Outcome Report

Healing the Brain, Transforming Lives

"... Our son is doing so well. His precious life has totally transformed this year since his treatment at Yellowbrick. He moved to be closer to family and our relationships have healed in so many meaningful ways. We are all working in family therapy while our son continues in individual counseling as well. We are so much closer as a family now. He has been working for a year now... has a fabulous job working for a solid company and was recently promoted. Management really respects him and his work ethic. We are all thrilled for him! He has faced his social awkwardness and is working through this. He has an amazing sense of humor that surprises us all. He is so funny.... who knew?!"

Parents of Emerging Adult

YELLOWBRICK®

FIND *YOUR* WAY HOME®

"I am back to pursuing a degree as I originally planned and leaving the option open to explore additional studies in grad school down the road when I have a greater degree of stability to manage the demands of more intensive academic work. I am now (relatively) comfortable with accepting that the future holds many possibilities, not just one that needs to be worked out now. I am very grateful for your honesty and support. It has given me the ability to see that in avoiding ambiguity I would only be continuing a past pattern of refusing to tolerate discomfort, which keeps me stuck and prevents me from moving towards the things I really want in my life."

Emerging Adult

Yellowbrick's Model

Yellowbrick's neurobiological model integrates leading edge findings from neuroscience, developmental psychology, evidence-based psychotherapies, and wellness medicine to treat complex, and often treatment-resistant problems in emerging adults. Findings from developmental neuroscience indicate that emerging adult brains are more neuroplastic and capable of enduring change than at any other time in adulthood. Research further indicates that the old adage, "experience is the best teacher" is true. The optimal conditions for brain healing and new learning require active engagement of those brain systems that are disconnected, underdeveloped and deregulated in order to achieve true lasting change. That is why at Yellowbrick we have a dual synergistic model: **Heal the brain,** by improving its neuroplasticity, interconnections and self-regulation, while we **Transform lives** through building cognitive, emotional, relational and life skills in the real world, in real time. It is only through mastering the everyday responsibilities of going to work or class, balancing a budget, managing healthy meals and a clean living space, developing realistic and fulfilling goals and plans, and in the ups and downs of relationships, that authentic competence and resilient self-worth is built. The synergism of neuro- modulation therapies with real-life mastery experience, and in-depth psychotherapies, within a supportive and accountable peer community, is what heals the brain and transforms lives.

Importance of Outcome Research

There are a range of therapeutic approaches available for complex, treatment-resistant and, often, life-derailing and life-threatening problems in emerging adults. How do you know what really works and what doesn't? It is quite challenging and expensive to evaluate real, observable improvement in such complex situations. Yet, without analyzing treatment outcomes, using well-established methods and procedures, one cannot assess the true efficacy of different interventions. This is why at Yellowbrick we allocate time and resources to evaluate the objective effectiveness of our treatment model and methods. As you will see, we use measures of treatment outcome that are scientifically valid and reflect the same dual approach to healing the brain and transforming lives.

Healing the Brain

Improved Brain Function

Consistent with Yellowbrick's neurobiological model, everyone who participates in an assessment or treatment receives a quantitative electroencephalogram or qEEG. The qEEG is a neuroimaging technique that records the electrophysiological activity in the brain in real time. This enables us to examine the underlying brain functions that correspond to the neuropsychiatric and neurobehavioral presentation with greater neural specificity and clearer treatment implications. For example, two individuals diagnosed with depression and anxiety may show different patterns of functional brain deregulation. The emerging adults who come to Yellowbrick usually have serious neurophysiological abnormalities and the results from the qEEG enable us to individualize and optimize the components of their treatment, which leads to better outcomes.

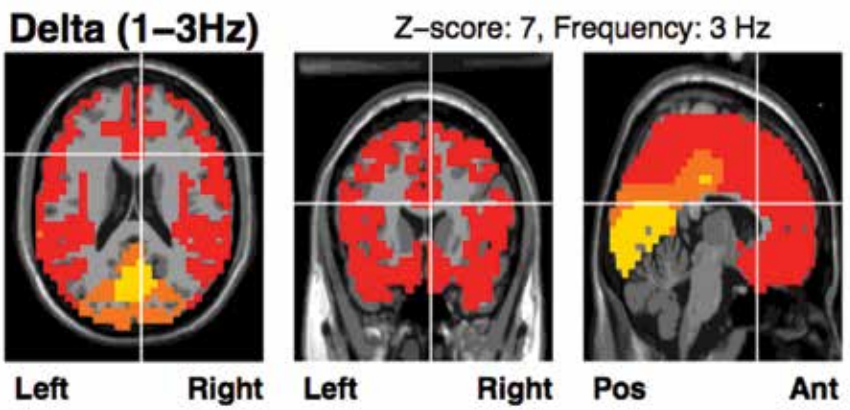
Our outcome research shows that treatment at Yellowbrick leads to improved brain self-regulation, flexibility and adaptability, and interconnectedness across brain regions. Specifically, statistical analyses of qEEG data shows that the overall percentage of severe brain deregulation (i.e., greater than 2 or more standard deviations from normal) decreased significantly over the course of treatment. In addition, the emerging adults' brains showed significantly greater connectivity across brain systems at discharge, as compared to the initial assessment. Also importantly, the right hemisphere of their brains showed significant improvement at the completion of treatment; whereas their left hemispheres did not. The right brain is widely established as the more "emotional" and "creative" brain; whereas the left hemisphere is considered the "thinking" and "rational" brain. These are generalities, of course, but the Yellowbrick results show that our treatment model is effectively targeting the more emotional processing and regulating functions of the emerging adult brain, while building connectivity and self-regulation across the whole brain.

Our research also demonstrated that emerging adults treated at Yellowbrick improve significantly in the degree of regulation and connectivity in two key areas of the brain, the prefrontal cortex and the cingulate cortex. These two areas are critically important for many aspects of cognitive, emotional and social functioning. These functions include: cognitive control of thought and action, behavioral execution based on internal goals and plans, reasoning and decision making, autobiographical and working memory, and executive functioning (prefrontal cortex) as well as emotion processing and regulation, risk-reward decision-making, personality patterns, and fear and threat response systems (cingulate cortex).

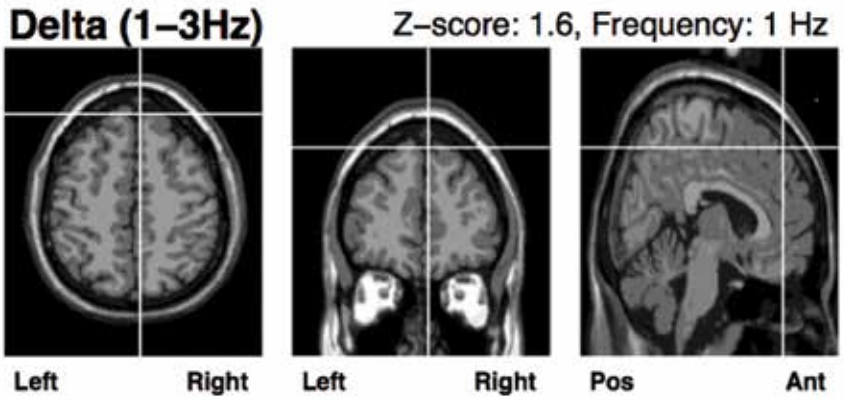
The statistical analyses comparing changes from assessment to discharge show significant improvement in the percentage of deregulated absolute power (actual electrical charge in units of Hz) in both the prefrontal cortex, especially the right prefrontal cortex, and the cingulate cortex.

The following illustrations are of a sample patient's Frontal Lobe at the Assessment then again at Discharge, and the Anterior Cingulate Cortex at the Assessment then at Discharge. The red areas indicate severe deregulation; the gray areas are normal.

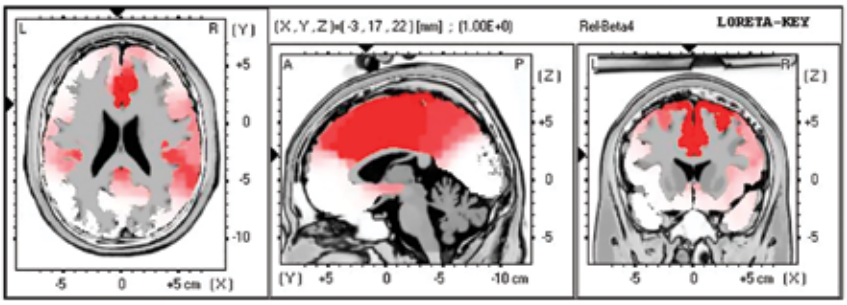
Frontal Lobe at Assessment



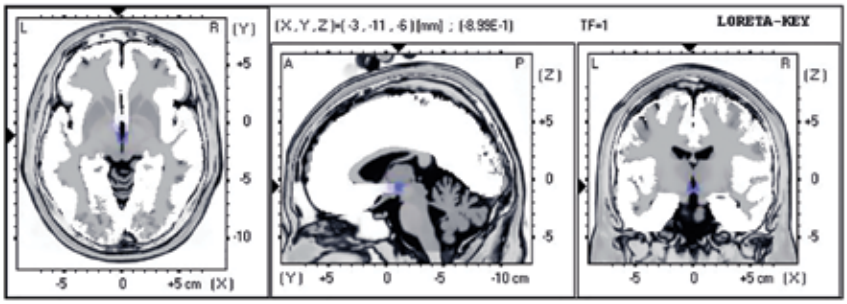
Frontal Lobe at Discharge



Anterior Cingulate Limbic Lobe at Assessment



Anterior Cingulate Limbic Lobe at Discharge



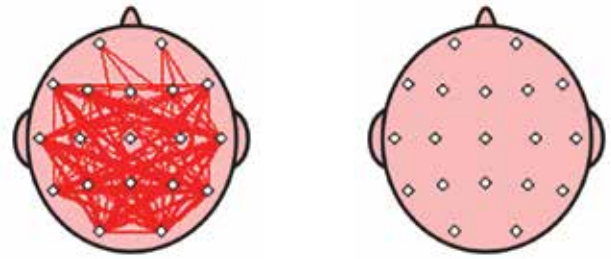
The Absolute Power illustrations reflect how dramatic these brain changes can be. They show before and after treatment qEEG studies for one of the emerging adults at Yellowbrick who presented with severe suicidal depression, anxiety and self-harm. The top illustration shows the qEEG before- (left panel) and after- (right panel) treatment findings for what is termed, "high beta hyper-coherence". This degree of high beta brain activity before treatment is most often associated with overwhelming anxiety, panic attacks, stress and worry. In this individual's case, the high beta activity was also hyper-coherent, which means the high-beta waves are interdependent across many different brain areas in an undifferentiated and inflexible pattern. This brain is "on fire" with anxiety and stress in a manner that prevents the emerging adult from responding effectively or adaptively. After treatment, however, this emerging adult's brain appeared totally normal and showed no excess of high beta or hyper-coherence whatsoever (right panel).

The second illustration shows hyper-coherence, but of theta activity, in the same emerging adult's brain (see left panel of bottom illustration). Theta brain waves are very slow waves reflecting a foggy or twilight state just before sleep. This emerging adult's brain before treatment was simultaneously hyper-anxious and almost asleep at the same time. These opposing mechanisms in the brain can reflect the brain's attempts to counterbalance or compensate for widespread and severe deregulation across numerous circuits and regions. In this neurophysiological state it would be extremely difficult to pay attention, learn, remember, set goals, solve problems, make decisions or relate to others effectively. By the end of treatment (see right panel of bottom illustration), this emerging adult's brain was normalized and he was able to complete cognitive, behavioral and interpersonal tasks quite effectively.

Such profound changes in the brain's overall adaptive regulation and interconnection is associated with changes in most, if not all, areas of neuropsychiatric and neurobehavioral functioning.

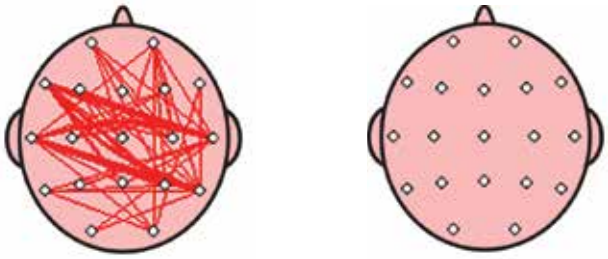
ABSOLUTE POWER

High Beta
(25.0-30.0 Hz)



Assessment **Discharge**

High Theta
(4.0-8.0 Hz)



Assessment **Discharge**

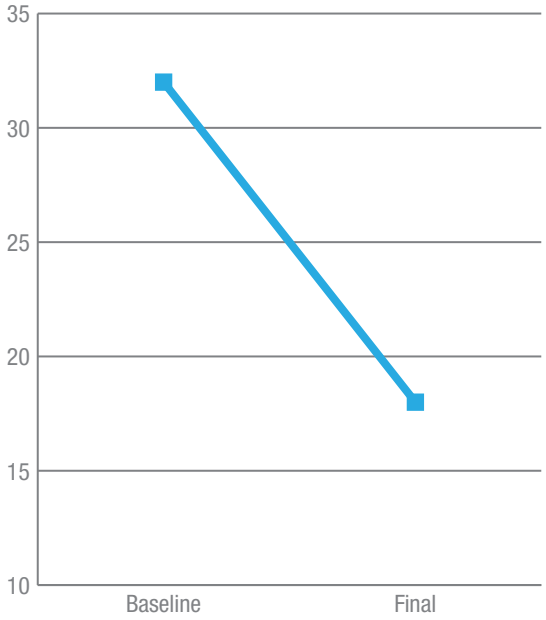
Transcranial Magnetic Stimulation (TMS)

Transcranial magnetic stimulation ("TMS") is a non-medication non-invasive easily tolerated neuromodular therapy that is FDA approved for the treatment of Major Depressive Disorder and Obsessive Compulsive Disorder. TMS treatment of depression consists of the rapid induction of a small electromagnetic pulse in the dorsolateral prefrontal cortex. Stimulation of this area produces an electromagnetic flux that reregulates healthy brain function both in the limbic system, the "emotional brain", and the frontal lobes, the "thinking brain". Large-scale international research studies show that TMS alleviates the symptoms of depression, with almost no adverse effects. Emerging adults at Yellowbrick with severe treatment-resistant depression can choose to receive TMS in addition to the other treatment modalities available.

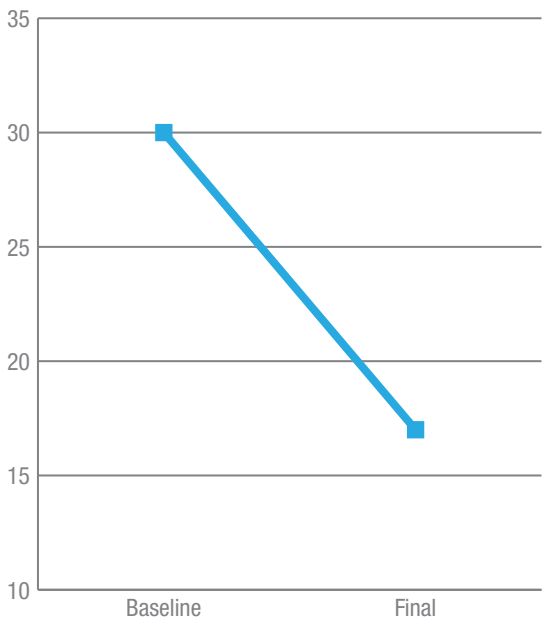
The findings for emerging adults who received TMS at Yellowbrick are very encouraging, despite the fact that our population is much more severe than are research subjects and most other clinical populations. On the Beck Depression Inventory (BDI), Montgomery-Asberg Depression Rating Scale (MADRS), Patient Health Questionnaire-9 (PHQ-9), and Beck Anxiety Inventory (BAI), TMS produced significantly decreased depression. Some of these findings are illustrated in the following graphs. Importantly, 58% of the patients reported a complete remission of depressive symptoms.

In keeping with our mission to advance neuroscience-based treatments, we have examined some of the mediating factors that may promote or prohibit optimal responses to TMS and other forms of treatment at Yellowbrick. In a paper presented at the International Neuropsychiatric Association, we found that emerging adults who had a deregulated cingulate cortex at admission, that is, greater than 2 standard deviations (SD) from normal, did not benefit from TMS relative to those who had more normally regulated anterior cingulate cortices. The cingulate cortex is central to the cognitive-emotional processing that is disrupted in depression. These results are illustrated below and have important implications for individualized treatment protocols, which incorporate patterns of brain regulation and deregulation to match optimal treatment modalities for each emerging adult.

BDI



MADRS



Genomic Analysis

Another area in which Yellowbrick is on the leading edge of neurobiological treatments is in customizing results from genomic analysis to individualize and optimize medication regimens. Pharmaco-genomic testing at Yellowbrick, using a saliva sample collected during each assessment, provides two critical types of clinical results: the genetics that influence three neurotransmitters that affect receptor and enzyme function in the brain for serotonin, norepinephrine and dopamine (i.e., pharmacodynamics) and the genetics of the biochemical pathways in the liver that are specific to the metabolism of psychiatric medications (i.e., pharmacokinetics). The three neurotransmitters targeted are essential to mood regulation and overall brain health. Nearly all of the Yellowbrick assessments show clinically significant genomic findings that directly influence the choice and level of medications we recommend.

At Yellowbrick, we are also doing academic research to examine some of the potential ways in which certain genes may interact with life experiences to influence clinical outcomes. For example, we studied two polymorphisms of the SLC6A4 gene, which is known to be important in the cognitive-emotion regulation associated with either vulnerability or resilience to the life experience of trauma, substance abuse and several other serious clinical conditions. Our results showed that a greater percentage of patients with the so-called "s/s" genotype (over twice as many) developed clinical PTSD when exposed to trauma as compared to those with the "l/l" genotype. Furthermore, the patients with PTSD had greater deregulation of the prefrontal cortex on qEEG. The prefrontal cortex is thought to be a central locus of action of the SLC6A4 gene as well as a primary brain center for cognitive-emotion processing and regulation. These results suggest that we can potentially use genomic analysis to identify those individuals who are most vulnerable and to prevent, or intervene early and more effectively, in the development of certain clinical conditions. The following graphs illustrate these findings.

SLC6A4, COMT and Deregulation of the Prefrontal Cortex in PTSD

Results

Chi-Square analyses showed that a significantly greater percent of patients with the SLC6A4 genotype s/s had PTSD, whereas l/l was greater in those who had trauma without PTSD ($p<.01$; see Figure 1). In fact, the s/s allele was more than twice as high as the l/l allele in those with PTSD (35.3% had s/s compared to 15.2% with l/l). Also consistent with impaired neurotransmitter function in the prefrontal cortex, a greater percentage of patients with PTSD showed at least 2 SD greater deregulation of the prefrontal cortex than did patients with trauma but no PTSD ($p<.01$). Nearly half of those with PTSD had a deregulated prefrontal cortex, as compared to close to a third of patients with trauma but no PTSD (see Figures 2 and 3). We did not find significant associations for the COMT polymorphisms met/met or val/val.

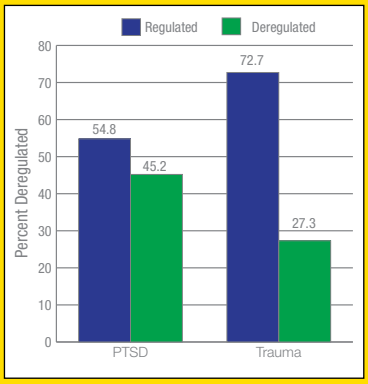


Figure 1.

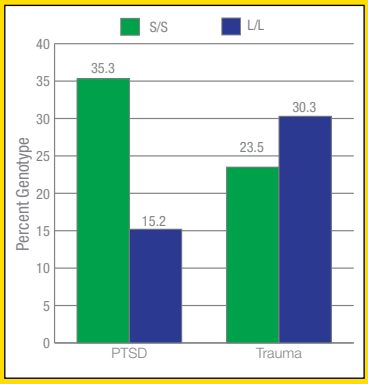


Figure 2.

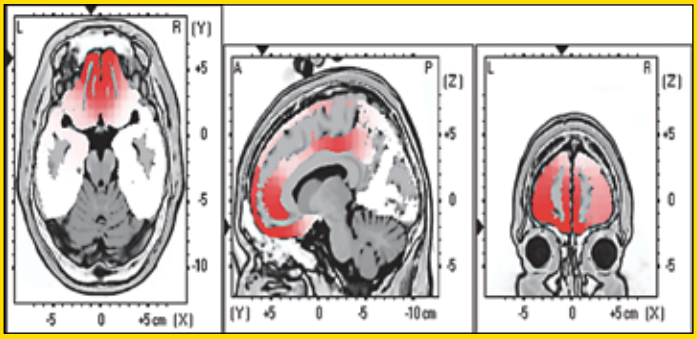


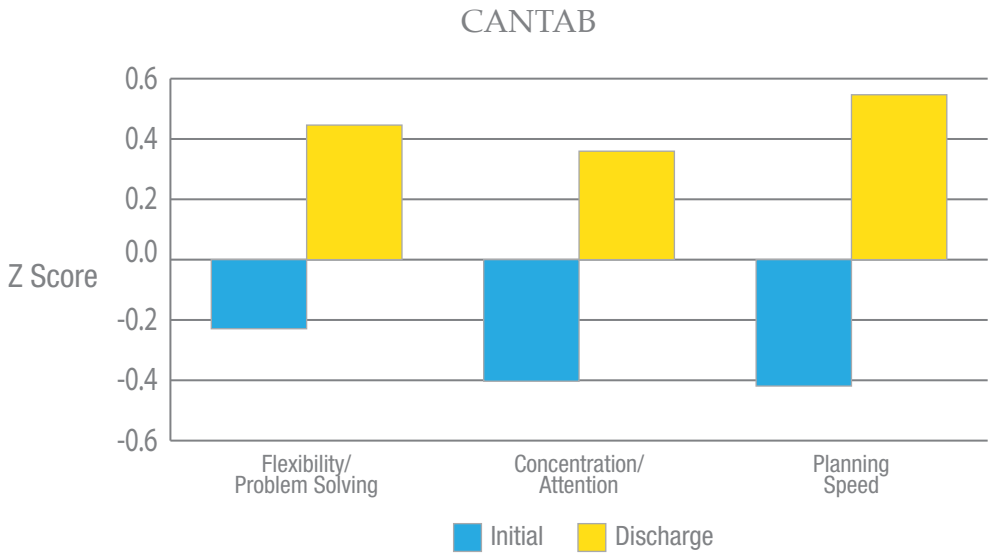
Figure 3.

"After a very long journey over a number of years, we may have our daughter back. She just finished her first week at vocational training school and is thrilled to be there. She has separated from a romantic relationship which had us worried for years. Her peers are now supportive, working and sober. She has a part time job and mostly supporting herself. She is sober and stable and accepting of her challenges."

Parent of Emerging Adult

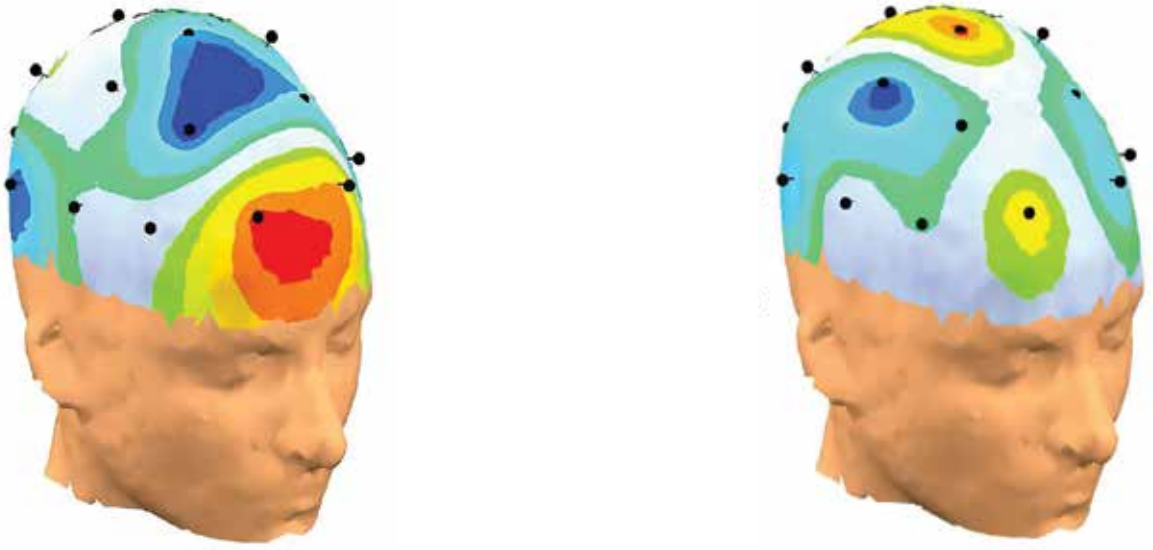
Improved Cognition

Nearly all of the emerging adults who come to Yellowbrick have cognitive impairments in a range of critical domains including attention, information processing, memory, and executive functions such as problem solving, planning and decision-making. In fact, most of the emerging adults at Yellowbrick have cognitive impairments as significant as 2 or even 3 standard deviations below their normal peers. Improved cognition is an important focus of treatment at Yellowbrick. By the time they are ready for discharge, they improve significantly, and normalize, in nearly all of these crucial cognitive domains. Our outcome research, utilizing the well-established CANTAB computerized neuropsychological assessment system, showed that emerging adults at Yellowbrick improve significantly in sustained and flexible attention, information processing, planning, problem solving and decision making.



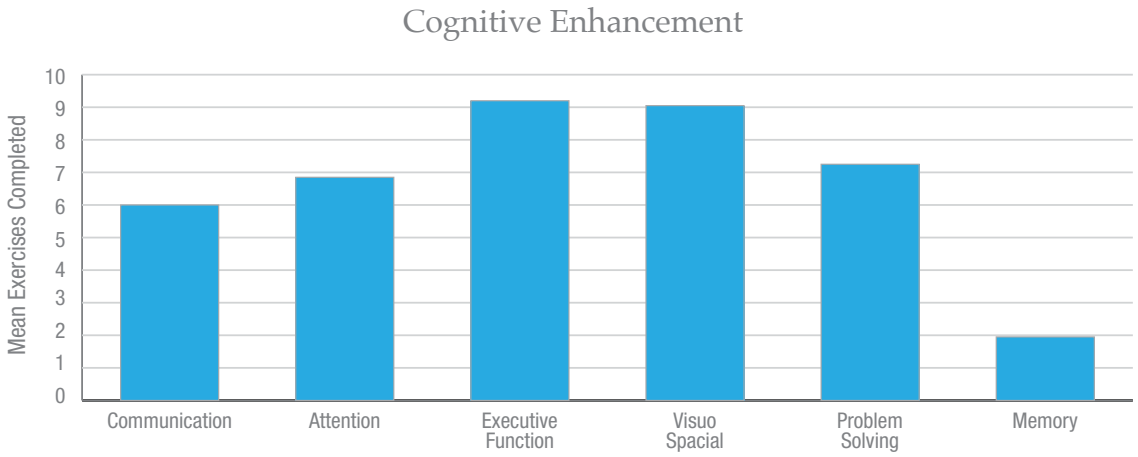
The following diagram of another emerging adult's brain illustrates the linkage between brain deregulation and cognitive impairment, before and after treatment at Yellowbrick. The areas of dark red and dark blue are the most severely deregulated, 2 or 3 or more standard deviations from normal. The gray area is normal brain functioning. As you can see from the left panel of the diagram, before treatment, the anterior prefrontal cortex is covered with red and dark red, indicating that it is extremely deregulated and hyper-activated in the delta wave range. Delta brain waves occur when the normal brain is asleep. The anterior prefrontal cortex is responsible for many critical intellectual and integrative functions including planning, organization, executive functioning, working memory, abstract thinking, intentional behavior and affective regulation.

Assessment **Discharge**



This emerging adult's brain before treatment was essentially asleep while she attempted to function. In fact, her cognitive testing, using the computerized CANTAB assessment system, showed that her performance was more than 2 standard deviations below normal on multiple critical cognitive activities that are localized in the prefrontal cortex. These include executive functions, attention, memory, and risk-reward decision-making. At the end of treatment, her anterior prefrontal cortex was fully awake and functioning much more normally, as illustrated in the right panel of the diagram. Consistent with these brain changes, all but 1 of her CANTAB findings were within the normal range when she completed her treatment at Yellowbrick.

In addition to the brain-based and psychotherapeutic modalities of treatment, Yellowbrick also provides direct training in cognitive performance across these crucial domains using a computerized program. As the following graph illustrates, on average the participants completed and passed 60-90% of the skill sets in attention, executive function, visual spatial planning, problem solving and communication.



"The program was just as important for my relationship with my family. We have never been closer or better at communicating. While many would like a quick fix for their problems, Yellowbrick is not some sort of panacea that will make its patients' lives perfect and make their problems go away. It is, however, a place that gives young people the tools to do hard work that will help them into long term recovery from serious issues.

In the couple years since I left, I finished my undergraduate degree and I now work in an industry I always dreamed about. Yellowbrick taught me that I matter to the world and gave me the skills to succeed."

Emerging Adult

Transforming Lives

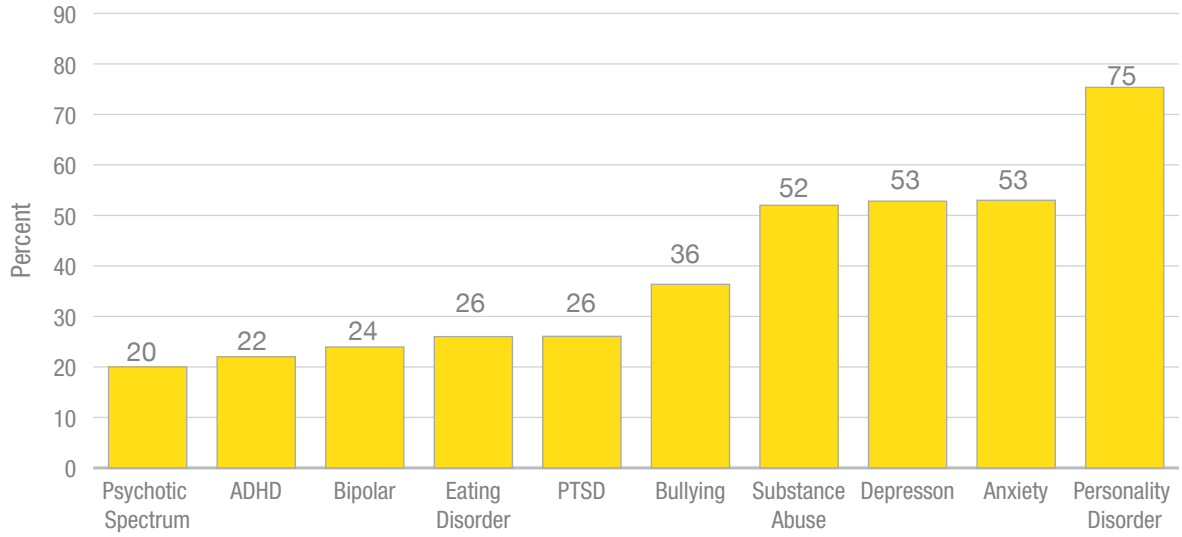
Yellowbrick's Population

Emerging Adults, age 18-30, come to Yellowbrick for intensive, multimodal treatment of the full range of neuropsychiatric disorders. Many of the emerging adults at Yellowbrick have mood and anxiety disorders, substance abuse, trauma, ADHD, and personality disorders, often in combination. Sixty-three percent of the emerging adults have experienced trauma and/or bullying and over 40% have attempted suicide when they come for assessment. Individuals are often referred from other treatment centers, from colleges, their families, or from their therapists and doctors at home who recognize that they need more intensive care. The graph below depicts the most common diagnoses among the emerging adults at Yellowbrick, based on formal research criteria from the Structured Clinical Interview for Diagnosis (SCID).

Yellowbrick's Length of Stay

The typical length of stay in the initial most intensive, immersive phase of treatment is 4 months. This is when over 80% of the emerging adults live at The Residence. Although the minimum length of treatment is 10 weeks, we have learned from over 12 years of experience that 4 months in The Residence is usually necessary to ensure deep and lasting improvement inside and out. The average emerging adult continues in the outpatient Life Strategies Program for an additional 4-6 months.

Clinical Features of Emerging Adults at Yellowbrick

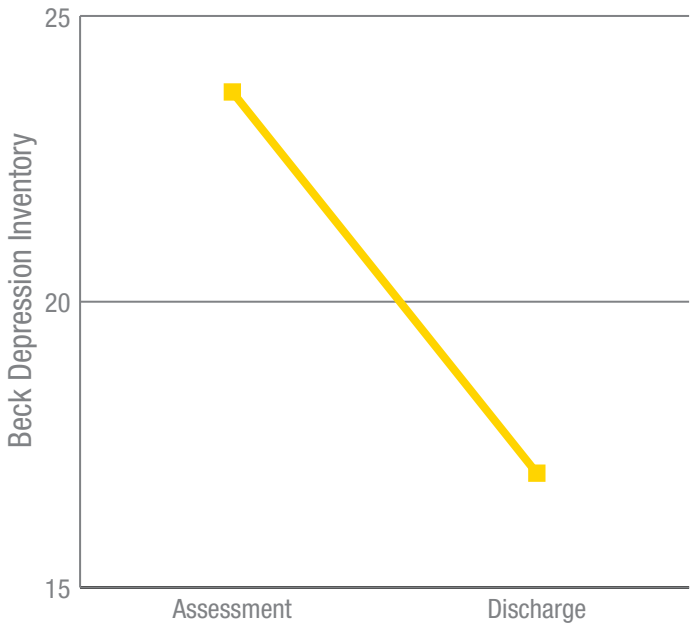


"I wasn't functional when I arrived at Yellowbrick, but you helped me learn what I needed to do to create the life I have today which includes being a certified peer mental health specialist and generally functioning well despite dealing with some of life's hardest things at the same time. I keep moving forward and am doing very well thanks to what my family provided for me like my time at Yellowbrick. Thank you all for helping me achieve a life very worth living."

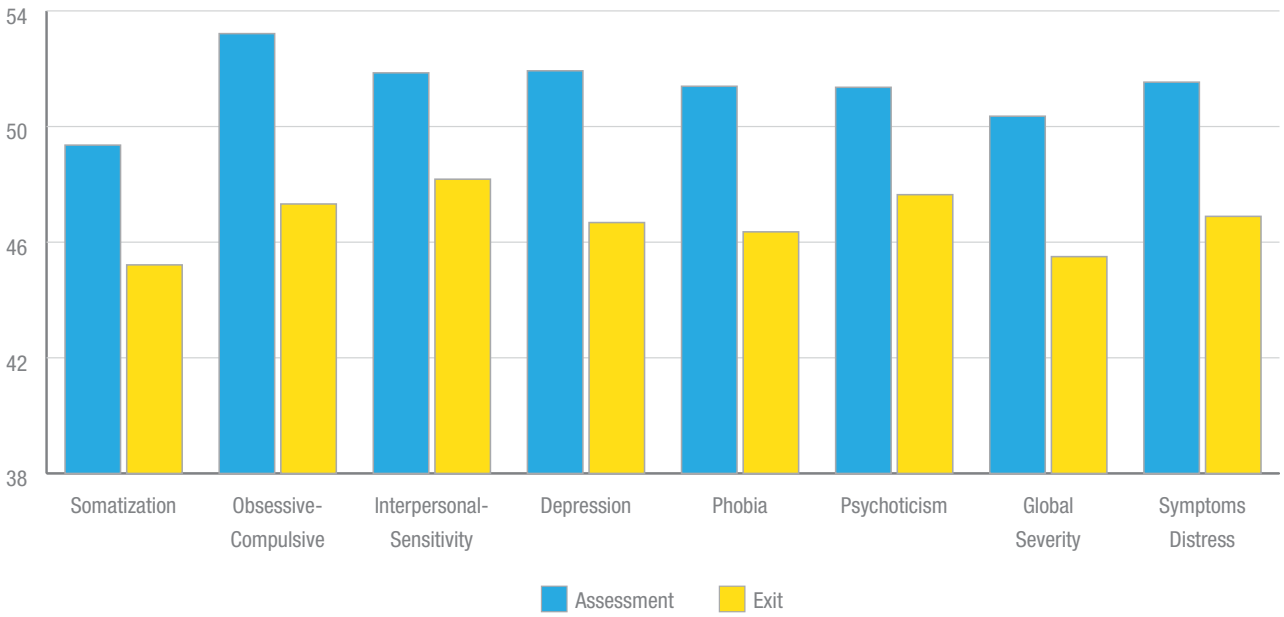
Emerging Adult

Improved Functioning

Emerging adults who complete treatment at Yellowbrick improve across a full range of presenting neuropsychiatric symptoms and behavioral problems. We used the well-established Brief Symptom Index to examine whether the emerging adults who complete treatment at Yellowbrick improve significantly in their level of symptomatic distress. The results showed significant improvement in nearly all their problem areas. These findings are illustrated in the bar graph below. Similarly, their scores on the widely used Beck Depression Inventory improved from "moderate" to "mild" levels of depression over their course of treatment. See the line graph that follows.



Brief Symptom Inventory (BSI)



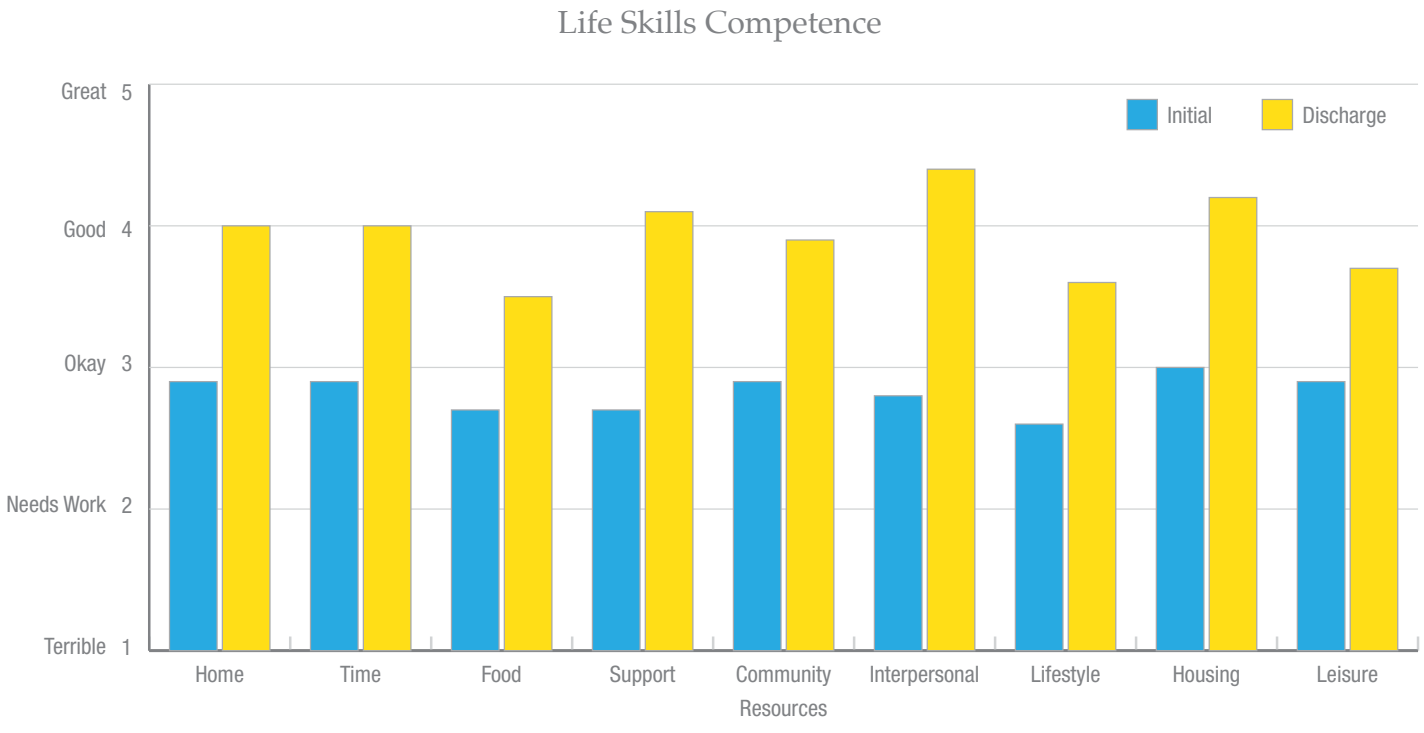
"Yellowbrick saved our son's life. It is that simple and that complex. Our son (now 21) spent 7 months in the Yellowbrick program and he too agrees that it saved his life. We have repaired our relationship together and enjoy each others' company; he has some measure of self-respect and competence (which he had none of when he entered YB); he is clean and sober; and he is committed to continuing to seek the treatment he needs.

Yellowbrick is clinically at the forefront of treatment. It does have a most clinically expert staff. The milieu of accountability they create is uniquely effective. Most importantly, our son would agree."

Parents of Yellowbrick Alumnus

Improved Life Competence

It is not enough, however, to improve symptomatically; consistent with the competence-based treatment model, emerging adults at Yellowbrick also improve across all areas of life competence. As illustrated in the following graph, 94% of the emerging adults discharged from Yellowbrick improved significantly in critical domains of life functioning such as effective management of their home, time, money and food as well as their ability to use supports and community resources (see graph below). In addition, despite severe neuropsychiatric and neurobehavioral impairments, almost two thirds of the emerging adults at Yellowbrick actively work toward building their futures during treatment by attending college classes, working, or volunteering in a relevant field. They also receive training in everything from study skills to time management and resume writing to prepare them to succeed where they often failed before.



"Like many, I came into Yellowbrick immature, angry and unable to live a productive life. I knew I couldn't live life the way I was living, but I was too angry and depressed to do anything about it. Spending time there helped me become self-confident and independent, to be able to face life's challenges head-on instead of running away from my problems.

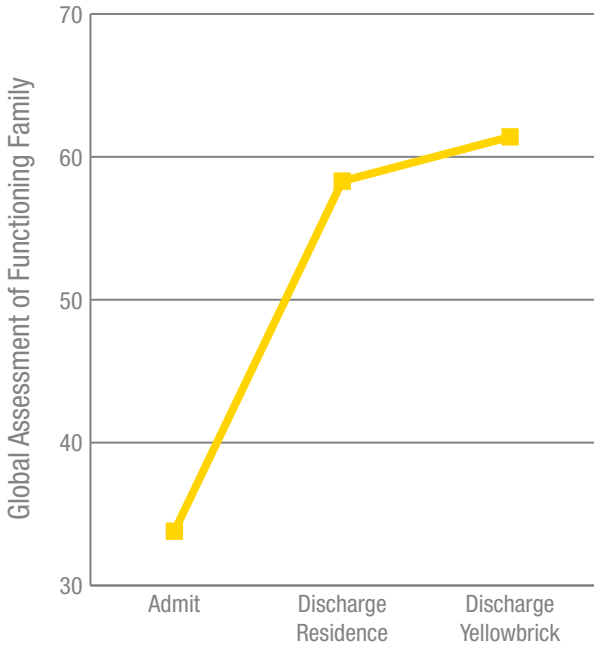
The program's strong focus on community and working together was also extremely beneficial and has helped me immensely going forward."

Emerging Adult

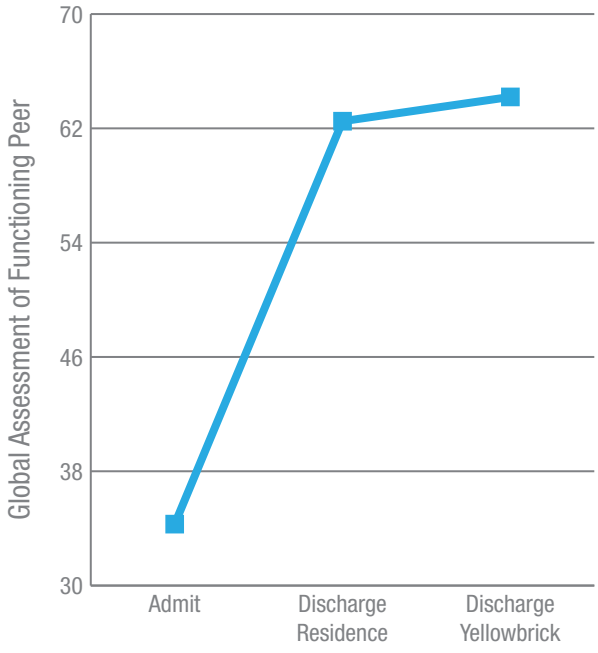
Improved Relationships

Relationships with family, peers, authorities and the broader community are essential to a meaningful and fulfilling life. Secure and supportive relationships are also the neurobiological foundation that facilitate neuroplasticity, brain growth and maturation. Healthy relationships are a primary focus at Yellowbrick and one in which emerging adults improve greatly. The graphs below depict improvements in the emerging adults' relationships with their families at admission, transition from the most intensive treatment phase of The Residence, and discharge from Yellowbrick. The second graph illustrates improvements in the emerging adults' relationships with peers at admission, transition from The Residence, and discharge from Yellowbrick.

Change in Global Assessment of Relationship Functioning: Family



Change in Global Assessment of Relationship Functioning: Peer

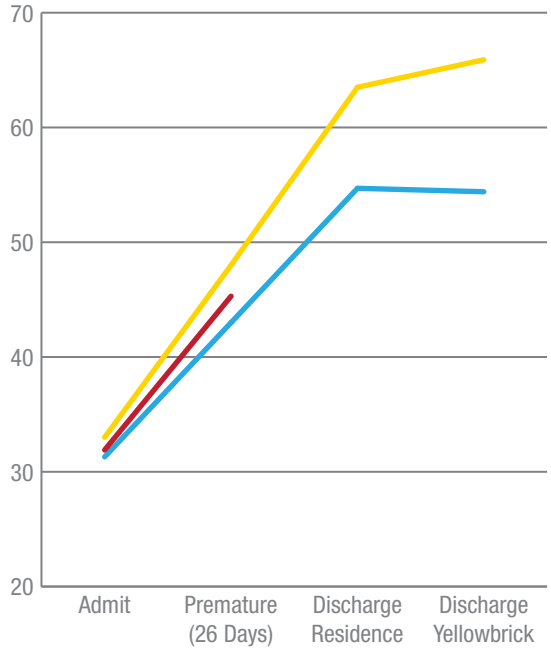


Collaborative and Noncollaborative Discharges

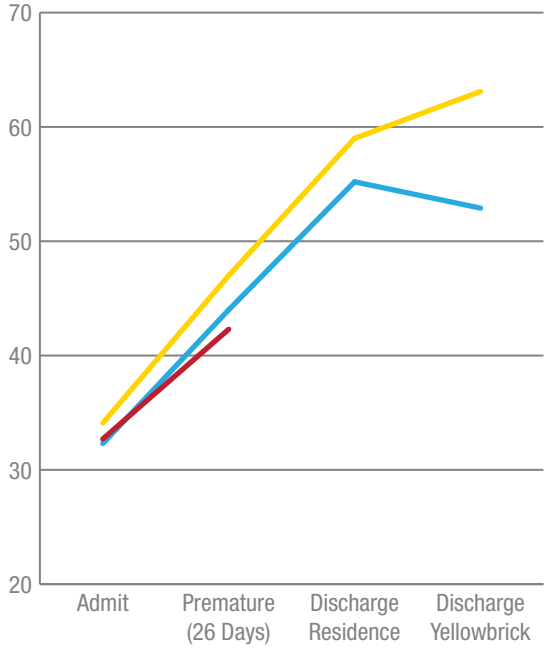
Not every emerging adult who completes treatment at Yellowbrick leaves in a fully collaborative manner. Sometimes they discharge before their progress is stable and they have built a life for themselves outside of treatment. It is important to us at Yellowbrick to understand whether there are different outcomes for emerging adults who complete treatment but leave in what we term, a Noncollaborative Discharge as compared to a Collaborative Discharge. The following graphs show that it does, indeed, appear to make a significant difference, in terms of longer-term outcomes. The graphs illustrate that the two groups are quite comparable as they approach discharge from The Residence, which is the most intensive, immersive phase of treatment. However, by the time they are discharged from Yellowbrick several months later, the Noncollaborative group is showing a significant decline across all the domains of neuropsychiatric and psychosocial functioning.

Collaborative Transition
Premature Termination
Noncollaborative Discharge

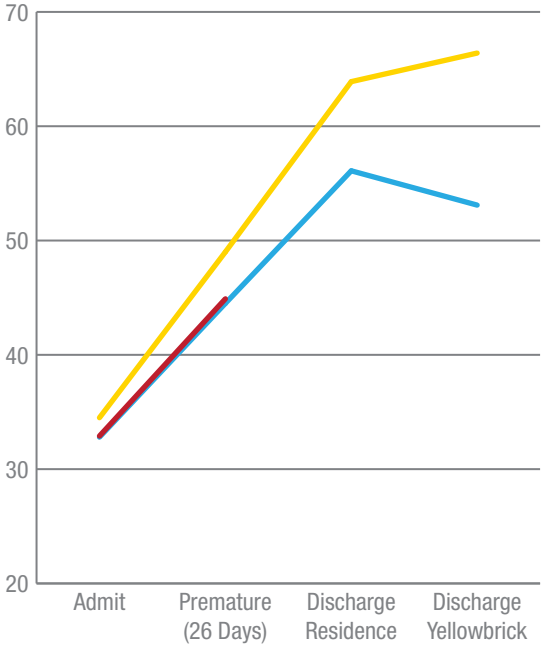
Global Assessment Functioning



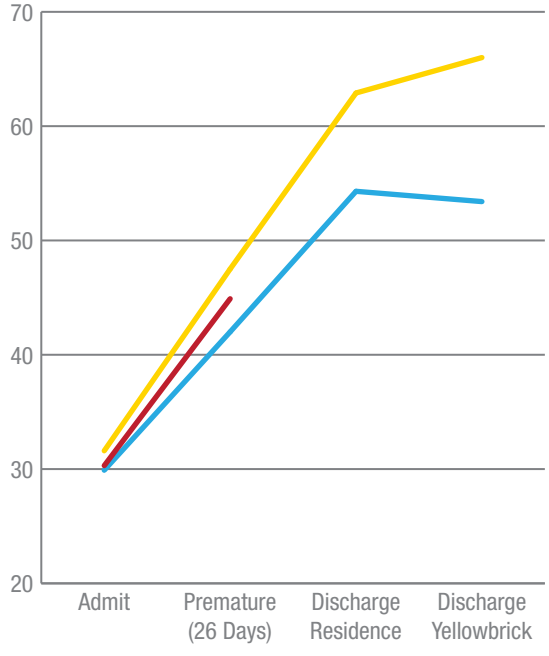
Global Assessment of Relationship Functioning: Family



Global Assessment of Relationship Functioning: Peer



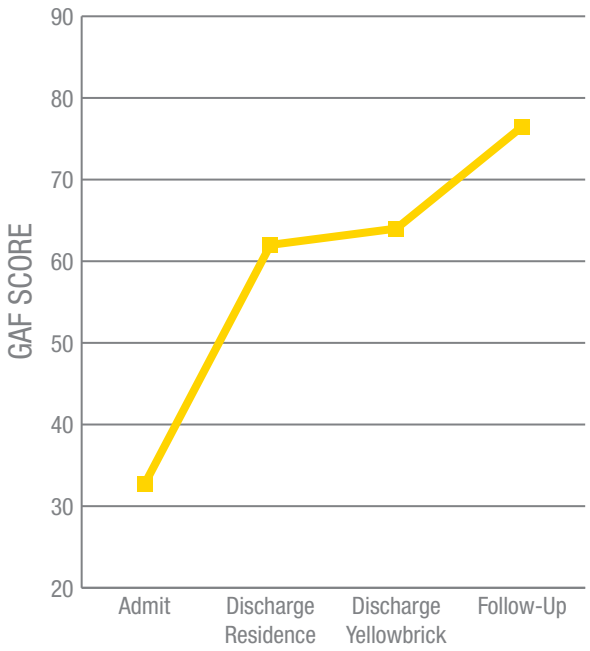
Change in Social and Occupational Functioning



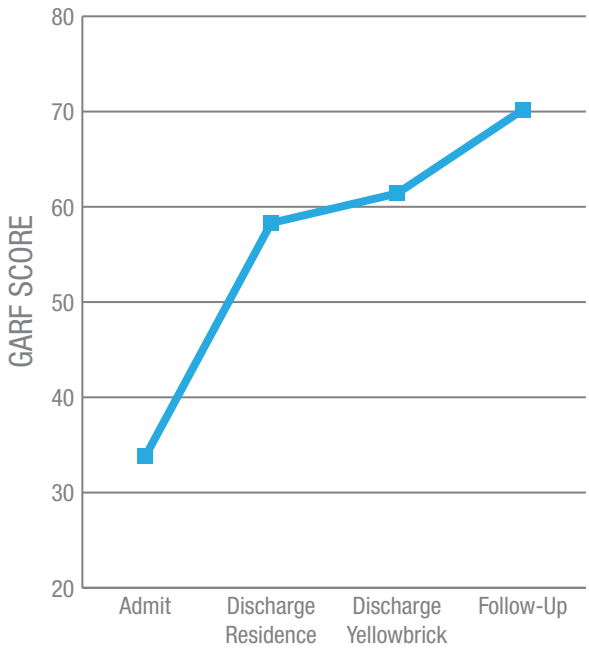
Long-term Follow-Up

Emerging adults continue to maintain, and even increase, their gains from treatment at Yellowbrick long after they leave. As illustrated in the following 4 graphs from the Global Functioning Scales, treatment improvements continue and increase with time in their overall neuropsychiatric and life functioning. They also continue to improve in family and peer relationships as well as in social and occupational functioning. Nearly all of the emerging adults who completed treatment 2-4 years earlier were employed or going to college or technical school.

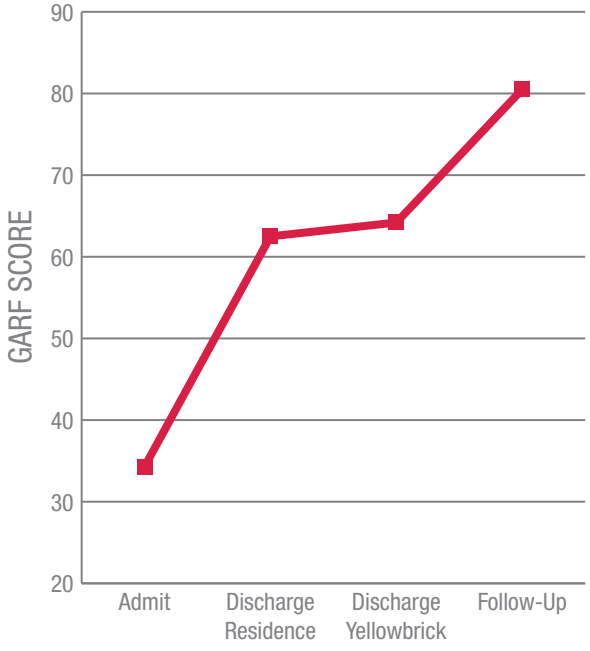
Follow-Up Overall Functions



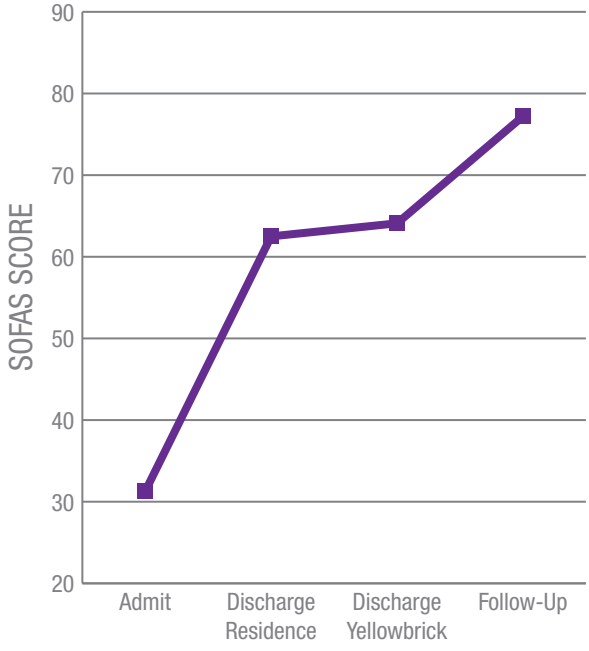
Follow-Up Family Relationships



Follow-Up Peer Relations



Follow-Up Occupational Functioning



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