



# TRACIE

HEALTHCARE EMERGENCY PREPAREDNESS  
INFORMATION GATEWAY

Explosives and Mass Shooting  
Topic Collection  
Updated 1/18/2017

## Topic Collection: Explosives and Mass Shooting

Research indicates that both the nature and outcome of terrorist attacks and mass shootings are shifting from incidents larger in scale committed by a group to smaller attacks committed by a “lone wolf” or a relatively smaller group of attackers. ASPR TRACIE updated this Topic Collection to include recently released resources on lessons learned from actual events in the U.S. and abroad, guidance documents, research, and links to curriculum. These resources can help emergency medical professionals plan for and respond to the changing nature of mass shootings or explosive events.

Each resource in this Topic Collection is placed into one or more of the following categories (click on the category name to be taken directly to that set of resources). Resources marked with an asterisk (\*) appear in more than one category.

### [Must Reads](#)

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### Must Reads

American College of Emergency Physicians. (2014). [Bombings: Injury Patterns and Care](#). Centers for Disease Control and Prevention.

This webpage includes numerous links to information on blast injuries. Links to the course curriculum are located at the bottom of the page.

Autrey, A., Hick, J., Bramer, K., et al. (2014). [3 Echo: Concept of Operations for Early Care and Evacuation of Victims of Mass Violence](#). (Abstract only.) *Prehospital Disaster Medicine*. 29(4):421-8.

The authors describe a three-phase approach first responders can use when responding to a blast or active shooter event: Enter, Evaluate, and Evacuate, or 3 Echo.

Biddinger, P.D., Baggish, A., Harrington, L., et al. (2013). [Be Prepared — The Boston Marathon and Mass-Casualty Events](#). *New England Journal of Medicine*. 368:1958-1960.

The authors explain how the Boston-area medical community's prior emergency preparedness efforts and related exercises and drills contributed to their response to the Boston Marathon bombing. The authors highlight the presence of medical tents, the

mobilization of communications and additional resources, and the activation of hospital emergency plans as helpful contributing factors.

Bulger, E., Snyder, D., Schoelles, K., et al. (2014). [An Evidence-Based Prehospital Guideline for External Hemorrhage Control: American College of Surgeons Committee on Trauma](#). *Prehospital Emergency Care*. 18(2):163-173.

This guideline is a culmination of an extensive literature review on the use of tourniquets and hemostatic agents for managing life-threatening extremity and junctional hemorrhage. An expert panel examined the results of the literature review, then provided recommendations for emergency medical services care.

Burstein, J., Lacy, C., and Donovan, C. (eds.). (2017). [Best Practices for Management of Explosive Incidents: Translating the US and Israeli Military and Civilian Experience for Use in US Civilian and Military Out-of-hospital and Hospital Health Care](#). *Annals of Emergency Medicine*. 69(1): Supplement. (Abstracts only.)

This supplemental issue of the *Annals of Emergency Management* highlights best practices in managing explosive incident scenes. This issue begins with an article featuring consensus statements and includes other pieces on blast physics, medical management of the scene, management in healthcare facilities, and the future of explosive scene management.

Callaway, D.W., Smith, E.R., Cain, J., et al. (2011). [Tactical Emergency Casualty Care \(TECC\): Guidelines for the Provision of Prehospital Trauma Care in High Threat Environments](#). *Journal of Special Operations Medicine*. 11(3).

These guidelines were developed based on the principles of Tactical Combat Casualty Care but take into account variations in the civilian environment (e.g., resources allocation, different patient populations). The authors list the goals of Tactical Emergency Casualty Care and strategies for achieving those goals.

Frykberg, E. (2002). [Medical Management of Disasters and Mass Casualties From Terrorist Bombings: How Can We Cope?](#) *Journal of Trauma*. 53(2): 201-212.

The author examines past terrorist bombing events and provides a summary of triage, treatment, and resource utilization differences.

Healthcare and Public Health Sector Critical Infrastructure Protection Partnership. (2015). [Active Shooter Planning and Response in a Healthcare Setting](#).

This guide provides a comprehensive overview of issues and response to active shooters in the healthcare environment and includes response plan templates in the appendix.

Hirsch, M., Carli, P., Nizard, R., et al. (2015). [The Medical Response to the Multisite Terrorist Attacks in Paris](#). The Lancet.

The authors describe the medical response to the attacks from the perspectives of three medical professionals: emergency physician, anesthesiologist, and trauma surgeon.

Jacobs, L., McSwain, N., Rotondo, M., et al. (2013). [Improving Survival from Active Shooter Events: The Hartford Consensus](#). The National Association of Emergency Medical Technicians.

The Hartford Consensus suggests that first responders to an active shooter scene apply the actions in the acronym THREAT: 1. Threat suppression, 2. Hemorrhage control, 3. Rapid Extrication to safety, 4. Assessment by medical providers, and 5. Transport to definitive care.

King, D., Larentzakis, A., Ramly, A., et al. (2015). [Tourniquet Use at the Boston Marathon Bombing: Lost in Translation](#). (Abstract only.) Journal of Trauma and Acute Care Surgery. 78(3):594-9.

Every Boston Level 1 trauma center populated a database regarding specific injuries, extremities affected, prehospital interventions, and the like experienced by victims of the marathon bombings. The authors found that after the event, extremity exsanguination was either left alone or treated with an improvised tourniquet. The authors stress the need to share the military's approach to controlling severe extremity bleeding with "all civilian first responders."

Smith, E.R., and Shapiro, G. (2012). [Changing the Paradigm: Tactical Emergency Casualty Care Guidelines for High Risk Scenarios](#). Committee for Tactical Emergency Casualty Care.

This presentation takes participants through a blast injury scenario at a busy train station. The authors explain the differences between "traditional" attacks and the "new threat environment" (e.g., improvised explosives, lone wolf shooters) and strategies for related casualty care.

The Interagency Board. (2015). [Improving Active Shooter/Hostile Event Response: Best Practices and Recommendations for Integrating Law Enforcement, Fire, and EMS](#).

This report emphasizes the importance of (and lists recommendations related to) having an integrated response to active shooter events by incorporating lessons learned from first responder agencies who have responded to these types of events.

The National Association of Emergency Medical Technicians. (2015). [TCCC Guidelines and Curriculum](#).

The principles of Tactical Combat Casualty Care (TCCC) can also be applied by first responders who are responding to bomb and mass shooting incidents. TCCC has three goals: 1) treat the casualty, 2) prevent additional casualties, and 3) complete the mission.

## Education and Training

\*American College of Emergency Physicians. (2014). [Bombings: Injury Patterns and Care](#). Centers for Disease Control and Prevention.

This webpage includes numerous links to information on blast injuries. Links to the course curriculum are located at the bottom of the page.

Autrey, A., Hick, J., Bramer, K., et al. (2014). [3 Echo: Concept of Operations for Early Care and Evacuation of Victims of Mass Violence](#). (Abstract only.) Prehospital Disaster Medicine. 29(4):421-8.

The authors describe a three-phase approach first responders can use when responding to a blast or active shooter event: Enter, Evaluate, and Evacuate, or 3 Echo.

\* California Hospital Association. (2016). [Planning for Active Shooter Incidents](#).

This webpage provides two pages of links to resources that can help hospitals and other healthcare facilities plan for active shooter incidents. It includes a checklist, plans, guidelines, educational videos, and other materials. Note: There are two pages of materials.

Centers for Disease Control and Prevention. (2008). [Blast Injuries: What Clinicians Need to Know](#).

The speaker provides a brief overview for healthcare providers on how to respond and care for persons injured by an explosion or blast event.

Centers for Disease Control and Prevention. (2010). [Blast Injuries: Crush Injuries and Crush Syndrome](#).

The authors define crush injury and crush syndrome, which are two injuries that could result from a bombing or explosion. Operational strategies for prehospital and hospital care settings are included.

Emergency Management Institute. (n.d.). [E912: Preparing Communities for a Complex Coordinated Attack IEMC: Community Specific](#). (Accessed 1/3/2017.)

This course is offered by the Emergency Management Institute and was designed to improve the ability of local jurisdictions to prepare for, protect against, and respond to complex coordinated attacks.

Hansen, S. (2008). [Mass Casualty Medical Command](#). South Central Preparedness and Emergency Response Learning Center. (Requires free registration.)

This course was designed for emergency responders caring for a large number patients after natural or human-caused incidents. Information on caring for patients exposed to chemical, biological, radiological, nuclear, or explosive (CBRNE) agents is also provided.

Hospital Association of Southern California. (2013). [Active Shooter Drill Materials](#).

The Hospital Association of Southern California developed several documents that can help a healthcare facility plan for active shooter incidents and carry out an active shooter drill (e.g., checklists, participant releases, and pocket cards).

Los Angeles Sheriff's Department. (2015). [Surviving an Active Shooter](#). (Requires access to YouTube.)

This video depicts active shooter scenarios and shares strategies for responding and surviving such events.

MESH Coalition. (2014). [Responding to an Active Shooter in a Healthcare Setting](#).

This video provides information on preparing for and responding to an active shooter event in a healthcare setting.

\* National Association of Emergency Medical Technicians. (n.d.). [Tourniquet and Hemostatic Gauze Training](#). (Accessed 1/3/2015.)

This presentation explains when and how to use tourniquets or hemostatic gauze to control severe hemorrhage.

National Association of Emergency Medical Technicians. (2015). [NAEMT Education](#).

This webpage provides links to educational opportunities in various categories (e.g., bleeding control, Tactical Combat Casualty Care, and trauma first response) offered by the National Association of Emergency Medical Technicians.

National Association of Emergency Medical Technicians. (2015). [TCCC-MP Guidelines and Curriculum](#).

This webpage provides links to educational material and guidance on caring for victims of active shooters. Information is categorized by topic, such as guidelines, curriculum, skill sheets, instructor guides, and reference documents.

\*Tennessee Emergency Medical Services for Children. (2012). [Preparing for Explosion and Blast Injuries](#).

This course can help healthcare professionals plan for and understand the terminology associated with explosive incidents. It also includes a section on pediatric patients.

Texas State University San Marcos. (2015). [Advanced Law Enforcement Rapid Response Training \(ALERRT\)](#). Bureau of Justice Assistance, VALOR, Texas Office of the Governor, and the Federal Bureau of Investigation.

This webpage contains links to information on the ALERRT curriculum, developed to help law enforcement and other first responders increase survivability of and improve response to active shooter events.

The City of Houston, Mayor's Office of Public Safety and Homeland Security, Ready Houston. (2012). [Run, Hide, Fight: Surviving an Active Shooter Event](#). (Requires access to YouTube.)

This video depicts active shooter scenarios and demonstrates how bystanders can increase their chances of survival.

\*The National Association of Emergency Medical Technicians. (2015). [TCCC Guidelines and Curriculum](#).

The principles of Tactical Combat Casualty Care (TCCC) can also be applied by first responders to bomb and mass shooting incidents. TCCC has three goals: 1) treat the casualty, 2) prevent additional casualties, and 3) complete the mission.

U.S. Department of Homeland Security. (2015). [Stop the Bleed](#).

This webpage highlights the national campaign that provides individuals with the ability to “act quickly and save lives” before emergency medical providers arrive on the scene.

\* U.S. Department of Homeland Security, Office of Health Affairs. (2015). [First Responder Guide for Improving Survivability in Improvised Explosive Device and/or Active Shooter Incidents](#). Department of Homeland Security.

This document incorporates lessons learned from the U.S. military experiences dealing with improvised explosive device and active shooter scenes and casualties. The guide includes a variety of scenarios and responses that can be used for tabletop exercises or general planning discussions.

University of Iowa, College of Public Health, Upper Midwest Preparedness and Emergency Response Learning Center. (2007). [Emergency Medical Services Operations and Planning for Weapons of Mass Destruction](#). (Requires free registration.)

This course is geared towards emergency medical service personnel and features modules on biological, radiological, incendiary, and explosive weapons. Modules on pre- and hospital decontamination are also included.

## Guidance Documents

- \* California Hospital Association. (2016). [Planning for Active Shooter Incidents](#).

This webpage provides two pages of links to resources that can help hospitals and other healthcare facilities plan for active shooter incidents. It includes a checklist, plans, guidelines, educational videos, and other materials. Note: There are two pages of materials.

- Callaway, D.W., Smith, E.R., Cain, J., et al. (2011). [Tactical Emergency Casualty Care \(TECC\): Guidelines for the Provision of Prehospital Trauma Care in High Threat Environments](#). Journal of Special Operations Medicine. 11(3).

These guidelines were developed based on the principles of Tactical Combat Casualty Care but take into account variations in the civilian environment (e.g., resources allocation, different patient populations). The authors list the goals of Tactical Emergency Casualty Care and strategies for achieving those goals.

- Committee for Tactical Emergency Casualty Care. (2015). [Tactical Emergency Casualty Care \(TECC\) Guidelines](#).

These guidelines were adapted from evidence-based studies from the battlefield and are applicable to high threat events such as active shooter situations.

- Federal Bureau of Investigation. (n.d.). [Federal Bureau of Investigation: Active Shooter Incidents](#). (Accessed 1/3/2017.)

This website provides guidance and general information on active shooter incidents from the Federal Bureau of Investigation.

- \* Healthcare and Public Health Sector Critical Infrastructure Protection Partnership. (2015). [Active Shooter Planning and Response in a Healthcare Setting](#).

This guide provides a comprehensive overview of issues and response to active shooters in the healthcare environment and includes response plan templates in the appendix.

- Hick, J., Hanfling, D., Evans, B. et al. (2016). [Health and Medical Response to Active Shooter and Bombing Events](#).

This discussion paper examines some of the issues and potential best practices during responses to terrorist incidents, including mass shootings and bombings. Response



coordination and planning considerations are also discussed which could optimize patient outcomes.

Interagency Security Committee Active Shooter Working Group. (2015). [Planning and Response to an Active Shooter: An Interagency Security Committee Policy and Best Practices Guide.](#)

This guide sets forth a new active shooter policy requirement for all nonmilitary federal facilities within the executive branch of the government and a set of recommendations to assist with implementing this policy.

Jacobs, L., McSwain, N., Rotondo, M., et al. (2013). [Improving Survival from Active Shooter Events: The Hartford Consensus.](#) The National Association of Emergency Medical Technicians.

The Hartford Consensus suggests that first responders to an active shooter scene apply the actions in the acronym THREAT: 1. Threat suppression, 2. Hemorrhage control, 3. Rapid Extrication to safety, 4. Assessment by medical providers, and 5. Transport to definitive care.

Smith, E.R. and Delaney, J.B. (2013). [A New Response: Supporting Paradigm Change in EMS' Operational Medical Response to Active Shooter Events.](#) Journal of Emergency Medical Services. 38(12): 48-50, 52, 54-5.

The authors emphasize the need for a paradigm shift in the emergency medical services field to accompany the changing nature of active shooter events.

Smith, E.R. and Shapiro, G. (2012). [Changing the Paradigm: Tactical Emergency Casualty Care Guidelines for High Risk Scenarios.](#) Committee for Tactical Emergency Casualty Care.

This presentation takes participants through a blast injury scenario at a busy train station. The authors explain the differences between "traditional" attacks and the "new threat environment" (e.g., improvised explosives, lone wolf shooters) and strategies for related casualty care.

The Interagency Board. (2015). [Improving Active Shooter/Hostile Event Response: Best Practices and Recommendations for Integrating Law Enforcement, Fire, and EMS.](#)

This report emphasizes the importance of (and lists recommendations related to) having an integrated response to active shooter events by incorporating lessons learned from first responder agencies who have responded to these types of events.

The Interagency Board. (2016). [Training Trigger: Integrated Response Operations in Active Shooter/Hostile Events \(ASHE\)](#).

This factsheet provides information about active shooter/ hostile events and provides some general guidelines that can assist organizations plan for and respond to this threat.

\*The National Association of Emergency Medical Technicians. (2015). [TCCC Guidelines and Curriculum](#).

The principles of Tactical Combat Casualty Care (TCCC) can also be applied by first responders who are responding to bomb and mass shooting incidents. TCCC has three goals: 1) treat the casualty, 2) prevent additional casualties, and 3) complete the mission.

U.S. Department of Health and Human Services, U.S. Department of Homeland Security, U.S. Department of Justice, Federal Bureau of Investigation, and Federal Emergency Management Agency. (2014). [Incorporating Active Shooter Incident Planning into Health Care Facility Emergency Operations Plans](#).

This document gives healthcare facility emergency planners, executive leadership, and others involved in emergency operations planning assistance with planning for active shooter incidents.

\* U.S. Department of Homeland Security, Office of Health Affairs. (2015). [First Responder Guide for Improving Survivability in Improvised Explosive Device and/or Active Shooter Incidents](#). Department of Homeland Security.

This document incorporates lessons learned from the U.S. military experiences dealing with improvised explosive device and active shooter scenes and casualties. The guide includes a variety of scenarios and responses that can be used for tabletop exercises or general planning discussions.

U.S. Fire Administration. (2013). [Fire/ Emergency Medical Services Department Operational Considerations and Guide for Active Shooter and Mass Casualty Incidents](#).

This document highlights guidelines and concepts that can be incorporated into standard operating procedures to enhance the fire and emergency medical response to an active shooter/ mass casualty incident.

## Lessons Learned

\*Almog, G., and Rivkind, A. (2005). [Surgical Lessons Learned from Suicide Bombing Attacks](#). (Abstract only.) Journal of the American College of Surgeons. 202(2):313-319.

The authors combined an analysis of data contained in the Israeli National Trauma Registry with their firsthand experience caring for suicide bomb victims at the Hadassah University Hospital to provide an overview of lessons learned.

Basavaraju, S.V., Hunt, R.C., Vikas, K., et al. (2010). [Updated In A Moment's Notice: Surge Capacity for Terrorist Bombings: Challenges and Proposed Solutions](#). Centers for Disease Control and Prevention.

The authors synthesized comments from a series of expert panel meetings on identifying innovative strategies hospitals could adopt to address terrorism-related surge issues.

Berkowitz, B., Gamio, L., Lu, D., et al. (2017). [The Math of Mass Shootings](#). The Washington Post.

This article uses interactive graphics to illustrate the history of mass shootings in the U.S. in which four or more people were killed by a lone shooter (or two shooters in three cases).

Biddinger, P.D., Baggish, A., Harrington, L., et al. (2013). [Be Prepared — The Boston Marathon and Mass-Casualty Events](#). New England Journal of Medicine. 368:1958-1960.

The authors explain how the Boston-area medical community's prior emergency preparedness efforts and related exercises and drills contributed to their response to the Boston Marathon bombing. The authors highlight the presence of medical tents, the mobilization of communications and additional resources, and the activation of hospital emergency plans as helpful contributing factors.

Blair, J.P. and Schweit, K.W. (2014). [A Study of Active Shooter Incidents in the United States Between 2000 and 2013](#). Texas State University and Federal Bureau of Investigation, U.S. Department of Justice.

In 2014, the Federal Bureau of Investigation initiated a review of active shooter incidents. This report includes data that can help law enforcement and other first responders plan for and respond to these events.

\* Burstein, J., Lacy, C., and Donovan, C. (eds.). (2017). [Best Practices for Management of Explosive Incidents: Translating the US and Israeli Military and Civilian Experience for Use in US Civilian and Military Out-of-hospital and Hospital Health Care](#). Annals of Emergency Medicine. 69(1): Supplement. (Abstracts only.)

This supplemental issue of the Annals of Emergency Management highlights best practices in managing explosive incident scenes. This issue begins with an article featuring consensus statements and includes other pieces on blast physics, medical management of the scene, management in healthcare facilities, and the future of explosive scene management.

Cassa, C., Chunara, R., Mandl, K., and Brownstein, J. (2013). [Twitter as a Sentinel in Emergency Situations: Lessons from the Boston Marathon Explosions](#). PLoS Currents. (Revised 2013 Jul 2.)

The authors compared the timing of social media reports against information shared through official emergency response channels after the Boston Marathon bombing. They suggest that first response agencies and healthcare providers can monitor social media to better tailor their response to an incident.

Claassen, C., Kashner, T., Kashner, T., et al. (2011). [Psychiatric Emergency "Surge Capacity" Following Acts of Terrorism and Mass Violence with High Media Impact: What is Required?](#) (Abstract only.) *General Hospital Psychiatry*. 33(3):287-93.

The authors examined emergency psychiatric treatment-seeking emergency room visits in the weeks after four events (the Oklahoma City Bombing, the Columbine High School shooting, the Wedgewood Baptist Church shooting, and the 9/11 terrorist attacks). They found that in the week following each event, there was minimal change in the number of visits.

Clements, B. (2013). [Public Health Response to the Fertilizer Plant Explosion in West, Texas](#). University of Washington, Northwest Center for Public Health Practice.

The speakers in this webinar discuss lessons learned from public health and medical response to the fertilizer plant explosion on April 17, 2013 in West, Texas.

Cole, L., Scott, S., Feravolo, M., and Lamba, S. (2014). [Preparedness in America's Prime Danger Zone and at the Boston Marathon Bombing Site](#). (Abstract only.) *American Journal of Disaster Medicine*. 9(1):17-24.

The authors of this study compared medical response capabilities for critical incidents in Newark (New Jersey's largest city), with those in Boston. The authors found significant disparities between the two locations, but concluded that because medical personnel in both sites had conducted exercises together often, Newark would likely be able to carry out an effective response to an incident like the Boston Marathon bombing.

Federal Bureau of Investigation. (2014). [Active Shooter Study: Quick Reference Guide](#).

This factsheet summarizes data as a result of a study into 160 active shooter incidents between 2000 and 2013.

Frykberg, E. (2002). [Medical Management of Disasters and Mass Casualties From Terrorist Bombings: How Can We Cope?](#) *Journal of Trauma*. 53(2): 201-212.

The author examines past terrorist bombing events and provides a summary of triage, treatment, and resource utilization differences.

\*Frykberg, E. (2004). [Principles of Mass Casualty Management Following Terrorist Disasters](#). *Annals of Surgery*. 239(3): 319–321.

The author presents an overview of three studies on mass casualty terrorist attacks in Israel. He notes several distinctive characteristics of these incidents that go "far beyond the standard surgical training and experience:" the large number of victims; young victims; and the severity of injury.

Gates, J., Arabian, S., Biddinger, P., et al. (2014). [The Initial Response to the Boston Marathon Bombing: Lessons Learned to Prepare for the Next Disaster](#). *Annals of Surgery*. (Abstract only.) 260(6):960-6.

The authors provide an overview of the medical response to the Boston Marathon bombing, and list the factors that contributed to positive outcomes.

\*Gutierrez de Ceballos, J., Turégano-Fuentes, F., Perez-Diaz, D., et al. (2005). [11 March 2004: The Terrorist Bomb Explosions in Madrid, Spain– An Analysis of the Logistics, Injuries Sustained and Clinical Management of Casualties Treated at the Closest Hospital](#). *Critical Care*. 9(1):104-111.

In 2004, 10 bombs exploded in four commuter trains in Madrid, Spain. The authors provide an in-depth overview of the 250 patients with severe injuries and found the following injuries in patients: soft tissue and musculoskeletal injuries (85%), ear blast injury (67%), blast lung injury (63%), and head trauma (52%).

Haug, C. (2015). [Report from Paris](#). *The New England Journal of Medicine*.

The author recounts an interview with several emergency medical care providers from Hôpital Saint Louis after the coordinated terrorist attack in Paris on November 13, 2015. They discussed their response and lessons learned from the attack, emphasizing the importance of planning and coordination.

Hirsch, M., Carli, P., Nizard, R., et al. (2015). [The Medical Response to the Multisite Terrorist Attacks in Paris](#). *The Lancet*.

The authors describe the medical response to the attacks from the perspectives of three medical professionals: emergency physician, anesthesiologist, and trauma surgeon.

InterAgency Board for Equipment Standardization and Interoperability (IAB). (2015). [Integrating Law Enforcement, Fire, and Emergency Medical Services During Active Shooter/Hybrid Targeted Violence Incidents](#).

This white paper describes some foundational principals related to implementing the concepts of integrated emergency services response to high-threat events, based on current best-practice operational models from Arlington, VA; Los Angeles, CA; and New York, NY.

Iselin, B. (2009). [Arlington County, Va., Task Force Rethinks Active Shooter Incident Response](#). *The Journal of Emergency Medical Services*.

The author describes the paradigm shift associated with the emergency medical response to an active shooter situation and other lessons learned from large mass casualty events.

Kelen, G.D., Catlett, C.L., Kubit, J.G., and Hsieh, Y.H. (2012). [Hospital-Based Shootings in the United States: 2000 to 2011](#). (Abstract only.) *Annals of Emergency Medicine*. 60(6):790-798.

The authors analyzed reports on acute care hospital shooting events in the U.S. from 2000-2011 and found 154 incidents in 40 states, resulting in 235 injured or dead victims. They provide additional demographic data (e.g., perpetrator characteristics, location of shooting).

Kellerman, A. and Peleg, K. (2013). [Lessons from Boston](#). *New England Journal of Medicine*. 368:1956-1957.

The authors summarize three key points from the Boston bombing incident: the low mortality rate and related factors; the vital role played by bystanders who offered on-scene medical care; and the role the well-exercised disaster plan played in the successful response.

\*King, D., Larentzakis, A., Ramly, A., et al. (2015). [Tourniquet Use at the Boston Marathon Bombing: Lost in Translation](#). (Abstract only.) *Journal of Trauma and Acute Care Surgery*. 78(3):594-9.

Every Boston Level 1 trauma center populated a database regarding specific injuries, extremities affected, prehospital interventions, and the like experienced by victims of the marathon bombings. The authors found that after the event, extremity exsanguination was either left alone or treated with an improvised tourniquet. The authors stress the need to share the military's approach to controlling severe extremity bleeding with "all civilian first responders."

Lakatos, B., Delisle, L., Mitchell, M., and Etheredge, M. (2014). [Psychiatric Advanced Practice Nurses Contributions to Supporting Survivors and Caregivers Affected by the Boston Marathon Bombings](#). (Abstract only.) *Clinical Nurse Specialist*. 28(2): 92-96.

The authors examined how psychiatric advanced practice nurses helped care for patients and their loved ones in the aftermath of the Boston Marathon bombing.

\*Mutafchieski, V., Popivanov, G., and Kjossev, K. (2014). [Medical Aspects of Terrorist Bombings - A Focus on DCS and DCR](#). *Military Medical Research*. 11;1:13.

The authors explain that many victims of blast trauma will require significant blood transfusions. They then highlight the differences between damage control surgery and damage control resuscitation.

Oser, M., Shah, S., and Gitlin, D. (2015). [Psychiatry Department Response to the Boston Marathon Bombings Within a Level-1 Trauma Center](#). (Abstract only.) Harvard Review of Psychiatry. 23(3):195-200.

The authors examined an academic medical center's Department of Psychiatry's response during the week after the Boston marathon bombings and share lessons learned.

Rasmussen, R. and Kellermann, A. (2016). [Wartime Lessons-Shaping a National Trauma Action Plan](#). (Abstract only.) New England Journal of Medicine. 375: 1612-1615.

The authors share information on strategies used by the U.S. military to reduce morbidity and discuss possible implications for improving care in non-military/combat settings.

Sylvester, K., Rocchio, M., Belisle, C., et al. (2014). [Pharmacy Response to the Boston Marathon Bombings at a Tertiary Academic Medical Center](#). (Abstract only.) The Annals of Pharmacotherapy. 19;48(8):1082-1085.

The authors (from a tertiary academic medical center) discuss the pharmaceutical response to the Boston Marathon bombing, which focused on staffing, supplies, and communication.

The Joint Committee to Create a National Policy to Enhance Survivability from Mass Casualty Shooting Events. (2013). [Active Shooter and Intentional Mass-Casualty Events: The Hartford Consensus II](#). Bulletin of the American College of Surgeons.

The author summarizes findings from a meeting of The Hartford Consensus on active shooter and mass casualty events. The group emphasizes the need for on-scene collaboration between emergency medical services and law enforcement, and highlights the supportive role that uninjured bystanders can also play in the response effort.

Wachira, B., Abdalla, R., and Wallis, L. (2014). [Westgate Shootings: An Emergency Department Approach to a Mass-Casualty Incident](#). Prehospital and Disaster Medicine. 29(05):1-4.

The authors describe the hospital response to the mass shooting at the Westgate mall in Nairobi, Kenya.

World Health Organization, Regional Office for Europe. (2007). [Mass Gatherings and Public Health: The Experience of the Athens 2004 Olympic Games](#).

This book features chapters on a variety of emergency medical topics related to preparing for the 2004 Olympics, including the following: epidemiological surveillance; preparedness for deliberate use of biological or chemical agents, or radionuclear materials; food and water safety; and emergency medical services preparedness.

## Pediatric Resources

Chokshi, N., Behar, S., Nager, A., et al. (2008). [Disaster Management Among Pediatric Surgeons: Preparedness, Training and Involvement](#). (Abstract only.) American Journal of Disaster Medicine. 3(1):5-14.

The authors discuss the results of an anonymous survey of American Pediatric Surgical Association members in 2007, which found that while 77% felt "definitely responsible" for assisting after a disaster, only 24% felt "definitely prepared" to do so. The authors listed factors associated with higher levels of preparedness and emphasized the need for more training.

Committee for Tactical Emergency Casualty Care. (2015). [Pediatric Tactical Emergency Casualty Care](#).

The committee presents guidelines for caring for pediatric patients during certain types of emergency situations (e.g., active shooter, structure collapse).

\*Tennessee Emergency Medical Services for Children. (2012). [Preparing for Explosion and Blast Injuries](#).

This course can help healthcare professionals plan for and understand the terminology associated with explosive incidents. It also includes a section on pediatric patients.

## Plans, Tools, and Templates

Byrne-Dugan, C., Cederroth, T., Deshpande, A., and Remick, D. (2014). [The Processing of Surgical Specimens With Forensic Evidence: Lessons Learned From the Boston Marathon Bombings](#). Archives of Pathology and Laboratory Medicine Online. (Epub ahead of print.)

Pathology departments throughout the Boston area received amputated limbs and other specimens from trauma surgeries, which were not accompanied by clear examination guidelines. The authors of this study developed a protocol (reviewed and approved by experts in forensic evidence collection) that can be used by pathology departments in the aftermath of a disaster.

\* California Hospital Association. (2016). [Planning for Active Shooter Incidents](#).

This webpage provides two pages of links to resources that can help hospitals and other healthcare facilities plan for active shooter incidents. It includes a checklist, plans, guidelines, educational videos, and other materials. Note: There are two pages of materials.



- \* Greater New York Hospital Association. (2013). [Integrated Explosive Event and Mass Casualty Event: Response Plan Template.](#)

This template was developed to help hospitals in New York prepare to respond to explosive and mass casualty events. The templates can help facilitate coordination between various hospital departments and can be customized by healthcare facility emergency planners across the country.

- Health Resources and Services Administration. (2007). [Preparedness for Chemical, Biological, Radiological, Nuclear, and Explosive Events: Questionnaire for Health Care Facilities.](#) Agency for Healthcare Research and Quality (Archive).

This questionnaire can be used in two ways: 1) by states, localities, and multi-hospital systems to determine overall hospital emergency preparedness, or 2) by individual hospitals or healthcare facilities as a checklist of areas to consider as a facility creates or updates emergency preparedness and response plans.

- \*Healthcare and Public Health Sector Critical Infrastructure Protection Partnership. (2015). [Active Shooter Planning and Response in a Healthcare Setting.](#)

This guide provides a comprehensive overview of issues and response to active shooters in the healthcare environment and includes response plan templates in the appendix.

## **Treatment**

- \*Almogy, G., and Rivkind, A. (2005). [Surgical Lessons Learned from Suicide Bombing Attacks.](#) (Abstract only.) Journal of the American College of Surgeons. 202(2):313-319.

The authors combined an analysis of data contained in the Israeli National Trauma Registry with their firsthand experience caring for suicide bomb victims at the Hadassah University Hospital to provide an overview of lessons learned.

- American College of Surgeons. (2015). [See Something, Do Something: Improving Survival – Strategies to Enhance Survival in Active Shooter and Intentional Mass Casualty Events: A Compendium.](#) Bulletin of the American College of Surgeons. 100(15).

This document was developed by the Hartford Consensus (a team of healthcare leaders) and is a comprehensive compendium of resources and supporting documents that first responders can use to facilitate planning and training and enhance survivability from mass casualty and active shooter events.

- Bulger, E., Snyder, D., Schoelles, K., et al. (2014). [An Evidence-Based Prehospital Guideline for External Hemorrhage Control: American College of Surgeons Committee on Trauma.](#) Prehospital Emergency Care. 18(2):163-173.

This guideline is a culmination of an extensive literature review on the use of tourniquets and hemostatic agents for managing life-threatening extremity and junctional hemorrhage. An expert panel examined the results of the literature review, then provided recommendations for emergency medical services care.

- \* Burstein, J., Lacy, C., and Donovan, C. (eds.). (2017). [Best Practices for Management of Explosive Incidents: Translating the US and Israeli Military and Civilian Experience for Use in US Civilian and Military Out-of-hospital and Hospital Health Care](#). *Annals of Emergency Medicine*. 69(1): Supplement. (Abstracts only.)

This supplemental issue of the *Annals of Emergency Management* highlights best practices in managing explosive incident scenes. This issue begins with an article featuring consensus statements and includes other pieces on blast physics, medical management of the scene, management in healthcare facilities, and the future of explosive scene management.

- DePalma, R.G., Burris, D., Champion, H.R., and Hodgson, M.J. (2005). [Blast Injuries](#). (Abstract only.) *New England Journal of Medicine*. 352:1335-42.

The authors explain the nature of blast injuries, highlight strategies for stabilizing patients and determining the severity of injury, and discuss treatment approaches.

- Duncan, E. Colver, K., Dougall, N., et al. (2014). [Consensus on Items and Quantities of Clinical Equipment Required to Deal with Mass Casualties Big Bang Incident: A National Delphi Study](#). *BMC Emergency Medicine*. 14: 5.

British researchers developed an expert consensus regarding the essential items and minimum quantities of clinical equipment necessary to care for 100 patients on the scene of a mass casualty explosion event.

- \*Frykberg, E. (2004). [Principles of Mass Casualty Management Following Terrorist Disasters](#). *Annals of Surgery*. 239(3): 319–321.

The author presents an overview of three studies on mass casualty terrorist attacks in Israel. He notes several distinctive characteristics of these incidents that go "far beyond the standard surgical training and experience:" the large number of victims; young victims; and the severity of injury.

- \* Greater New York Hospital Association. (2013). [Integrated Explosive Event and Mass Casualty Event: Response Plan Template](#).

This template was developed to help hospitals in New York prepare for and respond to explosive and mass casualty events. The templates can help facilitate coordination between various hospital departments and can be customized by healthcare facility emergency planners across the country.

\*Gutierrez de Ceballos, J., Turégano-Fuentes, F., Perez-Diaz, D., et al. (2005). [11 March 2004: The Terrorist Bomb Explosions in Madrid, Spain– An Analysis of the Logistics, Injuries Sustained and Clinical Management of Casualties Treated at the Closest Hospital](#). *Critical Care*. 9(1):104-111.

In 2004, 10 bombs exploded in four commuter trains in Madrid, Spain. The authors provide an in-depth overview of the 250 patients with severe injuries and found the following injuries in patients: soft tissue and musculoskeletal injuries (85%), ear blast injury (67%), blast lung injury (63%), and head trauma (52%).

Kearns, R., Myers, B., Cairns, C., et al. (2014). [Hospital Bioterrorism Planning and Burn Surge](#). *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science*. 12(1): 20-8.

The authors discuss injuries suffered as a result of an explosion at a manufacturing plant in North Carolina, and how pre-event preparedness and planning influenced the medical response.

\*King, D., Larentzakis, A., Ramly, A., et al. (2015). [Tourniquet Use at the Boston Marathon Bombing: Lost in Translation](#). (Abstract only.) *Journal of Trauma and Acute Care Surgery*. 78(3):594-9.

Every Boston Level 1 trauma center populated a database regarding specific injuries, extremities affected, prehospital interventions, and the like experienced by victims of the marathon bombings. The authors found that after the event, extremity exsanguination was either left alone or treated with an improvised tourniquet. The authors stress the need to share the military's approach to controlling severe extremity bleeding with "all civilian first responders."

\*Mutafchiyski, V., Popivanov, G., and Kjossev, K. (2014). [Medical Aspects of Terrorist Bombings - A Focus on DCS and DCR](#). *Military Medical Research*. 11;1-13.

The authors explain that many victims of blast trauma will require significant blood transfusions. They then highlight the differences between damage control surgery and damage control resuscitation.

\* National Association of Emergency Medical Technicians. (n.d.). [Tourniquet and Hemostatic Gauze Training](#). (Accessed 1/3/2017.)

This presentation explains when and how to use tourniquets or hemostatic gauze to control severe hemorrhage.

Office for Victims of Crime. (2015). [Helping Victims of Mass Violence and Terrorism: Planning, Response, Recovery, and Resources](#). U.S. Department of Justice, Office of Justice Programs, National Institute of Justice

This toolkit provides victim assistance resources for communities to include in their emergency response plans. There are links to resources on creating and maintaining partnerships, developing victim assistance protocols, and tools such as checklists, samples, a glossary, and a compendium of victim assistance resources.

Redhead, J., Ward, P., and Batrick, N. (2005). [The London Attacks--Response: Prehospital and Hospital Care](#). The New England Journal of Medicine. 353:546-547.

The authors detail the medical response to the 2005 London public transportation bombing. They discuss the nature of injuries, how a treatment center was set up in a nearby hotel, and the process of handing burn patients over to a regional burn center.

Sever, M. and Vanholder, R. (2013). [Management of Crush Victims in Mass Disasters: Highlights from Recently Published Recommendations](#). Clinical Journal of the American Society of Nephrology. 8(2): 328-335.

The authors discuss best practices regarding the treatment of crush victims, both at the disaster field and upon admission to hospitals.

Sylvester, K., Rocchio, M., Belisle, C., et al. (2014). [Pharmacy Response to the Boston Marathon Bombings at a Tertiary Academic Medical Center](#). (Abstract only.) The Annals of Pharmacotherapy. 19;48(8):1082-1085.

The authors (from a tertiary academic medical center) discuss the pharmaceutical response to the Boston Marathon bombing, which focused on staffing, supplies, and communication.

## Agencies and Organizations

**Note:** The agencies and organizations listed in this section have a page, program, or specific research dedicated to this topic area.

American College of Emergency Physicians. [Bombings: Injury Patterns and Care](#).

[Committee for Tactical Emergency Casualty Care](#).

[NAEMT Education](#).

U.S. Department of Homeland Security. [Active Shooter Preparedness](#).

U.S. Department of Homeland Security. [TRIPwire](#).

*This ASPR TRACIE Topic Collection was updated by ASPR TRACIE in January 2017. It was comprehensively reviewed in June 2015 by the following subject matter experts (listed in alphabetical order): **Scott Cormier**, Vice President, Emergency Management, EC and Safety, Medxcel; **Robert Dunne**, MD FACEP, Program Director, EMS Fellowship, Medical Director, Detroit East Medical Control Authority, Associate Professor, Wayne State University; and **John Hick**, MD, HHS ASPR and Hennepin County Medical Center.*

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