"Predictive Modeling of Injury Severity Utilizing Pre-hospital Trauma Triage and Mechanism of Injury Criteria for Advanced Automatic Crash Notification (AACN) Systems"

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University of Washington
Harborview Medical Center
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NHTSA Priorities

• **Advanced Automatic Collision Notification (AACN)**

• Description: AACN provides early contact with emergency personnel and GPS position when a severe crash occurs. Examine potential benefits and triage capabilities of AACN and **EMS connection to get serious injuries to a Level 1 trauma hospital**. Determine whether a rulemaking is warranted.
If you are severely injured, care at a Level I trauma center lowers the risk of death by 25%.

McKenzie, Rivara, Jurkovich...
NEJM, 2006
NHTSA AACN Activities

Outline

1. Overview
2. NHTSA and NHTSA/CDC AACN Work
3. EDR Rule and Analysis
4. Injury Prediction Algorithms
5. AACN Scorecard/Next Steps
Getting from Crash to Trauma Center

• Finding the car
• Notifying 9-1-1
• Appropriate EMS response
  – Getting the right people there
• Triage
  – Getting the right patient to the right hospital
• Care and transport
• Designated trauma centers
• Consistent communication essential
Current Need for Crash Notification Systems and GPS locations – CIREN case studies

- Driver found after 8 days, departed roadway down into roadside ravine
- Survived with critical injuries after very long treatment at the trauma center
- Would have benefited greatly from initial EMS response
Need for Crash Notification Systems for Notification and GPS locations – CIREN case studies

An elderly couple struck a tree late evening and rotated into ditch out of site.

- Couple not found until next morning and passenger had died and driver was critically injured.
- Injuries appeared survivable if EMS response was initiated.
Background

NHTSA/CDC AACN Work
“Vehicle telematics consistent with high risk of injury”
RECOMMENDATIONS FROM THE EXPERT PANEL:
ADVANCED AUTOMATIC COLLISION NOTIFICATION AND TRIAGE OF THE INJURED PATIENT

PREFACE BY THE
CENTERS FOR DISEASE CONTROL AND PREVENTION,
NATIONAL CENTER FOR INJURY PREVENTION AND CONTROL, DIVISION OF INJURY RESPONSE

WITH SUPPORT FROM
ONSTAR, THE GENERAL MOTORS FOUNDATION, AND THE CDC FOUNDATION

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
Advanced Automatic Crash Notification

- Critical information helpful to dispatch, respond and triage an injured occupant to final destination
  - Velocity change of vehicle
  - Principle Direction of Force
  - Seat belt usage
  - Crash with multiple impacts
  - Vehicle type
  - Voice (GCS proxy)

- Information can be collected in vehicle EDR for transmission
Event Data Recorders (EDRs)

- NHTSA published a final rule on August 28, 2006 regulating Event Data Recorders (EDR)
- Effective date of rule is Sept. 1, 2012
AACN : Next Steps

• AACN data can be used to predict injury severity, conveyed to EMS services and trauma centers, and integrated into the field triage process.

• CDC and NHTSA
  – Working together to create awareness
  – Meeting with industry to solicit cooperation
  – Determining course of action relative to Expert Panel Recommendations
  – Determining benefits
AACN

• Shows promise in improving outcomes in severely injured crash patients by:
  – Predicting the likelihood of serious injury
  – Decreasing response time
  – Assisting with field triage decisions
  – Decreasing time to trauma center
  – Decreasing death and disability
Triage Steps to Determine Transport to Level 1 Trauma Center

1. Measure vital signs and level of consciousness:
   - Glasgow Coma Scale: < 14
   - Systolic blood pressure: < 80 mm Hg
   - Respiratory rate: > 30 breaths per minute

2. Take to a trauma center. Steps 1 and 2 attempt to identify the most seriously injured patients. These patients should be transported preferentially to the highest level of care within the trauma system.

3. Assess mechanism of injury and evidence of high-energy impact.

4. Assess need for intubation and/or endotracheal intubation.

5. Step Two:
   - All penetrating injuries to head, neck, torso, and extremities proximal to elbow and knee
   - All closed or open fractures of upper or lower extremities
   - Amputation proximal to wrist and ankle
   - Pelvic fractures
   - Open or depressed skull fracture
   - Multiple

6. Step Three:
   - Falls:
     - Highland fence: > 12 feet (3.7 m) or twice the height of the child
     - High-risk auto crash:
       - Intoxication: > 0.12
       - Ejection: 12 inches (30.5 cm) or more
       - Death in passenger compartment
       - Vehicle deformed or crushed by other vehicle
     - Vehicle telecommunication, consistent with high risk of injury
     - Auto vs. pedestrian/bicyclist, run over, or with significant (> 20 m/s) impact
     - Motorcycle crash, run over

7. Step Four:
   - Age:
     - Older adults: Risk of injury/death increases after age 65 years
     - Children:
       - Fracture/dispersion and dislocation
       - Burns:
         - Without other trauma mechanism injury to burn facility
         - With trauma mechanism injury to burn facility
         - Non-severe penetrating injury
         - Non-severe crush injury
         - Non-severe other injury requiring dialysis
         - Pregnancy > 20 weeks
         - Injury > 20 weeks without other trauma

8. Contact medical control and consider transport to a trauma center or a specific resource hospital.

When in doubt, transport to a trauma center.
Current CDC GUIDELINES

YES → Take to Trauma Center

GCS < 14
SBP < 90 mmHg
RR < 10 > 29

NO → Proceed to next step

VS and LOC

YES → Take to Trauma Center

All penetrating injuries to head/neck/torso/extremities
- Flail Chest
- 2+ long bone fx
- Crush/degloving/mangled ext
- Prox amputation
- Pelvic Fx
- Open/depressed skull fx
- Paralysis

NO → Proceed to next step
Anatomy of Injury

Mechanism of Injury

-Intrusion >12 inches at occupant site
Intrusion > 18 inches any site
-Ejection/Partial Ejection
- Death in the same occupant compartment
- Vehicle telemetry data consistent with a high risk of injury
Background: Evidence for 2006 Guidelines

• 1995: South Carolina EMS registry data
  – 66 (16.1%) of 411 patients meeting mechanism-of-injury criteria had ISS of >15
  – 262 (63.7%) with ISS > 15 had mechanism of injury as the sole indication (i.e., with no physiologic or anatomic criteria)
  – MOI: Adding MOI criteria increased sensitivity for identifying severely injured patients

Background: Evidence for 2006 Guidelines

• 1997: Prospective study of 3,147 trauma patients
  – mechanism-of-injury criteria alone had a sensitivity of 70% for identifying patients with ISS of >16
  – Criteria: Ejection, occupant death, extrication time > 20 min

Predicting Trauma Center Need using the Mechanism of Injury Criteria

- Prospective observational study: 3 Level 1 Trauma Centers
- Adult injured patient (all ISS included)
- EMS interviewed upon ED arrival
- Patients who met step 1 or step 2 were excluded
- Used 1999 Field Triage Guideline Criteria
- Patients were followed to hospital discharge
- Definition: NEED TRAUMA CENTER:
  - Surgery (non-orthopedic) within 24 hours of ED arrival
  - Death prior to discharge
  - Admission to the ICU
- Data was analyzed by calculating sensitivity, specificity, likelihood ratios, and ROC curves

Results:

- 11,892 interviews conducted (9,483 patients Mechanism only) Likelihood Ratios

<table>
<thead>
<tr>
<th>Criteria</th>
<th>TC NEED</th>
<th>ISS &gt; 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death of an occupant</td>
<td>6.8 (2.7-16.7)</td>
<td>5.5 (2.2-13.6)</td>
</tr>
<tr>
<td>Extrication &gt; 20min</td>
<td>5.1 (3.2-8.1)</td>
<td>3.7 (2.2-6.0)</td>
</tr>
<tr>
<td>Intrusion &gt; 12 inches</td>
<td>4.2 (2.9-5.9)</td>
<td>3.2 (2.2-4.6)</td>
</tr>
<tr>
<td>Ejection</td>
<td>3.2 (1.3-8.2)</td>
<td>7.1 (3.6-14.1)</td>
</tr>
<tr>
<td>Deformity &gt; 20 inches</td>
<td>2.5 (1.9-3.2)</td>
<td>2.2 (1.7-2.8)</td>
</tr>
<tr>
<td>Speed &gt; 40 mph</td>
<td>2.0 (1.7-2.4)</td>
<td>1.8 (1.5-2.1)</td>
</tr>
<tr>
<td>Rollover</td>
<td>1.0 (0.7-1.5)</td>
<td>1.2 (0.9-1.7)</td>
</tr>
</tbody>
</table>
### Comparison of CDC Guidelines 1999 to 2006

<table>
<thead>
<tr>
<th>1999</th>
<th>CRITERIA</th>
<th>2006</th>
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<tbody>
<tr>
<td>x</td>
<td>Ejection</td>
<td>x</td>
</tr>
<tr>
<td>x</td>
<td>Death in Same Compartment</td>
<td>x</td>
</tr>
<tr>
<td>x</td>
<td>Intrusion &gt; 12 inches</td>
<td>Changed: &gt;12&quot; on pt side and &gt;18&quot; any side</td>
</tr>
<tr>
<td>x</td>
<td>Deformity &gt; 20 inches</td>
<td>removed</td>
</tr>
<tr>
<td>Not included</td>
<td>Vehicle Telemetry Data consistent with a high risk of injury</td>
<td>x</td>
</tr>
<tr>
<td>x</td>
<td>Extrication time &gt; 20 minutes</td>
<td>removed</td>
</tr>
<tr>
<td>x</td>
<td>Initial Speed &gt; 40 mph</td>
<td>removed</td>
</tr>
<tr>
<td>x</td>
<td>Rollover</td>
<td>removed</td>
</tr>
</tbody>
</table>

HIPRC/CIREN Research Project:

Validation of Pre-Hospital Triage
Mechanism of Injury Criteria

NASS analysis
2006 Mechanism Criteria
Sequential analysis of
algorithm
## RESULTS

<table>
<thead>
<tr>
<th>Criteria</th>
<th>ISS &gt; 9 PPV %</th>
<th>ISS &gt; 9 NPV %</th>
<th>ISS &gt; 15 PPV %</th>
<th>ISS &gt; 15 NPV %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>26.1</td>
<td>96.7</td>
<td>21</td>
<td>98.8</td>
</tr>
<tr>
<td>Step 2</td>
<td>92.9</td>
<td>97.1</td>
<td>48.5</td>
<td>99</td>
</tr>
<tr>
<td>Step 3</td>
<td>22</td>
<td>97.9</td>
<td>9.7</td>
<td>99.4</td>
</tr>
<tr>
<td>Step 4</td>
<td>3.6</td>
<td>98.1</td>
<td>1.4</td>
<td>99.4</td>
</tr>
<tr>
<td>Intrusion 30</td>
<td>36.2</td>
<td>96.4</td>
<td>21.9</td>
<td>98.5</td>
</tr>
<tr>
<td>Intrusion 46</td>
<td>32.1</td>
<td>96.3</td>
<td>20.5</td>
<td>98.4</td>
</tr>
<tr>
<td>Death in Vehicle</td>
<td>59.6</td>
<td>96.4</td>
<td>47.4</td>
<td>98.9</td>
</tr>
<tr>
<td>Ejection</td>
<td>35.6</td>
<td>96.4</td>
<td>22.4</td>
<td>98.5</td>
</tr>
</tbody>
</table>
Seattle CIREN Research Goal:

*Develop predictive models for AACN with telemetry data using the triage rules*

- All penetrating injuries to head/neck/torso/or extremities
  - Flail Chest
  - 2+ long bone fx
- Crush/degloving/mangled ext
- Prox amputation
- Pelvic Fx
- Open/depressed skull fx
- Paralysis

- Intrusion > 12 inches at occupant site
  - In intrusion > 18 inches any site
  - Ejection/Partial Ejection
- Death in the same occupant compartment
  - Vehicle telemetry data consistent with a high risk of injury

GCS < 14
SBP < 90 mmHg
RR < 10 > 29
Analysis focused on Step 3 data that could be utilized for AACN

**STEP 1**
- GCS > 14
- SBP > 90 mmHg
- RR > 12

**STEP 2**
- All penetrating injuries to head/neck/torso/or extremities
  - Flail Chest
- 2+ long bone fx
- Crush/degloving/man组织领导 ext
- Prox amputation
- Open/depressed skull fx
- Paralysis

**STEP 3**
- Intrusion > 12 inches at occupant site
- Intrusion > 18 inches at any site
  - Ejection/Partial Ejection
- Death in the same occupant compartment
- Vehicle telemetry data (DELTA V) consistent with a high risk of injury
Methods

• Conducted analysis utilizing NASS data to assess Step 3 mechanism criteria as a predictor of injury severity.
• Use CIREN case studies to illustrate the potential benefits of Step 3 to predict injury severity.
Data Analysis

- Selected all vehicles with model year 2000 and later from the 1999-2009 NASS/CDS data
- To correct for biases from missing data, we imputed missing data 20 times using a system of multivariate imputation by chained equations (MICE) as implemented in Stata


# Results

<table>
<thead>
<tr>
<th>Component</th>
<th>Odds of ISS &gt;= 16</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnitude of intrusion 30 cm at site</td>
<td>18.9</td>
<td>(14.0, 25.5)</td>
</tr>
<tr>
<td>Magnitude of intrusion 46 cm anywhere in passenger compartment</td>
<td>16.7</td>
<td>(10.6, 26.2)</td>
</tr>
<tr>
<td>Ejected from vehicle</td>
<td>47.5</td>
<td>(35.6, 63.4)</td>
</tr>
<tr>
<td>High dV (40+ kph)</td>
<td>13.1</td>
<td>(9.98, 17.2)</td>
</tr>
<tr>
<td>Rollover (3+ quarter turns)</td>
<td>10.4</td>
<td>(7.2, 15.2)</td>
</tr>
<tr>
<td>Death in vehicle</td>
<td>111.7</td>
<td>(84.1, 148.4)</td>
</tr>
<tr>
<td>Any step 3 criterion</td>
<td>29.4</td>
<td>(22.4, 38.7)</td>
</tr>
<tr>
<td>Any step 3 criterion (minus death in vehicle)</td>
<td>23.3</td>
<td>(18.3, 29.7)</td>
</tr>
</tbody>
</table>

- 30cm/12” intrusion at seated position is a statistically superior predictor over DV and rollover.

Death in vehicle is the strongest predictor, but unlikely to be captured by AACN.
## Methods:

<table>
<thead>
<tr>
<th>ISS score</th>
<th>Severe &gt;16</th>
<th>Not Severe &lt;16</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meets step 3 criteria</strong></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td><strong>Does not meet step 3 criteria</strong></td>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>

- **PPV:** $\frac{A}{A+B}$
- **NPV:** $\frac{D}{D+C}$

**Sens:** $\frac{A}{A+C}$

**Spec:** $\frac{D}{B+D}$
Results

Step 3 Criteria by ISS

- % of ISS >= 16 meeting Step 3 criteria (Sensitivity of Step 3): **65.6%**
- % meeting Step 3 criteria with ISS >= 16 (Positive Predictive Value of Step 3): **13.8%**
- % not meeting Step 3 criteria with ISS >= 16: **0.55%**

<table>
<thead>
<tr>
<th></th>
<th>Step 3 -No</th>
<th>Step 3 -Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISS &lt; 16</td>
<td>92.4%</td>
<td>6.1%</td>
</tr>
<tr>
<td>ISS &gt;= 16</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>
Results

Step 3 Criteria (minus death in vehicle) by ISS

• % of ISS $\geq 16$ meeting Step 3 criteria (minus death in vehicle) (Sensitivity): 60.1%

• % meeting Step 3 criteria (minus death in vehicle) with ISS $\geq 16$ (PPV): 13.1%

<table>
<thead>
<tr>
<th></th>
<th>Step 3 -</th>
<th>Step 3 +</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISS &lt; 16</td>
<td>92.5%</td>
<td>6.0%</td>
</tr>
<tr>
<td>ISS $\geq 16$</td>
<td>0.6%</td>
<td>0.9%</td>
</tr>
</tbody>
</table>
Results: Current Triage Patterns

• % meeting Step 3 criteria going to Level 1 trauma center: 43.8%
• % meeting Step 3 (minus death in vehicle) going to Level 1 trauma center: 43.7%
• % of ISS >= 16 going to Level 1 trauma center: 63.1%
Utilizing Step 3
Mechanism of Injury
today with CIREN data

- Implementing AACN will take time to fully implement

- Seattle CIREN team has trained trauma care providers to begin using the intrusion injury predictors on scene and transmitting digital images to level trauma center
Critical Clues at Crash

One can determine an injury mechanism based on the following:

• Restraint status (most important)
  – witness, first responder, locked open, belt burns
• Identify Seated Location
• Occupant compartment intrusion at patient location of 12” or more
• Intrusion = Injury!!
Results – NASS MAIS v Door intrusion

Lateral Impact Mechanism

Intrusion = Injury

Thorax  Abdominal  Lateral Pelvis  Bilateral Pelvis  Combination
12” of Door Intrusion

AIS 3 Pelvis Fracture to Driver
Intrusion = Injury

12” upper door panel intrusion

Think Thorax!! - AIS 3 Chest Injuries
12” of Instrument Panel Intrusion
AIS 3 Lower Extremity Fractures
Vehicle Documentation

- First responders document crash vehicles using digital cameras

- Trained medics, trauma staff, law enforcement to interpret intrusion mechanism
Photography guidelines

End Plane Damage
3 Views

Corner oblique views include both planes

Side Plane Damage
3 Views

Corner oblique views include both planes

Occupant seated locations
Photo from opposite side

Driver side views

Passenger side views
Front Right Passenger Critically Injured
Digital images utilized or even emailed to server at trauma centers
Direct trauma care providers and first responders to utilize CIREN NHTSA web page for on-line training
- Query CIREN electronic cases and review CIREN presentations
CIREN case viewer to assess injury causations and triage rules

CIREN Case Viewer
Case Number: 160117750

Crash Overview - Summary

Injury Causation

The 57-year-old male case occupant was the driver of a 2004 Toyota Tacoma that was involved in a head-on collision with a wooden utility pole. The case vehicle ran off the right side of the roadway due to the driving being left, causing the case vehicle to drive up onto the curb and the sidewalk where it struck a wooden utility pole head-on. The case occupant utilized the available 3-point lap and shoulder belt and the available driver front air bag deployment, upon impact the shoulder portion of the seatbelt limited the chestward forward movement. The force exerted by the seatbelt on the rib cage caused the internal rib fractures, sternal fractures and right-sided rib fractures. The lap portion of the seatbelt is the source of the contusions to the hips. His arms also moved forward where they impacted the instrument panel or both sides of the steering wheel causing the forearm contusions and abrasions on the right and bilateral hand contusions. The left arm posteriorly struck the door panel causing the left forearm contusion. The straightening of the spine during the crash is combined with the waist being caused to spin causing the lumbar compression fracture which resulted in the lumbar compression fracture. Upon impact the instrument panel and low pain intruded in the occupant’s compartment at the same time as the case occupant’s knees moved forward where they struck the knee bolster causing the left patella dislocation and meniscal tear as well as the right knee abrasion. This contact also resulted in axial loading of the left tibia and fibula causing the left tibia and fibula fracture. The forces exerted on the ankles from the intruding lower panel caused bilateral ankle disarticulation with fractures of the left malleolus and tibia and fractures of the right distal tibia, fibula and bilateral metatarsal.

Tibia fractures

Distal Tibia Fractures

- TiMCAF (2010) Fracture Classification
- Distal Tibia Fracture Classification
- Distal Tibia Fracture Classification
- Distal Tibia Fracture Classification
- Distal Tibia Fracture Classification
- Distal Tibia Fracture Classification
- Distal Tibia Fracture Classification

Tibial Plateau Fractures

- Tibial Plateau Fracture Classification
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- Tibial Plateau Fracture Classification
- Tibial Plateau Fracture Classification

Tibial Shaft Fractures

- Tibial Shaft Fracture Classification
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- Tibial Shaft Fracture Classification
- Tibial Shaft Fracture Classification

Forefoot Fractures

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- Forefoot Fracture Classification

Metatarsal Fractures

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Injury Source

- Injury Source Classification
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- Injury Source Classification
- Injury Source Classification

Confidence

- Confidence Classification
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- Confidence Classification
- Confidence Classification

Rank

- Rank Classification
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- Rank Classification

Case Overview

- Case Overview Classification
- Case Overview Classification
- Case Overview Classification
- Case Overview Classification
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- Case Overview Classification
- Case Overview Classification

TSA

- TSA Classification
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- TSA Classification
All Seattle Fire Calls on the Web

- Potential link of digital images to responses
Seattle 911 calls

Latest Seattle 911 calls

<table>
<thead>
<tr>
<th>ID</th>
<th>CALL INFO</th>
<th>UNITS SENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15:49:20 Aid Response 7119 Wolly Park N E</td>
<td>E28</td>
</tr>
<tr>
<td>2</td>
<td>15:38:17 Aid Response 11317 19th Av Ne</td>
<td>E39 M31</td>
</tr>
<tr>
<td>3</td>
<td>15:36:11 Aid Response 0512 Densmore Av N</td>
<td>E16</td>
</tr>
<tr>
<td>4</td>
<td>15:34:46 Aid Response 4323 Sw Admiral Way</td>
<td>E32</td>
</tr>
<tr>
<td>5</td>
<td>15:31:57 Aid Response 1005 Terrace St</td>
<td>E10</td>
</tr>
<tr>
<td>6</td>
<td>15:20:49 Aid Response 2645 California Av Sw</td>
<td>E29</td>
</tr>
<tr>
<td>7</td>
<td>Unable to map</td>
<td>E31</td>
</tr>
<tr>
<td>8</td>
<td>15:11:48 Aid Response 4th Av S / S Washington St</td>
<td>L1</td>
</tr>
<tr>
<td>9</td>
<td>15:10:58 Aid Response 611 12th Av S</td>
<td>A5</td>
</tr>
<tr>
<td>10</td>
<td>15:08:35 Aid Response 200 Broadway E</td>
<td>L10</td>
</tr>
</tbody>
</table>

Legend for 911 calls

Seattle 911 details

This site uses live data publicaly available on the Seattle Fire Dept. web site.
The data will automatically refresh every 1-2 minutes.
Integrate AACN with Intrusion Sensors

CIREN helped to implement door quadrant intrusion measurement documentation for both CDS/NASS and CIREN.
Washington State Collision Reporting

Seattle CIREN assisting in the addition of new elements for the redesign of the officer collision report form:

- Identify vehicles towed due to damage 
  *(vehicle level)*
- Intrusion (12 inches) into vehicle compartment at occupant level *(seated position)*
- Transport status and facility for each occupant
Washington State Collision Reporting

Seattle CIREN assisting in the addition of new elements for the redesign of the officer collision report form:

• Existing 10 point drawing; No shading, Use numeric system
  – Indicate most severely damaged areas of vehicle (up to 3 choices)
  – For each of 3 possible choices, determine if vehicle damage is “Minor” or “Major” (greater or less than 18” of crush)
Washington State Collision Reporting

Seattle CIREN assisting in the addition of new elements for the redesign of the officer collision report form:

- All collision reports are currently submitted at most jurisdictions electronically (E-reports) in 48 hours.
- Data elements exist to further evaluate triage rules and potentially use CDS stratification rules to evaluate ALL crashes.
Conclusions

• Step 3 Mechanism of Injury criteria alone predict 65.6% of severely injured patients requiring a need for level one trauma center

• 30cm/12” of component intrusion at the occupant seated position is a statistically superior predictor over Delta V and rollover.

• Death in vehicle is the strongest predictor, but unlikely to be captured by AACN.
Next Steps

• Utilize this database to evaluate current AACN algorithms (OnStar, URGENCY, BMW)
• Add occupant factors that may strengthen the prediction of injury (age, gender, GCS based on voice)
Future

• Begin to assess how to integrate intrusion sensors to compliment current AACN systems

• AACN will take time to integrate
  – Create EMS training programs
    • On- scene recognition of Step 3 mechanism criteria
    • Utilize digital photography documentation in the triage of patients on-scene or even remotely

• Implement Step 3 data into all police crash reporting systems for further analysis to examine all crashes
Thank you