A comparison of 3 v 3 wheelchair basketball game formats for inclusion at the Commonwealth Games: a multidisciplinary approach

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Introduction

• Wheelchair basketball (WB) is a 5 v 5 team sport played on a 28 x 15 m court

• WB is due to be included as a medal event at the 2022 Commonwealth Games for the 1st time in a 3 v 3 format

• Three versions of 3 v 3 WB currently exist:
  ➢ Full court  28 x 15 m (2 baskets)
  ➢ Half court  14 x 15 m (single basket)
  ➢ Modified court  22 x 15 m (2 baskets)
Aim

- To conduct some **preliminary** evidence-based research to help inform the International Governing Body about the most suitable 3 v 3 format to propose for the Commonwealth Games

Multidisciplinary approach

- Physical demands
- Technical demands
- User perceptions

Dr Andrea Bundon
University of British Columbia

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Methods

- 15 WB players participated in three different formats of 3 v 3 and a 5 v 5 match:
  - Full court (FC) 28 x 15 m (2 baskets)
  - Half court (HC) 14 x 15 m (single basket)
  - Modified court (MOD) 22 x 15 m (2 baskets)

- 5 v 5 match:
  - 4 x 10-min periods
  - Game clock
  - 24-s shot clock
  - Substitutions
  - 14pt classification limit

- 3 v 3 formats:
  - 2 x 10-min periods
  - Running clock
  - 18-s shot clock
  - No substitutions
  - 8.5pt classification limit

### Testing schedule for all 3 v 3 formats.

<table>
<thead>
<tr>
<th>Team</th>
<th>v</th>
<th>Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>v</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>v</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>v</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>v</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>v</td>
<td>5</td>
</tr>
</tbody>
</table>
## Methods – Physical Demands

- **External workload** was monitored using an indoor tracking system (ITS):
  - Relative distance covered (m·min\(^{-1}\))
  - Peak speed (m·s\(^{-1}\))
  - Time spent in fixed speed zones (%):

<table>
<thead>
<tr>
<th>Zone (Z)</th>
<th>Speed Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z1</td>
<td>&lt; 0.5 m·s(^{-1})</td>
</tr>
<tr>
<td>Z2</td>
<td>0.5 – 1.5 m·s(^{-1})</td>
</tr>
<tr>
<td>Z3</td>
<td>1.5 – 2.5 m·s(^{-1})</td>
</tr>
<tr>
<td>Z4</td>
<td>2.5 – 3.0 m·s(^{-1})</td>
</tr>
<tr>
<td>Z5</td>
<td>3.0 – 3.5 m·s(^{-1})</td>
</tr>
<tr>
<td>Z6</td>
<td>&gt; 3.5 m·s(^{-1})</td>
</tr>
</tbody>
</table>

- **Internal workload** was monitored via:
  - Mean & peak heart rate (HR) (beats·min\(^{-1}\))
  - Borg CR-10 RPE scale
Methods – Technical Demands

- All formats were filmed with actions coded to describe activities performed in relation to:

<table>
<thead>
<tr>
<th>Possession</th>
<th>Time, passes received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passing</td>
<td>Number, type (long/short)</td>
</tr>
<tr>
<td>Shooting</td>
<td>Number, type (field goal/3 pts), success rate</td>
</tr>
<tr>
<td>Defensive</td>
<td>Forced turnovers, rebounds, blocks</td>
</tr>
<tr>
<td>Errors</td>
<td>Fouls, turnovers, ball handling errors (catching/passing)</td>
</tr>
</tbody>
</table>

- Activities were expressed relative to time (10-mins)
  - Different playing times existed between 5 v 5 and 3 v 3 formats (due to substitutions & clocks)

- Activities were only analysed when ball was in play during 3 v 3 formats
Results – Physical Demands

- **Peak speeds during all 3 formats**
  - ES $\geq 1.1$ (moderate)

- **Peak speeds during HC**
  - ES $\geq 2.5$ (very large)

- **Distance covered during FC**
  - Effect size (ES) $\geq 2.0$ (very large)

- **Distance covered during HC**
  - ES $\geq 3.2$ (very large)

- No significant difference in distance covered between MOD & 5 v 5
  - ES = 0.5 (moderate); 90% CI (-0.3 to 1.4)

significantly different to: * 5 v 5; ^ FC; # HC

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Results – Physical Demands

Low Speed Activity:

<table>
<thead>
<tr>
<th>Speed区</th>
<th>5 v 5</th>
<th>FC</th>
<th>HC</th>
<th>MOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z1</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>#</td>
</tr>
<tr>
<td>Z2</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>^</td>
</tr>
</tbody>
</table>

Mod Speed Activity:

<table>
<thead>
<tr>
<th>Speed区</th>
<th>5 v 5</th>
<th>FC</th>
<th>HC</th>
<th>MOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z3</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>#</td>
</tr>
<tr>
<td>Z4</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>^</td>
</tr>
</tbody>
</table>

High Speed Activity:

<table>
<thead>
<tr>
<th>Speed区</th>
<th>5 v 5</th>
<th>FC</th>
<th>HC</th>
<th>MOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z5</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>#</td>
</tr>
<tr>
<td>Z6</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>^</td>
</tr>
</tbody>
</table>

significantly different to: * 5 v 5; ^ FC; # HC
Results – Physical Demands

- No significant differences in peak HR
- Mean HR ↑ during FC vs. HC
  - ES = 0.7 (moderate)
- RPE ↑ for 5 v 5 & FC vs. HC & MOD
  - ES ≥ 0.9 (moderate)

significantly different to: * 5 v 5; ^ FC; # HC
### Results – Technical Demands

#### Mean (±SD) technical parameters during game formats

<table>
<thead>
<tr>
<th></th>
<th>5 v 5</th>
<th>FC</th>
<th>HC</th>
<th>MOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possessions (s)</td>
<td>46 (30)</td>
<td>77 (39)</td>
<td>81 (42)</td>
<td>70 (33)</td>
</tr>
<tr>
<td>Passes (n/10-min)</td>
<td>9.9 (4.4)</td>
<td>14.4 (4.6)</td>
<td>12.0 (3.6)</td>
<td>14.1 (4.4)</td>
</tr>
<tr>
<td>Shots (n/10-min)</td>
<td>3.7 (2.4)</td>
<td>6.2 (2.8)</td>
<td>6.8 (3.5)</td>
<td>7.2 (3.3)</td>
</tr>
<tr>
<td>Rebounds (n/10-min)</td>
<td>1.6 (1.2)</td>
<td>2.7 (1.7)</td>
<td>3.5 (1.9)</td>
<td>3.4 (2.1)</td>
</tr>
</tbody>
</table>

- Only differences existed between all 3 v 3 formats in relation to 5 v 5:
  - ES ≥ 0.8 (moderate)
  - ES ≥ 1.0 (moderate)
  - ES ≥ 0.8 (moderate)

- No differences within 3 v 3 formats
Key Findings

- Game format of 3 v 3 WB has a: ............
  
  ...strong bearing on external workload

- Likely to be associated with changes in relative court area per player
  - Rhodes et al. (2016); Torres & Schelling (2016)

- Attributable to the fixed 18-s shot-clock?
- Under constant time constraints court dimensions don’t seem to impact upon technical performance?

<table>
<thead>
<tr>
<th>FC</th>
<th>HC</th>
<th>MOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 m²</td>
<td>35 m²</td>
<td>55 m²</td>
</tr>
</tbody>
</table>
Implications

• Current data could be interpreted in a number of ways……dependent upon priorities of IWBF……..

• High speed, dynamic version of the sport ……. 
  – FC↑ external demands; no Δ technical performance

• Representative of 5 v 5 WB…….. 
  – No significant difference in distance covered, low or mod speed activity between MOD & 5 v 5

• Half court would not appear to be a favourable format under the currents studies design 
  – Slower pace, without increase in technical activities
Conclusion & Future Considerations

Not currently in a position to make any strong recommendations about which 3 v 3 format might be most appropriate……

- Future research should explore the impact of different shot-clock durations
  - Could different time pressures affect technical performance?

- Need to incorporate **qualitative findings**
  - Determine what the expectations of 3 v 3 WB actually are??
  - Does it need to look like 5 v 5 WB??
  - What are the priorities??
  - What logistical considerations need to be accounted for?
Thank you for listening

Any questions........

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