“This project was supported, in part, by the Health Resources and Services Administration (HRSA) grant for the Leadership Education in Neurodevelopmental Disabilities (LEND) Grant T72MC11044 and by the Administration on Intellectual and Developmental Disabilities (AIDD) under the University Center of Excellence in Developmental Disabilities (UCEDD) Grant 90DD00106 of the U.S. Department of Health and Human Services (HHS). This information or content and conclusions are those of the author and should not be construed as the official position or policy of, nor should any endorsements be inferred by HRSA, HHS, or the U.S. Government.”

PT PRE at Cherry Creek Schools

Erica Salhus PT, DPT
University of Colorado Pediatric Physical Therapy Resident & LEND Trainee
Overview

What is PRE
PRE Process
Who was included

Scheduling
Protocol
Our Athletes

Reflection
Next Steps
Thank you!
Progressive Resistance Exercise (PRE)

Power training program for students in the schools with an IEP

Intensive adapted from Aurora Public Schools and Children’s Hospital Colorado
Adopting PRE in CCSD

1. Continuity of Evidence-Based Practice across school districts

2. Power training for functional strength and greater participation and confidence!

3. Increase effectiveness of school-based PT interventions

4. Opportunities for collaboration between PT, PTA, OT
How does PRE work in the school setting?
PRE Process

1. Determine who will participate
   How many students? Help from PT/PTA? Consent? Does the child understand what the intensive will entail?

2. Pre-testing
   Perform pre-testing to establish baseline and track changes after PRE intensive AND 1 Rep Max

3. Intensive
   Which exercises will be best for this child? Implement power training 2x per week. Be as consistent as possible!

4. Post-testing
   Retest to determine change
   Reflect - what went well? What could I change for next time?
Who?
Inclusion Criteria

**Age/Grade**
- 2nd - 12th grade
- 7-8 years old and up

**IEP**
- Student must have IEP and receive school-based PT services

**Cognition**
- Safety and self-awareness
  - Safely handle heavier weights, able to communicate discomfort, consent, follow multi-step directions

**Strength-related physical motor goals**
- Strength
  - Lower body and core strengthening, locomotor skills, gait speed, increase participation in PE and recess
Who?

Example diagnoses below

01 | Cerebral Palsy (CP)
02 | Developmental Coordination Disorder (DCD)
03 | Prader Willi Syndrome (PWS)
04 | Autism
05 | Down Syndrome
When?

6-8 weeks; 2 sessions per week; 15-20 minutes per session

January - April
(After Winter Break -Spring Break)

- Pull out from classroom
- During transition from specials to classroom time
- Brain-Break
Child's Name will receive 300 minutes semesterly direct physical therapy services from a licensed physical therapist or physical therapist assistant to address decreased power in motor skills. This service model allows flexibility in using either an episodic approach (1X/week) or a more intensive approach (2X/week with breaks in between each intensive).
What do I need?

**Equipment:**

1. Measuring wheel (feet or meters)
2. Weighted vest (small and large size) with sand bags/weights
3. Ankle weights
4. Sled bag with waist strap
5. Exercise step
Pre-Testing

01 Functional Strength (30s each)  
  - Sit to stand  
  - Lateral Step Up (R and L)  
  - Half Kneel to Stand (R and L)

02 Gait Speed  
  - 10 Meter Walk Test

03 Functional Gait Speed  
  - 1 Minute Walk Test
<table>
<thead>
<tr>
<th>Test</th>
<th>Date:</th>
<th>Date:</th>
<th>Pre/Post Change</th>
<th>Significant (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit to Stand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral Step Up Left</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral Step Up Right</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Half Kneel to Stand Left</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Half Kneel to Stand Right</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength Total Left</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(left step ups, left half kneel to stand, sit to stand)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength Total Right</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(right step ups, right half kneel to stand, sit to stand)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Functional Strength Testing (30 seconds each)**
**Sit to Stand Test**
- Student's hips and knees at 90 degrees of flexion
- Need to achieve less than 15 degrees of hip and knee extension
- MDC = 3 reps

**Lateral Step Up Test**
- 20 cm step
- Need to achieve less than 15 degrees of knee extension
- MDC = 4.8 to 5.2 reps

**Half Kneel to Stand Test**
- Start in half kneel with buttocks clear of floor or legs
- Need to achieve less than 15 degrees of hip and knee extension
- MDC = 2.2 to 2.8 reps

**Total Strength (Left and Right)**
- Combined step ups, half kneel to stand, and sit to stand for each side
- MDC = 7.3 to 8.8 reps

**Minimal Detectable Change (MDC)**
### Gait Speed Tests

#### 1 Minute Walk
- Walk as fast as you can for 1 minute (no 180 degree turns)
  --MDC = 13 meters or 9% increase

<table>
<thead>
<tr>
<th>Date</th>
<th>Distance in meters</th>
<th>Pre/Post Change</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Gait Speed (meters/second)
- Collect 3 trials and average
- Self-selected—Walk at typical speed from A to B (10 meters)
  --MDC = 0.1 m/s or 9% gain

<table>
<thead>
<tr>
<th>Date</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Average</th>
<th>Pre/Post Change</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Protocol

POWER training =

- heavy weights for 4-6 reps
- 3 sets
- 3 specific exercises
- Increase in weight every 1-2 weeks; depending on form fatigue with current weight

Exercise #1: Forward Step up

Exercise #2: Single Leg Calf Raise

Exercise #3: Sled Pull
The Athletes

3rd Grade
L

3rd Grade
J

5th Grade
D

8th Grade
A
<table>
<thead>
<tr>
<th>History</th>
<th>Cerebellar tumor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>Jump from monkey bars and run faster</td>
</tr>
<tr>
<td>Classroom</td>
<td>Gen Ed</td>
</tr>
</tbody>
</table>
L: Exercises and Results

Exercises

- Single leg sit to stand
- Single leg calf raise
- 40 ft sled pull

Results

- Number of sessions: 14
- SL Calf Raise: 10# → 18#
- SL Squat: 14# → 18# (increased to 20#, but decreased due to shoulder pain from vest)
- Sled Pull: 30# → 48#
## Functional Strength Testing (30 seconds each)

<table>
<thead>
<tr>
<th>Test</th>
<th>Date: 11/6/23</th>
<th>Date: 4/4/2024</th>
<th>Pre/Post Change</th>
<th>Significant (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit to Stand</td>
<td>19</td>
<td>24</td>
<td>5</td>
<td>Yes</td>
</tr>
<tr>
<td>Lateral Step Up Left</td>
<td>18</td>
<td>25</td>
<td>7</td>
<td>Yes</td>
</tr>
<tr>
<td>Lateral Step Up Right</td>
<td>21</td>
<td>28</td>
<td>7</td>
<td>Yes</td>
</tr>
<tr>
<td>Half Kneel to Stand Left</td>
<td>8</td>
<td>13</td>
<td>5</td>
<td>Yes</td>
</tr>
<tr>
<td>Half Kneel to Stand Right</td>
<td>10</td>
<td>17</td>
<td>7</td>
<td>Yes</td>
</tr>
<tr>
<td>Strength Total Left (left step ups, left half kneel to stand, sit to stand)</td>
<td>45</td>
<td>62</td>
<td>17</td>
<td>Yes</td>
</tr>
<tr>
<td>Strength Total Right (right step ups, right half kneel to stand, sit to stand)</td>
<td>50</td>
<td>69</td>
<td>19</td>
<td>Yes</td>
</tr>
</tbody>
</table>
1 Minute Walk Test

Plus: 14.79s shuttle run

<table>
<thead>
<tr>
<th>Date</th>
<th>Distance in meters</th>
<th>Pre/Post Change</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/16/23</td>
<td>99.06m</td>
<td>23.16m</td>
<td>Yes</td>
</tr>
<tr>
<td>4/4/24</td>
<td>122.22m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Average</th>
<th>Pre/Post Change</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/16/23</td>
<td>6.63s</td>
<td>6.46s</td>
<td>4.4s</td>
<td>5.83s (1.72m/s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4/4/24</td>
<td>4.8s</td>
<td>4.9s</td>
<td>4.6s</td>
<td>4.77s (2.09m/s)</td>
<td>1.06s (0.37m/s)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Gait Speed 10m (meters/second)
“I've noticed a difference in my speed and I can outrun most people now” - L
### History
- **Prader Willi Syndrome**

### Goals
- Jumping, hopping, skipping, running faster, endurance/gait speed

### Classroom
- Gen Ed and ILC
J: Exercises and Results

Exercises
- Single Leg Forward Step-up
- Quadruped Hip Abduction
- 40 ft Sled Pull

Results
- Number of sessions: 14
- SL Step-up: 15# → 28#
- Right Hip Abduction: 3# → 7#
- Left Hip Abduction 5# → 7#
- Sled Pull: 25# → 38#
Sled pull

Step ups
### Functional Strength Testing (30 seconds each)

<table>
<thead>
<tr>
<th>Test</th>
<th>Date:11/16/23</th>
<th>Date:4/4/24</th>
<th>Pre/Post Change</th>
<th>Significant (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit to Stand</td>
<td>10</td>
<td>15</td>
<td>5</td>
<td>Yes</td>
</tr>
<tr>
<td>Lateral Step Up Left</td>
<td>11</td>
<td>22</td>
<td>11</td>
<td>Yes</td>
</tr>
<tr>
<td>Lateral Step Up Right</td>
<td>10</td>
<td>15</td>
<td>5</td>
<td>Yes</td>
</tr>
<tr>
<td>Half Kneel to Stand Left</td>
<td>4</td>
<td>10</td>
<td>6</td>
<td>Yes</td>
</tr>
<tr>
<td>Half Kneel to Stand Right</td>
<td>5</td>
<td>7</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>Strength Total Left (left step ups, left half kneel to stand, sit to stand)</td>
<td>25</td>
<td>47</td>
<td>22</td>
<td>Yes</td>
</tr>
<tr>
<td>Strength Total Right (right step ups, right half kneel to stand, sit to stand)</td>
<td>25</td>
<td>37</td>
<td>12</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### 1 Minute Walk Test

<table>
<thead>
<tr>
<th>Date</th>
<th>Distance in meters</th>
<th>Pre/Post Change</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/16/23</td>
<td>54.9m</td>
<td>19.8m</td>
<td>Yes</td>
</tr>
<tr>
<td>4/4/24</td>
<td>74.7m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Gait Speed 10m (meters/second) Sample

<table>
<thead>
<tr>
<th>Date</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Average</th>
<th>Pre/Post Change</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/16/23</td>
<td>9.6s</td>
<td>8.07s</td>
<td>8.12s</td>
<td>8.6s (1.16m/s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4/4/24</td>
<td>8.01s</td>
<td>7.02s</td>
<td>6.09s</td>
<td>7.04s (1.4m/s)</td>
<td>1.6 s (0.2m/s)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Gait Speed 10m (meters/second) Sample
“I am better at pumping on the swings.” - J

“My legs are so much stronger, and I can do hard things.” - J
<table>
<thead>
<tr>
<th>History</th>
<th>ADHD (DCD?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>Core strengthening and coordination</td>
</tr>
<tr>
<td>Classroom</td>
<td>Gen Ed</td>
</tr>
</tbody>
</table>
D: Exercises and Results

Exercises

- Single Leg Calf Raise
- Single Leg Forward Step-up
- 40 ft Sled Pull

Results

- Number of sessions: 5 (about 1x per week)
- SL Step-up: 40# → 30# (not completing all reps, and shoulder pain from vest)
- SL Calf Raise: 40# → 30# (per student request)
- Sled Pull: 50# → 34#
Functional Strength Testing (30 seconds each)

<table>
<thead>
<tr>
<th>Test</th>
<th>Date: 12/18/24</th>
<th>Date: 3/28/24</th>
<th>Pre/Post Change</th>
<th>Significant (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit to Stand</td>
<td>14</td>
<td>15</td>
<td>1</td>
<td>No</td>
</tr>
<tr>
<td>Lateral Step Up Left</td>
<td>20</td>
<td>23 (w/o UE)</td>
<td>3</td>
<td>No (*no hands)</td>
</tr>
<tr>
<td>Lateral Step Up Right</td>
<td>21</td>
<td>24 (w/o UE)</td>
<td>3</td>
<td>No (*no hands)</td>
</tr>
<tr>
<td>Half Kneel to Stand Left</td>
<td>6</td>
<td>10 (w/o UE)</td>
<td>4</td>
<td>Yes</td>
</tr>
<tr>
<td>Half Kneel to Stand Right</td>
<td>7</td>
<td>12 (6 w/o UE)</td>
<td>5</td>
<td>Yes</td>
</tr>
<tr>
<td>Strength Total Left</td>
<td>40</td>
<td>48</td>
<td>8</td>
<td>Yes</td>
</tr>
<tr>
<td>(left step ups, left half kneel to stand, sit to stand)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength Total Right</td>
<td>42</td>
<td>51</td>
<td>9</td>
<td>Yes</td>
</tr>
<tr>
<td>(right step ups, right half kneel to stand, sit to stand)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Trial 1</td>
<td>Trial 2</td>
<td>Trial 3</td>
<td>Average</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>11/30</td>
<td>9s</td>
<td>6.9s</td>
<td>9s</td>
<td>8.3s</td>
</tr>
<tr>
<td>3/28</td>
<td>6.7s</td>
<td>6.7s</td>
<td>6.7s</td>
<td>6.7s</td>
</tr>
</tbody>
</table>

Gait Speed 10m (meters/second)
<table>
<thead>
<tr>
<th><strong>History</strong></th>
<th><strong>Autism</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goals</strong></td>
<td><strong>Stair navigation and Gait Speed</strong></td>
</tr>
<tr>
<td><strong>Classroom</strong></td>
<td><strong>ILC and Gen Ed</strong></td>
</tr>
</tbody>
</table>
Aména: Exercises and Results

Exercises

- Single Leg Calf Raise
- Single Leg Forward Step-up
- 40 ft Sled Pull

Results

- Number of sessions: 4 (1 day/week)
- SL Step-up: 18# → 24#
- SL Calf Raise: 6# → 12#
- Sled Pull: 12# → 30#
<table>
<thead>
<tr>
<th>Test</th>
<th>Date: 11/17/24</th>
<th>Date: 4/4/24</th>
<th>Pre/Post Change</th>
<th>Significant (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit to Stand</td>
<td>10</td>
<td>12</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>Lateral Step Up Left</td>
<td>8</td>
<td>15</td>
<td>7</td>
<td>Yes</td>
</tr>
<tr>
<td>Lateral Step Up Right</td>
<td>9</td>
<td>11</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>Half Kneel to Stand Left</td>
<td>9</td>
<td>7</td>
<td>-2</td>
<td>No</td>
</tr>
<tr>
<td>Half Kneel to Stand Right</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>Yes</td>
</tr>
<tr>
<td>Strength Total Left</td>
<td>27</td>
<td>34</td>
<td>7</td>
<td>Yes</td>
</tr>
<tr>
<td>Strength Total Right</td>
<td>23</td>
<td>31</td>
<td>8</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Functional Strength Testing** (30 seconds each) Sample 2
“Ms. Erica, I am so PROUD!”
“I’m going to tell T (her friend) he can be strong too!” - A
Reflection

What went well?

- 3 of 4 students who participated discovered new-found inner strength and motivation to stay active!
- Relatively seamless timing with the help of a PTA (shoutout to Carol! THANK YOU!)
- Very supportive parents and staff to cheer on our athletes

Barriers and Considerations for next time?

- The vest was too big for some students, and several expressed that they did not like the weight on their shoulders. May need to find a smaller vest with more even weight distribution
- Schedule with 5th grade was challenging
  - More time in the classroom means harder to pull out
  - Greater focus on friendships and prep for middle school
- Timing - missed some weeks for non-contact days, snow day, and Spring Break
Ideas for Next Steps

Peer modeling

● Pair with a peer who can help direct the activity

Adapt for students who are not ambulatory

● And/or upper extremity and core strengthening

Is one time per week of weighted exercise enough to make meaningful change?

● Higher intensity exercise can help students reach their goals in less time

Biggest hope is that more school-based PT/PTAs will use PRE in their practice!
Thank you!

Questions?
REFERENCES


Kinsey, Erin PT, DPT, PCS; Curto, Colleen PT, DPT; Glassman, Dana PT, DPT; Sundberg, Melissa PT, DPT; Rosemeyer, Kathryn PT, DPT; Rapport, Mary Jane PT, DPT, PhD, FAPTA. Changing the Paradigm of School-Based Physical Therapist Service Delivery: Using Evidence to Support Intensive Intervention. *Pediatric Physical Therapy* 34(1):p 73-80, January 2022. | DOI: 10.1097/PEP.0000000000000850


REFERENCES


