SLEEPING WELL
A KEY COMPONENT OF THE ESSENTIAL 8
Conflict of Interest

• I was the Chief Medical Officer and Co-Founder of SleepWatch by BodyMatter
LEARNING OBJECTIVES

• Sleep, what is it and how much does a person need?
• Circadian Rhythm, understanding your body clock
• What happens when we sleep?
• How do we measure sleep?
• What are we measuring
• Mechanism linking poor sleep and cardiovascular disease
Common Sleep Disorders

• Lack of Sleep (insomnia)
• Snoring and Sleep Apnea
• Circadian rhythm disorders
• Movement disorders (restless leg)
• Parasomnias (sleepwalking)
• Too much sleep (narcolepsy)
SLEEP FACTS

• Total Sleep requirement is age dependent
• Adults ages 18 and 64 need seven to nine hours of sleep
• More than one third of adults sleep less than 7 hours
• 80% of Americans report having a problem sleeping at least once a week
• Most people do not know they have the ability to improve sleep
• Insufficient or fragmented sleep can contribute to problems with blood pressure and heighten the risk of heart disease, heart attacks, diabetes, and stroke.
Sleep: A Multi-dimensional Health Behavior

- Naturally Recurring (rhythmic)
- Reduced or Absent Consciousness
- Perceptual Disengagement
- Relative Immobility
- Sleep Posture
- Reversible
- Patterned by Homeostatic and Circadian Factors

(Grandner and Hernandez (Science 2021))
Borbely's 2 Process Model

- Sleep-wake regulation is typically conceptualized as arising from two independent processes:
Stage 1 and 2 (Non-REM) LIGHT/CORE

- 45-55%
- TRANSITION FROM AWAKE TO SLEEP (short time)
- MUSCLES RELAX
- HEART RATE DECREASES
- BODY TEMPERATURE DROPS
- RESPIRATIONS SLOW
- MORE AROUSABLE IN EARLY STAGES
Stage 3 Non-REM DEEP SLEEP

• 13-25%
• Cardiovascular: Blood Pressure decreases
• Brain: Waste products including amyloid are removed
• Immune System: Antibodies and T&B Cells are released into the blood stream
• Muscles and Bones: Are Repaired and Regeneration occurs as Growth Hormone and Prolactin are increased
• Hormonal Changes: Ghrelin, Leptin, Cortisol, TSH, Insulin
RAPID EYE MOVEMENT (REM) SLEEP

• 20-25%
• BRAIN HIGHLY ACTIVE
• RAPID EYE MOVEMENTS
• MUSCLE PARALYSIS
• INCREASED HEART RATE
• BLOOD PRESSURE RISES
• EMOTIONAL REGULATION & MEMORY CONTROL
• PROCESSING AND INTEGRATING EMOTIONS, MEMORIES AND LEARNING FROM PRIOR DAY
What Happens When We Sleep?
Circadian Rhythms

Changes in physiology and behavior that follow a roughly 24h pattern. The same cyclical variation is seen from one day to the next.
HISTORY: EVALUATING SLEEP

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2413168/ 2005

• Research Sleep Lab 1925 (circadian rhythm) Nathaniel Kleitman
• Narcolepsy Lab Stanford 1964
• 1st Clinical sleep lab 1970 (Dr. Dement)
• Actigraphy (1990)
• Prospective Diary
• Retrospective Questioning & Data Mining
• Pittsburg Sleep Quality Index (Insomnia 1989)
• Consumer Wearables (Fitbit 2013, Watches, Rings)
WHAT IS BEING MEASURED?

- Brain Waves
- Eye Movement
- Skeletal Muscle Movement
- Sleep Stages
- **Total Sleep Time/Time in Bed**
- Sleep Rhythm
- **Cardiac Rate and Dipping Ratio**
- Heart Rate Variability
- Blood Oxygen

- Respiratory Rate
- Arousals
- Time to Fall Asleep
- Temperature
Cardiovascular Disease and Sleep

• 1977 A.G. Tilkian  Prevalence of Cardiac Arrythmia (15 patients)
• 1983 C. Guilleminault: Cardiac Conduction Disturbances during sleep 400 patients with sleep apnea
• 1992 E.D. Eaker Myocardial infarction and coronary death among women – psychosocial predictors (20yr follow-up Framingham)
• 2003 Prospective Study of Sleep Duration & CHD in Woman (Nurses' Health
• study 1986-1996)
• 2007 I. Ben-Dov Blunted Heart Rate Dip During Sleep and Mortality
• 2010 T. Chandola Effect of Short Sleep Duration on CHD is Greatest with Sleep Disturbance (Prospective Study 1985-2004 men and woman)
Cardiovascular Disease and Sleep

- 2013 J. Pepin Hypertension and Sleep Overview of a tight relationship
- 2013 M. Haack Increasing sleep duration to lower beat to beat blood pressure - a pilot study
- 2017 Y. Kubota Heart Rate Variability and Lifetime Risk CVD Atherosclerosis Risk in Communities Study 1987-89 follow-up 2013 Higher HRV ↑ lifetime risk
- 2018 K. Lo Subjective sleep quality, blood pressure and hypertension: a meta-analysis
- 2018 A. Sherwood Waking up to the importance of sleep well for cardiovascular health
- 2021 L. Wang Ideal Cardiovascular Health Metric and Its Change With Lifetime Risk of Cardiovascular Diseases: A Prospective Cohort Study
Mechanisms Linking Sleep and Cardiovascular Disease

• Sympathetic nervous system activation (fight or flight) seen OSA

• Inflammatory markers elevated in poor sleep. Chronic inflammation plays a significant role in development and progression of atherosclerosis, hypertension and heart failure

• Endothelial dysfunction occurs with poor sleep leading to impaired dilation and constriction of blood vessels, increased oxidative stress, and reduces nitric oxide availability
Mechanisms –continued

• Metabolic dysregulation occurs with poor sleep leading to alterations in glucose metabolism, insulin resistance, ↑ levels of Cortisol and ↓ leptin (appetite control)

• Circadian Rhythm disruption such as shift work or irregular sleep schedules have been associated with adverse cardiovascular outcomes

• In addition, misalignment between our internal body clock and external factors can lead to dysregulation in blood pressure, heart rate variability and other cardiovascular parameters
SLEEP APNEA & CVD A Model (2007)

Hypoxemia  Intrathoracic pressure
Reoxygenation  Arousals
Hypercapnia  Sleep deprivation

OSA

Sympathetic Activation  Endothelial dysfunction
Metabolic dysregulation  Systemic inflammation
Left atrial enlargement  Hypercoagulability

Disease Mechanisms

Systemic Pulmonary

Hypertension  Renal disease
Heart Failure  Stroke
Arrhythmias  Myocardial infarction

Associated CV Disease

Sudden cardiac death
CVD & ↑BP A WAY FORWARD

• Prioritize sleep
• Fixed wake and sleep time 7-9hr
• Wind down pre-sleep routine
• Dim lights
• Unplug from electronics
• No meals 3 hours before sleep
• ↓ Alcohol
• No Caffeine after 3PM

• Bedroom temp ↓68°F
• Block out light
• Drown out noise
• Light exposure (sun) in AM
• Be physically active during day
• Avoid daily sleep medications
• Restrict Bedroom Activity