Sleep Health:
Healthy Sleep
Healthy Heart

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Disclosures

- No Relevant Financial Disclosures
- No Relevant Non-Financial Disclosures
- No Discussion of Off-Label Uses

INTENTION: Evidenced Based vs Evidence Biased
Traditional wisdom for health…

1. Eat Your Vegetables
2. Go Outside and Play
3. Get Your Sleep

- Grandma

Traditional wisdom has touted the importance of sleep. Now, sleep has gone prime time with modern science.
The function & promise of sleep

10. RESTORE: Cool brain and body
9. RESET: Regulate ion channels
8. REPAIR: Optimize physiological growth
7. ANTI-INFLAMMATORY: Reduce inflammatory markers
6. IMPROVE MOOD: Soothe emotions & mental fatigue
5. HEART HEALTH: Actively cardio-protective
4. BRAIN HEALTH: Enhances neuro-plasticity
3. MEMORY: Improve memory formation & consolidation
2. JOY: Connects us physically, mentally & emotionally
1. ENERGY: Replete energy stores

Sleep honors health & healing
Optimal sleep

☑️ Quantity

The most common recommendation is for people to extend their sleep time

☑️ Quality

1. Person may be *aware* of disordered sleep
2. Person may be *unaware* of disordered sleep

Quantity **AND** Quality are needed
We all wish that we could sleep... like a baby

Teenagers are the “best” sleepers

We need less sleep as we get older

Most ALL adults need 7-9 hours...

Sleep changes in adults

Less Deep Sleep

More Arousable

... yet able to Cope with Arousals

Sleep evolves through adulthood

So, we must evolve our lifestyle to promote sleep
Epidemic of sleep problems began > 100 years ago the advent of electricity.

Our great grandparents slept $1\frac{1}{2} - 2$ hours longer than us.

Today, we give ourselves one less sleep cycle.
Stages of sleep

Wake = resting, eyes closed

Stage 1: transitional 5%
Stage 2: typical 50 - 55%
Stage 3: “deep” 15 - 25%
R.E.M.: “dream” 15 - 25%

RECOVERY SLEEP = key opportunity
Optimal sleep cycles

Hours

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

Awake

REM

Declarative Memory
Filtering Data
“Just the Facts”

PHYSICAL REPAIR

MENTAL & EMOTIONAL CLEARING

Making Connections
Creativity
Problem Solving
Sleep Apnea/Snoring
Periodic Limb Movements
Bruxism (Teeth Grinding)
Pain & Discomfort
Meds / Caffeine / Alcohol
Room Environment

Medical Conditions
- Psychiatric, (Depression/ Anxiety)
- Hormonal, Menopause
- Urological (Bladder*)
- Neurological
- Cardiovascular
- Autoimmune
- Inflammatory
Sleep apnea: signs and symptoms

- **NECK SIZE** > 17” in men & > 16” in women
- **CHIN** - Recessed jaw
- **NASAL AIRWAY** - Stuff or narrow
  - Deviated septum
  - Fracture
- **FAMILY HISTORY**
- **ALCOHOL OR SEDATIVES**
- **MEN of all ages; WOMEN after menopause**

Of all people with apnea, many without traditional risk factors
It is very important to treat apnea.
Consequences of poor sleep:

Sleepiness!
It’s NOT ‘normal’ to:

- Fall asleep if reading quietly in the afternoon
- “Drift off” at afternoon meetings
- Sleep on airplanes (excluding red-eye flights)
- Fall asleep watching TV in the early evenings
- Sleep when you are a passenger in a car
- “Doze off” while waiting at red lights or stop signs

Sleepiness: RED FLAGS SIGNS
Be curious… if you heard yourself say:

- “I do not need sleep…”
- “I am fine with 4-5 hours of sleep…”
- “Yes, I sleep… I get 10 or more hours every night.”
- “I catch up on sleep over the weekends.”
- “I am a great sleeper… … I can sleep anytime, anywhere.”

Sleepiness: RED FLAGS SIGNS
Consequences of poor sleep:

Sleep Deprivation Accumulates
Over time, we may have less insight into our impairment

ADD-like symptoms

ERRORS

Number of Errors

* Time In Bed (TIB)
- 0h TIB
- 4h TIB
- 6h TIB
- 8h TIB

days of sleep restriction
Brain Chemistry sends the following message:

- Give me SUGAR (Neuropeptide Y)
- Give me FAT (Gallanin)
- Give me NOW (Ghrelin & Leptin)

Reduced Production and/or Release of

- Testosterone
- Growth Hormone
- Repair Proteins

Sleepy brain craving brain & sedentary body
Consequences of poor sleep:

↑ Inflammation

↓ Sleep
Sleep Restriction/Insufficient Sleep Recovery

Chronic Hypoxia &/or Frequent Arousals

Stress & Autonomic System Activation

↑ Catecholamines, Blood Pressure, LV Afterload, Blood Glucose

↑ Leukocytes, Inflammatory Cytokines, CRP, Oxidative Stress

Pro-inflammatory, Platelet Aggregation, ↓NO, Endothelial Injury

Cardiovascular Comorbidities

Shamsuzzaman JAMA 2003
DISORDERED SLEEP

MECHANISM
- Inflammation
- Metabolic
- Vascular
- Hormonal

RISK FACTORS
- Hypertension
- Obesity
- Diabetes
- Hyperlipidemia

OUTCOMES
- Heart Disease
- Stroke
- Dementia
- Early Death
## Obstructive Sleep Apnea

<table>
<thead>
<tr>
<th>Apnea</th>
<th>(Full collapse ≥ 10 sec)</th>
<th>Hypopnea (Partial “ ”)</th>
<th>Index (Per hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5</td>
<td>= NORMAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - 15</td>
<td>= MILD *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 - 30</td>
<td>= MODERATE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 +</td>
<td>= SEVERE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Brown, J Clin Sleep Med 2007
Minoguichi, Am J Respir Crit Care Med 2005

### OSA & Inflammation

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Mild OSA</th>
<th>Severe OSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>28.3 ± 1.3</td>
<td>27.9 ± 1.0</td>
<td>28.1 ± 0.06</td>
</tr>
<tr>
<td>AHI</td>
<td>3.3 ± 0.6</td>
<td>11.0 ± 0.9</td>
<td>48.4 ± 0.04</td>
</tr>
<tr>
<td>Low SaO2</td>
<td>95.2 ± 2.6</td>
<td>83.7 ± 1.7</td>
<td>75.7 ± 2.1</td>
</tr>
<tr>
<td>CRP (mg/L)</td>
<td>0.90 ± 0.2</td>
<td>1.5 ± 0.3</td>
<td>2.8 ± 0.4</td>
</tr>
<tr>
<td>IL-6 (pg/mL)</td>
<td>0.91 ± 0.15</td>
<td>1.23 ± 0.14</td>
<td>2.25 ± 0.28</td>
</tr>
<tr>
<td>IL-18 (pg/mL)</td>
<td>181.9 ± 20.3</td>
<td>209.7 ± 27.0</td>
<td>273.5 ± 16.8</td>
</tr>
</tbody>
</table>
Sleep apnea: CPAP results

- Reduce CRP, TNF-α and IL-6
- Reversal of endothelial dysfunction via SDMA and ADMA
- Increases Nitric Oxide

Ryan Circulation 2005 & Dorkova Chest 2008
Ohike Circulation 2005
Schulz Thorax 2000
Sleep duration & inflammation

Elevated hs-CRP & IL-6

- U Shaped Impact
  - Short Sleep Duration < 5 hours
  - Long Sleep Duration > 9 hours

Stronger correlation in women than men

Miller Sleep 2009
Rohde Am J Cardiol 1999
Sesso Hypertension 2007
Short Sleep Duration (< 6 hours)

Negative effect in vivo
antibody response to novel antigen

Hepatitis B Vaccination
Influenza Vaccination

Possible explanation for poor sleep with increased susceptibility to infectious disease

Prather, Sleep 2012
Sleep duration & blood pressure

• Sleep-Related Breathing Disorders promote non-dipping of nocturnal blood pressure

  − Even mild OSA associated with increased risk of developing hypertension in 4 years
    • (OR 1.42: [1.13-1.78])

  − Moderate to Severe even greater risk
    • (OR 2.9: [1.5- 5.6])

Wisconsin Sleep Cohort, Sleep 2008
Sleep apnea: hypertension results

- CPAP lowers diurnal & nocturnal blood pressure
- Therapeutic CPAP versus sham CPAP reduced diurnal systolic by 6.7 & diastolic by 4.9 mmHg among males over a 6 week period
- Greater reductions in those with more severe OSA
Syndrome X + Sleep Disturbance

Proposed Model Fit with Syndrome X

Sleep Disturbance: $0.82 \pm 0.03; p < 0.01$

greater model fit than

- Insulin Resistance $0.67 \pm 0.05; p < 0.01$
- Hypertension $0.64 \pm 0.04; p < 0.01$
- Dyslipidemia $0.60 \pm 0.05; p < 0.01$
- Obesity: Model Fit $0.85 \pm 0.02; p < 0.01$

“Syndrome Z”

Nook, Sleep 2011
Sleep apnea: weight loss results

- CPAP treatment alone does not necessarily lead to weight reduction
- Best achieved when individuals participate in cognitive–behavioral weight-reduction programs
- Weight loss following laparoscopic gastric banding reduced AHI (baseline: 61.6; post-treatment: 13.4)
Sleep apnea: diabetes results

- Abnormal Glucose Intolerance
  - AHI 5-15 [OR 1.20 (0.98 – 1.64)]
  - AHI > 15 [OR 1.46 (1.09 – 1.97)]

- Patients with Type 2 diabetes and OSA, mean sleeping glucose decreased from baseline (122.0) to post-treatment (102.9 mg/dl)

- Insulin sensitivity improved even among non-diabetics

Punjabi Am J Epi 2004
Lam Eur J Resp J 2010
Sleep apnea: dyslipidemia

- In OSA, greater HDL dysfunction & oxidized LDL levels;
- AHI explained 30% of variance in HDL dysfunction in OSA
- Positive airway pressure improved abnormal lipid & lipoprotein with 6-month follow up showing an HDL increase by 5.8%
- Non-calcified, mixed plaque found in severe vs mild OSA 63% vs. 16% (P< 0.0001) controlled OR 7.0 (1.9 – 26.5)
- CPAP (AHI > 50) after 6 months reduced carotid IMT weighted mean difference by 0.121 mm (0.019 – 0.223)
Severe OSA and heart disease

<table>
<thead>
<tr>
<th>Sleep Heart Health Study notes</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart failure</td>
<td>2.38 (1.22–4.62)</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.58 (1.02–2.46)</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>1.27 (0.99–1.62)</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>4.02 (1.03–15.74)</td>
</tr>
<tr>
<td>Non-sustained ventricular tachycardia</td>
<td>3.40 (1.03–11.20)</td>
</tr>
<tr>
<td>Complex ventricular ectopy</td>
<td>1.74 (1.11–2.74)</td>
</tr>
</tbody>
</table>

Of all with apnea, only 10-20% know of their diagnosis

Shahar Am J Respir Crit Care Med. 2001
Mehra Am J Respir Crit Care Med. 2006
## Severe OSA and heart disease

<table>
<thead>
<tr>
<th>Condition</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI (males); low vs high quartiles</td>
<td>23.3 (3.9–139.9)</td>
</tr>
<tr>
<td>Stroke 10 years after coronary angio</td>
<td>2.89 (1.37–6.09)</td>
</tr>
<tr>
<td><strong>Untreated OSA after 10 years</strong></td>
<td></td>
</tr>
<tr>
<td>Fatal Myocardial Infarction &amp; Strokes</td>
<td>2.87 (1.17–7.51)</td>
</tr>
<tr>
<td>Non Fatal Cardiac Events</td>
<td>3.17 (1.12–7.52)</td>
</tr>
</tbody>
</table>

*Hung, Lancet 1990*  
*Valham, Circulation 2008*  
*Marin, Lancet 2005*
Sleep apnea: CPAP results

- In CHF, improve left ventricular function
- Improve fatal and non-fatal cardiovascular events with risk reduction of 64% over 6 years; Number Needed to Treat = 3.5
- CVD morbidity and mortality increases only among untreated patients over a 10 year follow up

Malone Lancet 1991
Buchner Am J Respir Crit Care Med. 2007
Marin Lancet 2005 & Doherty Chest 2005
Sleep apnea: CPAP results

- Improved insulin sensitivity and reduced systemic inflammation, oxidative stress and global CVD risk

- ≥ 4 hours/night CPAP use reduced 10 year risk of CV events from 18.8 to 13.9 %

- Metabolic syndrome decreased by 45% after 12 months of CPAP treatment
### Physiology and sleep

<table>
<thead>
<tr>
<th>From Awake to Sleep</th>
<th>From NREM to REM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain Waves <strong>Slow</strong></td>
<td>Brain Waves <strong>Faster</strong></td>
</tr>
<tr>
<td>Heart Rate <strong>Slow</strong></td>
<td>Heart Rate <strong>Faster</strong></td>
</tr>
<tr>
<td>Blood Pressure <strong>Drops</strong></td>
<td>Blood Pressure <strong>Increases</strong></td>
</tr>
<tr>
<td>Breathing Rate <strong>Slow</strong></td>
<td>Breathing Rate <strong>Faster</strong></td>
</tr>
<tr>
<td></td>
<td>Sexually <strong>Aroused</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Rapid Eye Movement</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Muscle Tone</strong> <strong>Drops</strong></td>
</tr>
</tbody>
</table>

*REM AHI: associated with higher incidence of CV events in those with CV disease*
Chronic insomnia

• Dissatisfaction with quantity or quality of sleep

• Repeated difficulty with sleep:
  – Initiation
  – Maintenance
  – Early AM awakening with inability to return to sleep

• Daytime distress or impairment:
  Social, Occupational, Educational, or Behavioral

• At least three nights per week and three weeks

• Rule out psychiatric, medical or other sleep disorders
# CBT-I
## Cognitive Behavioral Therapy for Insomnia

<table>
<thead>
<tr>
<th>Components</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Therapy</td>
<td>✓ Targets dysfunctional beliefs and attitudes about sleep</td>
</tr>
<tr>
<td>Sleep Restriction</td>
<td>✓ Restricts bedtime to actual sleep time</td>
</tr>
<tr>
<td>Stimulus Control</td>
<td>✓ Associate bed with sleep; limits stimulating behavior</td>
</tr>
<tr>
<td>Sleep Hygiene</td>
<td>✓ Teaches practices that help relax close to bedtime</td>
</tr>
<tr>
<td>Relaxation Training</td>
<td>✓ Advises on behaviors &amp; environment that impact sleep</td>
</tr>
</tbody>
</table>

**Face to Face  CBT-I is the best**

**Many online CBT-I sources show benefits**
Any activity that is not sleep in bed, will train the brain and body that it is okay not to sleep in bed.

Avoid Blue Light in the Bedroom: (TV, Computer, Cell Phones)

Create a room that is focused on sleep and/or intimacy.
Daytime Lifestyle sets up Sleep
Sleep sets up next Daytime
Alcohol and sleep

Following EVERY (1) SERVING, SLEEP impacted for 2 hours

1st hour of ↑ sedation, followed by
2nd hour of ↑ arousal or withdrawal
It may take up to 7 hours, to metabolize Caffeine by 50%.

A full cup at 8 AM... ¼ cup at 10 PM

Caffeine blocks brain chemical that induces deep sleep.
Exercise and deep sleep

- Exercise breaks down ATP and promotes ↑ adenosine
- ↑ adenosine enhances deep sleep

Adenosine is blocked by caffeine
BETTER SLEEP TIPS

- Schedule adequate number of hours (include nap time)
- Schedule same time, everyday of the week *(if needed, vary by one hour or less)*
- 1 hour before bed, start to ramp down:
  - “Turn Off” Computers, Phones, TVs
  - Dim the lights & promote darkness
  - Consider aromatherapy &/or a warm shower or bath

CREATE A RITUAL BEFORE BEDTIME
BETTER SLEEP TIPS

• If busy brain, seek a recitation
  □ Recite poem, prayer, hymn or mantra
  □ Count breaths
  □ Progressive relaxation from toe to head
  
  if and when the mind wanders, and it will..
  
  SMILE… and START OVER…

• If still awake after 20 minutes, GET OUT OF BED
  □ Read under a soft light
  □ Gentle stretch or yoga
  □ Relaxation techniques

CREATE A RITUAL BEFORE BEDTIME
Rx for optimal sleep & health

(1) Quantity and (2) Quality

Daytime Lifestyle ↔ Nighttime Sleep

Create Night Time Rituals

THANK YOU
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