Introduction

Wheelchair basketball is currently the fastest growing sport for people with a disability and at an elite level, a popular paralympic sport characterised by intermittent high-intensity wheelchair manoeuvring and ball handling skills. Implementation of standardised field testing protocols throughout a training season is often undertaken to enhance training and competitive performance. Regular physical testing using standardised field testing protocols can benefit coaches, athletes and sports scientists in many ways such as by providing baseline data to plan individual conditioning programs, benchmarking of athletes pre and post injury and as a monitoring tool. Physiological testing is now an important adjunct to the preparation of any squad not only to enhance performance but also to reduce the athlete’s susceptibility to injury. In order to fully represent the multi-dimensional nature of fitness of wheelchair basketball, physical assessment of players should include tests of aerobic capacity and anaerobic capacity as well as tests of speed and agility.

Athlete Preparation

Standardised pretest preparation is recommended to enable reliable and valid physiological data to be obtained. Refer to AIS Pretest Environment and Athlete Preparation document for more information.

Training -
Where possible, the time and type of training sessions within the previous 36 hours should be standardised between testing occasions. These training sessions should be familiar and of a light recovery nature.

Diet and Health Status -
There should be no radical changes to diet in the days prior to testing. However, all athletes should eat high carbohydrate meals for the two meals preceding the test. No food should be eaten three hours before the test, but it is important for athletes to present for testing euhydrated, having consumed adequate fluid in the 12 hours prior to testing. Furthermore, athletes should be tested under a consistent health status (preferably healthy).
Recommended Test Order

<table>
<thead>
<tr>
<th>DAY</th>
<th>TESTS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or AM</td>
<td>Anthropometry</td>
<td>Anthropometry conducted in laboratory</td>
</tr>
<tr>
<td>2 or PM</td>
<td>Basketball Line drill</td>
<td></td>
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<tr>
<td></td>
<td>Sprint test</td>
<td></td>
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<tr>
<td></td>
<td>Illinois agility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7min push test</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Divide players into groups of no more than 10.</td>
<td></td>
</tr>
</tbody>
</table>

Equipment Checklist

**Anthropometry**
- [ ] Stadiometer (seated preferred)
- [ ] Balance scales (accurate to +/- 0.05 kg)
- [ ] Skinfold calipers (Harpenden skinfold calipers)
- [ ] Marker pen
- [ ] Anthropometric measuring tape
- [ ] Individual recording sheet
- [ ] Pen

**Basketball Line Drill**
- [ ] Infrared light gate system with associated operating software
- [ ] Large orange cones
- [ ] Recording sheet
- [ ] Pen

**20m Sprint Test**
- [ ] Infrared light gate system with associated operating software
- [ ] Metal measuring tape
- [ ] Field marking tape
- [ ] Marker cones
- [ ] Recording sheet
- [ ] Pen
Illinois Agility Test
[ ] Infrared light gate system with associated operating software
[ ] Witches Hats
[ ] Metal measuring tape
[ ] Field marking tape
[ ] Recording sheet
[ ] Pen

7min Push Test
[ ] Metal measuring tape
[ ] Field marking tape
[ ] 4x Large orange cones, 4x small cones
[ ] Stopwatch
[ ] Recording sheet
[ ] Pen

Test Procedure – Anthropometry

Measurement of sitting height, body mass and sum of 4 skinfolds should be carried out prior to court testing protocols. Other anthropometric measures can be made as required (e.g. arm span).

Sitting Height -
Sitting height is measured to the nearest 0.1cm, using the Frankfort plane and instructing the player to breathe in when taking the measurement.

Body Mass -
Body mass is measured to the nearest 0.05kg with minimal clothing (shorts).

Skinfolds -
Skinfolds are recorded over 4 sites (triceps, biceps, subscapular, abdomen). Players should be marked up prior to measuring skinfolds - refer to the AIS Surface Anthropometry document and/or ISAK Manual 2011 for a detailed description of test procedures.

Test Procedure – Basketball Line Drill

The basketball line drill has been used for able bodied basketball athletes, where a foot is placed on or over each turning line but for this athlete population the test is modified so that each athlete is required to change direction around a cone placed on each line. Each athlete is required to complete the course in the shortest time possible, with all turns being made to the right.

- Place cones in the middle of each of the free throw lines, centre line and each baseline in a straight line (see Figure 1).
- Start gate should be set-up on the baseline to the left of the starting key, and the finish gate on the baseline to the right of the starting key. Light gates should be set at height where athlete’s centre of mass breaks light gate beam/s.
- Starting from the designated baseline, the test requires the athlete to push at maximal speed out to the nearest free throw line (5.8 m), complete a 180° turn around the cone, return to the starting baseline, complete a 180° turn around the cone, and then repeat this process at the centre line (14 m), furthest free throw line (22.2 m), and opposite baseline (28 m).
- The athlete begins with the wheels of their chair just touching the start line (0 m) inside the first set of timing lights.
- The athlete may start in their own time once they have been advised that the timing system is ready, thus eliminating reaction time.
- Timing ceases and the test is completed when the athlete breaks the timing beam of the finish gates.
- Only one attempt of the test is made.

![Figure 1. Lay out of the Basketball line drill](image-url)
Test Procedure – 20m Sprint Test

The sprint test is conducted over 20m, with intermediate distances of 3m, 5m and 10m. Athletes start from a stationary position, with their front wheels on the 0m point, in line with the start gate.

i. Measure specified distances with the measuring tape, checking that there are no twists in the tape when laid out. It is useful, where possible, to use a lane marker or sideline (straight line) to lay the measuring tape along.

ii. Mark each interval (i.e., 3, 5, 10 m) with masking tape including a start line (0 m) and a finishing line (20 m).

iii. Place two cones approximately 4 m after the last set of light gates.

iv. Set the light gates at the appropriate intervals (3, 5, 10 and 20 m).

v. Set the light gates on the start line at a lower height to ensure capture of the start. Other light gates should be set at approximately torso height and approximately 2.0 m apart.

vi. The starting position is with front wheels just touching the start line (0 m).

vii. Once the athlete is in the ready position, all subsequent movement must be in a forward direction (i.e., no rocking is allowed).

viii. The athlete may start in their own time once they have been advised that the system is ready.

ix. The athletes should be instructed to sprint as fast as possible, ensuring that they don’t decelerate until they have passed the cones set 4 m after the final gate.

x. Allow at least 2 min active recovery or rest between sprint trials.

xi. Record best 5m, 10m and 20m times, along with split times recorded for the fastest 20m time, to the nearest 0.01 s.
As with the basketball line drill, wheelchair athletes will be required to change direction around a cone and timing of each test will be provided by infrared timing lights.

- Measure and mark test area as per figure below. Use a measuring tape, checking that there are no twists in the tape when laid out, and place cones (A-F) at relevant points.
- Set the start and finish light gates at the lower height.
- The test requires the athlete to sprint 10 m forward to cone A, make a right hand turn around the cone, sprint forward to cone B, make a left hand turn around the cone, weave up through central line of cones (left of cone C, right of cone D, left of cone E), make a right turn around cone E and weave back to base cone (right cone D, left cone C, right cone B), make a left turn around cone B, sprint forward to cone F, make a right hand turn around the cone and sprint 10m forward to finish line passing through timing gate,
- The athletes begin with their front wheels on a start line in a stationary position, and once the timing lights are set the athlete can proceed when ready.
- Each athlete is allowed three trials with a minimum of 60 s between efforts and the best time will be used in the analysis.
Test Procedure – 7min Push Test

The 7 min push test is a wheelchair specific test which assesses the athletes aerobic work capacity, determined by recording the maximum distance achieved in 7 minutes of effort around an 80m course.

- Using a court surface, measure and mark a 20m x 20m square with a measuring tape checking that there are no twists in the tape when laid out. Mark each corner as well as halfway points of each sideline with marking tape. Place large cones on each corner and smaller cones on sideline halfway points.
- Athletes should be instructed that they must go around each corner cone without knocking them over.
- Athletes can begin at any corner and proceed in their preferred direction when given the command to start. Typically athletes proceed in an anti-clockwise direction, with maximum of two athletes performing the test simultaneously (start at opposite corners). Whilst testing more than two athletes simultaneously is possible, it results in too much overtaking and increases distance travelled by athletes.
- A stopwatch is used for timing and strong verbal encouragement should be provided to all athletes including the time remaining in the test.
- Record the number of completed laps to the nearest 1/8th of a lap (cones on sidelines are used to mark 1/8th of each lap).

Data Interpretation

All data collected from the above mentioned testing protocols is interpreted via comparison to previous test results as well as comparison to group averages.
**Normative Data**

**Anthropometric normative data for elite male Wheelchair Basketball athletes**

(mean ± SD; range)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Sitting Height (cm)</th>
<th>Body Mass (kg)</th>
<th>Arm Span (cm)</th>
<th>∑4 Skinfolds (mm)</th>
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</thead>
<tbody>
<tr>
<td>1.0 (n=4)</td>
<td>0.86 ± 0.08</td>
<td>67.1 ± 7.7</td>
<td>1.84 ± 0.04</td>
<td>49.9 ± 6.9</td>
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<tr>
<td>1.5 (n=2)</td>
<td>0.87 ± 0.08</td>
<td>55.6 ± 20.1</td>
<td>1.73 ± 0.16</td>
<td>37.8 ± 19.1</td>
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<td>2.0 (n=2)</td>
<td>0.94 ± 0.04</td>
<td>75.0 ± 9.5</td>
<td>1.84 ± 0.18</td>
<td>81.4 ± 25.0</td>
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<tr>
<td>3.0 (n=2)</td>
<td>0.91 ± 0.06</td>
<td>67.8 ± 16.7</td>
<td>1.80 ± 0.14</td>
<td>56.3 ± 26.9</td>
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<tr>
<td>3.5 (n=1)</td>
<td>0.86</td>
<td>48.0</td>
<td>1.78</td>
<td>24.3</td>
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<tr>
<td>4.0 (n=4)</td>
<td>0.95 ± 0.02</td>
<td>75.6 ± 11.6</td>
<td>1.82 ± 0.10</td>
<td>51.5 ± 20.4</td>
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<tr>
<td>4.5 (n=3)</td>
<td>1.0 ± 0.02</td>
<td>97.2 ± 15.0</td>
<td>1.94 ± 0.03</td>
<td>56.5 ± 17.1</td>
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<tr>
<td>All (n=19)</td>
<td>0.91 ± 0.07</td>
<td>71.3 ± 16.6</td>
<td>1.83 ± 0.12</td>
<td>54.7 ± 22.0</td>
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</table>

**Performance test normative data for elite male Wheelchair Basketball athletes**

(mean ± SD; range)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Basketball Line Drill (s)</th>
<th>20 m Sprint 5m Split Time (0-5m, s)</th>
<th>20 m Sprint 10m Split Time (0-10m, s)</th>
<th>20m Sprint 20m Time (s)</th>
<th>Illinois Agility Test (s)</th>
<th>7min Push Test (laps)</th>
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<tbody>
<tr>
<td>1.0 (n=4)</td>
<td>46.40 ± 2.01</td>
<td>1.96 ± 0.21</td>
<td>3.21 ± 0.25</td>
<td>5.40 ± 0.34</td>
<td>25.77 ± 0.55</td>
<td>18.2 ± 0.9</td>
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<tr>
<td>1.5 (n=2)</td>
<td>44.72 ± 1.97</td>
<td>1.82 ± 0.11</td>
<td>3.05 ± 0.16</td>
<td>5.17 ± 0.24</td>
<td>25.21 ± 0.21</td>
<td>19.6 ± 1.2</td>
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<td>2.0 (n=2)</td>
<td>48.88 ± 0.71</td>
<td>1.86 ± 0.07</td>
<td>3.14 ± 0.13</td>
<td>5.37 ± 0.23</td>
<td>26.26 ± 0.01</td>
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<td>46.52 ± 2.36</td>
<td>1.83 ± 0.17</td>
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<td>5.20 ± 0.30</td>
<td>25.60 ± 0.75</td>
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<td>47.20</td>
<td>2.27</td>
<td>3.52</td>
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<td>4.0 (n=4)</td>
<td>43.30 ± 3.59</td>
<td>1.67 ± 0.06</td>
<td>2.83 ± 0.07</td>
<td>4.83 ± 0.14</td>
<td>24.07 ± 1.22</td>
<td>21.8 ± 0.6</td>
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<tr>
<td>4.5 (n=3)</td>
<td>42.45 ± 2.50</td>
<td>1.72 ± 0.10</td>
<td>2.92 ± 0.16</td>
<td>5.01 ± 0.26</td>
<td>25.03 ± 0.90</td>
<td>21.1 ± 1.8</td>
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<tr>
<td>All (n=19)</td>
<td>45.77 ± 2.51</td>
<td>1.82 ± 0.18</td>
<td>3.05 ± 0.22</td>
<td>5.18 ± 0.32</td>
<td>25.33 ± 0.93</td>
<td>19.7 ± 1.7</td>
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## Traceability Information:

<table>
<thead>
<tr>
<th>Date</th>
<th>Protocol / Code</th>
<th>Change Authorised by</th>
<th>Details</th>
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<tr>
<td>June 2010</td>
<td>AIS Wheelchair Basketball Test Protocols 2010</td>
<td>Dale Chapman</td>
<td>Veer tests removed; Illinois agility figure updated</td>
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<tr>
<td>July 2011</td>
<td>AIS WC Basketball v1.0</td>
<td>Nicole Thomas</td>
<td>Document title changes; annual summary removed to separate document</td>
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<tr>
<td>Feb 2014</td>
<td>NP_Wheelchair Basketball_v1.1_2014</td>
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<td>National protocol document created; normative data added</td>
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