Stress and the Immune System

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The idea that psychological stress can make us -- or at least rats -- more vulnerable to illness was inadvertently proven by an eager yet clumsy physiologist back in the 1930s. Hans Selye, an Austrian-born endocrinologist working in Canada, was trying to prove that he'd discovered a new hormone by injecting lab rats daily with an ovarian extract. As the story goes, Selye was an inexperienced technician, and often dropped the rats and had to chase them around the floor with a broom in order to catch and successfully inject them.

A few months later, when the rats developed peptic ulcers and swollen adrenal glands, Selye was convinced he'd discovered a new hormone. Just to be sure, he ran a control group on more rats, injecting them with plain saline solution. The results? The control rats developed the exact same symptoms. The young scientist was forced to conclude that it was the stress of his sloppy lab-side manner that caused the rats' maladies. Selye had failed to discover a new hormone, but succeeded in proving a relationship between stress and physical disease. He went on to write more than 1,700 papers and 33 books on the subject of stress. Today, the late Hans Selye is known as "the father of the stress field."

Thankfully, most of us will never be chased around by giant hands attempting to stick us with sharp needles. But we will go through harrowing break-ups, moving days, and bad weeks at the office. Can stressful events like these actually make humans more likely to contract a disease? Can they hinder our recovery from hard-hitting illnesses like heart disease and cancer? Can they slow the healing of wounds? Increasing evidence suggests that stress may indeed affect the immune system in these and other ways. In fact, there is so much research on stress and immunity that it has its own field, called psychoneuroimmunology, complete with specialized journals and textbooks.

Stress and immunity

How exactly does stress from the mind end up affecting the immune system?

"Some kinds of stress -- very short-term, that last only a matter of minutes -- actually redistribute cells in the bloodstream in a way that could be helpful," says Suzanne Segerstrom, an associate professor of psychology at the University of Kentucky who has conducted studies on stress and the immune system. "But once stress starts to last a matter of days, there are changes in the immune system that aren't so helpful. And the longer that stress lasts, the more potentially harmful those changes are."

The fight-or-flight response (short-term stress) goes something like this: When a villager in Africa sees a lion charging at him, for example, the brain sends a signal to the adrenal gland to create hormones called cortisol and adrenaline, which have many different effects on the body, from increasing heart rate and breathing to dilating blood vessels so that blood can flow quickly to the muscles in the legs. Besides helping him run away, this type of acute stress also boosts the immune response for three to five days (presumably to help him heal after the lion takes a swipe at him).

When humans experience stress, our bodies react the same way that animals' bodies do. Once the lion is gone, a zebra or gazelle's stress level will return to normal, but humans have more trouble getting back to our routines after a stressful event, whether it's a car accident or a divorce. We'll think about it, dream about it, and worry about it for a long time, and that sets us up for long-term problems, says Robert M. Sapolsky, a Stanford University stress expert and author of Why Don't Zebras Get Ulcers.

Over time, continually activating the stress response may interfere with the immune system. How this affects your disease risk, Sapolsky suggests, depends partly on your risk factors and your lifestyle, including your degree of social support.

Stress and premature aging

The stress involved with caring for a loved one with dementia is well documented. According to the national Alzheimer's Association, 80 percent of caregivers report suffering high levels of stress, and nearly half suffer from depression. As a result, caregivers have become popular subjects for studies involving stress and the immune system.

A 2003 analysis of caregivers, for example, found that people caring for spouses with Alzheimer's disease showed a marked overproduction of an immune factor called IL-6, which is normally involved in the immune response to injury. A rise in IL-6 is associated with many age-related conditions, including cardiovascular disease, osteoporosis, arthritis, Type 2 diabetes, certain cancers, and mental decline.

Wound healing

In another study, dental students volunteered to receive small cuts on the roofs of their mouths on two occasions: once during summer break and again six weeks later, during exams. The students' wounds took 40 percent longer to heal when they were under the stress of exams. In addition, the students' levels of a protein called IL-1, which summons other immune cells to battle, were found

to be two-thirds lower when the students were in exams than in the summer.

A similar study found that marital discord was also associated with the healing of wounds. In the 2005 study published in the Archives of General Psychiatry, couples whose behavior was rated as "hostile" toward each other had a wound-healing rate that was 60 percent of the rate of couples with gentler relations.

Infectious disease

A handful of vaccine studies have also found that the immune system of highly stressed individuals have sluggish responses to challenges. In one study, published in the journal Psychosomatic Medicine in 2000, a pneumonia vaccine was administered to 52 older adults, including 11 people caring for spouses with dementia. After just six months, the levels of antibodies produced against pneumonia in the caregivers had dropped off, while the non-caregivers' levels remained stable. A similar study in which 32 caregivers were given the flu shot in 1995 also found that caregivers received less protection from the vaccine than did a control group of non-caregivers.

If you're stressed out, you're more likely to get sick -- at least it seems that way. A 1991 study in the New England Journal of Medicine actually found that higher psychological stress levels resulted in a higher likelihood of catching the common cold. The researchers accounted for many variables -- including the season; alcohol use; quality of diet, exercise, and sleep; and levels of antibodies before exposure to the virus -- and concluded that higher stress was to blame for lowered immunity and higher infection rates.

Stress and the "Big C": cancer

The relationship between stress and the big daddy of all diseases -- cancer -- has also been the subject of much research. "Our studies have shown that stress can adversely affect components of the immune system involved in fighting diseases like cancer," says David Spiegel, MD, a psychiatrist and researcher at Stanford University. The number of natural killer or NK cells -- cells that kill undesirables like bacteria and cancer cells -- has been found to be lower among people who are suffering from chronic stress, says Spiegel, who also directs Stanford's Center for Integrative Medicine.

Spiegel, among others, has conducted a number of studies that indicate that group counseling and stress-management techniques offered to people who have already been diagnosed with cancer may help boost their immune systems. For example, a study of 103 women with metastatic breast cancer (cancer that has spread beyond the breast) examined how much support from family and friends the women had to help them deal with their diagnosis and treatment. The study, published in the journal Psychosomatic Medicine in 2000, found that women who had greater social support displayed lower levels of cortisol in their saliva than the women who had less support. Lower levels of cortisol, says Spiegel, indicate a healthier immune system functioning.

But the evidence linking stress and cancer is murky at best. As Sapolsky points out in his book

Why Zebras Don't Get Ulcers, none of the cancer studies out there is able to directly link lower levels of stress with longer survival rates for cancer victims. And certainly, none of them can prove that stress causes any type of cancer in the first place.

"We must be careful not to blame the victim," Spiegel says. "We get cancer because we are biological creatures, not because we didn't handle stress right. Stress is just one variable among many."

Other conditions

Stress acts on the body through the immune system, and in recent years we have been learning that chronic inflammation -- the immune system's response to injury or irritation -- may be involved in everything from heart disease and diabetes to Alzheimer's disease and other dementia. So, indirectly, a stress-related imbalance in the immune system may have a wider-ranging effect than originally suspected.

Was Grandma right?

As we've seen, many studies show that stress can impact different facets of the immune system. Some suggest that stress slows recovery from illness or makes us more likely to catch colds. But can stress actually make us sick, or shorten our lifespans? Our immune systems are so complicated, and a person's immune response affected by so many factors, it's understandably a difficult area of study. In addition, it's hard to find stressed-out volunteers willing to expose themselves to viruses to see if they'll get sick or not.

In the meantime, there is enough evidence to convince us that we should find healthy ways to keep our stress levels down, which is advice we got from our grandmothers: Eat right, exercise, and get enough sleep.

"Stress is inevitable," Spiegel says. "The trick is to learn to manage it, to find some aspect of our stress and do something about it. Don't think in terms of 'all or nothing' but in terms of 'more or less.' "

-- Paige Bierma is a health and medical writer who has contributed to Hippocrates, Safety + Health magazine, and Vibe.

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Reviewed by Reviewed by Michael Potter, MD, an attending physician and associate clinical professor at the University of California, San Francisco.

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