


# The Boston Marathon Bombings.... Lessons Learned

November 2013



# Agenda for the Presentation

- Background of Health Care organizations within Eastern Massachusetts.
  - Background on the MGH.
  - Disaster planning in metro-Boston.
  - Events of Marathon Monday and beyond.
  - Lessons Learned.....
- 

# Massachusetts Health Care Organization

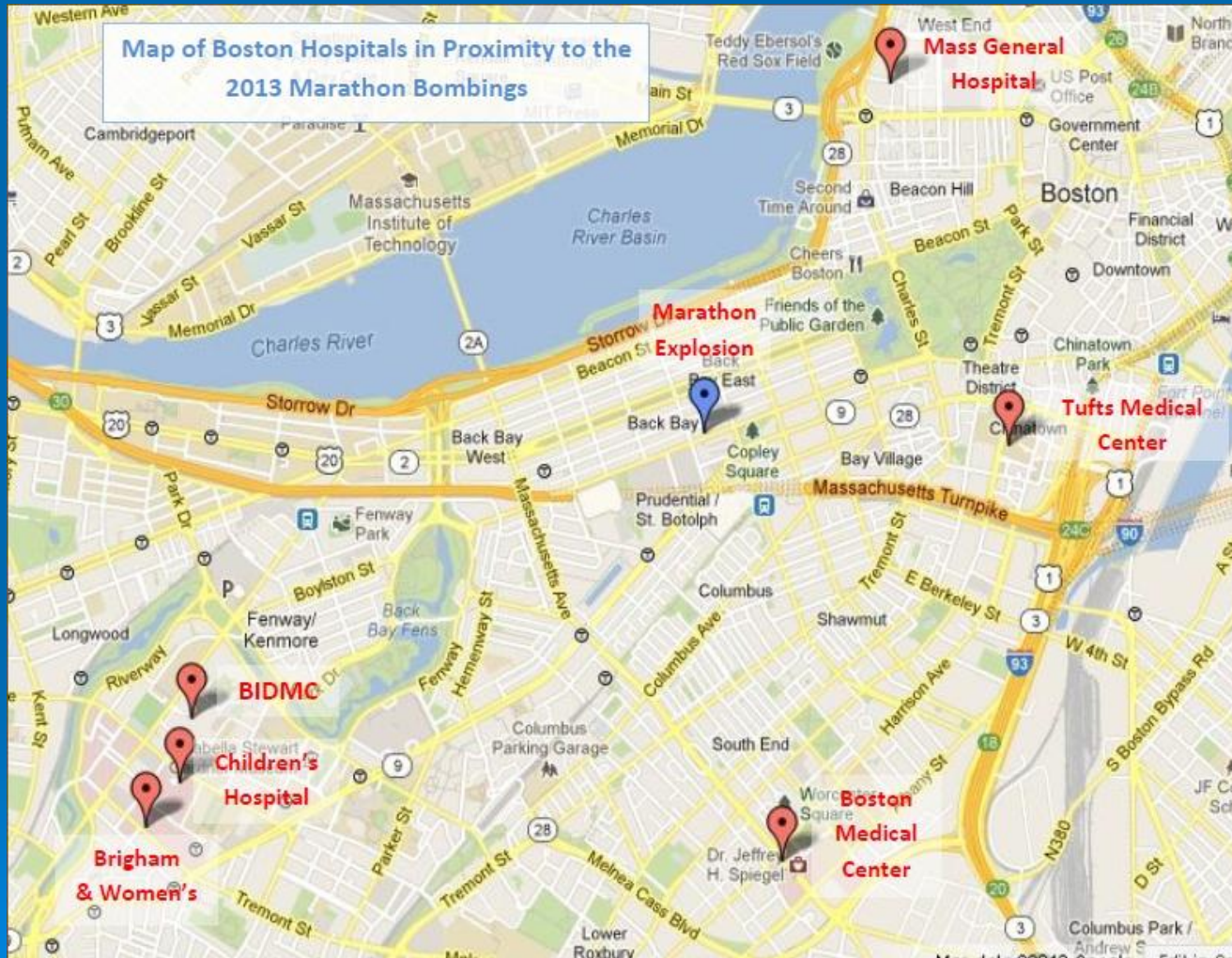
- Massachusetts has a very strong city and town organizational structure, counties are weak.
- There are 296 towns and 55 cities in Massachusetts.
- EMS is provided by the cities and towns, in Boston EMS is a third service, in other jurisdictions it varies but usually basic EMT are within Fire and ALS is contracted out.
- Hospitals are transitioning into networks which are fiercely competitive.
- The Massachusetts Hospital Association and COBTH.

# The Boston Hospitals and COBTH

- Boston has many major medical facilities.
- Three medical schools.
- Five adult Level 1 trauma centers and three level 1 pediatric trauma centers.
- Two level 1 adult burn centers and one (Shriner's supported) level 1 pediatric burn center.
- The Council of Boston Teaching Hospitals (COBTH) has a coordinating function.
- Disaster response and EMS oversight has been traditionally very collaborative. Regular meetings of EMS and Disaster sub-committees monthly.



# Map

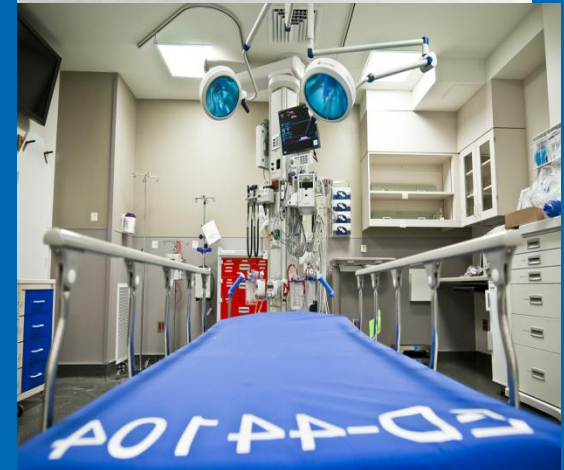


# Partners Healthcare



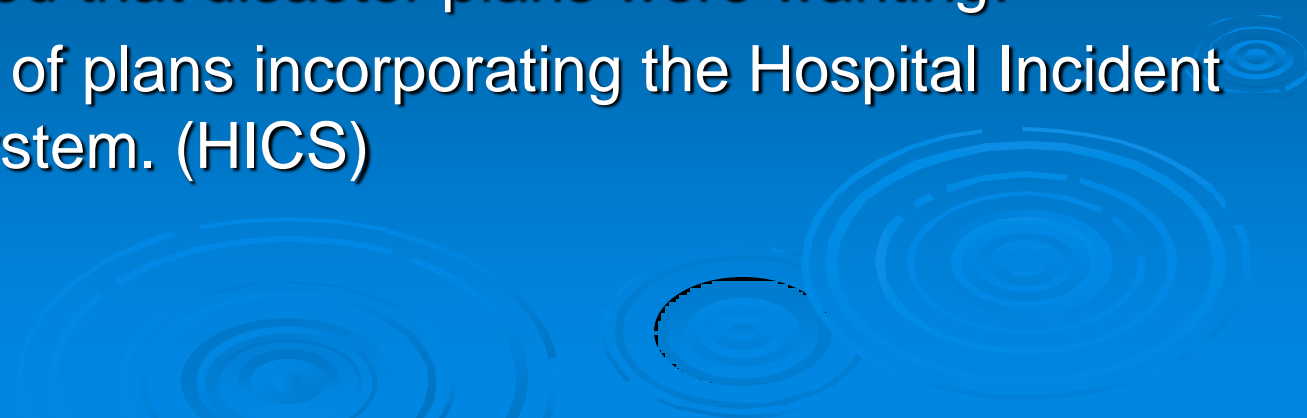
# Massachusetts General Hospital

- 1050 beds
- 48,493 inpatient admissions
- 3,699 births
- 41,304 surgical operations
- 102,300 Emergency visits
- 1.6M outpatient visits
- \$776M annual research budget
- 24,510 employees
- Harvard Medical School affiliated
- Level 1 trauma and burn center, adult and pediatric



*Data from fiscal year 2012*

# September 11<sup>th</sup> 2001.

- World Trade Center New York City.
  - Boston was informed that approximately 40 critical patients were going to be evacuated by train to Boston hospitals.
  - All major facilities activated their disaster plans – which were never needed.
  - Following the incident many hospitals – including the MGH – realized that disaster plans were wanting.
  - Total revision of plans incorporating the Hospital Incident Command System. (HICS)
- 



# H.I.C.S.

- Clear delineation of command structure based upon the model of fire fighting structure.
- Incident Commander, Liaison officer, Security Officer, Public Information Officer, Compliance Officer.
- Ensures that Operations, Planning, Logistics and Finance are all managed.
- MGH – and other Partners Hospitals – all underwent the modifications and training required.
- Disaster plans modified accordingly.

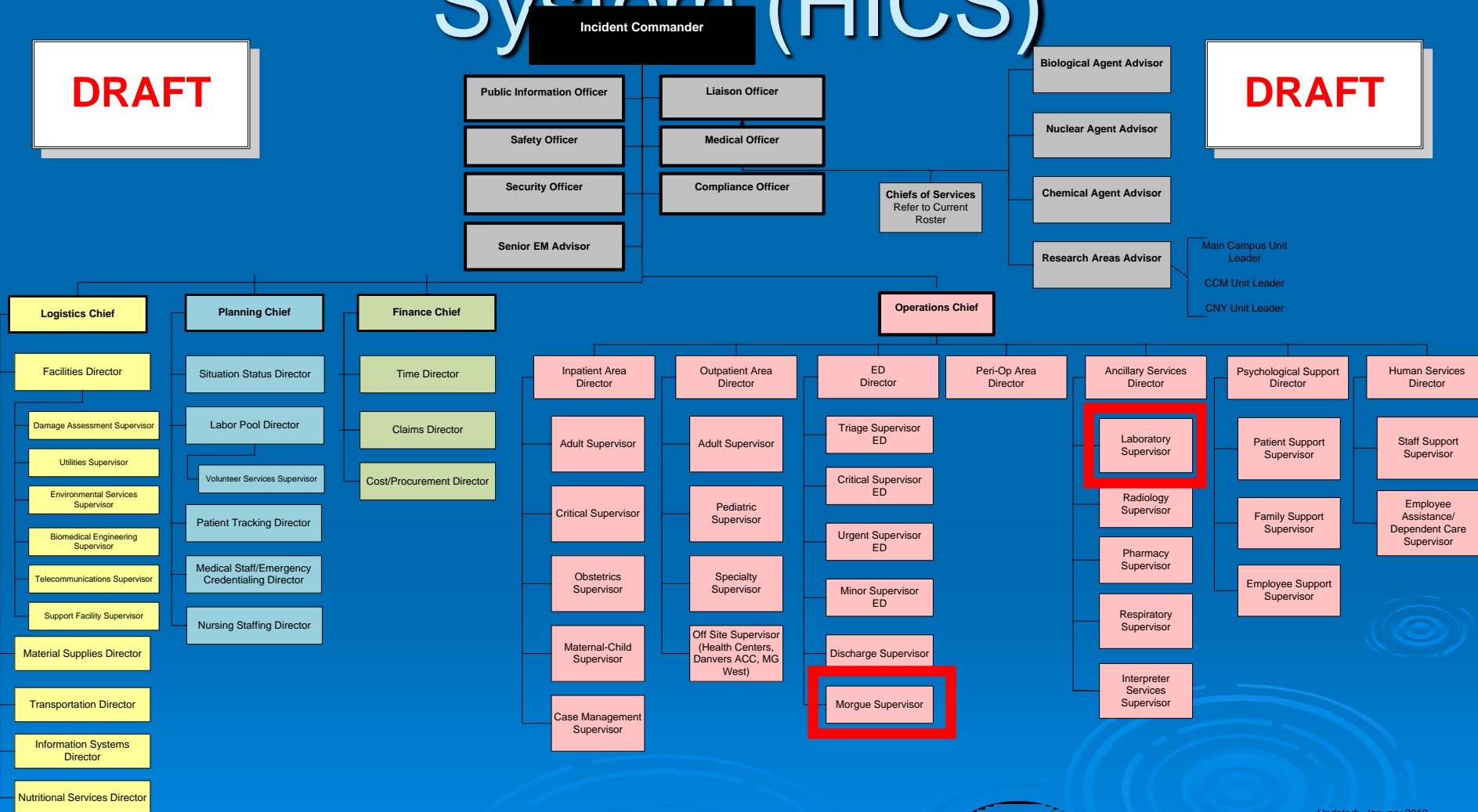
# Hospital Incident Command System

- HICS is designed to:
  - Be usable for managing emergency or planned events, of any size or type, by establishing a clear and efficient chain of command/reporting structure
  - Allow personnel from different agencies or departments to be integrated into a common structure that can effectively address issues and delegate responsibilities
  - Provide needed logistical and administrative support to operational personnel
  - Ensure key functions are covered and eliminate duplication

# Hospital Incident Command System (HICS)

**DRAFT**

**DRAFT**



Updated: January 2013



# Emergency Preparedness Plan at MGH

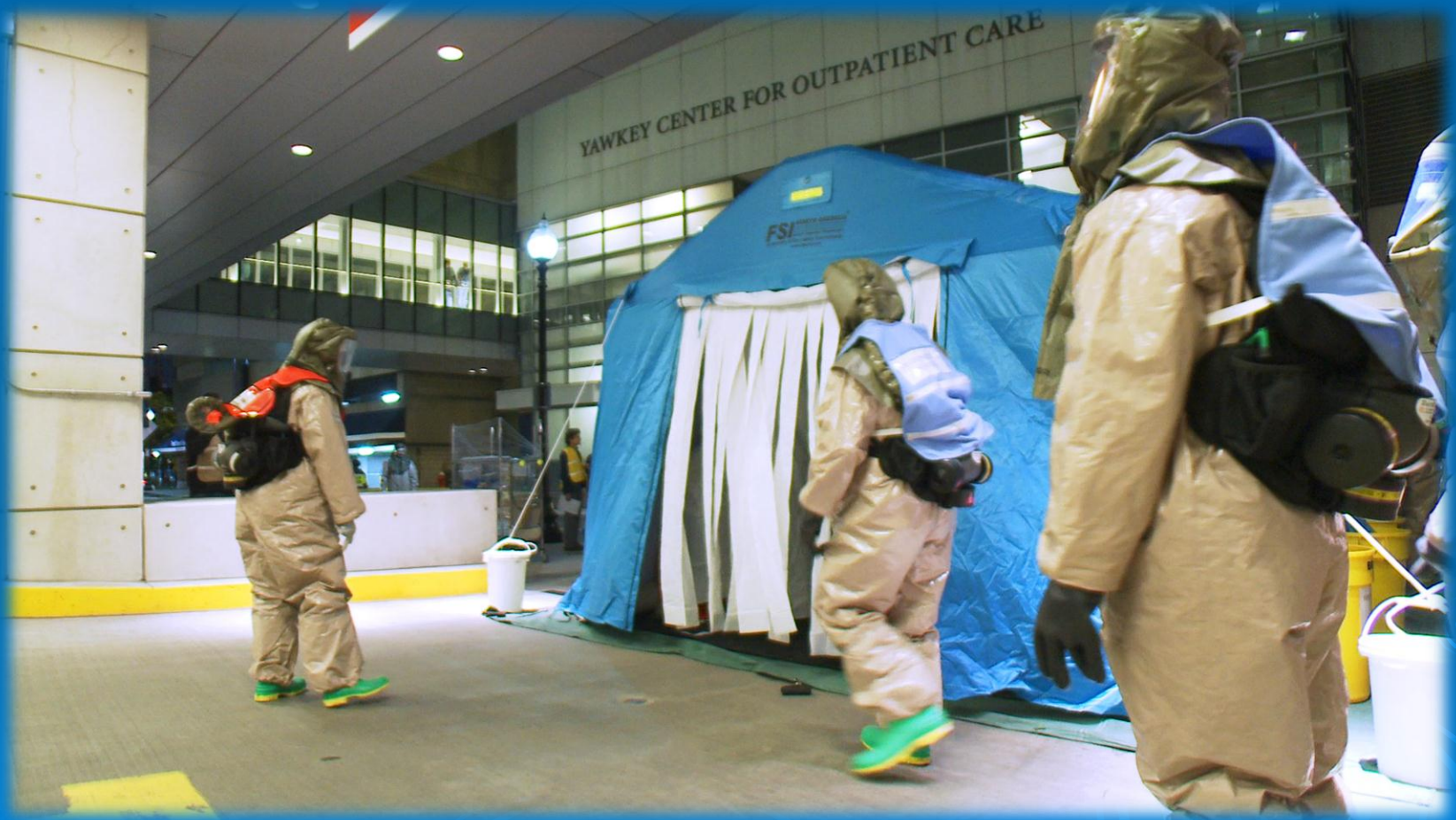
- Combines internal and external disaster plans into one “umbrella” plan. All MGH departments have a formal plan
- All-hazards approach to manage any incident
  - Additional “annexes” focus on specific threats and their unique qualities (e.g. MCI, HAZMAT, bio-threats, radiation, evacuation)
- The substance of the plan does the following:
  - Identifies “CODE DISASTER” to activate disaster response
  - Describes the concept of operations for disaster response
  - Outlines the authority to obtain resources for disaster response
  - Describes coordinating activities with external community agencies

# Exercises and Trainings

- In the past 5 years MGH has conducted over 150 exercises and training sessions
  - Weekly New Employee Orientation Session  
<http://www.massgeneral.org/emergencymedicine/news/multimedia.aspx?id=624>
  - Administrator On-call training and continuing education
  - 10-15 tabletop, functional, or full scale exercises per year
- Participants include:
  - Materials Management, Environmental Services, Patient Care Services, Emergency Departments, Perioperative Services, Buildings and Grounds, Engineering, Information Systems, Telecom, Police & Security, Safety Department
  - External partners: Boston Police Department, Boston EMS, Boston Fire department, and other local and regional hospitals



# HAZMAT Decontamination Exercise





# HAZMAT Decontamination Exercise



# And then there was Marathon Monday.

- A holiday in Boston – but not for the hospitals.
- The Marathon....
- The Red Sox game.....
- Thousand in the streets.....



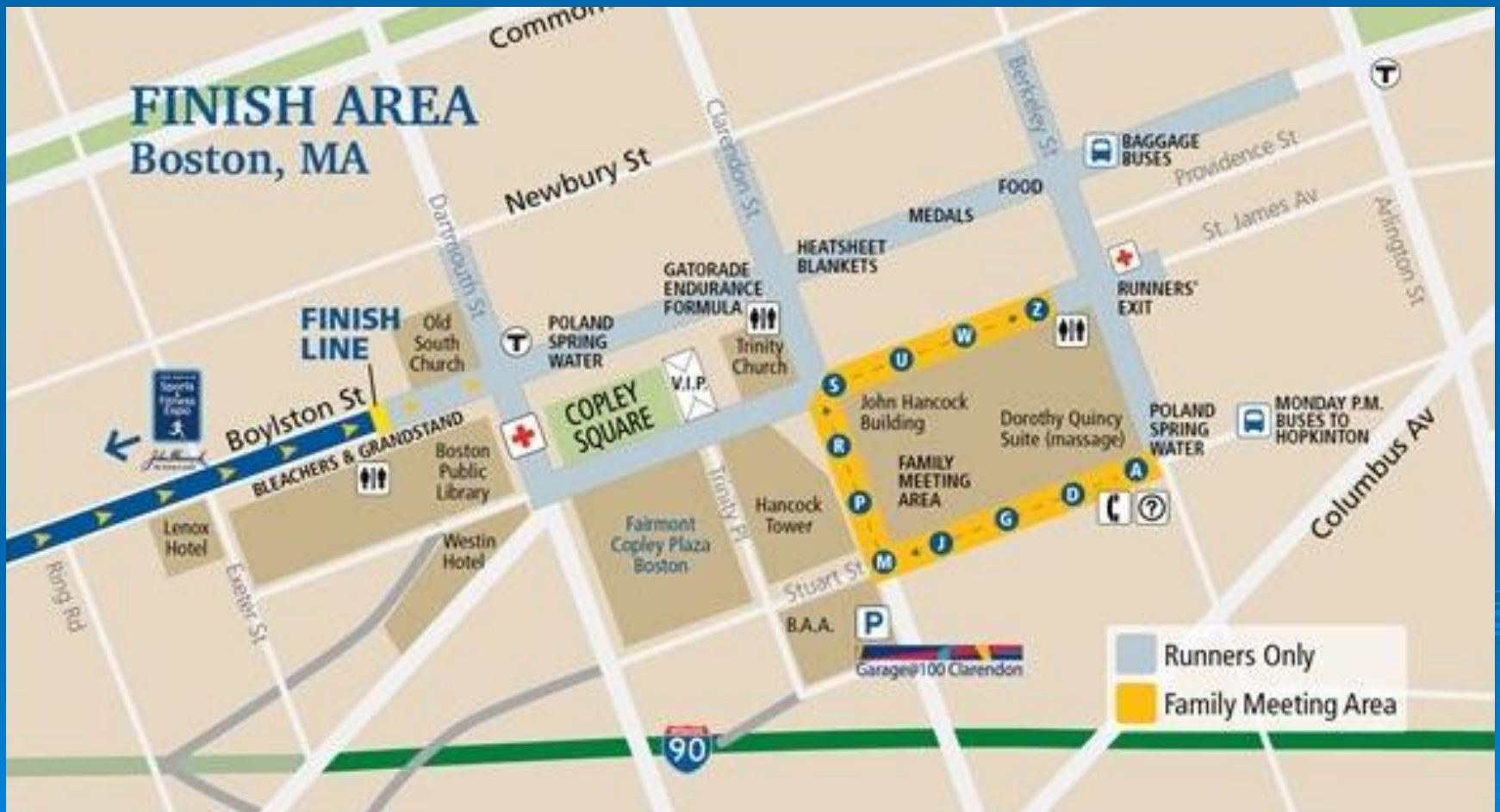
# The Boston Marathon



- This is considered a planned MCI for the City
- 16-20k registered runners
- We plan annually with our citywide partners and the BAA
- Our usual concerns surround weather extremes
- This year was perfect running weather



# Boston Marathon Finish Area





~2:50pm- Monday, April 15, 2013



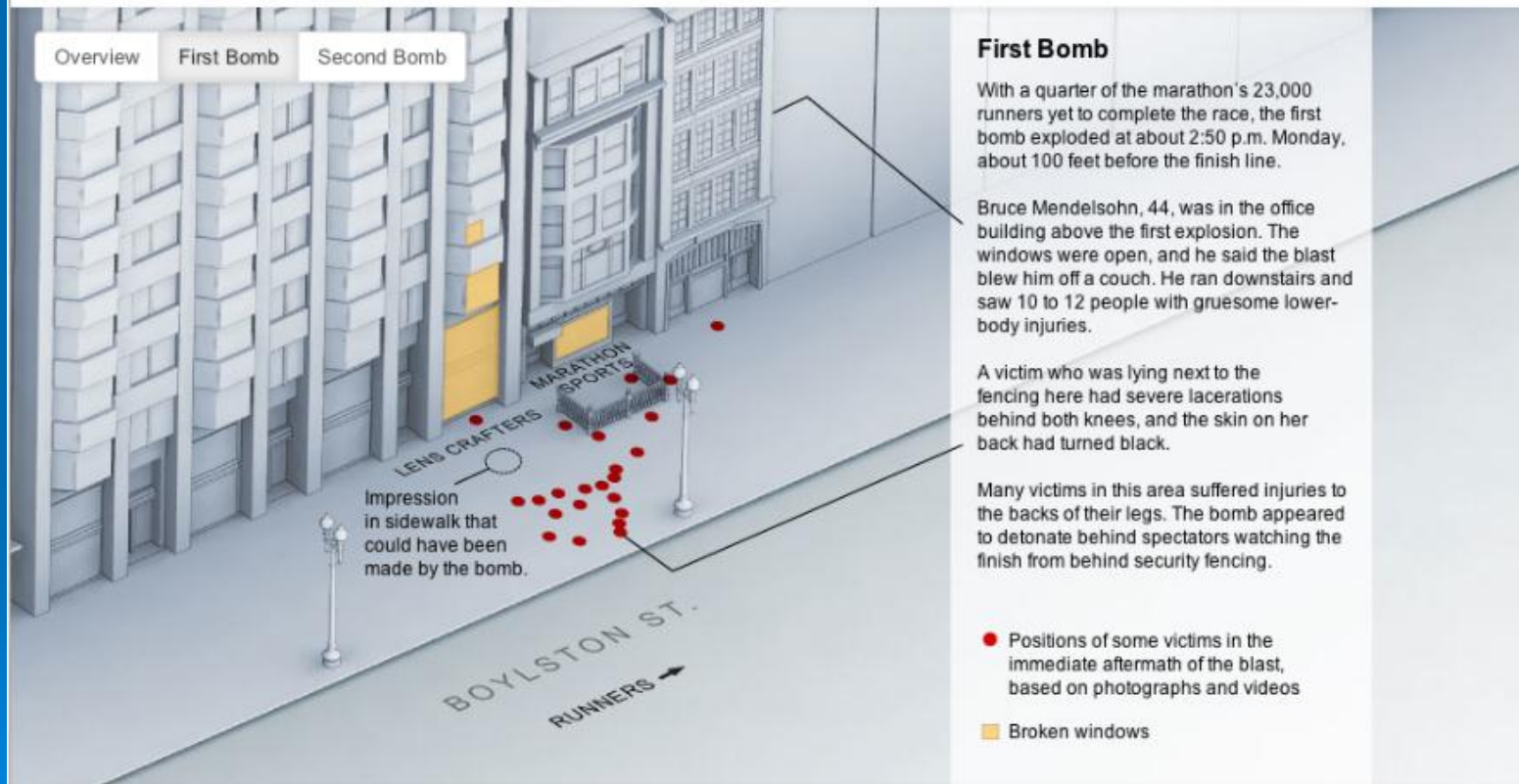
Published: April 17, 2013

[f FACEBOOK](#)
[t TWITTER](#)
[g+ GOOGLE+](#)
[E-MAIL](#)
[SHARE](#)

## Caught in the Blasts at the Boston Marathon

[Related Article »](#)

[Overview](#)
[First Bomb](#)
[Second Bomb](#)



### First Bomb

With a quarter of the marathon's 23,000 runners yet to complete the race, the first bomb exploded at about 2:50 p.m. Monday, about 100 feet before the finish line.

Bruce Mendelsohn, 44, was in the office building above the first explosion. The windows were open, and he said the blast blew him off a couch. He ran downstairs and saw 10 to 12 people with gruesome lower-body injuries.

A victim who was lying next to the fencing here had severe lacerations behind both knees, and the skin on her back had turned black.

Many victims in this area suffered injuries to the backs of their legs. The bomb appeared to detonate behind spectators watching the finish from behind security fencing.

● Positions of some victims in the immediate aftermath of the blast, based on photographs and videos

■ Broken windows





Published: April 17, 2013

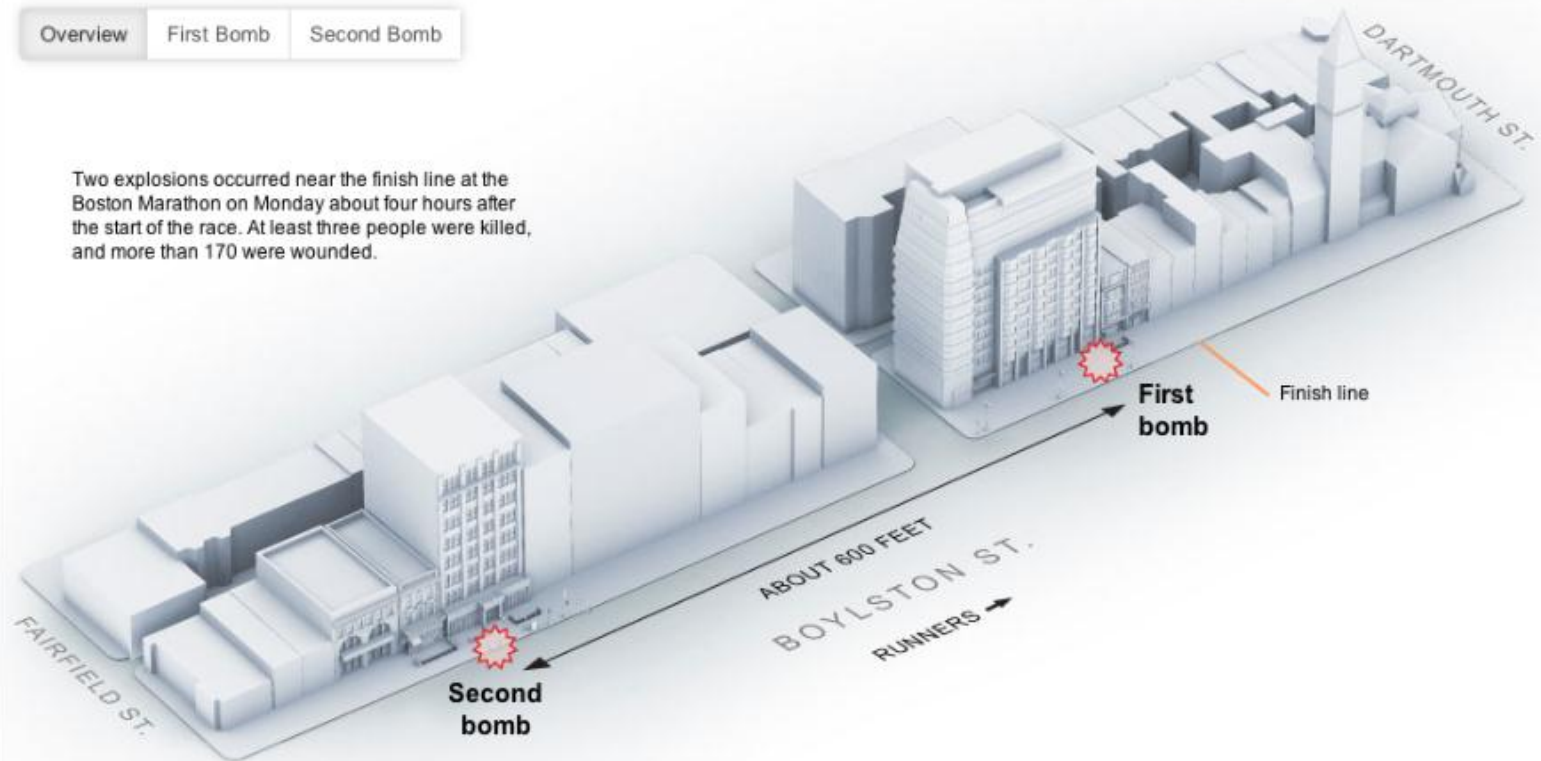
[FACEBOOK](#)
[TWITTER](#)
[GOOGLE+](#)
[E-MAIL](#)
[SHARE](#)

## Caught in the Blasts at the Boston Marathon

[Related Article »](#)

[Overview](#)
[First Bomb](#)
[Second Bomb](#)

Two explosions occurred near the finish line at the Boston Marathon on Monday about four hours after the start of the race. At least three people were killed, and more than 170 were wounded.

















# Impact Overview

- 264 patients treated at 27 hospitals with the majority to 5 Boston Level 1 trauma centers
- 3 deaths- all expired at scene
- 16 patients received amputations- some double





# Boston Globe

EMTs treat and transport some of the victims directly from the scene.

2:50:15



Over 100 wheelchairs and couriers stationed around the finish line to take runners to the tent, are used to transport victims.

2:50:00

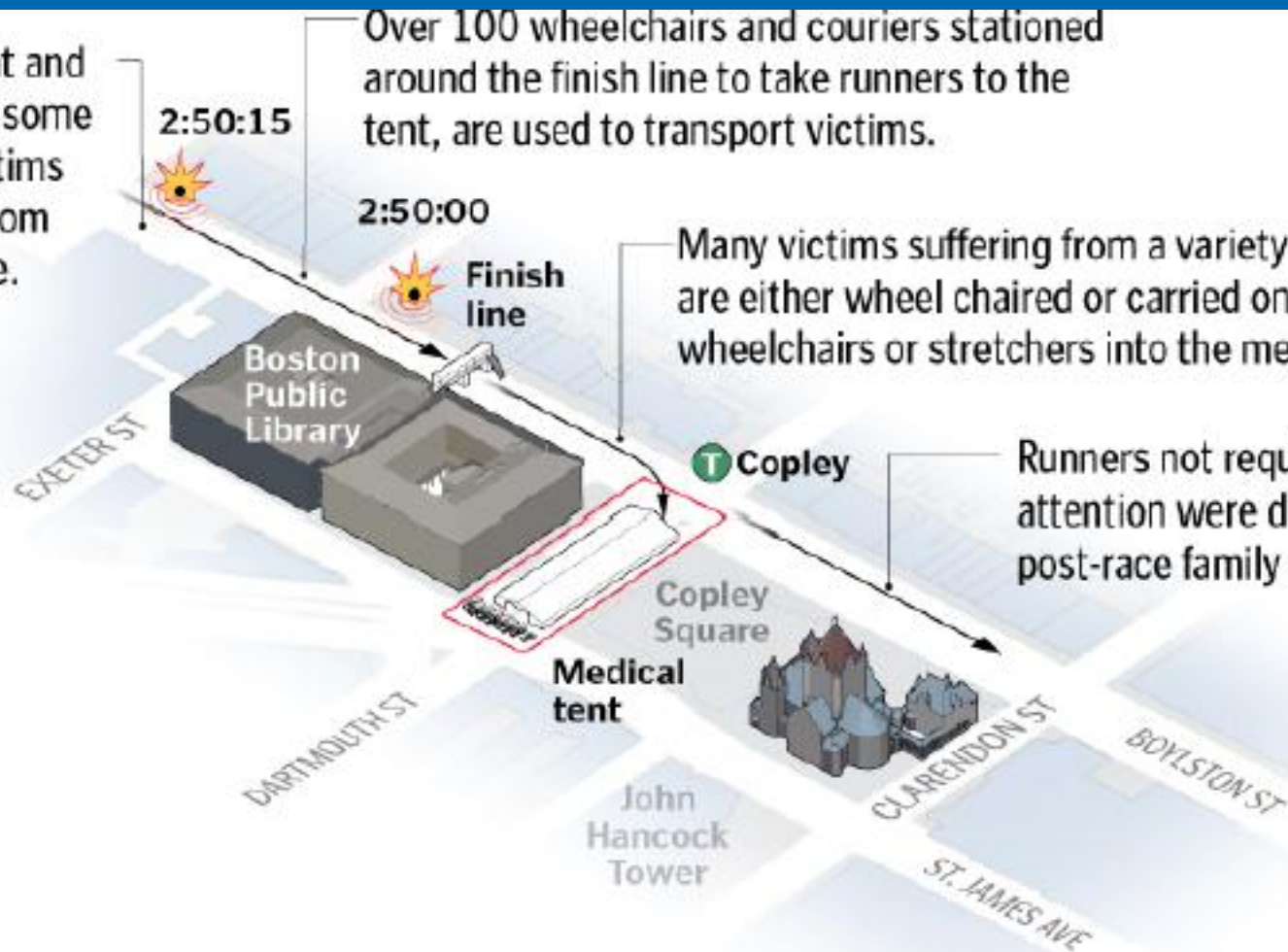


Finish line

Many victims suffering from a variety of wounds are either wheel chaired or carried on wheelchairs or stretchers into the medical tent.

T Copley

Runners not requiring attention were directed to the post-race family meeting area.



# Boston Public Health Commission

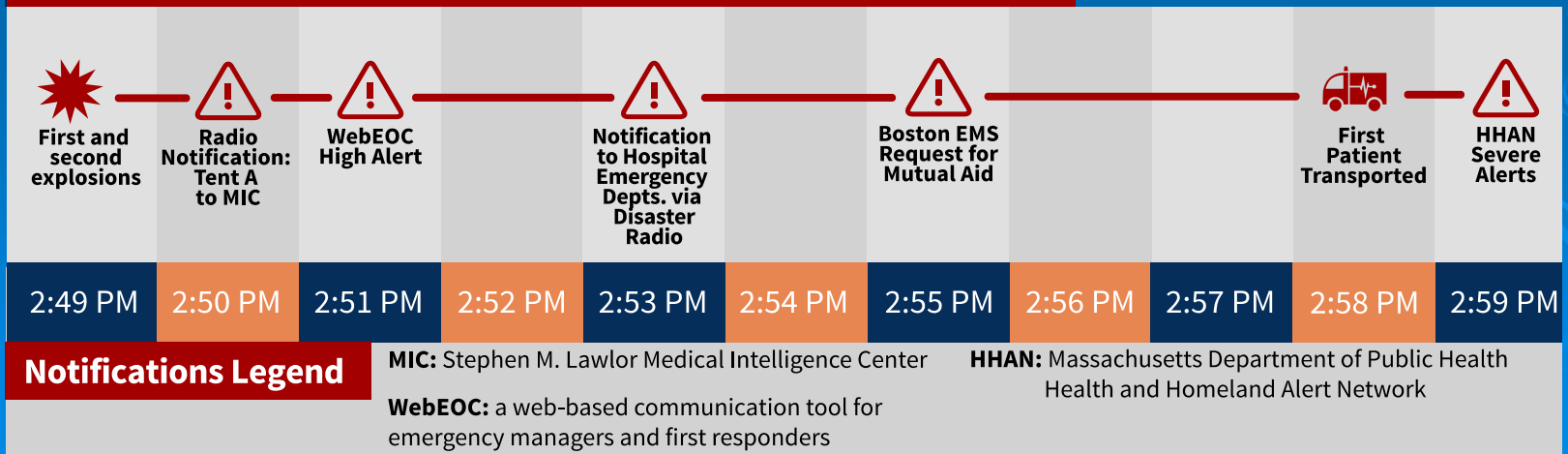
## 2013 BOSTON BOMBINGS

### *Response & Recovery*

This infographic preview summarizes health and medical notifications and EMS patient transports during the initial response to the 2013 Boston Bombings. The full version of the infographic will contain additional information related to public health, medical, and social services provided in response to the bombings.

## Initial Response

### The First Ten Minutes: Notifications





## PATIENT *Transports\**

**41%** of critical transports  
in 30 minutes

**75%** of critical transports in  
45 minutes

**100%** of critical transports  
in 60 minutes

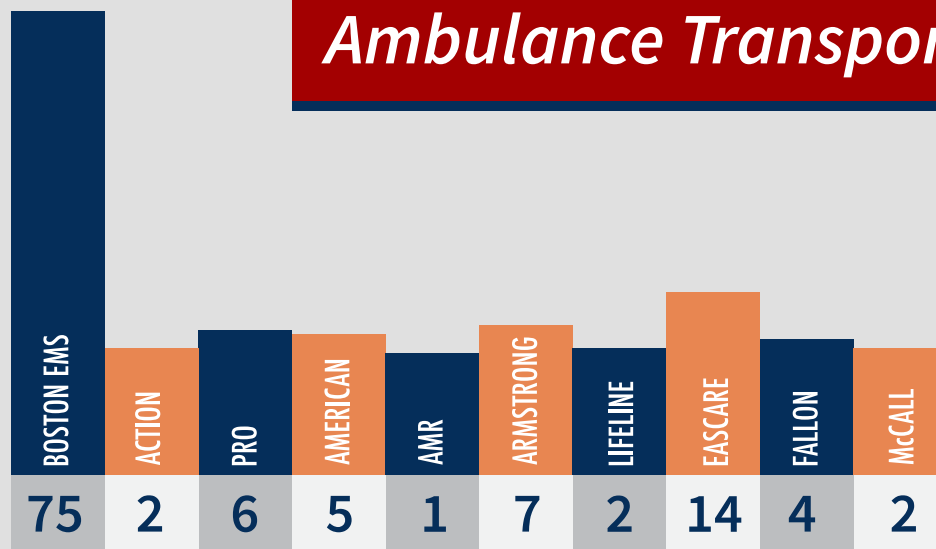
*\*16 non-critical patients were transported  
after 60 minutes, with the final transport  
occurring at 8:50pm.*

**118**  
AMBULANCE  
TRANSPORTS

**75**  
Transports by  
**Boston EMS**

**43**  
Transports by  
9 Mutual Aid Partners

## *Ambulance Transports*



### EMS Agency Legend

**Action:** Action Ambulance Service

**American:** American Ambulance Service

**AMR:** American Medical Response

**Armstrong:** Armstrong Ambulance

**EasCare:** EasCare Ambulance

**Fallon:** Fallon Ambulance Service

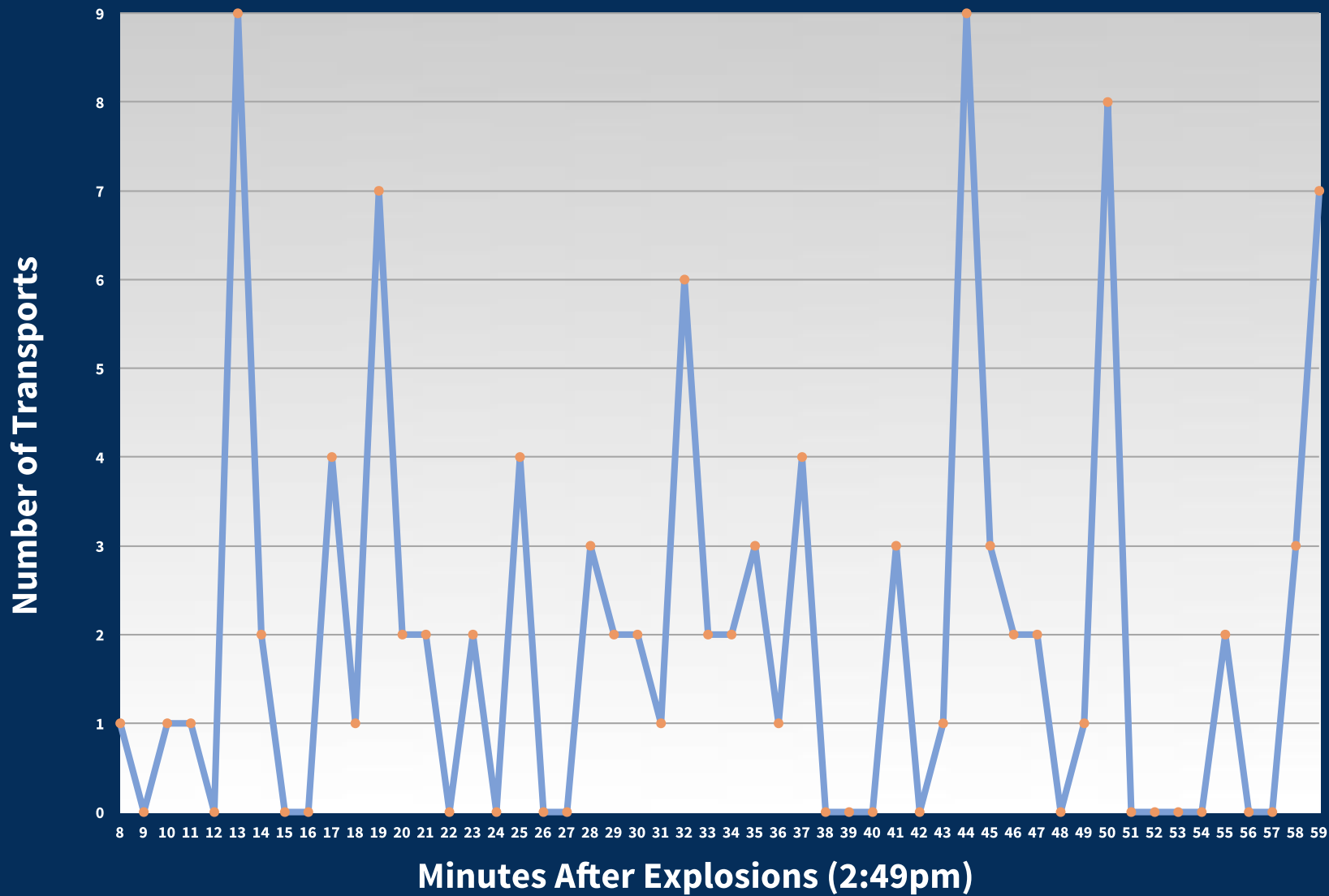
**LifeLine:** LifeLine Ambulance Service

**McCall:** McCall Ambulance Service

**Pro:** Professional Ambulance Service

**Brewster Ambulance Service**  
also responded to the incident,  
but did not transport patients.

# Ambulance Transport Timeline: First Hour






# EMS Field triage

- Patients funneled to marathon tent
- Wheelchairs used for many transports to tent
- Use of tourniquets
- Triage of patients
- Spreading of transfers throughout trauma centers

# Boston Marathon Bombing Notification

- At 2:55 pm Boston EMS and COBTH disaster radios transmitted notification of the explosion to all area hospitals and requested status. Additional notifications reported casualties.
  - MGH Hospital CODE DISASTER activated at 3:03 pm. Disaster plan and mass casualty protocols implemented
  - Hospital Emergency Operations Center (EOC) opened in administrative conference room per plan
  - First patient arrived at our ED by private vehicle at 3:04 pm
- 

# Non-Traditional Notification and Early Situational Awareness

- Twitter and Facebook posts from the scene immediately picked up by some hospital personnel
- Text messaging
- Cell phones
  - Communication from the incident site (temporarily disabled because the cell towers were closed down)
  - Provided photos, video, GPS
  - Improved incident command communication
- MGH utilized homepage, Twitter, and Facebook to push updates and status reports

# Patient Arrivals

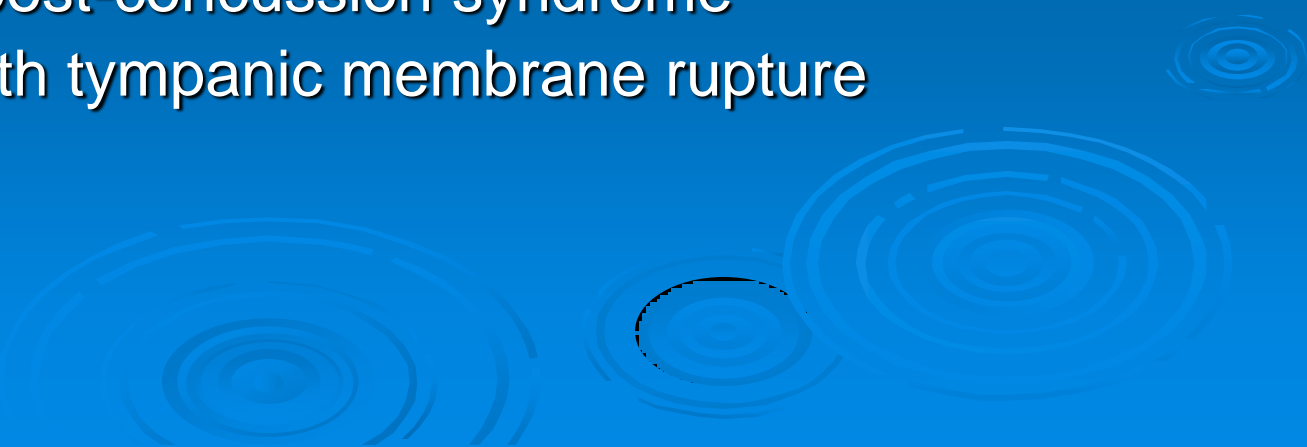
- Hospitals along the marathon route had been receiving some usual Marathon-related patients throughout the day (dehydration, dizziness, sprains/strains)
- First bombing related patients arrived at affected hospitals shortly after 3:00 pm
- Additional patients with amputations, open fractures, multiple trauma, and extreme blood loss
- Patients with limited minor injuries continued to arrive into the evening and for several days after the incident



# First MGH Patients

Date of arrival	Time of arrival	Status	Injury
4/15/2013 15:04	3:04:00 PM	Admitted	AMPUTATION
4/15/2013 15:05	3:05:00 PM	Admitted	KNEE INJ
4/15/2013 15:15	3:15:00 PM	Admitted	AMPUTATION
4/15/2013 15:17	3:17:00 PM	Discharged	L HAND INJ
4/15/2013 15:20	3:20:00 PM	Admitted	AMPUTATION
4/15/2013 15:22	3:22:00 PM	Admitted	AMPUTATION
4/15/2013 15:23	3:23:00 PM	Admitted	SHRAPNEL/FOOT
4/15/2013 15:27	3:27:00 PM	Admitted	AMPUTATION
4/15/2013 15:27	3:27:00 PM	Discharged	EXPLOSION INJ
4/15/2013 15:27	3:27:00 PM	Discharged	EXPLOSION INJ
4/15/2013 15:28	3:28:00 PM	Admitted	EXPLOSION
4/15/2013 15:30	3:30:00 PM	Admitted	TRAUMA
4/15/2013 15:41	3:41:00 PM	Admitted	TRAUMA
4/15/2013 15:52	3:52:00 PM	Discharged	DISASTER
4/15/2013 16:00	4:00:00 PM	Discharged	DISASTER
4/15/2013 16:22	4:22:00 PM	Admitted	EXPLOSION
4/15/2013 16:32	4:32:00 PM	Admitted	EXPLOSION

# Patient Injuries

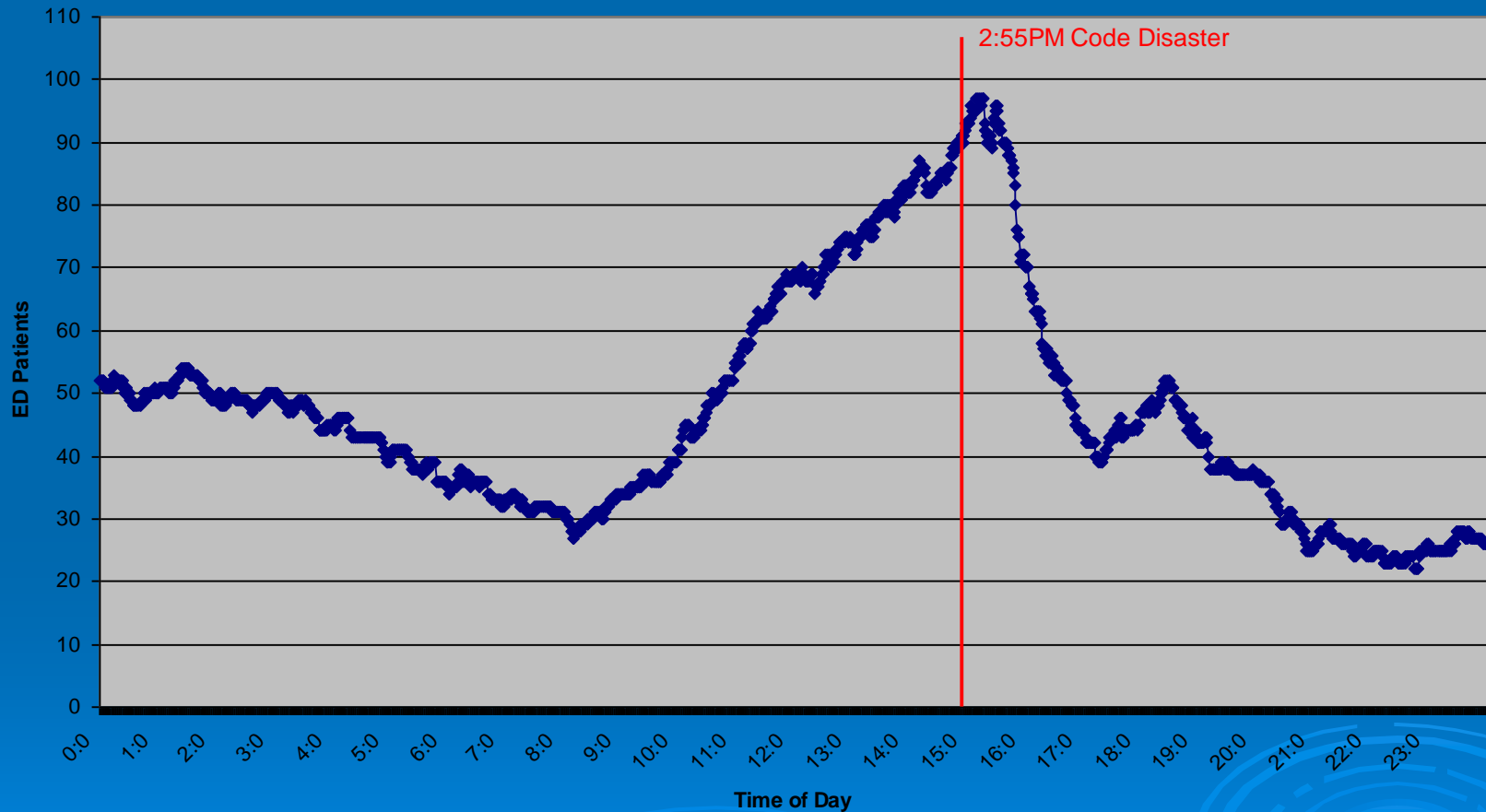
- Multiple below and above the knee amputations
  - Severe blood loss
  - 2nd and 3<sup>rd</sup> degree burns
  - Open fractures, open wounds, lacerations, embedded shrapnel with tissue injury
  - Closed fractures with contusions, sprains and strains
  - Head injuries, post-concussion syndrome
  - Hearing loss with tympanic membrane rupture
  - Acute anxiety
- 

# Acute Hospital Response

- The Acute area of the Emergency Department was cleared of all existing patients to make room for the injured
- Existing ED boarders were quickly accepted by inpatient units with limited handoff to decompress the ED
- Triage disaster protocols implemented and led by ED attending physicians. Trauma teams staged outside of each bay
  - External triage on the ambulance ramp staffed by EM MD and RN
  - Internal triage area created in ED waiting room
- Perioperative services reserved several operating rooms for expected incoming cases. Anesthesia, nursing, and surgical teams alerted staff
  - Six patients underwent surgery within 30 minutes of ED arrival
- Security secured the ED, ambulance bays, and front entrances

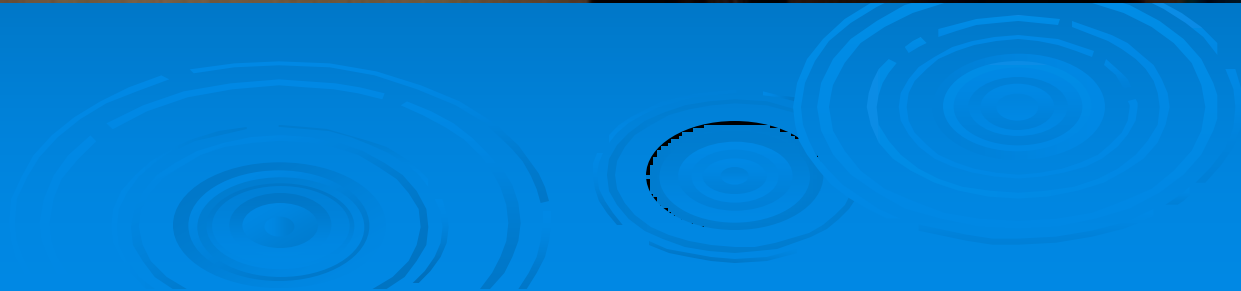
# Emergency Department decompression

ED Census  
April 15, 2013

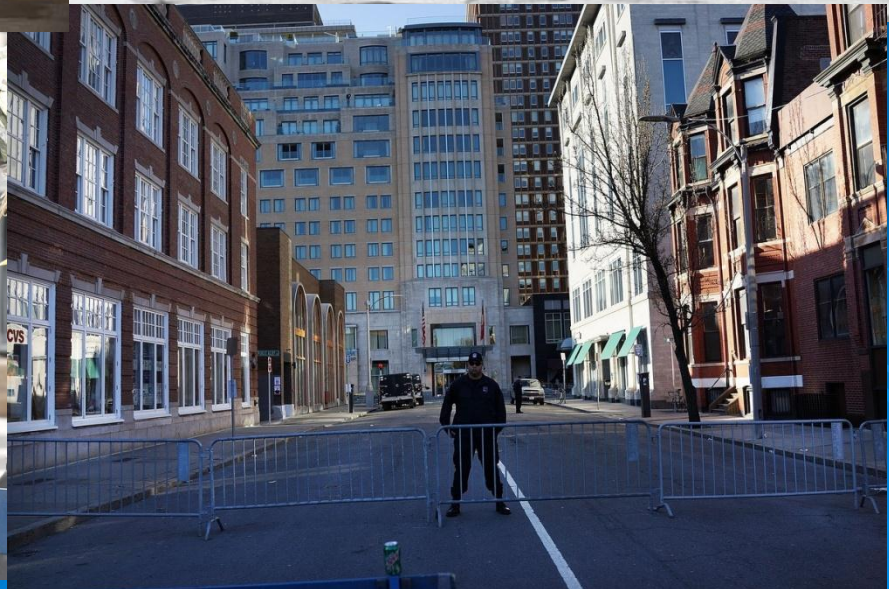


- ED volume decreased 97 to 39 patients within 1.5 hours





# *Post Event: April 15*





# Pursuit: April 18/19



# Pursuit: April 18/19

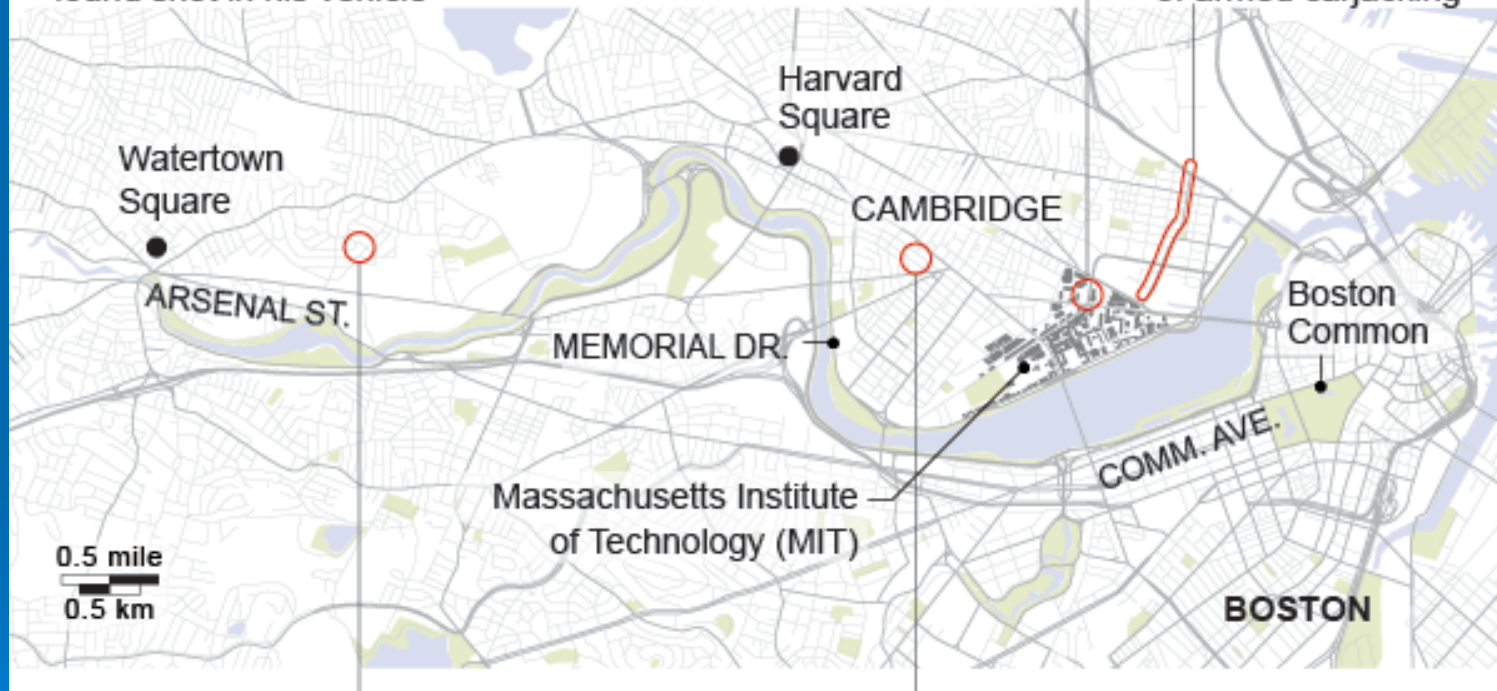
The series of incidents that unfolded last night in the Boston area

## 2 Vassar and Main streets

After the 7-11 robbery, MIT campus police officer is found shot in his vehicle

## 3 Third Street

Police receive reports of armed carjacking



## 4 Dexter and Laurel streets

Police and suspects exchange gunfire, one suspect is killed

## 1 7-11 robbery

Police release an image of one of robbers saying he is a suspect in the marathon bombings

Source: Cambridge Police Department



# *Pursuit: April 18/19*



## *Post Event: April 19*

➤ “Lockdown” vs “Shelter in Place”

➤ Who?

- Patients
- Families
- Staff

➤ Logistics?

- Public Transportation Shutdown
- Medications
- Lodging
- Meals



# *Pursuit: April 19*





# Lessons from Colleagues Embedded in MGH Plan

- We had learned key lessons from colleagues who have experience managing similar events
  - Israeli disaster management conference here in 2005
  - Aurora, CO mass shooting incident
  - Medical staff members with military experience
  - MCI research
  - Harvard School of Public Health
  - Deployment experience (DMAT, IMSURT)



# Key Lessons from Colleagues Embedded into the MGH Pain

- Expect little or no notice before first patient arrives
- Increase the speed of triage
- Manage patient distribution at site via EMS network (“red” patients) so no single hospital is overwhelmed
- Start decompressing ED and ORs before the first patient arrives
- Do not underestimate psychological trauma

# Lessons Learned from Marathon Monday

- Practice and drills made a world of difference.
- Immediate response by first responders, EMT's and Paramedics.
- Tourniquets were lifesaving.....
- Medical tent at the finish line resuscitated the injured.
- Ambulances at the scene managed to transfer patients within a few minutes.
- EMS Command at the scene distributed the critical patients roughly equally amongst the 6 trauma centers.

# How Boston was Lucky....

- We had 6 trauma centers within 2 miles of the finish line.
- Marathon Monday is a holiday but not for the hospitals – who were fully staffed but had a light elective OR list.
- Explosions occurred at the change of shift – all hospitals had “immediate double coverage.”
- Explosions were glorified fireworks – not C4; further they were outside (mortality is 4% - in an enclosed space the mortality doubles)
- Pressure cooker bombs were at ground level – explaining the nature of the injuries.

# Other Lessons...

- Cell phone towers immediately taken down after the first explosions but Wi-Fi was present.
- We were not sure of how many further explosions might occur.
- Quickly learned that there was no contamination.
- One hospital checked ambulance staff ID's.
- MGH had a misidentification.
- We will change from a digital trauma/ disaster MCI to an alphanumeric and digital. (Patient Alpha, Bravo, Charlie, Delta Echo Foxtrot etc)
- Better community feedback from hospitals on patient identity and injury.



# Lessons Learned

- Previous emergency exercises (2009 PHS *Infectious Disease Exercise*, 2011 PHS *IT Exercise*) and real events (*Rhode Island Nightclub Fire*, *H1N1 Outbreak*, *Hurricane Sandy*) have clearly demonstrated the need for a system-wide response capability
  - Lessons learned from Health Systems in New York after Hurricane Sandy point to an increased need for system wide planning and response protocols

# Debriefing / Areas for Improvement

- Notification to HICS personnel versus critical staff
- Communication to all staff; public affairs
- How do we incorporate social media into the MGH disaster plan?
- Patient/family reunification
- Emergency Department crowding during event
- Triaging “green” patients.
- Law enforcement interrogation of staff and patients

# Continued-Areas for Improvement

- Public transportation challenges
- Labor pool management
- Ongoing inpatient hospital operations
- Ongoing ambulatory hospital operations
- Communication with research community
- Release of information process/procedures; HIPAA
- Ongoing employee support (PTSD)
- Recovery, business continuity, tracking of expenses
  - Employee pay policy modification

# Out of Tragedy comes Innovation and Improvement

- The Coconut Grove Fire in Boston improved the management of burn injuries.
- The conflicts in Korea and Viet Nam taught us the benefits of rapid helicopter evacuation to specialized surgical units.
- The conflicts in Iraq and Afghanistan taught us the prompt use of tourniquets and better use of blood products.
- Perhaps the rapid treatment and evacuation of the Boston Marathon victims can teach us that system coordination and repeat drills will lead to improved patient survival.



# The Hartford Consensus

- Developed after the shootings at Sandy Hook School in Connecticut.
- Concern that existing management of multiple shooting incidents concentrates too much on “take the shooter down” before sending in EMS or Rescue personnel to both stop hemorrhage and evacuate wounded.
- Survival of those patients who managed to get to hospitals in Boston unprecedented.
- Use of tourniquets at the Boston Marathon Bombings was truly lifesaving.
- Perhaps consider in the future how to better manage and extricate shooting victims.

# The Boston Marathon





OFFICIAL WHITE HOUSE PHOTO BY PETE SOUZA



COURTESY TRACE ARNOLD

**BOSTON STRONG**

