Technical Investigation of the May 22, 2011, Tornado in Joplin, MO

December 10, 2012
NCST Advisory Committee Meeting

Emergency Communications and Public Response

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Objective #2
• Determine the pattern, location, and cause of fatalities and injuries, and associated emergency communications systems and public response

Presentation Outline
• Task 2.1: Gathering baseline data
• Tasks 2.2/2.3: Collecting archival records for other areas and Joplin (emergency communications and response)
• Task 2.4: Collecting information from 3\textsuperscript{rd} party sources
• Task 2.5: Analysis and report writing
TASK 2.1

Gather baseline information on the response of individuals to the Joplin tornado.
Data Collection on Response

NIST Interview Recruitment Strategies and Methods

• Tornado survivors, families/friends of victims, building managers/owners
• Recruitment of survivors and families/friends of victims for interviews
  – NIST Tech Beat article (10/14/11)
  – NIST flyer
  – Contacts in Joplin – radio stations, newspapers, public information officer, local emergency managers, faith-based organizations, chamber of commerce
  – In-person and phone interviews
NIST Interview Recruitment Strategies and Methods

• Interview methods (2 phases)
  – Convenience sample to generate specific knowledge about a particular event;
  – Phase 1: Respondents asked to describe their experiences from the time when they first became aware that something was wrong until the moment when they responded to the disaster
  – Phase 2: Unstructured, follow-up or clarification questions about important topics
Data Collection on Response, cont.

• Data collection completed when 2 requirements were met:
  – Certain topics of interest were saturated
    • Experiences with the tornado on May 22
    • Options for protective action
    • Previous experiences with and perspectives on warning systems and tornadoes
  – Sample varied by age, geographic location throughout the damage path (i.e., address), and physical location during the event (i.e., home, business, outdoors, or vehicle)
Data Collected on Response

- 165 interviews
  - 17 collected 5 days after tornado hit
  - 148 collected from October 2011 through February 2012
- Sample demographics
  - Age: ranged from 19 to 88, with a mean age of 51
  - Gender: 60% women
  - Authoritative role: 8%
  - Geographic location: well distributed across the tornado path through Joplin
Data Collected on Response, cont.

- Where interviewees were located when impacted by the tornado
**Data Collected on Response, cont.**

<table>
<thead>
<tr>
<th>Reported Physical Locations at Tornado Touchdown</th>
<th>% of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home/apartment (their or someone else’s home/apartment)</td>
<td>68</td>
</tr>
<tr>
<td>Private businesses (including theater, grocery stores, department stores, restaurants, etc.)</td>
<td>13</td>
</tr>
<tr>
<td>Driving or stopped in vehicle</td>
<td>7</td>
</tr>
<tr>
<td>St. John’s Regional Medical Center</td>
<td>5</td>
</tr>
<tr>
<td>Joplin area church</td>
<td>5</td>
</tr>
<tr>
<td>Outside (or unknown specific location)</td>
<td>2</td>
</tr>
</tbody>
</table>

- Respondents took protection in various places (homes): tornado shelters, full or partial basements, crawl spaces, the first floors of apartment complexes or duplexes, and internal locations within homes, such as bathrooms, closets, or hallways.
Tornado Fatalities – Revised

- 161 fatalities
- Death certificates obtained for all deaths from
  - Missouri Department of Health and Senior Services
  - Oklahoma State Department of Health
  - Kansas Department of Health and Environment’s Office of Vital Statistics
- Information obtained (examples)
  - place of injury/death, date of death, cause of injury/death, age, gender, occupation
- Most fatalities were categorized as impact related deaths attributed to the tornado; most deaths occurred the night of 5/22/2011

*Includes some victims whose
- Non-impact related deaths were attributed to tornado, and/or
- Deaths occurred at other locations, after 5/22/2011

Additional Sources: NWS; MO State Police; Dr. Andrew Curtis; Media accounts; NIST Survivor interviews

<table>
<thead>
<tr>
<th>Location at Time of Injury/Death</th>
<th># of Victims</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T store</td>
<td>1</td>
</tr>
<tr>
<td>Elks Lodge</td>
<td>4</td>
</tr>
<tr>
<td>Full Gospel Church</td>
<td>4</td>
</tr>
<tr>
<td>Greenbriar Nursing Home</td>
<td>19*</td>
</tr>
<tr>
<td>Harmony Heights Baptist Church</td>
<td>3</td>
</tr>
<tr>
<td>Home Depot #3023</td>
<td>8</td>
</tr>
<tr>
<td>Meadows Healthcare Facility</td>
<td>2*</td>
</tr>
<tr>
<td>Outside (12 in vehicles)</td>
<td>20*</td>
</tr>
<tr>
<td>Pizza Hut</td>
<td>5</td>
</tr>
<tr>
<td>Residences - apartments</td>
<td>12*</td>
</tr>
<tr>
<td>Residences - single family home</td>
<td>62*</td>
</tr>
<tr>
<td>Stained Glass Theater</td>
<td>3*</td>
</tr>
<tr>
<td>St. John’s Regional Medical Center</td>
<td>14*</td>
</tr>
<tr>
<td>Walmart Supercenter #59</td>
<td>3</td>
</tr>
</tbody>
</table>
Location of Fatalities

- Location where the injuries that led to death were sustained
Tornado Injuries

- 2 sources of information
  - ESSENCE is syndromic surveillance data (general overview) (Source: MO Department of Health and Senior Services)
  - CDC EPI-Aid Study (87 participants) (Source: MO Department of Health and Senior Services)

- Information obtained (examples)
  - Address where injury occurred, hospital admission history, initial admit diagnosis, ICU admittance, number of days in hospital, pre-tornado risk factors, information about injury/wounds, context surrounding injury

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TASK 2.2

Collect archival records relating to prior tornado incidents and associated community responses, and document codes, standards, and practices for tornado warnings.
Codes, Standards, and Practices Collected

• Codes/Standards applicable to public alerting systems, especially sirens
• Federal Guidance on outdoor warning systems (FEMA 1980, 2006)
• National Weather Service Instruction 10-511
• Current practice in over 75 U.S. counties, cities and towns
• Research on public response to tornadoes
TASK 2.3

Document pre-event archival records for Joplin in relation to tornadoes and the tornado warning system.
Historical Context of Joplin Tornado

- Emergency communications systems
  - **Outdoor warning sirens** (Source: Joplin/Jasper County Emergency Management Agency)
    - 25 sirens in Joplin “zone,” all tied to the same system (if one activated, they all activated)
    - Tested weekly at 10:00 AM (CDT) on Mondays, sounded for 1 min only
  - **Other channels** (Source: Joplin/Jasper County Local Emergency Operations Plan)
    - Primary and local Emergency Alert System (EAS) TV and radio stations
    - Reverse 911
    - NOAA Weather Radios
Historical Context of Joplin Tornado

• Procedures for tornadoes
  (Source: Joplin/Jasper County Local Emergency Operations Plan)
    – Communication
      • Warning systems are sounded only after…
        – Communications Operator has been notified that a tornado has been sighted
        – Tornado warning is issued by the NWS for Jasper, Newton or Cherokee County
        – Sustained winds are 75 mph or higher
      • Sounded for 3 minutes continuously, once, no “all clear”
    – Protective Actions
      • The burden of heeding warnings - individual communities and citizens
      • No guaranteed safe place during a tornado
      • Some locations are better than others

SOURCE: FEMA
TASK 2.4

Collect information from third-party sources including television interviews and newspaper articles.
Collection of 3rd Party Sources

Complete

• Over 100 media accounts of survivor and deceased victim experiences – collected

• Materials organized into database

• Used to develop the probing questions in survivor interviews; analysis of deaths/injuries
TASK 2.5

Analyze the data to study the public response to the tornado, including protective actions.
Qualitative Analysis of Transcripts

- All interviews transcribed
- Used qualitative analysis software
- Code list and code book created
Qualitative Analysis of Transcripts

- **Purpose** – Trends analysis/theory building
- **Accepted practice** in comprehensively analyzing qualitative data
  - Identify major themes within the data (code book)
  - Within each theme – identify properties (components or attributes) and dimensions (modes of variation within the category) of the data [Categories]
  - Detect patterns in the data: find/map links and connections between categories
    - Query by pre-storm individual factors and environmental cues (from storm), interpretations, and resulting protective actions
    - Identify trends in data, constant testing with each new data source
    - Conceptual model development of human response to Joplin tornado
General Trends from Interviews

• Survivors’ Behavior
  – Sirens – alert rather than warning
  – People did not react until perceiving danger or being told to take action
    • only a few risk averse, hypervigilant
  – Residents delayed taking protection (limiting shelter options)
    • some did not take shelter in time

• Conceptual model developed of human behavior during Joplin, MO tornado
Integration of Objectives 1-4

- Wind speed, building damage, behavioral response (survivors [non-injured], injured, and deceased)
- Causes of deaths and injuries in the following locations in Joplin:
  - Single family homes
  - Vehicles
  - Steel and concrete frame buildings, located at 2727 McClelland Boulevard (St. John’s Regional Medical Center)
  - Box-type building, located at 1501 South Range Line Road (Walmart Supercenter Store#59)
  - Unreinforced concrete masonry wall building, located at 2502 South Moffet Ave (Greenbriar Nursing Home)
- Locations chosen because there are sufficient data on wind speed, building damage, and response behavior (from interviews, injury data, and/or fatalities information) for each
Latest Progress/Next Steps

• Tasks 2-4 complete

• Still working with MO DHSS to obtain additional injury data (Task 1)

• Rough draft of objective chapter near complete (Task 5)

• Analysis and report writing in progress on Integration of Objectives 1-4 Chapter with Drs. Lombardo and Phan (Task 5)

• Issues and findings pertaining to survivor response to emergency communications are being developed

• Develop recommendations, as warranted, for potential changes to emergency communications and building and fire codes, standards, and practices to improve life safety in tornado disasters