 nurses by 2020 and too little space and supplies², - the additional burden of emergency preparedness compliance can often seem overwhelming.

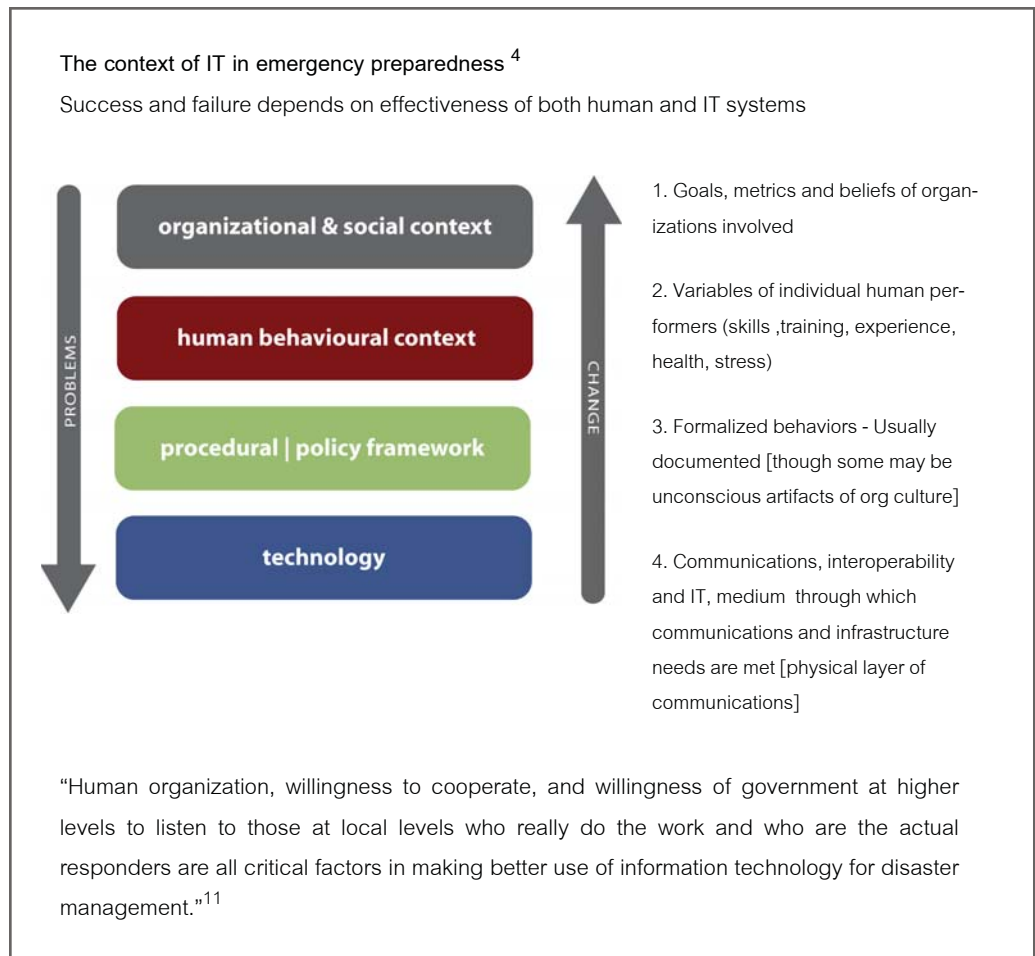
The silver bullet

As in other sectors, one oft touted solution to dilemmas of this nature is Information Technology. A soon to be released publication commissioned by the E-government Act of 2002 examines this very question; the role of IT in disaster management. The findings, released in a prepublication copy, make a number of recommendations (see box 1) but ultimately conclude, perhaps unsurprisingly, that there is no "IT Band-Aid" that will by itself "overcome underlying organizational and data quality problems that prevent effective information sharing and integration."³

While there is no one "Band-Aid" IT solution, there are a number of benefits to be derived from the use of IT in disaster management.

Box 1 - Role of IT in emergency management recommendations⁴

1. Greater organizational agility for disaster management
2. More robust, interoperable, and priority-sensitive communications
3. Better situational awareness and a common operating picture
4. Improved decision support and resource tracking and allocation
5. Better engagement of the Public
6. Enhanced infrastructure survivability and continuity of societal functions



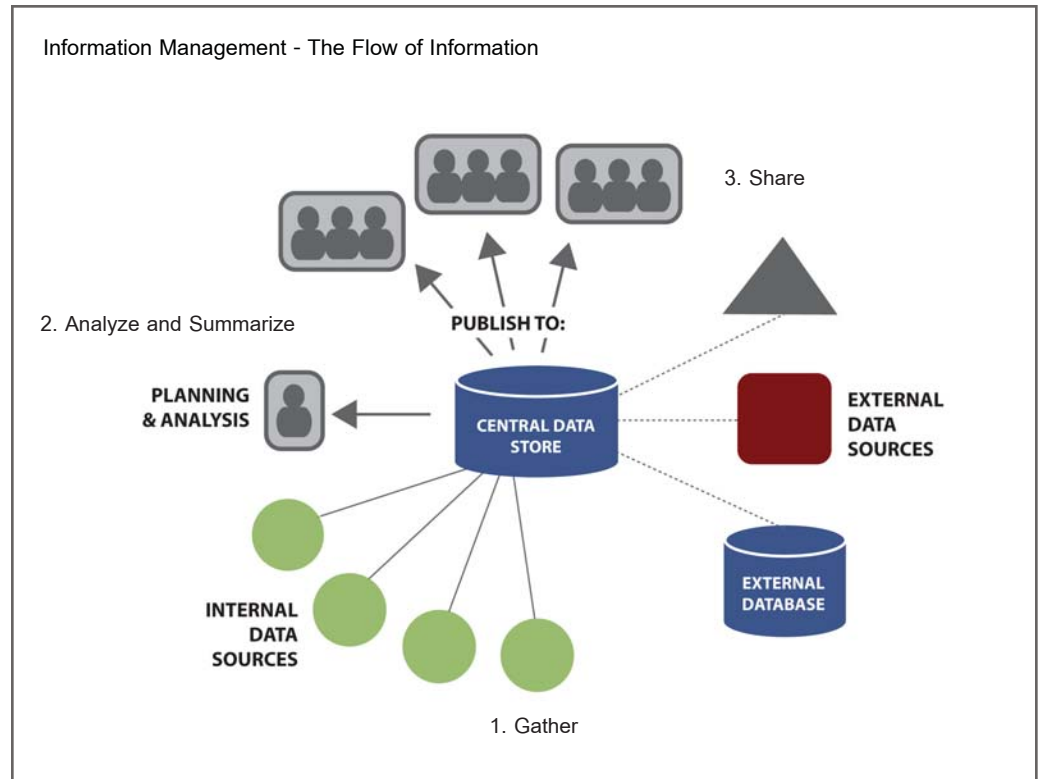
At the root of the problem is the very nature of a disaster itself. Disasters breed chaos. Those affected, and those responding to minimize harm to people and property, are thrust into an unknown, frightening, and often dangerous situation where they must perform unfamiliar tasks. One of the primary challenges responders face is the chaos imposed on information. Questions like: What is happening right now? How many people are affected? What is the risk to hospital staff and their families? Who knows how to cope with this situation? Where can I go for more information? can seem overwhelming in the midst of a disaster. Add to this confusion the fact that your brain cannot function at its best when under stress - impairing not only what we remember but what we think we remember,⁵ and hospitals often find that their biggest risk is not enough people know what to do when an incident occurs. Training goes a long way to alleviate this confusion. But even with a well developed emergency preparedness program encompassing mitigation, preparation, response and recovery, and an extensive training and exercise plan, the need to access pertinent information, when you need it, is paramount to a successful response and recovery.

Information Management to the rescue

The art of gathering information, analyzing and summarizing it, then sharing it with those who need it is known as information management. IT can assist in many aspects of this information management in the context of emergency preparedness. From preparation of plans, policies and procedures, to training and exercises, marshaling available resources, mobilizing skilled personnel, coordinating their actions, and gathering the data from a response to assist in organizational learning after the fact, the flow of information is crucial to successful disaster management.

Box 2 - Stages of an Incident⁶

1. Incident recognition
2. Notification/Activation
3. Mobilization
4. Incident Response
5. Demobilization
6. Recovery
7. Post-incident
"organizational learning"



Traditional disaster preparedness approaches are paper based. Committees meet, conduct a hazard vulnerability analysis and decide which types of incidents are the biggest risks to the hospital and surrounding communities. Plans are then drawn up on how to mitigate these risks, how to prepare for, respond to, and recover from these particular disasters. Once the plans are completed, they are placed in a box and pulled out only when a hospital needs them. While there is an encouraging trend towards more collaborative planning and drilling ("86 percent of hospitals reported having participated in a community-wide disaster drill with local police and fire departments, social service agencies, and other health care providers within the last year."⁷), the emergency preparedness process, and the resultant plans still reside on paper. The challenge is sharing this paper-based knowledge with the response community in the midst of a chaotic disaster. In order to ensure the proper flow of information, hospitals must rethink their emergency preparedness strategies and make use of existing IT tools to enable coordination of responders and resources.

All too often, IT becomes part of the problem rather than the solution when implemented without enough attention placed on the users of the system. A good IT solution for emergency management must extend the capabilities of the responders – not try to emulate these capabilities.

As such, key properties of a good solution are:

1. Data fusion from multiple sources
2. Dynamic information repositories
3. Shift from reporting to real-time data
4. Reduce barriers to information flow
5. Engage the public

>> Multiple sources of data

The array of data sources in emergency management is staggering. Data from voice, text, geospatial, video, sensors, databases, forms, satellites, telemetry, and eyewitness accounts all play a role in managing disasters. Add to this the variety of data at various stages of planning – pre-incident, trans-incident, and post-incident – and the volume and sources of data can become overwhelming. Of paramount importance to managing all of this information, and avoiding sensory overload, is the capability to fuse various data sources into a coherent view. Imagine a screen with summary information on current bed status, patient status, resource availability, and links to up-to-date response plans and guides. Now imagine logging in to five separate systems to access this information. The ability to access pertinent data in a timely fashion is fundamental to successful emergency management.

>> Information Repositories

Information repositories are critical for facilitating communications and information processing activities in managing disasters. Data from many sources is brought together and held in a central repository. This allows a common source for analysis and data reduction, decision-making and collaboration, and one source for information dissemination. The advantages are many. From awareness campaigns to enhance mitigation, planning coordination, and training exercises, to response situation awareness and a common organizational picture of the disaster, a single source of information facilitates communication throughout the response community.

One additional advantage of a data repository is the ability to share information with the outside community. As an incident unfolds, and responders gain more understanding and knowledge of the disaster, situational information will be maintained in a central repository. This information can then be accessed, summarized and reformatted to share with non-responders such as hospital staff not involved in the response, staff families, the public community and media. Keeping external stakeholders informed of the current incident status not only helps alleviate fears, it also allows these groups to participate in the response and become part of the solution.

>> Real-Time view

The traditional report based communication methodology – where reports are pushed out to responders at regular intervals - is being replaced by a real-time stream of information (box 3). The real-time view of information not only improves situational awareness, it also allows for greater flexibility in the actual response by actual responders. Regardless of the sophistication of your IT system or the value of your information, it is the people involved in the response that contribute most to its success. The inventiveness, improvisation and ingenuity of these people goes a long way to overcoming shortcomings in both processes and systems put in place before a disaster occurs. Timely information that can help them do their job is invaluable.

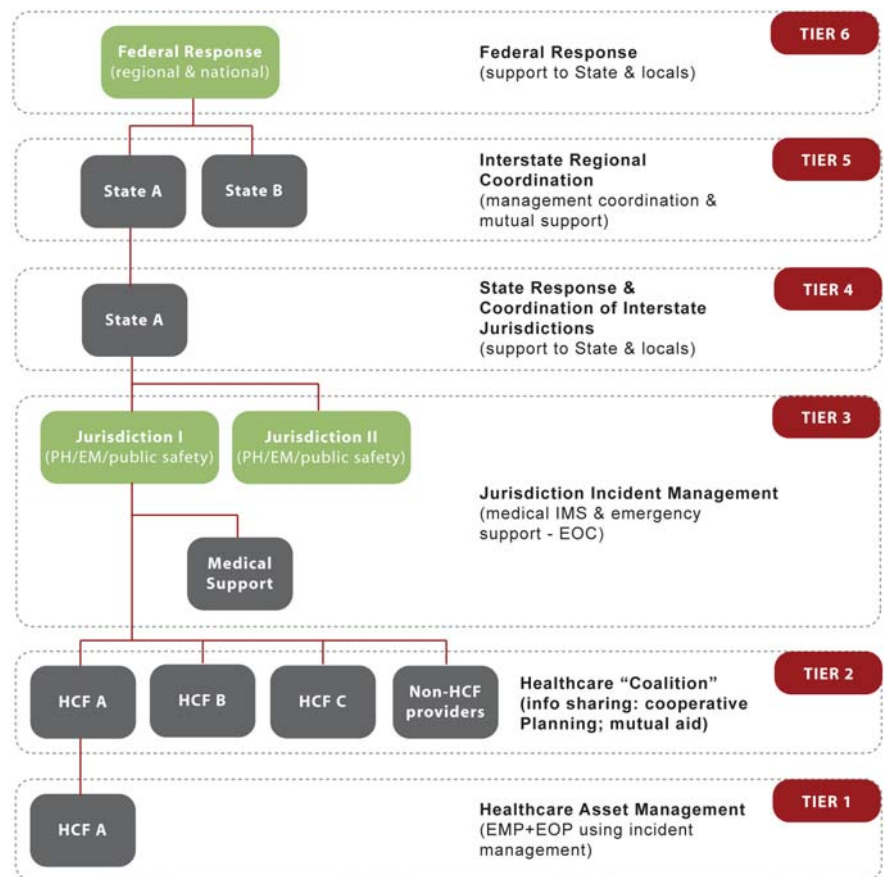
This 'live' stream of information is also important when communicating directives and authorizations (where to go, who to meet, reporting status). If A needs authority from B before they can perform their task, then the fewest communication delays between A and B then better.

Box 3 - Disaster Medical Response and Information Needs

One consistent challenge for disaster response is communication and information management. Effective response requires a moment-to-moment “situational analysis” and real-time information to assess needs and available resources that can change suddenly and unexpectedly. A critical “sequential inter-dependence” exists: accurate information from the field about the incident, casualties, medical needs, triage, and treatment impacts the utilization and preparedness of community resources such as ambulances, EDs, hospitals, and intensive care units. Similarly, information on available and accessible hospital, ED, and ambulance resources alters the management and disposition of victims at the scene. The importance of communication and information transfer was demonstrated in the September 11, 2001, WTC attacks. Analysis suggests that “lack of communication probably resulted in more problems than all other factors combined.”⁸

>> Reduce Barriers to Information Flow

An internal incident can be effectively managed with little additional planning and training or communication efforts. For instance a code for an aggressive patient requires staff to perform specific functions, but within daily parameters. Larger incidents, such as severe weather, or infectious diseases, require considerably more planning and training and well coordinated communication to effectively manage. Aside from the difference in scope, the later examples are also more challenging from a management perspective because they involve more than one location; as the jurisdiction of the response increases, so too does the need for effective communication.

Communication in a large scale incident⁶

One of the largest issues with current cross-jurisdictional communication is barriers to information flow. While the majority of these barriers are organizational (culture, semantics, authority), many barriers are technological in nature. Key issues include interoperability of data formats and the ability to share information across networks / firewalls. While adoption of web based protocols (IP) can alleviate many of the technological barriers, the willingness to share information with other hospitals, agencies, the public and the media may require organizational changes to existing protocol.

Box 4

“A year ago in Madrid, the first official help arrived 10 to 20 minutes after the explosions. In the meantime, as reported by Spanish-language newspapers, other passengers worked to get people out of the wrecked rail cars, tended their wounds, and urged calm in the chaos. Such incidents have prompted a growing number of disaster experts to call for a new disaster paradigm, one based on a grass-roots, public-first approach.”⁹

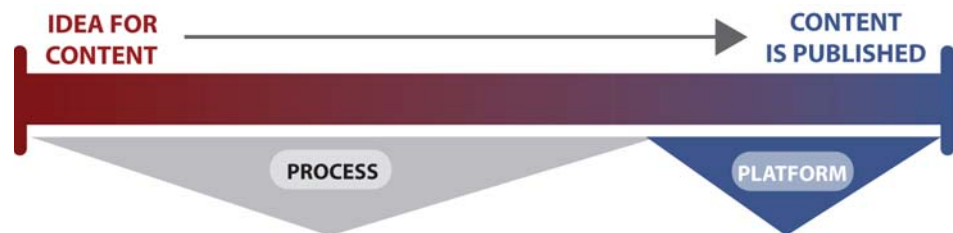
>> Engage the public

One of the most valuable, and least used resources in emergency management is the public. Not only is the public the first on the scene (see box 4), recent technological advances such as camera phones and audio and video recorders enable citizens to provide valuable information and feedback to the response community. In order to engage public help, the common citizen must be built into response planning and training – and not viewed as part of the problem. Furthermore, as much information as is reasonable should be made available in an easily accessible format (i.e. online) as disaster responses unfold to maintain public awareness. An informed public can then be used as a source of information; either by providing on-site information or through public reporting sites.

Implementing Information Management Solutions

There are some common barriers to adopting an Information Management Solution as an emergency management tool. Organizational resistance to new technology, lack of budget, and underestimating the offline effort when deploying an IT solution (see box 5) are all risks common to emergency management, as they are to IT implementations in general. There are also some specific barriers unique to this field – namely, important sources of funds only become available after a disaster has occurred, the need for cross-jurisdictional coordination, and the risk of relying on a new application during a crisis situation.

Box 5



“Content management is a process. It starts when someone gets an idea in their head that they want to publish (or change) some content somewhere. It ends when that content is actually published. This is the entire length of the process.”¹⁰

There are, however, some recent trends that help alleviate these issues.

>> Always on

Relying on little used or poorly understood technology to manage a disaster is a recipe for – well, disaster. In a crisis, we fall back on what we know. Having a response team dust off a rarely used emergency-only solution is adding considerably to the stress of an already stressful situation. The solution is the adoption of an emergency management tool that plays a vital role in every day operations and management.

The distinction between 'normal operations' and 'disaster mode' is in many ways a matter of each hospital's internal policies. Adjusting these policies to encourage use of disaster-like processes in every day operations and, conversely, every day processes during a disaster, will not only encourage staff to make daily use of a disaster management IT tool, it will also alleviate some of the foreignness, and thus stress, of response procedures. Some additional benefits to the always on approach are:

1. Establish beneficial response-like protocols that add to every day operations (i.e. resource management, status reporting)
2. Updated information from status reports and shared knowledge encourage a common operational picture and reduce misunderstandings
3. Greater virtualization of response activities can reduce the impact of a disaster by allowing more people to participate from their desks
4. Greater virtualization allows a more gradual activation of emergency procedures and a smoother transition back to normal operations.

>> Interoperability and Flexibility (Web Based)

In order to maximize the usefulness of an emergency management IT solution, the user must be able to decide how and when information is accessed. There is a big advantage in allowing first responders in the field to access information they need, as they need it (pull) rather than send them summary reports (push). In order to accommodate this flexibility, system users need access to the information management system and they need to be able to locate the desired information. Access is accomplished by network connectivity to a web based information repository. Locating the desired information in a timely fashion is accomplished by search features and advanced information architecture. An additional feature to enhance flexibility is allowing users to access this information in a manner that they are familiar with.

>> Separate UI and data layers

Not all responders will be on the same systems. Nor will they access information through the same devices. Therefore, to maximize access, information must be disseminated independently from the presentation layer. This means that the same information should be accessible through a browser or another device, like a phone. To accomplish this, the underlying data must be accessible to various external systems (web services) and in a format that can be understood (XML). As more and more agencies start adopting emergency management IT solutions, the standardization of an XML format for the sector is not far off.

The benefits of IT in Emergency Management

Information technology is not simply a tool to automate existing processes and 'get them online'. A good IT solution for emergency management allows your responders to do their jobs and extends their capabilities. Focused on collecting relevant information, storing this information for analysis and retrieval, and sharing this information with those that need it, the IT solution becomes an integral component of your daily operations and your emergency preparedness. The real benefit of adopting an IT solution for emergency management, especially one based on information management, is the "complementary investment in decentralized decision-making systems, training and business processes that come along with IT implementations that allow organizational efficiency improvements"⁴.

An IT solution alone is not enough to ensure adequate all-hazards preparedness. “Staff and resources must be dedicated by local emergency management, public health and public safety agencies in a non-partisan fashion to ensure development of capabilities and coordination across the health and medical spectrum of the community and the region. Important considerations include regular interface between system components (informal discussions, interagency planning meetings) and exercises (frequent inter-hospital communications tests also involving public agencies, regular mass casualty drills using the established systems, etc.)”¹²

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