Quantifying Environmental Conditions Associated with the Delaware Surf Zone Injury Study

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FSBPA 2018 National Conference on Beach Preservation Technology
February 7, 2018
OUTLINE

• Introduction to Surf Zone Injuries
• Injury Statistics
• Water Users and Injury Rates
• Environmental Data
• Results
What are surf zone injuries?

• Injuries occurring due to breaking waves in the surf zone
• Diving into shallow water
• Injuries resulting from surfing, body boarding, etc.
• Hydrodynamic-driven impact into shallow water as a result of beach activities
2014 STUDY

- Location: Data was collected along the Atlantic coast of Delaware at 5 different beach locations
- Time Frame:
  - Environmental Conditions collected between June 2 and August 22, 2014 (82 days)
  - Surf Zone Injury (SZI) data has been collected since 2010

* This study has continued through 2017 but I will only focus on the portion that I took part in, which only includes data through 2014.
2014 INJURY TOTALS

- **280** total injuries during the 2014 summer
- **169** injuries within 5 beach study area and 82-day time frame
- **33** serious injuries (8 cervical fractures, 11 spinal cord injuries, and 1 fatality)
- Up to **13** injuries occurred in a single day
2014 INJURY STATISTICS

- **2:1** ratio of males injured relative to females
- **6:1** ratio of tourists injured relative to locals
- Average injury age was **32 years old**

**Top 5 Activities at time of injury:**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Number of SZI</th>
<th>Percent of SZI Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wading</td>
<td>123</td>
<td>44</td>
</tr>
<tr>
<td>Body Surfing</td>
<td>55</td>
<td>20</td>
</tr>
<tr>
<td>Body Boarding</td>
<td>48</td>
<td>17</td>
</tr>
<tr>
<td>Skim Boarding</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Dive Injuries</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>
Three types of water user counts:

- **Daily Water User counts** – once per day during peak hours along 100-m segment of each beach
- **Intraday Water User counts** – 30-minute intervals between 9 am and 5 pm along 100-m segment of each beach
- **Beach Water User counts** – Counted twice per summer over the entire length of each beach
INJURY RATE

Injury rate calculated by dividing number of injuries by the total number of water users on a given day:

- Mean Injury rate of 0.02%
- Injury rate was greater than 0.05% on 12 days
- Maximum injury rate of 0.12%
Environmental Parameters:

- Beach Morphology
- Wave Height
- Peak Wave Period
- Wave Direction
- Wind Conditions

Variations in Beach slope at Bethany beach for entire length of study
Correlations between injury rate and environmental parameters were generally weak with the max correlation coefficient of 0.08 for significant wave height.

Data was divided into injury rate=0, low injury rate (<0.05%), and high injury rate (>0.05%):

- High Injury rate occurrence was greatest for moderate wave height days (Hs = 0.6 m)
- Wave Height alone does not indicate when surf zone injuries are likely to occur

“Delaware surf zone injuries and associated environmental conditions”, Puleo et Al., 2015
BEACH SAFETY AWARENESS

- Surf zone injuries were not purely random suggesting a complicated relationship between human factors and underlying environmental conditions.
- Increased education on the possibility of surf zone injuries especially on shore break beaches similar to rip current awareness campaigns.
- Higher number of tourists injured relative to locals may suggest that these campaigns need to target visitors to be most effective.