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Physical Activity Interventions That Address Motor and Balance Impairments and Skills for Adults With Traumatic Brain Injury (TBI) (2012-2021)

Beth Fields

University of Wisconsin-Madison

Kitsum Li

Dominican University of California, kitsum.li@dominican.edu

Adam Kinney

University of Colorado Anschutz School of Medicine

Olivia Condon

University of Illinois at Chicago

Emilio Villavicencio

Dominican University of California, emilio.villavicencio@students.dominican.edu

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Systematic Review Brief: Physical Activity Interventions that Address Motor and Balance Impairments and Skills for Adults with Traumatic Brain Injury (TBI) (12-21)

Beth Fields,¹ Kitsum Li,² Adam Kinney,³ Olivia Condon,¹ Emilio Villavicencio²

¹Department of Kinesiology, University of Wisconsin-Madison

²Department of Occupational Therapy, Dominican University of California

³Research Health Science Specialist, Rocky Mountain MIRECC for Suicide Prevention, Department of Veterans Affairs & Assistant Professor, Department of Physical Medicine and Rehabilitation, University of Colorado Anschutz School of Medicine

Abstract

Systematic Review Briefs provide a summary of the findings from systematic reviews developed in conjunction with the American Occupational Therapy Association's (AOTA's) Evidence-Based Practice Program. Each Systematic Review Brief summarizes the evidence on a theme related to a systematic review topic. The systematic review is on interventions to address motor and balance impairments to improve occupational performance for adults with TBI, the theme reported in this Systematic Review Brief is physical activity interventions.

Systematic Review Brief: Physical Activity Interventions that Address Motor and Balance Impairments and Skills for Adults with Traumatic Brain Injury (TBI) (12-21)

Full Systematic Review Question

What is the evidence for the effectiveness of interventions that address motor and balance impairments and skills to improve occupational performance for adults with TBI?

Current Theme Reported

Physical Activity Interventions for Adults with TBI

Clinical Scenario

Individuals with TBI may experience a range of physical symptoms, such as motor difficulties and dizziness or loss of balance (CDC, 2021; Mayo Clinic, 2021). These symptoms often impede a person's ability to perform valued occupations. Physical activity is one strategy that has been identified to improve TBI-related motor and balance impairments. According to the Occupational Therapy Practice Framework: Domain and Process 4th Edition (OTPF-4), physical activity can include "completing cardiovascular exercise, strength training, and balance training" (AOTA, 2021). This systematic review brief used the OTPF-4 to determine the types of physical activity interventions which address motor and balance impairments and skills to improve occupational performance for adults with TBI.

Summary of Key Findings

Two articles were included in this systematic review brief related to group-based physical activity interventions (Table 1).

Bottom Line for Occupational Therapy Practice

Occupational therapy practitioners can deliver physical activity-based interventions at both the individual and group levels, such as home exercise programs, activity diaries, functional balance

tasks, and cardiovascular and strength training. One of the critical features of these interventions is their intensity; the most frequent intervention dose was 5 times per week for 4-8 weeks. This finding sheds light on the importance of occupational therapy practitioners helping adults with TBI establish daily or weekly routines. Moreover, the occupation of physical activity serves to support health management, or the ability of a person to “develop, manage, and maintain health and wellness routines” (AOTA, 2021, p.32). Indeed, as the results of our review suggest, enhanced physical activity can improve motor and balance outcomes, such as mobility, stability, dizziness, ataxia, and gait among those with TBI. Very few of the included articles involved measures of occupational performance. Future occupational therapy research should examine the association of physical activity interventions on occupational performance. Practitioners can include measures of occupational performance in their treatment planning to better demonstrate improved health management of adults with TBI.

Note: Levels of evidence used in this review: <https://www.cebm.ox.ac.uk/resources/levels-of-evidence/oxford-centre-for-evidence-based-medicine-levels-of-evidence-march-2009>

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Table 1. Physical Activity Interventions to Improve Motor Outcomes for Adults with TBI

Author/ Level Evidence	Intervention	Statistically Significant Improvement from Intervention
	Group interventions “use distinct knowledge of the dynamics of a group and social interaction and leadership techniques to facilitate learning and skill acquisition across the lifespan” (AOTA, 2021, p.62). One level 1B RCT and one level 3B pre-post pilot study provided moderate strength of evidence that practitioners could use cardiovascular, strength and balance exercises when working with a group of adults with TBI	
Kleffelgaard et. al. (2019) 1B- RCT	Population: Adults with TBI with mild, moderate, or severe feelings of dizziness Intervention: Vestibular rehabilitation intervention which consisted of guidance, individually tailored exercises, a home exercise program, and an exercise diary. The intervention was based on principles from motor control theory for improving balance and theory of positive psychology for coping with symptom pressure and disease burden.	High level balance and mobility (e.g., running; walking on uneven outdoor surfaces)

Author/ Level Evidence	Intervention	Statistically Significant Improvement from Intervention
	<p>Delivery Method: Group in outpatient therapy</p> <p>Dose: 2x/week X 8 weeks</p>	
<p>Charrette et. al., (2016)</p> <p>3B- pre-posttest pilot study</p>	<p>Population: Adults with moderate to severe TBI</p> <p>Intervention: Exercises modified according to individuals' capacity to sustain target heart rate levels (50-80% of max. heart rate). Included endurance (stationary bike; stairs/steps; treadmill walking; obstacle course; overground walking) and strength exercises (free weights; TRX hanging system; body weight push-ups; balance exercises).</p> <p>Delivery Method: Group in community program</p> <p>Dose: 60-90 minutes, 3x/week X 6 weeks</p>	<p>High level balance and mobility (e.g., running; walking on uneven outdoor surfaces), cardiovascular endurance, and gait speed</p>
<p>Seven articles were included in this research brief related to individually-tailored physical activity interventions. Two level 1B RCT, one level 2B RCT, and five level 3B studies provided moderate strength of evidence that practitioners could use a variety of methods and tasks in preparation to support occupational performance of persons with TBI, such as elliptical machine, vestibular rehabilitation, body weight supported activities, and balance exercises</p>		

Author/ Level Evidence	Intervention	Statistically Significant Improvement from Intervention
Peirone et. al. (2014) 2B – Single- blinded RCT	<p>Population: Adult with chronic ABI, MMSE\geq24 and able to walk on level surface with supervision with or without an assistive device</p> <p>Intervention: Included practicing stability with sensory deprivation, different bases of support, and with body transport activities and balance exercises in dual task context, motor or cognitive.</p> <p>Delivery Method: Individual in rehabilitation center</p> <p>Dose: 50-min standard PT for balance impairment 3x/week X 7 weeks plus 30 mins/day, 6x/week X 7 weeks of tailored dual-task home-based exercises</p>	Postural control for functional balance
Angelis et. al. (2019) 3B- Retrospective cohort study	<p>Population: Adults with TBI in acute inpatient rehabilitation</p> <p>Intervention: As part of daily PT, use of the dynamic body-weight support therapy which is a system that applies a constant force while patients safely practice gait, ADLs, going up or down stairs, and performing balance exercises.</p> <p>Delivery Method: Individual in inpatient rehabilitation</p>	Mobility, locomotion, and social cognition

Author/ Level Evidence	Intervention	Statistically Significant Improvement from Intervention
	Dose: Daily, 3 hours inpatient PT	
Damiano et. al. (2016) 3B- One group pre-post pilot study	<p>Population: Adult with chronic TBI, able to walk safely and independently</p> <p>Intervention: Training on an elliptical machine with mild leg resistance initially until a cadence of 80–160 steps/min was achieved, then both leg resistance and cadence were gradually increased.</p> <p>Delivery Method: Individual in home-based program</p> <p>Dose: 30-min sessions for 5 x/week X 8 weeks.</p>	Reaction time in voluntary control of backward loss of balance, and automatic control of balance from external perturbation
Moore et.al. (2016) 3B- Pre- posttest exploratory study	<p>Population: Adult with post-concussional syndrome</p> <p>Intervention: A supervised home exercise vestibular rehabilitation program combined with aerobic training, delivered by a PT. Vestibular rehabilitation consisted of 3 categories of exercise: gaze stabilization, sensory organization and gait. Aerobic exercise training was completed using a stationary bike, 20-30 minutes.</p> <p>Additional in-clinic sessions, on as needed basis, that lasted 40-45 minutes to review, modify and updating the participant's home exercise program.</p>	Post-concussion symptoms and its impact on activity participation and psychosocial functioning, self-report of dizziness that negatively impacts function, postural stability

Author/ Level Evidence	Intervention	Statistically Significant Improvement from Intervention
	<p>Delivery Method: Individual at outpatient therapy</p> <p>Dose: 3-5x/week</p>	<p>during walking tasks, return to work/studying, and return to activity.</p>
<p>Peters et.al. (2014)</p> <p>3B-Prospective feasibility study</p>	<p>Population: Adults 3-months post-TBI, able to sit without support and walk with a maximum of 1 person for assistance</p> <p>Intervention: Intensive mobility training which includes gait training with a body-weight supported treadmill system, balance activities, and strength, coordination, and range of motion.</p> <p>Delivery Method: Individual at University research laboratory</p> <p>Dose: 150-min sessions for 5x/week X 4 weeks.</p>	<p>Walking balance with various task demands, cardiovascular endurance, gait speed in preferred and fast paces, fall risk, and fall efficacy</p>

Author/ Level Evidence	Intervention	Statistically Significant Improvement from Intervention
Ustinova et.al. (2015) 3B- Pre-posttest pilot study	<p>Population: Adult with chronic TBI, injury-related mild-to-moderate coordination abnormalities of upper and lower extremities, and postural instability</p> <p>Intervention: Therapeutic exercises to retrain whole-body coordination, posture and gait.</p> <p>Delivery Method: Individual at outpatient therapy</p> <p>Dose: 4-5x/week X 4-5 weeks, total 20 sessions</p>	Static and dynamic balance, postural stability during walking tasks, and ataxia symptoms
Leung et al. (2014) 1B- RCT	<p>Population: Adult with documented TBI and inability to walk 17 m without support and presence of ankle contracture</p> <p>Intervention: Tilt table standing with electrical stimulation to ankle muscles and ankle splinting</p> <p>Delivery Method: Inpatient rehabilitation</p> <p>Dose: 5x/week X 6 weeks and splinting for 12 hrs/day at least 5 days/week X6 weeks</p>	None