Early Power Mobility: Who, Why and How?

NRRTS webinar
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Objectives

- 1. Identify at least 2 different groups of children who can benefit from power mobility in early childhood
- 2. Identify at least 3 different developmental benefits of power mobility for children
- 3. Identify at least 3 environmental factors influencing use of power mobility with young children
Outline

- Introduction
- Who benefits?
- Why? Evidence supporting outcomes
- How?
  - Environmental factors influencing success
  - Training approaches
- Case studies

Why power mobility?

- Grounded cognition: early sitting, object interaction, locomotion
- Independent mobility is vital for overall development
- Children begin to move around independently and explore from 9-12 months
Why not manual mobility?

1 of 7 self-propels 3-18 years

6 of 7 drives independently 3-18 yr

Christina B. Ragonesi, BS; Xi Chen, BS; Sunil Agrawal, PhD; James Cole Galloway, PT, PhD

- Device feasible in preschool – no significant increase in socialization
- Follow-up - socialization training
- Increased socialization but still significantly lower than peers
- Suggestions:
  - Start power mobility training younger
  - Longer-term social skills training

Typical co-emergence of mobility and socialization

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Real-World Performance: Physical Activity, Play, and Object-Related Behaviors of Toddlers With and Without Disabilities

Samuel W. Logan, PhD; Melynda Schreiber, MS; Michele Lobo, PT, PhD; Breanna Pritchard, BS; Lisa George, BS; James Cole Galloway, PT, PhD

- 23 typical toddlers
- 2 toddlers - GMFCS IV and GMFCS I

- TD 3-4 hours a day combining physical activity, play & object-related behaviours
- CP - more time in sitting and much less time engaged in peer interaction or object-related behaviours
Why We Move: Social Mobility Behaviors of Non-Disabled and Disabled Children across Childcare Contexts  
*Frontiers in Public Health* 2016  
Samuel W. Logan, Samantha Mae Ross, Melynda A. Schreiber, Heather A. Feldner, Michele A. Lobo, Michele A. Catena, Megan MacDonald and James C. Galloway

- 55 children TD  
- 3 – GMFCS I, III and IV  
- Social mobility lower in classroom versus gym and playground  
- Substantial gap between children with and without disabilities  
- Gap widens - from age 3

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**Practice considerations for the introduction and use of power mobility for children**

Roslyn Livingstone¹ | Ginny Paleg²

- Children who will never walk  
- Children with inefficient mobility  
- Children who lose mobility  
- Children who require mobility assistance in early childhood

(Hays, 1987, Livingstone & Paleg 2014)
Children who will never walk

- Severe Cerebral Palsy GMFCS IV and V
- SMA type I and II
- Limb deficiencies
- Severe arthrogryposis
- Neonatal spinal cord injury
- Osteogenesis Imperfecta types II, III and VIII

Children with inefficient mobility

- Moderate Cerebral Palsy GMFCS levels II, III and IV
- C6 or C7 spinal cord injury
- Thoracic level spina bifida
- Osteogenesis Imperfecta types IV-VII
Children who require mobility assistance in early childhood

- Arthrogryposis
- Lumbar level spina bifida
- Osteogenesis Imperfecta
- Genetic disorders
- Complex medical conditions

Children who lose the ability to walk, or to walk efficiently

- Neuromuscular diseases e.g. Duchenne muscular dystrophy, Limb girdle dystrophy, SMA III
- Acquired brain injury
- Spinal Cord Injury
Poll

How many of you agree with providing power mobility to young children who are expected to walk or to use a manual wheelchair efficiently when they are older?

- Yes – and I have done it
- Yes - but I have not done it
- No - I disagree

Poll

What is the youngest age you have provided power mobility for a child who will never walk?

- Under 12 months
- 12-17 months
- 18-23 months
- 24-19 months
- 30-36 months
Body Structure and Function

- Cognition
  Level II - Jones et al., 2012
  Level V - Lynch et al., 2009

- Receptive language
  Level II - Jones et al., 2012
  Level V - Lynch et al., 2009

- Alertness and motivation
  Qualitative - Nilsson & Nyberg, 2003

- Sleep/wake cycle
  Level IV - Tefft et al., 2012
Activity

- **Independence**
  - Level IV - Bottos et al., 2001
  - Level V - Douglas & Ryan, 1987

- **Self-initiated movement**
  - Level III - Butler, 1986
  - Level IV - Deitz et al., 2002

- **Cause-effect**
  - Qualitative - Nilsson & Nyberg, 2003

Participation

- **Social and play skills**
  - Level IV - Tefft et al., 2012
  - Guerette et al., 2013
  - Level V - Ragonesi et al., 2010
  - Ragonesi et al., 2011

- **Personal-social and communication**
  - Level V - Jones et al., 2003

- **Peer relationships**
  - Level V - Everard, 1984
  - Qualitative - Wiart et al., 2004
Effects of power wheelchairs on the development and function of young children with severe motor impairments

Jones et al., 2012

- Increased receptive language
- Increased overall development
- Increased functional mobility
- Decreased need for caregiver assistance
- No negative impact on motor development

28 children (GMFCS IV or V) 14.8 to 30 months

The child and family experience of power mobility: a qualitative synthesis

Roslyn Livingstone¹ | Debra Field²

- Promotes developmental change & independence
- Enhances social relationships & engagement in meaningful life experiences
- Access & use influenced by factors in physical, social & attitudinal environments
Consensus on 9 messages:

- augmented mobility experiences below 8mo
- maneuver a PMD below 14mo...
- competent control ...18–24mo.
- support overall development
- enhance independence and meaningful participation...
- no evidence that PM impedes ... ambulation ...
- promote independence and...overall development
- self-initiated behavior and learning
- severe intellectual and/or sensory impairments ...
- practice time and learning support ...

Message 1: With access to a specialized power mobility device, it is possible for infants with disabilities to have augmented mobility experiences as early as 8 months of age
Message 2

Children around 14 months of age...

can begin learning to maneuver a power mobility device

Level II
- Jones et al., 2012

Message 2 continued

Children as young as 18-24 months...

have demonstrated competent power wheelchair control using a joystick

Level V
- Butler et al., 1983 and 1984
- Everard, 1984
- Jones et al., 2003
- Dunaway et al., 2012
**Message 3**

**For children with minimal mobility experience...**

a power mobility device can promote overall development as well as functional mobility


- Infant with L4/5 meningomyelocele
- 7 months - 12 months of age
- Power mobility training 2-3 times a week
- Increased:
  - Joystick activation
  - Average path length
  - Total distance
  - Goal oriented driving
- Gains in language, fine motor, cognition - Bailey III

Used with permission: University of Delaware photo services
Andrew video

Message 4
For children with inefficient mobility...

power mobility may enhance independence and facilitate participation in family, school and community life

Level IV – Guerette et al., 2013
Tefft et al., 2012
Bottos et al. 2001
Qualitative - Wiart et al., 2004
Positive impact of early powered mobility on children’s psycho-social and play skills. 
*Assistive Technology* (2013) Guerette, Furumasu & Tefft

- 23 children 18 months – 6 years
- 3 measurement points – at assessment, at wheelchair delivery and after 4-6 months of wheelchair use
- Positive impact on level of play and social skills
- Increased mobility but more difficulty remaining engaged in tasks

The Impact of Early Powered Mobility on Parental Stress, Negative Emotions, and Family Social Interactions
*Physical & Occupational Therapy in Pediatrics* (2012) Tefft, Guerette, & Furumasu

- Decreased parental stress
- Increased satisfaction with
  - Child’s play and social skills
  - Ability to go where desired
  - Belief that the general public accepts their child
  - Child’s sleep/wake cycle

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Message 5
There is no evidence that...

using power mobility at a young age impedes development of ambulation or other motor skills

- Level II - Jones et al., 2012
- Level IV - Bottos et al., 2001

Power-Up: Exploration and Play in a Novel Modified Ride-On Car for Standing

*Pediatric Physical Therapy* 2017 29(1), 30-37
Samuel W Logan, PhD; Michele A. Lobo, PT, PhD; Heather A. Feldner, PT, PhD, PCS; Melynda Schreiber, MS; Megan MacDonald, PhD; Haylee N. Winden, BS; Tracy Stoner, PT, DPT, PCS; James Cole Galloway, PT, PhD

- 42 pre-schoolers, 1 with a disability
- Stand-up ride-on toy car vs crutches
- Compared play in gym and playground
- Increased parallel play
  - in gym
- Increased peer interaction
  - in playground
- ‘right device, right time, right place’
Message 6
Children with conditions that limit early functional mobility...

may benefit from power mobility to promote independence and support overall development.


- Before and after design
- 25 children aged 3-8 years
- Tetraplegic CP
- 6-8 months baseline
- 6-8 months powered mobility use
- Highly significant increase in independence (COPM)
- No change in motor skills
Message 7

Mobility experience in a power mobility device may support development of self-initiated behavior and learning.


- 13 months old - Down Syndrome
- 6 baseline sessions
- 12 weeks intervention
- 4 retention sessions
- Increased independent mobility
- Increased self-care, mobility and social function
- Increased socialization with sister and other children in community

- 45 children and adults with profound cognitive disabilities
- 8 phases identified – growing consciousness of joystick use
- Participants empowered by increased tool use
- 8 individuals achieved goal directed power wheelchair use

**Message 8**

Many children with severe intellectual and/or sensory impairments... can learn to use a power mobility device competently with appropriate practice and environmental support.

- 21 month old
- Cerebral palsy – GMFCS level IV
- 1 week baseline
- 12 weeks intervention
- 2 weeks post intervention
- Increased mobility
- Increased vocalizations
- Increased functional mobility and social skills


- Cognitive level and motor deficit not statistically related to driving performance
- Most children 21/27 were able to drive including 7/13 with IQ below 55
Successful development of power mobility skills... may depend at least as much on...

**practice time** and quality of **learning support** within the child’s environment as the child’s motor, cognitive or sensory abilities

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Power mobility access and use is influenced by factors in the physical, social and attitudinal environment (Livingstone & Field 2015)

- Physical environment and transportation
- PWC features
- Other’s attitudes: Parents, public
  - Bottos et al., 2001; Tefft et al., 2012; Everard 1984
- Service delivery – therapists attitudes
A radical change from ‘last resort’ to ‘first choice’

- Developmentally appropriate power mobility devices – light weight, low cost, toy-based, affordable/fundable
- Designed in collaboration with children and families

Feldner et al., (2016) ‘Why the time is right for a radical paradigm shift in early powered mobility’ *Disability & Rehabilitation: Assistive Technology* 11(2):89-102


- 90 children aged 15-72mo
- Average loan period 15mo
- 67% achieved goals
  - Independence and autonomy
  - Social inclusion and play
  - Increased mobility skills
- *Happiness and enjoyment* – impact on child and whole family
Of 1009(676) pediatric therapists in US/Canada

- Most have a positive attitude
- Most in agreement with practice consideration statements
- Opportunity for practice and parental attitudes more influential when prescribing power wheelchair than providing experiences in therapy
- Few actively engaged in providing early power mobility experiences
- Few monitoring fit and function or providing training
- What are the barriers and facilitators?

How?

- How best to provide power mobility experience and training for young children?

Lisa K. Kenyon, PT, DPT, PhD, PCS; Lisa Hostnik, PT, DPT; Rachel McElroy, PT, DPT; Courtney Peterson, PT, DPT; John P. Farris, PhD

- Children up to 21 years
- 27 studies included - Evidence levels II-V
- Traffic lighting – insufficient evidence to make strong recommendations
- Strongest evidence supports combining play and natural environments
- Weak support for skills-based approaches
- Virtual reality and computer-based training supported for some children without physical or cognitive disabilities


- Training characteristics important to outcome:
  - Taking part in more than 30 training sessions
  - Training for more than 2 years
  - Training at more than one location
  - High degree of training with a professional trainer
  - No trainee characteristics significant to outcome

- 11 months old at risk for CP
- 🆙looking at and touching joystick on right
- 🆙moving wheelchair independently and in response to adult

**Video of Mya training**
Feasibility of a modified ride-on car intervention on play behaviors during an inclusive playgroup

*Physical & Occupational Therapy in Pediatrics* (2017)
Ross, Catena et al... Logan.

- 13 children, 5 with disabilities 1-3 years
- Weekly inclusive playgroup - SSRD AB
- Feasible for inclusive settings
- Some change in interactions

Ride-on Car Training: hospital environment

Huang et al., 2017a; 2017b

- 10 children CP, DS, DD – 11-34 months
- 9 weeks intensive ROC training vs conventional therapy (10 controls)
- Increased independent mobility – start/stop and switch use
- Increased mobility and socialization(PEDI-C)
- Control group increased socialization only
- Institutional environment feasible
Beginning Power Mobility:

Exploration of factors influencing use of power mobility in early childhood

- Wizzybug
- Bugzi
- Tiger Cub
- Toy Car
WhOM-YP
Importance and Satisfaction

Meet Holly
- Twin – born at 31 weeks
- CP - Spastic diplegia
- GMFCS III
- MACS III
- CFCS IV
- LSS 4 (support from pelvis)

Holly video in gym

Participation Outcome

Plays with other kids

Initial
- Importance - 10
- Satisfaction - 4

After 6 Months
- Importance - 9
- Satisfaction - 9
Holly video outside

Meet Skyla and Jayde

- Twins born at 25 weeks
- Dystonic CP
- GMFCS V
- MACS V
- CFCS IV
- LSS 2 (support from the head down)
Gobot and ride on toys

- Large indoor space
- Positioning support
- Alternate access
Car wash video

Timber video
### Skyla and Jayde

<table>
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<th>Enjoy movement</th>
<th>Initial</th>
<th>After 6 Months</th>
<th>Ability to use switches</th>
<th>Initial</th>
<th>After 6 months</th>
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### Emmett

- 16 months SMA I
- Level of sitting scale - 2 support from the head down
- CFCS – IV
- Using Tiger Cub – at home
Video
17 months – playing outside

19 months – inside video
Emmett

Activity Outcome

Able to move around home independently

Initial
- Importance - 10
- Satisfaction – 1

After
- Importance - 10
- Satisfaction -10

CONTACT INFORMATION

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