I-35W Bridge Collapse in Minneapolis, Minnesota on 01 August 2007

Rocco Forte
City of Minneapolis, Director of Emergency Preparedness, Minneapolis, Minnesota USA

Introduction: On 01 August 2007 at 18:00 hours, the unthinkable happened in downtown Minneapolis. A major, eight-lane interstate bridge over the Mississippi River suddenly collapsed during rush hour. There were 190 people and 120 vehicles on the bridge when it fell. In a matter of a few seconds, 13 people were killed, and >100 were injured. This event captured the attention of the international media. The response by local fire, emergency medical services, and law enforcement agencies has been described as a "model of effectiveness".
Methods: The local response to the bridge collapse—and the coordination with metropolitan, State, and Federal partners—demonstrated the extraordinary value of comprehensive disaster planning and training. The city's ability to respond had evolved over several years of investing heavily in all of the elements that make a crucial difference when events occur. In July 2007, the City of Minneapolis had just completed a five-year plan for emergency preparedness.
Results: The value of planning, conducting a gap analysis to identify shortcomings in response capability, and filling those gaps by acquiring equipment and training with regional partners will be discussed. In Minneapolis, this resulted in excellent working relationships. The success of the 800 MHz radio system also will be discussed. The city was in the best possible position to be successful while responding to this event.
Conclusions: The presentation, based on the after-action analysis conducted by the Federal Emergency Management Agency, will highlight 11 problem areas as well as 19 notable successes and best practices that other agencies and jurisdictions will find valuable.
Keywords: best practices; bridge collapse; Minneapolis; preparedness
Prehosp Disaster Med

Lessons Learned from the Ashmore Reef Refugee Boat Explosion: Australia's Most Remote Major Medical Response

I. Norton
Royal Darwin Hospital, Darwin, Australia, National Critical Care and Trauma Response Centre, Darwin, Australia

Objective: The objective of this study was to describe the clinical lessons learned from the medical response to treat 44 seriously injured asylum seeking refugees injured in an explosion aboard their vessel located 800 km from the nearest moderately-sized hospital.
Methods: Of the 49 passengers and crew onboard Suspect Illegal Immigrant Vessel (SIEV) Number 36 on 16 April 2009, 44 survived an explosion on board. These survivors had an average burn surface area of 25%, with several having burn areas in excess of 60%. Six required intubation by a medical response team in the field, and at least eight others had intubation on arrival at the health facility. Response procedures were reviewed in the wake of this incident, and several recommendations for future delayed and remote access responses will be presented.
Results: Notification and response coordination in a remote Australian context will be briefly discussed. Rates of intubation and the need for field escharotomy were decreased by careful titration of small aliquots of intravenous fluid. The use of thin sheets of protective plastic film was useful, but caused minor difficulties with treatment later due to long retrieval times. Several uniform and equipment innovations have been developed, and were tested and improved after this incident including lightweight vented shirts, innovative communications for patient information transfer from a remote location, and patient identification systems.
Conclusions: No patients died once rescued from the ocean, despite an average retrieval time to hospital of >27 hours.
Keywords: Australia; boat; explosion; intubation; medical response
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Preparedness of First Responders and Risk Rating of European Union Terror Threat Life Cycles

J. F. Urbánek;[1] R. Urban;[1] F. Steinhäusler[2]
1. University of Defence, Brno, Czech Republic
2. University of Salzburg, Salzburg, Austria

In the European Union (EU), the role of first responders as principal actors during crisis/emergency/disaster operations needs a new approach and a change in qualitative (i.e., relative) evaluation instruments of their function and effectiveness. The contemporary appearance and incidence of new global threats requires new approaches in the processes, serving to the extinguishment, elimination, and liquidation of these threats within their operational and incidental life cycles. Here, the needs of risk rate at real time need a defined environment as a principal domain (others fundamental domains include: (1) the nature of the attack; (2) the enemy; (3) country; (4) EU; (5) global economy; (6) real time and space; (7) information and media; (8) religious fundamentals; (9) social networks; (10) societies; and (11) politics). The situation indicates the priorities of never-ending crisis management and security research, which must develop, implement, and use more exact and predictable quantitative and qualitative rational indicators of crisis domains, participants, and behavior as well as situational awareness and more effective technologies. Such behavior requires new capabilities of control/regulation processes, systems, persons, and organizations, which exploit successful and effective crisis/emergency/disaster management in their work. The behavior of relevant entities in human corporations also requires new approaches within rating, assessment, and evaluation of the threats, hazards, perils, dangers risks, and biofeedback. It is one of the fundamental aims of the CAST security research project.

The functions and processes performance of the first responders and their management of Terror Threats Life Cycles, intended to decrease risk ratings, will be outlined. New approaches and mathematical dependencies of the operational algorithm and the behavior of first responders at the crisis interfaces will be discussed, which can contribute to more effective awareness and performance of

services by European first responders. It helps to clarify and recognize the roles of others fundamental crisis actors (e.g., radical terrorists, government, state/EU organs and management, habitants, military forces, police, fire brigades, rescue services, disaster medicine, and humanitarian organizations) in the future.

Keywords: European Union; first responders; preparedness; risk; terrorism; threat
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Evaluation of Prehospital Triage through Outcome Assessments and Lessons Learned from Mass-Casualty Events

Udi Katzenell; Yuval Ran; Yana Yegorov; Ori Ganor; Gil Hirschhorn
The Trauma Branch, The Medical Corps, Israel Defense Forces, Israel

Introduction: Triage is used to direct medical care to the patients whose outcome would be improved by prompt treatment and evacuation to the hospital. The purpose of this study is to assess mass-casualty triage algorithms discussed in the literature.

Methods: A review of the literature of articles that assessed triage was performed using Medline.

Results: Of the physiologic variables, the motor component of the Glasgow Coma Scale followed by the systolic blood pressure has the strongest association with severe injury.

A retrospective comparison of algorithms demonstrated that the START and CareFlight are similar in sensitivity (82%-85%) and specificity (86%-96%). In a review of a train crash in which the START algorithm was used, the sensitivity of diagnosis of immediate, life-threatening conditions was 100% although over-triage was frequent. Care Flight triage algorithm is the fastest because it measures the respiration and radial pulse qualitatively. There is a linear correlation between over-triage and critical mortality.

Discussion: The limitations of the algorithms reviewed indicate that there is no consideration of resource availability, there is no consideration of the mechanism of trauma and deterioration and they may cause over triaging and resources to be spent on victims.

The ability to walk is a useful approach for triage in situations with large numbers of people affected and limited resources. During non-MCEs, patients affected by high-risk mechanisms would be immobilized and given high priority for treatment and evacuation to the hospital. During a MCE, this would waste resources on patients who probably would not benefit from the high priority given to them.

There is a linear correlation between over-triage and critical mortality. The limitations of the START method and similar methods are that there is no consideration of resource availability, there is no consideration of the mechanism of trauma and deterioration and they may cause over-triage and resources to be spent on victims who are unsalvable or who are stable and neglect victims who can deteriorate.

Conclusions: All algorithms assess the respiratory and cardiovascular system, consciousness, and the ability to walk. There are not enough data to support preference of either algorithm. A triage algorithm for MCE should be used, but the triage decisions might be altered by the proximity to hospitals, the availability of resources, and the mechanism of injury.

Keywords: Care Flight; evaluation; mass-casualty incident; START; triage; Triage Sieve
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Lessons Learned from Prehospital Management by Magen David Adom Teams from 36 Terrorism-Related Multi-Casualty Incidents: May 2001–December 2004

Zvi Feigenberg, MD
Medical Director, Magen David Adom, Israel

Introduction: From May 2001–December 2004, Magen David Adom (MDA) teams responded to 36 explosions, and treated 2,048 victims. A total of 247 were dead-on-scene, and 410 were triaged as urgent. The per incident average was 57 injured, 116 emergency medical services (EMS) personnel, 42 ambulances. On average, the first ambulance arrived 3.9 minutes after the expolosion, the first injured victim was evacuated 10.7 minutes after the explosion, and the last severely injured victim was evacuated 25.2 minutes after the explosion.

Methods: A thorough medical debriefing is the source for data collection, and the understanding of problems and challenges for EMS teams responding to terrorism-related multi-casualty incidents (MCIs).

Results: Problems and challenges included:

1. *Upon arriving to the scene*—Team safety, first ambulances to arrive were mobbed by hysteric bystanders.
   Injured—Should the first paramedic to arrive command or treat? Should they wait for advanced life support (ALS) teams or begin triage and evacuation using basic life support teams?
   Early arrival of paramedics to scene—Unsalvageable injured still have vital signs, futile lifesaving procedures, and increased numbers of dead-on-arrival.
2. *Mechanism of trauma*—The severity of blast injury depends on: size of bomb, pressure of wave, and the distance from explosion. None of this is known in the prehospital setting. Some life-threatening injuries are caused by small shrapnel, but the patients are conscious and walking, only to deteriorate later. Their injuries only can be diagnosed by x-ray.
3. *Medical treatment on-scene*—When a MCI is declared, the focus is on the number of ambulances and personnel; therefore, the level of medical treatment decreases. There are not enough ALS providers to triage and treat urgent injuries, causing a lack of continuity.
   MCIs in remote regions—Fewer paramedics, more volunteering community physicians.
4. *Evacuation to hospitals*—Should ALS teams evacuate more severe injuries to a nearby hospital or to a distant trauma center?

Conclusions: This partial summary of MDA experiences can be a usful tool for every EMS Medical Director to plan the organizational response to a MCI.

Keywords: Israel; lessons learned; Magen David Adom; management; mass-casualty incident; prehospital; terrorism
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