

# Impact of an Interdisciplinary Rehabilitation System Platform on Return to Work Outcomes in ABI.

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## Abstract

Cognitive impairment is often the most common and critical symptom affecting the quality of life for individuals with chronic ABI. Presented with impaired attention, processing skills, problem solving, increased distractibility, and more, it can be incredibly difficult for individuals to return to work. Current standard rehabilitation care models struggle to rehabilitate this population with current global return to work rates at 40%<sup>1</sup>. Upon completing the ABI Wellness program, individuals report a 77% return to work rate. This in a chronic brain injury population that has typically tried a number of different traditional treatment models before entering our programs. By utilizing a completely integrated, interdisciplinary rehabilitation program that focuses on rebuilding cognitive capacity, ABI Wellness's current findings show an improvement in return to work rates of 37%.

## The Clinical Challenge

Traumatic brain injury (TBI) is both a major health issue and a major economic issue. In North America, there are over 6.8 million individuals living with TBI related disability. While some individuals recover within 3 months following the injury, roughly 50% continue to suffer moderate to severe disability beyond 1 year<sup>2</sup>. This chronic symptomology can lead to permanent disability and other comorbidities that influence long-term health and life expectancy<sup>3</sup>. Currently the approach to treat this population is through separate and distinct rehabilitation with very little integration while focusing on compensatory strategies that fail to address the underlying cognitive issues.

Cognitive impairment is the most critical symptom in terms of patient quality of life and functional outcomes, including the ability to return to work. Executive processing skills are frequently the most impacted following TBI, leading to impaired processing speed, reasoning, problem-solving, increased distractibility, and language impairment<sup>4,5</sup>. Memory is the most frequently reported deficit following TBI and is thought to be partially due to impaired attentional control<sup>6</sup>. Rehabilitation for treating cognitive deficits in TBI has traditionally consisted of focused attentional training with cuing strategies. Although this approach has had some limited success it fails to address the underlying cognitive impairment. Recently, rehabilitation programs have begun to utilize computerized working

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<sup>1</sup> Van Velzen, J. M., Van Bennekom, C. A. M., Edelaar, M. J. A., Sluiter, J. K., & Frings-Dresen, M. H. W. (2009). How many people return to work after acquired brain injury?: a systematic review. *Brain injury*, 23(6), 473-488.

<sup>2</sup> Humphreys, I., Wood, R. L., Phillips, C. J., & Macey, S. (2013). The costs of traumatic brain injury: a literature review. *ClinicoEconomics and outcomes research: CEOR*, 5, 281

<sup>3</sup> Traumatic brain injury: a disease process, not an event. *Masel BE, DeWitt DS J Neurotrauma*. 2010 Aug; 27(8):1529-40

<sup>4</sup> Kinnunen, K. M., Greenwood, R., Powell, J. H., Leech, R., Hawkins, P. C., Bonnelle, V., et al. (2011). White matter damage and cognitive impairment after traumatic brain injury. *Brain* 134, 449–463. doi: 10.1093/brain/awq347

<sup>5</sup> Rabinowitz AR, Levin HS. Cognitive sequelae of traumatic brain injury. *Psychiatr Clin North Am*. 2014;37(1):1–11. Epub 2014/02/18. pmid:24529420

<sup>6</sup> Stierwalt, J. A., & Murray, L. L. (2002). Attention impairment following traumatic brain injury. In *Seminars in speech and language* (Vol. 23, No. 02, pp. 129-138). Copyright© 2002 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel.:+ 1 (212) 584-4662.

memory cognitive training programs in addition to their other offerings. The focus of these programs are to train the individuals working memory ability through a variety of exercises that work on the underlying cognitive functions causing the functional impairment. Results from these programs indicate improvements in the specific area being trained, however there remain questions over the transferability to other cognitive areas<sup>7</sup>. Additionally, there are concerns on whether these tools have a meaningful, sustained impact to the patients. Due to the multitude of cognitive functions often impaired following brain injury, there is a need for a cognitive rehabilitation program that focuses on multiple cognitive domains that results in functional improvements.

Due, in part, to the limited options for sustained cognitive improvements, current global Return to Work (RTW) results for individuals with TBI are not having the desired outcomes. Traditional RTW programs focus on strategies to accommodate for the decrease in function and working with employers to help employees return to some capacity. For example, an individual may return to work part-time with a limited set of responsibilities in order to accommodate for the employees reduced ability.

A systematic review of the literature found an overall RTW rate of 40% in ABI populations<sup>8</sup>. While some studies have shown higher rates of return to work there remains major concerns regarding the long-term sustainability of the return. Recent research assessing the status of patients following RTW have noted that 50% of individuals with complete RTW continue to report multiple cognitive, physical, and emotional symptoms of at least moderate severity<sup>9</sup>. A possible explanation for this continued cognitive impairment is that most vocational rehabilitation continues to focus on strategies and limited cognitive rehabilitation leading to mild temporary improvements that do not carry over to other areas and disappear following the completion of the program. This ultimately results in individuals having to take absences from work, or leave the workforce, costing both the individual and the system. Additionally,

failing to return to work or stay at work can have a staggering impact on mental health with heightened levels of depression and anxiety.

### **The Administrative and Resourcing Challenge**

Paired with the challenges in delivering meaningful, lasting outcomes for individuals with brain injury, is the fragmented, specialized and often costly treatment models which make this type of care inaccessible. In cases where patients have access to rehabilitation care, these direct medical costs can range from \$12,000 in the first year of care, to upwards of \$40,000. At least 5%-10% of the complex cases cost more than \$20,000 in the first year alone<sup>10</sup>. For those patients who do have insurance and find themselves with persisting side effects, the cost of direct and indirect care, as well as losses in wage, significantly drive up legal and eventual claim sizes. While these claims in many cases are essential to support the individual, there is an opportunity to provide a cognitive intervention that can improve the quality of life and cognitive functioning of the patient, allowing them to have the ability to return to at least a portion of the usual activities of daily living.

The current clinical model for treating brain injury in the community or through outpatient settings also poses significant challenges from a patient-centred and resourcing point of view, due to the labour-intensive, fragmented nature of care.

The labour-intensive nature of the typical care model often makes care inaccessible. In most brain injury care models; a 1:1 care provider to patient ratio is in place, resulting in a high cost per hour for the patient; but also limiting the overall capacity of the health care system to serve the demand. The labour-intensive nature of this model is exacerbated by the high levels of manual, specialized reporting and assessment associated to brain injury, with a high number of small clinics spending 20%-30% of additional time<sup>11</sup> developing reports above and beyond clinical time spent with the patient. This is a significant problem across the healthcare system; around a third of a

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<sup>7</sup> Linares, R., Borella, E., Lechuga, M. T., Carretti, B., & Pelegrina, S. (2019). Nearest transfer effects of working memory training: A comparison of two programs focused on working memory updating. *PloS one*, 14(2), e0211321.

<sup>8</sup> Van Velzen, J. M., Van Bennekom, C. A. M., Edelaar, M. J. A., Sluiter, J. K., & Frings-Dresen, M. H. W. (2009). How many people return to work after acquired brain injury?: a systematic review. *Brain injury*, 23(6), 473-488.

<sup>9</sup> Silverberg, N. D., Panenka, W. J., & Iverson, G. L. (2018). Work productivity loss after mild traumatic brain injury. *Archives of physical medicine and rehabilitation*, 99(2), 250-256.

<sup>10</sup> Based on ABIW interviews with private care providers in North America

<sup>11</sup> Based on ABIW interviews with private care providers in North America

care provider's time is spent away from their patient and on reporting – in many cases on metrics and tools that have the opportunity to be more streamlined and automated. This is also the case with a few emerging cohort based brain injury models developed by a number of different hospital and providers in the region: with the absence of a clear, data-based patient tracking and reporting system to support cohort care; the risk is lower quality care, lack of effective intervention, and a high volume of labour intensive administration.

While there is an awareness regarding the importance of interdisciplinary care, many individuals with brain injury have to access multiple, multi-site specialists to access this care. As the literature grows on the efficacy of an interdisciplinary model to address brain injury, a number of patients and their families try to navigate the system through traveling and paying multiple sites for physical, mental, cognitive and other therapies, driving up specialist fees, driving up travel time and the barriers to care significantly. Across healthcare, the urgency to develop a “one stop shop” all at one site; with a patient-focused approach, has been validated. However, there are very few brain injury care models that actively and effectively address this principle.

In addition to the labour intensive and fragmented nature of the current state of care, patients are further hindered to access treatment. This is because diagnosis and assessment often dominate allocated claims and budgets; leaving little or no room for care. Across the system, the complexity of assessing the type of brain injury and the associated symptoms present significant challenges for the patient, provider, and insurance providers. Patients can spend anywhere between \$3,000 to over \$40,000 in brain injury assessments alone, without receiving an hour of actual therapy and treatment to address the problem<sup>12</sup>. This is because brain injuries are complex, and highly variable in presentation—and there needs to be an understanding of the nuances associated to each case. However, this does not indicate that these variable presentations may not be served with a varied dosage plan of the same, integrated, interdisciplinary care model.

## **The ABI Wellness Treatment Platform for Acquired Brain Injury**

The ABI Wellness program focuses on improving cognitive capacity across a wide range of higher order cognitive functions resulting in a generalized improvement of cognitive ability. The program has been developed with a well-scaled system platform that allows a health care professional to deliver a high quality individualize program at a 6:1 or 7:1 ratio, greatly reducing the cost of care to the clinic and to the client.

As part of our treatment platform, ABI Wellness provides management, supervision and implementation of its program to the hospital groups, regional health authorities and non-profit clinics across North America that opt to partner with ABI Wellness. These partners receive training, certification and access to intellectual property that has more than 30 years of success at improving individual's cognitive abilities.

The ABI Wellness system platform consists of 4-pillars (Figure 1):

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<sup>12</sup> Based on ABIW interviews with private care providers in North America



1. **Higher Order Cognitive Function Rehabilitation** using the tested Brainex cognitive rehabilitation tools and methodology



2. **Aerobic Exercise** catered for brain injury patients and integrated with the other key pillars to optimize overall treatment plan



3. **Mindfulness** through tailored sessions imbedded in program



4. **Integrated Health** including validated and reliable quality of life tracking and ongoing patient engagement tracking to allow for quick intervention and engagement with patients

Figure 1. ABI Wellness 4-Pillars

## 1. Higher Order Cognitive Function Rehabilitation

ABI Wellness uses the world-renowned Brainex Program. This program focuses on higher order **cognitive rehabilitation**. Four specific exercises target the regions of the brain responsible for executive functioning. These four exercises are called Symbol Relations, Symbol Thinking, Nonverbal Thinking and Predicative Speech. The program focuses on a wide range of cognitive functions including attention, auditory processing, concentration, executive processing, working memory, processing speed, inhibition control, and reasoning. Functionally, these higher order cognitive exercises help to restore a patient's ability to organize, plan and set goals, in addition to building cognitive capacities in verbal memory, verbal retrieval, reasoning and enhance overall self-awareness.

## 2. Aerobic Exercise

Aerobic exercise when dosed correctly is shown to have a positive effect on cognitive function and can be used to enhance neuroplasticity<sup>13</sup>. Additionally, research shows that regular physical activity improves mood,

decreases depression, and can improve cognition on its own<sup>14</sup>.

## 3. Mindfulness

Mindfulness meditation has proven to reduce depressive symptoms, overall stress and fatigue in patients with traumatic brain injury<sup>15</sup>.

## 4. Integrated Health Tracking

- a. From the initial assessment throughout the program, large amounts of data are constantly being tracked on each client. This allows for a deep level of understanding on the client's initial level of function and the progress made throughout the program. A key factor of this program is **effortful processing**. Meaning, the more effort a client puts into the activities, the greater the improvement is to be expected.
- b. Quality of Life Assessment is an important measure of the ABI Wellness program and is assessed using the TBI-QOL, which is a quality of life tool that has been designed and validated for individuals with TBI by Dr. Tulsy and his group at the University of Delaware<sup>16</sup>.

<sup>13</sup> Nanda, B., Balde, J., & Manjunatha, S. (2013). The acute effects of a single bout of moderate-intensity aerobic exercise on cognitive functions in healthy adult males. *Journal of clinical and diagnostic research: JCDR*, 7(9), 1883.

<sup>14</sup> Dinas, P. C., Koutedakis, Y., & Flouris, A. D. (2011). Effects of exercise and physical activity on depression. *Irish journal of medical science*, 180(2), 319-325.

<sup>15</sup> Bedard, M., Felteau, M., Marshall, S., Dubois, S., Gibbons, C., Klein, R., & Weaver, B. (2012). Mindfulness-based cognitive therapy: benefits in reducing depression following a traumatic brain injury. *Advances in mind-body medicine*, 26(1), 14-20.

<sup>16</sup>Tulsy, 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.

**Functional Outcomes**

The ABI Wellness program boasts a 77% return to work rate, which is significantly higher than what has been reported through other programs when looking at such a diverse population of ABI.

To date, over 50 individuals have completed the ABI Wellness program. The return to work population (defined as individuals who held a profession prior to their injury and were unable to return to full time work following their injury)<sup>17</sup> currently consists of 30 individuals. All clients have been within the chronic stage of recovery: over 6-months post injury. In most cases, these individuals had attempted and completed a number of traditional rehabilitation programs which had not improved their functional outcomes.

Brain injury is extremely heterogeneous and as such clients have presented with a wide range of injuries including mild, moderate, and severe TBI, stroke, anoxic brain injury, and brain tumors. The chart (Figure 2.) shows the break down of the diagnoses of the RTW population.

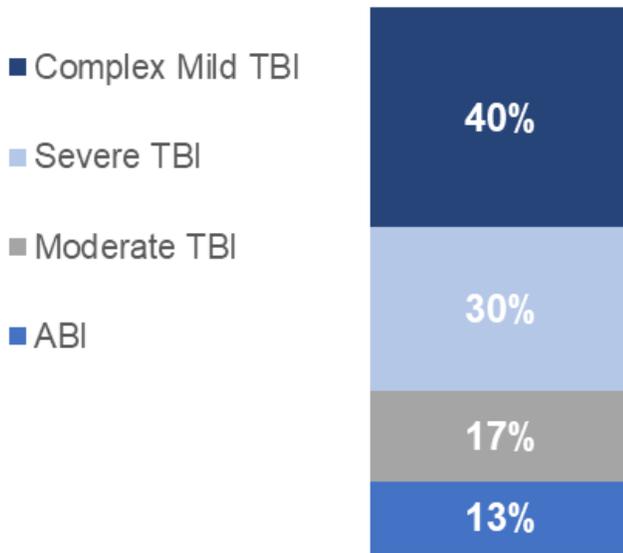


Figure 2. Client Diagnosis Distribution

Traditional rehabilitation programs for ABI continue to struggle with returning individuals back to work. Data

from a literature review assessing return to work rates for all ABI (both traumatic and non-traumatic injuries) identified 40% of individuals were able to return to employment. This suggests that there is significant room for improvement<sup>18</sup>. The clientele of ABI Wellness present with a similar mix of both types of ABI and within 1-month of completing their individualized program – **77% had returned to work** (Figure 3).



Figure 3. ABI Wellness RTW Rate compared to standard of care.

This is particularly significant since no case management or additional social support was provided by ABI Wellness. This suggests that by focusing on improving cognitive capacity, individuals are able to regain the processes and skills necessary to return to their employment at a much higher rate than standard.

Of those that were working part-time prior to the program, **88% returned to full-time work 1-month post program**. Of the 73% not working prior to the program, **60% returned to full-time work 1-month post program**.

The majority of TBI are considered to be “mild”, which typically resolve within 7-10 days<sup>19</sup>. For the portion that take longer to recover, most will resolve on their

<sup>17</sup> Return to Work data set consisted of 30 individuals. See data tables 1 and 2 in Appendix

<sup>18</sup> Van Velzen, J. M., Van Bennekom, C. A. M., Edelaar, M. J. A., Sluiter, J. K., & Frings-Dresen, M. H. W. (2009). How many people return to work after acquired brain injury?: a systematic review. *Brain injury*, 23(6), 473-488.

<sup>19</sup> McCrea, M., Guskiewicz, K. M., Marshall, S. W., Barr, W., Randolph, C., Cantu, R. C., ... & Kelly, J. P. (2003). Acute effects and recovery time following concussion in collegiate football players: the NCAA Concussion Study. *Jama*, 290(19), 2556-2563.

own or with limited rehabilitation. A recent systematic review identified that 80% of individuals with mild TBI returned to work by 6-months<sup>20</sup>. The clients that come to ABI Wellness are individuals that do not recover and continue to have significant symptoms 6-months and beyond, often even after other types of rehabilitation. When looking at the subset of clients with mTBI, **91% were able to return to work within 1-month of their program.**

The outcome of many rehabilitation programs is to get a client back to work, however the ability of an individual to return and stay at work for an extended amount of time is arguably a better measure of success. Sustained return to work is therefore a major area of concern for many ABI rehabilitation programs as after initially returning to work, up to 50% of individuals continue to suffer cognitive impairment and many are forced to leave their jobs<sup>21</sup>. To date, RTW data has been collected from clients following the ABI Wellness program for 1 month, 6 months and 1 year, with the results available below (Table 3).

Client Population	1 month	6 months	1 year**
<b>% of Participants sustained return to work</b>	~	<b>100%</b>	<b>100%**</b>
<b>% of Participants at Work Post Program</b>			
<b>Overall Population</b>	<b>77%</b>	<b>79%</b>	<b>70%**</b>

Table 3. ABI Wellness Sustained RTW rates

Currently, **100% of the individuals who returned to work following the program continue to be employed at 6 months and 1-year** suggesting that the program has led to long term changes and individuals are able to engage with their work and complete their objectives.

### Program Retention

The ABI Wellness program is delivered via a group model. Traditional group rehabilitation programs

struggle with recruiting individuals and have difficulty retaining them for the duration of the program. The ABIW program provides an individualized program specifically tailored to the individual's ability ensuring constant engagement and appropriate challenge, while also benefiting from the group effect on mental health and social health. **Currently, the ABIW program has an overall retention rate of 91.5%** indicating that when clients are enrolling, they are successfully completing their rehabilitation programs.

### Conclusion

The results of this initial analysis suggest that the ABI Wellness program, with its focus on cognitive, interdisciplinary care, is a robust cognitive rehabilitation program that has significant functional impact on individuals with chronic ABI. Traditional rehabilitation has been unsuccessful at providing adequate care for this population with a majority of individuals unable to return to work. This has a significant impact on the individual's quality of life and on society. By implementing the ABI Wellness program, clinics and rehabilitation centres can optimize the care being provided by utilizing a well dosed, standardized, and evidence-based program that can improve their patient outcomes while reducing costs.

<sup>20</sup> Bloom, B., Thomas, S., Ahrensberg, J. M., Weaver, R., Fowler, A., Bestwick, J., ... & Pearse, R. (2018). A systematic review and meta-analysis of return to work after mild Traumatic brain injury. *Brain injury*, 32(13-14), 1623-1636.

<sup>21</sup>Silverberg, N. D., Panenka, W. J., & Iverson, G. L. (2018). Work productivity loss after mild traumatic brain injury. *Archives of physical medicine and rehabilitation*, 99(2), 250-256.

## Appendix

	RTW Data Set	Pre-ABIW – Working	Pre-ABIW – Not Working
n	30	8	22
Mean Age	43.5	51.8	40.5
<b>Diagnosis</b>			
mTBI	12	4	8
Moderate TBI	5	3	2
Severe TBI	9	1	8
ABI	4	0	4
<b>Post-ABIW RTW</b>			
Full-Time	16	7	9
Part-Time	7	1	6
No RTW	7	0	7

Table 1. Return to Work Data Set by diagnosis and working status

<b>ABI Wellness Client Profile</b>	
<b>Average age:</b>	43.5
<b>Average time in Workforce:</b>	20-24 years
<b>Average time left in Workforce:</b>	~20 years
<b>Employment Type</b>	Skilled Professional (e.g. Education, Medical industries)
<b>Time Post-Injury</b>	6 months
<b>Accessed traditional rehabilitation services (public, private clinics)</b>	Yes
<b>Return to Work</b>	No

Table 2. ABI Wellness RTW Client Profile