Exercise & Sport for Recovery after Moderate-Severe Traumatic Brain Injury

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Outline of Presentation

Insider Knowledge

Severe traumatic brain injury (TBI)
Rehabilitation process after severe TBI

Impact of Moderate-Severe TBI

Incidence and burden of moderate-severe TBI
Cognitive & psychosocial impairments of TBI

Exercise after Moderate-Severe Traumatic Brain Injury

Benefits of exercise after TBI
Investigations about exercise after TBI

Current Multidisciplinary Research Program

Community-based physical activity programs
My current research in this area

Definition: Traumatic Brain Injury

- TBI is an injury to the head (craniocerebral trauma) with at least one of the following:
  - Alterations of consciousness or amnesia,
  - Neurologic or neuropsychological changes,
  - Skull fracture or intracranial lesions,
  - Death that results from the injury (WHO, 1996).

- NTBI (non traumatic brain injury)
  - Brain injury that is not caused by external forces to head
  - May be caused by a stroke or meningitis for example

Severities of TBI

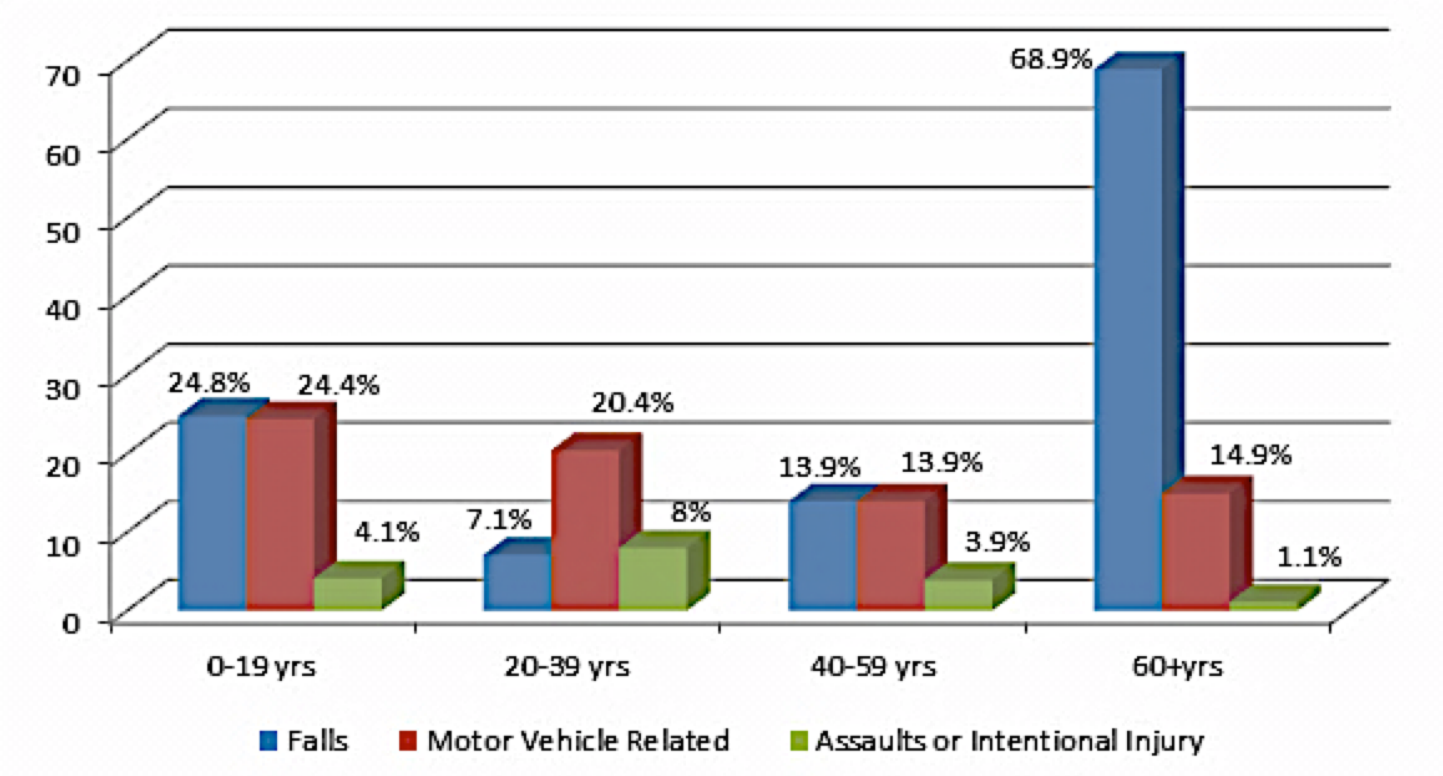
- Severity after TBI is typically measured with the Glasgow Coma Scale (GCS) immediately after injury:
  - Mild 13-15
  - Moderate 9-12
  - Severe ≤8 (Silver, McAllister, & Arcienegas, 2018).

- Approximately 80% of cases worldwide are classified as a mild TBI (mTBI) and remaining 20% is divided evenly between moderate and severe TBI.

Incidence of TBI

- In Canada, TBI is the number one cause of disability for people under the age of 45 (PHAC, 2018).
- The Centers for Disease Control and Prevention (2019) reported approximately 2.87 million TBI-related emergency department visits, hospitalizations, and deaths in the U.S.A. in 2014.
- TBI is considered a leading cause of long-term disability around the world (Dewan et al. 2018).

Etiology of TBI in Canada



- Causes of TBI in Canada 2003-2004 (Canadian Institute for Health Information, 2007)

Cognitive Impact of TBI

- Most common deficits after moderate and severe TBI are cognitive and include difficulties related to
  - Attention
  - Memory
  - Executive functions, and
  - Processing speed (Dikmen et al., 2009).

- Cognitive impairment is present up to ten years after TBI and is more common with moderate and severe cases

  (Colantonio et al., 2004; Draper & Ponsford, 2008).

Psychological Impact of TBI

- The leading psychiatric condition related to moderate-severe TBI is major depressive disorder, linked with
  - Poor functioning,
  - Reduced quality of life,
  - Increased impairment, and
  - Injury related disability

    (Hibbard et al., 2004; Pagulayan, Hoffman, Temkin, Machamer & Dikmen, 2008; Diaz et al., 2012).

- Depression, related difficulties and poor psychosocial functioning may persist for up to 10-20 years after moderate-severe TBI

  (Hoofien, Gilboa, Vakil, & Donovick, 2001; Draper, Ponsford, & Schönberger, 2007).

Societal Impact of TBI

- Behaviour difficulties associated with moderate-severe TBI negatively impact social and functional life

  (Fitzgerald, Carton, O'keeffe, Coen, & Dockree, 2012).

- Social consequences post-TBI are in excess of what pre-TBI characteristics account for (Temkin, Corrigan, Dikmen, & Machamer, 2009).

- Moderate-severe TBI survivors have increased rates of health service use for up to 10 years use when compared to non-injured controls (Cameron, Purdie, Kliewer, & McClure, 2008).

Physical Impact of TBI

- Physical therapy and aerobic training improve sub-maximal ambulatory efficiency after moderate-severe TBI – exercise is an essential part of rehabilitation

  (Mossberg, Orlander, & Norcross, 2008).

- After rehabilitation, individuals remain significantly less physically conditioned than healthy, sedentary, age, and sex matched controls

  (Mossberg, Ayala, Baker, Heard, & Masel, 2007).

Exercise after TBI

- Cardiorespiratory exercise is recommended for the specific alleviation of TBI-related sequelae (Archer et al., 2012).

- Exercise after moderate-severe TBI leads to upregulation of…
  - Brain Derived Neurotropic Factor, as well as
  - Related Proteins associated with Neuroplasticity and Anti-Apoptosis (Griesbach et al., 2009).

Cognitive Benefits of Exercise

- Literature supports the use of exercise to enhance neurocognitive functioning after moderate to severe TBI

  (Fogelman & Zafonte, 2012).

- Cardiorespiratory exercise is shown to be particularly effective for after moderate to severe TBI in the chronic phases of the recovery

  (Vanderbeken & Kerckhof, 2017).

Psychological Benefits of Exercise

- Exercise was shown to alleviate depression after TBI and increase positive mood states (Driver & Ede, 2009).
- Exercise is consistently shown to reduce depressive symptoms after TBI (Perry, Coetzer, & Saville, 2017).
- Exercise is the preferred method of treating depression for individuals with TBI (Fann et al., 2009).

Social Benefits

- Positive exercise maintenance after moderate-severe TBI is associated with improved mood, sleep, participation, and quality of life

  (Hoffman et al., 2010; Wise et al., 2012).

- Exercise and sport programs for military personnel who sustained TBI assist with the emotional adaptation process in the community

  (Peacock et al., 2018).

Gap in the Literature

- Driver, Ede, Dodd, Stevens, and Warren (2012) identified barriers to PA for individuals who recently suffered a TBI in rehabilitation.
- Self, Driver, Stevens, and Warren (2013) explored the subjective experience of PA following TBI in a comprehensive rehabilitation setting.
- There was a need to explore exercise experiences in the post-rehabilitation time period…

Subjective Experiences

Interpretative phenomenological analysis of exercise after severe TBI (Quilico, Harvey, Caron, & Bloom, 2020).

- Impact of TBI and Personal Development after TBI
  - TBI had a life-altering impact on the participants who discussed changes in abilities, self-perceptions after TBI, post-injury awareness, and acceptance of TBI impairments
- Facilitators and Barriers to Exercise
  - The men spoke about exercise barriers that were predominantly related to the TBI and discussed factors that helped them overcome these challenges.
- Exercise after TBI
  - They felt that exercise helped them to engage in meaningful activity and was a self-reported method of improving their TBI-related impairments, many years after injury.
  - *The participants established a pressing need for exercise support in the post-rehabilitation time frame.*

Community-Based Exercise and Health Programs

- Devine and colleagues (2016) people in recovery from moderate-to-severe TBI can, with minimal guidance, perform vigorous, community-based exercise.

- Driver, Reynolds, and Kramer (2017) showed that partnering with stakeholders (e.g., people with TBI) is effective to modify a health promotion program for individuals with TBI.

- Driver and colleagues (2018) demonstrated high adherence and significant changes in weight for individuals with TBI who participate in that health promotion program program.

Social Sciences and Humanities Research Council of Canada

Conseil de recherches en sciences humaines du Canada

Canada

SIRC

Les YMCA du Québec

AQTC Association québécoise des traumatisés crâniens

AQLPH Association québécoise pour le loisir des personnes handicapées

société inclusive

Co-creating, implementing, and evaluating a community-based peer-run physical activity program to enhance exercise and sport participation for adults with moderate to severe traumatic brain injury

Mr. Enrico Quilico, University of Toronto (Ph.D. student)

Dr. Angela Colantonio, University of Toronto (supervisor)

Dr. Bonnie Swaine, University of Montreal (co-supervisor)

Dr. Shane Sweet & Dr. Lindsay Duncan, McGill University

& Dr. Shawn Wilkinson, Concordia University (co-investigators)

University of Toronto

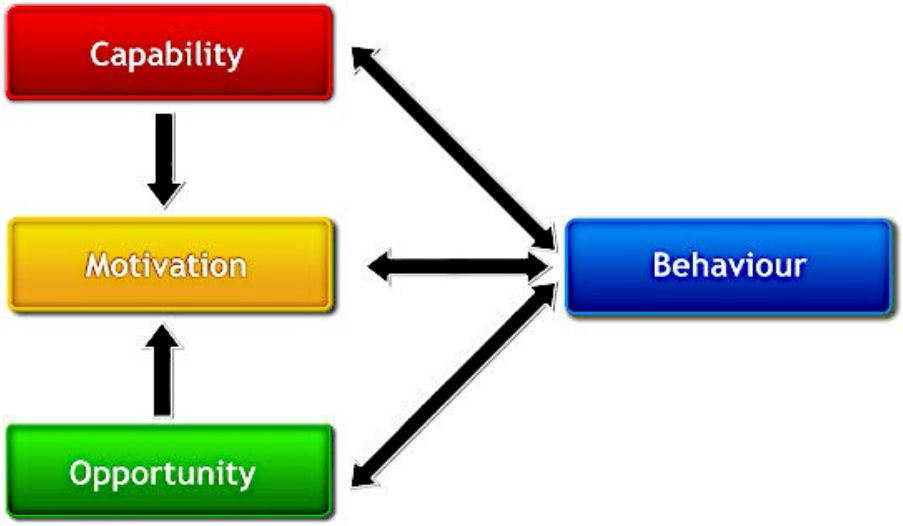
McGill

Université Concordia University

Université de Montréal

Strategies related to the COM-B Behaviour Change Model

(Michie, Atkins, & West, 2014)



- **Physical & Psychological Capacity**
  - The skills, strength, and endurance
- **Physical & Social Opportunity**
  - The environment and interpersonal influences
- **Reflective and Automatic Motivation**
  - The plans, evaluations, and emotional reactions

Strategies Related to Self-Determination Theory (Ryan & Deci, 2000)

- **Autonomy –** feeling in control of the choice
  - Example: encouraging participants to choose
- **Competence –** feeling able to complete the action
  - Example: providing necessary support for training
- **Relatedness** – feeling connected to others
  - Example: making sure participants feel appreciated

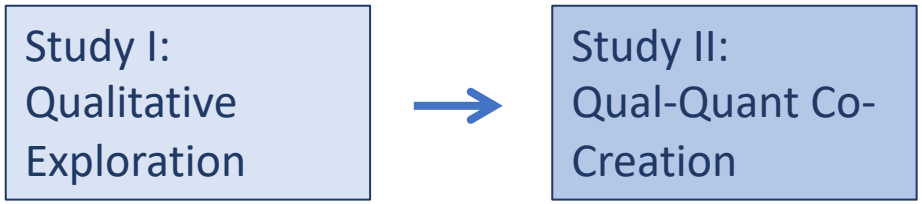
Objective of Study One in 2018

Study I:
Qualitative
Exploration

Exploration at the end of the 2018 program to understand what is positive, negative, and needs to be improved

- With particular attention to the participants, mentors, and administrators involved with the program…
- As well as sex and gender related preferences.

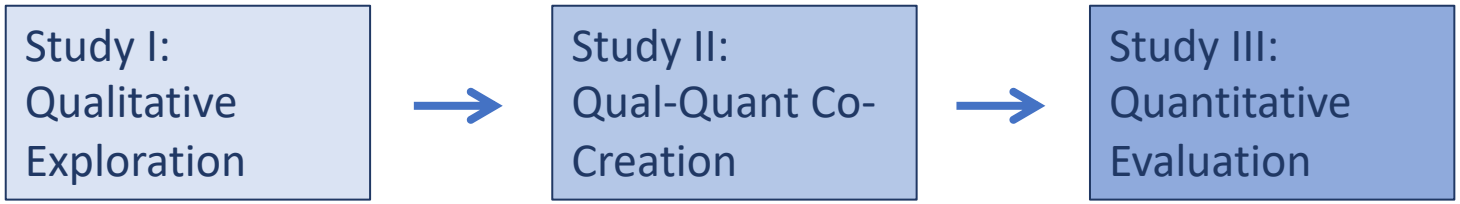
Objective of Study Two in 2019



Co-creation of the program's manual (formal protocols) and development the program's logic model

- Through a participatory approach with all the program partners, including the…
- Participants, mentors, organizations and researchers.

Objective of Study Three in 2020



Evaluation of the program through a feasibility study with new cohort in 2020 and a number of standardized measures

- In order to determine the impact and acceptability of the program, as much for the YMCA as the…
- Participants who are living with moderate-severe TBI.

Future of Program and Value of Partnering with Community Members

- The final outcome of this research is intended to be a financed program and adjunct form of care in rehab continuum…
- So that individuals with moderate-severe TBI may benefit from long-term Sport & PA outside of the clinical setting.
- In addition, the value of of partnering with individuals who live in the community with disabilities…
- Involves providing opportunities for
  - Individual and group empowerment
  - Professionalizing experiences
  - Financial compensation.

The process is incredibly rewarding for everyone involved.

Impact of Pandemic and Adapting to our Future Realities

- Purpose: Run a needs analysis on the post-program and pandemic impacts on participants by asking…
  - What are the lasting outcomes of a community-based peer-assisted PA program for adults with M-S TBI?
  - How did COVID-19 affect their ability to maintain PA behaviours from the program?
  - What kinds of supports would allow them to continue participating in PA under the current circumstances?
- Anticipated findings of study will help modify the PA program to meet the changing needs of our society…
  - Maintain physical distancing measures in a gym setting
  - Provide remote online/virtual formats in the form of
  - An additional module to the existing program

Thank You

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