

#### **Learning Objectives**

1. Identify the common network disruptions after concussion and how they can be treated

2. Analyze recent research on the efficacy of minimum visits on concussion treatment with just a concussion specialist and physical therapist

3. Explain tangible actions steps that those involved in WC can take to improve quality of concussion treatment



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# Introduction Thirty-three million children worldwide annually sustain a concussion (Davis et al. 2017) Estimated yearly impact of \$17 billion in health care costs (CDC, 2017)



#### Professional Background- Dr. Caze

- B.A. Adolescent Studies
- M.A. Community Counseling and School Counseling
- Ph.D. Clinical Psychology, concentration in sports neuropsychology
- Residency at UCLA in adult neuropsychology
- Fellowship at Children's Health James Andrews Institute
- Owner of Caze Concussion Institute

#### **Professional Background (Research)**

- 2020 Sports Neuropsychology Society Dissertation Award
- 2021 Pediatric Research in Sports Medicine Society Most Promising Career Award
- Co-Authored Sports Neuropsychology Society Poster Award 2021
- First to write a paper on tele-concussion (2021)
- Written over 20 articles (and still writing!) on concussion



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#### Professional Background- Dr. Larsen

- B.S. Kinesiology Kansas State University
- Doctor of Physical Therapy Creighton University
- Post-doctorate training in vestibular and concussion management
- Physical Therapist/Clinic Manager Athletico Physical Therapy





## Sports as a Laboratory Assessment Model (SLAM)



# Day Zero Research- A lesson from sports

- Those who established specialty concussion care within 7 days improved faster than those who received care after 7 days (Eagle et al., 2020; Kontos et al., 2020).
- Indeed, patients who delayed clinical care were about 6 times more likely to experience a prolonged recovery (i.e., >30 days; Kontos et al., 2020).



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#### Day Zero Research- A lesson from Sports

• At the patient level, medical care costs are tied to length of recovery. SRC recovery for children and adolescents typically occurs within 30 days and costs families \$800 per incident, but these costs may triple for recovery periods beyond 30 days (Sariaslan et al., 2016; Yengo-Kahn et al. 2020).

#### Day Zero Research- A lesson from Sports

Paper in press:

- 856 participants ages 12-18
- DSI:
  - Group 1: 48 hours or less (less than 2 days)
  - Group 2: 49-96 hours (2-4 days)
  - Group 3: 97-168 hours (5-7 days)
- Results:
  - Group 1: M=15 days, OR=3.23
  - Group 2: M=18 days, OR=1.88
  - Group 3: M=21 days





#### **Glossary of Terms**:

**Fragilista:** Someone who causes fragility because he thinks he understands what's going on. Also usually lacks sense of humor. See latrogenics. Often Fragilistas fragilize by depriving variability-loving systems of variability and errorloving systems of errors. They tend to mistake organisms for machines and engineering projects.

**Procrustean bed:** Procrustes got people to fit perfectly into his bed by cutting or stretching their limbs. Corresponds to situations in which simplifications are not simplifications.

**latrogenics:** Harm done by the healer, as when the doctor's interventions do more harm than good.

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#### **Glossary of Terms**:

**Naive Interventionism:** Intervention with disregard to iatrogenics. The preference, even obligation, to "do something" over doing nothing. While this instinct can be beneficial in emergency rooms or ancestral environments, it hurts in others in which there is an "expert problem."

**Turkey and Inverse Turkey:** The turkey is fed by the butcher for a thousand days, and every day the turkey pronounces with increased statistical confidence that the butcher "will never hurt it"—until Thanksgiving, which brings a Black Swan revision of belief for the turkey. The inverse turkey error is the mirror confusion, not seeing opportunities—pronouncing that one has evidence that someone digging for gold or searching for cures will "never find" anything.



**INCERTO** 

THE BLACK SWAN

ANTIFRAGILE

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#### **Concussion= Network Disruption**

- Neurometabolic (Giza & Hovda, 2014; Gardner, Iverson, & Stanwell, 2014)
- Axonal (Grossner, Mayer, & Hillary, 2019; Kontos & Collins, 2018)
- Cerebrovascular (Shenton et al., 2012)
- Autonomic (Leddy et al. 2016)
- Ocular motor (Mucha et al., 2014)
- Vestibular (Mucha et al. 2014)



















- Fight/Flight/Freeze
- Regulates Emotions



Image retrieved from https://dx35vtw kllhj9.cloudfront .net/universalst udios/cocainebear/images/re gions/us/onesh eet.jpg on 03/13/2023

### Autonomic Nervous System Common Symptoms reported include: • Fatigue • Sleep disturbance (too much or too little) • Exercise intolerance and/or symptoms are exacerbated with physical activity • Mood disturbance including an increase in irritability



#### Research

- Article: Haider, M. N., Bezherano, I., Wertheimer, A., Siddiqui, A. H., Horn, E. C., Willer, B. S., & Leddy, J. J. (2021). Exercise for sport-related concussion and persistent postconcussive symptoms. *Sports health*, *13*(2), 154-160.
- Article: Haider, M. N., Herget, L., Zafonte, R. D., Lamm, A. G., Wong, B. M., & Leddy, J. J. (2021). Rehabilitation of sport-related concussion. *Clinics in sports medicine*, *40*(1), 93-109.
- Article: Shen, X., Gao, B., Wang, Z., Yang, Y., Chen, Z., Yu, L., & Wang, Z. (2021). Therapeutic effect of aerobic exercise for adolescents after mild traumatic brain injury and sport-related concussion: a meta-analysis from randomized controlled trials. *World Neurosurgery*, *146*, e22-e29.



#### Research

- Article: Leddy, J. J., Baker, J. G., & Willer, B. (2016). Active rehabilitation of concussion and post-concussion syndrome. *Physical Medicine and Rehabilitation Clinics*, *27(2)*, 437-454.
- Article: Leddy, J., Hinds, A., Sirica, D., & Willer, B. (2016). The role of controlled exercise in concussion management. *PM&R*, *8*(3), S91-S100.
- Article: Leddy, J. J., Haider, M. N., Ellis, M., & Willer, B. S. (2018). *Exercise is medicine for concussion. Current sports medicine reports, 17(8),* 262.
- Article: Haider, M. N., Johnson, S. L., Mannix, R., Macfarlane, A. J., Constantino, D., Johnson, B. D., ... & Leddy, J. (2019). The buffalo concussion bike test for concussion assessment in adolescents. *Sports health*, *11*(6), 492-497.



#### Research

- Article: Seehusen, C. N., Wilson, J. C., Walker, G. A., Reinking, S. E., & Howell, D. R. (2021). More physical activity after concussion is associated with faster return to play among adolescents. *International journal of environmental research and public health*, 18(14), 7373.
- Article: Neely, L. M., Smulligan, K. L., Wingerson, M. J., Seehusen, C. N., Simon, S. L., Wilson, J. C., & Howell, D. R. (2022). The association between sleep and physical activity with persisting post-concussion symptoms among adolescent athletes. PM&R.
- Article: Lempke, L. B., Teel, E. F., Lynall, R. C., Hoffman, N. L., Buckley, T. A., Eckner, J. T., ... & Schmidt, J. D. (2023). Early exercise is associated with faster concussion recovery among collegiate athletes: findings from the ncaa-dod care consortium. *Sports medicine*, 1-13.



Vestibular/Ocular Motor Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
BASELINE SYMPTOMS:	N/A					
Smooth Pursuits						
Saccades – Horizontal						
Saccades – Vertical						
Convergence (Near Point)						(Near Point in cm): Measure 1: Measure 2: Measure 3:
VOR – Horizontal						
VOR – Vertical						
Visual Motion Sensitivity Test						

#### Measurement/DX • Article: Mucha, A., Collins, M., Elbin, R.J., Furman, J., Troutman-Enseki, C., DeWolf, R., Marchetti, G., & Kontos, A. (2014). A brief vestibular/ocular motor screening assessment to evaluate concussions. The American Journal of Sports Medicine. 42 (10), 2479-2586 • Article: Kontos, A., Surfrinko, A., Elbin, R.J., Puskar, A., & Collins, M. (2016). Reliability and associated risk factors for performance on the vestibular/ocular motor screening (VOMS) tool in healthy collegiate athletes. The American Journal of Sports Medicine. 44 (6), 1400-1406 • Article: Moran, R., Covassin, T., Elbin, R.J., Gould, D., & Nogle, S. (2018). Reliability and normative reference values for the vestibular/ocular motor screening (VOMS) in youth athletes. The American Journal of Sports Medicine. 46 (6), 1475-1980

Reliable
In it's totality, really good at detecting concussion
Very low false positive rate- few youth or college students at baseline will have a positive VOMS



Sensory Integration and Proprioception



Research
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- Article: Cheever K, McDevitt J, Phillips J, Kawata K. The Role of Cervical Symptoms in Post-concussion Management: A Systematic Review. *Sports Med*. 2021;51(9):1875-1891. doi:10.1007/s40279-021-01469-y
- Article: Smulligan KL, Wingerson MJ, Seehusen CN, et al. Dizziness Is Associated With Neck/Shoulder Pain Following Pediatric Concussion. *Clin J Sport Med*. 2022;32(6):e562-e567. doi:10.1097/JSM.000000000001054
- Article: Provance AJ, Howell DR, Potter MN, Wilson PE, D'Lauro AM, Wilson JC. Presence of Neck or Shoulder Pain Following Sport-Related Concussion Negatively Influences Recovery. *J Child Neurol.* 2020;35(7):456-462. doi:10.1177/0883073820909046
- Article: Schneider KJ, Meeuwisse WH, Nettel-Aguirre A, et al. Cervicovestibular rehabilitation in sport-related concussion: a randomised controlled trial. *British Journal of Sports Medicine* 2014;48:1294-1298.



















# Call to Action Let's be honest that what we are currently doing is not working Take ownership in how we may unintendingly perpetuating what is not working We owe it to our patients to find ways to challenge the current system and get people in and quickly as possible Let's come back again in a year, and annually, to examine the data and see what we need to do to improve care based on said data







