OBJECTIVES
• A longitudinal study was performed to explore the effect of cognitive reserve (CR) on cognitive remediation in adults with an acquired brain injury (ABI).
• Studies have shown that CR is a protective factor for brain injury.
• This study examines the moderation effects of cognitive reserve with a computerized cognitive remediation program (Brain Fitness Program) on the benefits of cognitive recovery on the brain injury population.

INTRODUCTION
• At least 5.3 million US citizens live with a permanent traumatic brain injury (TBI)- or stroke-related disability (Mar et al., 2011).
• Multiple studies demonstrate the benefits of cognitive remediation of individuals with ABI (Cicero et al., 2011).
• Many computerized cognitive training studies have demonstrated benefits for older adults and people diagnosed with schizophrenia (Mahncke et al., 2006; Biagianti & Vinogradov, 2013).
• Cognitive reserve proposes that individuals with higher lifetime intellectual enrichment, determined by level of education and vocabulary knowledge, are more suitable to withstand neurologic disorder before or without experiencing cognitive decline (Barn, 2009).
• Cognitive remediation is a type of cognitive rehabilitation that utilizes systematic, repetitive activities in order to practice cognitive skills (Rubin & Ruiz, 2012).
• Cognitive remediation can be used on any individual with cognitive deficits.
• The Brain Fitness Program (BFP) is a computerized, cognitive remediation intervention used to improve cognition and generalize improvements applicable to the real world (Medalia & Cho, 2020).

METHODS

Participants
- 60 adults (27 experimental and 33 controls) with chronic ABI (48 TBI and 12 stroke)
- Males and females between the ages of 24 and 69 years (M = 45.93, SD = 12.67)
- All participants were:
  - At least 1 year post-ABI
  - Fluent in the English language
  - Free of current alcohol or drug use disorder
  - Free from significant psychiatric history
  - Free from psychotropic, neuroleptic or benzodiazepine medication use

Procedures
- Participants who met the criteria for study were administered a baseline and follow-up neuropsychological battery
- For this study, the following cognitive measures were investigated:
  - WMS-III: Wechsler Memory Scale-III
  - Wechsler Test of Adult Reading (WTAR)
  - California Verbal Learning Test: Long Delayed Free Recall (CVLT-LDFR)
  - Woodcock Johnson: Understanding Directions (WJ-III)
- The BFP was used to target verbal and abstract working memory
- Participants in the experimental group completed 40 hours of Brain Fitness Program (BFP) training over a 10-12 week period
- BFP included 6 training exercises:
  - High or Low
  - Tell Us Apart
  - Match II
  - Sound Replay
  - Listen and Do
  - Story Teller

RESULTS

Table 1. Participant Demographics

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>Experimental (n = 27)</th>
<th>Control (n = 33)</th>
<th>Total (n = 60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>Range</td>
<td>Mean (SD)</td>
<td>Range</td>
</tr>
<tr>
<td>Age</td>
<td>43.37 (12.80)</td>
<td>26-69</td>
<td>45.58 (12.76)</td>
</tr>
<tr>
<td>Education (years)</td>
<td>15.52 (2.23)</td>
<td>10-19</td>
<td>15.80 (2.39)</td>
</tr>
<tr>
<td>Sex (Female %)</td>
<td>41% (n = 11)</td>
<td>64% (n = 21)</td>
<td>53% (n = 32)</td>
</tr>
<tr>
<td>Time since injury (months)</td>
<td>92.62 (92.47)</td>
<td>12-459</td>
<td>127.37 (129.81)</td>
</tr>
</tbody>
</table>

Table 2. “Higher” and “Lower” Education Differences of Mean Δ WJUD Scores

<table>
<thead>
<tr>
<th>Type Brain Injury</th>
<th>Stroke &lt; 7 TBI</th>
<th>Stroke &gt; 7 TBI</th>
<th>Stroke &gt; 8 TBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Education</td>
<td>2.85 ± 0.58</td>
<td>1.38 ± 0.70</td>
<td>1.07 ± 0.88</td>
</tr>
<tr>
<td>Lower Education</td>
<td>0.58 ± 0.58</td>
<td>0.70 ± 0.70</td>
<td>0.80 ± 0.88</td>
</tr>
</tbody>
</table>

• The results demonstrate a significant interaction between group and levels of education (R2 = 14; F (3,56) = 2.99, p < 0.05).

• The post-hoc analyses show the experimental group demonstrated greater gains in the WJUD at follow-up compared to the control group.

• Lower education was defined as participants whose education level were below the median whereas higher education was defined as participants whose education level were above the median.

• Both lower levels of education groups in the experimental and control group had lower performance at baseline compared to follow-up performance. The experimental lower education group had a mean WJUD score of 40.18 at baseline and increased to a mean WJUD score of 42.89 at the experimental high education group had a mean score of 46.59 at baseline and increased to a mean score of 48.52.

REFERENCES


ACKNOWLEDGEMENTS

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Thank you to Gerald Voelbel, PhD for allowing us to participate in this study, providing us with assistance during data analysis, and continuing to support us throughout the duration of the project.

CONCLUSIONS
• Individuals with ABIs with lower levels of education demonstrated greater gains on attention performance compared to higher levels of education.
• This may suggest the level of education does not support cognitive reserve as a protective factor for brain injury recovery.
• However, since the lower education group started at a lower performance their was greater room to improve.
• The results demonstrated levels of education is a moderating factor of cognitive remediation.
• Other cognitive outcomes factors examined: WTAR and mean number of hours of cognitively stimulating behaviors post injury were not moderating factors as measures of cognitive reserve.