Power Wheelchair Mobility Training for Young Children

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Chicago unit

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We provide surgical and non-surgical management of pediatric orthopedic conditions with state of the art techniques. In addition to orthopedic care for stable fractures in children, we provide specialized multidisciplinary teams for rare orthopedic conditions.

DISCLOSURE:

Three power wheelchairs for this study were originally donated to Shriners hospital by Permobil corp. They were koala power wheelchairs

Background: Children typically begin standing and walking to explore their environment around one year of age. For children with complex medical conditions that may delay or restrict this milestone, the question of what age a child should receive a powered wheelchair (PWC) remains unanswered.

The primary purpose of this study was to pilot test a PWC training intervention for young children age 12-30 months with neuromuscular disorders.

We also sought to explore characteristics of children who were successful in learning basic PWC mobility skills, and determine the number of PWC training sessions needed for children to attain basic driving mobility skills.

Hypothesis: our hypothesis was that children with neuromuscular disorders who were at least 12 months of age would be successful learning basic PWC driving skills within 16 therapy sessions.

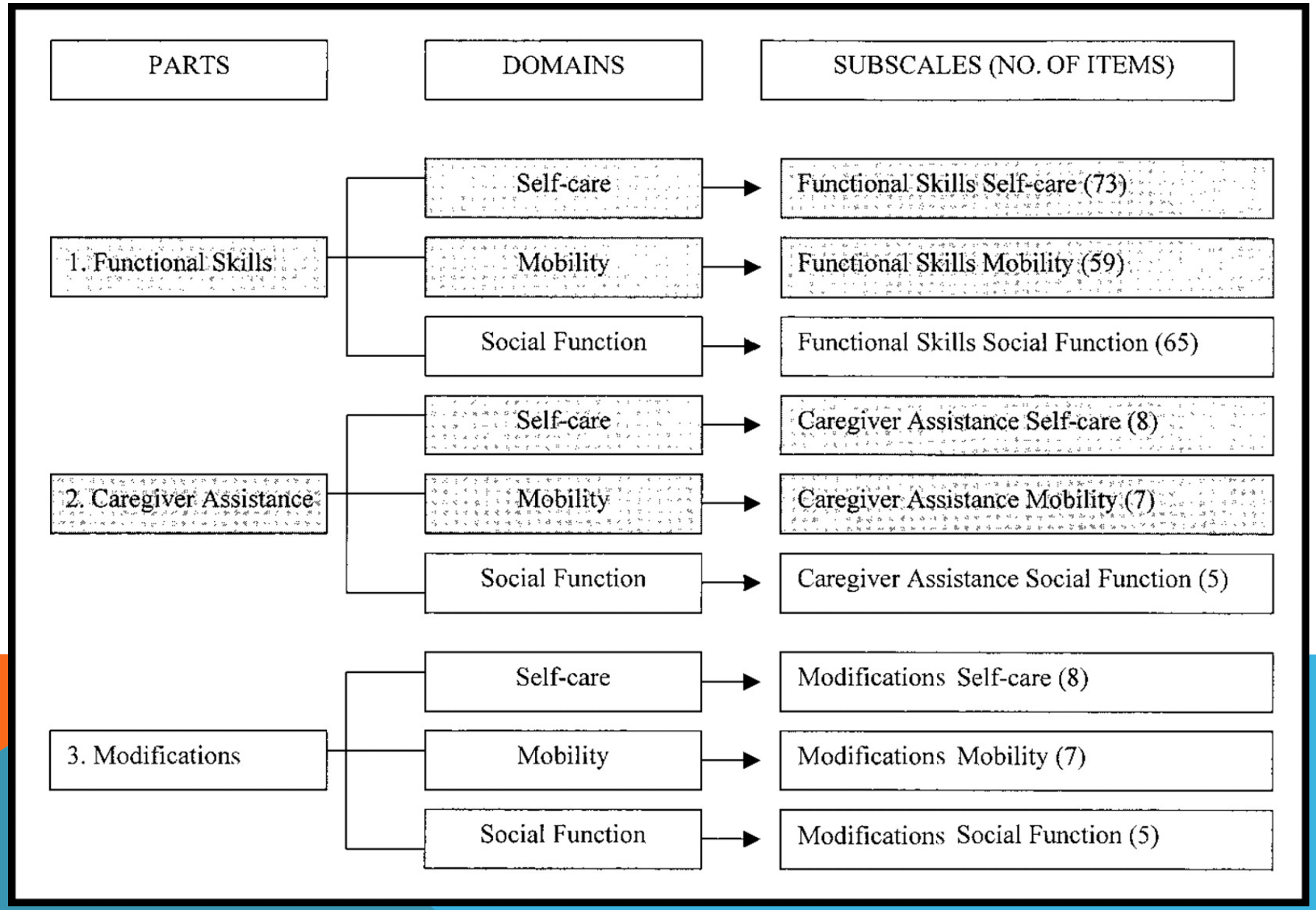
Subjects: 10 non-ambulatory children average age 20 months (range 12-29 months) with neuromuscular disorders were enrolled.

Diagnoses included: spinal cord injury with down syndrome, cerebral palsy, sacral agenesis, spinal cord injury, arthrogryposis and osteogenesis imperfecta. Eight children completed the training sessions; five as inpatients and three as outpatients.

Methods: prior to training a parent of each child completed the Pediatric Evaluation of Disability Inventory (PEDI) and demographic information was obtained. Power wheelchair training was provided in one hour sessions using the skill items described in the rancho los amigos powered mobility program (PMP).

Various types of input devices were used; five of the participants used a joystick for steering/control while 3 children used single touch switches/buttons. Data was collected from 2007 through 2010.

PEDI


PARTS
DOMAINS
SUBSCALES (NO. OF ITEMS)
1. Functional Skills
Self-care
Functional Skills Self-care (73)
Mobility
Functional Skills Mobility (59)
Social Function
Functional Skills Social Function (65)
2. Caregiver Assistance
Self-care
Caregiver Assistance Self-care (8)
Mobility
Caregiver Assistance Mobility (7)
Social Function
Caregiver Assistance Social Function (5)
3. Modifications
Self-care
Modifications Self-care (8)
Mobility
Modifications Mobility (7)
Social Function
Modifications Social Function (5)

READY, SET, GO:

Powered Mobility with Young Children

Donita Tefft, CCC-SP; Jan Furumasu, PT;
Paula Guerette, PhD

Los Amigos Research and Education Institute, Inc.
Rancho Los Amigos Medical Center, Downey, CA

Powered Mobility Program (PMP)

Furumasu, Guerette, Tefft
Los Amigos Research and Education Institute, Inc,
Rancho Los Amigos Medical Center, Downey, CA

Client Name:_____

I. Basic Mobility Skills	Practice Session Scores								Final Session
	Date	Date	Date	Date	Date	Date	Date	Date	Date
BEGINNING SKILLS									
Turns wheelchair power on and off.									
Maintains contact with the joystick for a minimum of 5 seconds.									
Pushes joystick to engage w/c in motion for 5 sec. and stops.									
Moves w/c in forward direction for 10 sec. and stops on command.									
Attends and looks in the direction of wheelchair movement.									
Stops spontaneously to avoid stationary objects.									
DIRECTIONAL CONTROL									
Moves w/c in forward direction for approximately 10 feet.									
Moves w/c in forward direction for approximately 35 feet.									
Turns w/c to the right starting from a stationery position.									
Turns w/c to the left starting from a stationery position.									
Moves w/c backward on command (minimum 2').									
Moves w/c forward making right and left curving turns following a person over a distance of approximately 50 feet.									
Veers spontaneously to avoid a stationery object.									
SPEED CONTROL									
Moves w/c forward maintaining a very slow speed.									
Demonstrates difference between fast and slow.									
Stops at a door with footrests within 12" without hitting the door.									
Stops at a line with front casters within 12" and not going over the line.									

Powered Mobility Program - Furumasu, Guerette, Tefft

II. Integration of Basic Skills for Functional Mobility - Structured Environment									Final Session
Maneuvers w/c through a doorway without hitting the door frame.									
Moving along a hallway, self correcting movement to avoid the wall for a minimum of 50 feet.									
Maneuvers w/c along a curving pathway with two turns.									
NEGOTIATING A RAMP									
Moves w/c up a ramp, staying in between the rails and turns a corner.									
Backs up far enough to negotiate a turn between the rails of a ramp.									
Turns w/c within a 5' by 5' space.									
Moves w/c down a ramp staying in between the rails.									
Stops w/c when driving down a ramp.									
Slows speed down when moving w/c down a ramp.									
NEGOTIATING A SIDEWALK									
Moves w/c along a narrow 28" wide sidewalk, w/o curb for a distance of 35' without veering off the sidewalk with supervision within 5'.									
Moves w/c along a 36" wide sidewalk with an unmarked 6" curb for a distance of 35" without veering off the sidewalk with supervision within 5'.									
III. Integration of Basic Skills for Functional Mobility - Unstructured Environment									
COMMUNITY MOBILITY									
Follows "rules of the road", e.g. stays on one side of a hallway, avoiding people and objects, looking at intersections of hallways.									
Moves w/c in an open, busy area maneuvering around multiple objects and moving people.									
Moves w/c along a sidewalk and down a ramp and stops before entering a parking lot.									
Recognizes difference between curb and curb cut.									
Moves w/c in and out of small rooms.									
Avoids potholes/hazards									

Final Evaluation Raw Score _____ divided by 34 =

Powered Mobility Program
Mobility Rating Scale

Jan Furumasu, PT; Paula Guerette, Ph.D.; Donita Tefft, CCC-SP

Rancho Los Amigos Medical Center, Downey, CA

0 - **Task not attempted** - The task is not introduced because prerequisite basic skills are still at levels 1-2.

1 - **Maximum assist of joystick with verbal cueing** - Child attempts task but requires complete assistance in order to execute task. Indicated by instructor providing continual (50 - 100% of time) hands-on assistance of wheelchair control to direct and guide wheelchair in order to complete task safely. Continuous verbal and/or gestural instructions are provided.

2 - **Minimal assist of joystick with verbal cueing** - Child able to perform basic components of task independently but needs some assistance in order to complete the entire task safely. The instructor provides intermittent (10 - 50% of time) hands-on assist of wheelchair control only to correct a particular deviation from course, not to direct or guide wheelchair in a continual manner. Continuous verbal and/or gestural instructions are provided.

3 - **Stand-by physical assist with verbal cueing** - Child able to perform entire task independently but needs guarding for safety. The instructor stands directly next to wheelchair on joystick side in order to assist if child begins to maneuver unsafely (<10% of time). Continuous verbal and/or gestural instructions are provided.

4 - **Verbal cueing only** - Child able to perform task independently without immediate stand-by assistance but with frequent verbal cueing. The instructor stands away from the joystick (5 feet or less) and does not provide any hands-on assistance to the child. Continuous (>25% of time) verbal and/or gestural instructions are provided to the child for safety purposes and to remind or redirect the child.

5 - **Age-appropriate supervision** - Child able to complete task independently with age-appropriate visual supervision and infrequent (<25% to time) verbal cueing. The instructor stands away from the joystick (5 - 10 feet) and does not provide any hands-on assistance to the child. Verbal cueing provided to the child intermittently and only to direct child's attention to maneuver in a certain direction (e.g., towards parent, away from curb).

The children were seen for 16 PWC training sessions. Inpatients were seen twice a day for two four-day weeks with 16 sessions during that period. Outpatients were seen for two sessions per week for eight weeks. Participants were evaluated using the PMP assessment tool at each session.

We operationalized successfully learning basic PWC mobility skills as scoring an average of 3 (“stand-by physical assist with verbal cueing”) on the first two sub-sections of the basic mobility skills section: beginning skills, directional control & speed control.

Results:

8 children completed the 16-week training, and four (50%) achieved an average of 3 on the first two sub-sections of the PMP assessment tool.

The 4 children who achieved a 3 included children who were 14, 19, 23, and 29 mos. old respectively. Two received the training as outpatients & 2 received the training as inpatients. Children achieved 3's after their 3rd, 4th, 11th, & 13th sessions. The four children who did not achieve a 3 included children who were 12, 14, 14, and 24 mos. old; three were inpatients, one outpatient.

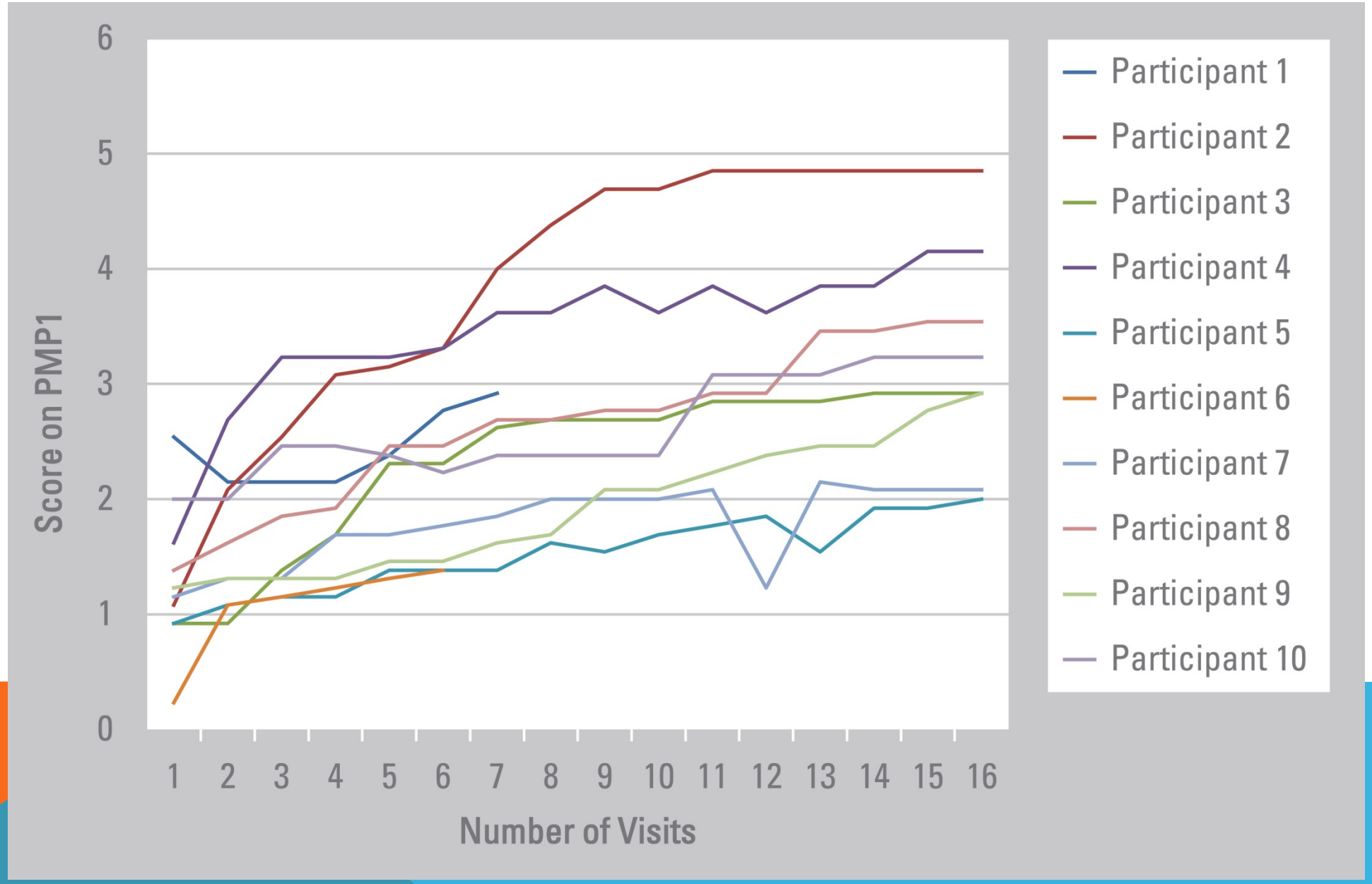
Important to note, two of the children in the "non-achieving" group scored a 2.92, indicating they were very close to attaining these skills.

Another child in the “non-achieving” group also had a secondary diagnosis of down syndrome.

A visual examination of the data indicated that children who achieved a 3 appeared to be older, and had higher scores on the PEDI at baseline (including the self-care, mobility, social function, and caregiver self-care, mobility and social functioning subscales).

Characteristics	*Did child achieve a "3" on the PMP1 by the end of the 16 sessions?*	
	Yes	**No**
Age (Median Months)	21	14
Baseline Pedi Scores (Median)		
Self-Care	23.5	10.5
Mobility	14	6
Social Function	28.5	18
Caregiver Self-Care	7.5	2
Caregiver Mobility	7.5	0
Caregiver Social Function	15.5	3.5

Table 1. Characteristics of children who did and did not achieve a "3" on the Powered Mobility Program (PMP).


Score on PMP1
0
1
2
3
4
5
6
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Number of Visits
Participant 1
Participant 2
Participant 3
Participant 4
Participant 5
Participant 6
Participant 7
Participant 8
Participant 9
Participant 10

PMP SCORE AT THE END OF 16-WEEK SESSION

Participant	Age (months)	First 2 Subsections	Total Score
1	21	---	---
2	23	4.85	3.71
3	14	2.92	2.15
4	29	4.15	2.79
5	12	2	1.44
6	28	---	---
7	24	2.08	1.5
8	19	3.54	2.94
9	14	2.92	2.21
10	14	3.23	2.15

Discussion:

Funding sources often claim that powered mobility is not necessary for young children who are not mobile on their own while research has shown that early independent mobility provides developmental, cognitive and psychosocial gains.

Findings from the current pilot study indicate that children who are non-ambulatory or delayed with functional ambulation because of a significant medical condition can learn to use a PWC as a step toward independent mobility.

In 16 sessions, at least half of the children moved from primarily dependent mobility to safely propelling a PWC in a structured environment with minimal to stand-by assist.

Children over 14 months of age showed the greatest improvement with the exception of the one child who displayed significant global developmental delay.

Six of the eight children completing the study have gone on to obtain a power wheelchair as their primary means of ambulation. Several have progressed to become therapeutic ambulators.

It has been our experience that often times, powered mobility is not considered necessary or worth funding for young children as a cost saving measure on the part of the funding source which can severely and negatively impact the children's developmental maturation and functional independence.

The investigators would like to see that all children acquire independent mobility as early as possible. A PWC may be the most practical form of independent mobility for some children with significant physical disabilities.

Conclusion:

This study was able to demonstrate that children as young as 14 months old can successfully learn basic PWC driving skills with several training sessions.

It was our initial hope that this pilot study would fuel interest in further investigation with a larger sample size to address the long term objective of early independent functional mobility for these children.

Since the completion of this study, there has been a surge in the profession in providing simple, home-made mobility devices for very young children due to the efforts of Dr. Cole Galloway and his Go Baby Go team.

This approach has turned the industry on its ear so to speak. Additionally we are moving to the opinion that mobility is a basic right, not just a need or want.

QUESTIONS?

Thank you

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GO BOT

I. BASIC MOBILITY SKILLS

A. Basic Cause and Effect Association

1. Turns wheelchair power on and off.

2. Maintains contact with the joystick for minimum of 5 seconds.

3. Pushes joystick to engage wheelchair in motion for 5 seconds, and stops

4. Navigates wheelchair in forward direction for 10 seconds and stops on command

5. Looks in the direction of movement.

6. Stops spontaneously to avoid stationary objects.

B. Directional Control

1. Navigates in forward direction for 10 feet.

2. Navigates in forward direction for 35 feet.

3. Turns to the right starting from a stationary position.

4. Turns to the left starting from a stationary position.

5. Navigates backward (minimum 2 feet).

6. Navigates forward making right and left curving turns following a person over a distance of 50 feet.

7. Veers spontaneously to avoid stationary object.

C. Speed Control

1. Navigates forward maintaining a very slow speed for 15 feet.

2. Changes speed in response to commands –"Slow down" or "Let's go faster."

3. Stops at a door with footrests within 12 inches without hitting the door.

4. Stops at a line with front casters within 12 inches without going over the line.

II. INTEGRATION OF BASIC SKILLS FOR FUNCTIONAL MOBILITY – STRUCTURED ENVIRONMENT

A. Negotiates Doors, Paths, Walls

1. Navigates a doorway without hitting the door frame.

2. Self corrects direction of forward motion when moving parallel along a wall for minimum of 50 feet.

3. Navigates a pathway with two turns.

B. Negotiates Ramps

1. Navigates up a ramp, staying between the rails and turning a corner.

2. Backs up to negotiate a turn between the rails of a ramp.

3. Executes a turn within a 5 by 5 foot space.

4. Drives down a ramp staying between the rails.

5. Stops on command when navigating down a ramp.

6. Slows speed on command when navigating down a ramp.

C. Negotiates Sidewalks

1. Navigates a narrow 28 inch wide sidewalk for a distance of 35 feet without veering off the sidewalk (supervision within 5 feet).

2. Navigates a 36 inch wide sidewalk with an unmarked 6 inch curb for distance of 36 feet without veering off the sidewalk (supervision within 5 feet).

III. INTEGRATION OF BASIC SKILLS FOR FUNCTIONAL MOBILITY - UNSTRUCTURED ENVIRONMENT

A. Community Mobility

1. Navigates along one side of a hallway, avoiding people and stationary objects for a distance of 100 feet.

2. Navigates in an open, busy area around multiple objects and people who are moving in a random pattern.

3. Navigates a sidewalk, down a ramp, and stops before entering a parking lot area.

4. Recognizes difference between a curb and curb cut.

5. Navigates in and out of a small room.

6. Avoids irregularities in ground surface (e.g.; cracks, gratings).

Powered Mobility Program (PMP)

Furumasu, Guerette, Tefft
Los Amigos Research and Education Institute, Inc.
Rancho Los Amigos Medical Center, Downey, CA

CLIENT NAME: _____

I. Basic Mobility Skills	Practice Sessions: Date								Final Session
BEGINNING SKILLS									
Turns wheelchair power on and off.									
Maintains contact with the joystick for a minimum of 5 seconds.									
Pushes joystick to engage w/c in motion for 5 sec. and stops.									
Moves w/c in forward direction for 10 sec. and stops on command.									
Attends and looks in the direction of wheelchair movement.									
Stops spontaneously to avoid stationary objects.									
DIRECTIONAL CONTROL									
Moves w/c in forward direction for 10 feet.									
Moves w/c in forward direction for 35 feet.									
Turns w/c to the right starting from a stationary position.									
Turns w/c to the left starting from a stationary position.									
Moves w/c backward on command (minimum 2').									
Moves w/c forward making right and left curving turns following a person over a distance of 50 feet.									
Veers spontaneously to avoid a stationary object.									
SPEED CONTROL									
Moves w/c forward maintaining a very slow speed.									
Understands difference between fast and slow.									
Stops at a door with footrests within 12" without hitting the door.									
Stops at a line with front casters within 12" and not going over the line.									

II. Integration of Basic Skills for Functional Mobility – Structured Environment									Final Session
Maneuvers w/c through a doorway without hitting the door frame.									
Moving along a hallway, self correcting movement to avoid the wall for a minimum of 50 feet.									
Maneuvers w/c along a curving pathway with two turns.									
NEGOTIATING A RAMP									
Moves w/c up a ramp, staying in between the rails and turns a corner.									
Backs up far enough to negotiate a turn between the rails of a ramp.									
Turns w/c within a 5' by 5' space.									
Moves w/c down a ramp staying in between the rails.									
Stops w/c when driving down a ramp.									
Slows speed down when moving w/c down a ramp.									
NEGOTIATING A SIDEWALK									
Moves w/c along a narrow 28" wide sidewalk, w/o curb for a distance of 35' without veering off the sidewalk with supervision within 5'.									
Moves w/c along a 36" wide sidewalk with an unmarked 6" curb for a distance of 35' without veering off the sidewalk with supervision within 5'.									
III. Integration of Basic Skills for Functional Mobility – Unstructured Environment									
COMMUNITY MOBILITY									
Follows "rules of the road", e.g. stays on one side of a hallway, avoiding people and objects, looking at intersections of hallways.									
Moves w/c in an open, busy area maneuvering around multiple objects and moving people.									
Moves w/c along a sidewalk and down a ramp and stops before entering a parking lot.									
Recognizes difference between curb and curb cut.									
Moves w/c in and out of small rooms.									
Avoids potholes/hazards.									

Final Evaluation Raw Score _____ divided by 34 =
Average Level of Assistance _____

Powered Mobility Program (PMP)

Furumasu, Guerette, Tefft
Los Amigos Research and Education Institute, Inc,
Rancho Los Amigos Medical Center, Downey, CA

Client Name:_____

I. Basic Mobility Skills	Practice Session Scores								Final Session
	Date	Date	Date	Date	Date	Date	Date	Date	Date
BEGINNING SKILLS									
Turns wheelchair power on and off.									
Maintains contact with the joystick for a minimum of 5 seconds.									
Pushes joystick to engage w/c in motion for 5 sec. and stops.									
Moves w/c in forward direction for 10 sec. and stops on command.									
Attends and looks in the direction of wheelchair movement.									
Stops spontaneously to avoid stationary objects.									
DIRECTIONAL CONTROL									
Moves w/c in forward direction for approximately 10 feet.									
Moves w/c in forward direction for approximately 35 feet.									
Turns w/c to the right starting from a stationery position.									
Turns w/c to the left starting from a stationery position.									
Moves w/c backward on command (minimum 2').									
Moves w/c forward making right and left curving turns following a person over a distance of approximately 50 feet.									
Veers spontaneously to avoid a stationery object.									
SPEED CONTROL									
Moves w/c forward maintaining a very slow speed.									
Demonstrates difference between fast and slow.									
Stops at a door with footrests within 12" without hitting the door.									
Stops at a line with front casters within 12" and not going over the line.									