

Newsletter

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Why sitting is a dangerous health threat

It's tied to obesity, diabetes and cancer – and exercise won't make up for it

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On Sept. 24, 2007, a Monday evening, Cathleen Renner sat down in her home office to tackle a project. Renner, 47, was a manager at AT&T, where she'd been for 25 years. It isn't clear how many hours she spent at the computer that night, making a plan for a possible employee strike, but she did send an email to a colleague at 12:26 a.m. When her son got up at 7 a.m., she was at her desk. Renner took him to the bus a little later, and as she walked out the door, she clutched her leg and let out a cry of pain. Still, she returned to work. At 11:34, she called an ambulance. Renner was dead by the time she reached the hospital.

Like most of us, Renner spent long hours on the job seated at her computer; in a workers' compensation claim filed after her death, her husband argued that sitting was what killed her. (Renner died of a pulmonary embolism after a blood clot formed in her leg.) The case was not exactly straightforward; AT&T called an expert who pointed out Renner was morbidly obese, weighing 304 lb., and had recently started taking new medication, birth control pills. But in 2011 a New Jersey judge ruled in James Renner's favour, noting his wife's job required her to "spend unusually long hours at her computer" and awarding him workers' compensation benefits as a result. The decision was extremely unusual, the first of its kind legal observers could recall. But if a growing number of health experts are right about the dangers of sitting, it could be a harbinger of things to come.

Like obesity or smoking before it, sitting is the new plague, and not just because it can lead to deadly blood clots. Alarmingly, the latest research links it to obesity, diabetes and the major killers, heart disease and cancer. And exercising the recommended half-hour a day, while beneficial, isn't enough to stave off the ill effects of sitting. "Thirty minutes is two per cent of your day," says Mark Tremblay, director of the Healthy Active Living and Obesity Research Group (HALO) at the CHEO Research Institute in Ottawa. "What about the other 98 per cent?"

The latest and most powerful warning comes from a team at the University of Leicester and Loughborough University in England. In a meta-analysis of 18 studies (which included almost 800,000 participants), they found that sitting for long periods increases the risk of diabetes, heart disease and death. And, as Tremblay suggested, sitting was shown to be a risk independent of exercise—meaning that a person who regularly visits the gym is still in danger if he or she is inactive for most of the rest of the day.

Sedentary behaviour—sitting at work, watching TV, commuting—now eats up the vast majority of our time. In another study, Australian researchers looked at TV watching specifically. "TV viewing time may have adverse health consequences that rival those of lack of physical activity, obesity and smoking," it stated. "Every single hour of TV viewed may shorten life by as much as 22 minutes."

Of course, those who aren't watching TV are likely sitting with an iPad, a computer, a video game or a book. We sit at the office, at home, in the car. We sit for work, and to relax. The difference between all these types of sedentary behaviour isn't understood, and we can't say how much is too much. "Not a lot of people study the health consequences of reading, and we need to," says Tremblay. In 2011, his group launched the Sedentary Behaviour Research Network (SBRN) to focus on the health impacts of

sitting. It is the first and only group of its kind in the world. We're just beginning to understand the sitting disease, but what we already know suggests that modern society is making us quite sick.

Even as a child, Dr. James Levine wondered why some people seem destined to be fat, whereas others can eat as much as they like and stay thin. Now an obesity researcher, he's spent decades looking into it. In a 1999 study, he fed test subjects an extra 1,000 calories a day on top of what they needed to maintain their current weight. Some gained almost nothing; others packed on 10 times as much. In 2005, Levine, a professor of medicine at the Mayo Clinic in Rochester, Minn., followed up with a twist: his subjects wore a pair of "magic underwear" he'd designed, interlaced with sensors to track every movement.

As Levine meticulously monitored caloric input and output, it became clear that those who stayed thin were moving around more, but they weren't devoting more time to formal exercise. Instead, they were unconsciously making little movements throughout the day, burning off the extra calories. They were also spending two hours less per day in a chair, compared with peers who gained weight. Years later, the fact that sedentariness is linked to obesity, independently of exercise, still surprises. "I just came from giving a talk at a sports centre," Levine says. "I thought people were going to throw their frozen yogourts at me."

The most cutting-edge research shows that if people sit too much, they're at increased risk of cancer, according to Christine Friedenreich, a University of Calgary cancer epidemiologist. A 2010 literature review in *Cancer Epidemiology, Biomarkers and Prevention* found that sitting was associated with a higher risk of colorectal, endometrial, ovarian and prostate cancer, as well as cancer mortality in women. Sedentary people are more likely to have metabolic syndrome (a cluster of symptoms like high blood pressure, insulin resistance and extra fat packed around the abdomen), which is associated with heart disease and some types of cancer.

The human body is built for movement, not for sitting still. "The leg muscles are the largest in the body, in terms of skeletal muscle," says Peter Katzmarzyk, a professor at the Pennington Biomedical Research Center in Baton Rouge, La. "When you sit, you're deactivating them." After a little under an hour, our metabolism starts to go to sleep. The body becomes less adept at vacuuming sugar and fat from the bloodstream, causing them to build up and insulin levels to spike. The human system is like a Ferrari, Levine says. "If you leave it to idle, it clogs up."

It takes a surprisingly short time even for early signs of muscle wasting to occur. In a 2010 study, a team of U.S. researchers recruited subjects to wear a platform shoe on one foot for 48 hours, preventing one leg from touching the ground. "We had them wear accelerometers so we could monitor their movements," says lead author Kimberly Reich, an assistant professor at High Point University in North Carolina. "Honestly, they were just couch potatoes all weekend. We instructed them to relax, but when they needed to move, they had to use crutches." Taking a muscle biopsy 24 hours after the shoe was off, they saw changes in gene expression that could lead to muscle wasting. "We'd hypothesized that when they started walking again, everything would be back to normal," she says. "It wasn't." (The team didn't collect biopsies more than 24 hours after, so we don't know if or when these changes were reversed.)

Before scientists started to chart the effects of too much sitting, sedentariness was treated as a neutral factor—shorthand for the absence of exercise. This was in spite of the fact that earlier research had hinted sedentariness could be dangerous: in the 1950s a study in *The Lancet* noted that London bus drivers had double the risk of heart attack compared to bus conductors, who walked around taking tickets. That's changing. "Too much sitting now may be seen as distinct from too little exercise," stated a 2012 paper from Neville Owen of the Baker IDI Heart and Diabetes Institute in Australia, published in the journal *Preventive Medicine*. In just the past few years, sitting has emerged as its own powerful risk factor.

It's a new way of thinking. We still don't have an across-the-board definition of what "sedentary behaviour" means. The research network has called for a standard definition that would classify it as a waking behaviour done in a sitting or reclining posture which has an energy expenditure less than or equal to 1.5 metabolic equivalents, or METs, a measure of the energy demand of movement. (One MET is resting, and brisk walking or running might account for three to eight METs.) Sleep doesn't qualify; it's a restorative state and, unlike when we're sitting, we don't tend to snack while we sleep. Still, even on the question of sleep there is disagreement. "Picture your great-grandfather doing

chores. He needed to rest so his muscles could rebuild," says Tremblay. "Today's world is different. The need to repair and regenerate is not really there."

Of all the types of sedentary behaviour, TV watching seems to be the worst, Tremblay says, "worse than playing a board game or working on a computer." He compares it to hibernation: "Your metabolic rate almost goes below resting." When tapping away at a computer, for example, we're a bit busier, more alert. "You may be less likely to be nibbling on something, whereas if you're watching TV, you might be snacking," he says. "You're exposed to commercials that prompt you to eat, smoke or drink."

The Australian study wasn't the only one to highlight the dangers of TV. Another, published in the online medical journal *BMJ Open* in July, found that the U.S. population could gain an estimated two years of life expectancy by reducing sitting to less than three hours a day, and gain 1.38 years from reducing television watching to less than two hours a day. A 2011 review of studies, in the *Journal of the American Medical Association*, estimated that among 100,000 Americans per year, each two-hour increment of TV watching per day was associated with 176 new cases of Type 2 diabetes, 38 new cases of fatal cardiovascular disease and 104 newcases of all-cause mortality.

But TV watching is also the most widely studied form of sedentary activity, partly because people tend to have a good sense of how much television they watch. It can be harder to recall how much time was spent sitting at a desk or in a car.

It will be years before we untangle it all, but for now a consensus is growing: too much sitting is deadly, no matter what kind. A recent series of articles in *The Lancet* went so far as to call physical inactivity a global pandemic. "Of the 36 million deaths each year from non-communicable diseases," a commentary states, "physical inactivity and smoking each contribute about five million." Over the years, we've instituted more and more sitting time into our lives. In 1970, two in 10 working Americans were at jobs that required light activity, like sitting at a desk; three in 10 were in high-activity jobs, like construction or farming. By 2000, more than four in 10 were in desk jobs, and only two in 10 were in high-activity jobs, said a 2010 commentary in *Mayo Clinic Proceedings*. We also spend longer hours at the office. Screen time has increased dramatically, the same report noted, and other contributors to daily sitting time, like hours spent watching TV and driving, are at all-time highs. Between 1989 and 2009, the number of households with a computer and Internet access jumped from 15 per cent to 69 per cent. Screens are ubiquitous. Almost one-third of U.S. children under age 2 have a television in their bedrooms, notes a 2011 study from the non-profit Common Sense Media.

Some companies are finding ways to build activity into their employees' work hours. Researchers at CHEO, home of Sedentary Behaviour Research Network, take walking meetings; if the group's too big, they'll book a room and stand. At the San Francisco headquarters of Square Inc., a mobile payment app, "a lot of our engineers and designers are at stand-up tables," CEO Jack Dorsey tells *Maclean's*. Dorsey, who also co-created Twitter, notes that Ernest Hemingway worked at a stand-up desk. (Not just Hemingway—Leonardo da Vinci, Ben Franklin and other great minds famously worked standing up.) "I feel more creative on my feet," he says. Standing desks are used at Google, AOL and Facebook.

Sensing a new market, office-supply companies are swooping in. Ergo Desktop, which sells adjustable-height desks, was launched in 2009. Back then, the company was "just myself and my wife's encouragement," says Dan Sharkey. Today, the Ohio-based business employs 16 people, sells \$3-million worth of desks a year and attracts clients like ESPN, Harvard University and NASA. Steelcase, another office supplier, worked with Levine to develop a desk mounted on a low-speed treadmill so employees can walk and work (it sells for upwards of \$5,000). Levine also developed the Gruve device, a personal activity monitor that vibrates if its wearer has been sitting too long. Australian inventors have created something called an "alarming cushion," which works on the same principle.

But overhauling a culture centred on sitting is easier said than done. Standing at a meeting can give the impression of restlessness or inattention. Walking at a treadmill desk while typing is an acquired skill. And standing all day isn't really healthy, either; not long ago, when more jobs were in fields like manufacturing, the workplace plague was standing. "It's fatiguing," says Alan Hedge, director of the Human Factors and Ergonomics Laboratory at Cornell University. Standing can also lead to its own health problems, like varicose veins.

Hedge has an electric desk that raises and lowers with the touch of a button—but he never stands to use it. It's too much of a bother. "When I raise it, I have to change the position of the screen on the computer and move things around, and I'm just not going to do that," he says. Fancy equipment or not, like Hedge, plenty of people would simply rather work sitting down. Cutting back on sitting time at home is equally troublesome. It seems we'd rather watch others exercise on *The Biggest Loser* than work out ourselves.

We still don't definitively know the best way to prevent the sitting disease. Of the research that's been done, one thing does seem powerfully effective: breaking up sedentary time. A 2012 study in *Diabetes Care* from a team including Neville Owen found that overweight or obese adults who interrupted their sitting time every 20 minutes with two-minute walks had healthier glucose and insulin levels in their blood.

It could be that we'll see recommendations from the World Health Organization and others on breaking up or reducing sitting time, like the ones that already push people to exercise. In Canada, it's already started: the Canadian Society for Exercise Physiology has released "sedentary behaviour guidelines" to warn kids off more than two hours of recreational screen time per day, and guidelines for adults will follow. In Denmark, according to a report in *Bloomberg Businessweek*, employers are required by law to provide adjustable-height desks for their employees.

We could see mandated walking breaks for office workers, and more workers' compensation claims. The floodgates could soon be open to legal claims similar to Cathleen Renner's. Perhaps with an eye on that possibility, AT&T has appealed the Renner decision, according to Patrick Caulfield, James Renner's lawyer; the case will be heard by the Supreme Court of New Jersey.

For the millions of us who are mostly sedentary, though, change would have to happen at a societal level—everything from the workplace to the commute to home life would be affected. It would be a monumental task, but observers insist there is precedent. After all, indoor smoking today is an anachronism; eventually, maybe spending long stretches seated in a chair will be, too. "If we said to people 20 years ago, 'There will be a smoking ban,' they would have been shocked," says Emma Wilmot of the University of Leicester, lead author of the meta-analysis. "Now, we accept it."