

TESTS & MEASURES

Test	Procedures	Statistics																																										
Timed Up & Down Stairs (TUDS)¹	E: Stopwatch, stairs (14 steps) S: Student wears shoes but no orthotics. Student stands 1 foot from the bottom of one flight of stairs (with 14 steps). D: Instruct child to "Quickly, but safely go up the stairs, turn around on the top step (landing) & come all the way down until both feet land on the bottom step (landing)."	8.1 sec (range 6.3-12.6 sec), age 8-14 y/o (N=27) or 0.58 sec per step																																										
Timed Up & Go (TUG)^{1,2}	E: Stopwatch, chair, tape or other marker S: Student is barefoot; sits with knees & hips bent 90°. D: On "go" student stands up, walks 3 meters (9 ft 10 in) to a designated mark, turns around, walks back and sits on the chair.	5.2 sec (range 4.4-6.7 sec), 8-14 y/o (N=27) - similar to that found in a study with larger sample (N=180) from Pakistan																																										
Timed Floor to Stand³	E: Stopwatch, tape measure, tape or other marker S: Student seated on floor in a cross-legged position. D: Student is asked to get up from floor, walk as quickly as possible for 3 meters (9 ft 10 in), turn around, walk back to starting line, & sit back down on the floor in cross-legged position.	6.6 sec (range 4.4-12.1 sec), age 5-22 y/o (N=150) <table border="1"> <thead> <tr> <th>Age</th> <th>Mean (sec)</th> <th>±SD</th> </tr> </thead> <tbody> <tr> <td>5-6</td> <td>7.5</td> <td>1.5</td> </tr> <tr> <td>7-8</td> <td>6.4</td> <td>1.1</td> </tr> <tr> <td>9-10</td> <td>6.4</td> <td>0.7</td> </tr> <tr> <td>11-12</td> <td>6.3</td> <td>1.2</td> </tr> <tr> <td>13-16</td> <td>6.6</td> <td>1.0</td> </tr> <tr> <td>17-21</td> <td>6.6</td> <td>1.0</td> </tr> </tbody> </table>	Age	Mean (sec)	±SD	5-6	7.5	1.5	7-8	6.4	1.1	9-10	6.4	0.7	11-12	6.3	1.2	13-16	6.6	1.0	17-21	6.6	1.0																					
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Thirty Second Walk Test^{4,5}	E: Tape measure, tape or other marker S: Demarcate a walking course using tape making sure to round off at the corners (-no sharp turns). D: Instruct student to walk as if they are line leaders (walk not run), beginning when told & stopping when instructed (30 sec.). Measure the distance walked to the nearest inch. The student's forwardmost foot placement is determined by the most advanced part of the foot in contact with the floor (e.g. heel at heel strike, toes at midstance). *For secondary school students, the instruction is to walk a "natural and comfortable pace".	(N=302) <table border="1"> <thead> <tr> <th>Age</th> <th>Mean (ft)</th> <th>±SD</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>135.3</td> <td>11.6</td> </tr> <tr> <td>6</td> <td>140.5</td> <td>23.5</td> </tr> <tr> <td>7</td> <td>152.9</td> <td>16.8</td> </tr> <tr> <td>8</td> <td>158.2</td> <td>17.2</td> </tr> <tr> <td>9</td> <td>162.6</td> <td>20.0</td> </tr> <tr> <td>10</td> <td>164.6</td> <td>17.9</td> </tr> <tr> <td>11</td> <td>156.3</td> <td>17.8</td> </tr> <tr> <td>12</td> <td>159.7</td> <td>18.0</td> </tr> <tr> <td>13</td> <td>155.2</td> <td>16.6</td> </tr> <tr> <td>14</td> <td>151.5</td> <td>20.5</td> </tr> <tr> <td>15</td> <td>146.4</td> <td>23.0</td> </tr> <tr> <td>16</td> <td>138.5</td> <td>17.0</td> </tr> <tr> <td>17</td> <td>135.8</td> <td>20.9</td> </tr> </tbody> </table>	Age	Mean (ft)	±SD	5	135.3	11.6	6	140.5	23.5	7	152.9	16.8	8	158.2	17.2	9	162.6	20.0	10	164.6	17.9	11	156.3	17.8	12	159.7	18.0	13	155.2	16.6	14	151.5	20.5	15	146.4	23.0	16	138.5	17.0	17	135.8	20.9
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6-Minute Walk Test⁶	E: Tape measure, tape or other marker S: Mark a walking course in a large open space (gym, large corridor) with tape, & place a cone or other marker at the starting point of each lap. D: At "go" student walks as fast as possible (without running) for 6 minutes. The therapist can provide verbal encouragement every 30 seconds. At the end of 6 minutes, measure laps completed & convert it to distance walked.	(N=328) <table border="1"> <thead> <tr> <th>Age</th> <th>Distance (m)</th> <th>Distance (ft)</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>383 ± 41</td> <td>1257 ± 135</td> </tr> <tr> <td>5</td> <td>420 ± 39</td> <td>1378 ± 128</td> </tr> <tr> <td>6</td> <td>463 ± 40</td> <td>1519 ± 131</td> </tr> <tr> <td>7</td> <td>488 ± 35</td> <td>1601 ± 115</td> </tr> <tr> <td>8</td> <td>483 ± 40</td> <td>1585 ± 131</td> </tr> <tr> <td>9</td> <td>496 ± 53</td> <td>1627 ± 174</td> </tr> <tr> <td>10</td> <td>506 ± 45</td> <td>1660 ± 148</td> </tr> <tr> <td>11</td> <td>512 ± 41</td> <td>1680 ± 135</td> </tr> </tbody> </table>	Age	Distance (m)	Distance (ft)	4	383 ± 41	1257 ± 135	5	420 ± 39	1378 ± 128	6	463 ± 40	1519 ± 131	7	488 ± 35	1601 ± 115	8	483 ± 40	1585 ± 131	9	496 ± 53	1627 ± 174	10	506 ± 45	1660 ± 148	11	512 ± 41	1680 ± 135															
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References:

- 1. Timed Up and Down Stairs Test: Preliminary Reliability and Validity of a New Measure of Functional Mobility.** Zaino, Christopher A.; Marchese, Victoria Gocha; Westcott, Sarah L. *Pediatric Physical Therapy*. 16(2):90-98, Summer 2004.
- 2. Assessment of balance abilities in Pakistani children: a cultural perspective.** Habib Z, Westcott S, Valvano J. *Pediatr Phys Ther*. 1999;11:73-82.
- 3. A physical performance measure for individuals with mucopolysaccharidosis type I,** *Developmental Medicine and Child Neurology*, 2006, Haley et al, 576-581.
- 4. Standard Task Measurement for Mobility: Thirty-Second Walk Test.** Knutson, Loretta M.; Schimmel, Patricia Ann; Ruff, Andrew; *Pediatric Physical Therapy*. 11(4):183-190, Winter 1999.
- 5. Age Expansion of the Thirty-Second Walk Test Norms for Children.** Knutson, Loretta M.; Bushman, Barbara; Young, Janice Clark; Ward, Gary; *Pediatric Physical Therapy*. 21(3):235-243, Fall 2009.
- 6. The 6-minute walk test: normal values for children of 4-11 years of age,** Lammers AE, Hislop AA, Flynn Y, Haworth SG, *Archive of Childhood Diseases*, August 2007

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Modified Energy Expenditure Index (Modified EEI)³	<p>E: HR monitor, tape or other marker S: Student wears a HR monitor. D: 1. Student walks at a <u>comfortable</u> self-designated pace on a level pre-marked 50m (164 ft) lap course. HR & distance completed are recorded at the end of 3 min. (This is called the Working HR: WHR.) 2. Student walks at a <u>fast</u> self-designated pace on a level pre-marked 50m (164 ft) lap course. HR & distance completed are recorded at the end of 3 min. (This is called the Working HR: WHR.)</p> <p>Modified EEI = $\frac{\text{WHR}}{\text{Distance (in meters)} \div 3 \text{ min.}}$</p>	<p>(N=150)</p> <table border="1"> <thead> <tr> <th>Age</th> <th>Comfortable walk</th> <th>Fast walk</th> </tr> </thead> <tbody> <tr> <td>5-6</td> <td>1.86 (+/- 0.19)</td> <td>1.65 (+/-0.13)</td> </tr> <tr> <td>7-8</td> <td>1.73 (+/- 0.25)</td> <td>1.56 (+/-0.15)</td> </tr> <tr> <td>9-10</td> <td>1.60 (+/- 0.23)</td> <td>1.54 (+/-0.18)</td> </tr> <tr> <td>11-12</td> <td>1.46 (+/- 0.19)</td> <td>1.40 (+/-0.15)</td> </tr> <tr> <td>13-16</td> <td>1.52 (+/- 0.24)</td> <td>1.35 (+/-0.19)</td> </tr> <tr> <td>> 16</td> <td>1.56 (+/- 0.32)</td> <td>1.40 (+/-0.23)</td> </tr> </tbody> </table>	Age	Comfortable walk	Fast walk	5-6	1.86 (+/- 0.19)	1.65 (+/-0.13)	7-8	1.73 (+/- 0.25)	1.56 (+/-0.15)	9-10	1.60 (+/- 0.23)	1.54 (+/-0.18)	11-12	1.46 (+/- 0.19)	1.40 (+/-0.15)	13-16	1.52 (+/- 0.24)	1.35 (+/-0.19)	> 16	1.56 (+/- 0.32)	1.40 (+/-0.23)												
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Pediatric Reach Test (PRT)^{7,8}	<p>E: Tape measure, paper, tape S: Student stands barefoot on a piece of paper that is taped to the floor. Tester traces student's feet on the piece of paper. One end of tape measure is secured to student's fingers while evaluator holds the other end. Record initial reading from tape. D: Student reaches one arm forward. Student is allowed to use whatever strategy he/she wishes as long as he/she does not touch the wall or take a step. Record final reading. Calculate final reading minus initial reading.</p>	<p>By Age (N=116)</p> <table border="1"> <thead> <tr> <th>Age</th> <th>Mean Reach (cm)</th> <th>Critical Reach (-2SD)</th> </tr> </thead> <tbody> <tr> <td>5-6</td> <td>21.17</td> <td>16.79</td> </tr> <tr> <td>7-8</td> <td>24.21</td> <td>20.57</td> </tr> <tr> <td>9-10</td> <td>27.97</td> <td>25.56</td> </tr> <tr> <td>11-12</td> <td>32.79</td> <td>29.68</td> </tr> <tr> <td>13-15</td> <td>32.30</td> <td>29.58</td> </tr> </tbody> </table> <p>By Height (N=80): 7-16 y/o</p> <table border="1"> <thead> <tr> <th>Height (cm)</th> <th>Mean (cm)</th> <th>±SD</th> </tr> </thead> <tbody> <tr> <td><130.2</td> <td>23.07</td> <td>4.34</td> </tr> <tr> <td>130.2-148</td> <td>30.66</td> <td>4.45</td> </tr> <tr> <td>148.1-168.5</td> <td>33.61</td> <td>5.18</td> </tr> <tr> <td>>168.5</td> <td>37.90</td> <td>7.01</td> </tr> </tbody> </table>	Age	Mean Reach (cm)	Critical Reach (-2SD)	5-6	21.17	16.79	7-8	24.21	20.57	9-10	27.97	25.56	11-12	32.79	29.68	13-15	32.30	29.58	Height (cm)	Mean (cm)	±SD	<130.2	23.07	4.34	130.2-148	30.66	4.45	148.1-168.5	33.61	5.18	>168.5	37.90	7.01
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Pediatric Balance Scale (PBS)^{9,10}	<p>E, S & D: The PBS is a 14-item test. Procedures & scoring for the PBS are very specific; see procedures & scoring sheets.</p>	<p>(N=634)</p> <table border="1"> <thead> <tr> <th>Age</th> <th>Mean</th> <th>±1SD</th> </tr> </thead> <tbody> <tr> <td>4.0-4.5</td> <td>49.5</td> <td>5.76</td> </tr> <tr> <td>4.6-4.11</td> <td>51.2</td> <td>5.07</td> </tr> <tr> <td>5.0-5.5</td> <td>54.0</td> <td>2.52</td> </tr> <tr> <td>5.6-5.11</td> <td>53.3</td> <td>3.20</td> </tr> <tr> <td>6.0-6.5</td> <td>53.8</td> <td>2.49</td> </tr> <tr> <td>6.6-6.11</td> <td>54.4</td> <td>1.89</td> </tr> <tr> <td>7.0 & 13.7</td> <td>55.2</td> <td>1.74</td> </tr> </tbody> </table>	Age	Mean	±1SD	4.0-4.5	49.5	5.76	4.6-4.11	51.2	5.07	5.0-5.5	54.0	2.52	5.6-5.11	53.3	3.20	6.0-6.5	53.8	2.49	6.6-6.11	54.4	1.89	7.0 & 13.7	55.2	1.74									
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Shuttle Run³	<p>E: Stopwatch, tape measure, tape, 2 cones, 2 blocks S: Mark off 30 ft with 2 pieces of tape & cones; place 2 blocks just behind the line opposite to the starting line. D: At "go" student runs from starting line to the opposite line, picks up a block, runs back to the starting line, placing the block behind the line. The student repeats this for the 2nd block. Measure time to complete task.</p>	<p>12.6 sec (range 9.0-16.7 sec.), age 5-22 yrs. (N=150)</p> <table border="1"> <thead> <tr> <th>Age</th> <th>Mean (seconds)</th> <th>±SD</th> </tr> </thead> <tbody> <tr> <td>5-6</td> <td>15.1</td> <td>1.1</td> </tr> <tr> <td>7-8</td> <td>13.0</td> <td>1.0</td> </tr> <tr> <td>9-10</td> <td>12.4</td> <td>0.9</td> </tr> <tr> <td>11-12</td> <td>11.5</td> <td>0.8</td> </tr> <tr> <td>13-16</td> <td>11.7</td> <td>1.2</td> </tr> <tr> <td>17-21</td> <td>11.3</td> <td>1.2</td> </tr> </tbody> </table>	Age	Mean (seconds)	±SD	5-6	15.1	1.1	7-8	13.0	1.0	9-10	12.4	0.9	11-12	11.5	0.8	13-16	11.7	1.2	17-21	11.3	1.2												
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References:

- The Use of Functional Reach as a Measurement of Balance in Boys and Girls Without Disabilities Ages 5 to 15 Years. Pediatric Physical Therapy. 6(4):189-193, Winter 1994. Donahoe, Betsy MS, PT, PCS, et al.
- Effects of Measurement Method and Subject Characteristics on the Functional Reach Test in Typically Developing Children. K Volkman, MS, PT, N Stergiou, PhD, W Stuber, PhD, PT, D Blanke, PhD and J Stoner, PhD; Munroe-Meyer Institute at the University of Nebraska Medical Center, and University of Nebraska at Omaha
- Pediatric Balance Scale: A Modified Version of the Berg Balance Scale for the School-Age Child with Mild to Moderate Motor Impairment. Pediatric Physical Therapy. 15(2):114-128, Summer 2003. Franjoine, Mary Rose MS, PT, PCS; Gunther, Joan S. PhD, PT; Taylor, Mary Jean MA, PT, PCS
- The Performance of Children Developing Typically on the Pediatric Balance Scale. Pediatric Physical Therapy. 22(4): 350-359, Winter 2010. Franjoine et al.

Legend: E=Equipment; S=Starting Position; D=Directions; N=Sample Size; SD=Standard Deviation; 1 foot=0.3048 meter; 1 inch=2.54 centimeter