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## CARDIOVASCULAR HEALTH

# Heart Rate Variability and Emotional Shifting: Powerful Tools for Reducing Cardiovascular Risk

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Heart Rate Variability, the beat-to-beat change in heart rate, is an accurate indicator of autonomic nervous system activity that can provide important insights into a patient's risk of cardiovascular disease. More importantly, it can play a central role in teaching patients how to reduce their own risk by showing them how their emotional states affect their heart health.

HRV has been used in medicine since the 1960s, initially in obstetrics. HRV is what is measured in 'fetal monitoring,' and indicates the well being of the fetus' autonomic system. It has also been heavily researched in cardiovascular disease, especially in relationship to arrhythmias. Rapid HRV changes can trigger atrial arrhythmias. Treatments affecting HRV may be useful in treating arrhythmias.

In essence, HRV provides a picture of the interplay between the sympathetic and parasympathetic branches. As such, it reflects the ways in which emotional states affect core physiology including, but not limited to, cardiac function.

As sympathetic tone increases, the heart's beats (R-R

intervals on the EKG) get closer together. As parasympathetic tone increases, they widen out. The ebb and flow of autonomic tone create patterns of heart rate acceleration and deceleration; thus HRV provides a picture of emotional and physiological states.

### Two Basic Patterns

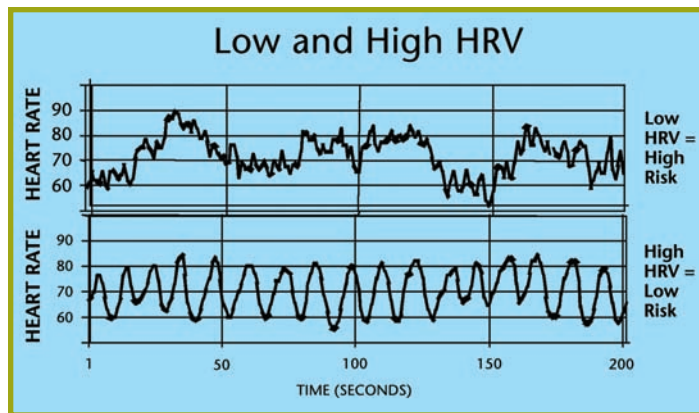
There are two basic patterns of HRV (see diagram). The incoherent HRV pattern (Top) is characterized by a low peak-to-

anxiety and hostility, trigger increases in parasympathetic tone, reflecting the autonomic system's attempt to achieve homeostasis. In a simple but reasonable analogy, it is like running your car with your foot on the gas and brake at the same time: the conflicting signals produce discordant function, which is reflected in the jagged and incoherent form of the HRV pattern.

The more coherent HRV pattern (Bottom) associated with positive emotional states represents a balanced, cohesive ebb and flow of sympathetic

Low HRV is associated with high sympathetic tone, and the detrimental cardiac effects of chronically elevated sympathetic tone are very well documented. They include increased arrhythmias, vaso-reactivity, hypercoagulability, and thrombosis (Sudhair V, et al. *Am J Cardiol.* 1994; 73: 653-657). Low HRV patterning is also associated with higher risk of sudden death and MI in patients with CAD (Khaykin Y, et al. *Can J Psychiatry.* 1998; 43:183-186. Enhancing Recovery in Coronary Heart Disease Patients (ENRICHED) Study Group. *Am Heart J.* 2000; 139: 1-9. Bernardi, et al. *BMJ* 2001; 323:1446-1449 Blumenthal JA, et al. *Am J Cardiol.* 2002 Jan 15; 89(2):164-8. Carney RM, et al. *Psychosom Med.* 2000; 62: 639-647).

Incoherent HRV is also found in people with CAD who are depressed. In Carney's post-MI study, those who were depressed had consistent incoherent HRV patterns compared to those who were not depressed. HRV was equally incoherent in those who had major depression, minor depression, or dysthymia, compared to those without depressive symptoms.



nadir difference in the waveform of the heartbeat, and it is typical of states of high sympathetic tone. Chronic sympathetic overactivity, as seen in states of depression, anger,

and parasympathetic tone. This occurs when both tonalities are at modest to low output, and it is characteristic of low-stress, high-satisfaction emotional states.

continued on p. 2

### Emotional States and HRV Patterns

The Institute of HeartMath, an institute dedicated to the study of the physiology of emotions, was founded in 1991 by a group of educators, engineers and researchers. HeartMath has published many studies evaluating the relationship of emotions and HRV (McCraty, R, et al. *Am J Cardiol.* 1995; 76:1089). In one study, power spectral density (PSD) analysis of HRV was used to compare autonomic activation and sympathovagal balance in subjects during a 5-minute baseline period, followed by a 5-minute period of self-induced anger, and then a 5-minute period of appreciation. These experiments used HeartMath's Freeze Frame® technique, a biofeedback method based on HRV.

The researchers found that both anger and appreciation caused an overall increase in autonomic activation, as demonstrated by an increase in power in all frequencies of the HRV power spectrum, as well as an increase in mean heart rate. However, the two emotional states produced very different effects in terms of sympathovagal balance.

Anger produced a sympathetically dominated power spectrum, whereas appreciation produced a shift toward increased parasympathetic activity (Tiller, W., McCraty, R., & Atkinson, M. *Altern Ther Health Med.* 1996; 2(1):52). These shifts were correlated with shifts in HRV to 'healthier' patterns correlating with lower cardiac risk. These and other findings from the HeartMath researchers strongly suggest that shifting to and maintaining a sincere, positive emotional state may shift physiology towards overall better health. This may explain why optimists have significantly lower mortality than those who are generally pessimistic (Kubzansky LD, et al. *Psychosom Med.* 2001; 63:910-916).

### Emotional Shifting and Health Improvement

Emotional shifting refers to techniques that help an individual switch their emotional

state consciously. These can be quick and easy, such as changing one's focus from an emotionally agitating situation to an emotionally calming or joyful one, or they can be longer, deeper and more involved, such as routine practice of a loving-kindness meditation.

Emotional shifting techniques have been studied in workplace settings, including hospitals and clinics, schools, and clinical environments. A host of data shows these techniques can reduce stress, depression, and negative emotion, while enhancing positive emotion, communication, and job satisfaction.

The techniques have significant physiological benefits, including enhanced autonomic nervous system balance as measured by HRV, reduced cortisol levels and increased DHEA (McCraty R., et al. *Integrative Physiol Behav Sci.* 1998; 33(2): 151.), improved immunity (Rein G, Atkinson M, McCraty R. *J Adv Med.* 1995; 8(2):87.), reduced blood pressure (McCraty R. *J Altern Compl Ther.* 2003; 9(3):355-69.), and improved exercise capacity in people with congestive heart failure (Luskin F, et al. *Prev Cardiol.* 2002; 5(4): 168-172.).

Emotional shifting techniques have also been shown to decrease hemoglobin A1c in a diabetic population (McCraty et al., 1999). This is likely due to decreases in catecholamines and cortisol, both of which enhance gluconeogenesis and glycogenolysis.

When shifting from a thought that is angry, hostile, or depressed to a mood state of appreciation in tune with one's values, there is first a decreased release of catecholamines. This then alters output from the vagus nerve to the body. This shift in vagal tone triggers a shift in HRV, which then sends information to the cortex, via the midbrain, to help facilitate cortical function. In simpler terms, when you relax and get happy, you get smarter.

### HRV and Emotional Shifting in the Workplace

In a study of employees of a state agency in California, the

HeartMath emotional shifting techniques were taught to 54 employees over the course of six weeks. This period happened to coincide with budget cuts and layoffs in this organization, a stressful time for many employees.

Participants applied HeartMath emotional shifting tools to the issues, challenges, and opportunities inherent in fundamental organizational change. They were taught Freeze Frame®, a more advanced problem solving technique using the Quick Coherence® concepts. They also learned the Heart Lock-In®, a technique similar to an appreciation meditation done for 20 minutes daily. A psychological survey measuring stress, negative emotions and organizational effectiveness was administered pre- and post-training. Participants were compared with a group of 64 employees who had not undergone the HeartMath training.

Seven weeks from the initial assessment, the HeartMath group showed significant reductions in stress and negative emotion, and significant increases in measures of positive emotion and organizational effectiveness compared with the controls. Key findings included decreased anger (20%), distress (21%) depression (26%), sadness (22%), and fatigue (24%), and increased peacefulness (23%) and vitality (10%). These percentages are improvements from baseline and were statistically significant.

There was also a reduction in stress symptoms, including anxiety (21%), sleeplessness (24%) and rapid heartbeats (19%). Organizational quality assessment revealed gains in goal clarity (9%) and productivity (4%). These changes were noteworthy in light of the major organizational challenges faced by the participants, and the short time in which the improvements took place.

In a second study, a cohort of police officers trained in HeartMath techniques demonstrated decreased stress, negative emotions, and fatigue, as well as increased calmness and clarity under the acute stress of simulated police calls. They

also showed more rapid recalibration to non-stress autonomic function following high-stress scenarios, compared to an untrained control group (McCraty et al. 1999).

The findings have significant implications for all of us in the medical profession, given the constant, intense stress we face in our work. What if you and your staff could lower stress while increasing performance? All it really takes is practice.

### Practical Application of HRV

There are several systems now available for home and office application of HRV monitoring and emotional shifting. The Freeze Framer® is commercially available through HeartMath.com and utilizes HRV to aid people in emotional entrainment. The concept is simple; Freeze Framer® tutorials teach various emotional shifting techniques, such as Quick Coherence. The software analyzes HRV through a finger clip pulse sensor. HeartMath recently introduced an ear clip sensor that allows users to have their hands free while monitoring HRV.

The program also comes with fun games powered by the user's ability to maintain coherent HRV patterns. The games include a black and white scenic picture that gradually fills with color, a hot air balloon that takes flight, or a pot that fills with gold, all by staying in a cohesive emotional state. HeartMath also teaches clinicians through teleconferencing, how to use Freeze Framer in the office with patients.

Another enjoyable new application of this technology is *The Journey to Wild Divine*. This is a home computer "game" using HRV monitoring and skin conductance levels (SCL), both measured through finger sensors. In *The Journey to Wild Divine*, a player navigates through colorful and exotic virtual environments, learning to use his or her own physiology as a guide. Certain game areas teach the player to relax, while

others teach how to consciously generate excitement and positive emotions, making for a fun adventure that just so happens to provide effective autonomic entrainment (For more information, visit [www.wilddivine.com](http://www.wilddivine.com)).

### Emotional Intelligence

For a bit of icing on the physiologic cake, the state of coherent HRV patterning is also associated with enhanced cortical function. When one is in a state characterized by elevated catecholamines, elevated cortisol, and low HRV, cerebral cortex function is inhibited. The opposite is true when one is in a state characterized by low catecholamine levels and coherent HRV. You can therefore enhance your cortical function and emotional intelligence by practicing techniques that induce low catecholamine, high HRV physiology. These include emotional shifting, meditation, prayer and deep breathing.

The interaction between the autonomic nervous system and the heart is dynamic and bidirectional. While it is clear that emotional states affect HRV, it is equally true that changes in HRV can affect changes in emotions and cortical function. People can learn to control HRV, which in turn, brings many emotional and physiologic benefits. When one shifts from a state of frustration, anxiety, hostility or depression to a state of appreciation, caring or loving, the HRV shift is quite dramatic. Voluntary practices such as prayer or recita-

tion of mantras positively affect HRV. The greatest effects occur when cyclic respiration is combined with entrainment of positive emotions. This will affect not only cardiovascular physiology, but also cortical function and perception.

Remind yourself and your patients that perception and cortical function are within our control. Whether through modern techniques like HeartMath or other applications of HRV and biofeedback, or through ancient spiritual practices in-

cluding prayer, mantra practice, or meditation, it is possible to entrain coherent and harmonious psychophysiological states that will go a long way toward improving overall health and reducing risk for many chronic diseases. ☺

## Simple Exercises for Shifting HRV

Many different techniques and exercises have emerged for reducing stress and shifting heart rate variability from incoherent, jagged, low amplitude patterns to coherent, smooth, high-amplitude forms. The latter are consistent with both a sense of well being and a reduction in cardiovascular risk.

Following are two specific techniques from the HeartMath® program. The first, called Quick Coherence®, is ideal for on-the-spot situations when longer meditations are not practical. The latter is a longer meditation, which gives the greatest benefits if practiced regularly. Both techniques are enjoyable, easy to learn, and easy to teach to patients.

### Quick Coherence®

Begin by sitting in a comfortable position. Start by taking deep breaths through the heart area. This brings your focus to your heart. Next, think of a positive feeling or attitude. For this you can use an image of a place, person or activity that gives you a positive emotion. Attempt to feel this emotion in

your body as you continue to breathe deeply. This technique can be used quickly and effectively to diminish stress in the moment.

### Loving-Kindness or Appreciation Meditation

This is a similar technique leading to quick coherence, but done for a much longer period of time, usually 20 minutes or more. In this practice you will use the image of someone you love.

Most people find focusing on those they love to be the most pleasing form of meditation. It intentionally brings the focus to the feeling of love, or being in love. It uses emotion as a focal point. All too often, we focus on something that causes anger. This is a way to inoculate against that habit.

Find a comfortable position, close your eyes. Take slow, deep breaths, until you feel relaxed and calm. Now visualize a person you love and appreciate. See yourself with that person. What do you see there? Are you sitting or standing? Can you feel the ground

beneath your feet or the place that you are sitting? Try feeling the air. What does it feel like? Are there any smells you can identify?

Now focus on the person you're with. Focus on your appreciation and love. In your mind, tell this person how you love and appreciate them. Hear what they say back to you, if anything. Be with them and admire them as you would a great piece of art. Thank them for being in your life. If your mind wanders, bring your focus back to this person or someone else you love.

You may want to walk together in a favorite place. If so, feel the ground beneath your feet. Smell and feel the air around you. Listen for any sounds you might hear. Enjoy the place and whom ever you are with.

When you are ready, say thank you and goodbye to your partner and bring your mind back to the room. By giving yourself this experience, you have altered your physiology as if you had really been there.