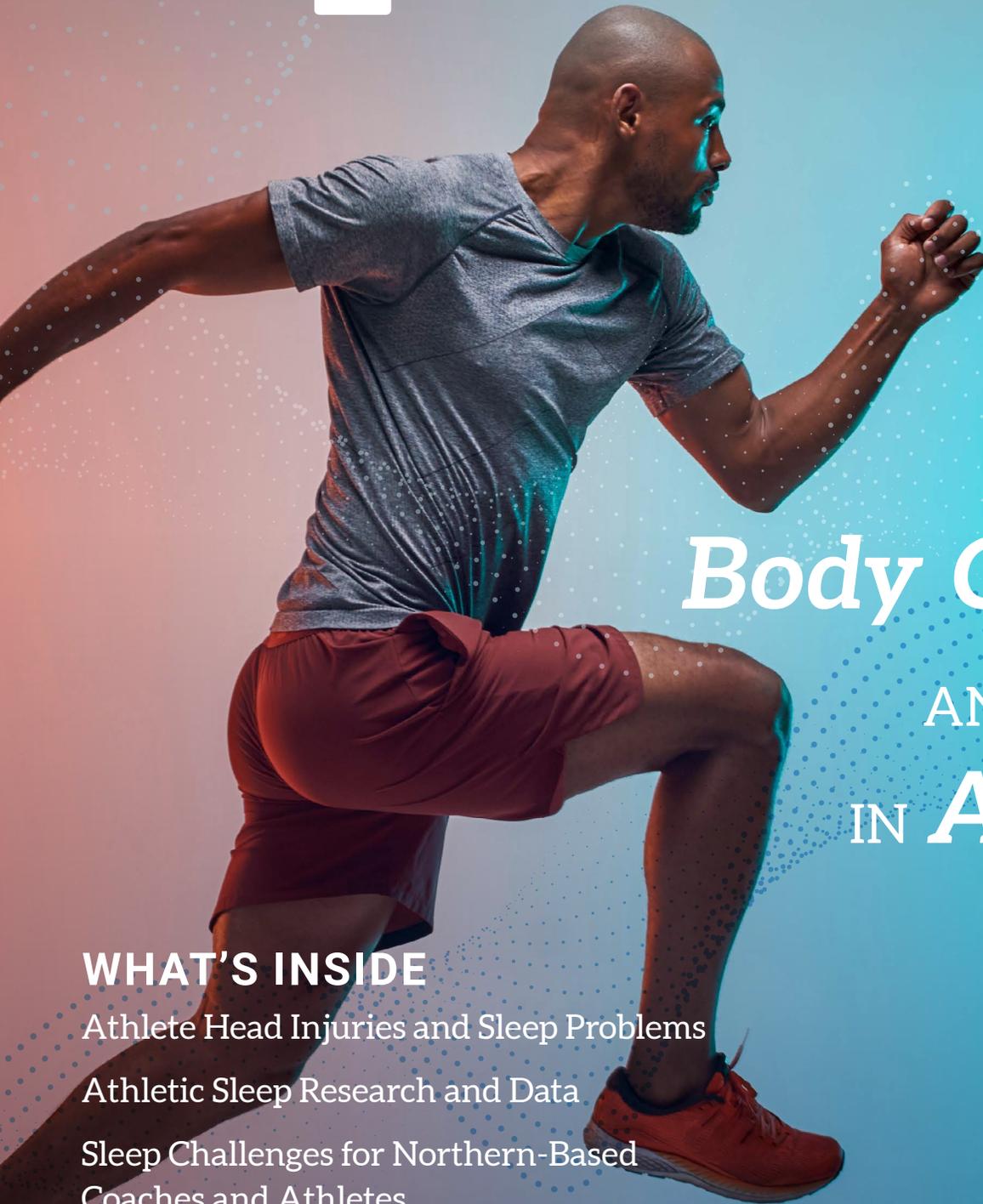




QUARTER ONE 2022 / VOLUME 31 / NUMBER 01



# Body Cooling AND *Sleep* IN *Athletes*

## WHAT'S INSIDE

Athlete Head Injuries and Sleep Problems

Athletic Sleep Research and Data

Sleep Challenges for Northern-Based  
Coaches and Athletes

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By Regina Patrick, RPSGT, RST

*Body-cooling measures can positively impact an athlete's sleep, leading to improved performance and less injuries. While the use of cryotherapy in sports medicine is increasing, more research is needed to determine its safety, beneficial effects and how to effectively use the therapy itself.*

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From the Editor

# Another New Beginning

By Rita Brooks, MEd, RPSGT, REEG/EPT, FAAST

With spring here and the most recent omicron variant surge begins to wane, the Centers for Disease Control and Prevention (CDC) continues to recommend vaccinations and boosters for COVID-19. I am hopeful that this will be the last significant surge and we can begin to get back to a new normal that includes in-person AAST educational offerings. In the meantime, take advantage of the AAST online educational modules that have been developed over the last few years, including the new ["Fundamentals of EKG"](#) training module course.

In this issue of *A<sub>z</sub>zz*, we look in depth at sleep and athletics, which is another new focus in sleep medicine and technology, and another new career pathway for sleep technologists with an interest in new ways of utilizing their skills. The articles in this issue provide information on a variety of topics relevant to sleep in athletes ranging from the effects of short winter days on circadian rhythms and the effects of concussions in athletes to the use of body cooling to improve sleep. Ian Dunican, PhD, provides a review of current research on

## *Renew your membership and take advantage of the free continuing education credits!*

sleep in athletes, discusses the differences in utilizing group versus individual data in these studies and provides recent findings on sleep, recovery and performance in athletes. Amy Bender, PhD, discusses the advent of sports coaches at all levels in athletics, and provides strategies for sleep technologists with sleep expertise and an interest in sports to become involved.

Laura Linley's Compliance Corner discusses a new Centers for Medicare and Medicaid Services (CMS) initiative that focuses on price transparency and the delivery of better value and results for patients through competition and innovation. The new rules require pricing information to be accessible to patients

prior to the delivery of services, including sleep medicine services. Assuring patients understand their financial responsibility and revising your sleep center protocols to allow time to obtain and provide this information to patients prior to scheduling their sleep studies is a focus of this important article.

If you have not already done so, renew your membership and take advantage of the free continuing education credits that accompany it, as well as the member discounts on our many excellent educational offerings.

Sleep well!

Rita





## President's Message

# Springing Into Advancements

By Laree J. Fordyce, RPSGT, RST, CCRP, CCSH, FAAST

With 2022 well underway and spring now here, I am eager for what's to come in the next few months for AAST, its members, and the sleep community and profession.

As many of you know, AAST has been working since the beginning of 2021 to understand current and anticipated market conditions in the field of sleep technology to better prepare those in the profession to address and/or adjust to trends. In March of 2021, we reached out to our members to not only participate in a workforce survey, but to share their current job roles, practices and where they believed the future of the sleep field is heading. In September of 2021, AAST leadership, in conjunction with AAST staff, released an executive summary report on the survey's findings.

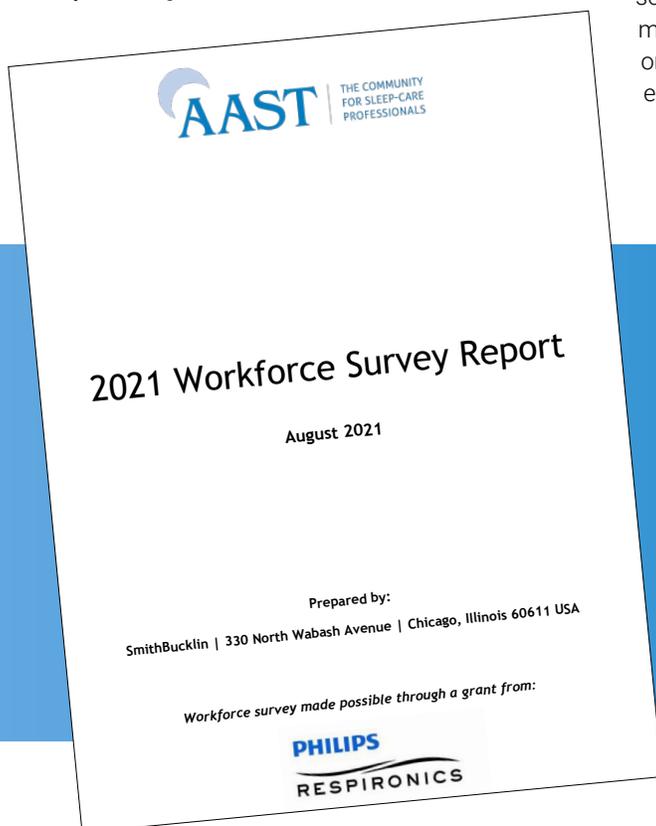
With the report now finalized, the AAST Board of Directors and staff will be meeting with industry leaders in early April for a collaborative summit. The goal of this meeting is to review the key findings of the workforce survey and work together to identify areas of the industry in which we can help advance knowledge and understanding, as well as define areas for growth and ways to combat change in a forward-thinking manner. I'll be sharing key takeaways from the summit in future president's messages, but in the meantime, if you have not done so already, be sure to view the workforce report [here](#).

Pivoting to AAST education, I'm excited to share that we will be launching two new opportunities this year focused on advancing knowledge around virtual patient monitoring and adult scoring rules. As a reminder, members receive discounts on AAST education products; I encourage those who are not

members yet to [join](#) to take full advantage of our educational offerings, including the newly released [Fundamentals of EKG module series](#) and [Enhanced CCSH Designated Education Program Modules](#).

Lastly, I'd like to take this time to remind members of AAST's [continuing education program](#). The AAST CEC Program is your all-in-one sleep technology education center and includes resources on RST and RPSGT recertification, the AAST Learning Center, online transcript access, a CEC calendar and education information. If you have any questions regarding CEC logistics or AAST-specific CEC opportunities, I encourage you to reach out to AAST staff via email at [info@aaastweb.org](mailto:info@aaastweb.org) or by phone at (312) 321-5191.

2022 is off to a great start and I look forward to sharing more updates on how AAST is helping to advance the sleep industry with you all soon.



*The goal of this meeting is to review the key findings of the workforce survey and work together to identify areas of the industry in which we can help advance knowledge and understanding.*

# Instructions for Earning Credit

AAST members who read *A<sub>2</sub>Zzz* and claim their credits online by the deadline can earn 2.00 AAST Continuing Education Credits (CECs) per issue, for up to 8.00 AAST CECs per year. AAST CECs are accepted by the Board of Registered Polysomnographic Technologists (BRPT) and the American Board of Sleep Medicine (ABSM).

To earn AAST CECs, carefully read the four designated CEC articles listed below and claim your credits online. You must go online to claim your credits by the deadline of **June 30, 2022**. After the successful completion of this educational activity, your certificates will be available in the My CEC Portal acknowledging the credits earned.

## COST

The *A<sub>2</sub>Zzz* continuing education credit offering is an exclusive learning opportunity for AAST members only and is a free benefit of membership.

## STATEMENT OF APPROVAL

This activity has been planned and implemented by the AAST Board of Directors to meet the educational needs of sleep technologists. AAST CECs are accepted by the Board of Registered Polysomnographic Technologists (BRPT) and the American Board of Sleep Medicine (ABSM). Individuals should only claim credit for the articles that they actually read and evaluate for this educational activity.

## STATEMENT OF EDUCATIONAL PURPOSE & OVERALL EDUCATIONAL OBJECTIVES

*A<sub>2</sub>Zzz* provides current sleep-related information that is relevant to sleep technologists. The magazine also informs readers about recent and upcoming activities of AAST. CEC articles should benefit readers in their practice of sleep technology or in their management and administration of a sleep disorders center.

## READERS OF *A<sub>2</sub>ZZZ* SHOULD BE ABLE TO DO THE FOLLOWING:

- Analyze articles for information that improves their understanding of sleep, sleep disorders, sleep studies and treatment options
- Interpret this information to determine how it relates to the practice of sleep technology
- Decide how this information can improve the techniques and procedures that are used to evaluate sleep disorders patients and treatments
- Apply this knowledge in the practice of sleep technology

You must go online to claim your CECs by the deadline of **June 30, 2022**.

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## READ AND EVALUATE THE FOLLOWING FOUR ARTICLES TO EARN 2.0 AAST CECS:

### Body Cooling and Sleep in Athletes

*Objective:* Readers will be able to differentiate between the two common body-cooling options practiced among athletes, and review recent research about the topic.

### Go to Bed, Sleepy Head: The Relationship Between Head Injuries and Sleep Problems

*Objective:* Readers will review the bi-directional relationship between head injuries and sleep problems, and develop a working knowledge of the right questions to ask, and associated sleep disorders to look for.

### It's Mean to Just Look at the Average: Athletic Sleep Research and Data

*Objective:* Readers will develop an understanding of the differences between a team-focused and an individual approach to research studies related to sleep and recovery in athletes to improve athlete knowledge, skills and safety.

### 3 Sleep and Performance Challenges for Northern-Based Athletes and Coaches to Manage

*Objective:* Readers will develop an understanding of three challenges northern-based athletes may encounter during the winter months and how they can impact sleep.



**Body  
Cooling  
AND Sleep  
IN Athletes**

*By Regina Patrick, RPSGT, RST*

**W**hen athletes obtain optimal sleep, their mood, fatigue, mental and physical performance, recovery, and cognition improve while their risk of injury decreases.<sup>1-4</sup> However, incorporating sleep as part of an athlete's training regimen is often overlooked. Additionally, obtaining sufficient sleep can be difficult as athletes travel to tournaments — especially if it involves traveling across time zones. The change in time disrupts an athlete's circadian rhythm, which can contribute to sleepiness and fatigue, and negatively impact an athlete's performance. A recent study by the American Academy of Sleep Medicine (AASM) demonstrated that baseball players' performance decreased as the season progressed due to frequent travel (i.e., disruptions in the sleep-wake schedule).<sup>4</sup> Improving sleep could potentially improve performance and prevent injury in athletes, and in recent years, scientists have used partial body and whole-body cooling as a way to do this. Some results have been promising.

In sports medicine, the use of cool temperatures as a therapy, such as to relieve inflammation and reduce muscle soreness, has traditionally involved applying ice packs to the effected part of the body or submerging one's body in a cold-water bath. Greater pain relief could presumably be accomplished by using extremely cold temperatures. With this in mind, in the 1970s, rheumatologist Toshima Yamauchi in Japan was the first to use the technique of whole-body cryotherapy (from the Greek *kryos* meaning "cold" plus *therapy*) to relieve pain in people with arthritis.<sup>5,6</sup> He found that this technique resulted in more relief than ice baths, and the technique was soon adopted by athletes to relieve pain and soreness.

Cryotherapy involves exposing the body to extremely cold temperatures of -148°F to -220°F (-100°C to -140°C) for two to five minutes. During the extreme cooling, blood vessels on the surface of the skin contract, thereby reducing blood flow to inflamed areas. On leaving the cryotherapy chamber, vessels very quickly expand (which brings more oxygenated blood to injured tissues) and levels of anti-inflammatory substances increase, which may decrease pain and soreness.

In cryotherapy, cold temperature exposure takes place in a cryotherapy chamber. The

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## *After undergoing partial or whole-body cryotherapy, athletes report improved sleep and recovery.*

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chamber can be a vertical, cylindrical tank that surrounds the whole body, except for the head (i.e., an open cryotherapy chamber), for partial body cooling or a tank that a person can fully walk into (i.e., closed cryotherapy chamber) for whole-body cooling.

In an open cryotherapy chamber, liquid nitrogen (-220°F/130°C) is sprayed into the chamber via ports. The liquid nitrogen quickly vaporizes because the human body is substantially hotter. However, because the vapor is at subzero temperatures, the body is surrounded in a cold nitrogen fog. In a closed cryotherapy chamber, liquid nitrogen is not sprayed into the chamber. Oxygenated air within the chamber is instead cooled by other means to a temperature of -148°F to -220°F (-100°C to -140°C).

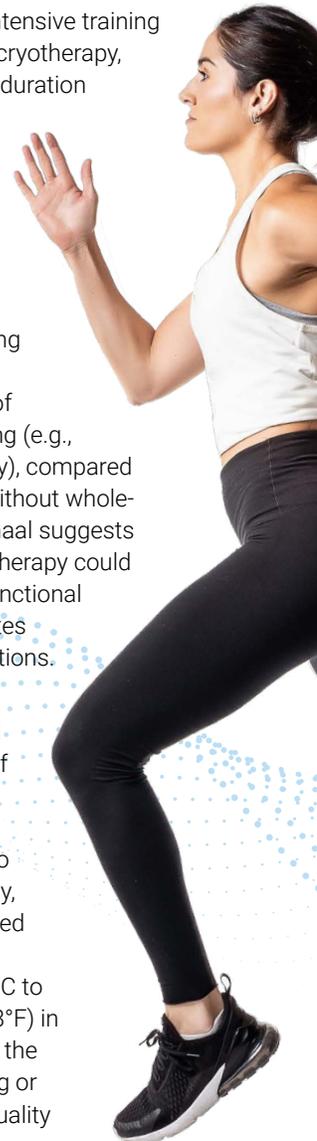
A closed cryotherapy chamber provides uniform cooling over the skin because a person's whole body is exposed to the cold air. In an open cryotherapy chamber, the lower extremities tend to be colder than the upper extremities because nitrogen vapor escapes around the head, which is exposed to ambient room temperature. While in a cryotherapy chamber, a person wears minimal clothing — socks, gloves and underwear — and in the closed chamber, a headband and mask — to protect the ears, nose and mouth from frostbite.

After undergoing partial or whole-body cryotherapy, athletes report improved sleep and recovery. For example, Schaal and colleagues<sup>7</sup> investigated whether daily whole-body cryotherapy during periods of intensive training could prevent exercise and sleep-related signs of overreaching (i.e., a short-term decrease in performance resulting from increased training stress). In their study, elite synchronized swimmers underwent intensive training periods, after which, some underwent daily whole-body cryotherapy while others did not. Swimmers wore a wrist actigraph nightly to monitor sleep the night after training with and without whole-body cryotherapy.

Schaal found that for intensive training sessions not followed by cryotherapy, swim speed decreased, sleep latency and fatigue increased from the baseline values, and sleep duration and sleep efficiency significantly decreased from baseline values. For intensive training sessions followed by cryotherapy, sleep latency, fatigue, duration and efficiency did not change significantly from the baseline values.

Based on these findings, whole-body cryotherapy during intensive training periods helped to decrease symptoms of functional overreaching (e.g., reduced sleep quantity), compared to intensive training without whole-body cryotherapy. Schaal suggests that whole-body cryotherapy could be used to alleviate functional overreaching by athletes preparing for competitions.

Bouzigon and colleagues<sup>8</sup> examined recovery and quality of sleep in professional male and female basketball players who underwent cryotherapy, which was administered for three minutes at temperatures of -110°C to -150°C (-166°F to -238°F) in the morning and/or in the evening after a training or match session. The quality



## Although whole-body cooling improves subjective recovery and muscle soreness, it does not improve functional recovery.

of sleep was assessed subjectively (using a version of the Spiegel Sleep Questionnaire). The athletes reported improved sleep quality for the nights that followed whole-body cryotherapy compared to the nights not preceded by whole-body cryotherapy. Even if the sleep duration was short after cryotherapy, the athletes reported having a deeper, quieter and less disturbed sleep. Bouzigon suggests that the improvement of the quality of sleep during competition and heavy training periods may enhance athletes' recovery, which potentially could result in less fatigue before the matches and decrease the risk of injury. Nighttime training sessions tend to worsen sleep in athletes (e.g., increased awakenings). With this in mind, Douzi and colleagues<sup>9</sup> examined the effect of whole-body cryotherapy exposure on sleep quality after evening training among healthy, physically active men. The evening training session involved 25 minutes of continuous running followed by intermittent running. Thirty minutes after the training session, the men underwent whole-body cryotherapy or passive recovery (i.e., the control condition; the participant rested in room temperature). Each night after the training session with or without cryotherapy, the number of movements were recorded with actigraphy. The next morning, the athlete's sleep quality and perceived pain were assessed subjectively (using the Spiegel Sleep Quality Perception Questionnaire and the visual analog scale, respectively). Douzi found that, after whole-body cryotherapy, the number of movements during the night were significantly lower, subjective sleep quality was significantly improved and pain was significantly reduced compared to the control condition. Based on heart rate variability, they also determined that the athletes had an increased amount of slow-wave sleep. Douzi concluded that three minutes of whole-body cryotherapy in the evening after evening training improves subjective and objective sleep quality in physically active subjects, which may result from greater pain relief.

Despite such encouraging findings, some scientists urge caution. Based on a review of the literature on the efficacy and effectiveness of whole-body cryotherapy, Bleakley and colleagues<sup>10</sup> found that, although whole-body cooling improves subjective recovery and muscle soreness, it does not improve functional recovery (i.e., recovery to a preinjury level). For example, strength, power and muscle soreness were not significantly different between athletes with exercise-induced muscle damage who did and did not undergo cryotherapy in the included studies.

No adverse events were reported among the studies included in the Bleakley review. However, cryotherapy can have adverse effects — in particular, frostbite (the skin surface freezes at 23°F to 25°F [-5°C to 3.8°C] and serious cellular damage can occur at around 14°F [-10°C]). In 2019, football player Antonio Brown experienced frostbite on the soles of his feet, causing him to miss virtually all of his training camp practices that year.<sup>11</sup> The frostbite was attributed to his wearing of improper footwear. Certain physical conditions may increase the risk of adverse events in people undergoing partial or whole-body cooling such as uncontrolled hypertension, coronary disease, arrhythmia, circulatory disorders, Raynaud's phenomenon (i.e., sudden vasoconstriction in response to cold that results in the loss of circulation to the fingers or other areas of the body), cold allergies (i.e., responses to cold such as hives or a burning sensation at a cold-exposed area), pulmonary disease and bronchial obstruction caused by the cold (e.g., cold-induced asthma). Another risk is nitrogen asphyxiation in an open cryotherapy chamber because nitrogen vapor

escapes around a person's head; therefore, the head must be sufficiently out of the chamber and exposed to environmental air to prevent this occurrence.

To date, cryotherapy chambers do not have U.S. Food and Drug Administration (FDA) approval because insufficient evidence exists regarding their safety and effectiveness.<sup>12</sup> The number of studies on the use of whole-body cryotherapy in sports medicine has increased in recent years but remains low among studies on cryotherapy.<sup>13</sup> More studies are needed to determine the safety, effectiveness and efficacy of cryotherapy in athletes, verify its beneficial effects and determine how to effectively use the therapy itself, especially for improving sleep. ☾



**REGINA PATRICK, RPSGT, RST**, has been in the sleep field for more than 20 years and works as a sleep technologist at the

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### References

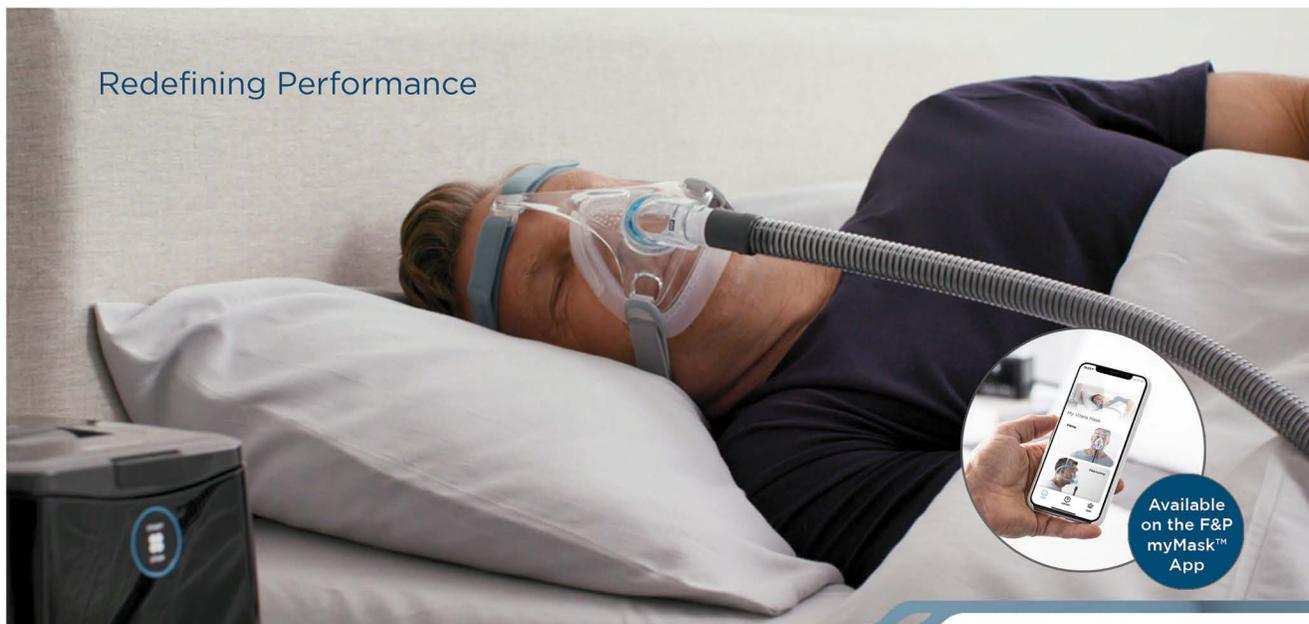
1. Charest J, Grandner MA. Sleep and athletic performance: Impacts on physical performance, mental performance, injury risk and recovery, and mental health. *Sleep Medicine Clinics*. 2020;15:41-57.
2. Mah CD, Mah KE, Kezirian EJ, et al. The effects of sleep extension on the athletic performance of collegiate basketball players. *Sleep*. 2011;34:943-950.
3. Bird SP. Sleep, recovery, and athletic performance: A brief review and recommendations. *Strength and Conditioning Journal*. 2013;35:43-47.
4. American Academy of Sleep Medicine (AASM). Studies link fatigue and sleep to MLB performance and career longevity [press release]. Darien, IL: AASM, Publication date: May 30, 2013. Available at <https://aasm.org/studies-link-fatigue-and-sleep-to-mlb-performance-and-career-longevity/>. Accessed on Feb. 2, 2022.
5. Bouzigon R, Grappe F, Ravier G, et al. Whole- and partial-body cryostimulation/cryotherapy: Current technologies and practical applications. *Journal of Thermal Biology*. 2016;61:67-81.



6. Yamauchi T. Whole body cryotherapy is method of extreme cold (-175°C) treatment initially used for rheumatoid arthritis. *Zeitschrift für Physikalische Medizin, Balneologie, Medizinische Klimatologie*. 1986;15:311.
7. Schaal K, Meur YLE, Louis J, et al. Whole-body cryostimulation limits overreaching in elite synchronized swimmers. *Medicine and Science in Sports and Exercise*. 2015;47:1416-1425.
8. Bouzigon R, Ravier G, Dugue B. The use of whole-body cryostimulation to improve the quality of sleep in athletes during high level standard competitions. *British Journal of Sports Medicine*. 2014;48:572.
9. Douzi W, Dupuy O, Tanneau M, et al. 3-min whole body cryotherapy/cryostimulation after training in the evening improves sleep quality in physically active men. *European Journal of Sport Science*. 2019;19:860-867.
10. Bleakley CM, Bieuzen F, Davison GW, et al. Whole-body cryotherapy: Empirical evidence and theoretical perspectives. *Open Access Journal of Sports Medicine*. 2014;5:25-36.
11. Sherman R. A cryotherapy expert explains Antonio Brown's frozen feet [webpage]. Los Angeles, CA: The Ringer; 2019 [cited August 8, 2019]. Available from: <https://www.theringer.com/nfl/2019/8/8/20797794/antonio-brown-extreme-frostbite-injury-cryotherapy-expert>. Accessed on Feb. 5, 2022.
12. U.S. Food and Drug Administration (FDA). Whole body cryotherapy (WBC): A "cool" trend that lacks evidence, poses risks [press release]. Silver Spring, MD: FDA, Publication date: July 5, 2016. Available at <https://www.fda.gov/consumers/consumer-updates/whole-body-cryotherapy-wbc-cool-trend-lacks-evidence-poses-risks>. Accessed on Feb. 5, 2022.
13. Lombardi G, Ziemann E, Banfi G. Whole-body cryotherapy in athletes: From therapy to stimulation. An updated review of the literature. *Frontiers in Physiology*. 2017;8:258.



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# Go to Bed, Sleepy Head: The Relationship Between Head Injuries and Sleep Problems

By Shane Creado, MD, BPT

*Content in this article was originally published in "Peak Sleep Performance: The Cutting-edge Sleep Science That Will Guarantee a Competitive Advantage."*

"It's raining, it's pouring,  
The old man is snoring,  
He bumped his head and went to bed,  
And couldn't get up in the morning."

—The Little Mother Goose

Reflecting on this nursery rhyme taught to me by my parents at age two, I now see how apt it is, almost four decades later. Head injuries have been a huge focus in the sports world since at least 2009 when numerous studies showed that repeated head trauma in athletes in the National Football League (NFL) could have serious consequences and downstream effects in players, including the increased risk of violence, mental health problems, spinal cord injuries and even dementia (chronic traumatic encephalopathy [CTE]).

In this article, I will not discuss the immediate assessment and treatment of concussions or the decisions determining when an athlete can return to play. I will instead discuss the bi-directional relationship between head injuries and sleep problems so that sleep professionals are aware of the right questions to ask and the associated sleep disorders to look for.

Equipped with this understanding, sleep professionals can better serve their patients, and anybody they know who is dealing with post-concussional syndrome (PCS).

## What Is a Concussion?

The Centers for Disease Control and Prevention (CDC) defines a concussion as "a type of traumatic brain injury — or TBI — caused by a bump, blow or jolt to the head or by a hit to the body that causes the head and brain to move rapidly back and forth.

This sudden movement can cause the brain to bounce around or twist in the skull, creating chemical changes in the brain and sometimes stretching and damaging brain cells."

TBI is considered mild, moderate or severe depending on the scoring of the symptoms using the Glasgow Coma Scale. The damage can range from light blows to the head with local bruising to hematomas (small blood clots), cerebral edema (brain swelling) and even as significant as shearing/tearing injuries of white matter to specific areas of damage (frontal, temporal, occipital lobes).

Even minor hits to the head that are brushed off as bumps or not even considered as hits can cause "fraying" of the brain and add up in terms of overall damage with severe long-term consequences.

Thus, an umbrella term like "concussion" is woefully inadequate. We have to take into account the severity of an injury, number of injuries, areas affected, loss of consciousness (or not), specific symptoms (indicating areas of the brain affected), duration of complete recovery from those symptoms and other factors impacting brain health (medications, substance use, sleep, inflammation, genetics, hormones, neurotransmitters, mental health, diet and others).

MRIs and CT scans may be normal in many cases. Thus, more sensitive testing such as single-photon emission computerized tomography (SPECT) imaging (functional brain imaging, that can tell us about blood flow and activity levels) is important to establish baseline measurements, quantify the degree of damage and create specific plans to help the brain heal.

---

*Even minor hits to the head that are brushed off as bumps...add up in terms of the overall damage with severe long-term consequences.*

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The initial and direct injury is only the beginning of the story. Soon after the initial damage, a waterfall of metabolic events sets in, which causes subsequent brain damage that may result from the generation of free radicals (substances that damage tissues), flooding of neurotransmitters, inflammatory responses, mitochondrial (the powerhouses of the cells) dysfunction and abnormal gene activation, among others.

Thus, based on the degree of damage and the regions affected, different symptoms may manifest and warrant an individualized treatment protocol for each patient. Unless we know what we are treating, we will not know how to treat it.

"I think in a couple [of] years, [sleep deprivation] will be an issue that's talked about, like the NFL with concussions." —Tobias Harris (professional American basketball player)

## What Can Concussions Do to Your Sleep?

It is estimated that a college (American) football player has already sustained thousands of hits to the head. In a 2019 study of just one season of college football, 38 players from the University of Rochester's Division III team sustained a collective 19,128 hits to the head. Only two of these encounters resulted in formal concussions, but a majority of the hits were not serious enough to warrant clinical diagnosis.<sup>1</sup>

A review of sleep disorder studies and surveys suggest that sleep disorders are three times more common in TBI patients than in the general population. Nearly 60% of people with TBI experience long-term difficulties with sleep.

Patients suffering from TBI of any severity in both the acute and chronic phases commonly report excessive daytime sleepiness, increased sleep need, insomnia, and sleep fragmentation or disruption.<sup>2-4</sup> In a meta-analysis of 1,706 TBI survivors across 21 studies, the most common sleep disturbances were:<sup>5</sup>

1. Insomnia – Present in 50% of survivors.
2. Difficulty maintaining sleep – Present in 50% of survivors.
3. Poor sleep efficiency – Present in 49% of survivors.
4. Early morning awakenings – Present in 38% of survivors.
5. Nightmares – Present in 27% of survivors.
6. Sleep apnea – Present in 23-36% of TBI patients, compared with 2-15% of middle-aged adults; central sleep apnea (CSA) may occur with increased frequency after TBI.<sup>3,6,7</sup> The prevalence of obstructive sleep apnea (OSA) varies widely across studies ranging from 11-77%.<sup>5,8-10</sup>
7. Restless legs syndrome (RLS) – Present in 13% of TBI patients (compared to 2-7% of the general population).
8. Excessive daytime sleepiness (hypersomnia or narcolepsy) – Ranges from approximately 50-80% in patients with TBI (compared with the rate in the general population of 10-25%).<sup>11-14</sup>

9. Increased sleep need (pleiosomnia) – To differentiate from excessive daytime sleepiness, the term pleiosomnia has been proposed to indicate an increased need compared with the patient's pre-TBI baseline.<sup>15</sup> Studies show that patients with TBI deal with both excessive daytime sleepiness and pleiosomnia (needing one to two hours of sleep more per 24-hour period).<sup>8,16</sup>
10. Circadian rhythm disturbances – These occur more frequently in patients with TBI. In one study, 36% of people who complained of insomnia after mild TBI met criteria for a circadian rhythm disorder.<sup>17,18</sup>
11. Abnormal movements or behaviors during sleep – Small studies have suggested that parasomnias and sleep-related movement disorders may occur with increased frequency after TBI in both the acute and chronic phases. These can include acting out dreams (rapid eye movement [REM] sleep behavior disorder), sleep talking, sleep walking and others.

## How Concussions Cause Sleep Problems

The mechanism of post-concussive sleep disorders is unclear but may be related to faulty signaling in neurons involved in normal sleep-wake control and circadian rhythm maintenance.<sup>19</sup>

One of the mechanisms is lowered orexin (hypocretin) levels in people who have suffered a TBI. Orexins are neuropeptides which are deficient in human narcolepsy type 1 (narcolepsy with cataplexy). Measured orexin levels in the cerebrospinal fluid (CSF) were low in 95% of 44 patients within the first four days of moderate to severe TBI.<sup>20</sup> These deficiencies are associated with sleep fragmentation and excessive sleepiness.

Severe TBI was also associated with a 17% loss of dorsal raphe nuclei neurons (which produce serotonin) and a 29% loss of locus coeruleus neurons (which produce noradrenaline). Both of these neurotransmitters are involved in mediating sleep and wakefulness.

Melatonin is the major mediator of the sleep-wake cycle (circadian pattern) and is produced by the pineal gland. Melatonin release may be disrupted following TBI.<sup>21</sup> Despite this data, melatonin supplementation is not very helpful after TBI. One still may need extra sleep while their brain is trying to heal from the brain injury.

Medications taken after a brain injury may cause problems going to sleep or staying asleep, or can make people sleepy during the day and make them unable to participate in activities. Medications that may cause problems include anti-seizure drugs, opioid pain medications, benzodiazepines (used for relaxation, anxiety and sleep), anti-psychotic medications and certain antidepressants. Medications that may cause or aggravate



insomnia include steroids, bronchodilators (asthma) and stimulants (used to treat attention deficit hyperactivity disorder [ADHD]). Alcohol use and other licit and illicit substance use are also relevant.

## How Sleep Problems Influence Concussions

Data pooled from Project REST (Recovery Enhancement and Sleep Training), the National Collegiate Athletic Association (NCAA), the NCAA Inter-Association Task Force on Sleep and Wellness, the NCAA Growth, Opportunities, Aspirations and Learning of Students (GOALS) survey, Pacific-12 Conference (Pac-12) and the American College Health Association (ACHA) show that:<sup>22-25</sup>

- Sixty-eight percent of collegiate athletes had “poor sleep” on the Pittsburgh Sleep Quality Index (PSQI).
- Sleep is the number one thing athletes’ athletic time commitments keep them from doing.
- Nearly three-quarters of athletes report receiving no education about managing sleep difficulties.
- On average, athletes received 6.27 hours of sleep while in season (8-12 hours is ideal).

College athletes may face greater risk for sport-related concussions if they have insomnia or are even just chronically sleepy. In a survey of 190 NCAA Division 1 athletes, the risk of getting a sports-related concussion during the next year was 14.6 times higher for those with both insomnia and excessive daytime sleepiness than for

those who were well rested. On its own, moderate to severe insomnia more than tripled the risk of concussion and excessive sleepiness (even two or more times a month) more than doubled the risk of concussion.

Studies estimate the prevalence of sleep disturbances in professional athletes ranges from 13-70%. Findings from the Concussion Assessment, Research and Education (CARE) study, which was a study of more than 30,000 student athletes and cadets, found that those who were sleep deprived had symptoms similar to a concussion (18,548 students and 12,039 cadets from four military academies).<sup>26</sup> Between 11-28% of these participants had a cluster of symptoms that would meet the definition of PCS despite no recent head injury.

As we already know, sleep deprivation can reduce reaction times and increase the risk of injury, including head injury. Additionally, being chronically sleep deprived can result in more severe symptoms following a concussion, as well as a delayed recovery from the concussion. Succinctly put, post-injury sleep declines may be associated with symptom severity and worsened reaction time during initial stages of recovery or may be the result of the concussion itself.<sup>26</sup>

On top of that, we already know all the possible sleep disorders that concussions can contribute to. All of them can not only cause distress, but also prevent one’s brain from healing after a concussion. We must also remember that a concussion may be accompanied by neck pain, headaches, other injuries and musculoskeletal pain, all of which can further impact sleep. Thus, sleep optimization is important before an athlete has a concussion to reduce the risk of a concussion, and then to improve the prognosis if one does occur.

## Improving Sleep in the Concussed Athlete

Many of the sleep-wake disturbances persist long term after the TBI, as shown by a study in which 31 out of 60 patients with TBI were evaluated at 18 months after injury.<sup>27</sup> With such a range of sleep disorders possible falling into every major category, it is absolutely essential to screen athletes periodically for these issues, so that we can direct them to appropriate care. For example, narcolepsy is treated with stimulants or wakefulness agents. These medications are banned by the World Anti-Doping Agency (WADA) unless there is a medical necessity, which requires extensive documentation and the completion of an application for a therapeutic use exemption.

The detection and treatment of such conditions can make or break an athletes’ career. Take insomnia for example. We need a sleep expert to make sure that a serious problem like central sleep apnea is not missed. Therefore, establishing a diagnosis is crucial. Before initiating medications for sleep, we need to screen for underlying factors and diagnose and treat any issues individually. Simultaneously, strategies such as sleep hygiene and cognitive-behavioral therapy for insomnia (CBT-I) can be started.

One’s brain knows it needs more sleep after a head injury. One of the quickest ways to heal the brain after a head injury is to get more recovery sleep. However, we must remember that an athlete may be sleep-deprived at baseline (prior to the concussion), and so when screening them post-concussion, it is very important to use a baseline of optimal sleep rather than a possibly sleep-deprived baseline when tracking their recovery from a concussion.

Medications should be used with caution because of potential adverse effects and drug interactions. Medications such as benzodiazepines, antidepressants, antipsychotics and antihistamines may increase the risk of seizures or interfere with brain healing (neuronal plasticity). In addition, benzodiazepines can cause (paradoxical) agitation, memory problems, addiction and rebound insomnia.

I strongly recommend avoiding benzodiazepines in TBI patients. In all patients who have sustained a TBI, I recommend a referral to a sleep specialist, whether or not there are sleep disturbances, because optimizing sleep post TBI can give an athlete the best chance of recovery from the injury. Other sleep disorders associated with TBI require specific testing and treatments that can be done by a competent sleep medicine physician.

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## Conclusion

Sleep problems and concussions have a bi-directional relationship. Sleep strategies and education to optimize athletes' sleep is necessary and possibly a preventative strategy for concussions. Post-concussion, it is recommended to train the concussed athlete on sleep improvement strategies (CBT-I), as well as periodically screen the athlete for ongoing sleep problems or ones that may develop later with validated screening tools. Treating a concussed athlete is a multi-disciplinary effort, and a qualified sleep physician needs to be an integral part of the team. 🌙



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## References

- Hirad AA, Bazarian JJ, Merchant-Borna K, Garcea FE, Heilbronner S, Paul D, Hintz EB, van Wijngaarden E, Schifitto G, Wright DW, Espinoza TR, Mahon BZ. A common neural signature of brain injury in concussion and subconcussion. *Science Advances*. Aug 7;5(8):eaau3460.
- Baumann CR. Traumatic brain injury and disturbed sleep and wakefulness. *Neuromolecular Medicine*. 2012;14:205.
- Castriotta RJ, Wilde MC, Lai JM, et al. Prevalence and consequences of sleep disorders in traumatic brain injury. *Journal of Clinical Sleep Medicine*. 2007;3:349.
- Ouellet MC, Beaulieu-Bonneau S, Morin CM. Insomnia in patients with traumatic brain injury: frequency, characteristics, and risk factors. *Journal of Head Trauma Rehabilitation*. 2006;21:199.
- Mathias JL, Alvaro PK. Prevalence of sleep disturbances, disorders, and problems following traumatic brain injury: a meta-analysis. *Sleep Medicine*. 2012; 13:898.
- Webster JB, Bell KR, Hussey JD, et al. Sleep apnea in adults with traumatic brain injury: a preliminary investigation. *Archives of Physical Medicine and Rehabilitation*. 2001;82:316.
- Guilleminault C, Yuen KM, Gulevich MG, et al. Hypersomnia after head-neck trauma: a medicolegal dilemma. *Neurology*. 2000;54:653.
- Baumann CR, Werth E, Stocker R, et al. Sleep-wake disturbances 6 months after traumatic brain injury: a prospective study. *Brain*. 2007;130:1873.
- Capaldi, VF 2nd, Guerrero ML, Killgore WD. Sleep disruptions among returning combat veterans from Iraq and Afghanistan. *Military Medicine*. 2011;176:879.
- Chaumet, G, Quera-Salva MA, Macleod A, et al. Is there a link between alertness and fatigue in patients with traumatic brain injury? *Neurology*. 2008;71:1609.
- Collen J, Orr N, Lettieri CJ, et al. Sleep disturbances among soldiers with combat-related traumatic brain injury. *Chest*. 2012;142:622.
- Masel BE, Scheibel RS, Kimbark T, Kuna ST. Excessive daytime sleepiness in adults with brain injuries. *Archives of Physical Medicine and Rehabilitation*. 2001;82:1526.
- Watson NF, Dikmen S, Machamer J, et al. Hypersomnia following traumatic brain injury. *Journal of Clinical Sleep Medicine*. 2007;3:363.
- Young, T.B. Epidemiology of daytime sleepiness: definitions, symptomatology, and prevalence. *Journal of Clinical Psychiatry*. 2004;65 Supplement 16:12.
- Sommerauer M, Valko PO, Werth E, Baumann CR. Excessive sleep need following traumatic brain injury: a case-control study of 36 patients. *Journal of Sleep Research*. 2013; 22:634.
- Imbach LL, Valko PO, Li T, et al. Increased sleep need and daytime sleepiness 6 months after traumatic brain injury: a prospective controlled clinical trial. *Brain*. 2015;138:726.
- Williams BR, Lazic SE, Ogilvie RD. Polysomnographic and quantitative EEG analysis of subjects with long-term insomnia complaints associated with mild traumatic brain injury. *Clinical Neurophysiology*. 2008;119:429.
- Weitzman ED, Czeisler CA, Zimmerman JC, Moore-Ede MC. Biological rhythms in man: relationship of sleep-wake, cortisol, growth hormone, and temperature during temporal isolation. *Advances in Biochemical Psychopharmacology*. 1981;28:475.
- Morse AM, Kothare, SV. Sleep disorders and concussion. *Handbook of Clinical Neurology*. 2018;158:127-134.
- Baumann CR, Stocker R, Imhof HG, et al. Hypocretin-1 (orexin A) deficiency in acute traumatic brain injury. *Neurology*. 2005; 65:147.
- Naseem M, Parvez S. Role of melatonin in traumatic brain injury and spinal cord injury. *Scientific World Journal*. 2014; 2014:586270.
- Kroshus E, Wagner J, Wyrick D, et al. Wake up call for collegiate athlete sleep: Narrative review and consensus recommendations from the NCAA Interassociation Task Force on Sleep and Wellness. *British Journal of Sports Medicine*. 2019 Jun;53(12):731-736.
- American College Health Association. American College Health Association-National College Health Assessment, Fall 2015, Spring 2016, Fall 2016, Spring 2017, Fall 2017. [data file] Hanover, MD: American College Health Association [producer and distributor]. 2018-11-15.
- Mah CD, Kezirian EJ, Marcello BM, et al. Poor sleep quality and insufficient sleep of a collegiate student athlete population. *Sleep Health*. 2018;4:251-7.
- National Collegiate Athletic Association. NCAA GOALS Study. Indianapolis, IN. 2016. <https://www.ncaa.org/sports/2013/11/20/ncaa-goals-study.aspx>
- Hoffman NL, Weber ML, Broglio SP, McCrea M, McAllister TW, Schmidt JD; CARE Consortium Investigators. Influence of Postconcussion Sleep Duration on Concussion Recovery in Collegiate Athletes. *Clinical Journal of Sport Medicine*. 2017 Nov 16.
- Imbach LL, Büchele F, Valko PO, et al. Sleep-wake disorders persist 18 months after traumatic brain injury but remain underrecognized. *Neurology*. 2016;86:1945.

# It's Mean to Just Look at the Average: Athletic Sleep Research and Data

By Ian Dunican, PhD, MBA, MMEEng, GCASSc, BA

*"The purpose of today's training is to defeat yesterday's understanding."*

—MIYAMOTO MUSASHI

Many of us love sports; they provide escapism from our day-to-day lives, and can be a means for us to socialize, band together and enjoy the pursuit of victory. The chance to sit back and watch teams battle each other, such as football or basketball, or individual athletes compete in a sport that requires a high level of skill, timing and precision, such as boxing or mixed martial arts, draws us into the world of sports.

What equally draws our attention is what these athletes do outside of competition to prepare for such events. We want to know their strength and conditioning routines, diet and mindset, and in the last five to 10 years, we have wanted to know more about their recovery strategies such as sleep, sleep timing, and sleep before and after a competition. Famous athletes such as Tom Brady and LeBron James have publicly spoken about the importance of sleep, specifically as they get older. Irish rugby scrum half player Peter Stringer played rugby into his forties and credits a focus on sleep, nutrition and recovery to his longevity in the sport. I have worked with elite athletes over 30 years old to focus specifically on these areas in Major League Baseball (MLB) and Formula 1 (F1). Athletes at this level grapple with repeated competition, such as baseball with 162 games in a season, the duration of the competition, such as an F1 race, and travel and jet lag associated with travelling the world to compete. Therefore, a focus on sleep and recovery is paramount to an athlete's performance.

But how much do we know about sleep, recovery and performance in elite athletic populations? How good is the research? Are the practitioners' approaches to athletes adequate? Since 2010 we have observed a significant increase in the quantity and quality of athletic research. More than 80% of this research is original and the vast majority of it has taken place in the last five years.<sup>1</sup>

Two main countries have contributed to this research. They are Australia, where I live (although I am from Ireland), and the United States. Australia is also home to the top four academic institutions that publish this research, including the Australian Institute of Sport; Central Queensland University; University of Technology Sydney and the University of Western Australia, where I am currently an adjunct senior research fellow.

While this increase in research and research outputs is excellent, the current approach is generally geared towards collecting large data sets to appease the statistical power required to find an effect over time or prove an intervention. Achieving large-scale data or repeated data collection over a day, week/s or season becomes cumbersome and difficult with athletes who are often overburdened with lots of data collection. It gets in the way of the technical aspect of the sport and the sport-specific training with the coaches and athletes. Imagine asking players to self-report one to two times a day their fatigue, sleepiness or mood and then imagine that over an entire season. The athlete and the coaches start viewing the data collection

as non-value adding and a pain to keep collecting over time.

In many studies, the focus has been on group data to collect sleep-wake behaviours over time using wearable devices such as actigraphy and sleep diaries or questionnaires. This helps generate group or team data to identify trends on specific days or nights, home versus away games, and for extended travel or periods of extreme jet lag. In addition, coaches and performance staff can use this data to plan practice times, travel, recovery and media engagements. However, we may be losing out with this approach as we are missing so much related to the individuals who make up that data point with standard deviation. We tend to lack the focus on the individual athlete, and there is a scarcity of studies in athletic populations aimed to support the individual athlete.

No one has been more guilty of this than me. I have published several studies with combat and contact athletes to generate group data to quantify the group sleep behaviours and have done this with teams and individuals.<sup>2,3</sup> There can be a significant variation between athletes. In a study my fellow researchers and I conducted with



elite rugby union players in the Super Rugby competition in the southern hemisphere, we found that the players went to bed three hours after a game compared to training days (23:08 ± 66 min versus 02:11 ± 114 min;  $p < .001$ ). What is lost in that data is that four players did not sleep after the game, and when looking at the maximum time at sleep onset, some players went to bed at 07:00.<sup>2</sup>

In recent years, I have redirected my focus, placing a greater emphasis on the individual athlete. In a current research project with an elite female basketball team, 12 female players and three male coaches wore actigraphy devices for 60 nights to assess sleep behaviors and completed questionnaires. We generated group and individual data and invited the group to a sleep education program consisting of a two-hour sleep education session followed by a personal consultation to identify improvements to sleep behaviours. In this applied research project, we analyzed the group data to improve the timing of training sessions, travel, recovery and chronotypes. The individual data allowed us researchers to engage with individual athletes with specific advice or referrals.<sup>4</sup> You can hear what the players thought of the project [here](#). (We have taken a similar approach with older amateur athletes, which is currently under review, "Understanding the sleep of ultra-marathon swimmers: Guidance for coaches and swimmers.")

I am proposing that research studies for sleep and recovery work with athletes going forward need to have a two-pronged approach to be conducted in tandem. The first approach being team focused, similar to the fatigue risk management systems approach in the industry,<sup>5</sup> whereby there is a focus on the organizational design, and the second being athlete focused, where the approach is more individualized.

A team-focused approach, and I have advocated this approach in recent work in high-risk remote mining environments,<sup>6</sup> is where coaches, performance staff and researchers should aim to collect group- or team-based data that includes:

- Training times and types (e.g. strength training, conditioning, skill specific)
- Timing of games or competition (e.g. early morning, afternoon, late at night)
- Overall sleep habit behaviours and sleep disorders
- Recovery and social time
- Additional support (e.g. psychological, financial)

An athlete-focused approach should aim to:

- Identify, diagnose and treat sleep disorders or problems if present
- Strategically use the chronotype of the athlete to maximize their recovery and performance
- Analyze individual sleep habits and behaviors with the athlete to identify areas for improvement
- Include individual consultation, education and support

Going forward we can do both through a shared, joint responsibility model that incorporates collaborating with the individual athlete to engage and educate them as well as equip them with the knowledge and skills to master their performance for a safe and healthy career. If we can do this, then the group or team data will improve and reflect this. So let's not just focus on the mean, let's get personal. 🌙

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## Research studies for sleep and recovery work with athletes need to be a two-pronged approach.

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### References

1. Lastella M, Memon AR, Vincent GE. Global Research Output on Sleep Research in Athletes from 1966 to 2019: A Bibliometric Analysis. *Clocks & Sleep*. 2020;2(2):99-119.
2. Dunican IC, Higgins CC, Jones MJ, et al. Caffeine use in a Super Rugby game and its relationship to post-game sleep. *European Journal of Sport Science*. 2018:1-11. doi: 10.1080/17461391.2018.1433238 [published Online First: 2018/02/13]
3. Dunican I, Martin D, Halson S, et al. Evening Use Of Electronic Devices—Effects On Sleep, Cognition And Performance Of Elite Athletes. *Sleep & Biological Rhythms*. 2015;13:76.
4. Dunican IC, Caldwell JA, Morgan D, et al. An education intervention in a professional female basketball team and coaching staff improves sleep and alertness. *Translational Sports Medicine*. 2020. doi: <https://doi.org/10.1002/tsm2.218>
5. Lerman SE, Eskin E, Flower DJ, et al. Fatigue risk management in the workplace. *Journal of Occupational and Environmental Medicine / American College of Occupational and Environmental Medicine*. 2012;54(2):231-58. doi: 10.1097/JOM.0b013e318247a3b0 [published Online First: 2012/01/25]
6. Maisey G, Cattani M, Devine A, et al. Digging for data: How sleep is losing out to roster design, sleep disorders, and lifestyle factors. *Applied Ergonomics*. 2022;99:103617. doi: <https://doi.org/10.1016/j.apergo.2021.103617>

# 3 Sleep and Performance Challenges for Northern-Based Athletes and Coaches to Manage

By Brendan Duffy, RPSGT, RST, CCSH, FAAST

Recently, I had the opportunity to explain on the [Fox Weather](#) streaming service why we sometimes feel sleepier in the winter than we do in other seasons.<sup>1</sup> The interview got me thinking about how these same challenges may be faced by college and professional winter sports athletes.

Many athletes and teams are in northern-based cities and towns that experience harsh, cold and long dark nights. The teams and coaches spend most of their scheduled season traveling in these cold, gray weather conditions with limited or reduced sunlight. Occasionally they may play a tournament away in a warm, sunny region, which is a welcome reprieve.

But why? Is it the warm sunlight that impacts them physiologically as well as physically? It is a welcomed reprieve to play in sunny conditions, but a short one for many of these teams. The reality is that their opponents for winter sports, such as basketball or hockey, are mostly other northern-based teams so they often stay within the early, gray, dark and dreary morning environments during the winter seasons.

*What should coaches and trainers look for that may be a unique challenge brought on by the environment?*

We all have heard the expression, "You can't change the weather," but what should college and professional athletes be aware of, and look out for, to manage through the winter season? What should coaches and trainers look for that may be a unique challenge brought on by the environment? Have high school players from southern states even given a thought to how well they will adapt and thrive in a frozen and dark environment if they chose a college in that region?

Let's look at three key areas of concern during the winter season for both college and professional athletes and coaches based in the northern United States.

## Adequate Sunlight

One of the biggest reasons many athletes may experience more tiredness is the absence of sunlight during the winter months due to nights being longer and days shorter. This leads to more of the sleep-inducing hormone melatonin to signal that it is time to wind down and prepare for sleep time. This tired feeling may make it harder for an athlete to complete workouts or practice their sport skills, as well as impact their performance in warmer, sunnier regions.

Athletes often play their games late in the day and sleep in, so an early 4:45 or 5 p.m. sunset seriously limits their chances for getting healthy, natural sunlight during the winter, which can negatively influence focus, workouts, mood and appetite for the players, coaches and trainers. This daily dose of natural sunlight is important for maintaining a consistent and healthy circadian sleep rhythm. Even as few as 20 minutes of sunlight in the morning can make a big difference for your sleep schedule, mood and energy level.

## Diet

With more time spent inside due to the cold weather, athletes may experience more difficulty controlling their weight. Winter is a time where we tend to eat heavier meals in the northern climates as opposed to the lighter "summer salad" fare enjoyed in the warmer months or down south in the warmer climates. With cold and ice outside, and less desire or opportunity to exercise, it's easy to start noticing your belt tightening during the winter seasons. Add to that the holidays, and we definitely can run afoul of our athletic dietary goals and targets.

Winter is full of comfort foods and sedentary indoor "grounded" times due to the cold and harsh weather. This can be the perfect storm for weight control issues.





This added weight can disrupt breathing and increase players' risk for developing sleep apnea or fragmented sleep due to gastroesophageal reflux disease (GERD) or heartburn. Team trainers and nutritionists need to educate and monitor athletes' caloric intake and choices even more carefully in the winter season due to the aforementioned risks.

## Seasonal Affective Disorder

Seasonal affective disorder (SAD) is a type of depression that occurs during similar times of the year (i.e., winter months) and is characterized by increased feelings of sadness, eating and sleeping.<sup>2</sup> SAD has been found to occur in some student athletes who move away from southern states to places with limited sunlight hours and colder weather (i.e., northern latitudes), predisposing them to the disorder.<sup>3</sup>

Coaches should pay special attention to not only the physical condition and readiness of these "transplanted" southern athletes, but more importantly the mental health of these athletes. Their mood and energy levels may be severely dampened, and they may have sleep issues as part of that seasonal emotional challenge. This may be especially true for freshman in their first season. They already have many stressors to handle, such as being away from home, difficult classes, practice schedules, and new friends and coaches. The dark and cold nights may be another challenge.

Players with SAD should be referred to sleep specialists who can assist them with coping mechanisms, rule out other sleep

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*Coaches should pay special attention to not only the physical condition and readiness of these "transplanted" southern athletes, but more importantly the mental health of these athletes.*

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issues and provide recommendations for supplemental light sources. Some helpful light sources are lux light boxes or personal lux eyewear glasses that a player can use in the morning to assist in resetting their circadian internal clock.

With a little knowledge and some preparation, coaches, trainers and players can rise to the challenge of a long winter season. If they make the necessary adjustments, just as they would for any other formidable opponent, they just may defeat the winter blues and enjoy a wonderful winter wonderland season! 🌙



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## References

1. Fox Weather. Why do you feel more tired in the winter? <https://www.foxweather.com/watch/play-56938efe8000757>
2. American Psychological Association. Diagnostic and Statistical Manual of Mental Disorders, 5th ed. Washington, DC. American Psychiatric Association. 2013.7.
3. Covassin T, Bretzin AC, Japinga A, Teachnor-Hauk D, Nogle S. Exploring the Relationship Between Depression and Seasonal Affective Disorder in Incoming First Year Collegiate Student-Athletes. *Athletic Training & Sports Health Care*. Vol. 11 No. 3 2019.

# Poor Sleep Is Not a Disease

By Pat Byrne

In the United States, there are thousands of professional athletes, hundreds of thousands of college athletes and tens of millions of high school, club and individual athletes that participate in every sport imaginable. However, being active and in good physical shape does not make one immune from the same frailties seen across the nation's entire population. According to the Centers for Disease Control and Prevention (CDC), 32% of 18-24 year olds and about 38% of those ages 25-34 sleep less than seven hours a night.<sup>1</sup>

An entire wearable industry has evolved to address this issue with athletes and teams. Unfortunately, wearables do little to solve the actual problem of low sleep hours and poor sleep quality. That is because they treat poor sleep as a disease and wearables as a cure. Poor sleep is not a disease; it is a symptom.

There are many causes of poor sleep amongst athletes, including sleep disorders, mental health issues, organic diseases, anxiety, medications, food choices, travel and lifestyle issues. These factors are not necessarily mutually exclusive. I have worked with athletes who suffer with sleep apnea but also have superimposed anxiety issues related to athletic performance, physical injuries and lifestyle issues. The sleep apnea diagnosis was helpful to the athletes who were able to get treatment that alleviated some of their poor sleep, however, for the other causes of their poor sleep, they were largely left on their own.

When athletes show up at a sleep clinic, they are there because of a perceived sleep problem. Whether they are eventually diagnosed with a sleep disorder or not, it is helpful for the practitioners to understand the other issues affecting the sleep of athletes.

## The Importance of Communication

High school and college athletes often have to juggle their time between academic studies and homework; their athletics games, practices and meetings; family commitments; and their social circles. Unfortunately, these groups rarely communicate with each other to help the athlete.

College athletic departments rarely speak with athletes' academic instructors and likely never with the athletes' families or social circles to coordinate the time needs of the athletes. Athletes are left on their own to juggle their commitments, often without any time

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*A more effective strategy might be to couple time management training with sleep hygiene education.*

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management skills and what suffers is often their sleep.

Now couple the impact of the lack of communication with the "elephant in the room" — adolescent circadian rhythms. The timing of academic instructions, athletic games, meetings and practices are often out of sync with young athletes' natural circadian rhythms, causing unnecessary sleep loss and circadian disruptions. While some schools recognize the issue and are trying to schedule school start times later in the day to allow for more sleep, athletic programs, for the most part, have not followed suit.

## The Importance of Studying Sleep

Game performance anxiety is often discussed as a factor in sleep loss prior to a game; however, a recent study in Australian rules football over an entire season found that athletes' sleep was not overly disturbed the night before a game, but post game they obtained 30% less sleep that night.<sup>2</sup> The study of sleep in athletics is fairly new with most of the work published within the last decade. There is so much more to learn, but we do know that athletes often suffer from sleep loss, which can affect their athletic



performance, academic performance and their overall health and safety.

The broader question is, "What can be done about it?" There are no simple solutions. Sleep hygiene education is often touted as a way for athletes to get better sleep. Unfortunately, there is little evidence sleep hygiene education by itself has any long-term effects on sleep practices. That said, sleep education can allow athletes to make smarter decisions about their habits when they have the opportunity to do so. I would argue that a more effective strategy might be to couple time management training with sleep hygiene education. More importantly, this strategy would likely only be effective if the academic and athletic institutions also undertook sleep education throughout their organizations and implemented policies and procedures that would assist athletes in obtaining more and better sleep.

Athletes are often encouraged to use wearables to track their sleep and to adjust their sleep accordingly. The difficulty with this approach (aside from the reliability

of the data) is that it assumes if athletes know how much they sleep, they can actually improve their sleep. There is rarely any discussion of the multiple causes of poor sleep, let alone any attempt to diagnose the various issues. There is now an acknowledgment that wearables can create unrealistic expectations amongst athletes which leads to anxiety and potentially further sleep loss.

Sleep practitioners play an important role in diagnosing and treating sleep disorders. It is helpful to understand that poor sleep amongst athletes often has multiple causes, many of which are due to systemic issues outside the direct control of athletes. 🌙



**PAT BYRNE** pioneered sleep and fatigue programs for professional sports in 2008. His systems and approach have since spread globally. "As I travel around the world visiting college athletic departments, professional sports teams and Olympic organizations in Australia, New Zealand, Asia, Europe, South America and North America, I see Pat Byrne's sleep science fingerprints everywhere."  
—Dr. Leonard Zaichkowsky. Byrne is the co-author of the 2020 book "Inconvenient Sleep: Why Teams Win and Lose."

### Reference

1. Centers for Disease Control and Prevention. Data and Statistics. [https://www.cdc.gov/sleep/data\\_statistics.html](https://www.cdc.gov/sleep/data_statistics.html)
2. Sargent C, Rogalski B, Montero A, and Roach GD. The Sleep Behaviors of Elite Australian Rules Footballers Before and After Games During an Entire Season. *International Journal of Sports Physiology and Performance*. Ahead of print. <https://doi.org/10.1123/ijspp.2021-0417>

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# Strategies to Help Athletes Jump-Start the Optimization of Their ZZZs

By Amy Bender, PhD

Sleep is a powerful performance-enhancing tool. When the difference between being on the podium or not can be such a slim margin, athletes are looking for anything they can do to gain that edge. Teams and athletes are starting to take notice and are looking for sleep coaches to help navigate the elusive sleep that is hard to come by. That's where you can come to the rescue!

Sports coaches at all levels are looking for guidance from someone with legitimate sleep expertise. In this article, uncover three strategies that can help you take the leap and begin working with athletes.

## 1. Find a mentor and gain experience

My first experience in the sleep field was visiting my aunt's sleep laboratory to see what she did. After that experience, I went home and called every sleep lab in my area to see if I could volunteer and observe. I found one sleep lab director that let me observe some night shifts, which helped me land my first job as a sleep technologist. If you are interested in working with athletes, you need to gain experience in working with them. You don't need to have a doctorate or master's degree to work with athletes (but it wouldn't hurt if you did), as knowledge can be gained with experience and training.

There's no better way to gain experience than to team up with someone else who is currently working with athletes and learn from them. But how do I find someone? That leads me to the next strategy...

## 2. Get on social media and establish your credibility

Social media is a way to meet #sleeppeeps and a fruitful way to collaborate and be seen. There are many sleep coach "experts" out there who are currently working with professional athletes, yet touting the amazing benefits of the polyphasic 90-minute cycle nap sleep system. As

a sleep professional with training, you know better than to tout this because you have extensive experience in the sleep field and professional training to back up your expertise.

Coaches and athletes are thirsty for a real sleep expert with legitimate sleep knowledge. And where are they looking for it? Social media. I have had numerous opportunities come through an Instagram or Twitter direct message. Coaches and high-performance directors search for sleep experts on the various social media platforms (e.g., Twitter, Instagram, LinkedIn) and if they find you through a different medium, they will be checking your social media afterwards to have a view into your content and expertise. Start now and post, post, post. Post about what you do, interesting sleep facts and new articles with your commentary. This will help to establish your credibility in the sleep field.

## 3. Know the basics

Athletes struggle with sleep in similar ways to the patients you are working with. But there are also many differences that you need to understand to help athletes solve their sleep problems such as travel and jet lag, irregular schedules, hyperarousal, exercise and eating before bedtime, bright light, and muscle soreness. Educate yourself in the sleep and athlete space. There are many resources available to check out and learn from. Free presentations, articles, books and even sleep screening material specific to athletes are easily accessible.

## Resources to Get Started

While there are many resources out there to help you get started in working with athletes, the below are my top five recommendations:

- Sleep and the Athlete: Narrative Review and 2021 Expert Consensus Recommendations from Neil P. Walsh, et al.
- Managing Travel Fatigue and Jet Lag in Athletes: A Review and Consensus Statement from Dina C. Janse van Rensburg, et al.
- Peak Sleep Performance for Athletes: The Cutting-edge Sleep Science That Will Guarantee a Competitive Advantage by Shane Creado, MD
- Inconvenient Sleep: Why Teams Win and Lose by Pat Byrne and Suzanne Byrne
- The Athlete Sleep Screening Questionnaire from the Centre for Sleep and Human Performance

Just like my first observation of squiggly lines over 15 years ago, becoming a sleep coach and working with athletes can take time. But you have to start somewhere — even if it is for your kid's local sports team. I still remember my first sleep and sports presentation and how horrible it was. With practice it gets better, and hopefully with these tips, you can be well on your way to helping athletes optimize their ZZZs and turning your dream into a reality. 🌙



**AMY BENDER, PHD**, is the director of clinical sleep science at Cerebra and adjunct assistant professor of kinesiology at the University of Calgary. She is passionate about changing the way we diagnose and treat sleep disorders and loves helping athletes optimize their sleep. You can follow her work @sleep4sport.

# Compliance Corner

By Laura A. Linley, CRT, RPSGT, FAAST

## Hospital Price Transparency Rule

The Center for Medicare and Medicaid Innovation (CMS Innovation Center) launched a bold new strategy with a vision for a health system that achieves equitable outcomes through high quality, affordable, person-centered care. The CMS Price Transparency Initiative is one of CMS's strategic initiatives designed to deliver better value and results for patients through competition and innovation.

Hospital price transparency helps patients know the cost of a hospital's "shoppable" service or corresponding ancillary services before they receive it. Hospitals operating in the United States are required to provide clear, accessible pricing information online about the items and services they provide in two ways:

1. As a comprehensive machine-readable file with all items and services
2. In a display of shoppable services in a consumer-friendly format

A shoppable service is defined as "a service that can be scheduled by a health care consumer in advance. Such services are routinely provided in non-urgent situations that do not require immediate action or attention to the patient, thus allowing patients to price shop and schedule a service at a time that is convenient for them."<sup>1</sup> Examples of common shoppable services include imaging and laboratory services, medical and surgical procedures, and outpatient clinic visits including sleep studies.

An ancillary service is defined as any item or service a hospital usually provides as part of or in conjunction with a shoppable primary service. Ancillary service examples include laboratory, radiology, drugs, delivery room (including maternity labor room), operating room (including post-anesthesia and postoperative recovery rooms), therapy services (physical, speech, occupational), hospital fees, room and board charges, and charges for employed professional services. These services may also include other special items and services for which charges are customarily made in addition to a routine service charge.<sup>1</sup>



Alternatively to a display of charges, hospitals can meet the requirements by maintaining an internet-based price estimator tool that allows consumers to obtain a current out-of-pocket cost estimate.<sup>1</sup> This tool needs to be prominently displayed on the facility's website and accessible without charge or need for a user account/password.

Making sure patients understand their financial responsibility prior to coming to the sleep center is best practice. Nothing will interfere with sleep more than being surprised by out-of-pocket expenses. This practice does require tracking of notification and allowing sufficient time for patients to be given a notice of insurance participation and an estimated personal cost for service. Every sleep center, regardless if hospital based or not, requires a list of service rates and a guideline for conveying charges to the patient. An understanding of the costs for services should be given to the patient as soon as possible prior to the date of service and be kept

*Making sure patients understand their financial responsibility prior to coming to the sleep center is best practice. Nothing will interfere with sleep more than being surprised by out-of-pocket expenses.*

# Compliance Corner continued

By Laura A. Linley, CRT, RPSGT, FAAST

*It is important that the entire team...understands the sleep service codes and description of services.*

on file. This requires a window of time before new patients can be added to the schedule. If last-minute scheduling is necessary, coordinating with the business office is required to prioritize the financial review.

In the final rule, CMS outlined a monitoring and enforcement plan to ensure hospitals comply with these new requirements. If CMS determines a hospital is noncompliant with one or more of the new requirements to make standard charges public, they may take any of the below actions, "which generally, but not necessarily, will occur in the following order:

- Provide a written warning notice to the hospital of the specific violation(s)
- Request a corrective action plan (CAP) if noncompliance constitutes a material violation of one or more requirements
- Impose a civil monetary penalty not in excess of \$300 per day and publicize the penalty on a CMS website if the hospital fails to respond to a request to submit a CAP or comply with the requirements of a CAP<sup>12</sup>

Educating the entire sleep team on this requirement is warranted and the rules should be regularly reviewed for understanding. It is important that the entire team, whether they are part of the business or clinical team, understands the sleep service codes and description of services. This is what is required to properly estimate cost. Examples of common sleep center [CPT codes](#) include:

CPT Code	Description
95800	Sleep study unattended with sleep staging
95805	Multiple sleep latency test
95806	Sleep study unattended and respiratory effort
95810	Attended in-lab study
95811	Attended in-lab titration

CMS is focused on driving health system transformation with the goal of putting all patients at the center of care. It is going to be imperative that attention to the updated CMS strategies is monitored. A white paper on the CMS Innovation Center Strategy is available online at <https://innovation.cms.gov/strategic-direction-whitepaper>.

Sleep centers are an important provider of care and will continue to be included in focused initiatives to improve patient centered care. 🌙

## References

1. CMS.gov. 10 Steps to Making Public Standard Charges for Shoppable Services. <https://www.cms.gov/files/document/steps-making-public-standard-charges-shoppable-services.pdf>.
2. CMS.gov. Special Edition – Monitoring for Hospital Price Transparency. [https://www.cms.gov/outreach-and-education/outreachffsprovpartprog/provider-partnership-email-archive/2020-12-18-mInc-se#:~:text=If%20we%20conclude%20a%20hospital,of%20the%20specific%20violation\(s\).](https://www.cms.gov/outreach-and-education/outreachffsprovpartprog/provider-partnership-email-archive/2020-12-18-mInc-se#:~:text=If%20we%20conclude%20a%20hospital,of%20the%20specific%20violation(s).)



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