Fourth congress on NeuroRehabilitation and Neural Repair

Digital Programme and Proceedings Book

From Science to Evidence-based Practice
31 May - 2 June 2023 | The Netherlands

Welcome

We are proud to announce the 4th International Congress on Neurorehabilitation and Neural Repair organized by the Dutch, Belgian and German Societies for Neurorehabilitation and the Association of Chartered Physiotherapists in Neurology in the United Kingdom which will bridge the gap between neuroscience and practice.

This 3-day meeting is focused on the most recent advances in neurorehabilitation research ready for translation, providing opportunities to share knowledge, experience, and most recent developments in the identification of biomarker of neuronal recovery, the added value of using innovative devices including robotics in the field of neurorehabilitation. The scientific program will include the most distinguished invited speakers in the field of neuroplasticity and neurorehabilitation, and will be dedicated to the management of most common problems such as gait and balance control, understanding and predicting motor recovery including management of spasticity, cognitive impairments, and implementation strategies of evidence in the field of neurorehabilitation such as stroke, Parkinson's' disease and MS. This multidisciplinary conference will be important for all professionals dedicated to neurorehabilitation such as physicians, neurologists, physical and occupational therapists, nurses, movement scientists, bioengineers as well as those who are more involved in the management of neurorehabilitation.

On behalf of the DSNR, BSNR, DGNKN and ACPIN, we wish you warm welcome at the 4th International Congress on Neurorehabilitation and Neural Repair in Maastricht.

Prof. Dr. Gert Kwakkel
President DSNR

Prof. Dr. Daphe Kos
President BSNR

Prof. Dr. Bernard Eslner
DGNKN Board

Prof. Dr. Jane Burridge
President ACPIN

Contents

Programme Schedule

Congress on
NeuroRehabilitation and Neural Repair

Organizing and Scientific Committee

Prof. dr. Gert Kwakkel	President of the Dutch Society for NeuroRehabilitation
Msc. Adine Adonis	Chair of the Association of Chartered Physiotherapists in Neurology (ACPIN)
Prof. dr. Jane Burridge	President of The Association of Chartered Physiotherapists in Neurology (ACPIN)
Prof. dr. Bernhard Elsner	Executive board member of the German Society of Neurorehabilitation (DGNKN)
Prof. dr. Alexander Geurts	Vice-president of the Dutch Society for NeuroRehabilitation
Prof. dr. Carel Meskers	Medical director of the Dutch Innovative Medical Devices Initiative (IMDI)
Prof. dr. Eva Swinnen	Board member of the Belgium Society for Neurorehabilitation (BSNR)
Dr. Erwin van Wegen	Treasurer of the Dutch Society for NeuroRehabilitation

Keynote speakers

Prof dr. Julie Bernhardt	Florey Institute of Neuroscience and Mental Health, Australia
Prof. dr. Rick Dijkhuizen	University Medical Center Utrecht (UMCU), The Netherlands
Prof. dr. Caroline van Heugten	Maastricht University, The Netherlands
Prof. dr. Alice Nieuwboer	KU Leuven, Belgium

Invited speakers

Dr. Hans Bussmann	Erasmus MC University Medical Center, the Netherlands
Prof. dr. Ulrik Dalgas	Aarhus University, Denmark
Prof. dr. Peter Feys	UHasselt, Belgium
Dr. Ulrike Hammerbeck	University of Brighton, United Kingdom
Prof. dr. Daphne Kos	KU Leuven, Belgium
Dr. Pavel Lindberg	Institute of Psychiatry and Neuroscience of Paris, France
Prof. dr. Vivian Weerdesteyn	Radboud University Medical Center Nijmegen, The Netherlands
Prof. dr. Frederike van Wijck	Glasgow Caledonian University, United Kingdom
Prof. dr. Ulf Ziemann	University of Tübingen, Germany

Wednesday 31 May 2023

Programme Pre Congress Workshops

13.00-14.30   **Intensity Workshop Room 0.5** | *B. Clark & L. Johnson*
B-STARS-rTMS Room 0.10 | *R. Dijkhuizen & J. Vink*
Management of gait impairments after stroke Room 0.11 | *J. Buurke & J. Nonnekes*

14.30-14.45   **Coffee break**

14.45-16.15   **Contrast 2.0 The assessment protocol Room 0.4** | *C. Meskers & R. Selles*
Developing understanding of Systematic Reviews, Guidelines and Consensus-based Recommendations Room 0.5 | *B. Elsner & G. Verheyden*
Measurement of Cognition Room 0.10 | *C. van Heugten & F. Domensino*
Functional electrical stimulation clinical practice guidelines to support walking in upper motor neuron conditions Room 0.11 | *T. Street & J. Burridge & A. Adonis*

16.15-16.30   **Coffee break**

16.30-18.00   **Virtual reality in neurorehabilitation: entertainment or treatment? Room 0.10** | *E. Swinnen & A. van Bladel & I. Brunner*
High Intensity Training and Physical Fitness Training for Parkinson's Disease Room 0.11 | *E. van Wegen & K. Musch*

Thursday 1 June 2023

Auditorium II

09.30-10.00 **Welcome & Opening** | *G. Kwakkel*
10.00-11.00 **Global Collaborations to Advance Science in Stroke Rehabilitation and Recovery** | *J. Bernhardt, Chair: G. Kwakkel*

11.00-11.30 **Coffee break & Exhibiton | ExpoFoyer**

11.30-13.00 **Young Scientist Competition** | *Chair: J. Burridge*
11.30-11.45 **Beyond gait speed** | *R. Felius*
11.45-12.00 **Gait-adaptability Training in People With Hereditary Spastic Paraplegia: A Randomized Clinical Trial** | *L. Venis*
12.00-12.15 **Correlation between change in upper limb motor impairment and activity in response to exercise-based therapy after stroke: A systematic review with meta-analysis** | *C. Yüksel*
12.15-12.30 **Pilot randomized controlled trial using novel technology to train sitting balance and trunk control in the subacute phase post-stroke** | *E. Wiskerke*
12.30-12.45 **A dose escalation study exploring the maximal session length of upper limb rehabilitation for people with moderate to severe upper limb sensorimotor impairments in the early phase post stroke** | *L. Tedesco Triccas*
12.45-13.00 **Brain-oscillation-synchronized stimulation to enhance motor recovery in early subacute stroke (BOSS-STROKE): A randomized controlled double-blind three-arm parallel group exploratory trial comparing personalized, non-personalized and sham repetitive transcranial magnetic stimulation** | *A. Lieb*

13.00-14.00 **Lunch & Exhibition | ExpoFoyer**

14.00-14.30 **Poster Visit | ExpoFoyer**
14.30-16.00 **Best Poster Competition** | *Chair: B. Elsner*
14.30-14.40 **Does combined gait training with the Incedo® improve walking performance and gait parameters in patients with chronic stroke-related hemiparesis? A pilot study** | *A. Sehle*
14.40-14.50 **The Speed Precision ObsTacle courSe (SPOTS): a new measurement tool for high-level walking for people with central neurological disorders** | *V. Janssens*

14.50-15.00 **The PREP Plus combined post-rehabilitation programme. Supporting upper-limb recovery in community-dwelling stroke survivors: a mixed methods, cluster-assigned feasibility study** | *N. Klempel*
15.00-15.10 **Personalized neuromodulation treatment for motor recovery after stroke in the subacute phase** | *M. Uscumlic*
15.10-15.20 **A home-Based Core Stability Exercises to Improve Balance Confidence, Quality of Life, Health Status and Gait Speed. A Pragmatic Randomized trial. Core-ataxia** | *R. Canabas-Valdés*
15.20-15.30 **Action observation with motor simulation improves reactive stepping responses following strong backward balance perturbations in healthy young individuals** | *L. Hagedoorn*
15.30-15.40 **Does task difficulty trigger paretic arm non-use in stroke population?** | *M. Coll*
15.40-15.50 **Clinical feasibility of assist-as-needed robot and electrostimulation supported leg training in moderate-severely affected stroke patients** | *C. Rikhof*
15.50-16.00 **Home-based augmented-reality gait-and-balance training for people with Parkinson's disease: a clinical feasibility study protocol** | *L. Hardeman*

16.00-16.30 **Coffee break & Exhibition | ExpoFoyer**

16.30-17.30 **Translation between experimental and clinical stroke recovery studies - challenges and opportunities** | *R. Dijkhuizen, Chair: S. Geurts*
17.30-19.00 **Welcome reception | ExpoFoyer**

Room 0.2/0.3

13.00-14.00 **IPSEN Lunch symposium | Room 0.2/0.3**
Smoothening the consequences of spasticity by addressing patient-relevant outcomes and improving strategies to facilitate shared decision making in spasticity management | *Chairman and speaker: H.C.J.W Kerstens, PhD, Invited speaker: T. van der Weijden*

Thursday | June 2023

Room 0.4

11.00-11.30	**Coffee break & Exhibiton | ExpoFoyer**

11.30-13.00	**Focused Symposium**
11.30-12.00	**Motor and Non-motor symptoms of Parkinson's Disease: avenues for rehabilitation** | *Chair: A. Nieuwboer*
11.30-12.00	**Motor learning for upper limb skills, pro's and cons of dual task practice** | *J. De Vleeschauwer*
12:00-12:30	**Leveraging sleep and other non-motor symptoms for optimal rehabilitation effects** | *M. Gilat*
12.30-13.00	**Training for early motor problems, what are the best evidence-based options?** | *N. de Vries*

13.00-14.00	**Lunch & Exhibition | ExpoFoyer**

14.00-14.30	**Poster Visit | ExpoFoyer**
14.30-16.00	**Focused Symposium**
	Interventions reducing sedentary behaviour in elderly | *Chair: van Wijck*
14.30-15.00	**Sedentary behaviour post stroke: What happens over the first 2 years post discharge?** | *N. Fini*
15.00-15.20	**Sedentary behaviour after stroke: the role of stroke service staff in supporting stroke survivors to move more in inpatient and community settings** | *S. Morton*
15.20-15.40	**Efficacy of aerobic exercise on aerobic capacity in slowly progressive neuromuscular diseases: a systematic review and meta-analysis** | *S. Oorschot*
15.40-16.00	**Discussion**

16.00-16.30	**Coffee break & Exhibition | ExpoFoyer**

17.30-19.00	**Welcome reception | ExpoFoyer**

Room 0.5

11.00-11.30	**Coffee break & Exhibiton | ExpoFoyer**

11.30-13.00	**Focused Symposium**
	Cochrane Rehabilitation and Cochrane reviews | *Chair: B. Elsner*
11.30-11.45	**Non-pharmacological interventions for spatial neglect after stroke** | *T. Platz*
11.45-12.00	**Cochrane Rehabilitation** | *G. Verheyden*
12.00-12.15	**Trunk training** | *L. Thijs*
12.15-12.30	**Noninvasive analysis of overactive, spastic muscle structure and elasticity after botulinum toxin type A injection: a systematic review and meta-analysis** | *M. Devis*
12.30-12.45	**Prognostic models to predict long-term recovery of independent walking after stroke: a systematic review** | *N. Wouda*
12.45-13.00	**Can therapists estimate therapy dose dimensions? A comparison between patient, therapist, and objective outcomes in (sub)acute rehabilitation** | *N. Bertels*

13.00-14.00	**Lunch & Exhibition | ExpoFoyer**

14.00-14.30	**Poster Visit | ExpoFoyer**
14.30-16.00	**Focused Symposium**
	(4D) EEG: towards a better understanding of upper limb sensorimotor recovery | *Chairs: J. van Ginkel, C. Meskers, F. van der Helm*
14.30-15.00	**The association between neurological recovery and behavioral restitution post stroke** | *C. Meskers*
15.00-15.20	**Time course of wrist hyperresistance components** | *C. Meskers*
15.20-15.40	**The role of corticospinal tract integrity** | *F. van der Helm*
15.40-16.00	**4DEEG: from brain signal propagation to functional understanding** | *J. Cruijssen*

16.00-16.30	**Coffee break & Exhibition| ExpoFoyer**

17.30-19.00	**Welcome reception | ExpoFoyer**

Thursday 1 June 2023

Room 0.10

11.00-11.30 Coffee break & Exhibiton | ExpoFoyer

11.30-13.00 Focused Symposium
Tailoring treatment to enhance upper limb recovery based on individual levels of sensorimotor impairment in people living with stroke | *Chair: M. Levin*
11.30-12.00 Application of principles of threshold control to improve sensorimotor outcomes after stroke | *M. Levin*
12.00-12.25 Unraveling stroke recovery by combining motor performance and movement quality | *D. Piscitelli*
12.25-12.50 Do neuroimaging biomarkers predict upper limb reaching performance to transcranial direct current stimulation? | *Chen*
12.50-13.00 Discussion

13.00-14.00 Lunch & Exhibition | ExpoFoyer

14.00-14.30 Poster Visit | ExpoFoyer
14.30-16.00 Focused Symposium
Exercise therapy - a cornerstone in MS rehabilitation | *Chair: U. Dalgas*
14.30-15.00 Exercise therapy - a cornerstone in MS rehabilitation | *U. Dalgas*
15.00-15.20 Effects of Exercise Training on Physical Functions of people with Multiple Sclerosis | *C. Ramari*
15.20-15.40 Implementation of exercise in the community | *P. Feys*
15.40-16.00 Tailored exercise and long-term adherence | *L. Taul Madsen*

16.00-16.30 Coffee break & Exhibition | ExpoFoyer

17.30-19.00 Welcome reception | ExpoFoyer

Room 0.11

08:30-09:15 BSNR General Assembly meeting

11.00-11.30 Coffee break & Exhibiton | ExpoFoyer

11.30-13.00 Invited Lecture and oral abstract presentations | *Chair: U. Ziemann*

11.30-12.00 Predicting motor neurorehabilitation outcome | *U. Ziemann*
12.00-12.15 Functional markers of spontaneous and therapy-related post-stroke recovery | *C. Zich*
12.15-12.30 Different aspects of upper-limb activity differ among people with varied upper limb levels in the chronic phase post-stroke | *B. Essers*
12.30-12.45 Recovery of inter-limb coordination of balance control in early subacute stroke: comparing two performance metrics in hemiparetic subjects | *J. Schröder*
12.45-13.00 System identification: a feasible, reliable and valid way to quantify upper limb motor impairments | *M. Ruit*

13.00-14.00 Lunch & Exhibition | ExpoFoyer

14.00-14.30 Poster Visit | ExpoFoyer
14.30-16.00 Invited Lecture and oral abstract presentations

14.30-15.00 Monitoring multiple sclerosis in daily life | *D. Kos*
15.00-15.15 Blended versus face-to-face CBT for MS-related fatigue: results of a non-inferiority multicenter randomized clinical trial | *M. Gier*
15.15-15.30 Exploring walking fatigability concept in people with multiple sclerosis | *F. Santinelli*
15.30-15.45 Reliability of walking and cognitive tests and objective fatigability measurement in moderate to severe multiple sclerosis patients | *C. Ramari*
15.45-16.00 Discussion

16.00-16.30 Coffee break & Exhibition | ExpoFoyer

17.30-19.00 Welcome reception | ExpoFoyer
19.00-20.00 ACPIN Annual General Meeting

Friday 2 June 2023

Auditorium II

08.30-09.30   **Cognitive rehabilitation: past, present and future**
| *C. van Heugten, Chair: J. Burridge*

09.30-10.00   **Coffee break & Exhibiton | ExpoFoyer**

10.00-11.30   **Focused Symposium**
Measuring fatigability in people with Multiple Sclerosis | *Chair: D. Kos*
10.00-10.30   **Setting the scene: challenges in assessing fatigue and fatigability in MS** | *D. Kos*
10.30-10.50   **Motor fatigability: assessment and implications for training** | *P. Feys*
10.50-11.10   **Cognitive fatigability: from lab testing to real life context** | *N. Peeters*
11.10-11.30   **Cognitive-motor performance during and after fatiguing protocols** | *Z. Abasiyanik*

11.30-12.30   **Lunch & Exhibition | ExpoFoyer**

12.30-13.00   **Poster Visit | ExpoFoyer**
13.00-14.30   **Invited Lecture and oral abstract presentations** | *Chair: U. Hammerbeck*
13.00-13.30   **Differences in arm recovery between ischemic stroke and intracerebral haemorrhage** | *U. Hammerbeck*
13.30-13.45   **Motor-Cognitive Dual-Task Ability; Strategies and performance of the upper extremity in healthy and individuals post-stroke** | *Y. Bachar Kirshenboim*
13.45-14.00   **Comparing capacity and daily-use of the affected upper extremity of individuals with and without post-stroke depression** | *D. Rand*
14.00-14.15   **Stroke patients' motivation for home-based upper extremity rehabilitation with eHealth tools** | *N. Langerak*
14.15-14.30   **Usability evaluation of the T-GRIP thumb exoskeleton to support lateral pinch grasp** | *A. Kottink*

14.30-15.00   **Coffee break & Exhibiton | ExpoFoyer**

15.00-16.00   **The exercise prescription for Parkinson's disease**
| *A. Nieuwboer, Chair: E. Swinnen*
16.00-17.00   **Awards & Closing ceremony**
Young scientist and best poster awards
Winner best poster competition
Closing ceremony

Room 0.2/0.3

11.30-12.30   **MERZ Lunch symposium**
ToxNet group: Peer Exchange on Challenges in Spasticity Management
Join our panel of internationally renowned experts for an interactive session on managing spasticity, including a new peer-developed curriculum
Speakers: A. Geurts (moderator), Th. Deltombe, N. Draulans

Friday 2 June 2023

Room 0.4

09.30-10.00	**Coffee break & Exhibiton	ExpoFoyer**

10.00-11.30	**Focused Symposium** **Wearable-supported @home arm-hand rehabilitation after stroke** | *Chair: H. Bussmann*
10.00-10.30	**The use of wearables in at-home upper-limb rehabilitation: opportunities, challenges & examples**	*H. Bussmann*
10.30-10.45	**Quality versus quantity assessments of arm movement in clinical trials**	*A. Luft*
10.45-11.00	**The Arm Activity Tracker: assessing the feasibility and exploring the efficacy of a sensor-based feedback device stimulating daily life upper extremity activity in stroke patients**	*N. Langerak*
11.00-11.15	**Immersive VR and Portable devices in minimally supervised arm-hand rehabilitation**	*L. Marchal-Crespo*
11.15-11.30	**Discussion**

11.30-12.30	**Lunch & Exhibition	ExpoFoyer**

12.30-13.00	**Poster Visit	ExpoFoyer**
13.00-14.30	**Focused Symposium** **Fatigue and the Post-Covid-condition**	*Chairs: C. Dettmers, M. Jobges*
13.00-13.30	**Assessment of physical endurance and motor fatigability in patients with post-COVID syndrome**	*C. Weich*
13.30-14.00	**Feasibility of a cognitive-behavioral group therapy for patients with post/long COVID syndrome in neurological rehabilitation**	*D. Mier*
14.00-14.15	**Predictors of depressive symptoms among COVID-19 patients up to 2 years after hospitalization**	*M. Bek*
14.15-14.30	**Telehealth-delivered supervised exercise and behaviour change support is feasible and shows promise as a path to sustained increases in physical activity after stroke: Results from the ENAbLE Pilot Trial**	*E. Ramage*

14.30-15.00	**Coffee break & Exhibiton	ExpoFoyer**

Room 0.5

09.30-10.00	**Coffee break & Exhibiton	ExpoFoyer**

10.00-11.30	**Focused Symposium** **Neuromodulation (rTMS/ tDCS)** | *Chair: R. Dijkhuizen*
10.00-10.30	**Continuous theta-burst stimulation of the contralesional primary motor cortex promotes upper limb recovery after stroke**	*J. Vink*
10.30-10.45	**Assessing age-related changes in control of gait using brain-muscle networks**	*T. Boonstra*
10.45-11.00	**The effect of contextual interference on engagement during motor practice in subacute rehabilitation for people post-stroke**	*G. Batsha-Kigel*
11.00-11.15	**High dosage upper limb rehabilitation for chronic stroke patients Protocol for a randomised controlled trial (INTENSIVE)**	*L. Tedesco Triccas*
11.15-11.30	**Discussion**

11.30-12.30	**Lunch & Exhibition	ExpoFoyer**

12.30-13.00	**Poster Visit	ExpoFoyer**
13.00-14.30	**Focused Symposium** **The influence of motor cognition on functional recovery after stroke** | *Chair: P. Lindberg*
13.00-13.15	**Relation between visuospatial attention and upper limb motor impairments in chronic stroke**	*P. Lindberg*
13.15-13.30	**Do post-stroke cognitive impairments interfere with motor learning?**	*Y. Vandermeeren*
13.30-14.00	**Influence of cognitive impairments on motor and functional upper limb recovery in stroke**	*J. Plantin*
14.00-14.15	**How mechanisms underlying limb apraxia may inform stroke recovery**	*E. Rounis*
14.15-14.30	**Combinations of functional neuroimaging and lesion analysis to inform about essential brain areas and neural recovery in apraxia following stroke**	*J. Hermsdörfer*

14.30-15.00	**Coffee break & Exhibiton	ExpoFoyer**

Friday 2 June 2023

Room 0.10

09.30-10.00	**Coffee break & Exhibiton | ExpoFoyer**

10.00-11.30	**Focused Symposium**
	Novel advances in the assessment and treatment of gait impairments after stroke | *Chair: A. Geurts*
10.00-10.20	**Gait impairments after stroke** | *A. Geurts*
10.20-10.45	**Novel advances in the assessment of gait** | *N. Keijsers*
10.45-11.10	**Ankle-foot surgery to improve gait capacity** | *J. Nonnekes*
11.10-11.30	**Evidence of ankle-foot surgery to improve gait capacity after stroke** | *B. Bloks*

11.30-12.30	**Lunch & Exhibition | ExpoFoyer**

12.30-13.00	**Poster Visit | ExpoFoyer**
13.00-14.30	**Invited Lecture and oral abstract presentations** | *Chair: P. Feys*
13.00-13.30	**Embracing the complexity of rehabilitation research** | *P. Feys*
13.30-13.45	**Therapeutic effect of a wearable soft-robotic glove on hand function used as assistive device to support people with impaired hand strength during activities of daily living** | *A. Kottink*
13.45-14.00	**Can we use the Functional Gait Assessment scale as part of vestibular rehabilitation?** | *N. Kos*
14.00-14.15	**Essential training variables of arm-hand training in people with cervical spinal cord injury: a systematic review** | *N. Bertels*
14.15-14.30	**HEROES, an exergame for stroke patients to train stepping responses at home** | *A. Ruiz-Rodríguez*

14.30-15.00	**Coffee break & Exhibiton | ExpoFoyer**

Room 0.11

07.30-08.30	**DSNR Annual General Meeting**

09.30-10.00	**Coffee break & Exhibiton | ExpoFoyer**

10.00-11.30	**Invited Lecture and oral abstract presentations** | *Chair: F. van Wijck*
10.00-10.30	**From exercise and fitness training to active living after stroke: how can we facilitate transfer?** | *F. van Wijck*
10.30-10.45	**Increased access to physical activity and exercise for patients with neurological conditions in the community: a service improvement evaluation** | *C. Appel*
10.45-11.00	**Optimizing protocol selection for cardiopulmonary exercise testing in slowly progressive neuromuscular diseases** | *S. Oorschot*
11.00-11.15	**Self-paced treadmill versus overground walking to evaluate the therapeutic effect of treadmill-based walking adaptability training in neurological patients** | *E. Zwijgers*
11.15-11.30	**Efficacy of the Myosuit for increasing gait capacity and daily life gait performance in the home and community setting in people with incomplete spinal cord injury: study protocol for a randomized controlled trial** | *L. Visch*

11.30-12.30	**Lunch & Exhibition | ExpoFoyer**

12.30-13.00	**Poster Visit | ExpoFoyer**

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Congress on NeuroRehabilitation and Neural Repair

Social programme

Get-Together Drink

The Get-Together Drink will take place in MECC Maastricht in the Expo Foyer, on Thursday 1st of June 2023, directly after the programme.
The organising committee invites all attendees to join us and exploit this opportunity to network, meet old friends and colleagues, and to make new ones.

Date: Thursday 1st of June 2023
Time: 17.30 - 19.00 hrs.
Location: Expo Foyer MECC Maastricht

Invitation lunch symposium

This is an educational event initiated and organised by Ipsen

Smoothening the consequences of spasticity

Addressing patient-relevant outcomes and improving strategies

to facilitate shared decision making (SDM) in spasticity management

Thursday June 1st 2023 13.00-14.00

MECC Maastricht
Room 0.2/0.3

Lunch will be provided at the entrance of the room

Keynote speaker

Prof. Trudy van der Weijden, MD PhD
Dept. Family Medicine,
CAPHRI School of Public Health and
Primary Care, Maastricht, Netherlands

Chairman and speaker

Dr. Hans Kerstens, PhD
Radboudumc/HAN University
of Applied Sciences,
Nijmegen, Netherlands

Handout presentations

Click here →

You can find the handout of the presentation afterwards by scanning the QR code. Or sent an email with the request to receive the Ipsen lunch symposium presentations to: Ipsen.nl@ipsen.com

IPSEN
Innovation for patient care

Floorplan

Level 0

Exhibition halls

Expo foyer

Lobby North

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Lobby South

Level 1

Forum Passage

mecc
MAASTRICHT

Registration desk

Trajectum

Entrance

Entrance

Wardrobe

Hotel

Auditorium 1

Stage

1.3

1.2

Auditorium II
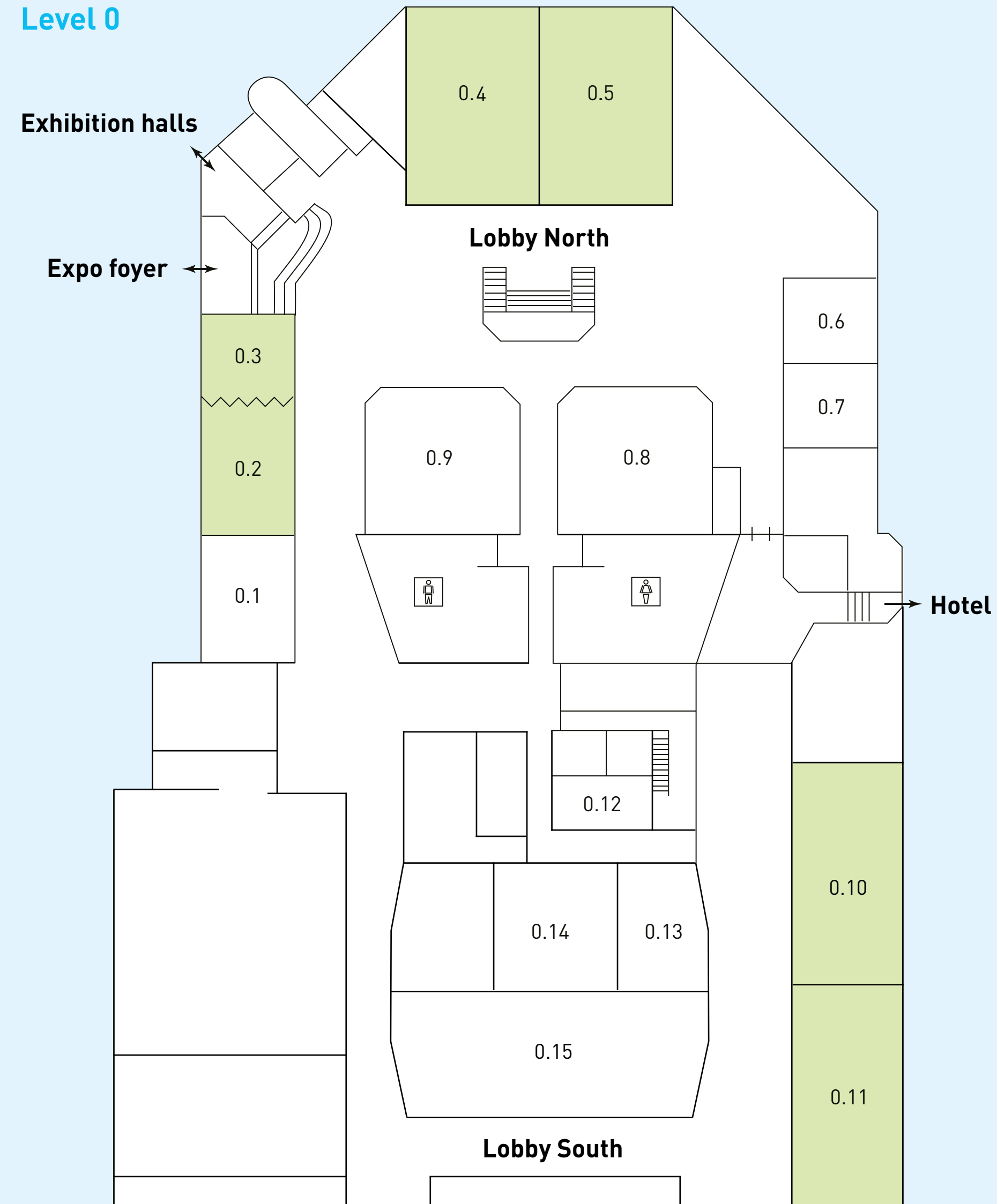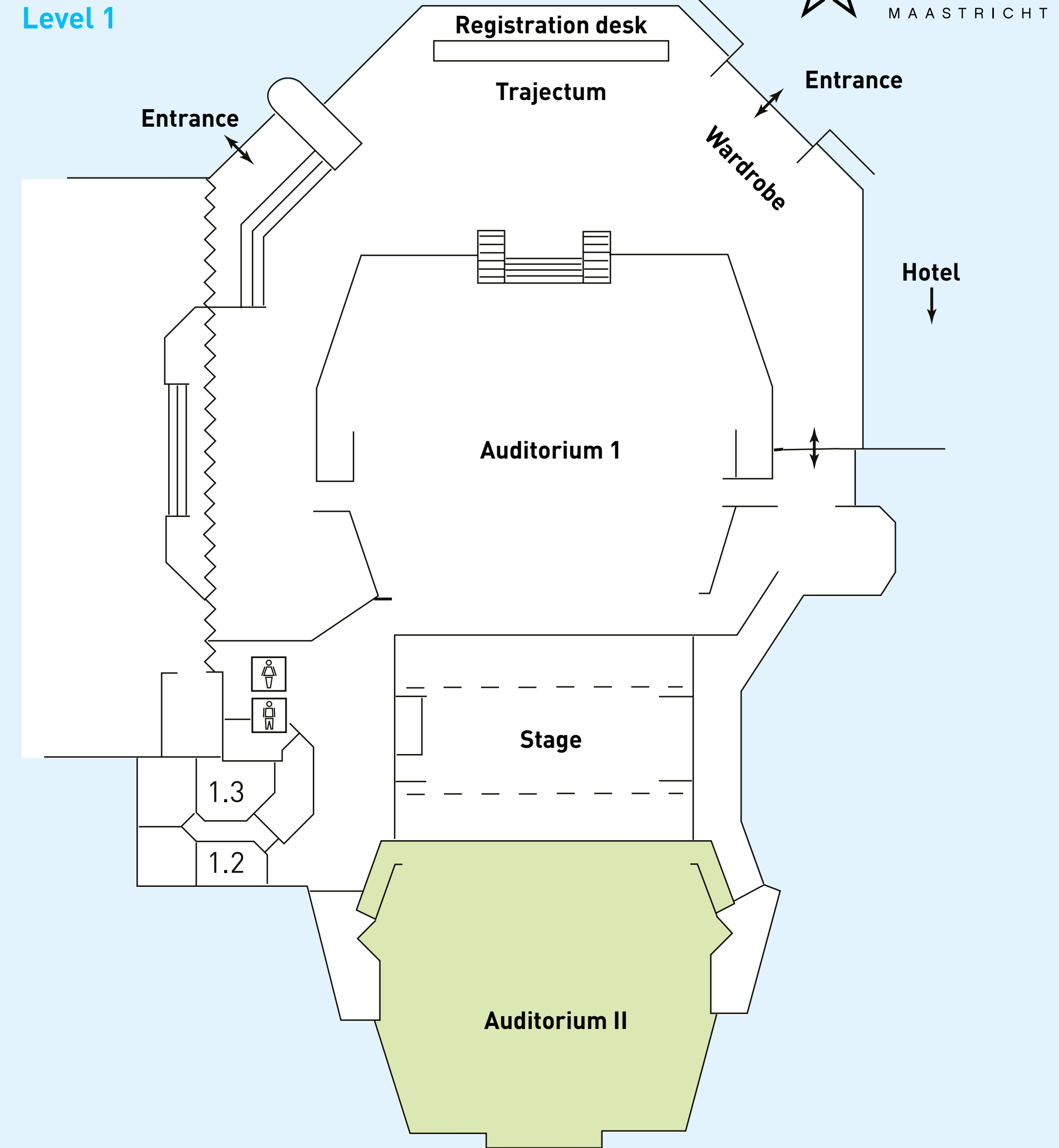
Floorplan

Expo foyer
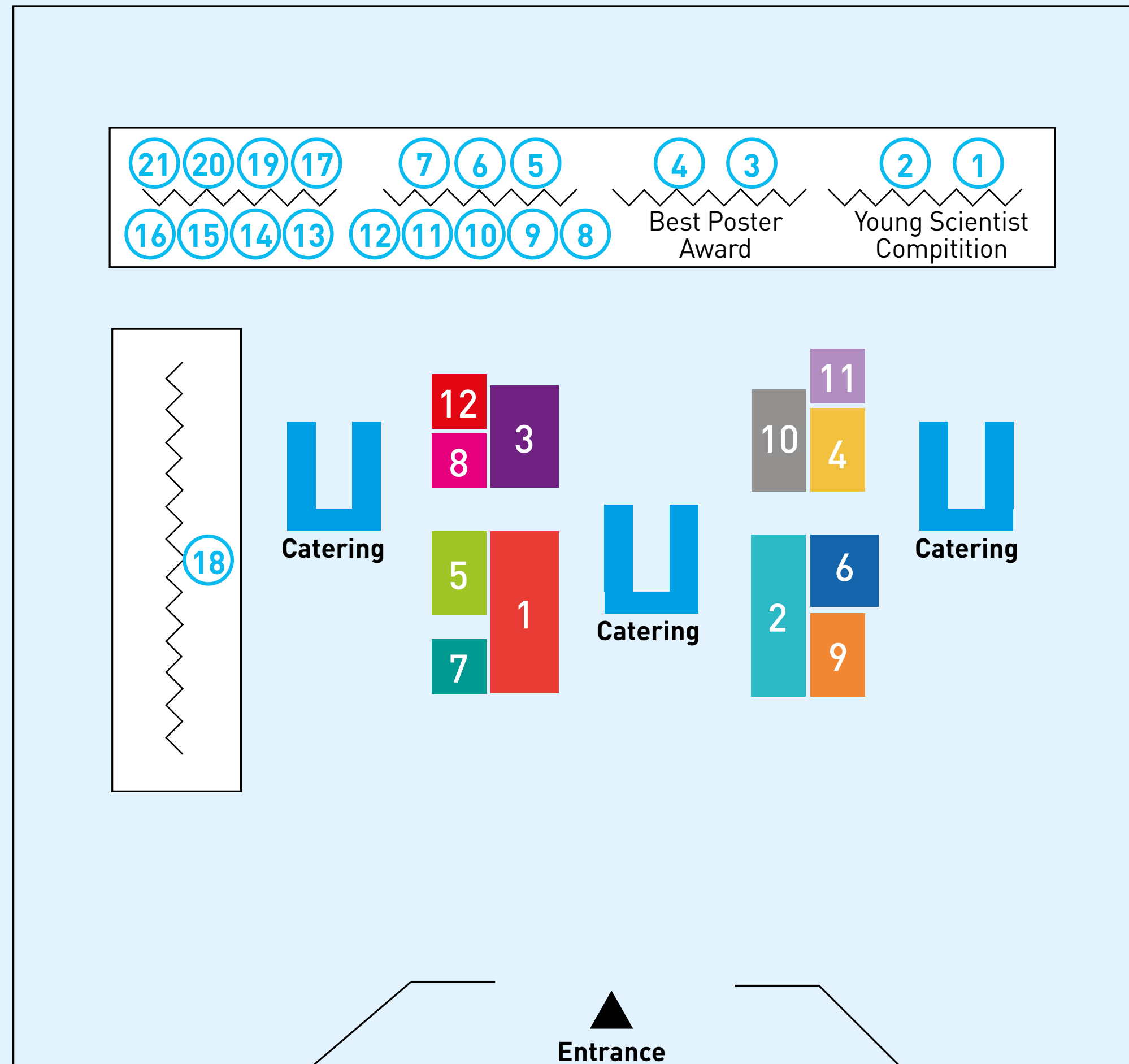
Legend:
- IPSEN Farmaceutica B.V.
- Merz Pharma
- Abbvie
- Will Pharma
- Hankamp Rehab
- IDROGENET - GLOREHA
- Nordic-Neurostim ApS
- Delsys Europe
- Arseus Medical
- DIH (Hocoma + Motek)
- MS Sherpa
- Össur
- Posters Area's

Poster topics:
Topic 1: Action observation/visuomotor imagery
Topic 2: Adaptive devices
Topic 3: Comprehensive rehabilitation programs
Topic 4: Family and environmental support
Topic 5: Functional diagnostics/prognostics
Topic 6: Gait analysis
Topic 7: Guidelines/implementation/reimbursement
Topic 8: Multiple sclerosis
Topic 9: Neuromuscular disorders/neuropathy
Topic 10: Neuropsychiatry/behavioral disorders
Topic 11: Neuropsychology/linguistics
Topic 12: Neurorobotics
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Topic 15: Parkinson's disease
Topic 16: Self-management/empowerment
Topic 17: Spasticity/dystonia
Topic 18: Stroke
Topic 19: Traumatic brain injury
Topic 20: Virtual reality training
Topic 21: Vocational/occupational rehabilitation

Scientific Information

Oral presentations

Please make sure to bring your PowerPoint presentation on USB drive to the congress and hand it in to a technician in the Speaker Preview Room (Room 0.6), upon arrival, but at least 3 hours before your presentation. Please note that you will **NOT** be able to use your own laptop or computer.

Poster presentations

Posters will be displayed throughout the meeting in the exhibition area in the Expo Foyer. The posters are divided per topic. Participants selected to give a poster presentation are required to attend their poster to answer questions during the poster-viewing sessions. All topics, titles and abstract numbers of the presenters are displayed on the poster boards.

Poster set-up and removal times

Please mount your poster before Thursday 1 June 2023, 09.30 hrs., and do not remove it before Friday 2 June 2023, 17.00 hrs. The Congress Secretariat will remove all posters which have not been removed by **18.00 hrs**.

Congress on
NeuroRehabilitation and Neural Repair
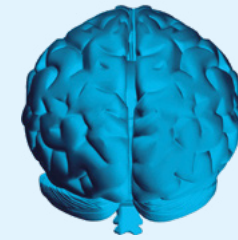
General information

Address details

The congress will take place in the Maastricht Exhibition and Congress Centre (MECC Maastricht). Forum 100, 6629 GV Maastricht.
All parallel sessions will be organised in the congress centre in the Lobby, the plenary sessions will be organised in the Auditorium II. The exhibition, lunch and coffee/tea breaks will be held in the Expo Foyer.

Parking

Parking at MECC Maastricht is € 4 per hour, with a maximum of € 19 per calendar day.
The maximum vehicle height in the parking garage is 2.05 meters.

Registration desk

The registration area in the conference centre will be open for registration and questions:
Wednesday 31 May 2023:   12.00-17.00 hrs.
Thursday 1 June 2023:   08.00-17.30 hrs.
Friday 2 June 2023:   08.00-17.30 hrs.

The registration fee includes:
• Admission to all scientific sessions
• Admission to the exhibition and poster area
• Daily lunch
• Daily coffee breaks
• Digital Programme and proceedings Book
• Attending the get together-drink

Accreditation

The congress is accredited by the following societies:
• ADAP (15 credits)
• NVN (10 credits)
• VRA (16 credits)
• Pro-Q-Kine (24 credits)
• V&VN (18 credits)
• VSR (18 credits)
• NAPA (16 credits)
• FGzPt (16 credits)
• KNGF (15 credits)
• EACCME (14 credits)

Payment registration fee

You can pay the registration fee on-site by credit card or cash. The official currency at the congress is Euros. Cheques and foreign currency are not accepted.

WIFI

You will have WIFI access on-site in the congress centre.
Network: MECC_FREE_WIFI
Password: no password needed

Badges

For security reasons, badges must be worn throughout the congress. Be careful not to lose your badge, as the Congress Committee cannot be responsible for lost badges, tickets or other valuable items. Entrance to lecture halls, poster and exhibition area will not be allowed to any person without a badge.

Certificate of attendance

All participants will receive a digital certificate of attendance by email after the congress.

Collaborating with experts

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Lunch and coffee breaks

Lunches and coffee breaks on Monday, Tuesday and Wednesday will take place in the exhibition area at the Expo Foyer.

Wardrobe

There is an attended cloakroom available at Trajectum. However if possible we would kindly request to leave your luggage in the hotel.

Anything lost?

Please go to the registration desk of the information desk of the MECC at Trajectum.

Language

The official language of the congress is English.

Liability

Upon registration, participants agree that neither the Organizing Committee nor the Conference Management can be subject to any liability concerning participation related activities. Participants should, therefore, organize their own (health and travel) insurance(s).

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Congress on
NeuroRehabilitation and Neural Repair

NL-BTX-230011

Wednesday 31 May 2023

Pre Congress Workshops

13.00-14.30 | Room 0.5
Intensity Workshop
B. Clark & L. Johnson

Delivering rehabilitation intensity - it starts with us! Delivering rehabilitation at sufficient "intensity" to optimise outcomes is a key challenge for rehabilitation service providers. There are many ways in which intensity could be increased, for example through different methods of delivery (e.g. groups or tele-rehab), or through the use of technology. Fundamental to any method for increasing rehabilitation intensity is the patient's ability to engage in the process. This workshop will first explore what is meant by the term intensity, and current evidence for intensity in rehabilitation. We will then focus on key concepts that are important for maximising a person's participation in intensive rehabilitation - with a focus of theories of activation and behavior change. We will discuss the importance of tailored and self-directed rehabilitation, and the changing role of the rehabilitation practitioner as a coach and mentor. Facilitators: Dr Beth Clark and Dr Louise Johnson - from the Wessex Academy for Skills in Personalised Care (WASP)

13.00-14.30 | Room 0.10
B-STARS-rTMS
R Dijkhuizen, J. Vink

Despite improvements in acute stroke therapies and rehabilitation strategies, many stroke patients are left with long-term upper limb motor impairment. A recent RCT and meta-analysis from the UMC Utrecht and Rehabilitation Center De Hoogstraat as well as an international guidelines paper show that contralesional inhibitory rTMS, within the first month post-stroke, can promote upper limb recovery after stroke. During this interactive workshop, we will introduce the background of rTMS treatment, demonstrate rTMS treatment procedures and provide room for people to practice working with TMS. Learning objectives:
• Gain insight into the background and working mechanism of rTMS treatment in the promotion of upper limb recovery after stroke
• Learn how to perform rTMS treatment (use neuronavigation, identify motor hotspot, determine resting motor threshold and execute treatment)
• Gain insight into future perspectives of rTMS treatment in promoting upper limb recovery

13.00-14.30 | Room 0.11
Management of gait impairments after stroke
J.Nonnekes, A. Geurts, J. Kamphuis,
H. van Duijnhoven, J. Buurke, J. Fleuren

Management of gait impairments after stroke is complex and shows a large variation across nations and institutions. During this interactive workshop, we will first introduce a novel framework detailing the causes of gait impairments after stroke. We then show how this knowledge can contribute to selecting the optimal treatment strategy, involving both training and medical-technical interventions, and obviously taking patient preferences into account. The role of instrumented gait analysis will be discussed and individual examples of treatment results will be given.
Learning objectives workshop:
• to gain insight into the underlying causes of gait impairments after stroke
• to gain insight into how clinical tests and instrumented gait analysis can contribute to understand individual gait impairments
• How to select treatment options for gait impairments after stroke.

Wednesday 31 May 2023

Pre Congress Workshops

14.30-16.00 | Room 0.4
Contrast 2.0 The assessment protocol
The Contrast/Impulse- consortium: how a new collaboration with neurologists and radiologists creates opportunities for neurorehabilitation research
C. Meskers & R. Selles

This workshop aims to highlight the opportunities that arise from a close collaboration between research in acute and chronic care for neurorehabilitation of stroke patients. The CONTRAST (COllaboration for New TReatments of Acute STroke) is a nationwide Dutch collaboration of academic researchers, private and public partners aiming to improve outcome of patients with stroke by merging translational research and pragmatic randomized clinical trials. Initially, CONTRAST focused acute treatment by improving and optimizing microvascular reperfusion. Recently, the consortium's scope enlarged to the subacute and chronic phase. In this workshop we will discuss a blueprint for a collaborative comprehensive research effort to optimize and improve long term outcome of stroke patients adopting a seamless progression from acute to chronic care. Topics involve:
• From acute to chronic care: Introducing the contrast consortium
• Theoretical background: from recovery to participation
• Long term follow-up and health care consumption: the contrast minimal assessment battery
• Understanding neurological recovery and prediction of outcome: the contrast extended assessment battery
• Contrast's Infrastructure and health economics (Lahr/Buskers)
• Discussion and participants input for the study protocols

14.30-16.00 | Room 0.5
Developing understanding of Systematic Reviews, Guidelines and Consensus-based Recommendations
B. Elsner & G. Verheyden

Current developments in the field of systematic reviews, such as (i) the GRADE-approach for grading the evidence strength, (ii) Network Meta-Analysis and (iii) Machine Learning for streamlining the literature search process of systematic reviews are highlighted and examples from neurorehabilitation are provided.Methodology, results and reflection for two recent consensus-based agreements in the domain of motor rehabilitation after stroke will be presented. In particular, the approach that was applied for developing the definition for motor rehabilitation after stroke as well as for the core set of clinical outcomes for sitting and standing balance and walking will be discussed.

14.30-16.00 | Room 0.10
Measurement of Cognition
C. van Heugten & F. Domensino

After an acquired brain injury, many people have cognitive impairments which can persist into the long term. Cognitive functioning can be measured on many different levels of functioning. How cognition is measured depends on the purpose of the assessment. Cognitive screening should be done to detect cognitive deficits at an early stage which will give information for further diagnostic assessment and treatment planning. In a diagnostic setting, the focus will be on detecting neurological dysfunction and guiding the differential diagnosis, and identifying the cognitive strengths and weaknesses. In addition to cognitive testing, information from the medical history, the intake, hetero-anamnesis, observations and questionnaires are used. In a rehabilitation setting,, it is important to gather information on the influence of cognitive functioning in daily life. For this purpose many different assessment techniques are available which can be discussed on a continuum from test situation to daily life experiences. In this workshop, the difference purposes and methods of measuring cognition will be considered in an interactive discussion with the participants based on their own practice.

14.30-16.00 | Room 0.11
Functional electrical stimulation clinical practice guidelines to support walking in upper motor neuron conditions
T. Street, A. Adonis, J. Burridge

Functional electrical stimulation (FES) has been used for over 25 years in clinical practice to support mobility for people with an upper motor neuron diagnosis such as multiple sclerosis and stroke. Despite increasingly becoming a standard treatment, until recently there have been no established clinical practice guidelines (CPG) to support delivery of treatment. Recently, clinical practice guidelines have been developed to support walking for all upper motor neuron conditions.
The objectives of the workshop are to:
• Describe how the recently developed FES CPG were developed and what they recommend.
• Understand how the recommendations may have an impact on clinical practice.
• Identify and understand potential barriers to implementing CPGs as well as strategies for overcoming potential barriers through shared experience and learning.
• Share experience CPG implementation and critically evaluate for future best practice.

Wednesday 31 May 2023

Pre Congress Workshops

16.30-18.00 | Room 0.10
Virtual reality in neurorehabilitation: entertainment or treatment?
E. Swinnen, A. van Bladel, I. Brunner

This workshop aims to explore:
- different virtual reality options for gait and upper limb rehabilitation in neurological populations.
- the advantages but also the pitfalls of using virtual reality for rehabilitation in neurological populations.
- the literature gaps concerning the use of virtual reality for gait rehabilitation in neurological populations.
- recent data concerning the influence of different modalities (i.e. level of immersion and optic flow speed) on the movement pattern of stroke survivors.
- recent data concerning the use of VR for unilateral spatial neglect and upper limb motor training in stroke survivors
- case studies of using virtual reality in stroke survivors, patients with brain injuries and patients with an incomplete spinal cord injury.

16.30-18.00 | Room 0.11
High Intensity Training and Physical Fitness Training for PD
E. van Wegen

This workshop focuses on the use of high intensity interval training (HIIT) as a potentially effective intervention in people with Parkinson's disease. There is growing evidence that HIIT can lead to improved motor and non-motor function, cardiovascular health and quality of life in people with Parkinson's.The workshop starts with an introduction of the rationale behind the use of HIIT in Parkinson's disease. Subsequently, it is discussed how exercise testing can be used to determine individual training intensity and how training protocols can be adapted to the individual needs of the participants.The emphasis is on developing a safe and effective exercise program, teaching participants how to adjust exercise intensity based on individual symptoms and how to monitor exercise progression. Other topics covered are the measurement of effects of HIIT on motor and non-motor function, balance, strength and endurance in people with Parkinson's. Participants will gain insight into the latest research findings on HIIT in Parkinson's and how these findings can be applied in practice.Finally, attention is paid to the role of the therapist in guiding patients in HIIT. This includes aspects such as monitoring training intensity, adapting training protocols to individual needs and supporting participants in achieving their goals. All in all, this workshop provides therapists and researchers with a practical and scientifically based overview of the use of HIIT in people with Parkinson's disease.

Thursday | June 2023

Keynotes

10.00-11.00 | Auditorium II
Global Collaborations to Advance Science in Stroke Rehabilitation and Recovery
J. Bernhardt
The Florey Institute of Neuroscience and Mental Health, Heidelberg, Australia

We are constantly encouraged to collaborate. In science, some of the most impactful discoveries of our time have happened when diverse groups of thinkers came together. Yet collaboration is not a simple endeavour, it comes with risk, challenge, effort, and it is not always successful. In this talk, Julie – a 'serial collaborator' - will talk about why she collaborates and what can be gained by it. She will outline work that she has undertaken to build research teams in hospital settings to undertake global clinical trials (like AVERT and AVERT DOSE) as well as consensus building between international clinicians, researchers and scientists in stroke recovery and rehabilitation (such as SRRR and ISRRA). Throughout the talk she will share some of the lessons she has learnt and provide tips for effective collaboration.

16.30-17.30 | Auditorium II
Translation between experimental and clinical stroke recovery studies – challenges and opportunities
R. Dijkhuizen
University Medical Center Utrecht, The Netherlands

Studies in animal models, mostly with small rodents, have provided critical insights into mechanisms of brain injury and plasticity that influence functional outcome after stroke. Rodent models, involving small or large vessel occlusion, mimic essential aspects of stroke pathophysiology that are also evident in patients. Moreover, the application of research methods that are also available in clinical settings, such as magnetic resonance imaging (MRI), has improved the translational potential of preclinical studies in animals. However, translational stroke research may be limited by differences in stroke pathology, time course of recovery and functional testing between stroke patients and rodent models. Guidelines to enhance the alignment of clinical and preclinical stroke recovery research have recently been published by the Stroke Recovery and Rehabilitation Roundtable consortium. For example, assessment of skilled reaching movement patterns, which show significant homologies between humans and rodents, has been proposed as one of the most potent translational behavioral tests for studying post-stroke recovery in rodents. In my lecture I will discuss how preclinical research in rodent models may aid in the elucidation of underlying mechanisms of post-stroke loss and recovery of function, and in the development of novel diagnostic and therapeutic strategies.

Thursday 1 June 2023

Invited Lectures

11.30-12.00 | Room 0.11
Predicting motor neurorehabilitation outcome
U. Ziemann
University of Tübingen, Tübingen, Germany

Introduction / Objective: Motor stroke recovery often follows the proportional recovery rule but there are many exceptions that are not well understood. Therefore, there is still a strong unmet need to improve prediction of motor stroke recovery at the individual level.
Methods: This presentation will provide a survey of recent findings using, in addition to clinical stroke severity, markers from transcranial magnetic stimulation (TMS), diffusion weighted MRI, TMS-EEG, quantitative EEG, resting-state functional MRI connectivity, and TMS-induced long-term potentiation (LTP)-like plasticity for individual motor stroke recovery prediction. The presentation will also include a summary of the recent Tübingen MWKNeuroReha study that employs a prospectively obtained big data set for stroke recovery prediction [Blum et al. 2022, BMC Neurol 22:238]. Finally, another study will be presented that uses TMS-EEG for prediction of post-stroke delirium, a frequent and with regard to outcome unfavorable complication in acute stroke [Bai et al. 2023, Clin Neurophysiol, 10.1016/j.clinph.2022.11.017].
Results: Preserved motor evoked potentials, low lesion load of the corticospinal tract, high-complexity TMS-EEG responses, functional connectivity in the ß-frequency band in the ipsilesional sensorimotor cortex, and preserved LTP-like plasticity in ipsilesional motor cortex predict good motor stroke recovery. High-complexity TMS-EEG responses in the acute stroke stage predict a low risk for post-stroke delirium.
Discussion: Combining clinical, neurophysiological and imaging markers enhances the accuracy of individual motor stroke recovery prediction.
Conclusion: Findings are potentially important for individualization of motor stroke rehabilitation treatment.
Acknowledgments: The MWKNeuroReha study was funded by the Ministry of Science and Arts of the Federal State Baden-Württemberg (42-5400/75/1).

14.30-15.00 | Room 0.11
Monitoring multiple sclerosis in daily life
D. Kos
KU Leuven & National MS Center Melsbroek, Leuven, Belgium

Introduction / Objective: Monitoring multiple sclerosis (MS) activity, symptoms and activity performance in daily life may support the understanding of the progression and consequences of the disease. This on its turn may facilitate the development of tailormade rehabilitation interventions.
Methods: Taking into account different elements of the International Classification of Functioning, disability and health (ICF), a comprehensive monitoring of disease activity, symptoms and functioning in daily life can be made possible. Apart from the function and activity level, activities, participation, personal and environmental factors can be monitored in real-life.
Results: Monitoring MS and its consequences in daily life can be performed using wearable devices, (smartphone) technology, patient reported measures or remote assessment.
Discussion: In this presentation, several initiatives and devices developed and evaluated in real-life circumstances in people with MS will be discussed.
Conclusion: Monitoring multiple sclerosis in daily life comprises various levels of function and functioning, can be performed by multiple devices and methods and may provide insights to guide prevention and rehabilitation of (the progression of) the disease.
Acknowledgments: This presentation is inspired by the work of the international network for best practice and research "Rehabilitation in MS" (RIMS), the Patient-Reported Outcome Measures for MS (PROMS) initiative and the International Advisory Committee on Clinical Trials in Multiple Sclerosis.

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Tailoring treatment to enhance upper limb recovery based on individual levels of sensorimotor impairment in people living with stroke

Application of principles of threshold control to improve sensorimotor outcomes after stroke

F. Levin [1], G. Feldman[2]
[1] McGill University, Montreal, Canada
[2] University of Montreal, Montreal, Canada

Introduction / Objective: The threshold control theory of motor control describes how central regulation of reflexes results in different motor actions such as muscle relaxation, motion, and isometric torque production.[1,2] Control is exerted by the CNS via descending systems mediating both direct and indirect influences on motoneurons. Control is manifested as the specification and regulation of Tonic Stretch Reflex Thresholds (TSRTs) in specific muscles. CNS injury leads to deficits in TSRT regulation and limitations in kinematic redundancy, appearance of abnormal muscle activation in specific joint ranges, and adoption of compensatory movements during task performance.[3] These problems lead to decreased functional ability and the ability to adapt movements to unexpected situations.
Objective: To describe the threshold control theory and how reduced threshold control due to CNS pathology results in altered movement patterns and decreased adaptability during reaching movements.
Methods: Reaching movements involving different degrees of freedom and in response to perturbations and changes in external load conditions will be used to illustrate the capacity for kinematic adaptation in people with stroke.
Results: Deficits in threshold control lead to the appearance of abnormal muscle activation patterns in agonist and antagonist muscles as well as to spasticity in the specific joint range defined by the upper limit of TSRT regulation. As a result, people with even mild stroke may use compensatory movement patterns and have difficulty in rapidly changing elbow-shoulder interjoint coordination patterns to adapt reaching movements to sudden perturbations of trunk or arm motion.[4-6]
Discussion: Altered movement patterns resulting from deficits in threshold control can also mask the capacity of post-stroke subjects to correct reaching errors when changes in external conditions occur[7] and may influence the capacity for motor learning.

Conclusion: Recommendations based on the threshold control theory for improving post-stroke sensorimotor outcome will be discussed.
References
1 Feldman AG, Levin MF. BehavBrainSci 1995;18:723-806
2 Lashley KS. In LA Jeffress (Ed), Cerebral_mechanisms_in_behavior. 1951:112-131. Wiley
3 Levin MF, Feldman AG. BrainResearch, 1994;657:23-30.
4 Shaikh T etal. NeurorehabilNeuralRep, 2014;28(4):355-366.
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7 Subramanian S.K. etal. NeurorehabilNeuralRep, 2020;34(3):210-221.

Unraveling stroke recovery by combining motor performance and movement quality

D. Piscitelli
University of Connecticut, Storrs, United States

Introduction: Six months after stroke, 50-70% of patients still experience impairments in upper limb (UL) function. In neurorehabilitation, a relevant question is whether sensorimotor improvements of the most-affected UL result from the recovery of impaired motor elements or the implementation of compensatory motor patterns[1]. Recovery can be investigated by combining movement performance (i.e., accuracy, speed, straightness of trajectory) and movement quality (i.e., spatial-temporal characteristics of individual joints and inter-joint coordination)[2]. Various Methods have been described to detect compensation during movements, e.g., hypothesis-driven description of spatial-temporal indices of movement variability, i.e., the Uncontrolled Manifold (UCM)[3] analysis, stochastic models and sagittal trunk displacement during reach-to-grasp.
Objective: To describe how the UCM[3] analysis and a novel Trunk-based Index of Performance (IPt)[4] that combines motor performance (i.e., endpoint accuracy and speed) and movement quality (i.e., trunk displacement) during reaching movements may differentiate between recovery and compensation in neurological populations.
Methods: Preliminary evidence about the clinical application of the UCM during functional tasks and the IPt will be reviewed and discussed.

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Results & Discussion: The UCM can differentiate between recovery and compensation by analyzing task-related variability in spatial and temporal domains. However, the computational complexity and the underlying Methods to collect kinematic variables during multiple trials with specific constraints hinder its clinical application. The IPt has appropriate metric properties and has potential for clinical use, but further validity and reliability studies are needed.

Conclusion: The assessment of kinematic variables, through the UCM and the IPt may be used to track sensorimotor UL recovery in stroke.

References

1 Levin MF, et al. What do motor "recovery" and "compensation" mean in patients following stroke? NNR. 2009;23:313-319.

2 Kwakkel G, et al. Standardized Measurement of Quality of Upper Limb Movement After Stroke: Consensus-Based Core Recommendations From the Second Stroke Recovery and Rehabilitation Roundtable. NNR. 2019;33(11):951-958.

3 Solnik S, et al. Movement Quality: A Novel Biomarker Based on Principles of Neuroscience. NNR 2020;34(12):1067-1077.

4 Piscitelli D, et al. Psychometric Properties of a New Measure of Upper Limb Performance in Post-Stroke Individuals: Trunk-Based Index of Performance. NNR. 2023;37(1):66-75.

Do neuroimaging biomarkers predict upper limb reaching performance to transcranial direct current stimulation?

L. Chen
University of Toronto, Toronto, Canada

Introduction / Objective: Transcranial direct current stimulation (tDCS) paired with neurorehabilitation may enhance stroke motor recovery. Original studies applied tDCS to inhibit an overactive contralesional motor cortex (cM1) based on the interhemispheric inhibition model. A subsequent Bimodal Balance-Recovery Model considers individual differences and suggests that the presence of an overactive cM1 may depend on the level of motor impairment. This newer model predicts: 1) individuals with less corticospinal (CST) damage will improve more from cathodal tDCS to inhibit an overactive cM1; 2) individuals with greater CST damage will improve more from anodal tDCS to facilitate cM1 activity.

Objective: To describe the different models and discuss the evidence that underlies tDCS application to enhance stroke motor recovery.

Methods: Preliminary evidence will be presented on how the amount of CST damage and type of tDCS (anode or cathode to cM1) influences the motor re-learning of a functional reaching task in patients with chronic stroke. Our novel approach also considers how behavioural recovery and compensation are affected by tDCS.

Results: Improvements in motor performance of the upper limb were greater with cathodal tDCS to cM1 as compared to anodal or sham tDCS. Individuals with greater CST damage showed smaller improvements with anodal tDCS to cM1, as compared to cathodal tDCS.

Discussion: Preliminary findings do not support the Bimodal Balance-Recovery Model.

Conclusion: We require more studies to fully evaluate the Bimodal Balance-Recovery Model as well as more discussions as to how to advance the field of tDCS research for stroke motor recovery.

11.30-13.00 | Room 0.5
Cochrane Rehabilitation and Cochrane reviews
B. Elsner - co chair G. Verheyden

Non-pharmacological interventions for spatial neglect after stroke

T. Platz
BDH-Klinik Greifswald, Greifswald, Germany

Introduction / Objective: Spatial neglect is defined as the inability to respond to sensory stimuli in the contralesional hemispace or –body of a neurological patient (Kerkhoff 2001, Husain 2008). Results of the Cochrane Systematic Review on *Non-pharmacological interventions for spatial neglect or inattention following stroke and other non-progressive brain injury* (Cochrane Database of Systematic Reviews 2021, Issue 7. Art. No.: CD003586.) will be summarized and the relevance of its findings for clinical decision making commented on. The review's main objective was to determine the effects of nonÐpharmacological interventions for people with spatial neglect after stroke and other adultÐacquired non-progressive brain injury.

Methods: The authors of the CSR searched for and included randomised controlled trials (RCTs) of any non-pharmacological intervention specifically aimed at spatial neglect. They excluded studies of general rehabilitation and studies with mixed participant groups, unless separate neglect data were available. The review authors categorised the interventions into eight broad types deemed to be applicable to clinical practice through iterative discussion: visual

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interventions, prism adaptation, body awareness interventions, mental function interventions, movement interventions, non-invasive brain stimulation, electrical stimulation, and acupuncture. They assessed the quality of evidence for each outcome using the GRADE approach.

Results: The authors included 65 RCTs with 1951 participants, all of which included people with spatial neglect following stroke. Most studies measured outcomes using standardised neglect assessments. Fifty-one studies measured effects on ADL immediately after completion of the intervention period; only 16 reported persisting effects on ADL (our primary outcome).

Discussion: Evidence from RTCs is available for different forms of non-pharmacological interventions for spatial neglect after stroke. Trials published so far can be considered „proof of principle" studies. The evidence is not sufficient to generate precise estimates of therapeutic effect and there is a substantial risk of bias. Accordingly, our confidence in the estimates of therapeutic effect is still low. Positive treatment effects both for neglect symptoms and ADL functions were documented for awareness interventions, movement interventions, non-invasive brain stimulation (rTMS & tDCS) and acupuncture, and (only) for neglect symptoms also for electrostimulation (TENS & GVS).

Conclusion: Based on evidence, these intervention can therefore be considered therapeutic options.

Cochrane Rehabilitation: what we can do for you

G. Verheyden

KU Leuven - University of Leuven, Leuven, Belgium

In this talk, Cochrane Rehabilitation will be presented, which is a 'Field' within the Cochrane Collaboration formally approved in 2016. The vision of Cochrane Rehabilitation is a world where all clinical decisions in rehabilitation are based on the best available evidence that is easily accessible and understood by all rehabilitation stakeholders. The mission of Cochrane Rehabilitation is to improve the production, synthesis, dissemination, implementation and impact of rehabilitation evidence at an individual, organisational and health policy level, with a global view beyond professions, culture, language and economic resources. The aim is to promote evidence-based clinical practice that integrates research evidence with clinical expertise and patient values. In the presentation, past, present and future initiatives will be given.

Trunk training following stroke?

L. Thijs [1], E. Voets [2], S. Denissen [2], J. Mehrholz [2], B. Elsner [2], R. Lemmens [2], G. Verheyden [2]
[1] UHasselt, Hasselt, Belgium
[2] KU Leuven - University of Leuven, Leuven, Belgium

Introduction / Objective: Earlier, systematic reviews and randomized controlled trials have examined the impact of trunk training after stroke. There is still uncertainty regarding the extent of outcome. The aim of this review was to evaluate the impact of trunk training on individuals after stroke, with a focus on various outcomes. In this review it was considered whether the comparative group was dose-matched (with an equal number of minutes) or non-dose-matched (with a different number of minutes).

Methods: We searched nine different databases (last searched October 2021) and further searched trial registries to identify additional relevant published, unpublished, and ongoing trials. We selected randomised controlled trials of trunk training versus non-dose-matched or dose-matched control therapy including adults (18 years or older) suffering from either ischemic or hemorr-hagic stroke. We used methodological procedures described in the Cochrane Handbook for Systematic Reviews. Results were pooled, using standardized mean differences with 95% confidence intervals, where appropriate and the quality of evidence was assessed by applying GRADE assessment.

Results: We included a total of 68 trials with 2585 participants in this review. In the examination of non-dose-matched groups it was observed that trunk training had a positive impact on activities of daily living, trunk function, arm-hand function, arm-hand activity, standing balance, leg function, walking ability, and quality of life. However, there was no significant difference in serious adverse events for non-dose-matched trunk training. Conversely, in the analysis of dose-matched groups trunk training was found to positively affect trunk function, standing balance, leg function, walking ability, and quality of life, but not activities of daily living and arm-hand function or activity. In this case as well, no significant difference in serious adverse events was noted for dose-matched trunk training.

Discussion: The reporting of serious adverse events was underreported, with only two trials indicating that someone fell during the trial. The degree of certainty varied from very low to moderate depending on the specific outcome measured.

Conclusion: The available evidence suggests that including trunk training in stroke rehabilitation programs can result in improvements in various areas.

Acknowledgments: We would like to thank all who contributed to this research.

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Noninvasive analysis of overactive, spastic muscle structure and elasticity after botulinum toxin type A injection: a systematic review and meta-analysis

M. Devis[1], F. Lecouvet[2], T. Lejeune[3], G. Stoquart[3]
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[2] Cliniques universitaires Saint-Luc, radiology, Brussels, Belgium
[3] Cliniques universitaires Saint-Luc, physical and rehabilitation medicine, Brussels, Belgium

Introduction: Injections of botulinum toxin type A (BoNT-A) are the first-line treatment for muscle overactivity (MO). Some authors observed that BoNT-A injections lead to changes in muscle structure and elasticity that are probably not completely reversible. This possible effect is critical, as it could negatively impact the effectiveness of BoNT-A interventions.
Main Objective: We aimed to evaluate the current literature regarding changes in muscle elasticity and structure after BoNT-A injection, by diagnostic imaging, in neurological populations with MO. Our second objective was to pool all articles published on this topic in order to provide a quantitative synthesis of the data.
Methods: A systematic search was conducted using different databases in accordance with PRISMA guidelines. Two independent reviewers screened articles for inclusion, extracted data, and evaluated methodological quality of the studies. A meta-analysis was performed to compare muscle elasticity and structure before and after BoNT-A injections.
Results and Discussion: A sample of 31 studies was selected for qualitative review and 17 for quantitative review. Meta-analysis of pre-post studies demonstrated significant decrease of muscle elasticity assessed by ultrasound elastography (USE) 4 weeks after BoNT-A injection. No statistically significant difference was found for muscle thickness, pennation angle, and muscle echo-intensity assessed by MRI and/or US at short-term. On the other hand, normalized muscle volume decreased at long-term after BoNT-A injection.
Conclusion: Muscle elasticity measured by USE decreases with a temporary effect at short-term following BoNT-A injections. Synthesis of studies that assesses muscle structure is hindered by methodological differences between studies. However, normalized muscle volume seems to decrease at long-term after BoNT-A injections suggesting that re-injections should be postponed after 6 months. Further work should focus on the long-term effect of repeated injections on muscle structure and elasticity in neurological populations.
Acknowledgements: We would like to thank Charles Rabet who participated in screening articles for inclusion, extracting data, evaluating quality of the studies.

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Prognostic models to predict long-term recovery of independent walking after stroke: a systematic review

N.C. Wouda[1], B. Knijff[2], M. Punt[2], J.M.A. Visser-Meily[1], M. Pisters[3]
[1] Center of Excellence for Rehabilitation Medicine, Utrecht, Netherlands
[2] University of Applied Sciences Utrecht, Utrecht, Netherlands
[3] University Medical Center Utrecht, Utrecht, Netherlands

Introduction: Patients recovering from a stroke experience reduced participation especially when they are limited in daily activities involving walking. Therefore, it is necessary to gain insight in predicting the recovery of independent walking after stroke. Insight in the recovery of independent walking, can be used by clinicians in the decision-making process and to inform patients about the recovery potential, resulting in more personalized stroke rehabilitation.
Main Objective: This systematic review provided an overview of current evidence about prognostic models and its performance to predict recovery of independent walking (i.e. walking without physical assistance) after stroke.
Methods: In MEDLINE, CINAHL and Embase we searched for all relevant studies in English and Dutch. Descriptive statistics, study methods and model performance in terms of discrimination (AUC value, overall accuracy, sensitivity and/or specificity) were extracted and divided into three phases: subacute phase, chronic phase after stroke and community walking.
Results and Discussion: Only sixteen papers (in total 2727 stroke patients) fulfilled all the search criteria, in which 30 prognostic models were developed. Six prognostic models showed an excellent performance (AUC value and/or overall accuracy ↗.90). The CART model of Smith et al (2017) showed highest overall accuracy (100%) in predicting the ability of independent walking in the subacute phase after stroke.
Conclusion: Recovery of independent walking can be predicted in several phases after stroke. Six prognostic models with excellent accuracy were identified. However, proper external validation and the applicability in clinical practice of identified prognostic models is still lacking due to the time consuming and burdensome test sets.
Acknowledgements: There are no conflicts of interest to declare. This study is part of the 'Making Sense of Sensor Data for Personalized Healthcare' consortium and was funded by the Taskforce for Applied Research SIA (RAAK.PRO03.006), part of the Dutch Research Council.

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Can therapists estimate therapy dose dimensions? A comparison between patient, therapist, and objective outcomes in (sub)acute rehabilitation

N. Bertels[1], H. Seelen[2], A. Spooren[1]

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Introduction: Arm-hand training at an intensive and individualized dosage potentially provides a powerful stimulus for neurological recovery. The current dosage is based on therapists' experience and subjective feelings, which might differ from patients' perceived dosage.
Main Objective: To assess differences in therapy dose dimensions (TDD) between patients' and therapists' perceptions and between therapists' perceptions and objective measured TDD in (sub)acute arm-hand therapy in PwC-SCI.
Methods: In this longitudinal observational study in 3 rehabilitation centers, PwC-SCI and their therapists estimated TDD difficulty and intensity of arm-hand therapy using a VAS. Active minutes within a session were estimated by the therapist and objectively measured using video recordings of the therapy. Measurements were taken during 3 weeks between 4-24 weeks post-injury, with an interval of 8 weeks, during 3 days per week. Paired sample T-test was used to assess differences.
Results and Discussion: The ongoing study measured 73 arm-hand sessions, including 8 patients (lesion C1-C5, mean age of 56.13 years SD(12.11) and mean post-injury weeks 7.5 SD(1.6) at inclusion) and 16 therapists (mean experience of 11.7 years SD(9.22)). Therapists estimated the difficulty (M(4.89);SD(2.08)) and intensity (M(4.97); SD(2.19)) significantly higher (p←0.005) than perceived difficulty (M(4.03); SD(2.43)) and intensity (M(3.66); SD(2.26)) by the patients. Fifty sessions (mean session length 40'03''; SD(25'12'')) were included for estimating active time. Therapists estimated the active time (M(29'44''); SD(20'30'')) significantly higher (p=0.003) than objectively measured (M(23'22'');SD(12'21'')).
Conclusion: These preliminary results indicate that therapists overestimate all TDD compared to patient perception and objective measurement. Updated results will be presented at the conference.
Acknowledgements: Not applicable.

11.30-12.00 Motor and Non-motor symptoms of Parkinson's Disease: avenues for rehabilitation

Chair: A. Nieuwboer

12.00-12.30 Motor learning for upper limb skills, pro's and cons of dual task practice

J. De Vleeschauwer

Dual tasking is highly relevant for daily life, yet impaired in patients with Parkinson's disease (PD) due to the loss of motor automaticity. Moreover, the motor learning process and more specifically, consolidation of learning is affected in PD due to the dopaminergic degeneration in the basal ganglia. Nevertheless, dual task training of gait and balance has been shown to be effective in mild to moderately affected PD patients. Unfortunately, dual training for upper limb activities has not been investigated extensively, yet manual dexterity deficits greatly affect daily life activities. Nackaerts et al. (2016) showed that intensive amplitude training, combining single and dual task training, significantly improved writing size, even at six weeks of follow-up. However, transfer to writing on paper was not maintained, indicating the typical difficulties with consolidation in PD. Therefore, novel strategies to boost motor learning and enhance consolidation are thus imperative. Pauwels and colleagues (2015) demonstrated that motor learning through contextual interference helped upper limb training in older adults. They showed that offering training in a random sequence, rather than simple blocked practice, was initially less effective for acquisition but in the long term more beneficial for consolidation. Along the same lines, increasing training complexity through dual task training could have a similarly advantageous effect for achieving sustained improvements in PD. Ongoing work in our group is investigating this very question by comparing dual task with single task training of touchscreen skills. Overall, we conclude that optimized motor learning programs, especially via the delivery of complex task training, could offer important avenues for future rehabilitation in PD.

12.30-13.00 Leveraging sleep and other non-motor symptoms for optimal rehabilitation effects

M. Gilat

Rehabilitation for people with Parkinson's disease (PD) requires a multidisciplinary approach. Indeed, besides motor symptom severity, several non-motor factors impact on training adherence that could determine treatment success. Moreover, motor learning is integral to

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many rehabilitation strategies for PD and yet the ability to learn and retain new motor skills is impacted by the disease. In this presentation I will therefore discuss the non-motor determinants of treatment adherence, as well as, how we may be able to leverage on non-motor features, such as sleep, to achieve optimal rehabilitation effects in the future.

Training for early motor problems, what are the best evidence-based options?
N. de Vries

Increasing evidence indicates that different types of exercise are effective in improving motor symptoms and quality of life of people with Parkinson's disease (PD). In addition, exercise is, one of very few available interventions for which there human and laboratory evidence for a disease-modifying potential. The mechanisms of action underlying these effects remain largely unknown. However, long-term adherence to exercise is a huge challenge and technology (i.e. gaming, remote tracking) may help in making exercise more feasible and fun. In this session, I will give an overview of the evidence on the effects of exercise in PD. I will also focus on how technology may be used to improve long term adherence.

14.30-16.00 | Room 0.10
Exercise therapy - a cornerstone in MS rehabilitation
U.D. Dalgas
Aarhus University, Aarhus , Denmark

Introduction / Objective: For many years, exercise was controversial in multiple sclerosis (MS) and thought to exacerbate symptoms and fatigue. However, having been found to be safe and effective, exercise has become a cornerstone of MS rehabilitation and may have even more fundamental benefits in MS by having potentially disease modifying effects. The aim of the presentation is to provide an overview of the existing knowledge on the effects of exercise as primary, secondary, and tertiary prevention in MS.
Methods: The presentation will critically cover the most recent literature published in the field.
Results: While initial studies established exercise as an effective symptomatic treatment (i.e., tertiary prevention), more recent studies have evaluated the disease-modifying effects (i.e., secondary prevention) of exercise as well as the impact on the risk of developing MS (i.e., primary prevention). Based on the existing evidence the "exercise induced postponement theory" will be presented.

Discussion: The presentation will cover and discuss some of the remaining challenges in the field including understudied patient populations, sustained behavior change, and relapse management.
Conclusion: Exercise is safe and beneficial for people with MS and should already at an early stage be individually prescribed and tailored as "medicine" to persons with MS, alongside conventional medical treatment.
Acknowledgments: The NNR conference is acknowledged for putting this topic on the agenda and for the invitation to speak. Also, members of the Neuroexercise team at Aarhus University in Denmark is acknowledged for their hard work in developing this research field.

Effects of Exercise Training on Physical Functions of people with Multiple Sclerosis
C.R. Ramari
University of Hasselt, Diepenbeek, Belgium

Introduction/Objectives: Multiple Sclerosis (MS) is an auto-immune and neurodegenerative disease of the central nervous system, which affects young adults worldwide. MS is a heterogeneous disease with different symptoms. MS disease affects physical functions (i.e., the ability to perform both basic and instrumental activities of daily living) in multiple domains of the International Classification of Functioning, Disability and Health (ICF) framework for describing and measuring disability and health from the World Health Organisation's (WHO). In order to recover physical functions and prevent the worsening of the MS symptoms over time, there is now compelling evidence for the beneficial effects of exercise for people with MS based on a proliferation of research over the past two decades. The objectives of this workshop are; To summarize the overall effects of exercise training on the ICF domains related to physical functions in persons with MS; To present the evidence on the effects of exercise training on physical functions according to the disability level (i.e., mild, moderate and severe MS).
Methods: Review of the literature presenting the effects of exercise training on physical functions of people with MS.
Results: General exercise can positively impact physical functions from different domains of the ICF. At the body function level, depending on the type of exercise, it can have a major impact on cardiorespiratory or muscle function. Beneficial effects on gait pattern, voluntary movement control and fatigue (perceived and objectively measured) are also reported. At the activity level of the ICF, physical training can lead to improvements of both walking speed and endurance, as well as in different mobility outcomes.
Discussion: Although there are improvements in physical functions, most of the studies

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include mild MS patients and improvements of physical functions in more disabled MS patients, specifically on walking endurance, are still challenging to achieve and depend on the type of exercise training.

Conclusion: Exercise training is a safe and well-recognized option to improve physical functions in people with MS.

Acknowledgments: not to report.

Implementation of exercise in the community
P.F. Feys
UHasselt, Hasselt, Belgium

Introduction / Objective: Supervised exercise has consistently been shown to lead to benefits on ICF body function and activity level. However, in a chronic condition such as MS, it is mandatory to remain physical active at sufficient intensity to keep benefits. As such, behavioral change techniques have to be included in programs. In recent years, the importance of personal and environmental factors has been acknowledged and the need of programs that are executed in the community is now recognized as being of great importance. In the workshop, we will evidence on how to implement exercise in the community and present a model developed by Move-to-Sport (Belgium).

Methods: The presentation will cover the existing evidence in the literature as well provide examples from own studies.

Results: In the Move-to-Sport initiative persons with MS are enrolled in a public challenge, where they train with a personalized prescription during at least three months to reach the goal. Training was mostly done in people's own environment with family, friends or therapists and are combined with group sessions. We present examples of a MS 5 km run study and an art & dance performance. Other models include mHealth techniques were subjects are reached individually or in groups with individually adapted assignments to enhance physical activity such as walking (walk-with-me app) or body training (physioweb, UK), also for those with higher disability levels.

Discussion: The strength and weaknesses of the presented models are discussed.

Conclusion: Because of the well-established beneficial effects of exercise for people with multiple sclerosis, development of new and efficient models that can support implementation of exercise into the community is of major importance to both patients, therapists and the society. This presentation provide examples that may pave the way forward for such models.

Acknowledgments: The Move-to-Sport organisation (movetosport.be) is chaired by Paul Van Asch.

Tailored exercise and long-term adherence
L.T.M. Taul-Madsen
Aarhus University, Aarhus, Denmark

Introduction / Objective: Exercise is a safe and feasible intervention when treating several symptoms in people with multiple sclerosis (pwMS). The two most applied exercise modalities are aerobic and resistance training, both known to have beneficial effects on physical function. However, the underlying physiological mechanisms affecting the different physical function tests remains unclear, resulting in an uncertainty of what modality to recommend. To optimize the effects of exercise in pwMS, a better mapping of baseline deficits may therefore be required. Another issue of major relevance to both pwMS and society is long term adherence which remains a challenge.

Methods: This presentation focus on how a better understanding of baseline deficits can help optimize tailoring of exercise in pwMS. Furthermore, the presentation will cover the existing evidence on the "long-term adherence challenge" of exercise in pwMS and discuss potential future solutions.

Results: Deficits in multiple domains can already be assessed at very early stages of multiple sclerosis if tested properly. Simple tests such as the Six Spot Step Test, the 6-minute walk test and the 5 times Sit to Stand test may provide useful information that can be used when tailoring exercise. Adherence to exercise is relatively high in scientific studies, but it seems to decrease over time.

Discussion: While tailored exercise that incorporates the preferences of the patient may improve this, other elements such as booster sessions may also be viable options.

Conclusion: Evaluation of both physiological and functional outcomes can help prescribe exercise targeted specifically to the physiological impairments and physical functional limitations of a pwMS. For pwMS to adhere to exercise over a longer period, specific measures should be made.

14.30-16.00 | Room 0.5
(4D) EEG: towards a better understanding of upper limb sensorimotor recovery
C. Meskers / F. van der Helm / J. Cruijsen

Upper limb motor recovery after ischemic stroke is a complex process occurring through a combination of spontaneous neurobiological recovery and learning-dependent brain plasticity, including reorganization of spared neuronal networks to regain lost neuronal function (behavioral

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restitution), and learning adaptive movement strategies (adaptation or compensation, Langhorne et al. Lancet 2011, Buma et al. Rest Neurol NeuroSci 2013). To understand how these processes relate to each other and develop over time is a prerequisite for better allocation of rehabilitative resources and to develop and evaluate novel tailored interventions. Previous work showed that taking, the Fugl Meyer score as a proxy measure for behavioral restitution, different patterns of neurological recovery can be discerned of which 20-30% shows no recovery at al., a group with almost full recovery and different subgroups in between (Vliet et al. 2020). Comparable to the motor recovery, it has been found that an estimated 20% to 30% show no proportional recovery in the somatosensory (sensory disturbances) while somatosensory recovery is conditional for full motor recovery (Zandvliet et al. 2020a; Zandvliet et al. 2020b). Furthermore, recent work suggested that multi- synaptic descending pathways when corticospinal tract integrity is compromised, may be the driver of peripheral neuromechanical changes resulting in the clinical phenotype of spasticity (Andringa et al. 2020). The course of somatosensory function recovery in the first weeks after the stroke is still virtually unknown. There are no well-validated clinical measures to reliably and precisely determine the integrity of somatosensory pathways.
An alternative method to investigate the course of somatosensory function recovery is by means of transcutaneous median nerve stimulation (SSEP) (Kalogianni et al. 2018) or by imposing wrist perturbations using a haptic robot (Vlaar et al. 2017; Zandvliet et al. 2020a). By applying SSEP and HR repeatedly over time and combining this with (diffusion) MRI and EEG, the relationship between sensory function and motor recovery can be further investigated. The present workshop introduces the clinical perspective and state-of-the-art of EEG driven quantification and visualization of somatosensory signal propagation in cerebro. We will address the following topics:

1. Introduction: clinical perspective and the introduction of a clinical model of multidimensional assessment of upper limb motor recovery post stroke.
2. Clinical case: development of post-stroke neuromechanical changes over time and the need for understanding the longitudinal interaction between brain injury with respect to sensorimotor impairments, neuroplasticity and observed changes in peripheral tissue properties.
3. The 4D EEG project: methods and state-of-the-art of quantification and visualization of signal propagation in cerebro after stroke
4. Future perspectives.

14.30-16.00 | Room 0.4
Interventions reducing sedentary behaviour in elderly
F. van Wijck

14.30-15.00
Sedentary behaviour post stroke: What happens over the first 2 years post discharge?
N. Fini

Introduction/Objective: Following stroke people commonly have high levels of sedentary behaviour which places them at risk of recurrent stroke. Understanding whether patterns of sedentary behaviour change over time and identifying associations between sedentary behaviour and specific risk factors could enable the development of novel interventions for secondary stroke prevention.
Methods: Primary stroke survivors admitted to a large metropolitan rehabilitation hospital in Australia were recruited. Outcomes were measured at rehabilitation discharge, six, 12 and 24 months later. Sedentary behaviour outcomes were measured by the Sensewear Armband. Other outcomes included cardiovascular risk factors, mobility, mood, cognition and fatigue.
Changes and associations between sedentary behaviour and cardiovascular risk factors over time were evaluated with random effects regression modelling.
Results: Participants (n=79, 32% female) had mean age 65 [SD 14] years and median gait speed 1.2m/s (IQR 0.8,1.4). Sedentary behaviour did not change significantly over time. Time spent in long sedentary bouts (≥ 10 minutes) appeared to reduce over time (mean change -21 minutes (CI: -42-1) at 24 months; p=0.060). Associations were found between (1) higher number and duration of sedentary bouts (ie breaking up sedentary time) and higher (better) HDL cholesterol (p≤0.01); and (2) lower sedentary bout duration and lower body mass index (p=0.02) at all time points. Better cognition at baseline was associated with lower sedentary time at two years (p<0.001).
Conclusion: Breaking up sitting time may be a valuable treatment goal to reduce recurrent stroke risk. People with poor cognition at discharge may be particularly important to target.
Acknowledgement: Co-authors on the main piece of work that will be presented: Prof Anne Holland, Prof Leonid Churilov & Prof Julie Bernhardt
COI: No conflicts of interest

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15.00-15.20

Sedentary behaviour after stroke: the role of stroke service staff in supporting stroke survivors to move more in inpatient and community settings

S. Morton

Introduction: Sedentary behaviour (SB) is evidenced to have negative impact on short- and long-term health and wellbeing. Prevalence is particularly high post-stroke. Patients in acute stroke units can spend up to 94%/day sedentary, in the community this is up to 75%/day. Given the negative health consequences it is imperative stroke survivors (SS) are supported to reduce SB. Stroke service staff can play a role here.

Methods: 1. Observations (132hrs) and interviews with stroke service staff (n=31) in two stroke services (UK). Observations: thematically analysed; interviews: analysed using Framework approach. 2. Review of SB after stroke interventions since Covid-19.

Results: Stroke service staff appreciated the consequences of prolonged SB and want to support SS to reduce their SB, providing they are confident doing so. Staff would benefit from training to gain necessary skills and resources to safely support SS to reduce SB. The built and social environment may limit opportunities for SS to move more in inpatient and community settings. Covid-19 has caused various impacts including delayed treatment and reduced staff resource. For some SS this reduced access to rehabilitation. More positively, there was an increase in novel delivery of rehabilitation interventions including increase use of digital interventions.

Conclusion: Stroke service staff can play a key role in supporting SS to reduce SB. It is important that staff have the skills to do this safely and confidently. The environment may limit opportunities to move, and Covid-19 may have exacerbated this. However, increased use of novel and digital interventions could be useful in supporting SS to reduce SB in novel ways.

Acknowledgement: Co-authors, observation and interview study: RECREATE team led by Prof Anne Forester, University of Leeds. Funder, observations and interviews: NIHR, Programme Grants for Applied Research £3,013,121; 01/10/2017-31/09/2024

COI - none

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Efficacy of aerobic exercise on aerobic capacity in slowly progressive neuromuscular diseases: a systematic review and meta-analysis

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Introduction: Adequate aerobic capacity positively affects physical and mental health and quality of life. Rehabilitation treatment in people with neuromuscular diseases (NMD) often involves aerobic exercise to improve their reduced aerobic capacity.

Main Objective: To summarize the evidence on the short- and long term efficacy of aerobic exercise for improving aerobic capacity in slowly progressive NMD.

Methods: MEDLINE, EMBASE, SPORTDiscus and Web of Science Conference Proceedings Index were systematically searched up to June 17, 2021. We selected randomized controlled trials that compared aerobic exercise to no aerobic exercise in adults with slowly progressive NMD, assessed by the peak oxygen uptake (VO_{2peak}) and several secondary outcomes, including adverse events. Meta-analyses were performed when outcomes were reported in more than two studies. Risk of bias was assessed using Cochrane risk-of-bias and quality of evidence using GRADE.

Results and Discussion: Nine studies were included, describing 195 participants with 8 different NMD. Eight studies were rated at high risk of bias and one study at some concerns. Exercise programs ranged between 6 and 26 weeks, with 3 weekly training sessions, prescribed as percentages of the (estimated) maximal capacity, for 20 to 40 minutes. Meta-analyses indicated short-term beneficial effects on VO_{2peak} (standardized mean difference [SMD]: 0.55, 95% CI: 0.23-0.86) and peak workload (SMD: 0.61, 95% CI: 0.24-0.99). No adverse events were reported and long-term effects were not assessed.

Conclusion: There is low-quality evidence that aerobic exercise is safe and leads to moderate short-term improvement of aerobic capacity in slowly progressive NMD, but the long-term efficacy remains unclear.

Acknowledgements: This study is funded by the Prinses Beatrix Spierfonds (PBS, W.OK17–3).

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Beyond gait speed

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Introduction: Measuring gait with inertial measurement units (IMUs) during clinical assessment results in objective information about the way people walk after stroke. However, it is unclear if the way people walk after stroke is associated with their walking behavior in daily life.
Main Objective: This study evaluated the additive value of IMU-based gait features over a simple gait speed measurement in the estimation of walking behavior in people after stroke.
Methods: The assessment consisted of two parts and was administered every three weeks during rehabilitation. In the first part, participants walked for two minutes on a fourteen-meter path with three IMUs. The dimensionality of the corresponding gait features was reduced with a principal component analysis. In the second part, the walking behavior was assessed during the two days after the two-minute walk test by measuring the number of steps, and the average and maximal gait speed in daily life. A gait-speed-only Linear Mixed Model was used as the baseline model to estimate each measure of walking behavior. The principal components (PC) were added to the baseline model via a forward selection procedure.
Results and Discussion: Eighty-one participants were measured during rehabilitation, resulting in 198 two-minute walk tests and 135 corresponding walking-behavior measurements.
Gait speed measured with the two-minute walk test was weakly associated with average and maximum gait speed, and moderately associated with the number of steps per day.
The PCs did not substantially improve the models.
Conclusion: Measuring the way people walk after stroke with IMUs does not improve the estimation of walking behavior in daily life.
Acknowledgements: We would like to thank all participants for their time and effort. This study is part of the `Making Sense of Sensor Data for Personalised Healthcare' consortium. This study is independent research and was funded by: SIA-RAAK (RAAK. PRO.03.006).

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Gait-adaptability Training in People With Hereditary Spastic Paraplegia: A Randomized Clinical Trial

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Introduction: In people with hereditary spastic paraplegia (HSP), reduced gait adaptability is common and disabling. The impairments with gait adaptability are due to lower extremity spasticity, muscle weakness, and impaired proprioception.
Main Objective: We assessed the efficacy of a five-week gait-adaptability training, added to usual care, in people with pure HSP.
Methods: We conducted a randomized clinical trial with a cross-over design for the control group, and a fifteen-week follow-up period after training. Thirty-six people with pure HSP were randomized to five weeks of i) gait-adaptability training (ten hours of C-Mill training - a treadmill equipped with augmented reality) or ii) waiting-list control period followed by five weeks gait-adaptability training. The primary outcome was the obstacle subtask of the Emory Functional Ambulation Profile. Secondary outcome measures consisted of clinical balance and gait assessments, fall rates, and spatiotemporal gait parameters assessed via 3D motion analysis.
Results and Discussion: The gait-adaptability training group (n=18) did not significantly decrease the time required to perform the obstacle subtask compared to the waiting-list control group (n=18) after adjusting for baseline differences (mean: -0.33 seconds, 95%CI: -1.3;0.6). Similar, non-significant results were found for most secondary outcomes. After merging both groups (n=36), the required time to perform the obstacle subtask significantly decreased by 1.3 seconds (95%CI: -2.1;-0.4) directly following five weeks of gait-adaptability training, and this effect was retained at the fifteen-week follow-up.
Conclusion: We found insufficient evidence to conclude that five weeks of gait-adaptability training leads to greater improvement of gait adaptability in people with pure HSP.
Acknowledgements: This study was conducted at the Center of Expertise for Rare and Genetic Movement Disorders of the Radboudumc (Nijmegen, The Netherlands), part of the European Reference Network for Rare Neurological Diseases (ERN-RND). The study was funded by the Jacques and Gloria Gossweiler Foundation and Ipsen Pharmaceuticals. The authors have no conflict of interest to report.

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Correlation between change in upper limb motor impairment and activity in response to exercise-based therapy after stroke: A systematic review with meta-analysis

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Introduction: Knowing whether exercise-based therapy improves motor impairment is important to drive neuromuscular restitution after stroke.

Main Objective: This review aimed to identify whether: exercise-based therapy produces greater benefit for upper limb (UL) motor impairment or activity; and, change in impairment and activity is correlated.

Methods: Electronic databases were searched from 2011 with key terms: stroke, UL and exercise. Eligibility criteria were: individually-randomised controlled trial; participants with UL motor impairment post-stroke; compared UL exercise-based therapy with no therapy, placebo/sham, or routine rehabilitation; UL motor impairment and activity were measured, and did not have a high risk-of-bias. Two Reviewers independently identified eligible trials, assessed risk-of-bias and extracted data. Outcome measures were ranked in priority order to ensure participants were included only once in meta-analyses. Top priority measures were Fugl-Meyer Assessment (FMA) and Action Research Arm Test (ARAT).
Using STATA, Cohen's d effect sizes were calculated for the meta-analysis of change in outcomes. Correlation between the effect sizes was assessed through meta-regression.

Results and Discussion: After deduplication there were 1359 records of which 29 studies were included. Meta-analysis results are presented as Cohen's d [95%CI]. Overall, exercise-based therapy improved motor impairment 0.84 [0.40,1.28], and activity 0.66 [0.27,1.05].Improvements were 0.95 [0.10,1.80] for FMA and 0.74 [-0.27,1.74] for ARAT. The significant positive correlation between change in impairment and activity overall was ($r=0.95; p\leftarrow0.001$) and for just FMA and ARAT ($r=0.98; p\leftarrow0.001$).

Conclusion: Exercise-based therapy improves UL motor impairment and activity. There is a strong relationship between changes in motor impairment and activity.

Acknowledgements: We appreciate Matthew Hawkes's assistance in developing the search strategy.

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Pilot randomized controlled trial using novel technology to train sitting balance and trunk control in the subacute phase post-stroke

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Introduction: Trunk function is a strong prognostic factor for independence in daily living after stroke and a key component in rehabilitation. Additional trunk therapy is effective for improving trunk function and activity, but an implementation limitation is the required supervision during more challenging training using unstable surfaces.

Main Objective: To investigate the potential effect on body function and activity of additional technology-assisted therapy utilizing the T-Chair in persons post-stroke.

Methods: Persons in the subacute phase post-stroke with reduced trunk function were recruited from the rehabilitation center Valens, Switzerland. After randomization, measurements of trunk function, lower extremity function, muscle strength, gait ability and mobility were performed pre-intervention. All participants received their inpatient rehabilitation program. Participants in the experimental group received additional trunk therapy with T-Chair in a structured exercise program, three times per week for 45 minutes over four weeks. Post-Intervention, all outcome measures were re-evaluated.

Results and Discussion: 15 persons in the experimental (EG) and 15 persons in the control group (CG) completed the trial. There were no significant differences between groups pre-intervention. Significant between-group improvements were found from pre- to post-intervention in trunk function (trunk impairment scale: EG:2.6±1.55; CG:1±1.90; p=0.017; effect size (ES)=0.926) and gait ability (functional ambulation categories: EG:1.6±0.74; CG:1±0.66; p=0.026; ES=0.861), with greater improvements in the experimental group. No significant between-group differences were found for lower extremity function, muscle strength or mobility.

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Conclusion: Additional technology-assisted trunk therapy for people in the sub-acute phase post-stroke attending inpatient rehabilitation is potentially effective in improving trunk function and gait ability.

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A dose escalation study exploring the maximal session length of upper limb rehabilitation for people with moderate to severe upper limb sensorimotor impairments in the early phase post stroke

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Introduction: Optimising upper limb recovery is likely to require a higher dose of rehabilitation training than is currently delivered, but the feasibility and acceptability of higher dose regimes is unclear.

Main Objective: To determine the feasibility and acceptability of high dose upper limb rehabilitation in patients with moderate to severe impairment in acute and early sub-acute stage of stroke.

Methods: Participants ($\rightarrow$3 days to 1 month post-stroke) are recruited from the acute stroke unit and rehabilitation center of ZOL, Belgium. Participants receive standard rehabilitation plus escalating doses of upper limb movement training for three days at four different levels: level 1 (40 minutes/day), level 2 (67 minutes/day), level 3 (100 minutes/day) and level 4 (133 minutes/day). Treatment starts at level 1 and if tolerated it is escalated to the next level, using a 3+3 dose-escalating research design. Safety assessment involving level of fatigue and perceived exertion is conducted before, during and after each session.

Results and Discussion: Nine participants (Mean age: 63.4 ± 11.8; Gender: 3 Females/8 Males; Mean days post stroke: 11.8 ±9.91; Upper limb motricity score range: 11-60) have completed the study to date. Three participants completed dose level 1 and five participants level 2. Level 2 training was perceived as more intensive (Mean score Borg Scale:14) and fatiguing (Mean score Visual Analogue Scale – Fatigue = 7) than level 1. However, none of the latter mean scores reached dose-limiting toxicity.

Conclusion: The study is still ongoing with participants currently receiving 100 minutes (level 3) of upper limb therapy in addition to standard upper limb rehabilitation. Updated results will be presented at the conference.

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Brain-oscillation-synchronized stimulation to enhance motor recovery in early subacute stroke (BOSS-STROKE): A randomized controlled double-blind three-arm parallel group exploratory trial comparing personalized, non-personalized and sham repetitive transcranial magnetic stimulation.

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Introduction: Repetitive transcranial brain stimulation (rTMS) has been used to enhance neuronal plasticity after stroke, yet with only moderate effect sizes. We propose a highly innovative technology that synchronizes rTMS to individual brain states.

Main Objective: This study investigates, for the first time, the therapeutic efficacy of personalized rTMS. We hypothesize that synchronization of rTMS with the individual brain state will lead to significantly stronger improvement of paretic upper extremity motor function than standard or sham rTMS.

Methods: 144 patients with early subacute ischemic motor stroke will be included in a multicenter 3-arm parallel, randomized, double-blind, standard rTMS and sham rTMS-controlled exploratory trial in Germany. In the experimental condition, rTMS will be synchronized to the trough of the sensorimotor μ-oscillation, a high-excitability state, over ipsilesional motor cortex. In the standard rTMS control condition the identical protocol will be applied, but non-synchronized to the ongoing μ-oscillation. In the sham condition, the same protocol as in the experimental condition will be applied, but with ineffective rTMS. The treatment will be performed over five consecutive work days. The primary endpoint will be motor performance after the last treatment session as measured by the Fugl-Meyer Assessment Upper Extremity.

Results and Discussion: The study is recruiting at 6 German University Hospitals from January 2023-2026. Positive results may catalyze a paradigm-shift towards personalized brain-state-dependent stimulation therapies.

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Does combined gait training with the Incedo® improve walking performance and gait parameters in patients with chronic stroke-related hemiparesis? A pilot study

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Introduction: In the past, two publications have reported beneficial effects of gait training with electrical stimulation of flexor reflex (FR) in subacute stroke patients (Quintern et al. 2004, Spaich et al. 2014).
Main Objective: This study was conducted to investigate the effect of gait training in combination with electrical stimulation of FR of the affected leg in chronic stroke patients.
Methods: 5 chronic stroke patients with hemiparesis (1 female, 4 male; 65,7 ± 11,1 years old; 45.5 ± 14.5 months after stroke). The study consisted of baseline, post and follow-up measurements as well as a 5-week training period. Motor functions were tested with a 10-meter walk test (10MWT), a 2-minute walk test (2MWT), and a gait analysis. These tests were performed with and without Incedo®. The gait training consisted of training on the treadmill and outdoor training in combination with electrical stimulation of FR in the affected leg (3x45 minutes per week).
Results and Discussion: This study showed that stroke patients walked significant faster in 10MWT and a longer distance in 2MWT both with and without Incedo® after the training period and in the follow-up tests. The gait parameters remained unchanged. Based on these case reports, we suggest using this technique to conduct a randomized controlled clinical trial in chronic stroke patients to verify the effect of combined gait training with activation from FR.
Conclusion: This study is relevant because for the first time the effects of gait training in combination with FR stimulation were examined in chronic stroke patients.
Acknowledgements: The study was supported by the Lurija Institute, Kliniken Schmieder, Germany. The authors would like to thank Nordic NeuroSTIM ApS, Aalborg, Denmark for providing financial support to this project.

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The Speed Precision ObsTacle courSe (SPOTS): a new measurement tool for high-level walking for people with central neurological disorders

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Introduction: There is limited availability of high-level walking measurement tools for neurological patients which integrate evaluation of quality and cognition while simulating walking activities of daily life.
Main Objective: We developed the Speed Precision ObsTacle courSe (SPOTS) and examined its psychometric properties
Methods: Participants with a central neurological disorder admitted to the inpatient rehabilitation center participated in this prospective study. Interrater and test-retest reliability, validity, and sensitivity were assessed between three observers at three different test moments (day one, day two, and one month later). The SPOTS is video recorded and evaluates quality and cognition during obstacle course walking (score range from 0 to 72 points).
Results and Discussion: Thirty-five participants with stroke, brain injury, brain tumor surgery and inflammatory disease were recruited (mean (SD) age 56 (14) years). All patients were independent walkers (FAC →=3).
SPOTS showed good to excellent interrater reliability (ICC=0.81–0.97) and moderate to good test-retest reliability (ICC=0.72–0.77). Bland-Altman analysis showed consistency of scores between observers. A learning effect from day one to day two was observed. Item analysis (weighted kappa) showed overall good to very good agreement. Compared to the 10MWT, the 6MWT, FSST and the CBM Scale, SPOTS score showed significant weak to strong correlations (r=0.31–0.69). A moderate effect size (Hedges' g=0.50) and a minimal detectable change of 9 out of 72 points (12.5%) was found.
Conclusion: The SPOTS is a new promising, reliable, valid, and sensitive clinical tool for assessing advanced community-like mobility in ambulatory patients with residual central neurological gait deficits.

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The PREP Plus combined post-rehabilitation programme. Supporting upper-limb recovery in community-dwelling stroke survivors: a mixed methods, cluster-assigned feasibility study

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Introduction: Upper limb recovery following a stroke is a substantial problem. Northern Ireland Chest Heart and Stroke have an established post-rehabilitation enablement program [PREP] for stroke survivors. Most of the programme focuses on cardiovascular fitness and the lower limb and therefore provides an opportunity to embed an evidence based upper limb programme into an established community-based rehabilitation programme.
Main Objective: The aim of this study was to evaluate the feasibility of embedding the Graded Repetitive Arm Supplementary Program (GRASP) into an established group-based exercise programme for stroke survivors.
Methods: Seventy-five adults who had completed statutory rehabilitation were recruited into either a group based post-rehabilitation enablement program (PREP) alone (Physiotherapist led exercise) or PREP Plus (PREP intervention plus GRASP). Participants completed 6 weeks in a community rehabilitation setting. Once the initial intervention and control group were completed, participant feedback resulted in iterative changes. This was repeated on five occasions throughout the study.
Results and Discussion: Qualitative and quantitative measures were evaluated to assess the acceptability, feasibility, and necessary adaptations of the PREP Plus intervention. Full data analysis will be completed prior to the conference.
Conclusion: Embedding an established upper limb programme into group-based exercise has the potential to provide longer term support for upper limb rehabilitation in the community.

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Personalized neuromodulation treatment for motor recovery after stroke in the subacute phase

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Introduction: Stroke patients with mild/moderate motor deficits are expected to recover 70% of their initial impairment, per the proportional recovery rule[Prabhakaran et al., 2008]. In these patients, global functional connectivity of motor areas correlates positively with motor outcomes[Nicolo & Rizk et al., 2015]. In severe motor deficits, recovery does not conform to the proportionality rule, and no effective therapy is yet available. Moreover, severe deficits commonly results from CST damage[Guggisberg et al., 2017] and are accompanied by secondary white matter degradation[Doughty et al., 2016]. We propose tailored modulation of deficit-specific neurophysiological targets to promote neuroplasticity in the subacute phase.
Main Objective: Stroke patients are assigned to one of two different studies, depending on their initial motor deficit. In study 1, we aim to promote motor recovery from mild to moderate deficits by fostering global connectivity of perilesional cortical areas with excitatory tDCS in combination with standard physical/occupational therapy. In study 2, we aim to preserve the CST integrity in severe motor deficits by using a closed-loop BCI-FES system to restore the link between an intended movement and its execution.
Methods: Both studies are double blind and sham-controlled. Pre, post, and follow-up assessments include clinical evaluations, resting-state EEG, MEPs and DTI.
Results and Discussion: Preliminary results of these ongoing studies suggest, in study 1 (24 patients), improvement in ARAT and a local increase of functional-connectivity positively correlated to motor change, and, in study 2 (20 patients) spasticity improvement without significant motor improvement.
Conclusion: We test the efficacy of patient-tailored neuromodulation targeting personalized neural targets for motor recovery and investigate the underlying neural reorganization.

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A home-Based Core Stability Exercises to Improve Balance Confidence, Quality of Life, Health Status and Gait Speed. A Pragmatic Randomized trial. Core-ataxia

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Introduction: Core stability exercises (CSE) could improve quality of life, balance and gait disorders in individuals with Hereditary Ataxias (HA).

Main Objective: To evaluate the effectiveness of a home-CSE program in terms of sitting and standing balance, balance-confidence, gait, lower limb functional strength, falls rate, quality of life and health status in individuals with HA.

Methods: This is a parallel pragmatic randomized trial with a blinded assessor. Twenty-three HA individuals aged ranged (18-67) years old were divided in two groups: control group followed their usual care and intervention group (IG) performed in addition to usual care a 5-week home-CSE program. The assessment was performed at baseline, 5-week (endpoint) and 10-week (follow-up). The primary outcome was sitting balance assessed by sitting section of Scale Assessment Rating for Ataxia (SARA). The secondary outcomes were standing balance and gait ability evaluated by SARA, gait speed by 4-meter walk test (4-MWT), balance-confidence by Activities-specific Balance Confidence (ABC), the functionally lower limb strength by 30-seconds sit-to-stand test, quality of life (QoL) by EQ-5D-5L, health status by EQ-5D, falls and adherence rates by diary.

Results and Discussion: Individuals ataxia severity ranged from mild to moderate. Statistically significant differences were observed between groups favoring IG in the ABC ($p=0.022$), the EQ-5D-5L ($p=0.007$), the health status ($p=0.038$), the 4-MWT ($p=0.036$) and falls rate at endpoint. To the best of our knowledge this is the first study that assessed a CSE program home-based in HA.

Conclusion: A 5-week home-based CSE improves balance self-confidence, QoL, health status, falls rate and gait speed in HA individuals.

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Action observation with motor simulation improves reactive stepping responses following strong backward balance perturbations in healthy young individuals

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Introduction: Perturbation-based training effectively improves reactive stepping responses. However, it requires expensive equipment and supervision, which limits its clinical uptake.

Main Objective: We investigated whether action observation of reactive steps with either motor imagery (AOMI) or motor simulation (AOMS) is effective to improve reactive stepping.

Methods: Sixty healthy young subjects were subjected to strong balance perturbations that elicited backward reactive steps. The AOMI group (n=20) was tested after action observation and motor imagery of a third person's reactive steps, while the AOMS group (n=20) additionally stepped along with the third person. The control group (n=20) was tested without any prior observation. We determined the quality of the first-trial response, which best represents a real-life loss-of-balance, quantified as the leg angle at stepping-foot contact. We also studied single step success and gains in reactive step quality over repeated trials.

Results and Discussion: Reactive step quality was significantly better in the experimental (AOMI and AOMS) groups than in the control group, but did not differ between the experimental groups. Single step success rates were also higher in the experimental groups compared to control, albeit not significantly. Reactive step quality improved upon repeated trials in all groups, however, the experimental groups needed fewer repetitions to reach plateau performance.

Conclusion: Our findings point at the potential applicability of action observation with motor imagery or motor simulation for home-based reactive balance training, for instance in serious games. It remains to be investigated whether similar beneficial effects also emerge in the target populations of balance-impaired individuals.

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Does task difficulty trigger paretic arm non-use in stroke population?

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Introduction: Learned non-use of the paretic arm is reported in the stroke population. However, when or why this behavioural change happens in chronic stroke survivors with sufficient motor capacity is still unknown. Understanding this could change the therapeutic approach for this population.
Main Objective: Create an experimental paradigm by modifying an existing KINARM task, to trigger a non-use reaction in a bimanual task and measure when it happens.
Methods: Chronic stroke participants (n=20) used a modified version of the bimanual Hit and Avoid task developed by KINARM. The task consisted in coloured dots falling towards the patient, who had two minutes to hit as many as possible, regardless of the colour, with either hand. Both the number of dots and the velocity increased over time. Then, working area covered with each hand throughout the task was measured.
Results and Discussion: Replicating the results from other studies, we show **1)** the non-paretic arm covers a wider workspace area in comparison to the affected one in a bimanual task. Most importantly, we also show the **2)** temporal progression of paretic arm non-use with increasing task difficulty and **3)** both patients in the high or low spectrum of moderate FM-UE show similar behaviour.
Conclusion: The results from this work show when non-use behaviour, or "paretic arm overload" appears in chronic stroke patients depending on the task load and will set a baseline from which we will be able to further study whether this non-use is triggered by a motor or a cognitive overload.
Acknowledgements: Special thanks to my supervisors Professor Nick Ward, Dr Sven Bestmann and Dr Sebastian Sporn for their support with the design of this study, their edititing help and their feedback.

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Clinical feasibility of assist-as-needed robot and electrostimulation supported leg training in moderate-severely affected stroke patients

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Introduction: Active and intensive rehabilitation is important to improve leg function after stroke. Such training is especially challenging to provide in severely affected stroke patients. Combining robotic leg support with actively-triggered electrostimulation and applying Assist-As-Needed support stimulates active contribution by severely affected patients during early-stage rehabilitation.
Main Objective: To investigate clinical feasibility of Assist-As-Needed support (provided by a robot in combination with electrostimulation) during knee extension and/or ankle dorsal flexion in early-stage stroke rehabilitation.
Methods: Currently, five sub-acute stroke patients are included in the ongoing study. They underwent 30 minutes of leg training, three times a week for 3-6 weeks, using a robot combined with electrostimulation (ROBERT®-SAS) via Assist-As-Needed control. The executed movements were determined for each patient individually. In case of knee extension and ankle dorsiflexion, robot support was combined with electrostimulation, other movements were only robot-supported. Motricity Index of the leg (MI leg) was obtained before training, after 3 and 6 weeks.
Results and Discussion: The preliminary results show no occurrence of adverse events. So far, 61 sessions were executed, in which 53 times at least one movement was performed with added electrostimulation. All patients tolerated the sessions well and were comfortable with the stimulation and robot support. MI leg ranged between 14 and 33 pre-intervention and time since the stroke ranged from 21 days to 44 days.
Conclusion: So far, it seems feasible to apply Assist-as-Needed training using a robot with additional electrostimulation in sub-acute stroke patients in the clinic, in addition to conventional rehabilitation.

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Home-based augmented-reality gait-and-balance training for people with Parkinson's disease: a clinical feasibility study protocol

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Introduction: Exergaming has the potential to increase adherence and improve gait and balance in people with Parkinson's disease (PD) through play and personalised home-based programs.

Main Objective: The objectives of this clinical feasibility study in people with PD are to evaluate 1) feasibility and 2) potential efficacy of Cue X: an augmented-reality (AR) home-based gamified gait-and-balance exercise program developed in collaboration with Strolll Limited as an extension of supervised physiotherapy.

Methods: Participants include 30 individuals with PD (H&Y stage 2-4) with self-reported gait and/or balance difficulties. The study comprises a 6-week (5 days a week, 30 minutes per day) waitlist-controlled AR home-based personalized training program, consisting of five complementary gait-and-balance exercises. Three laboratory visits are conducted to examine potential efficacy of Cue X on standard clinical gait-and-balance tests and targeted walking-related fall-risk assessment using Interactive Walkway walking-adaptability outcomes: before the 6-week waitlist period (t0), before (t1) and after the 6-week training period (t2). The main parameters to evaluate the clinical feasibility of Cue X are usability, safety, adherence, and patient-reported experience and outcome measures.

Results and Discussion: Inclusion has started in December 2022 and is now halfway. Results will be available before summer 2023. This clinical feasibility trial is the first remotely supervised, home-based AR gait-and-balance intervention for people with PD. The results form the basis for future randomized controlled studies on the effectiveness of home-based AR gait-and-balance interventions in PD.

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Functional markers of spontaneous and therapy-related post-stroke recovery

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Introduction: Stroke is the commonest cause of adult complex disability in the world. A major opportunity for improving outcomes is to target the mechanisms of brain recovery and repair.
Main Objective: Here, we investigate functional markers of spontaneous recovery in the acute phase and therapy-related recovery in the chronic phase (i.e., Queen Square Upper Limb (QSUL) Neurorehabilitation programme[2]).
Methods: So far, 39 **acute patients** (*time since stroke* [days]: M=5.32, SD=5.07; *age* [years]: M=65.51, SD=13.72; 33 males); 36 **chronic patients** (*time since stroke* [years]: M=3.24, SD=2.66; *age* [years]: M=54.87, SD=9.62; 31 males); and 21 **healthy controls** (*age* [years]: M=56.72, SD=11.61; 14 males), participated. Electroencephalography (EEG, 30 channels) was collected during passive movement of the left and right index finger (70 trials each) as well as 7 min resting state (eyes open).
Results and Discussion: All but two datasets proved good data quality. Results show a significant group (acute, chronic, control) x hand (affected, unaffected) interaction ($F_{2,91}$=8.063, $p \leftarrow 0.001$, h^2_p=0.151) for sensorimotor beta (13-30Hz) event-related synchronisation (ERS). ERS is reduced globally in acute patients, while chronic patients only show a reduced ERS for the affected, but not in the unaffected, hand. Further, ERS induced by passive movement of the affected hand was positively related to Action Research Arm Test (ARAT) in chronic patients (r(23) = 0.46; p = 0.02).
Conclusion: While data collection is still ongoing clear differences in brain activity are apparent in the acute and chronic stages. Structural data as well as clinical follow-up scores will further shed light on the neural underpinnings of stroke-related impairment and recovery.
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Acknowledgements:

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Different aspects of upper-limb activity differ among people with varied upper limb levels in the chronic phase post-stroke

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Introduction: Accelerometry is a means of quantifying the use of the affected upper limb (UL) in daily life after stroke. Generally, the amount of use of the affected UL is higher in patients with mild UL motor impairment and dominant hand affected. However, it is not known if these differences are also present in other accelerometry measures of UL activity.
Main Objective: To compare accelerometry measures of UL activity between patients with different UL impairment levels in the chronic phase post-stroke.
Methods: This exploratory study combined daily-life UL activity data collected with wrist-worn accelerometry from a Belgian and Danish cohort (n = 126). We compared activity ratio, magnitude ratio, and bilateral magnitude between three impairment groups categorized by Fugl–Meyer Assessment score, namely (1) severe (0–22), (2) moderate (23–50), and (3) mild (51–66) with One-Way ANOVA and Bonferroni Post Hoc Tests, and Wilcoxon Signed Rank test.
Results and Discussion: Patients with mild motor impairment (n=76) scored higher on all aspects of UL activity than those with moderate (n=31) or severe UL impairment (n=20) ($p \leftarrow 0.001$), but there was no difference between the moderate and severe groups. In the mild group, patients with the dominant UL affected had a higher activity ratio and a higher median magnitude ratio compared to those with the non-dominant UL affected (p=0.008).
Conclusion: In the chronic phase post-stroke, a certain level of UL motor function is needed to include the affected UL in daily life activities. Above this level, the UL is more active if the dominant side is affected.
Acknowledgements:

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Recovery of inter-limb coordination of balance control in early subacute stroke: comparing two performance metrics in hemiparetic subjects.

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Introduction: Fine-grained measures of inter-limb coordination are needed to show the qualitative performance changes when standing balance improves poststroke. Synchronization and symmetry of bilateral center-of-pressure (COP) movements are considered important markers of inter-limb coordination, but studies comparing these metrics longitudinally are lacking.

Main Objective: To investigate the time course of inter-limb coordination of quiet standing balance control in relation to lower limb motor recovery in the first 3 months poststroke, using two different performance metrics.

Methods: In a cohort of forty-eight hemiparetic subjects, either two adjacent force plates or a pressure plate were used to collect bilateral COP profiles at weeks 3, 5, 8 and 12 poststroke. A cross-correlation estimated the between-limb synchronization (BLS), and the dynamic control asymmetry (DCA) was determined as an index of the bilateral COP velocities. Motor impairment was measured with the Fugl-Meyer leg motor score (FM-leg). Time courses and associations with FM-leg as the independent variable, were investigated with linear mixed models.

Results and Discussion: After correction for measurement instrument, BLS (β=-0.10, SE=0.05, P=.127) and DCA (β=-6.95, SE=6.23, P=.681) yielded no significant change between week 3 and 12 poststroke. In the same time-window, FM-leg was a significant factor for BLS (β=0.02, SE←0.00, P←.001) but not for DCA (β=-0.05, SE=0.91, P=.959), such that more severe impairments were accompanied by higher synchronization irrespective of asymmetries in DCA.

Conclusion: Synchronization and symmetry seemingly reflect distinct aspects of recovery of inter-limb coordination, as even mildly-impaired subjects exhibited asymmetric balance control contributions by compensating with less-affected leg.

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System identification: a feasible, reliable and valid way to quantify upper limb motor impairments

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Introduction: Upper limb impairments in a hemiparetic arm are clinically quantified by well-established clinical scales, known to suffer poor validity, reliability, and sensitivity. Alternatively, robotics can assess motor impairments by characterizing joint dynamics through system identification.

Main Objective: In this study, we establish the merits of quantifying abnormal synergy, spasticity, and changes in joint viscoelasticity using system identification, evaluating (1) feasibility, (2) test-retest reliability, (3) differences between healthy controls and patients with upper limb impairments, and (4) construct validity.

Methods: Data were collected with the Shoulder-Elbow-Perturbator (SEP) in a group of 45 healthy controls, 29 chronic stroke, and 20 CP patients. Participants performed either a 'do not intervene' or 'resist' task while receiving torque perturbations to the elbow under varying amounts of weight support of the human arm. Elbow joint admittance was quantified to extract elbow viscosity and stiffness. Feasibility, test-retest reliability and (construct) validity of the measurements were captured by the total measurement duration, the intra-class correlations (ICC) and correlations with an alternative robotic assessment protocol.

Results and Discussion: Feasibility was confirmed by all participants successfully completing the study protocol within ~25 min. A fair to excellent test-retest reliability was found (ICC = 0.46-0.98), for patients, except for elbow stiffness with full weight support (ICC = 0.35). Construct validity was confirmed by a significant (all p←0.03) but weak to moderate (r = 0.36-0.50) correlation with parameters from the Re-Arm protocol.

Conclusion: This work demonstrates that system identification is feasible, reliable, and valid for quantifying upper limb motor impairments. Further work is required to optimize the experimental protocol and establish clinical value.

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Blended versus face-to-face CBT for MS-related fatigue: results of a non-inferiority multicenter randomized clinical trial

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Introduction: Cognitive behavioural therapy (CBT) leads to a significant reduction of MS-related fatigue. However, implementation of face-to-face CBT is hindered by limited treatment capacity and strainful traveling for patients to the treatment location. Based on the effective CBT protocol that was used in the TREFAMS-CBT study(1), a blended CBT called MS Fit was developed in which online treatment modules are supported with guidance by a therapist. van den Akker LE, Beckerman H, Collette EH, et al. Cognitive behavioral therapy positively affects fatigue in patients with multiple sclerosis: Results of a randomized controlled trial. Mult Scler. 2017;23(11):1542-53. doi:10.1177/1352458517709361
Main Objective: To evaluate if blended CBT is non-inferior to face-to-face CBT in reducing fatigue severity in severely fatigued patients with MS.
Methods: A non-inferiority multicentre randomized clinical trial (RCT), in which 166 patients with MS were allocated to either face-to-face or blended CBT. Primary outcome was fatigue severity assessed with the Checklist Individual Strength fatigue subscale directly post-treatment, at week 20. Mixed model analysis was used to determine between-group differences post-treatment. The upper limit of the 95% CI was compared to a pre-specified non-inferiority margin of 5.32.
Results and Discussion: Blended CBT (N=82) was non-inferior to face-to-face CBT (N=84) (B = 1.70, 95% CI -1.51 to 4.90). The proportions of patients achieving clinically significant improvement was 66.6% in the blended and 63.8% in the face-to-face condition. Blended CBT significantly reduced therapist time (B = -187.1 min, 95% CI 141.0 to 233.3 min). Post-hoc analysis showed that patients improved more (B = -5.35, 95% CI -9.22 to -1.48) when receiving their preferred treatment.
Conclusion: Blended CBT is an efficient alternative to face-to-face CBT. Offering the preferred CBT format may optimize treatment outcome.

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Exploring walking fatigability concept in people with multiple sclerosis

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Introduction: Distance walking fatigability (WF) is defined as a 10% decline in distance walked towards the end of the 6-minute walking test (6MWT), while abnormal gait changes could be named biomechanical WF (BWF) in people with multiple sclerosis (pwMS). Therefore, pwMS could behave differently during the 6MWT: no presence of DWF/BWF (NWF), only DWF or BWF, or a combination of both DWF/BWF.
Main Objective: To identify the hypothesized walking behaviours of pwMS during the 6MWT.
Methods: Fifty pwMS (EDSS-4.8±1.2, 33F/17M, 34RR/4PP/8SP, 6MWT:359±245m) and 21 healthy controls (HC, 18F/3M, 6MWT:593±135m) performed the 6MWT wearing six APDM sensors to quantify gait parameters. Distance walked minute-by-minute was used for DWF grouping. Absolute values and variability (coefficient of variation-CV) were calculated minute-by-minute for foot strike angle, toe-off angle, leg circumduction, and step duration for the strongest/weakest leg (SL/WL- defined by maximal voluntary contraction of leg extension). Gait variables were transformed into relative values: (min6-min1/min1)*100. Discriminative analysis (HC: average±2SD) was used to identify abnormal gait changes (i.e., BWF) in pwMS.
Results and Discussion: Foot strike angle (HC lower limit: SL- -15.43% and SW- -25.92%) and CV (HC upper limit-UL: SL- 62.5%), and step duration-CV (HC upper limit: SL- 38.52%) were used for discriminative validity, confirming different WF manifestations in pwMS: 17 pwMS presented BWF/DWF, 13 BWF, 5 DWF, and 15 NWF.
Conclusion: Our hypothesis of different manifestations of WF in pwMS was confirmed. The

Oral abstracts

definition of WF should be expanded, including anomalies in gait biomechanics. These results provided new insights for rehabilitation programs to address WF in a tailored manner.

Acknowledgements: The authors would like to thank the Research Foundation – Flanders (Grant no: 11O5823N) and King Baudouin Foundation for the financial support.

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Reliability of walking and cognitive tests and objective fatigability measurement in moderate to severe multiple sclerosis patients.

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Introduction: Fatigue is a disabling symptom of MS and a multi-dimensional concept. Although walking fatigability affects more impaired patients, reliability of walking and cognitive fatigability, and the association with perceived fatigue are lacking.

Main Objective: To investigate the reliability of walking and cognitive tests and fatigability in moderate to severe MS patients, and its correlation with perceived fatigue.

Methods: Forty-five persons with MS (age: 54.7±9.3y; EDSS: 3-6.5) and 21 healthy controls (HC) (age: 51.1±6.0y) were included. The distance walks and index (DWI) was calculated comparing
the distance at the last and first minute of the 6-minute walk test (6MWT). Cognitive scores and fatigability (CFI) were calculated for the Symbol Digit Modality Test (SDMT), and the Paced Auditory Serial Addition Test (PASAT). The Modified Fatigue Impact Scale (MFIS) measured perceived fatigue. Participants were tested on two sessions to determine day-to-day reliability (Intraclass Correlation Coefficients-ICC).

Results and Discussion: For cognitive function, SDMT and PASAT revealed good reliability [ICC range=0.76 to 0.86] for both groups. Cognitive fatigability showed poor reliability in MS and HC [ICC range=0.10 to 0.17]. The 6MWT revealed excellent reliability in both groups.

Walking fatigability showed moderate reliability for MS patients, only, [ICC=0.64]. No correlations were found among MFIS, DWI and CFI.

Conclusion: Clinical measure of walking fatigability is reliable for moderate to severe MS patients. Given the poor reliability of cognitive fatigability, new methods are needed for this population. No correlations among perceived fatigue and fatigability emphasize the different constructs of fatigue in MS.

Acknowledgements: We thank the therapists from the MS center for encouraging the participants t o contribute with the multiple sclerosis research projects.We thank all the participants.

Thursday | June 2023

Lunch symposia

13.00-14.00 | Room 0.2/0.3
Educational event initiated and organised by Ipsen.

IPSEN
Innovation for patient care

Smoothening the consequences of spasticity: Addressing patient-relevant outcomes and improving strategies to facilitate shared decision making in spasticity management
Chairs: H. C.J.W Kerstens, PhD
Presenters: H. (C.J.W.) Kerstens PhD[1], T. (G.D.E.M) van der Weijden MD PhD[2]
[1] Radboud University Medical Center, Radboud Institute for Health Sciences, IQ Healthcare, HAN University of Applied Sciences, Nijmegen, Netherlands
[2] Department of Family Medicine, CAPHRI School of Public Health and Primary Care, Maastricht, Netherlands
Corresponding author: H. (C.J.W.) Kerstens (hans.kerstens@radboudumc.nl)
Learning objectives: To learn: how to incorporate patient-relevant outcomes to facilitate shared decision making in the context of spasticity treatment in daily practice.

Proposed programme

13:00-13:15
H. Kerstens:
The Dutch and the UK national guidelines from the Royal College of Physicians on spasticity in adults1,2 address the use of patient reported outcome measurements (PROM) like Goal Attainment Scaling (GAS) or the Canadian Occupational Performance Measurement tool (COPM) in the treatment of patients for spasticity with botulinum toxin A. Both PROMs are used to engage patients in setting personal tailored goal(s) for their treatment and can be achieved through communication and discussion. In a recent practical guide on optimizing the benefit of post stroke spasticity intervention with botulinum toxin, the clinical experts involved in this guide stated that only half of them is using the GAS.3. Several publications on patient perspectives through interviews and surveys have shown that patient expectations often do not match with treatment results.4,5,6. Incorporating patient-relevant outcomes, in an attempt to "truly" assess the patients' perspective into the current assessment of spasticity and monitoring these outcomes, may improve spasticity management. Also, improvements with regard to communication and shared decision making would be especially welcomed by patients, and would help manage treatment expectations.6

13:15-13:45
T. van der Weijden:
Shared decision making (SDM) is an approach that aims to share the evidence of risks and benefits of healthcare options with the patient and to deliberate about patient preferences. SDM7,8-is advocated in this respect,9 but it has not been broadly adopted yet.10, 11 Clinical practice guidelines (CPGs) are systematically developed to support healthcare professionals, and sometimes patients, in making decisions about appropriate healthcare in specific circumstances. SDM strategies12, like how to structure the presentation of topics, to structure the deliberation process, to provide decision support tools and PROMs, are discussed during this seminar to facilitate shared decision making in clinical practice to improve patient outcomes in spasticity management.

13:45-13:55
H. Kerstens and T. van der Weijden:
To discuss strategies and recommendation within spasticity management on shared decision making within with the audience and to give the opportunity to ask questions.
Intended audience: Rehabilitation physicians, physiotherapists, neurologists, and physician assistants. Relevance to neurorehabilitation and neuroscience: This symposium reveals patient expectation within the treatment of spasticity with botulinum toxin and will provide the audience with practical recommendations on how to facilitate shared decision making in clinical practice.

Thursday 1 June 2023

Lunch symposia

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Friday 2 June 2023

Keynotes

Cognitive rehabilitation: past, present and future
C. van Heugten

After an acquired brain injury, many people have cognitive impairments which may persist in the long term. Cognitive impairments have a negative influence on daily functioning, participation in society and quality of life. Cognitive rehabilitation has been shown effective in domains of functioning which are most often impaired such as speed of information processing, attention, memory and executive functioning, but also in more specific areas such as visuospatial neglect. Current evidence shows that teaching people compensatory strategies to deal with their cognitive impairments in daily life is effective in all domains of cognitive functioning. Novel insights into neuroplasticity and the development of techniques to enhance neuroplasticity give rise to new forms of cognitive rehabilitation. Behavioral techniques may be combined with innovative brain-based treatment methods to enhance cognitive recovery. In this presentation an overview is given of the current state of the art and a look into the future on cognitive rehabilitatio

Exercise for people with Parkinson's disease: progression rather than freezing
A. Nieuwboer

Parkinson's disease (PD) is characterized by widespread pathology, progression and heterogeneity. Recently, many positive results have emerged about the effects of exercise as a therapeutic ingredient for people with PD. Effect sizes of exercise now underscore that this intervention can lead to moderate improvements in motor function as well as better quality of life. At the neurological systems level, it is also being revealed how exercise may work in PD. However, the complexity of delivering exercise in the context of a heterogenous disease such as PD is often underestimated. An important risk factor for immobility and falling in PD is freezing of gait (FOG), briefly defined as a brief episodic reduction of forward progression despite the intention to walk. FOG not only constitutes a very important marker of fall-proneness but also of treatment stratification, as it requires a specific rehabilitation approach. A number of motor and non-motor determinants predict the emergence of FOG, mostly indicating signs of higher disease burden. Not surprisingly, freezing of gait remains largely physiotherapy resistant but rescue strategies are helpful and direct evidence now shows that episodes occur less even in the home situation. A recent Cochrane review on exercise for falls pointed to the fact that fall rates of freezers worsened after training in contrast to non-freezers. This was ascribed to the increased mobility risks that freezers were taking after training. All this points to the personalization of rehabilitation, which requires both profiling of possible risks of training as well as of the capacity for resilience. Exercise effects in PD are not only highly dependent on patients' clinical profiles but also on the dose of delivery, which typically needs to be high and progressive. In this talk, the different targets and modes of exercise will be discussed as well as where the field needs to go next to capitalize on the potential of exercise as a realistic therapeutic option.

Friday 2 June 2023

Invited lectures

10.00-10.30 | Room 0.11
From exercise and fitness training to active living after stroke: how can we facilitate transfer?
F. van Wijck

A growing body of evidence, including several well-conducted evidence syntheses, show that exercise and fitness training can result in a wide range of physiological, functional and psychosocial benefits for stroke survivors. However the extent to which these benefits transfer to other activities or settings is often very limited, leading to suboptimal recovery post-stroke.

In our current healthcare environment, opportunities for providing specialist rehabilitation (including exercise) interventions are increasingly scarce and short-lived. An important question is therefore how to increase the likelihood that the effects of such interventions transfer to a longer-term active lifestyle, in order to optimise post-stroke recovery, reduce the risk of subsequent stroke, avoid deconditioning and promote health in general.

To this effect, a deeper understanding is needed of the complexity of exercise interventions and the demands these place on stroke survivors and carers, as well as the concept of 'transfer' and how best to facilitate this.

This presentation will analyse the nature of exercise interventions from a behavioural perspective, and identify factors that may help or hinder their transfer to new activities, habitual behaviours, and settings. Implications for further research, clinical practice and service development will be discussed, illustrated by examples of best practice from high, middle and low-income countries.

13.00-13.30 | Auditorium II
Differences in arm recovery between ischemic stroke and intracerebral haemorrhage
U. Hammerbeck
University of Brighton, Eastbourne, United Kingdom

Introduction / Objective: Arm weakness is the most common focal neurological deficit after stroke. Recovery is incomplete with significant impact on stroke survivors' independence. However, whether arm recovery differs after ischaemic stroke and intracerebral haemorrhage is unclear.
Methods: This presentation will explore the physiological differences of tissue injury and repair between ischaemic stroke and intracerebral haemorrhage.
Results: It will report on comparisons of arm recovery between these stroke types from a systematic review of the literature and an individual patient data meta-analysis using the VISTA database.
Discussion: The talk will conclude with presenting ongoing and future work to explore differences in recovery, including a co-developed smartphone app to Monitor Arm Recovery after Stroke (MARS) using patient reported outcome measures.
Conclusion: Differences in the amount and/or the trajectory of recovery between ischaemic stroke and intracerebral haemorrhage stroke should inform conversations with patients and carers and need to be considered in the provision of patient tailored rehabilitation.

Friday 2 June 2023

Invited lectures

Embracing the complexity of rehabilitation research

P. Feys
UHasselt, Hasselt, Belgium

Introduction / Objective: In a healthcare context, rehabilitation is defined as a multimodal, person-centred, collaborative process including interventions targeting a person's capacity and/or contextual factors related to performance with the goal of optimising the functioning of persons with health conditions currently experiencing disability or likely to experience disability (Cochrane Rehabilitation). Rehabilitation (research) is complex.

Methods: The presentation will discuss the content and targets of rehabilitation interventions with illustrations from research in MS and other pathologies, mainly with a physical function target or physical training component. Also methodological aspects of rehabilitation trials, particularly how designing the control intervention and group will be presented.

Results: The ICF is a framework for clinical reasoning and outcome measures but can also allow to document hypothesized mechanisms of actions in research and identification of targets and intermediate outcomes. So far, often single intervention modalities are not always fitting the baseline profile of included subjects, so actually another modality or a combination would be superior for an individual to improve a chosen target, for example fatigue or physical activity. Furthermore, detailed documenting of the intervention and progression criteria is required to facilitate implementation. Finally, a challenge is to design the control intervention. A workgroup within the SRRR (Stroke Recovery and Rehabilitation Round tables) is developing an online tool to guide researchers.

Discussion: Frameworks and definitions will be presented and illustrated. A shift towards best multi-modal intervention content and careful target selection is needed to truly understand and enhance the potential impact of interventions towards a daily life 'lived health experience'.

Conclusion: Bridging the gap between research and clinical practice remains a challenge, but truly reflecting on the development of research protocols within frameworks, understanding intermediate targets and documenting the best possible multi-modal interventions for an individual may lead to an higher embracement of rehabilitation research.

Friday 2 June 2023

Focused symposia

10.00-11.30 | Auditorium II
Measuring Fatigability in Multiple Sclerosis

Setting the scene: challenges in assessing fatigue and fatigability in MS

D. Kos[1], P. Feys[2], N. Peeters[2], Z. Abasiyanik[2]
[1] KU Leuven & National MS Center Melsbroek, Leuven, Belgium
[2] UHasselt, Belgium

Introduction / Objective: Fatigue in Multiple Sclerosis (MS) can be distinguished between the subjective of fatigue and fatigability, a decrease in performance over time. Further, people may experience motor and cognitive fatigability, either separately or in combination, especially in dual task conditions. Assessing fatigue and fatigability is challenging, but important to provide tailormade (rehabilitation) interventions.

Methods: In this Focused Symposium, after introducing a framework, the speakers focus on these challenges and provide examples of relevant and meaningful Methods to assess motor and cognitive fatigability in single and dual task conditions to use in clinical practice and research.

Presentations:

Setting the scene: challenges in assessing fatigue and fatigability in MS
Daphne Kos (KU Leuven & National MS Center, Belgium)
Motor fatigability: assessment and implications for training
Peter Feys (UHasselt, Belgium)
Cognitive fatigability: from lab testing to real life context
Niels Peeters (KU Leuven & National MS Center, Belgium)
Cognitive-motor performance during and after fatiguing protocols
Zuhal Abasiyanik (Izmir Katip Celebi Universitesi, Turkey, UHasselt, Belgium)

Discussion: The target group for this symposium includes all health care professionals interested in fatigue and fatigability in (MS) practice and research (physicians, physiotherapists, occupational therapists, psychologists, managers, nurses, neurologists …).

Conclusion: In multiple sclerosis, and broader in neurological rehabilitation, fatigue can be unraveled in fatigue versus fatigability, including motor and cognitive components and combinations of these. Several strategies are available to assess these dimensions to support the development and evaluation of tailor-made interventions to reduce (the impact of) fatigue and fatigability.

Acknowledgments: Insights presented in this symposium are gathered in research projects funded by MS Liga Vlaanderen, Claire Fauconnier, Ginettre Kryksztein & Joseph and Marie-Jeanne Philippart-Hoffelt (hosted by Koning Boudewijn Stichting), KU Leuven and Rehabilitation in Multiple Sclerosis (RIMS).

10.00-11.30 | Room 0.10
Novel advances in the assessment and treatment of gait impairments after stroke

A.C.H. Geurts[1], J. Nonnekes[1], B. Bloks[2], N. Keijsers[2]
[1] Radboud University Medical Centre, Nijmegen, Netherlands
[2] Sint Maartenskliniek, Ubbergen, Netherlands

Learning objectives: Up-to-date information on the pathophysiology, assessment and treatment options regarding gait impairments in people with stroke, with emphasis on ankle-foot-surgery.

Gait impairments after stroke, A. Geurts
Introduction of gait impairments after stroke. We will present a novel framework for recovery of balance capacity, leg motor control and gait adaptability, and elaborate on the implications for treatment of gait impairments.

Novel advances in the assessment of gait, Keijsers
Introduction of novel parameters to assess gait capacity in people with stroke, and their value for research and clinical application.

Ankle-foot surgery to improve gait capacity, J. Nonnekes
We will elaborate on the value of ankle-foot surgery to improve gait capacity after stroke, with a focus on indications for surgery and technical approaches.

Evidence of ankle-foot surgery to improve gait capacity after stroke, B. Bloks
Using the ICF-framework as a template, we elaborate on how the effects of ankle-foot surgery can be evaluated. We will present preliminary evidence from an ongoing clinical trial.

Friday 2 June 2023

Focused symposia

Continuous theta-burst stimulation of the contralesional primary motor cortex promotes upper limb recovery after stroke

E.C.C. Van Lieshout[1], S.F.W. Neggers[2], H.B. Van der Worp[1], J.M.A. Visser-Meily[1], R.M. Dijkhuizen[1]
[1] University Medical Center Utrecht, Utrecht, Netherlands
[2] Brain Science Tools B.V., De Bilt, Netherlands

Introduction / Objective: Despite improvements in acute stroke therapies and rehabilitation strategies, many stroke patients are left with long-term upper limb motor impairment. We assessed whether an inhibitory repetitive transcranial magnetic stimulation (rTMS) treatment paradigm started within three weeks after stroke onset promotes upper limb motor recovery.
Methods: Patients with ischemic stroke or intracerebral hemorrhage and unilateral upper limb motor impairment admitted to a single rehabilitation center were randomized to ten daily sessions of active or sham continuous theta burst stimulation (cTBS) of the contralesional primary motor cortex (M1) combined with standard upper limb therapy, started within three weeks after stroke onset. The primary outcome was the change in the Action Research Arm Test (ARAT) score from baseline (pre-treatment) at three months after stroke. Secondary outcomes included the score on the modified Rankin Scale (mRS) at three months and the length of stay (LOS) at the rehabilitation center. Statistical analyses were performed using mixed models for repeated measures.
Results: We enrolled 60 patients of whom 29 were randomized to active cTBS and 31 to sham cTBS. One patient randomized to active cTBS withdrew consent before the intervention and was excluded from the analyses. The mean difference in the change in ARAT score from baseline at three months post-stroke was 9.6 points (95%CI 1.2-17.9; p 0.0244) in favor of active cTBS. Active cTBS was associated with better scores on the mRS at three months (OR 0.2; 95%CI 0.1-0.8; p 0.0225) and with an 18 days shorter length of stay at the rehabilitation center than sham cTBS (95%CI 0.0-36.4; p 0.0494).
Discussion: Ten daily sessions of cTBS of the contralesional M1 combined with upper limb training, started within three weeks after stroke onset, promote recovery of the upper limb, reduce disability and dependence and leads to earlier discharge from the rehabilitation center.

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Assessing age-related changes in control of gait using brain-muscle networks

L. Roeder[2], T.W. Boonstra[1], M. Breakspear, G.K. Kerr
[1] Maastricht University, Maastricht, Netherlands
[2] Queensland University of Technology, Brisbane, Australia

Introduction: Changes in human gait resulting from ageing and neurodegenerative diseases are multifactorial. The neuromuscular control of gait is difficult to assess during overground walking.
Main Objective: Here we map brain-muscle networks to investigate inter-individual differences in the neural control of gait.
Methods: Mobile EEG and EMG was recorded from 24 young adults, 24 older adults, and 21 individuals with Parkinson's Disease (PD) during overground walking. Intermuscular and corticomuscular coherence was estimated and network analysis was used to map changes in connectivity within the gait cycle. Functional connectivity was correlated with participant characteristics and clinical scores to investigate the inter-subject variability in the neural control of gait.
Results and Discussion: Non-negative matrix factorization revealed three brain-muscle networks: 1) a network of bilateral leg muscles that was active during the double support phase, 2) a left-lateralized network that was active when active from left toe-off until left heel strike, and 3) a right-lateralized network that was active during the right swing phase. Assessing the inter-subject variability, we found a general reduction in neuromuscular connectivity at older age and a selective increase in activation of the bilateral network in participants with impaired tactile sensitivity of the foot. No significant associations were found between connectivity and PD measures.
Conclusion: There is general reduction in common spinal input to leg muscles with older age and the selective increase of the bilateral network may reflect a compensation strategy to maintain mediolateral gait stability with impaired sensory processing.
Acknowledgements: The authors would like to thank the European Commission (Marie Sklodowska-Curie grant no 895914) for providing financial support to this project.

Friday 2 June 2023

Focused symposia

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The effect of contextual interference on engagement during motor practice in subacute rehabilitation for people post-stroke

G. Batsha-Kigel[1], G.A. Bartur[2], L. Moskovitz-Melanker[1], M. Kafri[1]
[1] University of Haifa, Haifa, Israel
[2] Reuth Tel-Aviv Rehabilitation Hospital, Tel-Aviv, Israel

Introduction: Post-stroke rehabilitation involves training patients to regain motor skills that were impaired. The optimization of this learning process is influenced by the practice variables, including contextual interference (CI).

Main Objective: To investigate a potential emotional-cognitive mechanism of the CI-effect, which is believed to increase learner engagement in practice, by comparing engagement (attention and arousal) in practice under high vs low CI conditions.

Methods: Twenty-six patients (63.65 ±9.14 years) who were undergoing subacute rehabilitation following a stroke were randomly allocated to either a high or low-CI group. Both groups participated in three sessions conducted in consecutive days where they practiced three items of the Wolf motor function test (30 repetitions each), in either a random (high-CI) or blocked (low-CI) order. At the start, middle, and end of each practice session, a single-channel pre-frontal cortex electroencephalogram was recorded to measure the Cognitive Engagement Index (CEI). At the end, participants also self-rated their level of arousal.

Results and Discussion: Comparison of CEI between measurements (i.e. start, middle and end) within training session (mean of all days) demonstrated that CEI increased from start to middle in the high-CI group (p$\leftarrow$0.001), then decreased (p=0.01), while in the low-CI group, CEI increased from start to end (p=0.02). Arousal was higher in the low-CI group across measurements points (p=0.04).

Conclusion: Among people post-stroke in subacute rehabilitation, high-CI may impose a cognitive burden, leading to decreased engagement and low arousal, while low-CI may enable the maintenance of engagement.

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High dosage upper limb rehabilitation for chronic stroke patients Protocol for a randomised controlled trial (INTENSIVE)

LTT Tedesco Triccas[1], S.S. Sporn[2], M. Coll, I. Omana[2], S.B. Bestmann[2], N.S. Ward[2]
[1] UCL, London, United Kingdom
[2] University College London, London, United Kingdom

Introduction: High dose/intensity upper limb rehabilitation programs such as the Queen Square Upper limb program (QSUL) have led to clinical meaningful improvement in post-stroke impairment.

Main Objective: The primary aim of this study is to investigate the efficacy of high dose/intensity upper limb rehabilitation programs in people with chronic stroke in a randomised controlled trial setting.

Methods: Patients with moderate upper limb impairment (n=105, at least 6 months after stroke) will be randomised to: Group 1- QSUL: Group 2: VR-based programme; Group 3: A waiting-list control group. Groups 1 and 2 will receive a minimum of 45 hours of active time on task over 3 weeks. The primary outcome score is the Fugl Meyer Assessment at 3 months follow up. Secondary outcome measures will include clinical, kinematic and physiological measures at baseline (T1), immediately post-intervention (T2) and at three-months follow-up (T3) in keeping with the Stroke Recovery and Rehabilitation Roundtable Consensus recommendations. Analysis of changes in primary and secondary outcome measures will be performed using linear regression. The study has been approved by the Wales Research Ethics Committee 2 Cardiff (Rec reference: 22/WA/0065) and registered on ClinicalTrials.gov (NCT05527262).

Results and Discussion: The trial is ongoing.

Conclusion: The results from this work will provide evidence of the efficacy of high dose/intensity upper limb rehabilitation in chronic stroke patients delivered conventionally and using VR technology. Furthermore, the collection of neuroimaging and neurophysiological biomarkers will help (i) determine whether there are characteristics that influence response to this treatment, and (ii) whether high dose, high intensity upper limb training changes these biomarkers.

Friday 2 June 2023

Focused symposia

The use of wearables in at-home upper-limb rehabilitation: opportunities, challenges & examples

J.B.J. Bussmann
Erasmus MC University Medical Center Rotterdam, Rotterdam, Netherlands

Current stroke rehabilitation faces several challenges, such as the increasing demand for healthcare, limited personnel resources, and the need for improving effectiveness. Technology can play an important role and offers many opportunities for at-home upper-limb rehabilitation too. Wearable technology can be applied to assess patient status, but also to support at-home exercise and to motivate patients to apply their available capabilities in daily life activities. In this presentation, an overview will be provided of the development and application of at-home upper-limb rehabilitation technologies, focusing on at-home exercise and daily-life feedback. However, these developments and applications do not always prove to be a success. Many factors affect ultimate success and effectiveness. Some of these factors will be discussed, supported by examples of own research and experience.

10.30-10.45
Quality versus quantity assessments of arm movement in clinical trials

A. Luft
Center for Neurology & Rehabilitation, Hertenstein, Switzerland

Arm movement quality is often overlooked when rehabilitative training focuses on task-oriented exercises. If the quality is poor, it may lead to secondary complications or reduced use of the arm in daily life (poor transfer to participation levels). The assessment of arm movement quality is mostly based on subjective scoring like in the Action Research Arm Test (ARAT). Such scores are often complex to teach and remain subjective even for the expert user. Integrated monitoring units (IMUs) with gyroscopes and accelerometers can provide a more thorough assessment of kinematics and quality of arm movement. Such measures are useful as clinical trial outcomes and may serve as important markers for treatment progression especially when a patient goes home after inpatient rehabilitation. This talk discusses sensor-based arm quality assessments and their use in clinical trials and practice.

The Arm Activity Tracker: assessing the feasibility and exploring the efficacy of a sensor-based feedback device stimulating daily life upper extremity activity in stroke patients

A.J. Langerak [1], G.R.H. Regterschot [1], M. Evers [2], B.J.F. Van Beijnum [3], C.G.M. Meskers [4], R.W. Selles [1], G.M. Ribbers [1], J.B.J. Bussmann [1]
[1] Erasmus MC, Rotterdam, Netherlands
[2] Rijndam Rehabilitation, Rotterdam, Netherlands
[3] University of Twente, Enschede, Netherlands
[4] Amsterdam UMC, Amsterdam, Netherlands

Introduction / Objective: To stimulate daily life upper extremity (UE) use in stroke patients, we developed the Arm Activity Tracker (AAT), a system based on wrist-worn accelerometers measuring UE activity and providing direct visual and tactile feedback. This study aims to evaluate the feasibility of the AAT and secondarily explore its efficacy.
Methods: A randomised, cross-over within-subjects study was conducted in sub-acute stroke patients admitted to a rehabilitation centre. Feasibility encompassed 1) adherence: the dropout rate and the number of participants with insufficient AAT data collection; 2) acceptance: the Technology Acceptance Model (range: 7-112) and 3) usability: the System Usability Scale (range: 0-100). A two-way ANOVA was used to estimate the difference between the baseline, intervention and control conditions for 1) paretic UE activity and 2) UE activity ratio.
Results: Seventeen stroke patients were included. A 29% dropout rate was observed, and two participants had insufficient data collection. Participants who adhered to the study reported good acceptance (median [IQR]: 94 [77-111]) and usability (median [IQR]:77.5 [75-78.5]). We found small to medium effect sizes favouring the intervention condition for paretic UE activity ($\eta 2G=0.07$, $p=0.04$) and ratio ($\eta 2G=0.11$, $p=0.22$).
Conclusion: Participants who adhered to the study showed good acceptance and usability of the AAT and increased paretic UE activity. Dropouts should be further evaluated, and a sufficiently powered trial should be performed to analyse efficacy.

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Focused symposia

Towards minimally supervised neurorehabilitation: A human-centered design approach

L. Marchal-Crespo
Delft University of Technology , Delft, Netherlands

Introduction / Objective: The recovery of sensorimotor functions after an acquired brain injury requires a long, highly intense, and repetitive training program. Several new technologies have been developed to support this highly demanding training, among the most prominent being robotic devices and virtual reality. Recently, there has been an increased interest in minimally supervised and unsupervised rehabilitation to increase therapy dosage and complement conventional therapy at patients' homes. These new inventions should be co-created between different stakeholders if we aim to facilitate their usability and acceptance by the final user.
Methods: In this talk, I put forward a new human-centered mindset to design highly intuitive, acceptable, wearable, and usable immersive virtual reality environments using low-cost off-the-shelf Head Mounted Displays (HMD) and portable minimally actuated robotic devices for upper limb rehabilitation to overcome many of the fundamental limitations of traditional home rehabilitation.
Results: I will present our research activities aimed at defining the characteristics of suitable training environments for patients as a first step toward the development of immersive virtual training environments using HMDs. I will also present results from a usability study performed with our portable hand trainer for minimally supervised training, re-developed from an earlier prototype using informal feedback from therapists in a human-centered design approach to enhance its functionality, robustness, and ergonomics.

13.00-14.30 | Room 0.11
Technology-supported balance and gait training @Home

HEROES - Home-based exergaming to enhance resistance to falls in people with stroke

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Introduction / Objective:The risk of falling is dramatically increased in people living with the consequences of stroke (PwS). This pertains not only to those with severe stroke-related balance and/or gait impairments, but also to a majority of PWS who only sustained a mild stroke. Perturbation-based balance training – aimed at improving reactive stepping following a loss of balance - is an emerging and promising training modality for preventing falls that is rapidly gaining scientific interest. Its clinical uptake, however, is hampered by the need of expensive equipment and the labor-intensive mode of delivery.
Methods: In sequential studies, we 1) evaluated the effects of perturbation-based training on reactive step quality in PwS, 2) tested whether action observation with motor imagery or motor simulation of reactive stepping may confer similar benefits to practicing 'real' reactive steps, 3) determined the neuromuscular control of imagined/simulated reactive steps, and 4) designed a home-based exergame (HEROES) based on these principles for improving reactive stepping.
Results: The results of these studies will be presented, along with the steps we have taken in the user-centerd design of the HEROES exergame. In addition, a demonstration will be given of the current HEROES protoype.
Discussion: Upon proven safety and effectiveness, playing the HEROES exergame may help improve mobility in PWS, and reduce health-care consumption by preventing fall-related injuries and by (partly) replacing supervised training sessions in a rehabilitation center.
Conclusion: Scientific evidence supports the concept of the HEROES exergame, but its safety and efficacy in PwS have yet to be demonstrated.

Remotely prescribed and monitored home-based gamified augmented-reality gait-and-balance therapy in people with Parkinson's disease

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[3] Department of Rehabilitation, Sint Maartenskliniek, Nijmegen, The Netherlands

Background: Guidelines for people with Parkinson's disease (pwPD) promote physical therapy and exercise, but adherence remains challenging. Exergaming has the potential to increase therapy adherence through play and personalised interventions. Cue X is a remotely prescribed

and monitored augmented-reality (AR) home-based gait-and-balance exergaming intervention for pwPD. The objective of this study was to evaluate feasibility and potential efficacy of CueX.

Methods: Twente-four individuals with PD with self-reported gait and/or balance impairments participated in this 6-week waitlist-controlled home-based AR gait-and-balance exergaming intervention with CueX, prescribed for minimally five days/week for 30 minutes/day. AR gait-and-balance exergames were prescribed and adjusted on a weekly basis, using remotely obtained adherence and performance data. Potential efficacy was evaluated in three laboratory visits: t0 (baseline assessment), t1 (pre-intervention assessment after the 6-week waitlist period) and t2 (post-intervention after the 6-week Cue X intervention). Primary outcomes were feasibility (safety, adherence, user experience) and potential efficacy for improving gait-and-balance outcomes (TUG, miniBEST, 10MWT, LPAS and walking-related fall-risk score).

Results: Recruitment started in December 2022 and the final t2 assessment is scheduled in July 2023. Interim results on feasibility and potential efficacy for improving gait-and-balance outcomes will be presented, based on 20/24 participants.

Discussion: This clinical-feasibility trial is the first to evaluate a remotely prescribed and monitored, home-based gamified AR gait-and-balance intervention for pwPD. Implications of obtained feasibility and potential efficacy results will be discussed for future RCTs on the (cost-)effectiveness of CueX.

Conclusion: CueX, developed for pwPD, may be broader applicable in neurorehabilitation of gait-and-balance impairments.

Acknowledgements: This research is funded by EUreka Eurostars, Grant ID E115506.

Conflict of interest: This study is part of a collaboration between the Vrije Universiteit Amsterdam and Strolll, the manufacturer of CueX, formalized in a consortium agreement associated with their joint EUreka Eurostars grant. Anonymized movement and/or environmental data from the AR glasses and gold standards and information on exercise adherence and performance (e.g., tasks performed, hours spend on games) of the present study will be shared with Strolll for the further development of CueX. Per May 1, 2023, Melvyn Roerdink will work on a consultancy agreement for Strolll ancillary to his position as Associate Professor Technology in Motion at the department of Human Movement Sciences of the Vrije Universiteit Amsterdam.

Effectiveness of a home-based video-game balance training program on balance performance and neuroplastic changes in children with cerebral palsy

P. Meyns
Hasselt University, Hasselt, Belgium

Introduction / Objective: Children with cerebral palsy (CP) experience poor balance control during standing and walking due to sensorimotor disorders resulting from non-progressive brain lesions (Bruijn 2013), which often hampers their daily life activities (Pavão 2013). Several pilot studies investigated the effectiveness of exergame balance training in children with CP (Jelsma 2013; Brien 2011), but not all are effective. In addition, the effects of exergame-training on brain white matter in CP, are poorly understood. As such, we investigated whether exergame-training is effective to improve balance control outcomes, and whether this training induces neuroplastic changes in CP.

Methods: Data of two registered trials, at the University medical center location Boelelaan, Amsterdam (UMC; NTR6034) and university of Ghent (UGhent; NCT03219112) is presented. Children with spastic unilateral and bilateral CP were included. Children in the intervention group performed exergame-training, which comprised 6-8 weeks home-based X-box One Kinect (Microsoft) training. Kinect sports games focused on balance were used. Balance was assessed using clinical scales (e.g. Pediatric Balance Scale) and biomechanical outcomes (e.g. Margins of Stability). Children from UMC had MRI examination at baseline and after training. Nine age-matched typically developing (TD) children underwent baseline measurements.

Results: On group level, no post-intervention differences on clinical balance scores were found between the intervention and control group. Children with low baseline balance performance in the intervention group showed improvements in clinical balance after training, whereas children with high baseline balance performance did not. Few effects on biomechanical outcomes were found. MRI/DTI showed a consistent trend for volume increase within the right inferior parietal cortex, volume decrease within the right retrolenticular limb of the internal capsule, and an increase of white matter integrity within the right corticospinal tract.

Discussion: Exergame balance training shows mixed results in CP depending on balance outcome and baseline balance performance. A 6-week balance training seems to induce neuroplastic changes in CP.

Conclusion: Exergame balance training is promising to improve balance performance in children with CP that have low baseline balance performance.

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13.00-14.30 | Room 0.5
The influence of motor cognition on functional recovery after stroke

Does cognitive functioning influence recovery of dexterity after stroke?

P.G. Lindberg [1]
J. Plantin[2], E. Dziezuk[3], M. Térémetz[3], S. Hamdoun[3], G. Turc[3], J.C. Baron[3], C. Rosso[4],
M.A. Maier[5], J.L. Mas[3]
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[5] Université Paris Cité, Paris, France

Introduction / Objective: Finely controlled finger movements involve both sensorimotor and cognitive brain networks and growing evidence in stroke patients shows that lesion to non-motor brain areas can explain some of the variance in manual dexterity recovery. Clinical assessment of cognitive functioning early after stroke is a predictor of motor recovery and upper limb dual-task studies show impaired selective attention in stroke. Together this suggests that cognitive functioning is a key determining factor for recovery of upper limb function in stroke, in particular for manual dexterity recovery. Aims: to investigate the cognitive contribution to manual dexterity recovery post-stroke.
Methods: Cognitive predictors of dexterity recovery, from a longitudinal (3-weeks to 6-months) and chronic phase intervention study, are examined. Manual dexterity was measured using clinical scales and the Dextrain device for quantification of finger force control and independent finger movements. Clinical assessments of cognitive functioning are combined with visuospatial attention measures from a visuomotor force-tracking task.
Results: Dexterity recovery and its relation to general cognitive functioning will be presented. I will also present recent findings concerning how sub-clinical visuospatial attention impairments and intra-subject motor variability, a probe of task-related attention, can explain recovery of dexterity.
Discussion: Identifying the cognitive determinants of dexterity recovery after stroke is an important step in the elaboration of targeted more efficient treatments.

Do post-stroke cognitive impairment interferes with motor learning?

J.A.L. Vandermeeren
UCLouvain, CHU UCL Namur - Godinne, Yvoir, Belgium

The importance of cognitive fitness has been recently re-emphasized by several studies in aged healthy individuals and in stroke survivors. Cognitive impairments, whether as a direct consequence of stroke or as being part of a generalized cognitive decline along the mild cognitive impairment - dementia spectrum, have a strong influence on the post-stroke recovery of independence and daily life activities. Furthermore, even the recovery of motor control after a stroke seems to be influenced by simultaneous cognitive impairments. We will discuss whether and how cognitive impairment interferes with motor learning, a key function in post-stroke spontaneous recovery and neurorehabilitation.

The contribution of cognitive function as predictor of recovery of bimanual hand use and unimanual motor impairment after stroke

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M. Verneau[2], A.K. Godbolt[1], G.V. Pennati[1], E. Laurencikas[1], B.M. Johansson[3],
L. Krumlinde-Sundholm[4], J.C. Baron[2], J. Borg[1], P.G .Lindberg[1]
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Introduction / Objective: Cognitive impairment may impact hand motor recovery and assist in prediction modelling. We expected that recovery of complex bimanual task performance would be more strongly associated with initial cognitive status than recovery of unimanual sensorimotor impairment. We aimed to determine the contribution of cognitive function as predictor of recovery of bimanual hand use and unimanual motor impairment after stroke.
Methods: In this prospective longitudinal study 89 first-ever stroke patients with arm paresis, were assessed at 3 weeks, 3 and 6 months after stroke onset. Bimanual activity performance was assessed with the Adult Assisting Hand Assessment Stroke (Ad-AHA), unimanual motor impairment with the Fugl-Meyer Assessment (FMA). Barrow Neurological Institute Screen for Higher Cerebral Functions (BNIS) determined cognitive impairment. Other candidate

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predictors included SAFE-score (FMA-items shoulder abduction and finger extension), and sensory impairment. MRI was used to measure weighted corticospinal tract lesion load (wCST-LL).
Results: Ad-AHA correlated with FMA at each time-point (r→0.88, p←0.001) and recovery trajectories were similar. Multivariate models showed that both Ad-AHA and FMA recovery were predicted similarly. The main predictors were SAFE-score (R2~0.6), wCST-LL (R2=0.15-0.07) and sensory impairment (R2=0.15-0.07).
Discussion: Contrary to our hypothesis, cognitive impairment explained similar amount of additional variance in Ad-AHA outcome (R2 = 0.07) and FMA-UE (R2 = 0.06). Cognitive impairment also explained variance in recovery of distal hand motor impairment (FMA-Hand) (R=0.10) in addition to wCST-LL (R=0.41).
Conclusion: Cognitive impairment explained some additional variance of both unimanual sensorimotor impairment and bimanual hand use beyond that explained by SAFE-score, wCST-LL and sensory impairment.

The influence of Apraxia on functional impairment after stroke
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[2] MRC Biostatistics Unit, University of Cambridge, Cambridge, United Kingdom
[3] Birmingham and Solihull NHS Mental Health Foundation Trust, Birmingham, United Kingdom

Introduction / Objective: Limb apraxia (LA) is a sequela of stroke causing deficits in skilled action. Patients with LA cannot complete tasks, such as brushing their teeth, or gesturing for communicative, familiar actions. Previous studies have reported LA is linked to greater disability after stroke.
Methods: We carried out Principal Component Analyses on 247 stroke patients tested on the Birmingham Cognitive Screen (BCoS) at the sub-acute stage of stroke, in which apraxia tasks were either included or excluded. We entereted these into multivariate prediction models predicting patients' Barthel Index (BI) scores for Activities of Daily Living (ADLs) at the chronic stage. We used Root Mean Square and R^2 to identify which models best predicted independence on ADLs, using the BI.

Results: The multivariate models either involved the full set of cognitive variables, their PCAs, with and without apraxia measures, or apraxia measures on their own, correcting for age and sex. Apraxia tasks (on their own) best predicted BI scores for ADLs.
Discussion: Identifying apraxia after stroke has a predictive value on the outcome; future work will help 1) get a better understanding of this disorder and 2) obtain better screens to identify it in stroke patients as a way to stratify them into appropriate neurorehabilitative strategies as early as possible.

Combinations of functional neuroimaging and lesion analysis to inform about essential brain areas and neural recovery in apraxia following stroke
J. Hermsdörfer, C. Clara, A. Afra
Technical University of Munich, Munich, Germany

Introduction: Stroke does not only cause elementary sensorimotor deficits such a hemiparesis and sensory loss but also impairs cognitive aspects of motor control. The term apraxia summarizes a number of related symptoms like inability to imitate gestures, errors during pantomiming as well as during real tool use.
Main objective: The goal of the present study was to investigate whether motor cognition rigidly depends on specific brain areas or whether it can be reorganized during recovery after stroke.
Methods: To this aim, we used results from a lesion analysis in chronic stroke patients with left-sided lesions that associated lesion distribution to tests of tool use (VLSM). We compared these findings with brain activations recorded in an age-matched group of healthy participants during executing the same tool use actions in an MRI environment (fMRI).
Results and discussion: VLSM analysis revealed a lesion area in the inferior parietal lobe that was associated with apraxic errors even in the chronic state of the disease. fMRI analysis revealed a left-lateralized network with activations in the inferior parietal cortex during the planning and the execution of the tool use actions. Both the area of critical-lesions for apraxia and normal tool-use representation largely overlapped.The findings did not reveal clear indications of plasticity obvious as areas activated in fMRI but not relevant if damaged nor indications of an area generally critical for compensation obvious as irrelevant in fMRI but associated with apraxia in VLSM.

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Conclusion: Thus, disorders of motor cognition may be not very receptive to reorganization, suggesting a particular strong need for behavioral therapies.

13.00–14.30 | Room 0.4
Fatigue and the Post-Covid Condition
C. Dettmers, M. Jöbges:
Kliniken Schmieder Konstanz

The Post-Covid condition is a frequent finding in patients after an acute SARS-CoV-2-infection. Because of the high incidence of the Post-Covid condition and its increased social and economic burden, there is an urgent need to understand its pathophysiology as well as to develop effective treatment options. This session's first presentation, describes an objective method to measure motor fatigability. The second presentation illustrates experiences with cognitive behavioral therapy.

Assessment of physical endurance and motor fatigability in patients with post-COVID syndrome
C. Weich

In this study, we analyse physical endurance of patients with post-COVID syndrome. We used ergometer diagnostics framed by two six-minute walking tests on a treadmill. Thus, we evaluate, whether patients are exhausted objectively or whether they have to end the test prematurely due to subjective perception. Furthermore, the two six-minute walking tests in the pre-post comparison disclose whether exhaustion produced by the cycle ergometer test significantly alters the gait pattern. Through this procedure, we test whether there is an abnormality in motor fatigability. In summary, after fifty measurements, we can report that many patients delivered a significantly better performance (measured, for example, by maximum oxygen uptake) than they expected before the test (based on previously made statements). A significant modification of walking patterns occurred only in about ten percent of all cases.

Feasibility of a cognitive-behavioral group therapy for patients with post/long COVID syndrome in neurological rehabilitation
D. Mier, D. Huth, S. Tholl, A.-K. Bräscher, J. Fiess, C. Herrmann, G. Birke, M. Jöbges & M. Witthöft

Cognitive-behavioral therapy (CBT) is known to reduce persistent body symptoms and fatigue with small to medium effect sizes. Based on current CBT programs, we developed a CBT group intervention for individuals with post/long COVID syndrome. The feasibility (of the concept and its acceptance) was examined in patients in neurological rehabilitation. The treatment program comprises eight sessions and includes psychoeducational and experience based interventions on common psychophysiological mechanisms of persistent bodily symptoms. As part of the neurological post/long COVID rehabilitation, the feasibility of the treatment concept was tested using a one-group design in a naturalistic setting. 51 persons in rehabilitation after a SARS-CoV-2 infection participated, who were not hospitalized during the acute stage of their COVID-19 illness and did not have competing neurological diseases. After each session, assessment forms were completed and psychometric questionnaires were collected before and after the intervention. The treatment program was well received. Each session was rated as comprehensible and there was a high sense of overall satisfaction with the sessions. Pre-post effect sizes (of standard rehabilitation incl. new treatment program) showed a significantly reduced subjective fatigue and improved disease coping. The present results support the feasibility and acceptance of the newly developed CBT group concept for individuals with post/long COVID syndrome.

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Predictors of depressive symptoms among COVID-19 patients up to 2 years after hospitalization

L.M. Bek, C. Lückerath, J.C. Berentschot, M.E. Hellemons, J.G.J.V. Aerts, G.M. Ribbers, H.J.G. Berg-Emons, M.H. Heijenbrok-Kal
Erasmus MC, Rotterdam, Netherlands

Introduction: After hospital discharge, post-COVID-19 patients report depressive symptoms. Identifying patients at high risk for depressive symptoms is essential to provide optimal healthcare and limit long-term consequences.
Main Objective: We evaluated the incidence, course, and predictors (demographic, physical, cognitive, and psychological) of depressive symptoms among patients up to 24 months after hospitalization for COVID-19.
Methods: CO-FLOW is a multicenter prospective cohort study with data collection at 3, 6, 12, and 24 months after hospital discharge. Depression was measured using the Hospital Anxiety and Depression Scale (HADS), subscale depression score ↗11 indicated depressive symptoms. Generalized estimating equations with repeated measurements were used.
Results and Discussion: CO-FLOW enrolled 650 patients, and data from 581 (89%) patients who completed the HADS were analyzed. Mean age was 60.1 (SD 11.2) years and 400 (68.8%) were male. Throughout the 2-year follow-up, 9-11% of patients experienced depressive symptoms; Depressive symptoms improved over time (mean difference -0.5 (95% CI -0.9 to -0.09), p=0.006). Never smoking (0.6 (0.3 to 1.0)), non-European migration background (1.3 (0.8 to 1.9)), and males (0.22 (0.18 to 0.26)) and females (0.16 (0.12 to 0.21)) with fatigue, cognitive failure (0.02 (0.01 to 0.04)), and posttraumatic stress disorder (PTSD) (0.07 (0.05 to 0.09)) scored significantly (all p↖0.002) higher for depressive symptoms.
Conclusion: One out of ten COVID survivors had depressive symptoms after hospital discharge which improved over time. Besides non-European migration background and never smoking, fatigue, cognitive failure, and PTSD predicted depressive symptoms. These findings emphasize the importance of cognitive and psychological support in post-COVID-19 patients.

Telehealth-delivered supervised exercise and behaviour change support is feasible and shows promise as a path to sustained increases in physical activity after stroke: Results from the ENAbLE Pilot Trial

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Introduction: Supervised exercise after stroke may be critical to the success of lifestyle interventions that aim to increase physical activity and therefore reduce stroke recurrence risk.
Main Objective: This abstract reports on the feasibility and potential for effect of a supervised exercise intervention aimed at increasing physical activity (PA) after stroke evaluated through ENAbLE Pilot Trial.
Methods: A 4-arm randomised pilot trial involving people 3 months to 10 years after transient ischaemic attack or stroke. The trial involved a 6-month PA intervention (including 3 months of telehealth-supervised exercise and six months of behaviour change support). Feasibility indicators included adherence and retention. Evaluation of the PA intervention's potential for effect included self-reported physical activity (International Physical Activity Questionnaire) analysed using linear mixed models to with a random participant-level intercept. Robust Huber-White estimators of the variance were used to account for heterogeneity of residual variance.
Results and Discussion: Forty participants were randomised, 20 to the physical activity intervention. Median (IQR) attendance to physical activity sessions was 31 (26 to 34) of a possible 36. Overall retention of study participants was 93%, 90% and 73% at 3-month, 6-month and 12-months respectively. The estimated effect of the PA intervention (95%CI) from baseline on total self-reported physical activity was an increase of 744 (73 to 1415), 550 (-321 to 1421) and 1071 (271 to 1871) METmin/wk at 3-month, 6-month and 12month timepoints respectively.
Conclusion: A 6-month, telehealth-delivered PA intervention involving supervised exercise appears feasible. Our results suggest the intervention may have potential to deliver sustained improvement in physical activity after stroke.

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Increased access to physical activity and exercise for patients with neurological conditions in the community: a service improvement evaluation.

J. Alexander[2]
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Introduction: Patients with neurological conditions require early and ongoing access to physical activity and exercise opportunities to improve or maintain function but many are not meeting physical activity requirements.

Main Objective: To assess the impact of a pathway that increased access to physical activity and exercise for patients with neurological conditions.

Methods: A pathway of collaboration between health care and public services was developed to increase physical activity and exercise opportunities. Neuro physiotherapists offered a bespoke 12-week exercise programme that was continued by a fitness instructor in a local public gym. Using a pre-post design, outcomes relating to physical activity and strength were recorded at baseline and between 6 -12 weeks (health care) and 12-18 weeks (telephone follow up). Suitability of the pathway and outcomes were discussed with a physiotherapist focus group quarterly.

Results and Discussion: Thirty-six patients (21M, 15F) mean (SD) age 60 (15) with a range of neurological conditions were eligible and included. Ten participants dropped out: eight (22%) for medical reasons, two (5%) for other reasons. Due to the pandemic, four (11%) patients could not transition when facilities closed. Data for 22 (61%) participants were included in the analysis and showed: beneficial effects in strength and function and reduced waiting times to access third sector gyms. Patients and therapists reported that the pathway was feasible.

Conclusion: Outcomes suggested the pathway benefitted patients who needed increased access to physical activity and exercise during and following neurorehabilitation.

Acknowledgements: This evaluation included small numbers but will inform future investigation at scale.

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Optimizing protocol selection for cardiopulmonary exercise testing in slowly progressive neuromuscular diseases

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Introduction: Cardiopulmonary exercise testing (CPET) is recommended to last between 8 and 12 minutes, usually achieved by a protocol with pre-set workload increments based on clinical expertise of the assessor or using prediction equations. Using these procedures developed for healthy people in people with neuromuscular diseases (NMD) will likely result in tests outside the 8-12 minutes window.

Main Objective: To develop a predictive model to estimate CPET peak workload (W_{peak}) in people with slowly progressive NMD.

Methods: A linear regression model was developed using backward elimination, based on tests lasting 8 to 12 minutes, with W_{peak} as dependent variable, and 6-minute walk test (6MWT) distance, gender, age, height, weight, body mass index, and Medical Research Council (MRC) cycle score as potential independent variables. The mean difference between experimentally assessed W_{peak} and $W_{peak-predicted}$ was analyzed with a paired t-test, and the Limits of Agreement (LoA) to determine individual bias.

Results and Discussion: The regression analysis resulted in: $W_{peak-predicted}$ = -15.123 + 0.267*6MWT + 35.953*gender -0.878*age + 2.422*MRC (R^2=0.648). No significant difference was found between experimentally assessed W_{peak} (mean = 126.5 ± 60.6 Watts) and $W_{peak-predicted}$ (mean = 130.3 ± 46.6 Watts). The LoA were relatively wide with -79.4 to +71.7 Watts. Based on clinical judgement and the predictive model, respectively 73 (62%) and 105 (89%) of the 118 tests lasted between 8 and 12 minutes.

Conclusion: Our model predicted W_{peak} accurately at group level and applying the model was superior to clinical judgement for predicting CPET workload increments.

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Self-paced treadmill versus overground walking to evaluate the therapeutic effect of treadmill-based walking adaptability training in neurological patients

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Introduction: In the last decades, instrumented treadmills have been used as gait training and evaluation tool in neurological patients. To enable a natural way of controlling and varying walking speed on these treadmills, self-paced treadmill walking (SPTW) has been introduced. While previous studies have primarily focused on the comparison between SPTW and overground walking (OGW), the evaluation of the therapeutic effect of a treadmill-based intervention using SPTW compared to OGW has not been studied.

Main Objective: Comparing SPTW with OGW to evaluate the therapeutic effect of treadmill-based walking adaptability training in neurological patients.

Methods: Thirty people with incomplete spinal cord injury (iSCI) received six weeks of walking adaptability training on the Gait Real-time Analysis Interactive Lab (GRAIL). At baseline and postintervention, walking speed was assessed during SPTW and OGW by means of a two-minute walk test. Wilcoxon signed-rank tests were used to compare walking speed between SPTW and OGW.

Results and Discussion: Improvement of walking speed after training was significantly higher when assessed with SPTW (median (IQR) = 0.26 (0.09-0.35) m/s) compared to OGW (median (IQR) = 0.04 (0.00-0.08) m/s, $p \leftarrow 0.01$). This difference was caused by a significantly lower walking speed during SPTW at baseline ($p \leftarrow 0.01$), as the walking speed at postintervention was not significantly different ($p = 0.66$).

Conclusion: The therapeutic effect of treadmill-based walking adaptability training was overestimated when assessed with self-paced treadmill walking compared to overground walking. Although participants practiced self-paced treadmill walking before the assessments, familiarization with treadmill walking during the intervention likely caused the overestimation.

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Efficacy of the Myosuit for increasing gait capacity and daily life gait performance in the home and community setting in people with incomplete spinal cord injury: study protocol for a randomized controlled trial

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Introduction: People with incomplete spinal cord injury (iSCI) often have gait impairments that negatively affect daily life gait performance (i.e. ambulation in the home and community setting) and quality of life. They may benefit from light-weight lower extremity exosuits that assist in walking, such as the Myosuit (MyoSwiss AG).

Main Objective: The primary study objective is to test the effect of the Myosuit on daily life gait performance in the home and community setting in people with iSCI. Second, the effect of the Myosuit on gait capacity will be evaluated as well as its usability in the home and community setting.

Methods: The study is a two-armed, open-label randomized controlled trial (RCT). Thirty-four people with chronic iSCI ($\rightarrow$6 months after injury) will be included. The intervention group will receive a Myosuit training program (2 weeks). Thereafter, they will receive the Myosuit at their disposal at home for six weeks. The control group will receive a conventional gait training program (2 weeks) followed by a six-week home period. For the primary objective, physical activity (i.e. walking time per day) will be assessed by an activity monitor. For the secondary objectives, gait capacity and usability will be assessed by clinical tests (10MWT, 6MWT and SCI-FAP) and questionnaires (D-SUS and D-QUEST), respectively.

Conclusion: This is the first RCT to investigate the effect of the Myosuit on daily life gait performance in the home and community setting in people with iSCI.

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Friday 2 June 2023

Oral abstracts

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Motor-Cognitive Dual-Task Ability; Strategies and performance of the upper extremity in healthy and individuals post-stroke

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Introduction: Dual-task ability might be impaired post-stroke. Assessing dual-task ability using an upper-extremity (UE)-cognitive assessment may help understand daily hand-use post-stroke.
Main Objective: 1) To group healthy adults and individuals with stroke according to dual-task strategies and to compare dual-task ability. 2) To correlate UE-cognitive dual-task parameters to executive-functions and daily hand-use within stroke strategy-subgroups.
Methods: Healthy adults were matched to post-stroke individuals. Executive-functions were assessed by the Color Trail Test-part-B (CTT-B), Montreal Cognitive Assessment (MoCA) and Counting Backwards (CBT). The Box and Block Test (BBT) assessed dexterity and perceived daily hand-use was assessed. Motor-cognitive-dual-task assessment included the BBT (motor-task) while simultaneously performing CBT (cognitive-task). Motor and cognitive-cost were calculated for dominant-healthy/less-affected-hand stroke.
Results and Discussion: Twenty-one healthy and 20 individuals with stroke aged 22-87 participated in the study. Participants were grouped according to type of dual-task strategies; Mutual-interference (strategy#1) /Motor-interference with no cognitive-interference (strategy#2) / Motor-interference with cognitive-benefit (strategy#3). Healthy strategy-subgroups were not significantly different in age, executive-functions or UE-cognitive dual-task parameters. Significant differences were found between the stroke strategy-subgroups for dexterity and executive functions; worst performance for strategy#1 subgroup; median (IQR) BBT blocks/min; 46 (43-49) compared to 58 (48-60) (strategy#2) and 57 (50-61) (strategy#3). In strategy#3 subgroup, higher cognitive-cost was significantly strongly correlated with better executive-functions and less daily hand-use. However, in strategy#1 subgroup higher cognitive-cost was significantly strongly correlated to poorer executive-functions and higher daily hand-use.
Conclusion: Strategies of dual-task ability using an UE-cognitive dual-task assessment provides insight and might be the link to explain limited daily hand-use post-stroke.

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Comparing capacity and daily-use of the affected upper extremity of individuals with and without post-stroke depression

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Introduction: Post-stroke depression (PSD) is a frequent psychiatric complication. Despite the fact that it affects approximately 30% of the individuals, very few studies have investigated PSD and its relation to recovery of the affected upper extremity (UE) post stroke.
Main Objective: To compare UE's motor, functional ability and daily hand-use in individuals with and without PSD during the first six-months post-stroke.
Methods: We conducted a secondary analysis of a longitudinal multi-center study. Depressive symptoms were assessed using a score ↗5Geriatric Depression Scale. The Fugl-Meyer Motor Assessment (FMA), Action Research Arm Test (ARAT), Rating of Everyday Arm-Use in the Community and Home (REACH), assessed UE's motor ability, functional ability and daily hand-use, respectively.
Results and Discussion: PSD was present in 38% of 115 participants at admission (T1), 35% of 105 at six-weeks post-stroke (T2) and 28% of 88 participants at six-months post-stroke (T3). Differences were not found between groups at T1 and T2 but at T3, significant differences (p←.001) with a medium effect size were found. Participants with PSD had significantly lower scores on all UE measures. The median (IQR) of FMA was 62.0 (53.0-66.0) for the non-PSD compared with 31.0 (4.0-56.0) for the PSD group, ARAT was 57.0 (49.0-57.0) for the non-PSD compared to 24.0 (0-56.0) and the REACH was 4.0 (3.0-5.0) for the non-PSD and 2.0 (1.0-3.0) for the PSD group.
Conclusion: Whereas no differences were found between groups during in-patient rehabilitation, vast differences were found at six-months post-stroke, when participants were living at home. Possibly participants with PSD were overall less active and less independent in activities of daily living at home, which also negatively affected the ability and daily-use of their affected UE. Further research is needed to understand the clinical implications of treating the affected UE in individuals with PSD.
Acknowledgements: We thank the participants.

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Oral abstracts

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Stroke patients' motivation for home-based upper extremity rehabilitation with eHealth tools.

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Introduction: Over the past years, eHealth-based exercise therapies have been developed to increase stroke patients' adherence to home-based motor rehabilitation. However, these eHealth tools face a rapid decrease in use after a couple of weeks. To maintain adherence in at-home rehabilitation settings, a better understanding of stroke patients' motivation for home-based rehabilitation using eHealth tools is needed.
Main Objective: This study investigates stroke patients' motivation for home-based upper extremity rehabilitation with eHealth tools.
Methods: This is a qualitative study using thematic analysis. We conducted semi-structured interviews after inviting stroke patients with upper extremity motor impairments, who were discharged home from a rehabilitation centre and were advised to continue rehabilitation, to interact with a novel eHealth coach demonstrator in their homes for five consecutive days.
Results and Discussion: We included ten stroke patients. Thematic analysis resulted in eight themes for home-based rehabilitation motivation: Curiosity, Rationale, Choice, Optimal challenge, Reference, Encouragement, Social Support and Trustworthiness. These themes are grounded and related to three underlying Basic Psychological Needs: "Autonomy", "Competence", and "Relatedness".
Conclusion: The eight identified themes related to the underlying Basic Psychological Needs that describe stroke patients' motivation for home-based upper extremity rehabilitation may serve as a basis to better align eHealth tools to the patient's needs, resulting in increased motivation and therapy adherence. We recommend considering those themes when developing a home-based eHealth intervention for stroke patients to reduce motivational decreases in home-based rehabilitation.
Acknowledgements: We would like to thank the stroke patients for participating in this study and the ArmCoach4Stroke project group members.

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Usability evaluation of the T-GRIP thumb exoskeleton to support lateral pinch grasp

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Introduction: T-GRIP is a robotic hand exoskeleton that supports the lateral pinch grip by actuating the thumb movement. This frequently used grasp allows patients to complete a wide variety of tasks, including picking up and manipulating objects.
Main Objective: To assess the usability, performance, user acceptance and satisfaction of T-GRIP.
Methods: A feasibility study was conducted, in which five SCI individuals with hand function problems (C5-C6 lesion) performed a usability protocol. The System Usability Scale (SUS) and Usefulness, Satisfaction and Ease of use (USE) questionnaire were used to measure the subjective usability. Also unilateral hand performance was tested both with and without T-GRIP. User acceptance (Technology Acceptance Model) and satisfaction (Quebec User Evaluation of Satisfaction with Assistive Technology) were measured with questionnaires.
Results and Discussion: Both usability questionnaires showed a good usability (SUS score (mean (sd)): 80 (15.7); USE (mean (sd)): Usefulness 5.28 (0.95), Ease of use 5.42 (1.11), Ease of learning 6.65 (0.52) and Satisfaction 5.4 (1.17)). The Grasp and Release Test showed that T-GRIP especially supported participants during the manipulation of heavier objects (weight, fork and tape). All participants were not able to grasp these objects without using T-GRIP. In addition, a high level of user acceptance and satisfaction was measured. Participants were most satisfied with the safety and weight of the device. Comfort was rated lowest.
Conclusion: T-GRIP seems an interesting assistive device for SCI individuals, since the current prototype scored good on usability, performance, user acceptance and satisfaction.
Acknowledgements: We thank all participants for their participation in the study.

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Therapeutic effect of a wearable soft-robotic glove on hand function used as assistive device to support people with impaired hand strength during activities of daily living

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Introduction: Various patient populations, such as trauma and rheumatoid arthritis, experience difficulties in performing activities of daily living (ADL) due to reduced hand strength. A wearable soft-robotic glove supports the hand during ADL by strengthening grip. Previous studies in elderly with self-perceived hand problems showed, besides direct assistance, improved unsupported hand function after 4-week use.

Main Objective: To assess the therapeutic effect of an assistive soft-robotic glove (Carbonhand) on hand function.

Methods: A multicenter uncontrolled intervention study was conducted with three pre-assessments, and post and follow up assessments (1 and 4 weeks after intervention). Eight Dutch rehabilitation centers recruited 63 participants with chronic decreased hand strength. All participants used Carbonhand for six weeks during ADL at home. Outcome parameters are related to unilateral hand performance. All measurements were performed without Carbonhand system and results were compared pre-post.

Results and Discussion: Recently all measurements have been completed and data analysis is ongoing. Pinch strength (kg) increased in predominantly middle and ring fingers pre-post ($\nwarrow$ +0,3 ±0,9), sustained at FU ($\nwarrow$ +0,4 ±1,2), but didn't reach significance (p$\nwarrow$0.06). Performance on Jebson Taylor Hand Function test improved significantly (p$\nwarrow$0.000). Total completion time decreased on average by 14.8 (±25.8) s between pre-post, and by 15.6 (±27.0) s between pre-follow-up.

Conclusion: A soft-robotic glove is promising to not only support hand function directly, but also improve hand function after using the glove as assistive aid at home. If so, this would enable extending training into peoples' homes.

Acknowledgements: We thank all participants for their participation in the study.

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Oral abstracts

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Can we use the Functional Gait Assessment scale as part of vestibular rehabilitation?

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Introduction: To enhance the patient's dynamic balance during walking, the Functional Gait Assessment Scale (FGA) is used as an effective practice and also a measuring tool in the acute phase of recovery.

Main Objective: The aim of the prospective nonrandomised study was to determine, if FGA exercises can be used as part of vestibular rehabilitation.

Methods: In the study we included ten patients with central balance disorders, which was caused by the tumour in pontocerebellar angle. They were individually included in specially designed rehabilitation programs, emphasising on the improvement of dynamic balance during gait and focusing on the various functional and cognitive tasks which are part of the FGA scale. Balance disturbances were assessed by the FGA upon discharge from the hospital and after three months.

Results and Discussion: FGA score of 22 points is a reliable indicator of balance disorders. All patients had moderate to severe dynamic balance disorders at discharge. Three months after discharge, 7 patients scored more than 22 points (from 24–28/30), meaning that they had mild dynamic balance disorders, 3 patients scored less than 22 points (from 14-18/30), which means they had moderate to severe disturbances of dynamic balance while walking. In our study, 70% of patients exceeded the minimum calculated detectable change of 4 points according to FGA, which indicates an improvement in dynamic balance.

Conclusion: The FGA has proven to be an excellent training tool for detection of disorders and improvement of dynamic balance. We suggest multitasking FGA exercises to be considered as part of vestibular rehabilitation even in acute phase.

Acknowledgements: We thank the Department of Neurosurgery for agreeing to conduct the research project.

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Essential training variables of arm-hand training in people with cervical spinal cord injury: a systematic review

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Introduction: Motor training improves arm-hand functioning in people with cervical spinal cord injury (pwC-SCI); however, the optimal training content and dosage are not clear yet.

Main Objective: This review identifies and evaluates three training variables of arm-hand motor training programs: i.e., motor training strategies, therapy dosage, and persons' motivation in pwC-SCI in all rehabilitation phases.

Methods: Systematic literature research in 5 databases, including motor training incorporating active arm-hand movements. Methodological quality was assessed with Van Tulder checklist. Effect sizes were calculated with Hedge's g; mean effect sizes were calculated to compare outcomes on function and activity level of the International Classification of Functioning, Disability, and Health.

Results and Discussion: Eleven studies included in the narrative analysis reported mainly on skill training alone or combined with strength and/or endurance training, with durations from 3-12 weeks and 3-7 intervention days/week. Skill training programs reported at least 5 task-oriented training components. Seven studies included in the quantitative analyses demonstrated the highest ES on arm-hand skilled performance for skill training with additional strength and/or endurance training, including 8 task-oriented training components and training doses of at least 8 weeks with at least 3 intervention days/week. Use of client-centered goals resulted in high ES on persons' perception of arm-hand activities.

Conclusion: To improve arm-hand functioning, it is suggested to use skill training with at least 8 task-oriented training components with additional strength and endurance training for at least 8 weeks with 3 sessions per week. Further research on detailed therapy dosage and persons' motivation regarding arm-hand training is needed.

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Oral abstracts

HEROES, an exergame for stroke patients to train stepping responses at home

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Introduction: To improve balance and prevent falls in people with stroke, it's important to enhance their ability to recover from a perturbation by stepping. Serious videogames provide a way to train in a fun and challenging way. Some videogames train voluntary stepping, but remains challenging to induce perturbations and train recovery steps at home.

Main Objective: We proposed the design of an exergame to train stepping responses of stroke patients at home, using recent findings of action observation and motor imagery.

Methods: Following a User-Centred methodology, we designed the HEROES exergame with stroke patients, physiotherapists, game designers and experts in human movement. The game features an adventurer standing in a raft that travels on the sea. The participant needs to mimic the stepping responses of the adventurer. The therapeutic goal is achieved by managing directions, speed of response and length of the step and can train paretic and non-paretic legs. Using a Game Experience Questionnaire, consisting of 7 items on a 5 Likert scale, we evaluated the game with 12 healthy young participants.

Results and Discussion: The average on the items Competence, Sensory and Imaginative Immersion, Flow, and Positive affect was rated with high score (4 out of 5). The items Tension, Challenge and Negative affect had low score (2 out of 5).

Conclusion: This evaluation showed promising input regarding the game experience. However, the *Challenge* score was too low in this group of participants. Further analysis of the target population is needed to determine whether this needs improvement.

Friday 2 June 2023

Lunch symposia

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THERAPEUTICS

ToxNet group: Peer Exchange on Challenges in Spasticity Management
Join our panel of internationally renowned experts for an interactive session on managing spasticity, including a new peer-developed curriculum
Speakers: A. Geurts (moderator), Th. Deltombe, N. Draulans

ToxNET is a global educational initiative that aims to improve the quality of care for people with spasticity. The ToxNET group comprises 19 neurological rehabilitation specialists (clinicians and scientists) with a combined experience of more than 250 years in treating poststroke spasticity. The mission of ToxNET is to raise awareness of the best clinical practice for patients with spasticity and - by providing readily accessible tools for all clinicians who treat spasticity - improve patient outcomes.

In 2020, the group published a Consensus Paper: A Practical Guide to Optimizing the Benefits of Post-Stroke Spasticity Interventions with Botulinum Toxin A: an International Group Consensus. (J Rehabil Med, 2021;53:jrm00134. doi: 10.2340/16501977-2753.) Following this paper, this curriculum now aims to provide a blueprint, comprehensive training course covering the management of spasticity. The four different modules cover:

• **Module 1:** Pathophysiology and Assessment; Goal Setting. Covering the underlying pathophysiology of spasticity and identifying the muscles involved and the extent of that involvement. The importance of patient involvement and goal setting is considered as well as the best tools for patient assessment
• **Module 2:** Nonsurgical Management. Covering the most commonly used drugs and interventions. The optimal use of baclofen or botulinum toxin A (BoNT-A) and suitable adjunctive therapies are included in detail
• **Module 3:** Surgical Management. Covering patient selection for surgery and the appropriate surgical techniques to employ
• **Module 4:** Optimizing Outcomes. A helpful troubleshooting guide, which provides practical algorithms for assessing the reasons behind suboptimal with treatment oral drugs, alcohol/ phenol, intrathecal baclofen, or BoNT-A.

The entire group was divided into four subgroups, with each focusing on one particular module. However, all members of the group made contributions based on their clinical experience across the whole curriculum. The modules were refined by each subgroup and then circulated to everyone for approval. Illustrative case histories are provided; in some instances, videos allow the reader to fully appreciate the movement disorder caused by the spasticity of different muscles. Competency assessments allow the reader to test how well they have assimilated the information in each module.

We hope that this Curriculum will be widely used and will contribute to improving outcomes for patients requiring treatment and rehabilitation for spasticity.

This supplement comprises an introduction and four modules covering different aspects of spasticity assessment and management. All authors are listed alphabetically and each module acknowledges the authors responsible for that module. However, all authors were given the opportunity to read and comment on the entire supplement. All authors met the criteria for authorship and each author believes the manuscript represents honest work.

Posters

Topic 1: Action observation/visuomotor imagery

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Motor imagery and action observation on motor learning in healthy individuals and patients: A systematic review and meta-analysis

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Introduction: The combination of Action Observation (AO) and Motor Imagery (MI) added to physical practice might be beneficial therapy option.
Main Objective: We evaluated the effect of the combined intervention of AOMI on motor learning in healthy individuals and patients.
Methods: We systematically searched Cochrane Library, Embase, Medline Ovid, Physiotherapy Evidence database, PsycINFO, Scopus, SPORTDiscus, Web of Science and clinicaltrials.gov. Screening processes and data extraction were performed by two independent authors. Study methodologies were independently assessed with the Risk of Bias and the GRADE tools.
Results and Discussion: The interventions of the selected 22 randomized controlled trials out of 5440 references (total 869 participants: healthy individuals, Parkinson's disease, patients after stroke, patients after total hip arthroplasty, children and students with neurological impairments) differed greatly. Four studies were included in three meta-analyses. AOMI simultaneously and alternately compared to conventional therapy regarding dart throwing performance were both effective with SMD=0.38 (95%CI=- 0.24-1.01). AOMI training compared to conventional therapy alone were effective for ball rotation performance regarding completion time (SMD=-0.32 (95%CI=-0.91-0.28)) and error-rate (SMD=-0.21 (95%CI=-0.65-0.23)). Mainly, the first-person perspective was used for AO and MI and the kinesthetic mode for MI. The AOMI intervention lasted from 1 day to 8 weeks including 1 to 126 AOMI sessions with 3 to 630 AOMI trials.
Conclusion: Our results showed a positive effect of AO combined with MI on motor learning. So far, no final conclusion can be drawn on essential parameters (mode, perspective) of an AOMI intervention due to the high heterogeneity of the studies. PROSPERO register number: CRD42021242812.
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Brain dynamic and kinematic changes during a 4-week Action Observation Therapy program. New insights on the recovery profile in subacute stroke patients.

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Introduction: Action Observation Therapy (AOT) is a valuable option to foster motor recovery in stroke patients by activating the Mirror Neurons System (MNS).
Main Objective: This study aims to evaluate the behavioural (kinematics) and neurophysiological (qEEG) recovery profile during a 4-week AOT program in subacute stroke survivors.
Methods: Twelve patients with subacute stroke ($\leftarrow$6 weeks) and upper limb paresis measured by the Fugl-Meyer Assessment (FMA) were recruited. They received twenty AOT sessions over four weeks. Continuous EEG and kinematic recording were done during sessions.
Results and Discussion: Moderate stroke patients (FMA-UE $\nearrow$ 19) showed an increase in EEG activation (Event-Related Desynchronization, ERD) after the first week (p $\leftarrow$ 0.05). Conversely, ERD was not affected by time in severe patients. The overall sample showed a correlation between cortical activity in the affected hemisphere, the decrease in reaching time and trunk displacement, and an increment in peak velocity (p $\leftarrow$ 0.001).
Conclusion: This study highlighted how the quality of reaching movements and brain dynamics response during a 4-week AOT program were correlated. Moreover, in moderate stroke survivors, the effects lasted over time and reached a plateau after one week.
Acknowledgements: Thanks to Andrea Serino and Daniel Perez-Marcos of MindMaze SA (Lausanne, Switzerland) for their support in video realization.

Posters

Topic 1: Action observation/visuomotor imagery

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Effectiveness of Self-Action Observation Therapy as a novel method on paretic upper limb and cortical excitability post-stroke: A single subject study

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Introduction: Action Observation Therapy(AOT) is a top-down approach that has been recently introduced in the rehabilitation of neurological disorders mainly after stroke.

Main Objective: The main goal of this study was to investigate the effects and feasibility of a new technique in AOT procedure(called self-AOT) following periods of no treatment and routine AOT intervention on upper limb(UE) motor function, occupational performance and neurophysiological changes in a stroke patient.

Methods: A single-subject A-B-A-C design was used and a woman with a 3-year history of left hemiplegia poststroke participated in this study. In the baseline phases, the patient received no treatment. In the first intervention phase, a 4-week AOT, and in the second intervention phase, a 4-week of Self-AOT was practiced. In all phases, UE motor recovery as a target outcome was evaluated on 4 occasions using Fugl-Meyer assessment. Upper limb function, dexterity, and spasticity were assessed using Action Research Arm Test, Box-Block Test, and Modified Modified Ashworth Scale respectively. Occupational Performance/Satisfaction was assessed with Canadian Occupational Performance Measure and to assess neuroplasticity, Motor Evoked Potential was recorded. Visual analysis, slope, and percentage of non-overlapping data were used for assessing the changes between phases.

Results and Discussion: Percentage of non-overlapping data and slopes indicated that motor recovery had clinically relevant improvements after both interventions compared to baselines. Other outcomes also showed improvements except spasticity of wrist/elbow flexors and Motor Evoked Potential of opponens policis.

Conclusion: Self-AOT may be as effective as other procedures of AOT for improving upper limb motor function, occupational performance/satisfaction and cortical excitability post stroke.

Acknowledgements: We would like to thank the IUMS Ethics Committee for appraising this study.

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The Effects of Training Hand laterality Judgement after Stroke:

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Introduction: Hand laterality judgement (HLJ) involves mentally rotating your hand to match an image; stimulating implicit motor imagery (Parsons 1987) HLJ is possible after a stroke (Sapsford et al. 2019) but the benefits of practising it are unknown.

Main Objective: To examine the effects training HLJ in a small group of stroke patients

Methods:

Design: A descriptive case series

Sample: Four males aged 54 - 68; 1.5 -7 years post stroke.

Measures : 1. HLJ test with 288 rotated images of right and left hands. 2. Motricity Index upper limb scale. 3. Amount of HLJ practice.

Intervention: HLJ practice with the Recognise[tm] App for 30 minutes per day; 5 days a week for 3 weeks.

Data analysis Pre and post intervention mean response times and errors for the HLJ test ; motricity index scores; Amount of practice with the Recognise[tm] app.

Results and Discussion: An average of 130 blocks of 50 images were completed using the Recognise[tm] app. In 3 out of 4 cases mean response times increased and the number of errors decreased following practice. There were no changes in the motricity index scores. All participants were able to use the Recognise[tm] app but engagement varied. Participants responses were consistent with the use of implicit motor imagery (Parsons 1987) The slower response times post intervention were unexpected but may indicate an increased attention to the task.

Conclusion: Practicing HLJ using the recognisetmapp improves HLJ after stroke but this should be confirmed with a larger sample.

Acknowledgements: The authors would like to thank the Neuro Orthopaedic Institute Australasia for providing free licences for the Recognise[tm] app.

Posters

Topic 2: Adaptive devices

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ExerG – Adapting an exergame training solution to the needs of older adults using focus group and expert interviews

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Introduction: Exergames as playful technology-based exercise programs increase training motivation in fall-prevention programs when adapted age-appropriately.
Main Objective: We aimed an in-depth understanding of three different user groups' experiences in technology-based training (needs, expectations), to develop an exergame (ExerG) for older adults.
Methods: We conducted semi-structured focus group interviews with primary (older adults) and secondary end users (health professionals), and expert interviews with tertiary end users (health insurance experts). Interviews were voice recorded, verbatim transcribed, and analyzed using thematic analysis in an inductively, data-driven, iterative process.
Results and Discussion: We interviewed 24 primary (mean age 74.2±5.8 years; 9 females; 11 walking aid users), 18 secondary (age 35.3±7.5 years; 10 physiotherapists, 2 occupational therapists, 4 sports scientists, 2 psychologists; work experience 9.0±6.2years) and 9 tertiary end users (age 49.7±9.4 years; 3 females; work experience 26.7±10.7 years) at two rehabilitation centers in Austria and Switzerland. Our thematic analysis identified: 1) 6 primary end users' themes: safety, training goals, individualization, game environment, social interactions, and physical/technical overload; 2) 6 secondary end users' themes: meaningfulness, distraction, safety, gamification, availability, and accessibility of exergames; and 3) 5 tertiary end users' themes: aspects of financial support, target populations, professional training for the handling of exergames, training goals, and concerns about the usability of exergames.
Conclusion: Exergames for older adults must be safe, motivating and individually adaptable while promoting the return to or preservation of autonomy and independence in daily life. Our findings contribute to develop hard- and software extensions for the ExerG training device.
Acknowledgements: We would like to express our very great appreciation to every end user who participated in our study. Their valuable and constructive opinions, experiences and stories during the interviews contributed massively to this research work.

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Healthcare professionals' perspectives on development of assistive technology using the Comprehensive Assistive Technology model

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Introduction: The implementation of technology in healthcare shows promising results and provides new opportunities in rehabilitation. However, the adoption of technology into daily care is largely dependent on the acceptance rate of end-users.
Main Objective: This study aims to gather information from healthcare professionals on the development of assistive technology for neurological and elderly patients that match users' needs using the Comprehensive Assistive Technology model.
Methods: In total 27 healthcare professionals (12 occupational therapists, 8 physiotherapists, 3 nurses, 2 allied health directors, a physician and a speech therapist) attended one of four online focus group discussions. These focus group discussions were structured using a question guide based on three predefined scenarios (i.e., a smart walker to support gait, a smart brace for patients suffering from neglect and a smart IV-stand for hospitalized patients). Recordings were transcribed and data was analyzed using a thematic analysis (NVivo).
Results and Discussion: Major themes identified in this study were safety, price and usability. Additionally, for each specific scenario, relevant functions, measurements and barriers were discussed. Healthcare professionals focused on both functional capabilities of the user, as well as behavioral aspects of usability and attitude towards technology. Furthermore, the need for assistive devices that were catered towards the limitations in activity and user experience, was highlighted extensively.
Conclusion: Based on information gathered from healthcare professionals a user-centered approach in development of safe, low-cost devices that maximize both functional outcomes and user acceptance, could potentially increase the adoption of new technology in rehabilitation of neurological and elderly patients.
Acknowledgements: The authors would like to thank the healthcare centers and healthcare professionals who volunteered to take part in this study.

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Topic 3: Comprehensive rehabilitation programs

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Comparing the effectiveness of vestibular rehabilitation interventions in treating unilateral peripheral vestibular hypofunction: systematic review

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Introduction: Vestibular rehabilitation therapy (VRT) is an exercise-based program that consists of adaptation, habituation, substitution, and gait and balance training which facilitates central nervous system (CNS) compensation in response to sensory conflicts from vestibular hypofunction.
Main Objective: To synthesize the evidence about different vestibular rehabilitation interventions for treating unilateral peripheral vestibular hypofunction (UPVH) and to compare the effectiveness of existing interventions.
Methods: Relevant databases; MEDLINE, CINAHL, AMED, Web of Science, and Cochrane Library were searched using pertinent keywords from 2006 to 2021. Inclusion criteria encompassed randomized controlled trials (RCTs) published in English, among adults ↗18 years with UPVH, and diagnosed with a peripheral vestibular disorder. Methodological quality of the included studies was assessed using Physiotherapy Evidence Database (PEDro) scale.
Results and Discussion: Twenty-three RCTs were included based on the eligibility criteria. The studies recruited a total of 1,690 patients with different presentations of UPVH, including benign paroxysmal positional vertigo (n=90), vestibular neuritis (n=288), labyrinthine diseases (n=533), vestibular schwannoma (n=100), Meniere disease (n=358), and not-specified category (n=321). For methodological quality, twenty studies (87.0%) were "Good" and three (13.0%) were "Moderate" based on PEDro scale. The narrative synthesis confirmed the effectiveness of VRT interventions throughout the studies. More specifically, a customized or combined VRT intervention was found to be more beneficial in improving the selected outcome measures.
Conclusion: Any form of VRT intervention can be effective; however, a customized or combined VRT intervention including adaptation, habituation, substitution, and gait and balance is more effective due to improved compensation of CNS.
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Assessment and tailored rehabilitation in cerebellar impairments: systematic review of case-reports.

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Introduction: Cerebellar impairment (CI) manifests from different etiologies resulting in a heterogenic clinical presentation affecting walking and mobility. Besides, dysfunctions arising from the non-cerebellar pathophysiology may also be present. A framework to guide clinicians is the International Classification of Functioning, Disability and Health (ICF).
Main Objective: Case-reports are reviewed to provide an analytical clinical picture of persons with CI (PwCI) with differentiation of cerebellar and non-cerebellar impairments and to identify interventions and the assessment methods used to quantify impact on walking and mobility according to the ICF.
Methods: A literature search was conducted in PubMed, Web Of Science and Scopus. Case-report designs conducting physical rehabilitation and reporting at least one outcome measure of ataxia, gait pattern, walking or mobility were included.
Results and Discussion: 28 articles with a total of 38 different patients were included. Etiologies were clustered in 6 groups: spinocerebellar degenerations, traumatic brain injuries, paraneoplastic or cerebellar tumors, cerebellar stroke and miscellaneous. The physical rehabilitation interventions applied were mostly activity-based, including gait and balance training. Participation based activities such as tai chi, climbing and dance-based therapy were reported having positive outcomes on mobility. Outcomes on the body function such as ataxia and gait pattern were only reported in 22% of the patients.
Conclusion: The heterogeneity of etiology and clinical presentation in PwCI provides evidence for the need of a comprehensive test battery to encompass the key features of a PwCI on different levels of the ICF. The impact of interventions on body function level of the ICF was under reported.

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The effects of personalised vestibular rehabilitation at home on gait improvement in patients after acoustic neuroma surgery

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Introduction: The vestibular system impairment in patients after acoustic neuroma surgery is presented as a combination of perceptual, oculomotor, postural and autonomic dysfunctions during gait.
Main Objective: The aim of the study was to determine the effects of personalised vestibular rehabilitation at home on functional gait improvement.
Methods: The study was comprised of 40 randomly selected patients that underwent surgical removal of an acoustic neuroma and were divided into an exercise test group and a non - exercise control group. A score higher than 24/30 points on the Mini-Mental State Examination and 29/56 on the Berg Balance Scale were necessary to be included. While all patients underwent standard rehabilitation during hospital stay, only patients in the exercise test group performed personalised dynamic balance exercises after discharge. Participants were tested on the day of discharge and three months after, using the Functional Gait Assessment scale.
Results and Discussion: The smallest clinically significant change between two FGA scores of 5 points was exceeded by 17 patients in the exercise group and 12 patients in the control group. The improvement in FGA scores between groups differed statistically significantly (p=0,034), with a strong positive correlation coefficient measured in the relationship between the variables (r=0,852; p←0,001).
Conclusion: Personalised vestibular rehabilitation at home was found to be an effective strategy for faster recovery and improvement in functional gait three months after discharge.
Acknowledgements: The authors would like to thank the Department of Neurosurgery for agreeing to conduct the research project and the UMCL for providing financial support.

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Longitudinal follow-up assessment of late-onset Rasmussen Encephalitis during intensive multimodal rehabilitation management: A Case report and literature review

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Introduction: Rasmussen's encephalitis (RE) is a rare autoimmune encephalopathy typically occuring in early childhood. Patients suffer from presumed T-cell driven unilateral inflammation of the cerebral cortex that leads to progressive neurological deficits such as recurrent focal epileptic seizures. The late-onset form of RE manifests in adulthood and usually progresses slower and presents with atypical features. While the etiology is still unkown, diagnosis is difficult and treatment options are sparse.
Main Objective: We present a biopsy-proven case of 70 years under stable disease while on dual therapy with intravenous immunglobulines and rituximab with multiple follow-up imaging during a long-term multimodal rehabilitation program.
Methods: We here present clinical, laboratory, imaging, and therapy data in a case followed over totally six years of the disease.
Results and Discussion: In accordance with the literature, longitudinal imaging confirms the fulminant inflammation activity at the disease beginning that reaches a plateau to the end stage. Thereby, slowly spreading T2 hyperintensities evolve into parenchym atrophy of the same region over time. Complicating metabolic and vascular comorbidities of our case are discussed in the light of both immune modulating and anticonvulsive therapy regimens, particularly in elderly patients. Finally, we provide a review of the current literature on the long-term management of late-onset RE patients.
Acknowledgements: We'd like to thank all involved therapists in the patient intensive treatment over the years.

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Topic 3: Comprehensive rehabilitation programs

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Adapted physical activity and adapted sports in neurorehabilitation: unravelling the current field and implication of health care professionals

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Introduction: Physical activity is an essential component towards achieving health and numerous studies have demonstrated its efficacy in improving motor deficiencies of individuals with neurological lesions. Therefore, adapted physical activity and adapted sports are allies in neurorehabilitation.

Main Objective: To assess the development of adapted physical activity and adapted sports for individuals with neurological lesion, in Belgium. The use of adapted physical activity and sports in rehabilitation, and the role healthcare professionals play, will also be investigated.

Methods: A large-scale survey was conducted, and directed towards different populations, namely i) community-based sports clubs; ii) hospitals and rehabilitation centers; and iii) healthcare professionals working with persons with neurological lesions. Various online questionnaires were created, revised, then diffused. Responses were collected anonymously.

Results and Discussion: While 54% of the 330 sports clubs participating in the survey confirmed being accessible to individuals with neurological lesions, only 17% organized adapted sports programs. Similarly, only 4 of the 24 hospitals or rehabilitation centers offered adapted sports during neurorehabilitation. All 266 healthcare professionals believed that adapted physical activity was very beneficial, but actions undertaken to promote it among individuals with neurological lesions remain scarce.

Conclusion: Adapted physical activity and adapted sports remain poorly developed in Belgium, and healthcare professionals lack tools and knowledge of community-based opportunities in order to promote it to individuals with neurological lesions. Partnerships between the medical and the sports worlds are needed.

Acknowledgements: The authors would like to thank Professor Lejeune, for his advice, and the ADEPS for helping diffuse the questionnaire.

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Rehabilitation group training course on overcoming visual neglect syndrome

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Introduction: Currently, there are only a few universal non-medication rehabilitation options for patients with visual neglect syndrome (NS). In this regard, we have developed and implemented rehabilitation training course for patients with NS.

Main Objective: We assumed this training would improve the performance of visuospatial search among patients with NS, minimizing its manifestations.

Methods:
1) Luria's test battery, The Trail Making Test, The Bells Test;
2) The author's techniques, sensitive to NS for evaluating the effectiveness of the course;
3) Author's rehabilitation group training course. It consisted of 4 meetings in fortnight. The lessons included psychoeducation, training in strategies for overcoming NS and daily tasks.

Statistical methods:
1) A non-parametric Wilcoxon signed-rank test
2) Analysis of variance (ANOVA)

The sample amount was 20 patients with NS after stroke with right hemisphere damage. Two groups: a target (12 patients who underwent training) and a control (8 patients without it).

Results and Discussion: The Wilcoxon signed-rank test showed statistically significant changes in visuospatial search in the target group: decrease in the number of left omissions ($p \leftarrow 0.01$) and increase in overall visual activity ($p \leftarrow 0.01$). The total task completion time increased after training ($p \leftarrow 0.05$). Its extension may indicate an increase in consciousness and awareness of this action by patients.

Conclusion: Specific effects of the course were improvement of visual-spatial search performance, increase in visual activity of participants. Non-specific effects were the effect of participation, increased activity and readiness for other rehabilitation activities.

Acknowledgements: The authors would like to thank Lomonosov Moscow State University and National Medical and Surgical Center named after N.I. Pirogov for providing support in this project.

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Analysis of functional results in an intensive neurological rehabilitation unit

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Introduction: The importance of carrying out an intensive rehabilitation program in the acute phase after a stroke to promote functional recovery and reduce hospital stay times is well known.
Main Objective: To analyze the demographic characteristics and functional results of patients diagnosed with stroke and admitted to the neurological rehabilitation unit of a tertiary-level hospital.
Methods: Observational, descriptive, and retrospective study of patients admitted to the Neurological Rehabilitation Unit with a stroke diagnosis between 01/2021 and 12/2022. Two hundred five patients underwent an intensive rehabilitation program of at least 3 hours of occupational therapy, speech therapy, and physiotherapy. The following variables were measured upon admission and discharge: Rankin, Barthel, FIM, muscle strength measured by Jamar, and gait speed. Statistical analysis: t-Student for related samples ($p \leftarrow 0.05$). SPSS 25 program.
Results and Discussion: 122 men and 83 women with a mean age of 66, of which 152 were ischemic strokes, 53 hemorrhagic, and a mean stay of 14.5 days; 74% were discharged home. A significant difference was found for the following variables: Rankin 0.60 (95%CI 0.49 to 0.71, $p \leftarrow 0.001$),Barthel 25.187 (95%CI 22.85 to 27.52, $p \leftarrow 0.001$), FIM 20.18 (95%CI 18.44 to 21.93, $p \leftarrow 0.001$), Right Jamar 2.48 (95%CI 1.62 to 3.35 $p \leftarrow 0.001$), left Jamar 3.09 (95%CI 2.08 to 4.10 $p \leftarrow 0.001$).
Conclusion: Admission to an intensive neurological rehabilitation unit favors functional improvement in a short time and early return home.
Acknowledgements: This research received no specific grant from any agency in the public o private sectors.

The validity of the Talk Test in patients with Central Neurological Disorders - A clinimetric pilot study protocol

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Introduction: Cardiopulmonary exercise testing (CPET) is considered the gold standard to determine aerobic fitness and exercise intensity. However, CPET is expensive, quite burdensome and can only be performed in a laboratory.
Main Objective: To explore the validity, reliability and responsiveness of the Talk Test compared to CPET in patients with CND's.
Methods: Twelve patients with CND's will be measured before (T0), at the first training day (T1), and after a 12-week training program (T2).
Primary outcomes are; VT1 and VT2; Heart Rate (bpm) at VT1 and VT2; BORG scores at VT1 and VT2; Workload (watts) at VT1 and VT2; global perceived effect at T0 and T2.
Validity will be determined with Spearman correlation coefficients for heart rate, Borg scores and workload. Kappa scores of the VT1 and VT2 at T0 and T1 will be used to determine inter-rater reliability of the Talk Test. Responsiveness will be determined by anchor- and distribution-based responsiveness of the Talk Test between T0 and T2 compared with CPET.
Results and Discussion: Positive results will lead to a larger, multi-center investigation of clinimetric properties of the Talk Test in patients with CND's.
Acknowledgements: The authors would like to thank all participants for their time and effort.

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Topic 4: Family and environmental support

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Predictors of mental health among parents of children with cerebral palsy during the COVID-19 pandemic in Iran: A web-based cross-sectional study

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Introduction: Caring for children with cerebral palsy (CP) may affect caregiver's psychological health. Emergence of COVID-19 put added pressure on caregivers.
Main Objective: The aim of this study was to investigate the psychological health of Iranian caregivers of children with CP and associated risks during a lockdown period.
Methods: 160 caregivers of children with CP participated in this cross-sectional study. The Hospital Anxiety and Depression Scale(HADS), Perceived Stress Scale(PSS-4), Caregiver Difficulties Scale(CDS), and a demographic questionnaire were administered. Hierarchical multiple linear regression analysis was applied to identify risk factors related to caregiver psychological health.
Results and Discussion: Mental health problems were prevalent;(depression=45.0% and anxiety=40.6%). Significant correlations were found between CDS and HADS-Anxiety (r=0.472, P←0.001), HADS-depression (r=0.513, P←0.001), and perceived stress(PSS) related to COVID-19 (r=0.425, P←0.001). Burden(CDS) was found to significantly predict caregiver anxiety, depression, and stress. Furthermore, several demographic characteristics (being married, low educational level, and low income) were significantly related to high HADS Anxiety scores. For depression, only having a physical problem was significantly related to HADS among demographic variables.
Conclusion: During COVID-19, the mental health of these caregivers is affected by multiple factors such as the burden of care and demographic characteristics. Due to the importance of well-being among caregivers of disabled children, a comprehensive plan including psychological consultation, remote education, or in-person handouts for the self-care or handling of the children may enable better mental health for the caregivers.
Acknowledgements: We would like to acknowledge Iran University of Medical Sciences, for the appraisal of this study.

Topic 5: Functional diagnostics/prognostics

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Evaluation of the quality criteria of a sensorimotor assessment in physiotherapy for patients in early neurological rehabilitation

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Introduction: The use of standardized measurement tools is an important component of physiotherapy. In the field of neurological-neurosurgical early rehabilitation (NNER), measuring instruments such as the Barthel Index, the Functional Independence Measure or the Glasgow Coma Scale are often recommended. However, these instruments only contain a few items on the patients' sensorimotor functions and are therefore rarely used in the field of physiotherapy. For this reason, the "Sensorimotor Assessment Physiotherapy" (SeMo-P) was developed.
Main Objective: The aim of the study is to test the quality criteria (inter-rater reliability, criterion validity and change sensitivity) of the SeMo-P.
Methods: Included in the study are new admissions to NNER, regardless of the type, duration and severity of the disease. Immediately after the inclusion, the SeMo-P and other assessments are performed. Four and twelve weeks later, the entire test battery is retested.
Results and Discussion: So far, 46 NNER patients have been included in the study. Statistical analysis of the inter-rater reliability of the assessment shows very good results (r = 0.99; p ← 0.001). The criterion validity can also be considered as very good. The patients changed significantly from the first to the second test, both in SeMo-P and in comparable measurement instruments (ICU Mobility Scale, sensorimotor part of the Early Functional Ability Scale) and all three assessments showed comparable effect sizes in terms of the change over time.
Conclusion: In summary, the SeMo-P shows very good inter-rater reliability and criterion validity. It also appears to be sensitive to changes over time.
Acknowledgements: Thanks to the physiotherapists of the NNER of the Schmieder Kliniken in Allensbach

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Topic 5: Functional diagnostics/prognostics

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Distinct patterns of spasticity and other sensorimotor impairments in central versus peripheral nervous system lesions

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Introduction: Accurately quantifying sensorimotor impairments in neurological disorders remains a key clinical challenge.
Main Objective: The study aimed to compare profiles of spasticity and neuromuscular changes resulting from lesions to the central or peripheral nervous system.
Methods: A total of 54 patients in different phases after stroke and 19 patients with prior paralytic poliomyelitis were examined with the NeuroFlexor hand and/or foot module. Neural, elastic and viscous components of passive movement resistance were quantified (in Newton) using a biomechanical model, during passive wrist and/or ankle movements at controlled slow and fast velocities. Spasticity, muscle strength, fatigue and pain were assessed.
Results and Discussion: Clinically, both groups of patients suffered moderate to severe weakness. Sixteen out of 39 patients early after stroke presented pathologically high neural component in the upper extremity and 11 out of 15 chronic stroke patients in the lower extremity, consistent with hyperactivity of elicited stretch reflexes. Elastic component was increased in only few patients after stroke. In contrast, neural component decreased significantly in subjects with prior polio ($p \leftarrow 0.001$), with low values observed especially in individuals with severe muscle atrophy. Elastic component was altered compared to healthy subjects reflecting disruption in muscle architecture. Finally, NeuroFlexor components correlated significantly with the perception of fatigue and pain ($p \leftarrow 0.05$).
Conclusion: Biomechanical measures reveal specific neural and muscle adaptations in central and peripheral nervous system lesions. The NeuroFlexor may offer a clinically feasible and non-invasive way to objectively quantify post-stroke spasticity and polio-related neuromuscular alterations, and guide new therapeutic approaches.

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Temporal profiles of clinical risk factors for post-stroke osteoporosis: a multicenter study

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Introduction: Bone loss and fracture risk are serious complications of stroke and hip fracture substantially increase in morbidity and mortality for stroke survivors. Therefore, early screening and active maintenance of skeletal health after stroke should be an important clinical goal.
Main Objective: The aim of this study was to investigate the temporal profile and determinants of prevalence of osteoporosis in hemiplegic stroke patients, with special regard to potential role of post-stroke physical and functional impairment in developing osteoporosis.
Methods: This study retrospectively analyzed 741 stroke patients from two hospitals of Korea. To identify risk factors of osteoporosis, baseline demographic characteristics and clinical parameters of stroke (i.e. muscle strength and spasticity of hemiplegic lower extremity, ambulatory level, and cognitive function, initial NIHSS and mRS score) were collected. BMD was measured at lumbar spine, femoral neck and total hip by DXA. Binary logistic regression analysis was used to assess the prognostic implications of osteoporosis according to acute, subacute, and chronic stages after stroke.
Results and Discussion: The binary regression analyses showed that female sex was the major risk factor of osteoporosis in acute stage (OR 57.40, 95% CI 6.96-473.28, p 0.00), but had gradually weaker association across time after stroke (subacute, OR 7.58, 95% CI 3.78-15.18, p 0.00) (chronic, OR 3.01, 95% CI 1.01-8.98, p 0.05). Stroke-related variables had significant associations the subacute stage. Spasticity (MAS1) (OR 0.29, 95% CI 0.12-0.73, p-value 0.01) was protective factor and severe cognitive impairment (K-MMSE$\leftarrow$17, OR 3.14, 95% CI 1.53-6.45, p-value 0.00) and moderate or severe disability (mRS $\rightarrow$2, OR 3.43, 95% CI 1.54-7.60, p-value 0.00) were main risk factors of osteoporosis.
Conclusion: Subacute stage post-stroke and related risk factors, including functional disability and cognitive impairment is closely correlated with osteoporosis. Understanding the temporal profiles of clinical risk factors may aid early screening and timely treatment of patients for post-stroke osteoporosis.

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Test-retest reliability of sensor-based movement quality metrics measured during a reach to grasp task in healthy adults

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Introduction: Kinematic analysis of arm movement quality after stroke is important to monitor changes over time and to optimize upper limb therapy. Wearable movement sensors are increasingly applied for kinematic analysis of arm movements. However, little evidence exists for the clinimetric properties (e.g., reliability) of sensor-based quality metrics of upper limb movement.

Main Objective: We investigated the test-retest reliability of sensor-based quality metrics during reach to grasp movements in healthy adults.

Methods: Ten healthy adults (6 females; 20-27 years) performed five reach to grasp tasks while sitting on a chair next to a table. The tasks consisted of reaching to and grasping of a cylinder object positioned on the table. Each task was performed 15 times during a test session and retest session on the same day. Measurements were performed with IMU sensors on the hand, wrist, upper arm, shoulder, and sternum. Accelerometer and gyroscope data were used to estimate the quality metrics: hand movement time, hand smoothness, trunk displacement, mean hand velocity, maximum hand velocity.

Results and Discussion: Preliminary results showed that the mean value across 15 trials has good to excellent test-retest reliability for hand movement time (intra-class correlation (ICC)=0.73-0.92), hand smoothness (ICC=0.62-0.93), trunk displacement (0.63-0.97), mean hand velocity (ICC=0.63-0.90), and maximum hand velocity (ICC=0.62-0.93).

Conclusion: Preliminary results show that sensor-based quality metrics measured during reach to grasp movements have good to excellent test-retest reliability in healthy adults. In the next months we will evaluate clinimetric properties of sensor-based quality metrics measured during arm movements in stroke patients.

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How well do patient-reported outcome measures predict performance tests in neurologic populations?

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Introduction: Patient-reported outcome measures (PROMs) are not used widely to evaluate the benefits of rehabilitation services in neurologic populations. Evidence that they correlate highly with performance tests may allow for substitution resulting in resource, time, and cost savings.

Main Objective: Assess the strength of association between PROMs and performance tests in patients with neurologic conditions.

Methods: We recruited a convenience sample of adults with neurologic conditions who were prescribed a custom ankle-foot orthosis from three health care systems. PROMs included the EQ-5D; PROMIS Pain Interference, Physical Function, Participation in Social Roles and Activities, and Satisfaction with Social Roles and Activities short forms; and OPUS Quality-of-Life and Lower Extremity functional status (LEFS). Performance tests included the Timed Up and Go, 10-Meter Walk Test, and the 6-Minute Walk Test. Participants provided consent. We calculated descriptive statistics and Spearman's correlations between PROMs and performance tests that addressed the same concept.

Results and Discussion: The sample of 86 adults (55% male) had a mean age of 59±15 years and body mass index of 28±6. Neurologic disorders included stroke, spinal cord injury, traumatic brain injury, Parkinson's disease, multiple sclerosis and other neurologic impairments. OPUS LEFS had the largest correlation with performance tests (.49 to .55); PROMIS participation and EQ-5D-5L scores also correlated significantly with performance tests (.19 to 35). Device and service satisfaction scores from OPUS and QUEST 2.0 were not associated with performance test scores.

Conclusion: Rehabilitation clinicians may consider these PROMs for evaluating patients' experiences when they value concordance with performance tests of mobility and substitution allows for resource, time and cost savings.

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Topic 5: Functional diagnostics/prognostics

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Feasibility, Reliability and Validity of a New Diagnostic Device for Quantifying Hemiparetic Arm Impairments

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Introduction: Upper limb impairments in a hemiparetic arm are clinically quantified by well-established clinical scales, known to suffer poor validity, reliability, and sensitivity. Alternatively, robotics can assess motor impairments such as muscle weakness, abnormal synergy, spasticity, and changes in joint viscoelasticity using a single device.

Main Objective: In this study, we establish the merits of quantifying motor impairments of the upper limb using a robotic perturbator, evaluating (1) feasibility of the test protocol, (2) test-retest reliability and (3) (construct) validity.

Methods: Data were collected with the Shoulder-Elbow-Perturbator (SEP) to quantify muscle weakness, muscle synergy, spasticity, and viscoelasticity in a group of 45 healthy controls, 29 chronic stroke, and 20 CP patients. A series of measurements were performed including active and passive elbow movements while the arm was provided with different levels of weight support. Feasibility, test-retest reliability and (construct) validity of the measurements were captured by the total measurement duration, the intra-class correlations (ICC) and correlations with conventional clinical scales.

Results and Discussion: All participants successfully completed the measurements within 63 ± 11 min. Reliability was excellent, with an ICC → 0.75 for all impairments. Enhanced muscle weakness, spasticity, or changed viscoelasticity was found in many patients compared to healthy controls. Correlation analysis with clinical scales confirmed validity for the measures of spasticity and synergy.

Conclusion: The Shoulder Elbow Perturbator can effectively quantify the four most important impairments of the elbow in patients with a hemiparetic arm and distinguish impairment scores of patients from healthy controls.

Topic 6: Gait analysis

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Review of EMG and EEG signal use and their contribution to gait kinematic prediction

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Introduction: Neurological disorders which significantly reduce quality of life for those affected are becoming increasingly common in the general population. Brain-computer interfaces are a promising technology that aims to enhance recovery by predicting and responding to movement intent through analysis of neural biosignals at brain and/or muscle level.

Main Objective: This study systematically reviews the scientific literature to determine the lower limb muscles and brain region that are most used and most relevant for accurate prediction of lower limb kinematics during stepping and walking overground.

Methods: The search was conducted across five databases: Web of Science, Embase, PubMed, Scopus and CINAHL. Included studies were assessed using the Effective Public Health Practice Project (EPHPP) followed by rigorous appraisal and data extraction.

Results and Discussion: Of the 6,455 papers identified, only 16 papers met the inclusion criteria. The prediction tool that gave the highest accuracy and was commonly used across studies was neural networks: long short-term memory (LSTM) and convolutional neural network (CNN). These systems were fed in the identified studies with only EEG, only EMG, and with EMG combined with other kinematic data, and/or anthropological parameters. For EEG, the electrodes containing the most kinematic information has a central location (C3, C4, Cz, P3, F4, F8) while for EMG the most commonly used muscles contributing to the highest prediction accuracies were Vastus Lateralis, Rectus Femoris and Gastrocnemius.

Conclusion: No studies that combine EEG and EMG biosignals predict lower-limb kinematics during stepping and/or walking were identified, highlighting potential for development of this technology using central brain areas and primary lower limb muscles.

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Topic 6: Gait analysis

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Speed-dependent changes in the arm swing during independent walking after stroke.

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Introduction: Increasing ones walking speed is an important goal in post-stroke gait rehabilitation. Insufficient arm swing in people post-stroke might limit their ability to propel the body forward and increase walking speed.

Main Objective: To investigate if people post-stroke are able to adapt their arm swing during fast walking and if these changes in arm swing are related to clinical and gait parameters.

Methods: Twenty-four persons post-stroke (10 females/15 males; 53 ± 12.1 years; 40.72 ± 43.0 months post-stroke) walked on a treadmill at comfortable (0.83 ± 0.2 m/s) and fast (1.01 ± 0.2 m/s) walking speed. Elbow and shoulder kinematic curves and discrete parameters were compared between conditions using SPM analysis and paired sample t-tests or Wilcoxon signed-rank test. The relation between speed-dependent changes in upper limb kinematics and clinical and gait parameters were calculated using Spearman correlation coefficients.

Results and Discussion: The non-paretic arm swing showed speed-dependent kinematic adaptations whereas the paretic arm only showed an increase (p←0.001) in compensatory shoulder abduction and elbow flexion at fast speed. The paretic arm also showed increased shoulder flexion/extension range (p←0.001). More upper limb impairment (r= -0.521, p←0.01) and a wider step width (r=0.534, p←0.01) was related to a larger increase in elbow flexion during faster walking.

Conclusion: Persons post-stroke show different speed-dependent changes in arm swing at the non-paretic and paretic side. The changes are related to the impairment level and stability during walking, indicating that therapeutic interventions aiming to increase walking speed by improving arm swing should target these factors.

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Mixed-reality cueing: a greater field of view improves interaction with nearby obstacles and stepping targets

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Introduction: We have used HoloLens 1 (HL1) mixed-reality headsets to alleviate freezing of gait in individuals with Parkinson's disease by presenting holographic cues onto the ground. Although effective for individuals, excessive head rotations were required to get holographic cues nearby the feet into view, related to the limited mixed-reality field of view (MR-FOV). HoloLens 2 (HL2, second-generation HoloLens), has an enlarged MR-FOV. In this study we examined effects of MR-FOV on head orientation when interacting with nearby floor-based 2D and 3D holographic objects.

Main Objective: Examining the effects of MR-FOV on head orientation when interacting with holographic objects.

Methods: 16 healthy middle-aged adults walked over a walkway with real and holographic 2D stepping targets and a 3D obstacle wearing either HL1 or HL2 to measure headset orientation and position.

Results and Discussion: A greater initial downward head rotation was observed for holographically cued walking with HL1 than with HL2. Participants rotated their heads more downwards with HL1 compared to HL2 while traversing holographic obstacles. During all tasks, headset rotations were larger for interacting with nearby holographic objects than with comparable real objects.

Conclusion: MR-FOV of mixed-reality glasses are evolving in the right direction for interacting with nearby holographic objects, with required head orientations getting closer to those seen when interacting with real objects. This greater MR-FOV will probably enhance the efficacy of applications utilizing holographic content nearby the feet, like cueing applications to assist gait in individuals with Parkinson's disease or gait-and-balance training with holographic objects.

Posters

Topic 7: Guidelines/implementation/reimbursement

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Development of guidance to improve allied primary healthcare after acquired brain injury in the Netherlands

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Introduction: Effective treatment for people with stroke are often insufficiently used in Dutch primary care [Taule et al.,2015, Pindus et al., 2018, Arwert et al., 2019, Otterman et al., 2019], which can lead to suboptimal outcomes and inefficient care delivery. Improvement of the multidisciplinary referral process is considered part of the solution.
Main Objective: To answer the questions: (1) What knowledge and skills do occupational therapists, physiotherapists and speech therapists in primary care need to treat people with acquired brain injury (ABI)?; (2) How can the right care be provided at the right time within regional collaboration?; and (3) How can finding the right therapist be improved? Further, to report the answers in a national guidance to support the improvement of primary allied healthcare for people with ABI.
Methods: Data were collected through expert interviews (n=23), a scoping review of (inter) national literature (n=23), followed by a modified Delphi study among patients and healthcare providers (n=35).
Results and Discussion: 74 items were identified from the expert interviews and the scoping review. Consensus among experts was found for 97% of items and indicated that: therapists need sufficient expertise in ABI treatment with shared decision-making a recommended skill. Multidisciplinary collaboration is key in allied healthcare and requires financial compensation for implementation. Performing a warm handoff is recommended as is a central website listing qualified therapists.
Conclusion: The guidance 'Interdisciplinary Allied Primary Healthcare for persons with acquired brain injury' contains practical recommendations and focus points to improve primary allied healthcare for people with ABI.
Acknowledgements: The authors would like to thank all participants for their support and 'de Hersenstichting' [Dutch Brain Foundation] for providing financial support to this project.

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Goal-setting in stroke: development of implementation strategies.

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Introduction: Goal setting, or the process of collectively formulating target activities and a concrete plan to establish those goals using active patient involvement, in stroke rehabilitation is widely encouraged. Goal setting has a positive effect on patient satisfaction and clinical outcome. Nonetheless, implementation of goal setting in practice seems difficult. To facilitate implementation, different strategies can be applied, showing various results.
Main Objective: Previously, we developed a patient-centred goal-setting program and corresponding program theory. Now, we aimed at working out related implementation strategies.
Methods: The goal-setting program (*i.e.,* the content and process of goal-setting) was designed by systematically reviewing literature and input from healthcare professionals. The program was refined based on input of feasibility, acceptability, and appropriateness of the program. After identification of barriers and facilitator for implementation, a program theory was developed containing Context-Mechanism-Outcome (CMO) configurations. Thirdly, implementation strategies (based on the Expert Recommendations for Implementing Change strategies framework) were selected and developed by experts.
Results and Discussion: The goal setting program, containing six main domains, and their barriers were developed and identified.Implementation strategies consisted of 1) education and training of professionals and patients, 2) development of tools by establishing a care path and standardized evaluation process, 3) organizational (re)design using quality monitoring systems, 4) social (re) design consisting of environmental restructuring and building a coalition and 5) systematic evaluation.
Conclusion: In the next phase the goal-setting program, the corresponding program theory and its implementation process will be evaluated and refined using a realist evaluation approach.
Acknowledgements: We would like to acknowledge all those who participated in this project. The authors would like to thank Federal Public Service Health, Food Chain Safety and Environment (Belgium) for providing financial support to this project.

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Topic 7: Guidelines/implementation/reimbursement

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More steps towards an active life with high intensity gait training after acquired brain injury

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Introduction: Impaired gait function is common after acquired brain injuries (ABI) and can limit independence and participation in daily life activities. High-intensity gait training (HIGT) has proven effective in enabling persons with stroke to achieve improvement in walking and thus increasing the opportunities for an active and independent life. HIGT is based on substantial amounts of stepping practice at 70-85% heart rate max and addresses the large group of persons with gait impairments after ABI.
Main Objective: To implement and evaluate HIGT to improve the treatment of gait function, both at hospital and out-patient level for persons with ABI.
Methods: The implementation study is led by Hammel Neurocenter and University College Nord and will follow the Knowledge to Action (KTA) Cycle and the Consolidated Framework for Implementation Research. It takes part at two neurorehabilitation hospitals and three municipalities in Denmark. Frequent meetings will ensure continuity and support involved sites. The intervention consists of 45-60 minutes 4-5 days per week in in-hospital and 2-3 times in outpatient rehabilitation. Stepping training is in focus and participants are given a target training zone of 70-85% heart rate max.
Results and Discussion: Measures of feasibility and patients', therapists', and caregivers' experiences with HIGT will be presented and discussed. Outreach is a major focus and will be achieved by the partners who represent scientists and professional developers, undergraduate training, post-graduate training, and health professionals.
Conclusion: We expect that the implementation of HIGT will constitute knowledge that will constitute a game-changer towards evidence-based rehabilitation for persons with impaired gait function after ABI in Denmark.

Topic 8: Multiple sclerosis

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Factors affecting community mobility among patients with multiple sclerosis: a cross-sectional study

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Introduction: Community mobility is essential for patients with Multiple Sclerosis (MS) to remain physically active, but there is a lack of evidence discussing the factors affecting this area. Acknowledging the community mobility predictors can assist clinicians in providing a higher care standard, encouraging societal reintegration, and enhancing the quality of life.
Main Objective: To primarily determine the potential factors affecting community mobility among MS patients and secondarily explore the impact of trunk impairment on community mobility.
Methods: A cross-sectional study assessed thirty participants with MS for trunk impairment using the Trunk Impairment Scale (TIS), gait and balance using Performance Oriented Mobility Assessment (POMA), fatigue using the Modified Fatigue Impact Scale (MFIS), community mobility using Reintegration to Normal Living Index (RNLI), and depression and anxiety using Hospital Anxiety and Depression Scale (HADS). The outcome measures were analyzed using simple linear regression analysis.
Results and Discussion: All predictor variables have a significant influence on community mobility, including TIS (β= 0.48, p $\leftarrow$ 0.007), MFIS (β= -0.80, p $\leftarrow$ 0.0001), POMA (β= 0.63, p $\leftarrow$ 0.0001), MFES (β= 0.76, p $\leftarrow$ 0.0001), and HADS (β= -0.73, p $\leftarrow$ 0.0001). In multivariable analysis, MFIS (β= -0.80, p $\leftarrow$ 0.0001) was the most predicting factor for community mobility. It is advised to increase the sample size to emphasize the results further.
Conclusion: The current findings suggested factors contributing to community mobility limitations for MS patients, which provide valuable insights into rehabilitation aspects that can encourage this population to reintegrate into the community.
Acknowledgements: No financial support was received for this study.

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Topic 8: Multiple sclerosis

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Videogames Therapy Improves Motor Function, Psychological Well-being and Disability in Multiple Sclerosis. A Randomized Control Trial.

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Introduction: Multiple Sclerosis (MS) is often characterized by the presence of balance and cognitive impairments. Rehabilitative treatment of people with MS (PwMS) does not have to consider separately the motor and cognitive aspects. Videogame therapy (VGT) typically provides augmented feedback during training that can contribute to learning motor skills. Moreover, it can increase motivation and patients' engagement.
Main Objective: Testing the effects of a commercially available VGT on balance and cognitive function in ambulatory PwMS compared to a standardized balance platform training (BPT).
Methods: PwMS has been recruited and randomized to VGT or BPT group. Both the groups received 12 VGT training sessions (3 times/week) over 4 weeks. All subjects were evaluated for balance and mobility function, fatigue, physical and psychological wellbeing, and disability through validated measures. Cognitive functions were assessed with a computer-based assessment. Outcome measures were assessed before (T0) and after (T1) the treatment and at three months follow-up (T2).
Results and Discussion: 48 PwMS have been enrolled in the study. Both groups reported improvements not only in balance and mobility but also on mood, perceived fatigue and disability, with no differences between groups. On the contrary, we did not find improvements in attention. A significative reduction in anxiety was recorded only in the VGT group.
Conclusion: The use of video games could be considered a valuable option to manage balance and mobility disorders in PwMS, with positive effects on psycho-physic wellbeing, fatigue and self-reported disability. The role of video games on attention disorders needs to be further investigated.

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The effects of upper limb robot-assisted rehabilitation on motor synergies in patients affected by multiple sclerosis. An exploratory study

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Introduction: Multiple sclerosis (MS) is a chronic disease of the central nervous system (CNS) characterised by progressive motor, sensory and cognitive deficits. Notably, people with MS (pwMS) are characterised by the reorganisation of motor synergies, which define the recruitment of muscle groups to perform actions. Motor synergies could be used as prognostic and outcome measures in rehabilitation, but results are often conflicting.
Main Objective: We evaluated the effects of an exoskeleton, robot-assisted rehabilitation on motor recovery and upper limb synergies, as assessed by electromyographic recording, in MS.
Methods: Six PwMS and arm paresis clinically stable and cognitively preserved, were recruited (mean age 59.7 years, 4 females, 2 males, 3 secondary progressive MS, 2 primary progressive MS and 1 non-defined MS, average illness duration 17.8 years). Exclusion criteria were: severe comorbidities, upper limb muscle spasticity or pain, clinical worsening or changes in drug therapy, rehabilitation treatment or botulinum toxin injections in the last three months. Enrolled patients underwent 18 one-hour sessions of 3D-arm movements with a gravity-supported, computer gaming-enhanced exoskeleton (Armeo Power, Hocoma, Switzerland).
Results and Discussion: Functions and abilities of the upper limb undergoing treatment with a robot-assisted exoskeleton improved. Moreover, after treatment, two patients increased synergies in the most severely affected limb, two decreased them, and for two they were unchanged.
Conclusion: While upper limb motor function improved following treatment, motor synergies were very heterogeneous, suggesting highly variable treatment effects. Further studies could deepen this variability and its functional implications.

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Topic 8: Multiple sclerosis

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Factors affecting falls in people with multiple sclerosis: moderation and mediation effect of fatigue and balance on falls - a case-control study

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Introduction: Persons with Multiple Sclerosis (PwMS) are at high risk of falls, which may lead to serious injuries affecting the quality of life.
Main Objective: To assess the factors that primarily affecting falls and to find whether fatigue has a moderator effect and balance has a mediator effect on falls in PwMS.
Methods: One hundred and three PwMS with a mean age of (32.09 ± 7.17) were enrolled and assessed for balance using Berg Balance Scale (BBS), speed of gait using Timed Up and Go test (TUG), fear of falling using Falls Efficacy Scale International (FES-I) and fatigue using Modified Fatigue Impact Scale (MFIS).
Results and Discussion: There were significant results for BBS (OR: 10.88; 95% CI: 4.24 – 27.96), TUG (OR: 1.18, 95%; CI: 1.09 - 1.28), FES-I (OR: 1.06; 95% CI: 1.02 - 1.10), MFIS (OR: 1.04; 95% CI: 1.02 - 1.07). In multivariable analysis, BBS (OR: 3.92; 95% CI: 1.30 - 11.78), TUG (OR: 1.12; 95% CI: 1.02 - 1.23), and MFIS (OR: 1.03; 95% CI: 1.02 - 1.06) were the most predicting factors for falls. HAYES PROCESS analysis was significant for the moderation effect of fatigue on gait speed and falls (MFIS; effect; 0.10; 95% CI, 0.07 to 0.14) and mediation effect of balance on gait speed and falls (BBS; indirect effect; 0.08; 95% CI, 0.02 to 0.13).
Conclusion: The findings suggest that speed of gait, balance, and fatigue can be predictors of falls in PwMS, which can provide helpful insights into developing fall-prevention rehabilitation approaches
Acknowledgements: Nothing to report

Topic 9: Neuromuscular disorders/ neuropathy

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Paroxysmal Sympathetic Hyperactivity in an Adult with Tuberculous Meningitis: A Case Report

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Introduction: Paroxysmal sympathetic hyperactivity is a recognised complication of brain injury, especially traumatic brain injury. Its association with other CNS disorders is less well recognised. A case treated in our unit is described.
Main Objective:
Setting Inpatient specialist rehabilitation unit within Royal Stoke University hospital. Patient admitted for hyper-acute rehabilitation following referral from the Infectious diseases unit.
Presentation A 32 year old male, UK-resident, Indonesian factory worker presented with neck swelling and neurological abnormality following a short illness. On admission to the emergency department, he had global limb and trunk weakness, seizures and reduced conscious level. He was diagnosed with Tuberculous meningo-encephalitis on the basis of radiological findings, acid-fast bacilli cells and positive culture in neck abscess and cerebrospinal fluid.
Methods:
Initial management He was commenced on standard anti-tuberculous therapy and stabilised medically. He later developed obstructive hydrocephalus requiring venticulo-peritoneal shunt insertion.
Progress Following transfer to the rehabilitation ward, he developed swinging pyrexia, diaphoresis, tachycardia, tachypnoea and hypertension. These symptoms persisted over several days without obvious triggers. Multiple tests failed to show any new infective causes, so he was eventually diagnosed as having paroxysmal sympathetic hyperactivity (PSH). Bisoprolol was partially effective at reducing his heart rate, however once this was replaced with the non-cardioselective beta blocker Propranolol, his broader PSH symptoms resolved.
Conclusion:
Clinical lesson Paroxysmal sympathetic hyperactivity is a rare manifestation of tuberculous meningo-encephalitis. Early detection is very important as it can avoid diagnostic errors and overtreatment, especially with unwarranted antimicrobials.
Acknowledgements: Special thanks to Dr Alexandra Ball (Consultant Neuro - Rehabilitation) for the proof reading and guidance in writing this case report

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Topic 9: Neuromuscular disorders/ neuropathy

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Surgical correction of foot deformity in HMSN patients: study protocol

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Introduction: Foot deformities are common in people with hereditary motor and sensory neuropathy (HMSN) and surgical intervention should be considered. Although clinical experience with surgical treatment is extensive and generally positive, the scientific evidence for these surgical interventions is still limited. Further substantiation using clinical trials and a better understanding of the underlying mechanism is needed.

Main Objective: To evaluate the effect of surgical correction of foot deformity in patients with HMSN in terms of personalized goal attainment, gait capacity and daily life gait performance.

Methods: This is an observational intervention study with repeated-measures. Twenty-two HMSN patients with disabling foot deformity will be recruited from the Gait Expertise Center (LEC) of the Sint Maartenskliniek and Radboudumc. All patients will receive a personalized surgical intervention. Outcome measures will be collected at baseline, three months after baseline, and one-year post-surgery. Firstly, measurements include evaluation of the personal goals. Secondly, gait capacity is measured by clinical tests, 3D gait analysis, and a perturbations and precision stepping task at a instrumented treadmill (GRAIL). Lastly, physical activity and daily life gait performance will be measured in the home situation. Evaluation will be at group level using a repeated measures ANOVA with measurement time (baselines and postoperative assessment) as a within-subjects factor.

Results and Discussion: Primary outcome measurements are the Canadian Occupational Performance Measure (COPM), Time-Up-And-Go-Test and walking time during the day for the attainment of predefined personal goals, gait capacity and daily life gait performance, respectively.

Conclusion: This study establishes the next step toward evidence-based ankle-foot-surgery in people with HMSN.

Topic 10: Neuropsychiatry/ behavioral disorders

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The German Revised Version of the Niigata PPPD Questionnaire (NPQ-R): Development with patient interviews and an expert Delphi consensus

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Introduction: Persistent postural-perceptual dizziness (PPPD) is a functional disorder of the nervous system. The Japanese Niigata PPPD Questionnaire (NPQ), was developed but lacks content validity.

Main Objective: The aim of this study was to officially translate and culturally adapt the Japanese NPQ into German, evaluate its content validity, and revise the original version.

Methods: After official translation, the German version of the NPQ was revised. In a 3-round expert Delphi survey 28 experts from Switzerland, Germany, and Austria were asked to complete a first questionnaire on various aspects of PPPD, the original NPQ and their own related experiences (Round one), a second questionnaire with statements regarding PPPD they could agree or disagree with using a 6-point Likert-scale (Round two), and a third survey to finally reach consensus. Additionally, eleven patients (mean age 64.6±12.6 years; 6 females) diagnosed with PPPD according to the criteria of the Bárány Society participated in semi-structured interviews asking for their opinion on the content of the original NPQ. All collected data were analysed using a descriptive evaluation and a qualitative content analysis based on verbatim transcripts.

Results and Discussion: The revised NPQ-R comprises now 19 items divided into five subscales using a 7-point Likert-scale with two additional subscales relating to *associated symptoms* and *symptom behaviour* in PPPD. The new maximal score is 114 points compared to 72 for the NPQ.

Conclusion: The NPQ-R is the first patient-reported outcome measurement for patients with PPPD in German. Its extension represents a sound content validity evaluation and improves the assessment of PPPD intensity in affected patients.

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Topic 10: Neuropsychiatry/ behavioral disorders

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Convergent construct validity and test-retest reliability of the German NPQ-R

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Introduction: The Japanese Niigata Persistent Postural-Perceptual Dizziness Questionnaire was translated into German and revised to include the perspective of patients and experts and therefore improve content validity.
Main Objective: The aim was to examine convergent construct validity and test-retest reliability of the NPQ-R.
Methods: Patients with a diagnosis of PPPD filled in patient-related outcome measures for dizziness and potentially related constructs: NPQ-R, Dizziness Handicap Inventory (DHI), Vertigo Symptom Scale (VSS), Hospital Anxiety and Depression Scale (HADS), Activities-specific Balance Confidence Scale, SF-36. Internal consistency (Cronbach's Ð), convergent validity (Spearman's rank correlation coefficient r), and test-retest reliability (two-way mixed effect model, Intraclass Correlation Coefficent, ICC (1,1)) were calculated.
Results and Discussion: 100 patients (age 54.7±18.2 years; 56 females; dizziness duration: 60.2±90.1 months, PPPD mean 51.8±19.8) participated. Each subscale, showed acceptable internal consistency: upright posture (α=0.75), movement (α=0.77), visual (α=0.83), associated symptoms (α=0.73), symptom behavior (α=0.69). Test-retest reliability was satisfactory with ICC=0.86 (CI 0.79-0.90), the smallest detectable change was 21 points. Correlations between NPQ- R and DHI and VSS was high (r=0.60-0.76), between NPQ-R and HADS- A and VSS-A moderate to high (r=0.44-0.53). A correlation from 0.22 to 0.65 was shown between the NPQ-R and self-report measures of general quality of life (SF-36).
Conclusion: The NPQ-R demonstrated preliminary satisfactory convergent construct validity and test-retest reliability for the German version including 19 items (136 points) and 5 subscales (3 to 4 items with 18 to 24 points/subscale). The scale development should be further investigated regarding dimensionality using both structure-seeking and structure-checking procedures, respectively with factor analytic methods.
Acknowledgements: A special thanks to Prof. D. Straumann, Dr. C. Candreia and K. Weickhardt for their valuable contribution to the patient recruitment and Dr. Wiebke Trost for the advice regarding questionnaire development. We would like to thank all participants for participation.

Topic 11: Neuropsychology/linguistics

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The self-evaluation tool for early screening of cognitive function at an acute stroke setting

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Introduction: Cognitive disorders are common early after stroke but can be overseen in patients with mild stroke who seem to be functionally recovered but are at risk to experience difficulties in advanced daily activities. A self-evaluation tool to identify patients at risk for cognitive deficits is developed by the occupational therapy department. This self-evaluation tool is a paperwork task, to fill out independently by patients with mild stroke, pre-stroke independent for instrumental daily tasks. Semi-structured interpretation is performed by physician and may result in referral to the occupational therapy evaluation.
Main Objective: To examine sensitivity, specificity, and reliability of the self-evaluation tool.
Methods: Stroke survivors admitted to the stroke unit are recruited within the first week after stroke. Sensitivity and specificity of the self-evaluation tool are determined according to the Montreal Cognitive Assessment (MoCA) and the Oxford Cognitive Screen (OCS). The self-evaluation tool is evaluated twice (one-month interval) by two physicians independently assessing interrater and intrarater reliability.
Results and Discussion: Participants (n=45) are aged 76 (59-84) years and 10/45 (12%) are female. Sensitivity and specificity for the sefl-evaluation tool according to MoCA is 69% and 60% and to OCS 72% and 62%, respectively. Kappa for interrater agreement of the self-evaluation tool is 0,62 (95% CI: 0,36-0,87) and for intrarater agreement 0,74 (95% CI: 0,51-0,97).
Conclusion: This study describes the first steps of the development of a self-evaluation tool developed to improve acute stroke care and referral to occupational therapy evaluation. Sensitivity, specificity, and reliability are moderate and demand revision of the proposed self-evaluation tool.
Acknowledgements: The authors would like to thank Sarah De Wit and Charlotte Poncelet for their help in this study and all participants who were involved in this study.

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Topic 11: Neuropsychology/linguistics

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Fatigue's detrimental effect on motor learning - underlying mechanisms

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Introduction: Motor fatigue has a persistent, negative effect on performance and learning of new motor skills, yet the underlying neuromuscular mechanisms remain unclear.
Main Objective: To better understand this phenomenon, we analyzed data from a previously conducted randomized controlled trial involving 40 participants who were trained in a motor-skill task over two days.
Methods: Two groups (N=15) trained with motor fatigue on day 1 and were compared to a control group (N=10) that trained without fatigue. At the end of day 1, one fatigued group received depotentiating transcranial magnetic stimulation to disrupt motor memory formation. The other groups received sham stimulation. On day 2, all groups performed the same task without motor fatigue. Muscle activation patterns were analyzed from EMG.
Results and Discussion: Unfatigued participants showed steady performance improvement, that correlated inversly with variability of muscle activation. Fatigued participants showed significantly lower performance, that was paired with a missing reduction in variability. On day 2, both control and previously fatigued participants started with low variability. After sham stimulation, variability was not increased nor adjusted despite the continued bad performance after fatiguing training. Notably, disrupting consolidation in the primary motor cortex post-training restored both the variability of muscle activation patterns and the associated learning ability to pre-fatigue levels.
Conclusion: Our findings show that the recall of inadequate fatigue-induced muscle activation patterns is a key cause of the long-lasting detrimental impact fatigue has on motor-skill learning.
Acknowledgements: We thank Agostina Casamento for providing access and insight into the EMG database.

Topic 12: Neurorobotics

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Feasibility and Usability of JUNO, a Sensor Device, for At-Home Hand Neurorehabilitation in Chronic Stroke Patients with Mild Hand Impairment: A Pilot Study

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Introduction: Conventional home-based stroke rehabilitation with paper-based instructions has been reported to have very low compliance due to a lack of feedback and patient participation. The adherence is as low as 30%.
Main Objective: To assess the feasibility and usability of JUNO, a single-degree-of-freedom device that allows active training for hand functions, for at-home hand neurorehabilitation in chronic stroke patients with mild hand impairment undergoing independent training.
Methods: Four chronic stroke patients ($\rightarrow$ 6 months post-stroke) with mild hand impairment following their first stroke (FMA $\rightarrow$50). Participants and their caregivers received JUNO training at the clinic for three days and then underwent four weeks of independent training at home. Participants were encouraged to train for at least an hour daily, with gamified training sessions. The usability was measured using the System Usability Scale (SUS), User Experience Questionnaire (UEQ), and Intrinsic Motion Inventory (IMI). Clinical outcomes were measured pre- and post-training using the Fugl-Meyer Assessment (FMA), Box-and-blocks test (BBT), ABIL hand, and Barthel index.
Results and Discussion: Three participants used JUNO independently, and one required assistance from their caregiver. The average daily training duration was 81.6±32.15 minutes, with at least five days of training per week. Participants rated JUNO positively, with a SUS score of 78.15±2.07 and positive ratings on IMI and UEQ subscales. Technical assistance was required 4±3.8 times over four weeks. Post-training, participants showed improvement in hand function as measured by the FMA (8.5±4.39 points), BBT (1.75±5.12 blocks), ABIL hand (1.67±2.38 logits), and Barthel index (9.6±6.43 points).
Conclusion: Participants rated the system as having good usability and all of them preferred at-home training over outpatient training. The overall training duration over 28 days was 1886.8 minutes. Since JUNO is a sensor device (with no actuators), thus makes it inherently cost-effective, compact and thus possibly a clinically adoptable solution for training mild-moderate impairments.
Acknowledgements: Funding help from Tata-Elxsi CSR.

Posters

Topic 13: Neurostimulation/modulation

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More focal is not always better: effects of conventional versus high-definition transcranial direct-current stimulation on implicit motor sequence learning

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Introduction: Implicit motor sequence learning (IMSL) is a crucial skill that enables us to perform multiple single movemenThis type of learning has been shown to be impaired in Parkinson's disease (PD). Research in healthy individuals shows the potential for transcranial direct current stimulation (tDCS), a non-invasive brain stimulation technique, over the primary motor cortex (M1) to enhance IMSL.

Main Objective: In this study, we investigated the potential of M1 tDCS to enhance the acquisition, short- and long-term consolidation of IMSL in a larger and more cognitively diverse sample of individuals with PD.

Methods: Using a sham-controlled, double-blind design, we investigated effects of M1 tDCS on IMSL in 35 persons with PD and 35 healthy controls. Linear Mixed Models were used to analyze sequence-specific (primary outcome) and general learning effects (secondary outcome) during tDCS (acquisition), five minutes post-tDCS (short-term consolidation) and one-week post-tDCS (long-term consolidation) as measured by the serial reaction time task (SRTT).

Results and Discussion: In the PD group, anodal tDCS resulted in significantly larger sequence-specific learning effects in the acquisition phase (M = 51.9 ms), compared to sham (M = 32.29 ms). However, it did not affect short-term (p = .879) or long-term consolidation (p = .729). Anodal tDCS did not affect general learning in the PD group (p = .417). In the HC group, anodal tDCS did not influence sequence-specific (p = .343) or general learning (p = .076). In this study, anodal tDCS led to enhanced acquisition, but did not affect consolidation of IMSL. In healthy individuals, anodal tDCS did not influence sequence-specific or general learning.

Conclusion: These results highlight the potential of tDCS to enhance IMSL in PD. Future research should include multiple sessions and follow-up assessments to determine whether repeated stimulation induces larger and long-lasting effects on IMSL.

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Transcranial direct current stimulation in stroke - motor excitability and motor function

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Introduction: Transcranial direct current stimulation (tDCS) has frequently been applied in stroke patients to improve motor functions and activities of daily living. Despite a large number of randomized controlled trials, its efficacy is still under debate. In particular, not much is known about excitability changes evoked by anodal or cathodal brain stimulation in stroke patients.

Main Objective: To characterize motor excitability changes and changes of motor performance induced by a single anodal and cathodal tDCS session in subacute stroke patients.

Methods: Twenty patients ← 4 months after stroke participated. Motor performance was tested with the Box and Block Test [BBT]. Motor cortex excitability (short interval intracortical inhibition [SICI], intracortical facilitation [ICF], long interval intracortical inhibition [LICI]) was examined by paired pulse transcranial magnetic stimulation before and after a single tDCS session (20 minutes, 1,0 mA). On two different occasions, patients received anodal and cathodal tDCS over the affected hemisphere. TMS recordings were taken from both hands consecutively.

Results and Discussion: Anodal tDCS significantly reduced SICI without changing ICF or LICI. Cathodal tDCS did not change motor excitability. Both types of tDCS did not alter motor performance. Even prior to anodal tDCS, SICI in the affected hemisphere was lower than in the unaffected hemisphere and was correlated with BBT changes after anodal tDCS. Anodal, but not cathodal tDCS specifically modulated intracortical inhibitory circuits, leading to a disinhibition. The correlation between the degree of disinhibition and the degree of motor performance improvement suggests that disinhibition is potentially beneficial for motor functions after stroke.

Conclusion: This study amplifies our knowledge on excitability modulations of tDCS in stroke patients.

Posters

Topic 14: Orthotics/neuroprosthetics/FES

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Use and usability of custom-made knee-ankle-foot orthoses in polio survivors with knee instability – a cross-sectional survey

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Introduction: Knee-ankle-foot orthoses (KAFOs) for knee instability are commonly prescribed in polio survivors to enhance safe ambulation. However, there has been little research on factors of usability of these devices and their influence on an individual's decision to use their KAFO.
Main Objective: We investigated the use of custom-made KAFOs in daily life and differences in usability factors between users and discontinued users.
Methods: A questionnaire on KAFO use and usability was sent to 163 polio survivors who were provided with a custom-made KAFO at an outpatient clinic of a university hospital in the Netherlands. Components of usability were formulated using the ISO 9241-11 standard.
Results and Discussion: 106 respondents returned the questionnaire. Of these, 98 were eligible for analysis. Seventy-four (76%) of them used their KAFO. Compared to those who discontinued using their KAFO (24%), users experienced more limitations when walking without a KAFO (p=0.001), more often wore a pervious orthosis (p←0.001) and were more often prescribed a locked rather than a stance-control KAFO (p=0.015). Furthermore, users reported better effectiveness of their KAFO (p←0.001) and were more satisfied with goals of use, such as standing and walking stability, and with KAFO-related aspects like fit and durability(p←0.001).
Conclusion: The majority of polio survivors used their custom-made KAFO in daily-life. Factors related to continued KAFO use, such as walking ability without orthosis, expected benefits of the KAFO, previous orthosis experience and type of KAFO provided, should be taken into consideration and discussed when prescribing a KAFO in polio survivors.
Acknowledgements: We would like to thank the polio survivors that participated in this survey.

Topic 15: Parkinson's disease

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Validity and reliability of VO2-max testing in persons with Parkinson's disease

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Introduction: Cardiorespiratory fitness (VO_2-max) is an important health and performance indicator for persons with Parkinson's disease (pwPD) and is often used when prescribing exercise and evaluating aerobic exercise interventions. However, no study has examined the content validity of the direct whole body assessment of VO_2-max (VO_2-max test) in pwPD as well as the test-retest reliability (i.e., day-to-day variation) in both the ON and OFF medication state.
Main Objective: Therefore, the present study investigated the content validity and test-retest reliability of the VO_2-max test in pwPD both ON and OFF medication.
Methods: Twenty pwPD completed four VO_2-max tests (two tests ON and two tests OFF medication), in a randomized order, separated by four to sixteen days. The first tests ON and OFF medication were used to assess validity based on attainment of five pre-defined end-criteria (one primary and four secondary). Reliability was examined by intraclass correlation coefficients (ICC) and the day-to-day variation of the two ON and OFF medication tests.
Results and Discussion: In pwPD, 50% and 60% attained the primary end-criterion ON and OFF medication, respectively. A higher proportion (i.e., 70-90%) attained the secondary end-criteria both ON and OFF medication with no difference between medication states. Day-to-day variation was 1.2 and 1.8 ml O_2/kg/min, while $ICC_{2.1}$ was 0.97 (95%-CI: 0.92;0.99) and 0.96 (95%-CI: 0.90;0.98) ON and OFF medication, respectively.
Conclusion: The VO_2-max test has an acceptable content validity and excellent day-to-day reliability ON and OFF medication in pwPD.
Acknowledgements: The authors thank Lars Grøndahl Hvid for statistical assistance.

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Topic 15: Parkinson's disease

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Artificial intelligence in routine speech therapy care for Parkinson's disease: development of a human-centered implementation approach

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Introduction: 90% of patients with Parkinson's disease (PD) develop symptoms of speech intelligibility disorder (dysarthria), which requires high-frequency therapy. Cognitive speech recognition using artificial intelligence (AI) can enable personalized and high-frequency speech therapy. Users use AI when it is adapted to their needs and competencies.
Main Objective: Within the framework of a human-centered implementation approach, the project HUMAINE is investigating which factors and strategies are essential for a successful transfer of AI-based systems into routine speech therapy care. These are tested in a feasibility study using the technology ISi-Speech, an AI-supported speech assistance system for patients with PD.
Methods: Explorative surveys with speech therapists were used to determine workflows and user needs for the use of AI-based systems. Implementation strategies for the use of ISi-Speech were derived from the results. These are currently being tested and evaluated in practice.
Results and Discussion: From the interviews conducted with n=20 speech therapists, it became clear that there are uncertainties and fears in dealing with AI-supported systems. These are attributed to a lack of application knowledge. From the participants' point of view, acquiring digital competencies and standardized application guidelines are elementary for safe handling. At the start of the study, an application-oriented workshop on ISi-Speech was conducted with n=4 speech therapists. In addition, they received comprehensive manuals and counseling guidelines for the use of ISi-Speech.
Conclusion: The results of the ongoing study are to be used as the basis for a best practice model for the successful implementation of AI-based systems in routine care.

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Do people with parkinson's disease accept a study design: a feasibility study using a new cueing device and gait analysis insoles.

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Introduction: Compensatory strategies such as cueing and high frequency vibrotactile stimulation can reduce Freezing of Gait (FoG), a disabling symptom of Parkinson's Disease (PD) (1). Therefore, a new Sternal Vibrotactile Stimulation Device (SVSD) with cueing function has been developed.
Main Objective: The aim of this study was to investigate, if the proposed study design using a SVSD and gait analysis sensor insoles, was acceptable for people with PD.
Methods: This feasibility study was designed as a clinical randomized cross-over study. People with PD were recruited from self-support groups to take part in a one off 60-minute data collection session. The acceptability of the study design was assessed using mixed methods. Secondary outcome measures were the 10 Metre Walk Test, the Freezing of Gait Score and the Patient Global Impression of Change Scale. Gait parameters were captured with gait analysis sensor insoles.
Results and Discussion: Four women and nine men (median age 66 years, Hoehn and Yahr score ranging from 1 to 4) participated in the study. The median score of all aspects of the study design was very satisfactory. The feedback from open ended questions provided additional ideas and considerations for adaptations of future studies. All participants could perform the secondary outcome measures and were deemed feasible.
Conclusion: The proposed study design was acceptable for people with PD and could be used for larger clinical studies to evaluate a possible effect of SVSD on FoG.

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Topic 15: Parkinson's disease

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Targeted touchscreen training in people with Parkinson's disease: a pilot study.

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Introduction: People with Parkinson's disease (PD) previously demonstrated impaired sliding movements on a touchscreen. To tackle this problem, it is imperative to develop and test training programs to enhance touchscreen manipulation.

Main Objective: To examine the effectiveness of a two-week home-based touchscreen training versus no training in PD.

Methods: Thirty-four patients (HY I-III), ON-medication, were randomized in a training (EXP, N=16, age 69.9±7) or a passive control group (N=18, age 69±8). EXP practiced the Swipe-Slide Pattern (SSP) task for two weeks (5x/week, 10min/session). The SSP-task consisted of swiping predefined patterns as fast and as accurately as possible on a touchscreen. Single and dual (counting red or green dots) training conditions were randomly delivered. SSP-time (ms), SSP-accuracy (% correct trials) and time on the Mobile Phone task (MPT) (s) to assess transfer, were tested at baseline (T0), after two weeks (T1) and four weeks after T1 (T2). Separate ANCOVA's assessed immediate training and retention effects, controlling for baseline performance and cognitive scores.

Results and Discussion: At T1, we found a significant training effect for SSP-time ($F(1,28)=4.855$, $p=0.036$, $Đ^2=0.148$) and a trend for SSP-accuracy ($F(1,28)=3.117$, $p=0.088$, $Đ^2=0.100$) in the training group, but not at T2. Baseline performance had a significant impact on SSP-performance at T1 and T2 ($p\leftarrow0.001$). Finally, SSP-training did not transfer to the MPT.

Conclusion: A short home-based training program showed promising results for improving touchscreen skills in those who underwent training. To address the lack of retention and transfer, further investigation is warranted into who benefits most from touchscreen training.

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The relationship between vestibular function and spatio-temporal gait parameters in Parkinson's disease

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Introduction: Parkinson's disease (PD) decreases automaticity and increases reliance on sensory cues to enable stable gait. However, sensory input from the vestibular system can also be affected by PD.

Main Objective: To determine the relationship between vestibular function and gait parameters in PD.

Methods: Ten PD patients (Hoehn & Yahr stage II-II, age 68y±4) were recruited. Vestibular tests included video Head Impulse Test (vHIT) and cervical/ocular vestibular evoked myogenic potentials (c/oVEMP). Gait characteristics included step time, length, and width, calculated from kinematics recorded using the Gait Real-time Analysis Interactive Lab system in different projected virtual reality conditions. Point-biserial correlations and Pearson correlation coefficients between vestibular outcomes and gait parameters were calculated. Repeated measures ANOVAs were performed to assess effect of different VR conditions.

Results and Discussion: vHIT gain scores show some negative correlations across dual-task conditions with step time (ranging from -0.94 [p=0.001] to -0.70 [p=0.19]) and step width (-0.79 [p=0.019 to -0.75 [p=0.033]), but not during scenarios designed to evoke freezing of gait. Presence of VEMPs shows some significant positive correlations with step time (0.85 [p=0.007] to 0.77 [p=0.025]), but no clear pattern emerged from the VEMP inter-peak amplitudes. Task conditions significantly affected step time ($Đ_p^2=0.99$, $p\leftarrow0.001$) and width ($Đ_p^2=0.66$, $p=0.001$). Data collection is ongoing, additional analyses are needed to elucidate the mediating effects of task conditions on the relationship between vestibular function and gait.

Conclusion: Preliminary data suggest that vestibular (dys)function is likely associated with some gait parameters (step width, step time), underlining the importance of the vestibular system for stable gait in PD.

Posters

Topic 16: Self-management/empowermen

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The success of a collaborative, multi-agency, virtual, Neuro Café for members of LEGS (Local Exercise Groups for stroke & neurological conditions)

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Introduction: Our exercise groups prior to the pandemic included a discussion session, but we wanted to increase this offering during the pandemic to create a dedicated weekly online education and peer support Neuro café, to create an opportunity to come together as a community. We wanted to inspire a group where participants motivated, challenged, and encouraged each other to " thrive not just survive".

Main Objective: The aim was to create an accessible online Neuro café group collaborating with other individuals, charitable & commercial organisations to provide a holistic, varied and dedicated education and peer support session at no additional cost to LEGS. To create an offering that improved participants ability to self-manage their condition and to gain further knowledge and understanding.

Methods: Neuro café sessions were analysed to establish the number of sessions, number of collaborations and the participants surveyed to gain feedback on the success of the programme in delivering aims.

Results and Discussion:
102 Neuro café sessions
45 collaborations with other individuals, charities & organisations.
Closed captions, images, chat, white board used to increase accessibility of the café on Zoom.
100% of attendees reported improved self-management of their condition
100% of attendees reported excellent peer support.

Conclusion: All external speakers gave their time & resources for free, showing the feasibility of online collaborative education and support.
"Education is as important as exercise " (LEGS participant)
"All exercise groups need an education & peer support session, we would be lost without it " (LEGS participant)

Topic 17: Spasticity/dystonia

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Validity and reliability of the assessment of hand flexors stiffness using a new e.l.ectromechanical oscillatory device in people with stroke

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Introduction: Hyper-resistance after a central nervous system injury has been largely referred to as spasticity, which is but one of its neural-components. Assessment largely relies on clinical scales (Modified Ashworth and Tardieu scales – MAS and MTS) which are unable to distinguish between the non-neural (tissue-related) and the neural (central nervous system related) components of hyper-resistance.

Main Objective: This study assessed criterion validity and reliability (reproducibility) of muscle stiffness measures, namely, maximum elastic stiffness (EL_{max}), viscous stiffness (VI), and path length (L-path) in the hand flexor muscles among people with stroke.

Methods: Measurements were obtained with a wrist-electromechanical oscillatory device (w-EOD). Twenty-four people with arm impairment after stroke were evaluated with the w-EOD and clinical assessment (MAS and MTS), twice on the same day (short term reliability) and once 10 days later (long-term reliability). For criterion validity, a Spearman coefficient (r) was calculated between stiffness values and the clinical scales. For reliability, ICCs, SEM and MDC95 were calculated.

Results and Discussion: Moderate correlations were observed between EL_{max} and MAS (r= 0.49) and MTS (V2 r=0.43; V3, r=0.49) of the wrist flexors, and finger flexors (MAS r=0.60, MTS V2 r= 0.56, MTS V3 r=0.55). There was a poor correlation between the clinical scales and VI and L-path. Reliability was excellent for all stiffness measurements at short term (EL_{max} : 0.95, VI : 0.94, L-path : 0.92) and good at long term (EL_{max} : 0.87, VI : 0.76, L-path : 0.82).

Conclusion: In conclusion, stiffness measurements are valid and reliable to evaluate hyper-resistance in people with stroke.

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Topic 17: Spasticity/dystonia

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Involuntary Auricular Movements - A Physiotherapy Case Study

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Introduction: Few cases of involuntary auricular movements have been recorded. The spontaneous facial movements here are characterised by both entrainment and distractibility, which are considered typical of a functional movement disorder (FMD). Management of functional facial symptoms frequently consists of a diagnostic explanation, and addressing relevant triggers as well as comorbidities. Botulinum Toxin injections may be administered. Patients are not routinely referred for physiotherapy treatment, and its' role here is unclear.
Main Objective: To present the case of a patient with functional auricular movements, who was referred for physiotherapy.
Methods: A 52-year-old woman was referred for physiotherapy having received a diagnosis of FMD. She attended 4 appointments over a 9-month period. Treatment incorporated elements of the consensus recommendations for FND for Physiotherapy (2015) as well as the equivalent recommendations for Speech and Language Therapy (2021).
Results and Discussion: At the end of treatment, the patient rated her movement problem as "5 – Much improved" on a 5-point Likert scale. She described a greater sense of control in relation to her facial movements, which is consistent with video clips taken during sessions. We hypothesized that the following elements supported a positive treatment response: Using competing movements to 'pause' symptoms demonstrated the possibility of symptom reversal; the patient began to change a number of behaviours that we felt were precipitating and perpetuating her symptoms.
Conclusion: Patients with functional facial movement disorders may benefit from physiotherapy treatment which is informed by current consensus recommendations.

Topic 18: Stroke

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Brain (EEG) and muscle (EMG) activity related to 3D sit-to-stand kinematics in healthy adults and in central neurological pathology- A Systematic Review.

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Introduction: Sit-to-stand transfer, rising to standing from a seated position, is a fundamental movement of activities of daily living that is negatively affected in disorders of the nervous system. Despite its functional importance, the neurophysiological basis at muscle (electromyography (EMG)) and brain (electroencephalography (EEG)) level as related to kinematic movement is not well understood.
Main Objective: Synthesis of the published literature addressing central and peripheral neural activity during 3D kinematic capture of sit-to-stand transfers.
Methods: A pre-registered systematic review was conducted. Electronic databases (PubMed, CINAHL Plus, Web of Science, Scopus, EMBASE) were searched. The search was not limited by study type but was limited to populations of healthy individuals or individuals with a central neurological pathology.
Results and Discussion: Of the 13,703 papers identified, 51 were included. Fifty studies captured kinematic data of sit-to-stand with associated EMG activity only and one study captured kinematics with co-registered EMG and EEG data. Forty-nine studies examined sit-to-stand in healthy individuals, reporting four dynamic movement phases and three muscle synergies used by most individuals to stand-up. No studies described brain activity during the sit-to-stand movement. Five studies examined sit-to-stand in stroke and two in Parkinson's disease, both reporting no statistically significant differences in their kinematics and muscle activity patterns compared to healthy controls. However, following stroke individuals stand-up more slowly and show greater reliance on the unaffected limb. Individuals with Parkinson's Disease stand-up with increased hip flexion and significant bilateral differences.
Conclusion: While overall kinematic and muscle activation patterns appear preserved in neurological populations, little is known about cerebral activity during sit-to-stand.
Acknowledgements: Supported by a Science Foundation Ireland, Frontiers for the Future award. SFI reference 19/FFP/6747.

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Topic 18: Stroke

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Functional recovery following inpatient rehabilitation after stroke subtypes

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Introduction: Understanding and prediction the functional outcome of stroke survivor subtypes is important for treatment selection but literature results are mixed.

Main Objective: We aimed to compare inpatient rehabilitation outcomes between cerebral infarction (CI) and intracerebral hemorrhage (ICH) strokes.

Methods: We included patients after stroke admitted to the neurology department of the University Medical Centre Maribor between February and December 2022 undergoing early neurorehabilitation. We analyzed the demographic characteristics and the etiopathogenetic stroke mechanism. The Barthel index and the modified Rankin Scale (mRS) assessed the patient's functional status and the modified Ashworth scale (MAS) muscle tone.

Results and Discussion: 77 patients with stroke (17% hemorrhagic and 83% ischemic) were included with an average age of 71 years and 59% males. We found no differences in length of hospital stay between patients with ischemic (mean:26 ± SD: 13) and hemorrhagic stroke (22 ± 11; p=0.333), in MAS muscle tone (CI 1,3± 1,2, ICH 1,3 ± 1,1; p=0.64), Barthel index score (CI 61± 31, ICH 57 ± 33; p=0.758) and mRS (CI 2,7± 1,6, ICH 2,8 ± 1,4; p=0.967) at discharge.

Conclusion: We conclude that acute stroke subtypes of CI and ICH have similar functional outcomes and ability to perform daily activities at discharge from clinical rehabilitation.

Acknowledgements: The authors would like to thank their Neurology Department colleagues.

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Effects of flexor reflex stimulation on gait aspects in stroke patients. A pilot study

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Introduction: Eliciting the flexor reflex (FR) by electrical stimulation of the sole of foot has been described as a method of gait rehabilitation poststroke, but scientific evidence of the effects is limited (Quintern et al. 2004, Spaich et al. 2014).

Main Objective: This study was conducted to investigate the effect of FR stimulation during walking on gait performance and gait parameters in stroke patients within a single session of flexor reflex stimulation using Incedo®.

Methods: Randomized controlled trial 25 patients after stroke with hemiparesis (14 subacute; 11 chronic). Motor functions were tested with a 10-meter walk test (10MWT), a 2-minute walk test (2MWT), and a gait analysis. These tests were performed with and without Incedo® within a single session in randomized order.

Results and Discussion: This study showed that stroke patients walked significant faster in 10MWT and a longer distance in 2MWT with Incedo® compared to without electrostimulation. The gait parameters remained unchanged except for the step length. A subgroup analysis indicated that subacute and chronic patients responded similarly to the stimulation. There was a correlation between the degree of response to electrostimulation while walking and degree of improvement in 2MWT. A larger controlled clinical trial is warranted that addresses issues as the necessary number of therapeutical sessions and for how long stimulation-induced improvements outlast the treatment period.

Conclusion: This study is the first to examine FR activation effects in chronic stroke patients und suggests that stimulation effects are independent of the time since stroke.

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Topic 18: Stroke

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Robotic training after upper limb paresis in stroke: motor severity changes and impact of rehabilitation modalities after a 5weeks training

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Introduction: Robotic therapy (RT) integrated into upper limb (UL) post-stroke rehabilitation programs decreases motor deficits but functional outcomes remain uncertain.

Main Objective: The objectives were to evaluate the effects on motor impairments of a 5-week UL training combining RT with conventional therapy in subacute phase and to define how patients who shifted from impairments category differed from those who did not.

Methods: Clinically significant change was assessed by considering motor severity-based categories shift assessed by the Fugl-Meyer (FM) scale before and after therapy: severe ($0 \leftarrow$ FM score $\nwarrow 19$ pts), moderate ($20 \nwarrow$ FM score $\nwarrow 47$ pts), and mild (FM score $\nearrow 48$ pts). In RT, proportion of patients was explored considering training modality used (assisted/active/resisted) between patients who shifted (G1, n=15) and those who did not (G2, n=16).

Results and Discussion: At baseline (58(SD 26) days post-stroke), patients (n=31) had mean FM score of 18(13)pts, increasing to 30(17)pts 40 days post-training initiation ($p \leftarrow 0.001$). Proportion of patients per impairments category changed between baseline and post-onset ($p \leftarrow 0.05$): it decreased from 74% to 35% in severe, increased from 26% to 52% in moderate and increased from 0% to 13% in mild. Proportion of patients by robotic training modality differed between-groups ($p \leftarrow 0.001$): in G1, the assisted modality was used on average by 72% of patients (*vs* 95% for G2), the active modality by 64% (*vs* 46% for G2) and the resisted modality by 34% (*vs* 14% for G2).

Conclusion: This study indicated that a 5-week UL intensive combined training was associated with significant motor severity based-category shift from severe to moderate especially while active unassisted training was administered.

Acknowledgements: I would like to express my gratitude to my primary supervisor, Dr Christophe Duret, who guided me throughout this project. I would also like to thank my colleagues who supported me and offered deep insight into the study.

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Amount of daily time spent in rehabilitation in stroke in/outpatients: a French rehabilitation center study.

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Introduction: Stroke is the leading cause of disability worldwide. Stroke rehabilitation guidelines recommend to offer patients 3 hours of daily rehabilitation program to optimize recovery. However, does actual daily practice fit with these recommendations in a typical French specialized rehabilitation center?

Main Objective: The purpose of this study is to provide a quantitative and qualitative description of daily interventions offered to stroke in/outpatients.

Methods: This cross-sectional study was carried out in a French rehabilitation approved for rehabilitation to neurological disorders. All Patients with stroke who were hospitalized on a given date, selected as representative, were eligible for inclusion in the study. Data such as demographic characteristics (age, gender, side of lesion etiology and phase of stroke, severity, phasic or cognitive impairment), type of hospitalization, amount and type of prescribed training, were extracted from patient's medical records.

Results and Discussion: Data from 104 stroke patients were analyzed. The study sample had a mean age of 62.7 years; 51.0% were men and 71.2% had an ischemic stroke. Mean total daily time spent in rehabilitation was 122 minutes±49 consisting in approximately 2.5 sessions. Inpatients were inactive 73 % of the day. The type of hospitalization (inpatient or outpatient), and patient characteristics did not significantly impact the daily time spent in rehabilitation.

Conclusion: We found that the results of this study were consistent with literature, and not adequate with the 3 hours per day guidelines. However, to date, the real needs of stroke patients to optimize recovery are not established, although current rehabilitation programs might be under-dosed.

Acknowledgements: I would like to express my gratitude to primary supervisor, Dr Christophe Duret, who guided me throughout this project. I would also like to thank my colleagues who supported me and offered deep insight into the study.

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How is visuospatial neglect associated with standing balance throughout the first 12 weeks after stroke?

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Introduction: The association of visuospatial neglect (VSN) with standing balance throughout the first weeks post-stroke has been poorly investigated. However, this knowledge is important to improve stroke services, as independent standing is a prerequisite for regaining walking ability.
Main Objective: To evaluate the longitudinal association of VSN severity with 1) standing balance independence measured using a clinical measure, and 2) postural control mechanisms, evaluated using posturography of quiet standing balance in the first 12 weeks after stroke.
Methods: Thirty-six hemiplegic individuals after a first-ever unilateral stroke were evaluated at weeks 3, 5, 8 and 12 post-stroke. Egocentric and allocentric VSN severity was evaluated using the Broken Hearts Test. The clinical measure of standing balance included the standing item of the Berg Balance Scale (BBS-s). Posturographic measures of quiet standing balance included direction-dependent center-of-pressure velocities and weight-bearing asymmetry. A hierarchical linear mixed model was fitted to evaluate the association of VSN with standing balance over time, whilst controlling for age, muscle strength and sensory impairment of the most-affected leg.
Results and Discussion: Egocentric (β= -0.08, 95%CI[-0.15;-0.01], P=.029) and allocentric VSN (β= -0.09, 95%CI[-0.15; -0.04], P=.002) maintained significant predictors of the BBS-s after controlling for age, sensory loss and muscle strength of the most-affected leg for predicting the BBS-s. No significant independent longitudinal association of VSN with posturographic outcomes was found.
Conclusion: Severity of egocentric and allocentric VSN was associated with decreased standing independence, but not with measures of underlying postural control throughout the first 12 weeks post-stroke.
Acknowledgements: The authors wish to thank the cooperating hospitals/rehabilitation facilities (Algemeen Ziekenhuis Geel, GZA Sint-Augustinus, GZA Sint-Vincentius, Universitair Ziekenhuis Antwerpen and RevArte). They also express their gratitude to Erik Fransen (StatUA, University of Antwerp) for statistical assistance.

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3D-freehand Ultrasound Technique of Tibial Anterior Muscle Belly Volume and Echo-intensity in Stroke Patients: A Reliability Study

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Introduction: Adaptive changes in muscle properties of the tibial anterior muscle (TA) can occur in stroke patients with gait disorders. An objective estimation of muscle volume (MV) and echo intensity (EI), both for diagnosis and follow-up, may support the optimization of treatment related to gait disorders.
Main Objective: To evaluate the reliability of 3D freehand ultrasound (3DfUS) combining a motion-tracking system, which obtains the position and orientation of the US transducer during acquisition of MV and EI of TA.
Methods: Fifteen legs from patients with stroke and 10 legs from age-matched healthy subjects were included. Transverse 2D ultrasound images with probe position data were measured twice at rest by 2 different ultrasound technicians. Then, 3D reconstruction of MV and EI of TA was performed twice by 2 different evaluators. Inter- and intra-rater reliability for processing and acquisition was determined by ICC and SEM.
Results and Discussion: For MV, ICC's in the healthy cohort ranged from 0,971 to 0,985, with relative SEMs of 2,2 to 3,3%. ICC's in the stroke patient's cohort ranged from 0,974 to 0,991 with relative SEMs of 2,0 to 3,2%. For EI, ICC's in the healthy cohort ranged from 0,856 to 0,994, with relative SEMs of 1,5 to 6%. ICC's in the stroke patient's cohort ranged from 0,974 to 0,991 with relative SEMs of 2 to 3,2%.
Conclusion: These findings support the reliability of the use of a clinically feasible 3D-freehand ultrasound for quantification of tibial anterior muscle volume and echo intensity in patients with stroke.

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Error-enhancement as basis for novel upper limb rehabilitation in the chronic phase after stroke: preliminary results of an ongoing 5-day pre-post intervention study.

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Introduction: A large proportion of stroke survivors are confronted with upper limb (UL) problems in daily activities. The deXtreme robot offers error-enhancement forces during three-dimensional reaching movements. Error-enhancement is a new rehabilitation approach focusing on improving the quality of movement (QOM).
Main Objective: To investigate feasibility, clinical and QOM evaluation before and after a 5-hour error-enhancement training in the chronic phase post-stroke.
Methods: Our study has a pre-post intervention design, recruiting 20 patients more than six months after a first stroke, with a motor impairment yet no severe spasticity in the upper limb. All patients receive 1-hour robot treatment for five consecutive days. Pre- and post-measurements are clinical (Fugl-Meyer Assessment-UL (FMA-UE), Action Research Arm Test (ARAT), Motor Assessment Scale for UL and tone), patient-reported (hand subscale of the Stroke Impact Scale, Motor Activity Log (MAL), Visual Analogue Scale of pain and tone), and kinematic (KINARM robot) evaluations. At this preliminary stage, we present results descriptively with the median (interquartile range).
Results and Discussion: So far, data of 6 participants was processed. Small clinical and patient-reported median improvements were found (FMA-UE: 2pt (2.5), ARAT: 2pt (1.8); MAL_QOM: 9.3% (27.8)). Kinematically, an improved median accuracy (4.2% (12.2)) during a discrimination task was shown. Besides, a smaller median error (-4.8% (42.0)) and variability (-13.4% (81.0), and improved median accuracy (8.3% (28.4)) were found on a perception task. Additionally, a shorter median movement time (-11.6% (46.4)) and higher median maximum speed (15.4% (47.7)) were observed during a motor reaching task.
Conclusion: Our first results may suggest a positive effect, providing insight into the possibility to achieve clinical and QOM improvements in the chronic phase after stroke.
Acknowledgements: The authors would like to thank BioXtreme Ltd. (Israel) for providing financial support to this project.

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The association between post-stroke fatigue and life after stroke one year post-stroke

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Introduction: Prevalence and associated factors of post-stroke fatigue are reported in literature. From a stroke rehabilitation perspective, more knowledge regarding the association between post-stroke fatigue and life after stroke is needed.
Main Objective: To explore the association between fatigue and (1) life balance, (2) participation, and (3) quality of life (QoL) one year after stroke.
Methods: First-ever stroke survivors are evaluated one year after stroke: fatigue is evaluated by the Fatigue Assessment Scale (FAS; range 10-50); life balance by the Life Balance Inventory (LBI; 1,00-3,00); participation by the Stroke Impact Scale (SIS; 0-100) and QoL by the EQ-5D-5L (0-100). Two groups (participants reporting high fatigue versus those reporting limited to no fatigue) are created using FAS cut-off score of 21/50. Differences between both groups regarding life balance, participation and QoL examine the association between fatigue and life after stroke.
Results and Discussion: Participants (n=54) are aged 65±12 years, have a mean (SD) Barthel Index 83/100 ± 22.51 and 30/54 (56%) is male. In comparison to the high fatigue group (HFG) (n=21; 39%), the limited fatigue group (LFG) (n=33; 61%) shows significantly better life balance (HFG:2.36±0.36; LFG:2.56±0.24; p=0.029); QoL (HFG:62±19; LFG:76±15; p=0.005) and shows a trend towards better participation (HFG:41±22; LFG:61±26; p=0.05).
Conclusion: Post-stroke fatigue is related to reduced life balance, participation and QoL compared to participants with limited fatigue reported. To improve life after stroke assessment and interventions in stroke rehabilitation, such as self-management programs, should target post-stroke fatigue.
Acknowledgements: We would like to thank all participants who were involved in this study. We would like to thank Lambrechts C & Van Assche A (Rehabilitation Hospital RevArte, Edegem, Belgium); Vaes E & Janssens E (Jessa Hospitals – Rehabilitation Centre Sint Ursula, Herk-de-Stad, Belgium); Haccour E, Schots T, & Staes B (University Hospitals Leuven, Leuven, Belgium) for their assistance with recruitment of participants.

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Evaluation of a portable hand trainer for minimally-supervised stroke neurorehabilitation

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Introduction: Rehabilitation robots enable frequent, high-intensity, and motivating therapy for people after stroke. However, current robotic rehabilitation devices are often large, difficult to use, and expensive, which hinders their potential to be used in unsupervised at-home training.

Main Objective: We present the usability study of the second design iteration of our portable hand trainer for minimally supervised training of thumb and finger flexion/extension and forearm pronosupination.

Methods: The hand trainer was redeveloped from an early prototype using informal feedback from therapists in a user-centered design approach, improving functionality, robustness, and ergonomics. An unsupervised training scenario was simulated in a formal usability study including ten healthy participants and three physical therapists. The usability of the device together with a specifically developed computer game to train a sensorimotor task was investigated using standardized questionnaires. Additionally, participants' statements were gathered in semi-formal interviews.

Results and Discussion: Naive healthy participants could use the device mostly independently–assistance from the experimenters was only required by three participants due to technical issues and by two due to problems following the instructions. The results from the questionnaires show that the device has above-average usability, and is motivating to use while requiring a low mental and physical workload. The participants stated during the semi-structured interviews that they felt confident using the device independently, supporting the results.

Conclusion: Our portable hand training device is easy-to-use, motivating, and requires low physical and mental effort, potentially enabling additional minimally-supervised training at home or in clinics to enhance neurorehabilitation outcomes.

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How is the integrity of the CST and non-CST tracts related to independent walking after stroke? A meta-analysis.

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Introduction: Diffusion MRI (dMRI) can be used to measure integrity of the corticospinal tract (CST) and corticoreticular pathways (CRP), which are involved in walking execution. Yet, it is unclear how altered integrity poststroke associates with decreased walking independence.

Main Objective: To investigate the association between CST and non-CST tract integrity with walking independence before and after 6 months poststroke.

Methods: After a systematic literature search, twenty-four cross-sectional and longitudinal studies were identified. Walking was measured with the Functional Ambulation Categories (FAC). We included (1) correlation coefficients between FAC scores and integrity metrics, and (2) comparison analyses between groups with different integrity states.

Results and Discussion: (1) Fractionated anisotropy (FA) of CST integrity was weakly correlated with walking independence before 6 months (r=.33,n=3) and after 6 months (r=.44,n=3). Fiber numbers (FN) of CST were only weakly correlated after 6 months (r=.40,n=3). Parameters of CRP could not be pooled into a meta analyses due to unit-of-analysis issue, yet all separate correlation coefficients were considered to have no correlation before and after 6 months (r←.25,n=5). No correlations were found for other non-CST tracts before and after 6 months (r←.25,n=13).
(2) A pooled meta-analysis on mean differences was conducted according to groups divided based on intact CST (CST+) and non-intact CST (CST-). A medium mean difference was found after 6 months (MD[IC]=.57[.41-.73]).

Conclusion: The current meta-analysis shows weak associations between CST integrity and walking poststroke, however this field remains poorly investigated.

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Do we need to consider the head-on-body position, starting roll position and presence of spatial neglect when assessing verticality perception?

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Introduction: Since a variety of factors influence verticality perception, standardization of assessment methods is needed.

Main Objective: This retrospective pilot study examined the influence of head-on-body (HOB) position, starting position and visuospatial neglect (VSN) on the accuracy of the Subjective Visual Vertical (SVV) and the Subjective Postural Vertical (SPV) in stroke participants.

Methods: First-ever stroke survivors ($\leftarrow$85 years; $\leftarrow$100 days post-stroke) were assessed with a neutral, contralesional and ipsilesonal HOB position (in relation to the trunk) and seven starting positions of the laser bar/ tiltchair. The contribution of HOB position, starting position and VSN presence to the SVV and SPV errors and variability were evaluated using Linear Mixed Models.

Results and Discussion: Thirty four participants (24 VSN-/ 10 VSN+) were assessed. A tilted HOB position led to significantly greater SVV (VSN- and VSN+) and SPV (only in VSN- group) errors, whereas starting position only significantly influenced the SVV errors in the VSN- group. VSN presence led to a significant higher SVV and SPV variability, indicating a higher uncertainty of the VSN participants regarding a vertical position. Also, a tilted HOB position led to significantly higher SVV variability.

Thus, HOB position and starting position have a different impact on participants with or without VSN, which highlights the importance of VSN evaluation. Also, controlling the head in a neutral position, leads to the most accurate estimations.

Conclusion: Starting position of the laser bar, HOB position and VSN presence are important factors to consider, since these factors impact the SVV and SPV errors and variability.

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Feasibility of the application-based Strokecoach intervention: Acceptability, practicality and preliminary results for patients after a stroke

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Introduction: Patients after stroke (PaS) often experience long-term disability. Telerehabilitation might be a suitable therapy for addressing long-term secondary prevention. The Strokecoach Intervention Programme (SIP) comprises exercise, coaching and monitoring.

Main Objective: We aimed to evaluate the feasibility of the SIP for PaS.

Methods: Data were analysed retrospectively and descriptively regarding feasibility and acceptance. PaS received an application-based training programme, were instructed to measure their blood pressure daily and to wear an activity tracker (pedometer). Over the intervention period, participants were coached and motivated by a personal coach via messenger. The primary outcomes were recruitment, acceptance and satisfaction with the SIP. Secondary outcomes included potential effects on function, mobility and health-related quality of life.

Results and Discussion: A total of 122 PaS were recruited for the SIP. Nighty six out of 122 were able to start the programme (54% female, mean age 54.8 (13.1)). Patients appreciated the support provided by the personal coach and emphasized motivational aspects. Patients wore the activity tracker on 66% and tracked their blood pressure on 72% of their intervention days. A further analysed subgroup of 38 patients showed small improvements in patient-reported outcomes such as health-related quality of life (subdomains mental health, vitality and physical functioning). However, no statistically significant improvements were seen in other performance-based measures (Timed Up and Go test, gait speed).

Conclusion: This study showed that a blended therapy approach for patients after stroke with mild to moderate disability is feasible and was highly accepted by participants, who benefitted from the additional coaching.

Acknowledgements: We woiuld like to thank to all patients for their participation.

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Neuromuscular control of paretic-leg reactive stepping responses in people with stroke

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Introduction: Stepping responses are crucial to prevent falling following loss of balance. People with stroke (PWS) often show impaired reactive stepping capacity, even in the chronic phase, but the underlying mechanisms remain elusive.
Main Objective: We aimed to identify deficits in the neuromuscular control of paretic-leg stepping responses in PWS in the chronic phase using muscle synergy analysis.
Methods: 20 PWS and 14 able-bodied individuals (control group) performed reactive steps in response to multidirectional platform perturbations. Participants were instructed to step with their paretic (PWS) or non-dominant leg (control group). We collected surface EMG of eight muscles bilaterally: erector spinae, gluteus medius, biceps femoris, semitendinosus, soleus, rectus femoris, peroneus and tibialis anterior. Muscle synergies were extracted per leg using nonnegative matrix factorization. We used Pearson correlation coefficients to determine similarity in structure of synergies in PWS compared to the reference set of the control group. Additionally, we compared the activation coefficients between groups for each (similar) synergy.
Results and Discussion: The median number of synergies recruited in either group was 5. The presence and structure of 3 of the 5 synergies were rather similar between groups. Yet, in PWS, a synergy consisting of the peroneus and gluteus medius was less often represented and its structure was less consistent. In addition, during initiation of a backward step, PWS exhibited lower recruitment of the hamstring muscles concurrent with excessive recruitment of tibialis anterior and rectus femoris muscles.
Conclusion: We identified stroke-related deficits in neuromuscular control that may contribute to impaired reactive stepping capacity. It would be of interest to determine whether task-specific balance training may improve these deficits.

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Gait adaptability training for individuals in the chronic phase after stroke: study protocol for a randomized controlled trial

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Introduction: The majority of people with stroke (PwS) in the chronic phase have difficulties adapting their gait pattern to meet environmental demands, which is an essential skill for safe and independent walking. Although smaller-scale, uncontrolled studies have shown promising results for gait adaptability improvement in PwS, these results have yet to be confirmed in an adequately powered RCT.
Main Objective: To evaluate the efficacy of gait adaptability training using an instrumented treadmill with augmented reality against a waiting-list control condition.
Methods: This is a single-center, randomized, waiting-list controlled trial. We will enroll 84 PwS in the chronic phase ($\rightarrow$6 months) who are able to walk independently for 10 minutes. Following baseline assessment, participants will be randomly assigned to either the intervention group or to the waiting-list control group. Participants allocated to the intervention group will receive ten 1-hour training sessions targeting gait adaptability in a 5-week period, whereas the waiting-list control group will continue their standard care. Gait adaptability performance will be assessed pre and post intervention using the obstacle subtask of the Emory Functional Ambulation Profile (EFAP-obstacle) and the recently developed Walking adaptability ladder test (WALT). The WALT involves completing an adapted agility ladder as fast and accurately as possible. Primary outcomes are time needed to complete the EFAP-obstacle and the error-corrected time score on the WALT.
Results and Discussion: This is the first randomized controlled trial to evaluate the efficacy of a task-specific training program on gait adaptability in PwS in the chronic phase.

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What participant and intervention characteristics are related to improvement in physical activity outcomes six months after stroke?

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Introduction: High-intensity treadmill training and self-management strategies positively effect physical activity and walking outcomes after stroke. However, it is unclear how these strategies can be matched to individuals after stroke.
Main Objective: This study aimed to determine which participant and intervention characteristics predicted improvement in physical activity outcomes six months after an intervention post-stroke.
Methods: Secondary analysis of data from a randomized controlled trial recruiting participants within two months of stroke able to walk. Participants received a self-management program embedded in high-intensity treadmill gait training (3 x 30-minute sessions per week, 8 weeks). Outcomes measured at baseline and six months included age, fatigue severity, anxiety, walking distance, speed and daily step count. Intervention characteristics included treadmill performance (e.g. speed, distance) and self-management strategies used.
Results and Discussion: Fifty-six participants (62 SD11) years, completed the intervention. Participant characteristics at baseline, including fatigue (r=-.333, p=0.012), average steps/day (r=.417, p=0.001), self-selected (r=.404, p=←0.002) and fast walking speed (r=.445, p=←0.001); and distance (r=.487, p=0.000) correlated with physical activity at 6-months. Of the intervention strategies, action planning, was related to physical activity at 6-month (r=.307, p=0.022). Multiple regression showed that no individual intervention or participant characteristic predicted improvement in physical activity.
Conclusion: Interventions targeting long-term physical activity after stroke should consider baseline walking capacity, daily physical activity, and fatigue severity. Self-management action planning strategies are related to long-term improvement in physical activity after stroke. No single patient or intervention characteristic predicted improvement in physical activity over others.

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Physiotherapy practices in mobilizing Stroke patients who underwent Craniectomy

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Introduction: Decompressive craniectomy has shown significant reduction in mortality rate & better neurological outcomes in critically ill stroke patients with refractory intracranial hypertension. There is limited literature to guide physiotherapists on the type and timing of mobility interventions during the various phases of recovery following craniectomy and the present practice is unknown.
Main Objective: To determine the practices of physiotherapists in mobilizing stroke patients who underwent craniectomy.
Methods: A cross-sectional study was conducted through an internet-based survey among physiotherapists. A questionnaire of 37 items was developed and validated by six experts in the field of stroke rehabilitation. A JotForm was then created to circulate the questionnaire. Qualified physiotherapists involved in the management of stroke patients following craniectomy since a year were included through snowball sampling.
Results and Discussion: Out of 141 physiotherapists, 123(87%) of them were managing such stroke patients. Once the decompression was achieved, the most common practice reported by physiotherapists was restriction to in-bed mobility during first post-operative day (n=123) followed by out of bed mobilisation during third post-operative day (n=98). Ninety-one percent (n=112) reported that they will initiate abdominal or truncal exercises once the stitches were removed when the bone flap was placed in the peritoneal cavity. Very few therapists (n=14) used protective devices for patients in intensive care unit during ambulation training.
Conclusion: This study describes the present practices of mobilizing stroke patients who underwent decompressive craniectomy. Most physiotherapists (n=129, 93%) felt that there is a need for separate guidelines for mobilizing stroke patients after decompressive craniectomy.
Declaration: We declare no conflict of interest. There was no funding support for this study

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PREP2 algorithm: how knowing the upper limb functional prognosis influences the physiotherapy treatment in stroke survivors. A randomized controlled trial.

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Introduction: Upper limb hemiparesis is one of the most common and disabling impairments in post-stroke subjects in relation to its crucial impact on patient's independence. Predicting upper limb functional recovery is a key factor for providing appropriate rehabilitation interventions. PREP2 is a validated algorithm that predicts upper limb function at three months after stroke.
Main Objective: We tested how the PREP2 prognosis influences the decision-making on upper limb treatment of the rehabilitation team in a cohort of hospitalized subacute stroke survivors.
Methods: We enrolled subacute stroke survivors in the Neurological Units of the Ferrara University Hospital and we applied the PREP2 algorithm to all of them. Upon arrival in the Rehabilitation wards, all the subjects were randomized between the implemented (IG) and the control group (CG). Upper limb prognosis has been shared only with patients and the rehabilitation team of the IG. We registered upper limb interventions proposed by all the physiotherapists (i.e. Robotics, Task-Oriented Training, Action Observation Therapy). We analyzed differences in dosage and treatment type between groups matched for prognosis classes.
Results and Discussion: 65 patients have been included (IG=29; CG:31) with no statistical differences at the baseline. No statistical differences have been noticed both in *dosage* and *type* of the interventions proposed, except for robotics which has been provided mostly for patients of the IG (58.6% Vs 32.3% subjects, p= 0.05). IG's physiotherapists might have been influenced to propose more likely high-tech treatments.
Conclusion: The early knowledge of upper limb prognosis does not influence decision-making, except for robotics.
Acknowledgements: We thank all the patients involved and their care-givers.

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Boosting touch sensibility with somatosensory electrical stimulation for potential application in neurorehabilitation

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Introduction: Stroke patients are commonly affected by somatosensory impairments with detrimental consequences to perform activities of daily living. Somatosensory electrical stimulation (SES) is a promising technique for retraining sensorimotor functions. However, the potential of SES for neurorehabilitation is still poorly understood, limiting applications of sensory interventions in standard care.
Main Objective: The goal of this study was to investigate the effectiveness of SES on enhancing tactile discrimination training. We hypothesize that participants receiving SES during training will significantly better discriminate textures than participants not receiving SES, associated with modulated sensory brain activity (i.e., alpha power).
Methods: We developed a virtual reality-based robotic texture discrimination task to train touch sensibility. Twenty-six healthy participants were trained to passively explore (i.e., with robotic guidance) and discriminate the odd texture among three visually identical virtual textures (haptically rendered with a robotic device) with and without whole-hand SES applied below sensory threshold. Behavioral data and brain activity (EEG) were recorded before, during and after training.
Results and Discussion: We found a higher increase in task accuracy (p=0.053) and higher decrease in texture exploration duration (p=0.046) after training in participants who trained with SES vs. without SES. Further, participants with electrical stimulation showed a larger decrease in alpha power -indicative of enhanced sensory processing- during texture discrimination after training than participants receiving no stimulation.
We conclude that SES may facilitate sensory training compared with no stimulation.
Conclusion: Our study has both basic and applied implications and could transfer in future developments of more effective sensory interventions for individuals with stroke.
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Prediction of factors affecting community mobility among acute patients with stroke: a cohort study

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Introduction: Community mobility is an essential component of successful comprehensive rehabilitation for patients with stroke, despite its potential to improve quality of life and enable community reintegration, this area is not sufficiently addressed
Main Objective: To identify the potential factors that predict community mobility among stroke survivors and determine whether trunk control affects community mobility.
Methods: A prospective cohort study included sixty one acute stroke survivors who were assessed in an in-patient setting for Trunk Control Test (TCT), Modified Rankin Scale (mRS), Brief Resilience Scale (BRS), Hospital Anxiety and Depression Scale (HADS), Stroke Specific Quality of Life (SSQOL) and Modified Fall efficacy Scale (MFES). A 3-month follow-up assessment included community mobility as a dependent variable.
Results and Discussion: Sixty one patients with stroke with a mean age of 58 ± 12.5 years were included in the study. The mean duration from stroke insult was 8.7 ± 8 days. TCT was the most significant variable (b = 0.73, 95% CI; 0.005 to 0.007) predicting community mobility followed by mRS (b = -0.66, 95% CI; -0.16 to -0.09), SSQOL (b = 0.56, 95% CI; 0.003 to 0.006) and MFES (b = 0.46, 95% CI; 0.02 to 0.06),
Conclusion: The findings suggest that trunk control can be critical for community mobility after stroke. Which emphasises rehabilitation approaches targeting trunk control to promote community reintegration among acute stroke survivors.
Acknowledgements: Nothing to report

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Enriched Music-Supported Therapy in the rehabilitation of patients with chronic stroke

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Introduction: Most stroke patients still present upper-limb motor deficits after completing formal rehabilitation programs[1]. Music-supported Therapy is an effective intervention to improve upper-limb motor function and quality of life (QoL) post stroke[2]. We designed an enriched version of Music-supported Therapy (eMST) adapting it for home use and adding music therapy group sessions to promote autonomy and participation, essential elements for motor recovery[3]. We developed an app for electronic tablet to conduct the sessions with a MIDI-piano and percussion instruments[4]. Kwakkel G, et al. Stroke. 2003; 34:2181–6. Schneider S, et al. J Neurol. 2007;254(10), 1339–1346. Grau-Sánchez J, et al. BMC Neurology. 2021;21(1):19. Sanchez-Pinsach D, et al. Artificial Intelligent Research and Development. 2019.
Main Objective: We aimed to test the effectiveness of eMST in improving upper-limb motor functions and QoL of chronic stroke patients compared to a conventional home-based motor intervention.
Methods: We conducted a randomised controlled trial with 40 patients (10 women; age = 67.5 ± 12.7 years; time since stroke = 6.25 ± 5.58 years) randomly allocated to eMST or control intervention, both consisted of 4 one-hour sessions/week for 10 weeks. Patients were evaluated pre-, post-, and 3-months post-intervention. The effect of the intervention was assessed using the Minimal Clinically Important Difference and the difference between groups applying ANOVA's.
Results and Discussion: Patients from both groups clinically improved in motor functions without significant differences (mean improvement 6.8 and 5.8 respectively in the primary outcome). Patients undergoing eMST demonstrated a significant improved QoL compared to the control group (mean improvement 8.8 and -7.7 respectively).
Conclusion: The eMST showed to be an effective intervention for chronic stroke patients and could have a medical and social impact trying to avoid a health problem in people with daily living limitations.

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Loss of confidence in upper limb motor ability is not fully explained by upper limb impairment in chronic stroke patients

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Introduction: It is still an unresolved question whether the loss in confidence in UL motor ability following stroke is fully explained by UL motor impairment.
Main Objective: (i) To investigate whether UL confidence fully explained by UL motor impairment/ability. (ii) To investigate whether the relationship between loss of confidence and motor impairment is affected by task difficulty (iii) and whether movement kinematics are altered by confidence.
Methods: 22 chronic stroke patients (UL FM: mean 28, ±6) were asked to execute target reaches (10cm) 'as fast and accurately as possible' with either their affected or non-affected arm (50 trials each). Importantly, participants had to rate their confidence in successfully landing inside the target on a scale of 1–5 prior to reaching. No feedback on task success was provided. 5 different target sizes were presented (difficulty levels) which were normalised to baseline reaching ability of each arm. This effectively matched success likelihood across arms and difficulty levels. Consequently, confidence about task success should not be different between arms.
Results and Discussion: (i) We found no differences in success rate between arms (due to normalised difficulty levels), but confidence ratings were significantly lower for the impaired arm. This highlights that confidence is not fully explained by task success (i.e., motor ability) (ii) Task difficulty did not affect this result (iii) Movement kinematics differed significantly between arms but were not affected by confidence ratings.
Conclusion: Loss of confidence of UL motor ability is not fully explained by UL impairment or task difficulty which raises the concern of potential non-use even with successful rehabilitation.
Acknowledgements: Many thanks to my supervisors Profs Nick Ward and Sven Bestmann and my colleagues at the ArmLab!

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Location and etiology of stroke: are the determining factors of functional response in an intensive rehabilitation program?

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Introduction: Stroke is the third cause of disability worldwide, and an increase of 30% is expected in the coming years.
Main Objective: To assess whether the etiology or location of the stroke determines a better response to an intensive rehabilitation program in the hospital.
Methods: Observational, descriptive, retrospective study. We evaluated 205 patients who underwent an intensive rehabilitation program of at least 3 hours of occupational therapy, speech therapy, and physiotherapy between 01/2021 and 12/2022. Functional variables at admission and discharge (Barthel, FIM, and Rankin) were analyzed and evaluated by etiology (TOAST) and location (OXFORD). Analysis of variance (ANOVA) was performed with the statistical software SPSS v25.
Results and Discussion: Significant improvement was found in all the variables analyzed in the sample: Rankin 0.60 (95%CI 0.49 to 0.71, p←0.001), Barthel 25.187 (95%CI 22.85 to 27.52, p←0.001), FIM 20.18 (95%CI 18.44 to 21.93 p←0.001). When analyzing by location, no significant differences were found: Rankin difference: mean -0.6 [Of 0.78], Barthel difference: mean 25.19 [Of 16.86], FIM difference: mean 19.05 [Of 11.79], nor by etiology: Rankin difference: mean -0.57 [Of 0.79], Barthel difference: mean 25.62 [Of 17.58], FIM difference: mean 19.05 [Of 11.79].
Conclusion: An intensive rehabilitation program favors the functional improvement of the patients analyzed. However, neither the location nor the etiology looks like a determining factor in response to treatment.
Acknowledgements: The authors received no financial support for the research.

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Shared medical appointment for home- based stroke patients after hospital discharge; early identification and management in stroke by tailored consultations

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Introduction: After hospital discharge, stroke patients often experience problems like fatigue and cognitive deficits, that impact daily life. These problems cannot always be identified in an early phase, increasing the risk of negative societal consequences like delayed return to work, an increase in caregiver burden and healthcare use.

Main Objective: To determine if a shared medical appointment, early after hospital discharge, is a valuable method to identify and manage problems that may impact a stroke patients' life.

Methods: Stroke patients participated in a shared medical appointment 4-6 weeks after discharge from hospital. This included one consultation by a multidisciplinary team of healthcare professionals. Outcomes were 1) referral rate to the shared medical appointment, 2) self-reported fatigue, caregiver strain and societal participation, 3) referral rate for further treatment and 4) patient satisfaction.

Results and Discussion: Between December 2011 and April 2020, 367 of the eligible 890 stroke patients were included. During the shared medical appointment, most frequently reported problems were fatigue (58%) and caregiver strain (24%). Participants undertook less activities after suffering stroke, experienced few restrictions in daily living activities and were reasonably satisfied about their way of functioning. In total 38% of the participants were referred for further treatment. Participants reported a high level of satisfaction about the way the shared medical appointment was organized (91%).

Conclusion: A shared medical appointment, early after hospital discharge, is a valuable method to identify and manage stroke patients and caregivers' perceived problems.

Acknowledgements: No specific acknowledgments

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Impact of visuospatial attention on motor control and hand function after stroke

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Introduction: Manual dexterity requires interplay between sensorimotor and cognitive functions. Both are impaired after stroke, reducing autonomy and capacity to perform daily living activities involving dual-task.

Main Objective: To assess whether a cognitively demanding dual-task has greater impact on manual dexterity in chronic stroke patients than in healthy subjects.

Methods: A visuomotor grip-force tracking task, combined with oculomotor recordings, was applied in 12 chronic stroke patients with mild-moderate hemiparesis and in 15 age-comparable healthy subjects. The task included recording during (i) simple force tracking, (ii) attentional dual-task with visual distractors to don't-look-at, and (iii) working memory dual-task with performing saccades toward numbers and addition of them. Dual-task effect (DTE) was calculated as the difference in force control accuracy. Results were compared to clinical motor and cognitive assessments and with dexterity data obtained using novel force sensor technology.

Results and Discussion: Preliminary results show larger dual-task effect on force accuracy in stroke patients than healthy subjects (0.07 ± 0.1 vs 0.01 ± 0.07, p=0.13). Stroke patients also showed more motor errors during force tracking, especially in the attentional condition compared with healthy subjects (0.44 ± 0.22 vs 0.25 ± 0.14, p=0.028). Moreover, the patients group showed reduced saccade inhibition rate compared with controls ($12.89\pm17.2\%$ vs $5.2\pm10.7\%$, p=0.2). Differences were found between groups in cognitive and fine motor tasks (Stroop test p←0.001; Moberg pick up test (MPUT) p=0.04; Box and Blocks test p←0.001).

Conclusion: These preliminary data suggest an increased dual-task effects in stroke patients compared to healthy controls. The full results of this ongoing trial will be presented.

Acknowledgements: We are grateful to the subjects and patients included in the study.

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"Reach" for the reps: How many repetitions can be completed within a one hour physio led upper limb online exercise group for clients with neurological impairments?

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Introduction: Upper limb rehabilitation post stroke is recognised to be significantly under dosed (Ward et al 2019) and this experience is also felt by individuals living with other neurological pathologies with limited time spent on upper limb rehabilitation. During the COVID-19 pandemic we set up two weekly upper limb rehab groups on Zoom, with the hope of increasing intensity of exercise practice, building skill acquisition and increasing confidence with functional task practice.

Main Objective: We were interested to see what dosage was possible to achieve in a one hour online class on Zoom as the participants were making physical changes and also reported gaining emotional benefits from participation within the online Reach group.

Methods: Physiotherapy students from King's College, London, recorded the dosage of rehabilitation given within a Reach class. Students observed two Reach groups and analysed 20 participants. They recorded the reps achieved for the main circuit exercises and within the functional task practice. Warm up, sensory circuit and cool down exercises were not recorded. Each exercise was completed for 2 minutes. Students recorded reps on an anonymised live spreadsheet and statistical analysis was completed by the LEGS physio team.

Results and Discussion: Total reps within main circuit : 11,289. Total reps within functional task exercises : 4415. Mean reps per participant per 1 hour class : 785.2

Conclusion: King's physiotherapy students concluded that online upper limb groups allowed:
• Repetitive practice
• Endurance trainingFunctional task practice
• Self management advice and peer support. Both students and clinicians recognised that a focus on repetitions and being "counted" meant that:
• quality was not always maintained
• full available range not always worked through in quest to gain more reps which differed to usual classes

Acknowledgements: Physiotherapy students at Kings and clinical staff facilitating simulated practice week from uni & LEGS

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Voxel-based lesion symptom mapping analysis of finger dexterity in the acute phase of stroke

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Introduction: Stroke causes upper limb motor and manual dexterity impairments. Because recovery is often incomplete, persisting impairments can induce a loss of independence.

Main Objective: To quantify different aspects of dexterity in acute stroke patients with and without a clinical hand motor deficit, to compare their performances to those of healthy individuals (HI), and to analyze the relationship between tissue damage and dexterity.

Methods: We used the Dextrain Manipulandum to quantify key components of manual dexterity with finger-force-tracking task (FFT) to assess the precision of index finger force control and multi-finger-tapping task (MFT) to investigate finger individuation accuracy (errors) and selectivity (coactivation). 50 patients in the acute phase of stroke (4.6 ± 3.3 days) and 11 HI were included and evaluated twice (day 1 and day 3). Voxel-based Lesion Symptom Mapping (VLSM) was used to analyze the relationship between tissue damage and dexterity.

Results and Discussion: The force control precision (FFT) improved significantly in patients but remained unchanged in HI. Finger individuation accuracy (MFT) improved significantly in both groups but to a larger extent in HI, along with a non-significant difference in coactivation in both patients and HI. VLSM showed that damage to the right putamen impairs precision of force control and finger individuation accuracy.

Conclusion: Acute stroke involving the right putamen impairs dexterity but, in those able to achieve the tasks, recovery can be measured even after two days in the absence of specific intensive dexterity training.

Acknowledgements: We are grateful to the patients and HI, and we thank Maxime Teremetz for providing support with the Dextrain Manipulandum.

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Quantifying virtual reality sit-to-stand characteristics in people with chronic stroke: pilot study

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Introduction: Sit-to-stand (STS) is an important daily activity and when impaired it is related to poorer stability and a greater risk of falls, specifically in people after stroke. Therefore, STS is a focus of motor rehabilitation after stroke. Virtual Reality (VR) enables manipulation of task and environment characteristics in practice, such as simulated heights which providse an additional postural and potentially emotional load.
Main Objective: The aim of the current pilot study is to evaluate the effect of height manipulation in VR in people after stroke as compared to controls.
Methods: To date, 5 people after stroke and 7 controls performed a 5-times STS task without VR as well as in a virtual environment at floor level and at a height of 3.2m above ground, implemented using Unreal and an HTC Vive head-mounted display. STS kinematics was captured using an XSens MVN Link system.
Results and Discussion: Results demonstrated that people after stroke took longer to perform the task (Z=-5.0, p←0.001), had lower peak velocity (Z=-3.0, p←0.001) and larger hip flexion angles (Z=-2.3, p=0.02). In the stroke group (but not in controls), the virtual height condition was associated with slower peak velocity (Z=2.0, p=0.04) and a trend for longer movement duration vs. the non-VR floor level condition. These changes were not associated with increased subjective anxiety in the virtual height condition.
Conclusion: Overall, findings demonstrate that virtual heights negatively affect STS kinematics, which may reflect an additional perceptual or emotional load in people after stroke.
Acknowledgements: To study participants

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The effect of electrical stimulation in stroke rehabilitation to improve lower limb muscle characteristics: a systematic review

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Introduction: As stroke is known to cause acquired, long term disability, the implementation of strengthening interventions in stroke rehabilitation becomes an indispensable part to optimize recovery. Considering this, electrical stimulation might be a useful intervention to activate the sensory-motor system, thereby increasing muscle function.
Main Objective: This review aims to investigate the existing literature on electrotherapy in stroke rehabilitation.
Methods: A systematic literature search was conducted in MEDLINE, SCOPUS and Web of Science for studies investigating the effect of electrotherapy of the paretic lower limb on muscle strength in stroke patients compared to usual care or a sham intervention. Included studies were randomized controlled trials with a parallel design consisting of two or more arms. Data of interest were extracted from eligible studies and risk of bias was assessed.
Results and Discussion: In total 23 studies (933 stroke patients) were included of which 18 investigated the effects of electrotherapy (e.g., FES, motor TES and sensory TES) in combination with physical therapy on muscle strength (e.g., Manual Muscle Test, Motricity Index, etc.). A significant increase in muscle strength was found within groups in thirteen studies, and between groups in twelve studies. Related to the secondary outcomes, three studies investigated the effect on muscle structure, of which two found a significant difference both within groups, as well as between groups. Muscle activation was investigated in three studies, of which only one reported a significant increase in muscle activation.
Conclusion: The current evidence suggests that electrotherapy in combination with physiotherapy might have a positive effect on muscle characteristics in stroke rehabilitation.
Acknowledgements: We would like to thank all researcher involved in conducting this review.

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Effect of home-based dynamic intermittent pneumatic compression therapy on vascular and functional health outcomes in chronic stroke.

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Introduction: Intermittent pneumatic compression (IPC) therapy may benefit stroke patients as increases in venous return may allow people to engage with more physical activity. We wanted to explore therapeutic effects on vascular and functional outcomes of using an IPC device with individuals post stroke within a home setting.

Main Objective: To asess the feasibility and adherence of using a IPC device (G-MOVE SUIT) in stroke patients within the home environment and measure changes in clinical, functional and vascular outcomes as well as quality of life and psychosocial outcomes.

Methods: This study was a dual-center, parallel group, randomized controlled clinical trial. Thirty-one stroke survivors took part in this study and completed pre- and post-intervention assessments which consisted of measures of vascular health and functional capacity. Individuals were randomly assigned to either a 12-week, home-based intermittent-pneumatic compression (IPC) condition, or a usual care control (CON) group.

Results and Discussion: Our study demonstrated that 12 weeks of home-based IPC training significantly improved (reduced) peripheral and central systolic blood pressure and increased 6MWT distance in those individuals randomized to the IPC condition. These observed improvements, in combination with an increase in perceived physical activity and reduction in sedentary behaviours, are important positive findings when considering the use of IPC training for "at home" rehabilitation therapy for stroke survivors.

Conclusion: The observed improvements in blood pressure and six-minute walk test distance, in combination with an increase in physical activity and reduced sedentary behaviours, are important positive findings when considering the use of IPC training for "at home" rehabilitation therapy for chronic stroke survivors. Further research is needed to determine whether the observed benefits are maintained for a longer period of time, and whether similar findings are observed with other neurological populations.

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Physical behavior in people with subarachnoid hemorrhage: its relation with environmental and personal factors, participation and quality of life.

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Introduction: Improving physical behavior (PB) after subarachnoid hemorrhage (SAH) might improve fatigue and participation. Insight in factors possibly affecting PB and in PB in relation to participation and health-related quality of life (HR-QoL), may aid in developing effective rehabilitation strategies to improve PB.

Main Objective: To explore associations between PB, environmental and personal factors, participation and HR-QoL in people with SAH.

Methods: PB, expressed in duration, distribution and intensity of physical activity (PA; walking/running/cycling) and sedentary behavior (SB; lying/sitting) was objectively assessed with the Activ8 accelerometer during 7 consecutive days. Environmental and personal factors (social influence, health condition, illness perception, self-efficacy, fatigue, mood, kinesiophobia, cognitive functioning, coping, sleep), participation and HR-QoL were assessed with validated questionnaires. Correlation analyses were conducted.

Results and Discussion: In total 43 people with SAH participated, mean age was 53.6 years (SD=12.9), 55.8% women, and mean time post onset was 9.6 (SD=2.0) months. We found significant (p←0.05) correlations (moderate, r=0.300-0.500): Better social support and cognitive functioning were associated with better PA intensity and SB distribution. Worse illness perception, fatigue, higher age, smoking and longer hospital stay were associated with worse PA intensity and SB duration. Worse PA and SB distribution were associated with worse participation and HR-QoL.

Conclusion: It seems important that in rehabilitation aimed at improving PB in people with SAH social support, cognitive functioning, illness perception, smoking and fatigue are targeted and that PB in relation to participation and HR-QoL is discussed with the patient.

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The effect of Vestibular Rehabilitation Exercises on Balance Performance in Adults with Stroke: A Systematic Review with Meta-Analysis

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Introduction: Vestibular Rehabilitation (VR) is a treatment to optimize vestibular function and sensory integration. VR has demonstrated positive treatment effects on balance in some neurological conditions.

Main Objective: Patients after stroke often have balance and sensory system impairments: yet there is no consensus on whether VR is useful in this population. This review assessed if VR is an effective treatment to optimize balance performance after Stroke.

Methods: Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, four electronic databases were systematically searched for research studies comparing VR against routine care or controls in adults who had suffered a cerebral stroke in the last year. Study outcome data were collated and summarised narratively and meta-analysis on balance outcomes was conducted using a random effects model.

Results and Discussion: Six randomised controlled trials met the inclusion criteria, with all being included in the meta-analysis. The pooled standardised mean difference favoured the intervention as a beneficial treatment for balance recovery, with an effect of large magnitude (0.94; 95% confidence interval 0.39 to 1.48). No studies excessively influenced the outcome. No evidence for heterogeneity was revealed. One study showed low risk of bias, four some concerns and one high risk on the Cochrane Risk of Bias tool for randomised trials (Version 2) tool.

Conclusion: Vestibular rehabilitation is beneficial for improving balance in stroke patients with mild-moderate balance dysfunction, further research is needed on the application of VR in stroke patients to explore its clinical use in more detail.

Acknowledgements: The Physiotherapy Research Society and Chartered Society of Physiotherapy provided mentoring and financial support for the primary author.

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Upper-Limb Robots after Stroke: Hype or Hope?

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Introduction: Robot technology for poststroke upper-limb rehabilitation has rapidly developed over the last 30 years.

Main Objective: The primary aim of this research synthesis was to assess the effects of upper-limb robots (UL-RTs) on motor recovery of the UL post-stroke, compared with every other treatment or no therapy.

Methods: Relevant RCTs were identified in electronic searches. Meta-analyses were performed for measures of motor control, muscle strength and tone, UL-capacity, performance, and basic-ADL. Sensitivity-analyses were applied to identify factors potentially associated with the found ES on motor control, muscle strength and UL-capacity.

Results and Discussion: Ninety RCTs (N=4311) were included. Meta-analyses of 69 trials (N=2878) showed significant but small improvements in motor control (FM-UL MD 2.23 [1.11-3.35]), muscle power and basic-ADL. No effects were found for tone, UL-capacity, and performance. A significant association was found between baseline SD of FM-UL and the ES of FM-UL (MD 2.46 [1.37-3.5], p=0.024), and muscle power (SMD 0,34 [0,15-0,53], p=0.024), and between the baseline FM-UL and the ES of UL-capacity (SMD -0.01 [-0.15-0.12], p=0.03).

Conclusion: *Is the glass half-empty or half-full?* The robustness and consistency of our findings leave a critical question open: *How long should we continue with designing more UL-RTs?* Should we acknowledge these results as a hype to make more commercial UL-RTs, or should we consider the small effect sizes a signal for hope? To move stroke rehabilitation research on UL-RTs forward we need to better understand the mechanisms of stroke recovery, how motor learning may interact with it, and translate this knowledge in the design of future UL-RT trials.

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Allied Rehabilitation using caregiver-Mediated exercises combined with telerehabilitation for Stroke (ARMed4Stroke): a randomized controlled trial

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Introduction: Intensive, repetitive task-training promotes recovery of mobility and independence in ADL in the first six months poststroke. Training caregivers to become an exercise coach and perform task-specific exercises with the patient, Caregiver-Mediated Exercises, has potential to augment task-specific training without increasing costs.

Main Objective: To assess the added value of CME combined with telerehabilitation (Armed4Stroke) in addition to usual rehabilitation on self-reported mobility outcome after subacute stroke.

Methods: A multicenter, observer-blinded RCT. Patient-caregiver dyads were recruited within three months poststroke from four rehabilitation centers and randomized to the 8-week Armed4Stroke program or usual rehabilitation. The Armed4Stroke group was instructed to perform mobility exercises focusing on walking and balance for 2.5 hours per week supported by telerehabilitation. Outcomes were assessed pre- and postintervention, and after six months follow-up. The primary outcome was the self-reported mobility domain of the Stroke Impact Scale. Functional outcome, dyads' psychosocial wellbeing, and the care transition to the community were evaluated as secondary outcomes.

Results and Discussion: A total of 41 dyads (20 intervention, 21 control) were recruited. The primary outcome was not significantly different between groups postintervention, nor after six months. Significant beneficial effects were observed in caregivers' quality of life (p=0.013) and symptoms of depression (p=0.025) postintervention, and extended ADL (p=0.024) at follow-up. As a result of COVID-19 restrictions, the study is likely underpowered. However, these findings are confirmative of previous studies on this topic.[1,2]

Conclusion: The Armed4Stroke program yielded no differential effect on our primary outcome self-reported mobility. These findings are confirmative of previous trials and support future studies to optimize CME poststroke targeting mood and quality of life.

Topic 19: Traumatic brain injury

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Can a patient in minimally conscious state minus demonstrate emotions? A rare clinical case in Russia

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Introduction: We present a clinical report on a comprehensive assessment of consciousness in the patient with chronic disorder of consciousness (DOC), who had a reproducible and clear affective response to the situational context.

Main Objective: Detection clinical and "covert" signs of consciousness in the chronic DOC patient.

Methods: The patient (male, 40 years old) with DOC of traumatic etiology 15 months after injury was clinically evaluated using the Coma Recovery Scale Revised. Behavioral video analysis was used upon presentation of a 7-minute video recording (5 times with breaks) with humorous stories including the story from the patient's relatives. FMRI on 3T scanner was used with 9 passive and 3 active paradigms previously approbated on 10 healthy volunteers. FMRI data was processed using SPM12.

Results and Discussion: Triple clinical evaluations demonstrated that the patient was in minimally conscious state minus (the best CRS-R score was 2-3-2-1-0-2, for a total of 10). Behavioral video analysis showed a stable reaction of the patient's smile in response to the same joke of relatives at each presentation of the video. FMRI analysis showed significant activation in the respective areas in response to tactile and auditory non-speech paradigms. Moreover, the patient repeatedly demonstrated a "smile in response to a smile" reaction. Given the fact that the instructions were not followed, it can be concluded that the patient retains an involuntary response, but the ability to voluntary behavior is impaired.

Conclusion: We detected clinical and "covert" signs of consciousness in this patient that contribute to the personal selection of neurorehabilitation programs.

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Topic 19: Traumatic brain injury

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Collaborative working in brain injury rehabilitation
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Introduction: It is important to collaborate and maximise resources in brain injury rehabilitation, as it provided with better outcomes. We have established a network of community based therapists to improve the outcome of rehabilitation of our patients. This meant that complex rehabilitation interventions and also supporting rehabilitation near home results in minimal admission to hospitals with no extra expenditure.
Main Objective: To establish a pathway of community based therapy for patients with mild brain injurty.
Methods: a team of physiotherapist, occupational therapist, physical and rehabilitation medicine consultant was linked to provide early hospital discharge and rehabilitation at home for these cases.
Results and Discussion: 16 people with mild traumatic brain injury were included. They had weekly physiotherapy and occupational therapy after discharge , once a month they were reviewed by a physical medicine consultant. All reported good outcomes for community rehabilitation, return to driving and return to work. Onle 2 were having persistent medical problems related to headache and low mood.
Conclusion: a network of therapists in community can treat early discharge of head injury patients in community.
Acknowledgements: CHCP team
BSRM document on rehabilitation after brain injury 2015

Topic 20: Virtual reality training

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Digital gamification to increase physical activity: A scoping review of the effects on healthy and neurologically impaired people
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Introduction: Gamification is increasingly being used to encourage activity, with early evidence suggesting that it can have a positive impact on physical activity levels in both healthy and neurologically impaired people. The quality of this evidence, particularly for neurological patients, is considered low.
Main Objective: To provide an overview of the current literature, this scoping review summarizes and describes the effects of digital gamification interventions to increase physical activity in healthy individuals and patients with neurological conditions across different age groups.
Methods: The review follows the PRISMA recommendations. A systematic search is conducted in Medline (PubMed) and Cochrane Library databases, as well as in Google Scholar, OT-Seeker and PEDro. Intervention studies published in the last five years that evaluate changes in physical activity using a digital gamification intervention in healthy individuals and neurological patients are included. The risk of bias of the randomised controlled trials (RCT, n = 13) is assessed using the Risk of Bias 2 tool.
Results and Discussion: The search yields 464 publications. Seventeen are included (healthy individuals, n = 9; neurological patients ← 18 years, n = 3; neurologically impaired children, n = 5). Sixteen studies indicate a significant increase in physical activity after the gamification intervention in all subgroups. One RCT in healthy subjects shows a low risk of bias. Six RCTs have a high risk of bias and six have some concerns.
Conclusion: In conclusion, positive effects of digital gamification interventions to increase physical activity in healthy individuals and neurological patients of different ages can be confirmed with caution.

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ExerG: Usability evaluation of an exergame for neurological and geriatric patients and healthy elderly

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Introduction: Exergames are movement-based video games that train physical and cognitive functions. The development process of exergames for neurological and geriatric patients and healthy elderly (primary end users, PEUs) should include patients and rehabilitation experts (secondary end users, SEUs).
Main Objective: To evaluate the user experience and usability of an exergame functional model (ExerG).
Methods: PEUs' effort and enjoyment were measured using the Borg CR10 scale, Paas Mental Effort Scale, Self-Assessment Manikin (SAM) and Physical Activity Enjoyment Scale (PACES) at the Reha Rheinfelden (CH) and the Clinic for Rehabilitation Münster (A). SEUs assessed usability with the System Usability Scale (SUS), the safety harness set-up/closure duration, motion tracker calibration and software errors. Semi-structured interviews were conducted and data analysed using reflexive thematic analysis.
Results and Discussion: Twenty PEUs (11 women, median age 72.7 (range 18.0) years) and 22 SEUs (15 women, median age 28.0 (range 31.1) years) completed the study. Physical and mental effort were higher in patients than in healthy elderly. PEUs' median PACES score of 75.0 (18.0) and SAM pleasure rating of 7.5-8 (6) indicated high enjoyment, with similar scores in both PEU groups. Quick harness set-up/closure and median SUS score of 73.1 (47.5) suggested good usability.
Themes among PEUs comprised facilitators e.g., clear instructions, goal definitions and feedback, and motivation increasers like greater game variability and challenges. SEUs' themes included PEUs' emotional responses, game expansion suggestions, and clinical application requirements.
Conclusion: Results indicate a positive user experience and good usability of the ExerG, with further adaptations and expansions suggested.

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Towards personalized immersive virtual reality neurorehabilitation: effects of different levels of virtual environment richness on cognitive load

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Introduction: Head-mounted displays that offer immersive virtual reality could be exploited to provide personalized neurorehabilitation, for example, by adjusting the visual and auditory stimuli to modulate patients' cognitive load.
Main Objective: We aimed to evaluate the influence of different immersive virtual environments on cognitive load.
Methods: We conducted an experiment with 24 healthy young adults who performed a grocery shopping task in an immersive virtual supermarket under five conditions: (1) empty silent supermarket; (2) crowded silent supermarket; (3) empty noisy supermarket; (4) performing a concurrent arithmetic task (counting down from 99 by subtracting seven); and (5) all conditions combined. We measured the participants' cognitive load using the NASA-TLX and several physiological measures previously reported to be good estimates of cognitive load, i.e., mean pupil diameter, blink rate, and heart rate variability.
Results and Discussion: Participants reported higher cognitive load and exhibited higher blink rates in the conditions involving the arithmetic task compared to those without. However, we found no statistically significant differences between the conditions involving a crowded or noisy environment and the empty silent environment. Furthermore, we did not find significant differences in pupil diameter and heart rate variability across conditions.
Conclusion: Adjusting the amount of visual and auditory stimuli in virtual environments does not seem to impact the cognitive load of healthy young adults, in contrast to incorporating a concurrent arithmetic task. Additionally, blink rate seems to be a valid indicator of cognitive load. Further studies involving patients with cognitive impairments should be performed as

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they might be more sensitive to visual and auditory disturbances.

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Virtual reality to improve upper limb functions for children with Acquired Brain Injury

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Introduction: Intensive neurorehabilitation promotes a good long-term functional outcome in children with acquired brain injury (ABI). Virtual reality (VR) and video game technology are valuable adjuncts to traditional neurological rehabilitation but they are not routinely used. VR Intervention requires development and the associated influencing factors need to be explored before it can be used routinely in rehabilitation.

Main Objective: The aim is to understand the factors influencing VR use in upper limb rehabilitation for children with ABI.

Methods: Focus group or 1:1 semi-structured interview both in person and online were undertaken with physiotherapists (n=6); occupational therapists (n=6); play worker (n=1); and young person's advisory group (n= 4). An interpretative qualitative study using thematic analysis was performed to create a model which participants described as the factors influencing VR use for neurorehabilitation.

Results and Discussion: Five closely related major themes and the associated subthemes were developed: training, knowledge, promotion and consideration; barriers; and family factors. Lack of knowledge and understanding about the use of VR limits the motivation of staff to use VR. A training package with the available VR equipment, clinical indicators, and the scientific evidence is required. Staff need frequent training and the logistics (uninterrupted Wi-fi, software, hardware), and a simple manual. VR needs to be embedded in routine practice to facilitate behavior change.

Conclusion: The use of VR technology for upper limb rehabilitation of children with ABI, is dependent on the investment in training for health professionals, in order to improve their knowledge and thereby implement change in rehabilitation techniques.

Topic 21 : Vocational/occupational rehabilitation

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Effects of two exercise balance training programs with "initiated" or "reactive" movements in gait performance in subjects with cognitive impairment: a pilot study

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Introduction: Reactive movements or movements in reaction to external stimuli (externally triggered), has been shown to have shorter execution time than intentional movements (internally initiated) in upper limb and side-steps movements. Therefore, it would be relevant to evaluate this advantage of reactive movements in a balance exercise program in people with cognitive impairment.

Main Objective: Compare the effects of two balance training programs with "initiated" or "reactive" movements in gait functionality in subjects with mild/moderate cognitive impairment.

Methods: 31 subjects with medical diagnostic of mild/moderate cognitive impairment were randomly assigned in a "reactive" or "initiated" balance program groups (RG and IG, respectively). Each subject performed 10 sessions of 10 minutes (one session/week) in addition to their ongoing therapeutic treatment. Both programs included exercises of static and dynamic balance, displacement and changes of direction. In the RG, all movements were initiated in response to visual/auditory/vibrational stimuli implemented using the ROXPro©system (A-Champs). This system consists of small electronic devices that provide the stimuli with which the user interacts and that can be configured by the therapist through a mobile application. Before and after the intervention, performance in the Up & Go task was evaluated.

Results and Discussion: The statistical analysis (ANOVA Group*Test) showed a trend for a significant interaction (F=3.33, P=0.6). Delta scores showed a significant (P=0.04) better performance in the RG (3% improvement) in comparison with IG (9% deterioration).

Conclusion: Balance programs that include reactive exercises may be more effective in maintaining functional capacity than more traditional programs
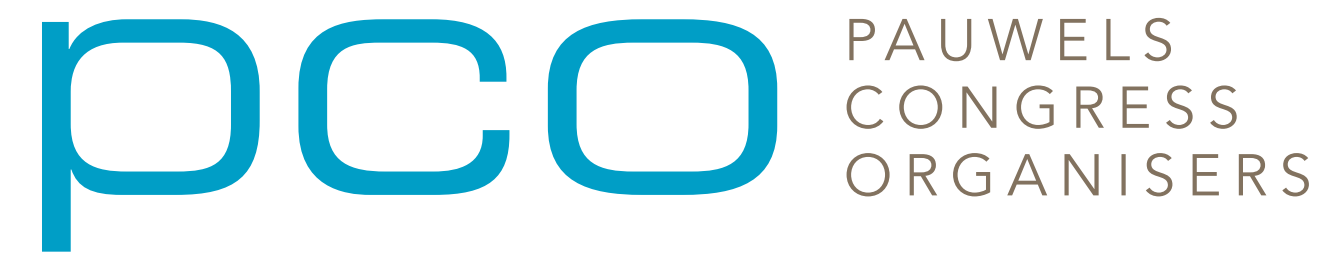
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