

Adaptability

By: Christopher J. Meyer, D.C.—Gonstead Diplomat (Gonstead Fellow as of October 2024)

Greenbay, WI

(From the February 2019 The Scope)

At the last Gonstead Meeting of the Minds I had a discussion with several people that led me to write this article. Over the past years, I have been following several different curious lines of research that seem to be outlining something big and new in the world of health. One piece of this bigger picture is the attempt to measure a quality called Adaptability.

If you look up the definition of adaptability you will find: **Adaptability** (Latin: Adapto “fit to, adjust”) and the dictionary definitions will be something like this: The ability of an organism to become suited to or fitted for its conditions or environment. The concept is similarly defined as it is used in other fields that involve complex systems: computers, business, etc. but, the concept is more nebulous and harder to nail down as I will use it, and blends into the realms of Allostasis and Resilience.

Allostasis is a more modern term, originating in 1988 and used to describe a broader concept beyond Homeostasis, that involves the organism maintaining stability through change. If a boat in storage or dry dock is in Homeostasis, then a boat free floating in the water is in Allostasis: dynamically changing and responding to the surrounding environment. Allostatic Load is the demand put on the dynamic systems of adaptation, much like large waves will put on the boat, which if high enough can be called Allostatic Overload, and result in the boat sinking. Some argue that there are 2 levels of Allostatic Load, and others argue that this is all just redefining Homeostasis. One can further split semantic hairs in this regard, but it is sufficient to introduce the concept for my purposes. Feel free to look it up further online.

Resiliency is a similar concept. Psychological resilience is the ability to successfully cope with a crisis and to return to pre-crisis status quickly, and without long-term negative consequences. You may wonder why I have the two terms: Adaptability and Resilience, why not just one? They are two different sides of the same thing. From the point of view of physiology, the quality is Adaptability, from the psychological point of view, it is resilience. They are different aspects of the same thing.

Seminars regarding Adaptability

There have been a series of three Adaptability Symposiums held in Chicago every other year in September. The last one was in 2018. They are the work of Dr. Rob Sinnott D.C. FPhC and include various cutting-edge researchers from various fields to present to a group of chiropractors. Dr. Dan Lyons has been a presenter at the last two, which I attended on his suggestion. I was impressed with the information presented.

Dr. Dan Lyons spoke on the Relationship Between Cervical Curve and HRV. This was very enlightening and needs to be followed up by the rest of us in the Gonstead community.

John Ferron PhD. went through a very thorough presentation of how to do quality Single Case Studies. If we as individual practitioners want to make a contribution to the world of research, this may be one of

the very best ways to do so. It is essential to gather quality data, document our findings that lead to our interventions and make the process reproducible for others. Even “failures” if well documented can be informative and help us advance our knowledge.

Dr. John Goodfellow, D.C. gave presentations over 2 days covering Spinal Bilateral Temperature Variation, and ICG and Bilateral Concha Cavum thermal measurements as indicators of SNS and PSNS function. These are a combination of old and new methods and can be used to quantify our analysis and offer pre and post adjustment objective indicators of physiological change.

Dr. Gary Berntson, PhD. was the keynote speaker at the last Symposium. He is Emeritus Academy Professor of Psychology at The Ohio State University and has been described as the “father of the field of Psychophysiology”, which is the field that focuses on Mind-Body research.

Dr. Lyons and I had the opportunity to attend a lecture by Dr. Berntson in June of last year in Columbus, OH. It was attended by psychophysiological professors, researchers, grad students and two chiropractors. It was a very intellectually stimulating weekend for us both. The takeaway was that science seems to be able to measure and quantify the complex variability of the body and mind in a way that leads us to believe that we can get a measure of a person’s Adaptability. That we can quantify and measure at least one part of the larger nebulous concept of what is (according to Dr. Sinnott) “The leading indicator of future health” i.e. Adaptability.

At the Chicago Adaptability Symposium, Dr. Berntson’s Keynote was on HRV & ICG: Research Metrics on Autonomic Function. He described these metrics in terms of both the research and real-world applications. He also touched on the Psychophysiological (Mind-Body) connection in greater depth. We focus so much on the physical component of health, that we may overlook the psycho or mind component. What stood out to me was the graph that showed the increase in mortality that comes from smoking, and then a longer bar that represented the increase in mortality from problem drinking, and finally an unlabeled bar on the graph that was longer than both of the other bars. He then asked us to guess what the third risk factor was—it was Loneliness. Perceived social isolation was more harmful than smoking and drinking combined. This and other research he presented opens doors to a richer and more complex view of human health, which coming from the often “cool and objective” field of research was a surprise. There’s a connection between the Psychological concept of Resilience and its other side which is the Physiologic concept of Adaptability.

This is big. There are many ill-defined and near impossible to measure concepts i.e. Wellness and the Mental Impulse, for example. But it appears that Adaptability can be measured and impacted. If Allostasis encompasses the concept of variability in the organism as a measure of dynamic responses that leads to homeostatic balance, and we assume health, then technology can allow us to measure the variability within the organism and quantify it. Fourier transformation, Poincare plots and much statistical analysis are all involved in the research. But when it is all said and done, we can get a real time measure of the internal dynamic balance of the organism in a way that has not been available to us until now. Each year the technology is getting better and cheaper and more practical for clinical use. We can assess specific parts of the Autonomic Nervous System with these tools, we can intervene with the

specific adjustment, and we can assess the response that the ANS and the whole organism has in response to the adjustment.

Dr. Gonstead spoke of adjusting with specific intent in the Parasympathetic NS and the Sympathetic NS to accomplish specific outcomes with regard to helping patients regain their health. We can now measure each of these systems with certainty and get firm numbers to assess the effects of our adjustments. To me, this is amazing.

For nearly 10 years, I have been working with a part of this technology—as has Dr. Lyons. Only in the last year or so have we begun to understand what it can tell us about patients' responses to our adjustments and other interventions. Although still in a steep learning curve, we can share some of what we have learned.

Technology

There are several methods of assessing particular aspects of the ANS. The most common for assessing SNS function are Galvanic Skin Conduction (GSC), Impedance Cardiography (ICG), Pupillometry and Low Frequency Heart Rate Variability (LF-HRV). The most common for assessing PSNS function are: High Frequency HRV (HF-HRV) and Pupillometry.

The most versatile and easily usable metric at this time seems to be HRV, and this will be the main focus of this article, but I could go further into the other metrics in a future article. The nature of HRV measurement is that depending on how the signal is analyzed, and the length of the reading, one can get a very clear signal of the PSNS function at the SA node of the heart. This may be used to study RSA: Respiratory Sinus Arrhythmia, which is the interaction between the afferent and efferent functions of the Vagus Nerve, (CN X) and the pacemaker of the heart. This is also used to determine overall Vagal Nerve tone and how well the brain and viscera are able to interact dynamically.

High Frequency HF-HRV readings can be accomplished with readings as short as one minute. This is due to the rapid effects of acetylcholine on cardiac cells: < 200 ms, or 1/5th of a second. So, when one focuses on this particular physiologic effect, you are focusing on PSNS modulated effects. Since the neurotransmitter norepinephrine takes almost 6 seconds to show effect, one needs a longer time measure to get sufficient data to determine variability of the heart to SNS neural inputs.

If there is a large degree of dynamic and organized change in the ANS as assessed by measuring RSA via HRV, this is taken to indicate a high level of Allostatic Capacity and hence Adaptive Capacity. If as Dr. Sinnott states; *“Adaptability is the leading indicator of future health status, and HRV allows us to measure Adaptability”*, then those interventions which lead to greater health and function, should also reflect in greater HF-HRV values in particular, as well as long term greater Adaptability and better health outcomes overall.

This line of reasoning seems to be supported by research in multiple areas over the last four decades, and which encompass over 70 different disease processes. In fact, the developers of the Elite HRV app

describe HRV as *“The best non-invasive method of assessing an individual’s health and wellness status.”*- Per HRV course taught by Elite HRV founder Jason Moore.

The statistical evidence correlating HRV with better health outcomes is substantial. There have been literally thousands of studies using HRV analysis to study health and disease processes, and P values of .0001 are common.

“The p value of <0.0001 translates to the chance of the findings not being accurate to less than 1 in 10,000 The importance of seeing an intervention showing improved coordinated autonomic transmission of impulses in such instances cannot be overstated. Especially so if they are not palliative in nature, but truly restorative to the autonomic tonal values.”

P119 of Sinnott’s *Textbook of Human Adaptability*.

Correlation is not causation, and we may find as I suspect that there will be deeper layers of complexity found as we study this further. But right now, HRV appears to be one of the very best tools to assess a person’s health in real time, as well as a way of assessing the effects of various interventions in both the short and long term.

The technology is getting better and more available every year, and Dr. Lyons and I are using HRV in our practices as a valuable tool to assess our patient’s state of ANS function and how they respond to particular adjustments. We are taking slightly different approaches but are finding intriguing and interesting results weekly. The HRV device that we most often use is the Intellwave HRV unit developed by Alexander Riftine. We have used this unit for approximately 10 years.

Uses of this Technology

Just last week, I used real time HRV data with a 42-year-old patient to modify my treatment. She had a Polar belt on and her smart phone with the Elite HRV app running was on a lanyard around her neck. I could determine the state of her SNS and Vagal tone in real time via changes in her HR and HRV values. A healthy resting heart rate of 75 is significantly lower than the SA node’s intrinsic rate which at age 20 is around 107 beats per minute and which decreases at age 50 to around 90 bpm. ¹

When the heart beats faster than the intrinsic rate, it indicates that the SNS is engaged. If it beats slower the PSNS is engaged. The PSNS is able to slow the heart rate to 20-30 bpm or even briefly stop it. ²

When she got up from lying down and began to elicit symptoms, I was able to see her HR was 120 bpm. I was able to focus my care on reducing her SNS activation and enhancing her PSNS, and was able, in real time, to see what effect my efforts were having on her alarmed physiology. She was able to regain a calmer state in a short time and left the office in a better state than when she came in.

1. *Opthof, T. (2000). The normal range and determinants of the intrinsic heart rate in man. Cardiovascular Research, 45, 177-184*

2. Tortora, G.J., & Derrickson, B.H. (2012). *Principles of anatomy and physiology* (13th ed.) New York: John Wiley & Sons, Inc.

I was also able to use the Intelliwave HRV unit to gather deeper data on a patient during a re-exam last week. I had a question regarding the effectiveness of her treatment and whether we were making progress in a particularly difficult chronic case. Due to a history of physical and other abuse and medication for multiple problems, this patient had much psychological and physical symptomatology. I was suspecting that I had reached the limits of what I could offer and was considering releasing/transferring the patient. I was pleasantly surprised to see that she was now in a state within 1 unit of the autonomic balance point, and her PSNS state went from -2.0 to -0.5. What we are doing is having a beneficial effect on her ANS and her ability to balance her physiological state. I needed to be more patient and give the body time to heal! Progress is being made.

For the past 2 years, I have also used the Elite HRV app for gathering my personal data on my own ANS responses to lifestyle choices as well as to identify those actions which can improve my overall health and adaptability. It has been a slow process of discovery, but I am beginning to get a clearer understanding of the factors affecting my own adaptability.

Major Categories of HRV

Presently, there seems to be 3 distinct avenues for HRV technology. As it becomes more available and affordable, it can be used more readily by the patients in your practice to assess their own health and wellness. Look up the concept of The Quantified Self. Most of the apps which use the phone's camera fit into this category. Quick and easy, poorer data quality at first, but likely to improve with time, i.e. the digital camera revolution. Elite HRV has a specially designed Photoplethysmography device that they sell, but there are several apps that use similar technology. Heart Math is a popular one.

Second is the Athletic Holter type monitor that gives a better data signal, but the sampling and error rate makes it somewhat less accurate relative to research grade equipment. Intelliwave which Dr Lyons and I have used, has an upgradeable version that uses direct adhesive skin leads and will allow EKG/ECG full wave form. The downside is the time it takes to set up and perform, and is a bit more invasive, especially for hirsute patients. Some recent studies, however, seem to indicate that the quality of the data for HRV using just a Holter Belt may rival direct lead ECG's:

<https://www.ncbi.nlm.nih.gov/pmc/article/PMC4751190/>

Third is research grade equipment that captures the very highest-quality data, but is also rather expensive, time intensive to use, and requires 5 to 10 times as much time after the data is gathered to process it properly for use. This may best be used by chiropractic researchers in academic settings, at least for the near future. An example of this is MindWare Technologies that many academic researchers use.

We are still sorting out which technology is best for which particular application in a rapidly changing area. It really depends on what your particular interests are. Do you want to be familiar with the technology that your patients are and will be using and be able to have an intelligent conversation with

them about it? Do you want to have a tool to use in the office during periodic evaluations, or for a deeper analysis of tough cases, to get a deeper understanding of their ANS? Do you want to have more objective evidence to back up/recognize your miracle cases when they happen? Do you want to do publication grade research, on single cases or particular groups or conditions?

We would be well-served to come up with a consistent systematic and thorough system for Gonstead doctors to gather and document data, so that in the coming years we can have something to be proud of, data that can meet the standards required for publication . What that will look like is being determined now, thanks to doctors Lyons, Sinnott, etc.

Dr. Sinnott estimates the clinically useful Pupillometry unit will be available this year. The nice thing about this method of ANS analysis is in the ease of use and lack of invasiveness, as only the eye is observed, and the skin is minimally touched. This also assesses both the SNS and PSNS functions in a shorter period than can be done by HRV.

Other Directions for This Technology

The Elite HRV app has a series of video seminars available which focus on using HRV for improving athletic training and performance. It is used to identify the point where overtraining is occurring, i.e. the point where Allostatic Overload is occurring. If this can be easily identified, the athlete can rest and allow recovery to occur and avoid injuries, thus costing them weeks or months less time in recovery. The idea is that by knowing when to do less, they can accomplish more.

In discussion with some of the researchers in the field of Psychophysiology, the HRV and other ANS measurement tools can be used to determine particular psychological states of a person or animal. Interest or attention to a particular stimulus can be determined independently and objectively, as can aversion and avoidance. One of the uses of this technology was in determining how people react to environmental stimuli. One large corporation that produces consumer products, used this technology in the following way: A subject wore a mask through which a stream of breathing air was passed. While their ANS was being measured, a short burst of a particular scent would be injected into the air stream. The stimulus would elicit a measurable reaction in the subject, and by evaluating their rapid (@ 200ms) response, their level of interest or aversion could be determined. They were able to test and evaluate stimuli that were so brief in duration, that the person was not even conscious of what was being tested. This information was then used to determine which compounds would most elicit a state of interest in the nervous system as a whole. In time a library of compounds was identified which could be used to elicit more of particular responses. The client was a large tobacco company. So, it stands to reason, that when a particular cigarette or food item is difficult to stop consuming, it is likely because the triggers for engaging particular reactions in our nervous system and limbic brain were determined by this technology. It is refreshing to see the technology that many would argue was used for destructive purposes, finally being used for constructive ones.

The association between Vagal tone, RSA and health outcomes is so strong, that the parent company of Google: Alphabet announced a partnership with Glaxo Smith Klein in August of 2016 to develop technology to stimulate the Vagus N. The goal of the \$715 million partnership was to develop the field of electro pharmacology or bioelectronics where electrical stimulators would be placed on the Vagal N, and the end function of the visceral organs would be altered and stimulated to effect health outcomes without having to use pharmacological agents. <https://www.reuters.com/article/us-gsk-alphabet-idUSKCN10C1K8>

The Palo Alto Homeostatic Capacity Prize is the second part of an ongoing 2-part contest that is attempting to use any and all methods available to extend life span by 50% in a population of mice. The second part is attempting to take middle aged mice and return them to the state of physiologic health comparable to young adult mice, again by any means possible. Each part of the contest has \$500,000 in prize money available to any team that can accomplish this task. For the second part, the way it will be determined if they have accomplished the task, and have won the prize, is by measuring HRV. The restoration of RSA and Vagal function, and with it, the restoration of healthy youthful physiologic function is the goal. Teams from around the world are preparing for this second part of the contest. I look forward to their findings.

How do We Respond?

So, it seems to me, that there is a question before us; What roll do we want to play in all of this? We claim to specifically adjust the spine to remove nerve interference, and restore the body's ability to heal itself. Gonstead doctors work with these different parts of the ANS on a daily basis. Are we up for using these tools and seeing where they can lead us? What might change? Do we have the courage to find out?

Dr. Dan and I had this discussion on our way back from attending Dr. Berntson's seminar in June. We agreed that if we are not willing to use this information to dispel our ignorance and potentially change methods that we have used for generations, then we don't deserve this tool. I'm not saying that anything will have to change. I just don't know what we will find, and we may find that what we thought we understood about how the body and mind work, are not as we have been led to believe. Are you willing to go down the rabbit hole and see where it leads? We are.

P.S. How to apply these in clinical practice and how to apply them to do deeper research in the work we do as Gonstead Doctors is still a work in progress. These are areas which could fill several seminars, and I believe could be a topic worthy of a future "*Meeting of the Minds*" seminar.

Ideas for another article: The ANS is not what we think it is: Poly Vagal Theory and the findings that Sacral Autonomics are solely Sympathetic in origin, Mind-Body stress. HRV optimization and what methods improve HRV. What effects other factors play in altering HRV: Stress, Inflammation, Diet. What is Hormesis and how to optimize it.

Potential Downsides of HRV

The data that one gathers has inherent errors. Typically, one finds what are called ectopic beats, which are signals originating from other muscles in the chest, and which clutter the signal. The common HRV apps use proprietary algorithms to remove this noise. The gold standard in research is to clean the data manually. The best data is that which was cleaned by hand. But to do so will add 10x or more time to your analysis, but it will be nearly perfect when you are done. The Apps will not tell you exactly how the data was cleaned, just that it was. This makes the information less than desirable for research purposes.

In private discussions with Dr. Berntson, I had a question as to what the Vagal afferent to efferent pathway that controls the phenomena of RSA was composed of, as I had a question on the drawing of the pathway, which included an interneuron. The neurology gets complex, as there is the Nucleus Ambiguus, Nucleus Tractus Solitarius, and the Dorsal Motor Nucleus. And there is the Interneuron. Suffice to say, the Interneuron encompasses a large part of the CNS including the mid brain and the centers of emotion, which makes HRV useful in assessing mental states of interest and avoidance as well as many others. This is where the Psychological/Physiological systems overlap, and while it is a rich area for research, it is also the source of confounding variables. This is also, I suspect, how Dr. Lyons was able to see HRV change after adjustments at S2 -S3 in patients. The Sacral Autonomics are solely Sympathetic and not Parasympathetic, so they must assert their actions through the mid brain or brain stem interneuron pathways.

HRV is not Adaptability and is not to be raised, just to raise it. More is not necessarily better. Holding a flame under your outdoor thermometer doesn't make it warmer outside. A couple disorders such as Gastric Ulcers and Enuresis cases are associated with higher HRV values relative to the population in general. We don't know why. I suspect there may be unexpected consequences to electrically stimulating the Vagal nerve to effect visceral organ changes.

The value of knowing a person's HRV value compared to a population may not be as helpful as knowing an individual's HRV readings over time, relative to themselves. Also, the published population data we see is likely too high, as the presence of even minimal noise that is not cleaned out of the data will skew the HRV numbers toward a higher value.

I'm not yet convinced that we can say these measures are a global measurement of the PSNS or SNS, as the exact neural circuits in the pupil vs SA node are not exactly the same, they do correlate and have similarities in supporting organism survival and adaptation, but they are not exactly the same things. Also, we do not understand the complexity in the ANS as a whole, it appears to be more complex than we had thought. See the Nature article on Sacral Autonomics, and the work of Steven Porges and Poly Vagal Theory, which while controversial, allows for better clinical outcomes than the old Gas vs. Brake model of the ANS. Also, the discovery that the Vagal N is at least 80-90 % sensory afferent, to me really shakes up our understanding.

Confounding Variables are likely both the Achilles heel, as well as the Silver Lining of this particular tool, depending on your perspective. To get a clear signal of what you think you are measuring is difficult. But the complexity of it all is going to teach us much more about what healthy adaptability is and how

interconnected the body and mind are. This will potentially offer many new avenues to achieve greater Allostatic Capacity, Adaptability and Health, than we are aware of at this time. I for one think that Gonstead specific adjustments are one of those avenues. We just need to get the data now to show that this is so. Or, adapt if we find out otherwise. This is a double-edged sword, no?

*If you found this article interesting/intriguing, be sure to register for the 2019 Meeting of the Minds.

"The sacral autonomic outflow is sympathetic"

Science. 2016 Nov 18;354(6314):893-897.

Espinosa-Medina I1, Saha O1, Boismoreau F1, Chettouh Z1, Rossi F1, Richardson WD2, Brunet JF3.

<https://www.ncbi.nlm.nih.gov/pubmed/27856909>