GLEANING DATA FROM DISASTER: A HOSPITAL-BASED DATA MINING METHOD TO STUDYING ALLHAZARD TRIAGE AFTER A CHEMICAL DISASTER

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IRB Approvals

• Institutional Review Board of the University of South Carolina
• Institutional Review Board of the South Carolina Department of Health and Environmental Control
• All databases were linked within the South Carolina Office of Research and Statistics, de-identified, and provided with a unique personal identification number prior to our receipt of the study data
Objective of This Presentation

To describe a successful approach to collect and extract clinical data for disaster-related triage effectiveness research

Participants: victims who received emergency care in South Carolina

Photo source: Environmental Protection Agency, Region 4, Southeast
Setting

January 5, 2005 2:39 AM
Graniteville

Norfolk Southern freight train crashed into a parked train on a side track in the center of town

Photo source: Environmental Protection Agency, Region 4, Southeast
Challenges of Mass Casualty Events

• Large numbers of injured patients that quickly overwhelm existing healthcare resources

• Identification and treatment of patients that have the greatest chance for survival with healthcare intervention

• Validity and effectiveness of triage data used to make life and death decisions about the priority of care
Incorrectly Performed Triage:

- Underestimates the need of critically injured patients for immediate care, resulting in preventable deaths or deformities (undertriage)
- Overestimates the extent of minor injuries, resulting in mortality or disability of patients with more severe injuries (overtriage)
Mass Casualty Incidents:

- Do not lend themselves to randomized, controlled, experimental trials
- Require special procedures for data collection storage and analysis
  - Ability to collect accurate, timely and valid data at the time of an incident is difficult
Research Methods Rely Predominately On:

- Detailed observational field notes
- Collecting and analyzing data produced by responding agencies
- Mass media sources such as photography and video
- Interviews and surveys which pose potential bias and recall errors
Method For This Study

Retrospective Study Secondary Data Analysis

Extracted data from medical records of chlorine disaster victims to accurately capture the data used for triage decisions at the time of a large chlorine leak that occurred in Graniteville, South Carolina in 2005.

If I'd known they wanted me to use all this info— I would never have asked for it!

infolytics.wordpress.com
Data Were Abstracted

From hospital records of victims

Sample: victims who received medical care after the 2005 chlorine release

- South Carolina Department of Health and Environmental Control (SC DHEC) in conjunction with
- Centers for Disease Control and Prevention (CDC)
Datasets Used In The Study

• **Hospitalization database** - (n=72) records abstracted
  - Included: demographics, clinical presentation, physical examination, laboratory, pulmonary, and radiological studies, pulse oximetry, medical treatment, medical outcome category (duration of hospitalization and need for intensive care support) and diagnosis

• **Multiple Emergency Room Admitted Patients** - (n=49) records abstracted
  - Included: demographics, clinical presentation, physical examination, laboratory, pulmonary, and radiological studies, pulse oximetry, medical treatment, medications, medical outcome category (duration of hospitalization and need for intensive care support), and diagnosis
Datasets Used In The Study

• **Medical Service Provider Reports** – (n=631) Included: exposure information, symptoms experienced, details about decontamination and transport to medical care, preexisting cardiac or pulmonary medical conditions, and exposure severity ratings (5 point scale)
  - Patient classified according to nine medical categories
  - Demographic characteristics of people who received medical care are stratified by primary exposure location and duration
The Process
Step 1

Create a merged de-identified research dataset from these abstracted data to include:

• Data points for triage model
• Patients’ clinical outcome
• Demographics
Step 2
Input Data Points For Triage Model
S.T.A.R.T. Triage

ALL WALKING WOUNDED

Minor

RESPIRATIONS

YES

Under 30/min

PERFUSION

Cap refill > 2 sec

Immediate

Immediate

Immediate

Immediate

MENTAL STATUS

Can follow simple commands

Delayed

Failure to follow simple commands

Immediate

Immediate

Immediate

Dead or Expectant

NO

NO

YES

Position Airway

Over 30/min

Control Bleeding
Step 2
Input Data Points For Triage Model

Simple Triage And Rapid Treatment (S.T.A.R.T.)

• Ability to walk
• Respirations
  – If $\geq$ 8 years old $>30$ or $<10$
  – If $\leq$ 8 years old $>45$ or $<15$
• Perfusion: capillary refill $>2$ sec
• Mental Status
  – Ability to follow commands
### Step 3

#### Patients’ Clinical Outcome

<table>
<thead>
<tr>
<th>Observed Outcome*</th>
<th>S.T.A.R.T. Triage Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deceased</td>
<td>Black</td>
</tr>
<tr>
<td>ICU/Ventilator</td>
<td>Red</td>
</tr>
<tr>
<td>Hospitalized 3+ days</td>
<td>Red</td>
</tr>
<tr>
<td>Hospitalized 1-2 days</td>
<td>Red</td>
</tr>
<tr>
<td>ED Repeat Visits</td>
<td>Yellow</td>
</tr>
<tr>
<td>ED With Significant Symptoms</td>
<td>Yellow</td>
</tr>
<tr>
<td>ED With Moderate Symptoms</td>
<td>Green</td>
</tr>
<tr>
<td>ED Without Symptoms</td>
<td>Green</td>
</tr>
<tr>
<td>Physician Office Visit</td>
<td>Green</td>
</tr>
</tbody>
</table>

### Step 4
Chart Abstraction Form Mapping

#### IV. Data from Emergency Room

<table>
<thead>
<tr>
<th>Questionnaire Name</th>
<th>Further Analysis / Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Yes / Yes</td>
</tr>
<tr>
<td>Time</td>
<td>Yes</td>
</tr>
<tr>
<td>Vital: Temp</td>
<td>Yes</td>
</tr>
<tr>
<td>BP</td>
<td>Yes</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>Yes / Yes</td>
</tr>
<tr>
<td>Heart rate</td>
<td>Yes / Yes</td>
</tr>
<tr>
<td>Time</td>
<td></td>
</tr>
<tr>
<td>O₂ Sat</td>
<td>Yes / Yes</td>
</tr>
<tr>
<td>On room Air</td>
<td>Yes / Yes</td>
</tr>
<tr>
<td>On liters of O₂ via nasal canula(NC) or face mask</td>
<td>Yes</td>
</tr>
<tr>
<td>On 100% non-rebreather (NRB)</td>
<td>Yes</td>
</tr>
<tr>
<td>On continuous Positive Airway Pressure (CPAP) with O₂</td>
<td>Yes</td>
</tr>
<tr>
<td>On ventilator with ____ % O₂</td>
<td>Yes</td>
</tr>
<tr>
<td>Notes from Emergency Room</td>
<td>Yes / Yes</td>
</tr>
</tbody>
</table>
Step 5
Select Data Points

• Used a combination of data points to build variable(s) for the triage model when the required data point was not directly collected and recorded

Example of Building Variables

Ability to walk - S.T.A.R.T. triage data point

• Assumptions:
  – The chlorine exposure victims did not present with other physical injuries; therefore just because a patient was brought in on a litter or by ambulance did not necessarily indicate they could not walk
  – Able to walk unless intubated or was hypoxic (<90% oxygen saturation measured by pulse oximetry)
Variable Creation for “Able to Walk” (EDWALK)

EDWALK – Set to ‘N’ (No) when any of the following are true; all other ‘Y’ (Yes)

- NOTESFROME = ‘Intubated’
- EDHYPOXIAO = ‘Yes’ (In ED Hypoxia on \( O_2 \))
- EDHYPOXIAAR = ‘Yes’ (In ED Hypoxia on room air)
Problems

• Incomplete data
• Missing data
• Similar data were found across the available datasets
• Additional data points not referenced in the available documentation related to the data sets
Conclusions

- The methodology outlined in this paper can be followed or extended in evaluating performance efficacy of triage models.

- The steps are reliable and repeatable and can easily be extended to other triage models or applied to other data sets or data sources.
QUESTIONS