Homework 1.

Due at the Beginning of Class
Wednesday January 20, 2016

Taylor Matekevitch
Wharton junior Owen Thomas (40), a six-foot-two, 240-pound defensive end, was a second-team All-Ivy player in 2009. He recorded 29 tackles and finished second in the league with six sacks.

Wharton Junior Found Dead Monday Afternoon
By Darina Shtrakhman
April 26, 2010, 8:41 pm

Wharton junior Owen Thomas was found dead at his off-campus residence around 2 p.m. Monday afternoon, University spokeswoman Lori Doyle and Director of Athletic Communication Mike Mahoney confirmed. He was a member of the football team.

Cause of death has not yet been determined, but “no foul play is suspected,” according to Doyle. Thomas, who played defensive end for the Quakers, was recently voted a captain of the football team.

Suicide Reveals Signs of a Disease Seen in N.F.L.
By Alan Schwarz
September 13, 2010

ALLENTOWN, Pa. — A brain autopsy of a University of Pennsylvania football player who killed himself in April has revealed the same trauma-induced disease found in more than 20 deceased National Football League players, raising questions of how young football players may be at risk for the disease.

Owen Thomas, a popular 6-foot-2, 240-pound junior lineman for Penn with no previous history of depression, hanged himself in his off-campus apartment after what friends and family have described as a sudden and uncharacteristic emotional collapse. Doctors at Boston University subsequently received permission from the family to examine Thomas’s brain tissue and discovered early stages of chronic traumatic encephalopathy, a disease linked to depression and impulse control primarily among N.F.L. players, two of whom also committed suicide in the last 10 years.

Thomas is the youngest and first amateur football player to be found with clear CTE.
And the two Penn neuro-ophthalmologists testing King-Devick—Steven Galetta and Laura Balcer—are starting to draw attention for their work.

Lanky, loping, contagiously affable Galetta, 54, and his energetically serious 46-year-old colleague Balcer are new to this hard-hitting world of concussions, and surprisingly exciting. Neuro-ophthalmology are considered the dorks of neurology, Galetta explains: “We’re like Rodney Dangerfields of the brain, no respect.” He views the new field of sports concussion research he’s entered as dominated by “expert opinion, the lowest form of medical evidence.”

Laura Balcer was Steve Galetta’s resident at HUP (where, among other jobs, he runs the neurology residency program) and rose in the department as his protégé. Kristin Galetta—daughter of Steve—is a medical student at Penn and was lead author on both papers on the King-Devick research.

A big part of the reason the research has been done at Penn and the Haverford School is that Galetta played on a football team at Penn, and is a longtime adviser to the university’s athletes program.
The King-Devick test and sports-related concussion: Study of a rapid visual screening tool in a collegiate cohort.


Abstract

Objective: Concussion, defined as a clinical syndrome resulting in symptoms ranging from mild to severe, is a common injury in athletes. The King-Devick test (K-D test) has been shown to be a useful tool for assessing visual function in the setting of concussion. The purpose of this study was to evaluate the efficacy of the K-D test in detecting visual dysfunction in a collegiate football player with a history of multiple sports-related concussions.

Methods: A 21-year-old male collegiate football player with a history of multiple sports-related concussions underwent a multidisciplinary evaluation for persistent symptoms. The K-D test was administered to assess visual function. The test was performed in a dimly lit room with the athlete seated at a distance of 3 meters from a computer screen. The athlete was asked to read aloud the letters on the screen as quickly as possible, starting with one letter every 0.5 seconds. The test was repeated three times, and the highest score was recorded.

Results: The athlete achieved a score of 61, which is considered abnormal based on published norms. Further evaluation revealed a right homonymous hemianopsia, consistent with persistent visual dysfunction.

Conclusion: The K-D test is a simple and objective tool that can be used to assess visual function in the setting of concussion. In this case, the test was able to detect persistent visual dysfunction in a collegiate football player with a history of multiple concussions.

Table 1: The effects of concussion during the playing season on K-D scores.

<table>
<thead>
<tr>
<th>Age at time of injury</th>
<th>Athlete with prior concussion</th>
<th>Athlete with no concussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.7 yrs (mean)</td>
<td>61 (best of 3 trials)</td>
<td>12 (best of 3 trials)</td>
</tr>
<tr>
<td>Soc. wk at start</td>
<td>0 (best of 3 trials)</td>
<td>0 (best of 3 trials)</td>
</tr>
<tr>
<td>Soc. wk at end</td>
<td>51 (best of 3 trials)</td>
<td>51 (best of 3 trials)</td>
</tr>
<tr>
<td>Start of season</td>
<td>2 (best of 3 trials)</td>
<td>2 (best of 3 trials)</td>
</tr>
<tr>
<td>End of season</td>
<td>2 (best of 3 trials)</td>
<td>2 (best of 3 trials)</td>
</tr>
<tr>
<td>Total weeks</td>
<td>51 (best of 3 trials)</td>
<td>51 (best of 3 trials)</td>
</tr>
</tbody>
</table>

Results: Among 210 athletes tested at baseline, post-season K-D scores were lower (better) than the best pre-season scores (25.7 yrs, 61/12, p < 0.001, Wilcoxon signed-rank test), reflecting mild learning effects in the absence of concussion. For the 10 athletes with prior concussions, K-D testing in the season showed significant worsening from baseline (46/57, 21/12, p < 0.001, with all except one athlete demonstrating worsening from baseline (7/12)).
Problems with the Study

- Small numbers
- Players with concussions were tested on the sidelines immediately after injury, but players without concussions were tested only at the end of the season

Revised Operating Characteristics
Estimated from the Confidence Intervals

Sensitivity = 0.76
Specificity = 0.99
Using the King-Devick Test to Evaluate High School and College Football Players for Concussion

Background
Recent developments have established that high school and college football players are at risk for chronic traumatic encephalopathy, which can have devastating consequences. Many observers believe that recognizing concussion is an important step in preventing chronic traumatic encephalopathy. Traditional methods for recognizing concussion have not been studied enough to establish effectiveness, and most take too long. The King-Devick test is short enough to be used during game conditions and has been studied in over 200 college athletes.

Problem
Assume that the sensitivity of the King-Devick test is 0.76 and the specificity is 0.99. Also assume that when trainers suspect a football player might have a concussion, half of the players eventually have a concussion confirmed and half have a concussion ruled out during an evaluation by a neurologist that includes specialized testing. Finally, assume that trainers use the King-Devick test to examine players during a game who they suspect might have a concussion and then refer all these players to a neurologist for further evaluation.

1. What is the probability that a football player will eventually have a concussion confirmed if the King-Devick test result is positive?

2. What is the probability that a football player will eventually have a concussion ruled out if the King-Devick test result is negative?

3. If the King-Devick test result is negative, should the player be allowed to continue playing? Why? Or why not?