# Physical activity in the management of mild Traumatic Brain Injury, where are we at? A scoping review


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## INTRODUCTION

- Clinical experts of an interdisciplinary traumatic brain injury (TBI) program wish to improve their use of physical activity (PA) in the management of individuals with persisting symptoms of mild TBI (mTBI).
- Recommendations from clinical practice guidelines lack specific information about how PA-based interventions should be delivered.
- Important PA intervention characteristics such as frequency, intensity, time, type of exercise and progression patterns, for example, are missing.
- Summarizing the different approaches and characteristics of PA-based interventions for individuals with mTBI could support clinical experts' decision-making about how to best use PA, and promote evidence-informed practice.

## OBJECTIVES

1. Identify characteristics of PA-based interventions available in the scientific literature designed to improve health-related outcomes in adults with persistent symptoms of a mTBI.
2. Report on the intervention's effectiveness, if available.
3. Document the health-related outcomes of the interventions.

## METHODS

***Scoping review using the 6-step iterative enhanced framework of Arksey and O'Malley (2010):***

**Step 1** Involvement of clinicians to define the research question
*What are the characteristics and health-related outcomes of physical activity interventions designed for individuals with mTBI?*

***N.B.*** PA is defined as *''Any form of body movement that has a significant metabolic demand. It includes training for and participation in athletic competitions, the performance of strenuous occupations, doing household chores, and non-sporting leisure activities that involve physical effort.''*

**Step 2** Five databases used to identify studies (MEDLINE, CINAHL, PsycINFO, SPORTDiscuss and EMBASE)

**Step 3** Two independent reviewers selected studies
Excellent inter-rater reliability (Kappa (κ) κ>.75) for abstract and title review, and full-text review

**Step 4** Extraction form created based on the 12-item *Template for Intervention Description and Replication checklist* (TIDieR) and the 16-item *Consensus on Exercise Reporting Template checklist* (CERT)
Validation of the extraction form by clinical experts

**Step 5** Quantitative and qualitative analyses reported in graphs and tables

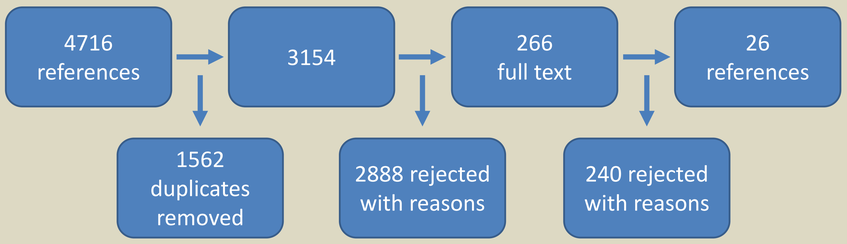
**Step 6** Consultations with clinical experts to improve clinical relevance of results and to determine best ways to mobilize knowledge generated by the review

**Inclusion Criteria / Exclusion Criteria**

| | |
|---|---|
| **Population** | ▪ Individuals of all ages;<br>▪ At least one study participant sustained a mTBI. |
| **Intervention** | ▪ Reports on a PA-based intervention, provided in any setting (e.g. in- or out-patient rehabilitation or community);<br>▪ Intervention may target persons with all types of injury severity, but must be pertinent for mTBI. |
| **Outcomes** | ▪ Designed to impact health-related (physical, mental, psychosocial) outcomes or participation. |
| **Design** | ▪ Opinion articles, posters, oral presentations, and conference abstracts. |

## RESULTS

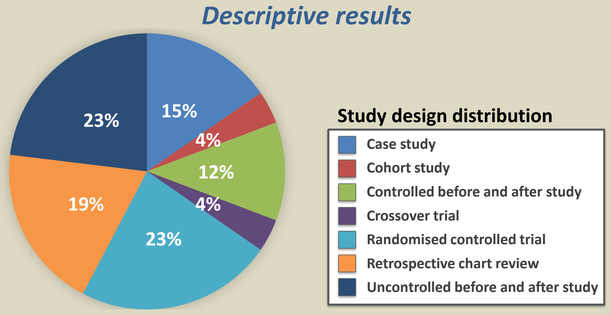
### *Flow chart*




### *Percentage of articles reporting information on items from the Consensus on Exercise Reporting Template (CERT)*

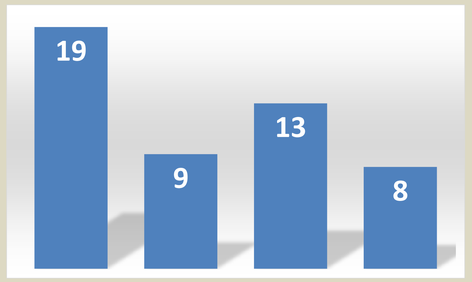
| Item # | Item Description | % |
|---|---|---|
| 5 | Detailed description of how adherence to exercise is measured and reported | 34.62 |
| 6 | Detailed description of motivation strategies | 26.92 |
| 8 | Detailed description of each exercise to enable replication | 69.23 |
| 9 | Detailed description of any home program component | 53.85 |
| 10 | Describes whether there are any non-exercise components | 46.15 |
| 11 | Describes the type and number of adverse events that occur during exercise | 38.46 |
| 13 | Detailed description of the exercise intervention (*Frequency, Intensity, Duration, Type*) | 88.46 |
| 15 | Describes the decision rule for determining the starting level | 80.77 |
| 16 | Describes the extent to which the intervention was delivered as planned | 50.00 |

### *Descriptive results*




- 38.5% of studies are on adults only
- 34.6% of studies are on children
- 26.9% are on both children and adults

### *Type and frequency of health-related outcomes*




- 73.1% of articles reported measuring **post-concussion symptoms**
- 34.6% reported measuring **mood and mental functions**
- 50% reported measuring **physical and physiological measures**
- 30.7% reported measuring **return to pre-injury activities**

### *Synthesis of PA-based interventions*

| % | Type of intervention | Focus | Exercise progression rules | Frequency | Intensity | Duration | Mode of exercise | Results |
|---|---|---|---|---|---|---|---|---|
| 42% | Multimodal intervention | Physical, physiological, post-concussion symptoms, mood and mental functions, activities and participation | Based on patient progressive tolerance to exercise measured by graded exertion test, self-reported effort perception and/or clinical judgment. | 2 to 7x/week, until symptoms resolves | Based on perceived exertion rating (2 or 3/10), 60-80% of heart rate achieved on exertion test, 50-60% of age-predicted maximal heart rate, based on patient tolerance | 15 to 90 minutes / session | 10 / 11 Have aerobic exercises (jogging, stationary bike, etc.) — Others are specific exercises | Improvement in balance, gait, coordination, mood, cognitive function, exercise tolerance, decrease in post-concussion symptoms, fatigue, dizziness and vertigo. Return to pre-injury level and improved functional independence levels. |
| 31% | Sub-symptom threshold exercise program | Physical, physiological, post-concussion symptoms, activities, and participation | The training protocol is determined by a graded exertion test repeated every 1-4 weeks. | 4 to 7x/week until symptoms resolves | 80% of heart rate achieved on graded exertion test | Equal of the duration of the exercise test OR 20 minutes | Self-selected, treadmill, elliptical trainer or stationary bicycle | Improvement in cerebral blood flow, BOLD signal, structural connectivity, post-concussion symptoms, exercise tolerance, attained heart rate. Return to pre-injury activities. |
| 12% | Moderate to vigorous aerobic exercise program | Physical and physiological | Speed and/or grade were continually adjusted to maintain heart rate within the target range | 3x/week for 12 weeks | Between 70 and 80% of the subjects' heart rate reserve | 30 minutes, + 5 to 10 minutes of warm-up and cool-down period | Walking or jogging | Improvements in cardiorespiratory fitness, and mood. Reduced self-reported fatigue severity. Vigorous activity was deleterious and was linked to a longer recovery. |
| 12% | Tai-Chi/ Qigong | Mood and mental functions | — | 1 to 4x/week for 6 to 8 weeks | — | 20 to 60 minutes | Tai-Chi/ Qicong | Improvement in mood, self-esteem, improved sense of empowerment and feeling of a positive effect on their course of recovery. |
| 4% | Walking program | Mood and mental functions | A gradual 5% increase in walking distance each week, until 40% of baseline | Daily for 12 weeks | 5% more walking distance than previously | — | Walking | Reduction of depressive symptoms and perceived stress. |

## CONCLUSIONS

- Several approaches have been used targeting varied outcomes, and sufficient details are provided allowing clinicians and researchers to replicate the PA-based interventions.
- The CERT checklist seems to be an important tool to document characteristics of PA-based interventions.
- Future studies should also better report strategies to measure adherence and include motivational strategies.
- This review should help clinicians select the most appropriate PA-based intervention on a case-by-case basis linked to desired outcomes.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