Developing a Hospital Disaster Preparedness Plan for Mass Casualty Incidents: Lessons Learned From the Downtown Beirut Bombing

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ABSTRACT

Mass casualty incidents (MCIs) are becoming more frequent worldwide, especially in the Middle East where violence in Syria has spilled over to many neighboring countries. Lebanon lacks a coordinated prehospital response system to deal with MCIs; therefore, hospital preparedness plans are essential to deal with the surge of casualties. This report describes our experience in dealing with an MCI involving a car bomb in an urban area of downtown Beirut, Lebanon. It uses general response principles to propose a simplified response model for hospitals to use during MCIs. A summary of the debriefings following the event was developed and an analysis was performed with the aim of modifying our hospital's existing disaster preparedness plan. Casualties' arrival to our emergency department (ED), the performance of our hospital staff during the event, communication, and the coordination of resources, in addition to the response of the different departments, were examined. In dealing with MCIs, hospital plans should focus on triage area, patient registration and tracking, communication, resource coordination, essential staff functions, as well as on security issues and crowd control. Hospitals in other countries that lack a coordinated prehospital disaster response system can use the principles described here to improve their hospital's resilience and response to MCIs. (*Disaster Med Public Health Preparedness*. 2018;12:379-385)

Key Words: mass casualty event, disaster preparedness, disaster response, hospital

Mass casualty incidents (MCIs) are becoming more frequent in the world, more specifically in the Middle East where the war in Syria has spilled over to neighboring countries like Lebanon.[1] The Global Terrorism Database has been tracking an increase in the incidence of terrorist attacks, with the Middle East and South Asia contributing the most to this increase. It has also been noted that terrorist bombings in the Middle East cause 6 times more deaths and 12 times more casualties than in other parts of the world.[1] Within the last 3 years, 6 large explosions from car bombs took place in the capital city of Beirut and in Tripoli, the second largest city in Lebanon, resulting in a total of more than 94 killed and 860 injured.

The Emergency Medical Services (EMS) system in Beirut is volunteer based, with several EMS agencies responding independently to emergency calls.[2,3] MCI casualties usually bypass the EMS transport and present by private transport to nearby hospitals, with the EMS-transported casualties being frequently sent to the same hospitals. As a result, hospitals near the MCI site are often flooded with patients, whereas more distant hospitals receive very few casualties.

A national EMS plan and disaster response framework is lacking despite several governmental initiatives such as the Emergency and Disaster Preparedness workshops that were conducted in 2013 by the Ministry of Public Health in Lebanon, in collaboration with the World Health Organization, in response to the unusual chemical attacks in neighboring Syria.

Emergency and disaster preparedness plans for hospitals have therefore been mostly organization-led initiatives.

In this report, we describe our hospital's response to an MCI event (car bomb explosion) in an urban setting using general response principles, and propose a model for hospitals to apply in similar settings where a centralized or coordinated EMS system is lacking. It aims to highlight aspects of a contingency plan that are necessary when a facility is expected to deal with an MCI in isolation, without its ability to rely on the EMS for a controlled influx or diversion of patients, aspects typically employed in settings on which previous literature on MCI planning have been published.

METHODS

Setting

The American University of Beirut Medical Center (AUBMC) is the largest academic tertiary-care center in Beirut with 49,000 emergency department (ED)

visits per year. AUBMC has its own emergency preparedness plan and conducts yearly drills in compliance with accreditation standards set by the Joint Commission International. Over the past 2 years, and with the increasing frequency of MCIs, several hospital-wide drills and modifications to the existing plan were carried out to ensure better coordination, communication, and availability of resources during an MCI response. This plan was tested on December 27, 2013, when a car bomb exploded at 09:45 AM at 1.4 km (0.87 miles) from AUBMC. A total of 32 patients (including 3 dead) were received by AUBMC within 2 hours of the explosion.

The Event

A car bomb targeting a previous minister of finance exploded at 9:45 AM. Emergency services rushed to the scene. The first casualty arrived to AUBMC 8 minutes after the explosion, at 9:53 AM, and was designated as red or immediate as per the Simple Triage and Rapid Treatment (START) Modified Careflight Triage algorithm[4,5] or T1 (North Atlantic Treaty Organization Triage System)[6] category. The disaster plan was activated at 10:04 AM, initially at Level 2 (notifying essential staff); however, it was upgraded to Level 1 (activating all staff) after ~10 minutes. A total of 16 casualties had arrived within the first 30 minutes after the blast. Most casualties were received within the first hour (22 casualties), with the rest arriving within the second hour of the event (10 casualties).

Description of the Plan

Activation of the plan relies on the presenting number of patients to assess the need to activate a corresponding level of response. The lowest level of activation is the Code D alert, whereby essential staff are notified to be on standby without the need to present to the hospital. Code D-Level 2 initiates a higher level of action, with all essential staff reporting to their corresponding departments including the ED. Code D-Level 1 initiates the highest level of response with all active staff reporting to their corresponding departments. The level of activation is based on the number and rate of patients presenting to the ED after an external MCI. The same levels apply for internal MCIs. Incident command staff and key positions are well described in the plan. The person in charge of activating the Code D plan is the Hospital Director, or—in his absence—the Chief of Staff, who is assigned the role of the incident commander. Essential staff and their key functions within and outside the ED are also well defined, as are the responsibilities of response leaders, sections, and team leaders (medical and nursing) of predesignated color-coded areas. Activation of the plan is relayed to hospital staff through announcement over the public address system (for Code D-Levels 1 and 2) and SMS. Two-way radios are available for use when the disaster plan is activated. Radios are distributed to designated key personnel from different departments. During the response, radio communication is minimized and consists of relaying essential information for coordination of response and resources. Cellular networks have a history of failing during MCI events,[7] and thus cannot be relied upon as part of a disaster plan. Information relayed from different sources including responding EMS agencies and news agencies is key to decide on activation.

Upon activation of the plan, ready charts with preregistered Mass Casualty Record (MCR) numbers linked to case numbers are promptly assigned to patients in the triage area. MCRs are considered unique identifiers and are used throughout the disaster response phase to identify and track casualties as well as for internal communication of information regarding these casualties. Patient-access officers are deployed to the ED upon activation of the plan, attempt to identify and record the true demographics of casualties, including their names, and maintain a log of active MCRs linked to patient names. This list is continuously updated and relayed to the command center in a timely manner. Merging of patient's names and MCRs is carried out at the end, during the recovery phase. Paper-based charts with minimal documentation are used instead of the usual electronic charting system during MCIs. Patients are assigned to different ED sections based on triage categories or assigned colors. Different sections of the ED are color-coded; for example, the trauma rooms are the "Red" areas, where immediate or "Red" patients are examined and where life-saving interventions are carried out. Each section has a team leader and is staffed by physicians from different specialties with different roles.[8] Section leaders track patients in the different sections using tracking lists.

The plan includes setting up a dedicated triage area immediately outside the ED at the ambulance ramp, which is staffed by a triage team including an ED physician, to color-tag patients upon arrival and direct them to the color-coded area based on their acuity category. The ED uses the Emergency Severity Index (ESI) scoring system for triage of emergency patients during regular daily operations. The ESI is an algorithm used in routine triage, which assigns patients a score from 1 (most acute) to 5 (least acute) according to the need for immediate medical attention and based on estimated required resources.[9] For MCIs, however, the plan adopts the Careflight triage system with minor modifications to include triage of pediatric patients (Figure 1).[10] The Careflight triage system has been shown to be equivalent to other MCI triage systems such as the Triage Sieve methodology and the START algorithm.[4,5] These systems are widely used by EMS agencies and providers for triage of mass casualties on scene. We had chosen the Careflight system as it was the simplest and quickest to apply because of the time limitation associated with a large influx of casualties to the ED triage area during an MCI.[10] All ED staff (physicians and nurses) were trained on this triage system.

During an MCI, the ED usually receives a large influx of people such as family members, medical and non-medical volunteers, as well as members of the media.[11] Upon disaster plan activation, the protection officers secure all ED access points. Entry is

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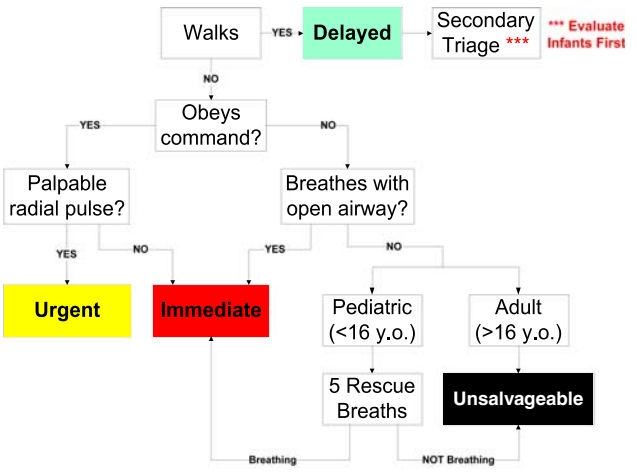
FIGURE 1

Modified Careflight Triage System.



limited to hospital staff with proper authorization. Elevators are manned and controlled to prioritize patient flow (radiology and OR). Help from security agencies is requested for crowd control outside the ED, as failure to control entry and exit points can cause disruption within the department.[12] The resultant overcrowding of the ED by unauthorized personnel can disrupt patient treatment and pose a safety risk (such as the possibility of a secondary attack).[6] Security and information officers also inform families of casualties to assemble in a designated area away from the ED (in the hospital's main entrance) where social services staff can help provide psychological support for families of victims.

The ED usually has a limited amount of time to prepare for the first wave of casualties, especially in urban disasters, which could possibly overwhelm the department's resources quickly.[12] Clearing the ED of existing patients is a priority upon MCI response activation to improve surge capacity (the ability to manage a sudden influx of patients) and plan for the influx of patients.[13] Patients awaiting admissions to regular beds can be sent to corresponding floors. The recovery room is used as a transition area for patients boarding in the ED for a critical-care bed. Cold cases, defined as low-acuity cases (ESI 4 or 5), and other cases (ESI 3) planned for possible discharge pending additional results, are discharged and instructed to follow up later. Regular activities of all essential departments are put on hold to prioritize handling ED casualties' throughput. Scheduled elective surgeries are cancelled and the operating rooms are readied to receive casualties needing emergency surgeries. The blood bank, the radiology department and the laboratory services institute measures to continue operating in a timely manner and to handle the needs of casualties. All hospital departments have ongoing, mandatory disaster training programs.

An inventory of equipment, medications, and supplies is constantly maintained by the hospital for MCIs. Stockpiles are readily available for deployment when needed. During an MCI response, recorders perform continuous monitoring of the availability of needed supplies. The ED director and nurse manager perform regular checks on different ED sections to assess the need for additional resources. Needs are immediately relayed to the command center.

Once the MCI response is terminated, the plan calls for actions to resume normal operations as soon as possible. During the recovery phase, the plan makes provision for documentation, record preservation, record merging (MCR with actual identification of patients), resupply of essential equipment and medications, and cleanup. Incident stress debriefing is carried out immediately after the event and again at a later stage.

Debriefings

Several debriefings were conducted after the event. The initial debriefing was carried out immediately after the incident for the ED attendants and nursing staff who took part in the MCI. Within a week, however, the hospital director, who is the head of central command, called for a debriefing that included all heads of the major stakeholder units including nursing, radiology, ED, surgery, laboratory, security, IT, and safety leaderships to discuss the performance of the MCI response plan. A summary of the debriefings was prepared, and it was used to modify the plan accordingly. The different elements of the plan including activation, escalation of response based on casualties' arrival, the overall effectiveness of the response, the roles and functions of staff during the event, the operations of other departments, communications, and coordination of resources were also evaluated.

RESULTS

The event took place between 2 major holidays, a period when several essential staff were on vacation. The ED staff were familiar with the plan and requested its activation on the basis of their initial assessment of the evolving situation. Announcement of "Code D-Level 2" was broadcast on the public address system at 10:04 AM, followed by "Code D-Level 1" at 10:14 AM. The announcement of the disaster plan activation through SMS experienced delays. The internal phone system was used as the main communication system as this was unaffected by the external MCI. Internet-based Wi-Fi applications such as "WhatsApp" were also reliable and functional during the event. Radios were underutilized during this event. The main ED physicians and charge nurses transitioned from clinical care to a supervisory role. This was very helpful in ensuring that the different ED sections were properly staffed and had the essential resources.

The first wave of patients reached the ED 8 minutes after the explosion. The disaster plan was not activated at first, and

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most patients bypassed triage directly into the trauma (red) area, which resulted in an overcrowding of the high-acuity areas. This was compounded by the over-triaging of patients, as they had undergone triage using the ESI (scale of 1-5) system at bedside before the activation of the plan (8 patients), with scores of 1 (13 patients), 2 (4 patients), or 3 (17 patients), and had also been assigned to high-acuity areas. During the event, however, a switch to the modified Careflight algorithm was implemented. This switch takes effect immediately when the MCI response plan is activated and upon formation of the MCI triage team. A slight delay in the activation of the response plan during this event caused a delay in the switch to the Careflight triage algorithm. Once implemented the algorithm worked smoothly.

The rate and number of patients presenting during the initial 20 minutes was higher than expected because the site of the blast was in close proximity to the hospital. By the time the plan was activated, the ED was already overflowing with a larger than expected number of casualties, and following the plan required catching up to manage existing patients. Some patients who were overtriaged into high-acuity areas were ultimately downgraded to lower-acuity sections to decongest the higher-acuity areas. Several physicians in each section were involved in the care of each patient and there was a loss of both coordination and continuity of care when patients moved from one section to another. As the activation of the plan was delayed, the registration officers also initially attempted to register patients through the regular ED registration mechanism, which is carried out at bedside. With the increasing numbers of casualties, ready charts were distributed and the MCRs were adopted as unique identifiers. There was, however, a constant need to gather accurate names of patients to constantly update the families of victims, authorities, and, later on, the media. The hospital information system continued to operate normally during this external MCI.

Upon activation of the MCI response plan, priority was given to empty the ED of existing patients. Close coordination with critical-care administering physicians allowed their taking over of the care of ED critical-care boarders. The discharging of cold cases was also carried out, and regular admissions were sent to their corresponding floors. All essential departments implemented MCI operating procedures and coordinated closely with the command center to cope with the surge in the number of patients and their needs. The surgery department, blood bank, and the radiology department sent staff to the ED to help coordinate needs and flow of patients to the radiology department and operating rooms. Stockpiles of equipment, medications, and supplies were deployed to the ED with some delay. Staff responding from other departments reported difficulty accessing essential equipment during the initial response phase. A lack of familiarity with available stockpiles was noted as a deficiency in the system. Medication carts were manned by pharmacists and stationed in strategic locations in the ED.

The media was the main source of information on the size of the MCI. Direct communication was established with responding EMS agencies to ensure up-to-date information and feedback on patient transport and distribution of casualties. Media personnel assembled near the ED entrance for live interviews of victims, family of victims, and physicians not designated as spokespersons by the hospital. Reports on the shortcomings of the ED lockdown by security personnel emerged the next day in the media concerning victims' families not being allowed to see their loved ones as they were being treated.

Once the disaster response plan was deactivated, actions to resume normal operations were taken. Cleanup of ED clinical areas, fatality management, resupply of essential equipment, and restocking of ED medications were performed. A challenging aspect was asking non-ED staff to return to their corresponding departments. The ED started receiving regular patients 15 minutes after the disaster response plan was deactivated. Debriefing was performed 1 hour after the event and involved staff from the ED who participated in the response. This was followed a week later by a larger meeting with heads of the departments to discuss the performance of the MCI response plan. Some patients, however, were discharged with little or no documentation carried out, and thus proper record preservation was a challenge.

DISCUSSION

This report described how a hospital plan performed during a live event, as well as the challenges faced and lessons learned (Table 1) using a framework for plan evaluation and focusing on the different elements of that response. These proposed steps could be applied in any ED setting or in hospital planning to set up a robust disaster response plan irrespective of how developed the EMS system at the location of the hospital or ED is.

Roles and responsibilities should be well defined in the response plan. Physicians staffing the ED need to be able to transition to a supervisory role to oversee operations and assess needs for additional resources and plan escalation.[8] The activation of additional resources can take at least 20-30 minutes during daytime and longer during nights, weekends, and holidays. One-to-one assignment of physicians to victims may enhance the quality of care for patients; however, this will only be possible if the number of physicians available is sufficient.[14] Also, the assignment of specific roles to some physicians or nurses might be beneficial; in the 1987 Enniskellen bombing, 1 physician was tasked with ensuring that all of the ED patients were pain free.[15]

The geographic location of the MCI has a major impact on the plan activation process. The number of potential victims arriving to the ED is highly dependent on the proximity of the event. Similarly, geographic location impacts the approximate

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TABLE 1

Summary of Essential Actions Taken and Lessons Learned

Events and Challenges	Lessons Learned
Large influx of patients before plan activation	Activation of a plan based on geographic proximity of the MCI
Ambiguity in personnel roles	Clearly define roles and responsibilities of ED physicians
Overcrowding of high-acuity areas with low-acuity patients when using the ESI scoring system for triage	Prioritizing triage setup during plan activation, and switching to a standardized triage system
Inefficient patient registration	Using unique identifiers numbers to identify patients
Loss of coordination during patient movement from one area to another	Training staff on properly tracking patients using an existing electronic system
Inadequate relay of the disaster code to essential staff	Utilizing multiple methods of communication to essential staff during activation of the plan
Delay in plan activation due to delay in information relay from the EMS agencies	Ensuring adequate communication with EMS and news agencies
Inadequacy of purely paper-based information systems	Using an expansion of the existing IT system
Delay in deployment of medical supplies	Deploying medical supplies upon the activation of the disaster plan and planning for ED stock
Large influx of non-essential personnel to ED	Complete lockdown of hospital access points
Demand from family members checking on condition of patients inside the ED	Designating an area next to the ED entrance for handling enquiries about patient status
Large patient surge to other hospital departments (blood bank, radiology, lab)	Close coordination between the ED and rest of the hospital departments
Managing patient flow inside the ED	Allow only the upgrading of patients to higher-acuity areas
	Tracking with casualty identifiers within the ED (manually or through a scanning system)
Influx of large numbers of non-essential medical personnel	Secure all doors, allowing only authorized essential staff to access the ED
Managing existing patients	Decongesting ED upon activation of plan
Assembly of media personnel at ED entrance	Designating an area outside the ED designated for the media
Definitive patient registration numbers	Coupling of MCR numbers to patients' actual hospital registration numbers during the recovery phase
Resuming normal ED activity	Debriefing, cleanup, waste disposal, and resupply of medical equipment during the recovery phase

Abbreviations: MCI, mass casualty incident; ED, emergency department; ESI, Emergency Severity Index; EMS, emergency medical services; MCR, Mass Casualty Record.

time of arrival of the first wave of victims, as well as the potential for patient distribution to other hospitals by EMS.[16] Using geographic location to activate the response plan was implemented after noticing that there was always a delay in activation related to waiting for the initial surge of patients to assess resources. The geographic area surrounding the hospital was mapped, taking into account the presence of other hospitals and their corresponding EDs' capacity, assessing patterns of patient flow during MCIs, and discussing transport patterns with EMS agencies. This allowed us to plot a radius where an MCI would immediately activate the disaster plan alert before receiving the first wave of casualties.

Communication is key during an MCI response. External communication with responding EMS agencies and local health departments is needed for coordination of response, patients' distribution, and MCI-scene status update.

Internal communication within the hospital can use several methods to notify essential staff. Usage of the overhead public address system, SMS, "WhatsApp", and pagers simultaneously to relay the activation of the plan guarantees its delivery to staff. Ensuring prompt access of essential staff to radios for internal communication is also important. Training of personnel on radio usage is a must. Radios are a good back up for the internal phone system for internal MCIs. Cell-phone services usually fail when used for external communication during an external MCI. The paging system, SMS, and Internet-based communication tools such as "WhatsApp" are quick and good alternatives, as messages can be delivered to a large number of people and as they are usually resistant to the breakdown of cellular phone lines.[7] The lessons learned from our experience concerning the delays in SMS messaging, the limitations of paging systems, and phone line outages during MCIs emphasized the importance of redundant systems of communication when relaying the activation of the disaster plan. Since the event, use of the Internet-based cross-platform messaging application "WhatsApp" has been added into the formal communication protocol: essential hospital staff contact numbers have been compiled into several messaging groups, based on the level of response activation, to inform them simultaneously about the MCI plan activation. It has also since been piloted a few times, and used in 1 live scenario for a subsequent MCI alert. Formal analysis of its effects on response time in comparison with more traditional communication methods has not been undertaken to date. Using the overhead paging system is also very effective for communicating information to all staff within the hospital and for initial mobilization of resources.[17]

A dedicated triage area should be set up first upon plan activation. Setting up a triage area and staffing it with a team

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is one of the recommended first steps during a disaster plan alert or activation. This would ensure a smoother distribution of patients within the ED, and would reduce retriage casualties once inside.[5] MCI triage systems commonly used in the field may be difficult to apply at the ED entrance when several victims are presenting simultaneously because of time constraints and security issues such as crowd control and visitor pressure. Adopting a fast and easy triage system that correlates with the injury severity score and morbidity is, however, recommended as it allows for any trained staff to conduct adequate triage when needed. The modified Careflight system (Figure 1) is one example, and would prevent overloading of high-acuity areas with low-acuity patients.[10]

Patient tracking and easy identification is needed during MCI response. A unique identifier for patients must be utilized to enable tracking and internal communication between the ED and other services. The identifier has to be simple (eg "Casualty 1" or "MCR 1"). Patient identification must take place in the background, and an updated list with patients' names must be maintained for communication with authorities, family members, and media. Several hospitals have found fully computerized systems unsuitable during large MCIs, and thus revert to a paper-based system during such events, much like the model we have implemented.[18] However, a completely paper-based system also has its downfalls, mostly in the area pertaining to manual patient tracking in addition to the lack of staff familiarity with such a system, as it is different from normal operations. Implementing a combination of paper and electronics-based systems, such as using the existing electronic dashboard but with preregistered MCIs, might offer solutions to problems pertaining to the accurate tracking of patients.[17] Another possibility is using automated patient-tracking systems during large MCIs, such as bar codes or radio-frequency identification tags, which have become recently available and have made the use of computerized systems during MCIs more feasible.[6] Using MCR numbers for patients also facilitates communication between the ED and other departments.

During an MCI, the plan must prioritize ED flow and throughput. Clearing the ED during the initial phase of plan activation is required to enhance the surge capacity when needed. Prearrangements with different departments must be in place when the plan is activated. Measures may include sending ICU boarders to prearranged alternative locations (recovery room), coordinating with the critical-care team to take over the care of existing ICU boarders, admitting regular patients to regular floors (hallways if needed), and discharging patients who are waiting for workup and having them return at a later time. Several resources are also needed during MCI, including radiography, which can cause a bottleneck in ED flow.[19] During the 1995 Oklahoma City bombing for example, 45% of 265 ED patients received at least 1 plain radiographic study, whereas in the 1996 Manchester bombing, 50% of 208 victims received at least 1 radiographic study.[20,21] Therefore, stationing a radiology attendant in the ED to help speed up the turnaround time for imaging results is recommended.[16]

Documentation is usually lacking during MCI response. Reducing documentation to essential elements can improve compliance and facilitate throughput. Using a simplified chart for MCI response or facilitating documentation in an existing information system through hybrid paper-electronic systems is possible.[18] During this event, for instance, we noted that medical students not directly involved in patient care assisted the trauma teams by entering electronic orders, particularly for radiology studies, on the electronic dashboard. There is often an influx of providers and volunteers arriving at the ED offering to help in MCIs who may be helpful if employed as scribes, for entering electronic orders, and for performing clinical documentation. Scribes have been shown to improve operational efficiency in day-to-day ED operations.[22] Our experience with the use of medical students as scribes, for ordering diagnostic labs or radiographic imaging, or for transporting blood products, was generally positive, yet their overenthusiasm to offer help meant that they were present in large numbers, causing overcrowding in an already crowded setting. This has warranted a change in the planning policy, which now designates a central location between the ED sections for volunteering students, from where they can be called upon when needed and be better organized. It may also be possible to enhance the efficiency of documentation during an MCI using technologies such as voice recordings, which can later be printed out.[23] Bar coding, for example, has been successfully used to record resuscitation data[24] and to generate an accurate, timed, typewritten record.[25] These code scanners have recently become commercially available and are capable of collecting data that can later be loaded onto a computer after the MCI event, which acts as one alternative to the paper-based system.[26,27]

The plan must predesignate different areas for treatment and nonclinical use in the event of an MCI. Color-coding areas of the ED according to triage categories is useful for patient distribution. This, in addition to assigning teams for different areas, can improve general communication and coordination. Reducing flow between the different ED areas (avoiding downgrading of patients to lower-acuity areas and upgrading only when necessary) can mitigate patient tracking challenges.

ED lockdown to regulate access control and to secure the clinical areas is usually needed. Elevators must also be manned and controlled to allow use prioritization.[16] Ideally, an ED would have a single entry point used for triage and to initiate patient registration and tracking, as multiple triage points can scatter resources and increase disarray.[12] A predesignated area near the ED entrance for handling enquiries from families of victims is also needed. A family support program, when put in place upon activation of the disaster plan, could handle enquiries about victims, provide

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counseling services, and deal with the worried. Another area must also be designated for media personnel, preferably away from the ED entrance, and for families of victims and visitors to assemble for obtaining information about victims without affecting the flow of patients into the ED.[12,17] A predesignated public information liaison or spokesperson can handle media enquiries through frequent press briefings or a press conference. Event-related information needs to be referred to the lead agency that is in charge of the overall incident response.

During the recovery phase, an MCI plan should establish procedures for clearing the ED of non-ED hospital staff to decongest the ED and to identify fatalities in coordination with authorities. More care must be given for proper documentation during and after the MCI to ensure proper record keeping, which would also enable a better assessment of the disaster response later on.

CONCLUSION

In this study, we presented our disaster plan performance during an MCI and the lessons learned in dealing with an explosion in an urban area of a developing country. Hospitals in different systems can use the principles described and tailor them specifically to their settings. Though overall preparedness of the EMS system is ideal for disaster response, hospitals should have in place a comprehensive disaster preparedness plan and work on establishing networks of communications through mutual aid agreements to improve their surge capacity in times of crisis.

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