The background image shows the exterior of Hancock Stadium at Illinois State University. The building is a large, multi-story structure with a mix of brick and light-colored panels. A large red cardinal logo is visible on the left side of the building. The words "ILLINOIS STATE UNIVERSITY" are written in red across the top of the building. A large red sign in the foreground features the cardinal logo and the text "THIS IS REDBIRD FOOTBALL". Several cars are parked in front of the stadium, and a road is visible in the foreground.

Managing acute concussions: Role of sleep and physical activity on symptom burden in young adults

November 8, 2020
Nikki Hoffman, PhD, ATC

Conflict of Interest Disclosure

In compliance with continuing education requirements, all presenters must disclose any financial or other associations with companies to which they have a direct link and/or financial relationship that is related to the topic/content of their presentation.

- ***Nothing relevant to disclose***



Learning Objectives

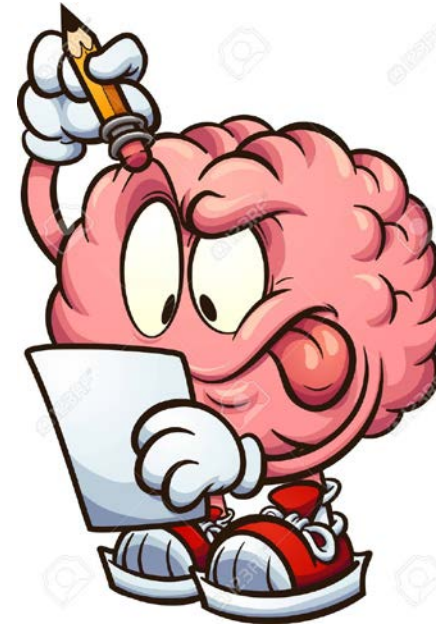
At the end of this presentation, participants will be able to:

- **Recognize the importance of sleep and physical activity in healthy individuals.**
- **Analyze the prevalence of sleep/wake disturbances following concussion and examine early benefits of physical activity on symptom burden in the literature.**
- **Interpret how findings are being utilized in concussion management.**



Clinical Question

In young adults with a concussion, do sleep and mild aerobic exercise decrease symptoms more than strict rest during the acute stages of recovery?



SLEEP: **Why Do We Care?**

THE SECRETS OF SLEEP

Why do we need it, and are we getting enough?

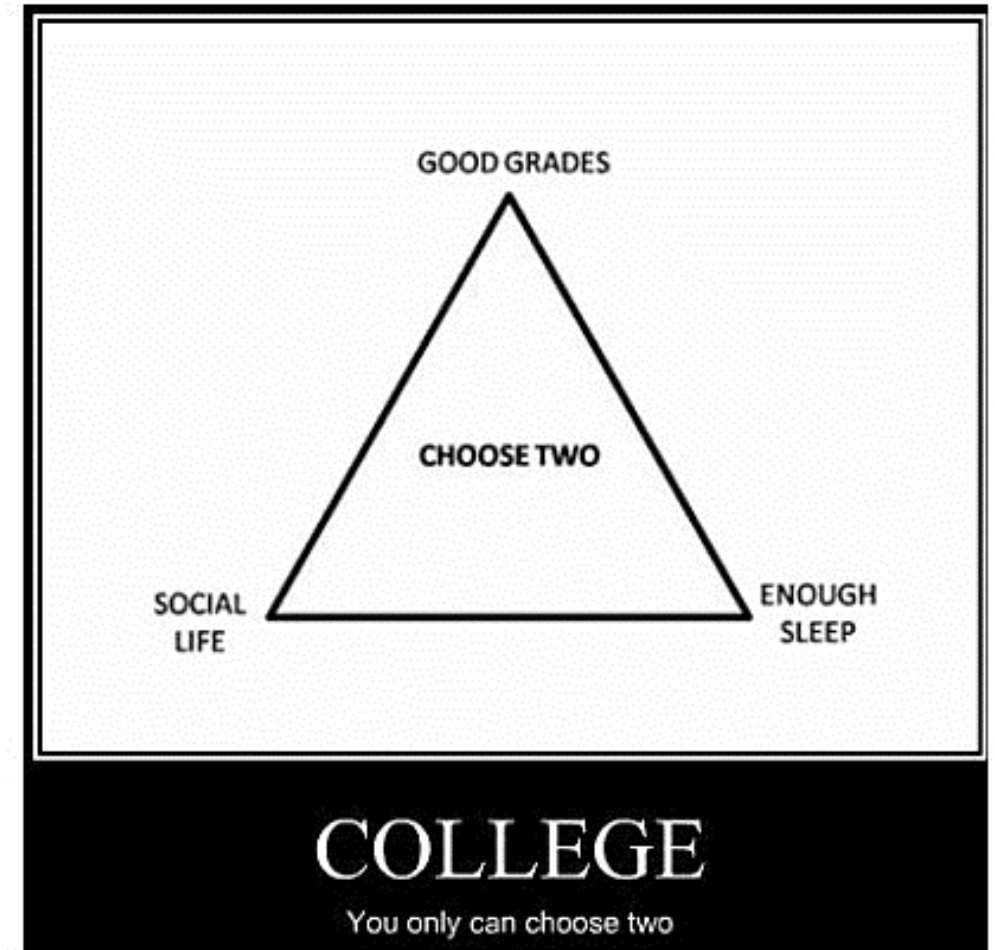
The science of how much sleep you actually need

NCAA convenes sleep and wellness summit

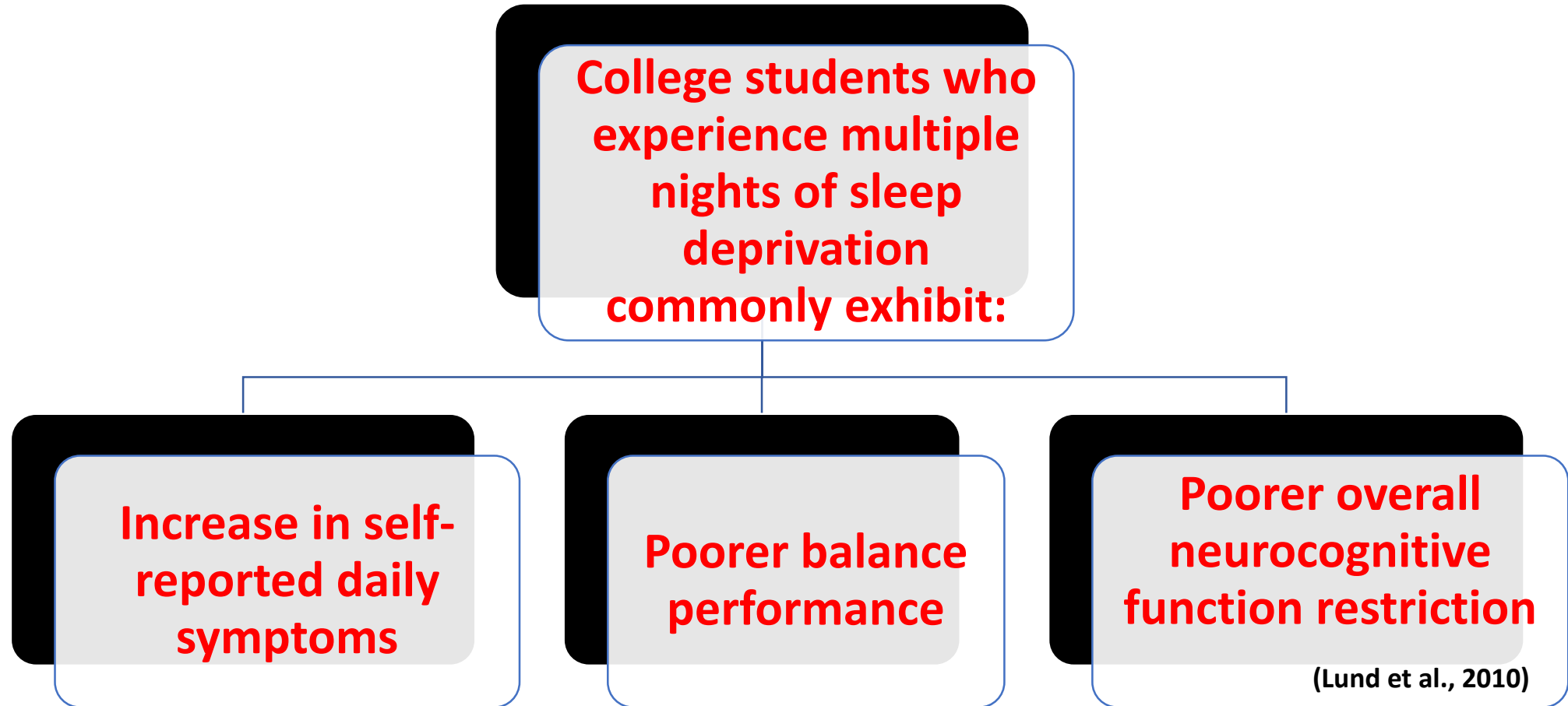
Sport Science Institute gathers task force to recommend methods for improving sleep

Sleep and College Students

- Erratic sleep patterns, poor sleep hygiene, and poor sleep quality = inadequate sleep and daytime sleepiness
- Sleep deprivation is associated with poor decision making and impaired cognitive function
- Prolonged disturbances → increased risk of depression, diabetes, obesity, and cardiovascular disorders



Sleep and College Students Cont.



Benefits of Physical Activity

- **Higher quality diet, better sleep habits, healthier weight status**
(Dinger et al., 2014)
- **Acute and regular exercise has small to moderate effects on sleep**
(Kredlow et al., 2015)
- **10-50% of college students meet moderate-intensity aerobic guidelines → one study at a large university showing ~96%**
(Frederick et al., 2020)



Symptom Burden Following Concussion

Headaches

Dizziness

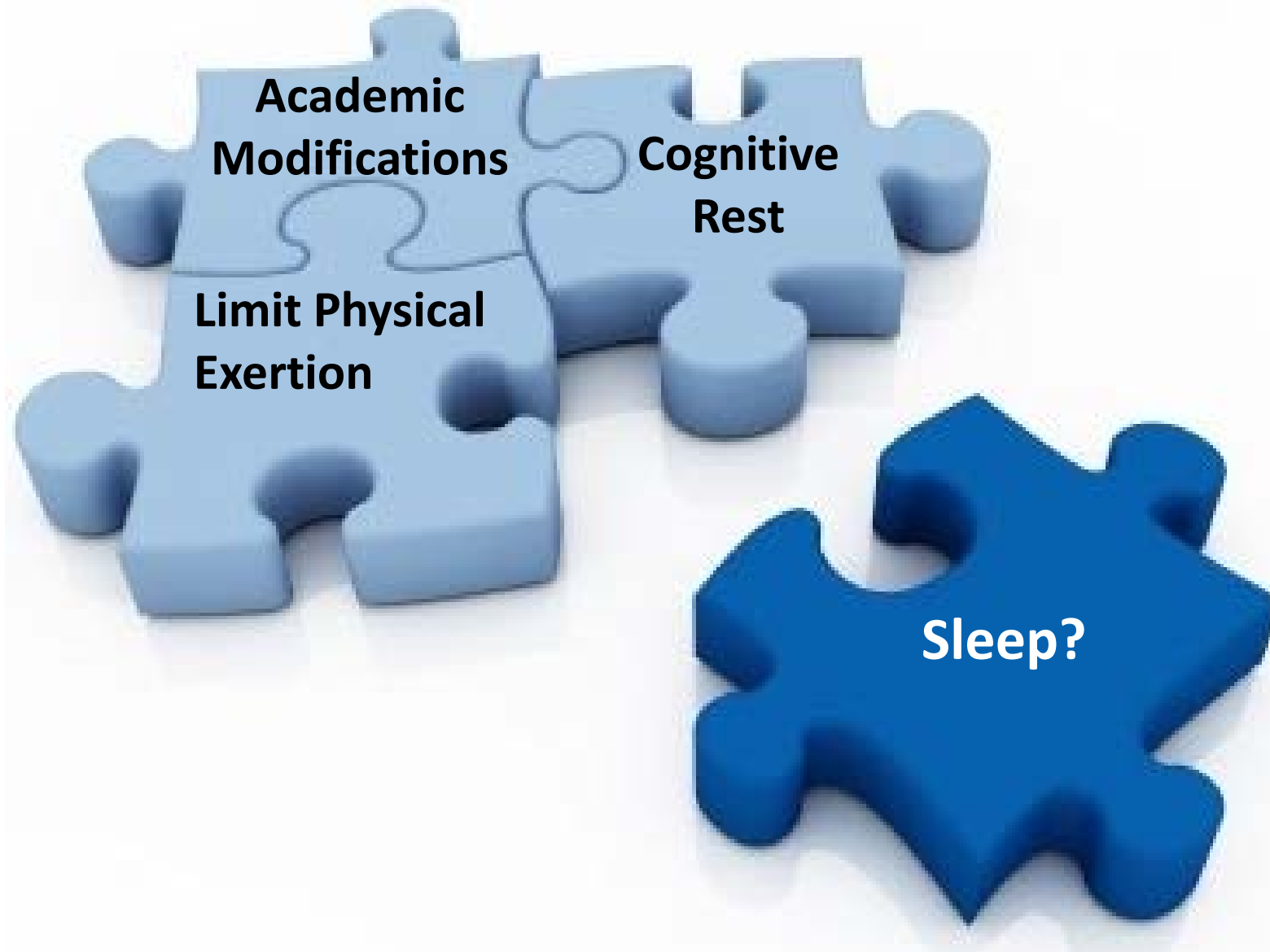
Nausea

Difficulties
Concentrating

- **Predictor of concussion recovery = number and severity of acute and subacute symptoms**
(Iverson et al., 2017; Harmon et al., 2019)
- **Greater symptom severity post-injury → increased odds of prolonged symptoms**
(Meehan et al., 2016)
 - By attenuating these symptoms → we may decrease symptom burden



Concussion Management – What are We Doing Now?





Sleep, Sleep Disorders, and Mild Traumatic Brain Injury. What We Know and What We Need to Know: Findings from a National Working Group

Emerson M. Wickwire^{1,2} • Scott G. Williams^{3,4} • Thomas Roth⁵ • Vincent F. Capaldi⁶ • Michael Jaffe^{7,8,9} • Margaret Moline¹⁰ • Gholam K. Motamedi¹¹ • Gregory W. Morgan¹² • Vincent Mysliwiec^{4,13} • Anne Germain¹⁴ • Renee M. Pazdan¹⁵ • Reuven Ferziger¹⁶ • Thomas J. Balkin⁶ • Margaret E. MacDonald¹⁷ • Thomas A. Macek¹⁸ • Michael R. Yochelson^{19,20} • Steven M. Scharf² • Christopher J. Lettieri⁴

Sleep Disturbances in Concussed Athletes: A Review of the Literature

REGINA KOSTYUN, MSED, ATC

**BRAIN
INJURY**

<http://informahealthcare.com/bij>
ISSN: 0269-9052 (print), 1362-301X (electronic)

Brain Inj, 2015; 29(2): 221–227
© 2015 Informa UK Ltd. DOI: 10.3109/02699052.2014.983978

REVIEW

Sleep disturbances in athletic concussion

Michael S. Jaffee¹, W. Christopher Winter², Christine C. Jones², & Geoffrey Ling³

Sleep: Overall of What We Know

Changes in sleep quality and quantity are common
during recovery

Sleep Disturbances in the Literature

- **Up to 70% of concussed young adults report:**
 - Short and long-term sleep problems
 - Fatigue
 - Daytime sleepiness
 - Vigilance disturbances (e.g. insomnia)
- **Greater acute sleep variation in total sleep time and sleep fragmentation post-injury**
(Raikes et al. 2016; Hoffman et al., 2019)
 - **Sleep variation may be associated with prolonged symptom duration**



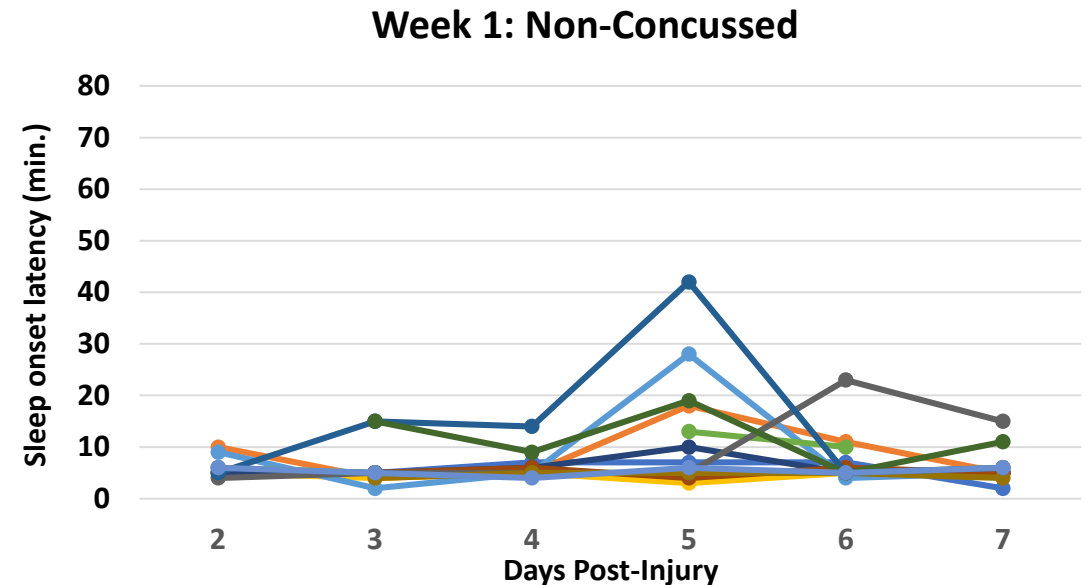
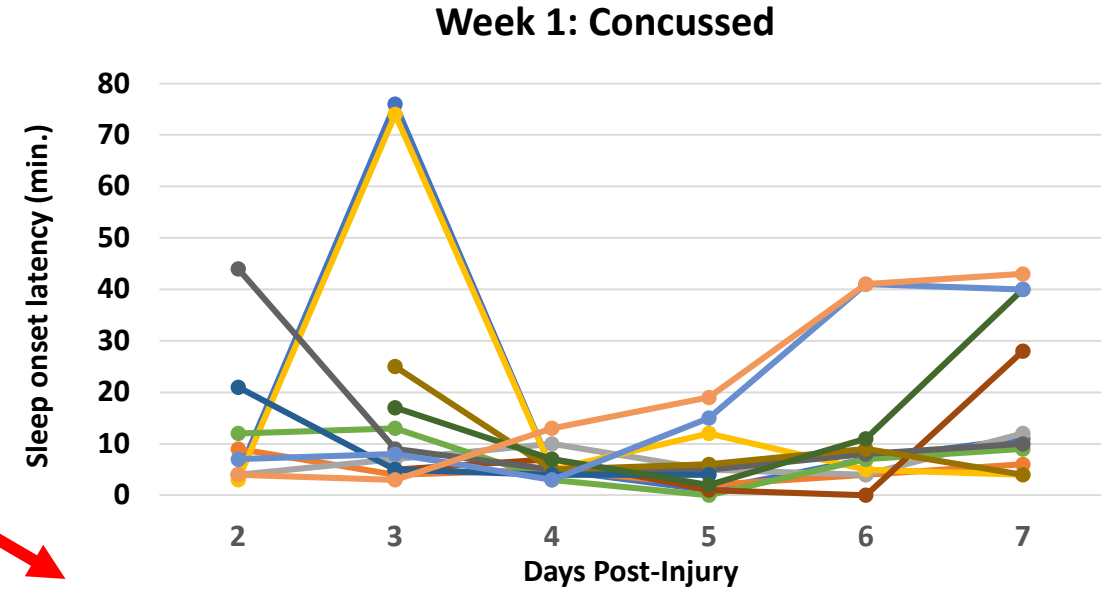
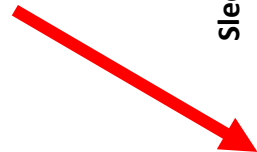
Sleep Disturbances in the Literature

Sleep After Concussion

- Concussed individuals took longer to fall asleep and greater night-to-night variation 2-3 days post-concussion (Hoffman et al., 2019)

Sleep Before Concussion

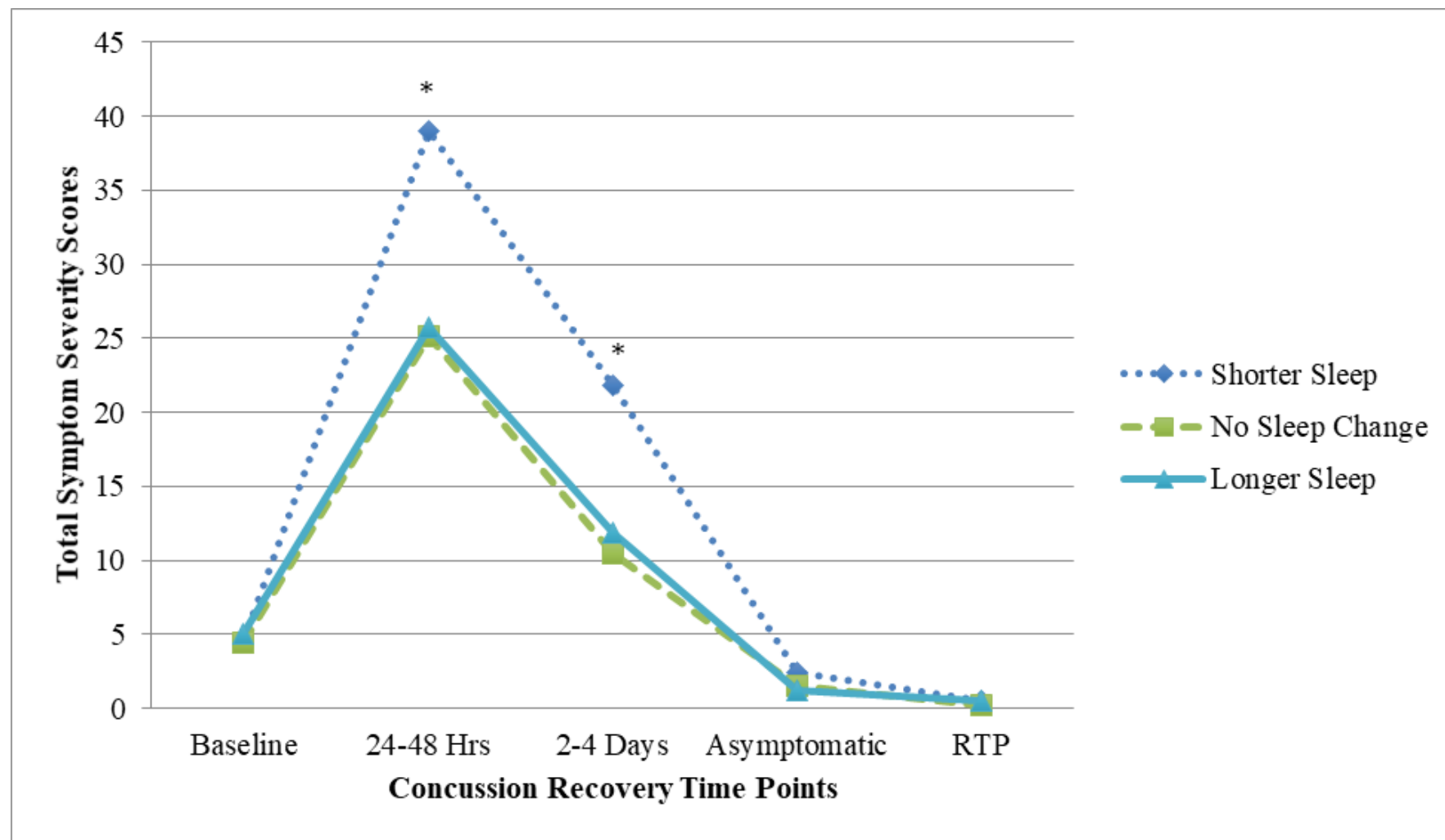
- Poor sleep quality prior to concussion → greater symptom burden at 2 days, 5 to 7 days, and 10-14 days post-injury compared to healthy controls (Sufrinko et al., 2015)



Influence of Postconcussion Sleep Duration on Concussion Recovery in Collegiate Athletes

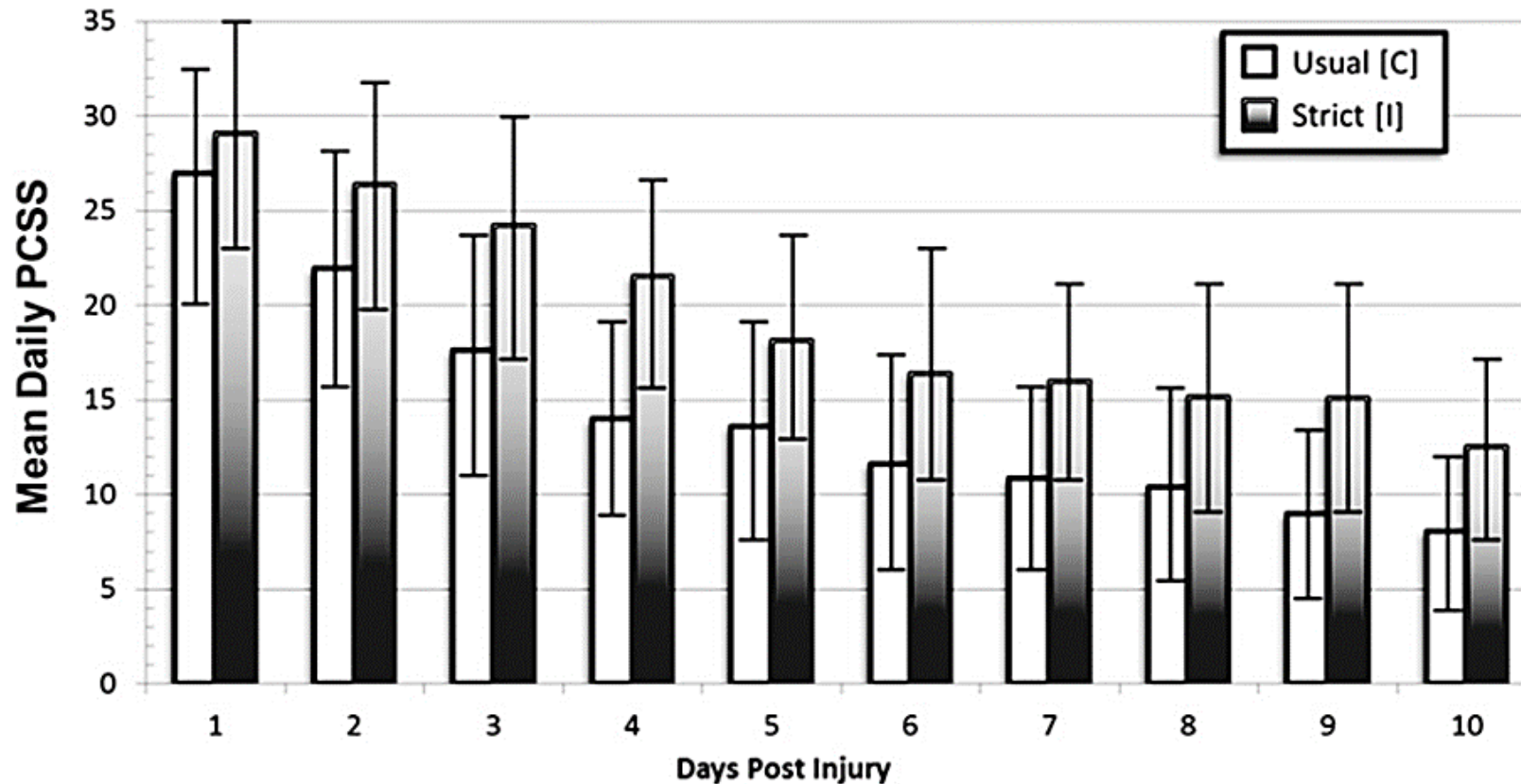
Nicole L. Hoffman, MS, ATC,*† Michelle L. Weber, MS, ATC,*† Steven P. Broglio, PhD, ATC,‡
Michael McCrea, PhD, ABPP,§ Thomas W. McAllister, MD,¶ Julianne D. Schmidt, PhD, ATC,*† and CARE
Consortium Investigators

Total Symptom Severity Scores and Recovery



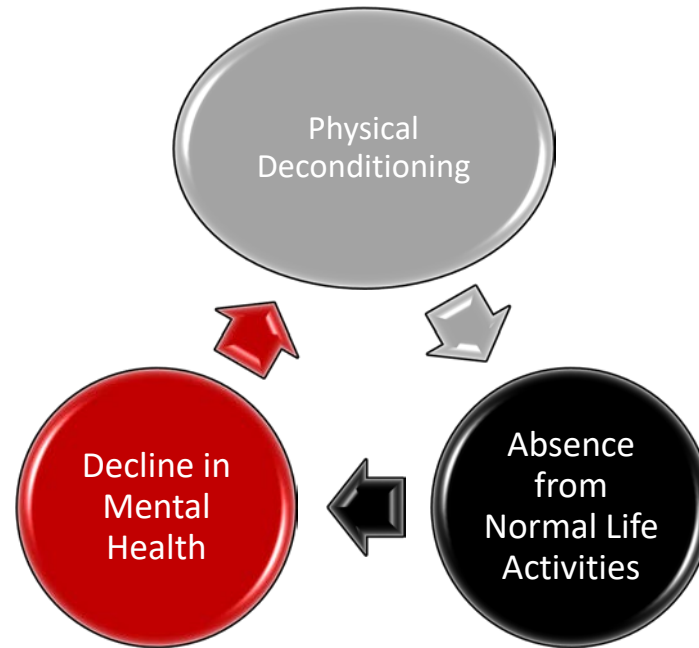
Strict Rest vs. Usual Care

- A RCT showed a decrease in symptoms with 1-2 days of rest followed by a gradual return to activity compared with strict rest of 5 days (Thomas et al., 2015)



Physical Activity in the Literature

- Recent studies are challenging the utility of prolonged rest as treatment for concussion → may result in:

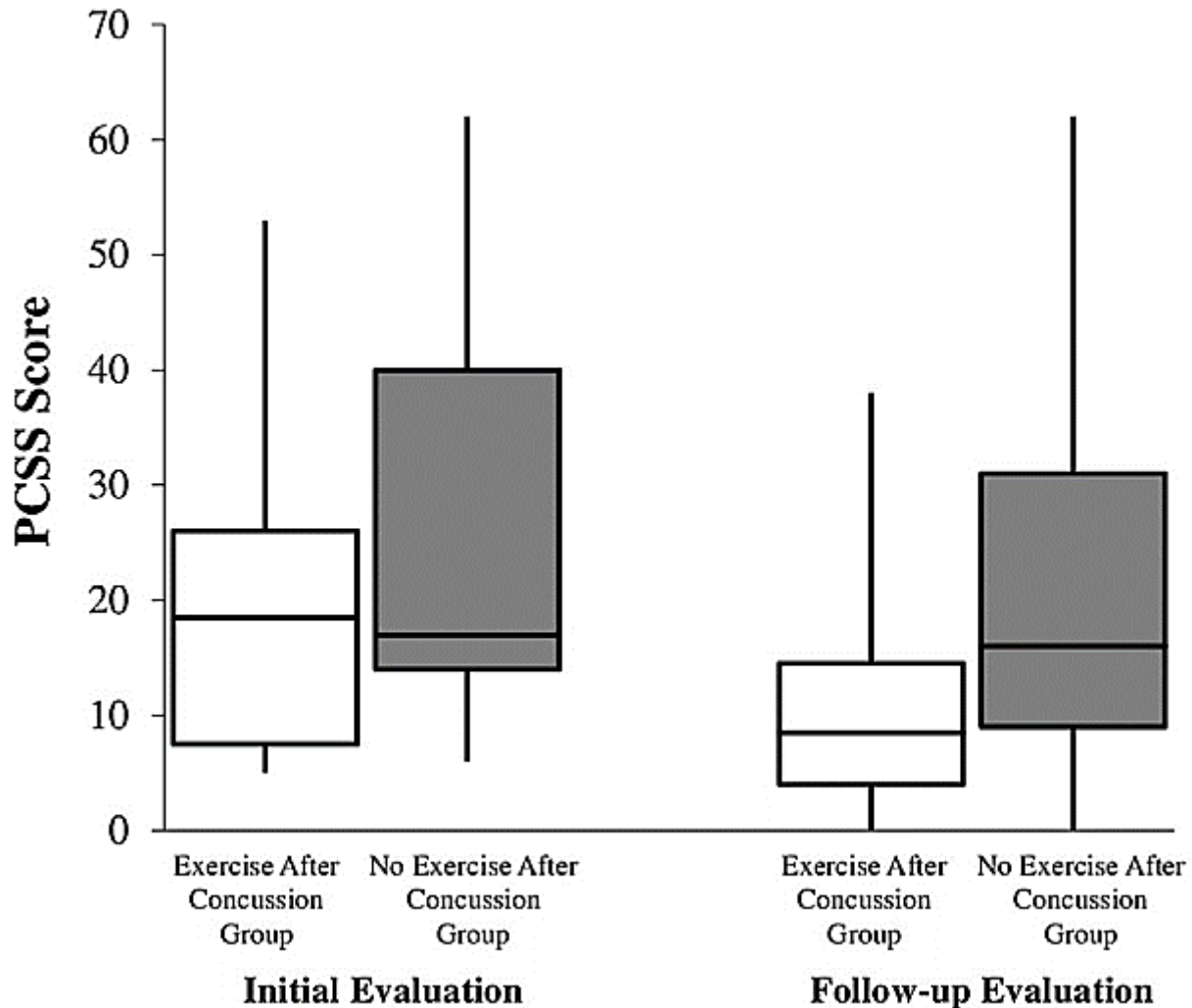


...growing evidence on early activity engagement post-injury

(Leddy et al., 2018; Harmon et al., 2019)



Early Benefits of Physical Activity in the Literature



- Aerobic exercise within the first week post-injury does not appear to be associated with detrimental clinical outcomes
 - Lower symptom severity within 2-7 days post-injury than no exercise group

(Howell et al., 2020)

Question to keep in mind though → would individuals with a higher symptom burden be able to exercise without provoking symptoms?





Concussion Management

What can we consider moving forward?

Concussion Management: Continue with Strict Rest?

- **No clear guidelines for how much rest is beneficial**
- **“Cocoon therapy” is not the way to go!**
- **Sleep may decrease symptom burden acutely post-injury**
- **Early active interventions may prevent prolonged recovery**

Ok...so what should we do?



Concussion Management: Now What?

- **Future research needed to determine optimal interventions for sleep disturbances post-injury:**
 - Sleep hygiene → tips on keeping healthy sleep patterns
 - Capture sleep objectively and subjectively
- **Future research needed to address optimal timing and intensity of aerobic physical activity**
 - Preliminary evidence that some amount of activity is beneficial to contribute to decreased symptom burden
 - Activities of daily living
 - Non-contact aerobic exercise
 - *Must be physician directed



Concussion Management: Sleep Hygiene

8

Have the right sunlight exposure.

Daylight is key to regulating daily sleep patterns. Try to get outside in natural sunlight for at least 30 minutes each day.

9



Don't lie in bed awake.

If you find yourself still awake after lying in bed for 20 minutes, get up and do some relaxing activity until you feel sleepy. The anxiety of not being able to sleep can make it harder to fall asleep.

How do you practice good sleep hygiene?

<https://www.sleepfoundation.org/articles/sleep-hygiene>



Perceived Exertion Rating	Description of Exertion
6	No exertion. Sitting & resting
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	
20	

Concussion Management: Validated Protocols

**Sample sub-symptom threshold
graded exercise protocols for
persistent symptoms:**

- Buffalo Concussion Treadmill test
- Balke Protocol Treadmill test
- Borg RPE (measures physical exertion)



Clinical Bottom Line

- Current consensus guidelines recommend that an initial period of rest is beneficial.

However...

- Growing evidence suggests sleep and symptom-limited physical activity may decrease symptom burden in young adults acutely following concussion.

References

- Dinger MK , Brittain DR , Hutchinson SR. Associations between physical activity and health-related factors in a national sample of college students. *J Am Coll Health* . 2014;62(1):67–74.
- Frederick GM, Williams ER, Castillo-Hernández IM, and Evans EM. (2020). Physical activity and perceived benefits, but not barriers, to exercise differ by sex and school year among college students, *Journal of American College Health*, DOI: 10.1080/07448481.2020.1800711
- Gipson CS, Chilton JM, Dickerson SS, Alfred D, Haas BK. Effects of a sleep hygiene text message intervention on sleep in college students. *Journal of American College Health*. 2019;67(1):32-41. doi:10.1080/07448481.2018.1462816
- Harmon, K., Clugston, J., Dec, K., Hainline, B., Herring, S., Kane, S., Kontos, A., Leddy, J., McCrea, M., Poddar, S., Putukian, M., Wilson, J., & Roberts, W. (2019). American Medical Society for Sports Medicine Position Statement on Concussion in Sport. *Clinical Journal of Sport Medicine*, 29(2), 87–100. <https://doi.org/10.1097/jsm.0000000000000720>
- Hoffman, N.L., O'Connor, P.J., Schmidt, M.D., Lynall, R.C., and Schmidt, J.D. (2019). Differences in sleep between concussed and nonconcussed college students: A matched case-control study. *Sleep* 42, zsy222.
- Hoffman, N., Weber, M., Broglio, S., McCrea, M., McAllister, T., & Schmidt, J. (2020). Influence of Postconcussion Sleep Duration on Concussion Recovery in Collegiate Athletes. *Clinical Journal of Sport Medicine*, 30 Suppl 1, S29–.
- Howell DR, Brilliant AN, Oldham JR, Berkstresser B, Wang F, Meehan WP 3rd. Exercise in the first week following concussion among collegiate athletes: Preliminary findings. *J Sci Med Sport*. 2020 Feb;23(2):112-117. doi: 10.1016/j.jsams.2019.08.294. Epub 2019 Sep 7.
- Iverson GL, Gardner AJ, Terry DP, et al. Predictors of clinical recovery from concussion: a systematic review. *Br J Sports Med* 2017;51:941–8.
- Kredlow, M.A., Capozzoli, M.C., Hearon, B.A., Calkins, A.W., and Otto, M.W. (2015). The effects of physical activity on sleep: A meta-analytic review. *J. Behav. Med.* 38, 427-449.
- Leddy, J. J., Wilber, C. G., & Willer, B. S. (2018). Active recovery from concussion. *Current opinion in neurology*, 31(6), 681–686. <https://doi.org/10.1097/WCO.0000000000000611>
- Lund H, Reider B, Whiting A, Prichard J. Sleep patterns and predictors of disturbed sleep in a large population of college students. *J Adolesc Health*.2010;46(2):124–132.doi:10.1016/j.jadohealth.2009.06.016. PMID:20113918.
- Meehan, W., O'Brien, M., Geminiani, E., & Mannix, R. (2016). Initial symptom burden predicts duration of symptoms after concussion. *Journal of Science and Medicine in Sport*, 19(9), 722–725. <https://doi.org/10.1016/j.jsams.2015.12.002>
- Raikes AC, Schaefer SY. Sleep quantity and quality during acute concussion: A pilot study. *Sleep*. 2016;39(12):2141-2147.
- Sufrinko, A., Pearce, K., Elbin, R., Covassin, T., Johnson, E., Collins, M., & Kontos, A. (2015). The Effect of Preinjury Sleep Difficulties on Neurocognitive Impairment and Symptoms After Sport-Related Concussion. *The American Journal of Sports Medicine*, 43(4), 830–838. <https://doi.org/10.1177/0363546514566193>
- Thomas DG, Apps JN, Hoffmann RG, McCrea M, Hammeke T. Benefits of strict rest after acute concussion: a randomized controlled trial. *Pediatrics*. 2015;135(2):213-223



Thank You!



Nikki Hoffman, PhD, ATC
Assistant Professor in Athletic
Training
Illinois State University
Email: nlhoff1@ilstu.edu