Nutrition, Lifestyle, and Sleep
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Focus Spring
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Rosen Shingle Creek Resort
Orlando, Florida

For Respiratory Therapists, Sleep Technologists and Critical Care Nurses
Disclosures

• I have no conflicts of interest to disclose.
• I receive no funding through pharmaceuticals.
• I am employed by Lee Health.
• I am author and have a website that provides sleep health information.
Objectives

• Discuss the scope and health implications of inadequate movement and rest in the population at large today.
• Emphasis on insulin resistance, inflammation, and cancer.
• Discuss the role of glycemic index on nutrition.
• Encompass both adult and pediatric aspects.
Rest
Environmental Rhythms
Biological Rhythms

- Testosterone: Mean (±SD) total testosterone serum concentration vs time for PP Populations.
- Melatonin: Levels peak in the middle of the night, production increases in the evening, and levels fall to normal daytime low by early morning.
- Cortisol: Circadian release of cortisol.
- Estrogen/Progesterone: Cycle phases including Menstruation, Follicular Phase, Ovulation, and Luteal Phase.
DID YOU GET ENOUGH SLEEP LAST NIGHT?

35% of U.S. adults are not getting the recommended 7 hours of sleep each night.

READ WHAT YOU CAN DO TO GET MORE SLEEP
www.cdc.gov/sleep/about_sleep
CDC researchers reviewed data from the 2014 Behavioral Risk Factor Surveillance System (BRFSS), a state based, random-digit–dialed telephone survey conducted collaboratively by state health departments and CDC.
Sleep Problems on the Rise

Sleep problems are becoming more of a concern at doctors offices. There has been an increase in prescription sleep medications.

- From 1999 to 2010:
  - Insomnia as CC: 4.9 to 5.5 million visits in 2010 (13% increase)
  - Office visits w sleep disturbance: 6.4 to 8.2 million (29% increase)
  - Dx of sleep apnea: 1.1 to 5.8 million (442% increase)
  - Any sleep related Dx: 3.3 to 12.1 million (266% increase)
  - Rx for sleep meds: 5.3 to 20.8 million (293% increase)
  - Rx for benzodiazepine receptor agonists (~430% increase)

Medications are **NOT** First Line Tx

• First line therapy for insomnia per America College of Physicians (ACP) is CBT-I (Cognitive Behavioral Therapy for Insomnia).
  
  • (1) ACP recommends that all adult patients receive cognitive behavioral therapy for insomnia (CBT-I) as the initial treatment for chronic insomnia disorder. (Grade: strong recommendation, moderate-quality evidence).
  
  • (2) Additionally, ACP recommends that clinicians use a shared decision-making approach, including a discussion of the benefits, harms, and costs of short-term use of medications, to decide whether to add pharmacological therapy in adults with chronic insomnia disorder in whom cognitive behavioral therapy for insomnia (CBT-I) alone was unsuccessful.

• *Ann Intern Med.* 2016;165
Sleep Affects Insulin Resistance

• Impaired sleep is an independent risk factor for all cause and cardiovascular, mortality/morbidity.

• Sleep abnormalities are causally linked to impairments in glucose homeostasis, metabolic syndrome and Type 2 Diabetes (DMII)

• Diabetology & Metabolic Syndrome. 2015;7:25
Sleep and Inflammation

How Inflammation and Pain Affect Your Sleep
Sleep and Inflammation

• “Chronic exposure to an innate immune cytokine reduced sleep continuity and depth and induced a sleep pattern consistent with insomnia and hyperarousal.”

• “Sleep loss may be one of the ways that inflammatory processes are activated and contribute to the association of sleep complaints, short sleep duration, and cardiovascular morbidity.”

• Sleep disorders may trigger immune system abnormalities inducing autoantibody production autoimmune disease: SLE, RA, etc.
Sleep and Cancer

• Meta-analysis suggests a positive association between long sleep duration and colorectal cancer, and an inverse association with incidence of hormone related cancers like those in the breast.
  • *Asian Pac J Cancer Prev.* 2013;14(12):7509-15

• Fatigue is a major complaint among cancer patients. some degree of cancer-related fatigue experienced during the day may relate to sleep/wake cycles or to the quality and quantity of sleep obtained at night.
  • *Eur J Cancer Care (Engl).* 2001 Dec; 10(4): 245–255.

• Meta-analysis confirms that the MBIs yielded a medium effect size on sleep quality and the effect was maintained for up to 3 months.
  • *J Clin Psychiatry.* 2014 Nov;75(11):1215-23
Circadian Timing in Oncology

• Circadian timing circuits regulated by clock genes influence pharmacokinetics and pharmacodynamics of oncology drugs

• In studies in colon cancer it was found that the administration of the chemotherapy in the morning resulted in an improved median survival over the use of the same drugs without regulating chronotherapy

• Improved chrono synchronization achieved with programmed exercise, meal timing, light exposure and sleep schedule

• Chrono-rehabilitation suggested to improve both quality of life and survival in cancer patients

• Ann Med 2014; 46: 191-207
Sleep and Biological Rhythms
Sleep and Biological Rhythms

Interplay Between Microbiome and Gut Circadian Clock
Sleep and Microbiome

Rhythmicity of the Intestinal Microbiota is Regulated by Gender and the Host Circadian Clock

- In mammals, multiple physiological, metabolic, and behavioral processes are subject to clock gene expression
- Disruption of clock gene expression through changes in the light/dark cycle was found to alter rhythmicity in the fecal microbiota composition
  - *Proc Natl Acad Sci* 2015; 112: 10479-10484
Microbiome and Melatonin

Melatonin regulation as a possible mechanism for probiotic in irritable bowel syndrome: a randomized double-blinded placebo study.

- There was an increase in salivary morning melatonin levels in males treated with probiotics.
- GI symptom improvement correlated with a rise in morning melatonin.
- **Probiotics may act by influencing melatonin production.**
Melatonin and the Mitochondria

- Melatonin can increase the activity of the mitochondrial respiratory complexes I and IV.
Sleep and Food is Medicine

EATING THIS...

CAUSES THIS

Disturbed Circadian Clocks
Leaky Gut
Imbalanced Gut Bacteria
Electronics and Sleep
Insomnia and EMF ???
Electro Magnetic Frequency?

Power Frequency fields of a 765 KV line in relation to observed biological effects.

http://www.safespaceliving.com/cmsimages/sources/safe-living-distance-to-power-lines.jpg
Mitochondria: Proper Calcium Ion Flux

- Mitochondria help maintain proper flow of calcium within various components of the cell.
Electro Magnetic Frequency !!!

Power Frequency fields of a 765 KV line in relation to observed biological effects.

http://www.safespaceprotection.com/cmsimages/sources/safe-living-distance-to-power-lines.jpg
EMF Activation of VGCCs Increases Free Radical Production

VGCC = Voltage-Gated Calcium Channels

CELL

- Nitric oxide
- Peroxynitrite
- Nitric oxide synthetase

EMF

Ca++

Ca++

Peroxynitrite produces free radicals, including hydroxyl radical and NO₂.

This increase in free radicals then leads to inflammation, oxidant stress, and damage to cell structures, including DNA.

The EMF doesn’t directly damage the cell. It just deranges cellular metabolism.

The free radicals that are produced by this change in metabolism are what causes the damage.

Source: Presentation Materials of Dr. Paul Dart, July 23, 2013, before a special session of the Eugene Water and Electric Board.
Insomnia...???

- Commonly reported neuropsychiatric symptoms following microwave EMF exposure.

- Pall, M.L., Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. *J. Chem. Neuroanat.* (2015)

<table>
<thead>
<tr>
<th>Symptom(s)</th>
<th>Numbers of studies reporting</th>
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<tbody>
<tr>
<td>Sleep disturbance/insomnia</td>
<td>17</td>
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<tr>
<td>Headache</td>
<td>14</td>
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<tr>
<td>Fatigue/tiredness</td>
<td>11</td>
</tr>
<tr>
<td>Depression/depressive symptoms</td>
<td>10</td>
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<tr>
<td>Dysesthesia (vision/hearing/olfactory dysfunction)</td>
<td>10</td>
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<tr>
<td>Concentration/attention/cognitive dysfunction</td>
<td>10</td>
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<tr>
<td>Dizziness/vertigo</td>
<td>9</td>
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<tr>
<td>Memory changes</td>
<td>8</td>
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<tr>
<td>Restlessness/tension/anxiety/stress/agitation/feeling of discomfort</td>
<td>8</td>
</tr>
<tr>
<td>Irritability</td>
<td>7</td>
</tr>
<tr>
<td>Loss of appetite/body weight</td>
<td>6</td>
</tr>
<tr>
<td>Skin tingling/burning/inflammation/dermographism</td>
<td>6</td>
</tr>
<tr>
<td>Nausea</td>
<td>5</td>
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</table>
Insomnia and EMF ???

Oxidative stress, melatonin level, and sleep insufficiency are noted among electronic equipment repairers.

- The electronic equipment repairers, exposed to ELF-EMF, are at a risk of oxidative stress and sleep insufficiency, which could be explained by lower plasma melatonin levels and higher MDA levels. Health education about the hazards of ELF-EMF, shortening of exposure time per day, and taking antioxidant vitamins should be done to ameliorate the oxidative effect of EMF on those workers.
Insomnia and EMF ???
Stress Reduction Activities?

• **1 in 5 Americans never engages in stress reduction activities**—and of those who do, two of the top named stress management techniques were >2 hours TV (40%) and surfing the Internet (38%).

Work-Life Balance?

• 82% of office workers log into work at least once every week outside of regular work hours. More than half (52%) log in every day. Only a third of all U.S. workers agree that they have a good work life balance.

• Workfront State of Enterprise Work Report 2015
Overtime & Breast Cancer

• 116,462 cancer free workers followed for mean of 10.8 years; 4371 developed cancer.
• Working hours unrelated to risk of developing colorectal, lung or prostate cancers.
• Working 55 h per week associated with 1.60-fold increase in female breast cancer risk. (95% confidence interval 1.12-2.29)
• Adjustment for age, socioeconomic position, shift and night-time work and lifestyle factors.
Overtime, Strokes and CHD

Compared to working 35–40 hours per week:

• Stroke risk was dose dependent
  • 30% increase in strokes at ≥55 hours/week
  • 27% increase in strokes at 49–54 hours/week
  • 10% increase in strokes at 41–48 hours /week

• 13% increase in risk of coronary heart disease in people working ≥55 hours/week.

• Increased risk was due to physical inactivity, high alcohol consumption, and repetitive triggering of the stress response.

Purpose of Meditation

- Focus and quiet the mind
- Promote relaxation
- Build internal energy or life force
- Develop love, patience and forgiveness
- Achieve better health
Mindfulness and Sleep
Mindfulness and Sleep

• Mindfulness Meditation For Chronic Insomnia.
  • Ong et al. A randomized controlled trial of mindfulness meditation for chronic insomnia. *Sleep*. 2014 Sep 1;37(9):1553-63

• Mindfulness Meditation Better Than Sleep Hygiene Training.
Mindfulness Builds Brain!

“Mindfulness Practice Leads to Increased Brain Gray Matter Density”

• The results of this longitudinal study suggest that participating in MBSR is associated with changes in gray matter concentration in brain regions involved in learning and memory processes, emotional regulation, self-referential processing and perspective taking.

Meditation Enhances Cognition and Brain Plasticity

• **Meditation** may affect multiple pathways that could play a role in brain aging and mental fitness. It reduces cortisol secretion and elevates BDNF. Meditation was also shown to lower oxidative stress in the body.

Meditation Decreases Inflammation

• The long-term practice of meditation may reduce stress reactivity and could be of therapeutic benefit in chronic inflammatory conditions characterized by neurogenic inflammation.

Meditation and Cardiovascular Risk

• Multiple studies have demonstrated the beneficial effects of meditation on various CV risk factors.

• In addition to decreasing CV mortality, meditation has also been shown to improve conditions such as hypertension, type 2 diabetes mellitus, dyslipidemia, and high cortisol levels.
Movement
The Problem?

• Less than 1/2 of patients receive clinical counseling on physical activity.
Inactivity and Mortality

- Inactivity accounts for 5% of global mortality.
- Inactivity is a greater health risk than being overweight or obese.
SITTING is the New Smoking
TV Time and CVD Mortality

Television time associated with increased risk of all-cause and CVD mortality.

Hazard ratios for each 1-hour increment in television/day were:

- 1.11 for all-cause mortality
- 1.18 for CVD mortality
- 1.09 Cancer mortality

Compared to <2h/d, the risk of all cause mortality was:

- 1.13 (95% CI, 0.87-1.36) for 2 to 4 h/d
- 1.46 (95% CI, 1.04-2.05) for 4 h/d

For CVD mortality the risks were

- 1.19 (95% CI, 0.72 to 1.99) for 2 to 4 h/d
- 1.80 (95% CI, 1.00 to 3.25) for 4 h/d

Circulation. 2010; 121: 384-391
Evolution... Something Went Wrong!
Mortality and Hours Weekly of Moderate to Vigorous Physical Activity

Anti-inflammatory Effects of Exercise

Exercise and Sleep

“People sleep significantly better and feel more alert during the day if they get at least 150 minutes of exercise a week.”

Mental Health and Physical Activity, Volume 4, Issue 2, Pages 65-69
Exercise and RLS

Yoga and RLS.

- Yoga may be effective in attenuating RLS symptoms and symptom severity, reducing perceived stress, and improving sleep and mood in women with RLS. Innes et al. [1]

Exercise and RLS.

- It is recommended to have comprehensive intervention as part of a cognitive-behavioral package as well as for exercise therapy and cognitive behavioral therapy for insomnia to be delivered as active treatments for RLS and/or PLMD. [2]
Regular Exercise Reduces Primary Cancers & Recurrence

- Melanomas injected into mice with a running wheel were 61% smaller after six weeks than were those in mice that had been unable to exercise.
- A similar reduction in size (58%) pertained to lung tumors.
- Only 31% mice with exercise wheels injected with diethylnitrosamine developed tumors at all—in contrast to 75% in mice lacking access to a wheel.
Making Physical Activity Counseling a Priority in Clinical Practice

Fidgeting

Non-Exercise Activity Thermogenesis
Fidgeting

• Spontaneous physical activity (fidgeting) inversely related to weight
• Spontaneous physical activity inversely associated with weight gain in prospective studies & experiments with increased calorie intake.
• Non-exercise activity thermogenesis (NEAT): fidgeting, walking and standing.
• NEAT benefits include increased caloric expenditure and reduced occurrence of the metabolic syndrome, cardiovascular events, and all-cause mortality.

Nutrition
The insulin-like growth factor (IGF) system has been implicated in the aetiopathogenesis of cancer, cardiovascular disease and diabetes.

IGF-1

Meat + Sweet

Processed Plate
Ultra-Processing
Profound Transformation of Diet

**Traditional:**
Meals prepared in the home from minimally processed foods

**Today:**
Meals often consist of ultraprocessed products prepared outside the home
Ultra-Processed Products

Extreme Chemical and Mechanical Manipulation

Traditional diet
• Composed of a variety of foods
  - vegetables
  - fruits
  - grains
  - legumes, etc.
• Marketed in limited forms

Ultra-processed diet
• Prepared primarily from 3 foods
  - corn
  - wheat
  - soy
  - (and animals raised on these)
• Marketed in enormous variety
Fast Food

The Prototypic Ultra-Processed Food

• Increased from 2% to 20% of calories in children’s diets since 1970s
• Fast food has penetrated all aspects of society, including schools, playgrounds and hospitals
• Strongly linked to obesity and related complications
Rate of Nutrient Digestion/Absorption

*Increased with Degree of Processing*

The Glycemic Index

A Measure of Carbohydrate Digestion Rate
# Glycemic Index and Hunger

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<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
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<tbody>
<tr>
<td>55 g whole egg</td>
<td>63.9 g steel-cut oats</td>
<td>60.9 g instant oatmeal</td>
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<tr>
<td>45 g egg white</td>
<td>160 g 2% milk</td>
<td>160 g 2% milk</td>
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<tr>
<td>40 g low-fat cheese</td>
<td>15 g H &amp; H cream</td>
<td>15 g H &amp; H cream</td>
</tr>
<tr>
<td>200 g spinach</td>
<td>16.0 g fructose</td>
<td>19.0 g dextrose</td>
</tr>
<tr>
<td>30 g tomato</td>
<td>0.0 g saccharine</td>
<td>0.2 g saccharine</td>
</tr>
<tr>
<td>185 g grapefruit</td>
<td>397 g water</td>
<td>397 g water</td>
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**Macronutrients (% carbohydrate/protein/fat):**

<table>
<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
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<tbody>
<tr>
<td>40/30/30</td>
<td>64/16/20</td>
<td>64/16/20</td>
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**Energy density (KJ/g):**

<table>
<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
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<tbody>
<tr>
<td>2.46</td>
<td>2.52</td>
<td>2.52</td>
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</table>
Glycemic Index & Hunger

Blood Glucose

Glycemic Index & Hunger

*Epinephrine*

Glycemic Index and Hunger

Cumulative Food Intake

Glycemic Effects in an Animal Model
Effects of Glycemic Index in Rodents

Study Design

- Sprague-Dawley rats given diets with identical macronutrients
  - high GI (amylopectin starch), n = 11
  - low GI (high amylose starch), n = 10
- Energy intake controlled to maintain identical mean body weight between groups
- Body composition measured at 18 weeks with triturated water

Effects of Glycemic Index in Rodents

Food Intake and Body Weight

Effects of Glycemic Index in Rodents
Differences in Body Composition

Effects of Glycemic Index in Rodents

Differences in Body Composition

Glycemic Load and Chronic Disease
Obstructive sleep apnea and type 2 diabetes: interacting epidemics.
*Chest.* 2008 Feb;133(2):496-506.

A Modern Approach to the Treatment of Mitochondrial Disease

The glycemic index: physiological mechanisms relating to obesity, diabetes, and cardiovascular disease.
*JAMA.* 2002;287:2414-2423

Nonalcoholic fatty liver, nonalcoholic steatohepatitis, ectopic fat, and the glycemic index
Valtuena et al. *AJCN* 2006, 84:136-42

The effect of statins on testosterone in men and women, a systematic review and meta-analysis of randomized controlled trials.
*BMC Med.* 2013 Feb 28;11:5

Dietary carbohydrate, glycemic index, glycemic load, and risk of cancer

Fructose: it's "alcohol without the buzz".

Sugar, Uric Acid, and the Etiology of Diabetes and Obesity

Inactivation of Nitric Oxide by Uric Acid

The wrong white crystals: not salt but sugar as aetiological in hypertension and cardiometabolic disease.
*Open Heart.* 2014 Nov 3;1(1)

Beta-blockers decrease melatonin release via specific inhibition of adrenergic beta1-receptors.
Ketogenic Diet and Cancer

• Ketogenic diets may be safely used as an adjuvant therapy to conventional radiation and chemotherapies.

• Ketogenic diet is suitable for even advanced cancer patients. It has no severe side effects and might improve aspects of quality of life and blood parameters in some patients with advanced metastatic tumors.

• Report an improved emotional functioning and less insomnia.
  • *Nutr Metab (Lond)*. 2011; 8: 54.
Long-term effects of a ketogenic diet in obese patients


**CONCLUSIONS:**
The present study shows the beneficial effects of a long-term ketogenic diet. It significantly reduced the body weight and body mass index of the patients. Furthermore, it decreased the level of triglycerides, LDL cholesterol and blood glucose, and increased the level of HDL cholesterol. Administering a ketogenic diet for a relatively longer period of time did not produce any significant side effects in the patients. The present study confirms that it is safe to use a ketogenic diet for a longer period of time than previously demonstrated.
Mechanistic Studies
Energy Expenditure & Weight Loss Maintenance

Methods

• 21 obese young adults, studied for 7 months
• 10 to 15% weight loss on a standard low calorie diet
• Then studied during weight maintenance on each of three test diets with the same calories:
  • Low fat (60% carbohydrate, 20% fat, 20% protein)
  • Low glycemic index (40% carbohydrate, 40% fat, 20% protein)
  • Very low carb (10% carbohydrate, 60% fat, 30% protein)
• Resting and total energy expenditure (calories per day) measured

Energy Expenditure & Weight Loss Maintenance

Effects on Metabolic Fuels in the Postprandial State

Walsh. PLoS ONE 8(3): e58172
Long-Term Effects of Macronutrients on Weight
Feeding Studies

Effect of Dietary Composition

DIRECT Study

Methods

• 322 obese adults, studied for 2 years
• Assigned to 3 diets designed to differ in macronutrients
  • Low fat, calorie-restricted
  • Mediterranean, calorie-restricted
  • Low carbohydrate, not calorie-restricted
• Intervention based at a work site, with partial food provision
• Completion rates approaching 90%

Shai. NEJM 2008, 359:229-41
Feeding Studies

Effect of Dietary Composition

Feeding Studies
Effect of Dietary Composition

HMG-CoA Reductase

- Rate-limiting step in cholesterol synthesis
- Statins act by competitively inhibiting HMG-CoA reductase
- Stimulated by Leptin and Insulin
Natural History of Type 2 Diabetes

Glycemic Index and Children?
Effects of Glycemic Load in Peds


METHODS

- 800 children from 8 European countries whose parents were participating in a weight loss maintenance study
- Diet: Low vs high protein; low vs high GI for 26 weeks – ad libitum
- Intervention: family counseling

RESULTS:

- High glycemic load diet showed greatest increase in adiposity
- *Low glycemic load diet showed greatest decrease overweight/obesity prevalence*
Energy Density
Calorie density is associated with poor nutritional quality, body weight & diabetes.

280 grams for 90 calorie portion
25 grams for 90 calorie portion

Fiber, Micronutrient & Phytochemicals
Progressive reduction in nutrient quality with degree of processing.

Fiber: 5 g
Many vitamins, minerals
Dozens or hundreds of phytochemicals

Fiber: 0 g
Virtually no vitamins, minerals
Minimal phytochemicals
“Primordial Palatability”
High Intensity Flavoring

• Emphasis on sweet, salt and fat (primarily flavors of breast milk)
• Flavors further enhanced through chemical manipulation
• May override endogenous satiety mechanisms
• Maintain taste preferences in an “infantilized state”
  • naturally sweet foods (e.g., fruit) taste bland
  • unsweet food (e.g., vegetables) taste unpalatable

Kessler. *The End of Overeating*, 2009
Lifestyle!
Daily Choices...
UNREFINED PLANT FOOD CONSUMPTION VS. THE KILLER DISEASES: HEART DISEASE AND CANCER

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage of deaths from heart disease and cancer</th>
<th>Percentage of calories from unrefined plant foods</th>
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<tbody>
<tr>
<td>Hungary</td>
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<tr>
<td>USA</td>
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<td>Laos</td>
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</table>

Legend:
- Red: Percentage of deaths from heart disease and cancer
- Green: Percentage of calories from unrefined plant foods
Open your eyes, and look within. Are you satisfied with the life you're living?

- Bob Marley
Does Provider Behavior Matter?

• Is there a relationship between the personal health habits of health care providers and their recommendations in patient counseling?

Yes! Provider Behavior Matters!

- Physicians who exercise are more likely to counsel patients to exercise.
- Those that do aerobic training, counsel on aerobic training, and those that do strength training counsel on strength training.
- The main barriers to counseling on exercise were:
  - inadequate time
  - lack of knowledge/experience with exercise counseling
Yes! Provider Behavior Matters!

Healthier Doctors = Healthier Patients

• “Physicians who practice healthy habits play a key role by helping their patients to adopt healthy lifestyles for primary prevention of chronic diseases.”

• “Improving the health of doctors is critically important, suggest physician wellness experts. Not only for doctors and their families, but also for patients.”
Yes! Provider Behavior Matters!
Thank You!

Contact: www.ParadiseSleep.com
JoseTheSleepGuy@gmail.com

_Encourage others to encourage others!_
—Jose Colon, M.D., MPH
To learn more about how IFM can help your clinical practice visit: www.FunctionalMedicine.org