Adapting Mass Casualty Response for the New Era

Brad Keating, MPH, CPH, NRP
Rocky Mountain Fire Department
United States of America
Disclosure

• I have no financial conflicts within this presentation and have no conflicts of interest with any of the products or materials presented.

• The opinions expressed in this presentation, while scientifically based, do not necessarily reflect those of the Rocky Mountain Fire Department.
Biographical Info

• Firefighter Paramedic for 13 years
• Tactical Paramedic for 5 years
• Tox-Medic Instructor
• International disaster response team leader for 6 years
  – Haiti, Japan, Philippines, Nepal
• Master’s Degree in Public Health in Global Disaster Management and Humanitarian Relief
What do the Following Have in Common for an MCI?

- ICS 100, 200, etc.
- National Response Plan (NRP)
- EMT/Paramedic School
- Fire Academy
- Police Academy
- Emergency Management Certifications

None of the educate initial responders how to manage and MCI
Gap in Training

- Red Card
- Blue Card
- ACLS
- PALS
- TCCC
- Tox-Medic

Anything for MCI?
Variety and Scope of Incidents

• **Nice Car Attack (2016)**
  – 86 Dead
  – 456 Wounded

• **China Knife Attack (2014)**
  – 33 Dead
  – 130 Injured

• **Paris Nightclub Shooting (2015)**
  – 137 Dead
  – 413 Injured

• **Syria Gas Attack (2017)**
  – Numbers Estimated in Hundreds

• **London Chemical Attack X 2**
  – Novichok (2018)
Why Do We Need Change?

• We don’t learn from our mistakes
  – Use outdated techniques and faulty logic
  – Fail to plan, prepare, or train for events

• We can’t triage correctly
  – Virginia Tech had 67% over triage rate

• We can’t manage a scene
  – Fort Hood Shooting cited lack of scene control to a chaotic response

• Increasing size and scope of events
  – Are you prepared for 15, 20, or even over 100 patients?
Failure To Learn From Past Mistakes

• April 20th, 1999
• Columbine High School
  – Two teens with semiautomatic weapons
  – 12 killed, 23 wounded

Image Credit: Wikipedia.com
Delayed Entry

• 11:19 AM
  – First shots fired

• 11:24 AM
  – Police arrive at school within 5 minutes
  – 6 officers on scene exchange gunfire with Harris
  – Did not pursue

• Approximately 2:16 PM
  – SWAT Teams make entry into area of building where shooters were
Cost of Delaying Care

• Dave Sanders
  – Shot at 11:26
• 911 aware of location and condition
• SWAT arrives 2:42
• First EMS contact 3:24

Image Credit: http://columbine.wikia.com/wiki/Dave_Sanders
Lessons Learned from Columbine

• Delayed entry costs lives
• Need for integrated response between FD/EMS and PD
• Unified command structure
• Change in how active shooters approached
New Plan for Active Shooters

- PD engages suspect quickly and eliminates it
- Allow EMS to gain access to the victims quicker
  - Plan still focused on PD and not FD/EMS
  - Did not include unified command
“Everybody has got a plan until they get punched in the face.”
- Mike Tyson
Pulse Nightclub

- June 12th, 2016
- 49 Dead
- 53 Wounded
- 184 minutes before EMS made entry into building

Image Credits: CBSnews.com
Delays in Care

Incident Location and Year

Minutes Until EMS Entry From Incident Beginning

- Columbine (1999)
- Paris (2015)
- Orlando (2016)
The Cost of Not Learning From Past Mistakes

Mommy I love you
2:06 AM

In club they shooting
2:06 AM

U ok
2:07 AM

Trapp in bathroom
2:07 AM

What club
2:07 AM
Use Faulty Assumptions in Our Training and Practices

• Advances in Civilian trauma care begin in War

Image Credit: www.army.mil
The Problem with Battlefield Correlation

- George Washington University study
  - 12 Active Shooter Events
  - 139 Fatalities

- Found that wounding patterns, fatal wounds, and survivable wounds differed greatly from battlefield data

- Cannot correlate battlefield data to drive our education and treatment of active shooter victims
# Wounding Patterns: The Battlefield Fallacy

## Battlefield Data
- Extremity Wound
  - 52-64%
- Head/Chest Wound
  - 48%
- Case Fatality Rate
  - 10.04%

## Civilian Active Shooting Data
- Extremity Wound
  - 20%
- Head/Chest Wound
  - 72%
- Case Fatality Rate
  - 46.5%
## Why the Difference?

<table>
<thead>
<tr>
<th>Soldier</th>
<th>Civilian</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Body Armor</td>
<td>• No Body Armor</td>
</tr>
<tr>
<td>• Kevlar Helmet</td>
<td>• No Helmet</td>
</tr>
<tr>
<td>• Average Engagement Distance</td>
<td>• Average Engagement Distance</td>
</tr>
<tr>
<td>– 20-30 meters</td>
<td>– Less than 2 meters</td>
</tr>
<tr>
<td>• Multisystem Trauma</td>
<td>• Single System Trauma</td>
</tr>
<tr>
<td>– IEDs</td>
<td>– 90% of killed had single system injuries</td>
</tr>
</tbody>
</table>
Top Three Preventable Causes of Death on the Battlefield²

- Extremity Hemorrhage: 60%
- Tension Pneumothorax: 33%
- Airway Obstruction: 6%
Top Three Preventable Causes of Death in Mass Shooting Events

- Pneumo/Hemothorax: 89%
- Airway Compromise: 8%
- Other: 3%
Reality of Mass Shooting Survival

- Only 7% of those killed in events studied had survivable wounds
- Rapid extraction within 10 minutes of injury occurring would have increased survival rates\textsuperscript{11}
- ZERO deaths from extremity exsanguination\textsuperscript{10}
We CANNOT Triage Correctly

• Virginia Tech
  – 69% over triage rate

• Fort Hood Massacre
  – Nearly 70% over triage rate
Why is Accurate Triage Important?

- Increases appropriate access to resources
- Leads to better patient outcomes

- Frequency and size of incidents increasing
  - Over a dozen school shootings in 2018
  - Number of patients increasing
    - Columbine, 1999 (12 dead, 23 wounded)
    - Paris, 2015 (137 dead, at least 350 wounded)

- Increase in lethality of incidents
Triage in Colorado

• Colorado does not have a standardized triage method
  – Only 18 states without standardized prehospital triage

• Lack of standard triage leads to:
  – Complications in actions of mutual aid responders
  – Scene confusion
  – Ultimately, an inaccurate triage of patients
Why is EMS Triage so Inaccurate?

• “Physiology of Fear” in Responders
  – Sympathetic response
  – Loss of critical thinking
  – Loss of fine motor skills
  – Reliance on basic muscle memory

• “Physiology of Fear” in Patients
  – Current triage makes false assumptions of human behavior

• Enhanced by overly-complicated triage algorithms
  – START
  – SALT
START Flaws

- Too Complicated
- Uses Respirations
- Uses Numbers
- Uses Cap Refill
SALT Flaws

- Global Sorting
- EMS Critical Thinking of Patient Survival
Need For Change

• Currently utilized methods (SALT, START) have only a 55-65% overall accuracy rate for appropriate triage\(^6\)

• Even when trained and immediately tested the accuracy of SALT was only around 70%

• Frequent training and simulations on triage can only expect accuracy improvements of at most 10% for EMS providers
Model Uniform Core Criteria (MUCC)

• CDC Project to Improve Triage

• **Findings:**
  – No Current System is Effective
  – Studies on Triage are Extremely Difficult to Perform

• **Suggestions:**
  – 24 Criteria including
    • Ease of use in austere environments
    • Easily remembered
    • Does not use numbers or vital signs
# Model Uniform Core Criteria

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Used by other triage systems</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Considerations</strong></td>
<td></td>
</tr>
<tr>
<td>Triage systems and all of their components must apply to all ages and populations of patients.</td>
<td>Yes</td>
</tr>
<tr>
<td>Triage systems must be applicable across the broad range of mass-casualty incidents in which there is a single location with multiple patients.</td>
<td>No</td>
</tr>
<tr>
<td>Triage systems must be simple, easy to remember, and amenable to quick memory aids.</td>
<td>Yes</td>
</tr>
<tr>
<td>Triage systems must be easy to apply and practical for use in an austere environment.</td>
<td>Yes</td>
</tr>
<tr>
<td>Triage systems are resource dependent, and the system must allow for dynamic triage decisions based on changes in available resources and patient conditions.</td>
<td>Yes</td>
</tr>
<tr>
<td>The triage system must require that the assigned triage category for each patient be visibly identifiable (e.g., triage tags, tarps, markers).</td>
<td>No</td>
</tr>
<tr>
<td>Triage is dynamic and reflects patient condition and available resources at the time of assessment. Assessments must be completed whenever possible and categories adjusted to reflect changes.</td>
<td>No</td>
</tr>
<tr>
<td><strong>Global Sorting</strong></td>
<td></td>
</tr>
<tr>
<td>Simple commands must be used initially to prioritize victims for individual assessment.</td>
<td>Yes</td>
</tr>
<tr>
<td>The first priority for individual assessment is to identify those who are likely to need a lifesaving intervention. They can be identified as those who are unable to follow commands and do not make purposeful movements, or those who have an obvious threat to life (e.g., life-threatening external hemorrhage).</td>
<td>No</td>
</tr>
<tr>
<td>The second priority for individual assessment is to identify those who are unable to follow the command to ambulate to an assigned place but are able to follow other commands (e.g., wave) or make purposeful movement.</td>
<td>No</td>
</tr>
<tr>
<td>The last priority for individual assessment is to identify those who follow commands by ambulating to an assigned place (or make purposeful movements) and have no obvious life-threatening conditions (e.g., life-threatening external hemorrhage).</td>
<td>Yes</td>
</tr>
<tr>
<td>All patients must be assessed individually regardless of their initial prioritization during global sorting. This includes the assessment of walking patients as soon as resources are available.</td>
<td>No</td>
</tr>
</tbody>
</table>
### Model Uniform Core Criteria

| **Lifesaving Interventions** |  
|-------------------------------|----------------------------------|
| Lifesaving interventions are considered for each patient and provided as necessary, before assigning a triage category. Patients must be assigned a triage category according to their condition after any lifesaving interventions. | Yes |
| Lifesaving interventions are performed only if the equipment is readily available, the intervention is within the provider’s scope of practice, the intervention can be performed quickly (i.e., in less than 1 min), and the intervention does not require the provider to stay with the patient. | No |
| Lifesaving interventions include the following: controlling life-threatening external hemorrhage, opening the airway using basic maneuvers (for an apneic child, consider 2 rescue breaths), performing chest decompression, and providing auto-injector antidotes. | No |

| **Individual Assessment** |  
|-------------------------------|----------------------------------|
| Each victim must be assigned to 1 of 5 triage categories (immediate, delayed, minimal, expectant, and dead). Each category must be represented with an associated color: immediate/red, delayed/yellow, minimal/green, expectant/gray, dead/black. | Yes |
| Assessment must not require counting or timing vital signs and instead use yes–or–no criteria. | No |
## Model Uniform Core Criteria

<table>
<thead>
<tr>
<th>Diagnostic equipment must not be used for initial assessment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary refill must not be used as a sole indicator of peripheral perfusion.</td>
</tr>
<tr>
<td>Patients who are not breathing after 1 attempt to open their airway (in children, 2 rescue breaths may also be given) must be classified as dead and visually identified as such.</td>
</tr>
<tr>
<td>Patients are categorized as immediate if they are unable to follow commands or make purposeful movements, OR they do not have a peripheral pulse, OR they are in obvious respiratory distress, OR they have a life-threatening external hemorrhage; provided their injuries are likely to be survivable given available resources.</td>
</tr>
<tr>
<td>Patients are categorized as expectant if they are unable to follow commands or make purposeful movements OR they do not have a peripheral pulse, OR they are in obvious respiratory distress, OR they have a life-threatening external hemorrhage, AND they are unlikely to survive given the available resources. These patients should receive resuscitation or comfort care when sufficient resources are available.</td>
</tr>
<tr>
<td>Patients are categorized as delayed if they are able to follow commands or make purposeful movements, AND they have peripheral pulse, AND they are not in respiratory distress, AND they do not have a life-threatening external hemorrhage, AND they have injuries that are not considered minor.</td>
</tr>
<tr>
<td>Patients are categorized as minimal if they are able to follow commands or make purposeful movements, AND they have peripheral pulse, AND they are not in respiratory distress, AND they do not have a life-threatening external hemorrhage, AND their injuries are considered minor.</td>
</tr>
<tr>
<td>Patients categorized as immediate are the first priority for treatment and/or transport, followed by patients categorized as delayed and minimal. Patients categorized as expectant should be provided with treatment and/or transport as resources allow. Efficient use of transport assets may include mixing categories of patients and using alternate forms of transport.</td>
</tr>
</tbody>
</table>
Building A New Triage System

• Pull from the best systems globally
  – Israel
  – CDC recommendations

• Use current, scientific-based approach
  – EMS must change when confronted with new evidence

• SIMPLIFY IT!!
RAMP Triage Model

Casualty without signs of obvious death

Casualty follows commands?

Yes

Radial pulse present?  

Yes

Delayed  

No

Urgent

No

Radial pulse present?  

Yes

Urgent  

No

Expectant/Deceased
Science Behind RAMP

• GCS directly correlates with hospital discharge in trauma
  – But we are terrible at scoring GCS

• Following basic commands as substitute
  – Study of 29,573 patients found this the best overall indicator of survival from trauma

• Lack of radial pulse and not following commands
  – 92% mortality rate

• Yellow category most inaccurate by EMS
Benefits of RAMP

- Ease of use
- Easily taught
- No reliance on numbers or critical thinking
- Easily remembered

- Uses Scientific Evidence
Scene Flaws in Current System

• Overly complicated triage
  – Does not follow scientific evidence of effectiveness
• Convoluted triage tags
• Excessive equipment on scene
• Absent unified command
  – Delays in allowing EMS access to victims
• Response models and protocols vary between agencies
Scene Management

- Where does everybody go?
- Zone approach
- Casualty collection point
- Who do I notify?
Scene Management

• Vehicles
  – On scene
  – Staging

• Ingress/Egress
  – Routes
  – Who has priority
<table>
<thead>
<tr>
<th>Zone Approach in Terrorism Situations[^1]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hot Zone</strong></td>
</tr>
<tr>
<td>• Portion of scene with active engagement of threat</td>
</tr>
<tr>
<td>• Law enforcement only</td>
</tr>
<tr>
<td><strong>Warm Zone</strong></td>
</tr>
<tr>
<td>• No direct threat, but potential for harm still exists</td>
</tr>
<tr>
<td>• Rapid triage</td>
</tr>
<tr>
<td>• Lifesaving interventions</td>
</tr>
<tr>
<td>• Interior casualty collection point</td>
</tr>
<tr>
<td><strong>Cold Zone</strong></td>
</tr>
<tr>
<td>• Safe area, outside of scene and away from danger</td>
</tr>
<tr>
<td>• Unified command</td>
</tr>
<tr>
<td>• Secondary Triage</td>
</tr>
<tr>
<td>• Evacuation</td>
</tr>
</tbody>
</table>

[^1]: Source of information - [4]
Scene Management

• Casualty Collection Point
  – What is it?
  – Where to put it?
  – Who should staff it?
  – What equipment should be there?

[Image of soldiers in a desert setting with a vehicle]
Scene Management

• Other items of note
  – Landing Zone?
  – Secondary devices?

• Maintain situational awareness
Equipment and Interventions

• What to carry
  – What stuff do I need?
  – What stuff do I not need?

• Life saving interventions
  – Stop hemorrhage
  – Open airway
  – Decompress tension pneumothorax
  – Seal off chest wound
Excessive Equipment on Scene

• Leave bulky equipment bags in rigs
  – Unless extended scene times are expected
  – NO BOARD AND COLLAR!

• Also pertains to apparatus
What to Carry (Primary Triage Units)

- **Triage Tape**
- **Life Saving Interventions**
  - Tourniquets
  - Hemostatic Gauze
  - Nasopharyngeal Airways
  - Chest Decompression Needles (10 gauge, 3 inch)

Image Credits: www.emsworld.com
Convoluted Triage Tags

- Remove emphasis on rapid transport
- Take too long to fill out

Image Credit: www.firefighternation.com
Triage Tape

- Can be applied in seconds
- Won’t soak through like paper cards
- No need to write on it

Image Credit: www.sosproducts.com
Life Saving Interventions

• Tourniquet
  – Apply to any significant extremity hemorrhage
  – Apply as high as possible on the limb

• Bleed out times
  – Femoral
    • 3-5 minutes
  – Brachial
    • 6-9 minutes

• https://www.youtube.com/watch?v=lJCbk2Zna6Q&has_verified=1
Life Saving Interventions

• Wound Packing
  – Hemostatic Agent
  – Used in junctional wounds
    • Neck
    • Groin
    • Armpit

– https://www.youtube.com/watch?v=prYu928LFMc
Life Saving Interventions

- NPA
  - Any patient with respiratory compromise
  - 26 french
  - Why not an OPA?
Life Saving Interventions

• Chest Decompression
  – Tension pneumothorax
  – DIB with mechanism

• Location?
  – Anterior
  – Lateral (preferred)

– https://www.youtube.com/watch?v=co9_RLN78IY
Life Saving Interventions

• Chest Seal
  – Vented vs Not Vented
  – Other options

– https://www.youtube.com/watch?v=vL9Kyf6-pd0
What to Carry (Transport Units)

• Stretcher or Litter
• Life Saving Intervention Kit

Image Credit: www.Dailymail.com
Response Protocol Variations

- TSA Agent shot at LAX in 2013
- TSA, EMS, and PD all with different response protocols
- Victim laid just inside the exterior doors
  - Visible from crews on the street
- Did not receive care for over 30 Minutes
  - Autopsy showed exsanguination in about 7 minutes

Image Credit: CBSnews.com
Image Credit: Latimes.com
Need For Unified Command

• Lack of planning on unified response
• Absent unified command
First 5 Minutes

• First Unit
  – Unify command with PD/EMS
  – Verbally establish corridor for transport units
  – Establish staging area for incoming non-transport units
  – Begin rapid triage

• Second Unit
  – Rapid triage (if not done by first unit)
  – Begin casualty removal
  – Verbalizes casualty collection point (CCP)
First 5 Minutes

• Third Unit
  – Establish Secondary Triage or Transport
  – Move casualties from CCP if needed

• Remaining Incoming Units
  – Transport units only stop for patient collection
  – Non-Transport units assigned as litter carriers
  – Follow ICS for command structure
  – May need multiple entry teams for large incident
First 5 Minute Fatal Flaws

• Over triage
• Over treatment
• Transport units delayed on scene
  – Unable to get into or out of scene
  – Attempt to gather too much patient info
  – Attempt to bring in too much equipment
• Failure to establish unified command
• Failure to notify hospitals of incident
Integrated Training and Planning

• Be prepared for active shooter events
• All responding agencies operate under a standard protocol
• Unified command structure
• Communication between agencies
• When disaster strikes, all responders are on the same page
Concluding Remarks

• Mass casualty incidents are becoming a more frequent reality in the current geopolitical environment
• Preparation is the key to a unified and effective response
• Deficiencies in responses can lead to an increased mortality rate for victims
• A more efficient triage and treatment system is needed for mass trauma situations
References

