

Aligning Comprehensive Assessment to Treatment: Evidence for Increased Quality of Life in Individuals with Brain injury

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Brain injuries are a global crisis and a major health concern in North America. There are approximately 6.8 million North Americans living with the aftereffects of a brain injury and over 1.6 million new cases occur every year^{1,2}. According to recent research a majority of individuals continue to suffer from impairments 1 year following injury regardless of the severity³.

Acute care has seen great improvements in treating brain injuries, resulting in a significant decrease in mortality rates. However, this has led to an increase in individuals surviving and transitioning back to the community and experiencing a lower quality of life (QOL). This resulted in a critical increase in the need for rehabilitation services aiming at improving this transition and helping individuals re-integrate back into society.

Due to the complexity of how brain injury presents itself, through a wide range of cognitive and physical symptoms, it is important to get good assessment followed by tailored rehabilitation that fits the individual's needs. A key problem continues to persist in the pairing of assessment to treatment. By spending limited resources on assessments that do not lead directly to treatment, patients are receiving a reduced and lower quality of care leading to poorer

*50% of individuals with brain injury
continue to be moderately to severely
disabled past 1-year*

Seabury, S. A., Gaudette, É., Goldman, D. P., Markowitz, A. J., Brooks, J., McCreary, M. A., ... & Boase, K. (2018). Assessment of follow-up care after emergency department presentation for mild traumatic brain injury and concussion: results from the TRACK-TBI study. *JAMA network open*, 1(1), e180210-e180210.

outcomes. Additionally, the approach to cognitive rehabilitation is extremely ad hoc and continues to focus on strategy-based designs, where tools and tips are used to help work around a deficit. There is a pressing need in brain injury rehabilitation for improved standardization of treatment that focuses on improving cognitive capacity and that pairs with assessment. ABI Wellness was founded around the vision of improving quality of life for

¹ Canada, Brain Injury. "About Acquired Brain Injury." *Brain Injury Canada*, 2019, www.braininjurycanada.ca/acquired-brain-injury/.

² Thurman, D. J. (1999). Traumatic brain injury in the United States; a report to Congress.

³ Nelson, L. D., Temkin, N. R., Dikmen, S., Barber, J., Giacino, J. T., Yuh, E., ... Mukherjee, P. (2019). *Recovery After Mild Traumatic Brain Injury in Patients Presenting to US Level I Trauma Centers. JAMA Neurology.*

individuals with brain injury through standardization and optimization of rehabilitation, allowing health care providers to increase access and improve outcomes for their patients.

Our team built the ABI Wellness platform on the foundation laid out by the Arrowsmith program over 30 years in the world of learning disability⁴. Dedicated to providing the best, evidence-based rehabilitation program, ABI Wellness began by studying our program in collaboration with the Faculty of Medicine at the University of British Columbia. Our goal was to investigate the research question: Can individuals with an acquired brain injury (whether it be traumatic or non-traumatic) improve their cognitive abilities through an individualized cognitive intervention focused on neuroplasticity? Through a combination of neuroimaging and neuropsychological testing, the researchers identified significant changes in both behaviour and function suggesting a generalized impact of the program in individuals with chronic brain injury⁵. These results along with the impact statements from the participants encouraged us to continue developing this program.

Following this first study, ABI Wellness continued with their strategic research approach and conducted more research and improved the program by adding in additional elements recommended by the best of evidence available including physical exercise⁶ and mindfulness meditation⁷. The final element added into the program was a measure of quality of life. Health-related quality of life (HRQOL) is a subjectively evaluated measurement that reflects the impact of a disease or disability on one's physical, emotional, cognitive, or social health (ref). HRQOLs can provide an excellent measure of generalizability of the intervention. ABI Wellness is focused on having an overall impact on improving quality of life and as such has established the Traumatic Brain Injury Quality of Life (TBI-QOL) measurement system as the primary outcome measure for the program.

The TBI-QOL is the first comprehensive scale covering a wide range of domains specifically tailored for individuals with TBI. This normed, and validated measure is a valuable tool that can improve TBI rehabilitation by instantly informing clinicians of an individual's standing on a wide range of subjectively important HRQOL domains⁸. This measure has been shown to be stable over time in a large study of over 200 community dwelling individuals with TBI. This research further proposed that changes in TBIQOL scores between 3 and 7 could be viewed as clinically meaningful⁹.

IMPROVING QUALITY OF LIFE

⁴ Arrowsmith Program Background. 2020. www.arrowsmithschool.org/background/

⁵ Porter, S., Torres, I. J., Panenka, W., Rajwani, Z., Fawcett, D., Hyder, A., & Virji-Babul, N. (2017). Changes in brain-behavior relationships following a 3-month pilot cognitive intervention program for adults with traumatic brain injury. *Heliyon*, 3(8), e00373.

⁶ Kramer, A. F., & Erickson, K. I. (2007). Effects of physical activity on cognition, well-being, and brain: human interventions. *Alzheimer's & Dementia*, 3(2), S45-S51.

⁷ Link, J. S., Barker, T., Serpa, S., Pinjala, M., Oswald, T., & Lashley, L. K. (2016). Mild traumatic brain injury and mindfulness-based stress reduction: a review. *Archives of assessment psychology*, 6(1), 7-32.

⁸ Tulskey, D. S., Kisala, P. A., Victorson, D., Carlozzi, N., Bushnik, T., Sherer, M., ... & Englander, J. (2016). TBI-QOL: development and calibration of item banks to measure patient reported outcomes following traumatic brain injury. *The Journal of head trauma rehabilitation*, 31(1), 40.

⁹ Poritz, J. M., Sherer, M., Kisala, P. A., Tulskey, D., Leon-Novelo, L., & Ngan, E. (2020). Responsiveness of the Traumatic Brain Injury–Quality of Life (TBI-QOL) Measurement System. *Archives of physical medicine and rehabilitation*, 101(1), 54-61.

The ABI Wellness system platform is designed to be implemented by physiotherapists, occupational therapists, and other rehabilitation specialists as a tool to help standardize and optimize their rehabilitation delivery for individuals with brain injury. Currently available at 4 sites, over 90 people have been through the ABI Wellness program over the past 4 years. The individuals have presented with a wide range of injuries including mild TBI, moderate TBI, severe TBI, anoxic brain injury, stroke, and other ABI (see Table 1 for client demographics). We have previously reported on our return to work data, where we are seeing an overall return to work rate of 77% across diagnoses. Among mild TBI that rate is 91%. This presents a significant improvement over the status quo as these individuals have either failed to return to work through traditional rehabilitation or simply been unable prior to accessing the ABI Wellness program¹⁰

Characteristic	Mean	SD	n
Age (years)	46.8	15.4	97
Characteristic	%	n	
Sex			
Female	46	45	
Male	54	52	
Injury Classification			
Complicated Mild TBI	24	23	
Moderate TBI	29	28	
Severe TBI	11	11	
Stroke ABI	15	15	
Other ABI	5	5	
Undocumented	16	16	

Table 1. ABI Wellness Client Demographics

Characteristic	Mean	SD	n
Age (years)	45.3	14.9	25
Education (years)	15.6	2.2	25
Time since Injury (years)	6.5	7.9	25
Characteristic	%	n	
Sex			
Female	52	13	
Male	48	12	
Race			
White	88	22	
Asian	12	3	
Injury Classification			
Complicated Mild TBI	28	7	
Moderate TBI	40	10	
Severe TBI	4	1	
Stroke ABI	20	5	
Other ABI	8	2	

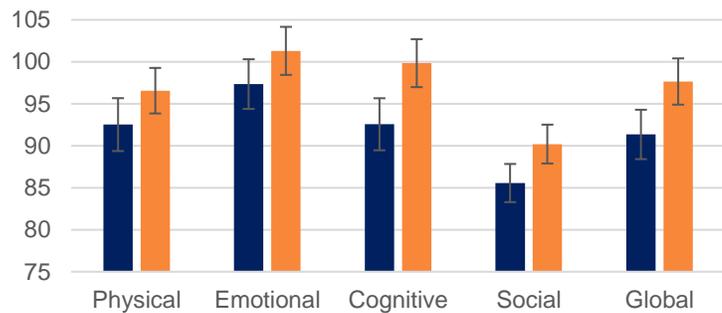
Table 2. Subset of ABI Wellness Clients Demographics

As in the initial research completed by UBC, we are continuing to see both cognitive changes and behavioural changes through the program. As the program has evolved over time, the first cohort of individuals to have completed the full ABI Wellness program is now complete. Therefore, an update was necessary to highlight the impact the full program is having on individuals and their quality of life. The following data represents 25 individuals that have been through the full program and completed the TBI-QOL before and after the intervention. See Table 2 for a breakdown of the client demographics of this group.

¹⁰ ABI Wellness Return to Work white paper. <https://www.abiwellness.com/wp-content/uploads/2019/06/ABIW-Return-To-Work-1.pdf>

Changes in Quality of Life

With the TBI-QOL as the primary outcome measure, we are seeing significant improvements across health domains. Figure 1 displays the scores for each domain both before and after the group underwent the ABI Wellness program.



Following their individually prescribed program, clients are showing clinically meaningful improvements across domains including Physical Health, Emotional Health, Cognitive Health, Social Health, and Global QOL as they are all well within the range established by Poritz and colleagues¹¹. The widespread improvements reported here are significant as they span across many domains of health suggesting a generalized impact of the program.

Change	+ 4.0	+ 4.0	+ 7.3	+ 4.6	+ 6.3
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Figure 1. TBIQOL Composite Score Changes at Intake and Exit of ABI Wellness program. Changes between 3 and 7 could be viewed as clinically meaningful.

When looking deeper into the results, it is possible to see the specific areas being influenced by the ABI Wellness program. The TBI-QOL provides a complete breakdown of the 22 subdomains that make up the composite scores, displayed in Figure 2.

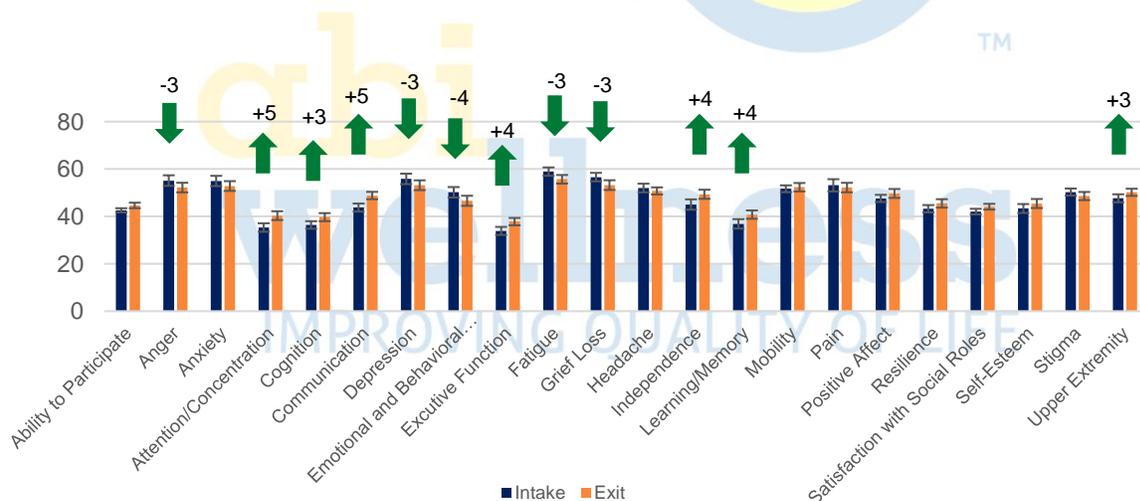


Figure 2. Intake and Exit Scores of TBIQOL Subdomains along with clinically significant changes.

Through ABI Wellness' interdisciplinary program, individuals are showing significant improvements across a wide range of subdomains including Attention and Concentration,

¹¹ Poritz, J. M., Sherer, M., Kisala, P. A., Tulsy, D., Leon-Novelo, L., & Ngan, E. (2020). Responsiveness of the Traumatic Brain Injury–Quality of Life (TBI-QOL) Measurement System. *Archives of physical medicine and rehabilitation*, 101(1), 54-61.

General Cognition, Communication, Executive Function, Independence, and Learning and Memory. Additionally, we are seeing clinically meaningful decreases in key areas of Anger, Depression, Emotional and Behavioural Dyscontrol, Fatigue, and Grief and Loss. Through the TBIQOL, the ABI Wellness program has demonstrated to be a program with clear generalizability that has a significant impact on subjectively important health related quality of life domains. In addition, many of the domains represent functions that are critical to activities of daily living, returning to work, and mental health.

These changes look to be directly related to participation in the ABI Wellness program and are a significant improvement over the status quo. Often, when an individual enters the chronic stage of recovery, there is a significant decrease in access to care due to a combination of lack of resources and lack of services. As such, many community dwelling individuals with TBI are often not actively receiving care. This was the case in the large data set of over 200 individuals with TBI who were observed over the course of 6 months¹². The researchers found that over the time period, the TBIQOL scores were stable and only showed minimal change across domains. Figure 3 provides a comparison of change scores across domains between the control group and the group that underwent the ABI Wellness program. These results suggest that the ABI Wellness program has a direct and significant impact on quality of life for individuals with brain injury. These results correspond with the feedback we have received from our clients that 94% successfully met their rehabilitation goals.

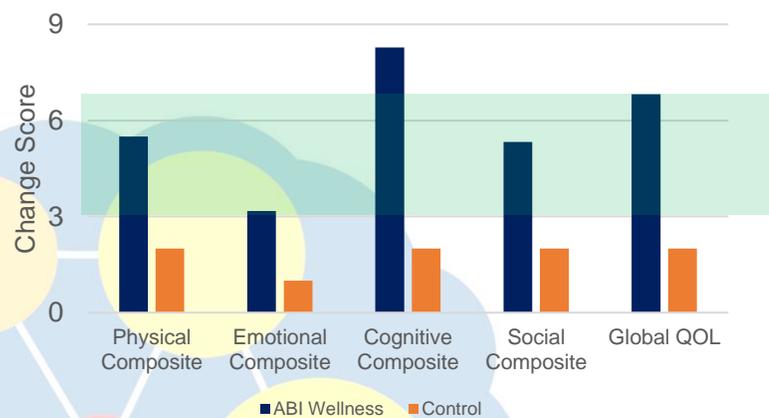


Figure 3. Change Scores of the TBIQOL Composites between ABI Wellness program and TBI Controls. All bars within green zone reflects clinically meaningful change.

Conclusion

The ABI Wellness program continues to demonstrate a significant positive impact on individuals with a wide range of diagnoses. Compared to individuals who accessed no rehabilitation, as is often the case in the current status quo, past clients of the ABI Wellness program show significant improvements in quality life across physical, emotional, cognitive and social domains. This is significant as many of the areas improved by the ABI Wellness program, Attention/Concentration, General Cognition, Communication, Executive Function, Independence, and Learning/Memory are all critical to recovery and successfully integrating back into the community.

¹² Poritz, J. M., Sherer, M., Kisala, P. A., Tulsy, D., Leon-Novelo, L., & Ngan, E. (2020). Responsiveness of the Traumatic Brain Injury–Quality of Life (TBI-QOL) Measurement System. *Archives of physical medicine and rehabilitation*, 101(1), 54-61.

These findings provide evidence of the importance of intensive cognitive functioning intervention over strategy or compensation based approaches to treatment for individuals who have entered the chronic stage of recovery and are not seeing the recovery that they would like. Change is possible, and by focusing on interdisciplinary rehabilitation with a focus on neuroplasticity, all individuals can improve their cognitive capacity and improve their quality of life.



If you are interested and would like to learn about the ABI Wellness program, please visit www.abiwellness.com or contact us at info@abiwellness.com.

