

Measuring the Autonomic Nervous System: How Stressed Are You?

By Janet Wagner

The first post in this blog post series covers how machine learning and artificial intelligence can be used to help individuals combat stress. Thanks to the availability of consumer-grade wearables and the wide adoption of smartphones, individuals now have access to advanced applications that can monitor and analyze stress levels in real time. Quite a few of these applications also allow users to take it upon themselves to learn holistic techniques for reducing stress.

The second post in this blog post series covers how numerous organizations are providing employees access to corporate wellness programs that include tools for reducing stress. Employee stress is not only a problem for individual employees, but also for employers who lose billions of dollars every year because of absenteeism, higher health insurance costs, and other stress-related issues. It's not surprising that numerous companies worldwide are providing corporate wellness programs that aim to help employees significantly reduce their stress levels.

Environmental stress caused by lifestyle choices and work environments is a significant risk factor for health problems and can greatly reduce an individual's quality of life. In 2014, NPR, in partnership with Robert Wood Johnson Foundation and the Harvard School of Public Health, [conducted a poll](#) asking Americans about their stress levels. According to the NPR study, 1 in 4 Americans reported having a great deal of stress the previous month and approximately 115 million American adults (about half of all adults) reported that they had experienced a major stressful event within the past year.

What exactly is stress and how is it measured?

Stress is a natural human physiological response to an emotional state caused by environmental stress such as work environments and lifestyle choices. Stress causes the brain to trigger the physiological reaction of "fight or flight" which leads to the release of adrenalin and cortisol into the bloodstream. Prolonged exposure to environmental stress can lead to chronic health problems and in many cases mental exhaustion.

The stress response is a component of the autonomic nervous system (ANS) and there are two key measurements used to monitor the state of the ANS; heart rate (HR) and heart rate variability (HRV). HR or "pulse" is the number of beats an individual's heart makes per minute. HRV is the variation in the time interval that passes between heartbeats. HR and HRV are key components when it comes to measuring stress. Measuring galvanic skin response and physical activity along with HR and HRV can provide an accurate assessment of an individual's current stress levels.

For decades, HR and HRV were measured at a physician's office or hospital using traditional technologies like the electrocardiogram (EKG or ECG) and Photoplethysmography (PPG). Most people are familiar with the [electrocardiogram](#), a device that shows the heart's electrical activity and checks for

problems with that electrical activity. Photoplethysmography is an optical measurement technique for detecting blood volume changes in the microvascular bed of tissue. PPG is often seen in hospitals and physician offices where it is used to measure a patient's pulse and blood oxygen levels. It's a device that glows red and is usually clipped onto the patient's finger.

Consumers today have access to advanced wearables featuring sensors and technologies that can be used for monitoring and measuring HR and HRV. Many wearables also feature technologies that can be used to measure physical activity levels and galvanic skin response. Monitoring all of these physiological signals together with the help of modern consumer wearables (and smartphones) can provide an accurate, real-time profile of an individual's stress status and overall health. You no longer have to wait until your next primary care physician visit or trip to the hospital to have your heart rate and stress levels measured.

So how stressed are you?

Today there are a number of wearable and smartphone applications available that are capable of telling you your current heart rate and can help you monitor your stress levels in real time. Some of these applications are capable of not only providing deep insights into your stress levels, but can also teach you holistic techniques for managing stress such as mindfulness, device-guided breathing, biofeedback, and meditation.

Prolonged stress can lead to serious health consequences if left unchecked. According to The New York Times [Health Guide](#), possible complications of persistent stress and anxiety include (but not limited to) heart disease, weight gain and obesity, chronic pain, and insomnia.

Download the BioBeats [Hear and Now](#) Application for iPhone and iPod to find out your current stress levels and learn techniques to help you manage stress. Be sure to follow up with your primary care physician who can provide a stress management plan and prescribe medications if needed.