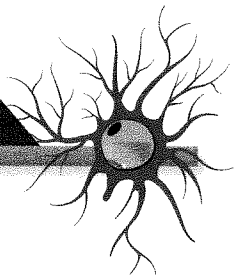

The importance of heart rate variability: Implications for healthy living

Imagine a shop in which many different clocks hang, all operating off of pendulums. As the clock pendulums are produced, they swing independently from one another, reaching the pinnacle of their journeys at different times. The sound produced as they all ticktock at different times is cacophonous.

At the end of the day, the clockmaker leaves. When he returns in the morning, the clocks are now swinging in sync, the ticking sound coherent and recognizable. This phenomenon, called entrainment, is the process through which two interacting oscillating systems that have different cycles when they function independently assume the same cycle.

Entrainment can also be seen in the practice of heart rate variability (HRV), in which the biometrics of respiration and heart rate can be observed and taught to become synchronous (entrained) through cognitive and emotional self-awareness and conscious cycling of the breath. Because the heart is so strong, it also pulls the brain into entrainment. It is not just the speed of the heartbeat that helps align the heart and the mind either. The closer the phase similarity is between the cardiac and respiratory systems during entrainment, the more coherent the two systems are said to be, like two clocks not only ticking at the same time but also swinging in the same direction. This coherence is associated with autonomic nervous system (ANS) balance, cardiac health and overall well-being.

Mental and emotional health involve the brain *and* the heart, not one or the other. We need to be able to gain insight not only into what the brain and mind are feeling and experiencing but also what the heart is feeling and experiencing, because it produces electrical impulses like the brain does. This is why HRV training is such a valuable tool for counseling.

HRV in action

In 2011, my wife, Kate, was diagnosed with a rare form of cancer that led to periodic blood tests, CT scans and two surgeries. She was aware of the high mortality rate of her illness, so the repeated diagnostic tests and surgeries, followed by uncertain periods of waiting for results, were nerve-wracking to say the least.

During her cancer battle, and for almost seven months after her final surgery, she used HRV training daily. By using diaphragmatic breathing and becoming more aware of her heart rate and HRV with biofeedback monitoring equipment, Kate learned to overcome the fear, stress, fatigue and general emotional upheaval that accompany receiving, and living with, a cancer diagnosis. She found that by increasing or decreasing her heart rate while maintaining a high HRV and coherence, she was able to move herself into the state of being best suited for the tasks ahead of her.

Every morning, when the fatigue was the worst, Kate would increase her HRV and heart rate by regulating her breath and focusing on the inhale. This allowed her to motivate herself to live the day more fully, creating a sense of inner peace despite the stress. In the evening, she used the process again, focusing this time on the exhale to reduce her heart rate while maintaining a high HRV, thus readying her mind and body for sleep.

Throughout her cancer journey, Kate learned to control her anxiety during the various blood tests and IVs, despite her fear of needles, by engaging in HRV training prior to (and sometimes even during) the procedures. When she felt that her mind was spinning out of control, she would train for balance, focusing on consistency in her breath and maximizing HRV coherence. From a neurocounseling perspective, regulating her breathing and heart rate resulted in a more stable mental and emotional state of being, allowing her to cope with the stresses of the situation.

How the heart drives the brain

A common misconception about the mind-body connection is that it is unidirectional. We talk about the brain as if it were a supercomputer, directing the minutia of ever-changing events in the body. By extension, we view the heart as if it were the engine, responding only to the brain's express orders.

However, the heart actually sends more signals to the brain than the other way around. The heart produces approximately 60 times more electrical activity than the brain does, and because of that, the heart can affect and even overwhelm the processes in the brain, including attention, judgment, emotional states and the stress response. Anyone who has ever been in love has experienced this intuitively. Although most clients are completely unaware of their brain's electrical and chemical activity, they can easily be made aware of the behavior of their heart.

The easiest observable mechanism through which the heart influences the brain is the heartbeat. The heartbeat is generated by the heart's sinoatrial (SA) node. It produces an electrical impulse that causes the heart to beat by contracting each of the four chambers of the heart in succession. The familiar heartbeat graph seen in an electrocardiogram is actually not a single signal, but rather four different signals that in combination move blood through the four chambers of the heart.

The SA node will generate on average 100-120 impulses per minute at rest if left to its own devices. However, the ANS, which is responsible for our nonvoluntary actions, constantly regulates the node's activity to keep the resting heart rate (in a healthy adult) between 50 and 70 beats per minute. Heart rate fluctuates because of the influence of the two subcategories of the ANS: the sympathetic nervous system (responsible for activation or safety behaviors, such as the fight-flight-or-freeze response) and the parasympathetic nervous system (responsible for deactivation behaviors, such as the rest-and-digest response).

The heart receives parasympathetic signals from the central nervous system through the vagus nerve and sends sensory information back to the brain about the health and well-being of the heart. The vagus nerve connects to the medulla, which is then connected to subcortical structures such as the amygdala, thalamus and hypothalamus, and then to the prefrontal cortex, all of which are regulatory structures in the brain. Because of this pathway, the heart is able to influence the brain's self-regulatory functions directly and indirectly.

The heart rate increases (the beats get closer together) when the sympathetic nervous system is activated because the ANS is not actively suppressing the SA node's activity as much. Then, when the parasympathetic nervous system is activated by the central nervous system, it leads to a decrease in heart rate (the beats get further apart) because the ANS once again strictly regulates this behavior and slows it down. This fluctuation is referred to as HRV, and it is happening constantly, although we are not naturally aware of it.

In an individual who is unhealthy (physically or mentally), the regulation of the SA node is compromised because the body remains in the sympathetic nervous system far longer than it should. The resultant reduced HRV is often associated with the stress response.

In more specific terms, whereas heart rate refers to the average beats per minute, HRV is the difference or variation in time between individual heartbeats due to the influence of the ANS. Both of these measures are useful, although each has a different role to play in assessing self-regulatory function.

What factors influence HRV?

Although you can connect monitoring equipment to individuals and observe their HRV directly through a photoplethysmograph, or blood pulse monitor, you can generally get a sense of when they are experiencing a low HRV by watching their breath and stress level.

As infants, we breathe with our abdomen, with a consistent cycle of inhalation and exhalation. Watch a baby sleeping, and you'll see what I mean. Babies' bellies get bigger as they breathe in and smaller when they exhale, and the cycle is slow and steady. Now watch stressed adults and see how they breathe. Most often, they are breathing shallowly (even holding their breath at times) and have begun "reverse breathing" — sucking their stomachs in when they inhale and letting them relax when they exhale. This breathing practice causes the heart rate to become erratic, HRV and respiration rates to become incoherent, and the HRV to reduce.

Teaching clients to breathe correctly and to become aware of their heartbeat at the same time is often a quick way to produce a more relaxed state for your clients. Because most adults have a negative, judgmental or frustrated cognitive and emotional experience of the world, their HRV becomes negatively affected too. If you see that clients are struggling with HRV training, it may be because of problems with their sleep, diet or exercise level; environmental stressors; or their mental state. For that reason, you can often use HRV monitoring and training as a mechanism for demonstrating and proving the mind-body connection to clients. It serves as a quantitative, objective outcome measure of a subjective experience.

Counseling applications

HRV and respiratory coherence can be used for assessment and insight into cognitions and emotions as well as a stress management and self-regulation tool. As a counselor, you can help clients improve their mind-body imbalance by using HRV instrumentation and software to confirm your observations and by teaching clients to consciously influence and change their own HRV patterns.

This equipment does not have to be expensive. In fact, there are even apps for smartphones and watches that are designed to record and monitor HRV. Some do not even require the use of extra hardware sensors, using the flash on the camera as a HRV monitor instead. Other, more professional and accurate systems exist that do a better job of monitoring and training with HRV if counselors want to integrate this into their normal practice. These systems are still relatively inexpensive, and some can be sent home with clients. Clients can be taught to use some of these systems on their own once they have mastered the skill with a counselor's guidance.

The first step in guiding any counseling change, including HRV, is gaining insight into the issue or behavior. After all, you can't change something if you aren't aware of it. Training HRV as part of a counseling session can start by recording a client's baseline and perhaps even offering a basic stress test. A stress test takes only 10 minutes and is made up of five two-minute segments: baseline, stressor, recovery, positive and rest. Clients should be connected to the HRV equipment without having them observe the readout. Observing the graph that is generated can influence clients' behavior, so it is best to face them away from the computer screen.

The first segment, the baseline, offers a chance to gain insight into your clients' HRV in their normal state of being. Begin the second segment, the stressor, by having them think of something stressful. Watch their heart rate to see how much it decreases in variability and coherence. The more jagged and inconsistent the graph becomes, the more stressed they are. The third segment, recovery, assesses for their ability to return to baseline, if they can. For the fourth segment, ask them to think of something positive and, finally, repeat the return to baseline. This type of assessment offers clients and counselors a wealth of information that can inform the counseling process. In addition, it provides clients hope that they possess the power to change.

The brain and the heart are equally important in creating and maintaining mental and physical health. HRV gives counselors a chance to validate their clients, showing them that we can see the proof of their struggles — that these challenges are very real and not just imagined. As counselors, we do so much from a subjective standpoint. HRV gives us an objective measure of how well-aligned a client's mind and body are in the moment and how the client can rise to the occasion by optimizing that alignment in the future. ❖

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