

SLEEP, RECOVERY, AND HUMAN PERFORMANCE

A Comprehensive Strategy for Long-Term Athlete Development

Post-exercise recovery and regeneration (PERR) is as important as the training regimen to the complex adaptive process of increasing athletic performance.¹ The foundation of PERR is sleep. Sleep constitutes the passive recovery, regeneration and rest process.



**CANADIAN
SPORT FOR LIFE**

Charles H. Samuels, MD, CCFP, DABSM & Brent N. Alexander, M.Sc

Table of Contents

Sleep, Recovery, and Regeneration	3
Sleep Length	5
Sleep Quality	9
Insomnia	10
Obstructive Sleep Apnea	11
Movement Disorders, Parasomnias	12
Environmental Sleep Disturbance	13
Mood Disorders	14
Sleep Phases	15
Final Comments	16
Sleep Recommendations	17
Sleep Log	18
References and Selected Readings	19

AUTHORS

Charles H. Samuels, MD, CCFP, DABSM ^{a,b}
Brent N. Alexander, M.Sc. ^a

a. Centre for Sleep and Human Performance
#106, 51 Sunpark Drive S.E.
Calgary, Alberta T2X 3V4, CANADA

b. Department of Family Medicine
University of Calgary
G012, Health Sciences Centre
3330 Hospital Drive, N.W.
Calgary, Alberta T2N 4N1, CANADA

Sleep, Recovery, and Regeneration



Sleep Recommendations

Active Start

(Females & Males 0-6 years)

Duration: 13-16 hrs

Quality:

- Establish and maintain a sleep/nap routine
- Ensure a comfortable/safe sleep environment
- Avoid stimulation 1-2 hrs before bed; minimize “screen time”

Phase:

- Consolidate nighttime sleep period
- Decrease naps to 1-2/day in the first year
- Natural light exposure first thing in the morning

Key Points:

- Establish stable sleep routines and a bedtime routine
- Use a sleep transition object
- Introduce independent sleep initiating behaviors

The effect of sleep on athletic performance has become a topic of great interest due to the growing body of scientific evidence that has demonstrated a relationship between critical sleep factors (sleep length, sleep quality and circadian sleep phase) and human performance.

Sleep, Recovery, and Regeneration

The role of sleep and the importance of sleep in Long-Term Athlete Development (LTAD) is the focus of this section.

Sleep factors have also been shown to have a direct effect on metabolic processes including energy balance, appetite and weight control. More importantly, sleep extension and circadian rhythm research in athlete populations has provided objective evidence that confirms the significance of these relationships and importance of considering sleep in LTAD.

The relationship of sleep to PERR and performance can be viewed in a structured fashion. Sleep length (total sleep requirement: hours/night), sleep quality (sleep disorders, environmental disturbance or fragmentation), and sleep phase (circadian timing of sleep) are the key factors affecting the overall recuperative outcome of the sleep state. These three parameters of sleep affect an athlete's ability to train, maximize the training response, and recover. Most importantly, these parameters change over the course of an athlete's career and life. Therefore, the athlete, parents and coaches have to have strategies to adjust to the changing sleep requirements throughout the athlete's career. **Finally, attending to the importance of sleep will reduce the risk of overtraining/under-recovery, enhance resistance to illness and improve recovery from injury.**

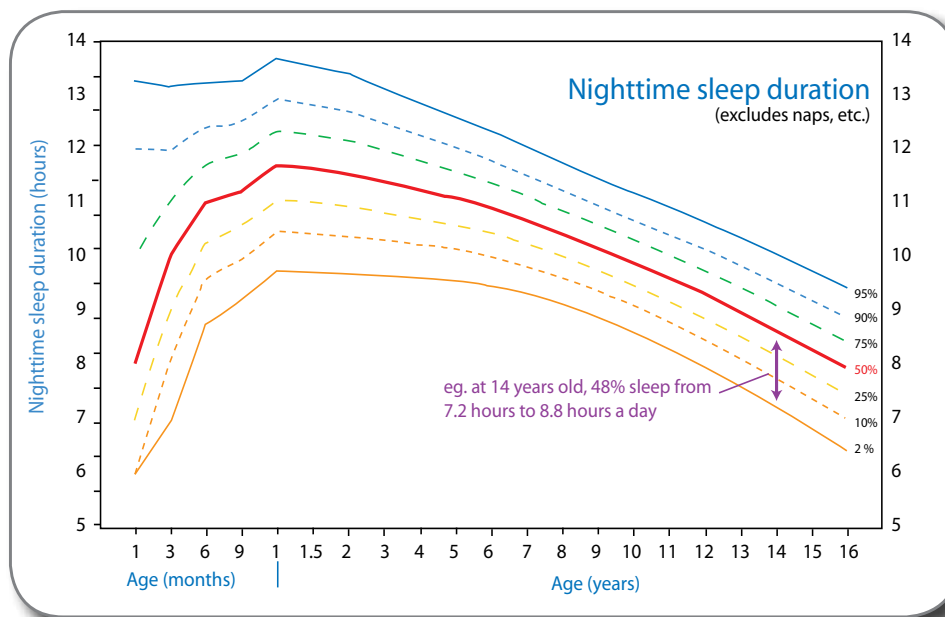
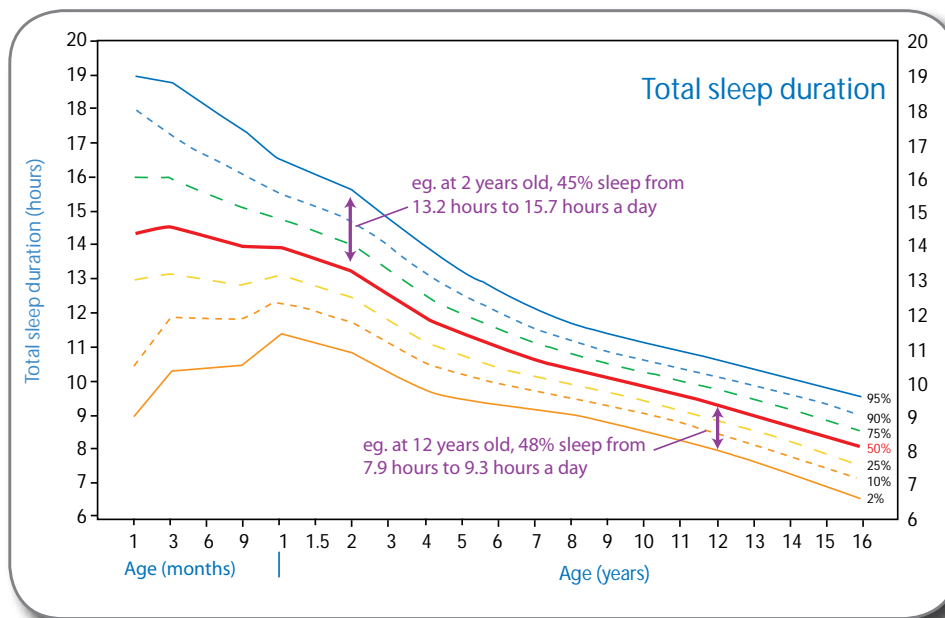


There is great interest and debate over the optimum amount of sleep (sleep length) required for humans to recuperate and function normally. Sleep requirements change over the course of an individual's life (figures 1 and 2). Figures 1 and 2 describe the general patterns of changes in sleep requirements and composition (sleep stages) over the course of a lifetime and provide sleep researchers/educators with the information to guide the advice provided for the athletes. It is a safe assumption that based on training demands the sleep requirement for an athlete would be greater than for the average individual who is not an athlete.

Therefore, establishing guidelines for athletes at various stages in their career development for sleep requirement, providing tools to assess sleep patterns/routines accurately and implementing strategies to achieve the recommended amount of sleep are important practical interventions. It is very important for athletes, parents and coaches to be aware of the fact that at the time in life (12–18 years old) when adolescents require the most amount of sleep (9–10 hours per night) they tend to develop a delay in their biological clock (circadian sleep phase) that reduces the amount of time available for sleep. This results in a chronic sleep restriction during a time of increasing training demands, growth and development.

Sleep Length

Figure 1 a & b. **Percentiles for total sleep duration** and nighttime sleep duration per 24 hours from infancy to adolescence. Adapted from Iglowstein et al. ³



Sleep Recommendations

FUNDamentals

(Females 6-8, Males 6-9)

Duration: 10-11 +30 min nap between 2-4pm

Quality:

- Maintain a regular sleep/nap routine
- Ensure a comfortable sleep environment
- Establish independent sleep initiating behaviors
- Observe sleep for sleep disorders

Phase:

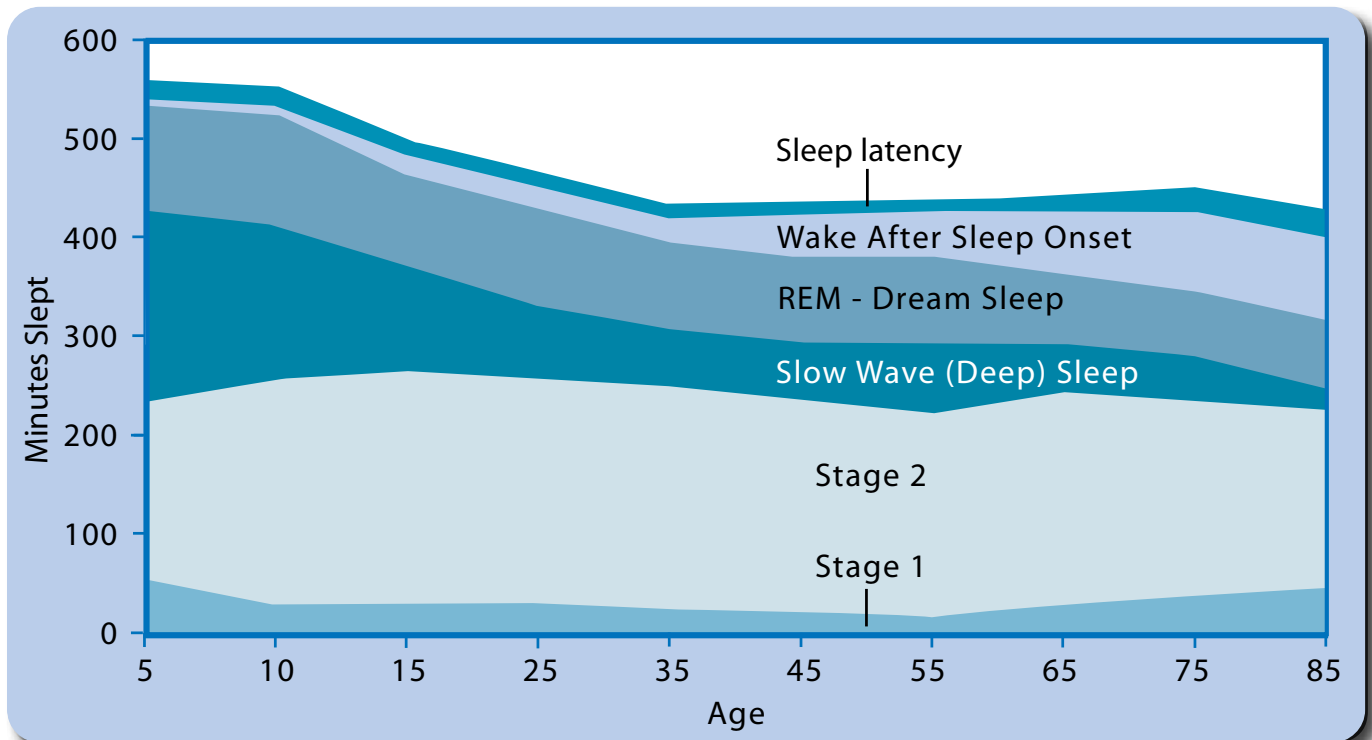
- Establish a neutral sleep pattern between 9pm and 8am.
- Encourage predictable afternoon nap/rest
- Establish reliable meal routines (breakfast is the most important meal of the day)

Key Points:

- Reinforce 15-30 min bedtime routine
- Avoid stimulation 1-2 hours before bed, control "screen time"
- Good nutrition and meal routines reinforce sleep routines
- Introduce independent sleep initiating behaviors

Sleep Length

Figure 2. **Sleep staging variations and changes** throughout the life span. Sleep latency – time to fall asleep, WASO – wake after sleep onset, REM – Dream Sleep, SWS – Slow Wave (Deep) Sleep, Stage 1 and 2 – Light Sleep. Adapted from Ohayon et al.⁴



From a Canadian perspective, a sample of 272 National and Olympic Team athletes and coaches ranging from 15 to 57 years old were screened during the 2009 annual medical review. The results revealed a range of 4.5 to 10.5 hours of sleep per night with an average of 7.8 hours of sleep per night in these athletes.

A recent study of intercollegiate athletes by Mah (2011) at Stanford University found that increasing the nightly sleep period of 18-20 year old varsity basketball players to at least 10 hours, for a duration of 5-7 weeks led to faster sprint times, increased accuracy, and improved overall ratings of physical and mental well-being during practices and games.² These results demonstrate a discrepancy between athletes' behaviours (how much sleep they get) and athletes' sleep requirements (how much sleep they need).

Therefore, it is important to establish sleep routines at the Active Start stage, maintain those routines insuring adequate sleep through the FUNdamental and Learn to Train stages (6 – 12 years old) and prepare for the challenges of getting adequate sleep (9 – 10 hours per night) during the Train to Train and Train to Compete stages (adolescence). This "upfront effort" will establish the importance of sleep and sleep routines for the demanding Train to Win stage so the added stress of travel can be more easily managed to reduce the impact of travel fatigue and jet lag.

Sleep Recommendations

Learn to Train

(Females 8-11, Males 9-12)

Duration: 9.5-10 +30 min nap between 2-4pm

Quality:

- Maintain a regular sleep/nap routine
- Ensure a comfortable sleep environment
- Observe sleep for sleep disorders

Phase:

- Maintain Neutral sleep pattern
- Get early morning light exposure for 30 min. daily*
- Maintain reliable nutrition routines (breakfast is the most important meal of the day)

Key Points:

- Maintain 15-30 min bedtime routine
- Monitor and control "screen time"
- Monitor caffeine intake

The lack of sleep or cumulative sleep debt is associated with changes in mood, concentration, motivation, endurance and recovery that have a negative effect on performance and put the athlete at risk for overtraining/under-recovery.

An athlete's total sleep requirement is the key to the foundation of PERR. The tools used to monitor sleep requirement are sleep logs (sample log on page 17). Sleep logs can be used to determine current behaviors and then to develop training and recovery routines to match the sleep requirement. Strategies for getting enough sleep include napping.

Sleep Length

Naps should also be a part of the routine and follow simple rules.

- 1) Naps should be limited to 30 minutes.
- 2) Naps should be scheduled in the mid to late afternoon (2 – 4pm) but not after 4pm so it does not affect the athletes ability to fall asleep at bedtime.
- 3) Naps can be combined with a dose of caffeine, for the older athletes (cup of coffee either before or immediately after the nap).



The combination of caffeine and napping has been shown to improve the restorative quality of the nap and post-nap alertness/concentration. It is paramount that the athlete determines the amount of sleep needed per week (e.g., 8 hours per day = 56 hours per week). This gives the athlete a sense of how much sleep they require and how much sleep debt they accumulate per week. With this information the athlete and support staff can develop sleep and napping strategies which will then dictate training routines with the ultimate goal of reducing cumulative sleep debt.

Sleep quality refers to the restorative quality of the sleep state/period and is subjectively assessed and reported by the athlete. The key point here is that an athlete may be getting “enough sleep” (hours/night) but the quality of the sleep could be poor and non-restorative. Typical factors that affect sleep quality are sleep disorders, environmental disturbance, and mood disorders. Normal sleepers usually fall asleep within 20-30 minutes of turning off the light and can sleep through the night with brief awakenings and wake spontaneously in the morning without an alarm feeling refreshed within an hour of waking up.

Sleep disorders are common and treatable, but often remain undiagnosed and untreated especially in children. Unrecognized sleep disorders affect personal health and may lead to chronic sleep loss which, in turn, can increase the risk of poor performance and injuries.



The most common sleep disorders that can affect athletic performance are insomnia, obstructive sleep apnea, movement disorders in sleep, and parasomnias. A sleep disorder in an athlete will compound the disturbance in sleep quality for the older athletes due to the chronic sleep disturbance and sleep loss resulting from rigorous training and competition schedules.

Sleep Recommendations

Train to Train

(Females 11-15, Males 12-16)

Duration: 9 +30 min nap between 2-4pm

Quality:

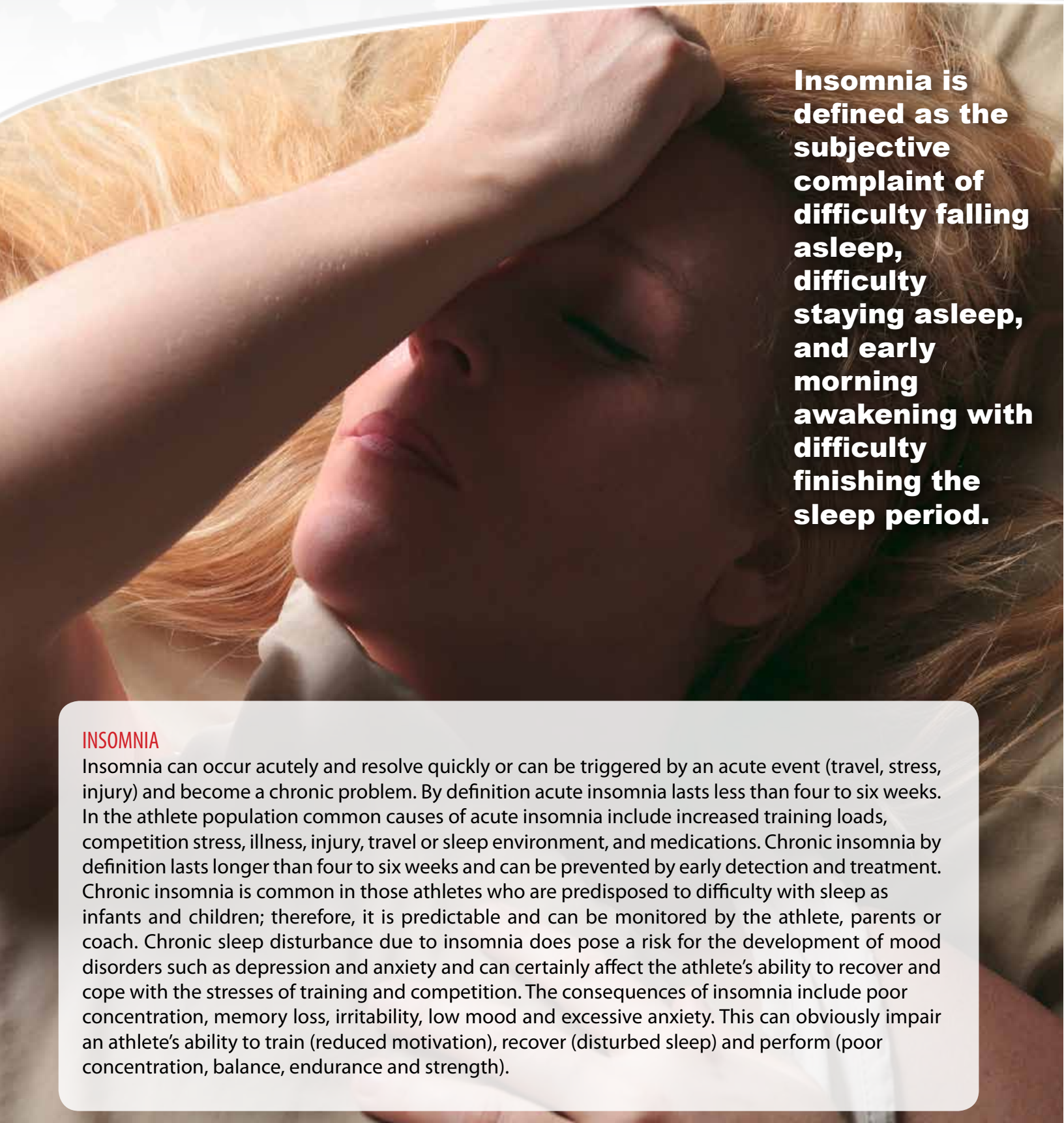
- Ensure a comfortable sleep environment
- Initiate regular napping strategy
- Monitor for excessive sleepiness & fatigue
- Observe sleep for sleep disorders

Phase:

- Maintain a regular sleep/nap routine
- Get early morning light exposure for 30 min daily*
- Monitor for a delayed sleep phase (difficulty falling asleep and waking up for school)
- Maintain reliable nutrition routines (breakfast is the most important meal of the day)

Key Points:

- Reinforce the importance of sleep routine
- Monitor for cumulative sleep debt (<9 hours/night or <56 hours/week)
- Monitor caffeine intake
- Do not train on an unrested body



Insomnia is defined as the subjective complaint of difficulty falling asleep, difficulty staying asleep, and early morning awakening with difficulty finishing the sleep period.

INSOMNIA

Insomnia can occur acutely and resolve quickly or can be triggered by an acute event (travel, stress, injury) and become a chronic problem. By definition acute insomnia lasts less than four to six weeks. In the athlete population common causes of acute insomnia include increased training loads, competition stress, illness, injury, travel or sleep environment, and medications. Chronic insomnia by definition lasts longer than four to six weeks and can be prevented by early detection and treatment. Chronic insomnia is common in those athletes who are predisposed to difficulty with sleep as infants and children; therefore, it is predictable and can be monitored by the athlete, parents or coach. Chronic sleep disturbance due to insomnia does pose a risk for the development of mood disorders such as depression and anxiety and can certainly affect the athlete's ability to recover and cope with the stresses of training and competition. The consequences of insomnia include poor concentration, memory loss, irritability, low mood and excessive anxiety. This can obviously impair an athlete's ability to train (reduced motivation), recover (disturbed sleep) and perform (poor concentration, balance, endurance and strength).

Obstructive sleep apnea (OSA) is a disorder associated with snoring and repeated interruption of breathing during sleep caused by obstruction of the upper airway.



OBSTRUCTIVE SLEEP APNEA

The obstruction occurs when the tongue relaxes during sleep and blocks the airway resulting in a pause in breathing, reduced oxygen levels and repeated arousal through the night. The obstructions in breathing occur repeatedly through the night, are usually not recognized by the individual and cause substantial disturbance to the sleep state. The most obvious symptoms of OSA include frequent cessation of breathing (apnea) during sleep that are observed by bed partners, loud and disruptive snoring, and choking or gasping during sleep. While OSA is rare in young healthy individuals, snoring is not. Those athletes who do snore (at any age) and do complain of non-restorative/restless sleep or daytime fatigue should be assessed for OSA because it is easily detected and treated. Obstructive sleep apnea that is left untreated in an athlete can seriously affect an athlete's ability to train, recover and perform.

Sleep Recommendations Train to Compete

(Females 15-21+/-, Males 16-23+/-)

Duration: 8 -10 +30 min nap between 2-4pm

Quality:

- Ensure a comfortable sleep environment when travelling and competing
- Monitor for competition stress & anxiety → insomnia
- Monitor for excessive sleepiness & fatigue
- Observe sleep for sleep disorders

Phase:

- Maintain regular sleep/nap routine
- Monitor for a delayed sleep phase (difficulty falling asleep and waking up for school)
- Get early morning light exposure for 30 min. daily
- Maintain reliable nutrition routines (breakfast is the most important meal of the day)

Key Points:

- Focus on reducing sleep debt. Get 56-70 hours of sleep/week
- Do not train if unrested and sleep deprived
- Avoid technology (screen time) before bed
- If your sleep is poor seek help

Movement disorders such as restless legs syndrome (RLS), periodic limb movements in sleep (rhythmic leg/arm kicking) and sleep bruxism (tooth grinding) are defined as sleep related movements that cause significant sleep disturbance.

MOVEMENT DISORDERS

Restless leg syndrome is characterized by a disturbing sensation in the legs and an irresistible need to move the legs that occurs when sitting quietly or in bed before falling asleep. Periodic limb movement disorder occurs during sleep and is characterized by rhythmic leg kicking and very restless sleep. Sleep bruxism or tooth grinding is characterized by audible grinding of the teeth during sleep and/or jaw tension causing sleep disruption and jaw and facial pain. These conditions occur in the athlete population and do disrupt the restorative quality of the sleep state.

Restless leg syndrome is hereditary (common within families) and occurs in individuals with low serum iron levels (common in female athletes). Periodic limb movement disorder is common in certain athlete populations such as swimmers. Sleep bruxism is common in those individuals who are anxious and stressed. Therefore, athletes who complain of non-restorative sleep or the symptoms of a movement disorder should see their doctor and get properly assessed and treated to preserve the integrity of the sleep state and PERR process.



PARASOMNIAS

Parasomnias (e.g., bedwetting, sleep walking, night terrors, and sleep eating) are unpleasant or undesirable behaviors that occur during sleep. Generally speaking, parasomnias are more common in childhood and tend to resolve during adolescence. While parasomnias tend not to be overly disturbing to the individual, they are disturbing to parents and bed partners. The fact is that if a parasomnia is present it can disturb the sleep state and PERR process. More importantly, the common triggers for parasomnias are emotional stress, sleep deprivation and medications that cause sedation or stimulation. Again, the important point here is that if these behaviors occur in an athlete and certainly if they occur while travelling the athlete should be assessed by their doctor and possibly referred to a sleep clinic for assessment.

ENVIRONMENTAL SLEEP DISTURBANCE

Environmental sleep disturbance is probably the most important and common modifiable factor affecting an athlete's sleep quality. Environmental sleep disturbance occurs when conditions in the surrounding sleep environment disturb the athlete's sleep. This can be caused by noise (bed partner snoring or noise from outside), bed motion (restless bed partner), light (through a window), temperature (being too hot or too cold), and most importantly from the athlete's exposure to technology (computer screens and smart phones) prior to sleep and during the sleep period. The sleep environment must be a sanctuary devoted to sleep and the room should be conducive to sleep. This means the athlete's pre-sleep routine should include a 1-2 hour downtime prior to bedtime that includes low light exposure, relaxing activities (no computer or video games and no excessive use of the smart phone). The bedroom should be quiet, pitch dark (light disturbs the sleep quality) and comfortable temperature and humidity. If noise and light are an issue the athlete should use earplugs and eyeshades for sleep (especially when travelling). The bed and mattress should be comfortable.

The sleeping environment should be respected by others to ensure that this area can be readily available for sleep. The sleep environment becomes more important and less stable when the athletes are travelling so it is important for the athlete to have a routine for managing sleep disturbance when travelling. Most importantly, the coaches need to attend to preferences if possible when the athletes are travelling, sharing rooms and sleeping in suboptimal environments.



Sleep Recommendations

Train to Win

(Females 18+, Males 19+)

Duration: 8-10 hrs +30 min nap between 2-4pm

Quality:

- Ensure a comfortable sleep environment when travelling and competing
- Monitor for competition stress & anxiety → insomnia
- Observe sleep for sleep disorders

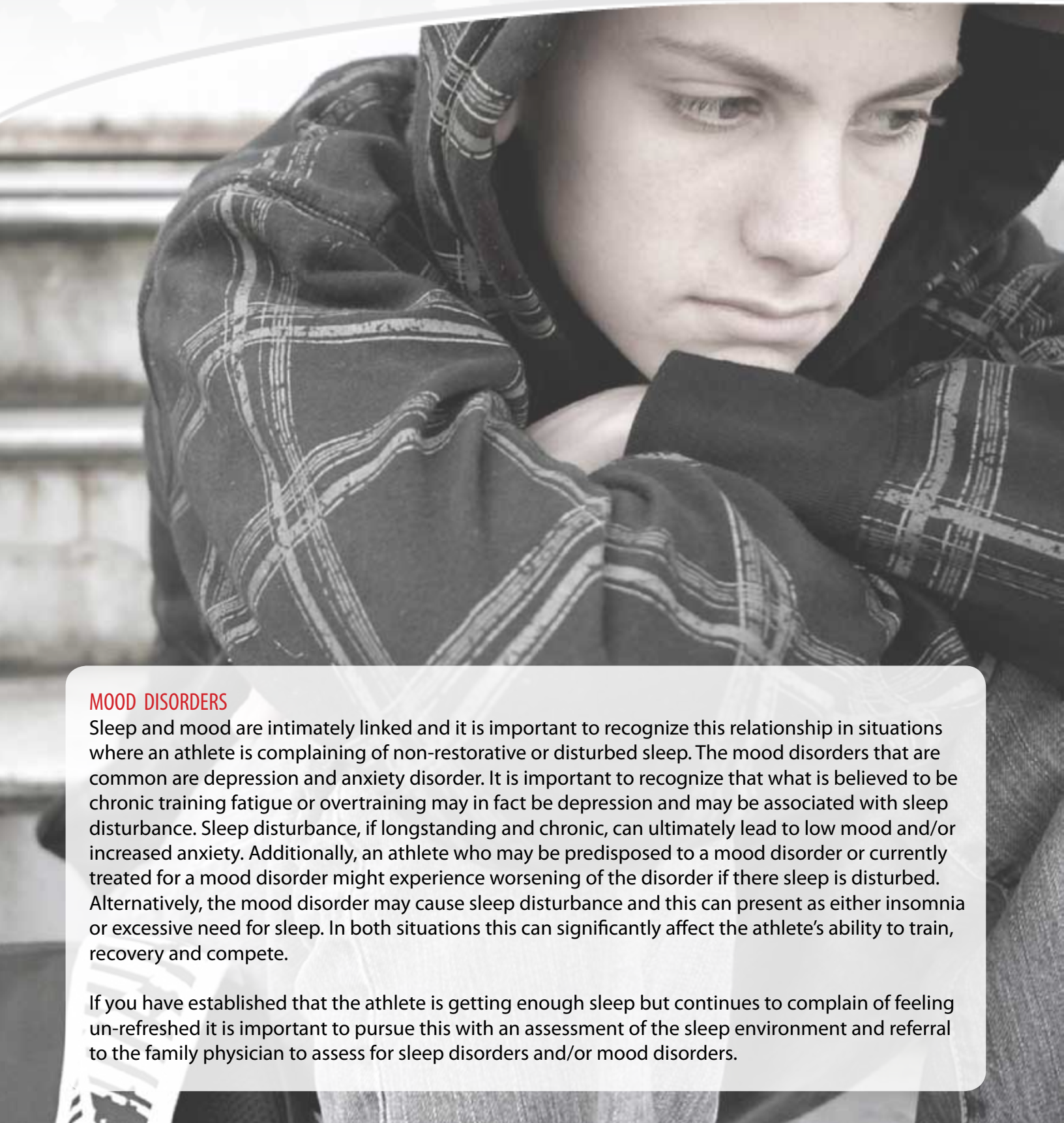
Phase:

- Maintain regular sleep/nap routine
- Monitor for a delayed sleep phase (difficulty falling asleep and waking up for school)
- Get early morning light exposure for 30 min daily*
- Maintain reliable nutrition routines (breakfast is the most important meal of the day)

Key Points:

- Focus on reducing sleep debt. Get 56–70 hours of sleep/week
- Do not train if unrested and sleep deprived
- Avoid technology (screen time) before bed
- If your sleep is poor get help

Mood Disorders



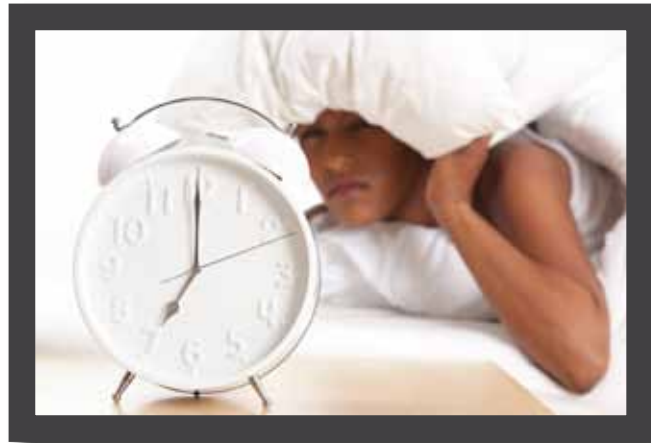
MOOD DISORDERS

Sleep and mood are intimately linked and it is important to recognize this relationship in situations where an athlete is complaining of non-restorative or disturbed sleep. The mood disorders that are common are depression and anxiety disorder. It is important to recognize that what is believed to be chronic training fatigue or overtraining may in fact be depression and may be associated with sleep disturbance. Sleep disturbance, if longstanding and chronic, can ultimately lead to low mood and/or increased anxiety. Additionally, an athlete who may be predisposed to a mood disorder or currently treated for a mood disorder might experience worsening of the disorder if there sleep is disturbed. Alternatively, the mood disorder may cause sleep disturbance and this can present as either insomnia or excessive need for sleep. In both situations this can significantly affect the athlete's ability to train, recovery and compete.

If you have established that the athlete is getting enough sleep but continues to complain of feeling un-refreshed it is important to pursue this with an assessment of the sleep environment and referral to the family physician to assess for sleep disorders and/or mood disorders.

CIRCADIAN SYSTEM

The circadian timing of sleep directly affects sleep length and sleep quality. Additionally, the circadian system regulates the feeling of sleepiness and wakefulness throughout the day which directly affects athletic performance. Generally speaking, upon awakening in the morning we feel alert until after lunch when most people become sleepy (the afternoon siesta time) for 30-60 minutes and then we are alert again with a peak in the evening around 6-8PM. Finally, as bedtime draws near, we become sleepy again and this facilitates the onset of sleep at bedtime. The circadian phase is genetically and environmentally determined. Each athlete has a preferred sleep schedule that suits his or her circadian phase; however, training, school, and work commitments can have a substantial impact on the athlete's ability to match their circadian phase to the available time for sleep. If the circadian phase and sleep schedule are not matched (out of phase) the amount of sleep that can be achieved, as well as the quality of that sleep will be affected. For example, adolescents have a natural tendency to become night owls, delaying bedtime. The delay in sleep onset (midnight to 1AM) in combination with having to get up for school (7-8am) and the fact that adolescents need 9-10 hours of sleep per day results in a chronic sleep debt that affects daytime performance, alters mood, increases appetite and impairs PERR. The circadian sleep phases can be managed and stabilized by establishing sleep routines as described in Table 1.



During adulthood, total sleep time tends to stay relatively stable and the amount of REM sleep tends to be maintained while the amount of SWS decreases and sleep progressively becomes lighter (more stage 1 and 2) and more disturbed (Figure 3). The three parameters of sleep discussed above (total sleep time, sleep disturbance, and circadian phase) are key factors that have dramatic impact on an athlete's potential to train, recover, and perform to an optimal level during competition, and as such, should form the basic foundation of every athlete's training regime.

Sleep Recommendations

Active for Life

(Any age participant)

Duration: 7-9 +30 min nap between 2-4pm

Quality:

- Maintain a regular sleep/nap routine keep your sleep debt to a minimum
- Ensure a comfortable sleep environment
- If your sleep is poor quality seek help!

Phase:

- Maintain a regular sleep schedule
- Get early morning light exposure for 30 min daily
- Maintain reliable nutrition routines (breakfast is the most important meal of the day)

Key Points:

- Get your sleep!
- Maintain meal routines and always eat breakfast
- Learn to nap
- Do not train if you are fatigued or sleep deprived

Final Comments



Sleep is the foundation of PERR. For the most part we have a tendency to ignore sleep or compromise sleep for other activities and not consider sleep a priority. Athletes have no choice but to make sleep a priority because their competitors do, and it could be the difference between winning and losing or experiencing a career ending injury. Parents, coaches and trainers have to help the athlete develop and maintain good sleep habits and routines during the off-season, pre-season and competitive season throughout the athlete's career. These routines have to take into account changing demands through the developmental stages such as sleep requirements, training volume/intensity and travel. The most important messages to remember and pass on to others are sleep requirements and potential disturbances change over time, establishing a sleep routine is the key, never compromise sleep for training, establish the importance of sleep early in the athletes career, provide time for sleep opportunity, and if the athlete complains of poor sleep get help.

Sleep and the Lifecycle of an Athlete

LTAD Stage Specific Sleep Recommendations	Sleep Recommendations			
	Duration (hrs/night)	Quality	Phase	Key Points
Active Start (Females & Males 0-6 years)	13-16	<ul style="list-style-type: none"> Establish and maintain a sleep/nap routine Ensure a comfortable/safe sleep environment Avoid stimulation 1-2 hrs before bed; minimize "screen time" 	<ul style="list-style-type: none"> Consolidate nighttime sleep period Decrease naps to 1-2/day in the first year Natural light exposure first thing in the morning 	<ul style="list-style-type: none"> Establish stable sleep routines and a bedtime routine Use a sleep transition object Introduce independent sleep initiating behaviors
FUNDamentals (Females 6-8, Males 6-9)	10-11 + 30 min nap between 2-4pm	<ul style="list-style-type: none"> Maintain a regular sleep/nap routine Ensure a comfortable sleep environment Establish independent sleep initiating behaviors Observe sleep for sleep disorders 	<ul style="list-style-type: none"> Establish a neutral sleep pattern between 9pm and 8am Encourage predictable afternoon nap/rest Establish reliable meal routines (breakfast is the most important meal of the day) 	<ul style="list-style-type: none"> Reinforce 15-30 min bedtime routine Avoid stimulation 1-2 hours before bed, control "screen time" Good nutrition and meal routines reinforce sleep routines
Learn to Train (Females 8-11, Males 9-12)	9.5-10 + 30 min nap between 2-4pm	<ul style="list-style-type: none"> Maintain a regular sleep/nap routine Ensure a comfortable sleep environment Observe sleep for sleep disorders 	<ul style="list-style-type: none"> Maintain Neutral sleep pattern Get early morning light exposure for 30 min. daily* Maintain reliable nutrition routines (breakfast is the most important meal of the day) 	<ul style="list-style-type: none"> Maintain 15-30 min. bedtime routine Monitor and control "screen time" Monitor caffeine intake
Train to Train (Females 11-15, Males 12-16)	9 + 30 min nap between 2-4pm	<ul style="list-style-type: none"> Ensure a comfortable sleep environment Initiate regular napping strategy Monitor for excessive sleepiness and fatigue Observe sleep for sleep disorders 	<ul style="list-style-type: none"> Maintain a regular sleep/nap routine Get early morning light exposure for 30 min. daily* Monitor for a delayed sleep phase (difficulty falling asleep and waking up for school) Maintain reliable nutrition routines (breakfast is the most important meal of the day) 	<ul style="list-style-type: none"> Reinforce the importance of sleep routine Monitor for cumulative sleep debt (<9 hours/night or <56 hours/week) Monitor caffeine intake Do not train on an unrested body
Train to Compete (Females 15-21 +/-, Males 16-23 +/-)	8-10 + 30 min nap between 2-4pm	<ul style="list-style-type: none"> Ensure a comfortable sleep environment when travelling and competing Monitor for competition stress and anxiety → insomnia Monitor for excessive sleepiness and fatigue Observe sleep for sleep disorders 	<ul style="list-style-type: none"> Maintain regular sleep/nap routine Monitor for a delayed sleep phase (difficulty falling asleep and waking up for school) Get early morning light exposure for 30 min. daily Maintain reliable nutrition routines (breakfast is the most important meal of the day) 	<ul style="list-style-type: none"> Focus on reducing sleep debt. Get 56-70 hours of sleep/week Do not train if unrested and sleep deprived Avoid technology (screen time) before bed If your sleep is poor seek help
Train to Win (Females 18+, Males 19+)	8-10 hrs + 30 min nap between 2-4pm	<ul style="list-style-type: none"> Ensure a comfortable sleep environment when travelling and competing Monitor for competition Stress & anxiety → insomnia Observe sleep for sleep disorders 	<ul style="list-style-type: none"> Maintain regular sleep/nap routine Monitor for a delayed sleep phase (difficulty falling asleep and waking up for school) Get early morning light exposure for 30 min. daily* Maintain reliable nutrition routines (breakfast is the most important meal of the day) 	<ul style="list-style-type: none"> Focus on reducing sleep debt. Get 56-70 hours of sleep/week Do not train if unrested and sleep deprived Avoid technology (screen time) before bed If your sleep is poor get help
Active for Life (Any age participant)	7-9 + 30 min nap between 2-4pm	<ul style="list-style-type: none"> Maintain a regular sleep/nap routine keep your sleep debt to a minimum Ensure a comfortable sleep environment If your sleep is poor quality seek help! 	<ul style="list-style-type: none"> Maintain a regular sleep schedule Get early morning light exposure for 30 min daily Maintain reliable nutrition routines (breakfast is the most important meal of the day) 	<ul style="list-style-type: none"> Get your sleep! Maintain meal routines and always eat breakfast Learn to nap Do not train if you are fatigued or sleep deprived

*see: <http://www.litebook.ca/>

Table 1. Stage specific recommendations for the critical determinants of sleep and associated key points. Adapted from Weiss.⁵

*EXAMPLE for completing sleep logs

SLEEP LOGS

(1) With a black marker, fill in time slept. (2) Fill in all nap times during the day. (3) Rate your sleep.

	PM	6	7	8	9	10	11	12	1	2	3	4	5	AM	6	7	8	9	10	11	12	1	2	3	4	5
Mon Jul 7																										

0 (very poor) – 10 (very good) sleep was rated 7

0 (exhausted) – 10 (refreshed), this morning I felt 6

	PM	6	7	8	9	10	11	12	1	2	3	4	5	AM	6	7	8	9	10	11	12	1	2	3	4	5
Tues Jul 8																										

0 (very poor) – 10 (very good) sleep was rated 4

0 (exhausted) – 10 (refreshed), this morning I felt 3

Patient Name: _____

Week Beginning: _____

	PM	6	7	8	9	10	11	12	1	2	3	4	5	AM	6	7	8	9	10	11	12	1	2	3	4	5
Date																										

0 (very poor) – 10 (very good) sleep was rated _____

0 (exhausted) – 10 (refreshed), this morning I felt _____

	PM	6	7	8	9	10	11	12	1	2	3	4	5	AM	6	7	8	9	10	11	12	1	2	3	4	5
Date																										

0 (very poor) – 10 (very good) sleep was rated _____

0 (exhausted) – 10 (refreshed), this morning I felt _____

	PM	6	7	8	9	10	11	12	1	2	3	4	5	AM	6	7	8	9	10	11	12	1	2	3	4	5
Date																										

0 (very poor) – 10 (very good) sleep was rated _____

0 (exhausted) – 10 (refreshed), this morning I felt _____

	PM	6	7	8	9	10	11	12	1	2	3	4	5	AM	6	7	8	9	10	11	12	1	2	3	4	5
Date																										

0 (very poor) – 10 (very good) sleep was rated _____

0 (exhausted) – 10 (refreshed), this morning I felt _____

	PM	6	7	8	9	10	11	12	1	2	3	4	5	AM	6	7	8	9	10	11	12	1	2	3	4	5
Date																										

0 (very poor) – 10 (very good) sleep was rated _____

0 (exhausted) – 10 (refreshed), this morning I felt _____

	PM	6	7	8	9	10	11	12	1	2	3	4	5	AM	6	7	8	9	10	11	12	1	2	3	4	5
Date																										

0 (very poor) – 10 (very good) sleep was rated _____

0 (exhausted) – 10 (refreshed), this morning I felt _____

	PM	6	7	8	9	10	11	12	1	2	3	4	5	AM	6	7	8	9	10	11	12	1	2	3	4	5
Date																										

0 (very poor) – 10 (very good) sleep was rated _____

0 (exhausted) – 10 (refreshed), this morning I felt _____

REFERENCES

- (1) Samuels C. Sleep, recovery, and performance: the new frontier in high-performance athletics. *Neurol Clin* 2008;26(1):169-180.
- (2) Mah CD, Mah KE, Kezirian EJ, Dement WC. The effects of sleep extension on the athletic performance of collegiate basketball players. *Sleep* 2011;34(7):943-950.
- (3) Iglowstein I, Jenni OG, Molinari L, Largo RH. Sleep duration from infancy to adolescence: reference values and generational trends. *Pediatrics* 2003;111(2):302-307.
- (4) Ohayon MM, Carskadon MA, Guilleminault C, Vitiello MV. Meta-analysis of quantitative sleep parameters from childhood to old age in healthy individuals: developing normative sleep values across the human lifespan. *Sleep* 2004;27(7):1255-1273.
- (5) Weiss SK. *Better Sleep for Your Baby & Child*. Toronto: Robert Rose Inc.; 2006.

SELECTED READINGS

- “Say Good Night to Insomnia: the 6-week solution” by G.S. Jacobs.
This book is an excellent resource for athletes who struggle with insomnia.
- “Take a Nap! Change Your Life.” by S.C. Mednick.
This book is recommended reading for athletes, coaches and trainers and gives excellent advice about napping routines.
- “Better Sleep for Your Baby and Child: A Parent’s Step-by-Step Guide to Healthy Sleep Habits” by S.K. Weiss.
This book is a must read for parents and gives excellent advice for establishing good sleep routines for babies, children and teenagers.

www.canadiansportforlife.ca



/CANADIANSPORTFORLIFE
/ACTIVEFORLIFE



@CS4L_ACSV
@ACTIVEFORLIFE



CANADIANSPORTFORLIFE
ACTIVEFORLIFEC4L

Other Canadian Sport for Life Resources

Canadian Sport for Life Resource Paper
A Sport Parent's Guide
Developing Physical Literacy
No Accidental Champions

Articles

The Role of Monitoring Growth in Long-Term Athlete Development
Competition is a Good Servant, but a Poor Master
Linking Sport for Life with Management by Values
Maximizing the Sport Experience for our Children
Recovery and Regeneration for Long-Term Athlete Development
The Female Athlete Perspective

We acknowledge the financial support of the
Government of Canada through Sport Canada,
a branch of the Department of Canadian Heritage.

Canada 