DEFENSE CENTERS OF EXCELLENCE
For Psychological Health & Traumatic Brain Injury

Gender Issues and Sport-related Concussion

Oct. 9, 2014, 1-2:30 p.m. (EDT)

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DVBIC Defense and Veterans Brain Injury Center
DHCC Deployment Health Clinical Center
National Center for Telehealth & Technology

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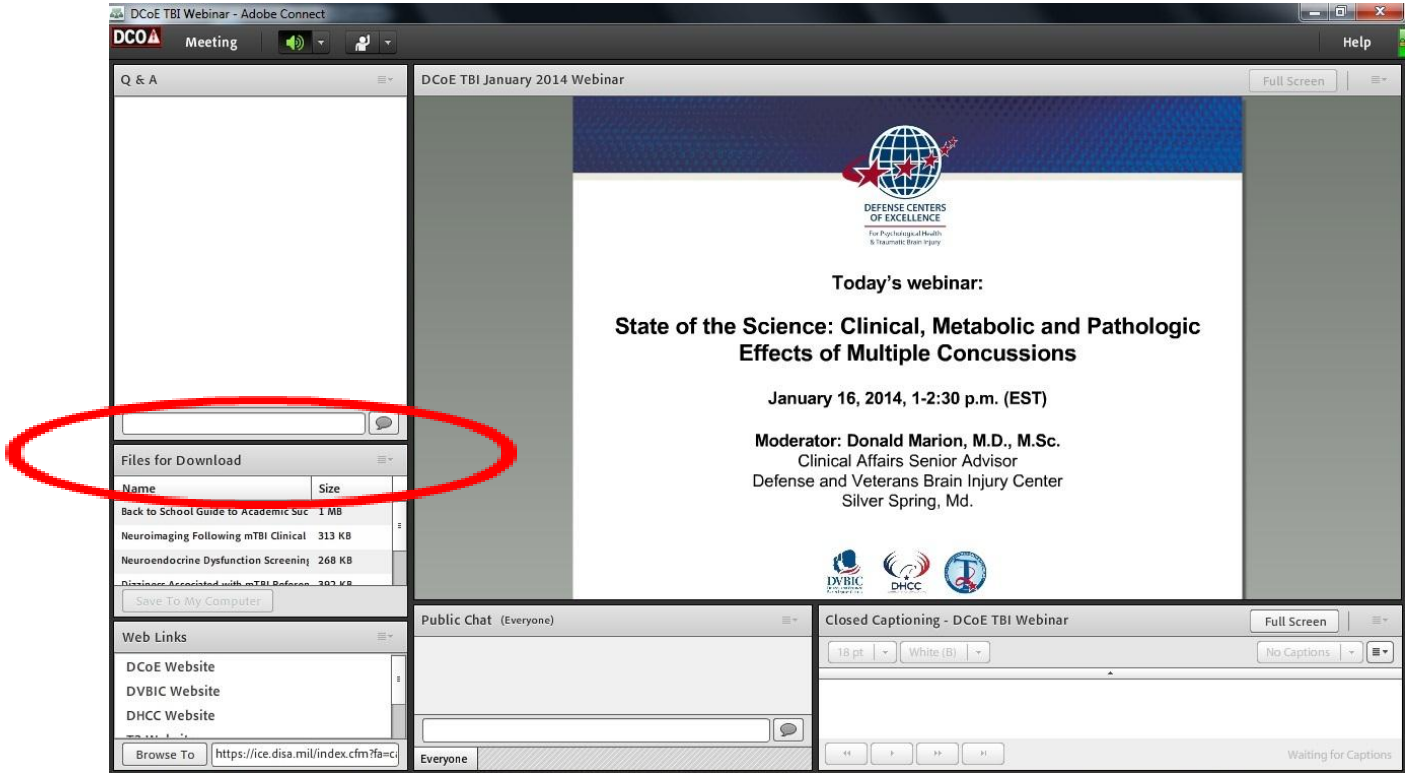

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National Association of Social Workers
Approval Year
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- Throughout the webinar, you are welcome to submit technical or content-related questions via the Q&A pod located on the screen. **Please do not submit technical or content-related questions via the chat pod**.
- The Q&A pod is monitored during the webinar; questions will be forwarded to presenters for response during the Q&A session.
- Participants may chat with one another during the webinar using the chat pod.
- The chat function will remain open 10 minutes after the conclusion of the webinar.

Webinar Overview

- The Centers for Disease Control and Prevention reports that approximately 1.6-3.8 million sport and recreational concussions occur annually in the United States.

- Epidemiological studies conducted to understand differences between female and male athletes with respect to sport injury incidence and prevalence have shown that female athletes at both the collegiate and high school levels are at a greater risk for incurring a concussion. In addition, females have been found to report slightly longer concussion symptoms and cognitive impairments.

- The empirical findings on sex differences in sport-related concussion warrant clinical considerations when assessing concussion among male and female athletes.

- At the conclusion of this webinar, participants will be able to:
  - Describe current research regarding gender issues and sport-related concussion
  - Identify sports at high risk for concussion at both the high school and collegiate level
  - Articulate gender differences in post-concussion symptoms and concussion outcomes
  - Discuss the importance of concussion management for male and female athletes

Presenter: Tracey Covassin, Ph.D., ATC

Tracey Covassin, Ph.D., ATC

- Associate Professor and certified athletic trainer in the Departments of Kinesiology and Intercollegiate Athletics at Michigan State University
- Served on the Institute of Medicine and National Research Council Sport-Related Concussion in Youth Committee which released “Sport-related Concussions in Youth: Improving the Science, Changing the Culture” in October 2013
- Directs a multi-site high school and college sport-concussion outreach program in the mid-Michigan area
- Sport-related research foci include sex and age differences in concussion outcomes, neurocognitive impairments and issues associated with multiple concussions
- Has received funding as a principal investigator from external sources including the National Operating Committee of Standards for Athletic Equipment, National Athletic Trainers Association Research and Education Foundation, NFL Charities, and the Centers for Disease Control and Prevention

GENDER ISSUES AND SPORT-RELATED CONCUSSION

Tracey Covassin, Ph.D., ATC

DISCLOSURES

- The views expressed in this presentation are those of the presenter and do not reflect the official policy of the Defense Department, U.S. Government or Michigan State University.
- The presenter does not intend to discuss the off-label/ investigative (unapproved) use of commercial products or devices.
- The presenter has no relevant relationships to disclose.

PRESENTATION GOALS

- Epidemiology of sport-related concussion
- Gender differences in concussion symptoms
- Gender differences in concussion outcomes
- Management considerations for male and female athletes

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POLLING QUESTION

Females are at a greater risk for concussion in sex comparable sports.

- ❑ True
- ❑ False

POLLING QUESTION

Compared to females, males have more injuries due to player-player contact than player-surface contact or player-equipment contact.

- ❑ True
- ❑ False

EPIDEMIOLOGY OF SPORT-RELATED CONCUSSION

- According to the Centers for Disease Control and Prevention, there are approximately 1.6-3.8 million sport and recreational concussions in the United States annually (Langlois, Rutland-Brown, & Wald, 2006)
- Researchers have reported that females have a greater risk and incidence for sport-related concussion than males in comparable sports. (Marar, McIlvain, Fields, & Comstock, 2012; Lincoln et al., 2011; Hootman, Dick, & Agel, 2007; Covassin, Swanik, & Sachs, 2003)

SERVICE MEMBERS

- Among the U.S. service members worldwide, nearly 23,000 concussions or mild traumatic brain injuries (mTBIs) were diagnosed in 2013, representing about 84 percent of all TBIs in that population.

DVBIC, 2014

SERVICE MEMBERS

- Although TBI has become the signature injury of the wars in Afghanistan and Iraq, more than 80% of TBIs in the military do not occur in the deployed setting.
- These TBIs most commonly occur from motor vehicle crashes (privately owned and military vehicles), falls, sports and recreation activities, and military training.

DVBIC, 2014

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SERVICE MEMBERS

- There is no reason to suspect that service members between the ages 18 and 22 who play intramural or service academy sports have different concussion risks than non-service member athletes.

SERVICE MEMBERS

- In an effort to reduce the number of concussions among Cadets, West Point has substituted flag football for intramural football and eliminated intramural rugby altogether.

Wolfe, 2013

NATIONAL COLLEGIATE ATHLETIC ASSOCIATION (NCAA) INJURY SURVEILLANCE PROGRAM

Photo courtesy of Michigan State University

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NCAA INJURY SURVEILLANCE PROGRAM

- A reportable injury
  - Occurred as a result of participation in an organized intercollegiate practice or competition
  - Required medical attention by a team certified athletic trainer (AT) or physician
  - Restriction of participation for one or more days beyond the day of injury

Hootman, Dick, & Angel, 2007

NCAA CONCUSSION RATES/ 10,000 ATHLETE EXPOSURES (AE)

Men's Sports

- Football – 6.0
- Ice Hockey – 6.0
- Soccer – 4.2
- Lacrosse – 6.0
- Basketball – 3.4
- Wrestling – 4.9
- Baseball – 1.1

Women's Sports

- Ice Hockey – 7.0
- Soccer – 6.7
- Lacrosse – 6.2
- Basketball – 4.8
- Field Hockey–4.0
- Softball – 2.3

Datalys Center, 2013

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EPIDEMIOLOGY OF HIGH SCHOOL CONCUSSIONS

- Examined the incidence and risk of concussion in 12 high school sports
- 1997-1998 and 2007-2008
- 25 high schools in Fairfax County, Va. public school district
- Certified athletic trainers
- Sports Injury Management System (SIMS)

Lincoln et al., 2011

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EPIDEMIOLOGY OF HIGH SCHOOL CONCUSSIONS

- Concussion was defined as an event that occurred during official game or practice, brought to the attention of an AT, and determined to be a concussion by the AT.
- Clinical exam, symptom checklist, standardized assessment of concussion (SAC), Immediate Post Assessment and Cognitive Test (ImPACT)

Lincoln et al., 2011

EPIDEMIOLOGY OF HIGH SCHOOL CONCUSSIONS

- 2,651 concussions
- Football highest injury rate of concussion (.60)
- Risk
  - 2.1 x greater risk for girls in soccer
  - 1.9 x greater risk for girls in softball
  - 1.7 x greater risk for girls in basketball
- Lacrosse higher injury rate in boys (.30) compared to girls (.20)

Lincoln et al., 2011

HIGH SCHOOL CONCUSSION RATES/10,000 AE

Men's Sports

- Football – 6.0
- Soccer – 1.7
- Lacrosse – 3.0
- Basketball – 1.0
- Wrestling – 1.7
- Baseball – 0.6

Women's Sports

- Soccer – 3.5
- Lacrosse – 2.0
- Basketball – 1.6
- Field Hockey – 1.0
- Softball – 1.1
- Cheerleading – 0.6

Datalys Center, 2013

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PERCENT INCREASE OF HIGH SCHOOL CONCUSSIONS OVER 10 YEAR PERIOD

Boy's Sports

- Wrestling 27%
- Lacrosse 17%
- Basketball 17%
- Baseball 14%
- Soccer 13%
- Football 8%

Girl's Sports

- Cheerleading 26%
- Basketball 24%
- Softball 23%
- Field hockey 20%
- Soccer 17%
- Lacrosse 17%

Lincoln et al., 2011

EPIDEMIOLOGY OF HIGH SCHOOL (HS) CONCUSSIONS

- Reporting Information Online (RIO) Injury Surveillance
- 2008-2010 for 20 sports
- 13.2% of all injuries were concussions
- Risk
  - 3.2 x greater risk for girls in softball
  - 2.1 x greater risk for girls in soccer
  - 1.3 x greater risk for girls in basketball
  - 1.7 x greater risk overall for girls compared to boys

Marar, McIlvain, Fields, & Comstock, 2012

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MECHANISM OF INJURY

- Females have more injuries due to player-surface contact and player-equipment contact compared to boys.
- Males have more injuries due to player-player contact compared to females.

WHAT MAY ACCOUNT FOR GENDER DIFFERENCES IN RISK FOR CONCUSSION?

- Females have 50% less isometric neck strength.
- Females have 23% less neck girth.
- Females have 43% less head-neck segment.
- Females had 50% greater head-neck peak angular acceleration.

Tierney et al., 2005

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WHAT MAY ACCOUNT FOR GENDER DIFFERENCES IN RISK FOR CONCUSSION?

- Risk of concussion directly related to amount of head acceleration (linear and angular) during force application Newton's Law of Acceleration
- As the mass of an object is increased, the acceleration of the object is decreased.
- Females have less mass, therefore, greater acceleration.

Gennarelli et al., 1982

WHAT MAY ACCOUNT FOR GENDER DIFFERENCES IN RISK FOR CONCUSSION?

- Researchers have also suggested that female soccer players have a larger ball-to-head size ratio than males, possibly predisposing them to concussion.

Barnes et al., 1998; Schneider & Zernicke, 1988

WHAT MAY ACCOUNT FOR GENDER DIFFERENCES IN RISK FOR CONCUSSION?

- Some of the differences in concussion rates between males and females may be explained by a lower rate of reporting of concussion symptoms by male athletes, although there is no definitive evidence that this is the case.

GENDER DIFFERENCES AND CONCUSSION SYMPTOMS AND OUTCOMES

Photo courtesy of Michigan State University

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GENDER DIFFERENCES AND CONCUSSION SYMPTOMS

- Recent study on HS and collegiate soccer players found concussed female athletes demonstrated more symptoms than concussed male athletes.
  - Total concussion symptoms
  - Headache

Colvin et al., 2009

GENDER DIFFERENCES AND CONCUSSION SYMPTOMS

- Female concussed athletes reported more concussion symptoms than male concussed athletes.
  - Poor concentration
  - Lightheadedness
  - Increased fatigue
  - “Seeing stars”

Broshek et al., 2005

GENDER DIFFERENCES AND CONCUSSION SYMPTOMS

- Examined the relationship between gender and post-concussion symptoms (PCS) in athletes who incurred a sports mTBI
- 215 patients reported to the emergency room (ER)
- Three months post-concussion administered the Rivermead Post Concussion Symptoms Questionnaire (RPQ)

Preiss-Farzanegan, Chapman, Wong, Wu, & Bazarian et al., 2009

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GENDER DIFFERENCES AND CONCUSSION SYMPTOMS

- Females are at greater risk of PCS compared to males in adulthood (18+ years).
- Females elevated risk for:
  - Headache
  - Dizziness
  - Fatigue
  - Irritability
  - Concentration

Preiss-Farzanegan, Chapman, Wong, Wu, & Bazarian et al., 2009

GENDER DIFFERENCES AND CONCUSSION OUTCOMES

- Administered the Concussion Resolution Index (CRI) to high school and collegiate athletes
- No sex difference at baseline
- Females had greater cognitive declines than males.
- Reliable Change Index (RCI) score for clinical significance
  - 57% of females impaired
  - 33% of males impaired

Broshek et al., 2005

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GENDER DIFFERENCES AND CONCUSSION OUTCOMES

- Females (no helmet), males (no helmet), males (helmet)
- Females demonstrated significantly slower response speed on Complex Reaction Time (CRT) and Processing Speed (PS), marginal slower Simple Reaction Time (SRT) compared to unhelmeted males.
- Females demonstrated slower response speed on SRT and more symptoms than helmeted males.

Broshek et al., 2005

GENDER DIFFERENCES AND CONCUSSION OUTCOMES

- RCI
  - 57% of females unhelmeted
  - 34% of males helmeted
  - 27% of males unhelmeted
- Female athletes cognitively impaired 1.7x more than male athletes

Broshek et al., 2005

GENDER DIFFERENCES AND CONCUSSION SYMPTOMS

- Administered ImPACT to 234 concussed high school and collegiate athletes
- Only used soccer players
- Males = 93, females = 141
- Female soccer players exhibited slower reaction time scores than male soccer players.

Colvin et al., 2009

GENDER DIFFERENCES AND CONCUSSION OUTCOMES

- To examine sex and age differences in post-concussion symptoms, neurocognitive (NCT) performance, and postural stability following concussion.
- We hypothesized that high school and female athletes would have greater concussion symptoms, worse NCT and postural stability than college and male athletes respectively.

Covassin, Elbin, Parker, Harris, & Kontos, 2012

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PARTICIPANTS

- A total of 296 (204 males, 93 females; 203 high school, 93 college) athletes from an ongoing sport concussion surveillance study in California, Michigan, Louisiana, and Tennessee
- After exclusionary criteria – 222 subjects
  - 157 males, 65 females

Covassin, Elbin, Parker, Harris, & Kontos, 2012

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METHODS

- ImPACT at baseline, 2, 7, and 14 days post-concussion
- Balance Error Scoring System (BESS) at day 1, 2, and 3 post-concussion
- All return-to-play decisions were determined by each concussed athlete's respective institutions' sports medicine staff.

Covassin, Elbin, Parker, Harris, & Kontos, 2012

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RESULTS: BESS

- Significant between subjects interaction for sex and age ($F_{[1, 111]} = 7.29$, p=.008)
- High school males (M=18.8±7.2) scored slightly worse than high school females (M=13.0±6.3).
- College females scored (M=21.1±8.7) significantly worse than male college athletes (M=16.9±8.6).

Covassin, Elbin, Parker, Harris, & Kontos, 2012

GENDER DIFFERENCES

- Females (m=14.5±1.6) reporting more symptoms than males (M=10.0±1.2)
- Female athletes performing worse than male athletes on visual memory (F [1, 118] = 3.95, p=.049)

Covassin, Elbin, Parker, Harris, & Kontos, 2012

GENDER DIFFERENCES AND CONCUSSION OUTCOMES

- To examine neurocognitive performance following concussion between male and female soccer players
- To compare concussion symptoms among male and female concussed soccer players

Covassin, Elbin, Fisher, & Lipchik, 2013

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PARTICIPANTS

- 39 males (BMI=22.21±2.34, age=17.69+2.1)
- 56 females (BMI=23.47±2.66, age=17.78+2.3)
- Athletes who had a learning disability, history of brain surgery, attention deficit/hyperactive disorder (ADHD), colorblindness or history of chronic migraine headaches were excluded from this study.
- ImPACT at baseline and eight days post-concussion

Covassin, Elbin, Fisher, & Lipchik, 2013

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RESULTS

- This study demonstrated partial support for sex differences on male and female concussed soccer athletes.
- Female concussed soccer athletes scored lower on visual memory compared to male concussed soccer athletes at eight days post-concussion.
- Female concussed athletes presented with greater number of total post-concussion symptoms than male concussed athletes.

Covassin, Elbin, Fisher, & Lipchik, 2013

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GENDER DIFFERENCES AND MULTIPLE CONCUSSIONS

- Examined using a dose-response model gender differences in computerized neurocognitive performance among athletes with a history of multiple concussions
- Retrospective with randomly selected concussion cases from four levels/numbers of previous concussion (no history, one concussion, two concussions, three or more concussions)

Covassin, Elbin, Kontos, & Larson, 2010

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GENDER DIFFERENCES AND MULTIPLE CONCUSSIONS

- Females with a history of two and three or more concussions performed better than males with a history of two (p = .001) and three or more concussions (p = .012) on verbal memory.
- Females performed better than males with a history of three or more concussions (p = .021) on visual memory.
- Males performed worse than females on processing speed (p = .029) and reaction time (p=.04).

Covassin, Elbin, Kontos, & Larson, 2010

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GENDER DIFFERENCES AND MULTIPLE CONCUSSIONS

- Male athletes may have incurred more severe concussions in this study compared to female athletes.
- Current study over-represented collision sports such as football and hockey.

Covassin, Elbin, Kontos, & Larson, 2010

WHAT MAY ACCOUNT FOR THESE GENDER DIFFERENCES?

- Estrogen, the primary female sex hormone, has a detrimental or a neuroprotective effect with regards to concussion.
- Emerson et al. (1993) administered estrogen prior to a brain injury to rats and found that it had a protective effect for males and was exacerbated in females.

Emerson, Headrick, & Vink, 1993

WHAT MAY ACCOUNT FOR THESE GENDER DIFFERENCES?

- Progesterone may act as a neuroprotective effect in animals as it may decrease cerebral edema or down regulate the inflammatory cascade in response to neurotrauma.

Roof & Hall, 2000

WHAT MAY ACCOUNT FOR THESE GENDER DIFFERENCES?

- Females have a greater rate of cerebral blood flow. (Esposito, Van Horn, Weinberger, & Berman, 1996)
- Females have a greater basal rate of glucose metabolism. (Andreason, Zametkin, Guo, Baldwin, & Cohen, 1994)
- A concussion may exacerbate the metabolic cascade, further decreasing cerebral blood flow and increased glycemic demands.
- Female athletes may exhibit longer neurocognitive impairments than male athletes.

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WHAT MAY ACCOUNT FOR THESE GENDER DIFFERENCES?

- Males may ‘play through pain’ and hide symptoms.
- Females may report their concussion symptoms with a greater frequency than males.
- Females more concerned about the effects of future health

WHAT MAY ACCOUNT FOR THESE GENDER DIFFERENCES?

- Females have less opportunity for professional careers than male athletes.
- May not be as affected when told they cannot participate due to their concussion

MANAGEMENT CONSIDERATIONS

- Always manage a concussed athlete or service member using a multi-faceted approach and on an individual basis.
- Females are at greater risk for concussion in soccer, basketball, softball, cheerleading.
- Females may have more concussion symptoms – headache, migraines.
- Females may report slower reaction times.

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MANAGEMENT CONSIDERATIONS

- Obtaining detailed information from service members on previous concussion history
- Obtaining detailed information from athletes on previous concussion history and not just football players!
  - Specific questions about previous signs and symptoms of concussion, not just the perceived number
  - Previous head, face, neck injuries
    - Coexisting concussion?
  - Inquire for both sport and non-sport injuries

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MANAGEMENT CONSIDERATIONS

- EDUCATE
  - Service members
  - Athletes
  - Coaches
  - Parents
  - Physicians
    - Pediatricians
    - Family physicians
    - ER staff

CULTURE CHANGE

- 44% of high school football players reported not wanting to leave the game as their reason for not reporting possible concussion. (McCrea, Hammeke, Olsen, Leo, & Guskiewicz, 2004)
- 66% did not think their injury was serious enough to warrant medical attention. (McCrea, Hammeke, Olsen, Leo, & Guskiewicz, 2004)
- In a 2012 survey of high school football players, a majority indicated that it was “ok” to play with a concussion and that they would “play through any injury to win a game,” despite being knowledgeable about the symptoms and dangers of concussions. (Anderson, Pomerantz, Mann, & Gittelman, 2013)

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ATHLETE PERSPECTIVE: CHRIS COYNE*

- First concussion hitting head on the bar high jumping as a HS freshman athlete – told AT
- Second concussion playing football – tight end
  - "Right away, I knew this was more severe than the first one because I couldn't walk straight and I couldn't remember plays from the huddle," Coyne said. "But I decided to play through it because of the position I was in, and I didn't want to let the team down."

* Permission obtained from Chris Coyne

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ATHLETE PERSPECTIVE: CHRIS COYNE

- Headaches and insomnia persisted for weeks, and Coyne's grades suffered as a result. But he remained quiet, vowing to "report the concussion as soon as the last game of the season was over."
- Third concussion was from 'horsing' around in the locker room
  - At this point decided to tell the AT and his mom about the other concussion
- Fourth and fifth concussion while playing HS sports

ATHLETE PERSPECTIVE: CHRIS COYNE

- Sixth concussion while doing a routine defensive end drill in preseason practice (Yale University), he suffered another helmet-to-helmet hit
  - Considered keeping quiet until he realized the severity of his concussion
  - "I would get up off the couch to get a Gatorade and then I wouldn't know why I was standing up."
  - "Or when classes started, I tried to take notes but I couldn't remember what the lecturer had said just seconds earlier."
  - "I still have memory lapses and I had to take ADHD medicine during my second semester at Yale."

ATHLETE PERSPECTIVE: CHRIS COYNE

- Medical disqualification November 2011
- Support from family, coaches, Dean of College and most teammates
- Some teammates didn’t understand his invisible injury
- Told him to tough it out, man-up, didn’t want him around the locker room
- Today - political science and economics major
- Sports Concussion Awareness and Prevention Program (SportsCAPP) based in Westport, Conn.

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CHANGING THE CULTURE

- A culture that encourages “playing through” a potentially concussive injury or returning to play too soon following a concussion can endanger the physical and cognitive well-being of the young athlete.

CHANGING THE CULTURE

- Military recruits are immersed in military values and culture, including devotion to duty, commitment, and service before self, and the idea that “there is no greater bond than the one they share with the people ‘to their left and their right’ (Halvorson, 2010), which may make them reluctant to self-report symptoms of concussion.

POLLING QUESTION

Would you allow your son to play football?

- Yes
- No

Photo courtesy of Michigan State University

REFERENCES

Anderson, B. L., Pomerantz, W. J., Mann, J. K., & Gittelman, M. A. (2013). “I Can’t Miss the Big Game”: High School (HS) Football Players’ Knowledge and Attitudes about Concussions. Presented at the Pediatric Academic Societies Annual Meeting, Washington, DC, May 6.

Andreason, P., Zametkin, A., Guo, A., Baldwin, P., & Cohen, R. (1994). Gender-related differences in regional cerebral glucose metabolism in normal volunteers. *Psychiatry Research*, *51*, 175-183.

Barnes, B., Cooper, L., Kirkendall, D., McDermott, P., Jordan, B., & Garrett, W. (1998). Concussion history in elite male and female soccer players. *American Journal of Sports Med*icine, *26*(3), 433-438.

Broshek, D., Kaushik, T., Freeman, J., Erlanger, D., Webbe, F., & Barth, J. (2005). Sex differences in outcome following sports-related concussion. *Journal of Neurosurgery, 102*(5), 856-863.

Colvin, A., Mullen, J., Lovell, M., Vereeke, R., Collins, M., & Groh, M. (2009). The role of concussion history and gender in recovery from soccer-related concussion. *American Journal of Sports Medicine*, *37*(9), 1699-1704.

Covassin, T., Elbin, R. J., Fisher, A., & Lipchik, A. (2013). Are their neurocognitive and concussion symptom differences between male and female concussed soccer players? *American Journal of Sports Medicine, 41*(12), 890-2895.

Covassin, T., Elbin, R. J., Kontos, A. P., & Larson, B.E. (2010). Differences in neurocognitive performance between male and female athletes with a history of multiple concussions. *Journal of Neurology, Neurosurgery, and Psychiatry, 81*(6), 597-601.

Covassin, T., Elbin, R., Parker, T., Harris, B., & Kontos, A. (2012). The role of age and sex in symptoms, neurocognitive performance, and postural stability in athletes after concussion. *American Journal of Sports Medicine, 40*(6), 1303-1312.

Covassin, T., Swanik, C., & Sachs, M. (2003). Sex differences and the incidence of concussions among collegiate athletes. *Journal of Athletic Training, 38*(3), 238-244.

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REFERENCES

Datalys Center. 2013b. NCAA Concussion Rates, 2004-2009. Institute of Medicine-National Research Council request. September 23.

Defense and Veterans Brain Injury Center. (2014). DoD worldwide numbers for TBI. Retrieved from http://www.dvbic.org/dod-worldwide-numbers-tbi

Emerson, C. S., J. P. Headrick, & Vink, R. (1993). Estrogen improves biochemical and neurologic outcome following traumatic brain injury in male rats, but not females. *Brain Research*, *608*, 95-100.

Esposito, G., Van Horn, J.D., Weinberger, D.R., & Berman, K. F. (1996). Gender differences with cerebral blood flow as a function of cognitive state with PET. *Journal of Nuclear Medicine, 37*, 559-564.

Gennarelli, T., Thibault, L., Adams, J., Graham, D., Thompson, C., & Marcincin, R. (1982). Diffuse axonal injury and traumatic coma in the primate. *Annals of Neurology, 12*(6), 564-574.

Halvorson, A. (2010). *Understanding the Military: The Institution, the Culture, and the People*. http://partnersforrecovery.samhsa.gov/docs/military_white_paper_final.pdf (accessed August 29, 2013).

Hootman, J., Dick, R., & Agel, J. (2007). Epidemiology of collegiate injuries for 15 sports: Summary and recommendations for injury prevention initiatives. *Journal of Athletic Training, 42*(2), 311-319.

Langlois, J., Rutland-Brown, W., & Wald., M. (2006). The epidemiology and impact of traumatic brain injury: A brief overview. *Journal of Head Trauma Rehabilitation, 21*(5), 375-378.

Lincoln, A., Caswell, S., Almquist, J., Dunn, R., Norris, J., & Hinton, R. (2011). Trends in concussion incidence in hig school sports: A prospective 11-year study. *American Journal of Sports Medicine*, *39*(5), 958-963.

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REFERENCES

McCrea, M., Hammeke, T., Olsen, G., Leo, P., & Guskiewicz, K. M. (2004). Unreported concussion in high school football players: Implications for prevention. *Clinical Journal of Sports Medicine,14*(1), 13-17.

Marar, M., McIlvain, N., Fields, S., & Comstock, D. (2012). Epidemiology of concussions among United States high school athletes in 20 sports. *American Journal of Sports Medicine*, *40*(4), 747-755.

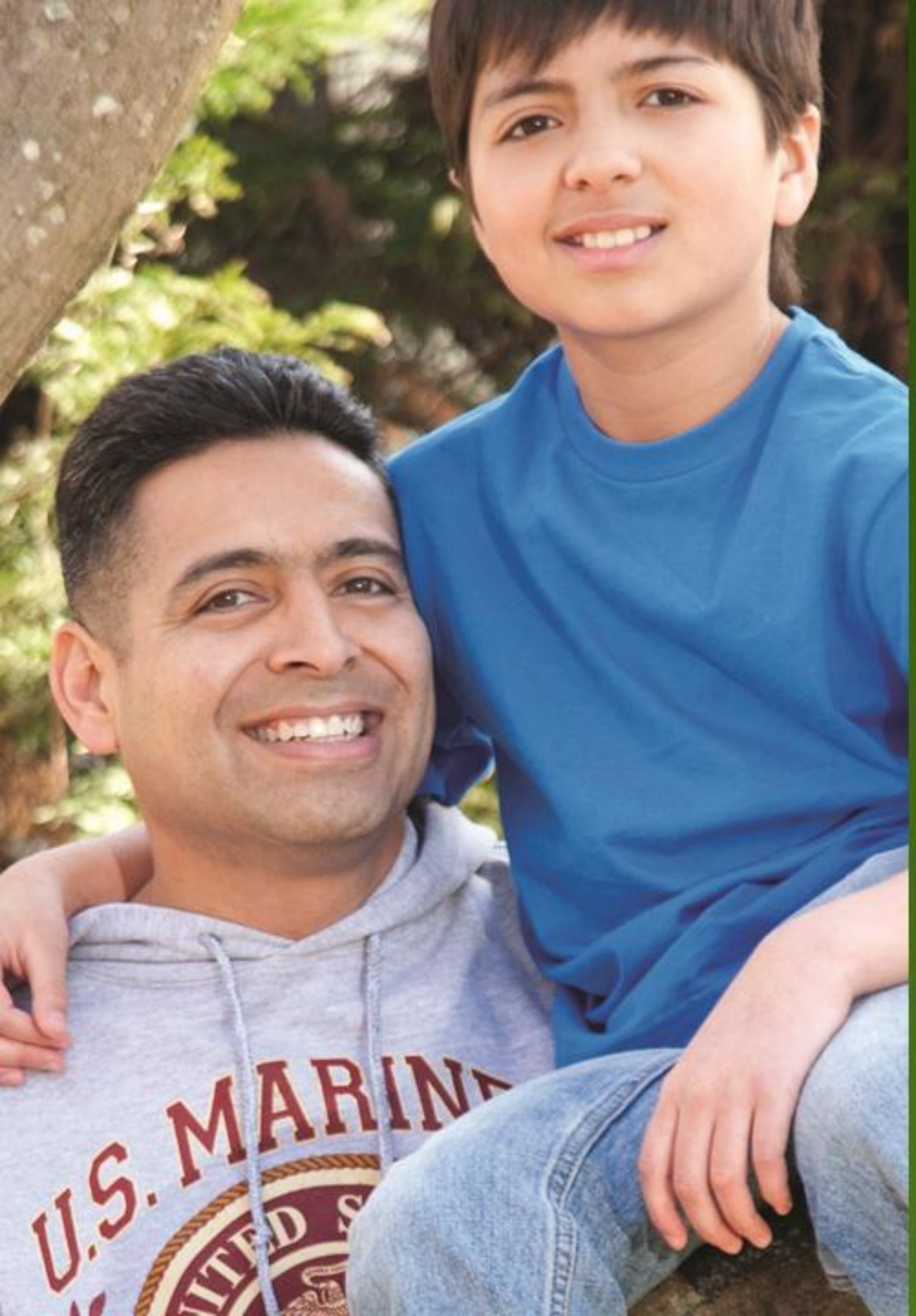
Preiss-Faranegan, S., Chapman, B., Wong, T., Wu, J., & Bazarian, J. (2009). The relationship between gender and postconcussion symptoms after sport-related mild traumatic brain injury. *Physical Medicine & Rehabilitation*, *1*(3), 245-253.

Roof, R. L. & Hall, E. D. (2000). Gender differences in acute CNS trauma and stroke: Neuroprotective effects of estrogen and progesterone. *Journal of Neurotrauma, 17*, 367-388.

Schneider, K. & Zernicke, R. (1988). Computer simulation of head impact: Estimation of head-injury risk during soccer heading. *International Journal of Sport Biomechanics, 4*(4), 358-371.

Tierney, R., Sitler, M.,Swanik, C., Swanik, K., Higgins, M., & Torg, J. (2005). Gender differences in head-neck segment dynamic stabilization during head acceleration. *Medicine and Science in Sports and Exercise, 37*(2), 272-279.

Wolfe, C. (2013, March 28). West Point health care providers focus on brain injury prevention, diagnosis, treatment. Retrieved July 25, 2013, from http://www.army.mil/article/99664/



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