

Beginning power mobility: Exploring factors influencing use and introduction of power mobility with young children

Physical Medicine Practice Group
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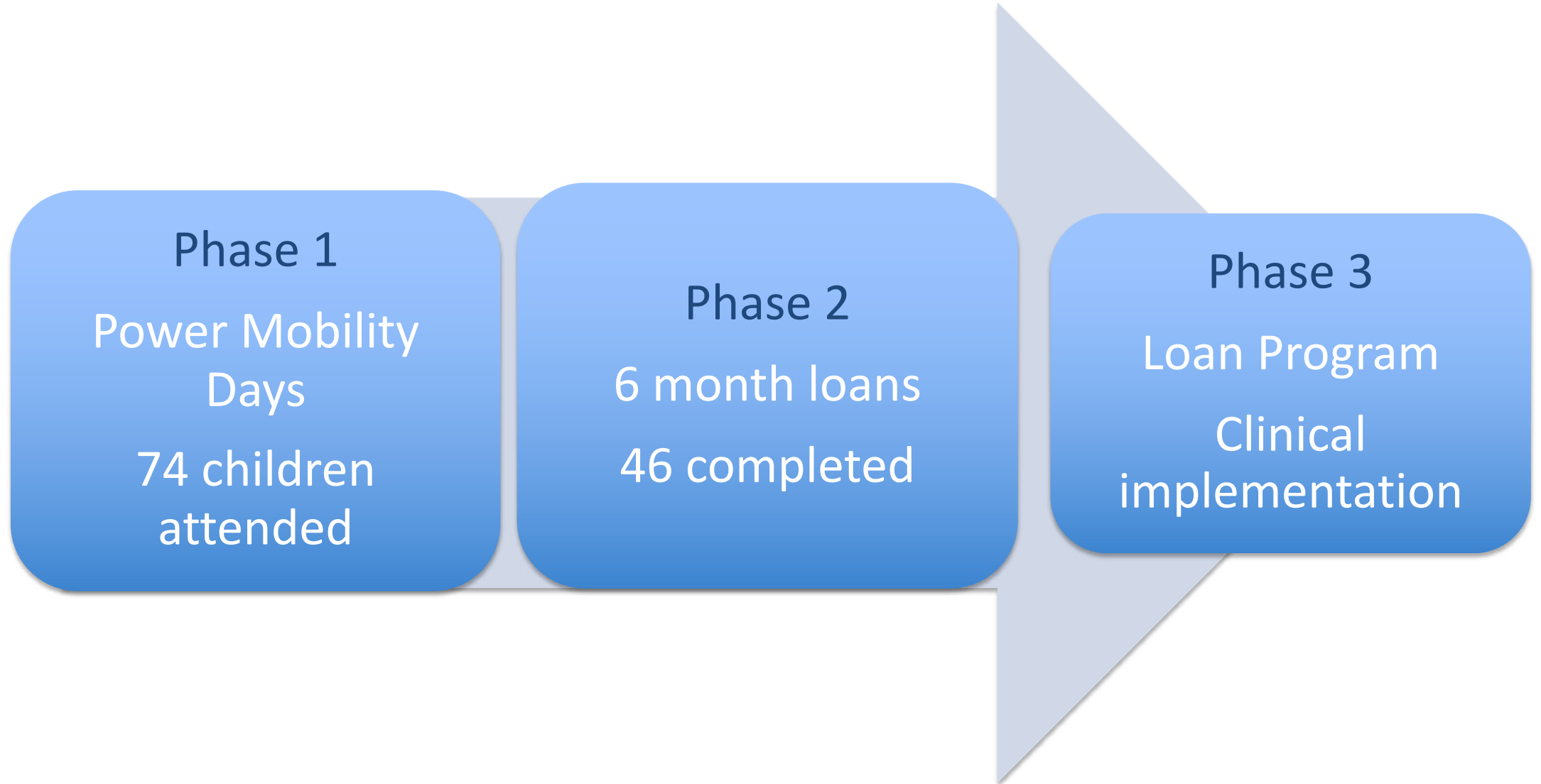


POLL QUESTION

How familiar are you with using power mobility with children <5 years?

1. Not familiar with the idea
2. Interested but not much opportunity to try
3. Interested but not sure how to go about it
4. Have used with some clients
5. Very familiar with a variety of options

Beginning Power Mobility



Beginning power mobility: An exploration of factors associated with child use of early power mobility devices and parent device preference

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Roslyn W Livingstone¹ , Jeffrey Bone²  and Debra A Field¹

Purpose

- Describe and compare children's use of different early power mobility devices during a single introductory session
- Explore factors in the child, environment or device that influence children's use and parents' preference for different early power mobility devices



Methods

- Cross-sectional, observational design
- Power Mobility Days: 60-90 minute exploratory sessions

Wizzybug



Bugzi



Tiger cub



Ride-on toy car



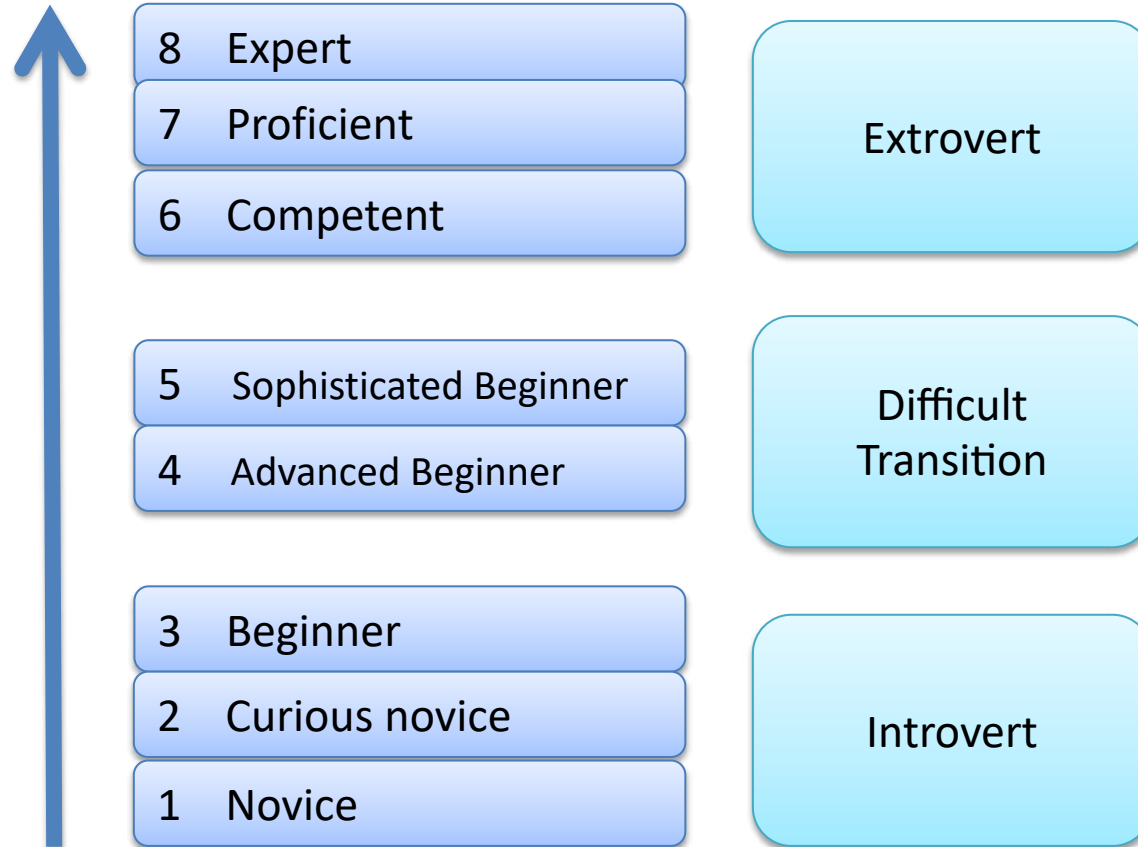
Measures

- Classifications:
 - Gross Motor Function Classification System (GMFCS)
 - Manual Abilities Classification System (MACS/miniMACS)
 - Communication Function Classification System (CFCFS)
 - Level of Sitting Scale (LSS)
- Assessment of Learning Powered mobility use (ALP)



Assessment of Learning Powered mobility use (ALP)

(Nilsson & Durkin, 2014)



<http://www.ncbi.nlm.nih.gov/pubmed/25357100>

	Attention	Activity & Movement	Understanding of tool use	Expressions & Emotions	Interaction & Communication	STAGE
8 Expert	Attention well established and sustained.	Occupation, composed of two or more activities. Fluid, smooth and precise movements. Driving is automatic. A means for doing other activities in multiple settings. Intuitively organizes and understands the task they are encountering. Knows what to do based on mature and practical understanding.	Integrated Tool Use. Consciousness is focused on the other parts of the occupation. Driving more or less subconscious. Consistent precision control of powered wheelchair. Consciously deliberates a situation and performs their own judgment of how to resolve the situation. Takes care of others while driving powered wheelchair.	Dependent on the doing of "other" activities.	Multi-level integrated interaction. Is able to interact with the machine, interact with the environment and interact with social partners.	Explore performance Extrovert stage – focus body, machine, environment & occupant
	Relaxed, active, not tense					
7 Proficient	Multi-channelled attention	Occupation for its own sake. Refinement of graded, varied movements. Driving for the sheer pleasure of driving. Navigating within the physical space.	Fluent Precise Use of Tool. Aware of consequences and conscious of how to control the steering with the joystick. Refining maneuvering skills to their use. Takes care of themselves within the powered wheelchair.	Happiness Satisfaction	Concurrent Interactions. Opensness to multi-level interactions - displays readiness to interact at more than one level. No longer easily interrupted by occurrences. Interacting with the machine in a playful way. Contrives interactions within the social space.	
	Generally focused					
6 Competent	Multi-channelled attention but easily disrupted	Activity. Controlled but unrefined movements. Able to coarsely steer in a desired direction. Concentrating on getting from A to B often ignores the environment and people around them.	Competent Use of Tool. Conscious of the need for sequencing of the acts in a certain order to reach a desired point or place. Controlled but coarse use of the tool. Regression to use body movements instead of tool use – using arm or foot to push away from obstacle.	Serious Content Laugh Exhilarated	Consecutive Interactions. One level interactions occur one after the other. Interaction with the machine has to stop due to disruptive occurrences.	
	Focused on using the tool goal directed					
	Attention	Activity & Movement	Understanding of tool use	Expressions & Emotions	Interaction & Communication	STAGE
5 Sophisticated beginner	Two-channelled attention	Sequences of chains of acts. Intentional more eager or violent movements. Exploring the machine. Experimenting with steering by comparing effects in different patterns. Experimenting to find the pattern of the tool.	Idea of Competent Use is Born. Conscious of the ability to cause many different effects, motion in different directions. Searching the steering pattern. Understands the use of electronic mobility guidance systems.	Engage Smile Serious	Reciprocated interaction. Directs attention by pointing to convey a message that requires the playmate to respond.	Explore sequencing Difficult transition – focus body, machine & environment
	Active, concentrated			Frustration. Periods of frustration. Knowing possibilities but not achieving desired tool use goals. Periods of blocking interbedded with short peaks of success.	Triadic Interaction. Interaction with a person on a third part – a person, an object or something else in the environment.	
4 Advanced beginner	Single channelled attention but able to shift spontaneously	Chain of acts. Intentional but cautious, careful movements. Exploring the joystick. Explorations of different effects – drive, stop. Testing out different grips. Able to press a single switch, hold and release.	Exploration of Extended Use. Conscious of more than one effect. Motion in different directions depending on how acts are combined. Exploring the consequences of activating the tool. Understands 2 switches have different functions.	Serious Smile Sometimes Laugh	Mutual interaction. Requests the attention of the playmate by pointing at objects or events in their close vicinity.	
	Attentive			Exhibits a desire to explore beyond the world of their toy. Shift focus in between near and far.		
	Attention	Activity & Movement	Understanding of tool use	Expressions & Emotions	Interaction & Communication	STAGE
3 Beginner	Single channelled attention but able to shift attention	Act. Distinct targeted movements. Activates joystick to get the effect of motion. Applying force. Able to press a single switch.	Basic Use. Conscious of how one act can cause one effect. Act starts motion. Change position within the room e.g. circling. Regression to using body movements to try and move the machine.	Serious Contented Smile	Initiates interaction. Keeps on responds to eye-contact. Facial signaling.	Explore functions Introvert stage – focus body & machine
	Alert					
2 Curious novice	Single channelled	Pre-act. Diffuse vague multi-directed movements. Touches or hits different parts of the chair. In between sitting still. Touches or hits a switch – experimenting with exerting a force.	Idea of Basic Use is Born. Pre-conscious of how a self-initiated act can cause the effect of setting the chair in motion.	Contented Curious Anxious Angry	Responds to interaction. Gets in eye-contact. Physical contact. Behavioral mirroring. Joint focusing on activity.	
	At times more alert. Passive					
1 Novice	Extreme distractibility. No response to interaction (focus on the novel tool or novel situation).	Excited. Intense in looking at and touching the tool. Non-Act. No specific intentional movements. May accidentally activate the joystick. Is still far from joystick. Protective withdrawal body language.	No or Vague Idea of Use. No or very limited consciousness of how own activity can cause an effect.	Open. Shows joy in experiencing guided motion. Neutral. Displays minimal facial expressions. Whole body displays motionlessness.	No response. May be aware of others' attention. Perceptive. Physical proximity – close in, draw back.	
	Passive or anxious.	Rejection. Displays stereotyped or rejecting behavior, wanting to get out of the powered wheelchair.		Anxiety. Worry, fear, amarguessa, crying.	Avoidance. Avoidance of touch from social partners. No work for interaction. Wants to get rid of the social partners.	

Analyses

- Descriptive analyses – sample characteristics, and distribution of scores
- Friedman's test – comparison of ALP phase across devices
- Linear Mixed Effects Regression – power mobility skill
- Multinomial Logistic Regression – parent device choice
- Classification levels dichotomized
 - GMFCS, MACS, CFCS: I-III vs IV-V
 - LSS – able to sit(5-8) vs requires support (1-4)
- Access method
 - joystick or switch



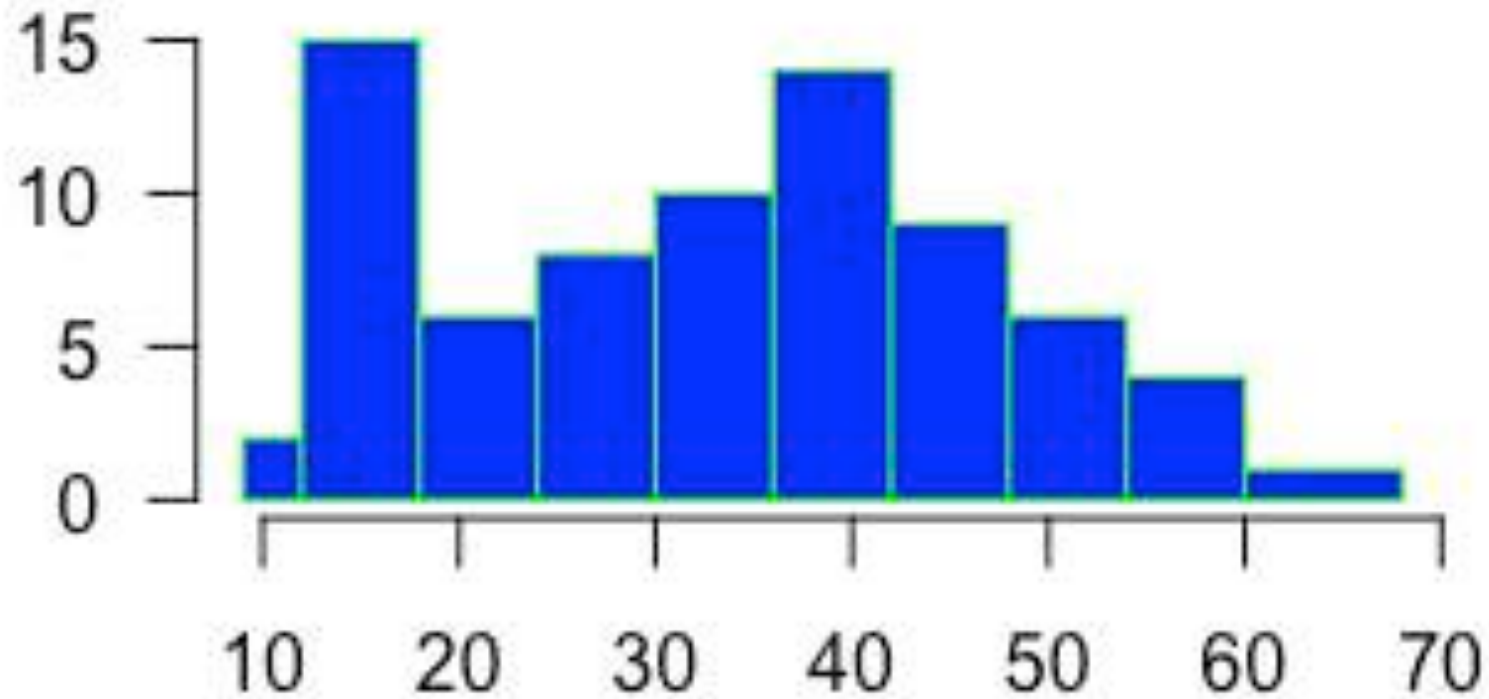


Results



Children's Age

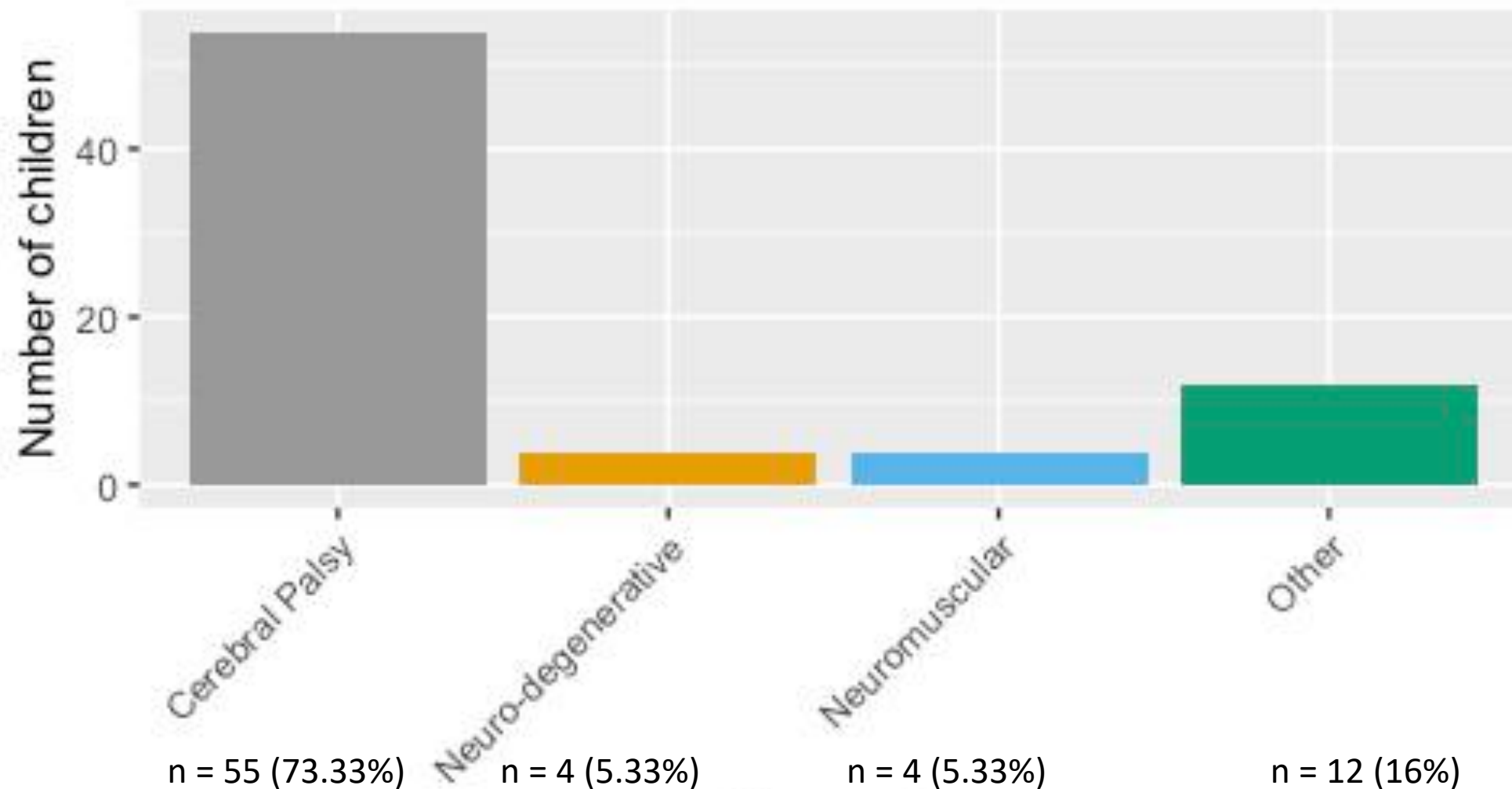
Number of children



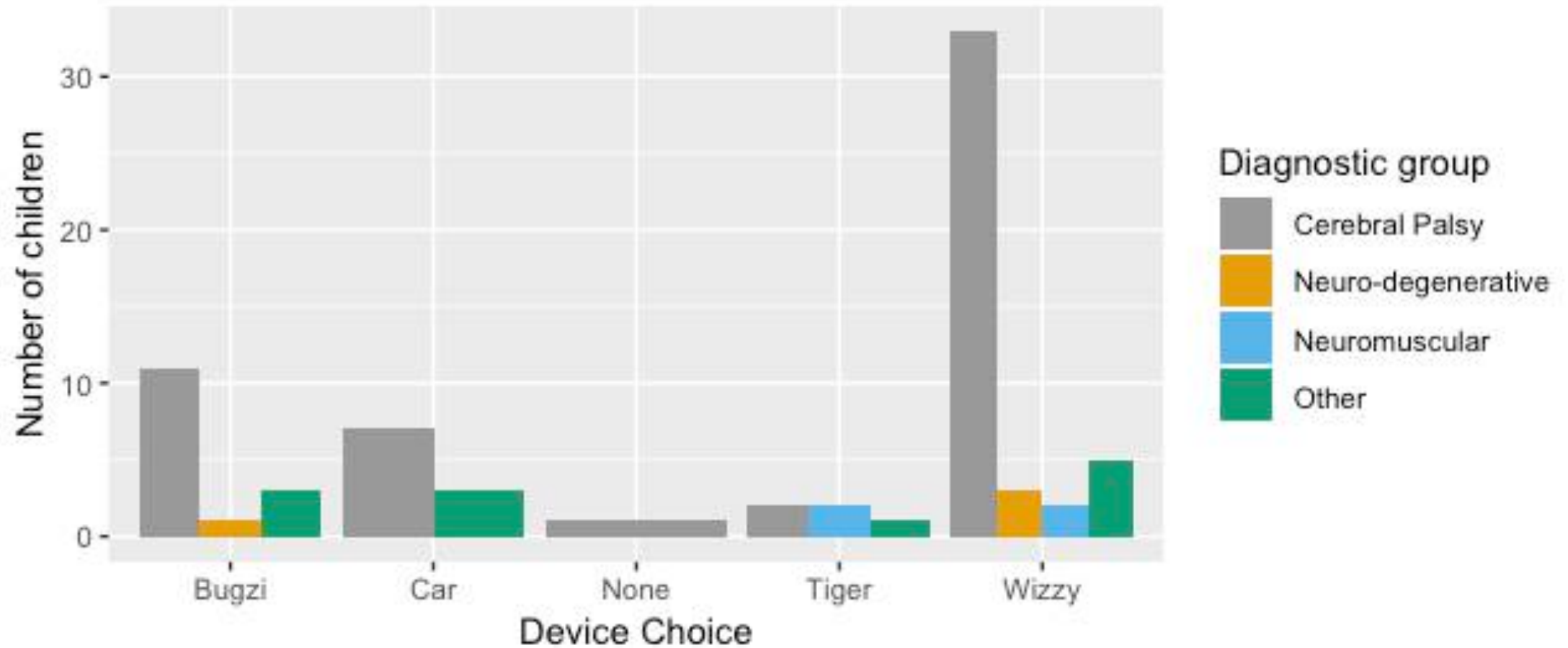
$n = 75$

32.45 months
14.08

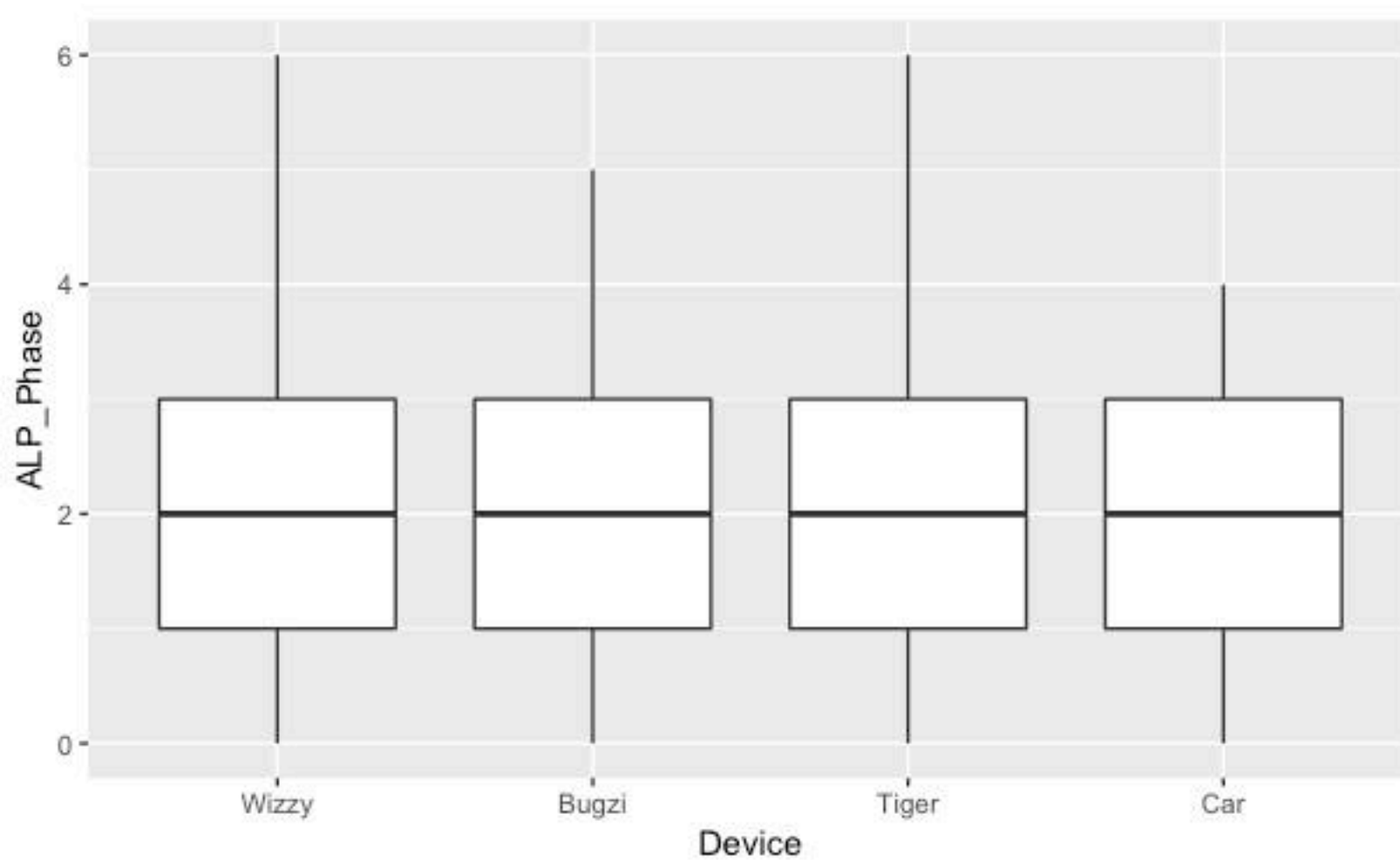
Diagnostic grouping n = 75



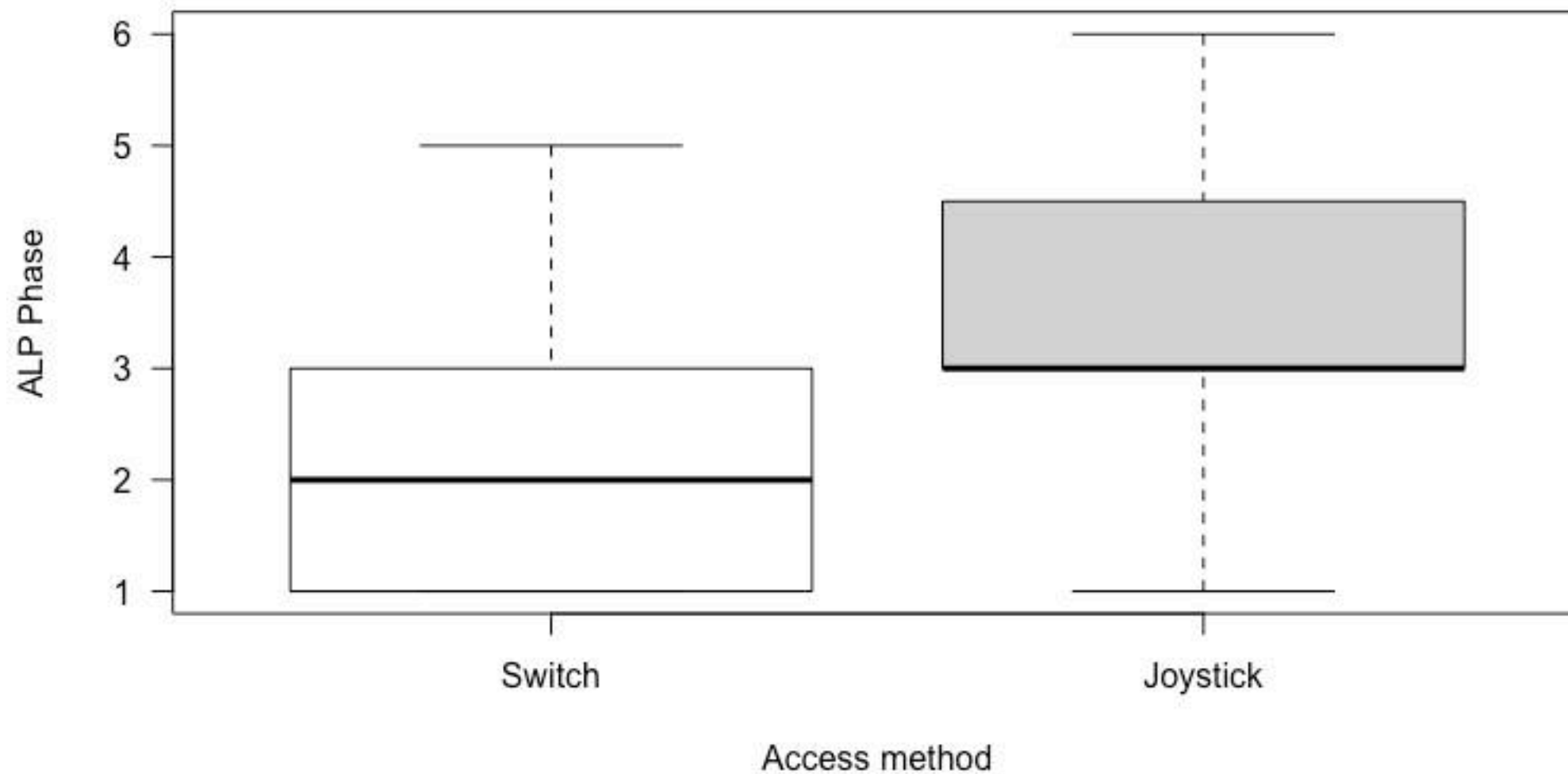
Device choice n = 74



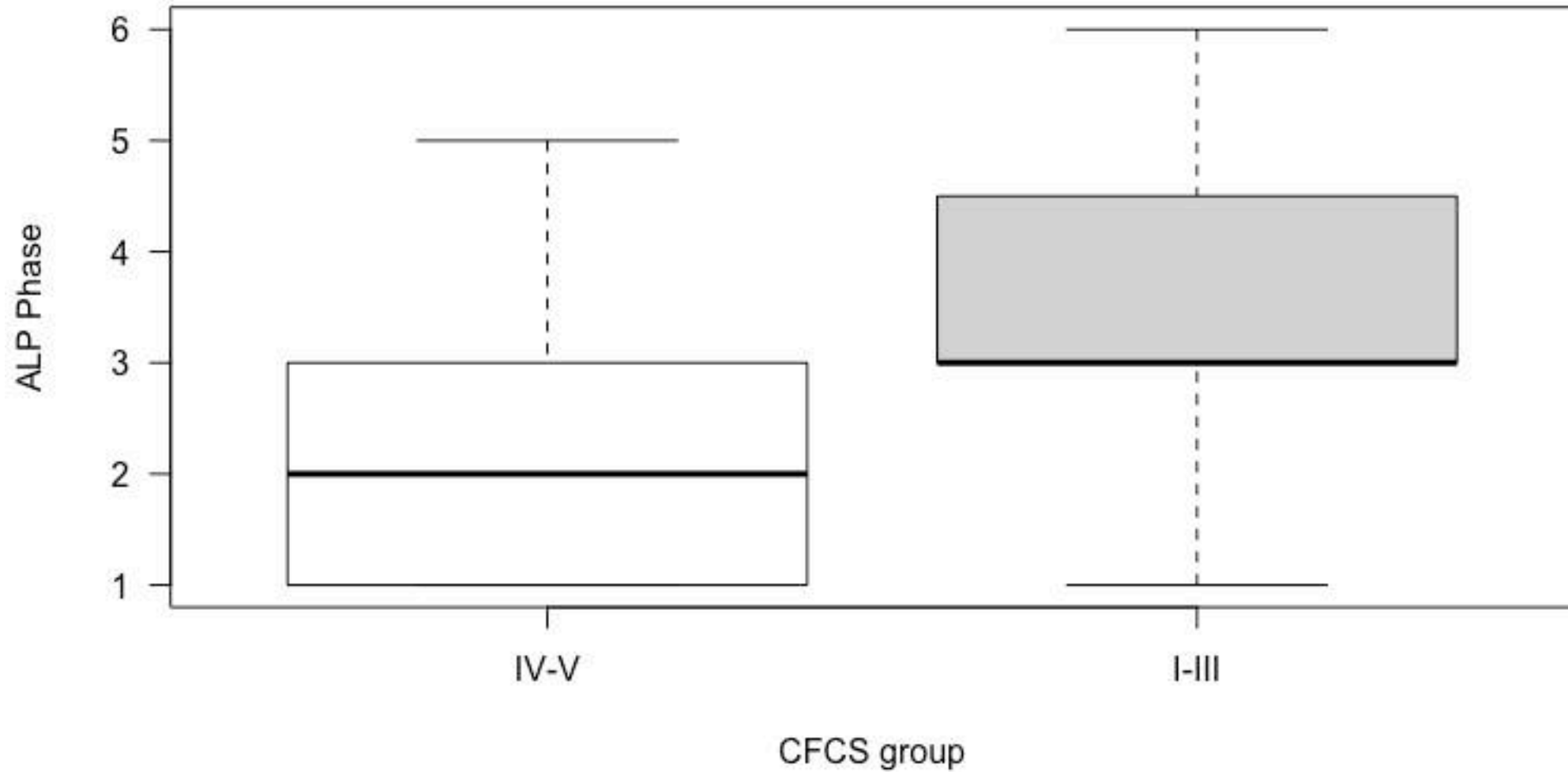
ALP phase in each device $n = 74$



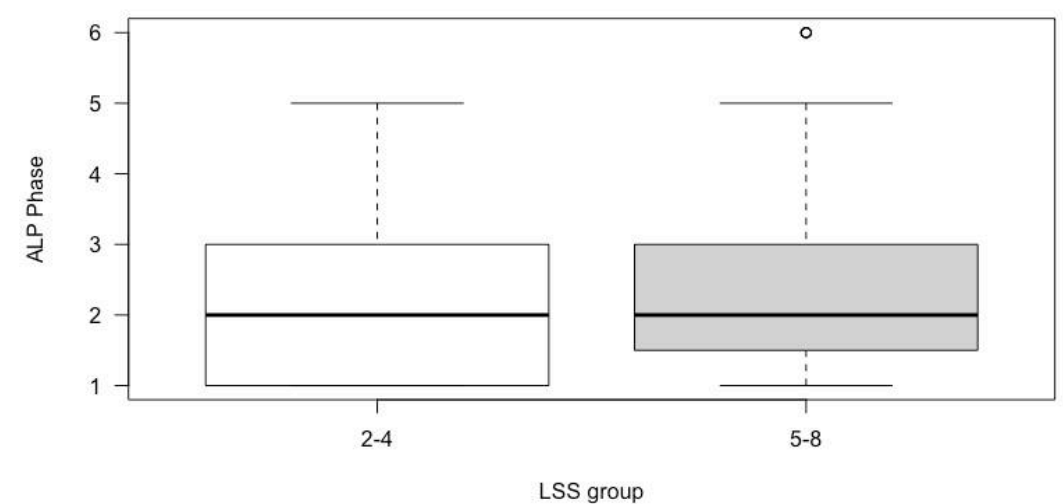
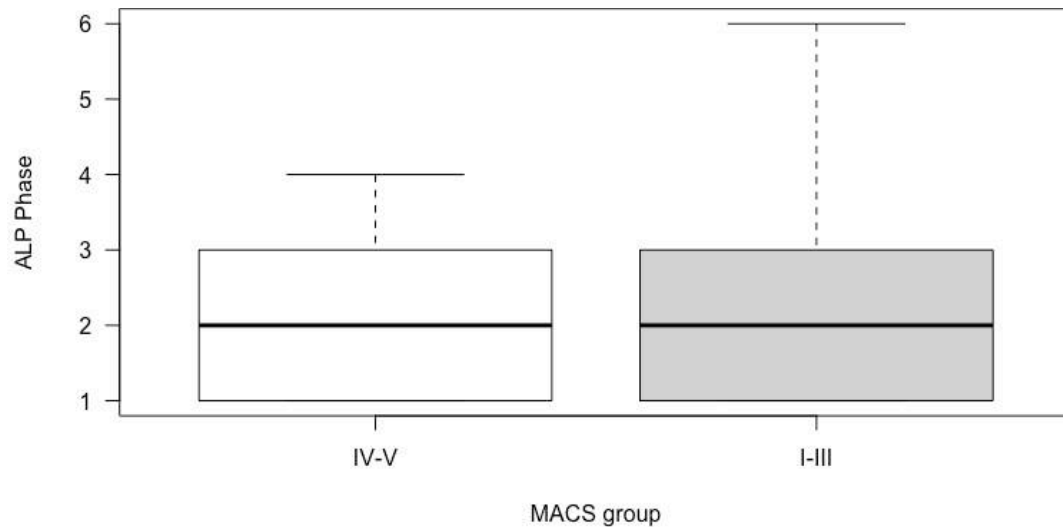
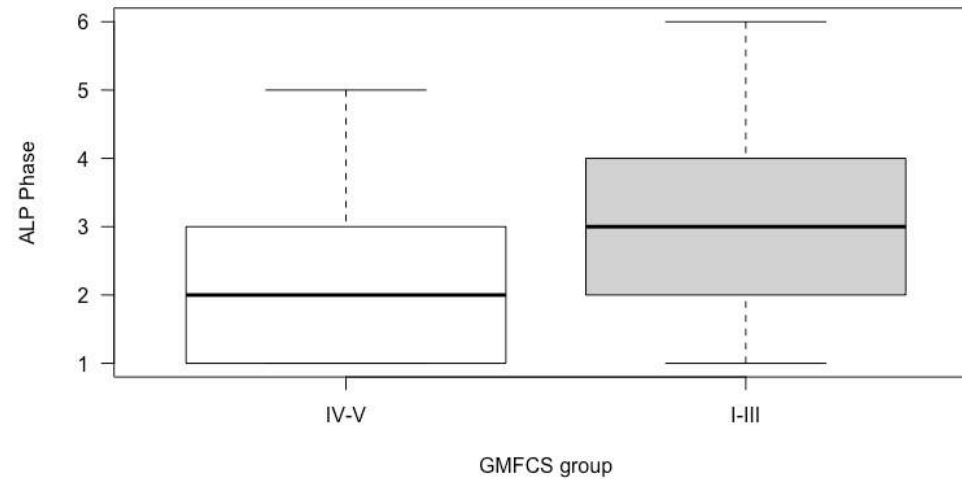
ALP phase and access method n = 74



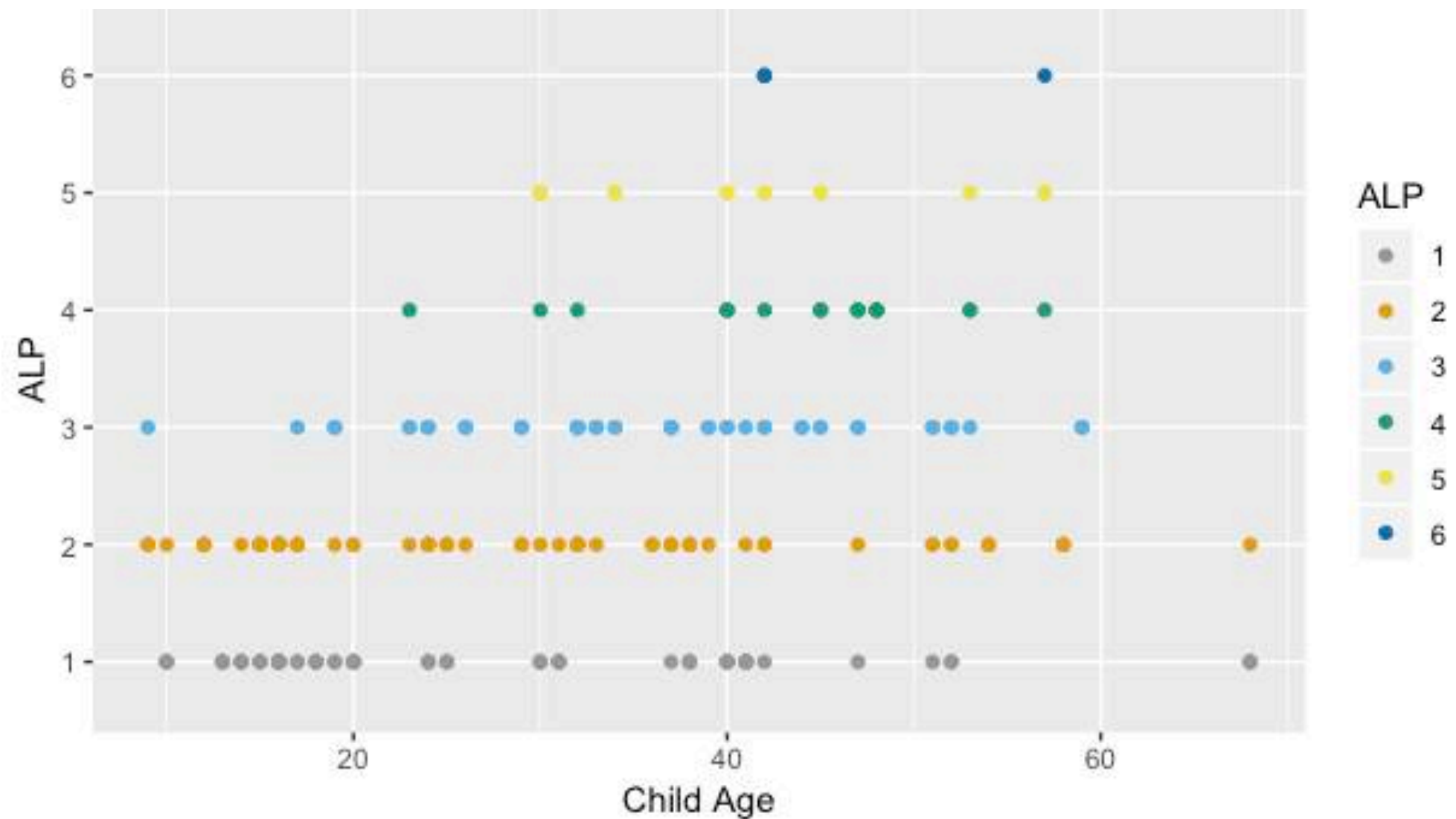
ALP phase and CFCS n = 74



ALP not related to GMFCS, MACS and LSS



ALP phase and child age $n = 74$



Preferred device

59%

n = 43



20%

n = 15



7%

n = 5



14%

n = 10






Bugzi rather than Wizzybug?

- Age ↑ 11% (OR 1.11)*
- Joystick ↓ 86% (OR 0.14)*
- Sits ↓ 92% (OR 0.08)*

Older
Switch users
Need supportive seating






Car rather than Wizzybug?

- Age  1% (OR 1.01)
- Joystick  91% (OR 0.09)*
- Sits  14% (OR 0.86)

Switch users



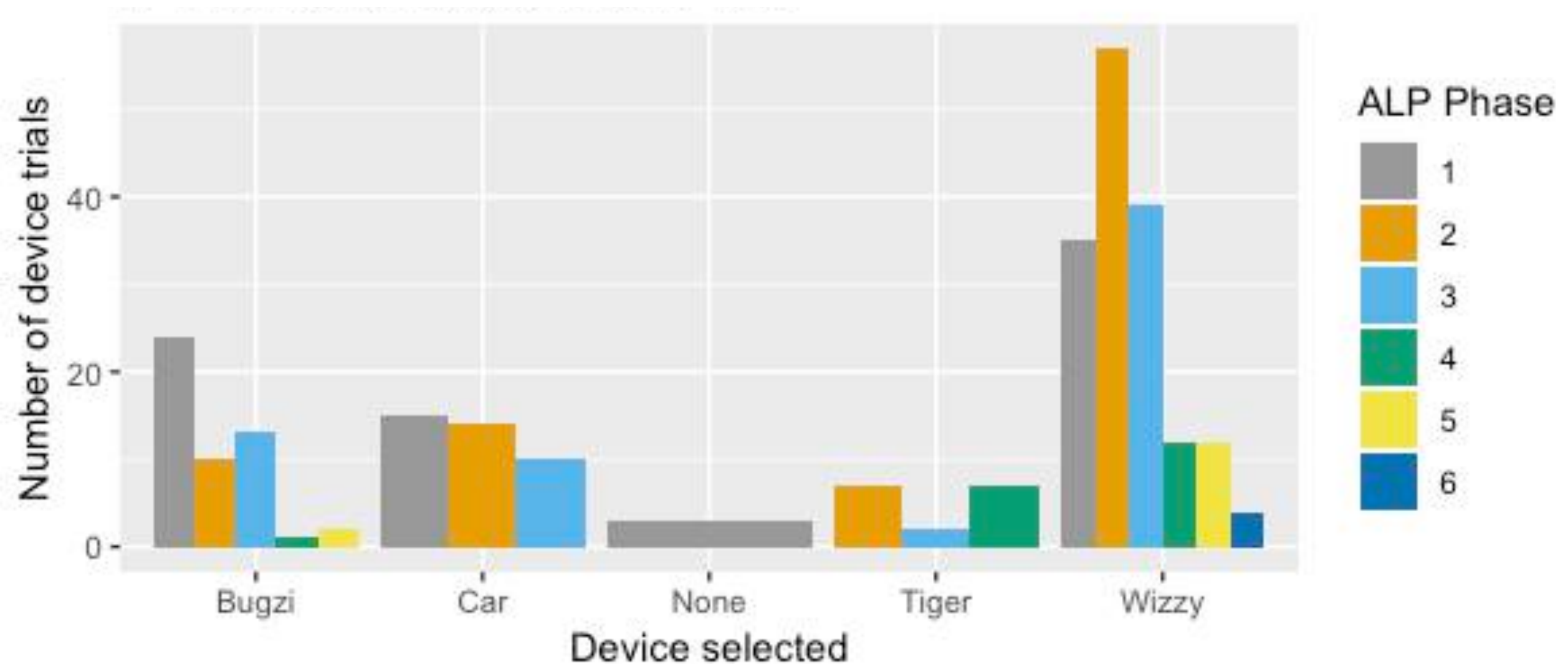
Tiger Cub rather than Wizzybug?

- Age  4% (OR 1.04)
- Joystick  31% (OR 0.69)
- Sits  79% (OR 0.21)

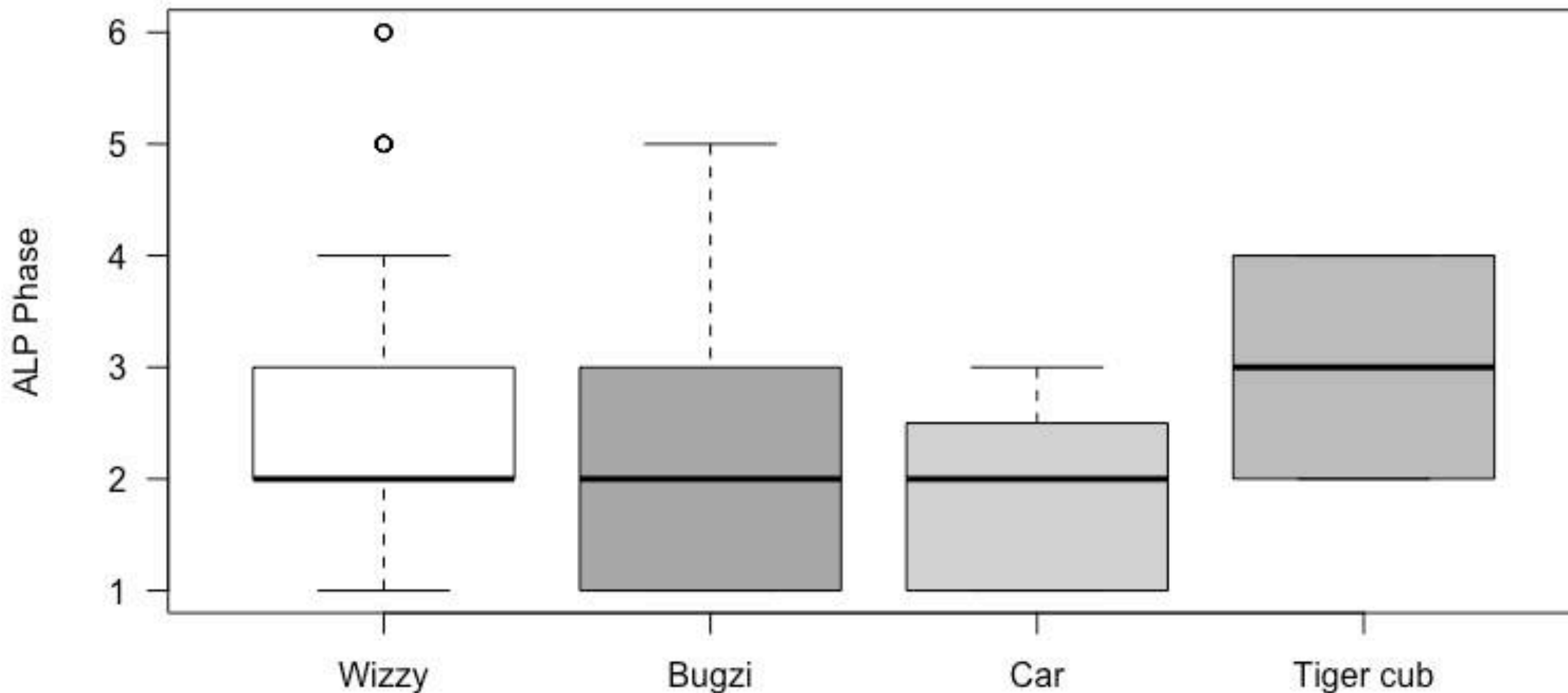
? Alternate access
? Supportive seating



ALP phase and device choice n = 74



ALP phase and device choice n = 73



Conclusion

- ALP phase influenced by child access method and communication abilities
- Parent device choice influenced by child age, access method and postural support requirements
- Parent choice LESS influenced by child power mobility skill (ALP phase) in that device than by other factors

POLL QUESTION

What surprises you by these Phase 1 results?

Please post your comments

<https://padlet.com/debrafield/bdfwkytysl5kueg>



Disability and Rehabilitation

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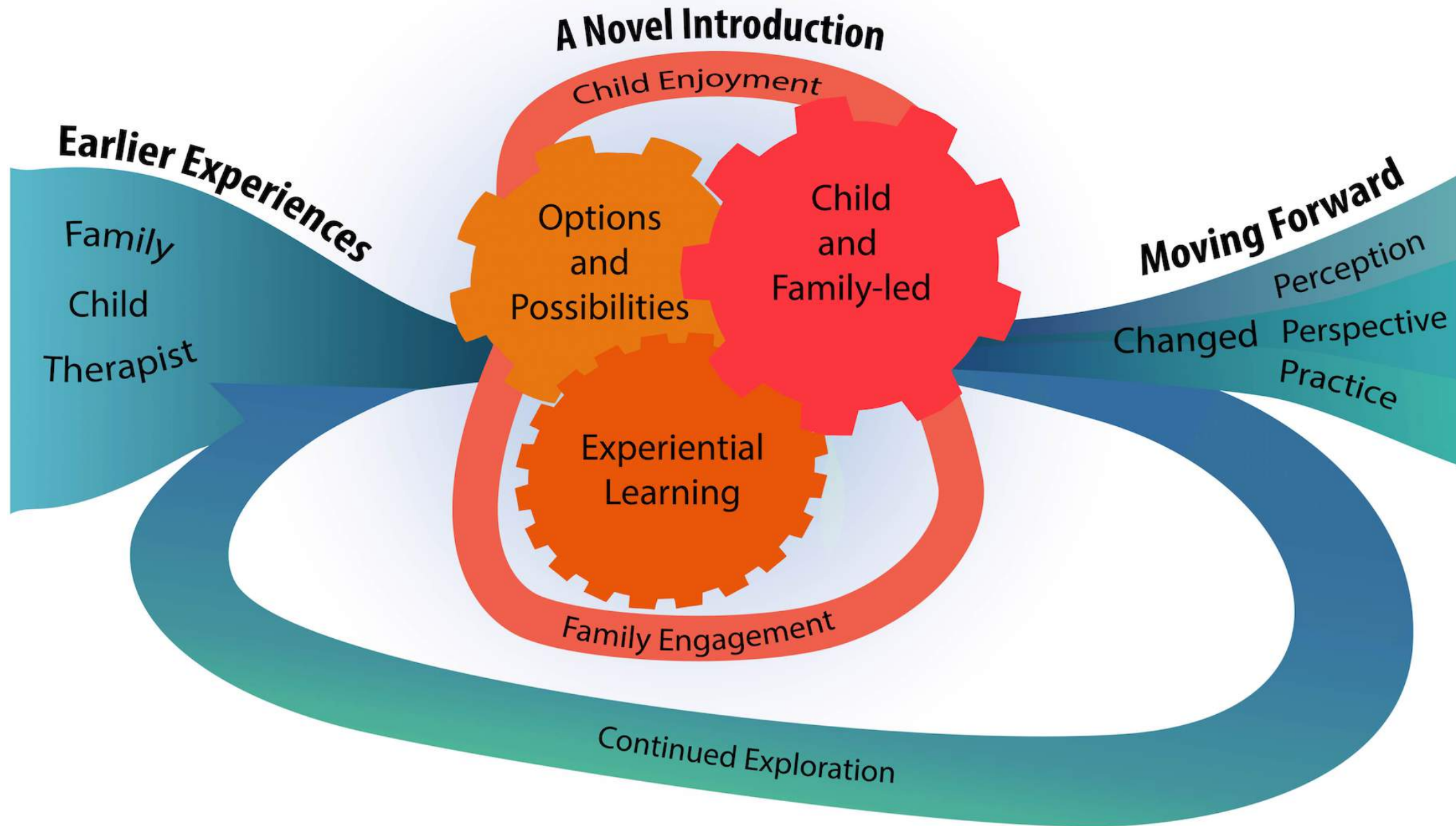
Beginning power mobility: parent and therapist perspectives

Roslyn Livingstone , Debra Field , Colleen Sanderson , Nicole Pineau & Jill G. Zwicker

Qualitative Semi-structured Interviews

- Aim: to explore experiences of a novel therapeutic situation
- Purposive sample
 - 11 parents of children aged 12 - 48 months
 - 6 PTs and 5 OTs
- MOT student project
 - Telephone interviews
 - Verbatim transcription
 - Coding, initial analysis and manuscript
- Re-analysis and abstraction
 - overarching theme and model development

Empowering Children and Families to Explore



Earlier Experiences

Attitudes

- “...I thought ... less focus would be spent on actually trying to get him to walk on his own” 3P
- “I thought it would be great...to give it a shot” 21P
- “I’m hesitant to have a failing endeavour” 8T
- “I was excited! To try it [power mobility]” 5T

Earlier Experiences

Knowledge

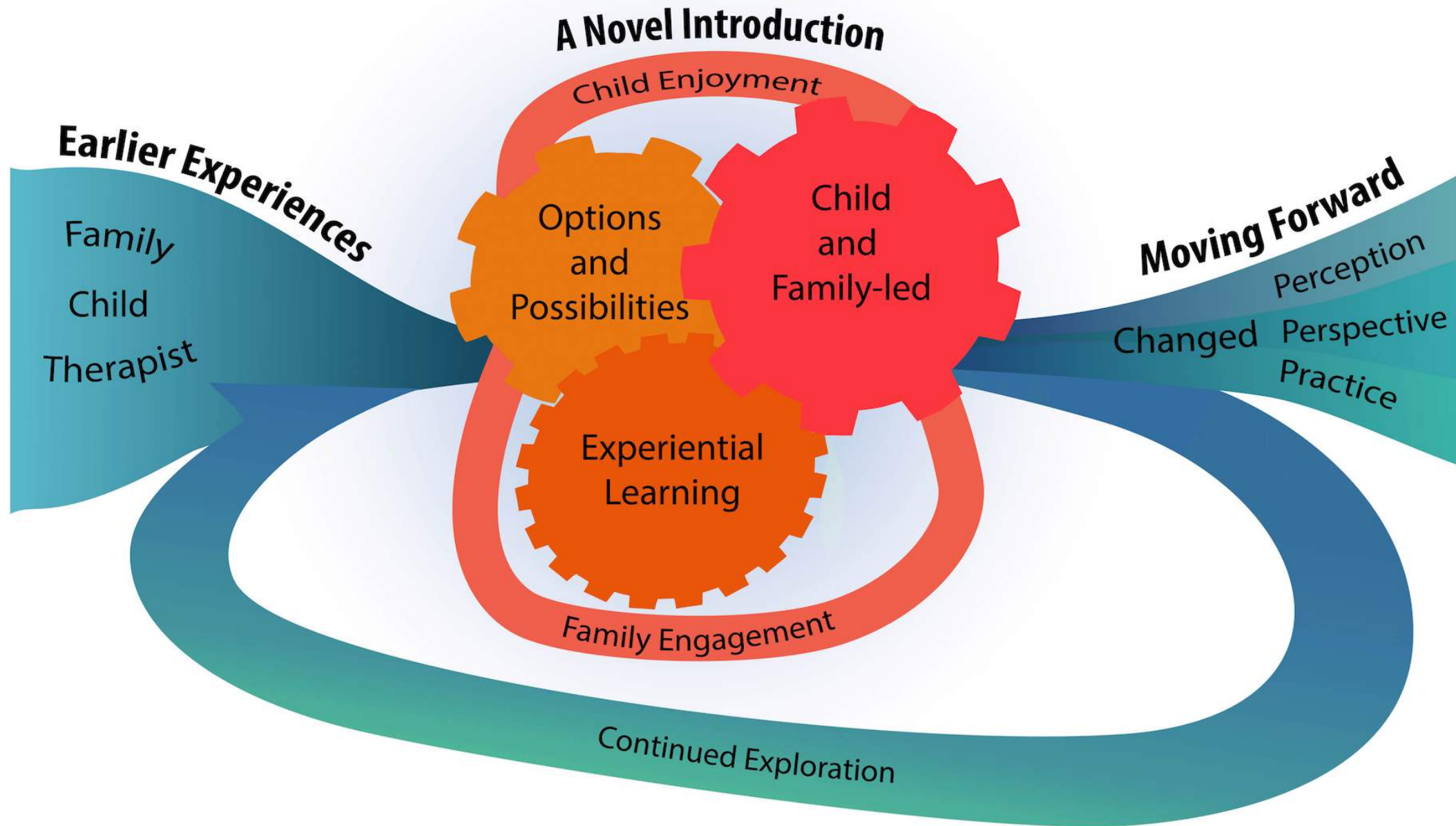
- “I didn't realize that it was potentially an option” 13P
- “Power mobility was maybe for children with severe...physical limitations” 6P
- “I think something like this would be a great way to look at how a child's brain is functioning” 4T
- “It was kind of a new experience for me” 7T

Earlier Experiences

Barriers

- “Devices can be so hard to get a hold of, having the opportunity to see them and try them all in one place...” 15T
- “I’m interested in doing it, I’m excited to do it, it’s just really difficult to do it” 2T

Empowering Children and Families to Explore



Child and Family Led

- “you could see their facial expressions that they were happy” 14T
- “I thought it was a great experience, cause it was the first time that he’s ever got to try anything like that, so, ...wish he had more experiences like that” 17P
- “It was kinda cool watching other kids use the devices as well” 6P
- “I actually loved having other families around” 17P

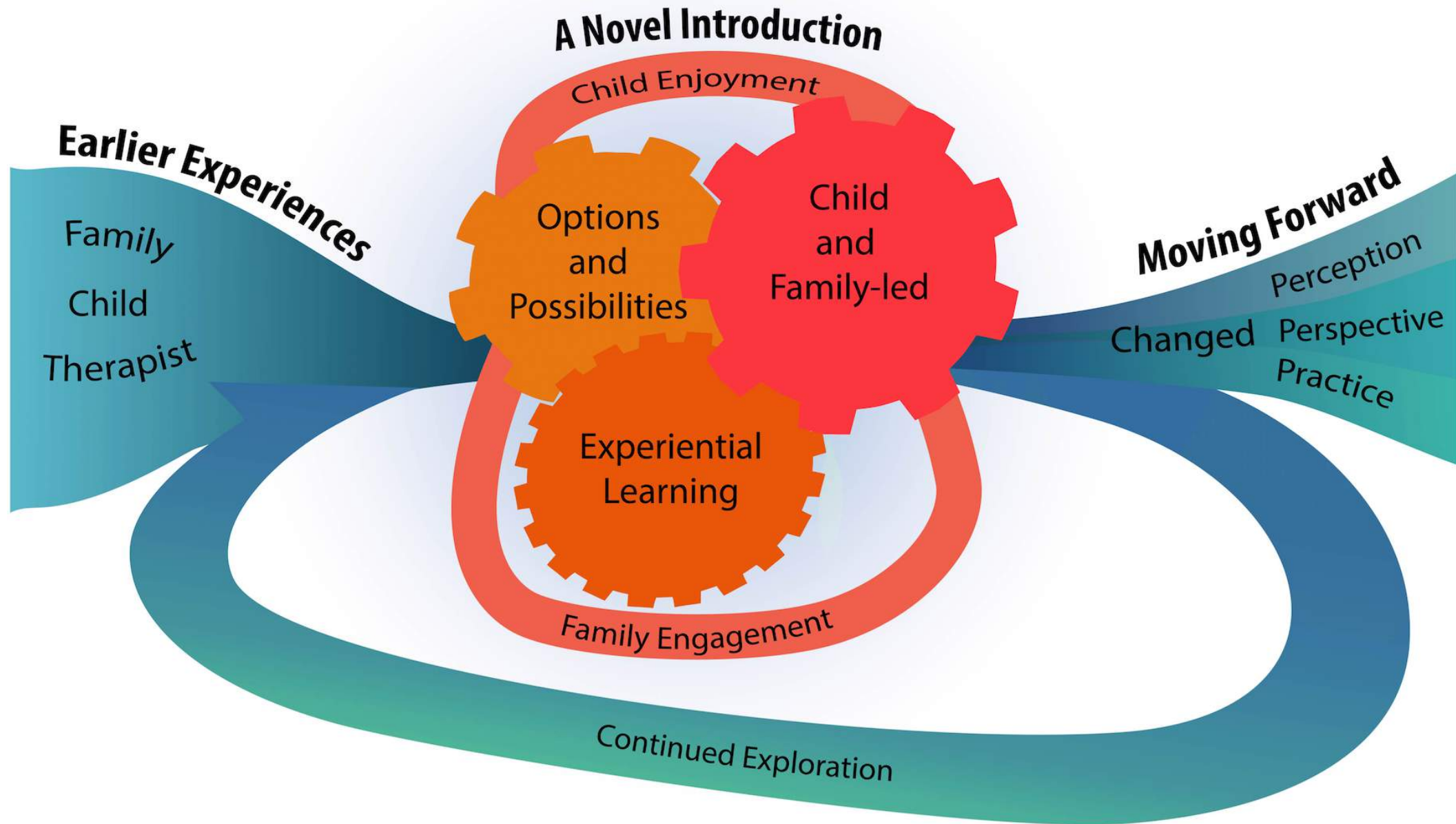
Experiential Learning

- “...gave a real window into...we saw some cognitive ability perhaps we didn’t know was there” 12T
- “[He] loved it...I think he benefited, it just broadened his horizons” 18P
- “the children enjoyed it, the parents were totally engaged and learned something about their kids and about what’s out there” 16T
- “I like having the therapists come together to problem-solve” 4T

Options and Possibilities

- “I think that each chair had pros and cons and would work for different children” 19P
- “I was worried that he wouldn’t be able to do it, but the head switches were awesome” 17P
- “...really kid-friendly to the kids who would come up to a kid in a power mobility device” 13P
- “We hadn’t really had that success in sort of typical power wheelchairs” 7T

Empowering Children and Families to Explore



Moving Forward

Changed Perception

- “She don’t understand nothing. But when I see her there, I think she understand a little bit” 9P
- “I think my eyes were opened up” 17P
- “They actually had mobility and they had movement that they just didn’t have control over before and the families could see that” 22T

Moving Forward Changed Perspective

- “It opened up a door we weren’t aware of” 21P
- “I wasn’t really expecting that benefit of focus and attention” 15T
- “She emailed me and just said ‘I can see her, I can see her driving down our street in our community,’ and now she wants it” 8T

Moving Forward

Changed Practice

- “...offered us an opportunity to have a discussion about mobility far earlier than we normally do” 22T
- “I think of it [power mobility] much earlier now” 16T
- “Some of these families come to this when they wouldn’t come to other things” 12T
- “I just hope that these devices make it to the point where we are able to take it out on loan. That would be awesome” 10P
- “It would be really great to have that opportunity early on in life, rather than waiting ‘til they’re older” 1P

Implications for Rehabilitation

- Exploratory sessions can provide a novel introduction to power mobility interventions
- Child enjoyment has a reciprocal impact on family engagement with power mobility
- Experiential child-and-family-led learning can increase awareness of power mobility options and possibilities

STRETCH BREAK





Disability and Rehabilitation: Assistive Technology

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Exploring change in young children's power mobility skill following several months' experience

Roslyn W. Livingstone & Debra A. Field



Phase 2 study

Pre Test

6 month device loan



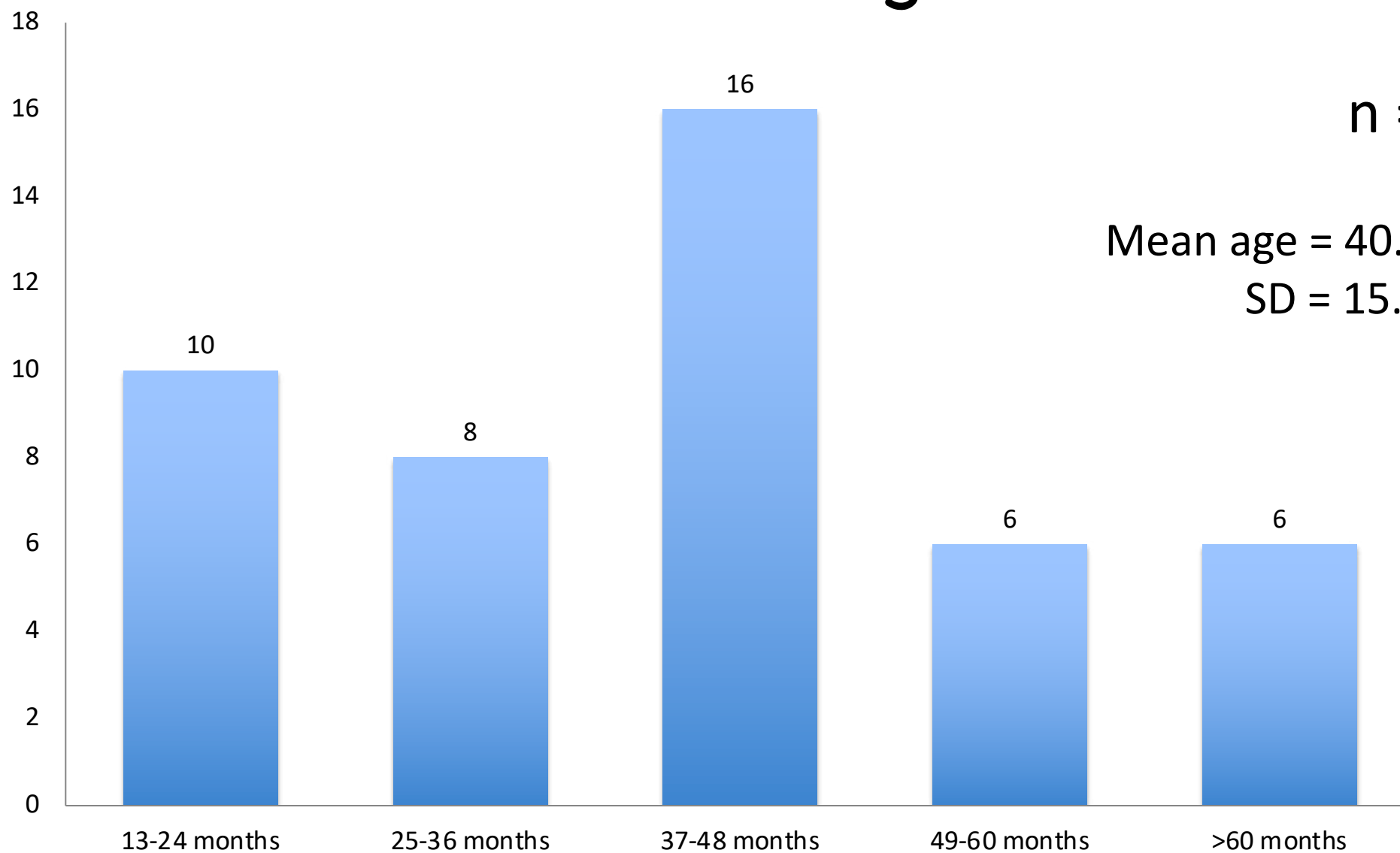
Post Test

Pre/Post Measures

ALP	(primary)
PMTT & PMP	(secondary)



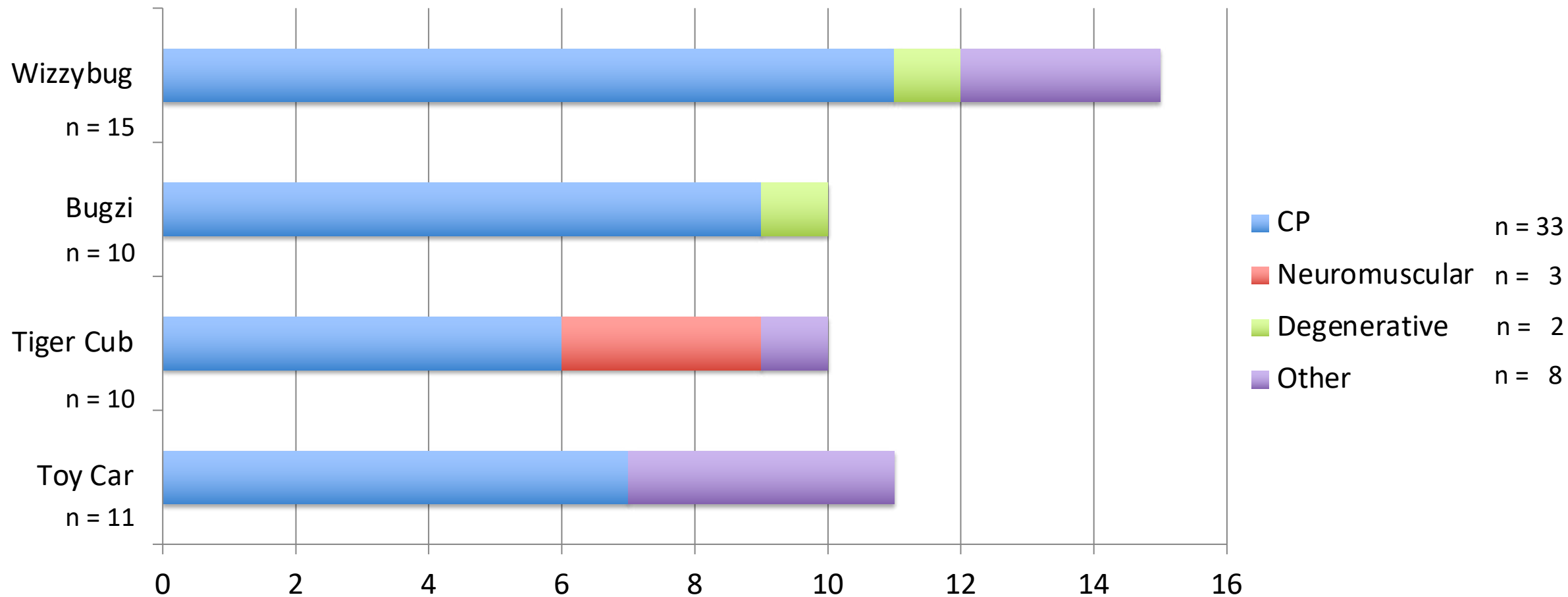
Children's Age



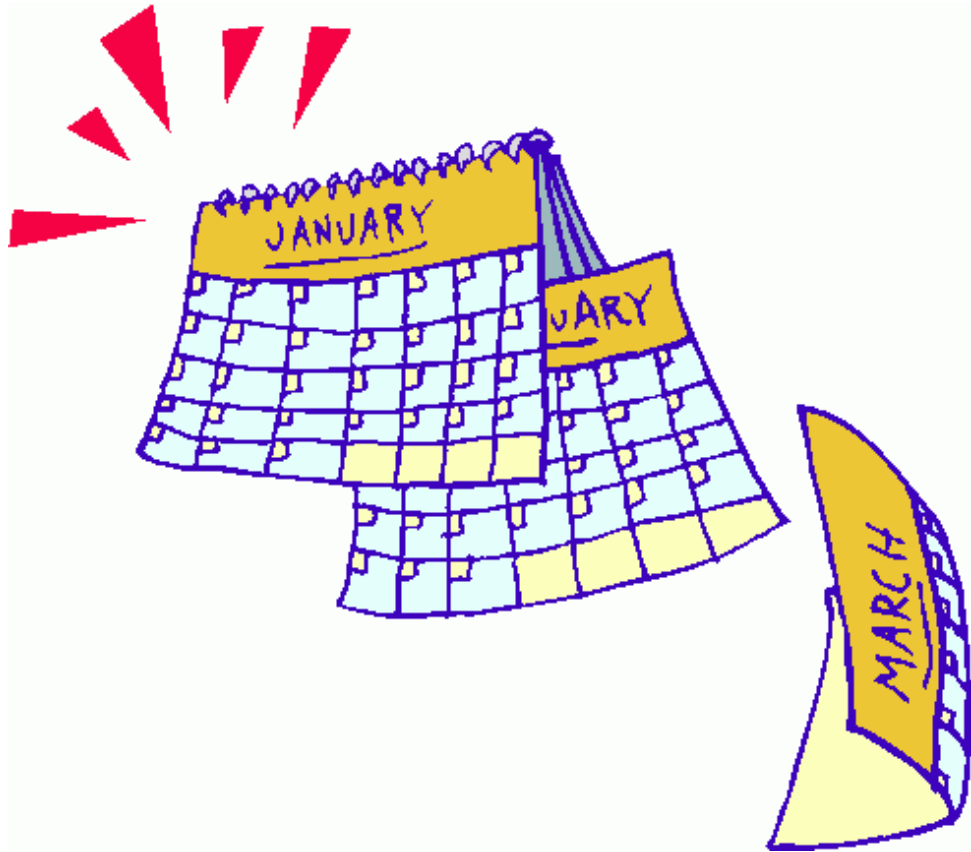
n = 46

Mean age = 40.4 months
SD = 15.6 months

Device & Diagnosis

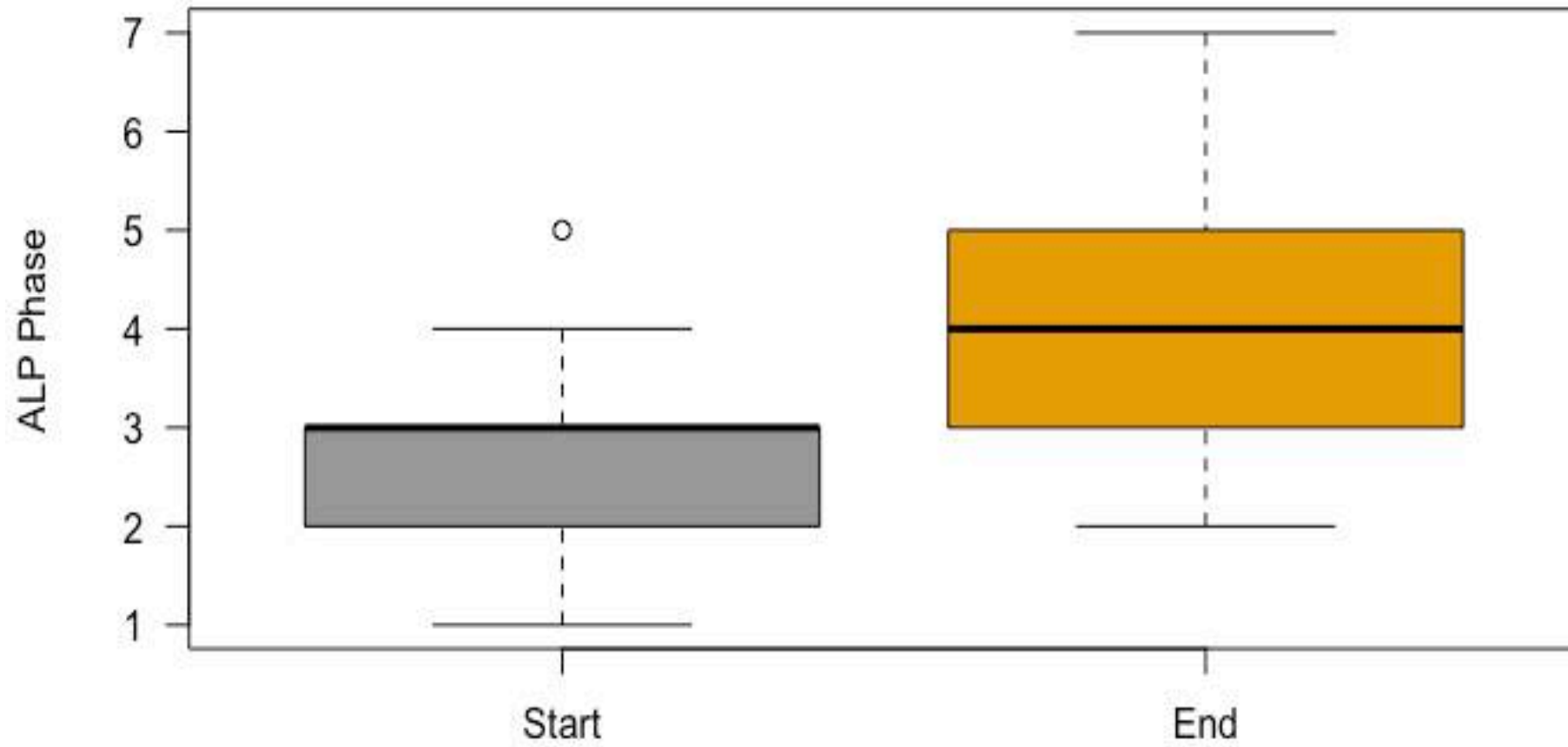


Primary Research Question



Do power mobility skills of children (6 months to 5 years of age) show change as measured on the *Assessment of Learning Powered mobility use (ALP)* following 6 months experience using an early power mobility device?

ALP Phase at start and end of loan n = 46

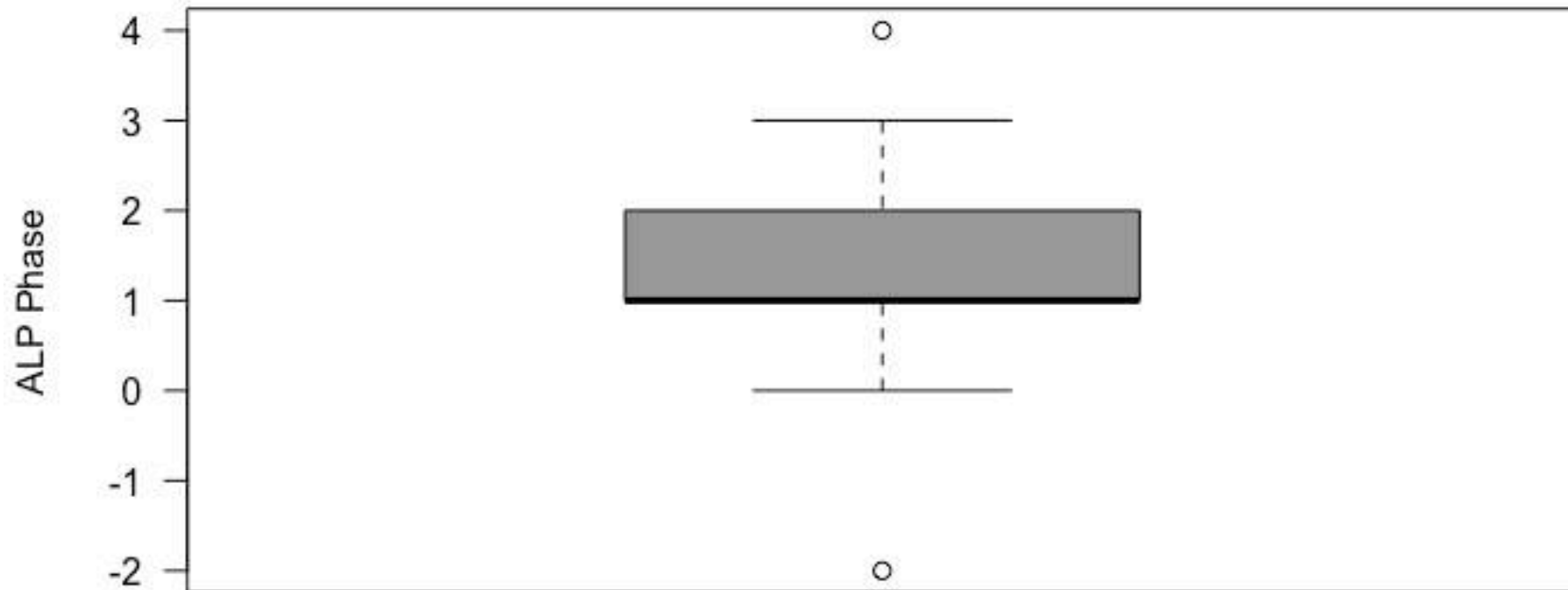


ALP Change

Median = 1 (CI₉₅ 0.98 - 1.58)

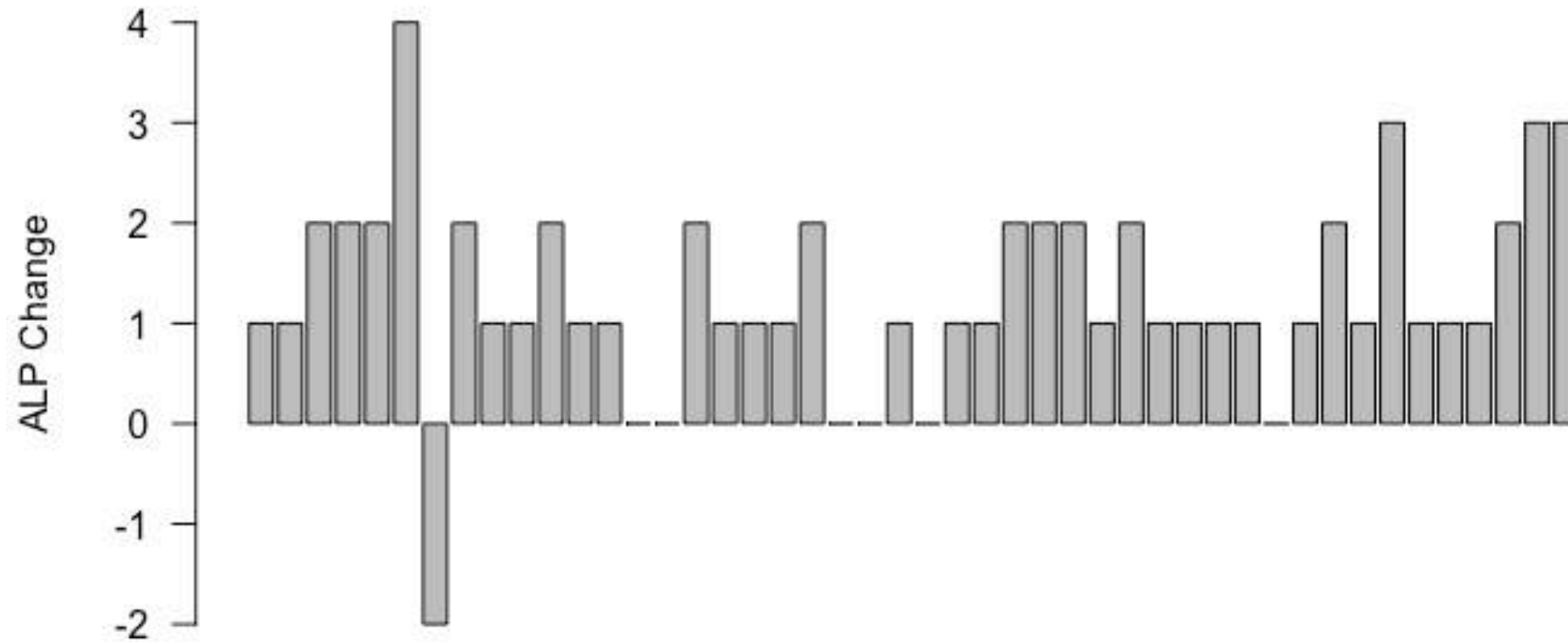
$r = 0.57$ (CI₉₅ 0.42 - 0.70)

ALP Change n = 46

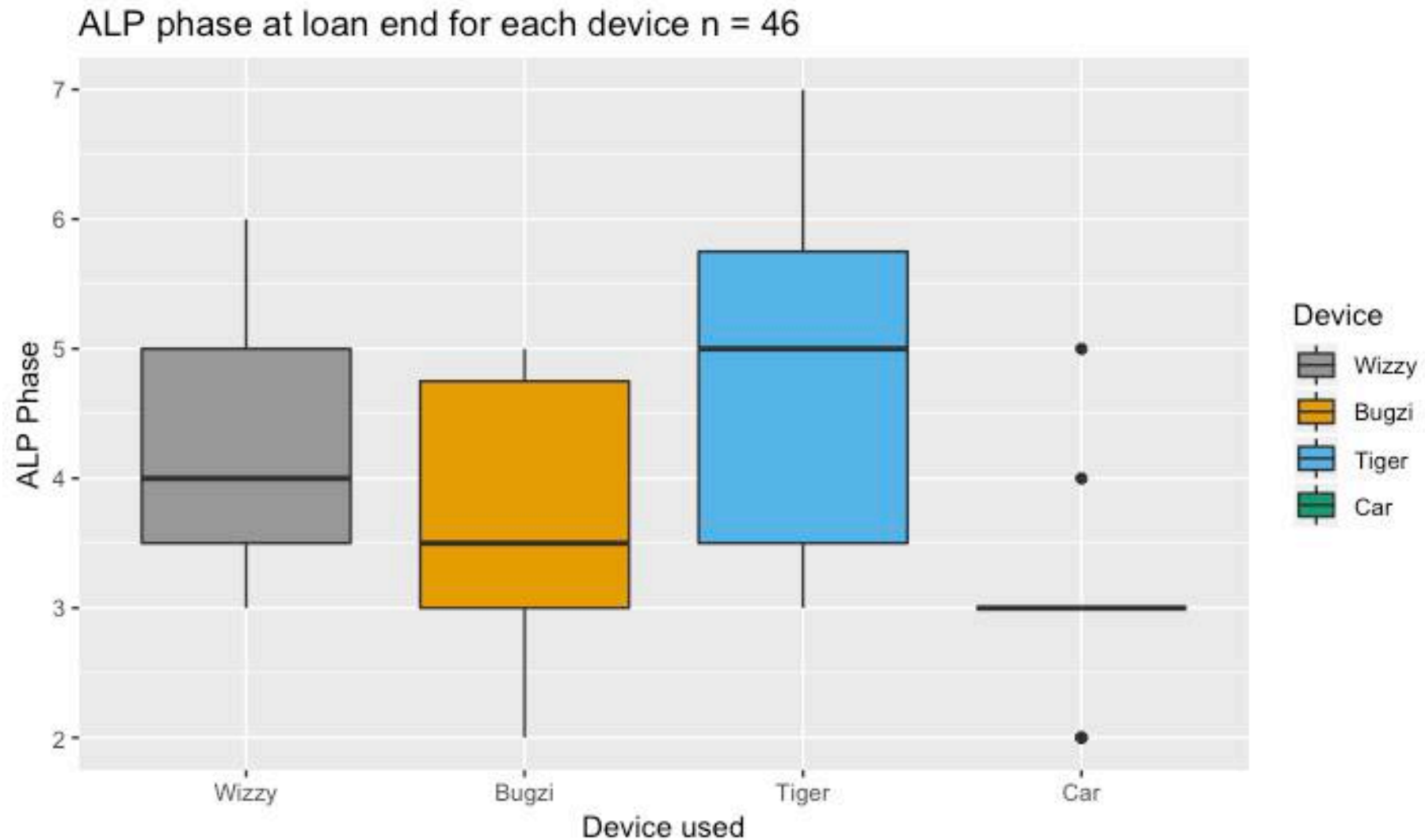


ALP Change

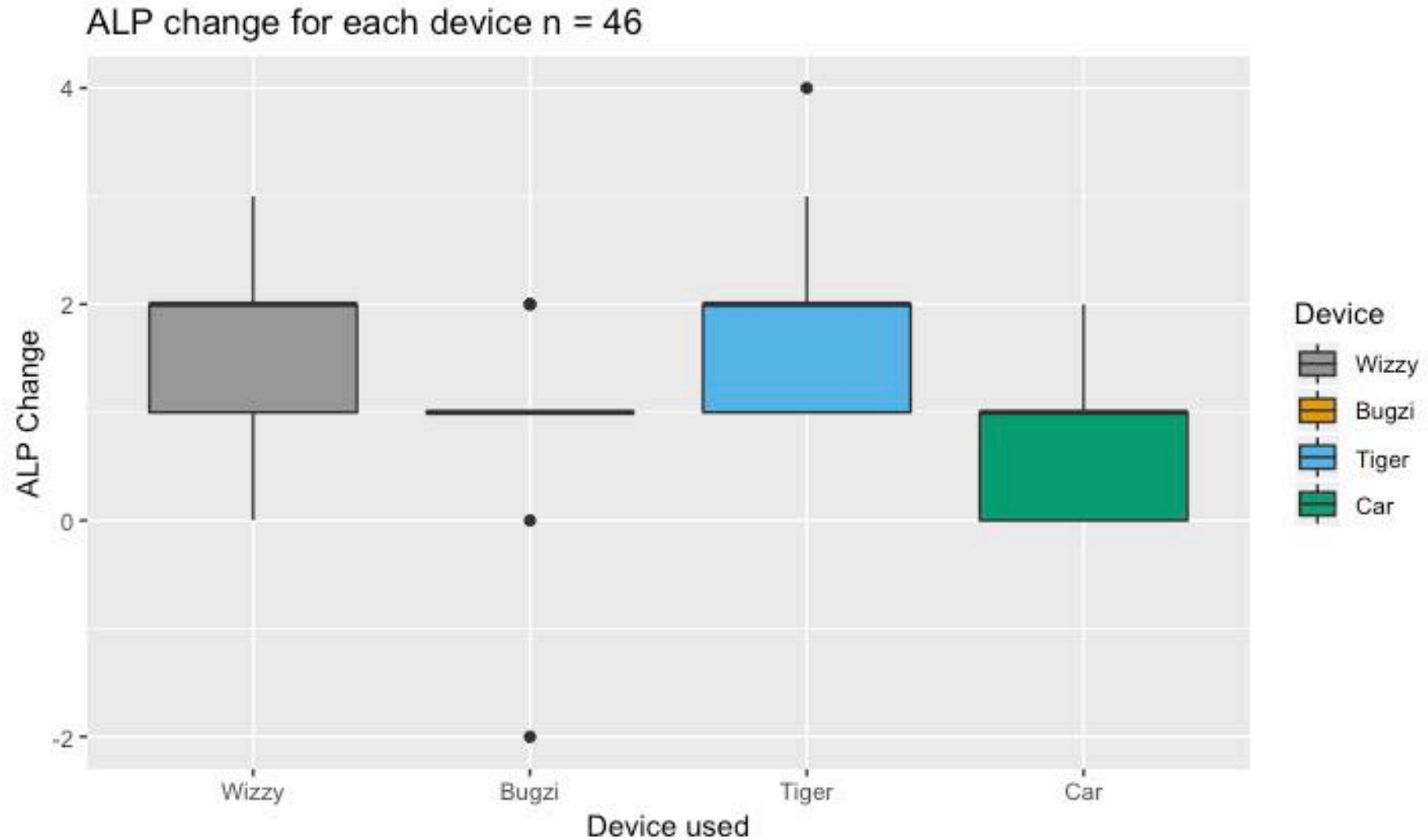
ALP change n = 46



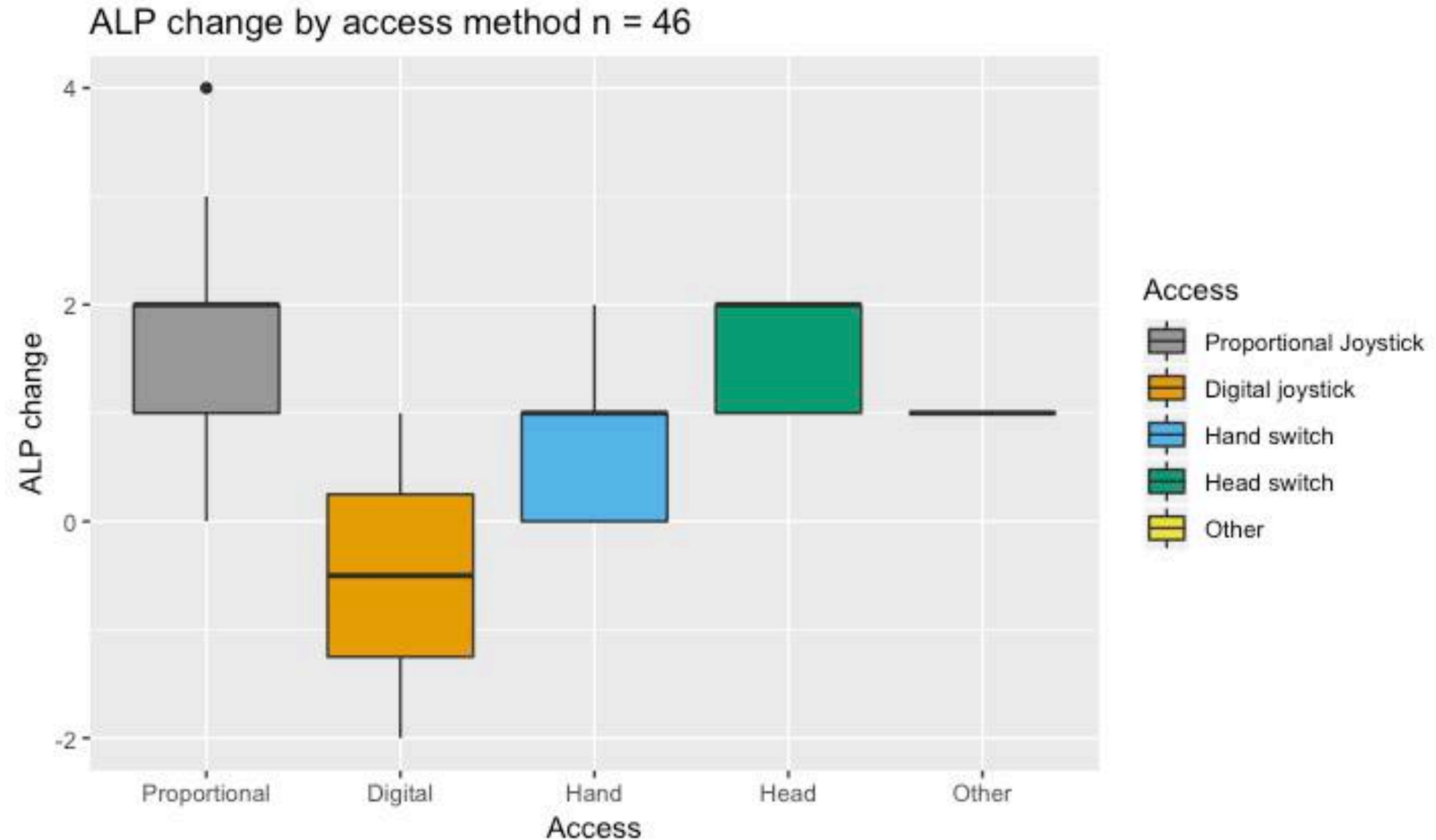
ALP by Device



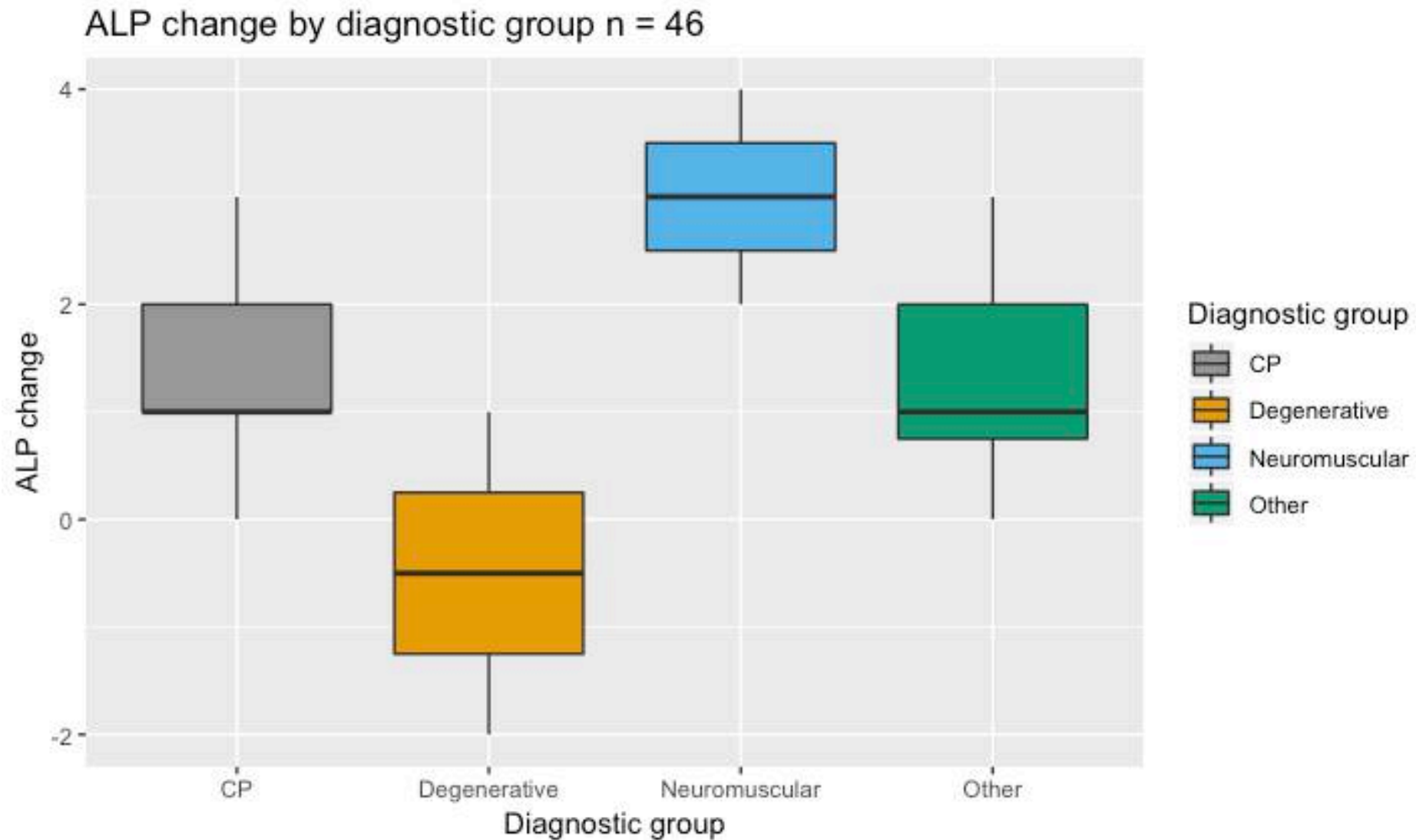
ALP Change by Device



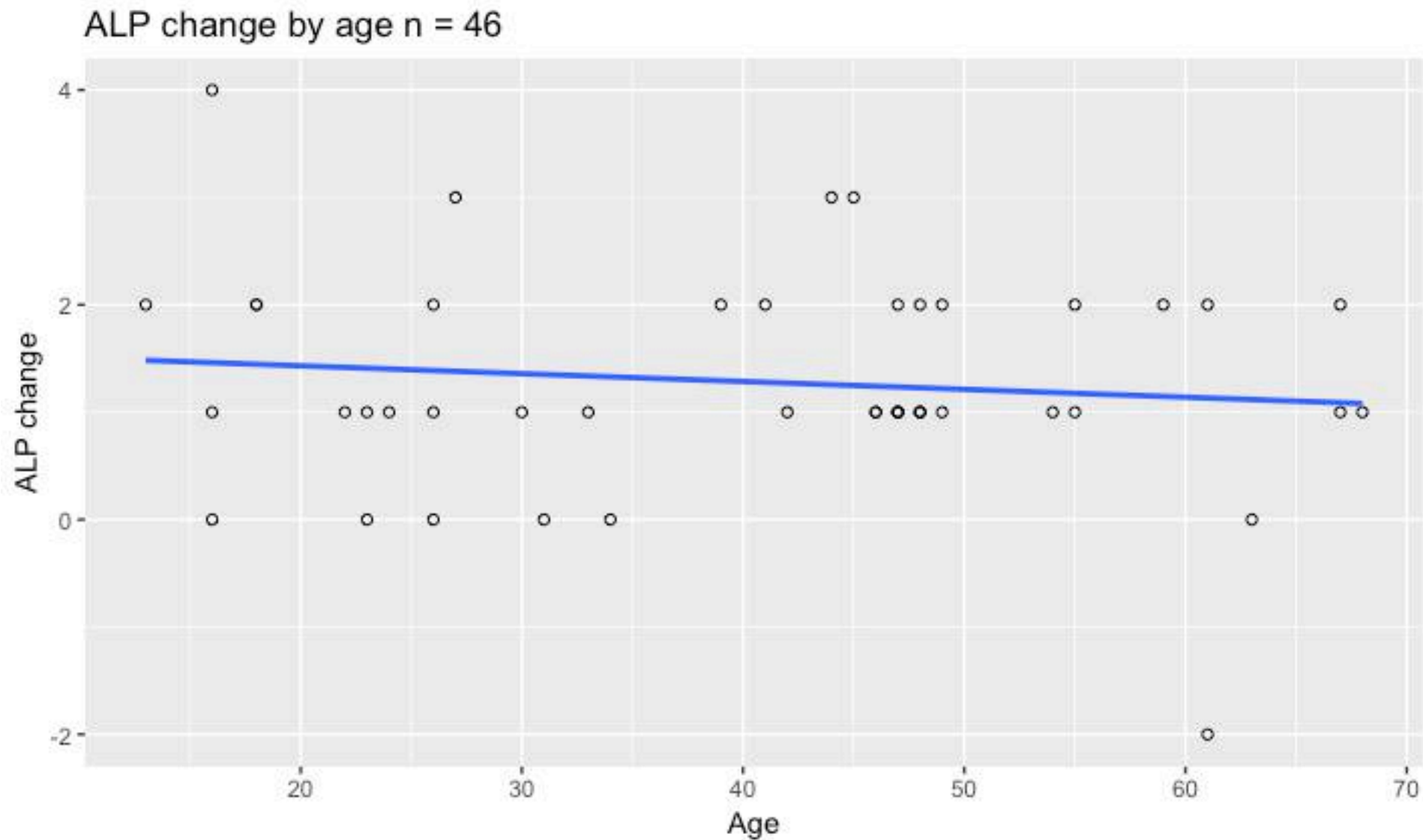
ALP Change by Access Method



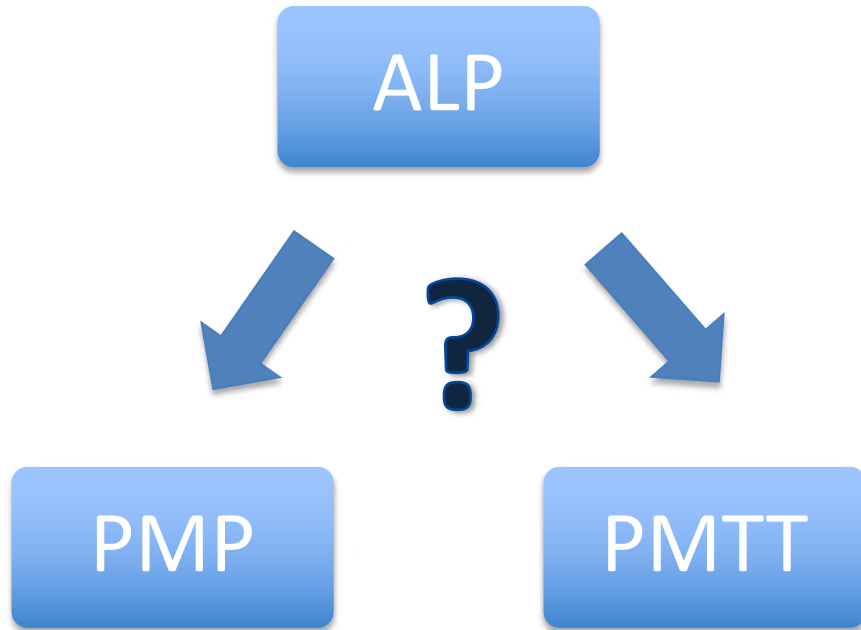
ALP Change by Diagnostic Group



ALP Change by Age



Secondary Research Questions



Are ALP change scores associated with change scores on

*Power Mobility Program (PMP) and
Power Mobility Training Tool (PMTT)?*

CLIENT NAME: _____		Pract _____			
		Date _____			
I. Basic Mobility Skills					
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					
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					

Power Mobility Program (PMP)

(Furumasu et al., 1996)

34 wheelchair mobility skills
0 (not attempted) – 5 (age-appropriate)



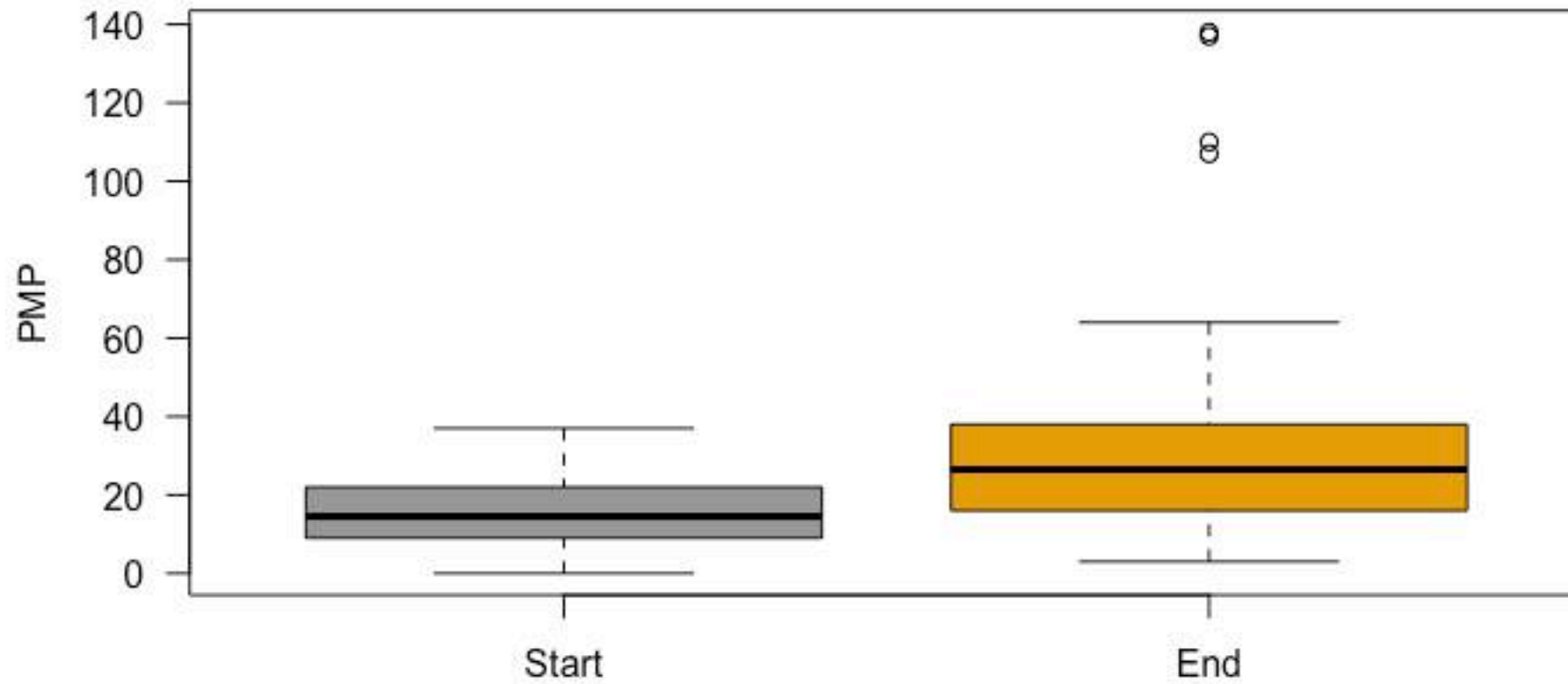
Basic Mobility
Directional and speed
control

Functional Mobility –
Structured environments

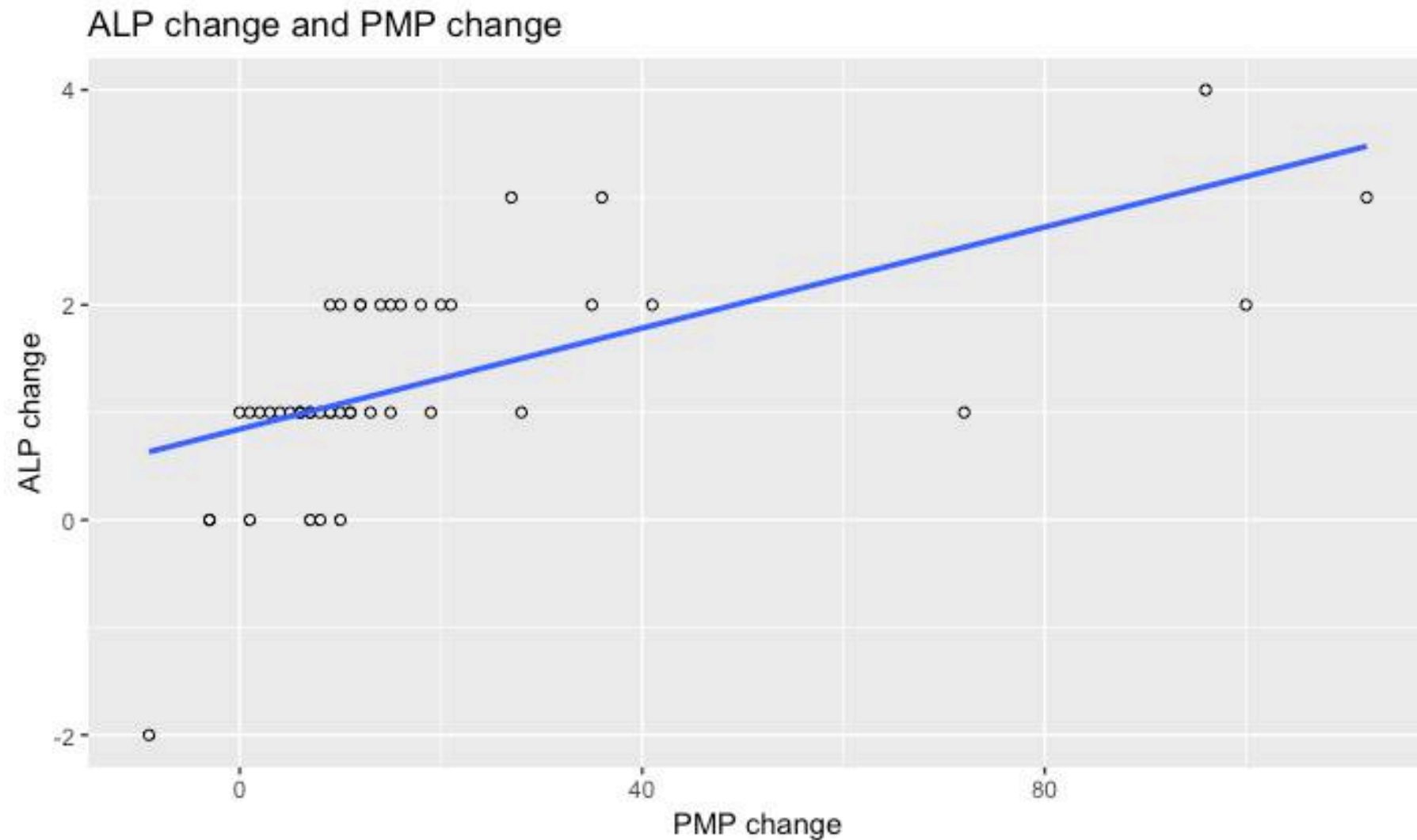
Functional Mobility –
Unstructured environments

PMP

PMP total at start and end of loan n = 46

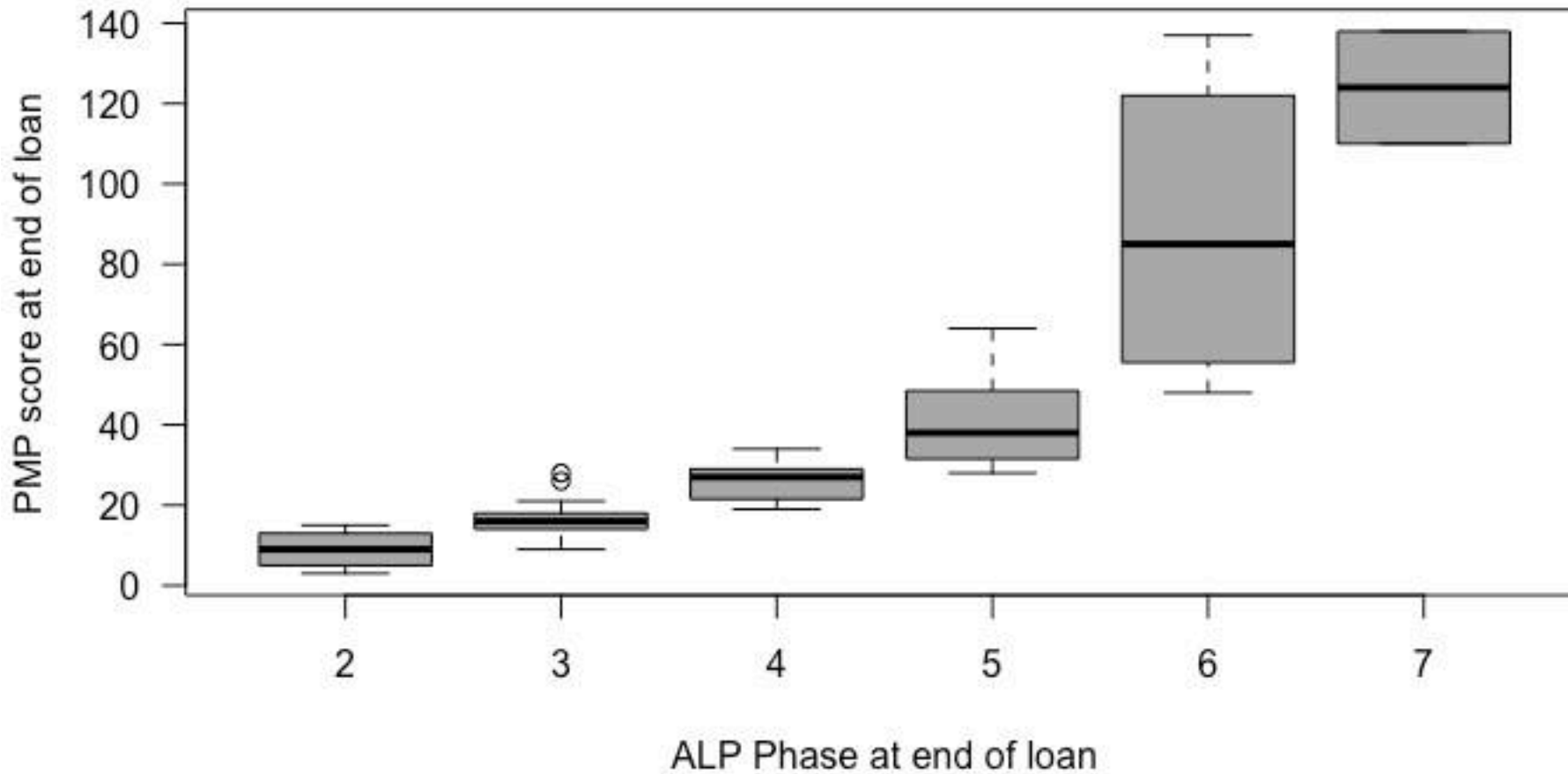


Correlation of ALP Change & PMP Change



$$r_s = 0.73$$

ALP & PMP End of Loan



Power Mobility Training Tool (PMTT)

(Kenyon et al., 2017)

12 skills

0 (not observed) - 4 (>90% of the time)

Non-motor skills

Motor skills

Driving Functions

NON-MOTOR SKILLS SUBSCALE

CAUSE & EFFECT CONCEPTS	
0 1 2 3 4	Appears to recognize the correlation between the access method (switch or joystick) and movement of the power mobility device
0 1 2 3 4	Appears to recognize the correlation between the access method (switches or joystick) and moving the power mobility device in different directions
STOP & GO CONCEPTS	
0 1 2 3 4	Appears to recognize that the switch or joy stick must be released to stop the power mobility device
VISUAL SKILLS	
0 1 2 3 4	Appears to notice large obstacles within 10-15 feet of the power mobility device when the power mobility device is in motion
/16	SUBSCALE SCORE

MOTOR SKILLS SUBSCALE

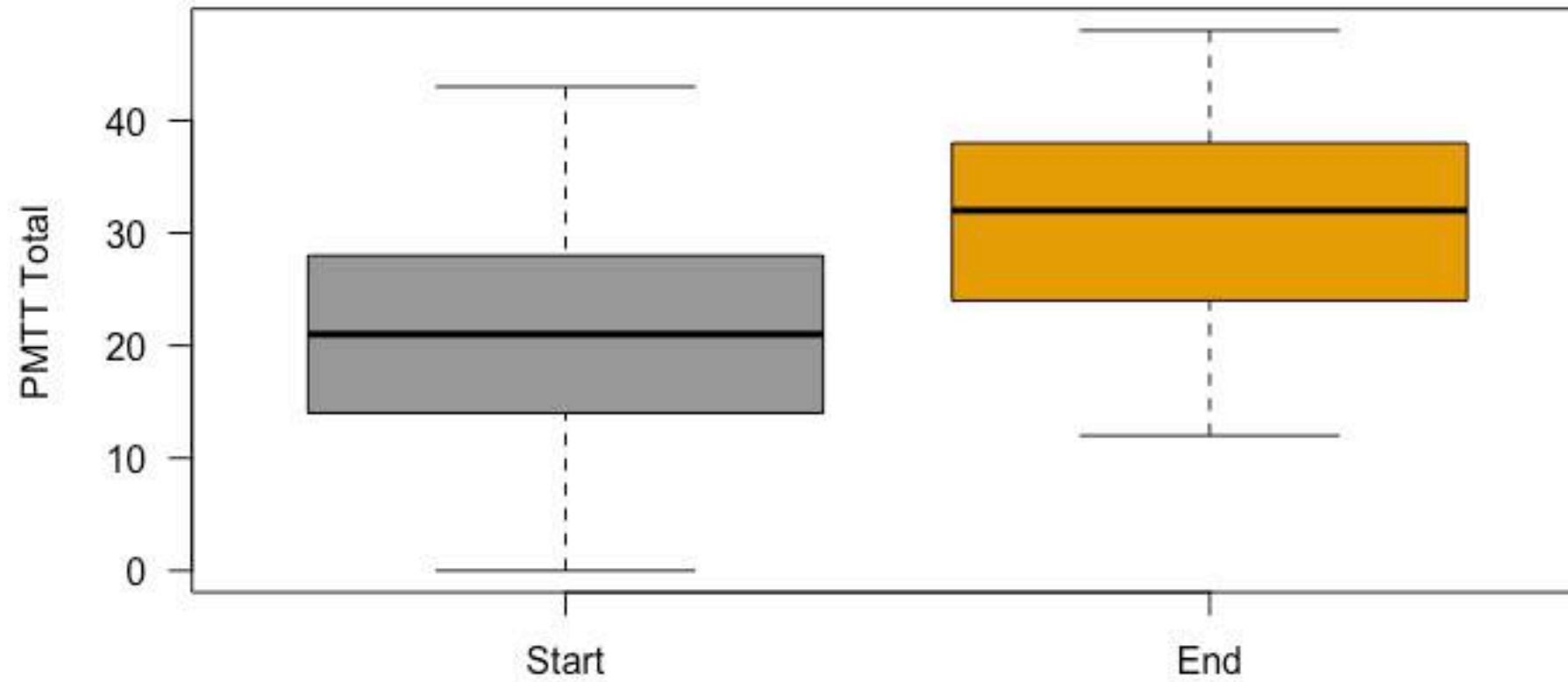
ACTIVATION OF THE ACCESS METHOD	
0 1 2 3 4	Demonstrates the motor ability to activate a switch or joystick to move the power mobility device in any direction
STOP & GO ABILITIES	
0 1 2 3 4	Demonstrates the motor ability to release the access method (switch or joystick) to stop movement of the power mobility device
0 1 2 3 4	Demonstrates the motor ability to sustain activation of the access method (switch or joystick) to move the power mobility device for >5 seconds
/12	SUBSCALE SCORE

DRIVING FUNCTIONS SUBSCALE

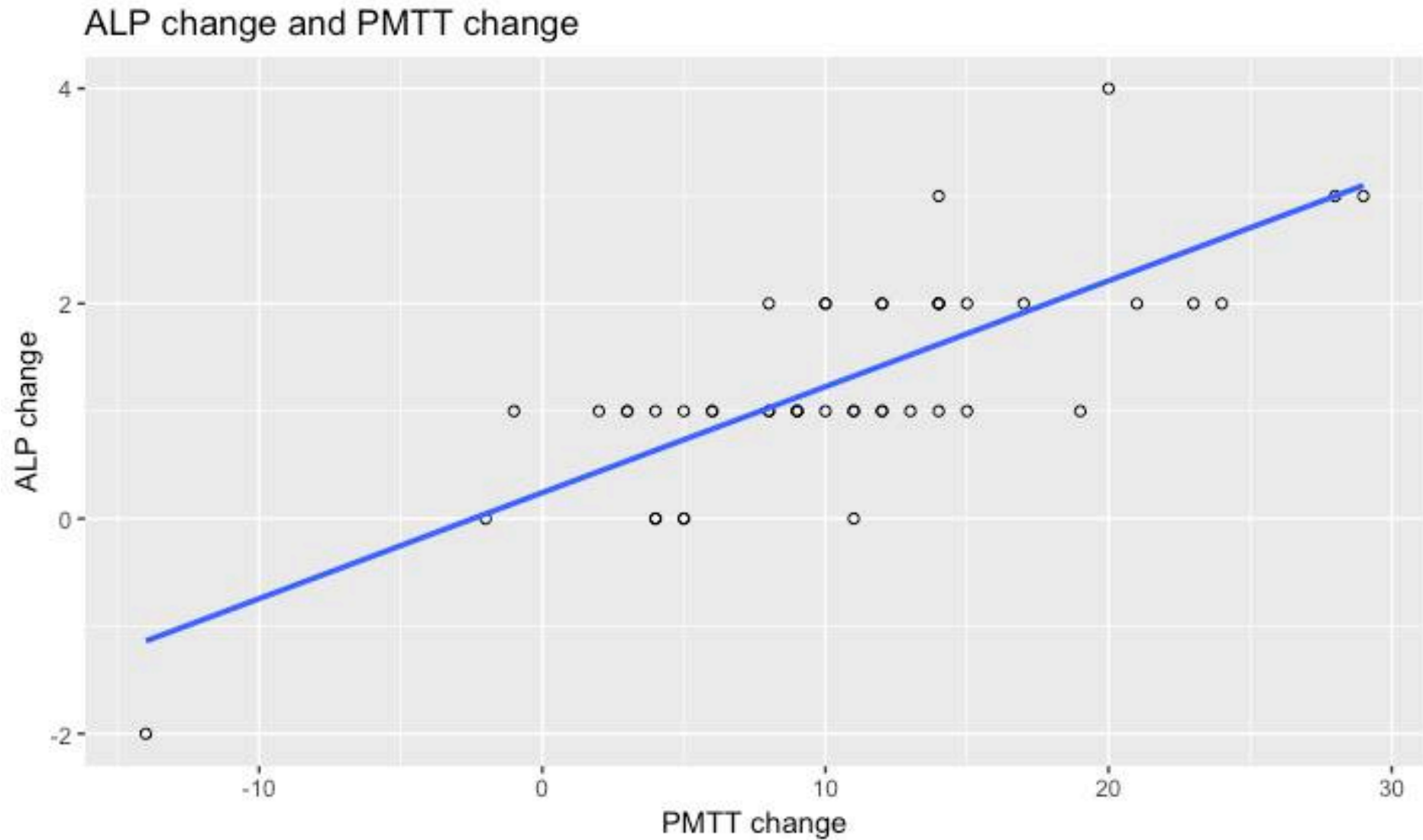
REFER TO ADMINISTRATION MANUAL FOR SCORING NOTES RELATED TO THESE ITEMS	
0 1 2 3 4	Demonstrates the ability to move the power mobility device forward at least 5 feet
	Demonstrates the ability to move the power mobility device:
0 1 2 3 4	To the right
0 1 2 3 4	To the left
0 1 2 3 4	In reverse
0 1 2 3 4	Maneuvers the power mobility device to avoid large obstacles in the path of the device
/20	SUBSCALE SCORE

PMTT

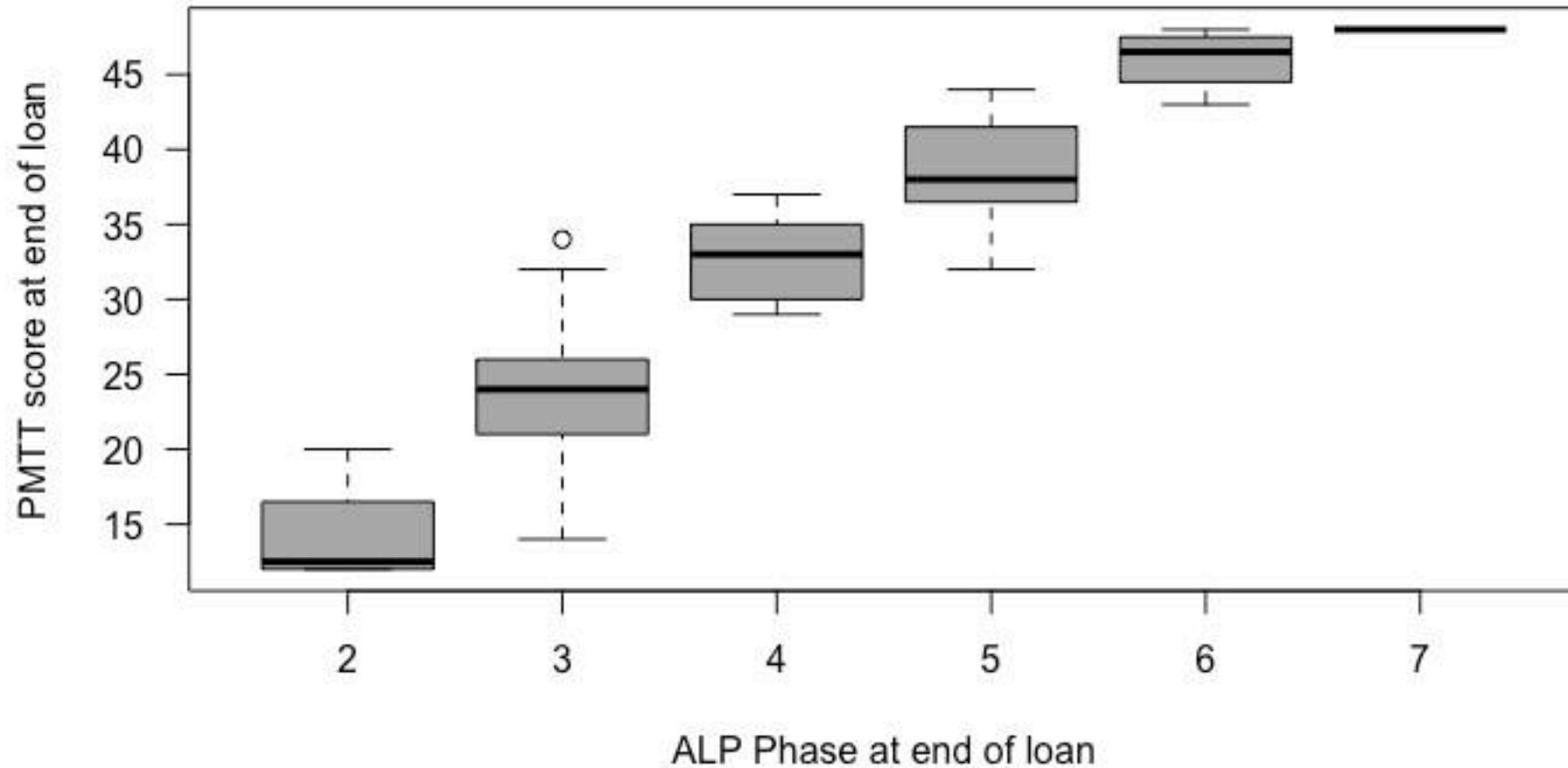
PMTT total at start and end of loan n = 46



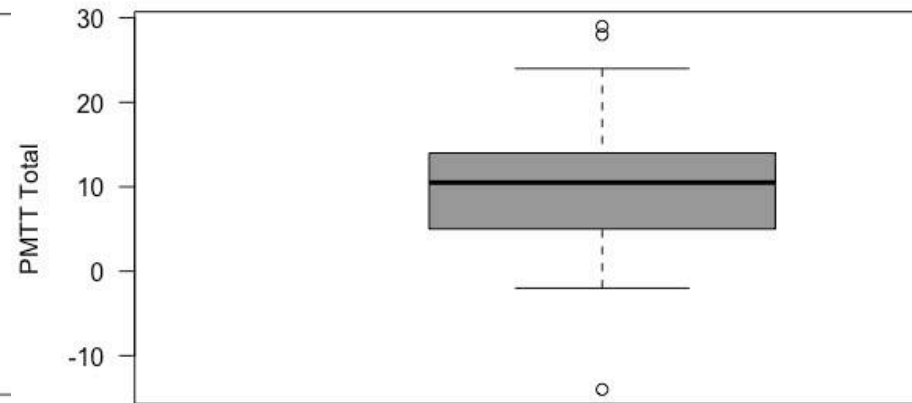
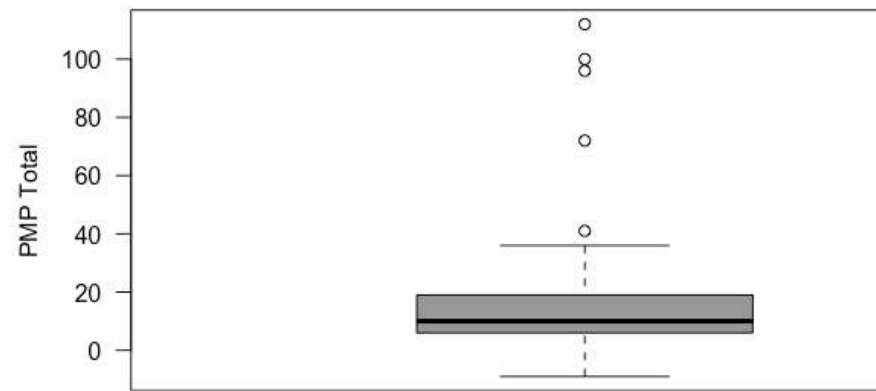
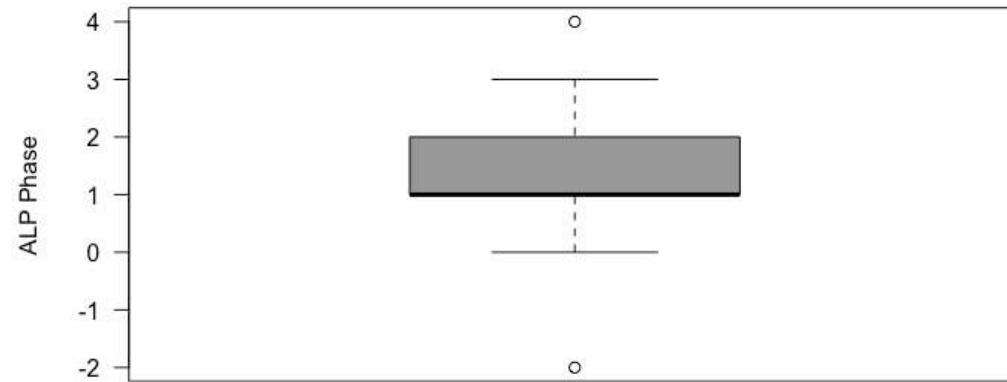
Correlation of ALP Change & PMTT Change



ALP & PMTT End of Loan



Comparison of Change Scores



Conclusions

Driving Skill Progression

ALP change is associated with PMP & PMTT change

- PMTT guides early skills training
- PMP guides advanced skills training

Most children showed ALP (≥ 1 phase) skill progression over 6 months




POLL QUESTION

What are your thoughts on these Phase 2 results?

Please post your comments

<https://padlet.com/debrafield/4007xpe6f1f203yq>

Exploring young children's activity and participation change following 6 months' power mobility experience

Roslyn W Livingstone^{1,2,3} , Debra A Field^{1,3}

British Journal of Occupational Therapy
0(0) 1-10

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Phase 2 study

Pre Test

6 month device loan



Post Test

Pre/Post Measures

ALP

PMTT & PMP

WHOM-YP

IPPA

(primary)

(secondary)

(tertiary)

(tertiary)



Tertiary Research Question

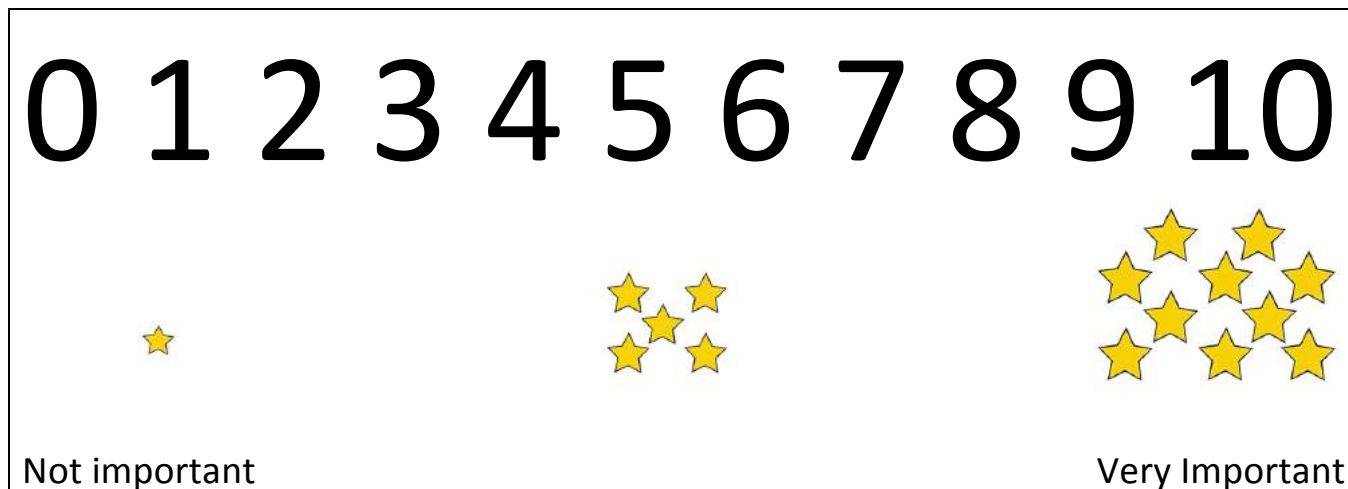
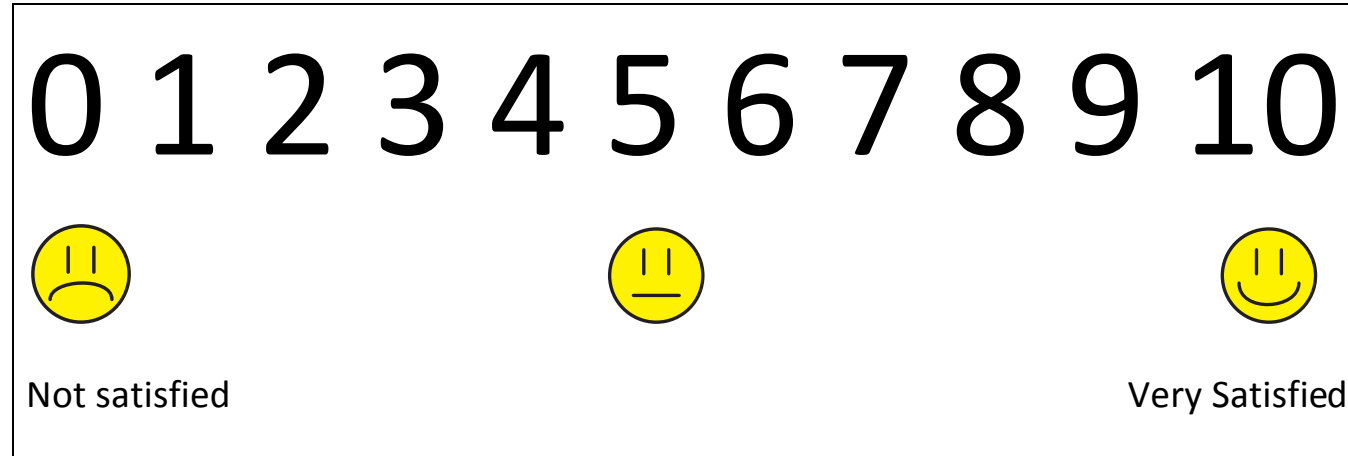
Activity and Participation Change

1. Is change in power mobility skill (ALP) associated with change in parent-identified activity and participation goals (WhOM-YP)?



Wheelchair Outcome Measure for Young People (WhOM-YP)

Field & Miller, 2020

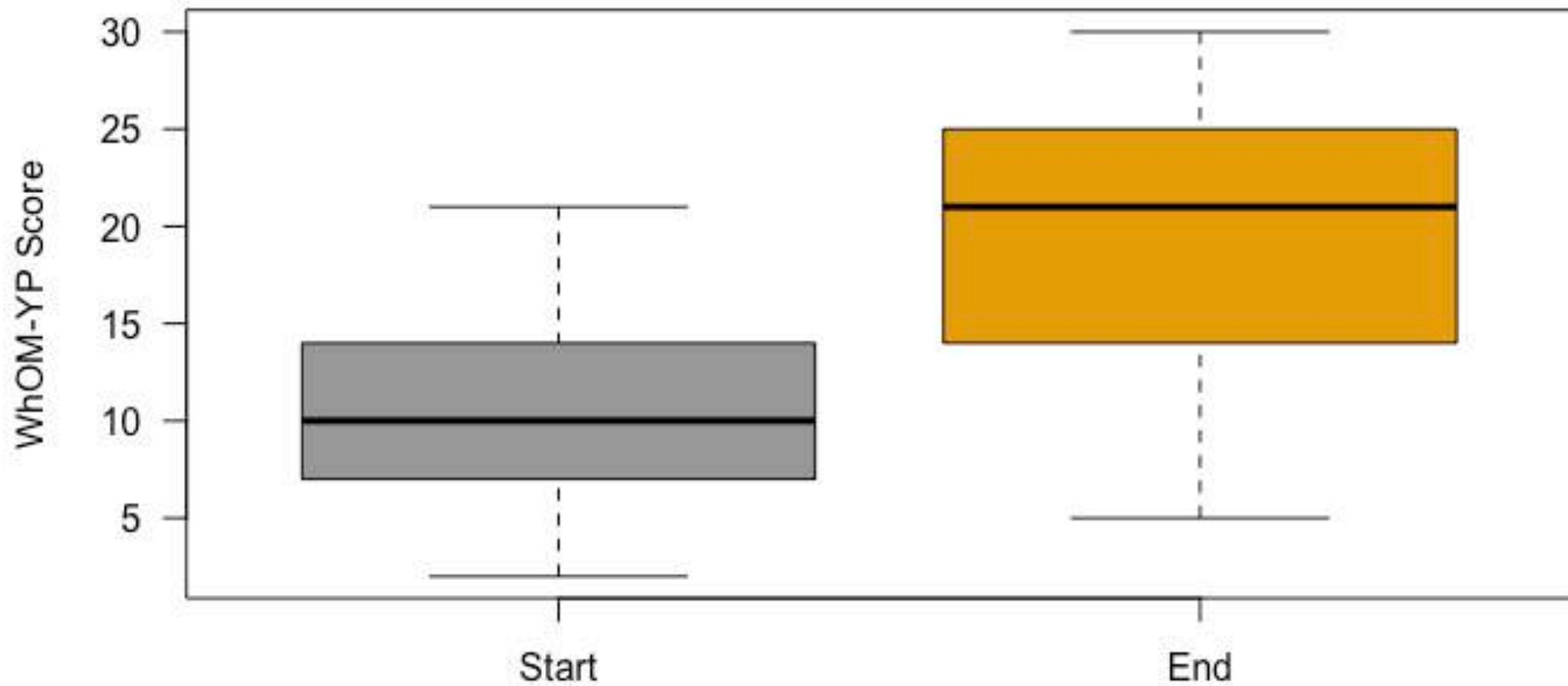


outside
movement
children
independence
switches
chasing
self-confidence
understanding
vision
enjoying
freedom
initiating
interaction
church
spatial-awareness
daycare
friends
social
participating
school
kite
inside
adults
workshopping
park
cousins
others
learning
desired
yard
flying
siblings
steering
exploring
brother
hands
playground
in-home
games
joystick
preschool
cause-effect
directions
independently

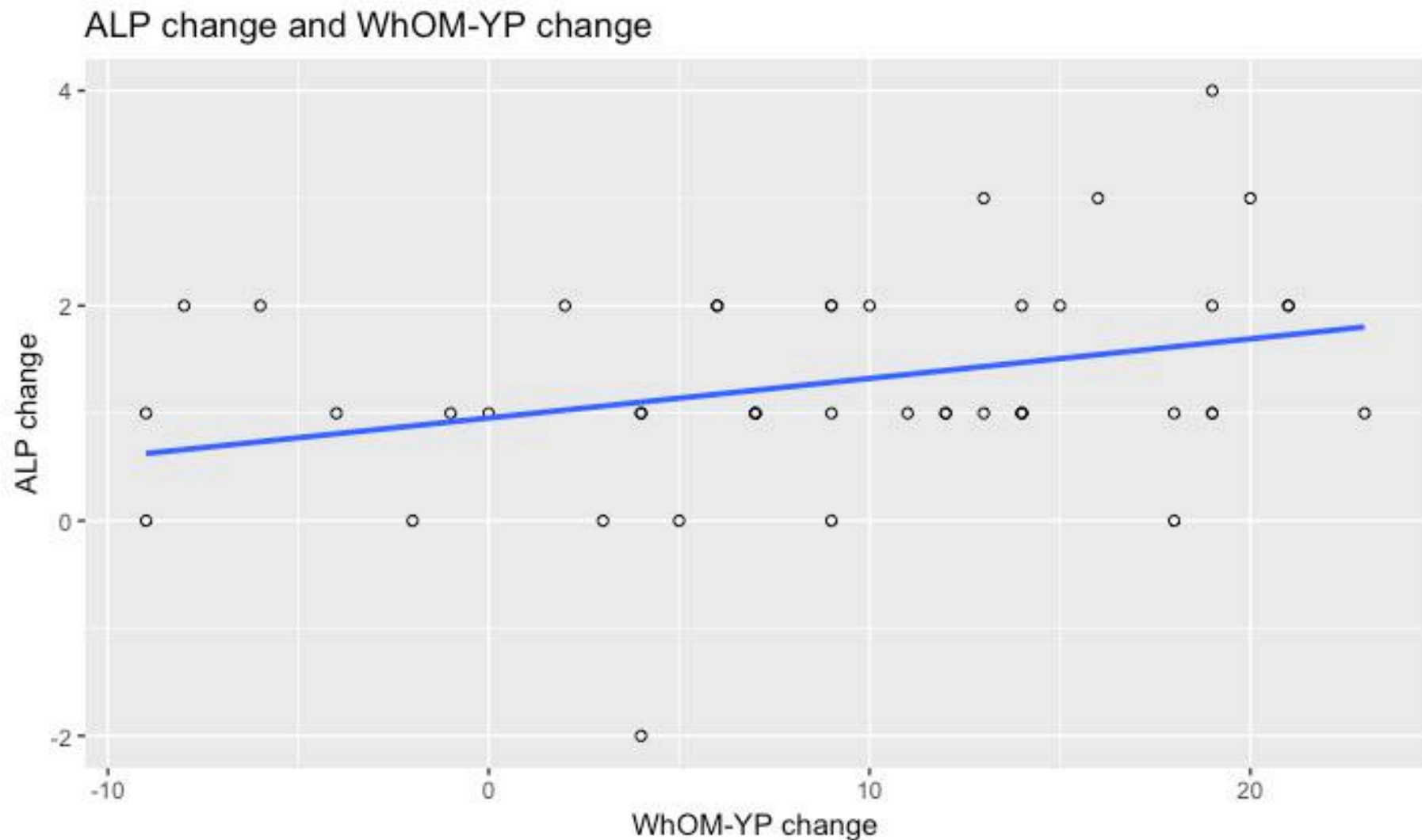
WhOM-YP

Activity & Participation Goals

Median Change = 3.17
(CI₉₅ 2.17-4.17)
Effect Size 0.51 (CI₉₅ 0.34-0.65)
n=45

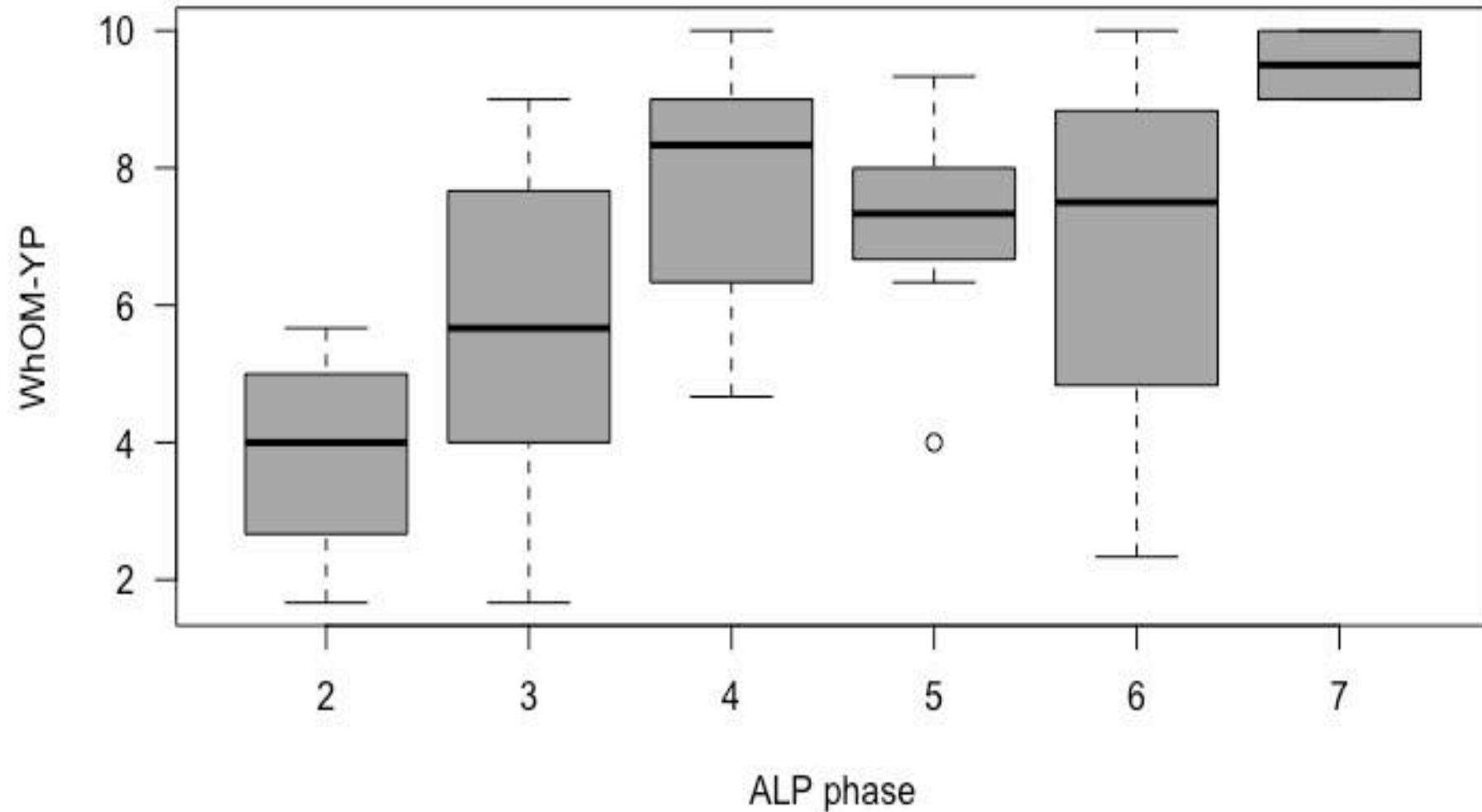


Correlation of ALP Change & WhOM-YP Change



$$r_s = 0.33$$

WhOM-YP Satisfaction by ALP Phase



Tertiary Research Question

Device Expectation Fulfillment

2. Is change in power mobility skill (ALP) associated with parent expectation fulfillment with how the device assisted their child to overcome individually - defined problems (IPPA)?



Individually Prioritized Problem Assessment (IPPA)

Wessels et al., 2000

How do you rate the importance of this problem?

1	2	3	4	5
Not important at all	Not so important	Somewhat important	Quite important	Most important

How do you rate the level of difficulty your child has with this problem in everyday life?

1	2	3	4	5
Not difficult at all	Little difficulty	Quite some difficulty	A lot of difficulty	Too difficult to do at all

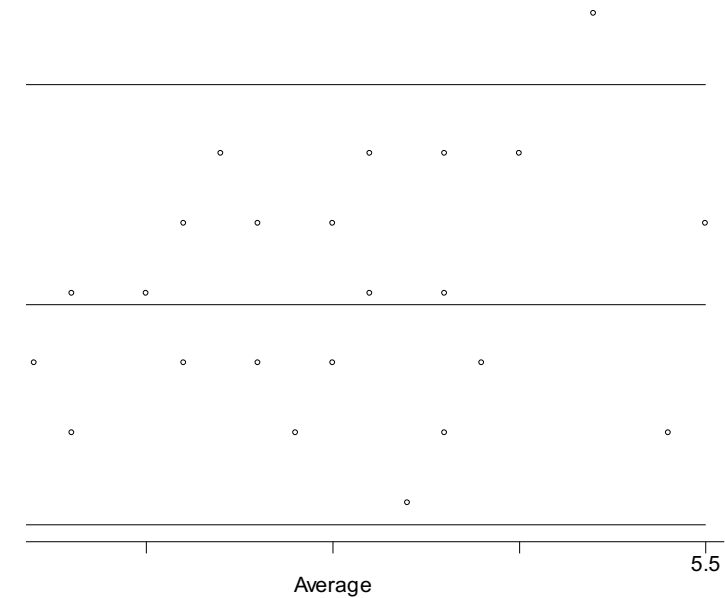
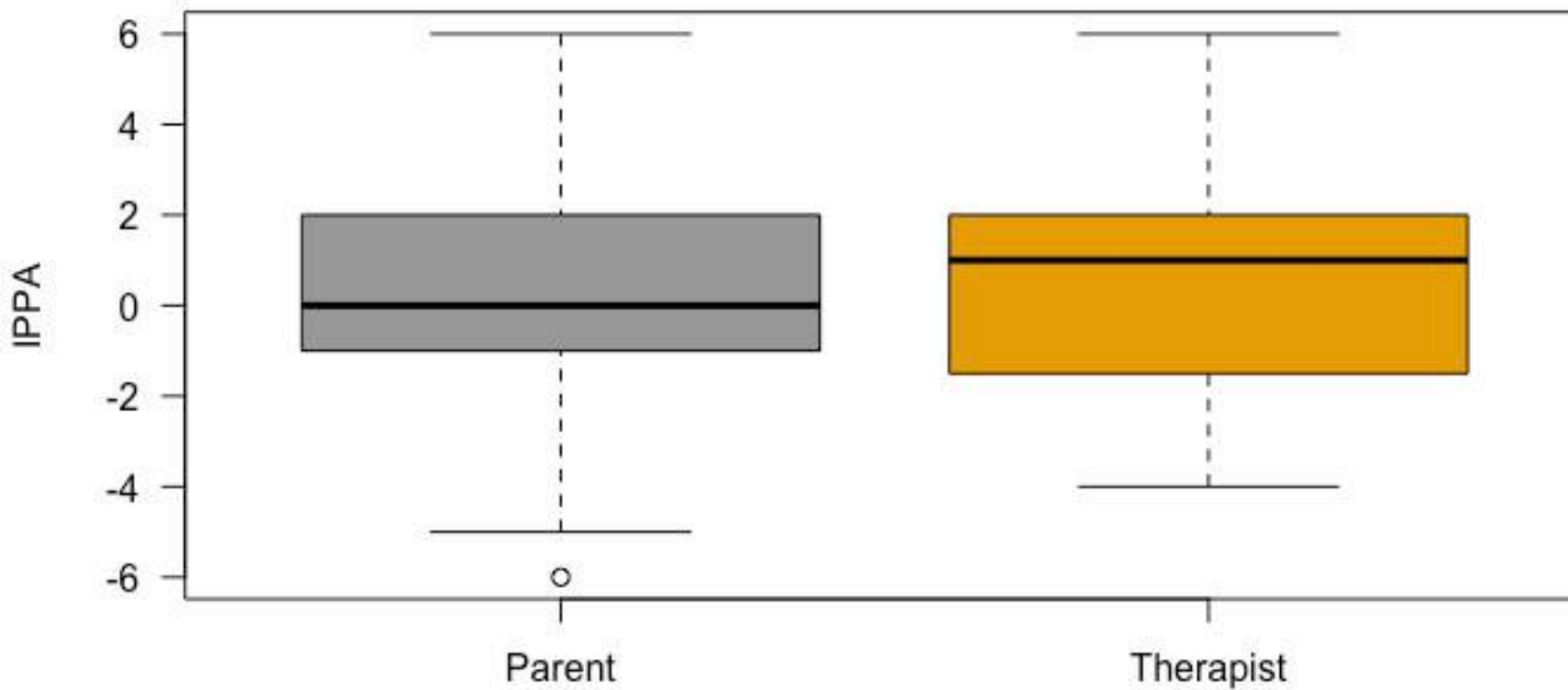
Expectation Fulfillment

Has using the power mobility device solved this problem as much as you thought it would?

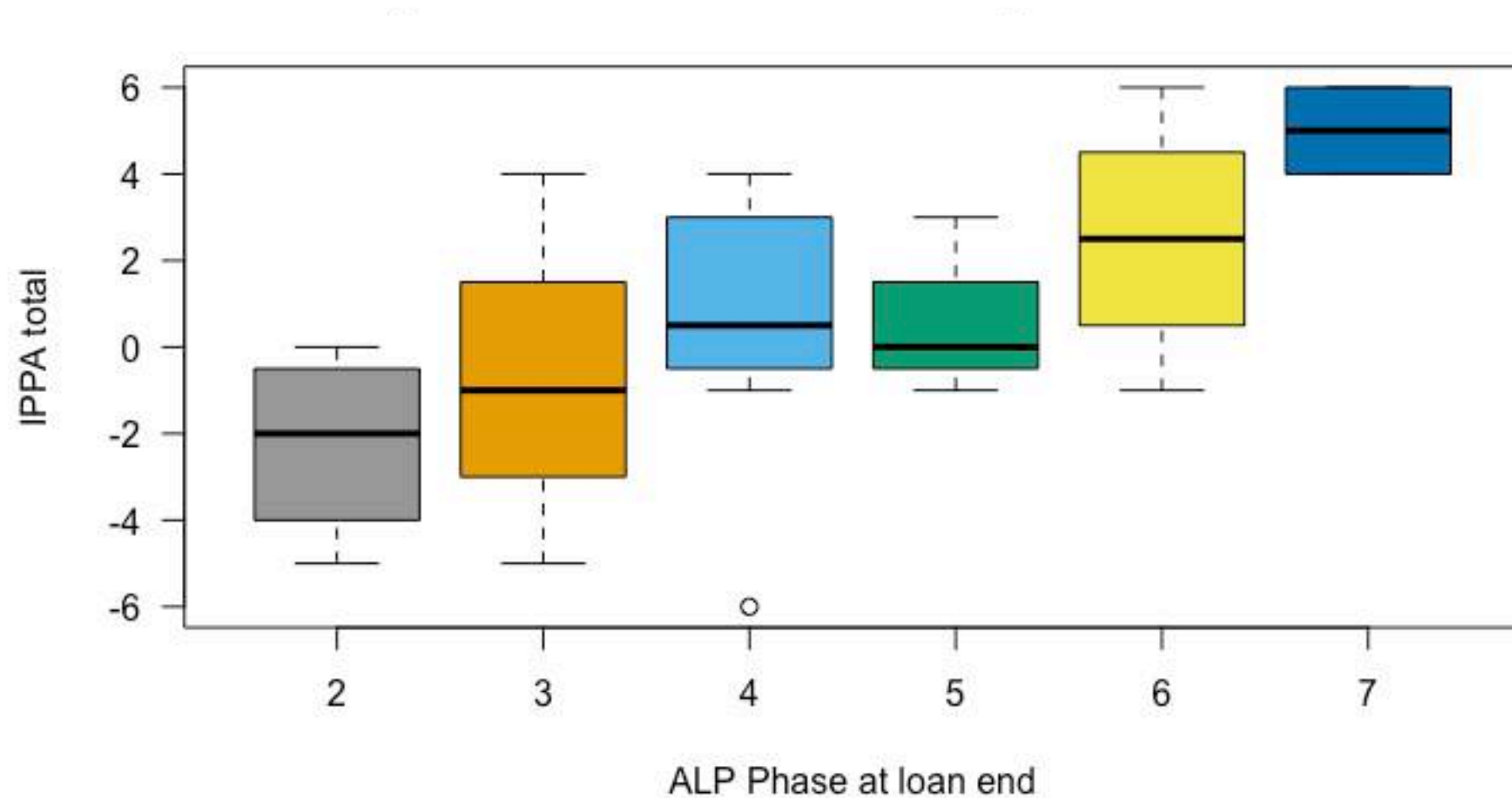
-2	-1	0	1	2
Much less than expected	Less than expected	As expected	More than expected	Much more than expected

Expectation Fulfillment Comparison

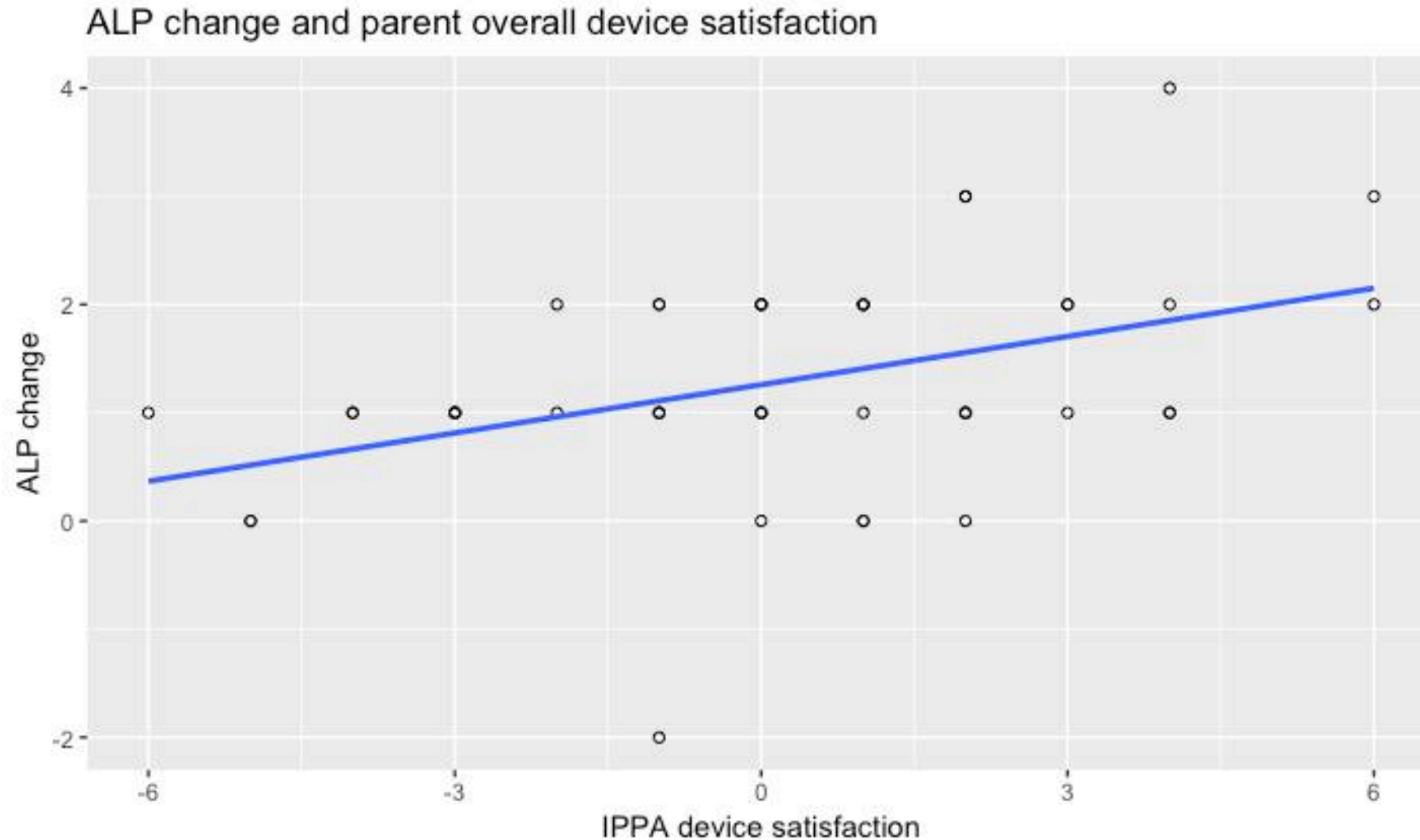
Parent and Therapist expectation fulfillment



Parent ALP & Expectation Fulfillment



ALP Change & Parent Expectation Fulfillment

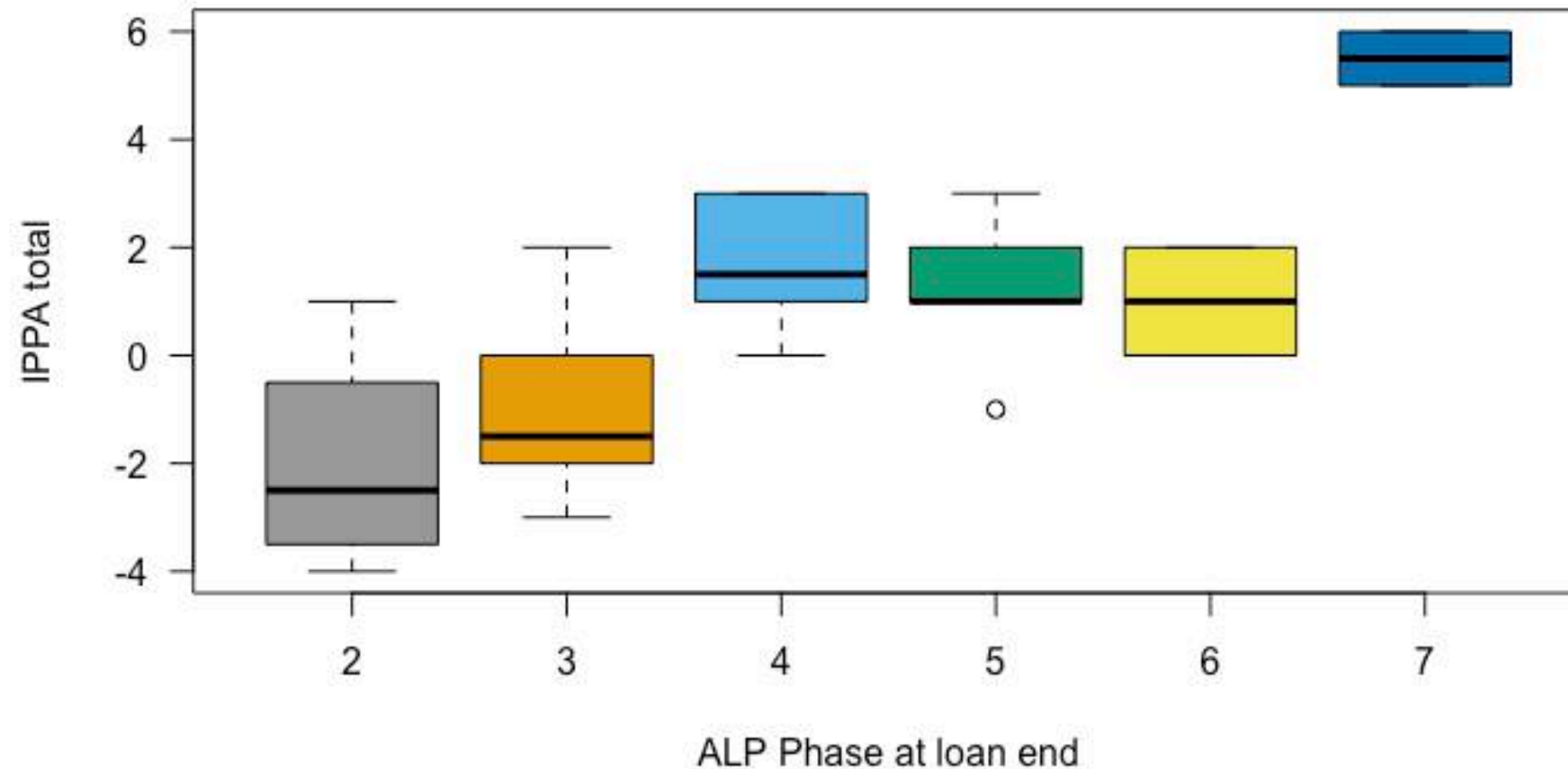


$$r_s = 0.4$$

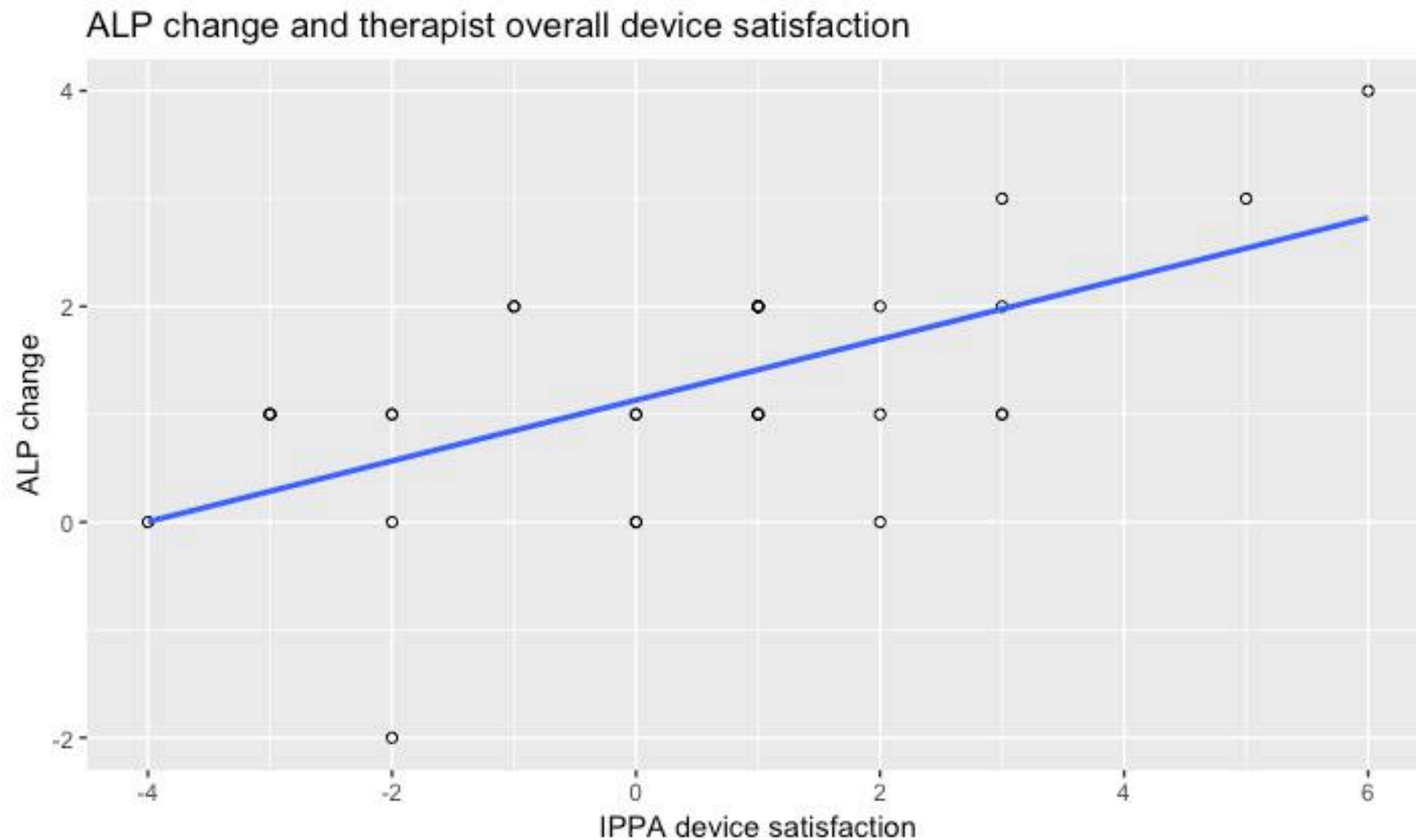
n = 45

Therapist ALP & Expectation Fulfillment

Therapist expectation fulfillment and ALP phase correlation n = 31



ALP Change & Therapist Expectation Fulfillment



$$r_s = 0.53$$

n = 31

Conclusions

Activity, Participation & Device Expectation

- WhOM-YP positive change for all phases
- Parent & Therapist expectation fulfillment (IPPA) increases with skill achievement
- Parent & Therapist ratings were similar



Thank You

Study participants:

children, families and community therapists

Sunny Hill Health Centre for Children

Sunny Hill Foundation for Children

Posture & Mobility Group



Posture &
Mobility
Group



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