Prevention of Recurrent Injury: The Role of EMS

“Injuries take only seconds to happen, but their effects can last a lifetime”

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Objectives:

- Review the epidemiology of injury
- Review the science of injury prevention
- Present a practical five-step injury prevention strategy you can use
Epidemiology: Scope of the Problem

- 140,000 Americans die from injuries/year¹
- Non-fatal injuries are even more common:
  - There are 400 injuries & 250 ED visits for every fatal injury²
  - Injuries represent 12% of hospital admissions¹
  - Injuries represent 25% of ED visits¹
  - 1 out of 4 Americans have an injury visit to an emergency department each year¹
  - There are 9-37 million injury visits to US ED’s annually ²³

The Injury Pyramid

1 Death
18 Hospital Admits
260 Emergency Dept Visits
400 Reported Injury Events
<table>
<thead>
<tr>
<th>Types of Injuries</th>
<th>UNINTENTIONAL</th>
<th>INTENTIONAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVC</td>
<td></td>
<td>Suicide</td>
</tr>
<tr>
<td>Falls</td>
<td></td>
<td>Homicide</td>
</tr>
<tr>
<td>Drownings/Diving</td>
<td></td>
<td>Battery</td>
</tr>
<tr>
<td>Poisonings</td>
<td></td>
<td>Rape</td>
</tr>
<tr>
<td>Firearms</td>
<td></td>
<td>Domestic Violence</td>
</tr>
<tr>
<td>Burns/Smoke</td>
<td></td>
<td></td>
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<tr>
<td>Bicycle</td>
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</tbody>
</table>
Injury is a disease of the young

- Injury is the 3rd cause of death overall, behind heart disease and cancer, but…
- Injury is the leading cause of death for ages 1-34\(^1\)
- 33,000 injury related deaths in this age group in 1995\(^1\)
- Injury accounts for 50% of deaths for ages 1-14\(^2\)
- Injury accounts for 78% of deaths ages 15-24\(^3\)

Drownings include bathtubs, pools or bodies of water, and 5 gallon pails which small children with their large heads cannot get out of once they fall in.

Fire fatalities are high in this age group as small children are not able to escape from a burning building by themselves.

MVC’s: a major cause of injury to youth

- MVC’s are the leading cause of death for the first three decades of life\textsuperscript{1}
- 7/1000 fifteen year old males are killed by age 25 due to MVC’s in the US\textsuperscript{1}

Unintentional Injury Deaths: Ages 15-24, U.S. 1992-95\textsuperscript{2}


Lost Future Productivity

- As injuries often occur to young people, the morbidity is profound, with huge societal expenses in terms of lost productivity and health care costs, about double that of heart disease and cancer
- 4 Million work-years lost due to injury...
- 2.1 Million work years due to heart disease
- 1.7 Million work years due to cancer

Injury does Not forgive the Old

- Although not the leading cause of death in the elderly…
- Elderly have the highest injury-related fatality rate, mostly due to falls\(^1\)
- 29,000 fatal injuries in 1995 to age 65 and older\(^2\)


The Testosterone and Age Factor

- Note the bimodal distribution of injury fatalities, the first occurring with young adult males who are greater risk takers, and the second with elders.

- Elders do not get injured as often, but when they do, the injuries often mark the beginning of a cycle of decompensation that leads to their death.

Injury is a Recurrent Disease

- Numerous studies have examined injury in terms of:
  - Age
  - Race
  - Alcohol Use
  - Socioeconomic factors

- These studies identify young black inner-city males as being at most risk for injury

- However, most of these studies examined only severely injured trauma registry patients

Waxweiler, RJ: The role of the emergency department in creating a safe America. Acad Emerg Med 1997;4:761-763.
Recurrent Injury is Actually a Widespread Problem

- Largest study to date by Madden: Prospective cohort study of ALL patients (34,378) presenting to an urban ED with ANY injury during a two year period
- Madden found a 22% recurrent injury rate in one year...
- A cohort mean of 1.3 injury visits per year..
- And that the best predictor of future injury was any injury visit in the previous year

Other studies support Madden’s findings

- The Philadelphia Injury Prevention Program found a recurrent injury rate of 19%\textsuperscript{1}
- A study by Williams, in a rural ED, found a recurrent injury rate of 12%, accounting for 24% of all injury related visits and an average of 1.2 injury visits per patient per year\textsuperscript{2}
- One study identified an increased injury risk to siblings of injured children: 1.75 relative risk versus 0.57, peaking at 4-10 days, and not returning to baseline until 2.5 months\textsuperscript{3}

Conclusions on Recurrent Injury

- Injury effects all demographic groups, transgressing age, race, socioeconomic and gender stereotypes
- Madden, “although there are factors that place patients at risk for recurrent injury, those factors are not demographic - all patients presenting to an ED with injury should be considered at risk for re-injury”.

Are you convinced of the importance of the prevention of recurrent injury

- There is a 22% injury recurrence rate that effects all individuals
- This is a sobering statistic, and likely an underestimate, as many people with repeat injury will present to other ED’s or health care providers than those in the studies
- Injury prevention represents a unique opportunity and responsibility for EMS personnel to intervene in the cycle of injury
Section II:
The Science of Injury Prevention
Most Injuries are not “Accidents”

“Accidents:”
Random, unpredictable, unavoidable occurrences with blame resting on the carelessness of an individual or due to an “act of God”.

Most Injuries Can Be Predicted & Prevented

- This was no “accident”, but rather a predictable and preventable outcome of feeding wild bears
- This was an injury that could have been predicted and prevented
The Cause of Injuries are Complex

- Injury used to be blamed on an individual’s carelessness, tendency to be accident prone, or an act of “God”
- With the modern science of injury prevention, there has been a shift in the theoretical view of injury from the individual to the environmental context
- The single-cause explanation for injury is inadequate: For example, “Drunk Driving” is not a cause of injury, as not all drunk drivers crash. There are a multitude of factors that lead to some drunk drivers crashing, while others do not.
- This way of thinking about injury has lead to the modern definition of injury...
Modern Definition of Injury

- Any unintentional or intentional damage to the body resulting from acute exposure to thermal, mechanical, electrical, or chemical energy or from the absence of such essentials as heat or oxygen
- Using this definition, one can analyze the mechanism of injury

Epidemiologists have traditionally analyzed disease in terms of three variables: host, agent and environment.

Gordon was the first to apply the classic epidemiological triad to the science of injury prevention.

Using the epidemiological triad, one can analyze the cause of a MVC injury. Such an injury may be due in part to the host (drunk driver), the agent (transfer of kinetic energy to the host when the vehicle crashes), and the environment (a sudden curve in the road). The factors in combination lead to the injury event of a MVC. The crash is not due to just the single factor of being intoxicated.

Injury events occur when task demand and performance ability are out of balance.

Injury events allow the transfer of uncontrolled energy to an individual in a permissive environment.
Injuries are Events that Occur Over Time

- **Pre-Injury Phase:** Prior to liberation of energy, injuries may be prevented here
- **Injury Phase:** Energy is transferred to the host - injury can be mitigated here
- **Post-Injury Phase:** Clean up the mess, EMS response and hospital care to limit damage

Haddon Matrix - Combines epidemiology and time-frame

- Advanced analysis
- Examines injury in terms of both:
  - Temporal, &
  - Epidemiological components
- Highlights multitude of intervention points

The Haddon Matrix

<table>
<thead>
<tr>
<th>Host</th>
<th>Agent</th>
<th>Env</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Inj</td>
<td>Event</td>
<td></td>
</tr>
<tr>
<td>Injury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Injury</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


### Haddon Matrix: Applied to MVC

<table>
<thead>
<tr>
<th>Event</th>
<th>Host</th>
<th>Agent/Vehicle</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Event</td>
<td>Driver’s Vision</td>
<td>Brakes</td>
<td>Weather</td>
</tr>
<tr>
<td></td>
<td>Experience</td>
<td>Tires</td>
<td>Visibility</td>
</tr>
<tr>
<td></td>
<td>Fatigue</td>
<td>Speed</td>
<td>Road Conditions</td>
</tr>
<tr>
<td>Injury Event</td>
<td>Seatbelt use</td>
<td>Vehicle Design</td>
<td>Guard Rails</td>
</tr>
<tr>
<td></td>
<td>Position in car</td>
<td>Airbags</td>
<td>Speed Limits</td>
</tr>
<tr>
<td></td>
<td>Osteoporosis</td>
<td>Safety Features</td>
<td>Other traffic</td>
</tr>
<tr>
<td>Post-Event</td>
<td>Age</td>
<td>Fuel System Integrity</td>
<td>EMS Response</td>
</tr>
<tr>
<td></td>
<td>Physical Condition</td>
<td>Extrication Time</td>
<td>Our Job</td>
</tr>
</tbody>
</table>

Each box in the Haddon matrix above represents a potential intervention point that can be altered to help prevent an injury from occurring.
Haddon identified ten countermeasures representing the various ways energy transfer can be controlled, modified, or interrupted to prevent injury.

- Prevent the creation of the particular form of energy in the first place
- Reduce the amount of energy marshaled
- Prevent the release of energy
- Modify the rate of spatial distribution or release of energy from its source
- Separate, in space or time, the energy being released from the susceptible structure
Haddons Ten Countermeasures Continued

- Interpose a material barrier to block or attenuate the energy transfer
- Modify contact surfaces
- Strengthen the structure, living or non-living, that may be damaged by the energy
- Quickly detect and evaluate damage and counter its continuation or extension
- Stabilize, repair, and rehabilitate the object of damage

Three E’s of Injury Prevention

- Education
- Enforcement
- Engineering

Active versus Passive Strategies

- Education and enforcement are known as active strategies, as they require an action on the part of an individual, such as buckling a seat belt.
- Engineering is a passive strategy as the individual is afforded protection automatically by how the system is designed, such as air bags in cars.
Goals of Educational Strategies

- Provide Information of injury risks and how to avoid them
- Change attitudes towards risk and safety
- Adopt behaviors that result in reduced injury rates

Enforcement

- If you can’t teach’ em, force' em
- Promulgation of laws requiring certain behavior by an individual
- Example: Motorcycle helmet laws
- Enforcement is more successful than education alone, and better if combined with education

Engineering

- Engineering builds safety measures into the environment
- Passive measures that protect everyone
- More effective than education or enforcement
- Unfortunately, not all injuries are amenable to engineered solutions

Examples of Engineered Injury Prevention Solutions

- Air bags
- Break-away utility poles
- Guardrails
- Fencing around pools
- Child-proof medicine bottles
Section III: An EMS Injury Prevention Strategy

- **RECUR** - Is a five-step EMS Injury Prevention Strategy to help prevent Recurrent injury. It starts pre-hospital and continues into the ED
  - R. Risk Identification
  - E. Education
  - C. Collection of Data
  - U. Upshot (Plan)
  - R. Referral
Risk Identification

- There is a 22% injury recurrence rate across all demographic groups
- Every patient presenting to the ED with injury should be considered at risk for re-injury
- Targeting only specific groups may miss large numbers of at risk patients

MVCs are Recurrent Injuries

Mancino:

- 68% of 150 patients admitted for MVC injury had history of prior MVC, of those...
- 48% had injuries requiring hospital admission

Alcohol is a risk factor for injury

- 37% (or more) MVC patients intoxicated
- 42% MVC patients diagnosed with alcohol abuse
- Mortality risk for drunken drivers:
  - 9 times the baseline if one DWI
  - 36 times the baseline if two DWIs

Alcohol is a risk factor for injury

Davison: A single alcohol-related ED visit is an important predictor of continued problem drinking, future DUI, and possible premature death

Numerous Studies Identify Urban Trauma as a Recurrent Disease

- Sims: 44% of 263 patients of assault had at least one more episode of violent trauma and a 20% mortality rate over the next 5 years
- Morrissey: 32% of 339 patients with penetrating trauma had a history of 2 or more previous violent trauma episodes


Recurrent Trauma
Not Just an Urban Problem

- Study in Northern Israel - an area with low crime/drugs - Found history of trauma to be significantly associated with future trauma, mostly young males (risk taking)

- Rural Mississippi: 40% of trauma patients had history of prior trauma, no difference between unintentional or intentional


Poole GV, Griswold JA, Thaggard VK, Rhodes RS: Trauma is a recurrent disease. Surgery 1993;113:608-611.
Adolescents at risk for Recurrent Trauma

- Especially true when associated with alcohol
- Positive Blood Alcohol Concentration in 38-48% of adolescents presenting to ED’s with trauma

Falls & the Elderly
A Fatal Combination

- 30% age over 65, and 40% those over 75 fall once a year
- Davies: Of 200 elderly patients presenting to the ED with falls, 30% had recurrent falls
- Falls in the elderly often initiate a downward cycle of decompensation that leads to their ultimate demise, even a simple fracture can be fatal due to its associated complications

Risk Identification

- **Groups as Risk**
  - MVC
  - Alcohol
  - Trauma/Violence
  - Youth
  - Elderly

- Screening and identification of these groups will allow for appropriate education, referral, and disposition decisions.

- Remember, however, that all patients with injury are considered at risk for re-injury.
Education - An injury prevention strategy you can do

- Discuss the injury with the patient
- Remember the Haddon matrix and analyze the injury in terms of its various causes
- Highlight potential intervention points


Education can be Effective

- Found 18/20 studies to be effective

Results:
- Decreased hot water temperatures at tap
- Increased use of seat belts and car seats
- Increased installation of smoke detectors
- Decreased incidence of falls

EMS Injury Prevention is Efficacious

- It satisfies two important criteria for success
  - The intervention comes to patient rather than waiting for patient to seek it out
  - Intervention occurs during “teachable moment”

- There are unique challenges as well
  - Low receptivity at height of crisis
  - Altered mental state (patients in a coma will not be very receptive to injury prevention!)

Collection of Data

- **Identifies cause of injury**
  - First step in prevention

- **Identifies needs for:**
  - Community outreach program
  - Education efforts
  - New laws/regulations
  - Allocation of resources
  - Product modifications
  - Public health response

E-Codes
External Cause of Injury Code

- Part of the International Classification of Diseases (ICD-10, ICD-9)
- Specifies mechanism (MVC, fire, fall, etc) & intent (unintentional, suicide, homicide)
- Large categories with specific sub-categories
- Diagnosis code specifies anatomic site and nature
- ICD-10 will have twice as many E-codes allowing for more precise coding
- 23 States require e-coding, including MA

Quality E-Coding Begins at the Scene of the Injury

- **Incomplete Documentation**
  - Closed Fracture Base of Skull, Hit Head
  - Does not mention the cause, location, or intentionality as does the next example of complete documentation

- **Complete Documentation**
  - Closed Fracture Base of Skull, 2nd to Accidentally Falling Off Scaffolding at Construction Site
    - Cause
    - Location (Work)
    - Intentionality
E-Coding - What you can do

- Gather complete information on cause of injury, location, and intentionality
- Document in medical record
- The role of EMS is critical in the collection of complete data for E-codes
- You are the eyes for the ED physicians
Upshot - Plan

- Develop a plan to reduce recurrent injury
- Identify risk factors & specific behavioral modifications
- Discuss specific things your patient can do differently in the future to help prevent recurrent injury
Referral

Lowenstein: Of 46% of intoxicated ED visits for trauma - only 13% received referral

– Conclusion: “Acutely intoxicated patients in the ED present an opportunity for therapeutic intervention which is usually missed”

Referral

- Madden: 0-13% of intoxicated drivers with MVC injuries received referral
- Maio: Only 34% of surviving adolescent trauma victims with a positive BAC received or were referred to counseling


Many opportunities to refer

- **When to Refer**
  - Drug/alcohol abuse
  - Victims of violence or domestic abuse
  - Psychiatric illness
  - Those in need of additional support services (elderly)

- **Referral Support**
  - Have referral system in place
  - List of local resources
  - Social service staff
  - Most important: Linkage with PCP to facilitate follow up
R.E.C.U.R. - Summary

- **R.** Risk Identification
- **E.** Education
- **C.** Collection of Data
- **U.** Upshot (plan)
- **R.** Referral

You can initiate this injury prevention strategy pre-hospital with your patients
Exam Answers

- Education, Enforcement, Engineering
- Pre-injury, Injury, Post-injury
- Host, Agent, Environment
- 20% of injuries are recurrent
- Recurrent injuries occur to all individuals
- RECUR: Risk Identification, Education, Collection of Data, Upshot (plan), Referral