Water Safety and Drownings in Hawaii

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Overview of presentation

• Part 1: Ocean drownings
  – Rate comparisons
  – County specific trends, data, and maps
    • Locations, victim residence, and seasonality (October-March vs. April-September)

• Part 2: Nonfatal drownings in ocean
  • Survival, related to EMS response times

• Part 3: Spinal cord injuries
  • Injuries related to ocean activities
## Leading mechanisms of fatal injuries in Hawaii, by 5-year periods, 1995-2014

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>motor vehicle (673)</td>
<td>motor vehicle (728)</td>
<td>motor vehicle (707)</td>
<td>drug poisoning (796)</td>
</tr>
<tr>
<td>2</td>
<td>drug poisoning (390)</td>
<td>falls (526)</td>
<td>falls (646)</td>
<td>falls (743)</td>
</tr>
<tr>
<td>3</td>
<td>suffocation (389)</td>
<td>suffocation (464)</td>
<td>drug poisoning (618)</td>
<td>motor vehicle (614)</td>
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<td>falls (384)</td>
<td>drug poisoning (426)</td>
<td>suffocation (504)</td>
<td>suffocation (604)</td>
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<tr>
<td>5</td>
<td><strong>DROWNING (309)</strong></td>
<td><strong>DROWNING (306)</strong></td>
<td><strong>DROWNING (373)</strong></td>
<td><strong>DROWNING (385)</strong></td>
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<tr>
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<td>firearm (257)</td>
<td>firearm (213)</td>
<td>firearm (186)</td>
<td>firearm (217)</td>
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<tr>
<td>7</td>
<td>cut/pierce (60)</td>
<td>poisoning (95)</td>
<td>poisoning (147)</td>
<td>poisoning (84)</td>
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<tr>
<td>8</td>
<td>poisoning (52)</td>
<td>other transport (67)</td>
<td>cut/pierce (58)</td>
<td>cut/pierce (66)</td>
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<tr>
<td>9</td>
<td>fires and burns (49)</td>
<td>cut/pierce (50)</td>
<td>other transport (38)</td>
<td>other transport (46)</td>
</tr>
<tr>
<td>10</td>
<td>other transport (42)</td>
<td>fires and burns (28)</td>
<td>fires and burns (24)</td>
<td>fires and burns (32)</td>
</tr>
</tbody>
</table>
Leading causes of fatal injuries in Hawaii, 2010-2014

- **suicide**: 908 (27%)
- **falls**: 605 (17%)
- **poisoning**: 552 (16%)
- **mvc-occupant**: 245 (7%)
- **DROWNING**: 176 (5%)

**Hawaii residents**

- **DROWNING**: 183 (49%)
- **suicide**: 43 (11%)
- **falls**: 32 (8%)
- **mvc-occupant**: 19 (5%)
- **poisoning**: 17 (4%)

Most (83%) of drownings occur in the ocean (89% for non-residents)

**non-residents**

Most (83%) of drownings occur in the ocean (89% for non-residents)

Most (83%) of drownings occur in the ocean (89% for non-residents)
Ocean drownings, 2005-2014
Ocean drownings in Hawaii, 2005-2014

- Average of 57 per year (range from 46 to 68)
  - No clear trend

- Slightly more non-residents (54%) than Hawaii residents (46%)
  - Varies by county: ~56% for Hawaii and Oahu, ~75% for Kauai and Maui
  - Widening gap? – 60% of victims in last 2 years were non-residents
Number and ten-year rate of ocean drownings in Hawaii, by residence of victim, 2005-2014

<table>
<thead>
<tr>
<th>Residence of Victim</th>
<th>Number of Drownings</th>
<th>Rate (/100,000) of Drownings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Country</td>
<td>83</td>
<td>168.2</td>
</tr>
<tr>
<td>U.S. Mainland</td>
<td>223</td>
<td>172.5</td>
</tr>
<tr>
<td>Visitors Total</td>
<td>306</td>
<td>163.2</td>
</tr>
<tr>
<td>Hawaii Residents</td>
<td>265</td>
<td>19.8</td>
</tr>
</tbody>
</table>

Japanese: 29       Caucasian: 21
Korean: 15          Chinese: 5
Ocean drownings in Hawaii, by residence and activity of victim, 2005-2014

- **Total (n=538)**: 140 (25%), 133 (23%), 81 (14%), 76, 57, 42 (7%), 35 (6%), 31, 22, 19, 15, 12, 10, 9, 6 (1%), 5, 4, 1

- **HI residents**
  - Boat accident: 1
  - Fell in/swept in: 15
  - Fishing shorecasting: 0
  - Picking opihi: 0
  - Free diving: 4
  - Scuba: 10
  - Snorkeling: 12
  - Swimming: 57
  - Surfing/body boarding: 31
  - Other activity: 19
  - Unknown activity: 38

- **Non-residents**
  - Boat accident: 5
  - Fell in/swept in: 21
  - Fishing shorecasting: 0
  - Picking opihi: 0
  - Free diving: 48
  - Scuba: 12
  - Snorkeling: 44
  - Swimming: 76
  - Surfing/body boarding: 31
  - Other activity: 19
  - Unknown activity: 43

- 70 (12%) from unintentional immersions
Summary of autopsy records for drowning victims, Honolulu, Maui and Kauai counties, 2004-2011

• Intrinsic factors were prevalent among 67% of the victims of ocean drownings

  – *Circulatory diseases (mostly heart disease):* 45%
    • *Most (65%) of victims over 50 years of age*

  – *Alcohol use 14%*
    • Positive illicit drug tests for 11%

  – *Other factors: traumatic injuries (10%), and seizure disorders (3%)*
County-specific data
Maui: 8 guarded beaches, 1 per 24 miles coastline
Oahu: 29 guarded, 1 per 6 miles
Kauai: 10 guarded, 1 per 22 miles
Big Island: 12 guarded beaches, 1 per 36 miles of coastline
Ocean drownings in relation to lifeguard towers:
- \( \frac{1}{2} \) mile
- 1 mile
- 1 \( \frac{1}{2} \) miles
- 2 miles
Ocean drownings, in proximity to lifeguard towers, 2005-2014

Honolulu

Kauai

Maui (island)

Hawaii

state total (bars)
Ten-year rate (/100,000) of ocean drownings in Hawaii, by residence status and county, 2005-2014

- **Hawaii residents**
  - Hawaii: 32.3
  - Oahu: 16.7
  - Kauai: 26.0
  - Maui: 22.8
  - State average: 20.0

- **non-residents**
  - Hawaii: 171.6
  - Oahu: 131.7
  - Kauai: 249.9
  - Maui: 184.9
  - State average: 164.8

- **state total**
  - Hawaii: 51.8
  - Oahu: 27.7
  - Kauai: 82.5
  - Maui: 64.5
  - State average: 39.0
Ocean drownings on Kauai, 2005-2014

• **Summary**
  - 69 total, 2 to 11 per year
  - No clear trend
  - Mostly (75%) non-residents
  - Activity: Swimming (30%) and snorkeling (23%)

Annual trends, by residence of victims

<table>
<thead>
<tr>
<th>Year</th>
<th>Total (69)</th>
<th>Non-residents (52, 75%)</th>
<th>HI Residents (17, 25%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>7</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>2006</td>
<td>9</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>2007</td>
<td>8</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>2008</td>
<td>8</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>2009</td>
<td>9</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>2010</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>7</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2013</td>
<td>11</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>2014</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Number of drownings, by activity

- Unint. immersion: 8
- Swimming: 21
- Snorkeling: 16
- Diving: 9
- Other activity: 12
- Unknown: 3

Kee-Princeville: 15 drownings:
- 12 non-residents (all US)
- 11 during October through March
- 3 at Queen's Bath, none since 2008
  (7 from 1999 to 2008)

Poipu area: 9 drownings:
- all non-residents (all US)
- no seasonality
- only 1 since 2011
Ocean drownings on Oahu, 2005-2014

• **Summary**
  • 273 total, 19 to 43 per year
  • No consistent trend
  • Slightly more residents (57%)
  • Activity: wide distribution

### Number of drownings, by activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total</th>
<th>Non-Residents (43%)</th>
<th>HI Residents (57%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>unint. immersion</td>
<td>34</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>swimming</td>
<td>55</td>
<td>22</td>
<td>33</td>
</tr>
<tr>
<td>snorkeling</td>
<td>67</td>
<td>26</td>
<td>41</td>
</tr>
<tr>
<td>diving</td>
<td>34</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>other activity</td>
<td>38</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>unknown</td>
<td>45</td>
<td>17</td>
<td>28</td>
</tr>
</tbody>
</table>

### Annual trends, by residence of victims

- Total (273) drownings
- Non-residents (117, 43%)
- HI residents (156, 57%)
North Shore: 23 drownings: only 9 (39%) from Oct-March; 16 (70%) residents

Leeward coast: 40 drownings: 52% residents; no seasonality

eastern Oahu (Honolulu-Kailua): 164 drownings (58%)
Point Panic-Ala Wai marina: 24:
- 19 residents

Hilton Hawaiian-Kapahulu: 38:
- 31 non-residents (10 US, 21 foreigners)

Kapahulu-Portlock: 35:
- 26 residents
- 12 at Portlock/Spitting Cave

Hanauma: 27:
- 25 non-residents
- 8 US, 15 foreigners

east Oahu

Residence status

- non-resident
- resident
South Shore: 110 drownings:
- 82 (75%) from April-September

Seasonality
- April-Sept
- Oct-March
Ocean drownings on Maui County, 2005-2014

- **Summary**
  - **125 total, 6 to 19 per year**
    - (115 on Maui, 7 Molokai, 3 on Lanai)
  - **Increasing trend**
  - **Mostly (73%) non-residents**
  - **Activity: Snorkeling (42%) and swimming (20%)**

### Number of drownings, by activity

- **unint. immersion**
- **swimming**
- **snorkeling**
- **diving**
- **other activity**
- **unknown**

### Annual trends, by residence of victims

- **total (125)**
- **non-residents (91, 73%)**
- **HI residents (34, 27%)**

- **2005**: 5
- **2006**: 6
- **2007**: 7
- **2008**: 5
- **2009**: 7
- **2010**: 11
- **2011**: 14
- **2012**: 19
- **2013**: 13
- **2014**: 16
Kaanapali: 34 drownings:
- 33 non-residents (29 US)
  -20 from 2011, incl. 8 in 2014
    -no seasonality
  -15 in Black Rock area, 10 since 2011

Kamaole-Oneloa (Big Beach) 27:
- 24 non-residents (20 US)
  -15 since 2010
  -little seasonality
- 6 at Makena Big (3) or Little (3) Beach,
  but only 2 since 2010

Molokini: 8
- 7 from 2011-2014
Ocean drownings on Hawaii County, 2005-2014

• **Summary**
  - 104 total, 4 to 16 per year
  - No consistent trend
  - Slightly more residents (56%)
  - Activity: wide distribution

### Number of drownings, by activity

- unint. immersion: 18
- swimming: 20
- snorkeling: 17
- diving: 19
- other activity: 14
- unknown: 16

### Annual trends, by residence of victims

- total (104)
- non-residents (46, 44%)
- HI residents (58, 56%)
Waikoloa Beach-Mauna Kea: 14: 
-11 non-residents (9 US)

Kailua Bay-Keauhou: 18

Kumukahi Lighthouse-Pohoiki: 10: 
-9 residents
west coast (Mauna Kea-Milolii):
- 37 of 55 (67%) victims non-residents

south and windward coasts:
- 35 of 41 (85%) victims non-residents
Prevention strategies

• Education:
  – General: websites, printed media, in-flight messaging, baggage claim PSA’s, hotel TV networks, etc.
  – On-site: signage, rescue tubes, and most importantly, lifeguards
    • Oahu tower lifeguards logged ~1.4 million “public contacts” and ~900,000 “preventive actions” in 2014

• Emergency response:
  – Ocean safety/lifeguards
    • Increasingly mobile agencies
  – Fire Departments, USCG, other BLS 1st responders
  – EMS
  – Definitive care
Know before you go

Choose an Island to View real-time conditions:

Kaua‘i
Maui

Hawai‘i

ACTIVE ALERTS

Hanauma Bay Closure
Repeats every week every Tuesday until Thu Dec 31 2015. Tuesday, July 7, 2015 (All day)
Hanauma Bay Nature Preserve is closed each Tuesday.

Beaches: Hanauma Bay

High Surf Advisory
Tuesday, July 7, 2015 - 11:43am to Wednesday, July 8, 2015 - 6:00pm
HIGH SURF ADVISORY FOR SOUTH FACING SHORES OF ALL ISLANDS THROUGH WEDNESDAY. HIGH SURF ADVISORY REMAINS IN EFFECT UNTIL 6PM HST WEDNESDAY. A HIGH SURF ADVISORY REMAINS IN EFFECT UNTIL 6PM HST WEDNESDAY. A HIGH SURF ADVISORY REMAINS IN EFFECT UNTIL 6PM HST WEDNESDAY. A HIGH SURF ADVISORY REMAINS IN EFFECT UNTIL 6PM HST WEDNESDAY. A HIGH SURF ADVISORY REMAINS IN EFFECT UNTIL 6PM HST WEDNESDAY.

Imagery: Moderate to heavy breaking waves. Offshore winds through Wednesday.

Beaches: Waikiki, Duke, Hanauma Bay, Waialua, Kailua Beach, Vans, Mokuleia, Kahana Beach, Kahala Beach, Waialae Beach,の Beach, Castle, Kawela Bay, Sandy Beach, Ala Moana Beach, Magic Island Lagoon, Hanalei Bay, Kamehameha Beach Park, Baldwin Beach Park, Ho‘okipa Beach Park, Makaha State Park, Spencer Beach Park, White Sands Beach Park, Kahalu‘u Beach Park, Anahulu Beach Park, Richardson Ocean Park, Leeward Beach Park, Pohoi Beach, Oneloa Bay, Beach Park, Hanauma Bay Beach Park, Keone Beach, Halona Bay, Anahola Beach Park, Kealia Beach Park, Lydgate Beach, Lydgate Pond, Poipu Beach Park, Salt Pond Beach Park, Kakaha Beach Park.

Hazard Ratings

Choose a beach that best matches your ability and comfort level in the water. For the safest beach experience select beaches with a normal caution level identified (yellow squares).

Caution
Approach with caution; conditions can change. This is the safest level of minimal or offshore conditions.

High Hazard
Conditions are hazardous. People are advised to stay out of the ocean.

Extreme
Conditions are extremely hazardous. People are advised to stay out of the ocean.

Types of Alerts

These alerts are in order of lowest to highest order of concern:

- Statement
A statement is issued to advise the community regarding events that are scheduled or can be reasonably predicted to happen that may affect beach or ocean usage.

- Watch
A watch is issued to allow time for preparation for a beach event.

- Advisory
An advisory is issued when events are occurring that are not a direct threat to life or property.

- Warning
Warnings are issued when a beach event is occurring or imminent and action is needed to protect life and property.

- Closure
Access to this city beach park is being denied for public safety purposes.
Prevention strategies

• Education:
  – General: websites, printed media, in-flight messaging, baggage claim PSA’s, hotel TV networks, etc.
  – On-site: signage, rescue tubes, and most importantly, lifeguards
    • Oahu tower lifeguards logged ~1.4 million “public contacts” and ~900,000 “preventive actions” in 2014

• Emergency response:
  – Ocean safety/lifeguards
    • Increasingly mobile agencies
  – Fire Departments, USCG, other BLS 1st responders
  – EMS
  – Definitive care
• Rescue Tubes
  – Started on Kauai, in 2009
    • Funded and maintained by Rotary
    • 240+ tubes in place in Kauai
    • 100+ recorded saves
  – Also being deployed in Hawaii County, Maui to follow
Prevention strategies

• **Education:**
  – General: websites, printed media, in-flight messaging, baggage claim PSA’s, hotel TV networks, etc.
  – On-site: signage, rescue tubes, and most importantly, lifeguards
    • Oahu tower lifeguards logged ~1.4 million “public contacts” and ~900,000 “preventive actions” in 2014

• **Emergency response:**
  – Ocean safety/lifeguards
    • Increasingly mobile agencies
  – Fire Departments, USCG, other BLS 1st responders
  – EMS
  – Definitive care
Nonfatal drownings in the ocean: survival related to EMS response times
Summary of data linkage, 2008-2013

**EMS data**

Deterministic linkage, (name, dob), by HHIC

Hawaii Health Information Corporation:
billing data for all hospital records in the state (ex. TAMC)

Response times

ICD9 dx or E-code for drowning

Emergency Departments

Hospital admissions

Patient vital status at discharge (n=1,136)
1,136 nonfatal drownings in ocean/saltwater

- 40%, or 450 on Oahu
  - 183 in Hawaii County, 379 Maui, 124 Kauai
- Most patients (89%, or 1,014) survived
  - 434 discharged from ED, 580 admitted
  - 11% (122) died
    - Fatality rate much higher among patients requiring EMS-administered CPR: 73% (94 of 129), vs. 1.9% (16 of 859)

- Transport time predictors:
  - 1. Minutes from dispatch to patient contact
  - 2. Minutes from dispatch to hospital
Mortality rates among patients transported for nonfatal drownings, by two response time categories

<table>
<thead>
<tr>
<th>Dispatch to patient contact</th>
<th>Dispatch to hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-8 min (n=367)</td>
<td>10-40 min (367)</td>
</tr>
<tr>
<td>9-14 min (438)</td>
<td>41-54 min (393)</td>
</tr>
<tr>
<td>15+ min (331)</td>
<td>55+ min (376)</td>
</tr>
<tr>
<td>9.8</td>
<td>13.1</td>
</tr>
<tr>
<td>10.5</td>
<td>10.7</td>
</tr>
<tr>
<td>12.1</td>
<td>8.5</td>
</tr>
</tbody>
</table>
Mortality rates among patients transported for nonfatal drownings, by time to patient contact and CPR status

No CPR required:
- 2% mortality rate

Patients with CPR:
- 73% mortality rate

Adjusted odds ratio:
- No CPR required: 3.7 (1.3-11.4) (p=0.05; significant)
- Patients with CPR: 2.7 (1.0-7.3) (p=0.05; significant)
Spinal cord injuries, 2009-2013
Hawaii Trauma Registry:
Leading causes of spinal cord injuries in Hawaii, 2009-2013

- ocean activities: 208 (33%)
- falls: 161 (25%)
- motor vehicle crashes: 137 (22%)
- striking: 33 (5%)
- other sports (non-aquatic): 15 (2%)
- water dives, non-ocean: 13 (2%)
- assault: 13 (2%)
- bicycle crashes (no MVC): 11 (2%)
- sky dive: 5 (1%)
- other injuries: 36 (5%)

Most (78%) are non-residents.

- body surfing: 53
- body boarding: 46
- “tossed by wave”: 63
- diving into ocean: 31
Hawaii Trauma Registry: Location (beach) of spinal cord injuries from ocean activities in Hawaii, 2009-2013

- Makena: 22
- Hapuna: 18
- Sandy: 16
- Brenneke: 15
- Laaloa: 12
- Waikiki: 10
- Waimea: 8
- Wailea: 7
- Kua Bay: 7
- Kaanapali: 6
- Polo Beach: 5
- Mauna Kea: 5
- 16 beaches: 2-4
- 20 beaches: 1
- Unknown: 19
Summary

• Part 1: Ocean drownings
  – *Non-residents much higher rates*
    • Comprise majority of victims on Kauai and Maui counties
  – *Lowest rates for Oahu*
    • *Most extensive lifeguard coverage, shorter EMS times*

• Part 2: Nonfatal drownings in ocean
  – *Survival is associated with EMS response times*
    • Time to patient contact, among patients needing CPR
      – *Need to study role of lifeguard 1st response*

• Part 3: Spinal cord injuries
  – *Ocean-related activities are the leading cause*
    • Mostly non-residents
    • Statewide distribution, but also high-risk beaches