Sleep: the young athlete's ultimate performance-enhancing drug

Kevin C. Smith, PhD

Pediatric Psychologist

Division of Developmental and Behavioral Sciences

Division of Pediatric Pulmonary and Sleep Medicine

Children's Mercy Kansas City

Children's Mercy KANSAS CITY

UMKC School of Medicine

BEST CHILDREN'S HOSPITALS U.S.News & WORLD REPORT RANKED IN 10 SPECIALTIES 2018-19

MAGNET RECOGNIZED AMERICAN NURSES CREDENTIALING CENTER

© The Children's Mercy Hospital, 2017

- I have no financial conflicts of interest to disclose.

Today's objectives:

- Describe the parameters of healthy sleep in children and adolescents
- Discuss the effects of sleep on athletic performance
- Discuss adaptive and maladaptive sleep habits
- Identify recommendations to improve the sleep of the student athlete

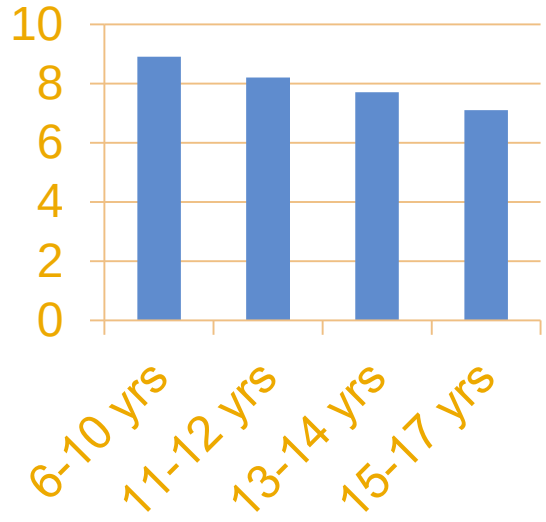
Children's Mercy KANSAS CITY



Children's Mercy KANSAS CITY

How much sleep are children getting?





Parent report: National Sleep Foundation's 2014 *Sleep in America* Poll

Children's Mercy KANSAS CITY

Contributors to teen sleep deprivation

- Personal electronics usage
  - Teens using electronic devices for 1 hour a day:
    - 35 percent slept fewer than seven hours.
  - Teens using electronic devices for five-plus hours a day:
    - 52 percent slept fewer than seven hours
    - 50 percent more likely to sleep less than teens who only use electronics 1 hour a day.

Children's Mercy KANSAS CITY

Twenge, J. M., Krizan, Z., & Hisler, G. (2017)

Contributors to teen sleep deprivation

- Caffeine usage
  - Three-quarters of adolescents report drinking at least one caffeinated beverage daily, and nearly one-third (31%) consume two or more such drinks each day.
  - Not surprisingly, teens who drink caffeinated beverages get less sleep than those who don't.
- Overscheduling/school schedules
- Stress
- Medical/psychological issues

National Sleep Foundation 2006, 2011 Sleep in America Poll

Non-restorative sleep and medical/mental health disorders

- Feeling unrefreshed after getting up in the morning (≥ 3x week) associated with greater frequency of:
  - upper airway inflammatory diseases, digestive (GERD) systems
  - mental health problems
  - metabolic (diabetes mellitus)
  - dermatological and immune/inflammatory (eczema and upper airway inflammatory diseases)
  - musculoskeletal (arthritis), ophthalmological (eye diseases)

Children's Mercy KANSAS CITY

Zhang et al, Sleep Medicine, 2012

Prevalence rates

- "Poor sleepers"
  - University students: 60%
  - *General population: 10-60%; insomnia diagnosis: 2-3%
  - Elite (adult) athletes: 33-50%
    - Most vulnerable prior to major competitive events, during periods of high-intensity training and following longhaul travel to competitions
  - Student (college) athletes: 66%

Children's Mercy KANSAS CITY

Bhaskar et al., 2016; Gupta et. al., 2017;

Prevalence rates

- Student athletes
  - High level of fatigue: 23%
  - Less than 7 hours of sleep: 43%
  - More than 30 minutes to fall asleep: 29%
  - Mild insomnia: 32%
  - Moderate insomnia: 12%

Brown et al., 2014; “Sleep and Health in Student Athletes” NCAA

Children's Mercy KANSAS CITY

Teen athletes have additional unique sleep deprivation risks

- Training schedules/games
  - Both before school and late night
- Traveling across time zones
  - Jet lag (mental/physical fatigue, altered appetite, irritability, constipation)
  - Can affect athletic performance

(Copenhaver & Diamond, 2017; Watson, 2017)

Children's Mercy KANSAS CITY

Teen athletes have additional unique sleep deprivation risks

- Psychological impact of athletic competition; Concomitant academic pressures; stress
  - May be =/> detrimental to sleep than decreased sleep from practices, games
- Increased risk for some medical sleep issues
  - Sleep disordered breathing
    - general population=4%; football players=14%; young-adult rugby players=43%
  - Restless leg syndrome

Children's Mercy KANSAS CITY

(Copenhaver & Diamond, 2017; Watson, 2017; Yoshitaka et al., 2019)







Children's Mercy KANSAS CITY

Sleep is a performance enhancer

- Accuracy/reaction time
  - 1 night of <=5 hours of sleep
    - Serving accuracy (tennis) decreased 53%
    - Decrease in dart throwing accuracy
  - Accumulated sleep debt=worsening end of week reaction time in student athletes
- (Watson, 2017)

Children's Mercy KANSAS CITY

Sleep is a performance enhancer

- Accuracy/reaction time
  - Increase in sleep of collegiate male basketball players
    - 2 hrs per night over several weeks
      - 9% increase in free throw and field goal percentages
  - 1.6 hr increase in sleep for tennis players
    - 36-41% increase in serving accuracy
  - Consistent findings across studies

(Watson, 2017)

Sleep is a performance enhancer

- Endurance
  - Sleep deprivation (24-30 hrs, minimal sleep per night):
    - Decreased performance in treadmill trails, time trials (cyclists), volleyball player exhaustion, maximal weights lifted
  - Increase of 2 hrs of sleep in collegiate basketball players
    - Improved sprint times, self report of performances in game, practice

(Watson, 2017)

Children's Mercy KANSAS CITY

Sleep is a performance enhancer

- Endurance
  - Mechanism(s) may be:
    - an increase in perceived exertion
    - Impaired recovery between bouts of strenuous exercise
    - Decrease levels of preexercise muscle glycogen stores
  - Results are mixed; May be more impactful during prolonged submaximal or progressive efforts

Children's Mercy KANSAS CITY

(Watson, 2017)

Sleep is a performance enhancer

- Injury prevention
  - Teens who sleep fewer than 8 hours
    - 1.7x more likely to have an injury
  - Injuries rates in youth athletes increase in games the day after <6 hours of sleep
  - Fatigue can increase decision-making errors which may increase risk of injury

Children's Mercy KANSAS CITY

(Copenhaver & Diamond, 2017)

Sleep is a performance enhancer

- Learning/executive function
  - attention and working memory, long-term memory and decision-making influenced by sleep deprivation
  - skills acquisition
    - Teen soccer players have steeper learning curves after habitual sleep versus period of sleep deprivation

(Watson, 2017)

Children's Mercy KANSAS CITY

Recommendations to improve adolescent athletes' sleep

- Screen for sleep problems during your outpatient visits
  - BEARS measure of sleep
    - Public domain (free)
    - Empirical support
    - Brief

(Owens and Dalzell, 2005)

	Preschool (2–5 y)	School-age (6–12 y)	Adolescent (13–18 y)
Bedtime issues	**To parent:** Does your child have any problems going to bed? Falling asleep?	**To parent:** Does your child have any problems at bedtime? **To child:** Do you have any problems going to bed?	**To child:** Do you have any problems falling asleep at bedtime?
Excessive daytime sleepiness	**To parent:** Does your child seem overtired or sleepy a lot during the day? Does he/she still take naps?	**To parent:** Does your child have difficulty waking in the morning, seem sleepy during the day or take naps? **To child:** Do you feel tired a lot?	**To child:** Do you feel sleepy a lot during the day? In school? While driving?
Awakenings during the night	**To parent:** Does your child wake up a lot at night?	**To parent:** Does your child seem to wake up a lot at night? Any sleepwalking or nightmares? **To child:** Do you wake up a lot at night? Have trouble getting back to sleep?	**To child:** Do you wake up a lot at night? Have trouble getting back to sleep?
Regularity and duration of sleep	**To parent:** Does your child have a regular bedtime and wake time? What are they?	**To parent:** What time does your child go to bed and get up on school days? Weekends? Do you think he/she is getting enough sleep?	**To child:** What time do you usually go to bed on school nights? Weekends? How much sleep do you usually get?
Sleep-disordered breathing	**To parent:** Does your child snore a lot or have difficulty breathing at night?	**To parent:** Does your child have loud or nightly snoring or any breathing difficulties at night?	**To parent:** Does your teenager snore loudly or nightly?

KANSAS CITY

(Owens and Dalzell, 2005)

Pediatric Insomnia Severity Index

Use the following scale when answering the questions:

0=Never 1=Once in a while 2=Sometimes 3=Quite Often 4=Frequently 5=Always

- (0 nights) (1-2 nights) (2-3 nights) (4-5 nights) (5-6 nights) (7 nights)
- 1) My child takes longer than 30 minutes to fall asleep after going to bed 0 1 2 3 4 5
- 2) My child has trouble falling asleep at bedtime. 0 1 2 3 4 5
- 3) My child awakes more than once during the night 0 1 2 3 4 5
- 4) After waking during the night may child has trouble returning to sleep 0 1 2 3 4 5

Children's Mercy KANSAS CITY

Pediatric Insomnia Severity Index

- 5) My child appears sleepy during the day 0 1 2 3 4 5

Number of hours per night

0=11-13 1=9-11 2=8-9 3=7-8 4=5-7 5=less than 5

- 6) How many hours of sleep does your child get on most nights? 0 1 2 3 4 5

No clinical cutoff, useful to track improvement over time

Children's Mercy KANSAS CITY

Recommendations to improve adolescent athletes' sleep

- Personal sleep monitors (e.g. fitbit)
  - Accessible, relatively inexpensive
  - Accuracy="OK", can identify trends, gets teens talking about their sleep
  - Sleep diaries work too (and they are free)*
  - If your clients/patients have sleep monitor, great, but not necessary

Children's Mercy KANSAS CITY

Recommendations to improve adolescent athletes' sleep

- Make sleep referrals as needed
  - Physical sleep concerns? Patient tired even after adequate amount of sleep OR never feels rested?
    - PCP/PNP, sleep specialist as needed
  - Insomnia, severe sleep habits, sleep environment, and/or sleep scheduling challenges?
    - Behavioral sleep psychologist/specialist, mental health specialist

Children's Mercy KANSAS CITY

Teen sleep tips

- At least 9 hours in bed
- Regular sleep schedule (weekday and weekend)
- Avoid caffeine. OR at least after 2PM.
- Break from electronics 30-60 min before bed

Teen sleep tips

- Create a bedroom environment conducive to sleep
  - Dark, quiet, comfortable temperature, comfortable bed
- Napping:
  - Short naps (<45 minutes) can be effective
    - Insomnia at night? No naps

Children's Mercy KANSAS CITY

Recommendations to improve adolescent athletes' sleep

- Use sports figures as sleep role models
  - Huffington Post professional sports figures' interviews about sleep
    - Kevin Durant, Larry Fitzgerald, Michelle Wii, LeBron James, Roger Federer, Lindsey Vonn

Children's Mercy KANSAS CITY

Recommendations to improve adolescent athletes' sleep: practice and games

- Afternoon training (versus before school/late night)
  - Allows for delayed wake time
  - Fewer circadian rhythm disruptions
- Traveling for games: Allow one day of recovery for each time zone crossed
- Practice and competition schedules that allow for rest and recovery between sessions

Children's Mercy KANSAS CITY

(Copenhaver & Diamond, 2017; Watson, 2017)

Resources

- How important is sleep for my young athlete?
  - http://nyshsi.org/wp-content/uploads/2012/08/NYSHSI-SLEEP.pdf
- Huffington post athletes' sleep
  - https://www.huffingtonpost.com/2014/08/13/these-famous-athletes-rely-on-sleep_n_5659345.html

Resources

- Sleep diary for kids sleepforkids
  - http://www.sleepforkids.org/pdf/SleepDiary.pdf
- Sleep and Athletes Gatorade sports science https://www.gssiweb.org/sports-science-exchange/article/sse-167-sleep-and-athletes
- Technology impacts sleep quality sleep.org
  - https://www.sleep.org/articles/ways-technology-affects-sleep/

Children's Mercy KANSAS CITY

Resources

- Teen sleep tips written for parents
  - https://www.sleepfoundation.org/sites/default/files/inline-files/teenstips.pdf
  - https://www.nhs.uk/live-well/sleep-and-tiredness/sleep-tips-for-teenagers/
- Sleep tips written for teens Washington.edu
  - https://depts.washington.edu/hcsats/PDF/TF-%20CBT/pages/4%20Coping%20Skills/Sleep/Sleep%20Tips%20for%20Teens.pdf

Children's Mercy KANSAS CITY

- BEARS sleep screening algorithm
  - https://www.google.com/search?rlz=1C1GGRV_enUS784US784&ei=uiudXP7zBqi0jwTF8KSwCA&q=BEARS+sleep+screening+algorithm&oq=BEARS+sleep+screening+algorithm&gs_l=psy-ab.3..0.33694.49420..49876...1.0..0.86.1993.32.....0....1..gws-wiz.....0i71j0i67j0i131j0i131i67j0i13j0i13i30j0i22i30j0i22i10i30.JRp2ewR6eJU
- Pediatric Insomnia Severity Index
  - Byars, K. C., Simon, S. L., Peugh, J., & Beebe, D. W. (2017). Validation of a brief insomnia severity measure in youth clinically referred for sleep evaluation. *Journal of pediatric psychology*, *42*(4), 466-475.

References

- Bhaskar, S., Hemavathy, D., & Prasad, S. (2016). Prevalence of chronic insomnia in adult patients and its correlation with medical comorbidities. *Journal of family medicine and primary care*, *5*(4), 780.
- Brown, G. T., Hainline, B., Kroshus, E., & Wilfert, M. (2014). Mind, body and sport: understanding and supporting student-athlete mental wellness. *Indianapolis: IN: NCAA*.
- Byars, K. C., Simon, S. L., Peugh, J., & Beebe, D. W. (2017). Validation of a brief insomnia severity measure in youth clinically referred for sleep evaluation. *Journal of pediatric psychology*, *42*(4), 466-475.

References

- Copenhaver, E. A., & Diamond, A. B. (2017). "The value of sleep on athletic performance, injury, and recovery in the young athlete." *Pediatric annals* 46.3 (2017): e106-e111.
- Gupta, L., Morgan, K., & Gilchrist, S. (2017). Does elite sport degrade sleep quality? A systematic review. *Sports Medicine*, *47*(7), 1317-1333.
- Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., ... & Neubauer, D. N. (2015). National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep health*, *1*(1), 40-43.
- "National Sleep Foundation 2014 poll" http://www.sleepfoundation.org/sleep-polls-data/sleep-in-america-poll/2014-sleep-in-the-modern-family.

Children's Mercy KANSAS CITY

References

- NCAA: Sleep and Health in Student Athletes” grant report. https://www.ncaa.org/sites/default/files/2017RES_InnoGrant_Grandner_FinalReport_20170206.pdf
- Owens, J. A., & Dalzell, V. (2005). Use of the ‘BEARS’sleep screening tool in a pediatric residents' continuity clinic: a pilot study. *Sleep medicine*, *6*(1), 63-69.

Children's Mercy KANSAS CITY

References

- Twenge, J. M., Krizan, Z., & Hisler, G. (2017). Decreases in self-reported sleep duration among US adolescents 2009–2015 and association with new media screen time. *Sleep medicine*, *39*, 47-53.
- Watson, A. M. (2017). Sleep and athletic performance. *Current sports medicine reports*, *16*(6), 413-418.
- Yoshitaka Iso, Hitomi Kitai, Etsushi Kyuno, Fumiyoshi Tsunoda, Naoya Nishinaka, Masahiko Funato, Eiichi Nishimura, Shuichi Akihiro, Hiroyuki Tanuma, Toru Yonechi, Eiichi Geshi, Takeyuki Sambe, Hiroshi Suzuki. Prevalence and significance of sleep disordered breathing in adolescent athletes. *ERJ Open Research*, 2019; 5 (1): 00029-2019 DOI: 10.1183/23120541.00029-2019

Children's Mercy KANSAS CITY

References

- Zhang, J., Lam, S. P., Li, S. X., Li, A. M., & Wing, Y. K. (2012). The longitudinal course and impact of non-restorative sleep: a five-year community-based follow-up study. *Sleep medicine*, *13*(6), 570-576.

Children's Mercy KANSAS CITY