

# TESTS & MEASURES

Test	Procedures	Range (Mean±2SD)																												
<b>Modified Energy Expenditure Index (Modified EEI)<sup>1</sup></b>	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. As above except “walks at a <u>fast</u> self-designated pace.” Modified EEI = $\frac{WHR}{\text{Distance (in meters)} \div 3 \text{ min.}}$ *A lower number is better.	<table border="1"> <thead> <tr> <th>Age</th> <th>N</th> <th>Comfortable walk</th> <th>Fast walk</th> </tr> </thead> <tbody> <tr> <td>5-6</td> <td>23</td> <td>1.48-2.24</td> <td>1.39-1.91</td> </tr> <tr> <td>7-8</td> <td>33</td> <td>1.23-2.23</td> <td>1.26-1.86</td> </tr> <tr> <td>9-10</td> <td>36</td> <td>1.14-2.06</td> <td>1.18-1.9</td> </tr> <tr> <td>11-12</td> <td>16</td> <td>1.08-1.84</td> <td>1.10-1.70</td> </tr> <tr> <td>13-16</td> <td>22</td> <td>1.04-2.00</td> <td>0.97-1.73</td> </tr> <tr> <td>&gt; 16</td> <td>20</td> <td>0.92-2.20</td> <td>0.94-1.86</td> </tr> </tbody> </table>	Age	N	Comfortable walk	Fast walk	5-6	23	1.48-2.24	1.39-1.91	7-8	33	1.23-2.23	1.26-1.86	9-10	36	1.14-2.06	1.18-1.9	11-12	16	1.08-1.84	1.10-1.70	13-16	22	1.04-2.00	0.97-1.73	> 16	20	0.92-2.20	0.94-1.86
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<b>Functional Reach Test (FRT)<sup>2,3</sup></b>	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.	By Age: <table border="1"> <thead> <tr> <th>Age</th> <th>N</th> <th>Reach (cm)</th> </tr> </thead> <tbody> <tr> <td>5-6</td> <td>22</td> <td>16.79-25.55</td> </tr> <tr> <td>7-8</td> <td>36</td> <td>20.57-27.85</td> </tr> <tr> <td>9-10</td> <td>15</td> <td>25.56-30.38</td> </tr> <tr> <td>11-12</td> <td>34</td> <td>29.68-35.90</td> </tr> <tr> <td>13-15</td> <td>10</td> <td>29.58-35.02</td> </tr> </tbody> </table> By Height, N=80: ( 7-16 y/o) <table border="1"> <thead> <tr> <th>Height (cm)</th> <th>Reach (cm)</th> </tr> </thead> <tbody> <tr> <td>&lt;130.2</td> <td>14.39-31.75</td> </tr> <tr> <td>130.2-148</td> <td>21.76-39.56</td> </tr> <tr> <td>148.1-168.5</td> <td>23.25-43.97</td> </tr> <tr> <td>&gt;168.5</td> <td>23.88-51.92</td> </tr> </tbody> </table>	Age	N	Reach (cm)	5-6	22	16.79-25.55	7-8	36	20.57-27.85	9-10	15	25.56-30.38	11-12	34	29.68-35.90	13-15	10	29.58-35.02	Height (cm)	Reach (cm)	<130.2	14.39-31.75	130.2-148	21.76-39.56	148.1-168.5	23.25-43.97	>168.5	23.88-51.92
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<b>Pediatric Balance Scale (PBS)<sup>4</sup></b>	E, S & D: The PBS is a 14-item test. Procedures & scoring for the PBS are very specific; see procedures & scoring sheets.	<table border="1"> <thead> <tr> <th>Age</th> <th>N</th> <th>Score</th> </tr> </thead> <tbody> <tr> <td>4.0-4.5</td> <td>52</td> <td>37.98-56</td> </tr> <tr> <td>4.6-4.11</td> <td>82</td> <td>41.06-56</td> </tr> <tr> <td>5.0-5.5</td> <td>99</td> <td>48.96-56</td> </tr> <tr> <td>5.6-5.11</td> <td>58</td> <td>46.9-56</td> </tr> <tr> <td>6.0-6.5</td> <td>67</td> <td>48.82-56</td> </tr> <tr> <td>6.6-6.11</td> <td>41</td> <td>50.62-56</td> </tr> <tr> <td>7.0 &amp; 13.7</td> <td>123</td> <td>51.72-56</td> </tr> </tbody> </table>	Age	N	Score	4.0-4.5	52	37.98-56	4.6-4.11	82	41.06-56	5.0-5.5	99	48.96-56	5.6-5.11	58	46.9-56	6.0-6.5	67	48.82-56	6.6-6.11	41	50.62-56	7.0 & 13.7	123	51.72-56				
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<b>5 Repetitions Sit to Stand<sup>5</sup></b>	E: Armless chair, rope S: Set up rope at the level of student’s body height. Student sits barefoot with hip flexed 90 deg. & knee flexed 105 deg. D: “Fold your arms across the chest. Stand up and sit down as quickly as possible for 5 times. Touch the rope with your head when standing up. The test will be finished when you return to seated position the 5th time. Continue sit-to-stand movement till I ask you to stop. If you try but cannot stand up, just let me know. Ready, go!” Time starts with trunk-initiated flexion. Time stops when the buttocks touch the seat for the 5th time.	<table border="1"> <thead> <tr> <th>GMFCS</th> <th>N</th> <th>Reps per sec</th> <th>Time (s)</th> </tr> </thead> <tbody> <tr> <td>TD</td> <td>62</td> <td>0.39-0.75</td> <td>6.67-12.82</td> </tr> <tr> <td>1</td> <td>53</td> <td>0.27-0.83</td> <td>6.02-18.5</td> </tr> <tr> <td>2</td> <td>43</td> <td>0.06-0.70</td> <td>7.14-83.33</td> </tr> <tr> <td>3</td> <td>12</td> <td>0-0.43</td> <td>11.63-∞*</td> </tr> </tbody> </table> *some students were unable to complete the 5 reps	GMFCS	N	Reps per sec	Time (s)	TD	62	0.39-0.75	6.67-12.82	1	53	0.27-0.83	6.02-18.5	2	43	0.06-0.70	7.14-83.33	3	12	0-0.43	11.63-∞*								
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<b>6-Minute Walk Test<sup>6,7</sup></b>	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.	From Lammers, et al (UK) <table border="1"> <thead> <tr> <th>Age</th> <th>N</th> <th>Distance (ft)</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>36</td> <td>987-1527</td> </tr> <tr> <td>5</td> <td>40</td> <td>1122-1634</td> </tr> <tr> <td>6</td> <td>40</td> <td>1257-1781</td> </tr> </tbody> </table> From Klepper, et al (NYC) <table border="1"> <thead> <tr> <th>Age</th> <th>N</th> <th>Distance (ft)</th> </tr> </thead> <tbody> <tr> <td>7-8</td> <td>28</td> <td>1308-2151</td> </tr> <tr> <td>9</td> <td>27</td> <td>1218-2271</td> </tr> <tr> <td>10</td> <td>35</td> <td>1193-2069</td> </tr> <tr> <td>11</td> <td>8</td> <td>1191-2311</td> </tr> </tbody> </table>	Age	N	Distance (ft)	4	36	987-1527	5	40	1122-1634	6	40	1257-1781	Age	N	Distance (ft)	7-8	28	1308-2151	9	27	1218-2271	10	35	1193-2069	11	8	1191-2311	
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1. A physical performance measure for individuals with mucopolysaccharidosis type I, Developmental Medicine and Child Neurology, 2006, Haley et al, 576-581.
2. The Use of Functional Reach as a Measurement of Balance in Boys and Girls Without Disabilities Ages 5 to 15 Years. Pediatric Physical Therapy.
3. 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
4. The Performance of Children Developing Typically on the Pediatric Balance Scale. Pediatric Physical Therapy. 22(4): 350-359, Winter 2010. Franjoine et al.
5. Reliability and validity of the five-repetition sit-to-stand test for children with cerebral palsy. Clinical Rehabilitation. 26(7): 664-671. 2011. Wang et al.
6. Reference values on the 6-minute walk test for children living in the United States. Pediatric Physical Therapy. 23(1): 32-40. Spring 2011. Klepper and Muir.
7. 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

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

Test	Procedures	Statistics							
<b>Timed Up &amp; Down Stairs (TUDS)*</b>	<p>E: Stopwatch, stairs, measuring tape, tape or other marker</p> <p>S: Student wears shoes but no orthotics. Student stands 12 inches from the bottom of one flight of stairs. Hands at sides</p> <p>D: "When I say go, quickly, but safely, go up the stairs, turn around on the top landing, and come right back down." Timing begins on the word "go" and ends when both feet reach the bottom landing.</p>	<b>Age</b>	<b>N</b>	<b>Mean per step (s)</b>	<b>2SD per step (s)</b>	<b>Range for 12 steps (s)</b>	<b>Range for 13 steps (s)</b>	<b>Range for 14 steps(s)</b>	
		5	190	0.91	.38	6.36-15.48	6.89-16.77	7.42-18.06	
		6	244	0.80	.32	5.76-13.44	6.24-14.56	6.72-15.68	
		7	217	0.72	.22	6.00-11.28	6.50-12.22	7.00-13.16	
		8	196	0.66	.20	5.52-10.32	5.98-11.18	6.44-12.04	
		9	200	0.62	.16	5.52-9.33	5.98-10.14	6.44-10.92	
		10	177	0.59	.14	5.40-8.76	5.85-9.49	6.34-10.18	
		11	95	0.57	.18	4.68-9.00	5.07-9.75	5.46-10.50	
		12	105	0.56	.18	4.56-8.88	4.94-9.62	5.32-10.36	
		13	43	0.57	.16	4.92-8.76	5.33-9.49	5.74-10.22	
		14	11	0.55	.16	4.68-8.52	5.07-9.23	5.46-9.94	
		<b>Timed Up &amp; Go (TUG)<sup>8</sup></b>	<p>E: Stopwatch, chair, tape or other marker</p> <p>S: Mark floor with 2 lines (using tape) 9 ft. 10 in. apart. Place armless chair behind one of the lines so that student's toes are touching the line when starting. Student sits with knees and hips bent at 90°. Shoes are on.</p> <p>D: "When I say go, stand up, walk to the line, turn around, walk back to the starting line, and sit back down on the bench. Walk, don't run. 1, 2, 3, GO." Timing begins on the word "go" and ends when the student sits back down.</p>	<b>Age</b>	<b>N</b>	<b>SD Range (s)</b>			
				5	186	4.84-9.32			
				6	244	4.44-9.12			
7	221			4.45-9.09					
8	197			4.00-8.68					
9	203			4.20-8.20					
10	180			4.33-8.17					
11	95			4.63-8.27					
12	110			4.86-8.54					
13	45			5.04-9.20					
14	10			4.89-8.85					
<b>Timed Floor to Stand-Normal (TFTS-N)<sup>9</sup></b>	<p>E: Stopwatch, tape measure, tape or other marker</p> <p>S: Mark floor with 2 lines (using tape) 9 ft. 10 in. apart. Student is seated on floor behind one of the lines in cross-legged position with the frontmost part of the body touching the line.</p> <p>D: "When I say "go" stand up, walk to the line, turn around, walk back to the starting line, and sit back down, crisscross applesauce" (for 5-8 year olds), or "with your legs crossed" (for 9-17 year olds). "Walk, don't run. 1, 2, 3, GO." Timing begins on the word "go"</p>			<b>Age</b>	<b>N</b>	<b>Range (s)</b>			
				5	183	5.61-12.33			
				6	239	5.54-11.54			
		7	214	5.32-11.48					
		8	195	4.61-11.21					
		9	204	5.16-10.76					
		10	178	5.26-10.62					
		11	99	5.32-10.84					
		12	111	5.69-10.85					
		13	12	5.92-11.80					
		14	11	5.33-11.21					
		<b>Thirty-Second Walk Test (30sWT)*</b>	<p>E: Stopwatch, rollator, 4 cones, tape or other marker</p> <p>S: Demarcate a walking course using tape making sure to round off at the corners (no sharp turns). Mark outside of each corner with a cone.</p> <p>D: "When I say go, walk like a line leader (5-8 year olds) or at a natural and comfortable pace (9-14 years old) until I say freeze, stay within the cones. Walk, don't run." Timing begins on the word "go" and the student stops on the verbal command "freeze." Distance measured to the nearest inch. The student's forward most 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).</p>	<b>Age</b>	<b>N</b>	<b>Range (ft)</b>			
				5	136	89.41-170.77			
				6	188	99.05-181.13			
7	172			104.97-179.61					
8	151			106.66-192.06					
9	177			114.64-190.32					
10	158			125.75-200.23					
11	78			121.92-196.68					
12	100			113.68-190.00					
13	41			113.91-179.99					
14	8			119.30-173.06					
<b>Shuttle Run (SR)*</b>	<p>E: Stopwatch, tape measure, tape, 2 cones, 2 blocks</p> <p>S: Mark off 30 ft. with 2 pieces of tape &amp; cones; place 2 blocks just behind the line opposite the starting line</p> <p>D: "When I say 'go', run, pick up a block, run back, put the block behind the starting line, then run, pick up the second block, and run back and put it behind the starting line. Don't throw the blocks." Timing begins with the word "go" and ends when the second block is placed behind the line.</p>			<b>Age</b>	<b>Male</b>		<b>Female</b>		
					<b>N</b>	<b>Range (s)</b>	<b>N</b>	<b>Range (s)</b>	
				5	73	12.86-21.30	98	14.02-21.78	
		6	116	12.35-19.35	109	13.86-20.18			
		7	84	11.82-19.42	112	12.68-20.57			
		8	83	11.32-16.92	76	11.81-18.85			
		9	69	10.88-16.84	120	11.65-17.73			
		10	64	10.49-16.17	100	11.39-17.35			
		11	39	9.81-15.77	39	11.36-17.32			
		12	23	10.19-14.35	42	11.16-17.88			
		13	9	11.17-15.57	23	11.21-17.41			

8. Timed Up and Go: Reference Data for Children Who Are School Age. Pediatric Physical Therapy. 28(2): 239-246, Summer 2016. Itzkowitz et al.

9. Timed Floor to Stand-Natural: Normative Data for School Age Children. Pediatric Physical Therapy. 28(1): 71-76. Spring 2016. Weingarten et al.

\* Unpublished DOE research by Frank Covino, Maura Doyle, Adina Itzkowitz, Michael Lieberstein and Goldie Weingarten.