Investigating the Clinical Effects of Performance-Focused Swimming Training for People with Cerebral Palsy: a Proof of Concept Study

Iain Dutia¹; Dr Mark Connick¹; Dr Emma Beckman¹; Dr Leanne Johnston²; Dr Sean Tweedy¹

¹The University of Queensland, School of Human Movement and Nutrition Sciences, Brisbane, Australia
²The University of Queensland, School of Health and Rehabilitation Sciences, Brisbane, Australia
Background: Cerebral Palsy and Physical Activity

• People with CP have physical impairments $\rightarrow$ ↓ ADLs $\rightarrow$ ↓ Participation

• Low levels of physical activity $\rightarrow$ ↓ Health status

• Recent research focus on moderate doses of physical activity

• Generally, it is recognised that moderate doses of physical activity can elicit favourable clinical outcomes
Cerebral Palsy and Performance-Focused Sports Training

• What about the clinical effect of physical activity which is designed to improve sports performance?

• ‘Performance-Focused’ training is typically associated with greater doses

• Paralympic athletes anecdotally attribute excellent clinical outcomes to their training

‘Hard training means 9 sessions per week, 2 hours per session of intense training. I haven’t always been able to do that – it took me years to reach that level...if I didn’t have swimming I’d probably be in a wheelchair, overweight and very fragile’. Jaqueline Freney, 2014
Therapeutic Value of Sport?

- Can these stories be substantiated with scientific evidence?

- Can training loads associated with sports training positively affect health and the impairments themselves?

- Aim:
  Evaluate the relationship between performance-focused swimming training and the clinical outcomes of Health-Related QoL and Gross Motor Function
Study Design

• Single Subject Research Design

• 1 Participant

• 3 Phases
  – $A^1 = \text{Baseline (15 weeks)}$
  – $B = \text{Training (30 weeks)}$
  – $A^2 = \text{Off-season (15 weeks)}$
## Intervention

<table>
<thead>
<tr>
<th>A&lt;sup&gt;1&lt;/sup&gt;</th>
<th>B</th>
<th>A&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Intervention (Introductory training)</td>
<td>Intervention (Performance-focused training)</td>
</tr>
<tr>
<td>15 weeks</td>
<td>15 weeks</td>
<td>15 weeks</td>
</tr>
</tbody>
</table>

- **First Part of B Phase** – introduction to sport
  - Low-moderate dose
  - Aerobic, Strength, Flexibility, Neuromotor Training

- **Second Part of B Phase** aims to optimise swimming performance
  - Higher dose (frequency, intensity, duration)
  - Intentional reduction leading into competition
Participant

• 21 years old

• Ataxic Cerebral Palsy

• GMFCS II, S7

• Insufficiently active for health

• Water safe

• Medically, intellectually able to train
Outcome Measures

• Health-Related QoL
  - SF-36 Physical Function Subscale

• Gross Motor Function Measure-66-Item Set
  - GMFM-66-IS

• Repeated measures: 5 data points in baseline, 10 in training, 5 in off-season

• Analysis: Data is plotted, visual analysis of central tendency and percentage non-overlapping data (Parker et al. 2007)
Results

• Training load well tolerated

• Positive changes in swim performance seen: 25m freestyle swim time reduced from 82s to 49s.

• Full description in presentation this afternoon: Angelo Macaro
Results: Gross Motor Function

GMFM-66-IS

<table>
<thead>
<tr>
<th>Timepoint</th>
<th>Median</th>
<th>PND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>52</td>
<td>N/A</td>
</tr>
<tr>
<td>Training</td>
<td>54</td>
<td>70% = moderate effect</td>
</tr>
<tr>
<td>Off-Season</td>
<td>53</td>
<td>0%</td>
</tr>
</tbody>
</table>
**Results: SF-36 Physical Functioning Subscale**

<table>
<thead>
<tr>
<th>Timepoint</th>
<th>Baseline</th>
<th>Training</th>
<th>Off-Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>Med</td>
<td>PND</td>
<td>N/A</td>
</tr>
<tr>
<td>1-2</td>
<td>25</td>
<td>52.5</td>
<td>55</td>
</tr>
<tr>
<td>3-4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Med**: 25

**PND**: N/A

100% = very high effect

0%
Conclusions

• A promising start at a proof-of-concept level: acceptable study design, outcome measures and intervention structure

• Functional relationship may exist

• Future research is required – continue longitudinal monitoring, multiple baseline design across 3 participants

• Implications for Neurological Rehab – sport as a therapy
Acknowledgements

- Queensland Academy of Sport
- Swimming Australia
- Australian Paralympic Committee
- International Paralympic Commitee

- Advisory Team
  - Dr Sean Tweedy
  - Dr Mark Connick
  - Dr Emma Beckman
  - Dr Leanne Johnston