The Neurofeedback Advocacy Project

The Impact of Infra-Low Frequency (ILF) Neurofeedback on Chronic, Cumulative Stress and Trauma

A White Paper

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Why ILF Neurofeedback

As a licensed psychologist, I have practiced neurofeedback for more than 30 years. I have seen it used to transform countless lives. It allows us to address trauma, particularly early childhood trauma, in a way that was out of reach until now.

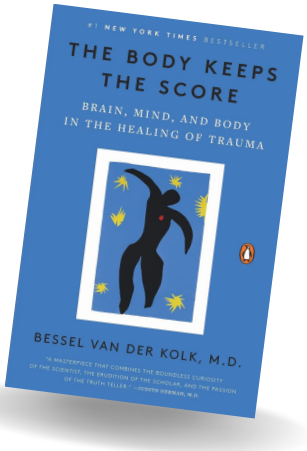
The Neurofeedback Advocacy Project promotes the use of ILF Neurofeedback in vulnerable populations, such as those impacted by years of systemic and intergenerational trauma, because of its unique ability to address chronic and cumulative toxic stress.

Our model is simple. We give agencies low cost access to training, clinical support and equipment and use our Results Tracking System to measure the impact. In turn, we use those results to encourage other agencies to try neurofeedback.

- Matthew Fleischman, PhD
President, Neurofeedback Advocacy Project

"Trauma results in a fundamental reorganization of the way the mind and brain manage perceptions... Once you start approaching your body with curiosity rather than with fear, everything shifts."

- Bessel A. van der Kolk, MD
Author, The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma



Chronic & Cumulative Stress and Trauma

Prolonged, additive stress, including stress from traumatic experiences have a profound impact on the body.

Toxic Stress
Toxic stress is defined as, "...strong, frequent, and/or prolonged adversity—such as physical or emotional abuse, chronic neglect, caregiver substance abuse or mental illness, exposure to violence, and/or the accumulated burdens of family economic hardship—without adequate adult support. This kind of prolonged activation of the stress response systems can disrupt the development of brain architecture and other organ systems, and increase the risk for stress-related disease and cognitive impairment, well into the adult years." (1)

Unfortunately, it is estimated that 60.7% of men and 51.2% of women experience toxic stress across their lifespans. (1)

It is important to distinguish between "stressors," the adverse events that occur in one's life and "toxic stress response," which is how one responds to that stressor. "Prolonged activation of the stress response systems that can disrupt the development of brain architecture and other organ systems and increase the risk for stress related disease and cognitive impairment." (2)

The stress response activates the nervous system and endocrine system. It can include increased heart rate and the flood of energy released with "flight or fight" responses. (3) "Prolonged activation of the stress response in the absence of protective buffering causes long term changes in the brain's structure. This process is referred to as the 'biological embedding' of experience." (3) While exposure to prolonged, toxic stress is detrimental at any age, developmental trauma that occurs during childhood impacts the brain's growth and development, potentially creating lifelong impacts.

> "Hyperarousal is the body's way of remaining prepared. It is characterized by sleep disturbances, muscle tension, and a lower threshold for startle responses and can persist years after trauma occurs. Hyperarousal is a consequence of biological changes initiated by trauma." (5)

Adverse Childhood Experiences (ACEs): A Type of Chronic, Cumulative Stress That Can Cause Trauma
Children and the elderly are especially vulnerable to the physical impacts of trauma. For children who experience toxic stress and adverse childhood experiences (ACEs), these health effects may not present until adulthood. (3)

ACEs include abuse, neglect and other traumas. (4) These experiences impact brain development and "increase a person's vulnerability to encountering interpersonal violence as an adult and to developing chronic diseases and other physical illnesses, mental illnesses, substance-related disorders, and impairment in other life areas." (5)

"While, in the course of development, most children have the chance to invest their energies in developing various competencies, complexly traumatized children must focus on survival." (6)

Adverse Childhood Experiences (ACEs)

Incredibly Common

Nearly half of all children age 0-17 experience at least one ACE, with 20% having 2 or more.(7) One in 6 adults have experienced 4 or more ACEs in their childhood. (8)

Emotional, Behavioral Impact

Eventually, the distress brought on by ACEs can lead to unhealthy coping mechanisms, such as self-harm or substance abuse. Over time, these behaviors can lead to disease, disability, social problems, and early death. (9) "Preventing ACEs could reduce the number of adults with depression by as much as 44%." (8)

Welfare System Disparities

Children involved in the child welfare system were much more likely to experience ACEs, with 27% experiencing 3 ACEs and 42% experiencing 4 or more ACEs. (10)

Significant Health Issues

ACEs are associated with at least 5 of the top 10 leading causes of death. (8) Having 6 or more ACEs reduces the average life span by 19-25 years. (11, 12)

People with four or more ACEs are:

- 38 times more likely to attempt suicide;
- 11 times more likely to have Alzheimer's or dementia;
- 5 to 7 times more likely to report illicit drug use and to 12 times more likely to develop a substance use disorder (5 or more ACEs);
- 3 times more likely to have chronic lower respiratory disease;
- 2 to 2 ½ times more likely to have a stroke, cancer, or heart disease; and
- 1 ½ times more likely to have diabetes. (9, 11, 13)

Higher ACE scores associated with higher instances of mental health disorders, including anxiety, depression, PTSD, and sleep disorders. For every additional ACE score, the rate of number of prescription drugs used increased by 62%. (9)

Resilience helps mitigate the effects of ACEs. Neurofeedback increases resiliency in children by taking them out of "survival mode" and allowing them the ability to self-regulate and respond rather than react to their circumstances.

Stories From Our Clients

View real-time, real-world data, including stories like these, online at **www.NeurofeedbackAdvocacyProject.com**.

"Mom reports that the biggest changes (in the client, age 10) are decreases in anger and obsessive worries, and feeling better about himself overall. Overall client has been able to recover from big feelings much faster now. Mom notices less anxiety at night, no longer getting up several times before falling asleep. Mom also notices an increase in feeling sad, but he is now able to verbalize how he is feeling much better."

"Client (age 15) reported that her emotional reactivity and attention span have improved: she can now focus and refocus easier. She also said that she can now use calming strategies better, feels calmer, is no longer self-harming, can enjoy games even if she doesn't win, and finds it easier to put things down and not obsess over them."

"Client (age 21) reports significant improvement in overall symptoms and impact of mental health concerns. They report experiencing more awareness of what is happening for them with regards to moods and emotional states, thus having less difficulty exerting some cognitive control over them. They report they are more able to think objectively about when emotionally escalated and more able to access coping mechanisms. They also report connecting and relating much better to romantic partner."

Impact of Trauma and Toxic Stress on the Body

A Neurobiological Perspectice

Essentially, the brain can become "stuck" in a constant state of hyper-arousal, hypervigilance or instability due to trauma. This can lead to cognitive, behavioral, physical and interpersonal symptoms as well as acute stress disorder or post-traumatic stress disorder (PTSD).

Neurobiological Impact of Trauma & Toxic Stress
The health consequences of toxic stress and trauma are well-documented, resulting in major co-morbidities and premature death. In addition to serious health consequences, the brain is specifically impacted. (14)

"The primary neural systems implicated in trauma exposure are the neural stress pathway and the emotion processing and regulation pathway." (15)

General changes to the brain include:

- impacted limbic system functioning,
- hypothalamic–pituitary–adrenal axis activity changes with variable cortisol levels, and
- neurotransmitter-related dysregulation of arousal and endogenous opioid systems. (5)

Smaller Hippocampus: This a key area for learning and memory. Trauma can also limit the brain's ability to regulate cortisol levels following stressful events.

Smaller Corpus Callosum: This part of the brain is "chiefly responsible for interhemispheric communication and other vital processes, such as arousal, emotion, higher cognitive abilities."

Smaller Cerebellum: This area helps coordinate motor movements.

Smaller Prefrontal Cortex:
Some research shows volume reduction to this part of the brain, which is a vital component for directing behavior, cognition, and emotion regulation Physical abuse can lead to a smaller orbitofrontal cortex, an area within the prefrontal cortex that is vital to social and emotional regulation.

Overactive Amygdala: Rather than reduced volume, the amygdala can be hyper-aroused, causing hypervigilance in scanning for threats and triggering heightened emotional responses.

Abnormal Cortisol Levels: This hormone affects how the body responds to stressors. This dysregulation can lead to lower energy, learning difficulties, externalizing disorders and more. (16)

History of ILF Neurofeedback

Of all neurofeedback methods, Infra-Low Frequency (ILF) neurofeedback is especially impactful in addressing trauma.

Some of the earliest work on neurofeedback and trauma was by the psychologist Eugene Peniston who, in the late 1980's developed a model he termed "Alpha/Theta brain wave training" to treat substance abuse. His work focused on using feedback to shift brain activity away from beta waves which are 12.5-18 Hz and to the alpha (8-12 Hz) and theta (3-8 Hz) range of brainwaves. Such activity is associated with deep relaxation and a hypnagogic state of dreaminess. In this state Dr. Peniston had subjects visualize their triggers to drink and to visualize how they might best handle the situation.

Dr. Eugene Peniston

Whether it was because he did his work in a VA hospital with veterans with alcohol abuse or by the nature of underlying issues with addictions, Dr. Peniston reported that during their sessions, in addition to visualizing triggers to drink, his patients often spontaneously recalled episodes of trauma, mostly combat related, and that they were able to work through memories with lasting positive impact on their emotions and substance abuse. The use of this "alpha/theta training" has since become an oft used modality of neurofeedback practitioners in the treatment addictions with and without PTSD. It is important to understand that the goal of Alpha/Theta is not to increase a permanent shift to those brainwaves. Rather it is to temporarily induce this state for in-session therapeutic purposes much like a therapist would induce a hypnotic trance or a temporary station of deep relaxation.

Dr. Barry Sterman

While Peniston focused on Alpha/Theta training, Dr. Barry Sterman, a neuropsychologist first demonstrated other brain waves could be altered via operant conditioning. His initial work was solely to investigate whether this was even possible given that we have no conscious awareness of our brainwave. Even more impressive is that he did that with cats. By pure serendipity it was discovered that in so doing, his cats became resistant to chemically induced seizures which in turn led to the first clinical application of neurofeedback, the treatment of epilepsy. Because treated patients also reported improvements in sleep, mood, focus and emotional control, various investigators studied its application of a wide range of diagnoses.

Sebern Fisher and Bessel van der Kolk made particular strides in the application of neurofeedback to PTSD and what is called developmental trauma -- trauma experienced in childhood and often so early or continuous that the person has little memory of specific incidents.

History of ILF Neurofeedback

Seburn Fisher

Dr. Bessel van der Kolk

The third major development her is the work of Susan Othmer and Siegfried Othmer. They were introduced to neurofeedback because of emotional and behavioral difficulties they were having with their son secondary to his epilepsy. They came upon a therapist in Los Angeles who was using neurofeedback to treat brain injuries and were so encouraged by the results that they decided to enter the view. Susan's background was in neuroscience and Siegfried was an experimental physicist working in missile command. Together they brought a strong investigative clinical approach and an entirely new model for understanding the complex signaling systems of a brain that has literally millions of cells firing at any second. Most importantly, they began moving the reward or training band to slower and slower brainwave frequencies and getting stronger and stronger results, especially with clients with a known or suspected history of trauma.

Today, the neurofeedback of the Neurofeedback Advocacy Project draws upon all these roots. (17-26)

Dr. Siegfried Othmer and Dr. Susan Othmer

How Does ILF Neurofeedback Work?

A high-level overview

Equipment and Software
The required hardware for conducting ILF neurofeedback includes:

- An amplifier which connects to both the electrodes and neurofeedback software through the computer
- A computer to run the Cygnet software
- A second monitor or TV for the client to watch the feedback
- Four 2-channel electrodes
- Speaker or headphones
- A tactile device that vibrates in coordination with the visual and auditory feedback (optional)
- A video game controller (optional)

The neurofeedback program is run on the computer via a software program such as Cygnet. This is where the neurofeedback technician controls the training protocols.

Conducting a Session
The client has the electrodes placed on their scalp and selects a feedback option, such as a video (YouTube, Netflix, etc.), a naturescape, or an interactive game. The electrodes are attached to the amplifier, which is plugged into the computer.

The technician uses the neurofeedback software to select the feedback shown to the client and run the session. The client sits in a comfortable chair and watches the feedback on a monitor or TV screen.

Software on the computer reads the brainwave activity and adjusts the feedback shown on the monitor to the client, through either rewards or inhibits, including:

- Audio volume increases or decreases
- The screen becomes larger or smaller
- The screen becomes brighter or darker
- For select feedback options, such as walking through the forest or flying a spaceship, the feedback speeds up or slows down

Electrode Placement
Four electrodes are placed on the scalp. These passively measure brainwaves through EEG readings - no signal is sent into the brain. The location for the placement of the electrodes on the head is determined by the technician operating the software.

There are a number of site combinations that can be targeted, depending on the symptoms and concerns that the client wants to address. The two starting site placements are at T3-T4 (bi-hemispheric) for stabilizing effects that regulate excitability and T4-P4 (right-side) for calming effects that regulate arousal. These two starting sites train at the same frequency.

Frequency Optimization
The neurofeedback technician must receive verbal feedback from their client in order to find the optimal training frequency for that client. Training at too high of a frequency can cause agitation, while training on too low of a frequency can cause sedation. The goal is for the client to feel a sense of relaxed alertness. As the client reports how they are feeling during the session, the technician adjusts the frequency higher or lower until relaxed alertness is achieved. This process may take a couple of sessions, but once an optimal training frequency is determined, this remains the frequency that the client will train at for the entirety of their neurofeedback training sessions.

If additional training sites or placements are added to the client's protocol, the training frequency may be adjusted. For instance, the technician will multiply the optimal training frequency by 2 when training exclusively left-side sites.

The technician controls the frequency through the neurofeedback software.

Photo Credit: BEE Medic

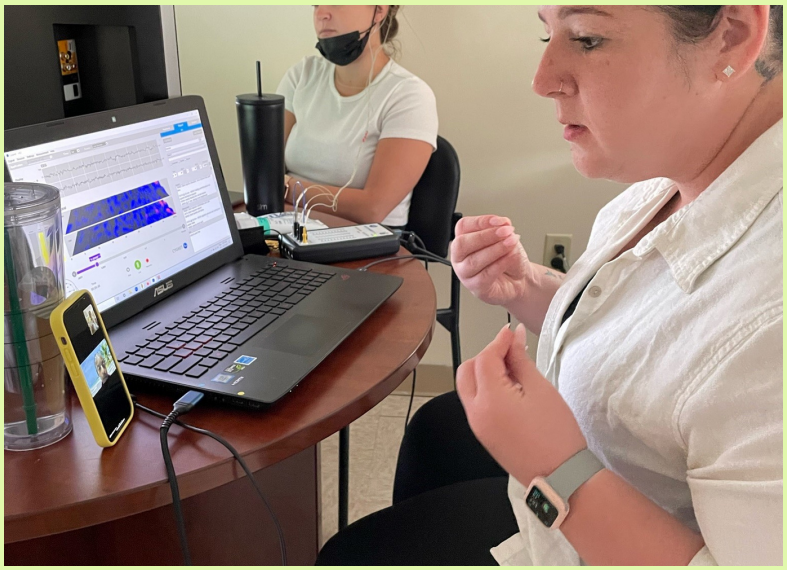


Photo Credit: Little Flower Children and Family Services of New York

ILF Neurofeedback for Trauma

Data from members of the Neurofeedback Advocacy Project available at **NeurofeedbackAdvocacyProject.com**.

53%

Reduction in Self-Harm / Suicidal Ideation

67%

Reduction in Discipline Actions at School

100%

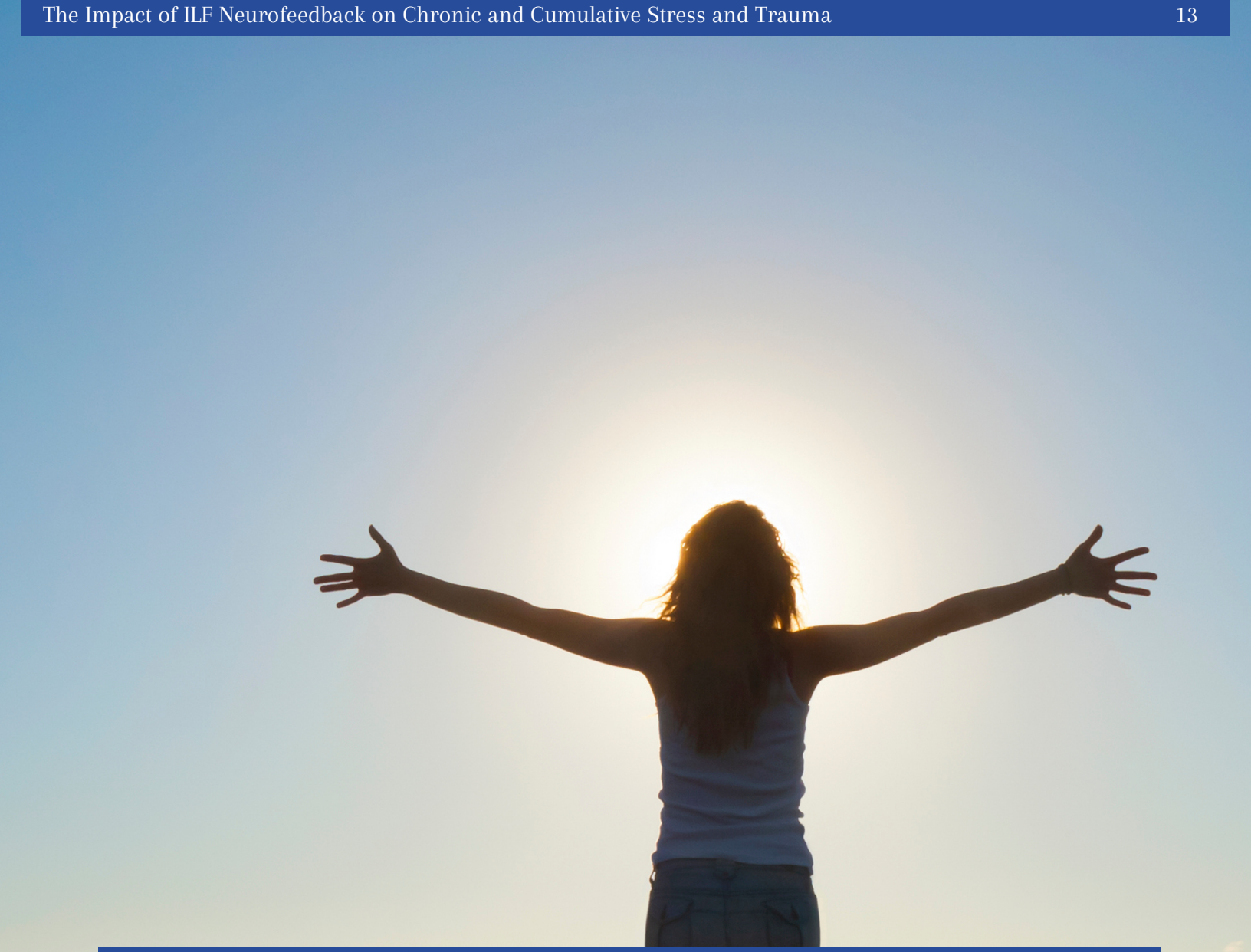
Reduction in Drug and Alcohol Relapses

83%

Reduction in ER Visits for Psychiatric Reasons

62%

Reduction in ER Visits for Medical Reasons



Client Success Story

An adult female client with severe PTSD had been enrolled in our EMDR services prior to receiving neurofeedback. While moderately effective, the client was not making as much progress as desired.

Within 90 days of beginning neurofeedback, the client's symptoms greatly improved. Her PCL-5 (PTSD diagnostic tool) score went from 52 down to 21. In fact, she no longer met the diagnostic criteria for PTSD.

Neurofeedback was greatly beneficial and improved the effectiveness of her EMDR sessions as well.

- Therapeutic Partners, an NAP Member

Implementing a Successful ILF Neurofeedback Program

A Recipe for Success:
There are a number of critical factors to success. If even one of these elements is missing, it can result in failure.

The Neurofeedback Advocacy Project (the NAP) helps ensure success by offering low-cost training, ongoing support and access to the Results Tracking System (RTS).

Staffing Capacity

- The NAP has found that teams of at least 4 are necessary for implementation. We recommend 3 clinicians and 1 supervisor.
- The agency or the supervisor must be licensed healthcare providers.
- Neurofeedback technicians do not necessarily need to be licensed but need to be able to connect with their clients, such as having a formerly incarcerated technician working within a justice system or a recovering addict working with substance use disorders.
- Supervision and quality control must be straightforward, simple processes. The Results Tracking System (RTS) tracks symptoms, placement sites and training frequencies, allowing supervisors to quickly review client files and ensure adherence to protocols.

Accessible Training

- Agencies must be able to train their clinicians and supervisors in a relatively short period of time using distance learning so as to not disrupt service delivery. The NAP offers a 36-hour live, online introduction course and monthly advanced classes.
- The neurofeedback equipment must be relatively easy to learn and use.

Positive Client Experiences

- The neurofeedback training must be trustworthy and safe. This starts with confidence in the staff.
- Clients must understand what neurofeedback is and how it works, be amenable to receiving it and able to quickly see benefits.
- Side effects must be mild to moderate and resolved quickly. NAP members report through the Results Tracking System (RTS) that this is the case with ILF neurofeedback. See real-time, real-world results online at NeurofeedbackAdvocacyProject.com.

Financially Feasible

- Nonprofit organizations, government agencies and others serving underserved populations must be able to train staff and acquire equipment at an affordable rate and without large up-front costs.
- Financial benefits must be realized relatively quickly, with increased revenue resulting from billing for services and lower no-show and cancellation rates. NAP members report a no-show/cancellation rate between 2-4%.
- The NAP offers heavily subsidized training and ongoing support services exclusively to organizations that serve low-income, Medicaid-eligible or otherwise underserved populations. Members of the NAP also receive an exclusive discount on a monthly equipment leasing program through our partner, BEE Medic.

Demonstrated Outcomes

- Clinicians and clients both need to be able to track their experiences and outcomes when receiving neurofeedback in order to objectively assess its impact over time.
- Agencies and organizations must be able to prove their return on investment through positive client outcomes.
- The Results Tracking System (RTS) provides an easy-to-use, HIPAA-compliant process for conducting intakes, tracking protocols, measuring progress and evaluating outcomes at the client, clinician and agency levels.

Want to learn more?

01

Visit Our Website

Check out resources, information and real-time, real-world results live from the Results Tracking System at **NeurofeedbackAdvocacyProject.com**.

02

Contact Us

Email us at **info@NeurofeedbackAdvocacyProject.com** to set up a time to discuss your questions and thoughts.

03

Read Our Blog

Learn more about neurofeedback in action and its history by visiting our blog at **NeurofeedbackAdvocacyProject.com/blog**.

04

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The Neurofeedback Advocacy Project

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