

PEAK PERFORMANCE REQUIRES OPTIMAL SLEEP AND ALERTNESS

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Coach, I had so much to do to prepare for today's competition that I had to stay up all night to be ready.

Coach, to prepare for the time zone change at the international competition I have been sleeping during the day and staying awake all night.

Coach, I couldn't relax and just kept worrying about today's big event but after a few beers I feel much better.

Hopefully, you will never experience these situations. In fact, they probably represent the exact opposite of what you and your athletes are working so hard to attain. Unfortunately, many common practices that are thought to be helpful or benign can actually create performance decrements equivalent to these scenarios.

Consider the diverse and complex array of factors that coaches and athletes address to achieve peak athletic performance and success. Conditioning, sport-specific skills training, nutrition, recovery, strength training, and mental/psychological considerations are just some examples of important factors that can significantly affect athletic performance. So, in all of your preparation, planning and training for your athletes and yourself, how and where do you address sleep, circadian rhythms (the body clock), and alertness?

Humans have some basic physiological requirements for survival: food, water, and air. Though often ignored or underestimated, sleep is also a basic human biological need, equal to food, water and air in its importance to life and for achieving optimal performance and alertness. Sleep is not elective; it is not an option, to be obtained when convenient. Overwhelming scientific data clearly show that sleep loss and circadian disruption can impair performance, degrade health, and disturb mood. More importantly, obtaining optimal sleep, addressing circadian factors, and effective use of alertness strategies can enhance performance, health, and mood and provide a competitive advantage.

An introduction to sleep and circadian basics, some example sleep and alertness strategies, and an approach to planning can provide an initial, informed foundation for addressing this basic physiological requirement.

I'm human, I sleep, I'm an expert.

About a decade ago, the National Sleep Foundation conducted a simple 10-item "Sleep IQ" test and found that 82% of respondents failed the test with an average score of 46% (1). Flipping a coin could provide a 50% score, so the average respondent did worse than chance. Generally, though our society has become more informed and active regarding exercise and nutrition, the need for sleep and its importance to our performance, alertness, safety, health, and mood continues to be ignored or diminished. Awareness about sleep may be increasing but knowledge and effective actions are alarmingly rare.

Here are four basics about sleep and circadian rhythms that everyone should know (2).

1. Sleep need. Physiologically, adult humans require about 8 hours of sleep; with a range of around 7 to 9 hours. The amount of sleep an individual requires is genetically determined and "training" cannot reduce this sleep requirement. Kids and young adults from junior high/middle school years through their early 20's physiologically require about 9 to 10 hours of sleep.

2. Sleep debt. Lose sleep and it builds into a cumulative sleep debt. Though most adults require about 8 hours of sleep, on average, they obtain about 1.5 hours less. This sleep loss accumulates into a sleep debt. For example, over a five-day work week, a daily 1.5 hours of sleep loss would build into a 7.5 hour sleep debt by the weekend. This equates to losing one full night of sleep (i.e., pulling an all-nighter) going into the weekend. (Coach, I had so much to do to prepare for today's competition that I had to stay up all night to be

ready.)

3. Circadian rhythms. Humans are hard-wired with a biological clock in the suprachiasmatic nucleus of the hypothalamus. This circadian (circa=around, dies=a day) clock controls the 24-hour rhythms of our physiological and behavioral activities. Its programming controls the 24-hour fluctuations in sleep/wakefulness, hormones, alertness, performance and is exhibited at the cellular level. Circadian disruption commonly occurs as a result of irregular schedules and crossing time zones and has similar negative effects on performance, alertness, health, and mood as sleep loss.

4. Experience ¹ reality. How alert an individual “feels” does not reflect reality. Generally, even though an individual might report feeling wide-awake and at peak alertness, the person’s actual performance could show significant impairment and the person might fall asleep in less than five minutes (a sign of pathological sleepiness). A person’s ratings of alertness and performance do not accurately reflect actual levels. This “disconnect” is one reason why individuals feel that sleep loss and circadian disruption have minimal or no effect.

Our whole society is sleep deprived, who cares?

Most people believe that they can lose sleep or disrupt their circadian clock with minimal or no consequences; ok, maybe they feel a little tired. Extensive scientific research clearly demonstrates that sleep loss and circadian disruption can degrade or impair just about every aspect of human capability and performance. For example, studies have shown that sleep loss can reduce judgment and decision-making, reaction time, attention, memory, communication skills, mood, and learning. Depending on the variable and amount of sleep loss, performance in these areas can be reduced by 10 to 50%. Performance during the lowest circadian point in the night could be reduced by up to 30%.

How much sleep loss does it take to see these levels of performance reduction? Studies have shown that getting 2 hours less sleep than needed can significantly impair performance. For example, in one study, allowing 8-hour sleepers to get only 6 hours of sleep (2 hours less than they needed) impaired performance to the equivalent of drinking 2-3 12 oz beers, a level that equates to about .05% breath ethanol concentration. Getting 4 hours of sleep (4 hours less than they needed) impaired performance to the equivalent of drinking 5-6 12 oz beers, a level that equates to about .10% breath ethanol concentration (3). (Coach, I couldn’t relax and just kept worrying about today’s big event but after a few beers I feel much better.)

Sleep loss and circadian disruption also can reduce safety and health. There could be an estimated 1 million car crashes annually due to fatigue and drowsy driving. National Sleep Foundation polls indicate that 60% of Americans have driven drowsy in the last year and 37% report nodding off at the wheel (1). Irregular schedules can be associated with up to a 50% increase in on-the-job injuries and accidents. Disturbed sleep and circadian disruption also can be associated with increased risks for heart and stomach problems, high blood pressure, cancer, pregnancy problems, obesity, anxiety, and depression.

Though not extensive, there are some scientific studies examining these issues and their effects on athletic performance. Most of the efforts have focused on circadian rhythms and circadian disruption associated with jet lag and travel across time zones. For example, one study found circadian variations in world record-breaking performances with most records broken by athletes in the early evening (4). Another study with British Olympic squad members showed performance impairments in several measures over a 5-day period after crossing multiple time zones (5). An examination of NFL Monday Night Football outcomes showed that West coast teams had a 20% higher win percentage compared to East coast teams playing at a worst circadian time (6). Even without overwhelming, solid data due to a paucity of studies, there is no justification to consider that the human physiological requirements related to sleep and circadian rhythms do not extend to athletes and their performance.

Optimal sleep and alertness strategies

There are a variety of scientifically validated strategies that are effective in promoting optimal sleep, alertness and performance. Here are two approaches for obtaining optimal sleep and one powerful strategy to increase performance and alertness.

1. Good sleep habits. The following “good sleep habits” should become part of everyone’s routine to obtain optimal sleep.

- a. Protect sleep from intrusions
- b. Keep a regular bedtime and wake time (whenever possible)
- c. Use a pre-bedtime routine to prepare for sleep
- d. Use the bed and bedroom for relaxation and sleep
- e. Avoid work and worry in the bed and bedroom
- f. Learn and practice a relaxation technique for sleep
- g. Avoid caffeine, alcohol, and exercise within at least 2 hours of sleep
- h. Get the sleep you need, make sleep a priority

2. Environmental factors. Evaluate and address the following “bedroom” factors.

- a. Noise (background vs intrusive events)
- b. Temperature (cooler is better than warmer)
- c. Light (use black out curtains; night light)
- d. Use a reliable, regular, effective alarm clock
- e. Determine personal comfort for mattress and pillows
- f. Consider privacy/security

3. Strategic naps significantly increase performance and alertness.

While at NASA, we conducted a study that provided commercial airline pilots a planned nap opportunity in-flight to determine the effects of a 40-min nap on performance and alertness (7). It remains a unique study, conducted in the real-world during actual flight operations with pilots flying 9 hour legs between the US and Japan, and included multiple flight legs both day and night. We physiologically monitored the pilots’ brainwaves and eye movements and they completed sensitive, validated performance tests (see photo). Our findings: on average, pilots fell asleep in about 6 minutes and slept for about 26 minutes. These 26-minute naps enhanced objective performance by 34% and increased physiological alertness by 54%, with effects lasting around 3 to 4 hours.

A planned nap is a very powerful alertness strategy that can significantly increase performance and alertness. Some general guidance for effective use:

- a. For a short nap, up to 40 minutes in length (helps to avoid deep sleep)
- b. For a longer nap, around 2 hours
- c. Avoid a long nap too close to planned bedtime
- d. Allow 10-15 minutes “wake-up” after nap
- e. Consider sleep aids: eye mask, ear plugs

Planning for optimal sleep and alertness

Before using any strategy in a travel or competitive situation, test it at home to ensure that it is safe, effective, and works for you and your athletes. Like any other aspect of coaching, training, strategy, and competition: have a plan. Create a specific plan for managing sleep, circadian rhythms and alertness at home and traveling to competitions. Identify specific strategies to obtain optimal sleep, how to manage circadian disruption, and when to use alertness strategies.

Without a plan or addressing the issues identified, performance will be reduced by sleep loss and circadian

disruption. Though only an introduction to a complex area, the knowledge and strategies presented can make a significant difference in successfully mitigating negative outcomes and helping to enhance performance and creating a competitive advantage. There is much more to learn and apply but you and your athletes will already have an edge by acknowledging these physiological and performance issues and applying strategies to achieve peak athletic performance through optimal sleep and alertness.

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