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
  
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-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.
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

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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)
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

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

Study I: Qualitative Exploration

Study II: Qual-Quant Co-Creation

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

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.

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

Study I: Qualitative Exploration

Study II: Qual-Quant Co-Creation

Study III: Quantitative Evaluation
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 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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