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## Healthy body, healthy mind: A mixed methods study of outcomes, barriers and supports for exercise by people who have chronic moderate-to-severe acquired brain injury

Laura S. Lorenz <sup>a, b, \*</sup>, Ann L. Charrette <sup>a, c</sup>, Therese M. O'Neil-Pirozzi <sup>a, d, e</sup>, Julia M. Doucett <sup>f</sup>, Jeffrey Fong <sup>g</sup>

<sup>a</sup> Supportive Living Inc. Research Council, Brain Injury Wellness Center, 7 Oakland Street, Lexington, MA 02420, USA

<sup>b</sup> Brandeis University, The Heller School for Social Policy and Management, 415 South Street, Waltham, MA 02453, USA

<sup>c</sup> Doctor of Physical Therapy Department, MCPHS University, 10 Lincoln Square, Worcester, MA 01541, USA

<sup>d</sup> Northeastern University, Department of Communication Sciences and Disorders, 360 Huntington Avenue, Boston, MA 02115, USA

<sup>e</sup> Spaulding/Harvard Traumatic Brain Injury Model System, 300 1st Avenue, Charlestown, MA 02129, USA

<sup>f</sup> Community Rehab Care, 51 Water Street, #205, Watertown, MA 02472, USA

<sup>g</sup> School of Pharmacy, MCPHS University, Worcester, MA, USA

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## ABSTRACT

**Background:** Few people with chronic moderate-to-severe brain injury are following recommended physical activity guidelines.

**Objective:** Investigate effects of planned, systematic physical activity while cultivating social and emotional well-being of people with chronic moderate-to-severe brain injury.

**Hypothesis:** Moderate-to-intensive physical activity would be associated with improvements in impairment and activity limitation measures (endurance, mobility, gait speed) immediately post-intervention and six weeks later (study week 12).

**Methods:** The intervention was a single group pre-/post-intervention study with 14 people with chronic moderate-to-severe brain injury who live in brain injury group homes and exercised 60–90 min, 3 days per week for 6 weeks at a maximum heart rate of 50–80%. Pre-post measures (administered weeks 0, 6 and 12) were the 6 Minute Walk Test, High-level Mobility Assessment Tool and 10 Meter Walk Test. The qualitative component used a brief survey and semi-structured interview guide with participants, family members, and staff.

**Results:** Following program completion, post-intervention group changes were noted on all outcome measures and greater than minimal detectable change for people with brain injury. Three transitioned from low to high ambulatory status and maintained this change at 12 weeks. During interviews, participants agreed the program was stimulating. More than eighty percent liked working out in a group and felt better being active.

**Conclusions:** Program impact included physical, cognitive and social/emotional aspects. Social aspects (group format, trainers) were highly motivating and supported by residents, family, and staff. Investments in transportation and recruiting and training interns to assist participants are critical to program sustainability and expansion.

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## Introduction

From Ancient Greece to modern day, physical activity has been seen as key to physical, intellectual and emotional health.<sup>1,2</sup> It is well known that physical activity intended to improve or maintain fitness in the general population results in better overall health,<sup>3</sup> and increasing physical activity is a health goal of US

\* Corresponding author. 7 Oakland Street, Lexington, MA 02420, USA.  
E-mail addresses: [llorenz@brandeis.edu](mailto:llorenz@brandeis.edu) (L.S. Lorenz), [Ann.charrette@mcphs.edu](mailto:Ann.charrette@mcphs.edu) (A.L. Charrette), [t.oneil-pirozzi@neu.edu](mailto:t.oneil-pirozzi@neu.edu) (T.M. O'Neil-Pirozzi), [juliamdoucett@gmail.com](mailto:juliamdoucett@gmail.com) (J.M. Doucett).  
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government.<sup>4</sup> Physical activity in adults with brain injury, particularly older adults in the chronic stage and with more severe injuries, has been encouraged and less studied.<sup>5,6</sup> despite evidence that physical activity in the chronic stage can result in improvements in physical function<sup>7</sup> and ability to perform activities of daily living (ADLs).<sup>5</sup> An estimated 3.2 to 5.3 million people in the US have disabilities from traumatic brain injury (TBI),<sup>8,9</sup> or about 2% of the US population. Among older adults, falls are responsible for 51% of TBIs<sup>10</sup>; following hospitalization for TBI, an estimated 37% of people will need long-term cognitive and functional supports.<sup>11</sup> Another 6.6 million US adults have disabilities from stroke,<sup>12</sup> a leading cause of chronic brain injury that disproportionately affects older adults.<sup>13</sup> Finding ways to promote physical activity among adults with chronic moderate-to-severe brain injury is a worthwhile goal.

Increasing access to physical activity does not guarantee participation. It is estimated that less than 10% of US adults adhere to physical activity guidelines published by the US Department of Health and Human Services,<sup>5,14</sup> and few people with chronic moderate-to-severe ABI are following recommended guidelines (2 h and 30 min of moderate-intensity, 1 h and 15 min of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate and vigorous aerobic activity per week).<sup>4</sup>

Studies of physical activity among elders and people with ABI, Developmental Disabilities, and type 2 diabetes point to numerous barriers, including knowledge and post-injury changes,<sup>15</sup> cognitive disabilities,<sup>16</sup> lack of social support,<sup>17</sup> older age,<sup>4</sup> health problems,<sup>18</sup> lack of transportation,<sup>15–17</sup> and cost.<sup>19</sup> Community-based exercise programs for people with more severe disabilities face increased resource requirements due to greater supervision and support needs.<sup>16</sup> The perspectives of people with chronic ABI on physical activity are of interest to rehabilitation providers, funders, people with this condition and their families.<sup>20–22</sup>

The International Classification of Functioning, Disability, and Health (ICF)<sup>23</sup> emphasizes environmental factors in creating disability or ability. Environmental factors can support or hinder function, activities, and participation. In the ICF model, a second, albeit less emphasized category is personal factors. From a conceptual standpoint, we need to understand how environmental (staff fears for resident safety) and personal (motivation to be physically active) factors may be mediating physical activity. Exercise is physical activity that is “planned, structured, repetitive and purposive” with the intention to improve fitness levels.<sup>3</sup>

This study was intended to investigate effects of a moderate-to-intensive exercise program on endurance, mobility, and gait speed while cultivating the social and emotional well-being of people with chronic moderate-to-severe acquired brain injury. We couple observed intervention outcomes with self-report data on impacts, barriers and supports from a brief survey and semi-structured interviews with people with chronic ABI, family members, and staff. We focus on both environmental and personal barriers and supports, and suggest strategies to reduce barriers and increase supports. We hypothesized that participation in moderate-to-intensive exercise (50–80% maximum heart rate or MHR), 3 times per week for 6 weeks would be associated with improvements in impairment and activity limitation measures (endurance, mobility, and gait speed) immediately post-intervention and six weeks later (week 12).

## Methods

We have used the terms acquired brain injury (ABI) and brain injury (TBI, stroke, brain tumor, anoxia) interchangeably. We have defined chronic moderate-to-severe ABI as requiring daily assistance with Activities of Daily Living (ADLs) (bathing, dressing) and Instrumental Activities of Daily Living (IADLs) (managing

medications, money) due to cognitive, physical and/or emotional disabilities after a brain injury, diagnosed at least two years prior to the study. Date and type of brain injury were provided by the residential services provider.

The study protocol was approved by the IRB committees of MCPHS University and Brandeis University. The intervention component was a single group pre-/post-intervention involving a six-week, moderate-to-high-intensity exercise program offered three days per week for 60–90 min, assisted by trainers under physical therapist supervision. The interview component entailed semi-structured interviews and a brief survey. Fig. 1 provides a diagram of participant flow.

People with chronic ABI were recruited from three community-based group homes for people with brain injury. Eighteen residents (out of 39) met the inclusion criteria: (1) could walk or stand independently with minimal assistance, (2) could walk with or

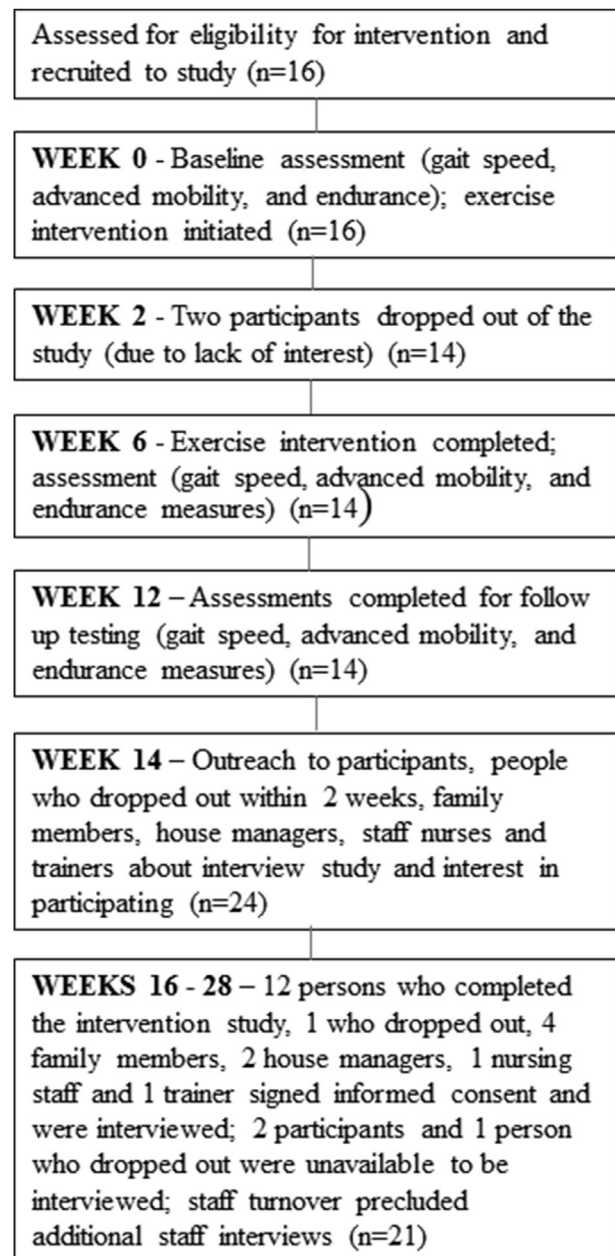


Fig. 1. Participant flow in the intervention and qualitative components.

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