

Does Sleep Loss Affect Your Heart?

Announcer: Welcome to the Mayo Clinic Cardiovascular Continuing Medical Education podcast. Join us each week to discuss the most pressing topics in cardiology and gain valuable insights that can be directly applied to your practice.

Dr. Hayes - Welcome back to the Mayo Clinic Cardiovascular Podcast Series, "Interviews with the Experts." I'm your host, Sharrone Hayes. I'm a non-invasive cardiologist and Vice-Chair of Faculty Development and Academic Advancement for the Department of Cardiovascular Medicine here in Rochester, Minnesota. Today I'm joined by Dr. Anna Svatikova. She is a preventive cardiologist and echocardiographer and does research in the area of sleep and cardiovascular medicine. Our topic today is, "How does sleep loss affect your heart?" So welcome, Anna.

Dr. Svatikova - Thank you for having me on this podcast, Sharrone.

Dr. Hayes - Yeah! So recently the American Heart Association updated the Life's Simple Seven metrics to measure cardiovascular health. And now it's the Life's Essential Eight, adding healthy sleep as an essential for optimal cardiovascular health. And so we've got the behaviors, nicotine exposure, physical activity and diet. And then we've got risk factors. Weight, blood glucose, cholesterol, blood pressure, and now we've added sleep. So what is some of the evidence for sleep being important for our heart health?

Dr. Svatikova - Yeah, great question. Thanks, Sharrone. That's right. The AHA extended the Life's Simple Seven to include the sleep, and now it's Life's Essential Eight. Sleep is likely the most effective thing we can do every day to reset the health of our brain and the body. And probably it led also to the incorporation of sleep into the metrics. Multiple data suggests that sleep health benefits cardiovascular health. We have learned that normal sleep provides time for low physiological stress. It's time for resetting and recovering our cardiovascular system. We know a lot about obstructive sleep apnea or central sleep apnea, but this goes beyond apneic sleep. It's about insufficient air and short sleep that a lot of population is suffering from. And these are big risk factors for heart disease. Recent epidemiological studies are showing that sleep loss is associated with increased risk of obesity, diabetes, high blood pressure, ischemic heart disease, stroke, but also with cancer-causing immunodeficiency, or leading to neuropsychiatric disorders. So if it's abnormal sleep like sleep apnea, or if it's insufficient sleep, both are important, but we are recognizing that we have probably lost track of the insufficient sleep and it has been a forgotten risk factor for heart disease and we need to start paying attention to it.

Dr. Hayes - Yeah, and we doctors need to pay attention because honestly, much of our career, we were like, "Wow, I can go for 32 hours without sleep and take care of patients." And I realized several years ago, that was the risk factor that I was really falling short of. And probably we can all look to that personally. Tell us briefly what happens during different stages of sleep and how it might influence cardiovascular regulation?

Dr. Svatikova - Yeah, that's an important question. We don't talk about it a lot. But as a reminder from med school, there are two main types of sleep. The non-REM sleep has four stages, stages one to four, and they correlate with increasing depth of sleep. During the deeper stages of sleep, there's an increase in the parasympathetic tone. So as we go from the stages one to four, our blood pressure goes down, heart rate goes down, and respiratory drive slows down. And also the electrical activity of the brain starts to slow down. Now during REM sleep, which is also called dream sleep, that's important typically for consolidation of information, experiences that we gained the day before, and we are storing it in our memory. But physiologically during the REM sleep, there are surges in sympathetic activity and transient increases in blood pressure and heart rate, as well as increased respiratory drive. And our sleep is structured into these 90-minute cycles. And each cycle has different amount of non-REM and REM sleep. So the physiology that happens during these stages is very important when it pertains to cardiovascular health.

Dr. Hayes - So how does then short sleep, or not getting enough, or maybe not getting enough of these stages, what does that do to us?

Dr. Svatikova - Yeah, so as I mentioned, the ratio of the non-REM and REM sleep in the 90-minute cycles changes as the night progresses. Early on, we have a more of the deeper non-REM sleep. And then in the second part of the night, most of the 90 minutes is occupied by the REM sleep or stage two or three sleep. So let's say you typically go to bed at 10:00 PM, and you wake up at 6:00 AM. So you get eight hours of sleep. But yesterday you had to wake up at -

Dr. Hayes - [Sharrone] I wish.

Dr. Svatikova - Yeah, but yesterday you woke up at four to complete a task, or to catch a flight. You woke up at 4:00 AM. So how much sleep did you lose? We can say, okay, two hours. So 25% of the sleep. But because we truncated the second part of the sleep, which is so heavy for REM sleep, you actually lost 52, you may lose as much as 50 or 60% of all REM sleep. And these short sleep has real consequences. Not only that, changes in sleep duration may prevent a typical dipping in blood pressure or lowering blood pressure during sleep, but also losing the REM sleep may reflect poor quality of sleep and depriving ourselves from the REM sleep, not only leading, may not only lead to cognitive problems, but there are studies that show plasma levels of oxidative stress markers, inflammatory markers, are going up, accelerating myocardial necrosis and fibrosis. Therefore we should pay attention to the length of our sleep and quality of our sleep.

Dr. Hayes - So is there evidence that there's like an optimal length of sleep?

Dr. Svatikova - Yeah, so the American Academy of Sleep Medicine recommends seven to nine hours per night for optimal adult health.

Dr. Hayes - And so that implies that if we don't get enough sleep, then we might have all of those things about myocardial necrosis that we have increased risk of, cardiovascular disease, hypertension. What are the specific things that may be an outcome from insufficient sleep?

Dr. Svatikova - Yeah, so that's what epidemiological observation and experimental data are showing. And more recent cross-sectional study from the enhanced database show that sleeping less than six hours reduce the odds of sufficient blood pressure control, even if patients were on anti-hypertensive therapy. So adequate sleep duration may be important addition to hypertension management. A recent study at Mayo done by Dr. Covassin and colleagues did a very elegant experimental study when they subjected 20 young healthy adults to four hours of sleep for nine days. And then in crossover study, they did a nine-hour experimental sleep. So either four hours or nine hours of sleep. What they found, interestingly, was a sex-specific increase in blood pressure in women who were sleep-deprived. Those that were sleeping four hours per night had their 24-hour systolic blood pressure was eight millimeter mercury higher and their nighttime systolic blood pressure was up 11 millimeters mercury.

Dr. Hayes - Substantial.

Dr. Svatikova - Substantial. Why the reason for the sex-specific increases, it's still a work in progress. But perhaps some hormonal changes in women may play a role. In addition, there are studies that show that sleeping less than six hours per night or having fragmented sleep are independently associated with atherosclerosis in noncoronary vessels. And higher cholesterol plaque burden in the carotid femoral arteries have been documented. So it may increase risk of subclinical atherosclerosis as well.

Dr. Hayes - So I think, say we're all gonna hear your message, and we're all gonna try to get our eight hours of sleep every night. But there are gonna be times, like getting up for a flight, where we're gonna have occasional sleep deprivation. What are the risks for perhaps a healthy person, but maybe somebody who's got some risk factors or coronary disease, for that occasional, is that a problem?

Dr. Svatikova - Right. So this is a very common scenario. And we are all part of it, like you said. And the main one is simply the transition to and from daylight saving time. So in the seven days after the spring transition, when we lose an hour of sleep, multiple studies documented significant rise in cardiac events. The circadian misalignment from losing one hour of sleep, which seems so benign, has been associated with up to 30% increase in acute MI, admissions to the emergency department with atrial fibrillation has been up 40% in the seven days after the spring transition, or daylight saving time. Stroke risk goes up to 20%. Increased risk of out of hospital cardiac arrest. So these numbers are pretty profound and therefore we really need to focus on getting the recommended seven to nine hours of sleep for optimum adult health.

Dr. Hayes - That's actually kinda scary, so I -

Dr. Svatikova - It is.

Dr. Hayes - Yeah.

Dr. Svatikova - It is, yeah.

Dr. Hayes - So switching gears just a little bit. Nobody's getting enough sleep. Everybody I know complains about, my patients, my friends. So we've got an epidemic of sleep deprivation, and an epidemic of obesity. Are those two connected?

Dr. Svatikova - Yeah, great question. And when we look at the map of United States, where is the obesity highest? When is the sleep deprivation highest? Actually the southeast states really overlaps, so there's a huge interplay between obesity and sleep deprivation. And this is also supported by research studies. In the Nurses' Health Study, over 68,000 women were part of, those that reported habitually sleeping less than five hours per night. They were on average 2.5 kilograms heavier at baseline. And then when they followed these women for the next 15, 16 years, they also noted that they continued to increase their weight more rapidly compared to those that were sleeping more than seven hours. And interestingly, those women that were sleeping less than five hours per night were 32% more likely to have 15 kilogram weight gain during that particular decade. There are other cross-sectional studies that show inverse relationship between BMI and sleep duration. And interestingly, for each hour of less sleep, an association with increased BMI was noted of 1.22. So each hour of less sleep was associated with 1.22 greater BMI. Now, yeah, go ahead.

Dr. Hayes - So do we understand the mechanism for this? I mean, is it just because they're awake, and can have longer period to eat? Or is it hormonal, or?

Dr. Svatikova - Yeah, probably.

Dr. Hayes - Right? I mean, there's a lot of things that could be going into that.

Dr. Svatikova - Right. It is thought to be mediated by cardiometabolic dysregulation hormones like ghrelin and leptin. And a study done at Mayo recently, again by Dr. Covassin and Dr. Somers and colleagues, they did a very interesting study when they now restricted participants to four hours of sleep for two weeks, versus letting them sleep for nine hours per night. So it was a crossover design. And they indeed showed that those that were sleeping only four hours per night ate more than 300 calories extra per day. They gained more weight. They ate more, or they had more fat intake, by 17% more fat, higher protein. But interestingly, the expenditure didn't change. They did not change their level of activity. Again, the thought is that the hormones played a role. The key ones we should be aware of is ghrelin and leptin. Ghrelin is the hunger hormone and leptin is the satiety hormone. So when we are sleep-deprived, our ghrelin, the

hunger hormone, goes up, and leptin, the satiety hormone, goes down. And it appears that probably this hormonal dysregulation and cardiometabolic dysregulation plays an important role.

Dr. Hayes - It's really interesting. I just remember when I was on call, if I was awake at two in the morning, I was starving. Even if I'd eaten something. So, I..

Dr. Svatikova - Yeah. And we would eat high-fat meals, right?

Dr. Hayes - And I would eat. Yeah. That sounded really great.

Dr. Svatikova - Cafeteria has the greasy food.

Dr. Hayes - So, I mean, we know that people who work shift work, particularly at night, have higher accident rates, and other adverse health outcomes. So how does this sleep, either short sleep or disrupted or rotating shifts, how does that figure into cardiovascular disease?

Dr. Svatikova - Yeah, so shift workers do indeed experience significant circadian misalignment, or what we call uncoupling between their biological clock and occupational schedule. And this actually involves about 28% of workforce in the United States, so it's..

Dr. Hayes - And a large part of the healthcare workforce.

Dr. Svatikova - Right. And this work schedule of working at night and changing our exposure to light and daytime and nighttime has been linked to a myriad of medical conditions, such as increasing obesity, diabetes, cardiovascular disease, as well as cancer. And the being exposed to nocturnal light disrupts simply the melatonin release and other neuroendocrine responses, as well as some other physiological metabolic derangements. And these may have the adverse health consequences for shift workers.

Dr. Hayes - It's all the rage, that whether it's a wearable device or a bed that's smart, but all these things that measure, right? That measure sleep or propose to measure sleep, or sleep quality or duration, they're really popular.

Dr. Svatikova - Yes.

Dr. Hayes - Are they accurate? And do they serve any benefit to our patients or to us, as improving sleep or giving us accurate feedback on sleep?

Dr. Svatikova - Yeah. Over the past few decades, there has been such a rapid rise in the number of the wearable sleep trackers, or mobile apps, the Apple Watch, Fitbit, Oura ring, and the

technology has really come a long way. Research so far is actually promising. For instance, some data suggests that a multisensor tracker can provide insight that is fairly close to that obtained by polysomnography. So the testing that the sleep laboratories use to look at your sleep architecture. The sleep tracking technologies allow users to track their sleep quality at home. They may pay attention to their daily sleep habits and the sleep environment. But we have to keep in mind that each sleep tracker is unique and the accuracy varies. It is important to note, and I feel that the sleep trackers promote general wellbeing and better sleep hygiene and improve sleep quality. First and foremost, they, I guess, motivate people to attain healthy sleep habits. However, it may not be for everybody. Tracking one's sleep can also introduce some stress or physical discomfort and potentially lead to adverse outcomes. Also, like you pointed out, Sharrone, sleep tracker is not a replacement for medical evaluation primarily in the elderly people, when we really are worried about presence of sleep apnea, obstructive central sleep apnea, or patients with chronic medical conditions.

Dr. Hayes - So it might help us raise awareness of the need to sleep, but we could get so focused on it, just like people getting focused on their ECG and developing some anxiety about the readings of their device.

Dr. Svatikova - Right.

Dr. Hayes - So let's wrap this up. Give us some top tips to improve our sleep, to advise our patients on how to improve their sleep and particularly focusing on those that might have the biggest bang for cardiovascular health, since we're cardiologists.

Dr. Svatikova - Yeah. So my top three things. Going to sleep at regular time. Around the same time of the day. Second, sleep in a dark, quiet, cool environment. And shut off of blue light devices, iPads, iPhones, as those hinder and delay the melatonin production. Those would be the top three. Remember, we all have to remember that sleep is essential part of our life. It occupies about third of our life. And good restorative sleep is important for cardiovascular health.

Dr. Hayes - Thanks for that great advice. Very practical and motivating, I think. So this wraps up this week's episode of "Interviews with the Experts." I'd really like to thank Dr. Svatikova for joining us today and discussing this important topic.

Dr. Svatikova - Thank you, Sharrone. Great to be here and part of this Cardiology Podcast Series.

- We look forward to you joining us next week for another "Interview with the Expert." Be well.