

Fitness Assessments for Athletes Who Use Wheelchairs

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Aims

- Provide a brief overview of Fitness testing for athletes who use wheelchairs
- Considerations for Pre- and Post testing procedures.
- Example of Lakeshore Foundation's Wheelchair Athletic testing.

What are fitness assessments?

- Fitness assessments are a combination of tests that help assess a person's health and fitness levels

Reasons for athletic exercise testing

- Current physical condition
 - “Fitness assessments can also help illustrate how your client is able to function and his or her mobility within an exercise environment”
- Pre-existing health risks
- Results can guide training
 - “fitness assessments can play an important role in determining the athlete’s appropriate training intensity and fitness levels”

Categories to be tested

- Cardiorespiratory Fitness
- Muscular Strength
- Muscular Endurance
- Body composition
- Balance
- Flexibility

How to select the right exercise tests

- Movements matter
 - Sport Specificity: Tests need to be similar to athletic competition
- Energy systems matter
 - Aerobic (endurance) vs. Anaerobic (Strength) vs. Anaerobic (Power)
- Timing of test matter
 - Time available vs. Time needed

	Cardio	Muscular Strength	Muscular Endurance	Balance	Flexibility	Body Composition
<i>Lab-Based</i>	-VO2 testing, -Upper body ergometer, -Wheelchair propulsion ergometer, -Wheelchair treadmill	-Biodex, -Dynamometer (isokinetic, handgrip)	-Wingate arm crank anaerobic testing (tests power)	-Biodex or Neurocom seated balance		-DEXA -Bod pod, -Hydrostatic Weighing (both bod pod and hydrostatic weighing are difficult and awkward for individual and should be limited)
<i>Lab-and-Field Mix</i>	-Six-Minute push test with VO2 testing (cosmed), -Spirometers (cardiorespiratory functioning), - Arm Crank, modified Astrand, -MACAFT	-Manual muscle testing, - One-repetition maximum, -Eight repetition maximum, -Myometry	-Wheeling up a ramp (modified Margaria, tests power)	-Tinetti performance orientation assessment	-Sit and reach, -Shoulder flexion and extension, -Trunk forward and lateral flexion with goniometer	-BIA - Segmented BIA
<i>Field-Based</i>	-Six-Minute push test, -12-Minute Wheelchair Propulsion test, -Multistage field test for wheelchair users (beep test), -Heart rate, Blood pressure	-Handgrip strength test, - Medicine ball throw	-Push-Ups, -Pull Ups, -Biceps curls test, - Curl ups	-STAR balance test	-Back scratch test, - Trunk rotation test	-Skinfold - BMI - Girth measurements

Lab vs Field based options

What are you testing?	Field Based (Easy and Cheap!)	Lab Based (Expensive but more data)
Endurance	12 minute Push Test	Arm Crank VO2 Max
Muscular Strength	Medicine Ball Throw	Biodex System3 5RM
Muscular Endurance	Push up test	Arm Crank Wingate Test
Balance	STAR balance test	Biodex Balance Test
Body Composition	Standing Height, Girth	DEXA scanner
Sport Specific Skills	Basketball target test	NWBA Target pass tests

When to conduct testing

Pre-Testing (Preseason)

- At or before the beginning of Training season
- Before any training effects have taken place.
- Before weight cutting or gaining.

Post-Testing (Post Season)

- After desired training season is completed
- Periodically throughout training to track progression
- After weight gain or loss has occurred.

How to run multiple tests in one day

- Give ample rest between tests.
- Consider athlete's needs before setting schedule
 - Taping
 - Binding
 - Time of day
 - Nutrition
 - Run tests that don't require sport chair first.
- Consider athlete's schedule

NCHPAD Recommended Order

- Resting measures such as heart rate and blood pressure
- Body composition and anthropometry
- Cardiovascular fitness
- Muscular strength and endurance
- Flexibility

Medical Considerations before testing Wheelchair Athletes.

- Blood Pressure
 - Autonomic Dysreflexia
 - Signs of cardiac distress
- Resting Pulse
- Medications
- Existing Injuries or pressure sores
- Shoulder Joint pain

Real World Application



2015 Lakeshore Wheelchair Basketball Program Evaluation

Hui-Ju (Zoe) Young, PhD.

- **Purpose:** to evaluate changes in physical function, basketball skills, and quality of life measures in individuals who participated in the 2015 wheelchair basketball program (Varsity team and DIII team).
- **Pre- and Post-Assessments**
 - Demographics (both teams)
 - Anthropometrics (both teams)
 - Physical Exercise Self Efficacy Scale (DIII team)
 - PROMIS Short Form 8a: 1) Ability to Participate in Social Roles and Activities; 2) Emotional Distress-Anxiety; 3) Emotional Distress-Depression; 4) Pain Interference; 5) Sleep Disturbance (DIII team)
 - Three-Item Loneliness Scale (DIII team)
 - Quality of life measures: 1) Emotional functioning; 2) Social functioning; 3) School functioning (Varsity team)
 - Grip strength (both teams)
 - Maximal basketball pass (both teams)
 - Medicine ball throw (both teams)
 - 20-meter Sprint Test (both teams)
 - Wheelchair basketball skills: 1) Passing test; 2) Lay-ups shooting test (both teams)
- Pre- and post-assessments were conducted in Oct 2015 and Mar 2016, respectively.

Evaluation Outcomes: Varsity Team

Assessment Items	Pre (n= 7)	Post (n= 7)	Percent Change (%)
BMI, kg/m²	26.1 ± 10.5	26.3 ± 10.6	0.8
Resting Heart Rate, bpm	99.8 ± 16.3	97.3 ± 16.1	-2.5
Grip Strength, kg			
<i>Dominant Hand</i>	36.4 ± 12.3	33.6 ± 9.9	-7.7
<i>Non-Dominant Hand</i>	34.9 ± 13.0	31.7 ± 13.0	-9.2
Maximal Pass, cm	705.4 ± 152.2	751.8 ± 179.7	6.6*
Medicine Ball Throw, cm	371.3 ± 136.8	359.7 ± 144.4	-3.1
20 Meter Sprint, sec	6.2 ± 0.9	6.3 ± 0.8	1.6
Passing Test, out of 10	5.3 ± 2.6	8.0 ± 2.3	50.9*
Lay-ups Shooting Test, out of 10			
<i>Right</i>	3.8 ± 1.2	4.2 ± 1.6	10.5
<i>Left</i>	4.0 ± 1.9	5.0 ± 1.8	25.0
Quality of Life Measures			
<i>Emotional Functioning</i>	345.8 ± 91.4	404.2 ± 76.5	16.9
<i>Social Functioning</i>	383.3 ± 76.9	366.7 ± 97.0	-4.3
<i>School Functioning</i>	341.7 ± 64.5	383.3 ± 54.0	12.2

Evaluation Outcomes: DIII Team

Assessment Items	Pre (n= 8)	Post (n= 8)	Percent Change (%)
BMI, kg/m²	23.1 ± 5.0	23.6 ± 10.2	2.2
Resting Heart Rate, bpm	85.2 ± 14.0	80.3 ± 11.5	-5.8
Grip Strength, kg			
<i>Dominant Hand</i>	32.7 ± 10.7	31.1 ± 9.7	-4.9
<i>Non-Dominant Hand</i>	31.1 ± 10.2	30.8 ± 8.9	-1.0
Maximal Pass, cm	663.6 ± 228.2	674.4 ± 223.5	1.6
Medicine Ball Throw, cm	329.3 ± 155.8	342.9 ± 138.3	4.1
20 Meter Sprint, sec	6.4 ± 0.8	6.2 ± 1.0	-3.1
Passing Test, out of 10	6.0 ± 3.8	6.3 ± 4.1	5.0
Lay-ups Shooting Test, out of 10			
<i>Right</i>	2.5 ± 3.0	3.3 ± 2.7	32.0
<i>Left</i>	1.9 ± 2.2	3.0 ± 2.4	57.9
Quality of Life Measures			
<i>Physical Exercise Self Efficacy Scale</i>	15.6 ± 2.6	15.1 ± 3.4	-3.2
<i>Ability to Participate in Social Role</i>	33.0 ± 4.3	32.3 ± 5.2	-2.1
<i>Emotional Distress- Anxiety</i>	32.0 ± 5.6	34.9 ± 4.5	9.1
<i>Emotional Distress-Depression</i>	33.8 ± 6.5	34.9 ± 4.9	3.3
<i>Fatigue</i>	30.1 ± 6.0	32.9 ± 4.4	9.3
<i>Pain Interference</i>	31.0 ± 6.8	33.0 ± 3.1	6.5
<i>Sleep Quality</i>	32.3 ± 5.5	31.3 ± 5.1	-3.1
<i>Loneliness Scale</i>	7.5 ± 2.0	8.1 ± 1.6	8.0*

Discussion

- Many athletes in both Varsity and DIII teams had high score to begin with in most assessment items, making the possible range of improvement smaller.
- All athletes in the **Varsity team** and 5 athletes in the **DIII team** also exercised outside of the program.
- One athlete on the **Varsity team** and 4 athletes on the **DIII team** changed exercise routine after the program started.
- While more detailed monitoring of exercise outside the program as well as a control group will be needed to really test the effects of the wheelchair basketball program, the project shows some promising results in improving basketball skills and quality of life measures after participating in such a program.

Final Keys to Reliable Testing Results

- Be Sport Specific in test selection
- Plan ahead and plan often
- Repeat exact testing conditions during Pre and Post testing
- Train testers before testing day
- Keep the athlete at the center.

Acknowledgments

- The Lakeshore Foundation (www.lakeshore.org)
- National Center For Health, Physical Activity and Disability
 - <https://www.nchpad.org>
- “*Fitness Assessments for Individuals who use a Wheelchair*”, National Center for Health, Physical Activity and Disability.
 - https://www.nchpad.org/fppics/NCHPAD_Fitness%20Assessments_revised.pdf
- Hui-Ju (Zoe) Young, PhD.

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