CrashHelp: An Innovative Tool to Assist in Rural EMS Response

March 1, 2012
Our research goal is to develop and test models and tools to improve technology enabled EMS systems.

Our focus:
- How can we more effectively collect, share, and visualize information?
- What existing and emerging technologies could be applied?
- What are the best practices and how can we improve upon them?
Prior Research Activities

- **Conceptual Model – 2004-2006**
  - Development of Time-Critical Information Services Model for EMS that emphasizes end-to-end performance

- **Case Study Research – 2005-2009**
  - Two case studies to validate the model and explore best practices: San Mateo County, Mayo Clinic Trauma System

- **Prototype Development and Beta Testing – 2009-present**
  - Review of Comparative Cases
  - Design and Testing of prototype: CrashHelp
  - Beta test in Boise, Idaho
Background: ITS and EMS

- The four “E’s” of transportation safety (USDOT, 2006)
  - Education, Engineering, Enforcement, Emergency Medical Services (EMS)

  “EMS is the Safety-Net of Transportation, it needs to be there when the other three E’s fail”
  - Idaho EMS Director

- ITS is needed to:
  - Support the end-to-end emergency response process
  - Provide information that can be used at the point of care, as well as to guide traffic safety analysis and improvements.
Almost 35,000 traffic related fatalities per year
- Approximately 60% are on rural roads, 70% in Minnesota
- Medical and emergency service costs are roughly 15 percent of the cost of MVC’s (NHTSA, 2008)
- According to FHWA, in 2005 dollars, the average cost of a fatality was $3,246,192
- **Timely** and **effective** emergency medical response to MVC’s can significantly reduce the likelihood of death, disability, and economic consequences.
Background: EMS

- An essential medical care safety net in the U.S.
- Over 240 million 9-1-1 calls every year (2009, FCC)
- Over 6,000 9-1-1 call centers
- Over 16 million medical transports to hospitals (IOM, 2006)
- Over 4,800 emergency departments (GAO, 2006)
- 80% of fire service calls are now EMS related (IOM, 2006)
## Past Research Findings

<table>
<thead>
<tr>
<th>Time-Critical Service</th>
<th>Incident Report (911 Call)</th>
<th>Incident Information Acquisition</th>
<th>Dispatch/Call Routing</th>
<th>Response/Coordination</th>
<th>Definitive Care</th>
</tr>
</thead>
</table>

- NextGeneration 911
- IP telephony
- AACN
- Mobile phones

- Computer Aided Dispatch (CAD)
- GPS/AVL/GIS
- Navigation
- Pagers, cell phones
- Interoperable 2-way radios
- e-Patient care records (PCR)
- Hospital availability/diversion systems
- Patient tracking systems

Many existing and emerging technologies for EMS
Past Research Findings

- Time-Critical Service
- Incident Report (911 Call)
- Incident Information Acquisition
- Dispatch/Call Routing
- Response/Coordination
- Definitive Care

- Major Gaps in Information exchange from **pre-hospital** to **hospital**.
CrashHelp High Level Design Principles

- Solution must facilitate information hand-off *at or before* patient hand-off to ED
- Solution must facilitate coordination across EMS organizations
- Solution must interfere in least possible way with medical care processes and practices
- Solution must provide value added context to decision makers at ED/Trauma Center
- Users must be protected from themselves (security & privacy)
- Users must want to use it, be able to use it, like to use it
- Leverage growth of mobile computing (smartphones)
- Leverage expansion of cell phone network
- Leverage the web
CrashHelp System Prototype

For: EMT's / Paramedics in the field
Google Android Compatible Phone
Android Application

For: Emergency Department / Trauma Center
Web based interface
CrashHelp System Architecture
CrashHelp Service Process Summary

Ambulance Crew

Medic unit creates and sends new incident record

Emergency Department

ED pager is notified of a new incident

A CrashHelp "Sticky Note" is attached to the Paper Patient Report

Medic is notified that ED "Acknowledged" receipt of new incident

ED clicks "Acknowledge" and views record details

Medic can "text" with the ED

ED can "text" with the Medic
Mobile Phone Application

- Secure login
- Add new Incident
- Review existing incidents
Mobile Phone Application

Take Pictures and Video
Mobile Phone Application

- Record audio messages, Paramedic/EMT verbal snapshot:
- Vitals
- Origin of incident
- Mechanism of Injury
- Treatments given
- Other: e.g., patient history
Mobile Phone Application

Review and add *basic* patient data

(gender, age, And name)
Mobile Phone Application

- Choose destination
- Get location
- Send phone number
- Send EMS personnel info
- Send data
- Data encrypted and stored securely on device and is “purged” after sending
- Data sends only when phone has a connection
Web Application
Web Application
Web Application
Web Application
Web Application
Pilot Test & Evaluation

- Boise, Idaho
- July 18 – Oct 31
- October Focus groups and interviews
- 20 Ambulances (2 providers)
  - Medics (18 participants)
- 6 Hospitals (3 hospital systems)
  - Charge nurses and ED nurses (20 participants)
  - ED Administrators (5 participants)
  - Physicians (2 participants)
- State EMS Agency (3 participants)
- State DOT – Office of Traffic Safety (2 participants)
Findings: CrashHelp Frequency of Use

<table>
<thead>
<tr>
<th>Hospital Name</th>
<th>Number of incidents received</th>
<th># of images</th>
<th># of Video Files</th>
<th># of Audio Files</th>
<th>Text Messages Sent/Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACP Non-Transport</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>CCP Non-Transport</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>St. Alphonsus Boise</td>
<td>136</td>
<td>108</td>
<td>7</td>
<td>82</td>
<td>21</td>
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<tr>
<td>St. Alphonsus Eagle</td>
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<td>1</td>
<td>0</td>
<td>3</td>
<td>2</td>
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<tr>
<td>St. Alphonsus Nampa</td>
<td>294</td>
<td>117</td>
<td>7</td>
<td>115</td>
<td>44</td>
</tr>
<tr>
<td>St. Luke's Boise</td>
<td>46</td>
<td>19</td>
<td>2</td>
<td>35</td>
<td>6</td>
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<tr>
<td>St. Luke's Meridian</td>
<td>101</td>
<td>101</td>
<td>9</td>
<td>75</td>
<td>12</td>
</tr>
<tr>
<td>West Valley</td>
<td>213</td>
<td>84</td>
<td>0</td>
<td>132</td>
<td>41</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>801</strong></td>
<td><strong>437</strong></td>
<td><strong>25</strong></td>
<td><strong>446</strong></td>
<td><strong>126</strong></td>
</tr>
</tbody>
</table>

Use increased as pre-hospital and hospital saw each other using it.

- “What drove me to use crashhelp was after talking to people at the facilities, that they were going to use it.” (Medic)
Findings: Camera and Audio Use

- What pictures were taken:
  - Vehicles: crash intrusion, damaged windshields, inside vehicle, unused motorcycle helmets, crash site (at a distance, ditch depths, tree sizes, skid marks)
  - Various trauma injuries: immobilized patients, wounds, blood pools
  - Brain attack facial shots
  - Burns
  - EKG’s, Paper run reports, medication bottle descriptions

- What audio was recorded:
  - The same (or similar) report provided over the radio to the ED including: Primary impression, patient demographics, patient condition, interventions, and ETA
Example Incident

#1785

1757
Findings: Overview

- Enhanced resource and care decision making by hospital personnel (for some incidents)

- Augmented communications processes between pre-hospital transport and hospital organizations

- Efficient and usable information collection for on-scene EMS personnel

- Technology “good fit” for multi-task-oriented ED environment
Findings: Enhanced ED Decisions

Created “heightened awareness” for pre-arrival preparation and resource decision making

- “…you’re sending me a picture of a car that’s totally demolished and you say you’re bringing in a patient that lived. I kinda stand up and it gets all the attention and the doc says ‘yes, this is significant’” (Charge Nurse)

- “the steering wheel’s bent or there’s a star on the windshield. Those are classic things. That makes a big difference even if I’m not seeing anything [on the patient] when they come in.” (ED Nurse)
Findings: Enhanced Medic/ED Decisions

Enabled patient monitoring of injury/health status progression

- “We had a burn patient whose face, and arm, upper chest is burned. So we took pictures of And you can see the progression certainly from the time we sent the pictures to the time we left the hospital how the burn has progressed.” (Medic)

- “They took a picture of him [stroke patient] sitting up and you could definitely see the whole side [of his face] was down and he was looking bad. Then you saw the next picture…he’s sitting up smiling, everything has resolved and…when you come in and tell the doctor what you saw…it’s not the same as seeing it as a picture.” (Medic)
Findings: Medic Efficiencies

Data collection efficiencies

“...when we first got ‘em [the phones]... I felt a lot of people’s attitude was ‘I don’t have to time to, you know, work with technology and take away from the patient.’ And so I was a little bit skeptical at first too until I started using it. And actually found that you can do that a lot quicker than you tend to call [radio] to the hospital. You have another ambulance on that channel already and you’re gonna have to sit and wait and then--- so I actually found it [CrashHelp] to be faster and more user-friendly than actually calling in to the hospital.” (Medic)
Enables multi-tasking in the ED

- “I can look at it [CrashHelp record] when it suits me. Cause that’s what I hate, when we’re talking to patients or I’m in the middle talking with a patient or trying to do something or I’ll have an upset patient I’m trying to calm them down or whatever. And ‘Oh, I’m sorry, I have to take this call.’” (Charge Nurse)
Findings: Challenges

- Need for protocols on what types and how many pictures provide the most value
- Value of video unknown. Use of 4G may boost value
- Accomodating every work flow variation across hospitals
- Some connectivity challenges (e.g., pagers in the ED)
- Keeping up with the demand for new features in fast moving mobile marketplace
- Data provider vs data consumer expectations
Findings: Future Directions

- Integration – EMR, PCR, CAD
- Additional ED notification types – auto phone call
- New views of the data for new users
- Hospital to hospital referrals
- Physician engagement
- Rural and remote pilot test

- “sometimes I would look at the report, or you know the pager would go off and then I look up and the’re [Medic & patient] coming through the doors. I think the guys who are coming from further out, well, its really helpful to have this information.” (Charge Nurse)
Findings Overview:

- Efficiencies achieved: Good
- Types of incidents used: All types (~25% trauma)
- Technical performance: Excellent
- Errors (when did it not work and why): Infrequent (~2-3%)
- Features most used: Camera, audio, texting, notifications
- Features less used: Map, GIS, Video
- Paramedic perspectives – Decision value: Good
- Charge nurse perspectives – Decision value: Good
- Physician perspectives – Decision value: (not enough data)
Implications

- Novel SmartPhone innovation focused specifically on improving communications between EMS and ED
- Demonstrates potential widespread value of multimedia information for making informed MVC patient decisions
- Bridges a research/demonstration gap between ITS and health care
- Demonstrates research and development opportunities related to mobile computing, ITS, and EMS
Acknowledgements

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CrashHelp Team:
- Drs. Thomas Horan & Benjamin Schooley
- Grad Students: Yousef Abed, Abdullah Murad, Joe Roberts
Questions?
Publications

Phase III

Phase II

Phase I
Future CERS Webinars

- **April 12, 2012, 1:30-2:30pm, Eastern: Lane Departure Avoidance;** Daniel Helms, P.E., PTOE, Mississippi Department of Transportation

- Visit the CERS website for updates: [http://www.ruralsafety.umn.edu/](http://www.ruralsafety.umn.edu/)

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