**PARTICIPATION AND QUALITY OF LIFE FOR PERSONS WITH OCULOMOTOR IMPAIRMENTS AFTER ACQUIRED BRAIN INJURY**

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**BACKGROUND**

**VISION - MORE THAN 20/20**
- Mary Warren’s hierarchy of visual skills
  - Base: oculomotor control, visual fields, acuity
    - Moving up: attention, scanning, pattern recognition, visual memory, visual cognition
    - Leads to: adaptation through vision

(Warren, 1993)

**WHAT ARE OCULOMOTOR IMPAIRMENTS?**
- Pursuits
- Saccades
- Binocular vision
- Convergence

**SYSTEMS MODEL OF MOTOR BEHAVIOR**
- Person
  - Sensorimotor
  - Cognitive
  - Psychosocial
- Environment
  - Physical
  - Cultural
  - Socioeconomic
- Occupation/Task

(Almhdawi, Mathiowetz, & Bass, 2014)

**THE LITERATURE**
- Prevalence of oculomotor impairment
  (Ciuffreda et al., 2007; Rowe et al., 2009)
- Symptoms
  (Ciuffreda et al., 2009; Capo-Aponte, Ursua, Stoomey, Robert & Sangha, 2012; Higginson et al., 2009; Rowe & VIS Group UK, 2011)
THE LITERATURE

- Reading
  - (Bashin et al., 2019; Capo-aponte et al., 2012; Goodrich, Capo, Arroyo, Chang & Martinez, 2013; Heitger et al., 2009; Rowe & VIS Group UK, 2013; Thiagappanipathi, Capo-aponte, Ludlam & Kapoor, 2014)

- Functional outcomes/Activities of Daily Living
  - (Ali et al., 2013, Heitger et al., 2009; Rowe & VIS Group UK, 2013)

- Quality of life

PURPOSE OF STUDY

Explore prevalence and nature of participation and quality of life for persons with ABI-related oculomotor impairments.

- Describe participation in everyday activities and social roles, and quality of life;
- Provide preliminary recommendations for occupational therapists and health care providers on which specific participation areas to assess and identify possible tools to use.

APPROACH

- Cross-sectional descriptive design
- 40 participants with ABI-related oculomotor impairments
- Questionnaires
  - ABI Vision Questionnaire
  - PROMIS Global Health Scale
  - Assessment of Life Habits (LIFE-H)
  - Follow-up questions

INCLUSION AND EXCLUSION CRITERIA

Inclusion
- Documented ABI
- ABI-related oculomotor or binocular impairments identified by occupational therapy screen
- 18 years of age or older
- Corrected visual acuity of 20/70 or better
- Sufficient cognitive, language, and hearing capability to participate in the informed consent process and assessment

Exclusion
- Visual field cut
- Evidence of hemi-inattention or spatial neglect
- Non-English speakers
- Significant physical impairment that affects level of difficulty to perform basic activities of daily living or that necessitate physical assistance

RESULTS:ABI DIAGNOSIS

<table>
<thead>
<tr>
<th>Condition</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>NonTBI (Tumor removal)</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>TBI/PCS/Concussion</td>
<td>37</td>
<td>92.5</td>
</tr>
</tbody>
</table>

Time since precipitating event

- Impact: 10, 27%
- Assault: 4, 11%
- Fall: 5, 13%
### Visual Impairments Identified by Occupational Therapy Screen

- **CI** (Convergence Insufficiency)
- **DI** (Divergence Insufficiency)
- Pursuits
- Saccades
- Light sensitivity
- Ambient Focal
- Other

### Demographics

- **Gender**
  - Male: 9, 23%
  - Female: 31, 77%
- **Ethnicity**
  - White: 37, 92%
  - Black/African American: 2, 5%
  - Asian: 1, 3%
- **Age**
  - 18-24: 16
  - 25-44: 29
  - 45-64: 15
  - >65: 10

### Demographics: Employment Status

- Full-time: 8, 20%
- Part-time: 9, 22%
- Unemployed: 23, 58%

### Change from status prior to event

- **n = 24, 60%**

### ABI Vision Questionnaire

#### (Symptoms)

<table>
<thead>
<tr>
<th>Item</th>
<th>M</th>
<th>SD</th>
<th>Min-Max</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtotal of 1-15 (reading and near vision)</td>
<td>40.7</td>
<td>9.54</td>
<td>16-56</td>
<td>39</td>
<td>97.5</td>
</tr>
<tr>
<td>Score ≥ 21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total score (1-23)</td>
<td>59.4</td>
<td>13.73</td>
<td>26-86</td>
<td>39</td>
<td>97.5</td>
</tr>
<tr>
<td>Score &gt; 32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Most Frequent Symptoms Identified from Questionnaire

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you have sensitivity to light?</td>
<td>85.0</td>
</tr>
<tr>
<td>Do your eyes feel tired when reading or doing close work?</td>
<td>85.0</td>
</tr>
<tr>
<td>Are you unable to sustain reading or close work for adequate periods?</td>
<td>80.0</td>
</tr>
<tr>
<td>Do you lose concentration when reading or doing close work?</td>
<td>77.5</td>
</tr>
<tr>
<td>Do you have headaches when reading or doing close work?</td>
<td>77.5</td>
</tr>
<tr>
<td>Are you bothered by movement in the surrounding environment?</td>
<td>72.5</td>
</tr>
<tr>
<td>Do your eyes feel uncomfortable when reading or doing close work?</td>
<td>72.5</td>
</tr>
</tbody>
</table>

* Indicates the items that 45% or more indicated “Always.”

### PROMIS Global Health Scale T-Scores (Quality of Life)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Min-Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Physical Health</td>
<td>40.54</td>
<td>4.80</td>
<td>29.6-54.1</td>
</tr>
<tr>
<td>Global Mental Health</td>
<td>39.20</td>
<td>5.66</td>
<td>25.1-56.0</td>
</tr>
</tbody>
</table>
**LIFE-H SCORES**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Min - Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIFE-H: Total Weighted Score</td>
<td>6.0</td>
<td>1.12</td>
<td>3.9 - 8.2</td>
</tr>
<tr>
<td>Daily Activities Domain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutrition</td>
<td>7.1</td>
<td>1.37</td>
<td>3.9 - 10.0</td>
</tr>
<tr>
<td>Fitness</td>
<td>6.2</td>
<td>1.46</td>
<td>2.2 - 8.9</td>
</tr>
<tr>
<td>Personal Care</td>
<td>8.5</td>
<td>0.83</td>
<td>6.8 - 9.7</td>
</tr>
<tr>
<td>Communication</td>
<td>5.9</td>
<td>1.33</td>
<td>3.1 - 8.4</td>
</tr>
<tr>
<td>Housing</td>
<td>6.2</td>
<td>1.41</td>
<td>3.9 - 9.6</td>
</tr>
<tr>
<td>Mobility</td>
<td>4.8</td>
<td>1.56</td>
<td>1.6 - 8.7</td>
</tr>
<tr>
<td>Social Roles Domain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibilities</td>
<td>6.7</td>
<td>1.50</td>
<td>3.2 - 9.1</td>
</tr>
<tr>
<td>Interpersonal Relations</td>
<td>6.4</td>
<td>1.78</td>
<td>3.1 - 9.3</td>
</tr>
<tr>
<td>Community Life</td>
<td>5.6</td>
<td>2.02</td>
<td>1.9 - 10.0</td>
</tr>
<tr>
<td>Education (n = 20)</td>
<td>3.0</td>
<td>3.21</td>
<td>0.0 - 8.9</td>
</tr>
<tr>
<td>Employment</td>
<td>3.6</td>
<td>2.63</td>
<td>0.0 - 7.2</td>
</tr>
<tr>
<td>Recreation</td>
<td>3.1</td>
<td>2.28</td>
<td>0.0 - 6.4</td>
</tr>
</tbody>
</table>

**LIFE-H IDENTIFIED ITEMS: >80% VERY DIFFICULT, ACCOMPLISHED BY PROXY OR NOT ACCOMPLISHED**

<table>
<thead>
<tr>
<th>Item</th>
<th># Very Difficult</th>
<th># Who Did This</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participating in sporting or recreational activities</td>
<td>35</td>
<td>39</td>
<td>90</td>
</tr>
<tr>
<td>Holding a paid job</td>
<td>34</td>
<td>38</td>
<td>89</td>
</tr>
<tr>
<td>Undertaking vocational training (continuing education)</td>
<td>24</td>
<td>27</td>
<td>89</td>
</tr>
<tr>
<td>Maintaining the grounds of your home</td>
<td>19</td>
<td>22</td>
<td>86</td>
</tr>
<tr>
<td>Doing major household tasks</td>
<td>25</td>
<td>29</td>
<td>86</td>
</tr>
<tr>
<td>Taking part in unpaid activities (volunteering)</td>
<td>25</td>
<td>30</td>
<td>83</td>
</tr>
<tr>
<td>Going to sporting events</td>
<td>29</td>
<td>35</td>
<td>83</td>
</tr>
<tr>
<td>Communicating with a group of people at home or in the community</td>
<td>32</td>
<td>39</td>
<td>82</td>
</tr>
<tr>
<td>Maintaining your home</td>
<td>31</td>
<td>38</td>
<td>82</td>
</tr>
</tbody>
</table>

**LIFE-H: COMMUNICATION AND MOBILITY ITEMS IDENTIFIED AS VERY DIFFICULT**

<table>
<thead>
<tr>
<th>Item</th>
<th># Very Difficult</th>
<th># Who Did This</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riding a bicycle</td>
<td>24</td>
<td>29</td>
<td>83</td>
</tr>
<tr>
<td>Communicating with a group of people at home or in the community</td>
<td>32</td>
<td>39</td>
<td>82</td>
</tr>
<tr>
<td>Reading and understanding written information</td>
<td>29</td>
<td>40</td>
<td>73</td>
</tr>
<tr>
<td>Using a computer</td>
<td>28</td>
<td>39</td>
<td>72</td>
</tr>
<tr>
<td>Driving a vehicle</td>
<td>26</td>
<td>38</td>
<td>68</td>
</tr>
</tbody>
</table>

**CORRELATIONS OF MEASURES**

<table>
<thead>
<tr>
<th></th>
<th>LIFE-H</th>
<th>PROMIS-Physical</th>
<th>PROMIS Mental</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABI</td>
<td>-.701(.000)*</td>
<td>-.644(.000)*</td>
<td>-.248(.122)</td>
</tr>
<tr>
<td>LIFE-H</td>
<td>.451(.003)*</td>
<td>.513(.001)*</td>
<td></td>
</tr>
<tr>
<td>PROMIS-Physical</td>
<td></td>
<td>.443(.004)*</td>
<td></td>
</tr>
</tbody>
</table>

* Spearman’s rho

**CORRELATIONS**

- Symptoms (ABI) and participation (LIFE-H)
  - Significant weak - moderate negative correlation
- Symptoms (AB) and physical quality of life (PROMIS physical)
  - Significant weak negative correlation

Based on these results:

Visual symptoms explain about half of the measured difficulties with participation.
FOLLOW UP QUESTIONS

- Asked of individual items identified at difficult
  - A little difficult
  - Very difficult
- Further questions about very difficult items
  - Tell me what specific activities/tasks are hard?
  - Tell me what makes this activity hard? How is it hard?

FOLLOW-UP QUESTIONS: NARRATIVE ANALYSIS THEMES

- Challenges of the task and environment
- Self-identified personal difficulties
- Changes to habits/priorities/roles

FOLLOW-UP QUESTIONS: NARRATIVE ANALYSIS

Challenges of Activities and Environment
- Specific Occupations/Activities/Tasks
- Activity/Task Requirements
- Physical Environment
- Socio-economic Environment
- Time

NARRATIVE EXAMPLES: TASK REQUIREMENTS

What am I going to do?
So much requires vision.
Classes are hard.

ENVIRONMENTAL CHALLENGES

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light/glare</td>
<td>36</td>
<td>90.0</td>
</tr>
<tr>
<td>Noise</td>
<td>33</td>
<td>82.5</td>
</tr>
<tr>
<td>Motion</td>
<td>32</td>
<td>80.0</td>
</tr>
<tr>
<td>People</td>
<td>21</td>
<td>52.5</td>
</tr>
<tr>
<td>Space/location/environment</td>
<td>12</td>
<td>30.0</td>
</tr>
<tr>
<td>Business/confusion/stimuli</td>
<td>9</td>
<td>22.5</td>
</tr>
<tr>
<td>Smell</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>Taste</td>
<td>2</td>
<td>7.5</td>
</tr>
<tr>
<td>Texture (food)</td>
<td>1</td>
<td>2.5</td>
</tr>
</tbody>
</table>

FOLLOW-UP QUESTIONS: NARRATIVE ANALYSIS

Self-identified Difficulties
- Physical
  - Adverse reactions
  - Physical difficulties making it harder
- Cognitive
  - Memory, attention, executive functioning and communication
- Socioemotional
  - Anxiety, overwhelmed, loss of motivation, self-image
Ice fishing: Very difficult... okay during, but afterwards physically a wreck. Head hurt, fatigue, body ached. Two and a half days of recovery. Had a great time, but paid for it.

I like my job, but it’s harder - much harder. I feel like I am behind the 8 ball, because it is hard to plan. Organization is taxing, reading is hard, things don’t get in my memory. I have to ask someone.

My brain is damaged. Nobody gets it or cares. I look okay, I talk okay. They think I am okay. I’m not okay, I am screaming inside.

I feel as if everything I did for my family has been taken away from me.

Put everything into work and self getting better. No time left for anything else. Don’t have play room. I pay for it for a day or two if I try. Personal and social needs, wants, and desires get put to the side.
**DISCUSSION**

**DISCUSSION: SYMPTOMS**
- Light sensitivity
- Eye fatigue and discomfort/pain with reading and near tasks
- Reading for shorter periods and at a slower pace
- Headaches with reading or near tasks
- Losing concentration with reading and trouble remembering what has been read
- Being bothered by movement in the environment

**DISCUSSION: PARTICIPATION**
- Roles and Activities
  - Recreation/leisure
  - Employment
  - Education activities
  - Home maintenance
  - Social groups
  - Spiritual practice
- Isolated tasks
  - Communication in a group
  - Reading
  - Computer Use
  - Driving

**RECOMMENDED TOOLS**
- Symptoms
  - ABI Vision Questionnaire
  - Insufficiency Symptoms Survey (CISS)
- Participation
  - Canadian Occupational Performance Measure or Patient Specific Functional Scale
  - Rivermead Head Injury Follow Up Questionnaire

**COMPLEX SITUATION**
- Not only vision
  - Sensory
  - Cognitive/communication
    - Slow down, no multi-tasking or interruptions
  - Balance
  - Fatigue
  - Emotions

**DYNAMIC AND INTERRELATED**
- Challenging task requirements and environment
- Adverse Symptoms + Personal difficulties
- Limits activity participation
- Modification of activity and/or environment
- Managed symptoms and Improved participation
- Changing priorities and managing energy budget

*Used with permission by Microsoft*
**Convenience sample**
- Only having OT
- Screen completed by OTs, vision issues not always formally diagnosed at time of interview
- Different stages of recovery
- Majority female and white
- High variability in scores
- Self-report - Perceptions of difficulty and problems

**FUTURE RESEARCH**
- What is the client experience of recovery and treatment for those with oculomotor impairments? What is most helpful?
- What treatments are currently being used for oculomotor impairments (including remedial, compensatory, and life management strategy training)?
- What is the relationship between oculomotor impairment and sensory sensitivities? What are the remedial treatment options for sensitivities?
- What is the balance between remediation and management of the symptoms? If patients complain of being overwhelmed and stressed, is it possible to remediate?

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- The doctoral OT faculty and clinical mentors (Dr. Mary Radomski and Dr. Nancy Flinn) who provided the framework, resources, and questions to make this journey a reality.
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**REFERENCES**