ORU
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Fysisk aktivitet og stillesiddende adfærd hos børn og unge med cerebral parese

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Den Ortopædkirurgiske Forskningsenhed

Ortopædkirurgisk afdeling, Odense Universitetshospital & Klinisk Institut, Syddansk Universitet

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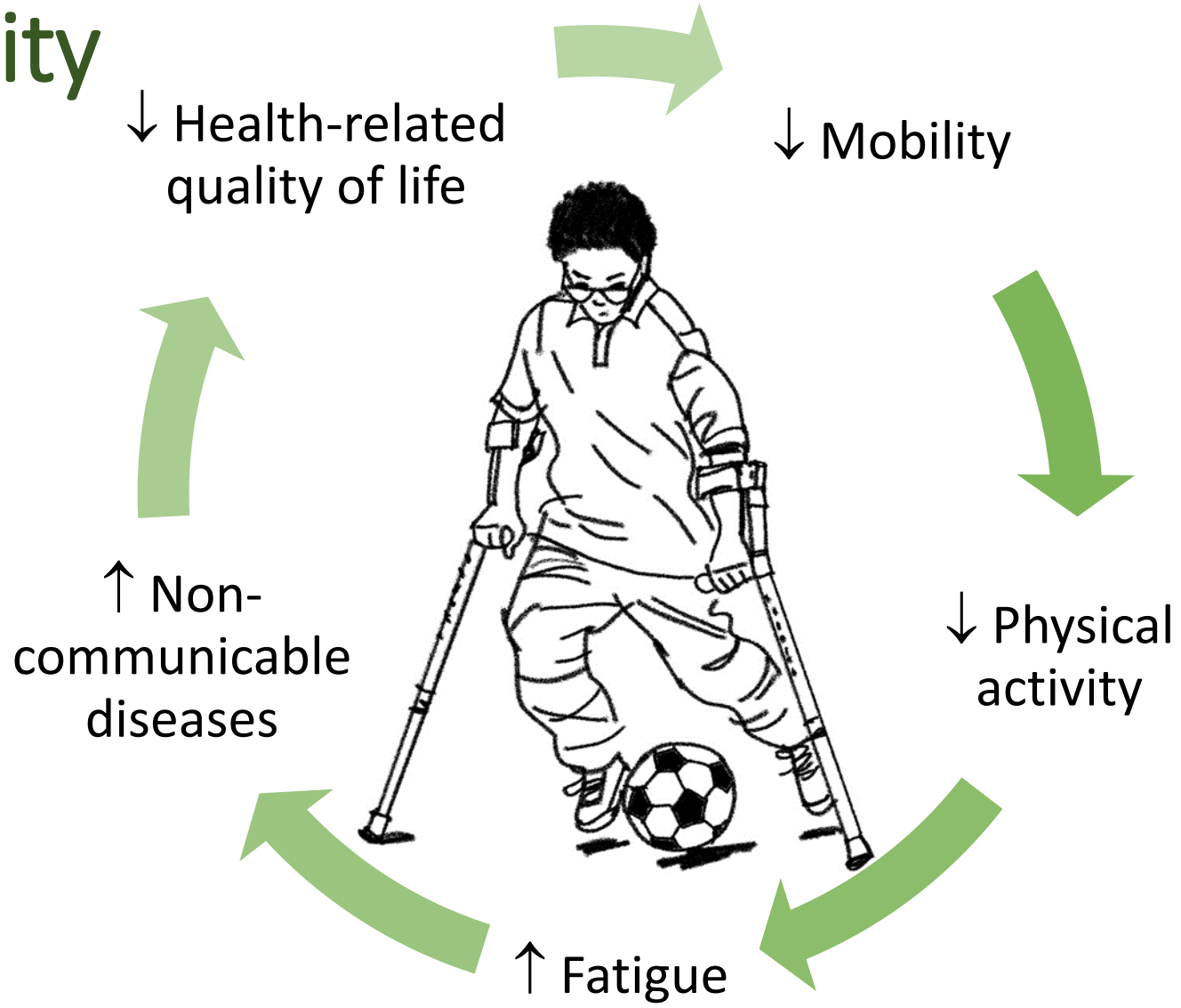
Region of Southern Denmark

Physical activity

- The World Health Organization (WHO) recommend that children and adolescents are physically active ≥ 1 hour/day.

Bull FC et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020
Carlon SL et al. Differences in habitual physical activity levels of young people with cerebral palsy and their typically developing peers: a systematic review. Disabil Rehabil. 2013

Physical activity



Verschuren O et al. Exercise and physical activity recommendations for people with cerebral palsy. Dev Med Child Neurol. 2016
Bjornson KF et al. Ambulatory physical activity performance in youth with cerebral palsy and youth who are developing typically. Phys Ther. 2007
Fowler EG et al. Promotion of physical fitness and prevention of secondary conditions for children with cerebral palsy: section on pediatrics research summit proceedings. Phys Ther. 2007

Sedentary behavior

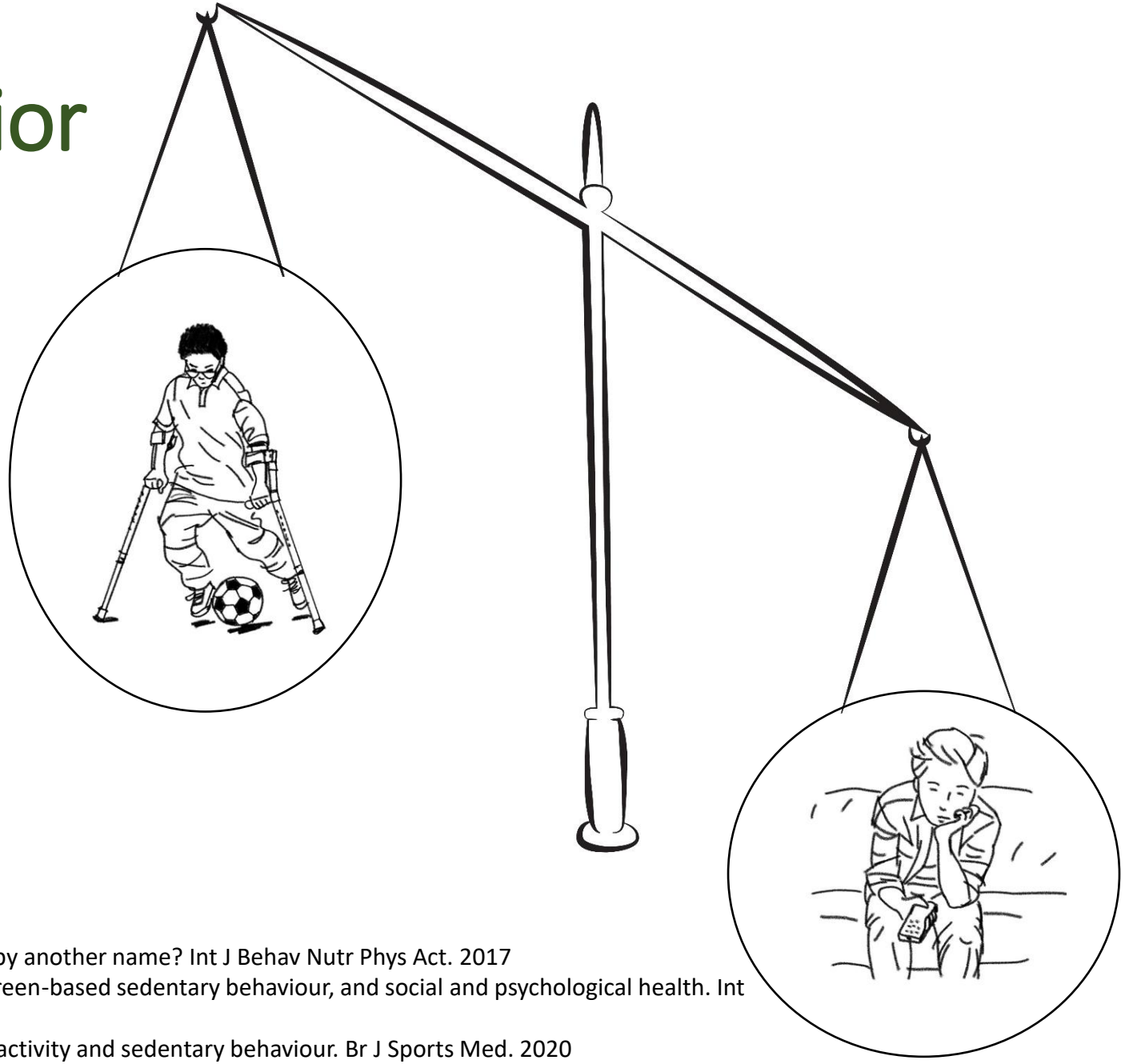
Sedentary behavior is associated with

- Fitness levels
- Cadiometabolic health
- Obesity
- Sleep duration

Bull FC et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020
Park JH, Moon JH, Kim HJ, Kong MH, Oh YH. Sedentary Lifestyle: Overview of Updated Evidence of Potential Health Risks. Korean J Fam Med. 2020

Sedentary behavior

Sedentary behavior and physical activity are not opposites



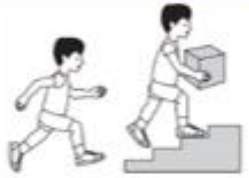
an der Ploeg HP et al. Is sedentary behaviour just physical inactivity by another name? Int J Behav Nutr Phys Act. 2017
Iannotti RJ et al. Interrelationships of adolescent physical activity, screen-based sedentary behaviour, and social and psychological health. Int J Public Health. 2009
Bull FC et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020

Overall aim of the presented studies

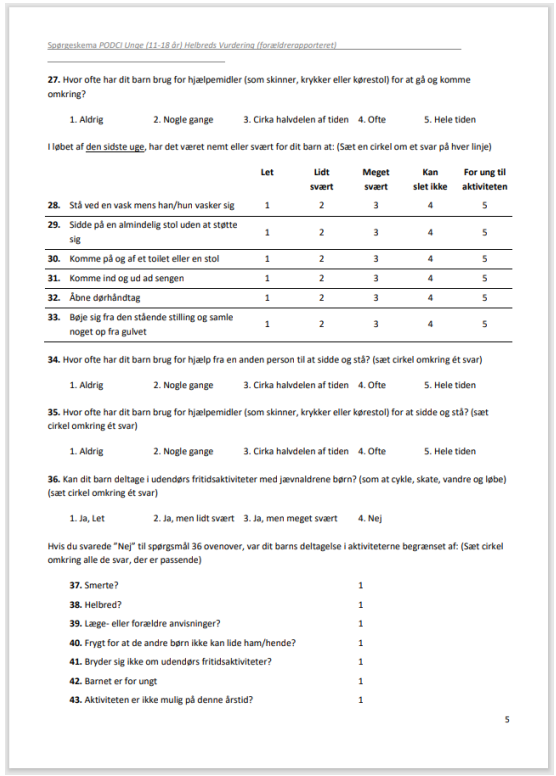
- to contribute to the evidence on ambulant/semi-ambulant children and adolescents with cerebral palsy regarding ***physical activity****, and* ***sedentary behavior****.*

Inclusion criteria for all studies

- 8 – 16 years of age
- Cerebral palsy diagnosis
- GMFCS level I–III

GMFCS Level	Between 6th and 12th birthday	Between 12th and 18th birthday
I		
II		
III		

Data collected



Spørgeskema PODCI Unge (11-18 år) Helbreds Vurdering (forældrerapporteret)

27. Hvor ofte har dit barn brug for hjælpemidler (som skinner, krykker eller kørestol) for at gå og komme omkring?

1. Aldrig 2. Nogle gange 3. Cirka halvdelen af tiden 4. Ofte 5. Hele tiden

I løbet af den sidste uge, har det været nemt eller svært for dit barn at: (Sæt en cirkel om et svar på hver linje)

		Let	Lidt svært	Meget svært	Kan slet ikke	For ung til aktiviteten
28.	Stå ved en vask mens han/hun vasker sig	1	2	3	4	5
29.	Sidde på en almindelig stol uden at støtte sig	1	2	3	4	5
30.	Komme på og af et toilet eller en stol	1	2	3	4	5
31.	Komme ind og ud ad sengen	1	2	3	4	5
32.	Åbne dørhåndtag	1	2	3	4	5
33.	Bøje sig fra den stående stilling og samle noget op fra gulvet	1	2	3	4	5

34. Hvor ofte har dit barn brug for hjælp fra en anden person til at sidde og stå? (sæt cirkel omkring ét svar)

1. Aldrig 2. Nogle gange 3. Cirka halvdelen af tiden 4. Ofte 5. Hele tiden

35. Hvor ofte har dit barn brug for hjælpemidler (som skinner, krykker eller kørestol) for at sidde og stå? (sæt cirkel omkring ét svar)

1. Aldrig 2. Nogle gange 3. Cirka halvdelen af tiden 4. Ofte 5. Hele tiden

36. Kan dit barn deltage i udendørs fritidsaktiviteter med jævnaldrene børn? (som at cykle, skate, vandre og løbe) (sæt cirkel omkring ét svar)

1. Ja, Let 2. Ja, men lidt svært 3. Ja, men meget svært 4. Nej

Hvis du svarede "Nej" til spørgsmål 36 ovenover, var dit barns deltagelse i aktiviteterne begrænset af: (Sæt cirkel omkring alle de svar, der er passende)

37. Smerte? 1
38. Helbred? 1
39. Læge- eller forældre anvisninger? 1
40. Frygt for at de andre børn ikke kan lide ham/hende? 1
41. Bryder sig ikke om udendørs fritidsaktiviteter? 1
42. Barnet er for ungt 1
43. Aktiviteten er ikke mulig på denne årstid? 1

5

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CPUP registry data

Demographic data

- Age
- Sex
- Region of residence

Clinical data

- Muscle tone
- Lower extremity joint range of motion
- Pain
- GMFCS
- GMFM-66
- Use of orthosis
- Wheelchair use
- Ability to climb stairs

Patient reported data

- Means of transport to and from school
- Participates in physical training in school
- Participates in recreational activities
- Functional Mobility Scale (FMS)
- Bikes

Proxy reported questionnaires

- Pediatric Quality of Life Inventory (**PedsQL**) Cerebral Palsy Module[1,2]

- Movement and Balance
- Fatigue
- Daily Activities
- School Activities
- Pain and Hurt
- Eating Activities
- Speech and Communication

1. Stalhut M et al. Oversættelse af PedQL [in Danish]. Fag Og Forskning. 2010
2. Varni JW et al. The PedsQL in pediatric cerebral palsy: reliability, validity, and sensitivity of the Generic Core Scales and Cerebral Palsy Module. Dev Med Child Neurol. 2006

Proxy reported questionnaires

- Pediatric Quality of Life Inventory (**PedsQL**) Cerebral Palsy Module[1,2]
- Pediatric Outcomes Data Collection Instrument (**PODCI**)[3]
  - Upper Extremity and Physical Function
  - Transfer and Basic Mobility
  - Sports and Physical Functioning
  - Pain/Comfort
  - Happiness
  - Global Functioning

1. Stalhut M et al. Oversættelse af PedQL [in Danish]. Fag Og Forskning. 2010
2. Varni JW et al. The PedsQL in pediatric cerebral palsy: reliability, validity, and sensitivity of the Generic Core Scales and Cerebral Palsy Module. Dev Med Child Neurol. 2006
3. Daltroy LH et al. The POSNA pediatric musculoskeletal functional health questionnaire: report on reliability, validity, and sensitivity to change. Pediatric Outcomes Instrument Development Group. Pediatric Orthopaedic Society of North America. J Pediatr Orthop. 1998

Proxy reported questionnaires

- Pediatric Quality of Life Inventory (**PedsQL**) Cerebral Palsy Module[1,2]
- Pediatric Outcomes Data Collection Instrument (**PODCI**)[3]
- Supplementary questions

- Demographic information
- Sleep duration
- Screen time
- Parent evaluated range of motion
- Participation in school physical training and recreational activities
- Pain
- Parental educational level

1. Stalhut M et al. Oversættelse af PedQL [in Danish]. Fag Og Forskning. 2010
2. Varni JW et al. The PedsQL in pediatric cerebral palsy: reliability, validity, and sensitivity of the Generic Core Scales and Cerebral Palsy Module. Dev Med Child Neurol. 2006
3. Daltroy LH et al. The POSNA pediatric musculoskeletal functional health questionnaire: report on reliability, validity, and sensitivity to change. Pediatric Outcomes Instrument Development Group. Pediatric Orthopaedic Society of North America. J Pediatr Orthop. 1998

Accelerometry

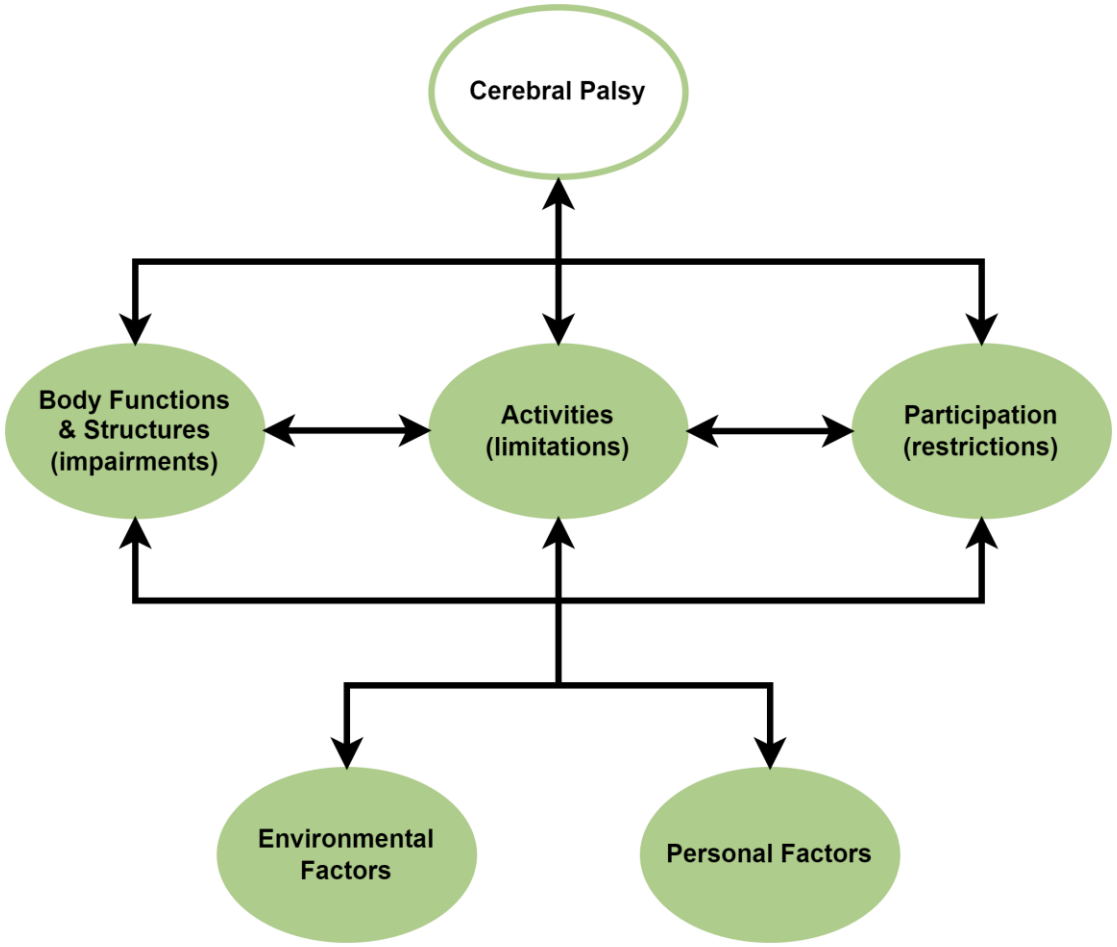
Arvidsson D et al. Measurement of physical activity in clinical practice using accelerometers. J Int Med. 2019
Gorter, J. et al. Accelerometry: A Feasible Method to Quantify Physical Activity in Ambulatory and Nonambulatory Adolescents with Cerebral Palsy. International Journal of Pediatrics. 2012

Study I - aim

*- to **identify and investigate potential predictors of habitual physical activity** in ambulant/semi-ambulant children and adolescents with cerebral palsy using objective variables included in the **Cerebral Palsy Follow-Up Program (CPUP) database** and **proxy-reported questionnaires**.*

Study I

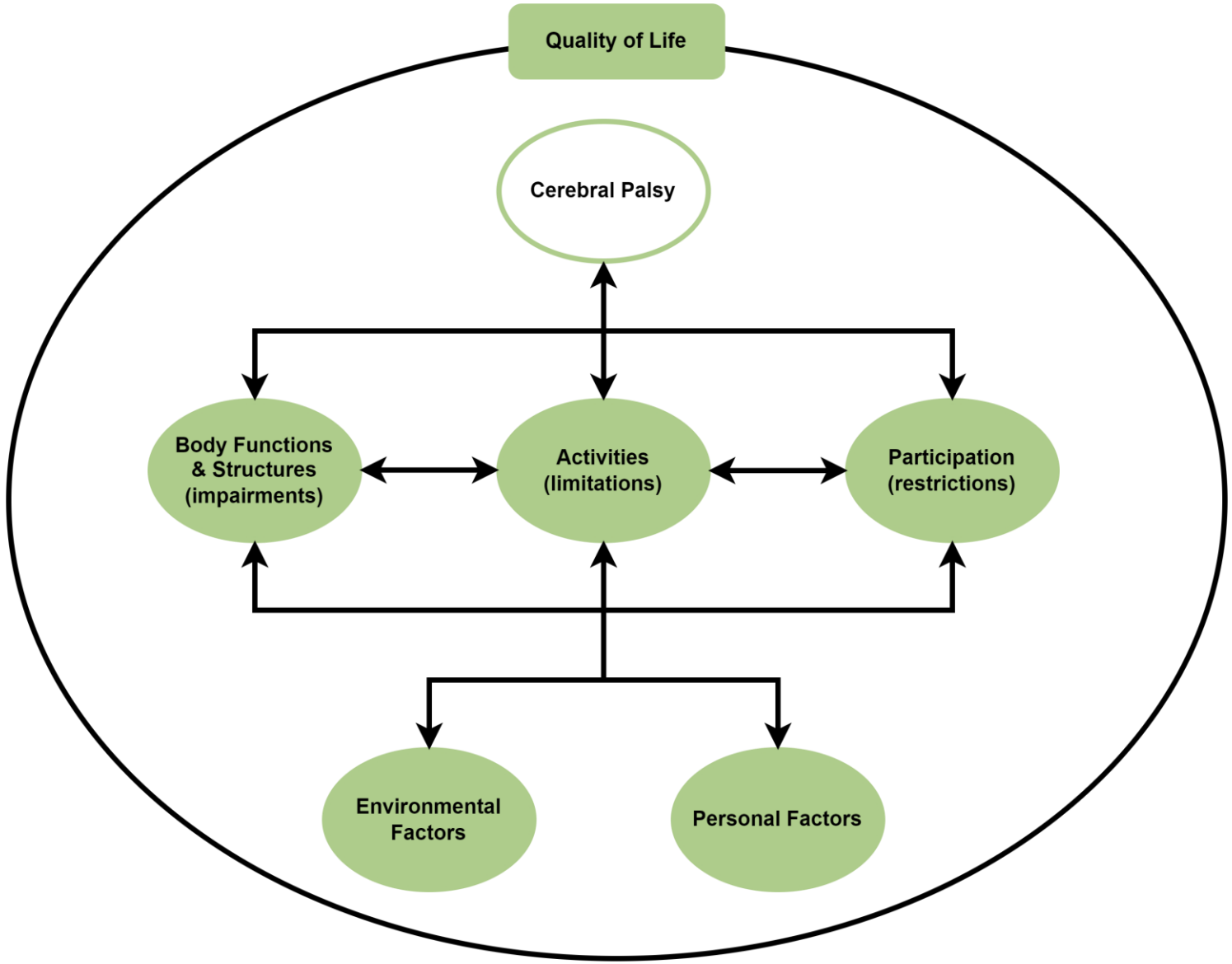
International Classification of Functioning, Disability, and Health (ICF) model



WHO. International classification of functioning, disability and health: ICF Geneva 2001. [cited 2022 Sep 29] Available from: https://apps.who.int/iris/handle/10665/42407

Study I

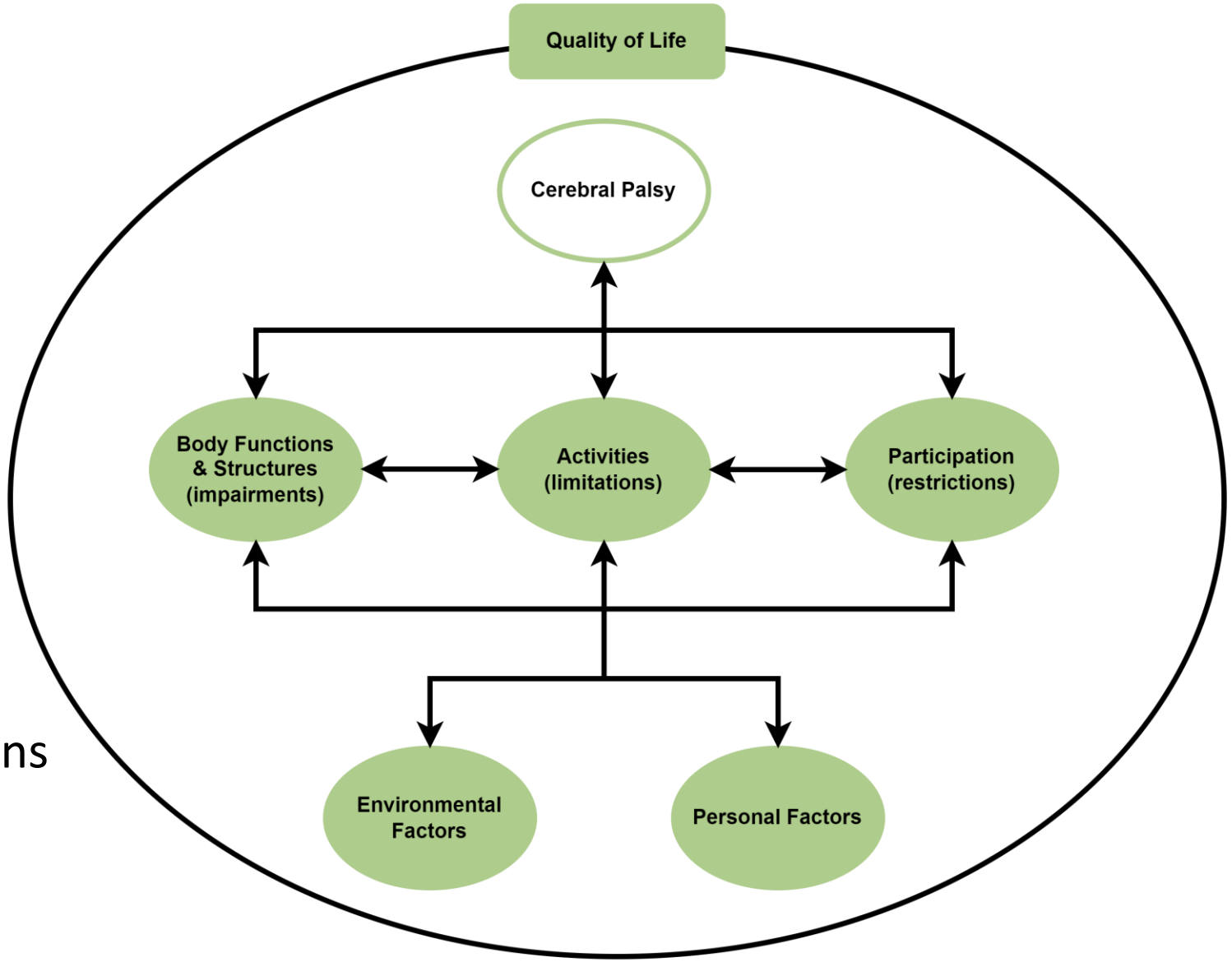
Modified International Classification of Functioning, Disability, and Health (ICF) model



McDougall J et al. The ICF model of functioning and disability: incorporating quality of life and human development. Dev Neurorehabil. 2010
Kostanjsek N. Use of The International Classification of Functioning, Disability and Health (ICF) as a conceptual framework and common language for disability statistics and health information systems. BMC public health. 2011

Study I

Modified International Classification of Functioning, Disability, and Health (ICF) model



Understanding which components are associated with physical activity, can help clinicians design interventions and strategies to promote physical activity.

McDougall J et al. The ICF model of functioning and disability: incorporating quality of life and human development. Dev Neurorehabil. 2010
Kostanjsek N. Use of The International Classification of Functioning, Disability and Health (ICF) as a conceptual framework and common language for disability statistics and health information systems. BMC public health. 2011

Study I

870

Families contacted	1459
Families who gave consent received questionnaires	446/1459
Accelerometry data	123/446
Participants with CPOP data	78/123

Study I

CPUP data only

n=78

ICF components and variables	β coefficient [95% CI]	p-value	Adj.R^2	RMSE
Body Function and Structure			-0.002	295
Range of motion				
Hip flexion	2 [-3, 6]	0.4		
Hip extension	-3 [-13, 7]	0.5		
Hip internal rotation	-3 [-10, 3]	0.3		
Hip external rotation	-0.5 [-8, 7]	0.9		
Hip abduction	2 [-7, 10]	0.7		
Knee extension	5 [-12, 22]	0.5		
Ankle DF with flexed knee	3 [-8, 14]	0.6		
Ankle DF with extended knee	-10 [-21, -2]	0.1		
Ely's test	2 [-2, 7]	0.3		
Popliteal angle	2 [-4, 8]	0.5		
Pain (*no*)	-9 [-250,233]	0.9		
Muscle tone (modified Ashworth Scale) *(yes)*	0.1 [-162, 162]	1.0		
Activities			0.07	284
FMS (5 m, 50 m 500 m)				
5 m (≥1)				
2–4	32 [-838, 903]	0.9		
5–6	166 [-912, 1244]	0.8		
50 m (≥1)				
2–4	-437 [-1478, 603]	0.4		
5–6	-115 [-998, 767]	0.8		
500 m (≥1)				
2–4	101 [-517, 719]	0.7		
5–6	213 [-208, 634]	0.3		
Ability to climb stairs				
Ascend (no)	-148 [-926, 630]	0.7		
Descend (no)	286 [-290, 862]	0.3		
Bike use (*never*)				
Rarely (a couple of times per month)	-44 [-483, 570]	0.9		
A couple of times per week	116 [-401, 632]	0.7		
Daily	44 [-483, 570]	0.9		
GMFCS level (I)				
II-III#	19 [-187, 224]	0.9		

Study I

CPUP data only

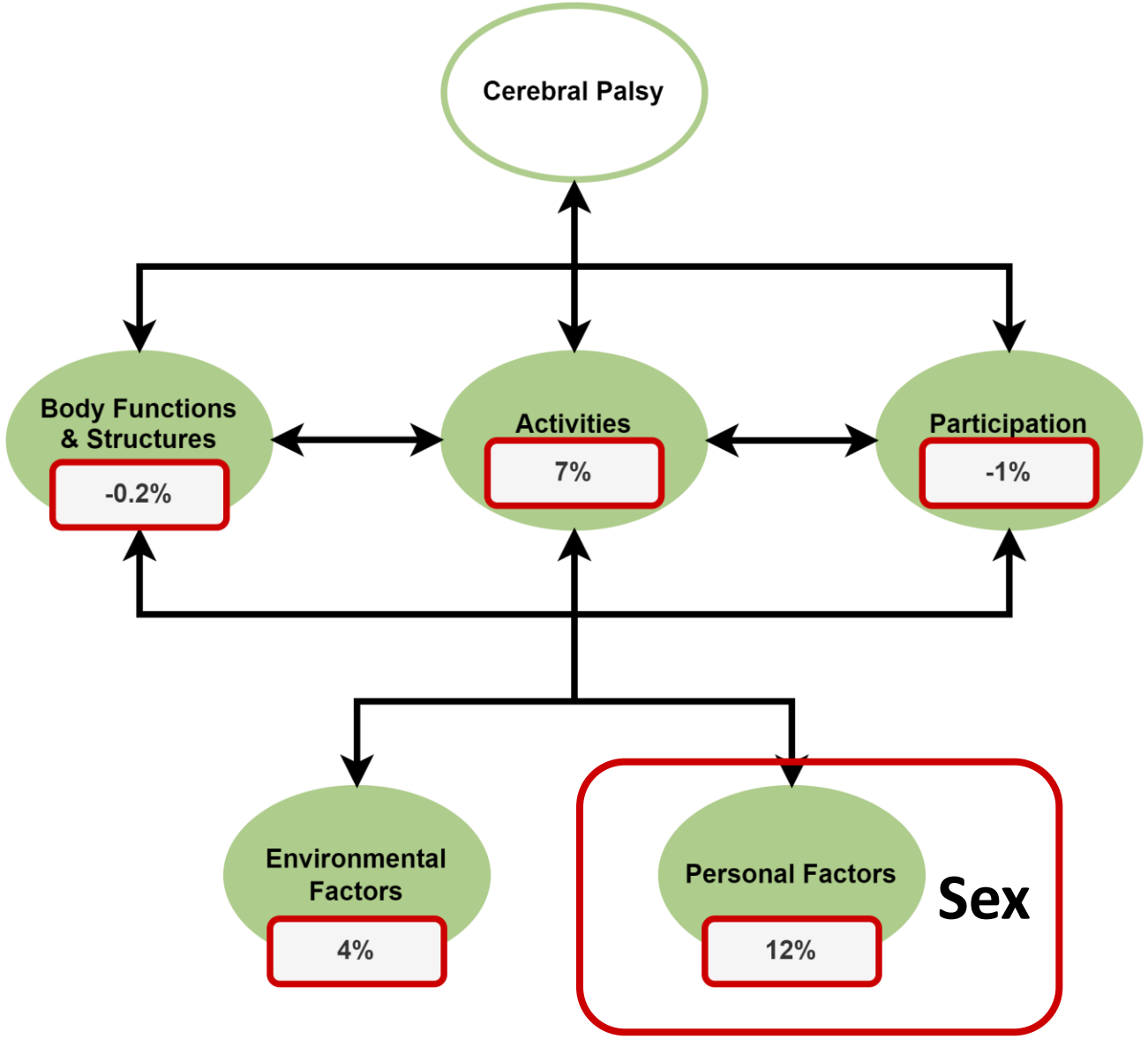
n=78

ICF components and variables	β coefficient [95% CI]	p-value	Adj.R^2	RMSE
Participation			-0.01	296
Participation in PT at school *(no)*	-98 [-327, 130]	0.4		
Participation in recreational activities *(no)*	-23 [-196, 149]	0.8		
Personal Factors			0.12	277
Age	-41 [-84, 2]	0.06		
Sex (*female*)	-201 [-331, -71]	0.003		
CP classification (*ataxic*)				
Dyskinetic	-15 [-497, 466]	1.0		
Non classified/mixed	-71 [-436, 294]	0.7		
Spastic	-177 [-484, 130]	0.3		
Environmental Factors			0.04	288
Residence region (*Capital Region of Denmark*)				
Central Denmark Region	9 [-179, 198]	0.9		
Region of Northern Denmark	176 [-55, 407]	0.1		
Region Zealand	127 [-96, 351]	0.3		
Region of Southern Denmark	62 [-119, 242]	0.5		
Use of orthosis *(no)*	95 [-75, 265]	0.3		
Use of wheelchair *(yes)*	-134 [-325, 57]	0.2		

Study I

Prediction of habitual physical activity within each ICF component

- CPUP data only



Study I

Prediction of habitual physical activity combining *all variables*

- CPUP data only

- Range of knee extension
- FMS 5m, 50m, 500m
- Bike use
- Age
- Sex

33 %

Study I

Questionnaire data

n=123

ICF components and variables	β coefficient [95% CI]	p-value	Adj.R^2	RMSE
Body Function and Structure			0.10	278
Range of motion				
Hip flexion	-151 [-350, 48]	0.1		
Knee extension	38 [-175, 251]	0.7		
Popliteal angle	-194 [-312, -75]	0.002		
Ankle dorsiflexion with extended knee	-27 [-154, 100]	0.7		
Ankle dorsiflexion with flexed knee	79 [-51, 209]	0.2		
Number of hours of sleep per night	13 [-53, 79]	0.7		
PODCI – pain/comfort scale	2 [-1, 4]	0.2		
Activities			0.17	268
FMS (5m, 50m 500m)				
5 m (1)				
2-4	63 [-699, 825]	0.9		
5-6	-3 [-763, 756]	1.0		
50 m (1)				
2-4	-605 [-1156, -53]	0.03		
5-6	NA			
500 m (1)				
2-4	101 [-278, 480]	0.6		
5-6	-80 [-384, 225]	0.6		
Means of transport to school *(walks)*				
Bikes	27 [-136, 191]	0.7		
Is transported (car, bus etc.)	-10 [-167, 147]	0.9		
Other	45 [-207, 298]	0.7		
Hours of screen time per day	-0.5 [-0.8, -0.2]	0.003		
GMFCS *(level I)*				
Level II	70 [-66, 206]	0.3		
Level III	-50 [-603, 502]	0.9		

Study I

Questionnaire data

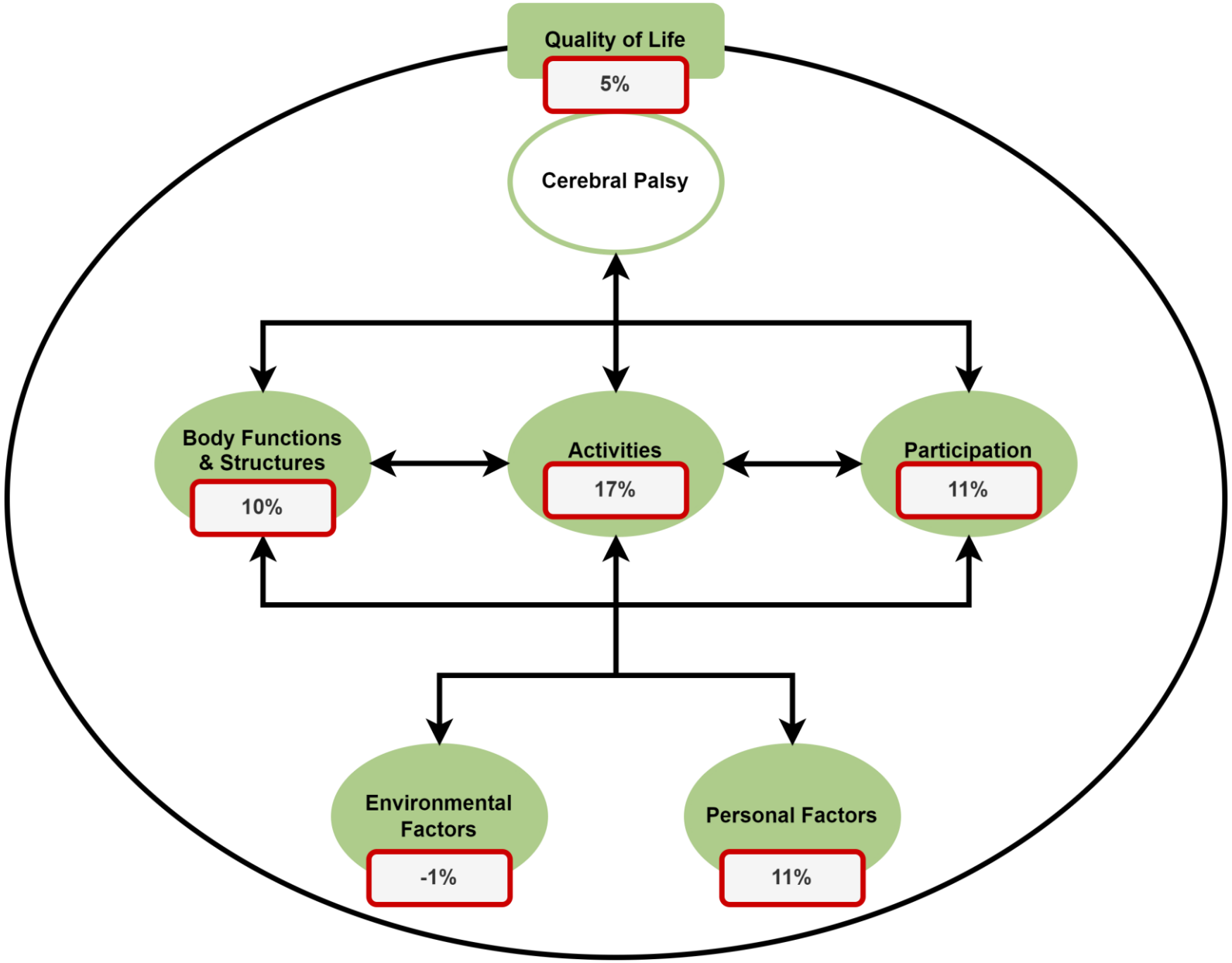
n=123

ICF components and variables	β coefficient [95% CI]	p-value	Adj.R^2	RMSE
Participation			0.11	278
Participation in PT at school *(no)*	-139 [-332, 54]	0.2		
Participation in recreational activities *(<1 time per week)*				
1–2 times per week	-15 [-145, 114]	0.8		
3–5 times per week	-51 [-217, 115]	0.5		
PODCI - Global Function score	-8 [-17, 1]	0.1		
PODCI - Sports and Physical Functioning score	9 [3, 15]	0.006		
Personal Factors			0.11	277
Age	-46 [-70, -22]	<0.001		
Sex (*female*)	-133 [-233, -33]	0.009		
Parent's education level (*ISCED 0–3*)				
ISCED 4–6	-168 [-357, 21]	0.1		
ISCED 7–8	-184 [-394, 24]	0.1		
Environmental Factors			-0.01	296
Residence region (*Capital Region of Denmark*)				
Central Denmark Region	3 [-140, 147]	1.0		
Region of Northern Denmark	80 [-116, 276]	0.4		
Region Zealand	71 [-93, 235]	0.4		
Region of Southern Denmark	112 [-43, 267]	0.2		
Quality of Life			0.05	287
PedsQL components				
Daily Activities	3 [-1, 7]	0.1		
School Activities	-1 [-4, 3]	0.8		
Movement and Balance	1 [-3, 4]	0.7		
Pain and Hurt	-1 [-4, 2]	0.4		
Fatigue	3 [1, 6]	0.008		
Eating Activities	-4 [-8, 1]	0.1		
Speech and Communication	-1 [-4, 1]	0.3		

Study I

Prediction of habitual physical activity within each ICF component

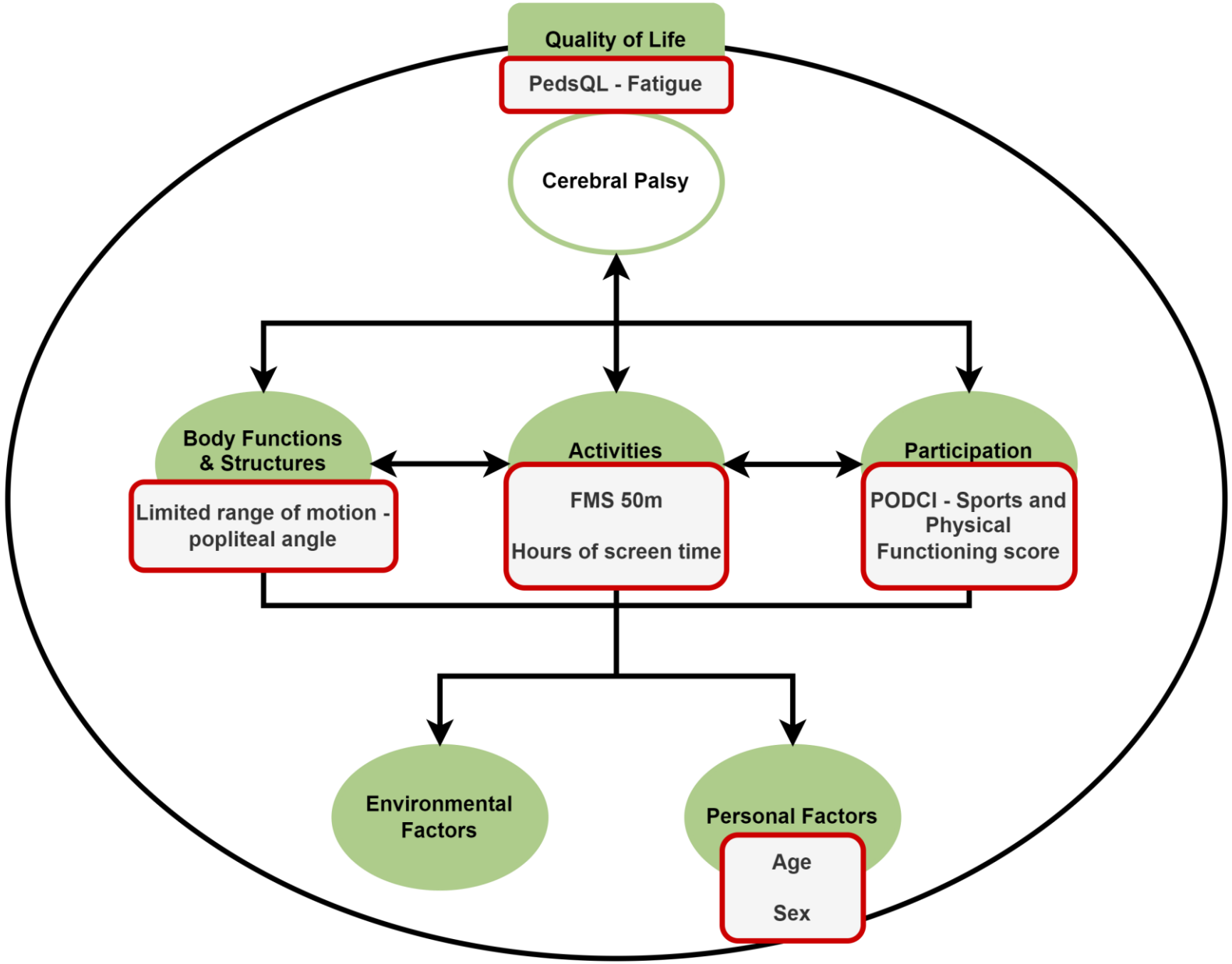
- Questionnaire data only



Study I

Prediction of habitual physical activity within each ICF component

- Questionnaire data only



Study I

Prediction of habitual physical activity combining *all variables*

- Questionnaire data only

- PedsQL - Fatigue
- PedsQL - Communication
- Limited range of motion - popliteal angle
- FMS 5m, 50m
- Hours of screen time
- GMFCS level
- Participation in physial training at school
- Region of residence
- Age
- Sex
- Parent's educational level

37 %

Study I – Clinical implications/perspectives

- Significant predictive variables (e.g. sex and age) can help clinicians identify which children are likely to have low levels of physical activity

Study I – Clinical implications/perspectives

- Significant predictive variables can help identify children who are likely to have low levels of physical activity
- The prediction model using all CPUP variables can be implemented in the CPUP database

Study II

Recreational screen time behavior in ambulant/semi-ambulant children and adolescents with cerebral palsy: a cross-sectional analysis

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Study II - aim

*- to describe **recreational screen time behavior** in ambulant/semi-ambulant children and adolescents with cerebral palsy and to analyze the **potential associations between screen time behavior** and **quality of life**, **participation in recreational physical activity**, **participation in sports with peers**, **physical functioning**, and **sleep duration**.*

Study II - SCREENS-Q questionnaire

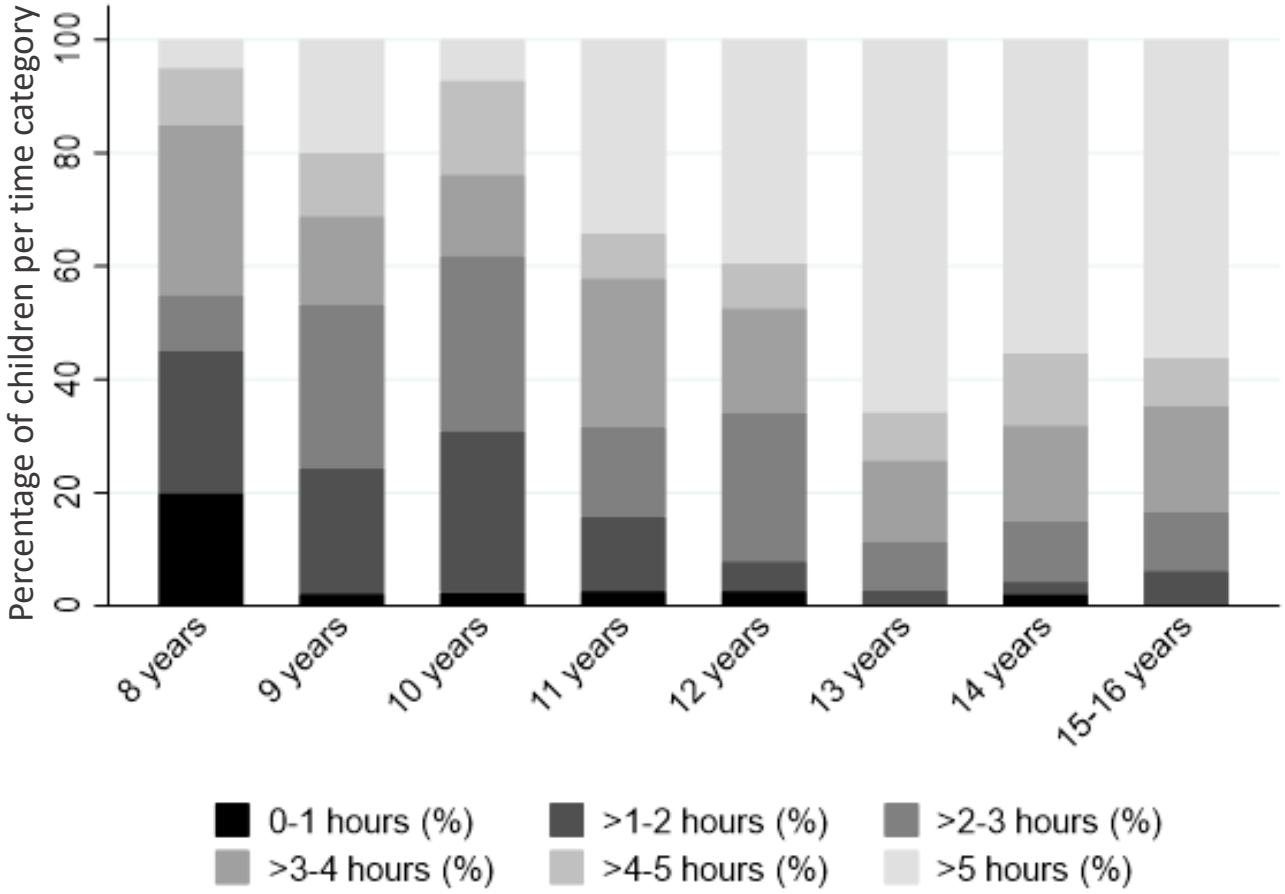
	Weekday (time per day)								Weekend days (time per day)							
	None	1-29 mins	30-59 mins	1-2 hrs	2-3 hrs	3-4 hrs	4-5 hrs	5 hrs or more	None	1-29 mins	30-59 mins	1-2 hrs	2-3 hrs	3-4 hrs	4-5 hrs	5 hrs or more
Movies, TV shows, YouTube video clips/movies, entertainment programs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Games (on smartphone, tablet, game console, PC)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
School-related tasks using screen media devices	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Video calls (e.g., Facetime, Skype)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Social media or other types of communication (e.g. Facebook, Messenger, Twitter, WhatsApp, Snapchat, Instagram, Email, SMS)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other (for example, drawing programs, making musical or stop-motion videos)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Klakk H et al. The development of a questionnaire to assess leisure time screen-based media use and its proximal correlates in children (SCREENS-Q). BMC public health. 2020

Study II

Sex *(n (%))*			
	Boy		224 (59%)
	Girl		157 (41%)
	Total		381 (100%)
Age in years *(mean (SD))*			
			12 (2)
GMFCS level *(n (%))*			
	I		250 (66%)
	II		104 (27%)
	III		27 (7%)
Screen time, hrs./day (median (Q1-Q3))			
	Weekday	n=324	3.5 (2.2-6.2)
	Weekend day	n=322	4.5 (3.0-7.2)
	Typical day	n=313	3.9 (2.6-6.4)

Study II - Total screen time use on a typical day by age



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Study II - Associations with recreational screen time

adjusted for age, sex, GMFCS level, and parental educational level

↑ **Recreational screen time**

↓ **Sleep duration**

↑ **Fatigue** (*PedsQL dimension*)

↓ **Movement and balance** *(PedsQL dimension)*

Participation in recreational activities

Sports and Functioning score *(PODCI core scale)*

Daily Activities

School Activities

Pain and Hurt

Eating Activities

Speech and Communication

PedsQL dimensions

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Study II - Clinical implications/perspectives

- 3.9 hours vs. 2.1 hours daily[1]

1. Pedersen J et al. Recreational screen media use in Danish school-aged children and the role of parental education, family structures, and household screen media rules. Prev Med. 2022

Study II - Clinical implications/perspectives

- 3.9 hours vs. 2.1 hours daily[1]
- Preventive approaches are needed to contribute to better health[2,3]

1. Pedersen J et al. Recreational screen media use in Danish school-aged children and the role of parental education, family structures, and household screen media rules. Prev Med. 2022
2. Bull FC et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020
3. Stiglic N, Viner RM. Effects of screentime on the health and well-being of children and adolescents: a systematic review of reviews.

Study II - Clinical implications/perspectives

- 3.9 hours vs. 2.1 hours daily[1]
- Preventive approaches are needed to contribute to better health[2,3]
- It is important to target physical activity as well as sedentary behavior[4]

1. Pedersen J et al. Recreational screen media use in Danish school-aged children and the role of parental education, family structures, and household screen media rules. Prev Med. 2022
2. Bull FC et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020
3. Stiglic N, Viner RM. Effects of screentime on the health and well-being of children and adolescents: a systematic review of reviews.
4. Iannotti RJ et al. Interrelationships of adolescent physical activity, screen-based sedentary behaviour, and social and psychological health. Int J Public Health. 2009

Conclusion

This project identified predictive factors that healthcare professionals can use to identify those who may benefit from increased physical activity support. Additionally, the research highlighted the negative impact of screen time on sleep, perceived fatigue, and quality of life, with variations between genders and age groups.

Funding & acknowledgements

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- Dagmar Marshalls Fond
- Fonden til Lægevidenskabens Fremme
- OUHs forskningspulje

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Odense University Hospital
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SDU
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Region of
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ORU
Orthopaedic Research Unit
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Fysisk aktivitet og stillesiddende adfærd hos børn og unge med cerebral parese

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