

Improving Sleep, Health And Safety In Firefighters



Sleep Matters Initiative

Sleep Health and Wellness Program

Train-the-Trainer Format



BRIGHAM HEALTH



BRIGHAM AND WOMEN'S
Sleep Matters Initiative



HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL



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Sleep Deficiency Epidemic



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- Nearly 1/3 of Americans sleep ≤ 6 hours/night, double the rate from 50 years ago
- 69% of Americans report regularly getting insufficient sleep
- 50-70 million Americans suffer from chronic sleep disorders
- Every month, 56 million Americans admit struggling to keep their eyes open while driving and 8 million fall asleep at the wheel monthly
- 500,000 driving injuries and 55,000 debilitating related injuries occur annually due to fatigue
- 6,400 sleep-related fatalities occur annually

20% of all serious & fatal
crash injuries





*24 hours of wakefulness
induces performance impairment
comparable with blood alcohol
concentration 0.10%*



What is Sleep?

As one firefighter responded,
“that thing that you don’t get”

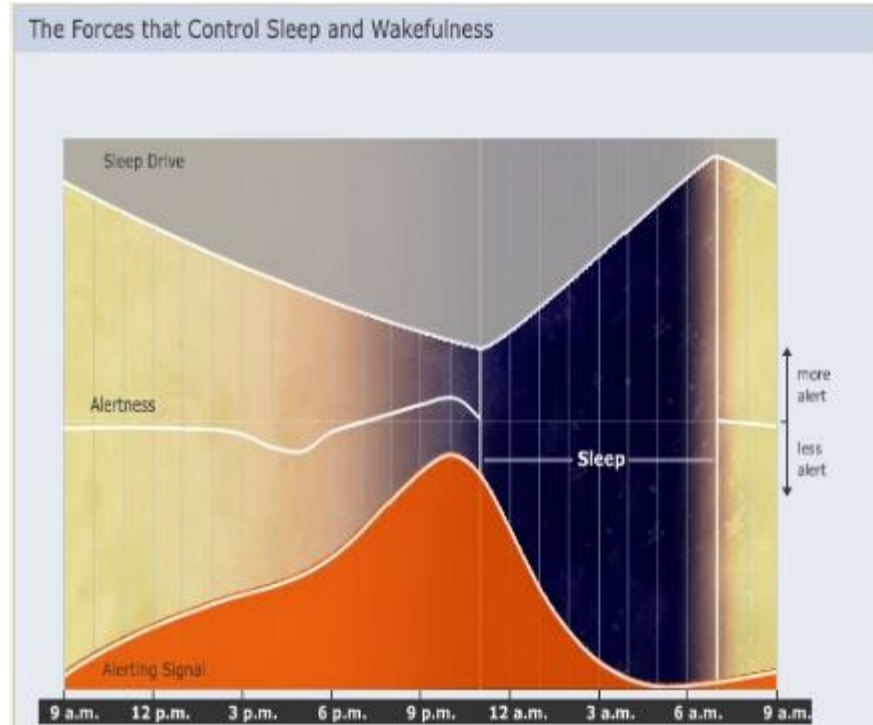
Characteristics of sleep

- Ubiquitous
 - All animals (e.g., mammals, insects)
 - Even firefighters!
- Obligatory
 - A biological necessity
 - Animals die if deprived of sleep long enough
- Complex
 - REM sleep and non-REM sleep
- Homeostatically regulated
 - Amount and content of sleep depends on prior wake duration (including naps, extended wake)
- If insufficient, waking affected
 - Performance, alertness
 - Errors and accidents
- Sleep Disorders are common
 - Associated with many chronic conditions including cardiovascular disease, diabetes, Alzheimer's dz, dementia



Sleep Regulation

- Homeostatic
 - *Level of sleep drive*
- Circadian
 - *~24 hour biologic clock*
 - *Regulates timing of sleep and wake*



Circadian Rhythms

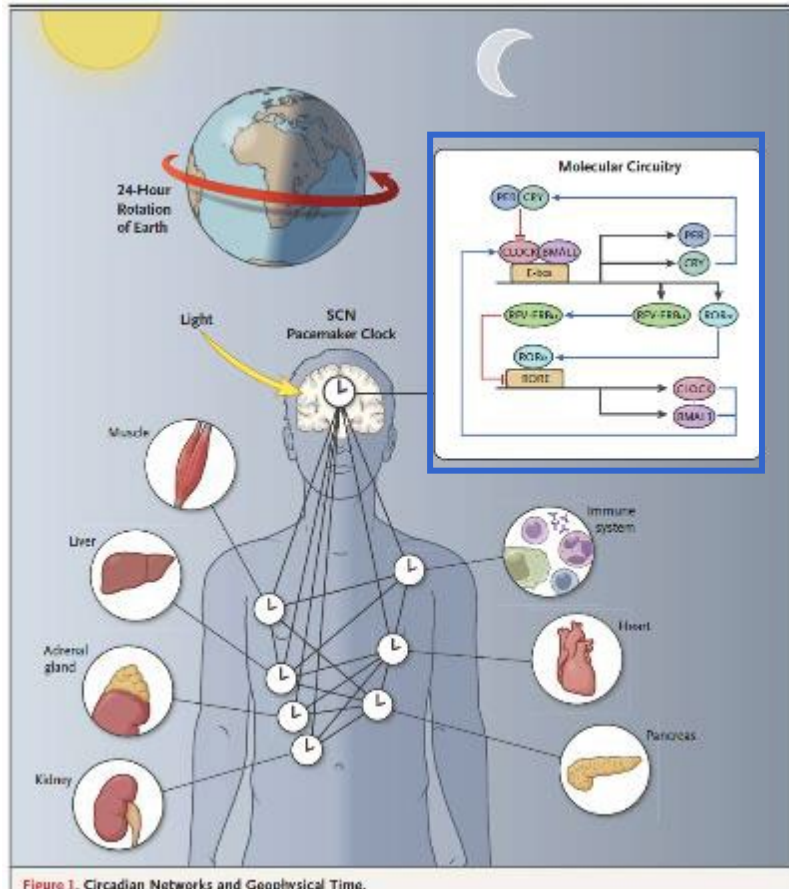


Figure 1. Circadian Networks and Geophysical Time.

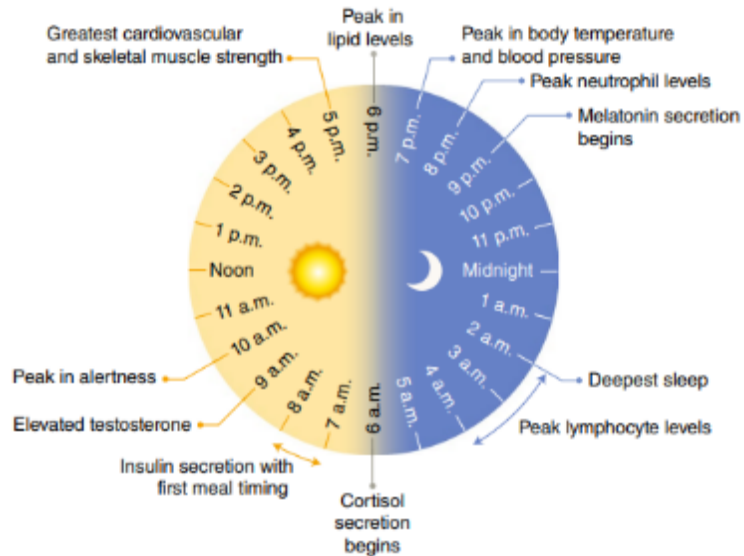


Fig. 1 | The mammalian circadian clock. An overview of rhythmic functions that are critically controlled by the human circadian pacemaker are outlined. The time of day at which peak endocrine functions occur, including deepest sleep, metabolic control, immune responses, alertness, and cardiovascular parameters, over the 24-h cycle is indicated. Information was adapted from several references^{96–99}. Figure credit: Debbie Maizels/Springer Nature.

Occupational Costs of Too Little Sleep

The NEW ENGLAND
JOURNAL of MEDICINE

ESTABLISHED IN 1812

OCTOBER 28, 2004

VOL. 351 NO. 18

- **168% more car crashes** commuting after ≥ 24 -h shifts
- **468% more near-miss car crashes** after ≥ 24 -h shifts
- **109% more attentional failures at night** > 16 hours
- **36% more serious medical errors** working 30-h
- **464% more serious diagnostic errors** in the ICU
- **73% greater risk of needle stick or scalpel lacerations** after > 20 consecutive hours at work
- **171% more complications** in patients undergoing elective surgery if attending surgeon had < 6 h sleep opportunity during prior night on call



Barger et al., NEJM 2005; Lockley et al., NEJM, 2004; Landrigan et al., NEJM 2004;
Ayas et al., JAMA, 2005; Rothschild, et al., JAMA 2009

JAMA

The Journal of the American Medical Association



512203116

Health/Performance Costs of Sleep Deficiency



- Impaired balance and coordination
- Longer reaction time
- Decreased 1-rep max deadlift, bench press, and grip strength (Knowles 2018)
- Reduced VO_2 max and VO_2 anaerobic threshold (Stavrou 2021)
- Decreased growth hormone
- Decreased testosterone in men: Restricted to 4 hours of sleep for just one-week, decreased testosterone by amount that is equivalent to 11 years of aging (Leproult & Van Cauter 2011)
- Chronic inflammation (IL6, CRP)
- Increased risk taking (elevated expectation of gains and attenuated response to losses)

Quality of Life Impacts of Too Little Sleep

- Police officers at high risk for a sleep disorder were significantly more likely to yell at a suspect or citizen and have citizen complaints filed against them



- Feel more sad
- Feel more irritable
- **More difficult to get along with colleagues**

Why Does the Brain Need Sleep?

Restoration of
Energy Stores

Brain Maintenance
Neural Connectivity
Waste Clearance

Memory Consolidation

Impairment of
Daily Learning
and
Problem Solving



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Why Does the Body Need Sleep?

Heart Health
Hypertension
and Blood
Heart Disease
Pressure
and Stroke
Regulation

↓ Vaccination
Immune
Response
System
↑ Colds and Flu
Regulation



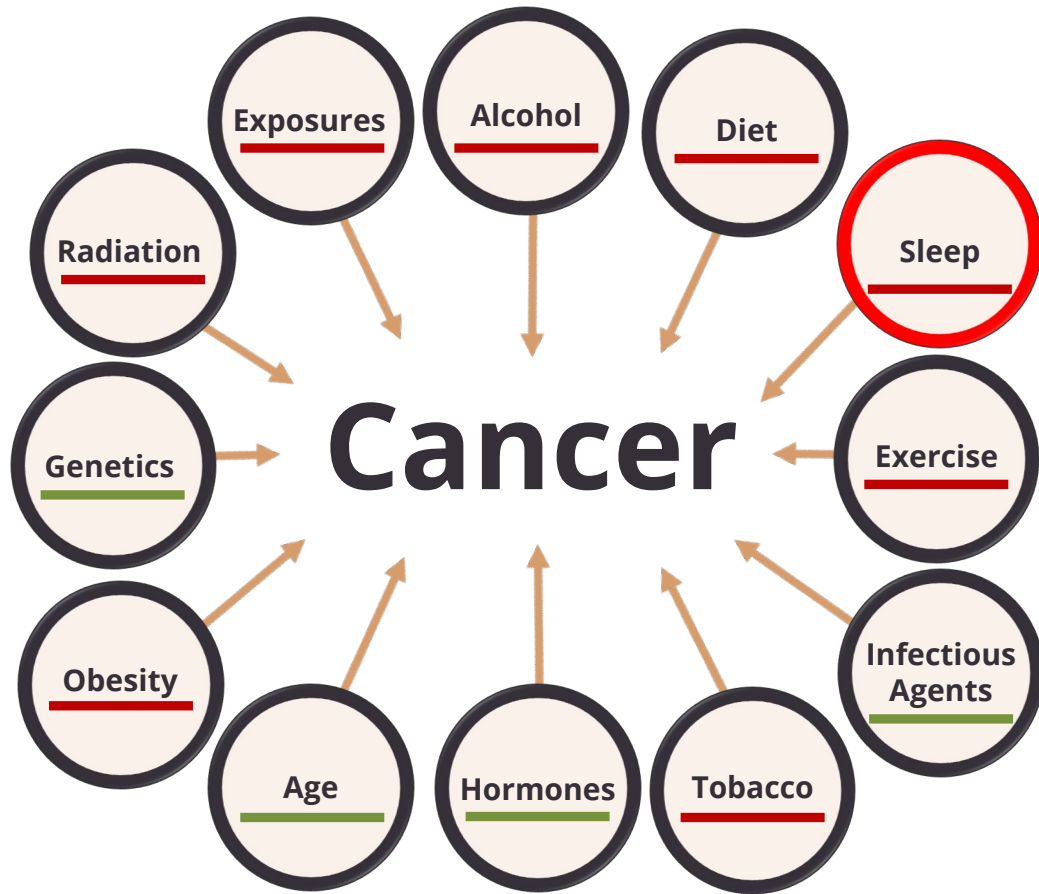
Maintenance
of Insulin
Synthesis
and Glucose
Metabolism



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University

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What is Healthy Sleep?

Duration

- Adults need at least 7 hours of sleep per night
- Children and adolescents require even more
- Sleepiness is one sign you aren't getting enough sleep



Sleep Debt

Hours Awake



Time of Day



Sleep Disorders



Sleep Inertia



Biological Factors That Cause Fatigue



Look for signs of fatigue in yourself and others

- Blurry vision
- Difficulty keeping eyes open
- Difficulty retaining new concepts
- Dizziness
- Errors
- Hallucinations
- Headache
- Heavy eyelids
- Impaired decision-making and judgement
- Impaired hand-to-eye coordination
- Impaired memory and other cognitive functions
- Impaired vision
- Irritability
- Isolation
- Lapses in attention
- Lethargy
- Loss of situational awareness
- Low motivation
- Slowed reflexes and responses
- Moodiness
- Muscle weakness
- Performance decrement
- Perseveration on a problem
- Poor concentration
- Reduced ability to pay attention to the situation at hand
- Reduced alertness
- Risk-taking behaviors
- Short-term memory problems
- Slow reaction time
- Trouble focusing

Fatigue Risk Mitigation Strategies

- Strategic Use of Caffeine
 - Use ~60mg of Caffeine every 2 hours to incrementally increase blood concentration, rather than a sharp peak and gradual reduction.
 - Consider only using caffeine when you need it (e.g. use it less on your days off and less as a ritual – use it as a tool so it is more effective when needed).
- Nap
 - Even brief naps are helpful to temporarily restore performance under conditions of sleep deprivation.
- Coffee Nap/Napacino©
 - It generally takes 20-30 minutes to process caffeine. You can take the 60mg dose of Caffeine and immediately take a 20-30 nap. This provides a dual strategy with both sleep and caffeine to enhance alertness, as well as mitigating sleep inertia upon awakening.
- Bright Lights
 - Exposure to bright blue/white light can enhance alertness.

Sleep Stealers

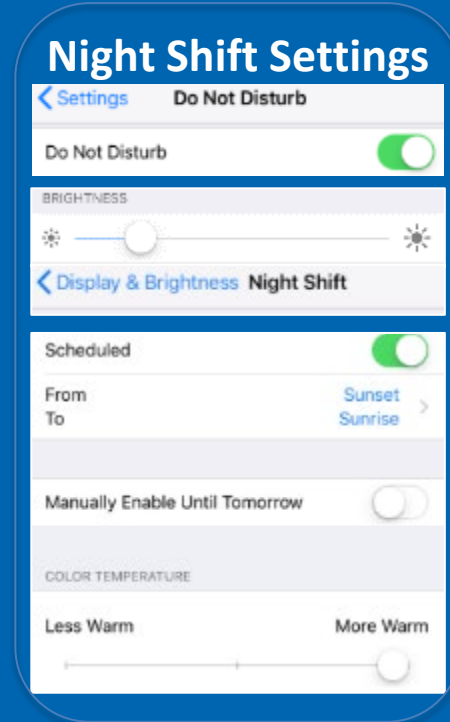


What Can You Do?

- Keep a consistent sleep schedule
- 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



- 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 (one brand is Pure Encapsulations), rather than the larger doses which are commonly available over-the-counter
- Consider Melatonin regularly if on prescription Beta Blockers (these suppress the release of Melatonin)



Common Issues for Firefighters

1. How do I get regular sleep?

- Anchor Sleep: Try to identify an interval (4 hrs or so) where you can always sleep. Sleep at that time every day. Supplement that sleep window with naps or other sleep intervals to achieve 7 or more hours.

2. How do I manage unpredictable calls for service?

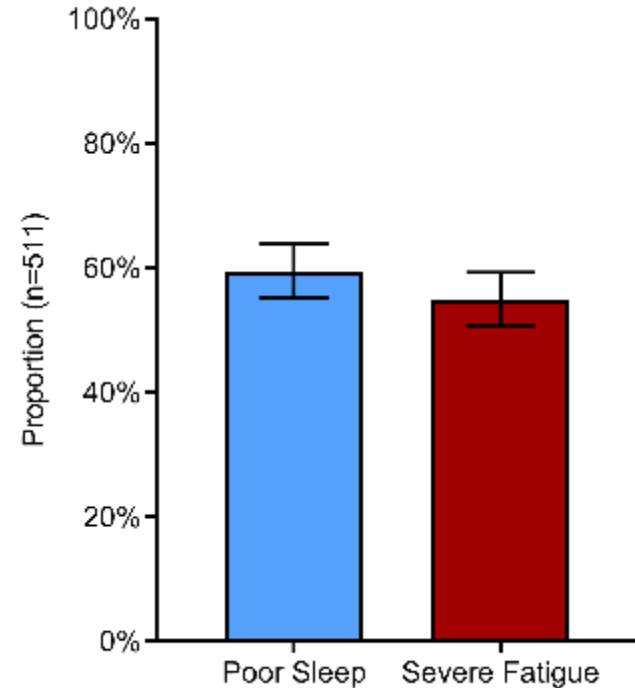
- Arrive to work with sufficient sleep (this will make you more resilient) and rest when you have the opportunity (advocate for on-shift sleep as a safety and health intervention).

3. How long should I sleep on my day off?

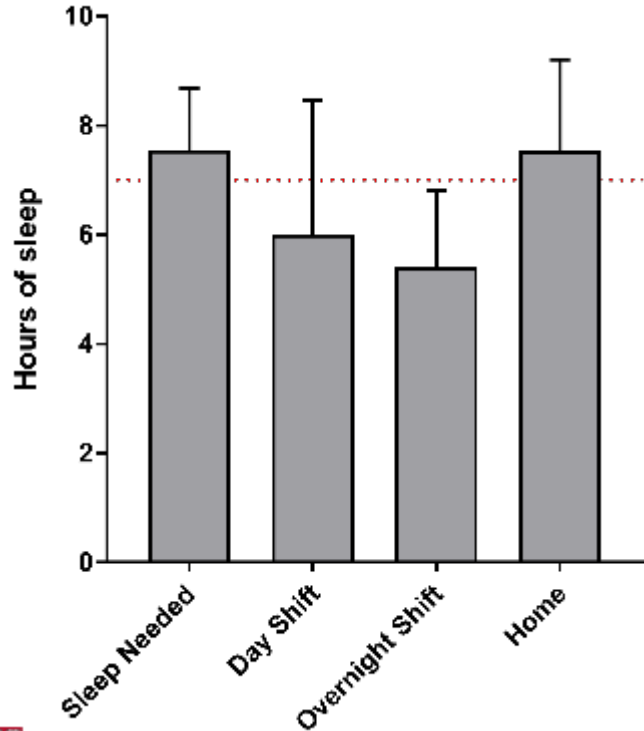
- This depends on your schedule. Assuming you have time between shifts to go back to a daytime schedule, sleep for a few hours and force yourself to wake. Then sleep early that night. If you are on a run of night shifts with 3 or fewer days in between, try to adapt to the night shift by sleeping during the day and remaining awake for most of the night during your scheduled shift.

Poor Sleep Quality and Fatigue is Common in Fire and EMS

- In a survey of 511 Fire and EMS providers, half reported poor sleep or severe fatigue (Patterson et al. 2012)
- National studies have found that more than 1/3 of providers report excessive daytime sleepiness (Pirrallo et al. 2012, Weaver et al. 2018)



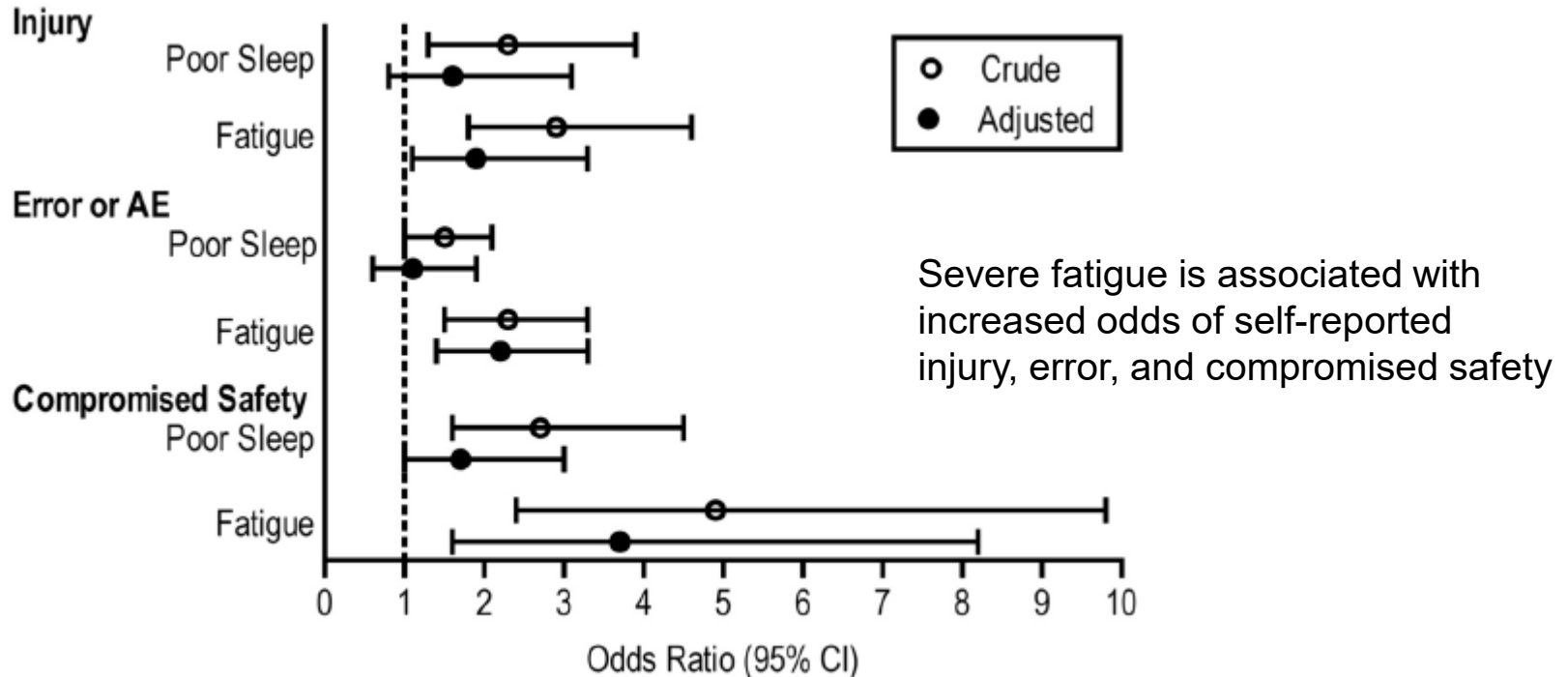
Sleep in Relation to Work

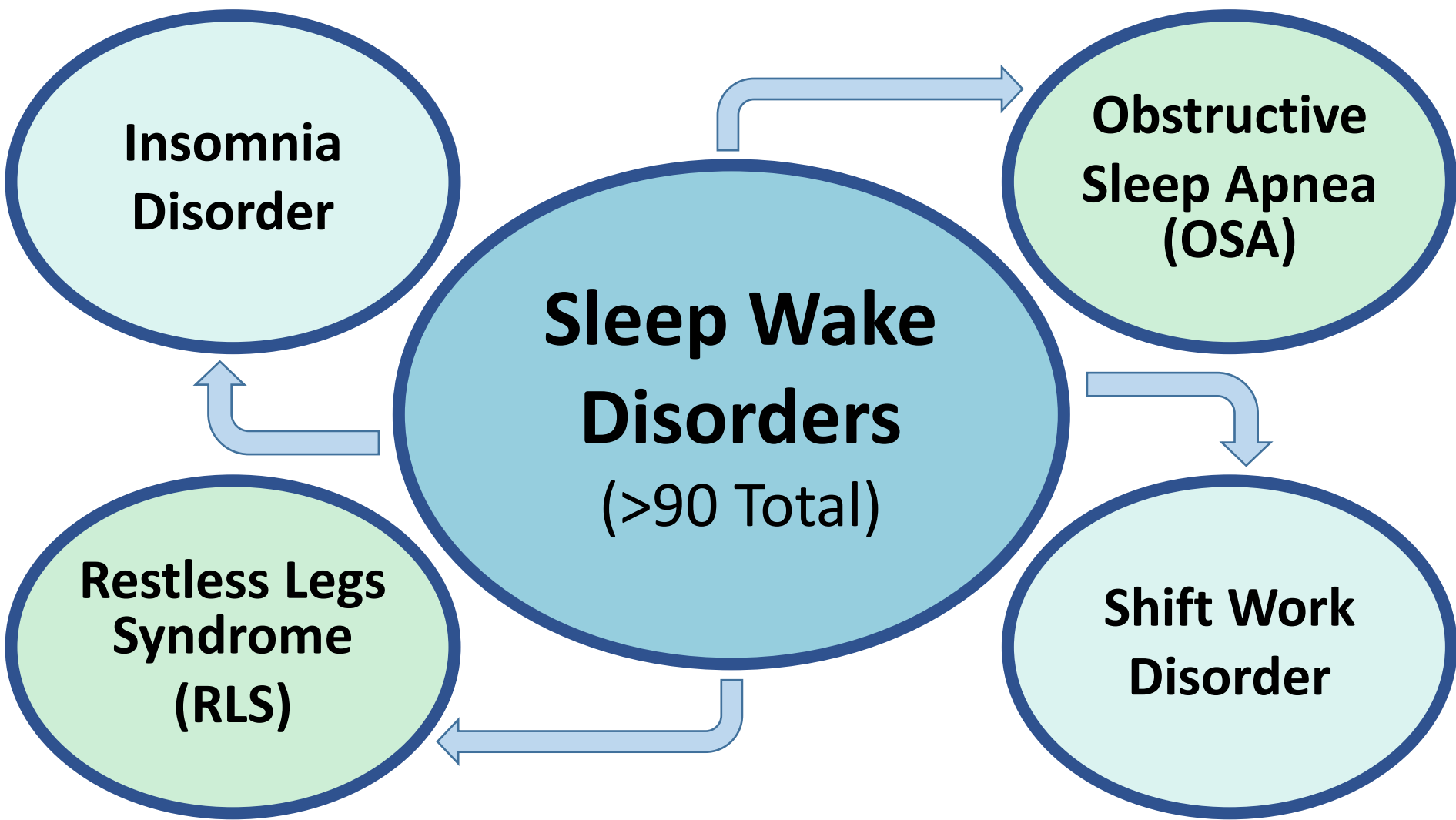


- Firefighters report needing 7.6 hours of sleep to feel rested, but obtained 6.0 hours when working regular day shifts and 5.4 hours on overnight shifts. (Barger et al, unpublished)
- Air medical EMS providers reported 6.8 hours of sleep on 24-hour shifts and 1 hour of sleep on 12 hour shifts (Guyette et al. 2012)
- **At least 7 hours is recommended**

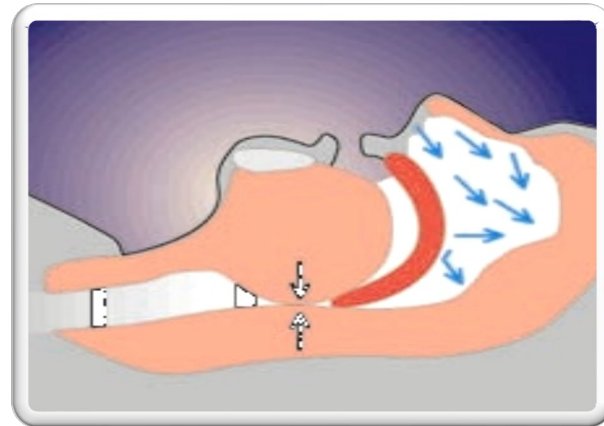
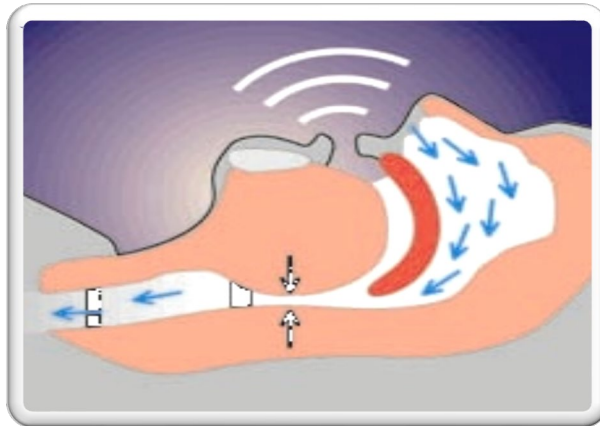
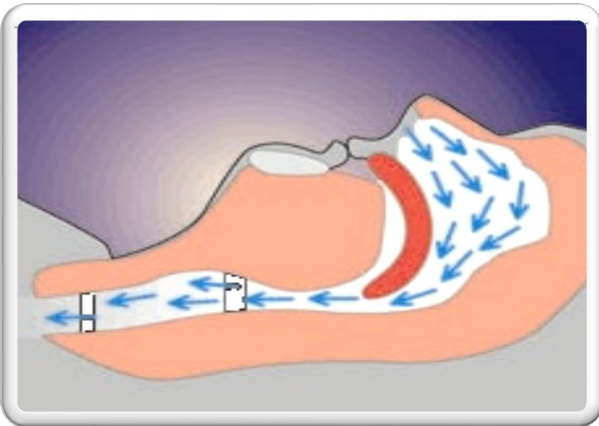
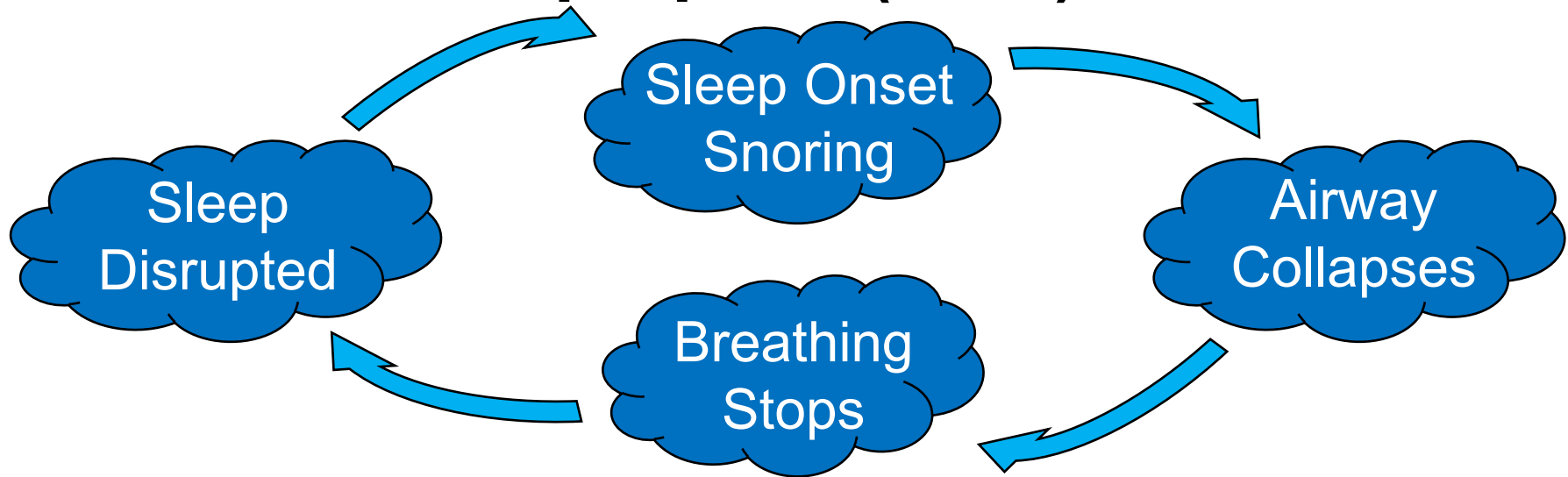


Poor Sleep Quality and Fatigue Affects Safety in Fire and EMS





Obstructive Sleep Apnea (OSA)





Obstructive Sleep Apnea (OSA)

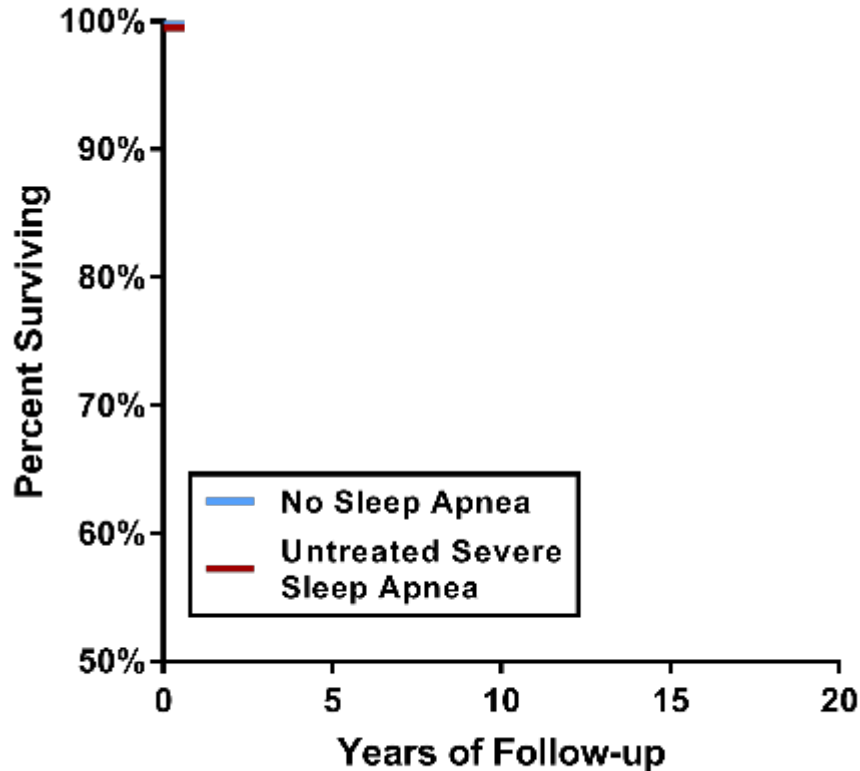


Chart courtesy of Young et al. Sleep. 2008; 31:1071.



OSA Treatments

- Continuous Positive Airway Pressure (CPAP)
- Oral appliances
- Surgery
- Positional Rx
- Medications
 - Adjunctive



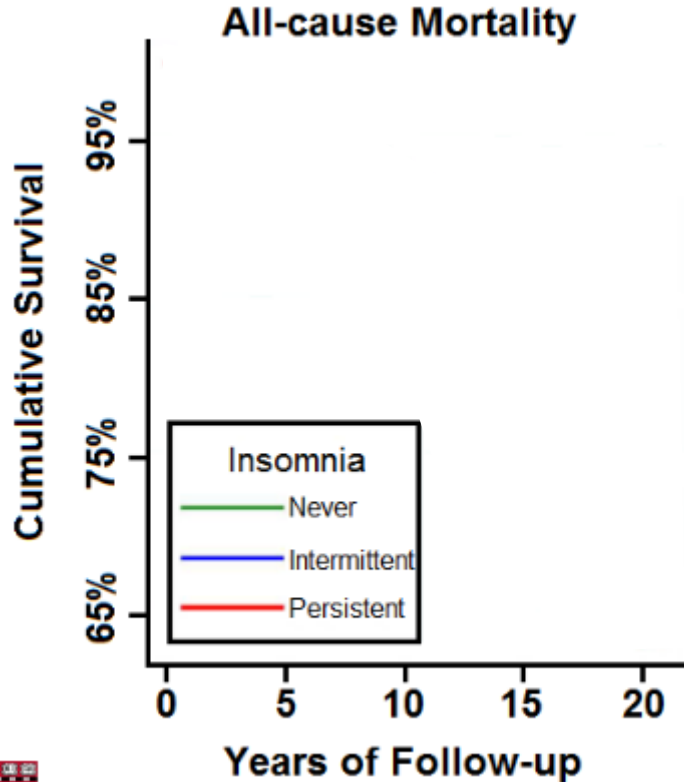
Additional long-term implications...

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



Insomnia

Inability to fall asleep, stay asleep, or early morning awakening

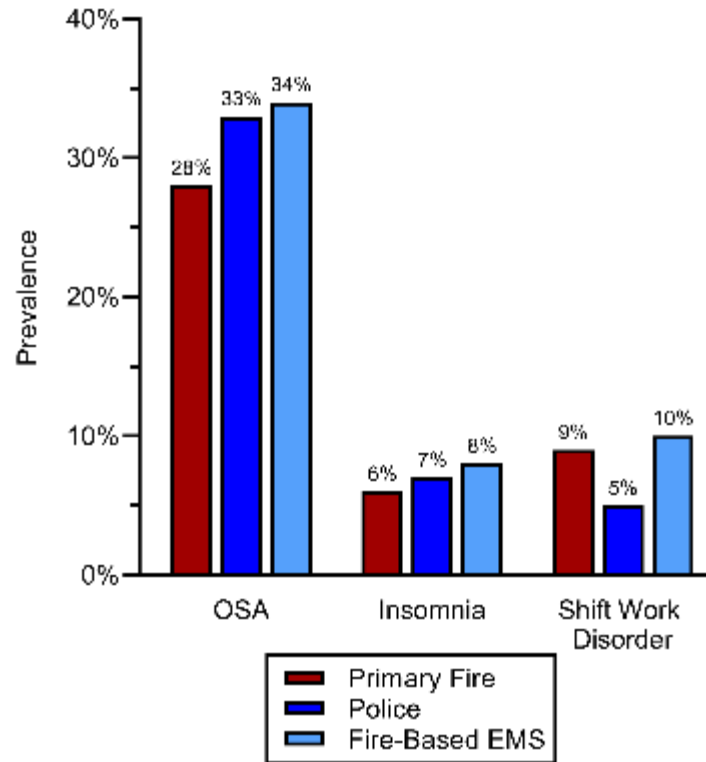


Insomnia Treatments

- Cognitive behavioral therapy for insomnia
- Relaxation techniques, Meditation, Yoga, Deep breathing
- Proper sleep hygiene
- Medication
 - Short Term



Sleep Disorders Are Common in the Public Safety Workforce

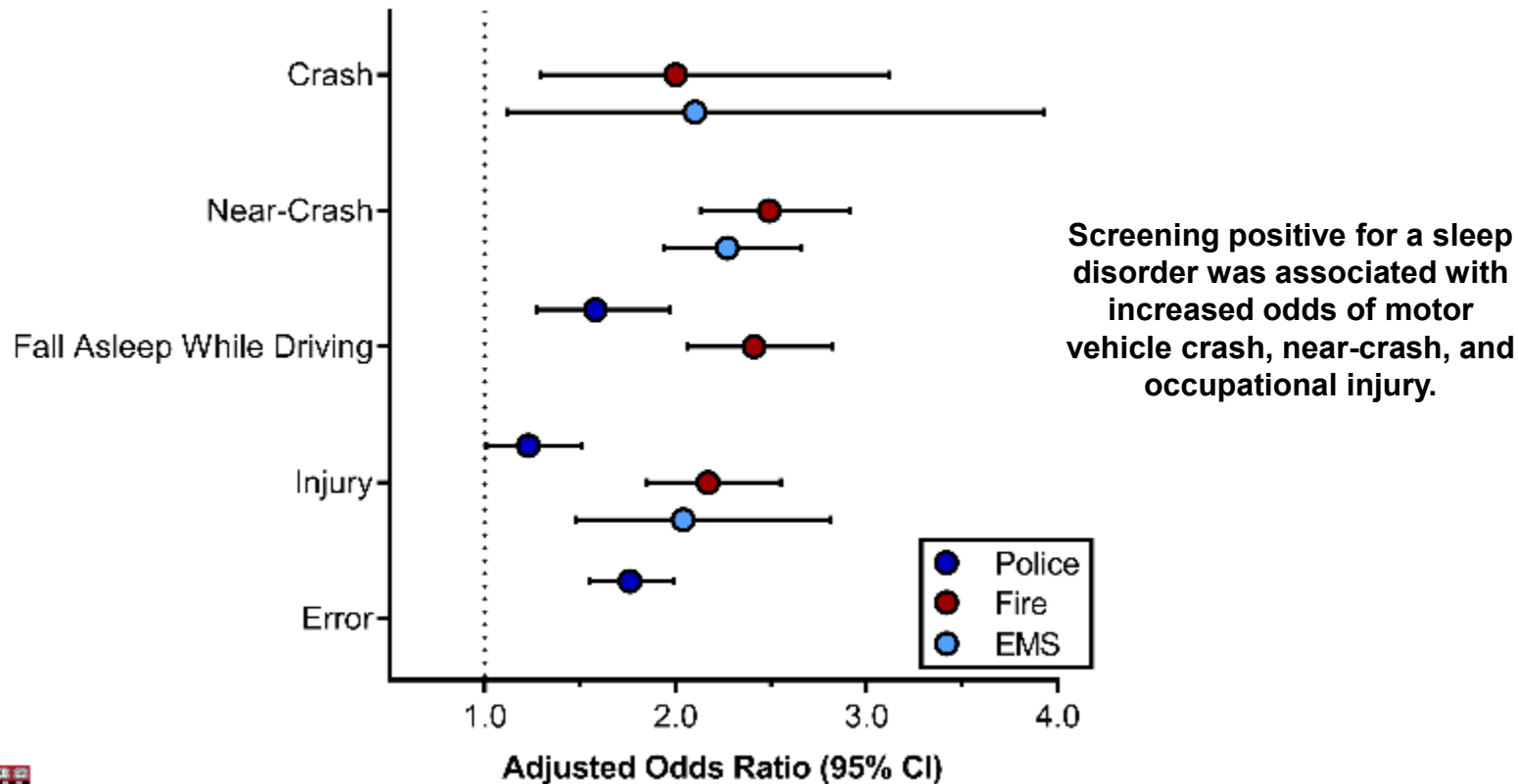


Sleep disorders are highly prevalent across all branches of public safety

The vast majority (9 in 10) are undiagnosed and untreated

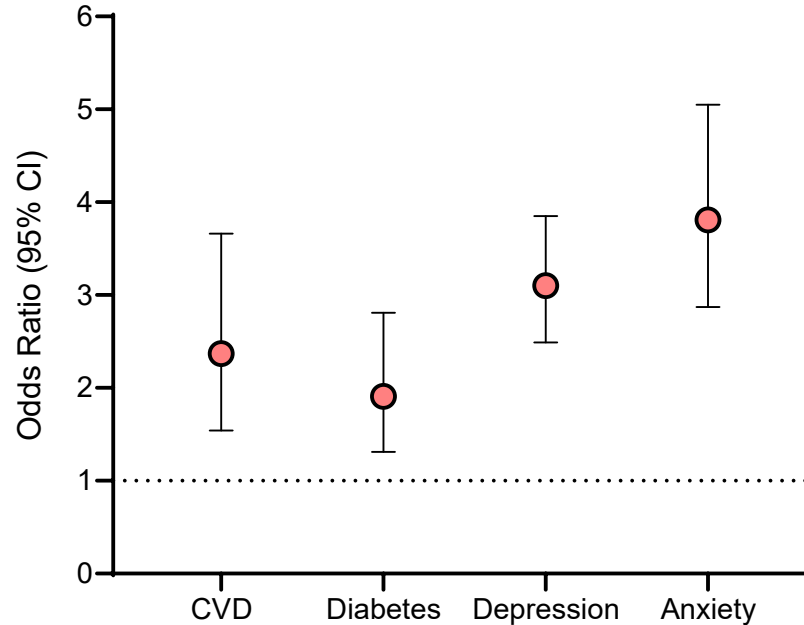


Sleep Disorders Are Associated with MVA and Occupational Injury



Adverse Health Outcomes Associated with a Positive Sleep Disorder Screening

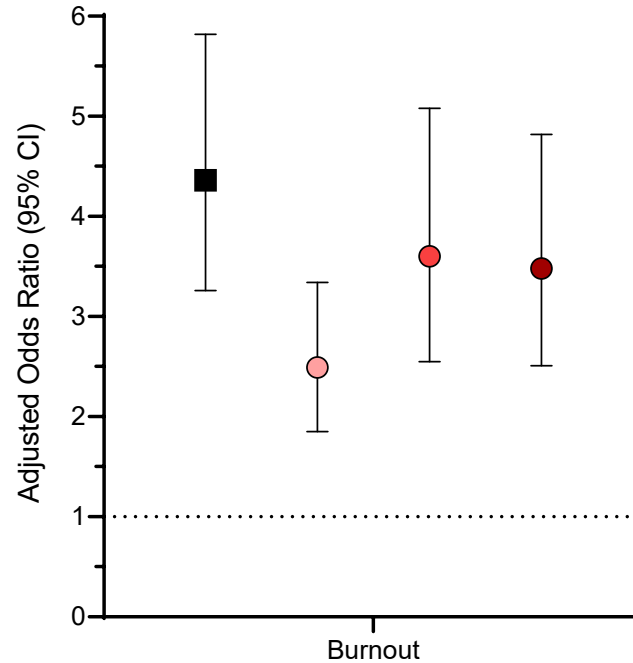
6,933 firefighters from 66
US fire departments



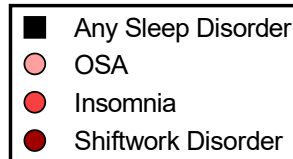
Screening positive for a
sleep disorder was
associated with increased
odds of a variety of
adverse health outcomes.



Sleep Disorders and Burnout in Firefighters



Screening positive for a sleep disorder was associated with more than 4 times the odds of occupational burnout.



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 (black-out shades), noise, bed type, personal space, temperature



Rest Policy Essentials

- Rest policies that allow sufficient time for sleep should be developed and implemented.
- Feasibility of different policies will vary from agency-to-agency. Identify what works for you and your providers.
- Key is to protect safety – both at work and on commute.

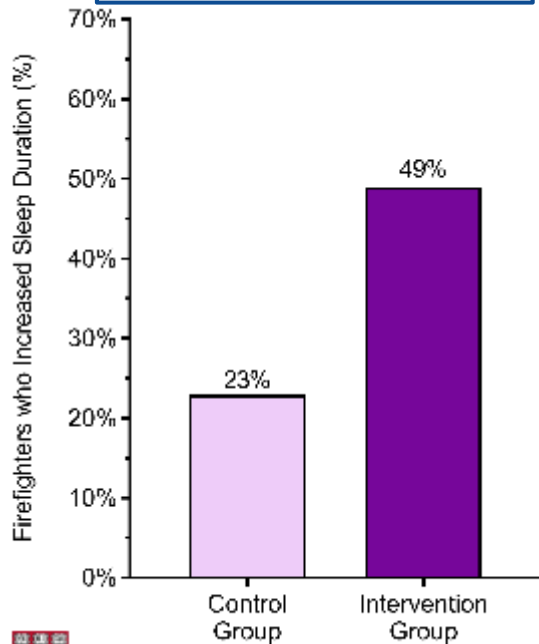


Upgrade alerting systems

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

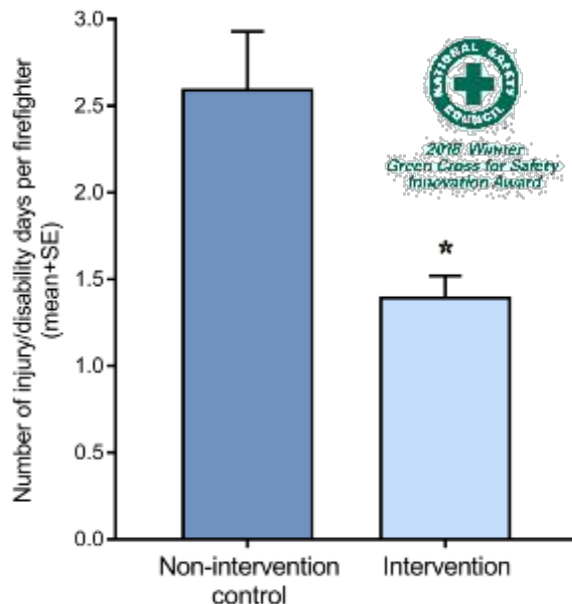
Improved Health and Safety following Sleep Health Education and Sleep Disorder Screening Programs

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

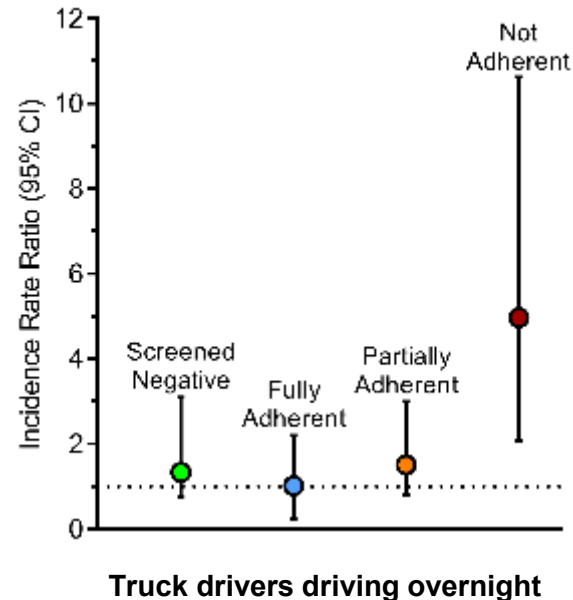


Firefighters working extended duration shifts

Reduced injuries and disability day usage— **24% fewer injuries** and a **46% reduction in disability day usage** (\$2.2 million annual savings).



Crash rate among drivers with OSA who were adherent to treatment was **80% lower** than those who were not adherent to treatment.



Truck drivers driving overnight



Three pillars of health

Sleep



Exercise



Nutrition



Work toward goals in all three

Take the Personal Sleep Assessment



Point your camera at the QR code to the left to navigate to the assessment tool.

OR

<https://sleephealth.partners.org/smi/>

OR

<https://bit.ly/shawscreen>

The assessment will take 7 minutes.

**SLEEP TIPS****My shift schedule changes on a predictable basis and I am expected to spend several weeks on day, evening, and night shifts. How do I best transition from one schedule to another?**

It can be difficult to make the transition from day to night shifts, but there are strategies that will help. First, plan your sleep and develop a consistent sleep schedule. Some workers find that sleeping immediately after getting home from an overnight is best for them. Others may preserve part of the day for life tasks while businesses are open, and choose instead to sleep later, such that they wake up at a time proximal to their next work shift. Choose what works for you and stick to it. Consistency is very helpful in adapting to your new schedule.

Once you have identified your planned sleep interval, avoid activities that promote wakefulness immediately prior to your planned sleep. The half-life of caffeine is about 6 hours. While you may perceive coffee to be unimportant to your sleep, it is best avoided for several hours prior. In general, exercise is great for your sleep. If you find that exercise too close to your planned bedtime keeps you up, try to fit it in a little earlier. Rich meals should be avoided prior to bed. The effects of alcohol on sleep can be deceiving. Alcohol may facilitate sleep onset, but results in lighter, more fractured sleep over the course of the sleep episode. Higher quality sleep is achieved in the absence of alcohol.

Create an environment that facilitates sleep. A dark, quiet, cool environment is often best. You may find it worthwhile to take extra steps to eliminate light sources from the bedroom, for example, hanging blackout shades or wearing an eye mask. Ear plugs help to block outside noise. Included in this environment is your phone or tablet. While you may need it nearby, try not to go to sleep while looking at your phone. The light from the device can make it more difficult for you to sleep. Even a small amount of light prior to or during sleep can have an impact. Consider adjusting the wavelength of light emitted from the device as well. You can use apps such as Night Shift (see Appendix) or F.lux to easily reduce the blue light which most affects your internal body clock. When you wake up, get as much light exposure as you can to adjust your clock to your new wake-time.

Gradual transitions in sleep and wake times are easier than abrupt ones. When possible, try to ease into your new schedule by incrementally adjusting your bedtime a couple of days in advance. Blue light systems, such as those sold commercially to treat seasonal affective disorder, can also be utilized. Exposure to blue light upon awakening will help your body adapt more quickly.

I mostly work day and evening shifts, but occasionally need to cover a night shift. How do I prepare for the night shift, and how can I best adjust afterward?

There are several strategies to approach these situations. The goal is to maintain alertness throughout the shift without shifting your internal clock. Let's outline a scenario where you are working an early shift, say 7a-3p, and you will be covering that night from 11p-7a. Ideally, you would plan to nap for 2 hours prior to the shift, perhaps from 8p-10p. Then after the shift, nap again for 2-3 hours. This approach will help with fatigue and will allow you to sleep at your normal bedtime that night. One thing to avoid, if possible, is sleeping for the entire day when you get home from work. This will make it difficult for you to maintain your normal schedule and make you feel less alert the next day. Furthermore, repeatedly shifting your body clock in such a way leads to a disconnect between your physiological drive to sleep and when your body clock will help you to sleep. This state of misalignment between the two systems can result in both sleepiness and insomnia.

Sometimes I find out at the last minute that I need to work longer than expected. What should I do?

Ideally, the workplace and nature of your work will allow you the opportunity to take a short nap when you feel sleepy. Take advantage of this if you can. Even a 20 minute nap can be helpful in restoring alertness. The traditional remedy, caffeine, can also be effective, but the way many people use caffeine is not ideal. If you know you will be forced to stay awake, you should take smaller doses of caffeine at regular intervals before you feel sleepy, tapering off as your shift goes on. You may find it to be much more effective. We suggest 60 mg every 2 hours when needed for alertness. This is about 1 oz espresso, 4 oz of brewed coffee, or an 8 oz black tea. There are also some over-the-counter medications that contain caffeine. Another way that caffeine can help is to use it less casually and more as a tool. Only use caffeine when you need it to stay awake and decrease your usage on your days off. You will lower your tolerance over time and increase the effectiveness when you need it. Be wary of sugary drinks for the powerful crash you may feel shortly afterward.

I feel sleepy all the time, even after I get a lot of sleep. What could be the cause?

There are a few things to consider. First, it is important to consistently get enough sleep for you. This amount varies for everyone, but healthy adults require, on average, 7-9 hours of sleep each night. If you are getting 6 hours during the week and 12 on the weekend, it is a sign you are not sleeping enough during the week. People who are sleep deprived sometimes take months to fully recover from their sleep debt once they start sleeping an adequate amount each night.

You should consider the possibility that you could have a sleep disorder. About one in three people has a sleep disorder. Prevalence is higher among shift workers. Common disorders include insomnia, obstructive sleep apnea, and shift work disorder and there are over 90 sleep disorders in all. Estimates suggest that 80-90% of sleep disorders are undiagnosed and untreated. See your doctor for an evaluation. A sleep lab visit is often not required for a definitive diagnosis. Treatment is often highly effective.

I have difficulty falling asleep at the time when I would like to. What are the best solutions?

A first step is to make changes to your bedtime ritual to program your mind that it is time for bed. Be sure that you are avoiding large meals, nicotine and caffeine for several hours prior to bed. Consider that exercise too close to your planned bedtime could also keep you up. As your bedtime approaches, dim all lighting and seek to cultivate a relaxed physical and mental environment. Turn off all electronic devices (e.g., television, phones, computers) an hour before bedtime. Consider keeping a bedside notebook to write down worries, lists or items which you want to remember in the morning. This can help to put your mind at rest. Meditation and other relaxation techniques such as stretching, yoga, a warm bath, deep breathing exercises or guided imagery can be effective as well. When it is time to sleep, create a dark, quiet environment through use of an eye mask and ear buds, if necessary.

If you continue to have difficulty falling asleep you should see your physician. Physicians often prescribe medications for short-term management of insomnia and treatment programs, such as online cognitive behavioral therapy for chronic insomnia, which have been proven to be effective.

I wake up at times when I need to be sleeping and toss and turn. What can I do?

It is easy to exacerbate the problem by feeling stressed about not being able to sleep. It may help to keep your alarm clock turned away from your bed to avoid the additional stress of watching the clock. Try not to look at your phone or watch television, as these activities can promote wakefulness through the light they emit, reminding you of the passage of time, and by piquing your interest. If you are not at all drowsy, try reading or playing soft, relaxing, instrumental music.

You can take some steps to prevent waking up before it happens. Drinking alcohol prior to bed will make it more likely that you wake up during the night, and can make it difficult for you to fall back asleep. Similarly, high levels of fluid intake prior to bed may cause you to wake up. A low-intensity, long-wavelength bathroom nightlight (avoid white or blue hues) can be helpful, rather than turning on a bright light if you wake up to use the bathroom. The previously mentioned eye mask and ear buds can help prevent awakening by transient light or environmental noise.

Take-home message

Getting enough sleep is objectively important. Many of us champion our ability to persevere with little sleep, but we lose the ability to accurately perceive how well we are doing on tasks when we are sleep deprived. Many people who are sleep deprived do not complain of sleepiness for this reason. We lose the ability to recognize our deficits, but the “new normal” isn’t quite as sharp. Beyond that, insufficient sleep can wreak havoc on your diet and metabolism and present a formidable safety hazard. Drowsy driving is easily one of the most dangerous activities you may encounter. Drowsy driving increases the risk of a crash or near-crash 4-6 fold and is responsible for about 20% of all serious crash injuries. Be mindful of these risks and consider taking a brief nap at your workplace before driving home. Alternative forms of transportation are preferred when you have been awake for a prolonged period.

Appendix: How to set-up Night Shift

The default settings for Night Shift are not ideal for minimizing circadian disruption. We recommend adjusting them slightly. To do so, navigate to Settings first, then Display & Brightness, then touch Night Shift to access the detailed Night Shift settings. Touch to enable scheduled activation of Night Shift, and change the scheduled settings to Sunset to Sunrise. Finally, move the color temperature to the warmest possible setting (all the way to the right).

