The Role of Sleep in Elite Athletes Performance

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Sleep

What is good sleep?

- Fall asleep within 30min
- Sleep through the night with brief awakenings
- Feel refreshed within 1 hour of awakening (5-7 days per week)

Consequences of Sleep Deprivation- Performance

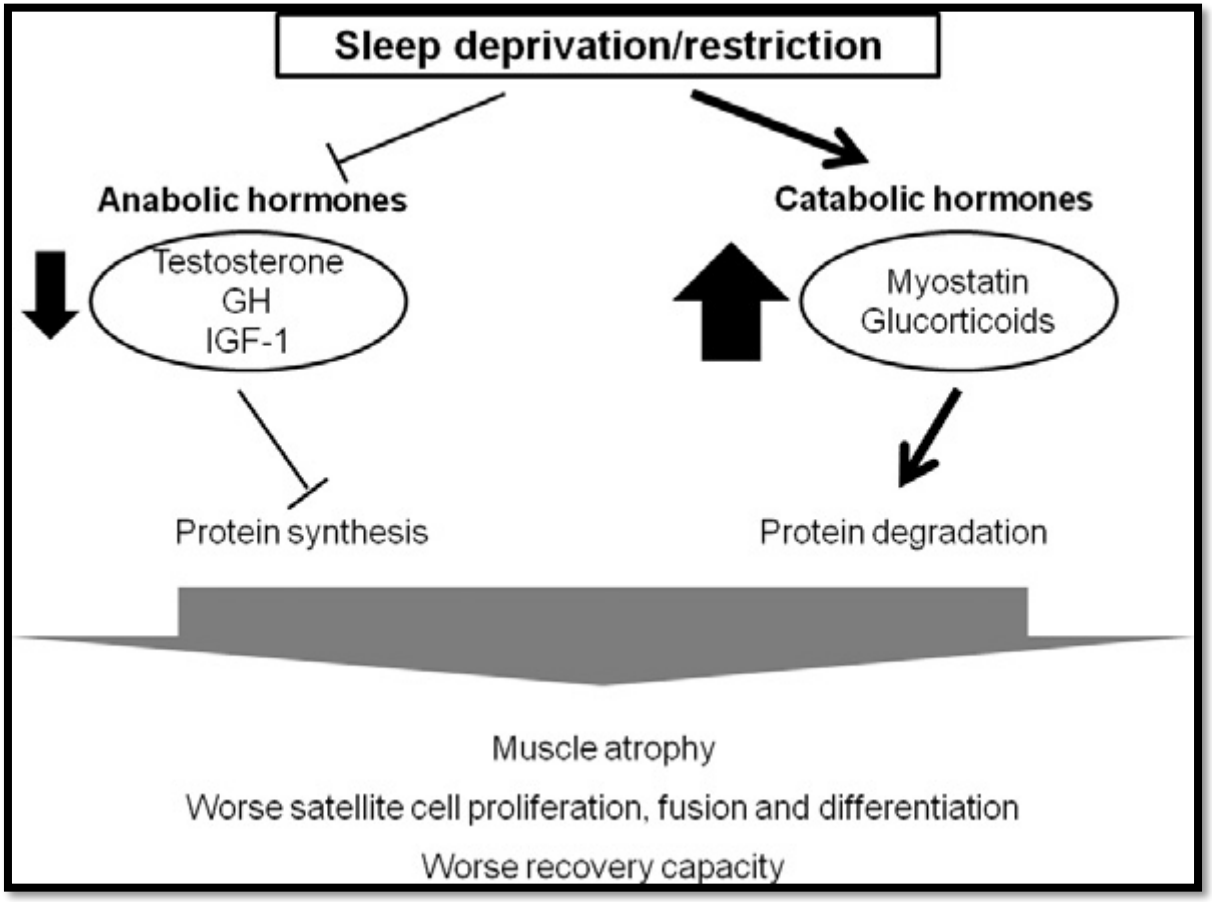
Two phenomena exist:

1. Sleep deprivation must be greater than 30 hours to have an impact on performance
2. Sustained or repeated bouts of exercise are affected to a greater degree than one-off maximal efforts (Reilly and Edwards, 2007; Blumert et al. 2007).

However, most athletes are more likely to experience acute bouts of partial sleep deprivation where sleep is reduced for several hours on consecutive nights.

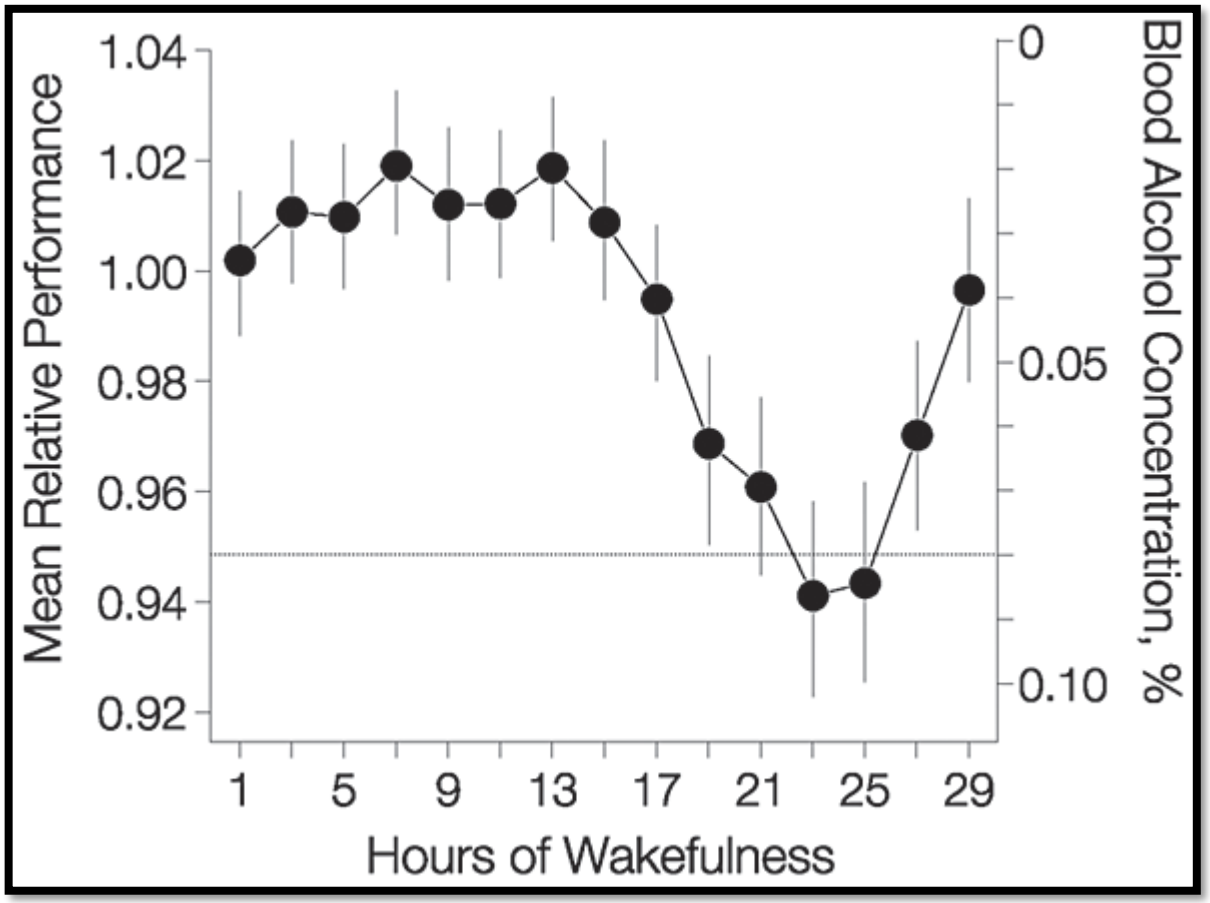
Sub-maximal prolonged tasks may be more affected than short maximal efforts (Reilly and Piercy, 1994).

Consequences of Sleep Deprivation- Recovery



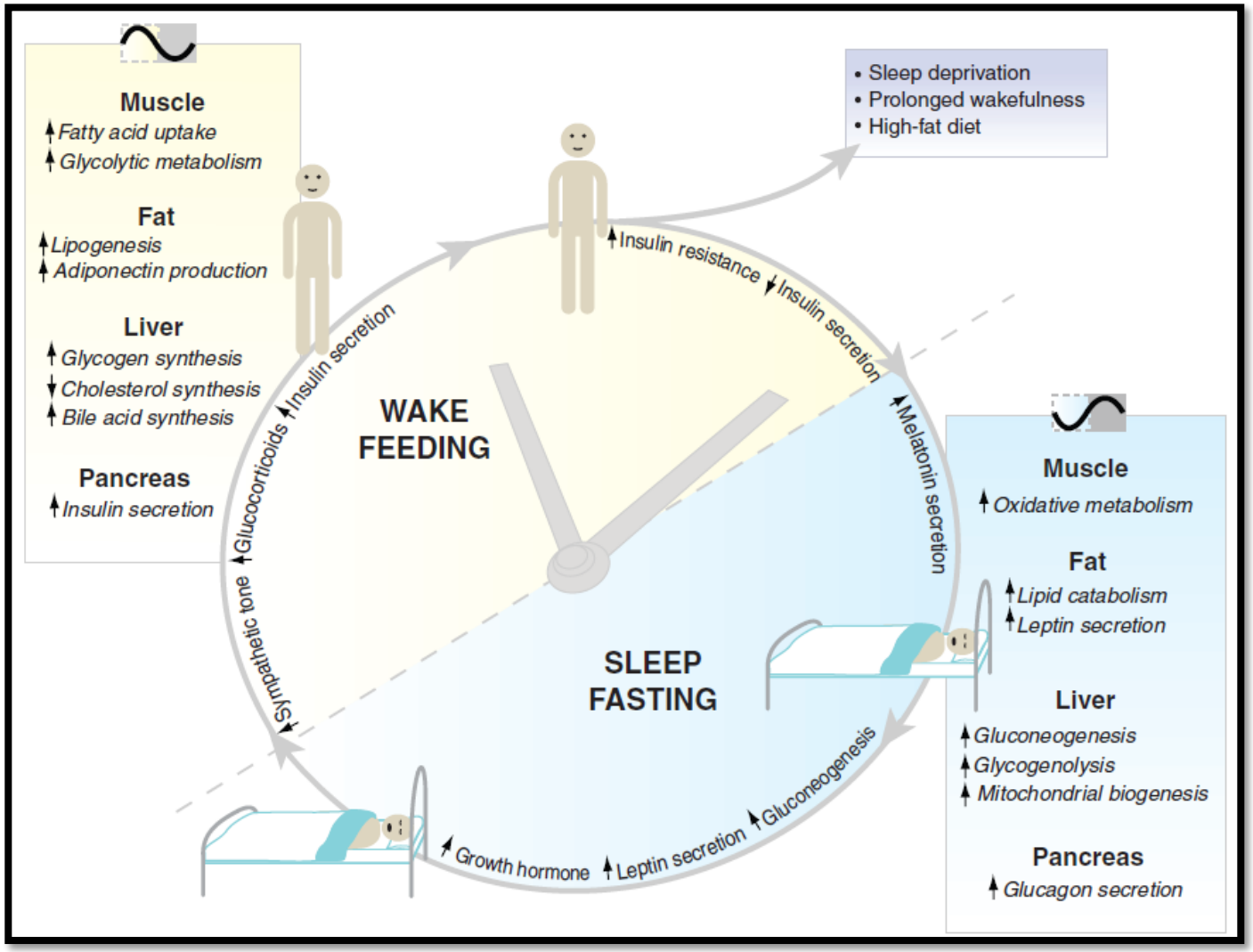
Dattilo et al. Medical Hypotheses, 2011

Consequences of Sleep Deprivation- Cognition



Dawson D et al. Nature, 1997

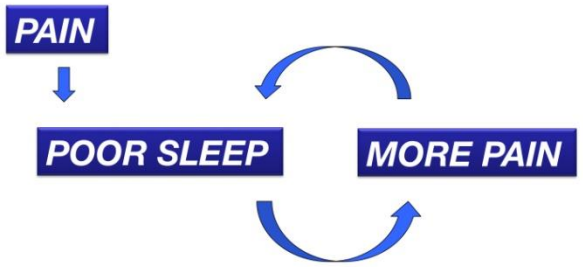
Consequences of Sleep Deprivation- Metabolism



Bass et al. Science, 2010

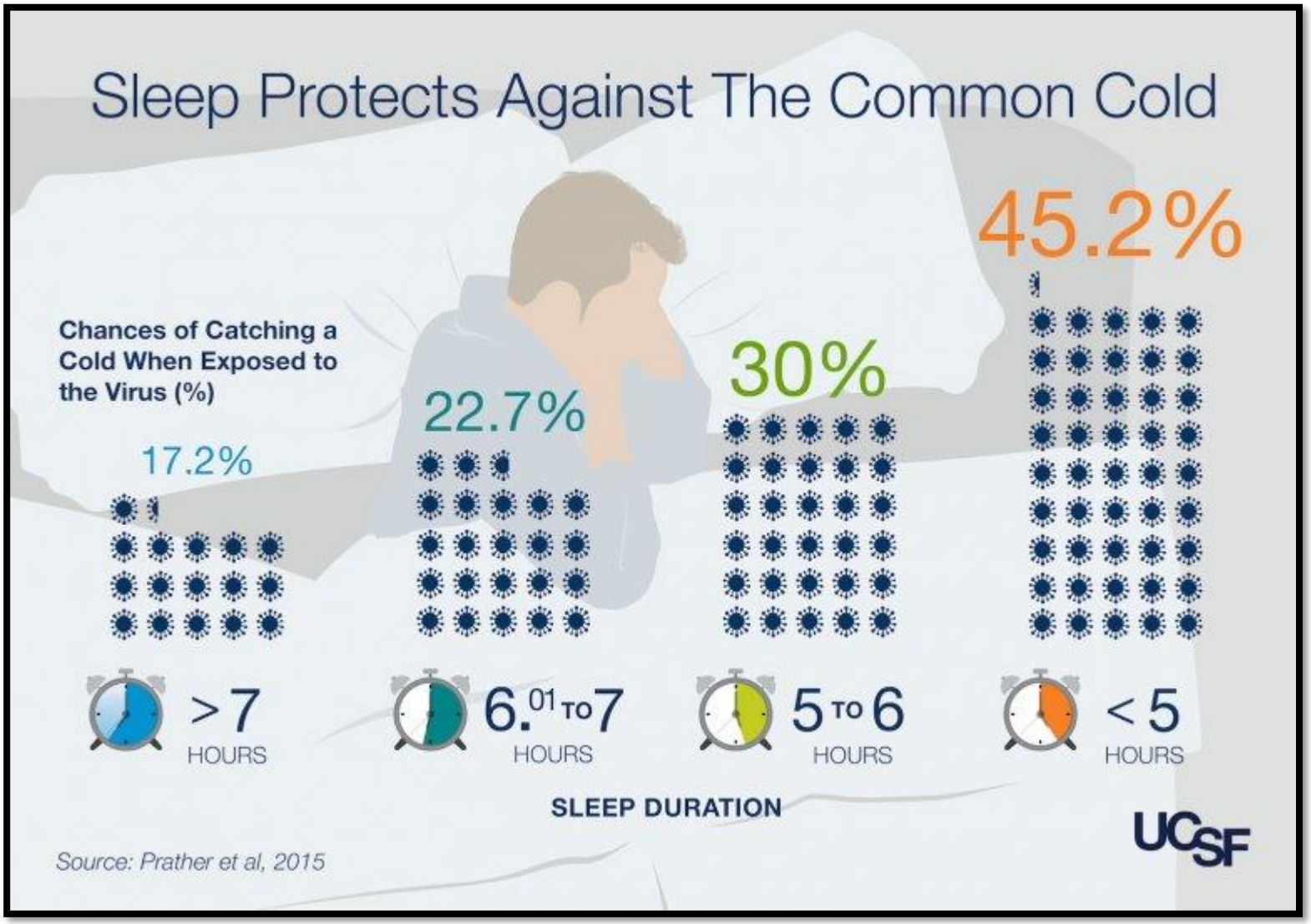
Consequences of Sleep Deprivation- Pain

- Sleep deprivation increases pain sensitivity and vulnerability to pain
- Pain enhances arousal and disrupts sleep
- A vicious cycle with sleep disorder and chronic pain maintaining and augmenting each other may result

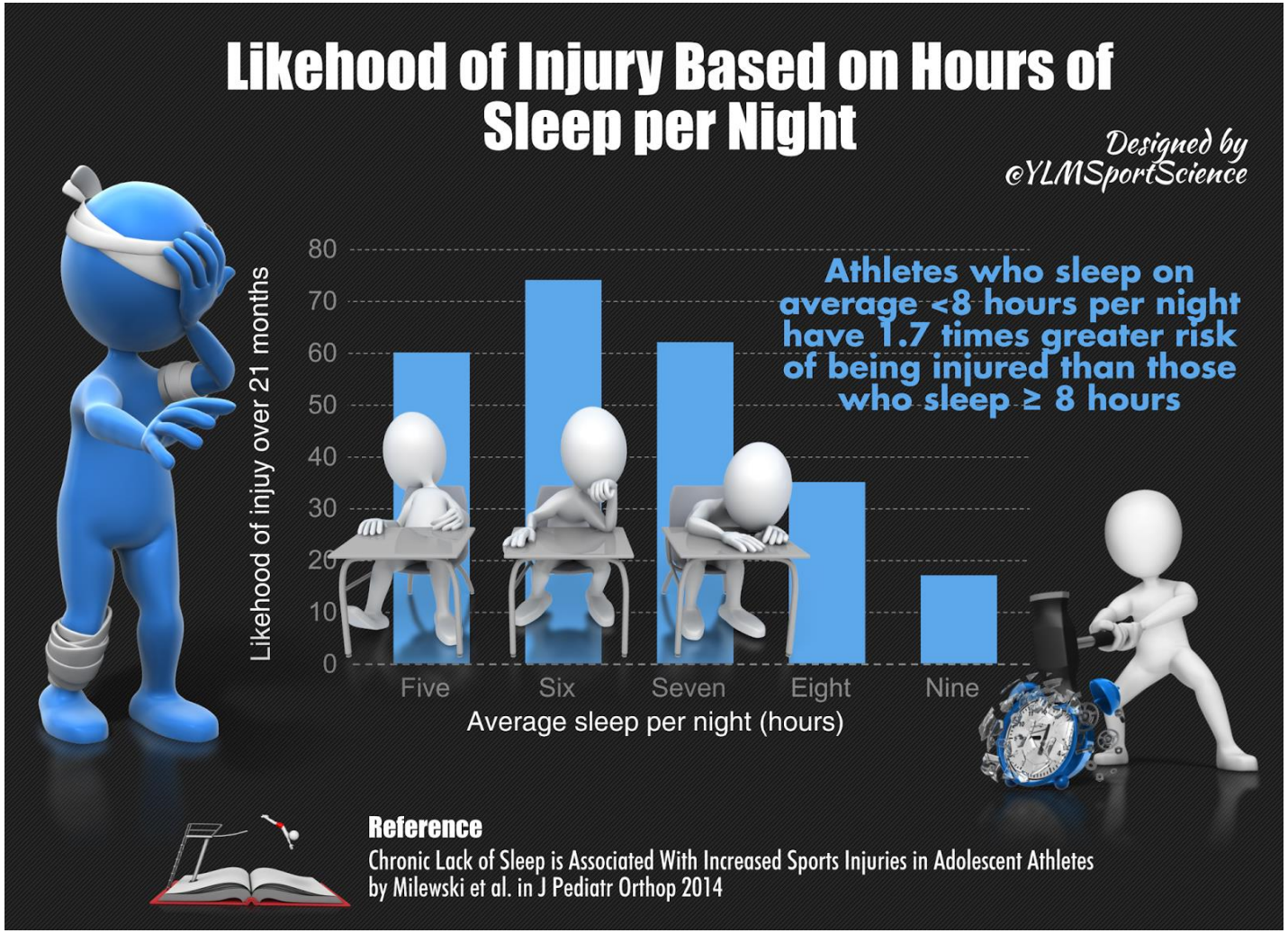


Kundermann et al. Psychosom Med 2004

Sleep and Illness



Sleep and Injury



Does Sleep Extension Improve Performance?

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The Effects of Sleep Extension on the Athletic Performance of Collegiate Basketball Players

Cheri D. Mah, MS[1]; Kenneth E. Mah, MD, MS[1]; Eric J. Kezirian, MD, MPH[2]; William C. Dement, MD, PhD[1]

[1]Stanford Sleep Disorders Clinic and Research Laboratory, Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA; [2]Department of Otolaryngology—Head and Neck Surgery, University of California, San Francisco, CA

Table 4—Athletic performance measures at baseline and end sleep extension

	Baseline	End Sleep Extension	P
282 feet sprint (sec)	16.2 ± 0.61	15.5 ± 0.54	< 0.001
Mean days of data	9.2 ± 3.6	6.9 ± 1.2	
Free throws (out of 10)	7.9 ± 0.99	8.8 ± 0.97	< 0.001
Mean days of data	9.2 ± 3.6	6.9 ± 1.2	
Three-point field goals (out of 15)	10.2 ± 2.14	11.6 ± 1.50	< 0.001
Mean days of data	9.2 ± 3.6	6.9 ± 1.2	
Subject self-rating at practices (1-10)	6.9 ± 1.41	8.8 ± 1.06	< 0.001
Mean days of data	8.9 ± 3.5	6.8 ± 1.3	
Subject self-rating at games (1-10)	7.8 ± 1.07	8.8 ± 1.19	< 0.001
Mean days of data	4.2 ± 1.7	3.7 ± 0.5	

Data presented as mean ± standard deviation.

Table 2—Total sleep time per night during baseline and sleep extension

	Baseline	Sleep Extension	P
Subject sleep journals (min)	470.0 ± 65.9	624.2 ± 68.4	< 0.001
Mean days of data	18.2 ± 5.6	41.5 ± 3.3	
Actigraphy (min)	400.7 ± 61.8	507.6 ± 78.6	< 0.001
Mean days of data	17.7 ± 4.8	41.2 ± 3.3	

Data presented as mean ± standard deviation.

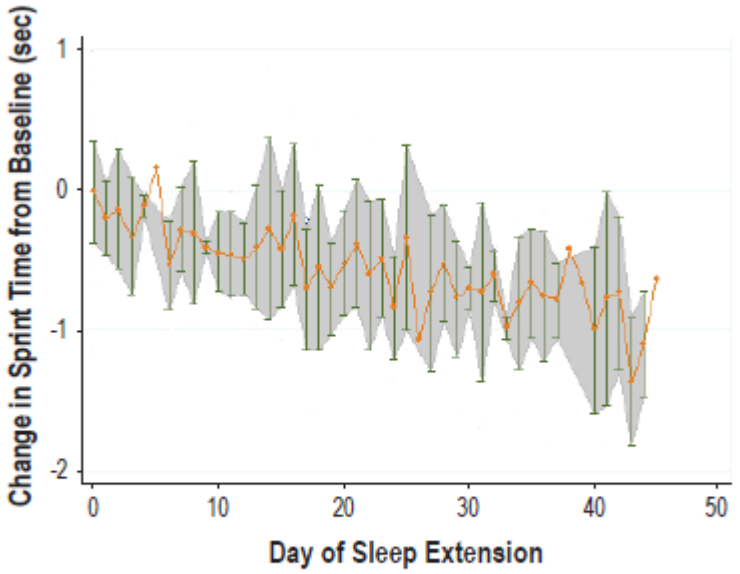
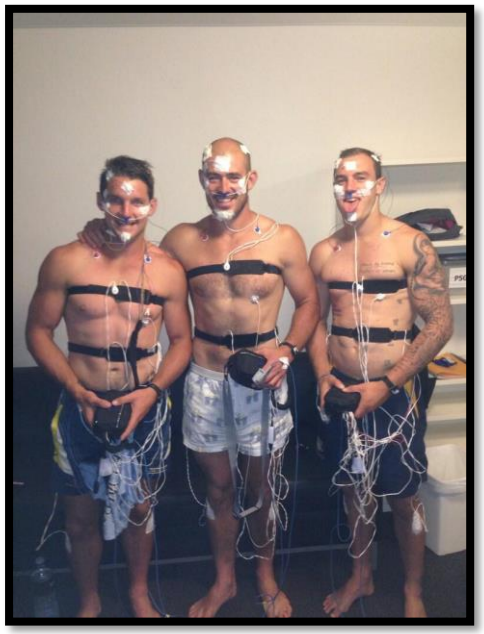


Figure 2—Change in 282 feet sprint time during sleep extension compared to baseline. Data presented as mean ± standard deviation.

Measuring Sleep- Polysomnography (PSG)

- PSG can be useful if there is suspicion of a sleep related breathing disorder comorbid with insomnia
- PSG is also indicated for the evaluation of recurrent unexplained nocturnal awakenings, which may be seen with periodic limb movement disorder (PLMD)
- Allows the determination of sleep stages (Non- REM and REM)



Measuring Sleep-Activity Monitoring

- Wrist Activity Monitors
  - *Large sample sizes*
  - *Non-invasive*
  - *Causes the least amount of disruption*

- Sleep Diaries
  - *Detailed information about sleep and wake patterns*

Sleep Diary (TDU-2007)

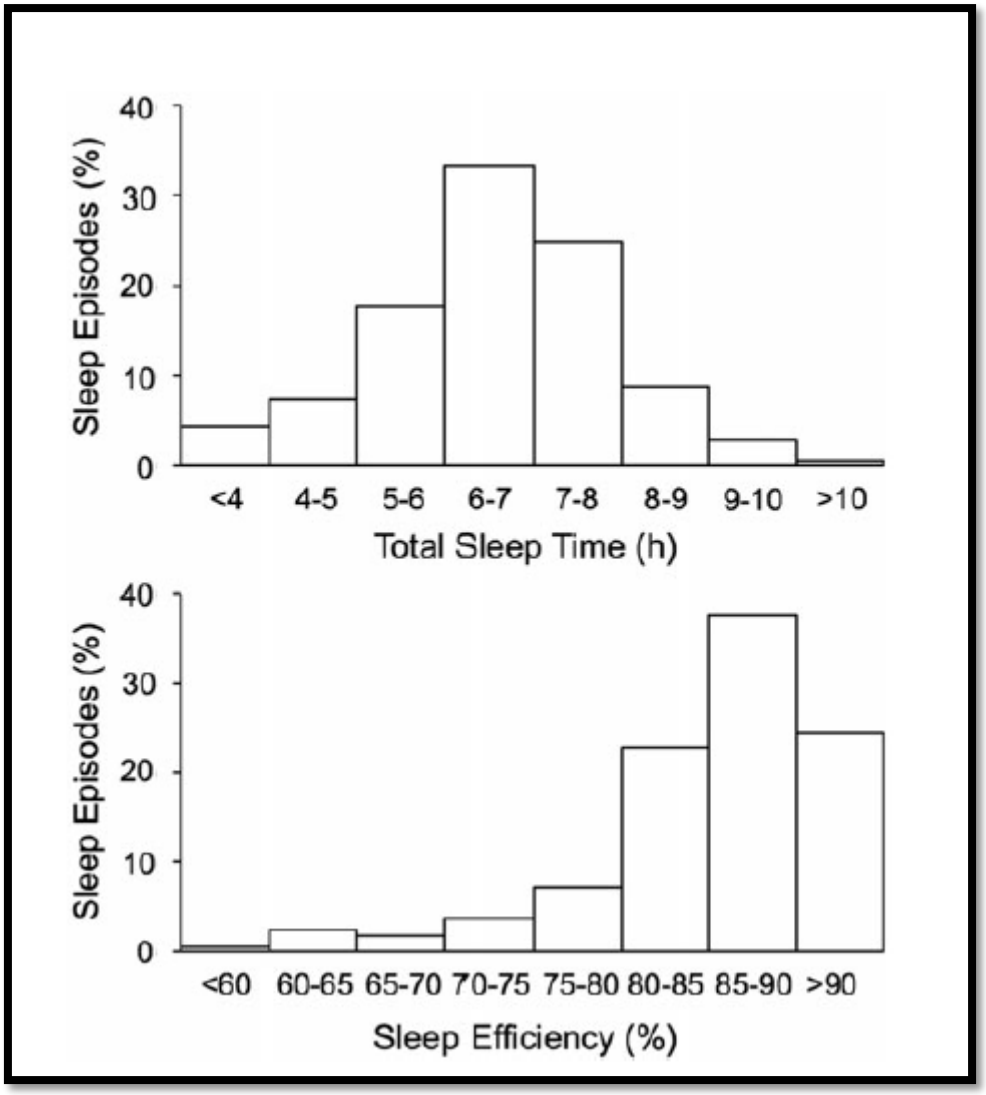
	Sleep Location	Start Date dd/mm	Start Time hh:mm	End Time hh:mm	Pre-sleep Fatigue Level	Post-sleep Fatigue Level	Sleep Quality	Remarks
eg	Home Away	13/01	23:00	07:00	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5	
1	Home Away				1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5	

Sleep in Australian Athletes

- *2636 nights of data (7 years)*

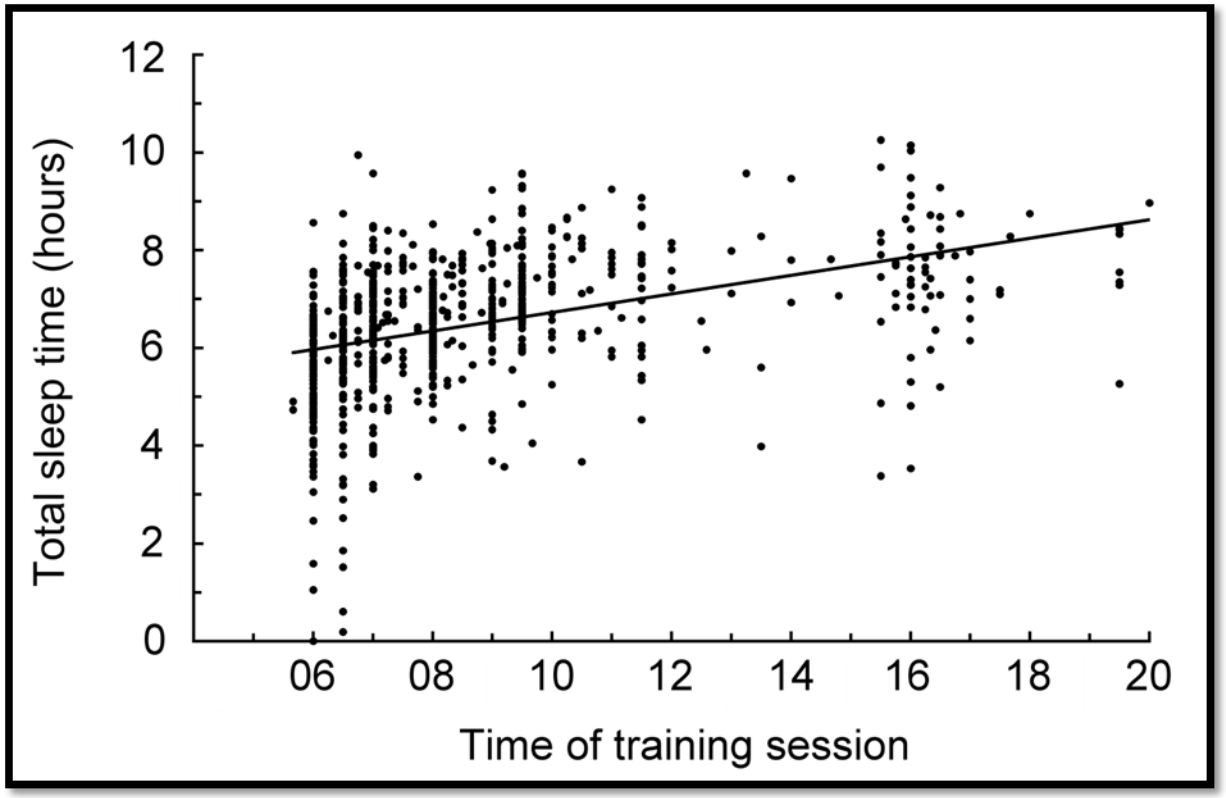
n = 2636	Mean ± SD
Bedtime (hh:mm)	23:22 ± 01:25
Wake Up time (hh:mm)	07:00 ± 01:30
Time in Bed (h)	8:14 ± 1:22
Total Sleep Time (h)	6:31 ± 1:26
Sleep Efficiency %	85 ± 7
Wake in Sleep (min)	66 ± 30
Sleep Latency (min)	23 ± 34
Sleep Quality	2.65 ± 1.02

Sleep Duration



Sargent, Lastella, Halson & Roach (2014)

Sleep Duration & Training Time



Variability in Sleep/Wake Time

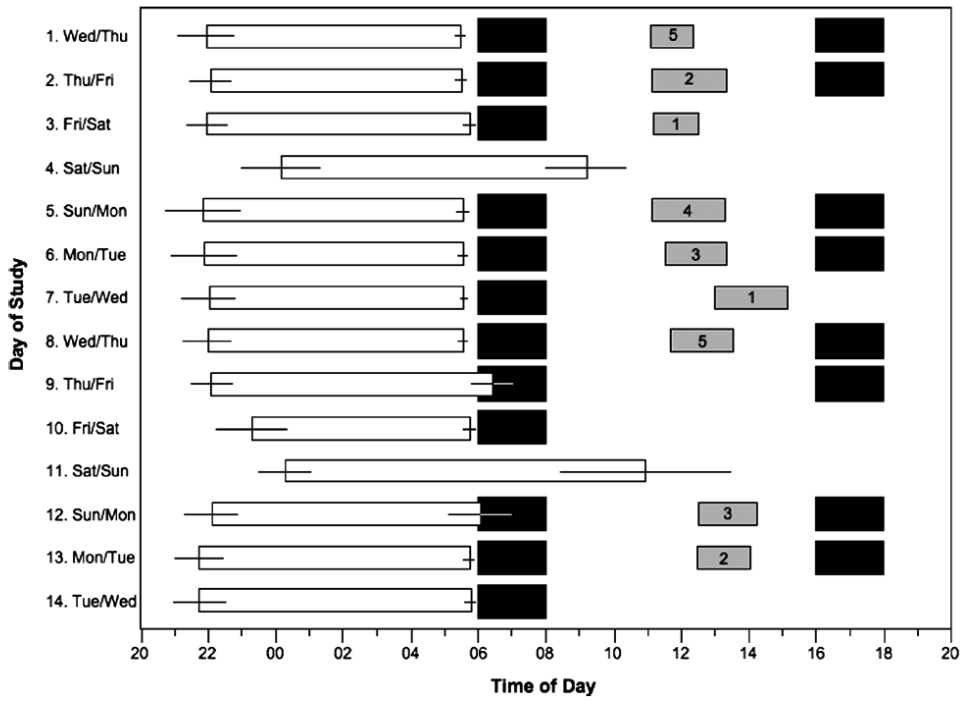


Figure 1. Sleep/wake patterns of seven elite swimmers during a 14-day high-intensity training programme. Each line represents a 24-h study day from 20:00 to 20:00 h. Black bars indicate the scheduled timing of training sessions. White bars indicate the mean ($\pm s$) start and end times of night-time sleep periods. Grey bars indicate the mean start and end times of daytime naps; the numbers in the grey bars represent the number of participants that napped on that day. On two occasions during the study, participants overslept and missed the scheduled start of training. This occurred on Day 9 for four participants and on Day 12 for two participants.

Sargent C, Halson S, Roach G. (2014)

Variability in Sleep/Wake Time

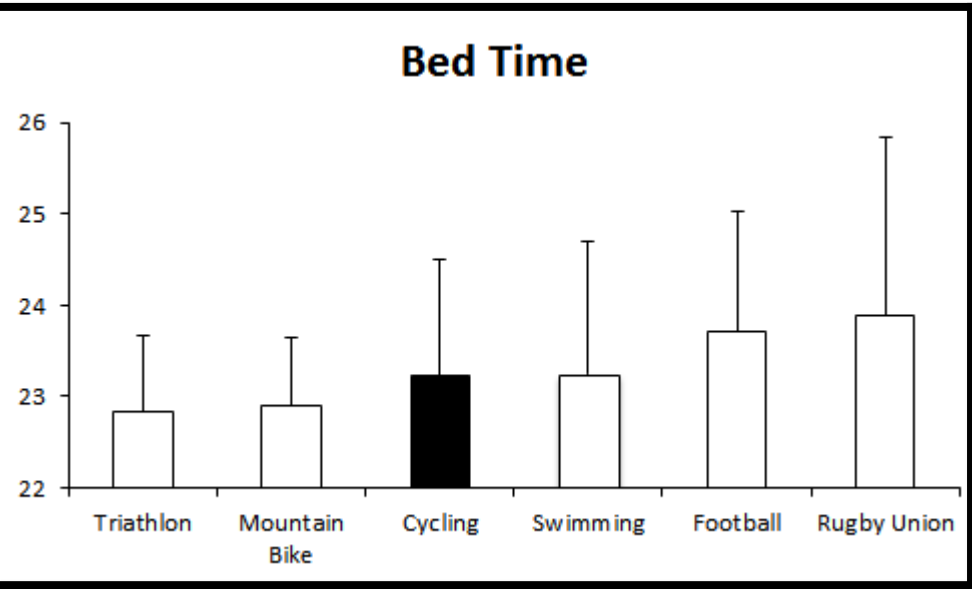
Table II. Sleep/wake variables on training days and rest days (mean ± *s*)

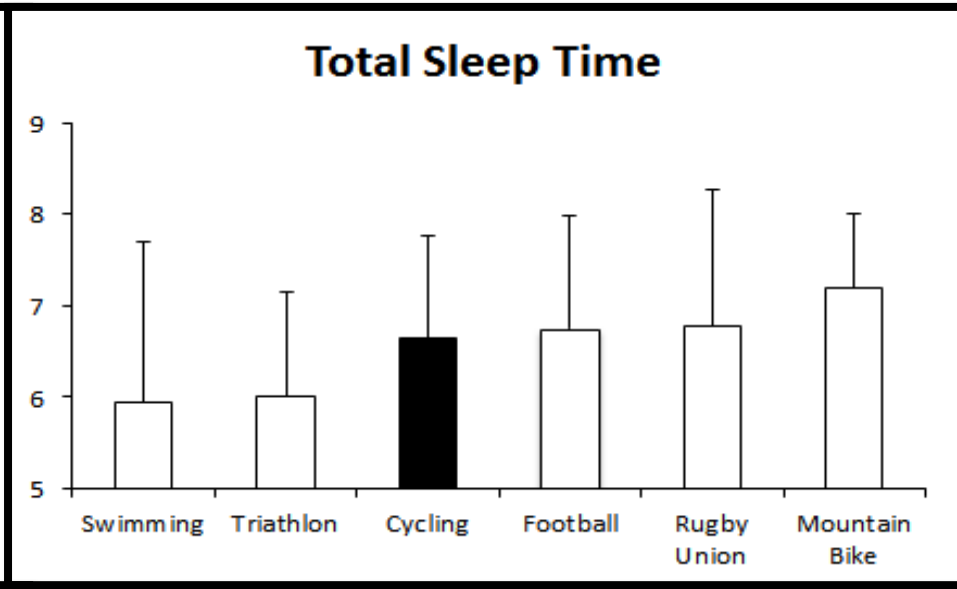
Measure	Training days	Rest days	*p*-Value
Bedtime (hh:mm)	22:05 ± 00:52	00:32 ± 01:29	<0.001
Get-up time (hh:mm)	05:48 ± 00:24	09:47 ± 01:47	<0.001
Time in bed (h)	7.7 ± 0.9	9.3 ± 1.7	<0.001
Sleep onset latency (min)	40.8 ± 43.2	31.8 ± 21.6	0.543
Sleep duration (h)	5.4 ± 1.3	7.1 ± 1.2	<0.001
Sleep efficiency (%)	70.7 ± 15.1	77.2 ± 7.5	0.220
Wake after sleep onset (%)	17.6 ± 8.8	16.2 ± 7.7	0.629
Daytime nap duration (h)	0.2 ± 0.5	0.0 ± 0.0[a]	0.108
Total sleep time (h)	5.6 ± 1.4	7.1 ± 1.2	0.006

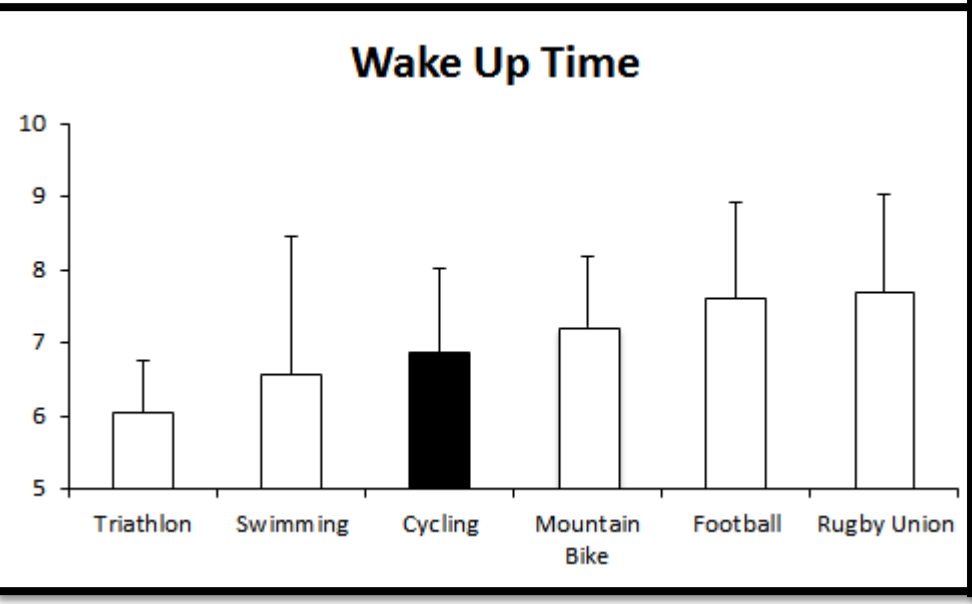
Note: [a]Participants did not nap on rest days.

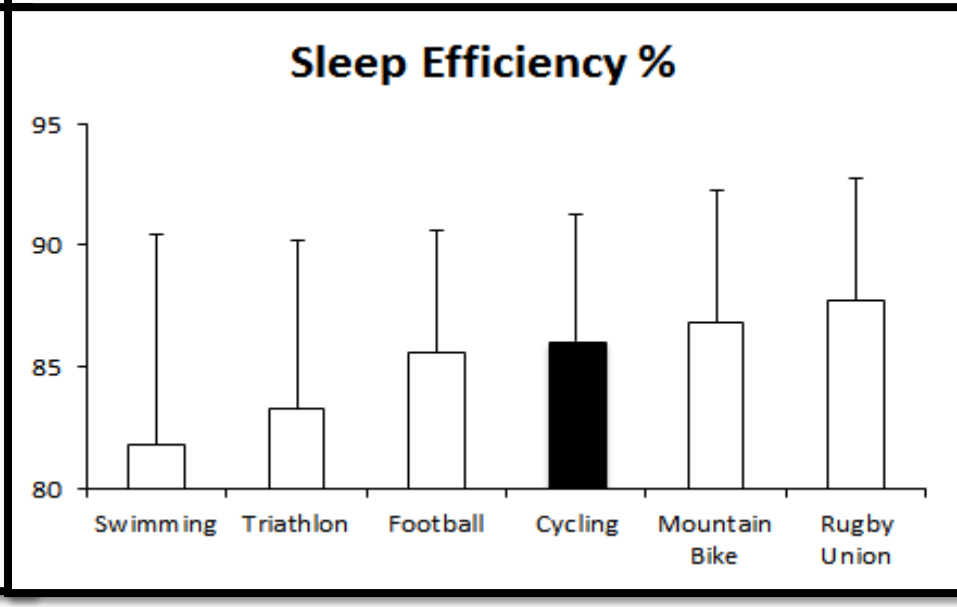
Sargent C, Halson S, Roach G. (2014)

Comparison Across Sports

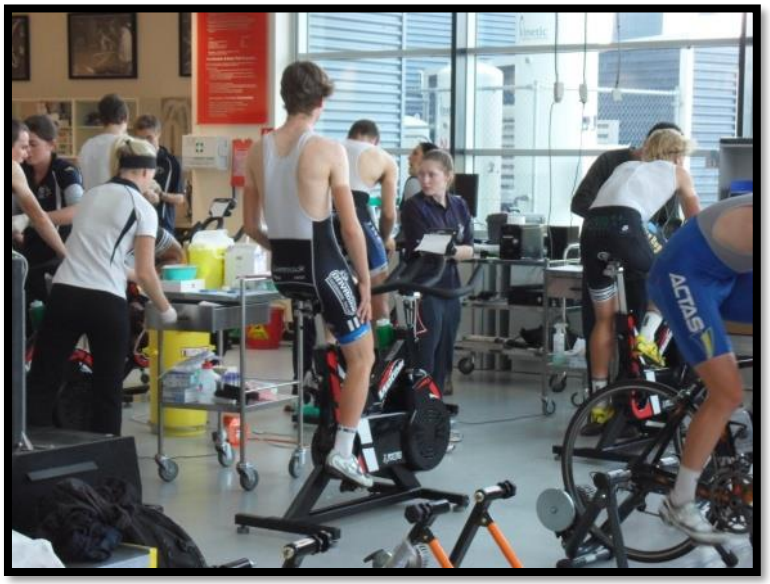




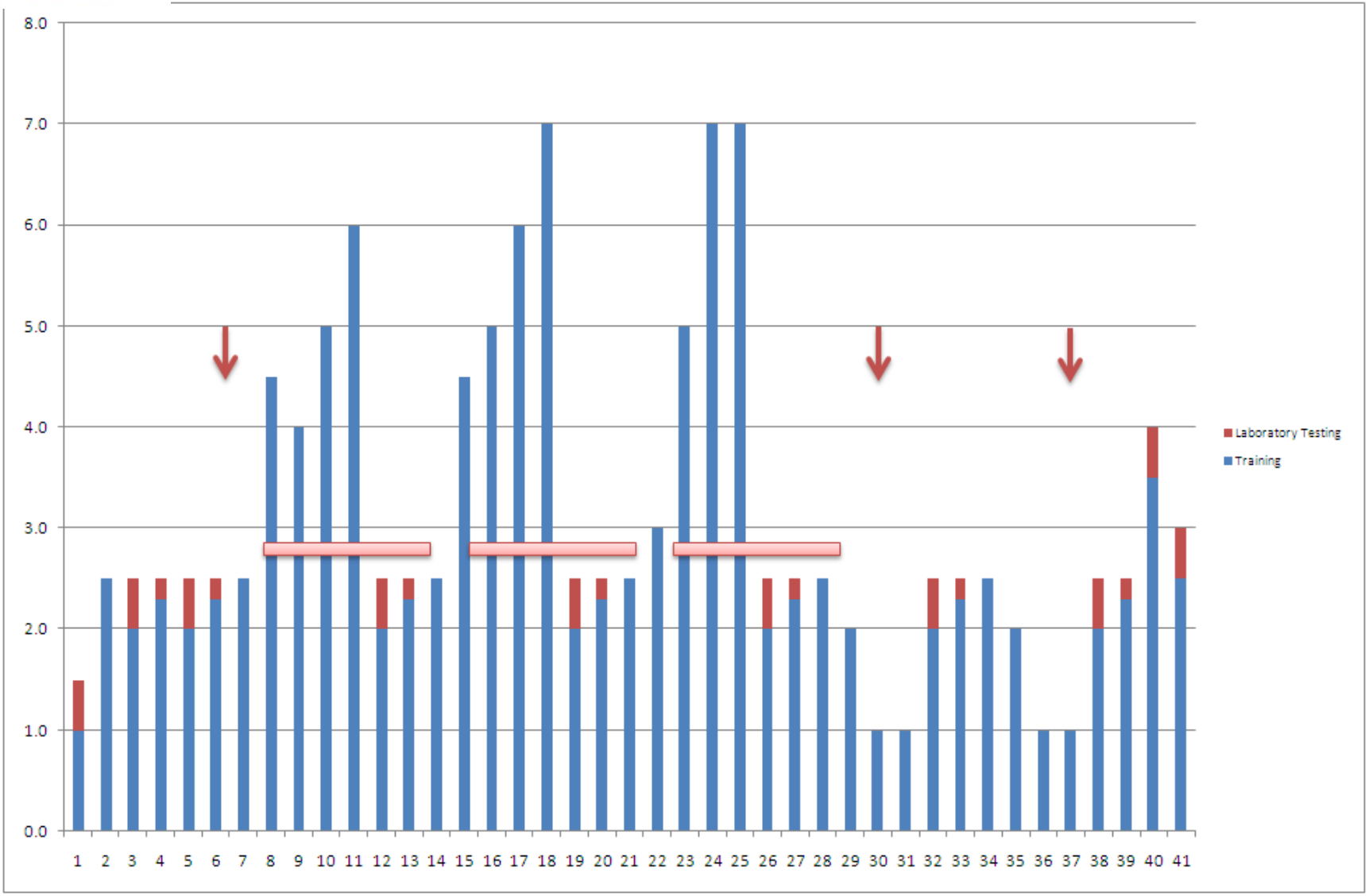


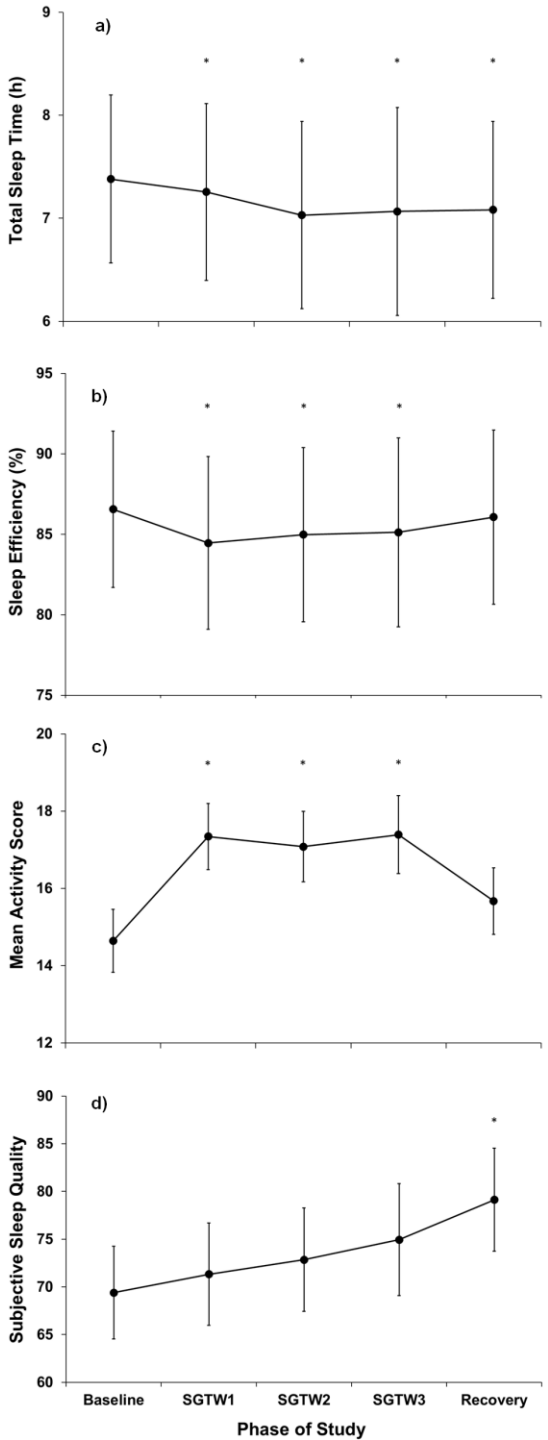


Intensified Training, Tapering & Sleep



Intensified Training, Tapering & Sleep




a)
Total Sleep Time (h)
9
8
7
6
*
b)
Sleep Efficiency (%)
95
90
85
80
75
c)
Mean Activity Score
20
18
16
14
12
d)
Subjective Sleep Quality
90
85
80
75
70
65
60
Baseline
SGTW1
SGTW2
SGTW3
Recovery
Phase of Study

Why Don’t Athletes Sleep?

- Fatigue, soreness, injury, nervous system activity
- Poor routine
- Poor sleep hygiene
- Sharing rooms
- Using computers, phones in bed, social media
- Competition times
- Jetlag
- Not understanding the importance of sleep

Recommendations

- Maintain a regular sleep-wake cycle (i.e. going to bed and getting up at the same time of the day)
- Use napping appropriately (naps should not interfere with nighttime sleep)
- Plan fluid/food intake
- Ensure bed is comfortable and the room temperature is appropriate (19-21°C is often recommended)
- Remove TV, computer, internet from bedroom
- Avoid thinking, planning or other mental activities while in bed- ‘to-do list’

Athlete Education

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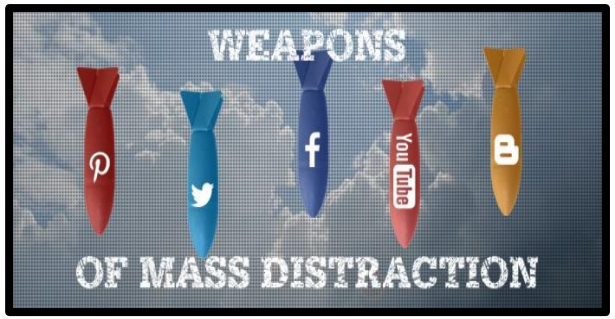

HOW TO GET A GOOD NIGHT SLEEP

THANK YOU

Australian Government

Australian Sports Commission

CQUniversity AUSTRALIA