5 Key Connections Between Sleep and Cancer

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January 22, 2019 By Michael Breus, PhD

In the first part of my series on sleep and cancer, I talked broadly about the risks that poor quality and disrupted sleep can have on our risk for the disease. Here, I’ll dig in a little deeper, to look at some of the different pathways and mechanisms by which sleep might affect our risk for developing cancer. Some of these may surprise you. For example, a lot of my patients are startled to learn that melatonin, a hormone that’s so strongly aligned with sleep, has an impact on how cancer cells grow.

Cancer remains one of the most frightening and difficult diseases of our time. Sleep can play a powerful and protective role in helping us manage and even reduce our cancer risk. It’s my hope that the more you understand about the different the ways sleep may affect cancer, the more attention you’ll give to your sleep every day.

Let’s jump in and explore the connections between sleep and some of the major underlying factors that drive cancer development.

Circadian rhythms

How circadian rhythms relate to sleep: Sleep is one of the many physiological functions that’s regulated by circadian rhythms, the 24-hour daily bio rhythms that govern so many of our physiological processes. When people experience trouble with sleep—in particular, when sleep disruptions are chronic—often, circadian rhythm disruption in an underlying cause. Our circadian rhythms and the clocks that regulate them are sensitive and finely tuned. Our bio clocks are affected most significantly by exposure to light (and to its absence, darkness). But circadian rhythms are also affected by our eating patterns, and as research suggests, by the makeup and activity of our gut microbiome. Other factors that affect circadian rhythms include stress and environmental factors such as toxins and pollutants.

When we sleep on irregular schedules—going to bed and waking up at drastically different times from one day or one week to the next, it can contribute to strain and disruption on our circadian clocks. Light exposure at the “wrong” times, particularly in the evening and overnight hours when we’d naturally be immersed in darkness, also pushes circadian rhythms out of sync. When we’re

active at times when the body is biologically programmed to sleep—such as overnights, evenings, and early mornings—that also disrupts circadian function. Disrupted circadian rhythms don't only make sleep harder to get and less refreshing. They affect a whole range of biological functions.

How circadian rhythms relates to cancer: Circadian rhythms are governed by a master circadian clock that's located in the brain, which in turn coordinates the timing of "peripheral" circadian clocks throughout the body, including in every one of our cells. Among the responsibilities of our circadian system is to regulate cellular function, including cell repair, growth, and division. Several genes—including the PER 1, 2, and 3 genes and CRY 1 and 2 genes—work to regulate the synchronicity and activity our circadian rhythms and of cell behavior itself. Among other factors, sleep deprivation has been shown to alter the activity of circadian clock genes.

Research strongly indicates that disruptions to circadian rhythms cause abnormal behavior in cells that can lead to the development of cancer, and to more aggressive growth in cancer cells. Dysfunction in the behavior of key circadian genes appears to be one possible root cause of this abnormal cellular behavior, driving abnormal cellular activity that can lead to cancerous cell proliferation. Changes to the activity of circadian genes has been linked to breast, prostate, brain, leukemia and non-Hodgkin's lymphoma, as well as other forms of cancer. Circadian rhythm disruptions are thought to be one reason why shift workers are at greater risk for cancer, and why shift work has been identified as a likely carcinogen by the World Health Association.

Circadian rhythm dysfunction may affect cancer risk through a number of mechanisms. Our bio rhythms govern immune function, metabolism, hormone activity and other key biological processes that affect cell function and potential development of cancer. There's a tremendous amount still to learn about the relationship between circadian function and cancer, but we may discover it is a fundamental

Melatonin

How melatonin relates to sleep: Melatonin is often referred to as "the sleep hormone" or "the darkness hormone," and is probably best known as a natural promoter of sleep. (Many people use supplemental melatonin to help sleep; I've written about melatonin, and its effectiveness as a supplement, here.) Like many of the body's hormones, melatonin follows a daily circadian rhythm, adhering to a 24-hour cycle of rising and falling production. Melatonin doesn't only follow circadian rhythms—its daily rise and fall also help to keep circadian clocks in sync. Melatonin delivers important cues to circadian clocks that keep them functioning properly. This sleep- and circadian-rhythm-regulating hormone is naturally suppressed by light and triggered by darkness. Melatonin production naturally increases in the evenings and levels typically hit a peak around 3-4 a.m., before falling to their daily lows around midmorning. The evening rise in melatonin makes us feel less alert, more relaxed, and more inclined for sleep.

Healthy sleep habits and routines include practices that keep melatonin production in sync and on schedule, and avoid outside influences that throw natural melatonin's daily cycles off course. Avoiding light exposure in the evenings is the biggest step we can take to prevent suppression of melatonin, and disruptions to sleep and circadian rhythms.

How melatonin relates to cancer: Though best known as a sleep promoter, melatonin has many functions in the body beyond facilitating sleep. And many of these functions have implications for cancer. Melatonin keeps circadian rhythms functioning well. It helps to regulate the immune system. Melatonin acts as an antioxidant. It helps to control and to inhibit cell division. It also inhibits the growth of new blood vessels (including in cancer cells). Melatonin is now recognized as having significant protective effects against cancer. Research indicates that melatonin is an inhibitor of cancer cell growth. Studies show that low levels of melatonin are associated with increased risk for several different types of the disease, including prostate and breast, endometrial, and ovarian cancers. One recent study found men with low melatonin levels had a four times greater risk of prostate cancer. Melatonin has anti-estrogenic effects—it is involved in lowering estrogen levels and reducing estrogen-related activity in the body. Estrogen is involved in the development of some forms of breast cancer, as well as ovarian and endometrial cancers.

Melatonin is being investigated and used in the treatment of several forms of cancer. I'll talk more about how melatonin is being used as a cancer fighter in an upcoming article.

Immune health and inflammation

How sleep relates to immune health and inflammation: Sleep and circadian rhythms have a tremendous impact on our immune health and function. Sleep strengthens the natural defenses of the immune system, reinvigorating its ability to adapt and respond to different potential threats to health. Sleep is a rejuvenating time for the immune system—and it's also a time when our natural immune activity increases, as our internal defense system goes to work to fight illness and disease. Immune activity follows circadian rhythms. When sleep and circadian rhythms are disrupted, immune activity is altered, compromised and suppressed. Our immune system becomes less effective at regulating itself and at defending against threats to health. Both acute and chronic lack of sleep reduce the effectiveness of immune function.

Chronic sleep loss in particular leads to a damaging, disease-producing change in immune response: increased, systemic inflammation. I wrote recently about the relationship between sleep and inflammation. Not getting enough sleep, sleeping poorly, sleeping too much—all can contribute to heightened inflammation. Inflammation, like sleep itself, is regulated by circadian rhythms. Dysfunction in the timing of circadian rhythms creates problems with immune function that include excessive, chronic inflammation.

How inflammation relates to cancer: Our immune system's inflammatory response sends white blood cells and other chemicals to repair cells, ward off infection, and fight disease. We need inflammation to help us heal. But when inflammation is chronic—existing in the body all the time, even when there's no pathogen to fight—it causes damage to cells and mutations to DNA. That cellular damage and those DNA mutations can lead to the development of cancer cells. Too much inflammation also feeds the growth of cancer, contributing to faster-growing, more aggressive cancers. We've learned a lot in recent years about the specific inflammatory pathways that may cause cancer growth. As many as 1 in 5 cancers develop at least in part from chronic inflammation, according to scientific estimates. We can't control all the factors that cause unhealthful, systemic inflammation. For example, our individual genetics play a role in how

vulnerable we each may be. But many lifestyle factors contribute to inflammation, and those are in our control, including diet, maintaining a healthy weight, and exercise. Sleep is another factor – a sometimes-overlooked one—that we can adjust to lower our inflammation risk.

Psychological stress

How stress relates to sleep: The connection between stress and sleep has been extensively studied and well documented. (That's not to say there isn't more to discover—with sleep, there always is!) Stress presents both mental and physical obstacles to sleep: increasing heart rate, creating physical tension and pain in the body, elevating alertness-producing hormones including cortisol and adrenaline, triggering agitated, uncomfortable thoughts and emotions. When under stress, it's much more difficult to fall asleep and to sleep soundly throughout the entire night. Psychological stress is a major contributor to insomnia.

The relationship between stress and sleep is also bi-directional. When we don't get enough restful sleep, we're more prone to the effects of stress. New research shows that a night of sleep deprivation triggers a big jump in next-day anxiety. In that study, brain scans revealed heightened activity in regions of the brain that produce fear (and the stress-induced "fight-or-flight" response). Less active after a night of no sleep? The areas of the brain that help us calm ourselves and keep negative emotions in check.

How stress relates to cancer: There is a lot of interest in the relationship between psychological stress and cancer development. Research establishing a direct link between emotional distress and cancer is mixed, with some studies demonstrating a connection, and others not. There are significant indications that stress can play a role in the development of cancer and in the progression of the disease. Psychological stress contributes to chronic inflammation, which is a risk factor for cancer. Chronic stress has negative effects on immune function more broadly, impairing its ability to effectively repair cells and DNA, and suppressing its ability to kill cancer cells. Research indicates stress contributes to more aggressive cancer growth and metastasis. And psychological stress can exacerbate other behaviors, including excessive drinking, smoking, and unhealthful eating habits, that in turn increase cancer risk.

Obesity and other metabolic problems

How obesity relates to sleep: I've written extensively about the connections among sleep, weight, and metabolic health, including in my books, The Power of When, The Sleep Doctor's Diet Plan and Good Night. Poor sleep and disrupted circadian rhythms are a contributor to weight gain and increase risk of obesity. How? Changes to the timing and production of hormones that affect appetite and metabolism, changes to energy expenditure, and changes to eating habits (including what we eat, how much we eat, and when we eat) all make weight easy to gain and hard to lose. Sleep and circadian rhythm disruption are also significant risk factors in the development of prediabetes and type 2 diabetes. Poor sleep and out-of-sync circadian rhythms interfere with the production of insulin and insulin's effectiveness in regulating blood sugar.

How obesity and diabetes relate to cancer: There's a complex relationship among obesity,

metabolic health and cancer that scientists are still working to understand. However, there's much that we already know about the links between obesity, type 2 diabetes, and cancer. Obesity is a well-documented risk factor for several types of cancer, including breast, colorectal, kidney, pancreatic, gallbladder, and endometrial cancers. A 2015 study estimated that in a single year in the U.S., roughly 3.5 percent of new cancer cases in men and 9.5 percent of new cancer cases in women were attributable to obesity. How may obesity contribute to cancer? Being obese is often accompanied by chronic inflammation, which can cause cell and DNA damage that leads to cancer cell growth. Having higher amounts of fat tissue leads to a greater production of estrogen and other hormones, which can elevate risks for breast, endometrial, ovarian, and other forms of cancer. Fat cells also alter the production of hormones and proteins that are involved in regulating cell growth, making us more vulnerable to cell proliferation that leads to cancer cells.

Studies show that people with type 2 diabetes are at significantly higher risk for developing cancer, and of dying from the disease. Insulin resistance and high blood sugar—the factors that lead to prediabetes and type 2 diabetes—have been shown to affect cancer growth and development. High levels of insulin and of a protein called insulin-like growth factor (IGF-1) have been connected to several types of cancer, including colorectal, kidney, prostate and endometrial cancers.

Ready for some good news about sleep and cancer? In the next installment of this series, I'll tell you about the cutting-edge ways scientists and physicians are using the power of sleep and circadian rhythms in cancer therapy.

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