Enhancing Community Disaster Resilience Through Mass Sporting Events

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ABSTRACT

Disaster response requires rapid, complex action by multiple agencies that may rarely interact during nondisaster periods. Failures in communication and coordination between agencies have been pitfalls in the advancement of disaster preparedness. Recommendations of the Federal Emergency Management Agency address these needs and demonstrate commitment to successful disaster management, but they are challenging for communities to ensure. In this article we describe the application of Federal Emergency Management Agency guidelines to the 2008 and 2009 Chicago Marathon and discuss the details of our implementation strategy with a focus on optimizing communication. We believe that it is possible to enhance community disaster preparedness through practical application during mass sporting events.

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Key Words: marathon, communication, disaster preparedness

Much great work has been done within the field of disaster preparedness. Some of the greatest challenges uncovered by efforts to improve disaster responses are problems with communication, coordination, and interagency cooperation.[1-3] Preventable injuries and deaths caused by communication failures are well described.[4] Civilians perished on the upper floors of the World Trade Center when 9-1-1 call centers were unable to tell them the location of the fires. Although the information was known, limitations in interagency communication prevented timely distribution of this information from preventing these deaths.[4] After Hurricane Katrina, victims were stranded even though vehicles existed that could have provided transportation. Issues of manpower, supplies, and resources can be overcome, but only if adequate logistics and organization are in place.[2,3] Despite decades of recognition and many proposed solutions, it is not clear that formalized, adequate solutions are widely established.[5-7]

Since the terrorist events of September 11, 2001, significant improvements in interagency communication have been made and solutions have been implemented. On a national level, in the wake of major disasters such as September 11 and Hurricane Katrina, the Federal Emergency Management Agency proposed implementing an incident command system (ICS) for disasters that centers on a unified command structure to coordinate the many agencies that respond to an event.[8] This system aims to optimize communication and coordination. New York City has implemented not only the ICS but also has created innovative solutions and increased community involvement through the Office of Emergency Management (OEM).[9]

The ICS, although critically important, may be challenging for smaller communities to develop and implement.[5,6] Decentralized planning places a large burden on communities that frequently do not have the requisite resources for disaster planning and response. Optimal preparedness for disasters requires a coordinated response of diverse agencies that may not routinely work together. Conflicts regarding command structure, roles, relationships, and authority are common. Overcoming such difficulties is essential for rapid, safe, and coordinated responses among fire, police, and emergency medical services. The optimal emergency coordinated response requires not only the resources of OEM but also civilian, volunteer, and private organizations.

Regional disaster drills and large-scale exercises are believed to be important for the smooth operation of these systems when a real disaster strikes; however, there is no evidence to support this claim. Some communities have increased the fidelity of their simulation drills by mandating multiagency and private business involvement. Despite these important steps, 1 limitation of the drills is that they cannot fully reproduce real-world dynamics. As a complement to disaster drills, we propose that mass gatherings and public events are an ideal venue to implement the ICS to help work through the dynamics of a large-scale organizational response.

We believe that multiagency engagement in a mass-gathering scenario provides an opportunity to practice

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high-quality, accurate communication. This opportunity, which inherently is less chaotic than a true disaster, allows participants the chance to communicate with accuracy, to ensure that their communications are representative of their message, and to identify problems in the chain of communication. Unfortunately, more communication does not guarantee effective message delivery. Through critical analysis of the communication at mass gatherings, however, we believe that these events can improve interagency coordination and thereby have a positive impact on response.

In this article, we specifically describe the use of ICS for the 2008 and 2009 Bank of America Chicago Marathon, one of the largest marathons in the world. Multiple private and public agencies come together, many of the same agencies that would be required to respond to a disaster. Police, fire, city and private ambulances, hospitals, the Red Cross, the Department of Public Health, and numerous other organizations (Table 1) work with private organizers to manage this mass gathering with disaster potential that involves 1.5 million spectators and athletes spread across a wide geographic area. There are predictable numbers of people requiring medical attention, ranging from 2% to 10% depending on conditions.[10]

To optimize communication and coordination, ICS guidelines were used. We recognize that these drills cannot, and should not, replace the disaster paradigm of training, but we believe that the communication and network development achieved complements the ongoing efforts of the disaster community. We review the history and rationale of the ICS and then detail the structure, process, and implementation of the 2008 and 2009 Chicago Marathon, with a focus on communication and report recommendations and lessons learned that may benefit other communities.

UNDERSTANDING THE FEDERAL GUIDELINES

To address the numerous challenges of disasters, the Department of Homeland Security developed the National Incident Management System (NIMS) to provide a "consistent nationwide approach for federal, state, tribal and local governments to work together to prepare for, prevent, respond to and recover from domestic incidents, regardless of cause, size or complexity."[8] The result highlighted the idea of an ICS structure, a "management system designed to enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures and communication operating within a common organizational structure."[11]

The key tenets of ICS rely upon a common terminology and a modular, top-down organizational structure. Emphasis is placed on having a predesignated chain of command with 1 incident commander to maintain a line of authority and a unified command (UC). The UC allows agencies with "different legal, geographic and functional authorities and responsibilities to work together without affecting individual agency responsibility, authority or accountability."[11] Within this structure there is an emphasis on managing resources, information, and communication. This structure aims to minimize conflicts in resource utilization and communications that have been recognized as weaknesses in disaster response.[1]

TABLE 1

Groups and Agencies Responsible for Creating Incident Action Plans and Groups Present in the Unified Command Center on Race Day

Event Groups (Bank of America)	City Agencies	Other Agencies
Event incident commander	OEMC	MABAS
Event medical director	CFD	American Red Cross
Event private EMS	Chicago Police Department	Private ambulance companies
Event weather update team	Mayor's Office of Special Events	Community volunteers
Event medical information team	Department of Health	
Event course updates	Chicago Transit Authority	
Event course command	Traffic Management	
Event runner dropout	Streets and Sanitation	
	Chicago Park Districts	

CFD, Chicago Fire Department; EMS, emergency medical services; MABAS, Mutual Aid Box Ambulance System; OEMC, Office of Emergency Management and Communication.

SHARED MENTAL MODEL

As mentioned above, responding to a disaster requires the smooth integration and coordination of multiple private and government agencies. Each of these agencies brings with it its own expertise, culture, biases, and infrastructure. Members of a single agency may have worked together in the past; however, unlike "expert teams" such as flight crews, most members of disaster leadership will not have worked together previously.[1] Research into teamwork has identified the lack of a shared mental model (SMM) as 1 obstacle to effective interagency coordination.[12] An SMM is "thought to provide team members with a common understanding of who is responsible for what task and what information requirements are."[13] The SMM allows every team member or group to anticipate the needs of the other members of the team and work in sync.

Communication research further demonstrates that preplanning fosters greater SMMs and improved efficiency in task completion.[13] This concept of the SMM has been examined in multiple settings ranging from aircraft carrier and flight crews to software developers. Across these fields, it has been noted that a strong SMM allows teams to have highly coordinated actions with little communication because the requisite steps are already ingrained. In contrast, a weak SMM leads to asyn-

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chrony and, as a result, efforts are duplicated and productivity is lost.

Local and regional disaster drills are a first step toward developing an SMM, as is development of a plan for an ICS; however, we believe that to be truly effective, a simulation should involve all of the members of the disaster response. This disaster response matrix includes not only government agencies and appointed officials but also extends to the health care agencies, communications networks, journalists, and community volunteers.[6] Leveraging a large-scale community event to implement an ICS structure and develop an SMM is a unique opportunity to include nongovernmental agencies that are difficult to enlist in a standard disaster drill.

Another benefit of implementing ICS during a community event is that the event is not a drill. Drills are important, but participants know inherently that consequences and casualties are theoretical. In Chicago, ICS-like structures have become standard, used in events small and large, from the annual Magnificent Mile Lights Festival to the 2008 Obama election night presidential rally. We believe that using ICS promotes event safety, but that it also enables refinement of the ICS process. The engagement is real, and the adequacy of actions, interactions, and performance has consequences. Although ICS-like structures have been used for sporting events in other cities, to our knowledge a full-scale, NIMS-compliant ICS has not been used in a large sporting event. The Chicago Marathon implemented NIMS-compliant ICS for the first time at the 2008 marathon.

APPLYING FEDERAL GUIDELINES

Organizers of the Chicago Marathon prepare annually for 45 000 participants and 1.5 million spectators.[14] An event of this size, even if executed well, requires many resources and has the potential to become a complex incident, requiring national resources. Taking this background into account, the Chicago Marathon organizers prepared by requiring all of the key officials of the race to be trained in NIMS specifically for the purpose of the marathon. These key officials included anyone in a decision-making capacity or command authority within police, fire, each city agency, and all private companies (Table 1), as well as the entire Chicago Event Management team (including the race director and the medical director). Incident action plans (IAP) for the marathon were created to detail how the event would be run and to provide a plan for multiple contingencies. Individual IAPs from the agencies listed in Table 1 were reviewed by the Office of Emergency Management and Communication (OEMC) and merged into a master IAP.

The primary goal of creating the master IAP was to specify the working details and emergency plans for the marathon. Beyond achieving a well-run event, the secondary gains realized from implementing the ICS structure were 2-fold. First, the key agencies involved were now familiar with the process of creating an IAP. Familiarity with the process would make future creation and implementation of IAPs possible with greater ease and efficiency. Second, through the creation of the IAPs, each group had sufficient time to research their resources and discuss available options with the other agencies involved. These groups completed the process with a more thorough understanding of the resources available to them, as well as the time, cost, and manpower to activate each of the resources and the impact of their utilization on the other agencies.

OPTIMIZING COMMUNICATION

As discussed above, communication failures have led to problems. In our planning for the Chicago Marathon, we sought to address these communication issues by 2 methods. First, we aimed to diversify the means of communication. Second, we enhanced the physical proximity of key people and agencies to minimize confusion and interference. Below we provide examples of each of these strategies.

Diversifying Means of Communication

During the 2007 Chicago Marathon, a weather disaster required a high level of communication to maintain the safety of the participants. The temperature rose to 88°F with high humidity; the marathon was stopped after 3.5 hours in compliance with the American College of Sports Medicine guidelines.[15] With this event as a reference point, the 2008 and 2009 IAPs included additional means to optimize communication with the runners and spectators. An event alert system was created, derived from similar event-rating systems, to notify the runners and spectators of the conditions.

In 2007, when the alert level was elevated, there was difficulty with runners responding to this communication. The 2008 IAP focused on improving communication. When the alert level was raised in 2008, the change was communicated through the UC center and a cascade of actions was triggered. The color-coded flags on the course were changed, loudspeaker broadcast announcements were made, and the operations and medical aid station captains were directly notified. This triggered preplanned resources to be dispersed, including opening fire hydrants to cool runners and mobilizing fluid resource trucks, cooling buses, and more ambulances. All of the activity was coordinated through the UC center.

Police helicopters used video to trace the runners through the course, and their pace was compared to expected times to catch early signs of heat exhaustion and slowing of the race. These videos were fed directly into the UC tent, as were the live television feeds of city street cameras. Police and traffic management used radio communication to control the course reopening. All of the key personnel carried handheld radios in case of a loss of cellular telephone communication. The layers of communication methods used allowed an unanticipated malfunction with 1 mode of communication to be absorbed by the alternative methods in place without any noticeable disruption (Table 2).

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On the day of the marathon, the UC tent was the nerve center of operations for the marathon. The UC, like the event, was preplanned in great detail to optimize communication by optimizing physical proximities. For example, flat-screen televisions broadcast live television coverage of the marathon and streaming video from police cameras, up-to-the-minute weather conditions, global positioning system ambulance tracking, and helicopter tracking of the marathoners.

Physical Proximity

Seating arrangements in the tent were predesignated to facilitate information flow between agencies (Figure). For example, should the private ambulance company (Superior) be unable to cover a response, they were sitting adjacent to the Chicago Fire Department (CFD) and could request the nearest ambulance without additional calls or duplicating efforts. Evidence

TABLE 2

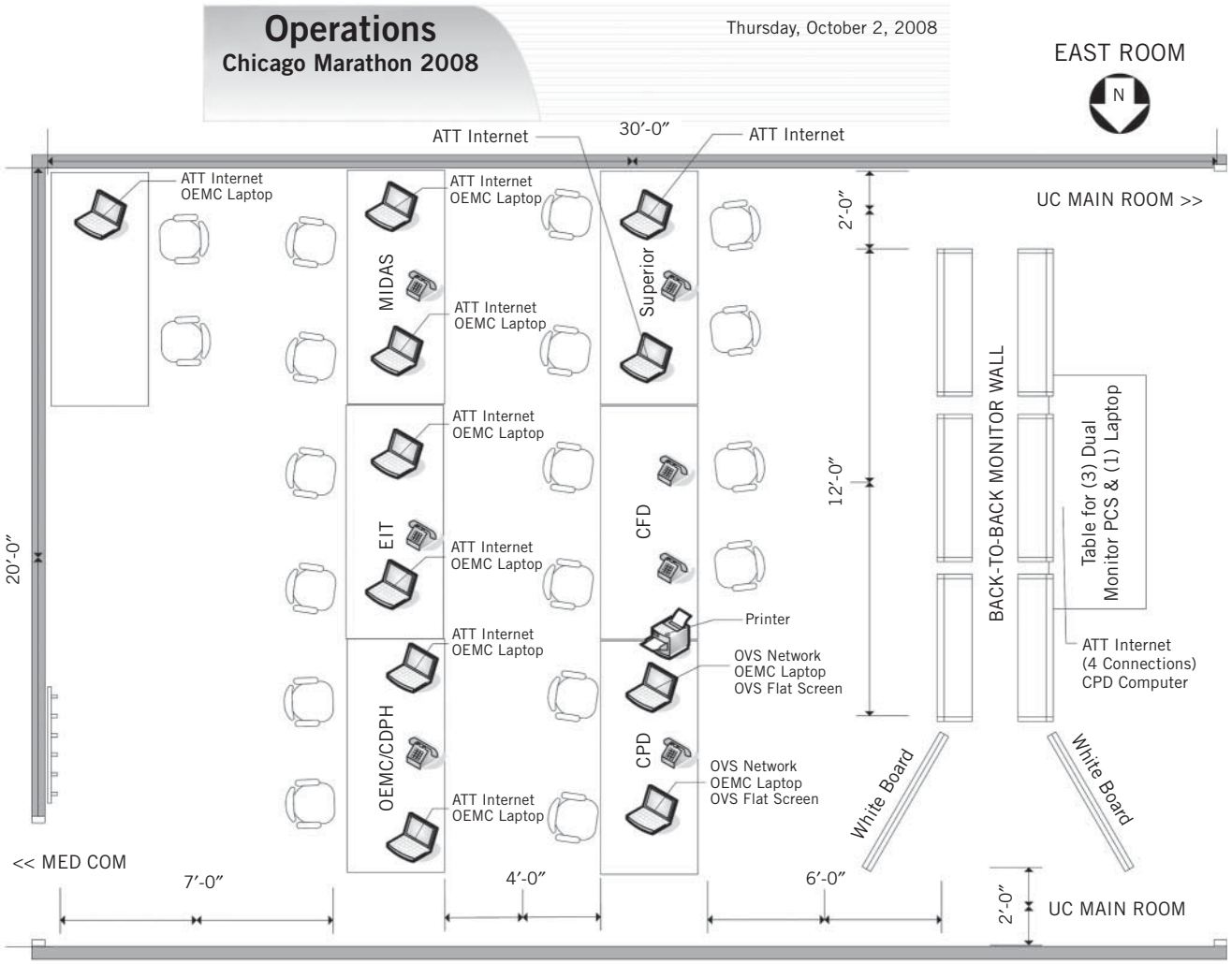
Communication Modalities Used by Personnel on Race Day

Closed circuit video feed from helicopter
Closed circuit video feed from traffic lights
Live television news coverage
Live weather feed
GPS ambulance tracking
Police/fire radio communications
Loudspeaker broadcasts on course
Cellular telephones
Handheld radios
Flags
Signage
Citizens with cellular telephones (9-1-1)

GPS = global positioning system.

FIGURE

Operations tent seating.



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intelligence tracking sat behind CFD monitoring all of the non–marathon-related police activity and provided CFD with information about resource demands to make the ambulance distribution decisions.

An issue that often arises during disaster response is the question of which agency takes the lead in different scenarios (eg, police, fire). The IAPs anticipated these situations in advance. Having police and fire act under the auspices of the OEMC and having predefined roles and leaders in close communication mitigated any rivalry in the command structure.

We believe that planning to this level of detail aids in both event management and disaster preparation. Considering proximities and adjacencies of the agencies and workers is the level of detail required to effectively "practice" for a disaster scenario. When a mass-casualty event occurs, this structure allows effective and immediate intercommunication; one needs to know immediately whom to contact. Meticulous advance planning prepares for the unpredictability of a disaster event by precoordinating the response structures, responsibility, and mechanisms for effective communication.

The UC structure enabled flexibility and adaptability. On the morning of the 2009 marathon, 1 of the major local hospitals was placed on ambulance diversion because of the lack of bed availability. The communication network and predesigned ambulance dispersal plans in the IAP allowed the emergency medical services providers to accommodate this last-minute change without hesitation. With effective coordination and communication, patient transports to hospitals were optimally disbursed to prevent overwhelming any individual local hospital. A total of 458 patients were cared for in the medical tent, 85 patients were transported to local hospitals, and there were no fatalities in 2008.

COMPARISON TO 2007

In comparison to 2007, the planning used in 2008 and 2009 was more robust. In 2006 and 2007, a command center concept was used. There was a unified approach by police and fire; however, it was not planned to the level of detail of 2008 and 2009. Separate agency IAPs did not exist. There was no diagram of seating arrangements in the management tent because the proximities and adjacencies of agencies were not planned to that level of detail. Participants did not wear vests to denote their roles. There was no coordination of the technology and routes of information transfer. As a result, different groups of people were privy to different pieces of information.

As described above, in 2007, the temperature on the day of the race rose to 88°F and the race was canceled. The decision to cancel was made in a timely fashion, and the communication was disbursed to people on the course in a timely fashion; however, the meaning of "cancel the race" had not been predefined and clarified. Thus, the individual police officer, 10 miles removed from the command center, did not know whether the race being canceled meant he needed to stop runners, he could allow them to walk, or he needed to clear all of the bystanders from the course. The system used in 2008 and 2009 worked to centralize both information and decision making and thus improved coordinated responses.

LIMITATIONS

The primary limitation of our description above is that mass gatherings with disaster potential are not, in fact, disasters. Although a marathon or similar gathering places a high demand on the infrastructure of a city, it is a planned event. The coordinators have the luxury of months of meticulous planning and preparation. This is inherently different from a disaster, which is unplanned and places an excess demand on a city's infrastructure. This unplanned excess demand (eg, loss of electricity, road or structural damage, multiple victims) adds new challenges to each disaster scenario. These conditions may draw new players into the command structure who were not previously anticipated or involved in mass-gathering events.

Although the marathon is limited in that it is not a disaster, it does provide an opportunity to build an SMM and use the event to improve interagency coordination. Most aspects of the marathon day are planned, but some elements are unpredictable. The weather is unknown; the demand that concomitant city events will place on other agencies is unknown. These unplanned circumstances seem small and manageable when compared with the unforeseen circumstances that must be considered in a true disaster, but working through the response process for these unplanned circumstances is a valuable exercise nonetheless. This exercise enables the same leaders who will respond to the larger crises of lost power or fallen buildings to gain real-world experience in coordinating efforts on smaller tasks. Although this exercise will never fully replace the importance of traditional disaster preparation, it does create an environment to practice a complex system response and provide an important real-world element of cooperation.

Finally, our description of the implementation of NIMS-compliant ICS shows significant success; however, our analysis is limited by the lack of objective endpoints inherent in evaluating such a process. Further objective analysis of the usefulness of implementing a NIMS-compliant ICS system for mass gatherings with disaster potential is needed. Prospectively defining and measuring metrics of frequency of use of communication networks is 1 potential metric. Evaluating the number of patients transported and their outcomes or looking at provider opinions is another potential area of future research. In addition, performing a failure modes effect analysis on the events with a detailed evaluation of the severity, frequency, and detection of failures of communication could provide important insight into the benefits and limitations of this structure.

CONCLUSIONS

Recommendations of the Federal Emergency Management Agency and NIMS demonstrate the commitment to successful disaster management but are challenging for communities

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to ensure. We believe that a major community event is a logical scenario in which to apply this organizational structure, bringing together all of the relevant agencies under a disaster-like command structure. Through the utilization of ICS, improvements in coordination and communication can be achieved, while simultaneously preparing for unexpected events. We are hopeful that coming together to exercise disaster preparedness will make the community stronger and better prepared for a true disaster.

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