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rTMS: From the Margin to the Mainstream

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Research International

INTRO

This paper was authored by Impakt and funded by Hathaway Research. This paper was motivated by the desire for more patients suffering from treatment resistant depression to learn about and gain access to Repetitive Transcranial Magnetic Stimulation (rTMS).

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Hathaway Research

Hathaway Research International (HRI) is a Canadian high-technology research and development company specializing in investigating advanced, novel and unconventional physics, materials, electronics, communications, energy and propulsion, using custom-built apparatus and based on fundamental measurements.

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Impakt

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VividLi EFX

My name is Lisa Tarasca, I am the owner of VividLi EFX, a creative solution company. My journey to becoming a business owner - and living my dream was not an easy one. I have a history of anxiety and depression. At times, I convinced myself this would be impossible! It was only through personal growth and medical guidance that I decided I was going to pursue my passion. Before I knew it, what started out as a simple idea, soon lead to more work than I anticipated. I had a lot of questions and I didn't know where to go or who to ask. This is when I stumbled upon RISE asset development which helped me with all aspects of running a small business. With what I learned at RISE, combined with my past education and experience, I felt I had the tools I needed to make my dream a reality. This would not have been possible if not for the supportive staff, specifically Kimber K. and Mary R. You both have changed my life and I will be eternally grateful! I am here today, designing this very document because of RISE connecting me to Impakt. I want to end with saying that the smallest step forward counts! You have the power within you to make your dreams a reality. If this treatment helps just one person, it is worth every second. You can change your life in ways you never imagined. Thank you to all involved for supporting me in my journey! - L.Tarasca

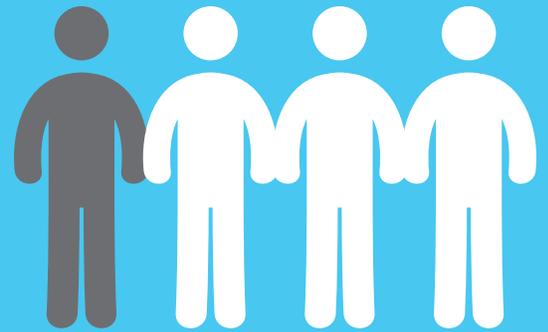
"I am weak. I am of poor character. I can't hack it. I have no courage. These were all things I thought I was personally responsible for. I thought of all of this as a deeply-embarrassing character flaw." Tate, Patient

These words and thoughts would be very familiar to the approximately 300 million people who suffer from the leading cause of disability worldwide that knows no geographical, age or socioeconomic boundaries. ¹ This disorder is depression ² and millions of patients still lack adequate and effective treatment options.

Depression inhibits people's lives, and strips them of their enjoyment and fulfillment. In Canada, it is estimated that **1 in 4 Canadians** has a degree of depression serious enough to need treatment in their lifetime. ³ Although the conversation is increasing around mental health and depression and there are more treatments being developed, there are hundreds of thousands of people in Canada who are resistant to the current most accepted treatments and are struggling to fight the disorder every day. For those who have ongoing depression, they are diagnosed with Major Depressive Disorder (MDD).⁴ **Between 30-60% of patients with MDD will be resistant** to much of the medication offered to treat depression and will have to attempt to live with the overwhelming impacts of depression. These people are often unable to hold steady jobs or stay in school, have difficulty supporting themselves and often rely on family members and all too often think about or act on thoughts of suicide. The disease costs the economy billions of dollars a year. For those with treatment-resistant depression (TRD), there are few options and little hope.

However, there is a promising treatment that is offered to patients in other countries that is largely unknown and inaccessible in Canada. **Repetitive Transcranial Magnetic Stimulation (rTMS) is a treatment option that can change the lives of these people and save the healthcare system billions of dollars.** Though there is still much to be learned about MDD and the treatment of patients with TRD, rTMS provides a promising opportunity for patients to regain their health and their lives.

1 in 4 Canadians has a degree of depression serious enough to need treatment



Between 30-60% of these Canadians will have Major Depressive Disorder



Canada



MAJOR DEPRESSIVE DISORDER

4 MILLION CANADIANS

TREATMENT RESISTANT DEPRESSION

1.2 - 2.4 MILLION CANADIANS

Alina* is a woman in her mid twenties who had been suffering from depression from the age of eight and described her depression as “completely debilitating.” She could not sleep at night, struggled to get out of bed in the morning, could not engage in activities, could not attend school and couldn’t focus on any one task without a self-critical voice in her head. She described feeling numb to everything, “I could be in an earthquake and I wouldn’t respond.” To live with Major Depressive Disorder can be crippling and detrimental. **In Canada, MDD represents twice the disease burden of heart disease and affects over 4 million Canadians in their lifetime.**⁵ The current most common treatment options for treating MDD are psychotherapy, or talk therapy, and pharmaceutical prescriptions. When a patient undergoes two or more unsuccessful courses of pharmaceuticals, they are diagnosed with treatment-resistant depression. In Canada there are approximately **1.2-2.4 million of these patients that are living consistently with depression.**

Another patient, Tate* classified his feelings of hopelessness as being at “rock bottom”; **“The thoughts of failure began to consume me. I could not concentrate. I wanted to be alone. I was tired, and I did not want to get out of bed. I thought of ending my own life, because I saw no future in my occupation and no alternatives. My mood and difficulty at work seemed permanent. I stopped exercising, and enjoying those things I was able to do away from work.”** As his depression increased in the late 90s and early 2000s, he was a lawyer recently out of law school struggling to cope with his workload. Tate also described physical symptoms including a hand tremor and difficulties with leg movement. From 2000-2007, Tate was tried on over 15 different antidepressants, none of which were successful. Tate’s depression lead to an unsuccessful suicide attempt and cost him his job.

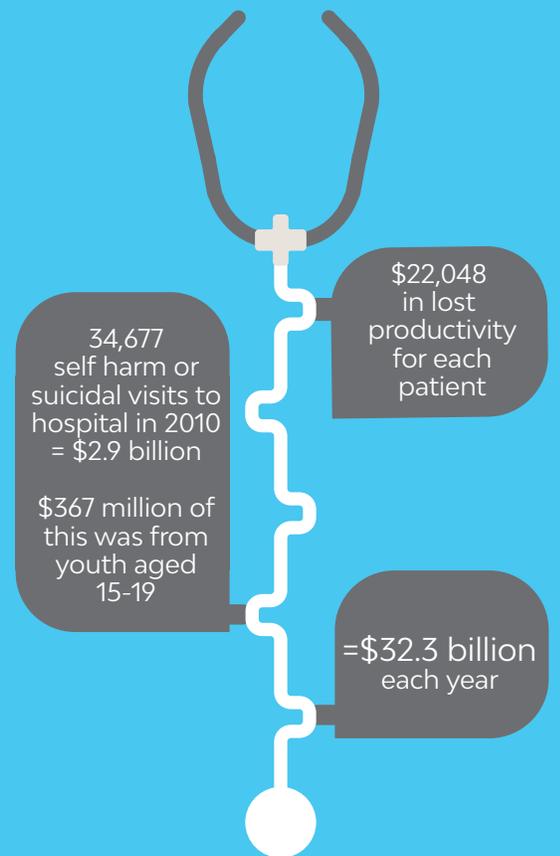
Beyond the immense personal and social effects of depression, the economic burden of the illness is extensive. There are many costs to the healthcare system, much of which come from self-harm and suicide attempts. **There were**

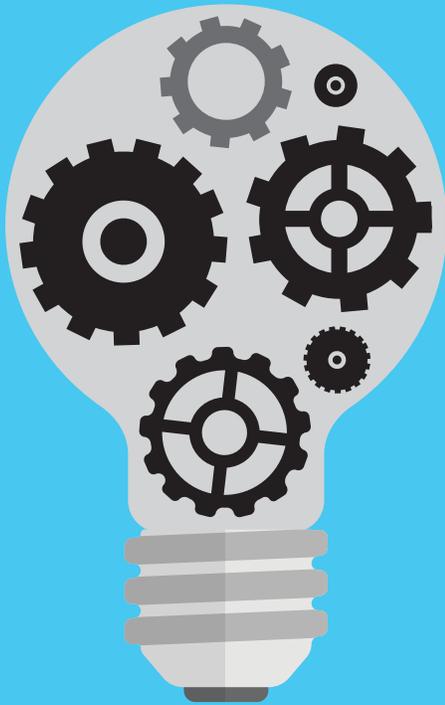


34,677 self-harm or suicidal visits to hospitals in 2010.⁵ The estimated cost due to injury from suicide or self-harm was **\$2.9 billion** CAD in Canada in 2010, **\$367 million** CAD of this was from youth aged 15-19.⁶ These numbers include only reported attempts, so numbers may be even higher. There are also undocumented costs of social welfare programs, and MDD (particularly TRD) is a large proportion of the caseload of most psychiatrists.⁴ In addition to direct healthcare costs, TRD costs an estimated **\$22,048 CAD in lost productivity** for each patient.⁷ Estimates have projected that in Canada, the economic burden is approximately **\$32.3 billion** CAD on the economy each year.⁸ Families and caregivers of people suffering from depression bear many undocumented costs for supporting their loved ones. While it is impossible to accurately quantify these costs, leaving patients untreated is thought to be more expensive than providing them with more effective treatment.

After 7 years of over 15 unsuccessful antidepressant trials, Tate began electroconvulsive therapy (ECT). The most common treatment recommendation for those with TRD is ECT, however less than 1% of those eligible for ECT will pursue treatment. ECT has proven to be a very effective treatment for TRD, saving the lives of many patients. Despite the effectiveness of this treatment, it has significant potential side effects,⁹ is arduous and there is notable stigma surrounding it.

Tate, who has undergone over 100 ECT treatments, described the process as "very difficult". Waking up from the treatment was very hard, "you don't know where you are, what day it is, why you're in hospital, and someone in the recovery room keeps saying 'breathe, breathe, breathe.'" After over 100 treatments, Tate has lost part of his visual memory. Despite this, ECT was effective for Tate and helped him manage his depression the majority of the time. However, ECT is an expensive treatment option to the healthcare system, combining equipment, clinic or hospital space, anaesthetic and the team of professionals administering the treatment. Due to the stigma, side effects and cost to the healthcare system, not enough patients are accessing ECT treatment.





Despite the fact that healthcare providers are continuing to learn more about depression and the best ways to treat it, many questions still remain about the best ways to treat the disorder. Almost every case of depression is unique and requires a different treatment combination. More treatment options are needed for TRD, especially for those who are unwilling to pursue ECT. However, there is hope. While conducting her own research on treatments for depression, Alina discovered a promising treatment that is widely available in other countries and has had transformational effects for patients.

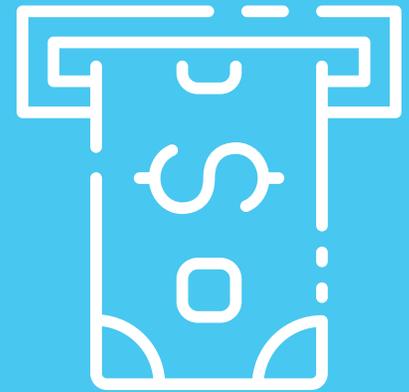
Repetitive Transcranial Magnetic Stimulation (rTMS) is a treatment for major depression and other psychiatric and neurological disorders. rTMS uses focused magnetic field pulses to directly stimulate a targeted brain region that is either underactive or overactive to return this area to healthy patterns of activity.¹⁰ rTMS does not require anaesthetic or an acute care admission and does not induce a seizure. There are almost no significant side effects with rTMS treatment, with a possibility of a seizure in less than 1 in 10,000 patients (which is lower than the risk with many antidepressants).¹⁰ Tate was recommended for rTMS therapy in 2011. He described the process of rTMS treatment; “You arrive at the rTMS clinic and sit down in a comfy chair. The assistant wheels out what looks like dentist light, rests it against the side of your head and starts the machine. You hear a loud click and it feels like someone is dropping a medium weight pin drop against your head; it’s not painful just a tapping.” For the correct coil placement, most patients have to wear a cap. Tate said with a laugh, “the cap makes you look like a fool. The worst part of the treatment is probably that ugly cap.”¹¹ rTMS treatment for depression is approved by the US Food and Drug Administration (FDA) and covered by many US insurers, and is also widely available to patients across Europe.¹² Health Canada approved rTMS treatment in 2002, however it is only publically covered in Quebec and Saskatchewan.¹³

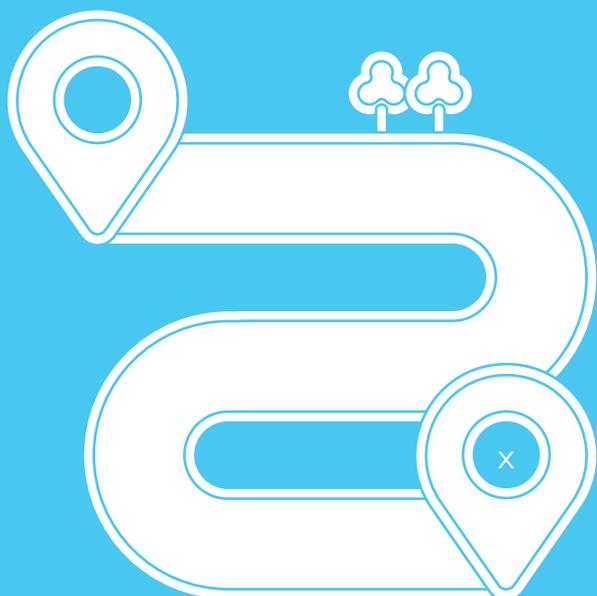


The once unimaginable recovery from their previously treatment-resistant depression leaves patients astounded and transformed. When the rTMS treatment started to work for Alina, she almost couldn't believe it, "I thought, 'Is this really happening? Is this really it?' And it just kept getting better. As time went on, I just felt myself becoming me again." She described becoming more engaged with life, and more interested in activities, more curious, more interested in learning. For Alina, "It really gave me back my life and my will to live." Tate had a similar overwhelmingly positive experience with rTMS, which has now worked for him for over 7 years.¹⁴ Since starting rTMS, he has lost over 30lbs, became active in sports again, socialized more, built more friendships and is back in a very successful career. According to Tate, "If you asked me in 2010 if I would lead the happy productive life I lead today? I would have said there was a 90% chance I would not. But here I am." On top of the psychological benefits to recovery from TRD, patients will avoid emergency room visits and hospital admissions and be able to return to the workforce. With rTMS treatment, people like Alina and Tate are able to gain back their independence, their enjoyment and their lives.

There are still barriers preventing patients suffering from TRD from accessing rTMS. However, for each of these barriers there are promising solutions as the treatment and associated technology advances

As previously noted, costs for rTMS are only covered publically in Quebec and Saskatchewan. There are several private clinics across the country offering rTMS, elsewhere treatment is only available through clinical trials, which many patients have to wait months to get into. [More public funding to support this promising treatment would allow for more centres to offer this treatment to more patients.](#) Due to the lack of public coverage, for healthcare providers and the healthcare system, the most common rTMS treatments are still cost restrictive, requiring a significant initial investment of approximately \$80,000 for the machine. And given the commonplace practice of 37 minute treatment, there are not many patients that can be seen every day.¹⁵





In May 2018, LANCET published possibly the largest ever brain stimulation trial, which compared the common treatment that lasts 37.5 minutes per session to a recent “theta burst” treatment that can be completed in 3 minutes. This study showed that there are insignificant differences in the outcomes of the treatments, and **the three-minute treatment can be as effective while greatly reducing the time.**¹⁶ Most Existing rTMS machines can be reset to administer this burst treatment. This advancement directly improves the accessibility and cost-effectiveness of rTMS. In addition, the cost barriers of rTMS have not been conclusive, as some studies show it is less costly than ECT treatment and some show it is more costly.¹⁸ Again, **more public funding would help cover the costs of the equipment and the associated treatment costs.**

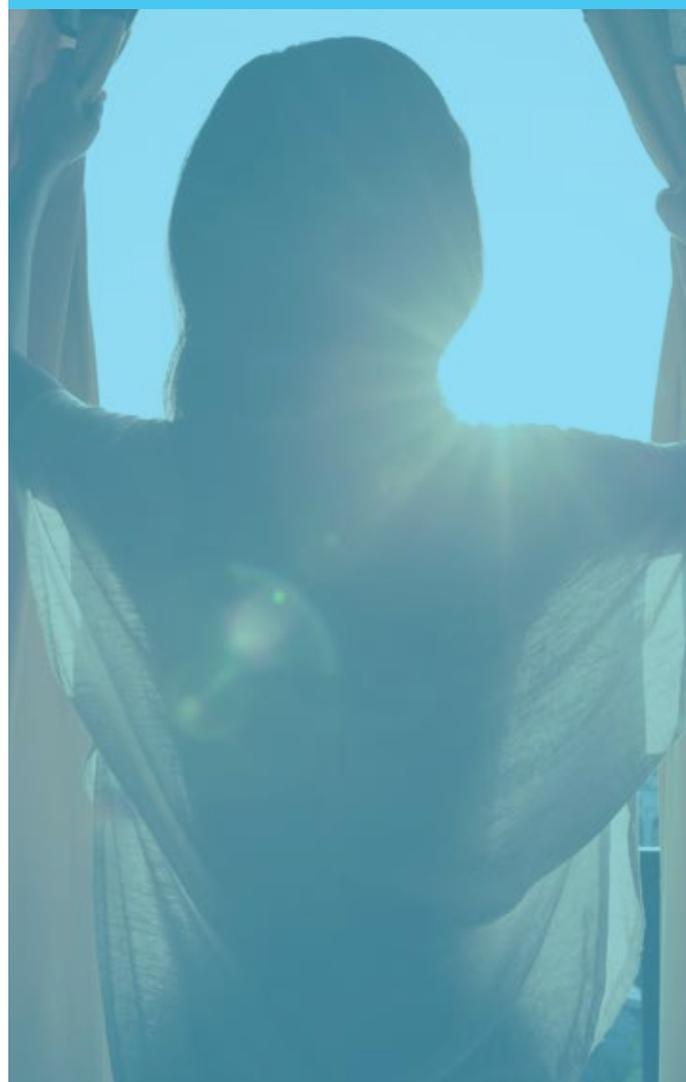
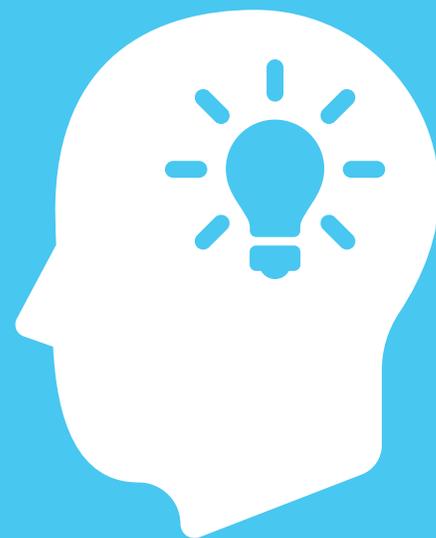
Due to the lack of public funding resulting in limited centres offering rTMS clinical trials, the geographic availability of the treatment is restricted for patients. Additionally, the initial commonplace course of rTMS requires patients to come in every day for treatment for 4-6 weeks. This acts as a barrier for patients who are not able to schedule this into their days, or who struggle with committing to a daily schedule. However, **technology is being explored to create smaller, portable rTMS machines that would allow patients to receive the treatment in their own homes as well as technology that shortens the length of initial treatment.**

Another barrier is the general lack of knowledge among the healthcare community, especially those who would refer patients to rTMS treatment such as GPs or psychologists and therapists. rTMS has been explored for over 25 years, and the optimal treatment process and science is still under investigation.¹⁹ Many of these healthcare providers may be relying on out-dated information regarding the efficacy and availability of rTMS. The majority of patients who are pursuing rTMS treatment are finding out about it on their own, from online searches or reading it in the media. **Ensuring more patients and mental health professionals know about this treatment and its recent advances is important.** rTMS has begun to be profiled in the media and science journals more, but more is still needed.



rTMS is successful for approximately 60% of patients who undergo the treatment. Approximately one third experience a remission of their symptoms, one third experience a reduction, and one third do not have any perceptible changes. This leaves room for the efficacy rates of the treatment to be improved. To address this barrier, there is **technology being developed that promises to increase the effectiveness of the treatment to close to 90%.**²⁰ rTMS is undergoing experimental trials to treat other psychiatric and neurological disorders, including bipolar disorder, obsessive compulsive disorder, schizophrenia, autism spectrum disorder, posttraumatic stress disorder and eating disorders. As there are more trials, the treatment will improve in effectiveness and accuracy.

Even though there is still much to learn about how to improve treatment for patients with MDD and TRD, **experts consulted in this study believe that rTMS could and should be considered now as an option on the care pathway of millions of people suffering from depression across Canada.** They believe that the technology will continue to advance to increase effectiveness and efficiency, and that rTMS has the ability to save the lives of thousands of Canadians. For Alina, it was a surprise to note that this treatment was not more accessible, “I just couldn’t believe this wasn’t available to more people. Medication is right there and it has all these side effects. And with them I felt no change.” In her words, **“The country is missing out so much by not making this treatment available. To me it is a necessity. Do you want to exist or do you want to live?”** Every patient deserves the chance to benefit from rTMS treatment and recover.



FOOTNOTES

1 WHO, 2018

2 Depression is a mood disorder characterized by feelings of sadness, worthlessness, hopelessness, guilt, anxiety, irritability and anger, a loss of interest in enjoyable activities, a withdrawal from others, and can have effects on concentration, learning, decision-making and education or employment. It can also affect the way people eat and sleep and lead to other physical health problems (Canadian Mental Health Association, Online)

3 Ontario Ministry of Health and Long-Term Care, 2015

4 When depression lasts for two or more episodes of depressed mood that last for a period of two weeks or longer, "and is accompanied by clinically significant impairment in everyday function, work and social interactions and has a high relapse rate, often resulting in long-term psychosocial impairment and distress, loss of productivity, and suicide," it is classified as Major Depressive Disorder (Leggett et al., 2014)

5 Leggett et. al, 2014

*names have been changed for privacy

6 Parachute, 2015

7 Alberta Health Services, 2017

8 Conference Board, 2016

9 These include potential partial memory loss and impacts on cognition. Immediately following treatment patients can experience potential confusion, nausea, headache, jaw pain or muscle ache, as well as any potential side effects from the anesthetic (Mayo Clinic Online)

10 UHN rTMS Clinic, Online

11 Not all treatments require a cap, Alina was not required to wear a cap for her treatment

12 Blumberger et al. 2018

13 Health Quality Ontario, 2016

14 Tate goes back every few months for maintenance treatment

15 Alberta Health Services, 2017

16 Blumberger et al., 2018

17 Alberta Health Services, 2017

18 Health Quality Ontario, 2016

19 Science Direct

20 NeuroQore. <http://www.neuroqore.com/>

Additional Resources

To learn more about rTMS or to explore this treatment, you may refer to any of the following.

Treatment Providers:

[UHN rTMS Clinic/ Altum Health](#) - Toronto

[CAMH](#) - Toronto

[The Royal](#) - Ottawa

[NINET Lab](#) - Vancouver

[Mood Disorders Association of British Columbia](#) - Vancouver

[Douglas Mental Health University Institute](#) - Montreal

Non-profits:

[National Institute of Mental Health](#)

[Brain Canada](#)

[Ontario Brain Institute](#)

[Mood Disorder Society of Canada](#)

Other nonprofits: Mood Disorder Society of Ontario, Canadian Mental Health Association, Mental Health Commission of Canada, Canadian Alliance on Mental Illness and Mental Health, Partners for Mental Health, National Network for Mental Health, Youth Mental Health Canada

Branch Out Foundation

Manufacturers:

[NeuroQore](#) (Canada)

Internationally: Medtronic (Denmark), Magandmore (Germany), Neuronetics (USA), Brainsway (Israel), Magstim (Britain), Neurosoft (Russia)

RESOURCES

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http://www.conferenceboard.ca/press/newsrelease/16-09-01/unmet_mental_health_care_needs_costing_canadian_economy_billions.aspx

WHO. Depression. 2018. (<http://www.who.int/news-room/fact-sheets/detail/depression>)

UHN rTMS Clinic. The rTMS Clinic at University Health Network. (<http://www.rtmsclinic.ca>)