**Circadian Rhythms in Sleep and Aging Laboratory**

**Laboratory Questions**

Correct answers are in **BOLD**

1. What is the “gold standard” for measuring sleep quality in older adults?
   1. Sleep diaries
   2. **Polysomnography**
   3. Pittsburgh Sleep Quality Index
   4. Actigraphy (either wrist or hip)
2. Circadian rhythms can be best described as:
   1. **The approximately 24 hour biological clock that helps align the sleep-wake cycle with the solar light-dark cycle**
   2. The physiological mechanism of the body which produces melatonin
   3. The mechanism by which we fall asleep and wake up
   4. A punk rock movement of the 1980’s which relied heavily on drum solos
3. You are planning a large (>1,000 participants) study to examine how sleep can impact academic performance in university students. Describe which measure of sleep you think you should use in this study and why.

**Possible answers include actigraphy and subjective sleep questionnaires (i.e., Pittsburgh Sleep Quality Index). Polysomnography is impractical in this instance because of the number of participants in the study. Actigraphy can provide an objective measure of sleep quality, although it is more expensive. Subjective sleep quality can provide a short and simple estimate of someone’s sleep quality (it’s not too burdensome).**

**Introduction**

Poor sleep is a risk factor for numerous diseases including cardiovascular disease, diabetes and dementia.1 While sleep quality and quantity does change as a natural consequence of the aging process,2 more than half of older adults experience some sleep complaint with the most common being the inability to sleep at night.3 Changes in the function of circadian rhythms are also closely tied to the natural changes in sleep quality that occur with aging.4,5 As the circadian signal weakens, so too does sleep quality.6 However, changes in circadian rhythms and sleep quality can be modified using lifestyle, behavioural, and pharmacological strategies.4 Doing so requires a good knowledge of how to measure sleep and circadian rhythms, as well as understanding the evidence-based methods by which we can modify them.

**Purpose**

1. Comprehend how sleep and circadian rhythms are related.
2. Understand the different methods by which sleep and circadian rhythms can be measured.
3. Critically-examine the different strategies for improving sleep quality and circadian rhythms

**Laboratory Outline**

1. REVIEW: What is sleep quality?
   1. Sleep duration
   2. Sleep efficiency
   3. Sleep latency
   4. Wake after sleep onset
   5. Sleep fragmentation
   6. Sleep architecture
      1. Stage 1
      2. Stage 2
      3. Stage 3
      4. Stage 4
2. REVIEW: What are circadian rhythms?
   1. *Zeitgebers*
   2. Entrainment
   3. Exogenous vs. Endogenous clock
   4. Sleep and circadian rhythms
3. How do we measure sleep quality?
   1. Objective Methods
      1. Polysomnography
      2. Actigraphy
      3. Apnea Hypopnea Index
   2. Subjective Methods
      1. Pittsburgh Sleep Quality Index
      2. Sleep Diaries
4. How do we measure circadian rhythms?
   1. Actigraphy
      1. Interdaily Stability
      2. Intradaily Variability
      3. Relative Amplitude
      4. M10
      5. L5
   2. Subjective Methods
      1. Munich Chronotype Questionnaire
      2. Morning-Eveningness Questionnaire
5. How do we intervene on sleep quality and circadian rhythms?
   1. Sleep quality
      1. Pharmaceutical intervention (Serroquel, Ambien, Trazadone, etc.)
      2. Cognitive-Behavioural Therapy
      3. Exercise
      4. Sleep hygiene
   2. Circadian rhythms
      1. Bright light therapy
      2. Physical activity
      3. Food timing
   3. Comparison of interventions
      1. Describe the pro’s and con’s of each method of intervening on sleep quality. Is there a best method for promoting sleep quality?
      2. Describe the pro’s and con’s of each method of intervening on circadian regulation. Is there a best method for promoting circadian rhythms?

**Reminder**

The two multiple choice and one short answer (<100 words) questions must be answered online on Canvas by 11:59pm on the day of the laboratory.

**References**

1. Ferrie JE, Kumari M, Salo P, Singh-Manoux A, Kivimäki M. Sleep epidemiology—a rapidly growing field. Oxford University Press; 2011.

2. Ancoli-Israel S, Alessi C. Sleep and aging. *The American Journal of Geriatric Psychiatry.* 2005;13(5):341-343.

3. Crowley K. Sleep and sleep disorders in older adults. *Neuropsychology review.* 2011;21(1):41-53.

4. Landry GJ, Liu-Ambrose T. Buying time: a rationale for examining the use of circadian rhythm and sleep interventions to delay progression of mild cognitive impairment to Alzheimer’s disease. *Front Aging Neurosci.* 2014;6:325.

5. Duffy JF, Zeitzer JM, Czeisler CA. Decreased sensitivity to phase-delaying effects of moderate intensity light in older subjects. *Neurobiology of aging.* 2007;28(5):799-807.

6. Mishima K. Circadian Regulation of Sleep. *Circadian Clocks: Role in Health and Disease*: Springer; 2016:103-115.