The Connection between Sleep and Autoimmune Disease

Sarah Ballantyne, PhD
(aka The Paleo Mom)


**Early to bed, early to rise makes a man healthy, wealthy and wise.**

“Sleep is boring.”

“A good laugh and a long sleep are the best cures in the doctor’s book.”

“Sleep is for the weak.”

“I’ll sleep when I’m dead.”

**HOW DO YOU FEEL ABOUT SLEEP?**
WE LOVE AND HATE SLEEP

Effects Of Sleep Deprivation On Our Human Body:

- memory lapses
- unable to concentrate
- unable to calculate
- mood swings
- hallucinations
- irritability
- feeling drowsy
- neurons begin to malfunctions
- neuronal connections begin to deteriorate

- constant yawning
- impaired immune system
- causes heart rate variability
- affect cell growth, repair & renewal
- hampered physical performance
THERE IS NO SUBSTITUTE FOR SLEEP
Sleep is fundamental for:

- Brain health
- Hormone health
- Immune health
- Metabolic health
The glymphatic system is a functional waste clearance pathway for the central nervous system. Cerebrospinal and interstitial fluid propel waste products of neuron metabolism to the para-venous space, then directed into lymphatic vessels to return to the circulation for clearance by kidney and liver.
Cells shrink causes a 60% increase in interstitial space while we sleep, providing far more efficient glymphatic flow.

WHY ELSE DO WE NEED SLEEP?

• Restoration
• Replenishment
• Repair
• Reinforcement of immune function
• Memory encoding and consolidation
• Dreaming
• Energy conservation
<table>
<thead>
<tr>
<th>Age</th>
<th>Recommended Sleep</th>
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<tbody>
<tr>
<td>Newborns (0-3 months)</td>
<td>14-17 hours</td>
</tr>
<tr>
<td>Infants (4-11 months)</td>
<td>12-15 hours</td>
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<tr>
<td>Toddlers (1-2 years)</td>
<td>11-14 hours</td>
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<tr>
<td>Preschoolers (3-5)</td>
<td>10-13 hours</td>
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<tr>
<td>School age children (6-13)</td>
<td>9-11 hours</td>
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<tr>
<td>Teenagers (14-17)</td>
<td>8-10 hours</td>
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<tr>
<td>Younger adults (18-25)</td>
<td>7-9 hours</td>
</tr>
<tr>
<td>Adults (26-64)</td>
<td>7-9 hours</td>
</tr>
<tr>
<td>Older adults (65+)</td>
<td>7-8 hours</td>
</tr>
</tbody>
</table>
# How Much Sleep Do We Need?

<table>
<thead>
<tr>
<th>Hours of Sleep</th>
<th>&lt;5</th>
<th>5 to 6</th>
<th>6 to 7</th>
<th>7 to 8</th>
<th>8 to 9</th>
<th>9 to 10</th>
<th>≥10</th>
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</thead>
<tbody>
<tr>
<td>General Health</td>
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<td>Cardiovascular Health</td>
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<tr>
<td>Metabolic Health</td>
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<tr>
<td>Mental Health</td>
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<tr>
<td>Immune Function</td>
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<tr>
<td>Human Performance</td>
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<tr>
<td>Breast Cancer</td>
<td></td>
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<tr>
<td>Pain</td>
<td></td>
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</tr>
<tr>
<td>Mortality</td>
<td></td>
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</tr>
</tbody>
</table>

**Key**

- Inappropriate (Panel Agreement)
- Inappropriate-to-Uncertain (Disagreement)
- Uncertain (Panel Agreement)
- Uncertain-to-Appropriate (Disagreement)
- Appropriate (Panel Agreement)
“Adults should sleep 7 or more hours per night on a regular basis to promote optimal health. Sleeping less than 7 hours per night on a regular basis is associated with adverse health outcomes, including weight gain and obesity, diabetes, hypertension, heart disease and stroke, depression, and increased risk of death. Sleeping less than 7 hours per night is also associated with impaired immune function, increased pain, impaired performance, increased errors, and greater risk of accidents.”
**SLEEP IS ON THE DECLINE**

**More Than A Third Of U.S. Adults Don’t Get Enough Sleep**

Percent of adults by self-reported sleep duration

- Less than 5 hours: 11.8%
- 6 hours: 23%
- 7 hours: 29.5% (Adults should get 7 or more hours of sleep.)
- 8 hours: 27.7%
- 9 hours: 4.4%
- More than 10 hours: 3.6%

Source: CDC


## Sleep is on the Decline

*Usually, how many hours sleep do you get at night?*

<table>
<thead>
<tr>
<th></th>
<th>1942 %</th>
<th>1990 %</th>
<th>2001 %</th>
<th>2004 %</th>
<th>2013 %</th>
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<tbody>
<tr>
<td>Five hours or less</td>
<td>3</td>
<td>14</td>
<td>16</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Six hours</td>
<td>8</td>
<td>28</td>
<td>27</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Seven hours</td>
<td>25</td>
<td>30</td>
<td>28</td>
<td>28</td>
<td>25</td>
</tr>
<tr>
<td>Eight hours</td>
<td>45</td>
<td>22</td>
<td>24</td>
<td>25</td>
<td>29</td>
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<tr>
<td>Nine hours or more</td>
<td>14</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td><strong>NET: Six hours or less</strong></td>
<td>11</td>
<td>42</td>
<td>43</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>NET: Seven hours or more</strong></td>
<td>84</td>
<td>57</td>
<td>56</td>
<td>59</td>
<td>59</td>
</tr>
</tbody>
</table>

**Average hours per night**

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<tr>
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</thead>
<tbody>
<tr>
<td>Hours</td>
<td>7.9</td>
<td>6.7</td>
<td>6.7</td>
<td>6.8</td>
<td>6.8</td>
</tr>
</tbody>
</table>

*GALLUP*
WE OVERESTIMATE HOW MUCH WE SLEEP

• On average, we report 0.8 hours more sleep than we actually get
• People who sleep 5 hours overreport sleep by 1.3 hours
• People who sleep 7 hours only overreport by 0.3 hours

If you get <6 hours sleep, chances are good that your sleep situation is worse than you think.

IS LACK OF SLEEP LINKED TO DISEASE?
SLEEP AND ALL-CAUSE MORTALITY

• Sleeping <6 hours per night increases risk of all-cause mortality by 12%.

• Being obese increases risk of all-cause mortality by 18%.

• Smoking doubles risk of all-cause mortality

• For every hour of physical activity that replaces sedentary time, risk of all-cause mortality drops by 16%.

• Every daily serving of vegetables (up to 5 servings), risk of all-cause mortality drops by 5%.

**SLEEP AND CVD RISK**

- <6 hours sleep increases risk of congestive heart failure by 67%
- <6 hours sleep increases risk of coronary heart disease by 48%
- <6 hours sleep doubles risk of stroke
- <6 hours sleep doubles risk of myocardial infarction


* Hospital discharges for cardiovascular disease (United States: 1970–2007). Hospital discharges include people discharged alive, dead, and “status unknown.”

SLEEP IS ON THE DECLINE


Sleep and Diabetes Risk

- <6 hours sleep increases risk of type 2 diabetes by 50%
- Pooling diabetes and impaired glucose tolerance together, <6 hours sleep increases risk by 2.4x


Figure 2. Trends in overweight, obesity, and extreme obesity among adults aged 20–74 years: United States, 1960–2008

NOTE: Age-adjusted by the direct method to the year 2000 U.S. Census Bureau estimates, using the age groups 20–39, 40–59, and 60–74 years. Pregnant females were excluded. Overweight is defined as a body mass index (BMI) of 25 or greater but less than 30; obesity is a BMI greater than or equal to 30; extreme obesity is a BMI greater than or equal to 40.

SLEEP AND OBESITY RISK

• <6 hours sleep increases risk of obesity by 55% (90% in children)
• Variability in bedtime during the week >2 hours increases risk of obesity by 14%
• Sleep duration variability increases risk of obesity 63% increase for each 1 hour of standard deviation.
• Late to bed, late to rise doubles risk of obesity

RISE OF CANCER

Chart 2: Number of People Diagnosed with Cancer in the U.S. 1975-2006

**SLEEP AND CANCER RISK**

- <5 hours does not increase risk of many cancer (prostate, breast, lung)
- <5 hours sleep increases risk of colorectal adenoma by 50%
- Once diagnosed with cancer, <6 hours sleep reduces survival rate
  - Breast cancer, 46% increased risk of death


**SLEEP AND AUTOIMMUNE DISEASE RISK**

- Non-apnea sleep disorders (eg. insomnia) increases risk of autoimmune disease by 50%
  - Systemic lupus erythematosus 81%
  - Rheumatoid arthritis 45%
  - Ankylosing spondylitis 53%
  - Sjögren's syndrome 51%
- Obstructive sleep apnea more than doubles risk of autoimmune disease
- Shift work increases risk by 50%
- Short sleep increases symptoms of many autoimmune diseases

AUTOIMMUNITY, SELF VS. INVADER

NORMAL IMMUNE RESPONSE
- Antigens invade
- Antibodies form
- Antibodies remove invading antigens
- Antibodies remain and protect

AUTOIMMUNE DISEASE
- Immune system forms antibodies to self-antigens
- Antibodies attack self-antigens
- Inflammation and tissue damage
What Causes Autoimmune Disease?

- Genetic susceptibility (30%)
- Infection, environmental triggers, or bad luck
- Diet and lifestyle

Immune Dysregulation
(the body attacks itself)
## Why Focus on Autoimmune Disease

- Our nation’s biggest health obstacle
- Fewest available medical interventions
- High direct health care costs, and even higher indirect health care costs

### The Cost of Autoimmune Disease

<table>
<thead>
<tr>
<th></th>
<th># People Affected in the U.S.</th>
<th>Estimated Direct Health Care Costs</th>
<th>Research Dollars in 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td>12 Million</td>
<td>$93 Billion</td>
<td>$6.1 Billion</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>25 Million</td>
<td>$273 Billion</td>
<td>$2.4 Billion</td>
</tr>
<tr>
<td>Autoimmune Disease</td>
<td>50 Million</td>
<td>$100 Billion (likely underestimated)</td>
<td>$591 Million</td>
</tr>
</tbody>
</table>
WHAT IS AUTOIMMUNE DISEASE?

- Any of >140 diseases
- Affects ~50 million Americans
- Difficult to diagnose
- Chronic and lifelong
- Incidence in increasing

WHAT IS IMMUNE DISEASE?

- All other chronic illnesses
REGULATION OF THE IMMUNE SYSTEM

Natural regulatory T cells

T\textsubscript{Reg} cell (CD4\textsuperscript{+}, CD25\textsuperscript{+}, FOXP3\textsuperscript{+})

TCR

CD80/CD86

CD25

\downarrow Proliferation

\downarrow \text{IFN-\gamma}

Inducible regulatory T cells

T\textsubscript{H3} cell

\downarrow Proliferation

\downarrow \text{IFN-\gamma}

T\textsubscript{R1} cell

\downarrow Proliferation

\downarrow \text{IL-4}

CD8\textsuperscript{+} regulatory T cell

\downarrow \text{CTL activity}

\downarrow \text{IFN-\gamma}

\text{IL-10 and/or TGF-\beta}

\downarrow \text{MHC and co-stimulatory molecules}

\downarrow \text{APC function}

\downarrow \text{Inflammatory cytokines}

Cell-cell contact

\text{Dendritic cell}
**SLEEP AND THE IMMUNE SYSTEM**

- Inadequate sleep causes increases generalized inflammation and immune activation (with increased susceptibility to infection).
  - Increased monocytes
  - Increased neutrophils
  - Increased B-cell activity
  - Increased Th1, Th2, Th17
  - Increased inflammatory cytokines, LDL
  - Decreased regulatory T-cell activity
  - Insulin resistance, reduced leptin, increased ghrelin
  - Increased cortisol, magnified stress response
  - Endotoxemia (gut barrier dysfunction?)
Inflammation is part of the pathogenesis of all chronic disease.

Understanding the link between sleep and the immune system is critical for health.
Autoimmunity and Sleep Problems

Having an autoimmune disease increases risk of disrupted sleep.

• Circadian rhythm disorder
• Pain
• Inflammation?
AUTOIMMUNE DISEASE AND PAIN

• Pain is a clinical feature of
  – Rheumatoid arthritis (1 in 100)
  – Polymyalgia rheumatica (1 in 140)
  – Sjogren’s syndrome (1 in 230)
  – Ankylosing spondylitis (1 in 300)
  – Psoriatic arthritis (1 in 330)
  – Ulcerative colitis (1 in 600)
  – Crohn’s disease (1 in 640)
  – Systemic lupus erythematosus (1 in 670)
  – Multiple sclerosis (1 in 900)
AUTOIMMUNE DISEASE AND PAIN

- Fibromyalgia:
  - 65% of patients with systemic lupus erythematosus
  - 57% of patients with rheumatoid arthritis
  - 24% of those with psoriatic arthritis
  - 31% in autoimmune thyroid disease

- Rheumatic diseases
  - 62% of in autoimmune thyroid disease

Buskila D and Sarzi-Puttini P. “Fibromyalgia and Autoimmune Diseases: the Pain behind Autoimmunity” IMAJ 2008;10:77–78
5. Weekly Sleep Debt by Pain Type

- No Pain: 0 minutes
- Acute Pain: 14 minutes
- Chronic Pain: 42 minutes

2015 Sleep in America © Poll Sleep and Pain Summary of Findings National Sleep Foundation
AUTOIMMUNE DISEASE AND SLEEP

Sleep Quality by Pain Type

No Pain
- Very Poor/Poor: 6%
- Fair: 28%
- Good/Very Good: 65%

Acute Pain
- Very Poor/Poor: 13%
- Fair: 42%
- Good/Very Good: 45%

Chronic Pain
- Very Poor/Poor: 25%
- Fair: 38%
- Good/Very Good: 37%

2015 Sleep in America ® Poll Sleep and Pain Summary of Findings National Sleep Foundation
Getting more sleep reduces pain.

Sleep can be therapeutic

- Reduces pain
- Regulates immune system
- Reduces inflammation

Sleep should be a focus in every treatment plan!
**Sleep Increases Compliance!**

- Decreases cravings
- Regulates hunger
- Regulates metabolism, insulin sensitivity
- Increases resilience to stress
- Regulates neurotransmitters

Sleep should be a focus in *every* treatment plan!
HOW TO SLEEP MORE AND BETTER

• Make sleep a priority
• Sleep hygiene
• Circadian rhythm entrenchment
• Hormone Regulation (insulin, cortisol)

Go To Bed: 14 Easy Steps to Healthier Sleep

• The science of sleep for optimal health
• 14-Day step-by-step sleep challenge
• Online community support

www.ThePaleoMom.com/GoToBed
MAKE SLEEP A PRIORITY

• Everyone needs a bedtime!
• Ideal bedtime should be 8-9 hours before the
time the alarm is set for.
• 30-60 minutes of wind-down time prior to
time.
• Consistency is critical!!!!!!
• Listen to your body
  – Avoid caffeine after noon
  – No nicotine!
• Sync with other household members
IS SLEEPING TOO MUCH A PROBLEM?

CONSENSUS STATEMENT from American Academy of Sleep Medicine and Sleep Research Society

• Sleeping more than 9 hours per night on a regular basis may be appropriate for young adults, individuals recovering from sleep debt, and individuals with illnesses. For others, it is uncertain whether sleeping more than 9 hours per night is associated with health risk.
SLEEP HYGIENE

- Dark
- Cool
- Quiet

- Comfortable
- Non-stimulating
- Dedicated
Circadian Rhythm Entrenchment

• Light-Dark Cycle
  – Outside during the day (or sun lamp)
  – Dim, red lights in the evening (amber glasses, avoid screens)

• Routine for:
  – Meal times
  – Exercise
  – Temperature

• Daytime:
  – Active
  – Social
  – Outside

• Evenings:
  – Quiet
  – Intimate
  – Dimly lit
HORMONE REGULATION

• Avoid eating 2+ hours before bed
• Avoid sugars in the afternoon
• Eat fiber-rich, moderate-fat diet
• Mild caloric deficit, if appropriate
• Improve resilience to stress
  – Meditation
  – Nature
  – Connection
  – Exercise
SLEEP BIOHACKS

• Amber-tinted (blue-blocking) glasses
• Light therapy box
• Light alarm clock
• Black-out curtains
• Duct tape!
• White noise machine
• Sleep meditation, deep theta tracks
• Weighted blankets
LEARN TO LOVE SLEEP!

“Sleeping will prolong my life”
“The coolest people go to bed early”
“Sleep is my favorite thing”
THANK YOU!!!!!!

www.ThePaleoMom.com/GoToBed