

SLEEP: A Modifiable Risk Factor

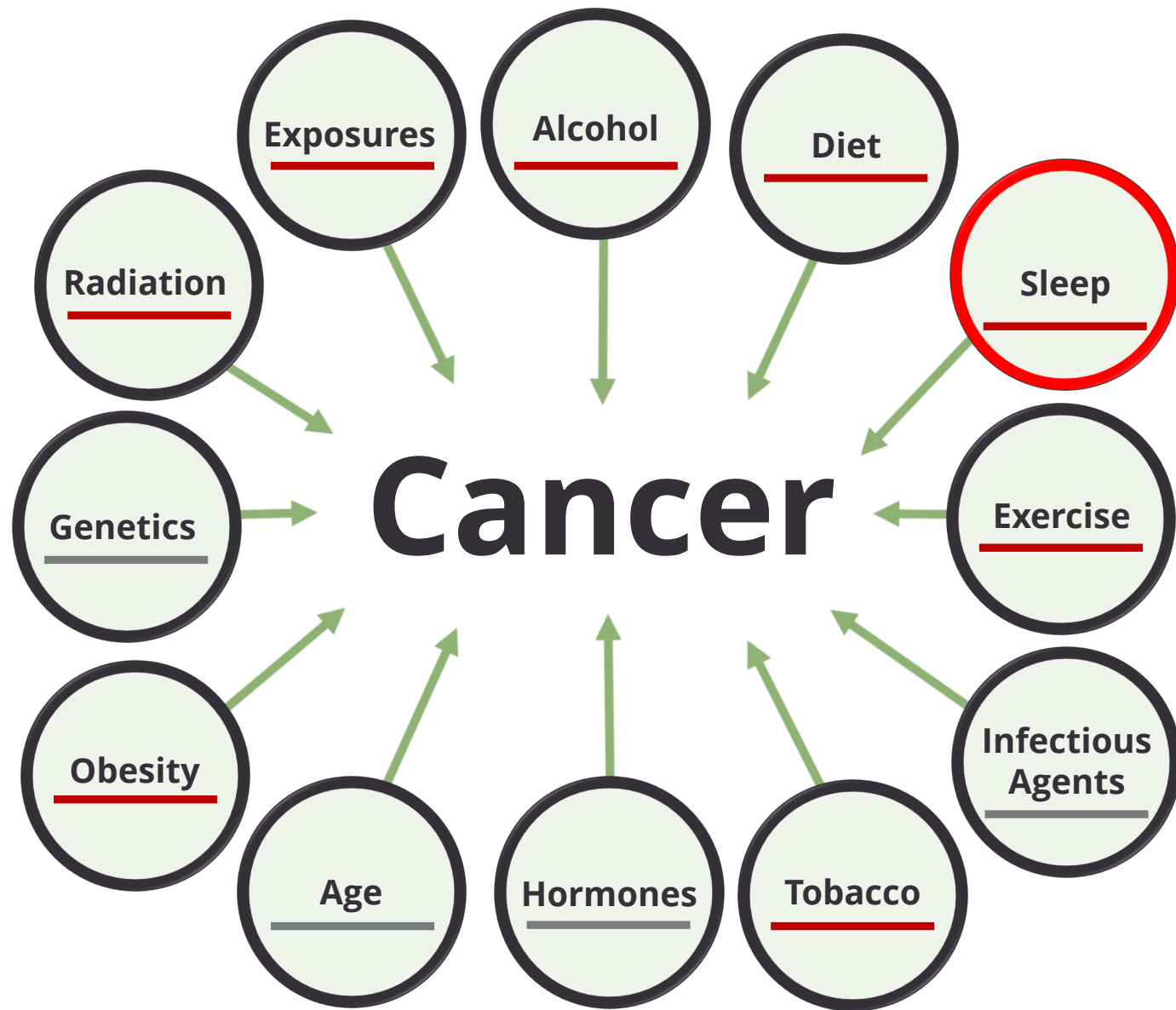
LAURA K. BARGER, PH.D.

DIVISION OF SLEEP AND CIRCADIAN DISORDERS

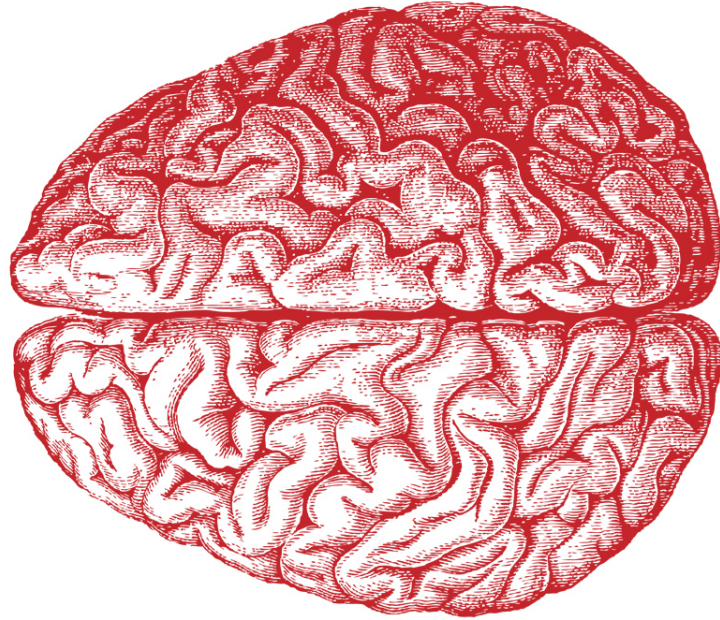
DEPARTMENT OF MEDICINE

BRIGHAM AND WOMEN'S HOSPITAL



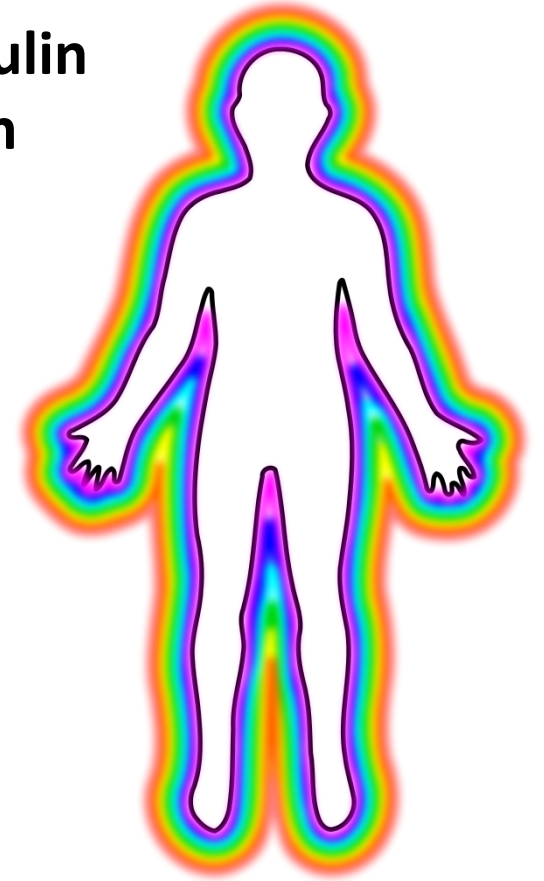


The Importance of Sleep



- **Restoration of energy stores**
- **Brain maintenance**
- **Neural connectivity**
- **Waste clearance**
- **Memory consolidation**
- **Integration of daily learning**

- **Heart health**
- **Blood pressure regulation**
- **Immune system regulation**
- **Regulation of appetite**
- **Maintenance of insulin**
- **Glucose metabolism**



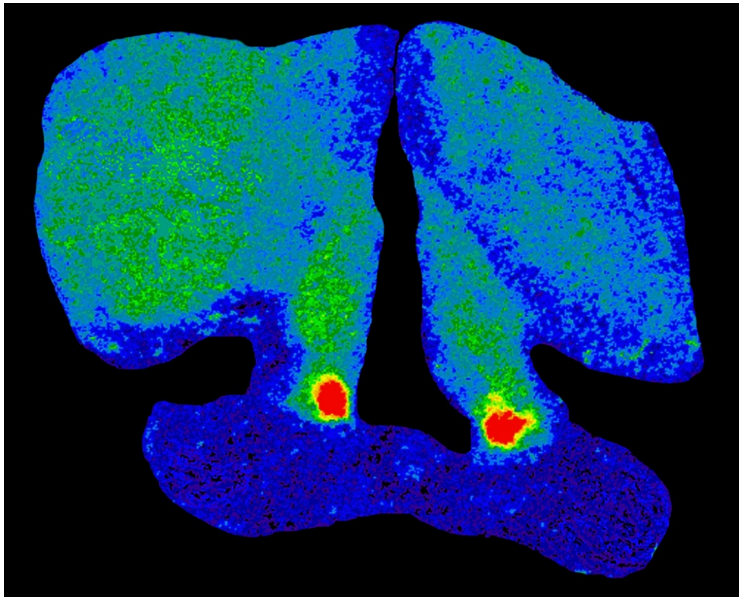


Nearly 1/3 of Americans sleep less than 6 hours/night...double the rate from 50 years ago
69% of Americans report regularly getting insufficient sleep

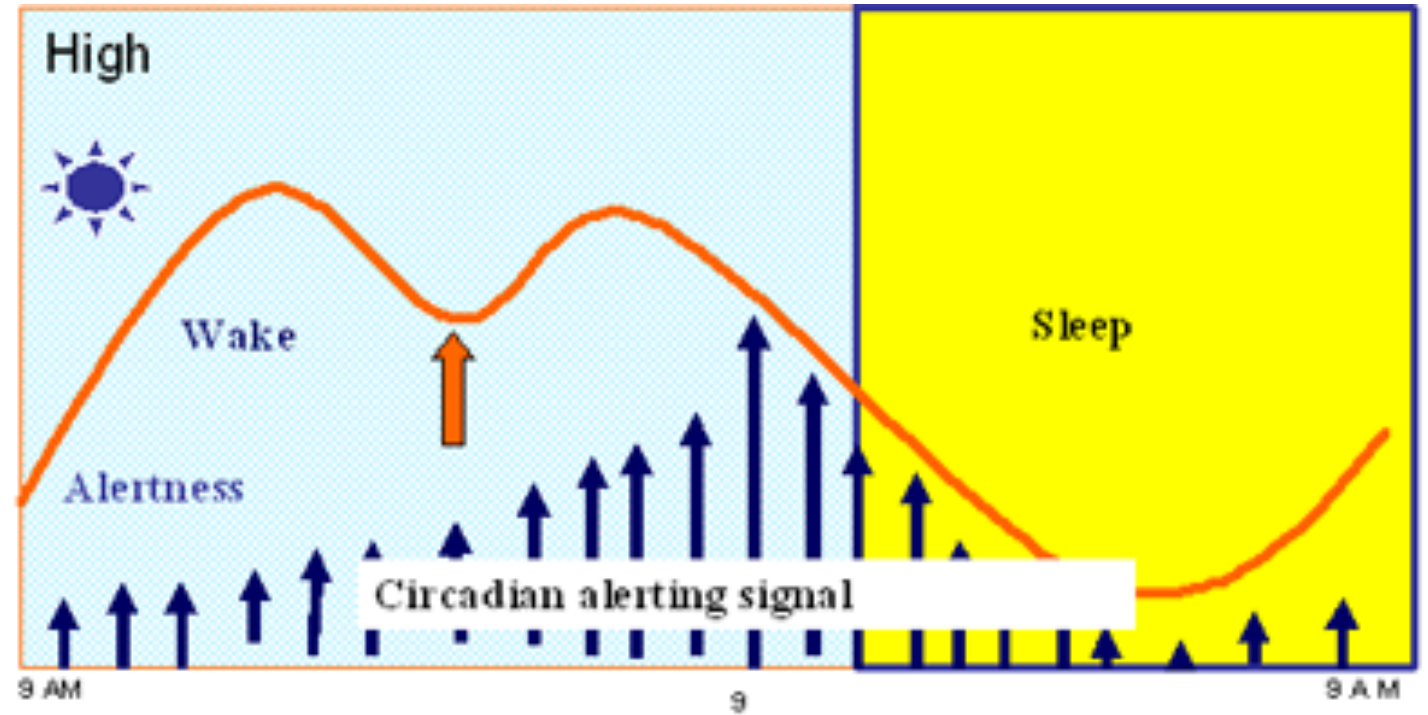


Shiftwork makes sleep more difficult

Circadian clock



Melatonin Receptor Binding on the Human Suprachiasmatic Nucleus (SCN): Courtesy of Dr. David Weaver, University of Massachusetts Medical School



Shiftwork effects may last into retirement

Shiftwork exposure has a dose-response effect on retirees' quality and quantity of sleep, even years after their retirement.

Retirees report worse sleep quality if they were ever shiftworkers

Telephone survey of >1000 retirees showed elevated PSQI scores of former shiftworkers (Monk et al., 2013 a)

Lab confirmation: Retirees have poorer sleep

Laboratory study of retirees found poorer sleep in former shiftworkers compared to non-shiftworkers -- suggesting potential **“circadian scarring”** (Monk et al., 2013 b)



SHIFT WORK – A CARCINOGEN?

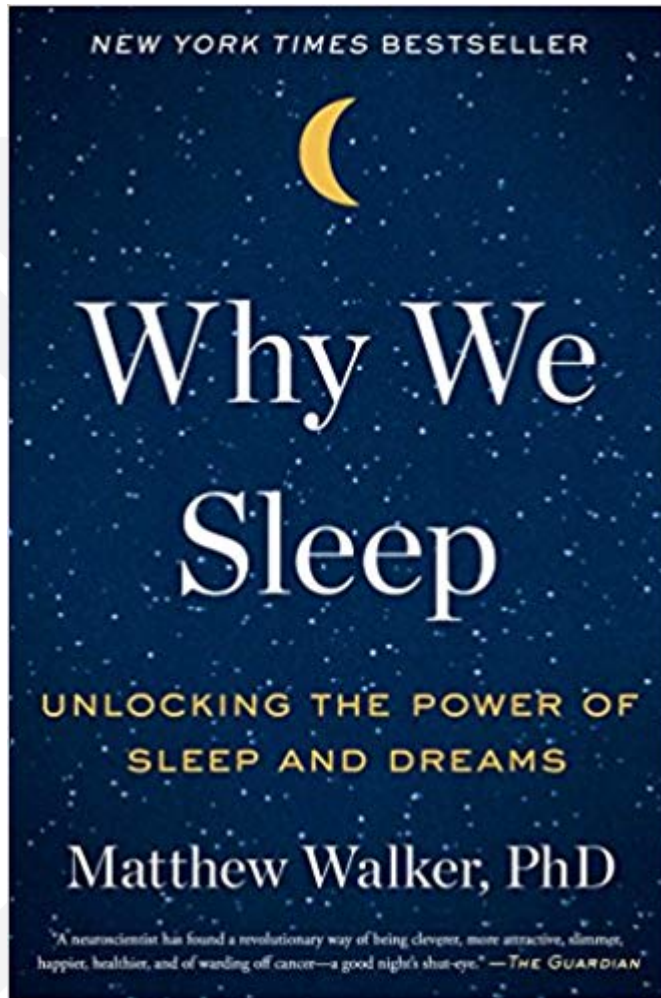
In 2007, the International Agency for Research on Cancer (part of the World Health Organization), classified **shift work** with circadian disruption as a **probable human carcinogen**.

Studies Demonstrating a Significant Risk for Cancer Among Shift Workers

Type of Cancer	Odds Ratio	95% CI	Reference
Breast cancer			
Night shift ≥0.5 year	1.5*	1.3 – 1.7	1
Night shift >6 years	1.7*	1.3 – 1.7	
“Graveyard shift” (any)	1.6*	1.0 – 2.5	2
Shift work ≥5.7 hours/week	2.3*	1.0 – 5.3	
Rotating nights; ≥30 years	1.36*	1.04 – 1.78	3
Rotating shift work: >20 years	1.79*	1.06 – 3.01	4
Prostate cancer			
Rotating shift work	3.0*	1.2 – 7.7	5

*P <0.05 vs comparator group.

1) Hansen J. *Epidemiology*. 2001;12:74-77. 2) Davis S, et al. *J Natl Cancer Inst*. 2001;93:1557-1562. 3) Schernhammer ES, et al. *J Natl Cancer Inst*. 2001;93:1563-1568. 4) Schernhammer ES, *Epidemiology*. 2006;17:108-111. 5) Kubo T, et al. *Am J Epidemiol*. 2006;164:549-555.



“After just one night of only four or five hours’ sleep, your natural killer cells – the ones that attack the cancer cells that appear in your body every day – drop by 70%”

Firefighter Sleep Disorder Screening

- 6,933 firefighters in 66 departments
 - 40 \pm 9 years
 - 6% female
 - 20% \geq 25 BMI
- 37.2% screened positive for a sleep disorder
 - 28.4% Obstructive Sleep Apnea
 - 6.0% Insomnia
 - 9.1% Shift Work Disorder
 - 9.1% Restless Legs Syndrome



More than 80%
were undiagnosed
and untreated



Self-reported safety outcomes, comorbidities and adverse health outcomes associated with positive sleep disorder screening result

	Positive Sleep Disorder Screening vs. No Positive Sleep Disorder Screening			
	Positive outcome with Positive sleep disorder screening n (%)	Positive outcome with Negative sleep disorder screening n (%)	Unadjusted OR (95% CI) P-value	Adjusted OR ^e (95% CI) P-value
Motor Vehicle Crash^a	48(2.0)	46(1.2)	1.71 (1.14-2.57) P=0.0101	2.00 (1.29-3.12) p=0.0021
Near Crashes^b	451(18.5)	345(8.7)	2.38 (2.04-2.76) P<0.0001	2.49 (2.13-2.91) P<0.0001
Nodding off or falling asleep while driving^b	498(20.7)	418(10.7)	2.17 (1.89-2.50) P<0.0001	2.41 (2.06-2.82) P<0.0001
Cardiovascular disease^c	60 (2.4)	36(0.9)	2.78 (1.83-4.22) P<0.0001	2.37 (1.54-3.66) P<0.0001
Diabetes^c	98 (3.9)	55(1.3)	3.01 (2.15-4.20) P<0.0001	1.91 (1.31-2.81) P=0.0009
Depression^c	266 (10.5)	143(3.5)	3.29 (2.66,4.05) P<0.0001	3.10 (2.49-3.85) P<0.0001
Anxiety^c	165 (6.6)	78(1.9)	3.66 (2.78-4.82) P<0.0001	3.81 (2.87-5.05) P<0.0001

^a Yes vs. no, ^b At least once vs. zero, ^c Yes vs. never or not now, ^d Poor, fair, good vs. very good, excellent, ^e Adjusted for age, gender, BMI, cigarette smoking, and alcohol consumption

Sleep and burnout in firefighters

- Collaboration between *Monash Uni, Brigham and Women's Hospital (US), Harvard Medical School (US)*
- US firefighters (n=6307) completed the Maslach Burnout Inventory and screened for sleep disorders

TABLE 2 High burnout outcomes associated with positive sleep disorder screening result (n = 6,307)

Burnout outcome ^a , n ^b	High burnout outcome in participants with positive sleep disorder screening No./No. total (%)				Unadjusted			Adjusted ^e		
	Insomnia positive screening		Insomnia negative screening ^d		OR	95% CI	p-value	OR	95% CI	p-value
EE	116/385	(30.1)	593/5,876	(10.1)	3.84	3.04-4.85	<0.0001	3.78	2.97-4.79	<0.0001
n	6,261									
DP	115/384	(29.9)	989/5,837	(16.9)	2.10	1.67-2.63	<0.0001	2.15	1.71-2.71	<0.0001
n	6,221									
PA	215/383	(56.1)	2,165/5,850	(37.0)	2.18	1.77-2.68	<0.0001	2.16	1.75-2.66	<0.0001
n	6,233									
High degree ^c	44/383	(11.5)	202/5,835	(3.5)	3.62	2.56-5.11	<0.0001	3.60	2.55-5.08	<0.0001
n	6,218									
	OSA positive screening		OSA negative screening ^d							
EE	349/1,830	(19.1)	362/4,375	(8.3)	2.61	2.23-3.06	<0.0001	3.09	2.56-3.71	<0.0001
n	6,205									
DP	426/1,824	(23.4)	665/4,341	(15.3)	1.68	1.47-1.93	<0.0001	2.00	1.71-2.35	<0.0001
n	6,165									
PA	758/1,828	(41.5)	1,607/4,350	(36.9)	1.21	1.08-1.35	0.001	1.20	1.07-1.34	0.002
n	6,178									
High degree ^c	112/1,824	(6.1)	133/4,339	(3.1)	2.07	1.60-2.68	<0.0001	2.49	1.85-3.34	<0.0001
n	6,163									



Obstructive Sleep Apnea (OSA)

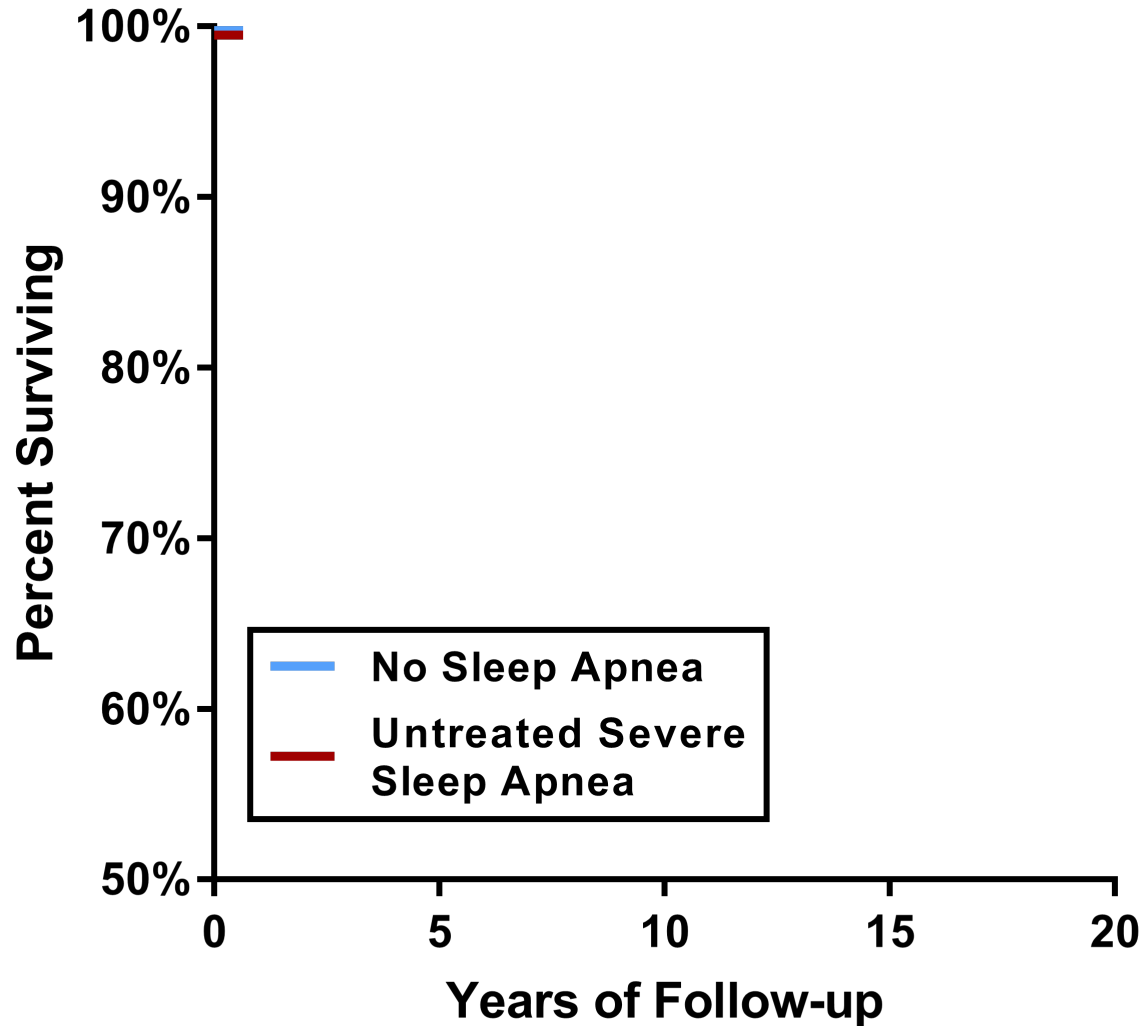


Chart courtesy of Young et al. Sleep. 2008; 31:1071.



OSA Treatments

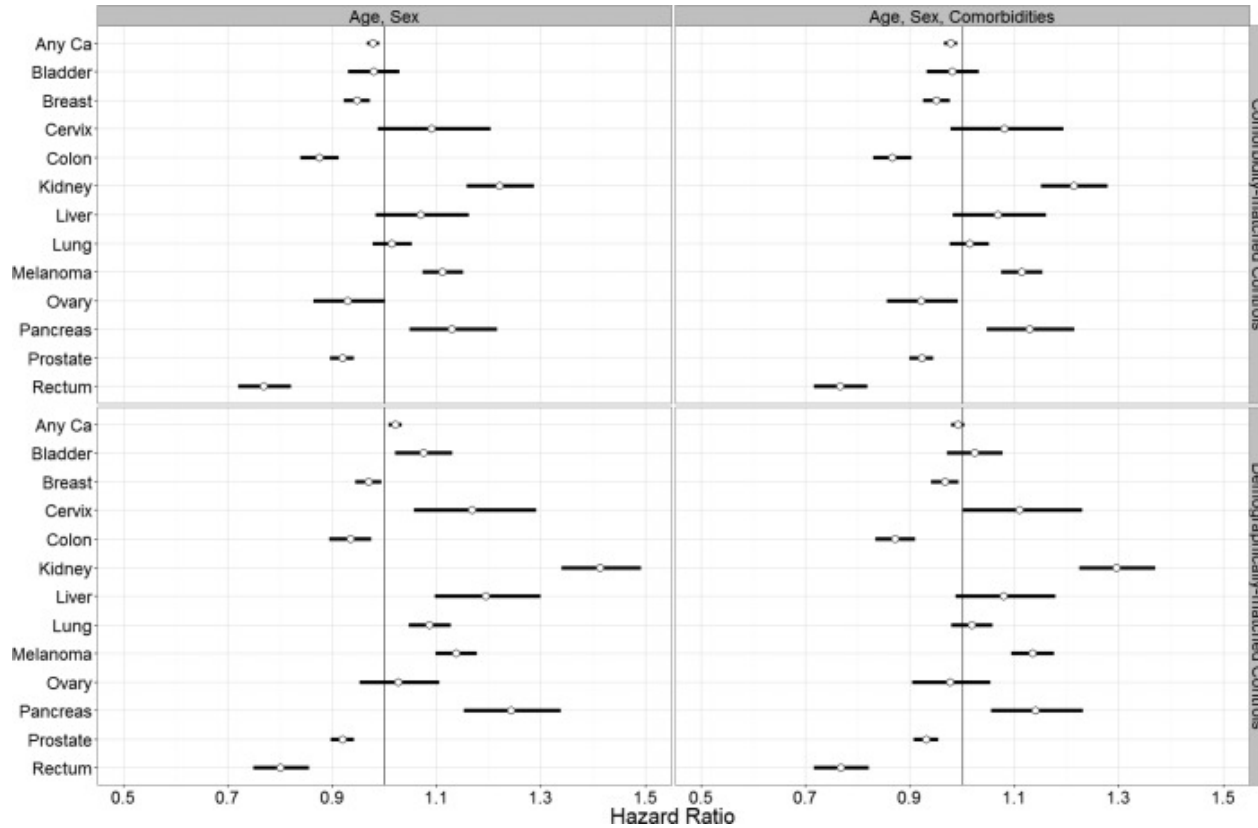
- Continuous Positive Airway Pressure (CPAP)
- Oral appliances
- Surgery



Additional long-term implications...

Cognitive impairment 10 years earlier; Alzheimer's Disease 5 years earlier

Sleep Apnea and Cancer: Analysis of a Nationwide Population Sample



Sleep disruption among older men and risk of prostate cancer

Compared with men without sleep disruption, those with problems falling and staying asleep were at significantly increased risk of **advanced prostate cancer** (\geq stage T3 or lethal disease):

- Hazard Ratio **2.1** (95% CI, 0.7–6.2) for problems falling asleep
- Hazard Ratio **3.2** (95% CI, 1.1–9.7) for those with problems staying asleep

*Within the prospective AGES-Reykjavik cohort study, we followed 2,102 men ages 67-96 recruited in 2002–2006 until the end of 2009.

Hazard ratios of incident cancer in OSA versus demographically matched and comorbidity matched cohort groups. Bar = 95% CI. Demographically matched control group-matched with OSA by age, gender, and state. Comorbidity-matched control group-matched with OSA by age, gender, and all comorbidities.

Gozal D, Ham SA, Mokhlesi B. Sleep Apnea and Cancer: Analysis of a Nationwide Population Sample. *Sleep*. 2016 Aug 1;39(8):1493-500.

Sigurdardottir LG, Valdimarsdottir UA, Mucci LA, Fall K, Rider JR, Schernhammer E, Czeisler CA, Launer L, Harris T, Stampfer MJ, Gudnason V, Lockley SW. Sleep disruption among older men and risk of prostate cancer. *Cancer Epidemiol Biomarkers Prev*. 2013;22:872-879.



FIREFIGHTER HEALTH

By Charles Czeisler, Laura Barger & Conor O'Brien

Sleeping in shared or dormitory-style rooms can make restful sleep difficult to achieve. Photo courtesy Orange County, FL, Fire Rescue

Managing Sleep, Health & Safety

What's the right approach for your department?

Heat attacks and motor vehicle crashes are the two leading causes of death in firefighters. Sleep deficiency—whether instigated by short sleep duration, circadian misalignment associated with working overnight shifts, or a sleep disorder—increases the risk of these two adverse health and safety outcomes.

These and other negative consequences of sleep loss are of major concern, with more than half of firefighters reporting sleep disturbances.

Sleep deficiencies: a national snapshot

There are several aspects of firefighting that make obtaining sufficient quantity and quality of sleep particularly challenging for firefighters. First, firefighting requires 24-hour coverage, 7 days per week, 365 days each year, and most firefighters work 24-hour shifts. The number of alarms sounded each shift and policies restricting on-duty daytime sleep may limit sleep duration on duty. Even when permitted, daytime sleep following night work

is more difficult due to light streaming through windows, noise at the fire station, and the circadian clock's push for wakefulness during the day. Further, the circadian disruption inherent in shift work has been associated with an increased cancer risk. Finally, firefighters often live together while on duty at the fire station, often sleeping in the same room. Therefore, when one firefighter or paramedic is awakened for or returns from duty, makes noise or snores loudly, the sleep of others may be disturbed.

A nationwide survey of nearly 7,000 firefighters in 66 fire departments across the country found that 37 percent of firefighters were at high risk for a common sleep disorder. More than one out of four firefighters (28 percent) screened positive

for obstructive sleep apnea (OSA), which is commonly associated with loud snoring. Nearly one in 10 (9 percent) screened positive for insomnia, with another 6 percent screening positive for shift work disorder and 3 percent for restless leg syndrome.

Those firefighters who screened positive for a sleep disorder had twice the risk of a motor vehicle crash, near-crash or falling asleep while driving. They were also more than twice as likely to have cardiovascular disease, almost twice as likely to have diabetes, and more than three times as likely to have depression or anxiety. Common sleep disorders are easily treated, but alarmingly, 83 percent of firefighters who screened positive for a sleep disorder were undiagnosed and untreated.

CHARLES A. CZEISLER, PhD, MD, is the director of the Sleep Matters Initiative, chief of the Division of Sleep and Circadian Disorders at Brigham and Women's Hospital, and the director of the Division of Sleep Medicine at Harvard Medical School.

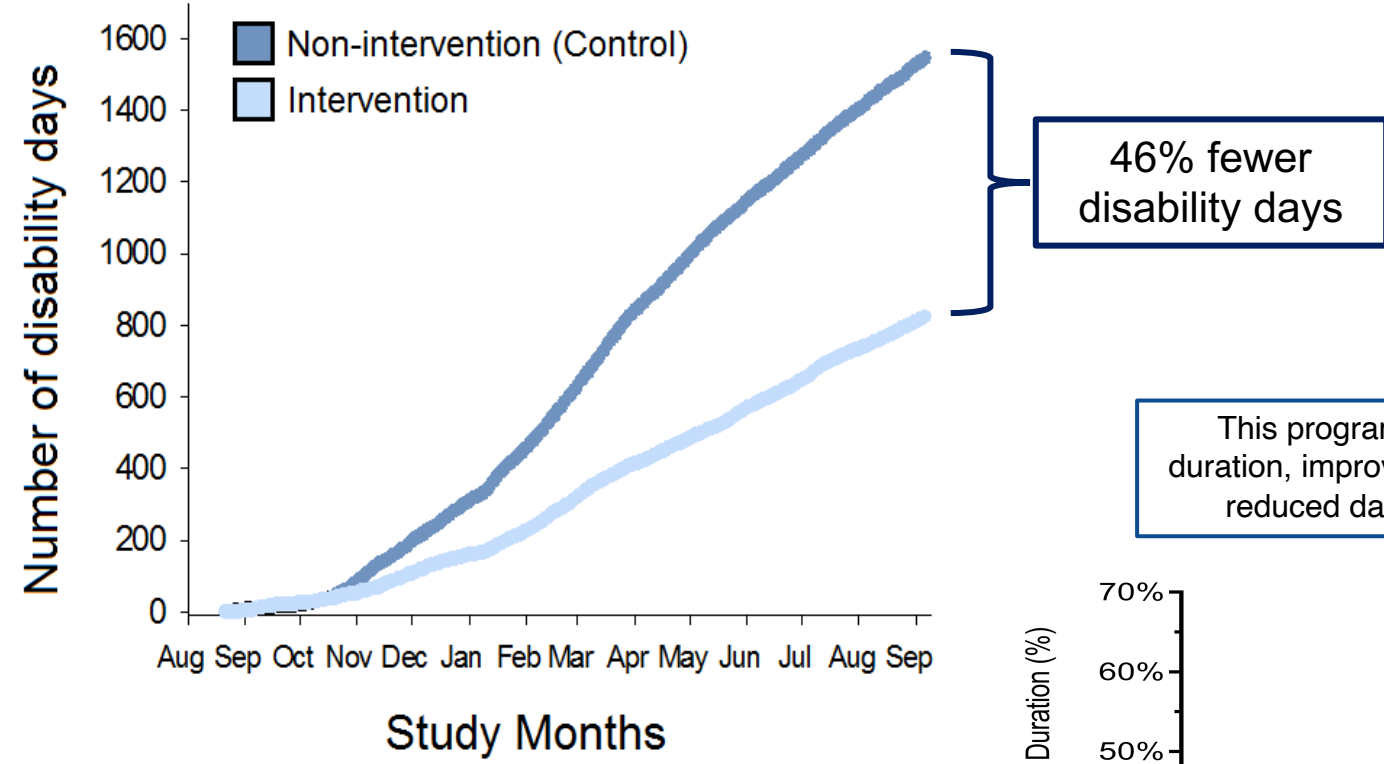
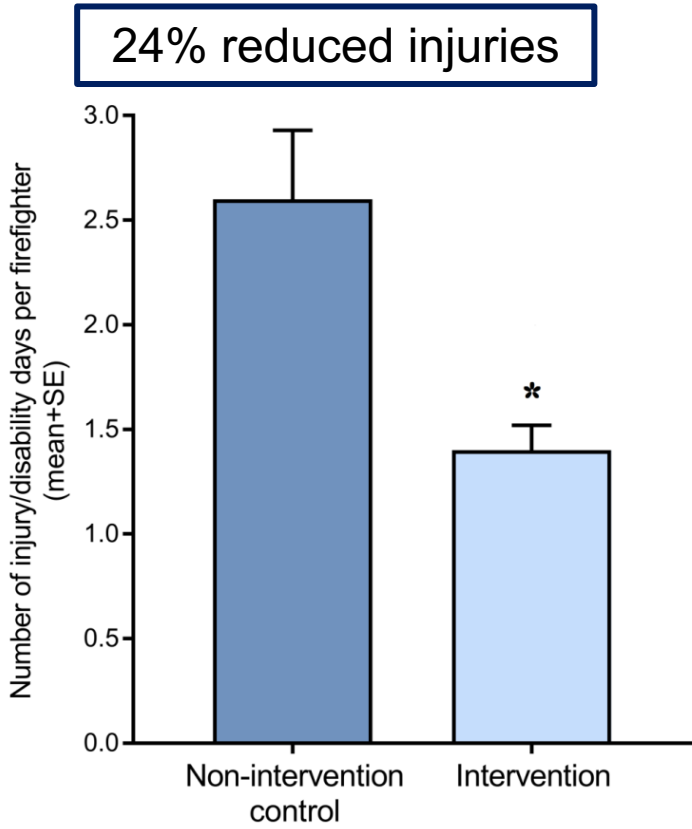
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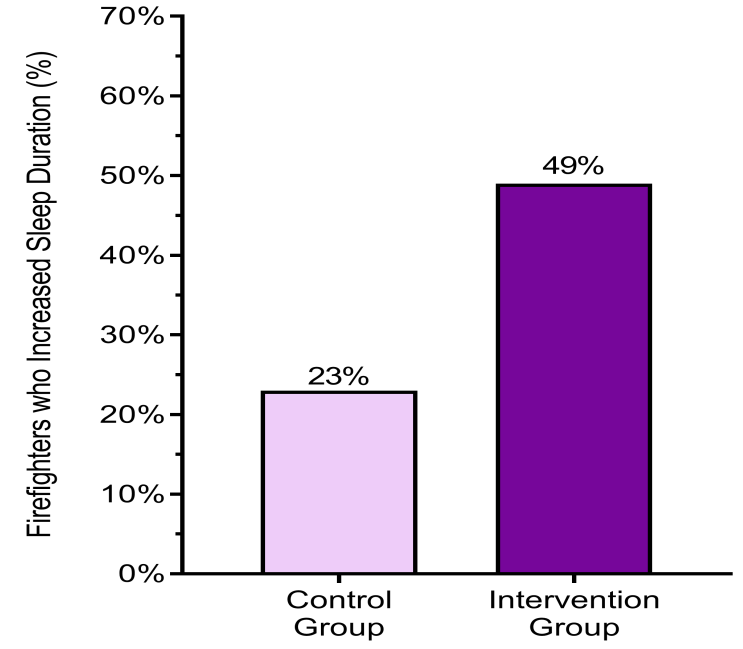
Our Solution: An Interactive, Evidence-Based Sleep Health and Wellness (SHAW) Program

- Engaging, 1-hour program (in-person or remote)
 - Expert led interactive education (importance of sleep on health, physical, mental performance, sleep disorders, 40 minutes)
 - Q & A session (12 minutes)
 - Tablet-based screening for sleep disorders (8 min)
 - Referral to local clinic for sleep disorder evaluation
- Follow-up engagement emails on sleep health (6 months)
- 90% of participants considered program important, helpful and would recommend
- Train-the-trainer and online education methodology available

Results of the SHAW Program in Firefighters



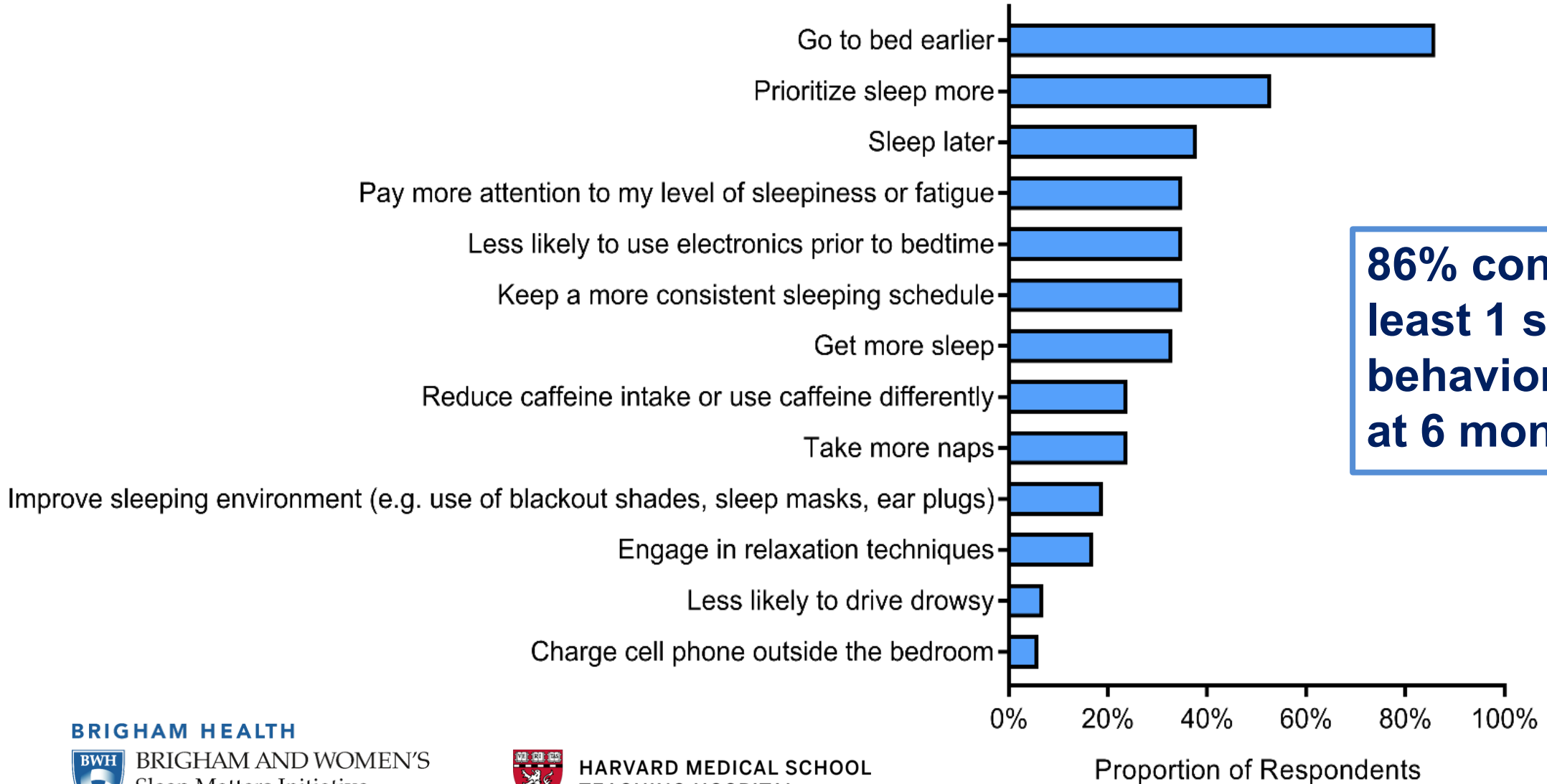
This program increased sleep duration, improved sleep quality, and reduced daytime sleepiness.



2018 Winner
Green Cross for Safety
Innovation Award

Sullivan et al. Sleep. 2017;40:1-10.

Behavioral Changes Persist



86% confirmed at least 1 sustained behavior change at 6 months.

BRIGHAM HEALTH



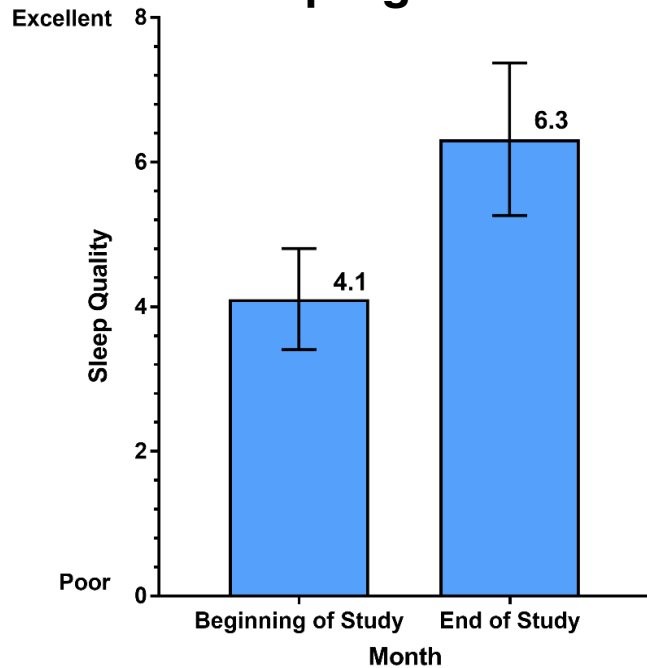
BRIGHAM AND WOMEN'S
Sleep Matters Initiative



HARVARD MEDICAL SCHOOL
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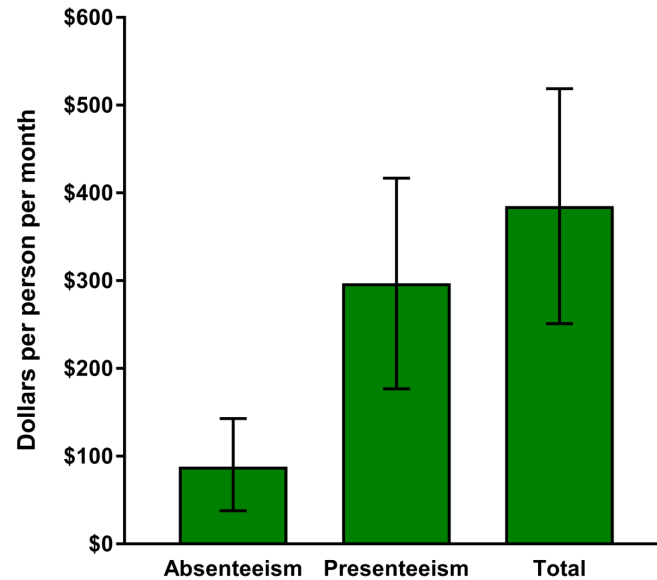
Results of the SHAW Program: Case History of a Canadian Insurance Company

Sleep quality over time among participants in the program.



Significant increase in sleep quality after participation in the program

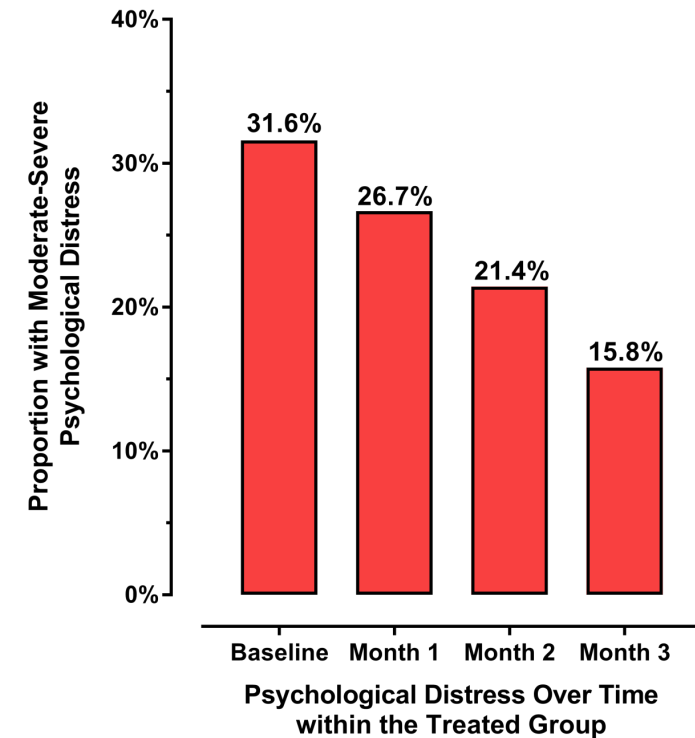
Absenteeism and presenteeism costs among those who screened positive for a sleep disorder.



Excess costs reported by those who screened positive for a sleep disorder compared to those who screened negative

Absenteeism and presenteeism costs were \$385 per person per month higher in the sleep disorder group

Psychological distress over time among those who reported treatment.



The prevalence of moderate-severe psychological distress was cut in half among those who screened positive and followed up to receive treatment

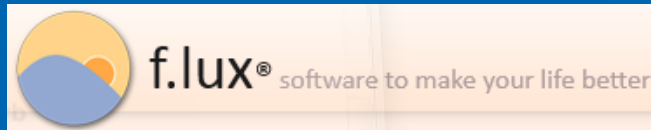
Sleep Stealers



Improving sleep every day

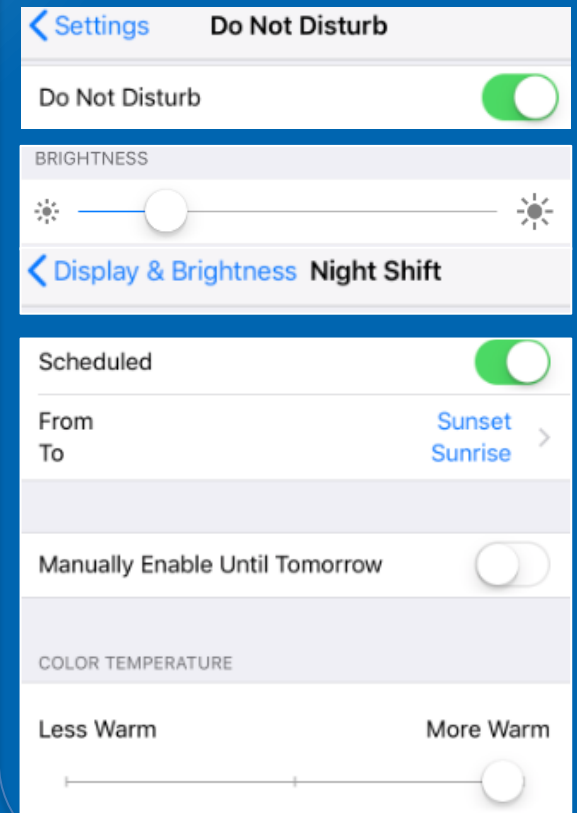
- Allow enough time in bed to sleep a sufficient amount each night
- Maintain a cool, **dark** bedroom environment
- Establish a relaxing nightly routine
- Exercise regularly
- Avoid alcohol in the hours before bed
- Keep electronics out of the bedroom
 - Phones should be set to Do Not Disturb with Night Shift or Equivalent
- Limit your exposure to light in the evening and night

Red night light



- Avoid off-label use of medications like Benadryl and Tylenol PM
- Melatonin can be helpful in isolated situations
 - Try 0.5 mg of pharmaceutical grade melatonin, rather than the larger doses which are commonly available over-the-counter

Night Shift Settings



Improving sleep in the fire station

Optimization of sleep in fire station

- Review and retrofit the sleeping quarters to provide a better environment for napping and sleep
- Focus on light, noise, bed type, space, temperature, and location



Proposed Rest Policy

- 2-3 hours of protected rest time during each 24-hour shift (~1pm – 8pm)
- If shift changes results in a firefighter working longer than a 24-hour shift, rest opportunity should be available, if operational feasible, any time during the second 24-hour period



Upgrade alerting systems

- Personalized alarms for specific crews or individual
- Best types of alarms

Questions?

**FIREFIGHTER
CANCER
INITIATIVE**

RESEARCH > EDUCATION > PREVENTION



UnderstandingSleep.org

Healthy Sleep

Understanding the one-third of our lives we so often take for granted

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Why Sleep Matters
Health, memory, safety, and the cultural significance of sleep

The Science of Sleep
The brain, jet lag, caffeine, and aging, and how they influence sleep

Getting the Sleep You Need
Achieving better rest and health, and knowing when to seek treatment

Continuing Medical Education for Physicians >

 WGBH

A resource from the Division of Sleep Medicine
at Harvard Medical School and WGBH Educational Foundation

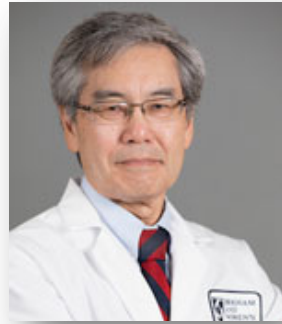
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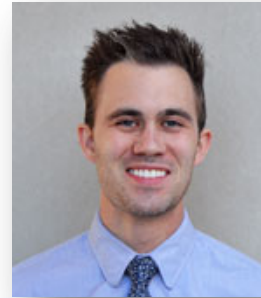
Sleep Matters Initiative



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