

Expression of Interest:

Addressing Chronic Pain in the era of connectivity using the FLOW principles: Early access to a multidimensional approach in curtailing the debilitating disease of chronic pain.

Why CHANGEpain Clinic and why now?

We are one of few College of Physician and Surgeons of British Columbia (CPSBC) accredited interdisciplinary facility focused on evidence-based pain management and rehabilitation; the largest of its kind west of Ontario.

CHANGEpain Clinic (CPC) has been running since 2013 and we've seen more than **36,000 new patients over 450,000 episodes of care**. Our team has rapidly evolved into more than 60 members from diverse academic and societal background consisting of 14 physicians and 21 allied health clinicians.

Since 2020, we've evolved multiple services to an online platform. CHANGEpain's health and pain care impact are realized through a combination of the online and in-person care that leverages our emerging knowledge of the role of functional connectivity in the regulation of the pain experience. The various access points make early access to a multi-dimensional approach a reality. The integrated aspects of this is missing in our current healthcare systems.

The Problem

The current British Columbia Chronic Pain Patient population is around 1 million of patients (20%) as of 2022. Recent statistics published by WorkSafeBC and ICBC show that just through work and motor vehicle based injuries alone, annually around **124,000** patients are injured and are at risk to develop chronic pain.

Chronic pain is intersectional to many other problems affecting the province:

- 1- Almost a million B.C. residents have no family doctors; this means 1 out of 5 B.C. residents have no access to coordinated, personalized attention by a primary care provider.
- 2- B.C.'s overdose crisis saw the highest number of deaths ever recorded in May 2022. The intersectionality between chronic pain and the opioid crisis has been widely studied.
- 3- Chronic pain has a tremendous cost impact on the economy. Calculations via the 2021 Health Canada National Taskforce Pain Report suggest that **\$38.2 to 40.3 billion** are the direct cost of chronic pain (e.g., Physician's service, prescription drugs and hospital attention).
- 4- In 2021, CPSBC regulations caused over 70% of pain services to close due to their rigour.
- 5- Healthcare worker shortage exacerbates all the above issues. This problem is increasing with retirement and burnout. The problems listed above represent those experienced across the world.

The Background

Pain processing is complex and the prefrontal cortex plays a significant role. A 3-year longitudinal study of subacute back pain patients indicates that greater functional connections between the dorsal medial prefrontal cortex (mPFC) and Amygdala-accumbens circuit contributes to risk of chronic pain. It has been suggested that changes in the brain reward pathway could have an impact on the proclivity for depression and suicide, in patients with chronic pain. (1)

The attached Ong paper is helpful to summarize core neuroimmune mechanisms of the chronification of pain. For example, stimulation of the left DLPFC in healthy subjects is found to exert a bilateral control on pain system. Antinociceptive effect of increased mPFC activity that is induced by BDNF. Proinflammatory mediators (e.g. cytokines) and activation of microglia and astrocytes could be responsible for the structural, functional, and molecular neuroplasticity changes observed in supraspinal structures, associated with pathological pain. Continually increased neuronal activity because of untreated pain could lead to neuroinflammation, and loss of neuronal processes in the mPFC, resulting in decreased modulation of pain. Early life exposure to pain might predispose to later pain. This could occur through long-term changes in brain opioid receptors in the PFC and PAG and may involve the gut microbiota and glial cells. Activation of the PFC or M1 with non-invasive strategy that could have the potential to relieve chronic pain. Hence activation needs to be individualized and examples of this combination included movement rehab, microbiome support, glial cell modulators, mindfulness, CBT, meditation, and music (2)

Greater dorsolateral PFC activation (anticipation of negative images minus anticipation of positive images) was associated with lower PTSD symptom severity and better visuomotor processing speed and executive functioning.

Flow states are complex and triggering them involves a balance between skills and challenge. At the neuroscience level, this means the stimulation of DLPFC supports flow (3)

Pain therapies is as much the external as the internal. Setting appropriate expectations, priming, changing mindset to growth are some learnings from flow that can be applied to enhance the outcomes of any pain therapy.

Robinson et al. presented a work with 30 chronic pain participants in which the experience of a group of patients was analyzed through data collection using a handheld palm device through electronic diary and early assessment. The study found a trend in lower pain intensity while in flow; a relationship between pain intensity and flow was demonstrated, it would support interventions that identify and facilitate engagement in specific activities that are likely to lead to flow experiences. (4)

Even though, Robinson's study was focused on non-pharmacological approach, Rebecca Dale and Brett Stacey explain how most patients go through what would be called a «*multi-modal*» approach as, it is unusual for a single medication to result in satisfactory pain relief in a unimodal, stand-alone fashion. Therefore, combination pharmacologic treatment is an important aspect of multimodal chronic pain management. (5)

Proposal is that early access to multi-dimensional approach and compliance induced mechanisms like setting expectation, coaching, accountability, physical /procedural therapies, trust in practitioners would reverse the chronic pain-induced changes in the PFC and increase grey matter and functional connectivity.

it has been suggested that cognitive brain networks may be exploited for the treatment of chronic pain. Early access is key to prevent aberrant plasticity from occurring in the CNS. (6)

This study builds on the need to examine the breadth and medium of multi-dimensional interventions that effectively address the many mechanisms involved in the chronification of pain. These include utilizing nutraceuticals, physical and mental exercise, intermittent fasting, or other strategies to strengthen PFC function. Together with social support, cognitive behavioral therapy, and other measures to improve the functioning of the brain reward pathway, the mixed methods of online content, with facilitated group medical visits for a social support and knowledge coach in addition to timely access to layered whole person pain and rehab approach with trusted expert providers has the potential to take advantage of our emerging knowledge of the role of functional connectivity in the regulation of pain experience.

The proposal

CHANGE Pain's experience as a chronic pain provider, has gathered enough evidence to understand through 30,908 encounters of care (EOC) delivered in 2020 and 2021 respectively, It's clear to us that the effects of a layered care, whole person, mixed method *multi-dimensional therapies* to treat chronic pain needs to be studied, and measured for both effectiveness and sustainability.

It's clear that purely online, medication, psychological, physical, or procedural are insufficient on their own.

It's clear that entrenched mindsets or gaps in health behaviours are exacerbated after injury due to impact on deconditioning, emotional fragility, or lack of intrinsic motivating factors.

This is then, a prospective study to analyze the experience, activation through early intervention of a fixed number of 100 'naïve' patients (no other intervention used before), to gather the information using the minimum data initiative parameters, contributing to the Canadian adult pain registry and at the same time, increasing access to a pain clinic for patients.

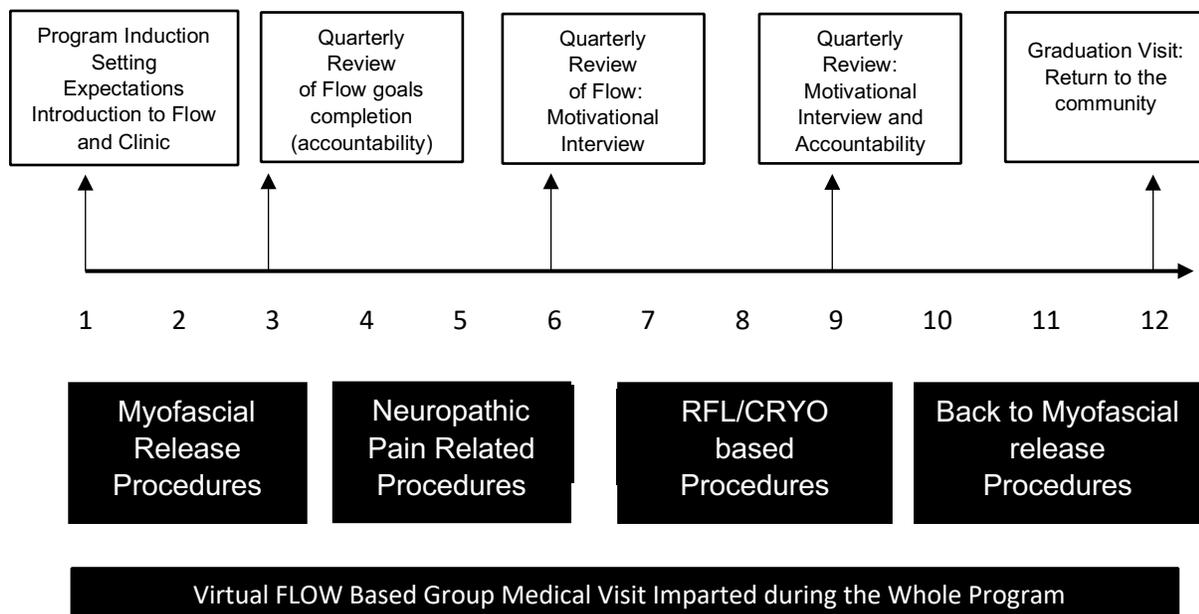
We propose that imbedding the conditions for FLOW will be beneficial for chronic pain patients in optimizing the outcomes of standard therapies. Studies like the one presented by *Peifer et al.* suggests that "*most of the research was conducted with (young) adults; there is a lack of flow research on children as well as adolescent and elderly populations. In general, there is a need for studies testing more complex models to understand multiple relations between variables*". (5-7)

This is an opportunity to gather more evidence of FLOW in a complex, heterogenous chronic pain population in the center of Vancouver, Canada. These findings have broad application to all chronic pain patients. (8)

The methodology

100 Naïve to treatment patients would be enrolled into a one year program. The program would involve [1] Early access to a multidisciplinary pain clinic [2] A FLOW-focused intervention using virtual group medical visits at least on a bi-weekly basis [3] Pain Intervention procedures [4] Monthly assessment by a flow-certified pain physician.

Patients would go through quarterly monthly reviews using standardized questionnaires to screen for pain interference, pain interference, anxiety, and major depressive disorder. Patients who after two quarters have NOT experienced at least an improvement on their Brief Pain Inventory of 20%, would be reassessed to consider other types of infusion or radio-frequency lesioning therapy.



Long term goals: commercialization of online content

Studies like these are needed to examine real life imperfect conditions of practice-based evidence. Early access to multi-dimensional care previously known as biopsychosocial model of care does not exist for most injured patients. Hence the chronification of pain is a natural negative outcome of delayed, fragmented standard medical and unconventional therapies.

Knowledge to support the content developed for the activation of PFC and other core neural networks in the anti-nociception and down regulation of exacerbated pain signalling, emotional uncoupling is key to developing an effective brain health training platform that supports prevention and early intervention.

We envision this platform would also act as a network to link providers who do not have access to an interdisciplinary team or have limited resources to support patients long-term using a neuroscience approach to brain health which leads to body health, social health, mental health and functional health in general.

Key stakeholders

Flow research collective CHANGEpain

clinic

Simon Fraser University

BC Ministry of Health

References

- 1- Aupperle et al. Dorsolateral prefrontal cortex activation during emotional anticipation and neuropsychological performance in post-traumatic stress disorder. *Arch Gen Psych.* 2012;69(4);360-371
- 2- Ong WY et al. Role of the Prefrontal Cortex in Pain processing. *Mol. Neuro.* 2019;56;1137-1166
- 3- Gold J, Ciorciari J. A Transcranial Stimulation Intervention to Support Flow State Induction. *Front Hum Neurosci.* 2019 Aug 8;13:274. doi: 10.3389/fnhum.2019.00274. PMID: 31440152; PMCID: PMC6694760.
- 4- Robinson ME, Brown JL, George SZ, Edwards PS, Atchison JW, Hirsh AT, Waxenberg LB, Wittmer V, Fillingim RB. Multidimensional success criteria and expectations for treatment of chronic pain: the patient perspective. *Pain Med.* 2005 Sep-Oct;6(5):336-45. doi: 10.1111/j.1526-4637.2005.00059.x. PMID: 16266354.
- 5- Dale R, Stacey B. Multimodal Treatment of Chronic Pain. *Med Clin North Am.* 2016 Jan;100(1):55-64. doi: 10.1016/j.mcna.2015.08.012. Epub 2015 Oct 17. PMID: 26614719.
- 6- Gold J et al. A review on the Role of the Neuroscience of Flow States in the Modern World. *Beh Sci.* July 2020 10: 137
- 7- Peifer C, Wolters G, Harmat L, Heutte J, Tan J, Freire T, Tavares D, Fonte C, Andersen FO, van den Hout J, Šimleša M, Pola L, Ceja L, Triberti S. A Scoping Review of Flow Research. *Front Psychol.* 2022 Apr 7;13:815665. doi: 10.3389/fpsyg.2022.815665. PMID: 35465560; PMCID: PMC9022035.
- 8- Canada H. Canadian Pain Task Force Report: March 2021 [Internet]. 2021 [cited 2021 Jun 17]. Available from: <https://www.canada.ca/en/health-canada/corporate/abouthealth-canada/public-engagement/external-advisory-bodies/canadian-pain-taskforce/report-2021.html>