Management of Conventional Mass Casualty Incidents: Ten Commandments for Hospital Planning

Mauricio Lynn, MD,* Daniel Gurr, MD,† Abdul Memon, MD,† Jennifer Kaliff, RN*

The successful management of mass casualty incidents (MCIs) requires standardization of planning, training, and deployment of response. Recent events in the United States, most importantly the Hurricane season in 2005, demonstrated a lack of a unified response plan at local, regional, state, and federal levels. A standard Israeli protocol for hospital preparedness for conventional MCIs, produced by the Office of Emergency Preparedness of the Israeli Ministry of Health, has been reviewed, modified, adapted, and tested in both drills and actual events at a large university medical center in the United States. Lessons learned from this process are herein presented as the10 most important steps (ie, Commandments) to follow when preparing hospitals to be able to respond to conventional MCIs. The standard Israeli emergency protocols have proved to be universally adaptable, flexible, and designed to be adapted by any healthcare institution, regardless of its size and location.
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Mass casualty events may occur as a result of natural or human-caused disasters or after an act of terrorism. In planning hospital response to a mass casualty incident, it is important to differentiate between two types of disasters: disasters that are insidious and disasters that occur suddenly. Insidious disasters produce victims over a longer span of time, with different peaks in the number and severity of patients presenting to the hospital. For example, radiation accidents will produce a large number of victims who will present days, weeks, months, or years after exposure, depending on the dose of radiation received. The spread of a biological agent or an avian flu pandemic will produce an extremely high number of victims who will present to hospitals during a span of days, if not weeks, depending on the agent and progression of symptoms. In the second type of disaster, there is a sudden surge of unexpected victims resulting from an event such as an explosion or a chemical release. After the sarin gas attack in a Tokyo subway in 1995, a total of 5500 victims were injured and required medical attention at local hospitals immediately after the attack.[1,2] The car bomb that exploded near the American Embassy in Nairobi, Kenya, killed 213 people and simultaneously produced 4044 injured patients, many requiring medical care at local hospitals.[3] The Madrid train bombing in March 2004 produced more than 2000 injured in minutes, overwhelming the city's healthcare facilities.[4] Human homicide bombers can produce hundreds of victims from a single incident. Finally, earthquakes may produce a large number of victims in areas in which the medical facilities are partially or completely destroyed.[5]

Sudden events bring an immediate operational challenge to community healthcare systems, many of which are already operating at or above capacity. Therefore, in disaster preparation, priorities should first be directed toward the development of infrastructures to respond to sudden mass casualty events. This infrastructure can then be easily adapted to manage more insidious events such as biological and radiation incidents.

Since September 11, 2001, billions of disaster preparedness dollars have been spent in the United States for education, training, equipment, supplies, and simulation drills. Despite these expenditures, the emergency response to Hurricane Katrina in 2005 dem-

*From the *Department of Surgery, Divisions of Trauma and Surgical Critical Care and †Department of Emergency Medicine, Jackson Memorial Medical Center, Miller School of Medicine, University of Miami, Miami, Florida*
Address correspondence to Mauricio Lynn, MD, DeWitt Daughtry Family Department of Surgery, Division of Trauma and Surgical Critical Care, Leonard M. Miller School of Medicine, University of Miami, Post Office Box 016960 (D-40), Miami, Florida, 33101.

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onstrated the lack of a unified response plan at local, regional, state, and federal levels. Federal after-action reports documented difficulties in command and control, lack of understanding of protocols, poor communications interoperability, and confusion created by following individual state and local response plans in addition to "relatively new" federal plans.[6] Although adequate funding for disaster response is necessary, the aftermath of Hurricane Katrina demonstrated that funding is not the most important factor in emergency preparedness and response. Rather, there is an urgent need to standardize the response to multiple casualty incidents. The goal of training healthcare professionals and support staff in disaster management is to be able to function as an integrated and unified team throughout the different healthcare facilities in the community. This goal can only be achieved after standardized emergency plans are produced at all levels of medical care, from prehospital protocols to detailed and comprehensive plans for hospital preparedness and deployment.

In the author's experience, the American concept of the "all hazards approach" for disaster preparedness negatively contributes to the already-difficult task of preparing health care systems to cope with disasters. The response plan for a "sudden" mass casualty incident, where the response is activated after the event occurs, has to be different from the response plan for a protracted or insidious mass casualty incident, where the response started before the event reaches full magnitude. The "all hazards approach" is confusing for inexperienced personnel and may require ad-hoc adaptation to a specific and stressful event.

A better approach is the Israeli system for managing frequent mass casualty incidents. For the past 50 years, standard protocols have been implemented at all hospitals in the country. These protocols are revised and modified periodically in accordance with new threats and lessons learned from drills and real events. The Israeli success in managing public health emergencies relies on the production of National standard templates. Each hospital then tailors the standard template according to geographical location, surge capacity, and clinical capabilities. The protocols are specific for conventional, chemical (toxicological), biological, and radiological mass casualty incidents. These protocols are readily adaptable for use elsewhere. The protocol used for response to a conventional mass casualty incident at the University of Miami, Jackson Memorial Hospital is one example. A standard Israeli protocol for hospital preparedness for conventional mass casualty incidents, produced by the Office of Emergency Preparedness of the Israeli Ministry of Health,[7] has been reviewed, modified, adapted, and tested in both drills and actual events. Lessons learned from this process are herein presented as the10 most important steps (Commandments) to follow when preparing hospitals to be able to respond to conventional mass casualty incidents.[8]

DISASTER PLANNING

Successful hospital disaster planning may be accomplished by following ten steps in order.

Step 1: Identification of Hospitals to Be Included in the Disaster Plan

The goal of a local, regional, and statewide disaster plan is to be able to care for the most severely injured first, assuring the highest possible chance for survival. In recognition that not all hospitals have the same capabilities and expertise to manage injured patients, small healthcare facilities that do not have the resources or personnel to care for trauma victims on a 24-hour-a-day basis should not be given the impossible task of caring for severely injured victims of mass casualty incidents. Instead, these hospitals may be used to manage mildly injured patients that require only minimal care. Therefore, the first step in planning for a mass casualty incident is to identify the hospitals that have the clinical expertise to provide care for one severely injured victim, 24 hours a day, including weekends and holidays. Minimal requirements include the immediate availability of a surgeon, an adequate number of critical care-trained nurses, an operating room immediately available for emergency surgery, a functional blood bank, and an intensive care unit to stabilize the patient in the postoperative period, before transfer. It cannot be overemphasized that a hospital lacking the capability to manage one severely injured patient cannot possibly manage multiple patients, regardless of the amount of funding made available!

Once a hospital capable of providing trauma care for a single patient is identified, the next step is to write a detailed and comprehensive plan for surge capacity that will enable the hospital to manage multiple severely injured patients simultaneously.

Step 2: Calculation of the Total Number of Patients and the Maximal Number of Severely Injured to Be Absorbed

This is the starting point of surge capacity planning. The maximal number of victims that any hospital is reasonably capable of absorbing during a mass casualty incident is 20% of the total number of registered beds. As an example, the maximal number of mass

Table 1. Distribution of victims by severity

Severity	% of victims
Severe	20
Moderate	30
Mild	50

casualty incident victims that can be managed in a 1500-bed hospital would be 300 patients. The maximal number of victims for a 500 bed hospital would be 100 patients.

After a conventional mass casualty incident, the distribution of victims by severity that may be expected is described in Table 1 Victims with severe injury are those with an immediate threat to life, including patients presenting with respiratory distress, hemorrhagic shock, or traumatic brain injury. The definition of moderate injury is any threat to limbs or organs, or any condition that could become a threat to life over a few hours. This category includes arterial injuries to the extremities, penetrating eye injury, or fragment (shrapnel) injury to the abdomen with developing peritonitis. All other injuries that will not compromise life or limb if managed later in the course of a mass casualty incident are classified into the mild injury category.

For planning purposes, approximately 50% of all patients will require surgery, but only 10% of the severely injured will require emergency operations for bleeding control or craniotomy.[9,10]

Following these guidelines, if a hospital normally has 800 beds, it should be prepared to manage up to a total of 160 patients (20% of 800), of which 32 will severely injured (20% of 160). Three of the severely injured (10% of 32) will require emergency surgery for either bleeding control or for evacuation of intracranial hematomas.

Step 3: Planning of Critical Personnel

This step describes the number and distribution of critical personnel that will be required to manage a mass casualty incident. The provision of adequate trained personnel is the most important component of surge capacity planning.

Critical medical and support personnel include:

1. Doctors; attending and residents, preferably representing surgical specialties.
2. Nurses; preferably critical care and/or trauma trained.
3. Respiratory therapists (RTs).
4. Escorts (transporters).
5. Clerks.
6. Radiology technicians.
7. Blood bank and laboratory technicians.
8. Administrators.
9. Security guards.

The number of personnel required for initial assessment and management is a function of the maximal predicted number and severity of victims as calculated in step 2. The benchmarks for personnel calculation are shown in Table 2[7,8]:

If we continue the example of an 800-bed hospital, in a disaster, there will be an additional 160 patients, including 32 who are severely injured. In response, management of the severely injured will require 32 doctors, 32 nurses, 6 RTs, 26 escorts, 18 clerks, 6 radiology technicians, and 3 blood bank runners. Three emergency operations are anticipated, for bleeding control or emergency craniotomy. Therefore, at least three surgeons/neurosurgeons, three anesthesiologists, and three operating rooms must be immediately available.

Table 2. Benchmarks for personnel calculation

	Triage	Severe	Moderate	Mild	Mental	Pedi (mild)
Attending/Fellow	1	1	1	1	1	1
Physician/patient ratio		1/1	1/10	1/10	1/3	1/10
Nurse/patient ratio	2 nurses	1/1	1/5	1/5	1/3	1/5
Respiratory therapist	n/a	1/4	n/a	n/a	n/a	n/a
Escort/patient ratio	1/10	1/3	1/10	1/10	1/10	1/10
Clerks/patient ratio	1–2 clerks	1/2	1/5	1/5	1/5	1/5
Radiology technicians	n/a	1/5	1/10	1/10	n/a	1/10
Blood bank runners	n/a	1/10	1/20	n/a	n/a	n/a
Security	5–10 guards	1	1	1	1	1
Administrator on site*	1	1	1	1	1	1

* Helps the Treatment Site Director with administration and logistics.

The operating room should be prepared to perform an additional larger number of emergency operations on short notice.

In addition to the 32 severely injured patients, our hypothetical 800-bed hospital also will manage 128 patients in the moderate- and mild-injury categories. For the acute phase of the will, there will be a total need for approximately 50 physicians, 60 nurses, 8 RTs, 40 escorts, 20 radiology technicians, 40 clerks, 10 blood bank runners, 5 administrators, and 15 security guards. A hospital that cannot meet these minimal standards should not be included in the community disaster plan.

Each hospital should maintain a list of all on-call physicians that are physically in-house at night, on weekends and during holidays. For the management of a conventional mass casualty incident, it is preferable to have attending physicians and residents (where applicable) from surgical specialties such as general surgery, vascular, cardio-thoracic, pediatric surgery, urology, ear, nose and throat (ENT), orthopedics, gynecology, neurosurgery, and maxillo-facial surgery. Anesthesiologists and emergency medicine physicians also are included in this category. The in-house physicians will be called to a predetermined meeting point when the mass casualty plan is activated. Other doctors will be called in from home using "disaster pagers" or other communications systems.

The rate-limiting step to hospital medical response is the number of nurses that can be mustered. Immediate in-house sources of highly trained nurses (in addition to the emergency department and trauma unit) include other intensive care units, including medical, surgical, neurosurgical, pediatric, and cardiac units and the postanesthesia or recovery rooms. The hospital should plan for immediate redistribution of nurses from these units to a predetermined meeting point when the hospital mass casualty plan is activated. Simultaneously, other nurses are called in to substitute for the redistributed nurses.

In terms of other personnel, all in-house RTs, radiology technicians, clerks, security personnel, and escorts should be made available to respond to the mass casualty incident, even if the normal assignment of these personnel is not the emergency department. As with nurses and doctors, off-duty personnel are called in from home. Other in-house personnel including electricians, maintenance workers, environmental workers and administrators may be pressed into service as transporters in a mass casualty incident, until more escorts can be called in. The initial priorities of security personnel should focus on lockdown of the hospital and crowd and media control.

The transportation systems normally used to send blood samples to the laboratory will likely be overwhelmed in a mass casualty incident. The primary function of blood bank runners is to manage blood samples, first by assuring appropriate identification, and then by personally carrying samples to the blood bank. The ordered blood products are then delivered in person by the runners to the location of the patients requiring transfusion. Because no laboratory tests are performed in the early stages of a mass casualty incident except for blood type and cross match, it is imperative that some laboratory technicians become blood bank runners while others continue to perform tests as requested.

The hospital administrator on call is notified to assist with the management of the severely injured, helping the treatment site director and charge nurse, continuing in this capacity until the Hospital Incident Command System is functional.

Step 4: Planning of Equipment and Supplies

After calculating the number of patients expected and the number of medical personnel that will be required, the next step is to calculate requirements for medical equipment and supplies. Critical equipment and supplies required to support a conventional mass casualty incident include ventilators, monitors, trauma carts, intensive care unit carts and blood products.

The number of ventilators required will be a function of the number of severely injured patients anticipated. In our example of an 800-bed hospital anticipating the care of 32 severely injured patients, there will be a requirement for an additional 32 ventilators at one or several points (resuscitation, intensive care unit, postoperative recovery) during the hospital stay. In planning, it is important that the same ventilator remains with the patient, if possible, during all phases of care. Otherwise, the costs of additional ventilators may be prohibitive.

A severely injured patient on a ventilator will require cardiac and pulse oximetry monitoring. Less severely injured patients who are breathing spontaneously do not require pulse oximetry, but approximately 20% of this group may require cardiac monitoring. Therefore, the required number of extra pulse oximeters will equal the anticipated number of severely injured patients, and the number of extra cardiac monitor will equal or exceed 120% of the number of severely injured. Continuing with the example already used, 32 patients in an 800-bed hospital will be expected to be severely injured; creating a need for 32 pulse oximeters and about 40 cardiac monitors.

A number of portable ventilators are commercially available. One design includes pulse oximetry and

promises to include cardiac monitoring in the near future. Such versatile and cost-effective equipment should be considered when planning for mass casualty incidents.

Alternate sites for medical care will be used when managing a mass casualty incident. Extra supplies for standard management of trauma patients should be stored in portable carts (one cart for every 20 patients) to be moved to alternate sites when needed. The total number of carts required is a function of the total number and severity of patients anticipated. Continuing with the example already used, an 800-bed hospital is expected to manage a total of 160 patients. It is assumed that the 32 severe patients will be treated in the emergency department/trauma area where supplies are already present; hence, there is no need to plan for additional supplies for this cohort. There will be a need to plan for the care of the additional 128 patients, who will require 6 supply carts, to be deployed at the alternate treatment sites.

A second cart is designed to house intensive care unit supplies. Planning for a mass casualty incident takes into consideration that NO intensive care unit (ICU) beds will be immediately available. Therefore, alternate ICU sites will need to be created. Opening these extra "ICU beds" is challenging but not impossible. Every stretcher may be temporarily used as an "ICU bed." The other components of an "ICU bed" include the redistributed ICU nurses from step 3, extra ventilators and monitors (above) and extra ICU supplies (Appendix 1). The ICU supplies should be stored in portable carts (each cart intended for 20 patients), which will be moved to alternate sites when needed. The total number of carts is a function of the total number of severe patients expected. Continuing with the example already used, an 800-bed hospital that is expected to manage 32 severe patients will have a surge requirement of approximately 30 ICU beds. This requirement would be met with two ICU carts.

The average amount of blood transfused to the severely injured patients in a MCI is 3 units per patient. Continuing with the example already used, an 800-bed hospital is expected to manage 32 severely injured patients; therefore this specific hospital should have a contingency plan for 100 extra units of blood.

Planning for a mass casualty incident also requires stockpiling of nonmedical equipment and supplies. Extra stretchers are required to temporarily increase the number of beds until definitive hospital beds become available. This process may take hours to accomplish. For planning purposes, the number of stretchers required is 150% of the normal emergency department or trauma bay positions. For example, if the emergency departments normally runs 30 beds, anticipate a planning need for 45 extra stretchers. Extra wheelchairs are required to transport, nonurgent, nonambulating patients. Approximately 50% of mass casualty incident patients will have limb injuries, including open wounds and fractures. These wounds will predominantly involve the lower extremities. The number of wheelchairs required is approximately 70% of the calculated number of patients with mild injuries. Megaphones will be useful at the triage area and at each treatment site. Instant film cameras or digital cameras are necessary for identification of comatose patients and infants. The pictures will be shown to family members who come to the family information center to find injured or missing relatives. Identification vests should be available for all healthcare professionals and support staff. These vests are important for role identification of the working staff as well as for security purposes, to distinguish between hospital workers and others, such as families, media, and law enforcement. Finally, portable two-way radios are of critical importance for communication between the triage area, treatment sites, operating room, family information center and hospital incident command, as well as between other leadership personnel.

Step 5: Planning of Treatment Areas and Stretcher Routes

Each hospital should have a preassigned triage area outside the emergency department. Separate treatment sites should be designated for patients with severe, moderate, and mild injuries; psychiatric trauma; and for pediatric patients. Alternate treatment sites, such as hospital lobbies and corridors should be established for overflow patients from the emergency department or trauma bays. Finally, there should be a predefined area to be used for family information.

The triage area should be a large covered space, planned and laid out to allow arrival and departure of ambulances traveling in one direction without the need for U-turns. The triage area should be large enough to absorb a large number of escorts (transporters) with stretchers and wheelchairs, who will be awaiting the arrival of patients. For hospitals that are also designated trauma centers, the triage area should NOT be at the entrance of the trauma admission area. Otherwise, the trauma admission area will become congested with patients with mild or moderate injuries, who comprise the vast majority of patients in a mass casualty incident. Personnel at the triage area should include a triage officer, one or two nurses, two or three clerks, and sufficient security personnel to control bystanders, families, and the media. The tri-

age officer should be a trauma surgeon or experienced emergency department physician. The nurses will function to provide only extreme emergent medical care such as placement of tourniquets or ventilatory assistance with a bag-valve-mask. No other medical care is performed at the triage area. The clerks will to provide identification bands to arriving patients, take photographs or arriving comatose patients or infants, and assist with the distribution of pre-assembled colored charts. Equipment and supplies located at the triage area should include stretchers and wheelchairs, a megaphone, a Polaroid or digital camera, and color-coded charts (red, yellow, and green) for distribution to patients according to injury severity as determined by the triage physician. Portable two-way radios are required to link the triage site with the hospital Incident Commander, and with the treatment sites, using pre-established medical frequencies.

There should be separate in-hospital treatment sites for severe (or immediate), moderate, and mild (or delayed) patients. Each of the treatment sites should include personnel as described in Table 2, that is, equipment, supplies, megaphone, and wireless radio communication for the site medical Director and charge nurse. A separate mental health site should be located outside of the emergency department or trauma area. Life-threatening pediatric injuries should be managed at the adult severe treatment site, following the routine practiced on a daily basis at most hospitals in the United States. Minor pediatric injuries are treated at the pediatric treatment site.

"Expectant" patient are defined as those who have an extremely poor prognosis with survival unlikely. The management of expectant patients consists of comfort measures, including analgesia and sedation. The predicted number of expectant patients after a conventional mass casualty incident is approximately 1% of the total number of patients arriving at the hospital. Using the previous example, an 800 bed hospital will receive up to 160 patients, of which 1 or 2 will be expectant. It is the opinion of the authors that this small number of patients does not justify opening a separate treatment site for expectant patients. Instead, expectant patients should be managed at the severe treatment site where the nurses have experience with the concept of "comfort measures."

Finally, it is important to designate alternate treatment sites. Alternate sites are defined as areas of the hospital that are not normally used for medical care on a daily basis. Examples include the cafeteria, large central hospital lobbies or parking areas close to hospital entrances.

It is preferable to have one or two large alternate sites instead of multiple small sites, because it is imperative to concentrate, rather than disperse, resources in a mass casualty incident. Important characteristics of an alternate site include separate inflow and outflow pathways to and from the site, adequate security, and availability of electricity and water. The site must be available for immediate activation 24 hours a day, weekends, and holidays. Endoscopy suites and cardiac catheterization laboratories are poor choices for alternate treatment sites, because these areas are difficult to make immediately functional after normal operating hours. Finally, the alternate site must be large enough to absorb most patients from the emergency department, in the event that evacuation of the emergency department becomes necessary.

When setting up triage and alternate treatment sites, there are three main pathways that need to be planned in detail. The pathways must be designed so that stretchers travel in one direction. In addition, there is a need to plan in detail which elevators are to be used in this process and who will have the responsibility for the elevators keys. The three pathways are 1) from the triage area to pre-determined treatment sites in the emergency department or trauma area; 2) from the emergency department or trauma area to alternate treatment sites for the purpose of emptying the emergency department in preparation for arriving patents; and 3) from the emergency department/trauma area to operating rooms, intensive care units, radiology, or hospital wards. To facilitate transfer from the triage area to the appropriate treatment area, lines or arrows colored red, yellow, and green should be painted on the corridor floors. After the patients are triaged and receive a colored chart according to the severity of injury, escorts or any other person that temporarily may function as an escort, may now transport the patients and follow the colored arrows to the treatment sites.

Step 6: Planning of a Family Information Center (FIC)

One of the most important lessons learned from managing many mass casualty incidents in Israel and, more recently, the train bombing in Madrid[4] is the need to have a FIC. When planning for a FIC, it should be anticipated that between three and five family members for each patient will arrive to the hospital. Depending on the size of the hospital, there may be 500 to 2000 people requesting information. For this reason, the FIC should be located in a large area, such as the hospital auditorium or cafeteria. The FIC should have 2 to 5 psychologists to provide support to family members and 5 to 10 social workers to both provide support and to assist with the identifi-

cation process of unknown patients. It is at the FIC that the Polaroid or digital pictures taken in the triage area or ED are shown to families to facilitate patient identification. An ED nurse should be available to provide triage of family members in need of emergency care. The FIC should have public payphones, computers linked to the hospital information database and to other hospitals as applicable, drinks and snacks and restrooms. The location of the FIC should be chosen based on good cell phone signal access.

Step 7: Personnel Call-in Plan

It is assumed that during regular working hours that most of the critical hospital personnel are already at work and available to provide initial management during a mass casualty incident. The need to call in hospital personnel usually occurs at the most inconvenient times: after hours, at night, on weekends, and during holidays. A personnel call-in plan must be devised to facilitate this process. Generally, approximately 30% of the called-in personnel will not be available. Therefore, it is necessary overestimate call-in requirements by 30% above the personnel needs calculated in step 3. The call-in list for attending and resident physicians (where applicable) is not always accurate. Call-in lists for resident physicians require yearly updates as new residents arrive and those who are finished with training leave the hospital. The attending staff also changes annually as new doctors enter practice and others retire. When residents are included in the call-in plan, the plan should include second-year residents and greater. Inclusion of interns should occur only as last resort. The call-in plan should include physicians in surgical and emergency specialties including emergency department physicians, anesthesiologists, and trauma, general, transplant, vascular, cardiothoracic, pediatric, ENT, orthopedic, gynecology, urologic, maxillofacial, and neurosurgeons. In addition, psychiatrists, critical care physicians (including pediatric), radiologists, internists, and family medicine doctors (to treat evacuated medical patients form the ED to alternate sites) are added to this list.

Residents and attending physicians of most specialties will be requested to function as "general doctors" in the early stages of a mass casualty incident, examining and resuscitating patients. At the discretion of the surgeon-in-charge, these physicians may then be requested in other areas such as operating rooms or intensive care units.

Call-in list for nurses will usually be more accurate and easier to maintain. Because nurses work in shifts, the called-in nurses are simply the ones who are presently off shift. It is useful to have a rotation of "disaster pagers" for a number of off-shift nurses or a "smart" communicator system to identify who is off-shift when a disaster occurs. As clerks, escorts, respiratory therapists, laboratory and radiology technicians and security guards also work in shifts, the same principles apply.

When call-in lists are activated, all designated personnel should be called-in at once. In a sudden mass casualty incident, there is no time to "go over lists" and call people separately. Therefore, the chosen call-in system should include technology capable of mass activation of all personnel listed in the system.

The personnel call-in plan must include provision of parking spaces that are available on a 24-hour-a-day basis. After employees are called in, they should report to a designated meeting point. At the meeting point, personnel are assembled, briefings are given, identification vests and portable radios are distributed, and assignments are made. The meeting point should be central and easily accessible, and large enough to accommodate incoming personnel. The meeting point should be equipped with tables and chairs, electrical outlets, and audiovisual equipment to facilitate briefings. Conference rooms are good locations for meeting points. Meeting points for incoming physicians and nurses should be as close as possible to the treatment areas. Meeting points for other support personnel (respiratory therapists, radiology and laboratory technicians, escorts and clerks) can be at their usual working areas.

Step 8: Hospital Emergency Incident Command

The Hospital Emergency Incident Command System (HEICS) is a modification of the standard prehospital Incident Command system (ICS) used by most emergency agencies and forms the basis of hospital command and control during a disaster. Nevertheless, a few questions need to be asked with respect to implementation of HEICS in the acute phase of a sudden MCI. Is there actually a need for a HEICS at this phase? Will there be enough time to activate the HEICS? Will the HEICS be able to control the acute phase? Because of the fact that the control of the acute phase of a sudden mass casualty incident is extremely difficult, updated Israeli protocols recommend that authority be delegated to the directors of the triage area, treatment sites, operating room, intensive care units, and supervisors for the support personnel. These directors must continuously communicate with the overall Incident Commander and with each other for updates on number and severity of patients and for logistical assistance. Several hospitals in Israel have actually "advanced" their Hospital Incident

Command to the emergency department/trauma area.

Step 9: Activation Plan

The activation plan is a preprepared check-list of tasks that need to be performed after notification that a possible mass casualty incident occurred. The surgeon in charge/emergency medicine physician at the time of the event and the charge nurse of the emergency department/trauma area all have similar check-lists. Examples of standard activation check-lists are described in Appendix 2 and 3.

Step 10: Planning of Standard Drills

Disaster drills test the ability of the hospital to function as an integrated and unified unit. The standardization of drills will enable evaluators, accreditation organizations, and the healthcare institution to have basic metrics for success or failure and will facilitate comparison of performances between various hospitals. Standardization of drills will reduce the workload required of each institution for drill preparation and thus may reduce costs. The performance of unannounced, well-designed, realistic and standardized drills that stress the entire system is probably the most important factor for the success of a response plan. Large drills are considered the last and "summarizing" event of a series of smaller modular exercises and drills.

Successful drills have several requirements. There is a need for a standard and detailed plan. A drill cannot be perceived as being detached from reality. Drills should reflect the true clinical capabilities and surge capacity of a hospital, and should focus on events likely to produce a mass casualty incident within the regional catchment area. All personnel involved in the planning or designated for response should have a general understanding of the entire plan, including designated parking locations and meeting points to be utilized when called in from home. This information may be disseminated by lecture. Treatment site directors, head and charge nurses and supervisors of support functions should know the plan in more detail. This is achieved by organizing workshops and tabletop drills for smaller groups. Modular exercises are performed quarterly, to test individual parts of the plan. Modular exercises could include an exercise to measure the time to empty the emergency department and/or trauma area using the preplanned routes, a drill to test the response percentage after massive paging of personnel, a drill to assess the time of arrival of critical personnel or an exercise that tests the opening of alternate treatment sites, including deployment of personnel, equipment and supplies to the sites. After the quarterly modular exercises are completed, it is of critical importance to organize a large drill every year to assess global hospital performance and to test the details of the entire plan.

After-action reviews should be held after the quarterly modular exercises and the annual large drill. Evaluators should be appointed in advance to facilitate this process. When several hospitals in the community are involved, the evaluators for the present drill should be the key personnel of the next hospital to conduct a drill. This enables an unbiased evaluation of performance and allows the next hospital to correct mistakes made by the previous hospital.

SUMMARY

The standard Israeli emergency protocols are versatile and designed to be adapted by any healthcare institution, regardless of its size and location. These protocols were reviewed, modified and tested at a large University Medical Center in America. They have proved to be universally adaptable, flexible and efficient in the management of conventional mass casualty incidents.

APPENDIX:

List of Supplies of ICU Cart (20 patients)

1. Two red emergency crash carts.
2. Two hospital intubation/airway trays.
3. One thoracotomy tray.
4. Two 28-Fr chest tubes.
5. Two 32-Fr chest tubes.
6. Sutures: one box 2.O silk straight needle.
7. Sutures: one box O silk straight and curved needle.
8. Twenty blood pressure cuffs (with continuous noninvasive capability).
9. Twenty monitors with EKG and pulse oximetry.
10. Forty sterile gowns, 20 sterile drapes, sterile gloves (one box each of size 7, 7-1/2, and 8)
11. Nonsterile gloves: two boxes each of small, medium, and large. Caps and masks: one box each.
12. Gauze 4 × 4 (four boxes), 8 × 12 (four boxes), and 2 × 2s (two boxes).
13. Syringes (3, 5, 10, and 20 ml): three boxes each.
14. Nasogastric tubes: 10 each.
15. Suction capabilities for 20 beds, minimum 2 per bedside.

16. Thirty suction canisters with tubing and extensions.
17. Central lines: 8-9.0 Fr -ntroducers, 8- to 20-cm triple lumen catheter.
18. Peripheral IVs: 10- to 20-gauge, 10- to 18-gauge.
19. Fifteen IV start kits.
20. Tape: silk tape, 3-inch and 5-inch, 10 rolls each.
21. Restraints: 15 pairs/
22. IV pumps: 20.
23. IV regulation Gtt tubing: 25 each.
24. IV primary pump tubing: 25 each.
25. Blood tubing: 15 each.
26. Normal saline (0.9%) 1-liter bags, 40 each.
27. Lactated Ringer's, 1-liter bags, 40 each.
28. D5LR 20 bags.
29. D51/2 + 40 mEq KCL/liter, 20 bags each.
30. Lab tubes: ABG syringes 100, tiger tops one box, purple/blue/green tops ones box.
31. Drugs: Morphine 4 mg ×50, morphine 10 mg ×50. midazolam 5 mg ×50, propofol 100-ml bottles ×10, lorzapam 2 mg ×60, Haloperidol (multidose bottle) ×10.
32. Potassium 20 mEq ×10, Potassium 10 mEq ×50.
33. Magnesium 1 g ×10.
34. Nitroglycerine, 25-mg bottles, ×4.
35. Furosemide, 20 mg ×10.
36. Ranitidine, 50 mg ×40.
37. Nicardipine, 50 mg ×2.
38. Labetalol: four bottles.
39. Intubation bronchoscope on standby.
40. Twenty patient charts.
41. Bag-valve-mask, ×20.
42. Pressure bags (liter size), ×15.
43. Oxygen flow meters, ×20.
44. Pleura vacs, ×3.
45. Alcohol swabs.
46. Yankaur suction, ×20.
47. Chlorhexidine and betadyne; five each
48. Stopcocks, ×40.
49. Tracheotomy tray ×1 with size 8 and 6 shiley cuffed tubes

APPENDIX 2:

Emergency Department/Trauma Charge Nurse Checklist

- Verify truth of event
- Verify type of event (conventional/chemical/unknown)
- Estimated number of victims
- Consult MD in charge
- Activate mass casualty protocol
- Activate call-in system
- Notify Security
- Activate overhead paging system
- Activate emergency stretchers plan
- Empty emergency department, trauma to alternated treatment sites
- Notify operating room
- Notify blood bank, radiology, laboratory, mental health departments
- Activate equipment/supplies plan, that is, emergency carts to predetermined sites
- Debrief arriving personnel nurses: event, plan
- Form medical teams for arriving victims: 1 MD, 1 RN per patient (team 1, first patient; team 2, second patient; etc)

APPENDIX 3:

Surgeon-in-Charge/Emergency Medicine (EM) Physician Checklist

- Verify truth of event
- Verify type of event (conventional/chemical/unknown)
- Consult with EM physician/surgeon-in-charge
- Call CEO/CMO/Administrator on-call for authorization to activate mass casualty incident plan
- Activate mass casualty protocol
- Activate call-in system
- Get portable radio
- Verify emptying emergency department/trauma area
- Verify notification of operating room and stop elective operations
- Verify notification of Security, respiratory therapy, blood bank, radiology, laboratory, mental health departments
- Call all residents in house to emergency department/trauma
- Debrief arriving personnel: event, plan
- Form medical teams for arriving victims: 1 MD, 1 RN per patient (team 1, first patient; team 2, second patient; etc).

Form immediate operating room teams: senior and junior residents

- Update hospital command center: number of victims, by age, specialties etc

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