Sudden Death in Sports

John Hatzenbuehler, MD FACSM
ACSM Team Physician Course
Jacksonville, FL 2016
Disclosures

• None
Objectives

• Review causes of sudden death in athletes
• Recognize that cardiac conditions are the leading cause for sudden death in athletes
• Name 4 other non-cardiac causes of sudden death
Figure 1. Number of cardiovascular (CV), trauma-related and other sudden death events in 1866 young competitive athletes, by year.

# 10 Leading Causes of Death by Age Group, United States - 2013

<table>
<thead>
<tr>
<th>Rank</th>
<th>&lt;1</th>
<th>1-4</th>
<th>5-9</th>
<th>10-14</th>
<th>15-24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>65+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Congenital Anomalies 4,758</td>
<td>Unintentional Injury 1,316</td>
<td>Unintentional Injury 746</td>
<td>Unintentional Injury 11,019</td>
<td>Unintentional Injury 16,209</td>
<td>Unintentional Injury 15,354</td>
<td>Malignant Neoplasms 46,185</td>
<td>Malignant Neoplasms 123,324</td>
<td>Heart Disease 488,150</td>
<td>Heart Disease 611,105</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Short Gestation 4,292</td>
<td>Congenital Anomalies 478</td>
<td>Malignant Neoplasms 447</td>
<td>Malignant Neoplasms 448</td>
<td>Suicide 4,878</td>
<td>Suicide 6,348</td>
<td>Malignant Neoplasms 11,349</td>
<td>Heart Disease 35,167</td>
<td>Heart Disease 72,568</td>
<td>Malignant Neoplasms 407,558</td>
<td>Malignant Neoplasms 584,881</td>
</tr>
<tr>
<td>3</td>
<td>Maternal Pregnancy Comp. 1,595</td>
<td>Homicide 337</td>
<td>Congenital Anomalies 179</td>
<td>Suicide 385</td>
<td>Homicide 4,379</td>
<td>Homicide 4,236</td>
<td>Heart Disease 10,341</td>
<td>Unintentional Injury 20,357</td>
<td>Unintentional Injury 17,057</td>
<td>Chronic Low. Respiratory Disease 127,194</td>
<td>Chronic Low. Respiratory Disease 149,205</td>
</tr>
<tr>
<td>4</td>
<td>SIDS 1,563</td>
<td>Malignant Neoplasms 328</td>
<td>Homicide 125</td>
<td>Congenital Anomalies 161</td>
<td>Malignant Neoplasms 1,406</td>
<td>Malignant Neoplasms 3,673</td>
<td>Suicide 6,551</td>
<td>Liver Disease 8,785</td>
<td>Chronic Low. Respiratory Disease 15,042</td>
<td>Cerebrovascular 100,602</td>
<td>Unintentional Injury 130,557</td>
</tr>
<tr>
<td>5</td>
<td>Unintentional Injury 1,156</td>
<td>Heart Disease 169</td>
<td>Chronic Low. Respiratory Disease 75</td>
<td>Homicide 152</td>
<td>Heart Disease 941</td>
<td>Heart Disease 3,258</td>
<td>Homicide 2,581</td>
<td>Suicide 8,621</td>
<td>Diabetes Mellitus 13,061</td>
<td>Alzheimer’s Disease 83,786</td>
<td>Cerebrovascular 128,978</td>
</tr>
<tr>
<td>6</td>
<td>Placenta Cord, Membranes 953</td>
<td>Influenza &amp; Pneumonia 102</td>
<td>Heart Disease 73</td>
<td>Heart Disease 100</td>
<td>Congenital Anomalies 362</td>
<td>Diabetes Mellitus 684</td>
<td>Liver Disease 2,491</td>
<td>Diabetes Mellitus 5,399</td>
<td>Liver Disease 11,951</td>
<td>Diabetes Mellitus 53,751</td>
<td>Alzheimer’s Disease 84,767</td>
</tr>
<tr>
<td>7</td>
<td>Bacterial Sepsis 578</td>
<td>Chronic Low. Respiratory Disease 84</td>
<td>Influenza &amp; Pneumonia 67</td>
<td>Chronic Low Respiratory Disease 80</td>
<td>Influenza &amp; Pneumonia 197</td>
<td>Liver Disease 676</td>
<td>Diabetes Mellitus 1,952</td>
<td>Cerebrovascular 5,425</td>
<td>Cerebrovascular 11,364</td>
<td>Influenza &amp; Pneumonia 48,031</td>
<td>Diabetes Mellitus 75,578</td>
</tr>
<tr>
<td>8</td>
<td>Respiratory Distress 522</td>
<td>Septicemia 53</td>
<td>Cerebrovascular 41</td>
<td>Influenza &amp; Pneumonia 61</td>
<td>Diabetes Mellitus 193</td>
<td>HIV 631</td>
<td>Cerebrovascular 1,687</td>
<td>Chronic Low. Respiratory Disease 4,819</td>
<td>Suicide 7,135</td>
<td>Unintentional Injury 45,942</td>
<td>Influenza &amp; Pneumonia 56,979</td>
</tr>
<tr>
<td>9</td>
<td>Circulatory System Disease 458</td>
<td>Septicemia 35</td>
<td>Cerebrovascular 48</td>
<td>Complicated Pregnancy 178</td>
<td>Cerebrovascular 508</td>
<td>HIV 1,246</td>
<td>Septicemia 2,445</td>
<td>Septicemia 5,345</td>
<td>Septicemia 30,080</td>
<td>Nephritis 47,112</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Neonatal Hemorrhage 389</td>
<td>Pernatal Period 45</td>
<td>Benign Neoplasms 34</td>
<td>Benign Neoplasms 31</td>
<td>Chronic Low. Respiratory Disease 155</td>
<td>Influenza &amp; Pneumonia 449</td>
<td>Influenza &amp; Pneumonia 681</td>
<td>HIV 2,378</td>
<td>Nephritis 4,047</td>
<td>Septicemia 28,815</td>
<td>Suicide 41,140</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>10-14</th>
<th>15-24</th>
<th>25-34</th>
<th>35-44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unintentional Injury</td>
<td>775</td>
<td>11,619</td>
<td>16,209</td>
<td>15,354</td>
</tr>
<tr>
<td>Malignant Neoplasms</td>
<td>448</td>
<td>Suicide 4,878</td>
<td>Suicide 6,348</td>
<td>Malignant Neoplasms 11,349</td>
</tr>
<tr>
<td>Suicide</td>
<td>386</td>
<td>Homicide 4,329</td>
<td>Homicide 4,236</td>
<td>Heart Disease 10,341</td>
</tr>
<tr>
<td>Congenital Anomalies</td>
<td>161</td>
<td>Malignant Neoplasms 1,496</td>
<td>Malignant Neoplasms 3,673</td>
<td>Suicide 6,551</td>
</tr>
<tr>
<td>Homicide</td>
<td>152</td>
<td>Heart Disease 941</td>
<td>Heart Disease 3,258</td>
<td>Homicide 2,581</td>
</tr>
</tbody>
</table>
Sudden Death: NCAA Athletes

• All sudden death in NCAA athletes from 2004-08
• 273 deaths & nearly 2 million athlete-participation yrs
• 2% of deaths associated w/ SCT
• 72 (26%) deaths in football athletes
  – 52 (72%): trauma unrelated to sports activity
  – 20 (28%): medical causes
  – 9 (45%): cardiac

Harmon; BJSM 2012
10 yr Study of German Athletes

- 87 cardiac deaths (88%)
- 2 strokes
  - 1 HTN cerebral hemorrhage
  - 1 subarachnoid hemorrhage
- 1 PE
- 1 sepsis
- 1 leukemic CNS hemorrhage

Turk BJSM 2008
Epidemiology Continued

• Maron 1996
  – 15% of 158 sudden death in competitive athletes due to non-cardiac reasons

• Eckart 2004
  – 126 cases of sudden, non-traumatic deaths
  – 51% cardiac
  – 35% idiopathic
  – 14% non-cardiac
Eckart Military Study: non-cardiac

- 3 sickle-cell crises
- 2 pulmonary embolism
- 1 internal hemorrhage
- 5 intracranial hemorrhage
- 4 pulmonary causes
  - 2 asthma, 1 sarcodosis, 1 alveolar hemorrhage
- 3 exertional rhabdomyolysis or heat stroke
Collapsed Athlete

- Think cardiac!
- Collapse DURING exercise = CARDIAC
- Post exercise collapse
  - Think cardiac 1\textsuperscript{st}
  - % of other causes increases
Non-cardiac sudden death in athletes

**Differential Diagnosis**

- Heat or cold illness
- Neurologic
  - Seizures
  - “Second impact?”
  - Intracranial bleed: malformations
- Pulmonary
  - Asthma
- Hyponatremia
- Hypoglycemia
- Anaphylaxis
Sudden Death: HEAT

- 3% of all cause mortality in Harmon’s NCAA study
- 40 HS football players diet of heat stroke in 20yrs!
- US: 103 deaths in sports from 1960-2000 compared to 5 from 1931-1959
- Preventable

National Centers for Catastrophic Sports Injury Research
Sudden Death: SCT

- SCT present in 5-8% of African Americans
- Athletes +SCT are at increased risk of sudden death
  - Intensity & conditioning may be key factors
  - May develop fulminant rhabdo
  - Metabolic derangements lead to arrhythmias
- 2462 athletes sudden death over 31 yrs
  - 0.9% +SCT overal
  - 3.3% +SCT black athletes  
    Harris: AM J Cards 2012

- All deaths associated w/ SCT occurred in black D1 football athletes
  Harmon: BJSM 2012
Sudden Death: Anaphylaxis

- Food triggers
  - peanuts/nuts
  - Milk proteins
  - Seafood
- Exercise associated anaphylaxis
  - Epipen
  - Never exercise alone
- Exercise + Food anaphylaxis
Sudden Death: Asthma

- Fatal asthma reported in athletes during exercise
- 35 cases between 1993-2000
- Practices & games
- White > black males age 10-20 highest risk
- Increased risk: basketball & track
- Majority w mild intermittent or persistent asthma

Summary

• 80-90% of sudden deaths in athletes are cardiac
  – Data may be inaccurate as coroner’s reports & autopsy findings may not identify true cause

• Asthma deaths in exercise
  – Most not on controller medications

• Heat is a major risk

• Diabetes, anaphylaxis, seizures & other less common neurologic problems have all been implicated

• SCT risk is complex & may mimic other causes

• Don’t forget mood disorders