

6th REHABMOVE
Congress

Groningen
The Netherlands
December 12-14, 2018

REHABILITATION: MOBILITY, EXERCISE & SPORTS

Program book



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Welcome Address

Dear attendees

Welcome to the 6th edition of the RehabMove congress. You have come to Groningen from over twenty countries of all continents, which has already made this congress a success! We are proud to present an impressive line-up of keynote speakers, thematic oral presentations and posters, combined with a large exhibition and social program. We look forward to either meet you again, or get to know you during the next couple of days!

As congress chair I follow in the footsteps of Professor Lucas van der Woude, who has led and pushed this congress successfully for the previous five editions. Fortunately, he was willing to share his experience by serving as the vice-chair and thereby warrant the successful continuation of the RehabMove congress. Together with the future generation of researchers and professionals we hope to preserve and expand the legacy of the RehabMove congresses. Hopefully the students participating in the Ability Battle Hackathon will feel welcome and keep challenging us with their energy and creativity.

Already over 30yrs the 5-yearly cycle of 'RehabMove' congresses has brought together Human movement-, rehabilitation- and allied sciences, to embrace their ambitions together. This ever-growing network has tried to provide answers in the fields of rehabilitation and adapted sports, while simultaneously generating new questions and challenges. Working alongside each other has thus helped to further deepen our understanding of (impaired) human movement and functioning, and stress the importance of continued multidisciplinary (inter)national collaboration.

The take home message of the RehabMove2018 congress is therefore a plea for continued multidisciplinary research in the fields of rehabilitation and adapted sports, to keep pace with the high-speed technological developments and growing societal challenges. There is a continued need for more precise notions of human functioning, the effects of practice and training, improved supportive technology and the awareness of 'human and technology asset management' over the lifespan.

By maintaining state-of-the-art multi-disciplinary research collaborations, we anticipate to continue to support rehabilitation medicine. We also hope to ensure a stronger embodiment of preventive and lifestyle medicine in rehabilitation practice. Indeed, now and beyond, healthcare and rehabilitation practice require a healthy and active lifestyle management agenda in the context of the (primary, secondary, tertiary) prevention.

I wish you an inspirational and interactive time in Groningen, where I hope you will make new friends and lay the foundation for continued collaboration, as we anticipated to stimulate with this 6th RehabMove event.

Riemer Vegter,
Congress Chair



Organizing Committee

The congress is organized by the Center for Human Movement Sciences and Center for Rehabilitation of the University Medical Center Groningen (UMCG), the Faculty of Human Movement Sciences of the VU University in Amsterdam and the Wenckebach Instituut of the UMCG.

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Thomas Le Rütte

Merle Matijssen

Yvet Mooiweer

Ridi Muhametaj

Lise Onnink

Thomas Rietveld

Charlie Schillemans

Betty Schulte

Paolo Spada

Cosima Von Uechtritz

Vera Velhorst

Annemieke Wargers

Faculty of Human Movement Sciences, VU University Amsterdam

Annemarie Boer

Keynote Speakers



Prof. John Buckley, has a career in sport (originally as a tennis coach) and in exercise and health (exercise physiologist) has spanned over 30 years. It includes having set up his own exercise, fitness and physiotherapy business in Shrewsbury and managing it with his physiotherapy partners for 21 years. In parallel to this, since 1989 he has held part-time teaching and research posts initially in the School of Physiotherapy at Keele University (1989-2006) where he gained his PhD in 2003, and then in 2006, moving to the University of Chester to lead up the MSc in Cardiovascular Rehabilitation. Since 1999, he has also held the position of Exercise Physiologist at the national McArdle Disease Clinic, which is now based at the MRC Neuromuscular Centre, University College Hospital London. He has held positions of national and international leadership in sport and exercise science and cardiovascular health and rehabilitation, including: President of the British Association for Cardiovascular Prevention and Rehabilitation (2009-2011); Chair of the BASES Division of Physical Activity for Health (2003 – 2007); Advisory panel member, Department of Health Commissioning Guide for Cardiac Rehabilitation; Expert panel advisor to Skills Active (Since 2002); Co-chair and co-author of the International Charter on Cardiovascular Prevention and Rehabilitation. John's health & recreation pursuits and hobbies include playing tennis as a member of the Shropshire County Senior Men's team, and Trumpeter at the Shrewsbury Cathedral and in small Jazz ensembles.



Prof. Andreas Daffertshofer, PhD, studied complex dynamics of motor-related neural systems and its formal and conceptual assessment in terms of nonlinear dynamics and non-equilibrium statistics. Research activities cover spatio-temporal aspects of neural synchronization for information transfer during perceptual-motor tasks. Over the years, he appropriated various methods for the analysis of multivariate signals for kinematic, electromyographic and encephalographic data. For example, he developed methods for the extraction of principal or independent components in the vicinity of qualitative changes in motor performance yielding a significant reduction of dimension and thus allowing for the analysis of motor (in-)stabilities, in general, and for classifying (switches between) gait patterns, in particular, including the patterns of accompanying cortical activity. Furthermore, he added to several research fields in theoretical physics, ranging from quantum information to diffusive systems and generalized thermostatics. He is currently working on the link between sensorimotor performance and neural synchronization using neuro-physiologically motivated stochastic neural models, bifurcation theory, and graph theory. This includes several PhD and Research Master projects involving both experimental approaches and theoretical ideas, also to investigate the interplay of dynamical and stochastic aspects of complex neural networks.



Prof. Dario Farina, PhD, received PhD degrees in automatic control and computer science and in electronics and communications engineering from the Ecole Centrale de Nantes, Nantes, France, and Politecnico di Torino, Italy, in 2001 and 2002, respectively. He is currently Full Professor and Chair in Neurorehabilitation Engineering at the Department of Bioengineering of the Imperial College London, UK. He has previously been Full Professor at Aalborg University, Aalborg, Denmark, (until 2010) and at the University Medical Center Göttingen, Georg-August University, Germany, where he founded and directed the Department of Neurorehabilitation Systems (2010-2016). His research focuses on biomedical signal processing, neurorehabilitation technology, and neural control of movement. Within these areas, he has (co)-authored >420 papers in peer-reviewed Journals, which have currently received cumulatively >21,000 citations, and over 500 among conference papers/abstracts, book chapters, and encyclopedia contributions. Professor Farina has been the President of the International Society of Electrophysiology and Kinesiology (ISEK) (2012-2014) and is currently the Editor-in-Chief of the official Journal of this Society, the Journal of Electromyography and Kinesiology. He is also currently an Editor for IEEE Transactions on Biomedical Engineering and the Journal of Physiology, and previously covered editorial roles in several other Journals. He is a Fellow IEEE, AIMBE, EAMBES.



Prof. Mindy F. Levin, PhD, trained as a physiotherapist at McGill University and practiced for several years at the Rehabilitation Institute of Montreal where she specialized in neurological rehabilitation. She then obtained a M.Sc. degree in Clinical Sciences from the University of Montreal followed by a Ph.D. in Physiology from McGill University under the directorship of Dr. Christina Hui-Chan. She completed an additional two years of post-doctoral training in neurophysiology at the University of Montreal under the co-directorship of Drs. Yves Lamarre and Anatol G. Feldman. From 1992 to 2004, Dr. Levin held positions as researcher and professor in the School of Rehabilitation at the Université de Montréal. She taught courses at the undergraduate and graduate level mainly in the areas of electrotherapy and neurology. Dr. Levin was Scientific Director of the Research Centre of the Rehabilitation Institute of Montreal from 1997 until November 2001. She was a Research Scholar of the Fonds de la Recherche en Santé du Québec from 1992 until 2004. In 2004, Dr. Levin became the Director of the Physical Therapy Program in the School of Physical and Occupational Therapy at McGill University until 2008 and was awarded a Tier 1 Canada Research Chair in Motor Recovery and Rehabilitation (2005-2012, 2012-2019). Dr. Levin served as President of the International Society of Motor Control from 2005 to 2008 and is currently editor of the Society's journal "Motor Control". She was a founding member and is immediate Past-President of the International Society for Virtual Rehabilitation as well as a founding member and current executive member of the International Neurological Physiotherapy Association of the World Physical Therapy Association. Dr. Levin's research focuses on elucidating the mechanisms underlying arm sensorimotor deficits and their recovery in adults and children with central nervous system lesions. Her research program aims to elaborate the pathophysiological mechanisms underlying disordered motor control and learning after brain damage and then to develop and test treatment interventions to remediate sensorimotor impairments and disabilities based on these findings. Amongst her research methodologies are new technologies such as virtual reality and robotics.

Prof. Kathleen Martin Ginis, PhD, is the Reichwald Family Chair in Preventive Medicine at University of British



Columbia's Southern Medical Program. She is also a UBC Distinguished University Scholar, Professor in the School of Health and Exercise Sciences, and an ICORD Principal Investigator. Dr. Martin Ginis completed her B.Sc. in Psychology at the University of Toronto, her PhD in Kinesiology at the University of Waterloo, and a postdoctoral fellowship at Wake Forest University. Her research program focuses on physical activity behaviour change, and the psychosocial consequences of physical activity participation. She has a particular interest in spinal cord injury and established the SCI Action Canada partnership in 2007 to advance physical activity participation research and knowledge translation for people with SCI. Dr. Martin Ginis has received over \$11 million in research

funding. She currently holds a \$2.6M SSHRC Partnership Grant to study social participation among people with physical disabilities (The Canadian Disability Participation Project www.cdpp.ca). She has published over 250 peer-reviewed research articles and book chapters. Her research frequently appears in the media and has been featured on CBC's Quirks & Quarks, and in "O" The Oprah Magazine, Men's Health & Fitness, and Shape Magazine, among others. In 2014, the Government of Ontario recognized Dr. Martin Ginis's long-standing contributions to science designed to improve the lives of people with spinal cord injury, by awarding her the Ontario Medal of Good Citizenship. Dr. Martin Ginis resides in Kelowna, British Columbia where she loves to run, snowshoe, and kayak with her husband and daughter.

Prof. Bert Mulder, PhD, has a background in Psychology and Futurology and was head of the IT department of



Veronica Broadcasting Organization for ten years. After this he was a VOTA consultant new media and internet before becoming information advisor of the Second Chamber of the Dutch Parliament. In 1999 he founded 'De InformatieWerkplaats', which is a think tank in the field of societal internet applications. He stayed with the company as a partner for eleven years, before Mulder was appointed Associate Professor in Information, Technology and Society at The Hague University of Applied Sciences. His main focus within this department lies with IT-applications aimed at healthcare and government. Mulder is also a member of the European Cultural Parliament.



Prof. Brett Smith, PhD, holds a Chair in Physical Activity and Health and is the Director of Research in the School of Sport, Exercise and Rehabilitation Sciences at the University of Birmingham, UK. He is a leading expert on disability, health, and physical activity. He is also internationally recognised as a methodologist in qualitative research. Numerous funding bodies, such as the ESRC, Public Health England, and Disability Rights UK, have supported the research he often co-creates with disabled people. Brett's work has been published widely in leading journals, such as Health Psychology, Social Science and Medicine, and Disability and Rehabilitation. In addition to 200+ publications, Brett has given over 30 keynotes and 150 invited talks to audiences around the world. He is founder and former Editor of the international journal Qualitative Research in Sport, Exercise and Health (QRSEH). Currently he is an Associate Editor of Psychology of Sport and Exercise (PSE) and Sport, Exercise and Performance Psychology (SEPP). Brett's latest book is the Routledge Handbook of Qualitative Research in Sport and Exercise (2016).



Prof. Walter R. Thompson, PhD, is Associate Dean for Graduate Studies and Research and a tenured Regents' Professor of Kinesiology and Health (College of Education & Human Development) and in the School of Public Health, and in the Department of Nutrition (College of Nursing and Health Professions) at Georgia State University in Atlanta. Prior to joining the faculty at Georgia State University in 1994, Dr. Thompson was a tenured Professor of Exercise Science and Director of the Laboratory for Applied Physiology at the University of Southern Mississippi and Program Director for the Center for Cardiac Rehabilitation and Health Enhancement at Swedish Covenant Hospital in Chicago. He has also held adjunct academic appointments at Northeastern Illinois University and at George Williams College. Dr. Thompson has been the Chairman of the ACSM Committee on Certification and Education, Chairman of the ACSM International Relations Committee, Chairman of the ACSM American Fitness Index, Chairman of the ACSM Publications Committee, and the Founding Chairman of the Committee on Accreditation for the Exercise Sciences for the Commission on Accreditation of Allied Health Education Programs. He has given lectures on health-related topics in 26 different countries (some multiple times) on the continents of Europe, Africa, North America, South America (including Central America), and Asia. Dr. Thompson also serves on the Sports Science Committee of the International Paralympic Committee (IPC) where he is charged with the coordination of international research projects at all IPC sanctioned events (including the winter games in PyeongChang). Dr. Thompson has published over 125 research-based, peer-reviewed articles on many different topics and has received over \$35 million in funding for his various initiatives. He has authored or has edited 14 books. He served as Senior Editor for the 8th edition of ACSM's Guidelines for Exercise Testing and Prescription. His current interests include wellness coaching as a primary mechanism for behavior change and the integration of sport and physical activity for people with disabilities. Because of his personal interest in at-risk kids living in the inner city, he serves as the Executive Director of the After-School All-Stars Atlanta, a comprehensive after-school initiative for middle school aged children now in 23 sites with an average daily attendance of 3000 and 1600 in summer academies. Dr. Thompson has served on the ACSM Board of Trustees and was twice elected to its Administrative Council. He now serves as the President of the American College of Sports Medicine.

Esther Vergeer is one of the greatest Dutch athletes of all time. For years, she was the unquestioned number one female wheelchair tennis player in the world. For almost her whole career, wheelchair tennis player Esther Vergeer remained undefeated. Esther won 470 consecutive singles matches, which made her one of the most successful athletes in Dutch sport history. On February 12 2013, Esther, who was awarded the Laureus World Sports Award in 2002 and 2008, ended her impressive career. In December 2016, she was awarded with the Fanny Blankers-Koen Career Award, an award for the biggest Dutch sports heroes. At the moment, Esther is the tournament director of the ABN AMRO World Wheelchair Tennis Tournament in Rotterdam. Alongside Richard Krajicek, she is responsible for the organization of the wheelchair tennis tournament and integrating it with the ATP 500 tournament of Rotterdam. Furthermore, she is a NOC*NSF advisor for the Dutch Paralympic team. As a mentor for talented Paralympic athletes and deputy Chef de Mission, she promoted the development of sports for disabled athletes before, during and after the 2016 Games in Rio de Janeiro. Esther was the Chef de Mission of Paralympic Team NL during the Games in PyeongChang_2018.



Guests of Honor



Prof. At Hof was born in 1946 and studied electrical engineering at Twente University. Since 1972 he has worked at the University of Groningen, finally at the Department of Human Movement Science where he taught Biomechanics and Dynamical Systems, and at the Center for Rehabilitation where he was head of the Movement Laboratory. His research has centred around the subject of human locomotion, in which three themes are apparent. One is electromyography, the relation between EMG and muscle force in movement and the speed dependence of EMG patterns in walking and running. The second are the elastic properties of muscle and how they are used in locomotion. Finally the fundamentals of human balance, again with an emphasis on balance during locomotion.



Prof. Han Kemper is born in 1941 in Amsterdam and married with G. Bertheke Post. He is the father of two daughters: Ilse and Birgit and grandfather of five grandchildren: Ruben, Sten, Kirsj, Tom and Jim. He changed career from teaching in physical education (St Ignatius College in Amsterdam, 1963- 1973) to an academic position as exercise physiologist at the University of Amsterdam (1965- 1980). He taught sports physiology at the Central Institute for Sport Coaches (CIOS) in Overveen (1968- 1971) and at the Higher Institute for Physical Education (KALO) in Tilburg (1971-1985). He finished his PhD at the Free University in Brussels (Belgium) in 1968. Title of his thesis is: Experimental research into the effects of differential training (force, speed, coordination and endurance) methods on standardized arm movements. In 1985 he was appointed as full

professor at the Faculty of Human Movement Sciences at the University of Amsterdam and the Vrije University in Amsterdam. His chair was teaching and research of Health Science with respect to Physical Activity". In 1996 he joined the VU University Medical Center in the EMGO+ Institute for Care and Health Research (now: Amsterdam Public Health Research Institute at Amsterdam UMC). He was the principle investigator of the Amsterdam Growth and Health Longitudinal Study (AGAHLS) from 1974 till 2004. With his research group he published more than 350 articles in (inter)national journals and 10 books (or chapters in books). He was Associate Editor of Pediatric Exercise Science (USA) from 1988 till 2018. From 1998 till 2012 he was member of the Health Council of the Netherlands (Gezondheidsraad) and president of two standing committees about "Prevention of overweight and obesity" and "Relationship between physical activity and physical environment". Han CG Kemper received three honorary degrees from universities in London (UK, University of Surrey) in 1998, Budapest (Hungary, Semmelweis University) in 2001 and Riga (Latvia, Radins University) in 2004. In 2002 he received in St Louis (USA) the citation award from the prestigious American College of Sports Medicine based upon his publication records in the field of Sports and Exercise Sciences. His citation records in 2016 from the ISI Web of Knowledge amounts more than 5000 citations from 200 articles. The average citation per article is 25 and his Hirsch Index (H) is 57. Since his official retirement in April 2004, he reduced his scientific non-fiction writing in favour of fiction; something which started as a hobby- writing fairy tales for his grandchildren- and which he hopes to develop. Presently he is writing his "memoires". In his free time he worked 10 years as volunteer for the Dutch organization Victims Help (SHN) and nowadays he is a consultant for the Dutch Association for Euthanasia (NVVE). As a human movement scientist, he is not only preaching daily physical activity (Dutch norm of 30 minutes daily exercise of moderate intensity) but also practicing: jogging, bicycling, playing tennis and volleyball with friends and visiting the sport school weekly with his wife for other exercises.



Prof. Klaas Postema Klaas was born as youngest of six boys in Ouderkerk a/d Amstel. He started his medical study in 1971, enjoyed being a student very much and took 14 years for it. One and a half year before he graduated he passed his PhD at the VU University in Amsterdam after a study into the effects of Dantrolene Sodium (spasmolyticum) in children with spastic cerebral palsy. At the department of Rehabilitation Medicine, together with Jaap Harlaar and Arie Prevo, he was one of the founding fathers of the Movement Laboratory. In 1985 he started as resident in Rehabilitation Medicine in the Roessingh in Enschede. Shortly after his graduation he published the book (in Dutch): "Orthopedic footwear in medical practice".

REHABILITATION: MOBILITY, EXERCISE & SPORTS

The Dutch Government decided in the 80s that the field of Rehabilitation Medicine should be strengthened by training some of the medical specialists as a researcher. Klaas was allowed to participate in this 4-yr training. Some years after this, in 1996 he moved to Nijmegen, where he worked in the St Maartenskliniek and the University Radboud Hospital. In 2000 he was asked to become the head of department of Rehabilitation Medicine at the Academic Hospital in Groningen. One year before the merge of the Academic Hospital and Beatrixoord Center for Rehabilitation he became interim medical director of Beatrixoord. The merge formed one department for Rehabilitation of both within the Academic Hospital Groningen, later the University Medical Center Groningen.

Klaas enjoyed in Groningen especially the cooperation with other disciplines, in which Movement Sciences was and still is a natural partner. After eight years he stepped down as head of department to be able to go back much more to research and patient care. SPRINT, as one of the IMDI research centers, came along and together with Bart Verkerke he managed this for five years. His interest in research focusses mainly on clinical gait analysis, in combination with lower limb orthotics and prosthetics. Obviously, part of the orthoses is orthopaedic/pedorthic footwear. In this field he can rightfully claim to be expert. In 2018 he published as editor-in-chief the textbook: "Pedorthic footwear; Assessment and treatment". 54 Authors from 7 countries contributed to this book. Three other editors supported him. In the meantime the book has been sold in 20 countries; a beautiful success. All revenues go to the Foundation BERJALAN ('walking' in Indonesian language), with the goal to raise knowledge about foot-, gait- and motion disorders and treatment with pedorthics/orthopaedic footwear and orthoses in Asia (mainly Indonesia). The Foundation can, among others, stimulate the work of Klaas in Indonesia (as visiting professor at the Airlangga University in Surabaya).

In one sentence, Klaas is retired since June 2016, but his wife Gerdie does not always notice this.

Practical Information

General information

Badge

Please wear your badge at all times. The congress venue is open to the public. Therefore, badge identification will be used during scientific sessions, breaks and dinners.

Registration Desk

Fontein Patio, Ground Floor

The registration desk is open on Tuesday from 3PM to 5PM and on Wednesday, Thursday and Friday from 8AM to 5PM. There will be continuously one person available for all your questions.

Upload Desk

Fontein Patio, Ground Floor

Invited speakers and oral presenters are asked to hand in and check their ppt presentation at the upload desk. The upload desk is located directly next to the registration desk. From the upload desk your presentation will be uploaded to the speakers desk in the 'Blauwe Zaal'. Please upload the presentation at least 2 hours before the start of your session.

Student Assistants

A group of 22 student assistants is involved in the flow and organization of the congress. They are responsible for many different tasks. Please do not hesitate to ask them. They are recognizable by their dark blue blouses with the congress logo.

Conference room

Blauwe Zaal, Ground Floor.

All keynote and oral presentations are held in this room. For late delegates, the room has two entrances at the first floor, which can be reached by stairs or elevator.

Exhibition

Fontein Patio, Ground Floor.

The exhibition is in the same area where the coffee, tea and lunch breaks are held, and will be open between Wednesday 8AM and Friday 4PM. The exhibition area is set up according to the map with designated sites for each of the companies.

Website

On the website www.rehabmove.nl all the information you need during the congress will be available, e.g. the program and abstracts.

WIFI

There is free wifi in the University Medical Center Groningen. Network: UMCG-Guest.

Certificate

Participants can receive a digital certificate of attendance on request after the Congress.

Conference Proceedings

All regular or extended abstracts of the oral- and poster presentations will be published as conference papers in Zenodo, which is an online library for research outputs. The proceedings will be available under the 'RehabMove 2018' community and are published under 'open access' unless indicated otherwise. If you have not submitted your extended abstract yet, you can hand it in at the congress desk.

Special Issue Disability & Rehabilitation

A selection of full papers will be published in a special issue of the SCI-journal Disability & Rehabilitation. The organizing committee will select these contributions during the congress.

Continuing Medical Education

Continuing Medical Education credits will only be requested at two Dutch Societies: VRA (Dutch Society for Rehabilitation doctors) and the KNGF (Dutch Society for Physiotherapists).

- Accreditation has been received by the VRA with 18 points (6 points each day).
- Accreditation (ID 26984) has been received by the Royal Dutch Society of Physiotherapy (KNGF) with 19 points.

Insurance

The meeting organizer cannot accept any liability for personal injuries, loss or damage to properties belonging to participants, either during or as a result of the meeting. Participants are advised to take out their own personal travel insurance.

Ability Battle Hackaton

In the days before the Congress (December 9-11, 2018) the Ability Battle Hackaton took place at the UMCG. For more information, visit www.abilitybattle.nl. The closing and award ceremony of the Ability Battle Hackaton will take place on Wednesday evening before and during the buffet.

Social program

All participants are invited to join the social program: the welcome reception with refreshments on Wednesday afternoon and the dinners on Wednesday and Thursday evening.

Welcome reception

Fontein Patio, Ground Floor

The welcome reception is offered to you on behalf of the University of Groningen, the Municipality of Groningen and the Province of Groningen.

Dinner, Wednesday December 12, 7.30PM-9.30PM

Restaurant UMCG, Near Fontein Patio

After the closing ceremony of the Ability Battle Hackathon dinner will be served in the restaurant near the Fountain Patio in the UMCG.

Dinner, Thursday December 13, 7PM-10PM

Academy Building University of Groningen, Broerstraat 5

On Thursday, dinner will be served at the Academy Building of the University of Groningen. This is in the city center, Broerstraat 5. See the map of the city center. Thirty minutes transfer time is calculated between the last keynote and the start of the dinner.

Pubquiz

A pubquiz will be organized after dinner on Thursday between 10PM and 11.30PM. The student crew will organize a pubquiz in the pub 'Uly Duck'. For information, registration and ticket sales please visit the registration desk.

Morning walk

In the context of healthy lifestyle and physical activity, a free morning walk is organized on Thursday morning. Meeting point is at the frontside of the Martini Tower at 7.15AM. The morning walk guides you through the streets of Groningen and students will give you more information on sight seeings. The morning walk ends at the UMCG before the start of the first keynote speaker.

Twitter

Follow the congress on Twitter: @rehabmove2018 or www.twitter.com/rehabmove2018. If you post a tweet about the congress, please include #rehabmove2018.

Twitter Contest

During this years converence a Twitter Contest will be held. The best tweet using #rehabmove2018 will be selected and the winner will be mentioned at the closing ceremony.

Presentations

Keynote lectures

We are proud to have nine international keynotes, three on each day. They provide together a broad as well as in depth view on today's scientific developments in rehabilitation, human movement and sports sciences. The final presentation of each day – in early evening – will be held by one of them giving sufficient thought for food and discussion, just prior to the dinner.

Oral presentations

There are eleven sessions with oral presentations. All oral presentations last for 15 minutes including some time for discussion.

Poster presentations

ENGELSE PATIO, GROUND FLOOR.

The poster sessions are on Thursday and Friday from 11.45-12.30hr. Since the poster area is near the Fonteinpatio it is possible to walk around there during coffee, tea and lunch breaks as well. Poster presentations with an even code number (P2, P4. Etc.) will be presented on Thursday, odd code numbers (P1, P3, etc.) on Friday. All posters are available in the poster area during all three congress days.

Travel information

Venue

University Medical Center Groningen, address: Hanzeplein 1, 9713 GZ Groningen.
Groningen is situated in the North-East of the Netherlands.

From/to Schiphol by train

Train connections link the city with Schiphol International Airport every 30 minutes. Travel time by train is approximately 2 hours. The Central Station in Groningen is at 20 minutes walking distance from the UMCG. For timetables visit www.ns.nl/en. Tickets can be bought on internet as an e-ticket, and tickets can be bought using the yellow ticket machines on the station. When you buy an OV-chipcard using the ticket machine, make sure that you check in at the station, even when it is a single journey ticket, otherwise the ticket is not valid.

By bus in Groningen

Arriving at the Central Station in Groningen, several busses will take you to the city center (e.g. bus 3, 4 and 5). Some busses will take you directly to the University Medical Center Groningen, see www.9292.nl/en. Both the city center (5 min) and the University Medical Center (10 min by bus) are also at walking distance from the Central Station. You can buy a 2,50 euro ticket in the bus. This ticket can be used for one hour, check the stamp the bus driver put on it to see when it was given to you. Within this hour you can change from bus to bus. Just show the ticket to the bus driver. Be aware that in some busses the payment can only be done by PIN or creditcard, namely in lines 1-6 and 12. In the

REHABILITATION: MOBILITY, EXERCISE & SPORTS

other busses you can only pay by cash. If you want to travel longer than one hour, or buy a day ticket, you can ask the driver. He/She will help you to get the right ticket. A taxi stand is situated in front of the railstation as well.

By car

Parking facilities are available in Parking garage Noord (paid parking, for directions visit www.umcg.nl).

Taxi

There is a taxi stand outside the hospital. If you need help by booking a taxi please go to the registration desk. Also wheelchair taxis can be arranged.

The Netherlands

Language

Dutch is the predominant language in the Netherlands but English is very popular and is spoken almost everywhere. The meeting language will be English. There will be no simultaneous translation facilities.

Currency and Banks

The currency is Euro (€). Major Credit Cards are accepted at most restaurants, shops and hotels.

Shopping

Most shops and department stores are open from 10.00-18.00 from Tuesday to Friday, Monday from 13.00-18.00, and Saturday from 10.00-17.00. Some shops are open on Sunday. Major credit cards are widely accepted.

Weather

The climate in the Netherlands is a sea-climate with temperatures in December between 2-6°C. It is helpful to note that there is always a chance of rain or snow, due to variable weather patterns.

Time

The Netherlands is two-hours ahead on Greenwich Mean Time (GMT), one-hour ahead of the Central European Time (CET), and seven-hours ahead of U.S. Eastern Time.

Power

Electricity sockets take two pin round plugs. The electrical current in the Netherlands is 220 volts.

Traffic

Apart from cobble stone paved streets, old Dutch cities are sometimes small and narrow, and traffic can be very hectic, chaotic even. Especially busses and bikes show unpredicted behavior, be aware of that.

Presentation Instruction

There are some guidelines for all the scientific oral and poster presentations.

Oral presentations

- Each oral presenter has 15 minutes max, 12 minutes to present and 3 minutes for discussion. Because there is a strict timetable, the session-chairs will end your presentation after 15 minutes exactly. Please keep this in mind while preparing your presentation.
- Uploading of a ppt-presentation is possible during the Congress at the Upload Desk, situated next to the Registration Desk in the UMCG.
- Please take care to deliver your usb-stick, with the ppt-slides of your presentation, as early as possible to the people at the upload desk, to make sure that your presentation will run properly.
- Please use PowerPoint Format slides: 16:9 (Office 2010).
- Especially presenters scheduled on Wednesday morning are invited to upload their presentation between 8-8.30 am. Uploading is also possible on Tuesday between 3 and 5pm.
- To avoid lines: all other presenters please upload your presentation during the day.

Poster presentations

Posters are exposed during all three days of the congress. There is time to visit the poster exhibition during coffee & tea breaks, lunches and during the poster sessions. There are two scheduled poster sessions. The presenters of the posters with an even numbers are asked to take place next to their poster at least during the poster session on Thursday, to explain their presented work and answer questions. For presenters of the posters with an odd number this applies to the poster session on Friday. The presenter is invited to be near his/her board at least at the 45 minutes of the designated poster session. Mounting your poster is possible on Tuesday from 15.00 – 17.00 hrs and on Wednesday from 08.00 – 09.00 hours. Mounting material is available at the Registration Desk (or nearby the Poster boards). Please remove the posters on Friday after the tea-break.

Guidelines for preparing your poster:

- The poster boards are 100 cm width and 120 cm high. So be sure that your poster is not wider than 100 cm.
- Make sure that your poster is legible from 1,5 m distance.
- Aim for a clear and concise message.
- Figures, graphs, illustrations and text should support this main message.
- If you upload files of photos, make sure that their resolution is high enough for poster print.
- Keep the amount of text limited.

Mapping the Congress Venue

Wenckebach Instituut

For health care professionals



The Wenckebach Instituut is a department of the University Medical Center Groningen.



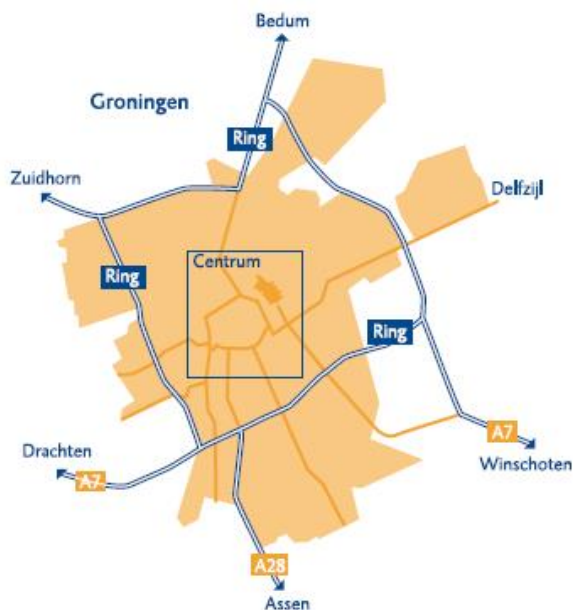
Route by car

For visitors to congresses or other events the University Medical Center Groningen (UMCG) has a car parking at the north end of the terrain. To get there follow from the Groningen Ring the signs 'UMCG Noord'.

Public transport

The UMCG is easily reached by public transport. Several bus lines departing from the Central Railway Station drive in about 10 minutes to the UMCG. Some buses stop at the head entrance of the hospital, others at the side and at the north end. You can also use the 'park and ride' city bus. Because the bus schedules vary often, we direct you for up to date information to the sites for public transport (www.929200v.nl and www.citybus.nl/English). Regretfully, the 929200v.nl site is in Dutch. However, its homepage offers the possibility to make an inquiry that probably is understandable, even if you do not speak Dutch.

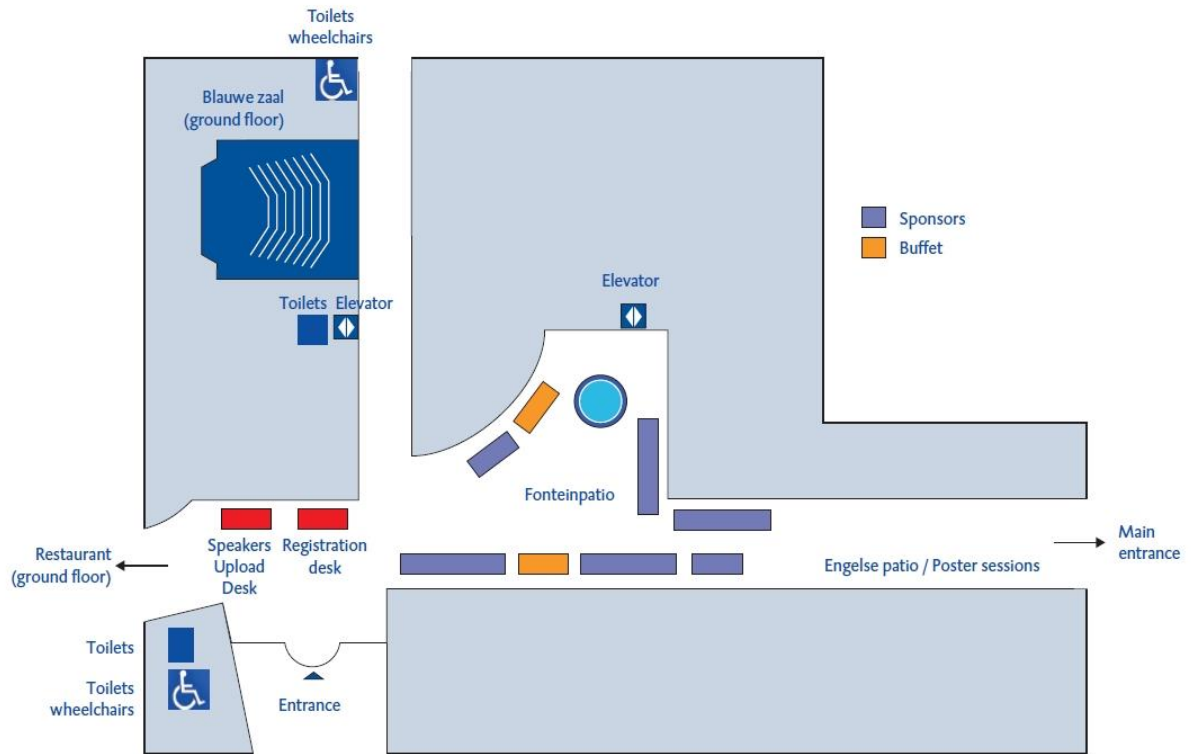
Wenckebach Instituut UMCG
Hanzeplein 1 Postbus 30.001
9700 RB Groningen
The Netherlands
Telephone (050) 361 61 61
Fax (050) 361 36 06
info@wenckebach.umcg.nl
www.wenckebachinstituut.nl

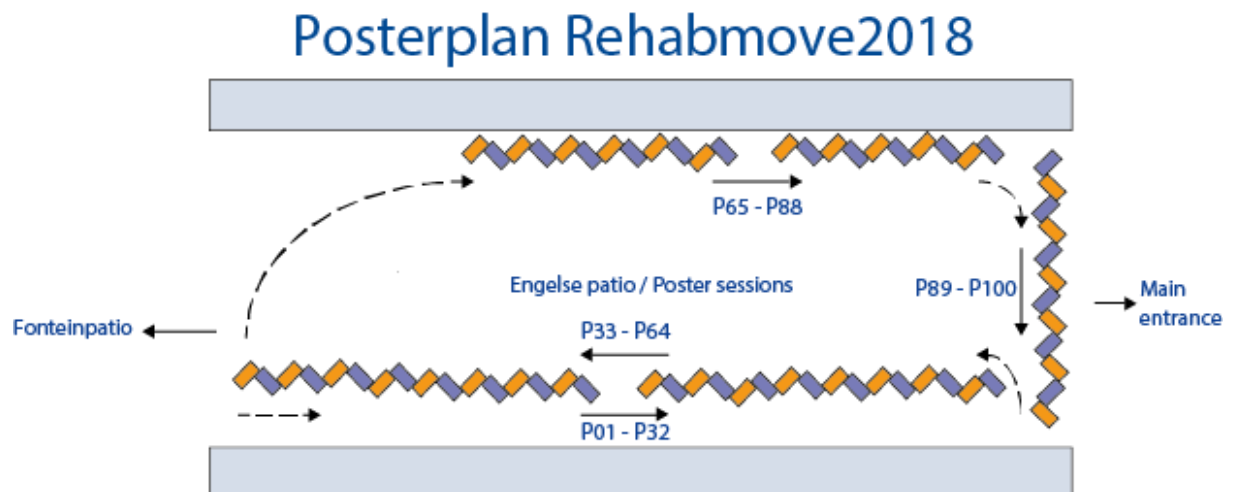
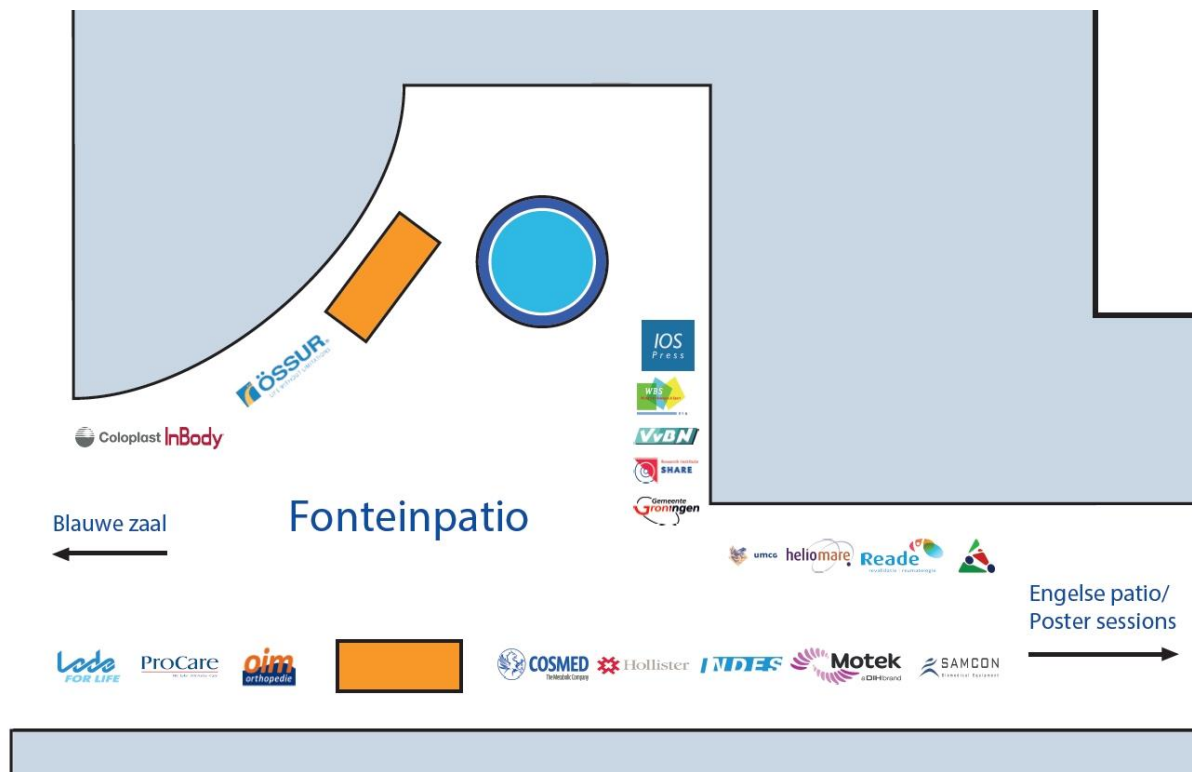


Note:
Follow the signs to UMCG-Noord and not to the UMCG main entrance.



Floorplan UMCG & 'Blauwe Zaal'





Program

Mobility, Wednesday December 12, 2018

08.00 Registration + Coffee
 Speakers Upload Desk Open

09.00 Opening
 Dr. Riemer Vegter, *Congress Chair*
 Prof. M. Joëls, *Dean University Medical Center Groningen*

Theme: Man-Machine Interfacing

Chair: Dr. Raoul Bongers

09.15 Keynote lecture 1: 'Man-machine interfacing for the control of upper limb prostheses'
 Prof. Dario Farina

Session 1: Power assistive technology

Chairs: Dr. Casper van Koppenhagen & Dr. Helco van Keeken

10.00 **A-1: MYOELECTRIC ASSISTIVE DEVICES: DOES EMG PATTERN DISTINCTNESS REFLECT CONTROL ABILITY**
 AW Franzke, MB Kristoffersen, CK Van der Sluis, RM Bongers, A Murgia
 University of Groningen, GRONINGEN, Netherlands

A-2: CAN LOW-COST MOTION CAPTURE SYSTEMS BE USED TO MEASURE ACCURATELY JOINT REACTION IN POWERED-EXOSKELETON USERS?

ML Lancini¹, FA Fornaser², PS Pasinetti¹
¹University of Brescia, BRESCIA, Italy; ²University of Trento, TRENTO, Italy

A-3: A FRAMEWORK OF EXOSKELETON-SKILL-TESTS IN PATIENTS WITH COMPLETE SPINAL CORD INJURY

R.B. van Dijksseldonk¹, I.J.W. van Nes², H. Rijken², H. van de Meent², N.L.W. Keijsers²
¹Sint Maartenskliniek, NIJMEGEN, Netherlands

10.45 Coffee-break & Exhibition & Posters

Session 2: Daily Mobility Optimization

Chairs: Prof. Dirkjan Veeger & Dr. Rienk Dekker

11.15 **A-4: OPTIMIZING MANUAL WHEELCHAIR SETTINGS USING NUMERICAL SIMULATION TO IMPROVE MOBILITY IN VARIOUS DAILY-LIFE ACTIVITIES**

S. Hybois¹, J. Bascou², F. Lavaste³, H. Pillet³, C. Sauret³
¹Institut de Biomécanique Humaine Georges, Arts et Métiers ParisTech, PARIS, France ; ²Centre d'Etudes et de Recherche sur l'Appareillage des Handicapés, CRÉTEIL, France ; ³Institut de Biomécanique Humaine Georges Charpak, Arts et Métiers ParisTech, PARIS, France

A-5: FACTORS ASSOCIATED WITH TRANSFER INDEPENDENCE IN MEN WITH PARAPLEGIA

R.E. Cowan¹, A.A. Guccione², R.E. Keyser², D. Murray², C.S. Fitzmaurice¹, A. Rounds³, I. Ljungberg³, S. Groah³
¹University of Miami Miller School of Medicine, MIAMI, FL, United States of America; ²George Mason University, FAIRFAX, VA, United States of America; ³MedStar Health Research Institute, HYATTSVILLE, MD, United States of America

A-6: WHEELCHAIR USERS' SUPRASPINATUS TENDONS CHANGE WITH LOADING: RELATIONSHIP WITH THE SUBACROMIAL SPACE AND SUBJECT CHARACTERISTICS

FM Bossuyt¹, U Arnet¹, A Cools², ML Boninger³
¹Swiss Paraplegic Research and University of Luzern, NOTTWIL, Switzerland
²University of Ghent and University of Copenhagen, GHENT, Belgium
³Department of Veterans Affairs and University of Pittsburgh, PITTSBURGH, United States of America

A-7: THE ROLL-OVER SHAPE WHILE WALKING WITH AND WITHOUT ANKLE-FOOT ORTHOSES IN CHILDREN WITH CEREBRAL PALSY

YL Kerkum¹, H Houdijk², MA Brehm³, AI Buizer⁴, J Harlaars

¹OIM Orthopedie, ASSEN, Netherlands; ²Amsterdam Movement Sciences- VU University, Human Movement Science, AMSTERDAM, Netherlands; ³Amsterdam Movement Sciences- Academic Medical Center, dept. Rehabilitation, AMSTERDAM, Netherlands; ⁴Amsterdam Movement Sciences- VU University medical center, dept Rehab. medicine, AMSTERDAM, Netherlands; ⁵Delft University of Technology, Department of Biomechanical Engineering, DELFT, Netherlands

12.15 Lunch break & Exhibition & Posters

Theme: Motor Learning

Chair: Dr. Helco van Keeken

13.30 Keynote lecture 2: 'Motor learning in neurological rehabilitation'
Prof. Mindy Levin

Session 3: Biomechanics & Motor Control

Chairs: Dr. Han Houdijk & Dr. Aline Vrieling

14.15

A-8: BIOMECHANICAL EFFECTS OF TWO DIFFERENT CHOPART PROSTHESES DURING LEVEL GROUND WALKING

TK Kaib¹, JB Block², DH Heitzmann², AM Alimusaj², SW Wolf²

¹HEIDELBERG, Germany; ²University Hospital, HEIDELBERG, Germany

A-9: WALKING ADAPTABILITY TRAINING IN PEOPLE AFTER STROKE: A RANDOMIZED CONTROLLED TRIAL

C Timmermans¹, M Roerdink¹, CGM Meskers², PJ Beek¹, TWJ Janssen¹

¹Vrije Universiteit Amsterdam, AMSTERDAM, Nederland; ²VU Medical Center, AMSTERDAM, Nederland

A-10: MOTOR LEARNING OUTCOMES OF WHEELCHAIR PROPULSION DURING SPINAL CORD INJURY REHABILITATION AND IN EXPERIENCED USERS

M.T. Leving¹, S. De Groot¹, R.J.K. Vegter¹, F.A.B. Woldring², M. Tepper², L.H.V. Van der Woude¹

¹GRONINGEN, Netherlands; ²University Medical Center Groningen, GRONINGEN, Netherlands

A-11: ARE INDIVIDUALS WITH UNILATERAL TRANSTIBIAL AMPUTATION ABLE TO ADAPT TO AN ACUTE PROSTHETIC INTERVENTION?

AR De Asha¹, RJ Foster², T Skervin², CT Barnett³

¹C-Motion Inc., GERMANTOWN, United States of America; ²Liverpool John Moores University, LIVERPOOL, United Kingdom; ³Nottingham Trent University, NOTTINGHAM, United Kingdom

A-12: PROPULSION BIOMECHANICS DURING WHEELCHAIR TURNING MANOEUVERS IN YOUNG ABLE-BODIED MEN AND WOMEN

D Chaikhot

University of Essex, COLCHESTER, United Kingdom

15.30 Tea break & Exhibition & Posters

Session 4: Motor Skill Acquisition

Chairs: Dr. Astrid Balemans & Dr. Marina Schoemaker

16.00

A-13: THE EFFECTIVENESS OF VIDEO GAME-BASED BALANCE TRAINING IN CHILDREN WITH CEREBRAL PALSY

P. Meyns¹, C. Bras², J. Harlaar³, L. Van de Pol², F. Barkhof², A.I. Buizer²

¹Hasselt University, DIEPENBEEK, Belgium; ²VU University Medical Center, AMSTERDAM, Nederland;

³Delft University of Technology, DELFT, Nederland

A-14: HANDRAIL HOLDING ON A SPLIT-BELT TREADMILL REDUCES LOCOMOTOR LEARNING

TJW Buurke, CJC Lamoth, D Vervoort, LHV van der Woude, AR den Otter

University of Groningen, University Medical Center Groningen, GRONINGEN, Nederland

REHABILITATION: MOBILITY, EXERCISE & SPORTS

A-15: TRAINING MOVEMENTS FOR DISTINCT ELECTROMYOGRAM PATTERNS USING SERIOUS GAMING

MB Kristoffersen¹, AW Franzke¹, A Murgia², RM Bongers², CK van der Sluis¹

¹University of Groningen, UMCG, Department of Rehabilitation Medicine, GRONINGEN, Netherlands

²University of Groningen, UMCG, Center for Human Movement Sciences, GRONINGEN, Netherlands

A-16: INTENSIVE WHEELED MOBILITY WORKSHOPS FOR PHYSIOTHERAPISTS AND OCCUPATIONAL THERAPISTS - A LESSON TO BE LEARNED

O Fliess Douer¹, Amos Pollack², Dalit Romem³, Elisheva Daube³

¹Sylvan Adams Sport Institute at Tel Aviv University, TEL AVIV, Israel; ²The Academic College at Wingate

Isnatitute, NETANYA, Israel; ³Rehabilitation and Mobility Unit, Ministry of Health, Israel Government,

TEL AVIV, Israel

17.00 Welcome reception with refreshments
The Drinks are offered to you by the University of Groningen, the Municipality of Groningen and the Province of Groningen

Theme: Data & Society

Chair: Prof Thomas Janssen

18.00 Keynote lecture 3: 'The future of rehabilitation: digital infrastructure empowers networks of patients and professionals'

Dr. Bert Mulder

18.45 Ability Battle Hackathon

19.30 – 21.30 Buffet at the Restaurant of the University Medical Center Groningen and awards Ability Battle Hackathon

Exercise, Thursday December 13, 2018

07.15 – 08.00 Morning Walk, meeting point at the frontside of the Martini Tower.

08.00 Registration + Coffee
Speakers Upload Desk Open

Theme: Adapted Physical Activity

Chair: Dr. Sonja de Groot

08.30 Keynote lecture 4: 'From guidelines to practice: The development and implementation of disability-specific exercise guidelines in rehabilitation and community settings'
Prof. Kathleen Martin Ginis

Session 5: Adapted Physical Activity

Chairs: Dr. Karin Gerrits & Dr. Noor Mouton

9.15

B-17: RE-AIM ANALYSIS OF A CANADIAN PEER MENTORING PROGRAM THAT PROMOTES PHYSICAL ACTIVITY

RB Shaw¹, SN Sweetz², KR Todd¹, WK Adair³, CB McBride⁴, HL Flaros⁵, KA Martin-Ginis¹

¹The University of British Columbia, KELOWNA, Canada; ²McGill University, MONTREAL, Canada

³SCI Canada, TORONTO, Canada; ⁴SCI British Columbia, VANCOUVER, Canada; ⁵Ability New Brunswick, FREDERICTON, Canada

B-18: INTERRATER AND INTRARATER RELIABILITY OF VENTILATORY THRESHOLDS DETERMINED IN PEOPLE WITH SPINAL CORD INJURY

I Kouwijzer¹, R.E. Cowan², J.L. Maher², F. Groot³, F. Riedstra³, L.J.M. Valent¹, L.H.V. Van der Woude⁴, S. De Groot⁵

¹Helimare Rehabilitation Center, WIJK AAN ZEE, Netherlands; ²University of Miami, MIAMI, United States of America; ³Sport-en Beweegkliniek, HAARLEM, Nederland; ⁴University of Groningen, GRONINGEN, Netherlands; ⁵Reade, AMSTERDAM, Netherlands

B-19: CARDIOVASCULAR RISK FACTORS AND LEISURE TIME PHYSICAL ACTIVITY AMONG OLDER ADULTS WITH SPINAL CORD INJURY

S.J. Jörgensen¹, LS Magnusson¹, SS Svedevall¹, KMG Martin Ginis², J.L. Lexell³

¹Lund University, Skåne University Hospital, LUND, Sweden; ²School of Health and Exercise Sciences, University of British Columbia, KELOWNA, Canada; ³Lund University, Skåne University Hospital/Uppsala University, LUND, Sweden

B-20: ADAPTED PHYSICAL ACTIVITY AND FUNCTIONAL CAPACITY OF ADULTS WITH INTELLECTUAL DISABILITY OVER 40 YEARS-OLD

SS Santos¹, JR Ramos¹, ME Stevens¹, ES Sousa¹, FG Gomes¹
CRUZ QUEBRADA, Portugal

10.15 Coffee break & Exhibition & Posters

Session 6: ADL Implementation Guidelines

Chairs: Dr Janneke Stolwijk & Dr. Monique Berger

10.45

B-21: PHYSICAL ACTIVITY AMONG PEOPLE WITH SPINAL CORD INJURY: A COMPARISON BETWEEN THE NETHERLANDS AND CANADA

F. Hoekstra¹, S. de Groot², J. Bruin³, L.H.V. van der Woude⁴, T. Hoekstra³, M.W.M. Posts¹, K.A. Martin Ginis¹

¹University of British Columbia, KELOWNA, Canada; ²Amsterdam Rehabilitation Research Centre, Reade, AMSTERDAM, Netherlands; ³Vrije Universiteit Amsterdam, AMSTERDAM, Netherlands; ⁴University of Groningen, University Medical Center Groningen, GRONINGEN, Netherlands;

⁵UMCG/RuG/Kenniscentrum Revalidatiegeneeskunde Utrecht, GRONINGEN, Netherlands

B-22: A PARTICIPANT-LED PHYSICAL ACTIVITY PROGRAMME FOR DISABLED PEOPLE WHO ARE READY TO BECOME PHYSICALLY ACTIVE

E.A. Jaarsma¹, B. Smith

University of Birmingham, BIRMINGHAM, United Kingdom

B-23: DEVELOPMENT AND VALIDATION OF PHYSICAL ACTIVITY PRACTICE GUIDES FOR AMPUTEES

MPL Pacheco Lopes¹, LMP Moniz-Pereira²

¹Faculty of Human Kinetic, University of Lisbon, CRUZ QUEBRADA, Portugal; ²CIPER, Faculty of Human Kinetics, University of Lisbon, CRUZ QUEBRADA, Portugal

B-24: LONGITUDINAL ASSOCIATIONS BETWEEN ACTIVITY PACING, FATIGUE, AND PHYSICAL ACTIVITY IN ADULTS WITH MULTIPLE SCLEROSIS

US Abonie¹, BL Seves², F Hoekstra², T Hoekstra², CP Van der Schans², R Dekker², LHV Van der Woude², FJ Hettinga¹

¹School of Sport, Rehabilitation and Exercise Sciences, University of Essex, COLCHESTER, United Kingdom

²University of Groningen, University Medical Center Groningen, Center for Human S, GRONINGEN, Nederland

Poster session 1

11.45 Presentation of posters with an even code number (P2, P4, etc.)

12.30 Lunch break & Exhibition & Posters

Theme: Exercise Physiology

Chair: Dr. Han Houdijk

13.45 Keynote lecture 5: 'The changing landscape of cardiac rehabilitation; from early mobilization and reduced mortality to chronic multi-morbidity management'

Prof. John Buckley

Session 7: Clinical Exercise Physiology

Chairs: Dr. Nicole Voet & Dr. Noël Keijsers

14.30

B-25: HOT BATHS: AN EFFECTIVE SUPPLEMENT TO EXERCISE IN DISABILITY?

C.A. Leicht¹, S.P. Hoekstra¹, S. Faulkner², N.C. Bishop¹, F. Tajima³, V.L. Goosey-Tolfrey¹

¹Loughborough University, LOUGHBOROUGH, United Kingdom; ²Nottingham Trent University, NOTTINGHAM, United Kingdom; ³Wakayama Medical University, WAKAYAMA, Japan

B-26: PEAK OXYGEN UPTAKE IN DIFFERENT UPPER-BODY EXERCISE MODES - A META-ANALYSIS

JK Baumgart, B Brurok, Ø Sandbakk

Centre for Elite Sports Research, TRONDHEIM, Norway

B-27: DIFFERENCES IN EXERCISE EFFECTS FROM STATIC VERSUS DYNAMIC STANDING IN NON-AMBULATORY CHILDREN WITH CEREBRAL PALSY

ÅB Tornberg¹, V Hansson², A Jakobsson², K Lauruschkus¹

¹Department of Health Sciences, Lund University, LUND, Sweden ²Mathematical Sciences, Lund University, LUND, Sweden

B-28: EFFECT OF RESPIRATORY MUSCLE TRAINING ON EXERCISE CAPACITY AND RESPIRATORY MECHANICS IN ATHLETES WITH TETRAPLEGIA

C.R. West¹, C.M. Gee¹, A.M. Williams¹, A.W. Sheel², N.D. Eves²

¹ICORD/University of British Columbia, VANCOUVER, Canada; ²University of British Columbia, VANCOUVER, Canada

15.30 Tea break & Exhibition & Posters

Session 8: Measurement during daily life

Chairs: Dr Rita van den Berg & Dr. Rienk van der Slikke

16.00

B-29: ACTIVITY AND MOBILITY USING TECHNOLOGY (AMOUNT) REHABILITATION TRIAL- DESCRIPTION OF COMMUNITY PHASE INTERVENTION

LM Hassett¹, MEL Van den Berg², H Weber², S Chagpar³, S Wong⁴, A Rabie⁴, K Schurr⁴, MA McCluskeys, R Lindley⁶, M Crotty², C Sherrington³

¹School of Public Health/Faculty of Health Sciences, University of Sydney, SYDNEY, Australia;

²Department of Rehabilitation, Aged and Extended Care, Flinders University, ADELAIDE, Australia;

³School of Public Health, University of Sydney, SYDNEY, Australia; ⁴South Western Sydney Local Health District, SYDNEY, Australia; ⁵Faculty of Health Sciences, University of Sydney, SYDNEY, Australia;

⁶Westmead Clinical School, University of Sydney, SYDNEY, Australia

B-30: RECOVERY OF EXERCISE CAPACITY IN PEDIATRIC BURN PATIENTS: A PRELIMINARY INVESTIGATION

M. Akkerman¹, L.J. Mouton², S. de Groot³, A.S. Niemeijer⁴, S.M.H Scholten-Jaegers⁵, M.E. van Baar⁶, M.M. Stoop⁷, L.H.V. van der Woude², M.K. Nieuwenhuis

¹Association of Dutch Burn Centres, GRONINGEN, Netherlands; ²Center for Human Movement Sciences, University of Groningen, UMCG, GRONINGEN, Netherlands; ³Amsterdam Rehabilitation Research Center | Reade, AMSTERDAM, Netherlands; ⁴Martini Academy, Martini Hospital, GRONINGEN, Netherlands;

⁵Association of Dutch Burn Centres, Burn Centre Martini Hospital, GRONINGEN, Netherlands; ⁶Association of Dutch Burn Centres, Burn Centre Maasstad Hospital, ROTTERDAM, Netherlands;

⁷Association of Dutch Burn Centres, Burn Centre Red Cross Hospital, BEVERWIJK, Netherlands

B-31: ECOLOGICAL MOMENTARY ASSESSMENT OF EXERCISE AND NEUROPATHIC PAIN EXPERIENCED BY MEN WITH SCI: PARTICIPANT PERCEPTIONS

K.R. Todd, R.B. Shaw, K.A. Martin Ginis

University of British Columbia, KELOWNA, Canada

B-32: ARE AMBULATORY PEOPLE WITH SPINAL CORD INJURY 'AT RISK' FOR INACTIVITY AFTER REHABILITATION?

K Postma¹, H.J.G. van den Berg-Emons², J.B.J Bussmann³, T. van Diemen⁴, M.W.M. Post⁵

¹Erasmus MC, ROTTERDAM, Nederland; ²Erasmus MC, University Medical Center Rotterdam, ROTTERDAM, Nederland; ³ErasmusMC, ROTTERDAM, Netherlands; ⁴Sint Maartenskliniek/De Hoogstraat/UMCG, Nederland; ⁵UMCG/RuG/Kenniscentrum Revalidatiegeneeskunde Utrecht, GRONINGEN, Netherlands

B-33: HIGH-INTENSITY INTERVAL TRAINING IN YOUTH WITH PHYSICAL DISABILITIES

M. Zwinkels¹, T Takken², J.M.A. Visser-Meily³, O Verschuren⁴

¹UMC Utrecht and De Hoogstraat Rehabilitation, UTRECHT, Nederland; ²Child Development and Exercise Center, UMC Utrecht, UTRECHT, Nederland; ³Department of Rehabilitation, Physical Therapy Science & Sports, UMC Utrecht, UTRECHT, Nederland; ⁴Center of Excellence for Rehabilitation Medicine, UMC Utrecht and De Hoogstraat, UTRECHT, Nederland

17.15

Break with refreshments

Theme: Big data / Machine Learning

Chair: Dr. Riemer Vegter

18.00

Keynote lecture 6: 'Big data, big buzzwords, and big challenges'

Prof. Andreas Daffertshofer

18.45

Closing

Walk to the Academy Building

19.00

Buffet at the Academy Building (University of Groningen)

22.00-

Pubquiz

Sports, Friday December 14, 2018

08.00 Registration + Coffee
Speakers Upload Desk Open

Theme: Paralympic research future

Chair: Dr. Rienk Dekker

08.30 - 9.15 Keynote lecture 7: 'Paralympic research: Past, present, future'
Prof. Walter Thompson

Session 9: Technological performance enhancement

Chairs: Prof. Coen van Bennekom & Dr. Monique Berger

9.15

C-34: KINEMATICS, KINETICS AND MUSCULAR ACTIVITY OF 15-S ALL-OUT HANDCYCLING EXERCISE IN ABLE-BODIED PARTICIPANTS

O. J. Quittmann¹, T. Abel¹, K. Albracht², H.-K. Strüder¹

¹German Sport University Cologne, COLOGNE, Germany; ²FH Aachen University of Applied Sciences, AACHEN, Germany

C-35: ANALYSIS OF GROUND REACTION FORCES BY FOREARM CRUTCHES DURING INSTEP KICK IN AMPUTEE FOOTBALL

T.K Kobayashi¹, Y.U Urabe¹, H.F. Fujishita², J.S Sasada¹, N.M Maeda¹

¹Hiroshima University, HIROSHIMA, Japan; ²Hiroshima University Hospital, HIROSHIMA, Japan

C-36: HOW DO WHEELCHAIR COURT SPORTS COMPARE REGARDING WHEELCHAIR MOBILITY PERFORMANCE?

R.M.A. van der Slikke¹, M.A.M. Berger¹, D.J.J. Bregman², H.E.J. Veeger²

¹The Hague University of Applied Sciences, DEN HAAG, Netherlands; ²Delft University of Technology, DELFT, Nederland

C-37: THE NEED FOR PARA-CYCLING CLASSIFICATION RESEARCH

C.F.J. Nooijen, J. Liljedahl, A. Bjerkefors, T. Arndt

Swedish School of Sport and Health Sciences (GIH), STOCKHOLM, Sweden

10.15 Coffee break & Exhibition & Posters

Session 10: Physical Performance enhancement

Chairs: Dr. Sonja de Groot & Prof. DirkJan Veeger

10.45

C-38: PERIOD PREVALENCE AND POINT PREVALENCE OF SPORTS-RELATED INJURIES AND ILLNESSES IN SWEDISH PARALYMPIC ATHLETES

KF Fagher¹, ÖD Dahlström², JJ Jacobsson², TT Timpka², JL Lexell¹

¹Rehabilitation Medicine Research Group, Lund University, LUND, Sweden; ²Athletics Research Center, Linköping University, LINKÖPING, Sweden

C-39: EFFECT OF RESPIRATORY MUSCLE TRAINING ON PULMONARY AND CARDIOVASCULAR FUNCTION IN ATHLETES WITH TETRAPLEGIA

CM Gee, AM Williams, AW Sheel, ND Eves, CR West

VANCOUVER, Canada

C-40: ONABOTULINUMTOXIN A INJECTION FOR NEUROGENIC DETRUSOR OVERACTIVITY AND UPPER BODY EXERCISE PERFORMANCE IN WHEELCHAIR ATHLETES

C Perret, J Pannek

Swiss Paraplegic Centre, NOTTWIL, Switzerland

C-41: THE INFLAMMATORY RESPONSE TO EXERCISE IN SPINAL CORD INJURED INDIVIDUALS-THE INFLUENCE OF AUTONOMIC FUNCTION

SP Hoekstra¹, CA Leicht¹, YI Kamijo², T Kinoshita², BT Stephenson¹, VL Goosey-Tolfrey¹, NC Bishop¹, F Tajima²

¹Loughborough University, LOUGHBOROUGH, United Kingdom; ²Wakayama Medical University, WAKAYAMA, Japan

Poster session 2

11.45 Presentation of posters with odd code numbers (P1, P3, etc.)

12.30 Lunchbreak & Exhibition & Posters

Theme: Active Living / Recreational Sports

Chair: Dr. Noor Mouton

13.45 Keynote lecture 8: 'Promoting active living for disabled adults: Some modest suggestions'
Prof. Brett Smith

Session 11: Recreational Sports

Chairs: Dr. Marina Schoemaker & Dr. Noël Keijzers

14.30

C-42: UNDERSTANDING THE TRANSITION INTO ELITE DISABILITY SPORT

A Papathomas¹, T Paulson²

¹Loughborough University, LOUGHBOROUGH, United Kingdom; ²English Institute of Sport, MANCHESTER, United Kingdom

C-43: SCAPULA CLUSTER AND MULTYBODY OPTIMIZATION FOR SCAPULAR TRACKING DURING WHEELCHAIR OVERHEAD SPORTS

D. Haering¹, S. Hybois², J. Bascou³, F. Lavaste², H. Pillet², P. Fodé², C. Sauret²

¹ENSAM, PARIS, France ; ²Institut de Biomécanique Humaine Georges Charpak, PARIS, France ; ³CERAH, CRÉTEIL, France

C-44: OXYGEN SATURATION PROFILE OF PARTICIPANTS OF THE 2017 BRAZILIAN SCHOLARSHIP PARALYMPIC GAMES

JIG Gorla¹, JFF Fernandes Filho², AACS Costa e Silva³, JRB Buratti¹, NC Souza¹, DRC Callegari⁴, CDN Nogueiras⁵, IBV Vieira⁶, AC Cliquet Junior⁷

¹University of Campinas, CAMPINAS, Brazil; ²Federal University of Rio de Janeiro, RIO DE JANEIRO, Brazil; ³Federal University of Pará, BELÉM, Brazil; ⁴State University of Maringá, MARINGÁ, Brazil; ⁵Universidade Castelo Branco, RIO JANEIRO, Brazil; ⁶San Antonio University of Murcia, MURCIA, Spain; ⁷Faculty of Medical Sciences - University of Campinas, CAMPINAS, Brazil

C-45: SPORTS PARTICIPATION, PHYSICAL ACTIVITY AND HEALTH-RELATED FITNESS IN YOUTH WITH CHRONIC DISEASES OR PHYSICAL DISABILITIES

K.M. Lankhorst¹, T. Takken², M. Zwinkels³, F. Backx⁴, L. van Gaalen¹, S. Te Velde¹, O. Verschuren³, H. Wittink¹, J. de Groot¹

¹University of Applied Sciences Utrecht, UTRECHT, Nederland; ²Wilhelmina Children's Hospital, UTRECHT, Nederland; ³De Hoogstraat Rehabilitation, UTRECHT, Nederland; ⁴University Medical Center Utrecht, UTRECHT, Nederland

15.30 Tea break & Exhibition & Posters

Theme: Athlete's perspective

Chair: Prof. Thomas Janssen

16.00 Keynote lecture 9: 'Athlete's perspective'
Esther Vergeer

16.45 Closing session
Dr. Riemer Vegter

Poster-/Oral presentations by Theme

Activity Monitoring

ID	Title	First author
B24	Longitudinal associations between activity pacing, fatigue, and physical activity in adults with multiple sclerosis	US Abonie
B31	Ecological momentary assessment of exercise and neuropathic pain experienced by men with sci: participant perceptions	KR Todd
B32	Are ambulatory people with spinal cord injury 'at risk' for inactivity after rehabilitation?	K Postma
P4	Designing an app-based platform to promote activity-based therapy adherence for spinal cord injury	J St. John
P15	Daily activity monitoring of robotic arm support users with muscular weakness	H Essers
P20	Is fitbit charge 2 a feasible instrument to monitor daily physical activity in wheelchair users?	MC Maijers
P32	A multidimensional approach of physical behavior types in fatigued ms patients	H Braakhuis
P47	Everyday use of lower limb orthotics and quality of life in subjects with neuromuscular disease	JB Block
P50	Health and injury monitoring in disabled athletes	A Boer
P60	Amsterdam spinal cord injury (ams-sci): design of a longitudinal cohort study	G van Werven
P70	Feasibility of objective arm-hand activity feedback applied via a wrist-worn device in stroke patients	GRH Regterschot

Adapted Physical Activity

ID	Title	First author
B20	Adapted physical activity and functional capacity of adults with intellectual disability over 40 years-old	SS Santos
B21	Effectiveness and feasibility of activity coach ; a physical activity intervention in hard-to-reach physically disabled people	F Hoekstra
B22	A participant-led physical activity programme for disabled people who are ready to become physically active	E Jaarsma
B23	Development and validation of physical activity practice guides for amputees	M Pacheco Lopes
B27	Differences in exercise effects from static versus dynamic standing in non-ambulatory children with cerebral palsy	A Tornberg
C35	Analysis of ground reaction forces by forearm crutches during instep kick in amputee football	T Kobayashi
P2	Psychosocial correlates of physical activity of students with intellectual disability	SS Santos
P9	Determinants of physical activity in wheelchair users with spinal cord injury and lower limb amputation	J Holla
P18	Unravelling fatigue and activity pacing in maintaining a physically active lifestyle after stroke rehabilitation	BL Seves
P34	The effects of sport and physical recreation for people with physical disabilities: an evidence review	L Hassett
P36	Physical activity in wheelchair-using youth with spina bifida	MAT Bloemen
P37	Determinants of physical activity in wheelchair-using youth with spina bifida	MAT Bloemen

P57	We12bfit! Improving physical fitness and lifestyle physical activity in 7-12 year old children with dcd	P Braaksma
P67	Collaboration between psychomotor therapy and human movement sciences; a literature review in mental health context	C Boerhout
P85	Stimulating physical activity in hard-to-reach physically disabled people; systematic development of a community-based intervention	LA Krops
P86	Effectiveness and feasibility of activity coach ; a physical activity intervention in hard-to-reach physically disabled people	LA Krops

Assistive Technology

ID	Title	First author
A1	Myoelectric assistive devices: does emg pattern distinctness reflect control ability	A Franzke
P6	Designing accessible educational resources for people with spinal cord injury	M Todorovic
P14	Fixed muscle synergies and their potential to improve the intuitive control of myoelectric assistive technology	TA Valk
P24	Determining the appropriate resistance for assessing wheelchair propulsion performance using the lode esseda ergometer	S Briley
P63	Automatized, standardized and patient-tailored progressive walking adaptability training: a proof-of-concept study	C Timmermans
P90	Viability of myocontrolled assistive technology from a motor coordination perspective	R Bongers
P96	The pie=m project; development of a tool to enforce exercise as medicine in hospital care	AJ Bouma

Biomechanics and Motor Control

ID	Title	First author
A9	Walking adaptability training in people after stroke: a randomized controlled trial	C Timmermans
A12	Propulsion biomechanics during wheelchair turning manoeuvres in young able-bodied men and women	D Chaikhot
A14	Handrail holding on a split-belt treadmill reduces locomotor learning	TJW Buurke
C34	Kinematics, kinetics and muscular activity of 15-s all-out handcycling exercise in able-bodied participants	O Quittmann
P16	Gait stability training in a virtual environment in incomplete spinal cord injured patients	RB van Dijksseldonk
P19	Changes in propulsion technique and shoulder complex loading following low-intensity wheelchair practice in novices	M Leving
P21	Feasibility of virtual reality task for assessing weight-shifting skills in aging: a pilot study	V de Rond
P29	Effects of rocker shoes on plantar fascia strain in patients with plantar fasciitis	C Greve
P31	The differences in muscle contraction properties between lower limb amputees and able-bodied	H Fujishita
P52	Dynamic parameters of forward propulsion could be used for manual wheelchair users' classification	S Fotso
P55	Computational modeling of impaired movements and restauration there-of	H Wagner
P66	Machine learning methods to identify gait patterns of geriatric patients with and without cognitive impairment	Y Zhou
P71	Effect of different heel rocker profiles on lower-limb joint biomechanics and plantar pressure	L van Kouwenhove

P92	Differences between oxygen consumption and ground reaction forces during self-paced and fixed-speed treadmill walking–pilot study	K Theunissen
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Daily Mobility

ID	Title	First author
A5	Factors associated with transfer independence in men with paraplegia	RE Cowan
P23	Gait of adults with intellectual disabilities, and its association with physical fitness	A Oppewal
P48	Self-perceived gait stability modulates the effect of daily-life gait-quality on falls in older adults	R Weijer
P61	Experienced seating-related problems and association with personal, lesion and wheelchair characteristics in paraplegia and tetraplegia	L Valent

Exercise Physiology

ID	Title	First author
B18	Interrater and intrarater reliability of ventilatory thresholds determined in people with spinal cord injury	I Kouwijzer
B25	Hot baths: an effective supplement to exercise in disability?	C Leicht
B26	Peak oxygen uptake in different upper-body exercise modes – a meta-analysis	JK Baumgart
B28	Effect of respiratory muscle training on exercise capacity and respiratory mechanics in athletes with tetraplegia	C West
B30	Recovery of exercise capacity in pediatric burn patients: a preliminary investigation	M Akkerman
B33	High-intensity interval training in youth with physical disabilities	M Zwinkels
C39	Effect of respiratory muscle training on pulmonary and cardiovascular function in athletes with tetraplegia	CM Gee
C41	The inflammatory response to exercise in spinal cord injured individuals–the influence of autonomic function	S Hoekstra
C45	Sports participation, physical activity and health-related fitness in youth with chronic diseases or physical disabilities	K Lankhorst
P3	Spinal cord injury and training status impact the differentiated rpe response to incremental wheelchair propulsion	MJ Hutchinson
P8	Ventilatory threshold assessment in cardiopulmonary exercise test results of people after stroke	I Blokland
P11	The acute and chronic effects of hot water immersion on inflammation and metabolism	S Hoekstra
P26	Rpe-guided exercise training: impact on perceptual responses in adults with spinal cord injury	MJ Hutchinson
P28	Combined arm-leg ergometry in subjects with a lower limb amputation	E Simmelink
P30	The 6-minute push-test in wheelchair-using youth with spina bifida; reliability and physiologic response	KMS Damen
P42	Comparison of test protocols on the attainment of peak oxygen uptake during upper-body poling	B Brurok
P56	Feasibility of the talk test with cycling in frail elderly patients during orthopaedic geriatric rehabilitation	K Gerrits
P65	Metabolic cost of daily activities in people with lower limb amputation – a study protocol	E Blaauw
P74	Aerobic exercise and coaching to improve physical fitness in neuromuscular diseases: i'm fine study protocol	S Oorschot

P78	From waiting to training: feasibility of pre- and postoperative rehabilitation for cardiac surgery patients	S Dijkstra
P81	Handcycling in an mri: a new platform to understand local metabolic changes because of training	R Vegter
P82	The implementation of v?o2 kinetics to evaluate training effects in cancer patients	R Vegter
P83	Changes in body composition in people with recent spinal cord injury during inpatient rehabilitation	Y Ma
P84	Probe-design: heart rehabilitation in patients awaiting open-heart surgery preventing complications and improving quality of life	J Hartog

Handcycling

ID	Title	First author
P39	Three-dimensional kinematics of competitive and recreational recumbent handcyclists at different sport specific exercise intensities	B Stone
P41	Practice effects on low-intensity synchronous handcycling in able-bodied men: a biophysical approach	C Kraaijenbrink
P91	How can we organize the handbikebattle in other countries focussing on culture, organizational structure, marketing?	B Gunderson

Implementation of Physical Activity

ID	Title	First author
A13	The effectiveness of video game-based balance training in children with cerebral palsy	P Meyns
B19	Cardiovascular risk factors and leisure time physical activity among older adults with spinal cord injury	SJ Jörgensen
B29	Activity and mobility using technology (amount) rehabilitation trial- description of community phase intervention	L Hassett
P17	Physical activity promotion to people with spinal cord injury by health professionals: a scoping study	TL Williams
P35	The effectiveness of exercise-based technologies in rehabilitation on mobility and physical activity: amount rehabilitation trial	L Hassett
P45	Developing evidence-based guidelines for functional electrical stimulation cycling in spinal cord injury	JW van der Scheer
P46	European dissemination of spinal cord injury exercise guidelines	JW van der Scheer
P88	The next steps of the respect cohort study: connecting rehabilitation practice and science	F Hoekstra

Motor Learning

ID	Title	First author
P94	The immediate influence of implicit motor learning on gait in stroke patients	M Kleynen

Motor Skill Acquisition

ID	Title	First author
A3	A framework of exoskeleton-skill-tests in patients with complete spinal cord injury	RB van Dijksseldonk

REHABILITATION: MOBILITY, EXERCISE & SPORTS

A15	Training movements for distinct electromyogram patterns using serious gaming	MB Kristoffersen
P73	Effects of a pediasuit adapted protocol in the motor function of children with cerebral palsy	RSK Kos
P77	Practice-based skill acquisition of pushrim-activated power-assisted wheelchair propulsion versus regular handrim propulsion in novices	R de Klerk

Paralympic Research Future

ID	Title	First author
C36	How do wheelchair court sports compare regarding wheelchair mobility performance?	R van der Slikke
C37	The need for para-cycling classification research	C Nooijen
C38	Period prevalence and point prevalence of sports-related injuries and illnesses in Swedish Paralympic athletes	K Fagher
C40	Onabotulinumtoxin a injection for neurogenic detrusor overactivity and upper body exercise performance in wheelchair athletes	C Perret
C42	Understanding the transition into elite disability sport	A Papathomas
C43	Scapula cluster and multibody optimization for scapular tracking during wheelchair overhead sports	D Haering
C44	Oxygen saturation profile of participants of the 2017 Brazilian scholarship Paralympic games	Jl Gorla
P27	Paralympic sports classification and spatiotemporal parameters of wheelchair racers in male's 100m sprint	H Jung
P33	Validation of the MYJUMP2™ app in countermovement jump in young cp football amateur players	AACS Costa e Silva
P38	A survey of falls during wheelchair basketball from the official video observation	R Shimizu
P51	Dermatoglyphic and somatotypic profile of the Brazilian Paralympic football five-a-side national team	J Fernandes Filho
P54	Muscle activity and spasticity during boccia throwing in athletes with cerebral palsy	E Pondman
P62	Handcycling classification: a first look into the current classification system	RA Muchaxo
P79	Glove types and spatiotemporal variables of wheelchair racer according Paralympic sports classification in 100m sprint	H Jung

Physical sports performance

ID	Title	First author
16	The psychosocial impact of wheelchair tennis on participants in developing countries	V Richardson
45	Validity of ambulatory measured wheelchair kinematics	RMA van der Slikke

Prosthetics and orthotics

ID	Title	First author
P12	Immediate effects of wearing a soft ankle brace on proprioception and dynamic postural control	I Barelds
P58	Activity profiles during wheelchair tennis: effects of division, result and score margin	B Mason
P93	Feasibility of vigorous training intensity with a resistance training program for adults with intellectual disability	S Weterings

Recreational Sports

ID	Title	First author
P98	Which factors are important when people with a physical disability start organized sports?	M Fluit

Robotics

ID	Title	First author
A2	Can low-cost motion capture systems be used to measure accurately joint reaction in powered-exoskeleton users?	M Lancini
P22	The effects of asymmetrical guidance settings during lokomat guided gait in stroke patients	S Weiland
P95	The effect of assist-as-needed support on energy expenditure during robotic gait training of stroke patients	B Fleerkotte

Technological sports performance

ID	Title	First author
P43	Effects of seat height, wheelchair mass and glove use on mobility performance in wheelchair basketball	M Hoozemans

Wheeled Mobility

ID	Title	First author
A4	Optimizing manual wheelchair settings using numerical simulation to improve mobility in various daily-life activities	S Hybois
A6	Wheelchair users' supraspinatus tendons change with loading: relationship with the subacromial space and subject characteristics	F Bossuyt
A10	Motor learning outcomes of wheelchair propulsion during spinal cord injury rehabilitation and in experienced users	M Leving
A16	Intensive wheeled mobility workshops for physiotherapists and occupational therapists – a lesson to be learned	O Fliess Douer
P53	Simulating the manual wheelchair rotational and translational behavior during free movement, following a rotational impulse	J Bascou
P59	Kinematic analysis of experienced and inexperienced 0.5-point wheelchair rugby athletes	YT Oh
P64	Restoration of elbow extension by tendon transfer: effect on wheelchair mobility	U Arnet
P76	Propulsion biomechanics of manual wheelchair users with upper limb pain	T le Rütte
P80	Capturing physical performance in daily wheelchair mobility: what "real life data" to measure?	W de Vries

Other

ID	Title	First author
B17	Re-aim analysis of a Canadian peer mentoring program that promotes physical activity	RB Shaw
P7	Association between central sensitization and lifting and aerobic capacity in chronic low back pain patients	J Ansuategui Echeita
P10	The effect of fore-aft crank position on the biomechanics, coordination and physiology of recumbent handcycling	RJK Vegter
P40	Rehabilitation interventions to improve paretic propulsion in individuals after stroke – a systematic review	J Alingh

REHABILITATION: MOBILITY, EXERCISE & SPORTS

P68	Extended cardiac rehabilitation improves aerobic capacity and fatigue: the opticare randomized controlled trial	N ter Hoeve
P69	Development of a resting energy expenditure equation in individuals with chronic sci for an application	D Hoevenaars
P72	Stories of arthritis and physical activity: the role of exercise in telling illness stories	E Hunt
P87	Moving towards an exercise & movement-friendly academic hospital: the UMCG lifestyle navigator	RA de Roos
P97	The shoulder disorder screening for wheelchair marathon runners	Y Sasaki
P99	Evaluating legacy to developing sport policy in the medical and health aspects	K Jung

Book of Abstracts

Oral Presentations

Mobility, Wednesday, December 12, 2018

Keynote Lecture 1: Man-Machine Interfacing for the control of upper limb prosthetics

Prof Dario Farina

Robotic limbs can be autonomously moved with great dexterity and can convey information about the external environment with higher precision than biological limbs. Nonetheless, our limited capacity of interfacing these robotic devices with the human body and transferring motor and sensory information from and to human users substantially downscale these possibilities. Over the past 60 years, academic research has progressed in the field of controlling upper limb prostheses with man-machine interfacing. However, a very small number of these academic achievements has been implemented in commercial systems so far. This gap between industry and academia is due to the relatively small functional improvement in daily situations that academic systems offer, despite the promising laboratory results, at the expense of a substantial reduction in robustness. I will provide an overview of both commercial and academic control systems for upper limb prostheses. The approaches described will range from classic methods to relatively novel techniques, including algorithms for simultaneous and proportional control of multiple degrees of freedom and the use of individual motor neuron spike trains for direct control.

Session 1: Powered assistive technology

A-1: MYOELECTRIC ASSISTIVE DEVICES: DOES EMG PATTERN DISTINCTNESS REFLECT CONTROL ABILITY

AW Franzke, MB Kristoffersen, CK Van der Sluis, RM Bongers, A Murgia
University of Groningen, GRONINGEN, Netherlands

PURPOSE: Literature suggests that improvements in control of a pattern-recognition based myoelectric device are governed by increased distinctness of surface EMG patterns (dEMG). We investigated the relation between control ability and dEMG.

METHODS: Able-bodied participants learned to control a pattern-recognition based myoelectric device over 5 days. Each day, they were fitted with 8 surface EMG electrodes around their forearm and performed 3 training sessions. The procedure in each session was as follows: First, participants performed muscle contractions following movement prompts (e.g. "wrist flexion"). The EMG signals were used to train a software algorithm to recognize the different EMG patterns associated to each movement. Second, a test was performed where the same movement prompts were presented to the participants again, who performed muscle contractions accordingly. The algorithm then estimated the movement performed by the participant. Performance was assessed by the percentage of correctly estimated movements (pCEM) per session. dEMG was calculated as a modified Mahalanobis distance in the EMG feature space per session. The strength of the relationship between pCEM and dEMG was assessed by fitting a function to the data (across all participants and sessions) and calculating the goodness of fit.

RESULTS: 33 participants (mean age 21.6ys, 17 females) completed the study. From first to last session mean pCEM increased from 64% to 85% ($p < .0001$, $\eta = 0.43$). An exponential fit of dEMG to pCEM resulted in $R^2 = 0.33$ (with a standard error of estimate = 0.25).

CONCLUSIONS: Performance significantly increased from first to last session, but the correlation between dEMG and pCEM was poor. This suggests that participants could improve their performance without making EMG patterns more distinct, indicating that the ability to control a pattern-recognition based myoelectric device is not strongly reflected in EMG pattern distinctness.

A-2: CAN LOW-COST MOTION CAPTURE SYSTEMS BE USED TO MEASURE ACCURATELY JOINT REACTION IN POWERED-EXOSKELETON USERS?

ML Lancini¹, FA Fornaser², PS Pasinetti¹

¹University of Brescia, BRESCIA, Italy

²University of Trento, TRENTO, Italy

PURPOSE: The purpose of this study was to investigate if a low-cost markerless motion capture system, coupled with low-cost force sensors, could be used to accurately assess joint reactions during assisted gait. The case of powered-exoskeleton users who lost their locomotion due to Spinal Cord Injury (SCI) is of interest because (i) shoulder joint reactions are difficult to assess by therapists with visual inspection, but are critical factors to avoid secondary health issues, (ii) exoskeletons induce unexpected visual occlusions and shape deformation with respect to standard motion capture protocols, (iii) SCI subjects wearing powered exoskeletons still need to use crutches, but for balance only, with load patterns scarcely studied in the literature.

METHODS: One expert user of a Rewalk P5 model suffering from paraplegia (T12 complete) was asked to walk in straight line. The subject was given a custom-made low-cost set of wireless instrumented crutches able to measure the ground reaction forces. A Kinect-array markerless motion system was deployed in the room. A numerical model of the subject, previously validated, was implemented in Opensim. 21 tests were repeated in the same conditions. A marker-based motion capture was used as gold standard, with a position accuracy of 0.1mm. Kinematics and dynamics results were computed with both the markerless and the reference system as input data.

RESULTS: The root mean square (RMS) error for upper limbs kinematics ranged from 5 deg (arm adduction) to 20 deg (elbow flexion), except for rotations around the body axis, which reached 110 deg. The RMS error for shoulder joint reactions ranged from 0.4% (longitudinal) to 1.1% (vertical) of the body weight.

CONCLUSIONS: While the system is unable to provide accurately the kinematics parameters, mainly due to axial symmetry of body segments, the assessment of the joint reactions is not affected and shows good accuracy. This could make measuring subjects while training feasible.

A-3: A FRAMEWORK OF EXOSKELETON-SKILL-TESTS IN PATIENTS WITH COMPLETE SPINAL CORD INJURY

R.B. van Dijksseldonk¹, I.J.W. van Nes², H. Rijken², H. van de Meent², N.L.W. Keijsers²

¹Sint Maartenskliniek, NIJMEGEN, Netherlands

PURPOSE: For safe application of exoskeletons in people with spinal cord injury at home, it is required to have completed an exoskeleton training in which users learn to perform basic and advanced skills. The aim of this study was to develop and test the reliability of a framework for measuring the progress in the ability to perform basic and advanced skills.

METHODS: Eighteen participants with paraplegia were given twenty-four training sessions (1.5 hour) in eight weeks with the Rewalk-exoskeleton. During the 2nd, 4th and 6th training week the Intermediate-skills-test was performed consisting of 27 skills, measured in an hierarchical order of difficulty, until two skills were not achieved. When participants could walk independently, the Final-skills-test, consisting of 20 skills, was performed in the last session. Each skill was performed at least two times with a maximum of three attempts. As a reliability measure the consistency was used, which was the number of skills performed the same in the first two attempts relative to the total number.

RESULTS: Fourteen participants completed the training program. Their number of achieved intermediate skills was significantly different between the measurements $X_F^2(2,13)=18.37$, $p<.001$. Post hoc analysis revealed a significant increase in the achieved intermediate skills from 4 [range 0–7] at the first to 6 [4–20] at the second and 10.5 [1–26] at the third Intermediate-skills-test. Twelve participants met the criteria to perform the Final-skills-test. Their number of successfully performed final skills was 17.5 [13–20] and 17 [14–19] skills in the first and second time. An overall consistency of 77% in the Intermediate-skills-test and 84% in the Final-skills-test was achieved.

CONCLUSIONS: The framework measured the progress in performing basic and advanced exoskeleton skills during a training program. The skills-tests could discriminate across participants' skill-level and the overall consistency was considered acceptable.

Session 2: Daily Mobility Optimization

A-4: OPTIMIZING MANUAL WHEELCHAIR SETTINGS USING NUMERICAL SIMULATION TO IMPROVE MOBILITY IN VARIOUS DAILY-LIFE ACTIVITIES

S. Hybois¹, J. Bascou², F. Lavaste³, H. Pillet³, C. Sauret³

¹Institut de Biomécanique Humaine Georges, Arts et Métiers ParisTech, PARIS, France

²Centre d'Etudes et de Recherche sur l'Appareillage des Handicapés, CRÉTEIL, France

³Institut de Biomécanique Humaine Georges Charpak, Arts et Métiers ParisTech, PARIS, France

PURPOSE: Manual wheelchair (MWC) locomotion is an exhausting task for the upper limbs (van der Woude et al., 2001). Hence, reducing energy loss can improve users' mobility. The purpose of this study was to investigate how numerical optimization could allow decreasing the energy loss (swiveling and rolling resistance) by numerically adjusting MWC settings, including seat height and anterior-posterior position, seat and backrest angles, and wheelbase.

METHODS: Eighteen participants performed a set of daily-life MWC maneuvers, including start-up, straight propulsion or u-turns. All subjects were positioned in the same instrumented wheelchair (Dabonneville et al., 2005; Hybois et al., 2018) allowing handrim, seat, backrest and footrest forces and torques to be measured. These mechanical actions were used as inputs of a mechanical model to assess instantaneous values of rolling and swiveling resistances. This numerical model was parametrized with several settings, including fore-aft and vertical positions of the seat, wheelbase and seat/backrest angles. For each subject and each task, a numerical optimization procedure was designed and implemented in Matlab (MathWorks, USA) to find the configuration minimizing energy loss while ensuring no-tipping of the MWC.

RESULTS: Numerical optimization allowed the total energy loss to be decreased. Optimal settings were different according to the subject and the task that was performed. This mobility improvement was reached at the expense of the overall stability.

CONCLUSIONS: MWC settings optimization through numerical optimization allows defining a MWC configuration that would improve users' mobility by decreasing energy loss by rolling and swiveling resistance. This preliminary investigation should be completed with a musculoskeletal model of the upper limbs to generate optimal wheelchair locomotion taking into account shoulder loading.

A-5: FACTORS ASSOCIATED WITH TRANSFER INDEPENDENCE IN MEN WITH PARAPLEGIA

R.E. Cowan¹, A.A. Guccione², R.E. Keyser², D. Murray², C.S. Fitzmaurice¹, A. Rounds³, I. Ljungberg³, S. Groah³

¹University of Miami Miller School of Medicine, MIAMI, FL, United States of America

²George Mason University, FAIRFAX, VA, United States of America

³MedStar Health Research Institute, HYATTSVILLE, MD, United States of America

PURPOSE: To determine if personal and clinical characteristics are associated with transfer independence and for factors associated with transfer independence, to identify thresholds with high transfer independence specificity.

METHODS: Eighty-four men with spinal cord injury ≥ 6 months post injury who used a manual wheelchair completed the study at one of three centers in the United States. Weight, height and body mass index (BMI) were measured. Questionnaires assessed injury level & completeness, age, age at injury, and injury duration. Graded exercise tests to volitional exhaustion determined peak aerobic power. SCIM-III self-report questions about bed, shower/toilet, and car transfers quantified transfer independence. Persons indicating they needed no assistance in all three transfers were coded as independent and those needing assistance or adaptive devices in any transfer were coded as dependent. Unadjusted associations between candidate variables and transfer independence were identified using individual binary logistic regressions. Receiver operating characteristic curves were used to identify thresholds with high transfer independence specificity.

RESULTS: Candidate variable means (SD) included: age (39(13) years (yrs)), age at injury (28(11) yrs), injury duration (11(11) yrs), weight (81(18) kgs), BMI (25.6(5.9) kg/m²), motor completeness (75% complete), sensory completeness (56% complete), fall concern (23(7) points), and peak aerobic power (1.1(0.31) watts/kg). Of these, three were associated with transfer independence: age at time of injury, fall concern, and peak aerobic power, all $p < 0.01$. Age at injury ≤ 41 years, fall concern ≤ 29 points, and peak aerobic power ≥ 0.81 Watts/kg each provide $\geq 90\%$ transfer independence specificity.

CONCLUSIONS: Practitioners could use thresholds for fall concern and peak aerobic power as additional rehabilitation goals and the threshold for age at injury to indicate that assistance or adaptive equipment may be required.

A-6: WHEELCHAIR USERS' SUPRASPINATUS TENDONS CHANGE WITH LOADING: RELATIONSHIP WITH THE SUBACROMIAL SPACE AND SUBJECT CHARACTERISTICS

FM Bossuyt¹, U Arnet¹, A Cools², ML Boninger³

¹Swiss Paraplegic Research and University of Luzern, NOTTWIL, Switzerland

²University of Ghent and University of Copenhagen, GHENT, Belgium

³Department of Veterans Affairs and University of Pittsburgh, PITTSBURGH, United States of America

PURPOSE: Wheelchair users' supraspinatus tendons - continuously loaded during propulsion – are often subject to subacromial impingement causing tendon degeneration and pain. This study aims to identify acute changes in supraspinatus tendon thickness after wheelchair propulsion and to associate tendon thickness with the acromio-humeral distance (AHD) and subject characteristics.

METHODS: This quasi-experimental study includes 49 wheelchair users with spinal cord injury, at T2 or below (22 % female; 50 ± 10 years of age, 27 ± 12 years since injury). Participants performed 15 minutes overground wheelchair propulsion including, rests, right/left turns and start/stops. Before and after propulsion, tendon thickness of the supraspinatus was assessed two times for each timepoint with ultrasound and averaged.¹ Covariables include the AHD during a weight relief while retracting and depressing shoulders before and after propulsion, lesion level, body mass index (kg/m²), and years since injury.

RESULTS: A multilevel mixed-effects linear regression controlling for between subject variability and covariables ($P < 0.001$) demonstrated a reduction in supraspinatus tendon thickness after propulsion (Pre: 5.42 mm; 95 % CI = 5.17 - 5.66, Post: 5.27 mm; 95 % CI = 5.02 - 5.51) ($P < 0.05$). Furthermore, persons with an in general thicker supraspinatus tendon had a greater AHD during the weight relief after propulsion (95 % CI = 0.88-7.26) and had more years since injury (95 % CI = 0.014-0.06).

CONCLUSIONS: The thicker supraspinatus tendon in persons with more years since injury likely indicates chronic changes associated with arm overuse. Mechanical loading induced by wheelchair propulsion acutely reduced the supraspinatus tendon thickness. Investigating acute changes associated with a common task will likely provide insight into injury mechanisms and possibly highlight ways to prevent injury.

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A-7: THE ROLL-OVER SHAPE WHILE WALKING WITH AND WITHOUT ANKLE-FOOT ORTHOSES IN CHILDREN WITH CEREBRAL PALSY

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PURPOSE: To investigate the Roll-Over Shape (RoS) of foot and ankle while walking with and without Ankle-Foot Orthoses (AFOs) with different degrees of stiffness in children with Cerebral Palsy (CP) walking with excessive knee flexion.

METHODS: 15 children with CP walking with excessive knee flexion were prescribed a ventral shell AFO with a rigid footplate and integrated ankle hinge of which stiffness could be varied. All participants walked barefoot (BF), with shoes only (Sh) and with AFO in a rigid (rAFO), stiff (sAFO) and flexible (fAFO) setting. Centre of pressure (CoP) and shank kinematics of 3 steps of the most affected leg were collected. RoS was determined during single support, based on a circular fit of CoP data in the local reference frame of the shank. The radius (R) and arc length (Alength) were calculated and normalized for shank length.

RESULTS: Circular RoS fitting was possible for all subjects in BF, while in the other conditions some data could not be fitted, especially for sAFO (n=7) and rAFO (n=9). Compared to BF and Sh, mean(SD) R and Alength increased significantly with an AFO (R: BF=0.32(0.18); Sh=0.31(0.19); fAFO=0.51(0.31); sAFO=0.46(0.15); rAFO=0.41(0.32), Alength: BF=0.22(0.10); Sh=0.21(0.07); fAFO=0.24(0.08); sAFO=0.26(0.06); rAFO=0.31(0.06)). RoS was translated backward in all conditions relative to the barefoot condition.

CONCLUSIONS: The backward shift of the RoS and increased R and Alength while walking with AFOs is related to a decreased inclination of the shank. A larger R could thus indicate better shank alignment during walking. However, RoS could not be fitted in all cases, suggesting an absence of a circular RoS. As a result of the rigid footplate and restricted ankle range of motion, the second rocker motion and roll-over of the foot is lost in some

cases with an AFO. Our data thus suggests that RoS analysis could be informative of AFO behaviour and alignment in children with CP.

Keynote Lecture 2: Motor learning in neurological rehabilitation

Prof Mindy F. Levin

The primary focus of neurological rehabilitation is the reacquisition of lost motor skills to improve independence in activities of daily living and quality of life. To achieve this, rehabilitation takes advantage of central nervous system neuroplasticity through motor learning mechanisms (Kleim and Jones 2009). This presentation will describe how motor learning mechanisms can be addressed through practice and feedback paradigms delivered in various platforms including virtual reality (VR) based simulations (Levin et al. 2015). Underlying motor control mechanisms will be related to motor relearning in consideration of the reacquisition of upper limb movement (Levin et al. 2015). Key outcome measures at the motor performance and movement quality level will be identified to distinguish between motor recovery and compensation. Although the presentation will focus on sensorimotor relearning in stroke, principles can be generalized to other neurological populations.

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Session 3: Biomechanics & Motor Control

A-8: BIOMECHANICAL EFFECTS OF TWO DIFFERENT CHOPART PROSTHESES DURING LEVEL GROUND WALKING

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PURPOSE: Chopart amputation is associated with the loss of relevant forefoot lever and a reduced base of support. The aim of this study was to investigate the biomechanical effects of two different chopart prosthesis (Bellmann prosthesis (BP), Clamshell prosthesis (CSP)) during level ground walking. Patients kinematics, kinetics, plantar and socket pressure as well as prosthetic performance was investigated.

METHODS: 13 chopart amputees were recruited (4 BP, 11 CSP). Two subjects were fitted with both types, therefore measured twice. Subjects underwent 3D gait analysis (Vicon,UK) using Vicon Plug-in-Gait model (Vicon,UK) with additional plantar and socket pressure measurement (Novel,GER) during level ground walking. Differences between both types were analysed. Parameters (BP vs. CSP) were compared using a student's T-Test ($p < 0.05$).

RESULTS: Range of motion in the ankle joint was in BP 32° compared to 8° with CSP ($p < 0.001$). Furthermore the maximal dorsal flexing ($p < 0.004$), knee ($p < 0.03$) & hip extending moments ($p < 0.009$) were higher in CSP compared to BP. Accordingly forefoot pressure at terminal stance appeared higher in CSP compared to the BP ($p < 0.005$).

CONCLUSIONS: Although BP showed advantages by higher ankle range of motion compared to CSP, a lower ankle joint moment was measured during terminal stance. Correspondingly low forefoot pressure appeared at late stance. Thus the BP group was not able to apply sufficient force to the forefoot resulting in a poor push off. In contrast the combination of a ventral shell and a rigid carbon fibre sole of the CSP showed higher forefoot pressure leading to a pronounced dorsal extending moment during terminal stance. Indicating a longer effective forefoot lever. Based on these finding, the dynamic effects of the CSP enabled the users to adapt proximal joint kinematics and kinetics in a more physiological way. These findings show a potential mechanical advantage of the CSP compared to the BP in creating an adequate toe lever.

A-9: WALKING ADAPTABILITY TRAINING IN PEOPLE AFTER STROKE: A RANDOMIZED CONTROLLED TRIAL

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PURPOSE: The ability to adapt walking to environmental properties and hazards, a prerequisite for safe walking, is often impaired in persons after stroke. This study aimed to compare the efficacy of two walking-adaptability interventions: treadmill-based C-Mill therapy (therapy with augmented reality) and the overground FALLS program (conventional therapy program using physical context). We hypothesized that, besides the difference in type of environmental context, C-Mill therapy would result in better outcomes than the FALLS program, owing to its expected greater amount of walking practice operationalized by the number of steps taken per session.

METHODS: Within a randomized controlled trial with pre-intervention, post-intervention, retention and follow-up tests, 30 persons after stroke (≥ 3 months) with walking and/or balance deficits were randomly allocated to either 5 weeks of C-Mill therapy or the FALLS program. Outcome measures were walking speed and walking adaptability, using 10MWTs with or without physical context and a novel Interactive Walkway assessment with augmented context. A cognitive task was added to assess dual-task performance. The amount of walking practice was scored using the treadmill's inbuilt step counter (C-Mill therapy) and video recordings (FALLS program).

RESULTS: Both interventions showed significant improvements in walking speed, walking adaptability and cognitive dual-task performance when walking in enriched environments. Furthermore, C-Mill therapy showed a greater improvement in walking speed at the 10MWT with physical context compared to the FALLS program; however, this was no longer significant at retention. C-Mill therapy encompassed twice as many steps per session compared to a FALLS program session.

CONCLUSIONS: Both C-Mill and FALLS training led to task-specific improvements in walking adaptability; the greater improvement in walking speed might be explained by the greater amount of walking practice during C-Mill therapy.

A-10: MOTOR LEARNING OUTCOMES OF WHEELCHAIR PROPULSION DURING SPINAL CORD INJURY REHABILITATION AND IN EXPERIENCED USERS

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PURPOSE: 1. To describe the motor learning outcomes of wheelchair propulsion across 6 weeks of clinical spinal cord injury (SCI) rehabilitation 2. To compare those outcomes between persons at discharge from clinical rehabilitation and experienced community-dwelling wheelchairs users.

METHODS: 8 Individuals with a recent SCI performed a submaximal exercise test once-weekly across 6 weeks, starting at the beginning of active rehabilitation. Energy consumption and propulsion kinetics were recorded. In the first and the last week of the 6-week period, participants performed a peak graded exercise test and a 10-item wheelchair skill circuit. 15 experienced individuals with a SCI performed all above-mentioned tests on one occasion.

RESULTS: Mechanical efficiency (ME) ($6.4 \rightarrow 6.2\%$, $p=0.23$) and propulsion technique (push frequency $58 \rightarrow 56$ push/min, $p=0.84$; contact angle $71 \rightarrow 74^\circ$, $p=0.712$; positive work per push $8.3 \rightarrow 8.9$ J, $p=0.30$) did not change during the first 6 weeks of active SCI rehabilitation. Peak power output increased (38 W \rightarrow 45 W, $p=0.01$) between the first and the last week. Performance time on wheelchair circuit improved ($18.4 \rightarrow 16.6$ s, $p=0.01$) and ability score showed a borderline increase ($8.4 \rightarrow 8.9$, $p=0.09$).

No difference in propulsion technique was found between the recent SCI at discharge and experienced group (respectively, push frequency 56 vs. 50 push/min, $p=0.57$; contact angle 74 vs 78° , $p=0.57$; positive work 8.9 vs 9.6 J, $p=0.65$). ME was higher in the recent SCI group (6.1 vs 5.1% , $p=0.03$). Peak power output (45 vs 59 W, $p=0.11$), ability score (8.9 vs 9.6 , $p=0.06$) and performance time did not differ between the groups (16.6 vs 15.3 s, $p=0.12$).

CONCLUSION: Recent SCI group did not improve ME and propulsion technique across 6 weeks of active rehabilitation but exhibited an improvement in the peak capacity and wheelchair skill. Between groups comparison provided surprising results as the only significant difference showed higher ME in the recent SCI group.

A-11: ARE INDIVIDUALS WITH UNILATERAL TRANSTIBIAL AMPUTATION ABLE TO ADAPT TO AN ACUTE PROSTHETIC INTERVENTION?

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PURPOSE: Individuals with a unilateral trans-tibial amputation (UTA) are known to minimise internal extension moments at the residual knee during running, in order to reduce discomfort in the residuum and reduce in-socket torques. When a running specific prosthesis (RSP) is altered or replaced, e.g. varying its stiffness, it is unknown whether individuals with UTA can quickly adapt to the perturbation, modulating moments at the residual knee in order to protect the residuum, or if such adaptations require an extended accommodation period. The purpose of this study was to investigate acute adaptations to a change in RSP stiffness in individuals with UTA.

METHODS: Optical motion capture and force data were recorded while eight male participants ran at their self-determined, normal running speed using their prescribed RSP (NORM; all; Blade XT, Blatchford, Basingstoke, UK) and also immediately after it was replaced with both stiffer (STIFF) and more compliant (COMP) RSPs (+/- one spring category, respectively). A 17 segment model (head, torso, pelvis, thighs, shanks & intact foot, with the RSP modelled as nine linked rigid segments) was constructed within Visual3D (C-Motion, MD, USA). Running speed, peak residual knee flexion and peak residual knee extension moment were compared between conditions.

RESULTS: There was no significant difference in running speed (NORM 3.49 (0.35) m/s; STIFF 3.53 (0.33) m/s; COMP 3.56 (0.36) m/s, $p = 0.41$), residual knee flexion (NORM 33 (2)°; STIFF 33 (9)°; COMP 31 (8)°, $p = 0.86$) or residual knee extension moment (NORM 1.50 (0.84) N.m/kg; STIFF 1.55 (0.87) N.m/kg; COMP 1.62 (0.90) N.m/kg, $p = 0.45$).

CONCLUSIONS: Individuals with UTA, who run using an RSP, are able to adapt immediately to an alteration in the RSP stiffness in order to minimise moments at the residual knee, and thus potentially minimise torques at the residuum/socket interface. This is achieved without a reduction in running speed or change in residual knee flexion.

A-12: PROPULSION BIOMECHANICS DURING WHEELCHAIR TURNING MANOEUVERS IN YOUNG ABLE-BODIED MEN AND WOMEN

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PURPOSE: The purpose of this study was to characterize push characteristics and force requirements of left (TL) and right (TR) turnings compared with straight-line (SL) propulsion in men and women.

METHOD: Twenty able-bodied subjects (10 men; 10 women, 26 ± 5 yrs, 1.68 ± 0.07 m, 64.2 ± 8.4 kg) received a 12-min familiarization trial of multiple turns around a rectangular course. Subsequently, they performed three tasks in a random order: SL, TR and TL. A Smart^{wheel} was mounted at the right wheel of a standard wheelchair to measure forces and timing parameters of the inner hand during TR or the outer hand during TL. A repeated measure analysis of variance was used to detect the difference across tasks and groups ($P < 0.05$).

RESULTS: In the turning manoeuvres, adjustments were made in the approach, turning and depart phase. Overall speed of TR and TL was lower compared with SL. Turning for both men and women was accomplished by a deceleration initiated in the approach phase, accompanied by an increasing braking force of the inner hand (11.2 times higher compared with SL) and a higher push frequency of the outer hand during the turning phase and then increasing peak force and torque during the depart phase (1.5 times higher than the turning phase). Men were faster than women in SL (0.98 ± 0.17 m/s vs. 0.72 ± 0.14 m/s), as well as in the approach phase of TR (0.78 ± 0.11 m/s vs. 0.65 ± 0.13 m/s) and depart phase of TL (0.69 ± 0.07 m/s vs. 0.59 ± 0.10 m/s). Peak force in men was greater than women in SL, TR and TL. Men showed a higher braking force in the turning phase and a higher peak force and torque in the depart phase, 1.5 and 1.6 times higher.

CONCLUSIONS: The present study is the first to address the biomechanics of turning manoeuvres in wheelchair propulsion, identifying an asymmetric turning strategy for both men and women. Men are faster and demonstrate higher peak forces throughout all sections, with higher braking forces when turning.

Session 4: Motor Skill Acquisition

A-13: THE EFFECTIVENESS OF VIDEO GAME-BASED BALANCE TRAINING IN CHILDREN WITH CEREBRAL PALSY

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PURPOSE: To determine whether 6 weeks home-based video game-based balance training (VGBT) is effective to improve gait stability and standing balance in children with cerebral palsy (CP).

METHODS: Preliminary data of our registered trial (NTR6034) is presented. Eight children with CP (8-16 years old) were included if they had: bilateral spastic CP, GMFCS level II, no surgery <12 months, and no Botulinum-Toxin A injections <6 months. VGBT comprised 6 weeks home-based X-box One Kinect (Microsoft) training. Kinect sports games (tennis, football, bowling) were used 5x/week, 30min/session. Time played was monitored. Pre and post VGBT, participants performed unperturbed treadmill walking trials at self-selected speed. Total body (Plug-In-Gait) kinematics were collected via a 10-camera Vicon system at 120Hz. For gait stability, medio-lateral Margins of Stability (MoS) was calculated as the position of the extrapolated center of mass (XCoM) relative to the lateral malleolus of the leading foot. High MoS indicates more stable gait. Variability of MoS (sdMoS) was determined (high variability indicates less stable gait). Standing balance was assessed with Pediatric Balance Scale (PBS); a 14-item measure concerning everyday tasks (on 56 points; high PBS indicates good balance).

RESULTS: Only sdMoS improved significantly post VGBT ([Mean±SD] pre sdMoS 2.6±1.2cm versus post sdMoS 2.0±0.7, $p=0.030$). MoS and PBS did not change significantly post VGBT (pre MoS 17.8±2.8cm versus post MoS 18.5±4.3, $p=0.401$; pre PBS 49.1±5.4 points versus post PBS 50.6±3.5, $p=0.673$).

CONCLUSION: Preliminary results indicate that VGBT did not induce improvements on PBS in children with CP. On the other hand, sdMoS did improve significantly after VGBT in the current population. These findings may indicate that PBS is less sensitive to training-induced changes or that training-induced sdMoS improvements are not clinically relevant.

A-14: HANDRAIL HOLDING ON A SPLIT-BELT TREADMILL REDUCES LOCOMOTOR LEARNING

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PURPOSE: The purpose of this study was to determine whether and how handrail holding in split-belt treadmill gait influences locomotor learning. A common split-belt adaptation paradigm (*in which a treadmill with two belts forces gait asymmetry upon participants, to which participants adapt, followed by after-effects upon return to symmetric belt speeds*) was used to study locomotor learning.

METHODS: Participants were (HANDRAIL; N=10), or were not (CONTROL; N=10) instructed to hold the handrails on the lateral sides of the treadmill. Both groups participated in the same protocol of 5 min fast tied-belt baseline (1.5 ms⁻¹), 5 min slow tied-belt baseline (0.5 ms⁻¹), 10 minutes split-belt adaptation (1.5:0.5 ms⁻¹), and 5 minutes slow tied-belt deadadaptation (0.5 ms⁻¹). Gait symmetry parameters (*in which a value of 0 indicates perfect gait symmetry*) were extracted from forceplate recordings. Adaptation and deadadaptation curves were compared to determine differences in locomotor learning.

RESULTS: Gait was symmetric (0) for both groups during fast and slow baseline. Gait asymmetry increased after initial exposure to split-belt gait, but significantly less so in HANDRAIL (-0.3) compared to CONTROL (-0.6). Furthermore, HANDRAIL showed little after-effects (0.05) in deadadaptation, indicative of a lack of adaptation, whereas CONTROL showed larger after-effects (0.2).

DISCUSSION: Handrail holding reduces locomotor learning, as indicated by a lack of after-effects. This is likely due to a reduced challenge for dynamic balance, as the initial perturbation was lower and gait more symmetric overall in HANDRAIL than CONTROL. Handrail holding in populations without severe balance problems should be reconsidered to improve locomotor learning, and possibly be replaced by other safety precautions, such as a body harness, to guarantee participant safety.

A-15: TRAINING MOVEMENTS FOR DISTINCT ELECTROMYOGRAM PATTERNS USING SERIOUS GAMING

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PURPOSE: The purpose of this study was to investigate if a serious game, Myobox, could be used to train participants to generate distinct electromyography (EMG) patterns for use in EMG-controlled assistive devices such as upper-limb prostheses.

METHODS: Participants were fitted with 8 electrodes around their forearm and performed 5 training sessions lasting 30 minutes on 5 consecutive days, playing Myobox for 20 minutes. Myobox is controlled using a direct mapping from electrode orientation to avatar movement in a 2-dimensional space. Players explored different hand and wrist movements in order to learn which movements caused the avatar to move in the desired direction. A successful control of the game indicated that the player had found 8 movements resulting in distinct EMG patterns. After each game session, EMG data from each movement were used to train a machine learning system, used to classify the participant's movements. The participant was then tested by asking him/her to reproduce the movements without the game's feedback. Expected outcomes were an increase in the percentage of correct movements classified, an increase in EMG pattern separability measured as the average Mahalanobis distance between each pattern and all of its neighbours in the EMG feature space and a decrease in game score.

RESULTS: 13 Able-bodied participants (mean age 21.3ys, 6 females) participated. Mean percentage of correct movements increased from 56% to 73% ($p < .0001$). Mean pattern separability increased from 20.73 to 28.62 ($p = .004$). Mean game score decreased from 98680 to 19356 ($p = .002$).

CONCLUSIONS: A serious game can be used to train participants to find the movement set that provides the most distinct EMG patterns. The game seems to be a promising training tool for this purpose. However, it remains to be seen if such training improves performance of people using an EMG-controlled assistive device.

A-16: INTENSIVE WHEELED MOBILITY WORKSHOPS FOR PHYSIOTHERAPISTS AND OCCUPATIONAL THERAPISTS - A LESSON TO BE LEARNED

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PURPOSE: To evaluate the impact of providing intensive large-group training on wheeled mobility self-efficacy and skill capacity among clinicians

METHODS: Two instructors provided a total of 4 hours of wheelchair skills training to 8 groups of 15-20 clinicians, including a brief lecture, instruction, demonstration, and hands-on practice. Main outcome measures included perceived Self Efficacy in Wheeled Mobility (SEWM, score range 0-40), perceived Self-Efficacy in teaching wheeled-mobility (score range 0-24), and the modified Test of Wheeled Mobility (TOWM) ability score (range 0-8). Satisfactory survey post-workshop (score range 0-5) and Narrative reports were also collected

RESULTS: 106 clinicians (out of 130) completed the measures. Mean \pm SD of TOWM ability score was 5.34 ± 1.7 . Mean \pm SD of SEWM score was 31.08 ± 4.7 . Results showed a significant difference between Pre and Post workshop perceived Self-Efficacy in teaching WM scores, $F(1, 81) = 42.97$, $P < 0.001$, partial $\eta^2 = 0.35$. The mean pre workshop score was 16.3, while the mean post workshop score was 19.3, reflecting a significant increase of 18%. Overall workshop satisfaction survey mean score was 4.6 ± 0.3 . Many important and applicable insights were learned from what the participants reported narratively.

CONCLUSION: Participants demonstrated improvements and acquired wheeled mobility advanced skills using short training session. This study provides evidence for using an intensive training format as an effective strategy to increase clinicians' confidence and wheeled mobility skills' ability, preparing them to place greater emphasis on, and achieve better success in training future clients.

Keynote Lecture 3: The future of rehabilitation: digital infrastructure empowers networks of patients and professionals

Dr Bert Mulder

In the coming years organisations and professionals in rehabilitation will be confronted with the urgency to change. The reason is found in the demographic development in many countries paired with the increasing use of digital solutions by patients and professionals. The presentation will outline specific digital developments as a necessary strategic development for rehabilitation. It does that by reporting the results of the Dutch Fast@Home project that aimed to create a digital rehabilitation environment in the patients' home to support patients faced with the necessity to take more responsibility for their own rehabilitation. The results of the project show an outline of a 'national digital architecture for rehabilitation' with the different functionalities that will contain and the standards that will be necessary to support it. Such an architecture would be the strategic context for all current and coming e-health and e-rehabilitation developments in many countries and require professionals to align their own developments.

Exercise, Thursday, December 13, 2018

Keynote Lecture 4: From guidelines to practice: the development and implementation of disability-specific exercise guidelines in rehabilitation and community settings

Dr Kathleen A. Martin Ginis

Among people with physical disabilities, one of the most frequently-cited barriers to physical activity participation is a lack of basic physical activity information. Likewise, rehabilitation, recreation and fitness specialists often cite a lack of knowledge about what to recommend or prescribe, as their primary reason for not promoting physical activity to clients with disabilities. The development and implementation of disability-specific physical activity guidelines are important steps toward addressing these barriers. Physical activity guidelines are systematically developed, evidence-based statements that provide age- and ability-specific information on the course of action required to maintain or improve fitness or health. This presentation will address the importance of disability-specific guidelines for rehabilitation and community settings. Using the Multiple Sclerosis Physical Activity Guidelines and the International Scientific Spinal Cord Injury Exercise Guidelines as examples, a systematic, evidence-based and community-engaged process for formulating guidelines will be shared. Finally, strategies will be discussed for translating and implementing physical activity guidelines into rehabilitation and community practices.

Session 5: Adapted Physical Activity

B-17: RE-AIM ANALYSIS OF A CANADIAN PEER MENTORING PROGRAM THAT PROMOTES PHYSICAL ACTIVITY

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PURPOSE: Participation in recreational activities for people with spinal cord injury (SCI) can lead to physical and psychosocial benefits. Peer mentoring (PM), typically described as a one-to-one interaction between a mentor and mentee, has been shown to help facilitate recreation participation. Although PM has the potential to engage people with SCI in recreational activities, no research has assessed the impact of this service beyond the individual level. Using the RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) framework, this study evaluated the impact of a Canadian SCI PM program at both the individual and organization level.

METHODS: Data from one provincial SCI organization in Canada was analyzed for this study. The organization provides PM services throughout its province and prioritizes the promotion and facilitation of recreation engagement. The executive director of the program completed a survey examining different elements of the PM program they offer. Measures of all five RE-AIM dimensions were included in the survey. Data were analyzed using summary statistics to describe peer mentorship at both the individual and organizational level.

RESULTS: For the 2016-2017 fiscal year, the PM program reached 4.16% of people living with SCI in the province where the service is offered. The effectiveness of the organization's PM program is tracked through testimonials, whereby increased involvement in recreation and parallel sport was reported as an outcome. The PM program has been in operation for 60 years and is offered in community and hospital settings. Currently, just 0.4% of the total operating budget is allocated towards implementing the service.

CONCLUSION: PM appears to be a financially feasible approach to engage individuals with SCI in recreation activities. A detailed assessment of how access to, and allocation of resources influence the reach and effectiveness of this service is needed.

B-18: INTERRATER AND INTRARATER RELIABILITY OF VENTILATORY THRESHOLDS DETERMINED IN PEOPLE WITH SPINAL CORD INJURY

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PURPOSE: Individual training regimes are often based on ventilatory thresholds (VTs). The purpose was to examine whether VTs could be determined in individuals with spinal cord injury (SCI) during arm crank ergometry, and to study the intra- and interrater reliability of VT1 and VT2 determination.

METHODS: Thirty individuals with tetraplegia (N=11) or paraplegia (N=19) performed an arm crank ergometry graded exercise test (GXT) with 1-minute increments. Two sports physicians assessed all 30 GXTs in a random, blinded sequence for both VTs twice. The power output (PO), heart rate (HR) and oxygen uptake (VO₂) at each VT were compared between the two repeated sessions and two raters using a paired samples t-test, intraclass correlation coefficient (ICC) and Bland Altman plots.

RESULTS: Of the 240 VTs to be assessed, 23 VTs could not be determined; 9% were VT1s and 91% were VT2s; 30% belonged to individuals with paraplegia, whereas 70% belonged to individuals with tetraplegia. For the successfully determined VTs, there were no systematic differences between sessions and raters. The intrarater and interrater ICCs for PO, HR, and VO₂ at each VT were high to very high (0.82 – 1.00). Bland Altman plots showed relatively small to wide 95% limits of agreement for intra- and interrater reliability, respectively.

CONCLUSIONS: The relative agreement for VTs that could be determined, was high to very high, although the absolute agreement varied. However, for some individuals with tetraplegia, determination of VT2 might be challenging. For those individuals, other training methods could be considered.

B-19: CARDIOVASCULAR RISK FACTORS AND LEISURE TIME PHYSICAL ACTIVITY AMONG OLDER ADULTS WITH SPINAL CORD INJURY

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PURPOSE: Cardiovascular disease is one of the leading causes of death in people with spinal cord injury (SCI). There is therefore a need to elucidate modifiable, lifestyle-related factors that could prevent this outcome, especially in older adults with long-term injury. In this population, overweight, hypertension, dyslipidemia and impaired fasting glucose are highly prevalent, and almost one third perform no leisure time physical activity (LTPA) at all (Jörgensen et al 2018, Jörgensen et al 2017). The purpose of this study was to describe the association between cardiovascular risk factors (i.e., body mass index (BMI), waist circumference (WC), blood pressure, blood glucose and blood lipids) and LTPA in older adults with long-term SCI.

METHODS: Data from the Swedish Aging with Spinal Cord Injury Study (SASCIS), including 123 participants (mean age 63 years, mean time since injury 24 years, injury levels C1-L5, American Spinal Injury Association Impairment Scale A-D). Data were collected through home interviews, assessments and blood samples. The Physical Activity Recall Assessment for People with Spinal Cord Injury was used to assess LTPA. Associations were investigated using multivariable linear regression analyses adjusted for age, gender, level and severity of injury, cause of injury and time since injury.

RESULTS: In the multivariable analyses, more minutes/day of moderate-to-heavy intensity LTPA were significantly associated with lower BMI (B=-0.04; p=0.001, adjusted R²=0.11) and lower WC (B=-0.09; p=0.012, adjusted R²=0.13). No other significant associations between the cardiovascular risk factors and LTPA were found.

CONCLUSIONS: Participation in LTPA is partly linked with better cardiovascular health in older adults with long-term SCI. Further studies are needed to establish the amount of LTPA needed to obtain positive health effects in this group and the directional causality of the associations.

B-20: ADAPTED PHYSICAL ACTIVITY AND FUNCTIONAL CAPACITY OF ADULTS WITH INTELLECTUAL DISABILITY OVER 40 YEARS-OLD

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The increase in the average life expectancy of persons with intellectual and developmental disabilities (IDD) led to the emergence of a new population group, the elderly with IDD, with new challenges in terms of support and intervention. The purpose of this article is to analyse the contribution of an adapted motor activity program (AMA) to the functional capacity, psychomotor and cognitive competences of 7 participants between 42 and 57 years-old (50.14 ± 5.43), with "mild or moderate" IDD attending a Centre of Occupational Activities of an institution in Lisbon. A Checklist of Motor Activity was elaborated and applied in three moments: baseline assessment (resulting from two evaluations prior to the beginning of the intervention), final and retention (one month after the ending of the program). Based on baseline scores and considering the characteristics of the participants, an AMA program for 3 months and with weekly sessions (50 minutes each) was established. Friedman's and Wilcoxon tests were used to analyse the differences between the three moments of evaluation. Results pointed out the benefits of the intervention at the functional level, with significant differences between the pre and post-program. Main differences (evolutions) were observed in physical and functional aptitude (e.g.: sit-up, strength conditioning, walking), and in balance. Benefits obtained in the application of this adapted physical program may be a possible response at the intervention level for this population subgroup. Implications for practice and research will be presented: individualized supports within person-centred programs, for a life with (more) quality, assessment of interventions effectiveness, and need for more research with larger samples and longitudinal analyses for the establishment of physical activity programs (exercise' frequency, intensity, quantity and duration) for this subgroup aiming an active ageing.

Session 6: ADL Implementation Guidelines

B-21: PHYSICAL ACTIVITY AMONG PEOPLE WITH SPINAL CORD INJURY: A COMPARISON BETWEEN THE NETHERLANDS AND CANADA

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PURPOSE: The purpose of this study is to compare participation in leisure time physical activities among Dutch and Canadian individuals with a spinal cord injury (SCI).

METHODS: This international comparative study used cross-sectional data from Dutch individuals with SCI (n=398) and Canadians with SCI (n=694). Leisure time physical activity was measured using a selection of items from the PASIPD and the PARA-SCI. Additional questions were included to collect information about the type of activities. Physical activity levels were reported in MET hrs/day.

RESULTS: In both countries, 50% of the participants reported no or low levels of leisure time physical activities (the Netherlands: <4.8 MET hrs/day; Canada: <0.1 MET hrs/day). Handcycling (59%) and resistance training (33%) were the most frequently reported types of activities in, respectively, the Netherlands and Canada. While preliminary results showed that leisure time physical activity levels tend to be higher among Dutch individuals with SCI compared to Canadians with SCI ($p < .001$), the results need to be interpreted with caution due to differences in terminology and questionnaires used in both countries.

DISCUSSION: In this study, a unique dataset is created including information on leisure time physical activity of more than 1000 individuals with SCI in the Netherlands and Canada. The study highlights challenges and opportunities related to international comparative studies on physical activity levels among SCI. International collaborations are needed to standardize terminology and measurements for sport, leisure time physical activities and daily physical activities used in SCI research and to create an international SCI dataset on sport and physical activities. The findings of this international comparative study may provide new directions for optimizing strategies to promote leisure time physical activities among people with SCI.

B-22: A PARTICIPANT-LED PHYSICAL ACTIVITY PROGRAMME FOR DISABLED PEOPLE WHO ARE READY TO BECOME PHYSICALLY ACTIVE

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BACKGROUND: Despite physical and psychosocial benefits of participating in regular physical activity, disabled people are amongst the most inactive people in the community. To successfully increase physical activity participation in disabled people it is crucial that people have the intention to become physically active. Therefore intenders are the ideal target for physical activity promotion interventions.

PURPOSE: Main objective of this study was to evaluate a 30 week participant-led physical activity programme for disabled intenders. Second objective was to explore the positive and negative experiences of disabled people during the process of becoming physically active.

METHODS: A mixed method design using focus groups and questionnaires. Thematic analysis was used to analyse data from focus groups. Friedman tests were used to determine differences in physical activity, sitting time and self-efficacy in week 1, week 12 and week 30. Post hoc tests were performed using Wilcoxon tests.

RESULTS: 15 participants completed the PA programme, showing significant decreases in sedentary time and increases in PA levels and self-efficacy. Action planning and coping strategies helped participants to become and maintain their activity levels.

DISCUSSION: Physical activity programmes for inactive disabled people should start with reducing sitting time before improving physical activity and focus more on 'every active minute helps'. Finally action plans were useful tools to become physically active.

B-23: DEVELOPMENT AND VALIDATION OF PHYSICAL ACTIVITY PRACTICE GUIDES FOR AMPUTEES

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PURPOSE: The purpose of this study was to develop and validate physical activity (PA) practice guides for amputees in Portuguese language.

METHODS: literature searches' where conducted. Search 1 – PA literature directed to disabled persons, search 2 and 3 – PA and amputation. An analysis of existing practice guides was performed (grid comparison of guides and evidence from search 2/3) and produce a draft of the PA guide content and design. Submission to an expert panel was conducted for product validation, experts included 2 MD (sport medicine, fisiatrics), 2 physical therapists (amputee specialist), 3 sport and PA college professors and 2 amputee (both sexes, congenital, traumatic, lower and upper limb, 1 paralimpic athlete). Experts request: 1) analyze if the PA guide provided knowledge about PA and disability to promote PA practice in amputee. 2) verify the accuracy and clarity of the information, the practicality and accuracy of the exercises and exercise plans, the design and binding choices (clear and adjusted to the population, easy handling for upper limb amputee).

RESULTS: literature search resulted in 40 documents (manuals, guides, flyers, web-pages, etc.), 2 in Portuguese language. An initial draft was produced thru grid comparison. Draft structure: general PA information, general information on amputation, specific information, exercise suggestions, strategies to exercise, plans and PA suggestions. Submission to expert panel resulted in 3 rounds (1- content analysis, 2/3 - content and design analysis). A consensus was reached. Final structure: introduction, PA (general and population specific information), exercises (strategies to exercise and exercise suggestions), plans and suggestions of PA.

DISCUSSION/CONCLUSIONS: The expert panel determined the PA guide accurate and served the purpose to inform and promote PA in amputees. Content, form and effect validity will be the object of further studies on a larger group of target population.

B-24: LONGITUDINAL ASSOCIATIONS BETWEEN ACTIVITY PACING, FATIGUE, AND PHYSICAL ACTIVITY IN ADULTS WITH MULTIPLE SCLEROSIS

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PURPOSE: The purpose of this study was to evaluate how activity pacing relates to physical activity and health-related quality of life over a one year period in a sample of adults with multiple sclerosis.

METHODS: 68 adults with multiple sclerosis (mean age= 42 ± 11 years) filled in questionnaires on their active engagement in pacing decisions and perceived difficulty in preventing overactivity (5-point Activity Pacing and 2-point Risk of Overactivity Questionnaire), fatigue (7-point Fatigue Severity Scale), physical activity (adapted Short Questionnaire to Assess Health-Enhancing Physical Activity) and health-related quality of life (RAND-12 Health Survey) post rehabilitation and at one year follow up, as part of the Rehabilitation, Sports and Active lifestyle study (a nationwide multi-centre program aimed at stimulating and promoting an active lifestyle in rehabilitation in the Netherlands). Multilevel modelling was used to analyse the associations between activity pacing, fatigue, physical activity and health-related quality of life.

RESULTS: No associations were found between activity pacing and physical activity ($\beta = -0.21$; $p > 0.05$), and between activity pacing and health-related quality of life ($\beta = -0.10$; $p > 0.05$) at long-term. Fatigue was negatively related to health-related quality of life ($\beta = -0.35$; $p < 0.001$). Perceived risk of overactivity moderated the association between fatigue and health-related quality of life ($\beta = -0.13$; $p = 0.039$).

CONCLUSIONS: These findings suggest that persons who experience decreases in health-related quality of life with increased fatigue, are more likely to be engaging in 'overactive' behaviour. The lack of associations between activity pacing and physical activity, and between activity pacing and health-related quality of life suggests there is no clear strategy among persons with MS that is successful in improving physical activity and quality of life either in short or long-term when no interventions are introduced.

Keynote Lecture 5: The changing landscape of cardiac rehabilitation, from early mobilization and reduced mortality to chronic multi-morbidity management

Prof John Buckley

In the 18th century it was reported by William Heberden to the Royal College of Physicians, London, that sawing wood for 30 minutes per day helped relieve a man of his angina. Similar reports recommending exercise followed in the 19th century but then all went quiet until the late 1940s, where bed rest had become the prime recommendation for people with atheromatic heart disease. In the 1950s Hellerstein invented the modern cardiac rehabilitation programme based around early mobilisation and exercise to prevent neuromotor decline from bed rest and accelerate patients' return to work. In the 1970s and 80s the psychosocial benefits of post-MI rehabilitation added to the success story. By the end of the 1980s there were enough controlled clinical trials to demonstrate a reduction in premature mortality for heart patients who took up exercise. However, in the 1990s, advances in aggressive medical and emergency management of heart disease contributed to a sharp decline in premature mortality following heart disease and by the new millennium the effect of exercise started to be challenged. In current cardiac rehabilitation settings patients are now older, with multiple morbidities and there is now a new challenge to manage these longer surviving patients as a group with chronic disability. This talk aims to cover key details and implications for the future of delivering the exercise component of cardiac rehabilitation.

Session 7: Clinical Exercise Physiology

B-25: HOT BATHS: AN EFFECTIVE SUPPLEMENT TO EXERCISE IN DISABILITY?

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Body temperature elevations are crucial to induce increases in markers associated with the health benefits of exercise. In support, anecdotal, historical and epidemiological evidence advocates the health benefits of alternative interventions resulting in passive body temperature elevations, such as sauna or hot water immersion (HWI) therapy. This may be particularly relevant for populations with restricted ability to be physically active.

PURPOSE: Here we present findings of four studies investigating HWI in both able-bodied individuals (AB) and individuals with cervical spinal cord injury (CSCI), with a focus on its impact on inflammation and glycaemic control. **METHODS:** All studies employed HWI protocols that increase body temperature by 1–2°C by passively immersing participants in hot water for 1 hour.

RESULTS: An acute bout of HWI blunts the postprandial peak glucose concentration after HWI when compared with the postprandial response following exercise matched for body temperature elevation. Further, the acute inflammatory response to HWI, evidenced by elevations in interleukin-6 and interleukin-1ra, does not differ between AB and CSCI. This contrasts with the blunted inflammatory response to exercise in CSCI. Finally, a two-week chronic intervention of repeated daily HWI decreases resting plasma heat shock protein, blood glucose and insulin concentrations.

CONCLUSIONS/OUTLOOK: Our experimental data show that HWI leads to beneficial inflammatory and glycaemic responses that can match, and for some markers even exceed, the responses found following exercise. Although the effect of chronic HWI therapy has yet to be confirmed in populations with disability, HWI may hence represent an attractive alternative and/or supplement to exercise for populations whose ability to be active is restricted.

B-26: PEAK OXYGEN UPTAKE IN DIFFERENT UPPER-BODY EXERCISE MODES - A META-ANALYSIS

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PURPOSE: To investigate differences in peak oxygen uptake (VO_{2peak}) between the arm crank ergometry (ACE), wheelchair ergometry (WERG) and wheelchair treadmill (WTR) mode.

METHODS: PubMed, CINAHL and SPORTDiscusTM were systematically searched in January 2018 using a Boolean search string. Study titles were first screened, after which eligible abstracts and thereafter full-text articles were read. Studies comparing VO_{2peak} between ≥ 2 of the modes (ACE, WERG, WTR) were included. A meta-analysis was performed with the random-effects approach of DerSimonian and Laird by pooling the differences in VO_{2peak} between upper-body exercise modes.

RESULTS: 872 studies were screened, of which 9 studies that compared VO_{2peak} between the ACE and the WERG mode in 199 participants, and 4 studies that compared VO_{2peak} between the WERG and the WTR in 42 participants, were included. No significant difference in absolute or body-mass normalized VO_{2peak} between testing in the ACE or WERG mode was found (overall effect \pm 95% CI: $0.001 \pm 0.03 L \cdot min^{-1}$ and $0.2 \pm 0.9 ml \cdot kg^{-1} \cdot min^{-1}$, $p > 0.95$). Body-mass normalized VO_{2peak} was significantly lower in the ACE compared to the WTR mode ($-2.7 \pm 1.3 ml \cdot kg^{-1} \cdot min^{-1}$, $p < 0.001$), although no significant difference was found for absolute VO_{2peak} ($-0.04 \pm 0.12 L \cdot min^{-1}$, $p = 0.51$). Only one study compared body-mass normalized VO_{2peak} between the WERG and the WTR mode in 13 participants and found no significant differences.

CONCLUSIONS: The similar VO_{2peak} found in ACE and WERG indicates that differences between the synchronous and asynchronous propulsion, respectively, and possible differences in trunk involvement do not seem to influence VO_{2peak} . Therefore, both ACE and WERG might be used interchangeably to test VO_{2peak} . Whether differences in VO_{2peak} exist between ACE and WTR remains unclear due to the limited amount of studies that compared VO_{2peak} in these two modes.

B-27: DIFFERENCES IN EXERCISE EFFECTS FROM STATIC VERSUS DYNAMIC STANDING IN NON-AMBULATORY CHILDREN WITH CEREBRAL PALSY

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PURPOSE: To compare the metabolic adaptive effects to four months of two types of structured training regimes, static standing (StS) versus dynamic standing (DyS), on cardiopulmonary and metabolic parameters among non-ambulatory children with cerebral palsy (Na-CP).

METHODS: Eighteen Na-CP participated in an exercise intervention study with a crossover design, comparing four months of StS to four months of DyS. During StS, the Na-CP were encouraged to exercise according to standard care recommendations in Sweden including daily supported StS for 30-90 minutes. During DyS, daily exercise for at least 30 minutes at a speed between 30 to 50 rpm in an Innowalk (Made for movement, Norway) was recommended.

We assessed adaptive effects from the exercise programs through indirect calorimetry during 30 minutes of StS and DyS. Exercise test to evaluate StS was performed in a standing frame and to evaluate DyS using an Innowalk (Made for movement, Norway). An airtight mask covering the mouth and nose was worn in order to measure breath-by-breath VO_2 , VCO_2 and VE (Oxycon Mobile, Jaeger, Germany). Heart rate was recorded continuously throughout the test (Polar T1, Polar, Finland).

As many of the variables were linearly correlated, we used robust Principal Component Analysis (rPCA) to determine the components carrying most information. A multidimensional Shapiro-Wilk test indicates that the data can be well described as being multivariate normal distributed, allowing the use of a Hotelling T^2 test.

RESULTS: In a multidimensional statistical analysis of metabolic exercise effects, oxygen consumption, carbon dioxide production, and ventilation were concluded to carry most information and additionally, seen to be statistically different between StS and DyS revealing a p-value for the two groups having different means of 4.6×10^{-5} .

CONCLUSION: A highly statically significant difference was found in the metabolic adaptation, described as VO_2 , VCO_2 and VE, to StS versus DyS.

B-28: EFFECT OF RESPIRATORY MUSCLE TRAINING ON EXERCISE CAPACITY AND RESPIRATORY MECHANICS IN ATHLETES WITH TETRAPLEGIA

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PURPOSE: To examine whether six weeks combined inspiratory and expiratory respiratory muscle training (RMT) improves peak exercise capacity and respiratory mechanics during sub-maximal exercise in wheelchair rugby athletes with tetraplegia.

METHODS: Six athletes (5M/1F, 33 ± 5 years) were assessed for maximal, sub-maximal and field-based exercise performance pre and post six-week pressure-threshold RMT, and again following six-weeks of no RMT. During each testing session, athletes first completed a ramped arm-ergometer exercise test to exhaustion for the determination of peak work rate and peak oxygen uptake. Following a 30 minute break, athletes completed a sub-maximal arm-ergometer test at 20, 40, 60, and 80% of peak work rate. Inspiratory capacity maneuvers were performed in the final minute of each stage to determine end-expiratory lung volume (EELV) and calculate end-inspiratory lung volume (EILV). Breath-by-breath cardiopulmonary indices were recorded throughout both exercise tests. On a separate day, athletes were assessed for time to complete a field-based 20x20 metre repeated sprint test.

RESULTS: Following RMT, there were increases in peak work rate (69 ± 22 post vs. 60 ± 20 W pre, $p=0.03$), oxygen uptake (20.3 ± 5.9 vs. 17.6 ± 5.0 mL/kg/min, $p=0.04$), and minute ventilation (54 ± 18 vs. 46 ± 12 L/min, $p=0.03$). Dynamic hyperinflation was present during all tests as evidenced by an increase in EELV with increasing exercise intensity; however, during post-RMT testing both EELV and EILV were significantly lower than pre-RMT throughout exercise ($p<0.05$). At follow-up, no indices were different from post-RMT. Field-based repeat sprint performance was unchanged by RMT.

DISCUSSION: RMT enhances exercise capacity in athletes with tetraplegia. Whether this is due to an increased peak ventilation or the circulatory benefits of an enhanced respiratory muscle pump, lower operating lung volumes, and/or an attenuation of the respiratory muscle metaboreflex remains to be determined.

Session 8: Measurement during daily life

B-29: ACTIVITY AND MOBILITY USING TECHNOLOGY (AMOUNT) REHABILITATION TRIAL- DESCRIPTION OF COMMUNITY PHASE INTERVENTION

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PURPOSE: To describe technology use and physiotherapy support provided to participants to improve mobility and physical activity in the community phase of the AMOUNT trial.

METHODS: Process evaluation including participants (mean age 70 (SD18)) randomised to the intervention group ($n=149$). Intervention was additional to standard rehabilitation, prescribed using a protocol which matched games/exercises from eight technologies to the participant's mobility limitations. Technologies included video and

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computer games/exercises, tablet applications and activity monitors. Participants were taught to use the technologies during inpatient rehabilitation and were then discharged home to use the technologies ≥ 5 days a week for the remainder of the 6-month trial. Trial protocol required the physiotherapist to provide support every 1–2 weeks using a health coaching approach. Intervention datasheets were audited to determine technology use and frequency, duration, mode and type of support provided.

RESULTS: Participants used an average of 2 (SD 1) technologies with 98% participants using an activity monitor. Physiotherapists had contact with participants on average 15 (SD 5) times (approximately every 11 days), consisting of 6 (SD 3) home visits (46 min duration), 8 (SD 4) phone calls (8 min duration) and 1 other (email, video conference, hospital) type of contact. Contact primarily incorporated health coaching (68%) with 8% for technology support. Topics discussed during health coaching included discussing data from prescribed technologies (79%), physical activity and mobility status (70%) and adherence (64%).

CONCLUSIONS: Technologies to support ongoing exercise are likely to become increasingly important as the proportion of older people in the population increases and rehabilitation resources become limited. A health coaching model to support technology use post hospitalisation is feasible. Some support can be provided remotely limiting the need for frequent home visits.

B-30: RECOVERY OF EXERCISE CAPACITY IN PEDIATRIC BURN PATIENTS: A PRELIMINARY INVESTIGATION

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PURPOSE: To systematically describe exercise capacity of pediatric burn patients over the initial six months post-discharge; and to examine whether exercise capacity at six months can be predicted from burn and/or sociodemographic characteristics, or prior assessment.

METHODS: Eligibility criteria for this prospective cohort study were age 6-18 years, admission to a Dutch burn center with burns covering $\geq 5\%$ of total body surface area (TBSA), and/or a length of stay of ≥ 2 weeks. Exercise capacity was measured at discharge, 6 weeks, 3 months, and 6 months post-discharge using the Steep Ramp Test (SRT). Outcomes were compared to data from healthy Dutch peers. Multilevel regression analyses were performed to determine the evolution of exercise capacity and to identify predictors of exercise capacity at six months.

RESULTS: Twenty-four pediatric patients with burns covering 0.1-34% TBSA were included. At group level, exercise capacity was low at discharge, improved significantly over time, but did not reach healthy reference values at six months post-discharge. At individual level, the evolution of exercise capacity varied widely and 48% of the participants scored more than one standard deviation below the healthy reference mean at six months post-discharge. SRT outcomes at discharge, six weeks, and three months explained 37%, 76%, and 93% of the variance in exercise capacity at six months, respectively.

CONCLUSIONS: Group level exercise capacity of pediatric burn patients improved significantly from discharge to six months post-discharge. However, 48% of the participants was found to be 'at risk' for deconditioning. Further research, including larger patient populations, is required to strengthen our preliminary conclusion that early application of the SRT can help to identify those individuals.

B-31: ECOLOGICAL MOMENTARY ASSESSMENT OF EXERCISE AND NEUROPATHIC PAIN EXPERIENCED BY MEN WITH SCI: PARTICIPANT PERCEPTIONS

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PURPOSE: A couple of laboratory-based studies have examined the effects of exercise on neuropathic pain (NP) in adults with spinal cord injury (SCI). However, pain levels observed within a laboratory may not be representative of what is experienced in the real-world. Ecological momentary assessment (EMA) can address this limitation by

assessing pain in real time, and within an individual's natural environment. Despite these advantages, EMA protocols have had limited use and development in SCI research. This study evaluated participants' perceptions of: a) their daily NP fluctuations, and b) the utility of EMA to assess their NP patterns.

METHODS: Six physically active men with chronic SCI participated in a 6-day Smartphone based EMA protocol assessing their NP from pre- to post-exercise and four other times throughout the day. This protocol was followed by a semi-structured exit interview. Qualitative and quantitative data were analyzed to provide a comprehensive overview of participants' perceptions of their NP and their perceived value of using EMA to map their NP patterns.

RESULTS: All 6 participants reported that exercise reduced their NP sensations. For some participants, the momentary measurement aspect of EMA increased their awareness of their NP in a negative manner. Conversely, increased awareness was beneficial for others as it made them critically think about the specific NP sensation being felt. Participants stated that the EMA protocol was not onerous and did not impede on daily life, which was supported by compliance rates to the EMA prompts (80.56%-113.89%; M=94.91).

CONCLUSIONS: Using EMA to gain an understanding of the temporal aspects of NP, and how NP changes following exercise, was perceived to be useful. Tracking NP patterns may have value for those who experience high levels of NP, or when engaging in new activities. Overall, EMA shows promise as a viable methodology to evaluate temporal aspects of NP in the SCI population.

B-32: ARE AMBULATORY PEOPLE WITH SPINAL CORD INJURY 'AT RISK' FOR INACTIVITY AFTER REHABILITATION?

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INTRODUCTION: Physical activity (PA) plays an important role in health and longevity. People with spinal cord injury (SCI) are known to have extremely low PA levels. Previously we found that PA in wheelchair-dependent people with SCI strongly declined after inpatient rehabilitation and remained extremely low (1,2). It is unknown whether people with SCI who can walk have similar unfavorable (changes in) PA.

OBJECTIVE: To study (changes in) PA during the first year after inpatient rehabilitation in ambulatory people with SCI.

METHODS: PA (walking, cycling, running and wheelchair-driving) was objectively measured with accelerometer-based activity monitors at three moments in time: before discharge of inpatient rehabilitation (T1), and at 6 (T2), and 12 (T3) months after discharge. PA was expressed in min/24 hours.

Patients: Data of 26 participants who successfully finished all three measurements was analyzed. Mean (SD) age was 56.1 (14.9) years, 15 were male, 15 had tetraplegia, and all participants had a motor incomplete lesion.

RESULTS: PA increased significantly over time ($p = 0.032$); mean (SD) at T1 was 89 (6), T2 105 (9), T3 110 (11) min/24hours.

DISCUSSION AND CONCLUSIONS: On average, (changes in) PA levels were more favorable than found previously in wheelchair-dependent people with SCI. Nevertheless, variation between persons was large and several people had extremely low PA.

Clinical message: These preliminary results suggest that as a group ambulatory people with SCI are less at risk of inactivity than people who are wheelchair-dependent. Future studies are necessary to determine ambulatory subgroups at risk.

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B-33: HIGH-INTENSITY INTERVAL TRAINING IN YOUTH WITH PHYSICAL DISABILITIES

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PURPOSE: To investigate the effects of high-intensity interval training (HIT) on physical fitness in youth with physical disabilities who 1) are able to run, 2) walk independently but are not able to run, and 3) propel a manual wheelchair.

METHODS: A total of 70 children and adolescents were recruited from schools for special education in the Netherlands (mean age 13.4±2.9, range 8-19 years, 56% boys). The sample consisted of 35 runners, 24 walkers, and 9 wheelchair users. They had various physical disabilities; cerebral palsy (41%), spina bifida (8%), other neuromuscular diseases (34%), musculoskeletal (4%), cardiovascular (4%) and metabolic diseases (9%). HIT was performed for eight weeks, twice a week, containing 8-12 interval of 30 seconds all-out exercises followed by active recovery. Anaerobic performance was measured by the Muscle Power Sprint Test, agility with the 10x5 meter sprint test and a shuttle run/ride test (SRT) was performed to determine aerobic performance (shuttles) and VO₂peak.

RESULTS: Exercise attendance was 85%. Following HIT, anaerobic performance improved in both runners ($p=.011$) and walkers ($p=.020$), but not in wheelchair users ($p=.463$). Both agility and aerobic performance showed a significant training effect in all groups; runners ($p=.001$; $p<.001$), walkers ($p=.024$; $p=.006$) and wheelchair users ($p=.024$; $p=.012$). However, no changes were found for VO₂peak (ml/kg/min) in any of the subgroups.

CONCLUSION: Both anaerobic and aerobic performance improved in all subgroups after HIT, except for anaerobic performance in wheelchair users. No effects were found for VO₂peak. For clinical practice, 30 seconds all-out intervals are feasible and safe in youth with physical disabilities. Future research should focus on wheelchair users specifically. To improve VO₂peak short-term, we suggest for future research to increase training frequency to three times a week and/or increase time per interval (i.e. training volume).

Keynote Lecture 6: Big data, big buzzwords, and big challenges

Prof Andreas Daffertshofer

According to Wikipedia “big data is a term used to refer to data sets that are too large or complex for traditional data-processing application software to adequately deal with”. This ‘definition’ appears vague in many respects: what is ‘too large or complex’ what is ‘traditional data-processing’ and what is meant by ‘adequately’? Admittedly, the progress in acquisition, transfer, and storage is leading to an overabundance of data. Not only the size of data sets but their heterogeneity calls for reformulating protocols in statistics. Simple general linear models are not suitable for assessing the plethora of a single patient’s clinical data, supplemented by his/her daily life activity recorded through a mobile phone application or home-based sensors. Combining this with the data of ten to some power other patients will not simplify the search for communalities or statistically relevant contrasts. When glancing at the recent literature, it appears that machine learning and especially deep learning is the solution for everything – whether or not machine learning falls in the category of ‘traditional’ data-processing is a good question. Already some 75 years ago, Alan Turing used machine learning to crack the enigma. Around the same time Kolmogorov and Smirnov formulated their test scheme for normality, just twenty years after Fisher formalized the analysis of variance and some 30 odd years after William Sealy Gosset introduced the t-statistic. The history aside, there is no doubt that machine learning can be very useful for data mining. As will be shown, deep learning can help to classify (pathological) movement patterns, gradient-boosted decision trees can identify features in kinematics that potentially predict freezing in gait in Parkinson’s, just to name a few examples. These successes, however, deserve a warning. High tech must not come with low mind. Machine learning, if bluntly applied, hardly deepens our (mechanistic) understanding of (statistical) relationships in the data.

Sports, Friday, December 14, 2018

Keynote Lecture 7: Paralympic research: past, present, future

Prof Walter R Thompson

The 1996 Atlanta Paralympic Games are noteworthy for many reasons. Although the Games were held in the same city beginning in 1988 for the Summer Games (Seoul) and 1992 for the Winter Games (Albertville), the “one bid, one city” agreement between the International Olympic Committee (IOC) and the International Paralympic Committee (IPC) was not signed until 2001. The IOC-IPC agreement guaranteed that the Paralympic Games and the Olympic Games would be held in the same city and it was the obligation of the host city to organize the Paralympic Games. In 1996 there were still two Local Organizing Committees (LOC) with the Games separated by just two weeks. The IPC games-time research program prior to 1996 was not well organized. In 1996 there were 14 research proposals for data collection during the Games (29 researchers). For the first time in the short history of the IPC, the LOC appointed a local research coordinator who would work with and liaison between the IPC, the LOC, venue managers, competition managers, teams, and researchers. The local research coordinator became an important part of the IPC research team. It would not be until more lessons were learned in the 1998 Winter Games (Nagano), the 2000 Summer Games (Sydney), and the 2002 Winter Games (Salt Lake City) and a separation of the IPC Sports Science Committee from the IPC Medical Committee that the 2004 Summer Games (Athens) included a highly coordinated research program. Beginning in 2004, researchers aspiring to collect data at any IPC sanctioned event, including the Paralympic Games, must contact the IPC and participate in a rigorous application process. If approved, researchers receive appropriate credentials allowing them to collect data. The IPC Sports Science Committee was responsible from 2004 until 2018 (PyeongChang) to review research applications, to work with research scientists to enable data collection during the Games, and to ensure that research projects were published in high impact scientific journals. In 2018 the terms of office of the IPC Sport Science Committee ended as did the Sports Science Committee. The IPC is initiating a new science and research strategy focusing on Classification, Athlete Health & Well Being, Athlete Sports Science Support, Social Legacy, Adaptive Equipment as priorities. This keynote will review the history of the Paralympic research program, the impact of research on athletes, and the future of IPC research initiatives.

Session: 9: Technological Performance Enhancement

C-34: KINEMATICS, KINETICS AND MUSCULAR ACTIVITY OF 15-S ALL-OUT HANDCYCLING EXERCISE IN ABLE-BODIED PARTICIPANTS

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PURPOSE: The aim of this study was to examine the biomechanics of handcycling during the course of a 15-s all-out sprint test in able-bodied participants.

METHODS: Twelve able-bodied competitive triathletes performed a 15-s all-out sprint test in a recumbent racing handcycle that was attached to an ergometer. During the sprint test, tangential crank kinetics, 3D joint kinematics and muscular activity of ten muscles of the upper extremity and trunk [M. trapezius (TD); M. pectoralis major (PM); M. deltoideus, Pars clavicularis (DA); M. deltoideus, Pars spinalis (DP); M. biceps brachii (BB); M. triceps brachii (TB); forearm flexors (FC); forearm extensors (EC); M. latissimus dorsi (LD) and M. rectus abdominis (RA)] were examined using surface electromyography (sEMG) and motion capturing. Muscular activity was assessed by muscular effort (iEMG), onset, offset and range of activation (RoA). Variables were examined with respect to crank position and used to determine the maximum, minimum and range within crank cycle. Parameters were compared between revolution one (R1), revolution two (R2), the average of revolution three to thirteen (R3) and the average of the remaining revolutions (R4).

RESULTS: Whereas the crank torque demonstrated a decrease during the course of the sprint test, cadence rather increased. Shoulder abduction and internal-rotation increased, whereas maximal retroversion was decreased during the course of the sprint. DA, PM, DA, BB and RA demonstrated an increase in iEMG. The onset of muscular activation occurred earlier in crank cycle for PM, DA, BB, TB and RA. RoA increased for PM, DP, BB, TB and LD.

CONCLUSIONS: The study demonstrates that kinematics, kinetics and muscular activation of all-out handcycling exercise are altered during the course of a 15-s sprint test. The most notable alterations occurred in shoulder kinematics and the activation of DA that is spanned across. There is need to pay particular attention on the condition of the shoulder region.

C-35: ANALYSIS OF GROUND REACTION FORCES BY FOREARM CRUTCHES DURING INSTEP KICK IN AMPUTEE FOOTBALL

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PURPOSE: The purpose of this study was to compare the difference in ground reaction forces (GRF) generated by forearm crutches during instep kick of amputee football players between experienced players and beginners.

METHODS: 12 collegiate students without amputation of their leg participated in this study as the subjects simulated amputee. They were composed of 6 experienced players (height: 170.9 ± 3.4 cm, weight: 66.6 ± 9.9 kg, experience period: 1.8 ± 1.1 years) and 6 beginners (height: 170.0 ± 2.1 cm, weight: 62.8 ± 7.2 kg). They performed a maximal instep kick by using crutches instead of the support leg. The peak vertical components of GRF (vGRF; superior: +) and anteroposterior components of GRF (apGRF; posterior: +) in the kicking leg side (KLS) and the non-kicking leg side (NKLS) generated by crutches were collected by eight force plates.

RESULTS: In the experienced players, the peak vGRF of NKLS (8.2 ± 1.0 N/kg) was larger than that of KLS (7.1 ± 1.2 N/kg; $p < 0.05$), and the peak apGRF of NKLS (2.7 ± 0.5 N/kg) was larger than that of KLS (1.0 ± 0.4 N/kg; $p < 0.05$). In the beginners, the peak vGRF of NKLS (6.7 ± 1.3 N/kg) was larger than that of KLS (5.0 ± 1.8 N/kg; $p < 0.05$), and the peak apGRF of NKLS (1.3 ± 0.6 N/kg) was larger than that of KLS (0.7 ± 0.3 N/kg; $p < 0.05$). The GRF of experienced players in terms of all analyzed items were greater than those of beginners ($p < 0.05$).

DISCUSSION and CONCLUSION: In amputee football, two crutches replace the support leg, particularly the crutch in NKLS which is the same side of support leg is required similar roles. Because amputee football players also approached the ball from an angle to the direction of ball flight, the vGRF and apGRF were larger in NKLS in both groups. Additionally, vGRF and apGRF of experienced players were greater than those of beginners. In conclusion, generating larger vGRF and apGRF, especially in NKLS, is important to improve the skills of instep kick in amputee football.

C-36: HOW DO WHEELCHAIR COURT SPORTS COMPARE REGARDING WHEELCHAIR MOBILITY PERFORMANCE?

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PURPOSE: Given the impairment of the athletes in wheelchair sports, a lot of individual factors need to be taken into account in optimizing performance, but only limited information of wheelchair performance is available. Better insight in the resemblances and differences between sports could pinpoint to what extent performance knowledge across sports could be utilized, or when sport specific knowledge is required.

METHODS: To quantify performance across sports, the wheelchair mobility performance monitor (WMPM) was used to measure 29 basketball athletes, 32 rugby athletes and 15 tennis athletes of national and international level during match play.

RESULTS: As hypothesized based on sport characteristics, wheelchair basketball athletes show the best wheelchair mobility performance (WMP) outcomes and wheelchair rugby the lowest, whereas wheelchair tennis athletes range in-between for most outcomes.

CONCLUSIONS: Based on the well quantified WMP profiles, the WMPM could be used to support in individual performance perfection, but also for optimizing wheelchair design and sport referral in the rehabilitation process. Future research, with large scale data collection could be used to obtain more detailed performance profiles, differentiated by classification, competition level or field position. Furthermore, the WMPM allows for calculation and representation of a wide variety of kinematic outcomes, with tailor-made representation.

Keywords: *Wheelchair mobility performance - Wheelchair characteristics - Wheelchair basketball – Wheelchair tennis – Wheelchair rugby – Paralympic sport.*

C-37: THE NEED FOR PARA-CYCLING CLASSIFICATION RESEARCH

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PURPOSE: The para-cycling classification system is mostly based on expert opinion rather than on scientific evidence. In a valid classification system, one would expect demonstrable differences in performance between different sport classes. The aim of this study was to determine the differences in race performance between para-cycling classes at the latest major international competitions.

METHODS: We used results from the men's C1-C5 (C1 most impaired) time trial races at the 2016 Paralympic games in Rio de Janeiro and the 2017 UCI World Championships in Pietermaritzburg (PMB) as performance measures. Distances in Rio were 20 KM for C1-C2 and 30 KM for C3-C5; in PMB 23.3 KM for C1-C3 and 31 KM for C4-C5. Average race speed was calculated from official race time results. The race speeds of the gold medalist of each class were compared and Kruskal-Wallis tests used to compare the race speeds of the fastest 10 athletes of all classes.

RESULTS: Overall median race speed was 41.8 km/hr (interquartile range:40.2-43.6). The difference in race speed between gold medalists was smallest between C1-C2 with C2 only 0.3 km/hr faster in Rio and 0.06 km/hr slower in PMB; and largest between C2-C3, with C3 3.6 km/hr faster in Rio and 3.3 km/hr in PMB. Race speeds of the fastest 10 athletes were not significantly different ($p>0.05$) at both events between C1-C2, C3-C4, and C4-C5; with the smallest median difference between C3-C4 of 1.0 km/hr in Rio and 0.8 km/hr in PMB. Only differences between C2-C3 were significant with C3 median race speed 2.5 km/hr faster in Rio ($p=0.02$) and 1.8 km/hr ($p=0.02$) in PMB.

CONCLUSIONS: Performance between athletes in the C2 and C3 classes were significantly different while differences between all other consecutive classes were only small. Moreover, there was almost no difference in average race speeds of gold medalists in C1 and C2. These results stress the need for para-cycling classification research and an evidence-based classification system.

Session 10: Physical Performance Enhancement

C-38: PERIOD PREVALENCE AND POINT PREVALENCE OF SPORTS-RELATED INJURIES AND ILLNESSES IN SWEDISH PARALYMPIC ATHLETES

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PURPOSE: To describe among Paralympic athletes the 1-year retrospective period prevalence of severe sports-related injuries and illnesses (SRIIPS) and point prevalence of SRIIPS, and to examine possible differences in prevalence proportions of SRIIPS, between athletes with different demographics, and characteristics related to their behavior, impairment, pain and sport.

METHODS: A total of 104 Paralympic athletes responded to a questionnaire with questions about period prevalence of severe SRIIPS, point prevalence of SRIIPS, and athlete characteristics. Differences in prevalence proportions were analysed with chi-square statistics.

RESULTS: In summary, 31% (95% CI 23-40) reported a severe injury, 32% (95% CI 24-41) a current injury, 14% (95% CI 9-23) reported a severe illness and 14% (95% CI 8-22) a current illness. More severe injuries ($p<.05$) were reported by athletes that were 18-25 years, not using an assistive device, having pain during training, using analgesics, continuing training when injured and feeling guilt when missing exercise. Athletes that reported a previous severe injury, having pain in daily life and during training, using NSAID and being upset when unable to exercise, had higher point prevalence of injuries ($p<.05$). Athletes below age 30 years reported more severe illnesses ($p<.05$). Being female, previous severe illness, using prescribed medications and feeling anxious/depressed were associated with more present illnesses ($p<.05$).

CONCLUSIONS: Paralympic athletes, in particular of younger age, reported a fairly high prevalence of SRIIPS. Also, mental aspects as well as pain and use of medication seem to play a role in the occurrence of SRIIPS. This indicates that the existence of associated factors for SRIIPS is complex and calls for a broad biopsychosocial approach when developing preventive measures. Further large prospective studies are needed to identify risk factors and causations to provide stronger evidence for prevention.

C-39: EFFECT OF RESPIRATORY MUSCLE TRAINING ON PULMONARY AND CARDIOVASCULAR FUNCTION IN ATHLETES WITH TETRAPLEGIA

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PURPOSE: To investigate the pulmonary and cardiovascular response to six weeks combined inspiratory and expiratory respiratory muscle training (RMT) in elite wheelchair rugby athletes with tetraplegia.

METHODS: Seven athletes (6M/1F, 33±4 years) completed two sessions of 30 repetitions pressure threshold RMT, five days per week, for six weeks. At pre-RMT, post-RMT and six-week follow-up athletes were assessed for resting pulmonary (lung volumes, spirometry, maximum inspiratory and expiratory mouth pressure) and cardiovascular function (two-dimensional echocardiography, hemodynamics), as well as the cardiovascular response to 45 degree head-up tilt. The initial pressure threshold was set at 60% of pre-RMT maximal inspiratory (PImax) and expiratory (PEmax) mouth pressure. By the end of the intervention the absolute inspiratory resistance had increased from -45±7 to -64±8 cmH₂O and expiratory resistance from 34±6 to 43±11 cmH₂O. Adherence to the RMT program was 98±3%.

RESULTS: Following RMT, PImax significantly increased from -83±24 to -109±23 cmH₂O, and subsequently decreased to -100±9cmH₂O following washout (all p<0.05). PEmax was also significantly higher following RMT (74±29 vs 60±24 cmH₂O, p=0.004); At follow-up PEmax (71±25 cmH₂O) was not significantly different compared to post-RMT (p>0.05). Although lung volumes were unaffected by RMT, peak expiratory flow was higher post-RMT vs. pre-RMT (7.54±1.57 vs. 6.88±1.43 L/s, p=0.013). Hemodynamic and cardiac indices were not different between time-points in either the supine or tilted position. However at all time-points tilt elicited a reduction in end-diastolic volume and stroke volume (all p<0.02).

DISCUSSION: RMT is a feasible intervention for athletes with tetraplegia that enhances the strength of respiratory muscles and expiratory flow rates. The benefits of RMT are partially maintained following six weeks cessation of RMT.

C-40: ONABOTULINUMTOXIN A INJECTION FOR NEUROGENIC DETRUSOR OVERACTIVITY AND UPPER BODY EXERCISE PERFORMANCE IN WHEELCHAIR ATHLETES

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INTRODUCTION: Most patients with a suprasacral spinal cord injury (SCI) suffer from neurogenic detrusor overactivity (NDO), which can lead to renal damage or even death. Anticholinergic medication is the standard treatment of NDO. However, in a significant number of patients, this medication is not sufficient or leads to intolerable side effects. A therapeutic alternative is the injection of onabotulinumtoxin A into the detrusor. Although this injection seems to be effective and safe for the treatment of NDO, it is still unclear, if there exist some systemic side effects, which might influence exercise performance. The aim of this case study was to investigate, whether an onabotulinumtoxin A injection reduces exercise performance in a wheelchair basketball player.

METHODS: A wheelchair basketball player with NDO performed a Wingate test before as well as 10 days after the onabotulinumtoxin A injection. Additionally, a female handcyclist served as control and performed the same exercise testing without intervention two weeks apart.

RESULTS: The injection showed no negative effects in the wheelchair basketball player. Peak power was 4.6 W/kg (pre) vs. 4.7W/kg (post), average power 2.6 W/kg vs. 2.9 W/kg and time to peak 4.0s vs. 4.0s, whereas in the handcyclist who served as control a slight performance impairment was found. Peak power were 5.3W/kg (pre) vs. post 4.7W/kg (post), average power 3.9W/kg vs. 3.8 W/kg and time to peak 3.8s vs. 4.6s.

CONCLUSIONS: An onabotulinumtoxin A injection to treat NDO in a wheelchair basketball player did not lead to performance decreasing effects. However, further data to prove this single case finding are needed. Before a prove of concept can be made and to be on the safe side, we recommend to schedule onabotulinumtoxin A injections at least six weeks before important competitions.

C-41: THE INFLAMMATORY RESPONSE TO EXERCISE IN SPINAL CORD INJURED INDIVIDUALS-THE INFLUENCE OF AUTONOMIC FUNCTION

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The acute inflammatory response to exercise is attenuated in individuals with a cervical spinal cord injury (SCI), possibly related to autonomic dysfunction, resulting in an impaired sympathetic innervation below the lesion.

PURPOSE: This study investigates the influence of autonomic function on the acute inflammatory response to endurance exercise in people with SCI using exercise-induced as well as resting measures of autonomic function.

METHODS: Seventeen wheelchair athletes with a cervical SCI (CSCI, N=7) and without a cervical SCI (NON-CSCI, N=10) participated in a wheelchair half-marathon. Blood was taken prior, post and 1 h post-race to determine serum concentrations of adrenaline and noradrenaline as measures of autonomic function and interleukin-6 (IL-6) as a measure of the inflammatory response to exercise. Supine blood pressure and heart rate variability were measured to assess autonomic function at rest.

RESULTS: CSCI showed a lower ratio of the low and high frequency power of the variability in RR intervals (LF/HF RRI, $p=0.038$) and low frequency power of the systolic blood pressure variability (LF SBP, $p=0.005$) compared to NON-CSCI. Following the race, catecholamine concentrations increased only in NON-CSCI ($p<0.036$). The increase in IL-6 post-race was larger in NON-CSCI ($p=0.040$). Post-race catecholamine levels explained 60% of the variance in the IL-6 response ($r=0.77$, $p=0.040$), which was further increased when LF/HF RRI and LF SBP were added to the regression model ($R^2=81\%$, $p=0.012$).

CONCLUSIONS: Post-exercise plasma catecholamine concentrations and the autonomic function measures at rest revealed impaired autonomic function in CSCI, which was strongly associated with the attenuated IL-6 response to exercise in this group. Therefore, the autonomic dysfunction present in individuals with a cervical SCI may make exercise less effective in preventing chronic low-grade inflammation in this population.

Keynote Lecture 8: Promoting active living for disabled adults: Some modest suggestions

Prof Brett Smith

This talk will focus on different ways to promote active living for disabled adults. It will also offer some critical thoughts about the promotion of sport and physical activity. First, the value of narrative as a way to promote active lifestyles is discussed. Evidence is presented as to why narratives matter and connections are made to physical activity, para-sport, social activism, and social media. The dangers of narrative are also highlighted with reference to exercise as medicine. A second way to promote physical activity via infographics is then attended to. Commissioned by Public Health England, and supporting the UK Chief Medical Officers' physical activity guidelines, the first evidence-based and co-produced infographic to communicate physical activity recommendations for a range of experiences of disability are presented. Learning from the infographic co-production process with over 350 disabled adults, 10 user-led organisations, and 50 health professionals is shared. Last, key messengers of physical activity and sport for health promotion is discussed. It is highlighted that social workers are a neglected yet highly valued and trusted group of messengers among disabled adults. Evidence-based and co-produced guidance for social workers to promote active living are offered. Throughout the talk the dangers of ableism and disablism in physical activity and sport research, rehabilitation practices, and health promotion are highlighted. Some modest suggestions for challenging ableism and disablism are also proposed.

Session 11: Recreational Sports

C-42: UNDERSTANDING THE TRANSITION INTO ELITE DISABILITY SPORT

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PURPOSE: Researching transitions in sport can provide important insights into how athletes experience significant change. Little is known about the transition from participatory disability sport into the intensities of Paralympic

training and competition. This study adopted a qualitative design to explore the perceived transition experiences of disabled athletes en route to elite status.

METHODS: We recruited 6 disabled athletes (3 female, 3 male) who had recently entered into an elite development programme. Within the sample, a variety of sports (e.g. boccia; rowing; canoeing; archery; track athletics; dressage) were represented, as well as various acquired and congenital disabilities. Participants engaged in prospective semi-structured interviews on two separate occasions; at the start of the project (early transition) and 9 months later (mid-transition). More than 10 hours of interview data was transcribed verbatim and subject to an interpretive thematic analysis.

RESULTS: Preliminary findings suggest that the period of transitioning into disability sport demanded significant psychological resource. This was particularly the case for “fast track athletes”; those who quickly achieved great success despite minimal experience in the event. The transition was helped by factors such as organisational support, sport psychology and learning from fellow athletes across different events. Athletes also cited their own focus and determination as a valuable commodity.

CONCLUSIONS: Disabled athletes transitioning into elite Paralympic sport should be supported to manage the psychosocial demands associated with this change in lifestyle. Support efforts should be tailored to suit individual circumstances, with priority afforded to athletes without previous experience of elite sport and/or those athletes who experience accelerated success.

C-43: SCAPULA CLUSTER AND MULTYBODY OPTIMIZATION FOR SCAPULAR TRACKING DURING WHEELCHAIR OVERHEAD SPORTS

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PURPOSE: Manual wheelchair (MWC) overhead activities are likely to cause shoulder injuries (Heyward et al., 2017). To understand their mechanisms, shoulder kinematics assessment is critical, but soft tissue artefacts around the scapula make it difficult. The scapula locator (SL) is a non-invasive reference tool for anatomical landmarks tracking (Van Andel et al., 2009). However, it is operated manually on movements of restricted volume and velocity. Technical cluster (TC) on the scapular spine combined with multi-body kinematics optimisation (MKO) is an alternate method for scapula tracking during any type of movement. Specific evaluation of this method for MWC propulsion, basketball shoot, and tennis serve, is required before its use on shoulder injury prevention.

METHODS: 8 participants, with various levels of disabilities, performed a set of MWC propulsions on a ergometer, and simulated basketball shoots and tennis serves. Simultaneously, a SL was held by an experimenter on 3 anatomical landmarks of the scapula. Location of reflective markers of the trunk, upper limbs, TC, and SL were recorded by a motion capture system.

Thorax and scapula anatomical frames were built according to ISB recommendations (Wu, et al. 2005). Then, the scapula orientation was computed either from the TC, or the SL. Cardan angles with an y-x'-z" sequence was chosen. In combination to TC, a custom closed-chain model extended from (Seth et al. 2016) was used with MKO to avoid bone penetration, joint dislocation, and to minimize soft-tissue artefacts.

RESULTS: Preliminary results on scapular kinematics from TC without MKO showed peak scapula misorientation of 5°, 9° and 12° during propulsion, basketball shoot, and tennis serve, respectively. Average misorientation angles affected mostly lateral/medial rotation.

CONCLUSION: MKO with personalized clavicle length and a thorax ellipsoid surface contact is expected to reduce errors which would be beneficial, especially for overhead movements.

C-44: OXYGEN SATURATION PROFILE OF PARTICIPANTS OF THE 2017 BRAZILIAN SCHOLARSHIP PARALYMPIC GAMES

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PURPOSE: Pulse oximetry is one of the most common forms of monitoring in the critical care setting. Through a finger oximeter, it is possible to verify the presence of hypoxemia. The objective of this study was to verify the Heart Rate (HR) and the hemoglobin oxygen saturation (StO₂) in athletes participating in the 2017 Brazilian Scholarship Paralympic Games.

METHODS Participated in the study 49 male athletes of the CP Football (n=30) and Boccia Sports (n=19). The physiological variables heart rate (HR) and the hemoglobin oxygen saturation (StO₂) were measured at rest.

RESULTS: CP Football athletes presented 94.7±7.2 and 84.3±14.8 for %StO₂ and HR (bpm) respectively. On the other hand, to Boccia athletes was found values of 82.1±22.0 and 81.2±29.6 for %StO₂ and HR(bpm). Paralympic athletes, especially those with Cerebral Palsy (CP) can experience lower physical fitness levels which could undergo to oxygen desaturation. A possible explanation for this is that oxygen desaturation would be related to the VO₂max and the physical level of the athletes (MIYACHI, 1999).

CONCLUSIONS: In conclusion, athletes with CP has presented lower levels of StO₂. Because it is a pioneering study in the area of Paralympic sport with athletes who present impairments (Cerebral Palsy and others), we realize the need for a special attention in their level of blood saturation, since the lack of oxygen in the blood can have relations to a training of high intensity that will lead to hyperventilation done wrong or inadequate.

Keywords: Disability. Oxygen Saturation of Hemoglobin. Heart rate. Cerebral Palsy.

C-45: SPORTS PARTICIPATION, PHYSICAL ACTIVITY AND HEALTH-RELATED FITNESS IN YOUTH WITH CHRONIC DISEASES OR PHYSICAL DISABILITIES

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Youth with chronic diseases and/or physical disabilities (CDPD) often show reduced fitness and physical activity (PA) levels and participate less in organized sports compared to healthy peers. The purpose of this study was to examine the associations between participation in sports and health-related fitness and PA in youth with CDPD. A total of 163 participants (mean age 14; range 8-19 years) with CDPD were included in this cross-sectional study, with 81 participating in organized sports and 82 not. Participants were recruited between October 2014 and November 2016 in the Netherlands. Aerobic and anaerobic fitness, agility and muscle strength were assessed in the lab while PA was monitored in daily life using accelerometry during one week. Linear regression analyses were used to assess the associations of sports participation (independent variable) with health-related fitness and PA (dependent variables). Results show that youth with CDPD participating in organized sports two times a week performed better on all outcome measures. They reached a higher peak oxygen uptake (difference of 4.9 ml O₂/kg/min, P=0.001) compared to their peers not participating in sports. Also, anaerobic fitness, agility, muscle strength and PA were all positively associated with sports participation. Moreover, the association between sports participation and aerobic fitness was mediated by PA for 31% (P=0.045). In conclusion, participation in sports is associated with both higher levels of PA and health-related fitness in youth with CDPD. Promotion and stimulation of participation in sports seems a good way to promote health-related fitness as well as a healthy active lifestyle in youth with CDPD.

Keywords: Pediatrics, Exercise, Health, Sport

Keynote Lecture 9: Athlete's perspective

Esther Vergeer

For almost her whole career, wheelchair tennis player Esther Vergeer remained undefeated. Esther won 470 consecutive singles matches, which made her one of the most successful athletes in Dutch sport history.

REHABILITATION: MOBILITY, EXERCISE & SPORTS

She started her sport career as a wheelchair basketball player in the mid-nineties, made it to the Dutch national team, and surged to victory in the European championship with her teammates in 1997. Having already played wheelchair tennis at a high level during that period, a couple of months later she chose tennis as her number one sport. Not only did she win the US Open, but also the Dutch Open and the Swiss Open. Then, she became the world number one and spent 668 weeks in that position.

Apart from all her singles victories, Esther celebrated several wins playing doubles: the first singles and doubles wins that resulted in gold medals at the Paralympics followed in 2000 (Sydney). She showed her supremacy again the first few years after the Paralympics. The last time she faced defeat was in 2003, where after she triumphed in all her matches. This brought her five more gold medals at the Paralympics. Winning the last gold medal, during the London 2012 Paralympics, turned out to be her last match in singles tennis.

On February 12 2013, Esther, who was awarded the Laureus World Sports Award in 2002 and 2008, ended her impressive career. In December 2016, she was awarded with the Fanny Blankers-Koen Career Award, an award for the biggest Dutch sports heroes.

Esther Vergeer is one of the greatest Dutch athletes of all time. For years, she was the unquestioned number one female wheelchair tennis player in the world. At the moment, Esther is the tournament director of the ABN AMRO World Wheelchair Tennis Tournament in Rotterdam. Alongside Richard Krajicek, she is responsible for the organization of the wheelchair tennis tournament and integrating it with the ATP 500 tournament of Rotterdam. Furthermore, she is a NOC*NSF advisor for the Dutch Paralympic team. As a mentor for talented Paralympic athletes and deputy Chef de Mission, she promoted the development of sports for disabled athletes before, during and after the 2016 Games in Rio de Janeiro. Esther was the Chef de Mission of Paralympic Team NL during the Games in PyeongChang.

Esther is the founder of the Esther Vergeer Foundation. Since 2004, the foundation introduces children with a disability to sports and its positive effects. As a figurehead of the foundation, she is closely involved with all the activities by the Esther Vergeer Foundation.

Esther: “We try to inspire, motivate and encourage the children to be pro-active. The focus of our activities is on the fun side of sports, not on the disability of the young athlete. Sports strengthens your health, self-reliance and self-confidence and provides opportunities for them; the kids can join in and get a chance for a future.”

Esther Vergeer speaks openly and honestly about being a top athlete with a disability. Her stories about dealing with setbacks and her perseverance are impressive. Motivation, sincerity and enthusiasm are the key components of her speeches. Esther talks about her career on the tennis court and gives insights into her current life.

Poster Presentations

Poster session 1

EVEN ABSTRACT ID NUMBERS

THURSDAY DECEMBER 13, 11.45-12.30

Poster session 2

ODD ABSTRACT ID NUMBERS

FRIDAY DECEMBER 14, 11.45-12.30

P2: PSYCHOSOCIAL CORRELATES OF PHYSICAL ACTIVITY OF STUDENTS WITH INTELLECTUAL DISABILITY

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Physical activity is recognized as a relevant marker of cardiovascular health. Nevertheless, studies reported that many young people, especially those with intellectual disability are not active enough to benefit their health. Recently in Portugal, the need to know more about physical activity engagement and effects on populations with disabilities has emerged, especially since the special education law was declared in 2008, stating that all children should be in regular schools with the same opportunities. Portuguese educational setting is facing new challenges such as the design, implementation and monitoring of appropriate intervention for these students. It is necessary to have a broader overview about what contents and skills should be taught and enhanced, providing instructions on physical activity or sport-related health benefits and special physical education programs and/or school sports. So far little is known about the factors related to physical activity participation in different contexts among children and adolescents with intellectual disability. Therefore, our study aimed to analyze and compare the psychosocial correlates of physical activity of 60 children and adolescents (with and without intellectual disability), between 10 and 16 years, within regular schools trying to determine the factors that influence this engagement. Findings point out the inexistence of differences between groups in scholar sport, attitudes towards physical and physical education, as also in health/competence perception and task/ego orientation. Significant differences were found in parent's physical activity and with peers, organized and non/organized physical activity, and physical activity frequency. There are scarce studies in this area and therefore, the emphasis should be on studying and looking for solutions and strategies to enable all children to access to physical activity in and out of school.

P4: DESIGNING AN APP-BASED PLATFORM TO PROMOTE ACTIVITY-BASED THERAPY ADHERENCE FOR SPINAL CORD INJURY

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PURPOSE: To design a dynamic and user-friendly smart device app to be used by service providers, clinicians and clients to promote adherence to personalised activity-based programs.

METHOD: In conjunction with neurorehabilitation specialists (*Making Strides*, Burleigh, Australia), app development enterprise (*App Factory*, Gold Coast, Australia), and Griffith University (*Spinal Injury Project*), a secure mobile app and web portal were developed for iPhone and Android platforms. The mobile app manages client data (personalised activity-based programs), and the web portal provides raw data access for practitioners, researchers and administrators. The app and associated web portal were developed using an iterative design approach with focus groups, alpha and beta testing involving four staff from *Making Strides*.

RESULTS: The Spinal Injury Project Rehabilitation (SIPR) mobile app contains a catalogue of activity-based exercises produced by neurorehabilitation specialists for clients to access and perform. Sets, repetitions, time, and/or weights and emotional status can be recorded and the client's progress displayed graphically in summary and individually for each exercise. Motivational push notifications are sent as reminders or when clients have achieved their targets. A web portal provides practitioners and researchers access to the raw data for each client in order to evaluate adherence and progress with client data maintained with high security including one-way encrypted passwords, email authentication, and PIN app login. Program can be re-evaluated and updated when necessary.

CONCLUSION: The SIPR mobile app enables rehabilitation service providers, clinicians and the researchers with a means to constantly monitor client participation and compliance with prescribed activity-based programs. Importantly, it provides early warning indications when clients are not participating to enable support professionals to intervene with clients to help maintain participation.

P5: CLASSIFICATION OF ARM COORDINATION IMPAIRMENT IN WHEELCHAIR RUGBY

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PURPOSE: Classification of athletes with coordination impairment in wheelchair rugby (WR) is based on expert opinion and activity observation. The aim of the current study is to develop impairment tests for arm coordination.

METHODS: Forty-three WR athletes with a health condition causing coordination impairment, who had no strength impairment in the arms, and 20 volunteers without impairments participated. They performed two validated tests for arm coordination impairment: the finger-nose test (FNT) and the spiral test (ST). In addition, they performed novel Repetitive Movement Tests (RMT) for five movement levels in the arms: shoulder flexion-extension (RMS), elbow flexion-extension (RME), forearm pro-supination (RMQ), wrist flexion-extension (RMW) and finger flexion-extension (RMF). Participants had to perform as many repetitions possible in 20 s. Arm scores (AS) were based on expert opinion of WR classifiers. Spearman-rank correlation coefficients (SCC) were calculated for AS and FNT, ST, and all RMT, with a cut-off value for moderate-high correlation of 0.40. Test scores for each test were plotted in relation to AS. To determine minimum eligibility (ME) criteria, the mean scores ± 2 SD in participants without impairment were used as cut-off score for FNT, ST and RMT. Test performance was calculated for each test.

RESULTS: SCC were: FNT-AS 0.00, ST-AS 0.50, RMS-AS 0.31 and 0.40-0.53 for all other RMT. No clear borders between AS were observed in any of the tests. Test performance for ME ranged from 90% to 100%.

CONCLUSIONS: Based on the correlations with AS, ST and all RMT and test performance, all RMT, except for RMS can be used to determine ME for coordination impairment of the arms in WR. However, it is not possible to define categories of arm coordination impairment based on the current results. Assessment of the relationship between arm coordination impairment and sport specific activities is needed to determine categories in arm coordination impairment.

P6: DESIGNING ACCESSIBLE EDUCATIONAL RESOURCES FOR PEOPLE WITH SPINAL CORD INJURY

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PURPOSE: To identify themes of interest for the production of educational resources for people with spinal cord injury (SCI).

METHODS: A mixed methods exploratory survey of individuals (n=6) with SCI (level of injury: C4-L3; time since injury: 1.5-12 years; age: 39-66 years) was undertaken to qualitatively (open questions) and quantitatively (Likert scale 1-5) identify themes of interest for the design and production of educational resources. Interviewees were surveyed regarding their goals for recovery and physical rehabilitation. They were also asked to rank and provide details regarding the following broad themes; *community resources & services*; *“your” injury*; *current research*; *maintaining health & wellbeing*; *equipment*; and *body physiology*.

RESULTS: Quantitative evaluation demonstrated that interviewees highly rank (Likert median: 5) all broad themes as important for the development of educational resources. Common detailed responses for each theme included the perceived need for the following information: *Community resources & services* – gym access; *“Your” injury* – details on specific injury-type; *current research* – realistic and in lay terms; *maintaining health & wellbeing* – mental and physical changes (fitness, infections, pain, and motivation); *body physiology* – details on specific injury-type. Regarding recovery goals, few interviewees found the information provided after their injury useful/relevant. Most interviewees were offered physical rehabilitation and/or physical rehabilitation advice, however, many had a poor perception of physical rehabilitation and stated that more could be done to enhance participation/experience with physical rehabilitation.

CONCLUSION: We have identified multiple areas of interest for the design and production of educational resources for those with spinal cord injury. Further insight has also been obtained regarding resources that may support and enhance recovery goals and participation in physical rehabilitation.

P7: ASSOCIATION BETWEEN CENTRAL SENSITIZATION AND LIFTING AND AEROBIC CAPACITY IN CHRONIC LOW BACK PAIN PATIENTS

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BACKGROUND: Central Sensitization (CS) may occur in patients with Chronic Low Back Pain (CLBP). CS reflects changes in pain processing pathways of CNS and may explain magnified, widespread, and persistent pain perception. CLBP is negatively associated with functional capacity. The association of CLBP with lifting capacity has been extensively studied, but with aerobic capacity has been moderately explained and results are contradictory. Additionally, it is unknown whether CS is related to either or both lifting and aerobic capacity.

OBJECTIVES: To analyze the relationship between CS, and lifting and aerobic capacity in patients with CLBP. To analyze immediate and 24hr pain response to maximal aerobic capacity test in patients with CLBP.

METHODS: Cross-sectional observational study where CS, lifting and aerobic capacity were correspondingly measured with Central Sensitization Inventory (CSI), standardized maximal lifting test, and maximal Cardiopulmonary Exercise Test (CPET). Pain response to CPET was measured with Pain Response Questionnaire (PRQ). Statistical analyses included: 1) stepwise-forward multiple regression for lifting and aerobic capacity (dependent), CSI (independent), and physical, work-and disability-related characteristics (covariates); 2) paired t-test for pain response comparing PRQ-1 to PRQ-2 and PRQ-3.

PROVISIONAL RESULTS: Data collection is ongoing. Currently data of 23 patients are collected, but 40 are anticipated for the presentation in December. Higher CSI was associated with lower performance in both capacity tests; however, associations were not significant in the present final models. The models included patient's physical characteristics, and explained 25% and 72% of model's variance for lifting and aerobic capacity respectively.

Immediate pain response decreased in the low back whereas it increased in the legs, the extent of the effects were at present small and medium respectively. 24hr pain response revealed no significant differences.

P8: VENTILATORY THRESHOLD ASSESSMENT IN CARDIOPULMONARY EXERCISE TEST RESULTS OF PEOPLE AFTER STROKE

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PURPOSE: Assessment of ventilatory threshold (VT) in people after stroke could provide valuable information for daily life participation, since VT identifies the workload below which activities can be sustained for a long period of time. This study aimed to give insight in the VT of people after stroke. The purpose was twofold: 1) to assess the inter- and intra-rater reliability of VT assessment by experienced assessors, 2) to report on VT values of sub-acute stroke patients in rehabilitation.

METHODS: 59 cardiopulmonary exercise tests (CPET) from sub-acute stroke patients (14F/44M, 59±11 years, 16±56 weeks since stroke) were selected from the Heliomare database. Tests were presented in a random order to two experienced sports-physicians, who independently determined VT by a combination of the V-slope method¹ and the ventilatory equivalents method, to assess inter-rater reliability. One physician repeated this sequence one week later to assess intra-rater reliability. Intra-class correlation coefficients (ICC) type 2,1 and standard error of measurement (SEM) were calculated to establish reliability for oxygen uptake values at VT (VO₂-VT). If a good reliability (ICC>0.8) was established, the average values of the experienced rater were presented to describe VO₂-VT in this cohort.

RESULTS: VT was determined by both raters in 55/59 tests. Inter- and intra-rater reliability of VO₂-VT determination were good (ICC 0.88 and 0.98, SEM 1.15 and 0.47 ml/kg/min resp.). Average VO₂-VT values were 9.4±2.5 ml/kg/min, corresponding to 43.1±8.5% of peak oxygen uptake.

CONCLUSION: The VT can be determined reliably for people after stroke from CPET data, by experienced raters. Relative VO₂-VT values in this cohort are comparable to those reported in other cohorts of people after stroke. However, both relative and absolute VO₂-VT are (very) low in comparison to the healthy population. This low VT could be limiting daily life functioning for people after stroke².

P9: DETERMINANTS OF PHYSICAL ACTIVITY IN WHEELCHAIR USERS WITH SPINAL CORD INJURY AND LOWER LIMB AMPUTATION

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PURPOSE: The aim of this study was to gain insight into determinants of physical activity behavior in wheelchair users with spinal cord injury or lower limb amputation, from the perspective of both wheelchair users and professionals. Insight in these determinants is crucial for the development of future lifestyle interventions.

METHODS: With the use of a semi-structured question guide, seven focus group discussions were conducted with 37 participants: five with wheelchair users (N=26, mean age of 56.3 ± 8.7 yrs), and two with professionals (N=11). Audio recordings were transcribed verbatim. Open, axial and selective coding was performed. The reported determinants of physical activity behavior were categorized using the physical activity for people with a disability (PAD) model, which distinguishes personal and environmental determinants.

RESULTS: Personal determinants of physical activity were general health status, age, stage of life, problems with burning calories, time (in terms of scheduling), personal energy, balance in daily life, attitude and previous experiences with a healthy lifestyle. Reported environmental determinants of physical activity were guidance from professionals, accessibility of facilities, costs, transportation difficulties, equipment difficulties, and social support from family and friends.

CONCLUSIONS: Determinants of physical activity that might be influenced with interventions are: time (in terms of scheduling), personal energy, balance in daily life, attitude, guidance from professionals, accessibility of facilities (knowing how to find accessible facilities), and social support from family and friends. The combined insights of both professionals and wheelchair users may facilitate the development and effectiveness of tailored lifestyle programs for wheelchair users.

P10: THE EFFECT OF FORE-AFT CRANK POSITION ON THE BIOMECHANICS, COORDINATION AND PHYSIOLOGY OF RECUMBENT HANDCYCLING.

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Recumbent handcycles are used for different Paralympic sports and recreational competitions. These handcycles aim to benefit the athlete for an optimal athletic performance, yet little research has been done on how to individually configure the handcycle to the athlete. The objective of the current study was to investigate the effect of four different fore-aft crank positions relative to arm length on 1) the resulting elbow and shoulder angles, 2) the consequent propulsion kinematics and kinetics, and 3) the physiological responses.

Twelve able bodied male participants were tested on crank distances standardised at 94%, 97%, 100% and 103% of the participants' arm length, while performing two submaximal exercise tests in a recumbent handcycle attached to an ergometer (Cyclus2, 30 and 60 W, 3min, 70 rpm). The kinematics (Vicon) kinetics (Rotor instrumented crank) and physiological responses (Cortex) were continuously measured. A two-way repeated measures Anova (Fore-aft position and power output) was performed on 1) the resulting elbow angle and shoulder protraction during max extension. 2) the torque (Nm) during different stages of the cycle and the percentage of work done during the pull phase (%). 3) the mechanical efficiency, VO₂ (L/min) HR (beats/min). The manipulation relative to arm length ranged 5.5 to 8.5 cm between individuals. This resulted in significant kinematic changes in both the elbow flexion-extension and shoulder protraction. Consequently, a shift in the distribution of kinetic work production was observed over the propulsion cycle. Despite these changes in propulsion kinetics there were no significant changes in oxygen consumption. The kinetic variables indicated that a fore-aft position of 94% might have been most favourable, since this configuration resulted in the lowest percentage of work done in the pull phase and led to the most equal distribution of torque.

P11: THE ACUTE AND CHRONIC EFFECTS OF HOT WATER IMMERSION ON INFLAMMATION AND METABOLISM

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The acute inflammatory response induced by exercise is suggested to improve the inflammatory profile and insulin sensitivity. As elevations in body temperature partly mediate the acute inflammatory response to exercise, passive heating may be a viable tool to improve metabolic health in individuals with a restricted ability to be physically active. **PURPOSE:** To investigate the acute and chronic effects of hot water immersion (HWI) on inflammatory and metabolic markers.

METHODS: Ten able-bodied, overweight (BMI: 31.0±4.2 kg/m²) males were immersed in water set at 39°C for 1 h (IMM) and completed 1 h of seated rest at ambient temperature as a control condition (AMB). Venous blood was obtained prior to, immediately post and 2 h post-session for assessment of plasma concentrations of extracellular heat shock protein 72 (eHsp72), interleukin-6 (IL-6), nitrite, fasting glucose and insulin. Thereafter, participants underwent a 2-week intervention period (INT), consisting of 10 HWI sessions. Eight BMI-matched participants (BMI: 30.0±2.5 kg/m²) were included as control for the chronic arm of the study (CON).

RESULTS: Plasma IL-6 and nitrite concentrations were significantly higher immediately after IMM compared with AMB ($p<0.04$). Following the 2-week intervention period, the concentrations of fasting glucose ($p=0.04$), insulin ($p=0.04$) and eHsp72 ($p=0.03$) were significantly lowered in INT compared with CON.

CONCLUSION: A single HWI session induces an acute inflammatory response and increases nitric oxide bioavailability, which could both positively impact on glucose metabolism. Indeed, the reduction in fasting glucose and insulin concentrations following the intervention period suggests that HWI could serve as a tool to improve glucose metabolism; with the reduction in resting eHsp72 concentration possibly contributing to this finding. Therefore, this study provides strong rationale to further investigate the health promoting potential of HWI in populations with disability.

P12: IMMEDIATE EFFECTS OF WEARING A SOFT ANKLE BRACE ON PROPRIOCEPTION AND DYNAMIC POSTURAL CONTROL

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PURPOSE: The purpose of this study was to investigate the effect of ankle bracing on proprioception of the ankle and dynamic postural control in participants with chronic ankle instability (CAI). With this knowledge, current brace methods can be optimized and compliance towards the use of braces in athletes who are at risk for an ankle sprain can be improved.

METHODS: A cross-sectional observational study was conducted. Proprioception of the ankle and dynamic postural control were measured with and without a soft ankle brace in each participant in randomized order. Males and females with CAI aged 18-35 years were included in this study. Joint position sense (JPS) was measured with an Angle Reproduction Test on an isokinetic device for plantarflexion and inversion. Dynamic postural control was measured with the Y-balance Test™ (YBT). Paired t-tests were used to compare test results with and without ankle brace for both JPS and dynamic postural control.

RESULTS: When participants wore the ankle brace, JPS absolute error scores were significantly lower for plantar flexion ($p=0.03$), in comparison without ankle brace. No significant difference was found in JPS absolute error scores for inversion ($p=0.20$). The YBT normalized reach distances did not significantly differ when performed with or without brace ($p>0.50$).

CONCLUSION: Wearing a soft ankle brace has statistically significant, but small, effect on the JPS in plantar flexion of the chronically unstable ankle. Ankle bracing has no effect on JPS in inversion and dynamic postural control in participants with CAI. When advising athletes on using an ankle brace, it should be explained that the effect of bracing is probably not caused by improving proprioception, but through other mechanisms. However, athletes should still be encouraged to use an ankle brace during sports due to the preventive effect that is shown in other studies.

P13: ANKLE BRACING FOR PRIMARY AND SECONDARY PREVENTION OF ACUTE ANKLE INJURIES IN ATHLETES: SYSTEMATIC REVIEW

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PURPOSE: Numerous prevention strategies such as ankle bracing, taping, and neuromuscular training are available for acute ankle injuries. Ankle bracing has been verified as being effective for secondary prevention of ankle injuries, however, new studies have recently been published that are not included in meta-analysis. To systematically review the literature about the effectiveness of ankle bracing on primary and secondary prevention of acute ankle injuries in athletes.

METHODS: Pubmed, Embase, Sportdiscus, CINAHL, and PEDro were searched for eligible articles until March 2017. RCTs that studied ankle bracing versus no intervention for athletes were included in this review. Risk of bias was assessed with the Cochrane Risk of Bias tool. Meta-analyses were conducted to study the effect of ankle bracing for primary and secondary prevention of ankle injuries. The GRADE method was used to determine the quality of evidence.

RESULTS: Six RCTs were included. Significant risk ratios of 0.53 (95%CI: 0.32;0.88) and 0.37 (95%CI: 0.24;0.58) were found in favor of ankle bracing versus no ankle bracing for primary (low quality of evidence) and secondary prevention (moderate quality of evidence) of acute ankle injuries.

CONCLUSION: Ankle bracing is effective for primary and secondary prevention of acute ankle injuries among athletes. Wearing ankle braces reduces the risk of ankle injuries by 47% and 63% in athletes without or with prior sprain, respectively. Further research is recommended regarding cost-effectiveness of ankle bracing for the primary prevention of ankle injuries.

P14: FIXED MUSCLE SYNERGIES AND THEIR POTENTIAL TO IMPROVE THE INTUITIVE CONTROL OF MYOELECTRIC ASSISTIVE TECHNOLOGY.

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PURPOSE: Making the control of myoelectric assistive technology (AT), such as hand prostheses, more intuitive may resolve the difficulties patients experience in using this technology. Intuitive control may be achieved if it is based on the neuromotor control principles with which myosignals naturally are produced. A candidate principle is the idea of fixed muscle synergies, in which functionally related muscles are grouped in a limited number of synergies. Therefore, the purpose of the current study was to examine the extent to which fixed muscle synergies can be used to improve the intuitive control of myoelectric AT for upper extremities. Effective use of this principle in AT requires that the same set of fixed muscle synergies can produce the variety of myosignals as used in multiple tasks and conditions. The current study assessed this requirement when multiple conditions within one task were compared.

METHODS: Healthy participants made multidirectional pointing movements with different end-effectors, i.e. index finger and rods of different lengths. From these movements, myosignals were collected from muscles in the arm, trunk, and back, and partitioned into muscle synergies per end-effector. Subsequently, muscle synergies were assessed on their similarity of structure and explanatory ability of myosignals across end-effectors.

RESULTS: Per end-effector condition, 3-5 muscle synergies could explain 73-81% of the observed myosignals. However, these muscle synergies were dissimilar in structure across end-effectors. Also muscle synergies extracted for one condition only explained a small part of the variance in myosignals of another condition.

CONCLUSION: Muscle synergies differed across end-effectors. This questions whether myosignals are produced via the same set of fixed muscle synergies. These results place limitations on the extent to which the idea of fixed muscle synergies can be used to improve the intuitive control of myoelectric AT for upper extremities.

P15: DAILY ACTIVITY MONITORING OF ROBOTIC ARM SUPPORT USERS WITH MUSCULAR WEAKNESS

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INTRODUCTION: People with upper extremity muscle weakness can benefit from arm support devices to regain independence [1]. Capability of performing activities of daily life (ADLs), such as feeding, increases when using an arm support [1]. However, diaries and questionnaires on device usage at home indicate low compliance rates [1]. An objective assessment of compliance rates in support devices is lacking so far.

Aim: To objectively identify supported activity and to extract compliance rates and ADLs types at home.

METHODS: Accelerometer sensors were attached to the upper and lower arm of six people with muscular weakness, and on the support device [2]. Accelerations were recorded for a week and processed to calculate activity counts [3], and body segment orientation. Simultaneous activity (counts>50) of lower arm and support device indicated arm support usage. A diary was used to record ADLs type and arm support usage.

RESULTS: Preliminary data (N=1) showed a discrepancy between diary-reported (155±114min) and accelerometer-based arm support usage (72±33min per day). The lower arm was active for 663±74min resulting in a compliance rate of 11±6% per day. Self-feeding, and computer work were reoccurring ADLs on the diary, up to three times per day. Self-feeding was characterized by repetitive activity bursts and alternating orientations, while computer work by low activity counts without changes in orientations.

DISCUSSION/CONCLUSION: Daily arm support usage was low with a high degree of day to day variability. Some ADLs were identifiable from multi-sensor activity/orientation changes, but currently required visual inspection and diary recordings.

References:

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[2] Koene et al. 2016, *Domains of Daily Physical Activity in Children with Mitochondrial Disease: A 3D Accelerometry Approach*

[3] Bouten et al. 1994, *Assessment of energy expenditure for physical activity using a triaxial accelerometer*

P16: GAIT STABILITY TRAINING IN A VIRTUAL ENVIRONMENT IN INCOMPLETE SPINAL CORD INJURED PATIENTS

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PURPOSE: Many patients with incomplete spinal cord injury (iSCI) have impaired gait and balance capacity, which impacts their daily functioning. Reduced walking speed and impaired gait stability are considered as important underlying factors for reduced daily functioning. Patients can train their gait stability in a virtual environment, such as with the Gait Real-time Analysis Interactive Lab (GRAIL). Our objective was to evaluate the effect of 6-weeks GRAIL-training on gait and dynamic balance in ambulatory iSCI patients.

METHODS: Fifteen patients with a chronic iSCI participated. The GRAIL-training consisted of 12 one-hour sessions during a 6-week period. Patients performed 2-minute walking tests on the GRAIL in self-paced mode at the 2nd and 3rd (baseline measurements) and 12th session. The primary outcome was walking speed. Secondary outcomes were stride length, stride frequency, step width, and balance confidence. In addition, 5 biomechanical gait stability measures were derived: dynamic stability margin (DSM), XCoM-CoP distance in anterior-posterior (AP) and medial-lateral (ML) direction and CoM-CoP inclination angles in AP and ML direction. The effect of GRAIL-training was tested with a repeated measures ANOVA ($\alpha=0.05$) and paired t-tests ($\alpha=0.017$).

RESULTS: Walking speed was higher after GRAIL training (1.04m/s) compared to baseline measurements (0.85m/s and 0.93m/s) ($F(2,28)=18.53$, $p<0.001$). Significant improvements were also found for stride length ($p<0.001$) and stability measures in AP direction (XCoM-CoP_{AP} ($p<0.001$) and CoM-CoP_{AP} ($p<0.001$)). Stride frequency, step width, DSM, XCoM-CoP_{ML} and CoM-CoP_{ML} did not improve. Balance confidence was increased after GRAIL training ($p=0.001$).

CONCLUSIONS: The increased walking speed, stride length, gait stability in AP direction, and balance confidence suggest that GRAIL-training improves gait and balance in patients with chronic iSCI. In contrast, stability measures in ML direction did not respond to GRAIL-training.

P17: PHYSICAL ACTIVITY PROMOTION TO PEOPLE WITH SPINAL CORD INJURY BY HEALTH PROFESSIONALS: A SCOPING STUDY

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PURPOSE: Health professionals are in an ideal position to promote physical activity and have been identified by people with spinal cord injury (SCI) as valued messengers of physical activity information. The purpose of this scoping study was to identify and map the literature related to physical activity promotion by health professionals to people with SCI. The specific aims were to 1) ascertain the extent, range and nature of the literature, 2) explore the key characteristics of the body of evidence for successful physical activity promotion and 3) identify the main barriers and facilitators of physical activity promotion by health professionals to people with SCI.

METHODS: A comprehensive search of key databases was undertaken. Following application of the inclusion and exclusion criteria, 18 studies were included for review.

RESULTS: Health professionals across studies predominantly included physiotherapists but also comprised occupational therapists, nurses, personal trainers and exercise/leisure therapists. Most studies delivered interventions by health professionals to increase physical activity in people with SCI in both in-patient and community settings. Interventions containing tailored exercise programs, behavioural components and on-going counselling support were considered essential for increasing motivation, self-efficacy and physical activity. Other studies sought to understand and/or improve physical activity promotion behaviour in health professionals. There were multiple barriers that constrained physical activity promotion including a lack of education and training. A need to improve and sustain physical activity knowledge was identified if physical activity promotion is to become a structured and integral component of practice.

CONCLUSION: This study provides valuable information for the design of interventions to increase physical activity participation in people with SCI and improve physical activity promotion by health professionals.

P18: UNRAVELLING FATIGUE AND ACTIVITY PACING IN MAINTAINING A PHYSICALLY ACTIVE LIFESTYLE AFTER STROKE REHABILITATION

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PURPOSES: 1) To identify fatigue trajectories after stroke rehabilitation, 2) to determine which factors are associated with trajectory membership before discharge, and 3) to investigate how fatigue and activity pacing are related to physical activity after stroke rehabilitation.

METHODS: Stroke patients (N=303) were followed from baseline (T0: 3-6 weeks before discharge) to 14 (T1), 33 (T2) and 52 (T3) weeks after discharge from rehabilitation in the Rehabilitation, Sports and Active lifestyle study. Latent Class analysis was conducted to determine fatigue trajectories (T1-T3) using self-reported data of the Fatigue Severity Scale. Binomial regression analyses were performed to determine personal and health-related factors and behaviours of activity pacing associated with trajectory membership at T0. Multilevel analyses were used to investigate how self-reported physical activity levels were related to fatigue and activity pacing after rehabilitation (T1-T3).

RESULTS: Three fatigue trajectories were identified: high (N=167), low (N=33) and recovery (N=6). Compared with the low fatigue trajectory, stroke patients in the high fatigue trajectory were less likely to be highly educated (p=.023), experienced a lower quality of life (p=.004) and were more aware of their activity pacing (p=.015). Sustained physical activity was related to less fatigue (p=.006) and less awareness of activity pacing (p=.002) after rehabilitation.

CONCLUSIONS: This study identified three fatigue trajectories after stroke rehabilitation. Low education level, low quality of life scores, and high awareness of activity pacing before discharge identified stroke patients in the high fatigue trajectory. Lower levels of physical activity after stroke rehabilitation were related to a higher awareness of activity pacing, but without advice on activity pacing patients did not succeed to reduce their fatigue. These findings highlight the need to focus on the potential of activity pacing in today's rehabilitation practice.

P19: CHANGES IN PROPULSION TECHNIQUE AND SHOULDER COMPLEX LOADING FOLLOWING LOW-INTENSITY WHEELCHAIR PRACTICE IN NOVICES

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BACKGROUND: Up to 80% of wheelchair users is affected by shoulder pain. The Clinical Practice Guidelines for preservation of upper limb function following spinal cord injury suggest that using a proper wheelchair propulsion technique could minimize the shoulder injury risk. Yet, the exact relationship between the wheelchair propulsion technique and shoulder load is not well understood.

PURPOSE: This study aimed to examine the changes in shoulder loading accompanying the typical changes in propulsion technique following 80 min of low-intensity wheelchair practice distributed over 3 weeks.

METHODS: Seven able-bodied participants performed the pre- and the post-test and 56 min of visual feedback-based low-intensity wheelchair propulsion practice. Kinematics and kinetics of propulsion technique were recorded during the pre- and the post-test. A musculoskeletal model was used to calculate muscle activity and glenohumeral reaction force.

RESULTS: Participants decreased push frequency (51->36 pushes/min, $p=0.04$) and increased contact angle (68° -> 94° , $p=0.02$) between the pre- and the post-test. The range of motion of the upper arm increased, approaching significance (297->342 mm, $p=0.06$). Range of motion of the hand, trunk and shoulder remained unchanged. The mean glenohumeral reaction force per cycle decreased by 13%, approaching significance (268->232 N, $p=0.06$).

CONCLUSIONS: Despite homogenous changes in propulsion technique, the kinematic solution to the task varied in magnitude and direction among the participants. Participants exhibited two glenohumeral reaction force distribution patterns: 1) Two individuals developed high force at the onset of the push, leading to increased peak and mean glenohumeral forces 2) Five individuals distributed the force more evenly over the cycle, lowering both peak and mean glenohumeral forces.

P20: IS FITBIT CHARGE 2 A FEASIBLE INSTRUMENT TO MONITOR DAILY PHYSICAL ACTIVITY IN WHEELCHAIR USERS?

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PURPOSE: As self-reported diaries are insufficient to monitor daily physical activity including training accurately, we used the opportunity of the HandbikeBattle 2017 to conduct a pilot study on the usage of a multi-sensor activity tracker with both accelerometer and heart rate output in persons with spinal cord injury (SCI). The aim of our study was to investigate the feasibility of a low cost and widely used fitness tracker to monitor daily physical activity and handbike training activity in wheelchair-dependent persons with SCI.

METHODS: Six persons with SCI of the Utrecht HandBikeBattle team were enrolled in the study. All participated to wear a Fitbit Charge 2® 24 hours a day for at least 2 weeks and were questioned about the usefulness and user-friendliness of this device and data was compared with self-reported physical activity.

RESULTS: Five participants wore the device nonstop for 2 weeks and most continued usage for multiple weeks and months. Beside high compliance, we found enthusiasm about the direct feedback and user-friendliness and valid data amongst our participants. Data collected during 3 months on 3 participants and during 8 months on one of them showed the possibility to detect training days and observe interpersonal and intrapersonal variation in daily physical activity level.

DISCUSSION AND CONCLUSION: A commercially available multi-sensor wrist device like the Fitbit Charge 2® is a promising instrument to monitor training schedules of wheelchair athletes and daily activity levels among wheelchair-users with SCI. Our study illustrates how innovative measurement methods, commercial dashboard and log data can be used in patients, as they benefit from direct feedback of their training activity and timely intervention.

P21: FEASIBILITY OF VIRTUAL REALITY TASK FOR ASSESSING WEIGHT-SHIFTING SKILLS IN AGING: A PILOT STUDY

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PURPOSE: Transferring bodyweight during changing conditions is important for maintaining postural stability. This weight-shifting ability deteriorates with aging, and may be influenced by attention. This pilot study aimed at

investigating a novel virtual reality task to assess the effect of aging on weight-shifting during single- (ST) and dual-task (DT) conditions.

METHODS: Three young and 3 older participants performed a wasp-task (WT), requiring challenging weight-shifts to 'shoot' virtual wasps under ST and DT conditions in 8 directions. Weight-shifting was evaluated at 50% and 80% of the individual's functional limits of stability (fLOS). The DT condition included an additional cognitive arrow-counting task, presented in changing directions and colors after different time intervals (1.5s, 5s, random 1.5s-4s). Participants had to count arrows from a specific direction and color. Outcome measures included the number of wasps hit and the percentage of correctly counted arrows. Balance performance was also assessed with the mini-BEST test.

RESULTS: The older adults showed a trend towards smaller fLOS than the younger ones in all directions, except when shifting weight posteriorly. Although the WT was individualized, older adults tended to have decreased WT scores in both the ST and DT condition than the young. WT scores did not differ between ST and DT conditions in both groups. However, particularly during DT conditions (1.5s interval), both cognitive and WT performance showed a trend towards discriminating between young and older adults. Mini-BEST scores correlated with WT scores in both ST and DT conditions.

CONCLUSIONS: The WT is feasible for use in both young and older subjects. It correlates with balance performance, and has the potential to discriminate between age groups. However, so far, the DT did not affect WT performance and therefore a more difficult DT version will be adopted in future protocols.

P22: THE EFFECTS OF ASYMMETRICAL GUIDANCE SETTINGS DURING LOKOMAT GUIDED GAIT IN STROKE PATIENTS

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PURPOSE: The Lokomat, a robotic exoskeleton, offers the possibility to train asymmetrically and to study the neuromuscular linkage between the legs. A previous study in healthy young participants (Weiland et al., 2018) showed that ipsilateral muscle activity can be influenced by asymmetrical guidance settings: (1) ipsilateral muscle activity increased when contralateral guidance was lowered and (2) ipsilateral muscle activity decreased when contralateral guidance increased. By providing asymmetrical guidance during Lokomat therapy in stroke patients, the capacity of the unaffected leg might be utilized to evoke a higher muscular output in the affected leg. To test this idea, we examined the effects of asymmetric movement guidance on gait related muscle activity in hemiplegic stroke patients.

METHODS: Ten chronic hemiplegic stroke patients walked in the Lokomat, while guidance to the legs was offered symmetrically (both legs received 30% or 100%) or asymmetrically (one leg receiving 30% and the other leg 100%). Surface electromyography (EMG) was recorded from Biceps Femoris, Rectus Femoris, Vastus Medialis, Medial Gastrocnemius and Tibialis Anterior. Group averaged EMG levels were compared between conditions.

RESULTS: The amount of muscle activity of the affected leg depended on the level of guidance offered to the unaffected leg. Muscle activity (Rectus Femoris, Vastus Medialis, Medial Gastrocnemius and Tibialis Anterior) of the affected leg increased when guidance to the unaffected leg was lowered. Conversely, muscle activity of the affected leg decreased when more guidance was offered to the unaffected leg.

CONCLUSION: This study shows that muscle activity of the affected leg of stroke patients can be influenced by contralateral guidance levels. The observed effects demonstrate the existence of interlimb transfers and give evidence for a neuromuscular linkage between the legs in hemiplegic stroke patients.

P23: GAIT OF ADULTS WITH INTELLECTUAL DISABILITIES, AND ITS ASSOCIATION WITH PHYSICAL FITNESS.

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PURPOSE: Gait is a relevant and complex aspect of motor functioning. Gait disturbances and delayed motor development are often seen in adults with intellectual disabilities (ID). These disturbances may be associated with the low physical fitness levels of adults with ID, and may be a reason why physical activity seems to be so intense for them. However, little is known about the gait disturbances and its association with physical fitness. Therefore, we assessed the gait characteristics of adults with ID, and the association with physical fitness.

METHODS: Spatiotemporal gait parameters of 31 adults with mild to moderate ID (42.77 ± 16.70 years) were measured with the GAITRite at comfortable and fast speed. Physical fitness was measured with body composition (BMI, waist circumference), muscular endurance (chair stand tests), grip strength (hand dynamometer), and balance (four stances). Differences between gait parameters at comfortable and fast speed were analysed, together with associations with physical fitness.

RESULTS: Gait characteristics of adults with ID were comparable to those seen in adults of the general population of on average 20 years older. Adults with ID did have a broader and more variable gait. Gait at comfortable speed was associated with body composition, while gait at fast speed was associated with the other fitness components.

CONCLUSIONS: The gait characteristics of adults with ID seem to resemble an older gait pattern. Physical fitness may be more important for gait at more challenging conditions, which is an important implication for safe community participation and participation in physical activity. These insights are important for developing interventions to improve gait in adults with ID.

P24: DETERMINING THE APPROPRIATE RESISTANCE FOR ASSESSING WHEELCHAIR PROPULSION PERFORMANCE USING THE LODE ESSEDA ERGOMETER

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PURPOSE: The development of dual-roller wheelchair ergometers, such as the Esseda (Lode B.V., Groningen, The Netherlands) allows performance during wheelchair propulsion (WCP) to be assessed in a controlled setting. However, the resistance applied to the rollers must be such, as to reflect the biomechanical and physiological demands of overground WCP. Therefore, the aim of the study was to determine the appropriate resistance for using the Esseda to assess WCP in a sports wheelchair.

METHODS: Seven able-bodied participants familiar with WCP completed three trials on i) a motorised treadmill (1% incline), and on the Esseda with the resistance set at ii) 0.022 and iii) 0.024 arbitrary units. Participants pushed a sports wheelchair for 4-min at 1.0, 1.5, 2.0 and 2.5 m·s⁻¹, with 5-min rest between bouts. Oxygen uptake ($\dot{V}O_2$), ventilation (VE) and respiratory exchange ratio (RER) were measured throughout trials. Resultant forces applied to the push rim were collected over 15 consecutive push cycles using an instrumented SMART^{WHEEL} on the right side of the wheelchair. One dimensional statistical parametric mapping was used to evaluate differences between the mean, time-normalised, resultant force waveforms in MATLAB.

RESULTS: There was no significant difference in physiological responses between trials. Mean difference and 95% confidence intervals were narrower for 0.024 than 0.022 when compared to the treadmill for $\dot{V}O_2$ (0.32, -6.94-7.00 vs -0.51, -7.05-6.03 ml·kg⁻¹·min⁻¹), VE (-1.5, -29.8-26.7 vs -4.3, -28.6-20.1 L·min⁻¹) and RER (-0.05, -0.20-0.10 vs -0.04, -0.22-0.14). Mean resultant force waveforms did not differ between conditions at any speed.

CONCLUSIONS: To replicate the physiological and biomechanical responses to WCP on a treadmill on the Esseda wheelchair ergometer, a resistance of 0.024 seems advisable. Further investigation is required to determine if the resistance is representative of over-ground WCP on different surfaces.

P25: A PROSTHETIC LEG PROTOTYPE WITH IMPROVED MEDIOLATERAL BALANCE

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PURPOSE: The purpose of this study was to validate a new prosthetic prototype by comparing it to a classic prosthetic set-up on mediolateral balance control parameters.

METHODS: Three adult unilateral transfemoral amputees, and three matched unimpaired subjects were measured in a Gait Real-time Analysis Interactive Lab (GRAIL). Subjects were perturbed during stance on their prosthetic leg by moving the treadmill multiple times randomly to the medial or lateral side. Amputee subjects were measured once with a classic prosthetic set-up, and once with the prototype. Mediolateral balance responses were compared between cases on differences in mediolateral Centre of Pressure (CoP_{ml}) variability.

RESULTS: A classic prosthetic setup shows a highly similar, stereotypical CoP_{ml} rollover pattern across steps, due to the rigid connection between foot and knee. However, step-by-step variations in CoP_{ml} were observed when walking with the prototype, as well as in unimpaired walking.

CONCLUSIONS: Prosthetic walkers display step-by-step variations in CoP_{ml} when walking on the prototype. This pattern more closely resembles the CoP_{ml} variability found in unimpaired individuals, who are able to correct initial errors in foot placement by mediolateral CoP_{ml} displacements. Prosthetic walkers walking on the prototype thus have improved mediolateral balance control.

P26: RPE-GUIDED EXERCISE TRAINING: IMPACT ON PERCEPTUAL RESPONSES IN ADULTS WITH SPINAL CORD INJURY

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PURPOSE: Using Ratings of Perceived Exertion (RPE) offers a potentially feasible method for regulating, monitoring and progressing exercise intensity within training programs for adults with spinal cord injury (SCI). However, it is suggested to familiarise participants prior to prescribing exercise based on RPE. The aim of this study was to investigate the impact of training with or without RPE-guidance on the peripheral (RPE_p) and central (RPE_c) RPE responses to moderate-vigorous exercise in adults with SCI.

METHODS: Nineteen participants (41 ± 11 years) with chronic SCI were randomly assigned to either RPE-guided ($n = 11$; EXP) or active control ($n = 8$; CON) groups. EXP performed 16 weeks of supervised aerobic training for 20 mins, twice weekly, at 3-6 using the CR-10 RPE scale. CON used the same exercise equipment but received no advice as to their exercise training regime. Participants completed a graded exercise test (GXT) using an arm crank ergometer pre and post-training to determine peak oxygen uptake ($\dot{V}\text{O}_{2\text{peak}}$). Of interest, were the post-training RPE_p and RPE_c , which were recorded each minute throughout the GXT.

RESULTS: The training did not lead to an improvement in $\dot{V}\text{O}_{2\text{peak}}$ or peak power output in EXP or CON. Post-training, at 50% $\dot{V}\text{O}_{2\text{peak}}$ there was no significant difference between RPE_p and RPE_c (1.5 ± 0.9 vs 1.2 ± 0.9 , $P = 0.12$), or EXP and CON (1.5 ± 0.9 v. 1.2 ± 0.9 , $P = 0.39$); at 70% $\dot{V}\text{O}_{2\text{peak}}$ RPE_p was significantly higher than RPE_c (3.7 ± 1.2 vs 3.0 ± 1.3 , $P = 0.01$, $ES = 0.61$), however there was no difference between EXP and CON (3.5 ± 1.5 vs 3.2 ± 1.0 , $P = 0.70$).

CONCLUSIONS: Training with or without RPE-guidance for 16 weeks had no effect on post-training aerobic capacity or differentiated RPE response to moderate-vigorous exercise in adults with SCI. These data challenge whether familiarisation or anchoring of RPE is necessary for effective use of RPE to regulate exercise intensity in this SCI population, but support greater emphasis being placed on RPE_p .

P27: PARALYMPIC SPORTS CLASSIFICATION AND SPATIOTEMPORAL PARAMETERS OF WHEELCHAIR RACER IN MALE'S 100M SPRINT.

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PURPOSE: The purpose of this study was to investigate the differences in the spatiotemporal parameters of Sports classification with male's wheelchair racer during 100m sprint

METHODS: We analyzed 136 male's wheelchair racer from publicly available Internet broadcasts. Based on the classification system created by the International Paralympic Committee (IPC), we included the T51 to T54 class (distribution of subject; T51: 22, T52: 29, T53: 41, T54: 44).

These races included Paralympic (2008-2016), and World championships (2013-2017).

All of sprinter's races, the average speed (S_{100}), stroke length (Sl), and stroke frequency (Sf) were calculated by using the number of strokes (Sn) in conjunction with the official race time (ORT).

One-way analysis of variance was performed to compare S_{100} , Sl, and Sf (dependent variables) of the T51, T52, T53 and T54 (independent variables). We also calculated effect sizes. Bonferroni post hoc multiple comparison tests were performed if a significant main effect was observed.

RESULTS: The results showed that there was significant difference in all variables (effect size; S_{100} : 0.96, Sl: 0.54, Sf: 0.53). The S_{100} was higher in the order of lower impaired (m/s; T51: 4.47, T52: 5.57, T53: 6.61, T54: 6.97). Differences in velocity among 4 groups were associated with both Sf and Sl. We also founded at the wheelchair propulsion strategies of each group. T51 and T52 differed only in Sf (not in Sl). Whereas T53 and T54 differed only in Sl (not in Sf). That is, groups with lower impaired indicate A power strategies (the more Sl).

CONCLUSIONS: Current results suggest that spatiotemporal parameters during a 100-m race of wheelchair racer is varied by Paralympic Sports Classification. This will help in training and preventing injuries.

P28: COMBINED ARM-LEG ERGOMETRY IN SUBJECTS WITH A LOWER LIMB AMPUTATION

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PURPOSE: Physical fitness of subjects with a lower limb amputation (LLA) predicts walking ability and is assumed to be improved by physical exercise and training. A maximal exercise test, prior to training, is recommended for establishing cardiovascular risks and design of exercise programs. A potentially suitable ergometer for maximal exercise testing in subjects with LLA is the combined arm-leg (Cruiser) ergometer. The aim of this study was to determine feasibility, safety and reliability of (sub)maximal exercise testing on the Cruiser ergometer in subjects with LLA.

METHODS: Subjects with LLA performed one submaximal exercise test and three maximal exercise tests on the Cruiser ergometer. Feasibility was studied by examining whether key variables such as heart rate and oxygen uptake (VO₂) were correctly and confidently measured, whether a test was maximal, by studying reasons for non-completion and by measurement of gross efficiency. Safety was analyzed by recording complications and by registration of electrocardiogram (ECG) and blood pressure. Reliability was tested by comparing the results of the 2nd and 3rd maximal exercise test.

RESULTS: Seventeen subjects (14 male and 3 female), out of twenty-one preselected subjects, completed the study. In general, the maximal Cruiser exercise test was feasible. Almost three quarters indeed reached maximal performance. The test was safe: no complications occurred, although ECG and blood pressure could only be confidently registered in most subjects just before and after the test. Reliability was good.

CONCLUSION: The Cruiser ergometer is a feasible, safe and reliable ergometer to measure physical fitness in this study population with LLA.

P29: EFFECTS OF ROCKER SHOES ON PLANTAR FASCIA STRAIN IN PATIENTS WITH PLANTAR FASCIITIS

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Plantar fasciitis is one of the most frequently occurring overuse injury of the foot and characterized by pain under the foot which aggravates during standing, walking and running. A frequently used treatment option for plantar fasciitis is the rocker shoe. The rocker shoe has a proximal apex position and a stiff insole. The rocker shoe is assumed to unload the plantar fascia during gait because it minimizes peak achilles tendon forces and dorsiflexion angles of the toes. However whether a proximal apex position and a stiff insole minimize the strain on the plantar fascia and how these two parameter interact has not been investigated yet. The current study aimed to establish the biomechanical effect of a proximal apex position and a stiff insole on the strain of the plantar fascia during gait?

A musculoskeletal model similar to a previously published study and data from a cadaver study was used to estimate the strain of the plantar fascia in ten healthy young adults and nine patients diagnosed with plantar fasciitis. The participants walked for 60 seconds on their comfortable speed on a treadmill. Four different shoe conditions were randomly applied by varying sole stiffness and the apex position of the shoe.

Preliminary analysis of the acquired motion and force data indicates that a proximal apex position in combination with a stiff insole alone is insufficient in minimizing plantar fascia strain during gait.

This will be the first study to show the biomechanical effects of a rocker shoe in a group of patients with plantar fasciitis. Our results have direct implications for the prescription of rocker shoes in the treatment of patients with plantar fasciitis.

P30: THE 6-MINUTE PUSH-TEST IN WHEELCHAIR-USING YOUTH WITH SPINA BIFIDA; RELIABILITY AND PHYSIOLOGIC RESPONSE.

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PURPOSE: The purpose of this study was to determine reliability and physiologic response of the 6-minute push test (6MPT) in youth with spina bifida (SB) who self-propel a wheelchair.

METHODS: A sample of 53 youth (5-19 yrs, mean age 13 yrs and 7 mths; 32 boys/21 girls) with SB who use a wheelchair for daily life, long distances or sports, performed a minimum of two exercise tests: the 6MPT and Shuttle Ride Test (SRIT) to maximal exhaustion. Heart rate, minute ventilation, respiratory exchange ratio and oxygen uptake were measured using a calibrated mobile gas analysis system and a heart rate monitor. For reliability, Intra Class Correlation coefficients (ICC), Standard Error of Measurement (SEM) and Smallest Detectable Change (SDC) for total covered distance and heart rate were calculated. Physiologic response during the 6MPT was expressed as percentage of maximal values achieved during the SRIT.

RESULTS: The ICC for total distance was excellent (ICC 0.95), ICC for heart rate was good (ICC 0.81). The SDCs for both covered distance and heart rate were $\pm 15\%$ of the mean scores. The physiologic response for all parameters during the 6MPT was 85-89% of its maximal value, except minute ventilation, which was 70.6% of the maximal value.

CONCLUSION: Reliability of total covered distance during the 6MPT in wheelchair-using youth with SB seems to be excellent. Reliability for heart rate was good. In general the 6MPT is a functional exercise test of vigorous intensity for youth with SB using a wheelchair.

P31: THE DIFFERENCES IN MUSCLE CONTRACTION PROPERTIES BETWEEN LOWER LIMB AMPUTEES AND ABLE-BODIED

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PURPOSE: The purpose of this study was to investigate the differences in muscle contraction properties between lower limb amputations on intact limb and able-bodied on normal limb.

METHODS: Six amputees male (36.5 ± 5.4 years old, height: 174.8 ± 8.7 cm, body weight: 71.7 ± 20.9 kg, BMI: 23.2 ± 5.1 kg/m²) and six able-bodied male (33.2 ± 4.4 years old, height: 169.1 ± 5.4 cm, body weight: 63.8 ± 6.4 kg, BMI: 22.3 ± 2.1 kg/m²) participated. Tensiomyography (TMG) allows a non-invasive neuromuscular function assessment, through different specific skeletal muscle contractile properties, including muscle stiffness and contraction time. TMG measurements of maximal radial displacement of the muscle belly (Dm) and contraction time between 10 and 90% of Dm (Tc) in gastrocnemius medialis (GM), lateralis (GL), rectus femoris (RF), vastus medialis (VM), and lateralis (VL) were measured.

RESULTS: Muscle contraction time in gastrocnemius muscles were significantly different between amputees and able-bodied. Tc in GM for amputees and able-bodied were 27.0 ms and 22.3 ms, respectively ($p < 0.05$). Tc in GL were 24.1 ms and 18.9 ms, respectively ($p < 0.05$). And Dm in VL was significantly lower amputees than able-bodied ($p < 0.05$).

CONCLUSIONS: Muscle contraction time in gastrocnemius muscles in amputees were significantly delay. These changes of muscle contraction properties would be characteristics of lower limb amputation on intact limb. However, the mechanics of muscle contraction properties changes have not cleared in this study.

P32: A MULTIDIMENSIONAL APPROACH OF PHYSICAL BEHAVIOR TYPES IN FATIGUED MS PATIENTS

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PURPOSE: Identification of types of physical behavior (PB) can contribute to better understanding of variability of PB within fatigued MS patients. In MS, PB is affected in multiple dimensions and has to be considered as a multidimensional construct. Therefore the goal of this study was to explore identification of physical behavior (PB) subtypes in fatigued MS patients based on multidimensional PB outcome measures.

METHODS: Baseline accelerometer (Actigraph) data, demographics and clinical characteristics of the TREFAMS-ACE participants (n=212) were used for secondary analysis. Principal component analysis was performed to define

key outcome measures for PB. A 2-step cluster analysis was used to identify PB types. Differences between PB types were tested using ANOVA and Kruskal-Wallis tests.

RESULTS: Three stable and valid PB types were derived based on five key outcome measures: % sedentary behavior (SB), total time in prolonged moderate-to vigorous physical activity (ttMVPA), number of SB bouts and two types of change scores between dayparts (morning, afternoon and evening). The types could be defined as 'sedentary', 'moderate sedentary' and 'active' patients. The most active patients were the youngest patients ($p=0.032$) and those with the highest ambulatory ability ($p<0.001$).

CONCLUSION: Despite all patients reported sufficient levels of fatigue, this study showed that subsequent heterogeneity of PB was present since three stable PB types could be identified. These results indicate that patients' PB levels vary widely and opens the possibility to tailored rehabilitation programs.

P33: VALIDATION OF THE MYJUMP2(TM) APP IN COUNTERMOVEMENT JUMP IN YOUNG CP FOOTBALL AMATEUR PLAYERS

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INTRODUCTION: The Countermovement Jump (CMJ) is widely used to evaluate the muscles power in several populations as well as in individuals with physical disabilities. MyJump2™ (MJ2) is a mobile APP developed to measure the CMJ; however, it was not validated for football players with cerebral palsy (CP). The aim of this study was therefore to compare CMJ performed by athletes with CP measured by a mobile (iPhone 6 plus) with those obtained by a force plate (FP) (BIOMECH400, EMG System do Brazil – here considered the gold standard).

METHODS: 9 young males football players with CP (14.3 ± 1.0 years, 60.4 ± 3.2 kg and 169.3 ± 4.7 cm) participated in this study. The CMJ was performed and assessed using Force Platform and the mobile at the same time. The following dependents variables were computed by MyJump2™ app and the force plate: jump height, flight time and jump velocity.

RESULTS: No significant differences were found between the instruments measures for the tested variables (jump height, MJ2: 30.0 ± 16.2 ; FP: 33.4 ± 15.2 cm, $p = 0.148$ - flight time, MJ2: 482.3 ± 133.9 ; FP: 512.4 ± 128.3 ms, $p = 0.149$ and - jump velocity, MJ2: 1.18 ± 0.33 ; FP: 1.23 ± 0.46 m.s⁻¹, $p = 0.153$). Additionally, strong reliability was found between the equipments for all variables (ICC = 0.95, $p < 0.001$).

DISCUSSION: In this preliminary study, MyJump2™ seems to be reliable to assess the CMJ jump performance in young Footballers with CP. Our results are in accordance with others which have shown good agreement between the mobile app outputs and reference methods (Balsalobre-Fernández et al., 2015). In this sense, MyJump2™ can be used in the training control of these Paralympic athletes.

CONCLUSIONS: Our results are suggesting that the MyJump2™ is reliable tool to measure the CMJ in young athletes with CP.

P34: THE EFFECTS OF SPORT AND PHYSICAL RECREATION FOR PEOPLE WITH PHYSICAL DISABILITIES: AN EVIDENCE REVIEW

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PURPOSE: To determine the effects of sport and physical recreation on participation, activity and impairment for people with physical disabilities.

METHODS: Six electronic databases were searched. Any quantitative study design was included. One author screened the search output, extracted data and this was independently checked by a second author.

RESULTS: Ten randomised controlled trials (RCT) were included (n=499; 65% adults; 51% people with Parkinson's disease, 20% people with Cerebral Palsy), with one RCT on sport (table tennis for children with Developmental Coordination Delay). Non-RCTs included 12 longitudinal and 14 cross-sectional studies (n=829; 58% adults; 49% people with Spinal Cord Injury, 45% people with Cerebral Palsy). A range of physical recreation (e.g. dance and yoga) and sport (e.g. wheelchair rugby) activities were evaluated with majority wheelchair sports. RCTs reported positive findings for participation (1 study, dance in people with Parkinson's disease) and activity (5 studies); however mixed findings on impairment measures (e.g. fatigue and depression). Similarly, longitudinal studies reported positive findings for participation (1 study, integrated basketball), activity (8 studies including wheelchair skills and mobility) and mixed findings on impairment measures. Three cross-sectional studies measured participation and reported that people who were athletes, who had played more sports, or who had played sports for more years, showed greater societal participation e.g. employment. Six cross-sectional studies also demonstrated sport enabled sufficient time in heart rate training zone for cardiovascular benefit.

CONCLUSIONS: Despite the need for some caution in interpreting these results, the included studies consistently found benefits of sport participation for people with physical disabilities. Future research needs to include better designed studies measuring participation outcomes with a focus on ambulant and non-ambulant sports.

P35: THE EFFECTIVENESS OF EXERCISE-BASED TECHNOLOGIES IN REHABILITATION ON MOBILITY AND PHYSICAL ACTIVITY: AMOUNT REHABILITATION TRIAL

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PURPOSE: To evaluate the effect of the addition of exercise-based technologies to usual care on mobility and physical activity in people with mobility limitations admitted to inpatient rehabilitation compared to usual care alone.

METHODS: Pragmatic, assessor-blinded, parallel-group randomised trial of 300 consenting rehabilitation inpatients. The intervention group received exercise-based technologies prescribed by a physiotherapist to target mobility and physical activity problems for 6 months. Technologies included video and computer games/exercises, tablet applications and activity monitors. The control group received no additional intervention and both groups received usual rehabilitation care. Coprimary outcomes were mobility (Short Physical Performance Battery, SPPB, 0-3 continuous score) and objectively assessed physical activity (proportion of the day spent upright using activPAL) at 6 months after randomisation.

RESULTS: Participants (mean age 74 (SD14); 50% female; 54% with neurological conditions limiting mobility) received on average 12 (SD11) inpatient sessions using 4 (SD1) different technologies and 15 physiotherapy contacts to support technology use in the post-hospital phase. At 6 months mobility was significantly better in the intervention group compared to the control group (mean CSPA between-group change score 0.2 points; 95% CI 0.1 to 0.3; p= 0.006), however physical activity was similar between groups (mean between-group difference (95%CI) proportion of the day spent upright: -0.2 (-2.7 to 2.3; p=0.87)). Secondary mobility outcomes also favoured the intervention group as did other aspects of physical activity (eg self-reported walking), particularly for younger participants.

CONCLUSIONS: A tailored intervention using technology, targeting specific mobility limitations and promoting physical activity, in addition to usual rehabilitation improved mobility and some aspects of physical activity and appears to have greater impact in younger people.

P36: PHYSICAL ACTIVITY IN WHEELCHAIR-USING YOUTH WITH SPINA BIFIDA

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PURPOSE: To quantify physical activity in wheelchair-using youth with spina bifida and evaluate the intensity of activities.

METHODS: Children and adolescents (5-19 years) with spina bifida who use a manual wheelchair for daily life, long distances or sports were included. VitaMove data of 34 participants were used to assess time spent in several types of activities and were presented as time spent sedentary and time spent physically active. This was compared to reference data of typically developing youth. Actiheart data of 36 participants were used to assess time spent in several intensities. The intensities were categorized according to the American College of Sports Medicine, ranging from very light intensity to near to maximal intensity. Data of 25 participants could be used to combine type of activity and intensity.

RESULTS: Children and adolescents with spina bifida who use a manual wheelchair were more sedentary (94.3% versus 78.0% per 24 hours, $p < 0.00$) and less physically active (5.0% versus 12.2% per 24 hours, $p < 0.00$) compared to typically developing peers. Physical activity during weekend days was worse compared to school days; 19% met the Guidelines of Physical Activity according to the American College of Sports Medicine during school days and 8% during weekend days. The intensities per activity varied extensively between participants.

CONCLUSIONS: Children and adolescents with spina bifida who use a manual wheelchair are less physically active and more sedentary than typically developing youth, with weekend days being worse compared to school days. The extraordinary low levels of physical activity are alarming and need our attention in pediatric rehabilitation practice. The different intensities during activities indicate the importance of individually tailored assessments and interventions.

P37: DETERMINANTS OF PHYSICAL ACTIVITY IN WHEELCHAIR-USING YOUTH WITH SPINA BIFIDA

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PURPOSE: To explore associations between physical activity and VO_{2peak} , age, gender, and Hoffer classification in wheelchair-using youth with spina bifida.

METHODS: Dutch children (5-19 years) with spina bifida who use a manual wheelchair for daily life, long distances or sports were included through rehabilitation centers, spina bifida outpatient services, private practices. VitaMove data of 34 and Actiheart data of 36 wheelchair-using youth with spina bifida were used to assess physical activity. Time spent sedentary, time spent physically active and time spent in moderate to vigorous physical activity was analyzed. The Shuttle Ride Test was used to measure VO_{2peak} , the Hoffer classification was used to classify ambulatory status. Univariate and multivariate regression analyses were performed with physical activity as the dependent variable. Independent variables were VO_{2peak} , age, gender, and Hoffer classification.

RESULTS: Time spent sedentary and time spent physically active during a school day was influenced by both age ($\beta = 0.326$ / $\beta = -0.320$) and Hoffer classification ($\beta = 0.409$ / $\beta = -0.534$) and during a weekend day by Hoffer classification ($\beta = 0.617$ / $\beta = -0.428$) alone. Time spent in moderate to vigorous physical activity was influenced by Hoffer classification ($\beta = -0.527$) during a school day and by age ($\beta = -0.600$) during a weekend day.

CONCLUSION: Physical activity is associated with age and Hoffer classification, with older age and the inability to walk influencing physical activity negatively. Gender and VO_{2peak} seem not to be associated with physical activity in wheelchair-using youth with spina bifida. This implies that increasing cardiorespiratory fitness alone will not improve physical activity in wheelchair-using youth with SB. Furthermore, stimulating physical activity should start early in life in wheelchair-using children with spina bifida so a physically active lifestyle becomes a habit.

P38: A SURVEY OF FALLS DURING WHEELCHAIR BASKETBALL FROM THE OFFICIAL VIDEO OBSERVATION

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PURPOSE: Wheelchair basketball is played by athletes with dysfunction of the lower limbs and/or trunk. Falls frequently cause various sports injuries including bruises, concussions, and fractures. However, no survey has explored falls in wheelchair basketball. This study aimed to clarify the situation of falls in wheelchair basketball using official videos and, thereby, help prevent sports injuries.

METHODS: A total of 20 game videos of the top eight teams of men and women competing in wheelchair basketball at the Rio de Janeiro Paralympic Games 2016 were obtained from among the official videos of the International Paralympic Committee. The situation of falls was surveyed in the official videos. The number of falls, time of fall, body part that contacted the floor first, and direction of the fall were recorded. A fall was defined as when the body came in contact with the ground.

RESULTS: With 263 falls in total, the frequency was 13.2 falls per game. In the first and second halves of the game, 109 and 151 falls occurred, respectively, and 3 falls occurred during overtime. The hand was the most frequent body part to first touch the ground in 221 falls. The directions of falls ranked in descending order were as follows: 145 forward, 53 backward, 29 right, 14 left, 7 right front, 4 left front, and 11 unknown.

CONCLUSION AND DISCUSSION: In wheelchair basketball, falls occurred mostly in the latter half with the hand contacting the ground first in most cases. The direction of the fall was more often forward and backward than to the right and left. Wheelchair basketball uses sports wheelchairs that use the rear-wheel camber. Moreover, wheelchair basketball players tend to tilt their wheelchair on one side when shooting and rebounding. These results and characteristics led to various sports injuries. However, what kind of injuries will occur in this survey is unknown. Future research is needed to investigate injuries due to falls.

P39: THREE-DIMENSIONAL KINEMATICS OF COMPETITIVE AND RECREATIONAL RECUMBENT HANDCYCLISTS AT DIFFERENT SPORT SPECIFIC EXERCISE INTENSITIES

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PURPOSE: The current knowledge on recumbent handbike configuration and handcycling technique is limited. Thus, the purpose of this study was to evaluate and compare the upper limb kinematics and handbike configurations of recreational (REC) and competitive (COMP) recumbent handcyclists, during sport specific intensities. A secondary objective was to identify characteristics of configuration and technique that were associated with successful performance.

METHODS: Thirteen handcyclists were divided into two discrete groupings based on peak power output (PO_{peak}); COMP (n=7; 5 H3 and 2 H4 classes; PO_{peak}: 247±20W) and REC (n=6; 4 H3 and 2 H4 classes; PO_{peak}: 198±21 W). Participants performed two five-minute bouts, at moderate (50% PO_{peak}) and vigorous intensity (70% PO_{peak}), and a 20s sprint whilst three-dimensional kinematic data (thorax, scapula, shoulder, elbow and wrist) were collected using a VICON system. Data were normalised to cycle length and statistical parametric mapping was used to compare the kinematics of COMP and REC. Handbike configurations were determined from additional markers on the handbike.

RESULTS: COMP flexed their thorax (~5°, P<0.05), flexed their shoulder (~10°, P<0.01) and anteriorly tilted their scapular (~15°, P<0.05) more than REC. Differences in scapular motion occurred only at the moderate intensity while differences in shoulder and thorax flexion occurred both at moderate and vigorous intensities. No differences were observed during sprinting. No significant differences in handbike configuration were identified.

DISCUSSION: This is the first study to compare the upper limb kinematics of COMP and REC at sport-specific intensities. COMP employed significantly different propulsion strategies at moderate to vigorous intensities. Since no differences in handbike configuration were identified, these kinematic differences could be due to technical training adaptations potentially optimising muscle recruitment or force generation of the arm.

P40: REHABILITATION INTERVENTIONS TO IMPROVE PARETIC PROPULSION IN INDIVIDUALS AFTER STROKE - A SYSTEMATIC REVIEW

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PURPOSE: We aimed to review literature on rehabilitation interventions targeting propulsion of the paretic leg during walking post stroke.

METHODS: Studies were selected from Pubmed, Web of Science, Embase and Pedro. Search terms included stroke, exercise, intervention, walking, propulsion, ground reaction force and kinetics. To be eligible for inclusion, studies had to report changes in propulsion measures before and after an intervention in individuals post stroke (>18 yr.). Study selection, data extraction and quality assessment were performed independently by 2 authors.

RESULTS: A total of 23 studies were included. 17 Studies evaluated gait training interventions consisting of single (N=5) or multiple sessions (N=12), and 6 studies involved other training interventions. Propulsion measures included peak propulsive force (N=12), propulsion impulse (N=7), propulsion symmetry (N=5), ankle plantarflexion moment (N=7), and ankle plantarflexion power (N=4). Propulsion measures generally did not change following single (N=1) or multiple sessions (N=3) of treadmill training with or without body weight support, whereas ankle moment improved after a single split-belt treadmill training (N=1). Single (N=1) and multiple sessions (N=7) of gait training combined with functional electrical stimulation of ankle plantar and/or dorsiflexors were found to improve propulsion. Single sessions of lower extremity modified constrained induced movement therapy did not show improved propulsion (N=2), whereas multiple training sessions showed superior gains compared to a control group (N=1).

CONCLUSIONS: Regular treadmill training does not seem to affect paretic propulsion after stroke. Instead, gait training combined with electrical stimulation showed promising results, but all findings were reported by the same research group. In addition, findings should be interpreted with caution since evidence regarding the superiority of the interventions compared to usual care is often lacking.

P41: PRACTICE EFFECTS ON LOW-INTENSITY SYNCHRONOUS HANDCYCLING IN ABLE-BODIED MEN: A BIOPHYSICAL APPROACH

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PURPOSE: The aim of this study was to investigate the effects of three short low-intensity practice sessions, with a total of 36 minutes, on physiological parameters and force application during low-intensity synchronous handcycling. We hypothesize that the total practice time is too short to cause metabolic changes, i.e. no changes in the physiological parameters will be present. However, we expect that people will learn how to handcycle more efficient in terms of force application and timing.

METHODS: Twelve able-bodied male novices rode an instrumented add-on handcycle at 1.94 m/s on a level motorized treadmill. The practice program consisted of a pre-test, three practice sessions and a post-test. Every session contained three blocks of 4 minutes exercise with 2 minutes rest in-between. Physiological parameters (VO₂ (ml/kg/min), VE (L/kg/min), HR (bpm), Energy Expenditure (W/kg)) and 3D force components (tangential, radial and mediolateral) were recorded. Over the last minute of every block (4th, 8th and 12th minute) of the pre- and post-test, mean values of the physiological parameters as well as the 3D force components were calculated. Fraction effective force was calculated as (mean tangential force/mean resultant force)*100%. Practice effects were analyzed with a repeated measures ANOVA (P<0.05) with test (pre-post) and time (4th, 8th and 12th minute) as within-subject factors.

RESULTS: Other than an effect of time on heart rate (P=0.008, partial eta squared=0.352), with a significant increase from fourth to the 12th minute, and an interaction effect of VO₂ (P=0.041, partial eta squared=0.252), no significant effects were found for any of the physiological parameters. Significant effects on neither of the force components nor fraction of effective force were found.

CONCLUSION: No practice effects were found in terms of force application in the total group. It is assumed that the persons instinctively ride efficient at a low-intensity in a synchronous crank mode.

P42: COMPARISON OF TEST PROTOCOLS ON THE ATTAINMENT OF PEAK OXYGEN UPTAKE DURING UPPER-BODY POLING

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PURPOSE: Seated upper-body poling (sUBP) is applicable for sport-specific testing of athletes with a disability. The purpose of this study was to compare values of peak oxygen uptake ($\text{VO}_{2\text{peak}}$) and related parameters between four different incremental protocols of varying increases in workload- and duration during sUBP .

METHODS: Thirteen upper-body trained individuals completed the tests within a 2-week period, with minimum of 2 days between. After a standardized warm-up, the following incremental tests were performed in a randomized order: 1) 10 W every 30 s, 2) 20 W/30 s, 3) 20 W/60 s and 4) 10 W/60 s, until volitional exhaustion.

Cardiopulmonary gas exchange parameters were measured breath-by-breath. Heart rate and power output was recorded continuously during- and blood lactate after the tests.

RESULTS: No significant differences between the four test protocols were found in $\text{VO}_{2\text{peak}}$ ($\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$): 37.0 ± 4.9 , 36.3 ± 5.0 , 37.2 ± 5.3 , 37.2 ± 6.8 , peak heart rate ($\text{beats}\cdot\text{min}^{-1}$): 167 ± 16 , 169 ± 15 , 170 ± 12 , 170 ± 12 , peak ventilation ($\text{L}\cdot\text{min}^{-1}$) and peak blood lactate ($\text{mmol}\cdot\text{L}^{-1}$), (test 1 to 4, respectively). However, except for the comparison between test 1) 169 ± 27 and 3) 175 ± 25 W ($P=0.09$), peak power differed between the remaining test comparisons (i.e. 189 ± 30 W in test 2) was significantly higher than 152 ± 21 W in test 4) (all $P=0.0001$).

Furthermore, peak VCO_2 was higher in test 1) and 2) compared to 4), ($P=0.04$ and $P=0.01$) and respiratory exchange ratio (RER) was higher in test 2) and 3) compared to 4) ($P=0.003$ and $P=0.038$).

CONCLUSIONS: The current study indicates that test protocols with increment-increase in workload and duration in the range of 10 W/30 seconds to 20 W/60 seconds during sUBP do not influence peak values of VO_2 , heart rate, blood lactate and ventilation. However, the tests may not be used interchangeably to determine peak values of power output, VCO_2 and RER.

P43: EFFECTS OF SEAT HEIGHT, WHEELCHAIR MASS AND GLOVE USE ON MOBILITY PERFORMANCE IN WHEELCHAIR BASKETBALL

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PURPOSE: The aim of this study was to examine the effects of seat height, wheelchair mass and glove use on wheelchair mobility performance (WMP) in elite wheelchair basketball players, while performing a standardized field-based WMP test, and to determine whether these effects are different for wheelchair basketball players of either low or high classification.

METHODS: Elite wheelchair basketball players with a low ($n=11$, class 1 or 1.5) or high ($n=10$, class 4 or 4.5) classification performed a standardized field-based WMP test. Players performed the test six times in their own wheelchair, of which five times with different (wheelchair) configurations, i.e. with a higher or lower seat height, with additional distally or centrally located mass, and with use of gloves. The effects of these configurations on performance times on the WMP test and the interaction with classification were determined.

RESULTS: Total performance time on the WMP test was significantly reduced when using a 7.5% lower seat height. Additional mass (7.5%) and glove use did not lead to changes in performance time. High and low classification players showed similar responses to the interventions.

CONCLUSIONS: The presented methodology can be used in a wheelchair fitting process to search for the optimal individual seat height to enhance WMP. Further research should focus on other potentially effective adjustments to wheelchair configurations to optimize WMP in wheelchair basketball.

P44: GAIT DEVIATIONS OF PEOPLE WITH A TRANS-FEMORAL AMPUTATION, DURING 'STEP BY STEP' STAIR CLIMBING.

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PURPOSE: The majority of people with a unilateral trans-femoral amputation (PTFA) use the step by step strategy (SbS)[1] for stair climbing, in which the sound side is the leading limb, and the prosthetic side is the trailing one.

Similar to level walking [2], adequate foot clearance in swing is a prerequisite in stair climbing to prevent falls. In this study, the approaches of PTFA to ensure foot, stair step clearance are investigated.

METHODS: 19 reference subjects (REF / $74.5\pm 7.8\text{kg}$; $175.9\pm 7.8\text{cm}$; $27.4\pm 5.1\text{years}$) and 6 PTFA ($76.0\pm 11.6\text{kg}$; $179.5\pm 4.7\text{cm}$; $36.2\pm 11.7\text{years}$) were equipped with markers according to Plugin-Gait (Vicon). Four markers used to

track trunk motion [3]. A 12 camera motion capture system (Vicon) was utilized. Subjects walked up an instrumented staircase (5 steps / 2 AMTI force platforms) with SbS strategy. Foot edge clearance was defined as the minimal distance between the Plugin-Gait TOE marker and the stair edge. Parameters (REF vs. PTFA) were compared using an independent samples Mann-Whitney U Test ($p < 0.05$).

RESULTS: PTFA had a reduced, but not significantly smaller, minimum foot, stair edge clearance compared to REF (PTFA 78.64 ± 12.10 mm vs. REF 91.85 ± 26.98 mm $p = 0.303$). PTFA had smaller peak knee flexion ($p < 0.001$), a further extended hip ($p = 0.011$) and a greater anteriorly tilted pelvis ($p < 0.001$) and trunk ($p < 0.001$) during trailing limb swing. PTFA showed a significantly greater peak internal knee and hip extension moment of the sound side in comparison to REF (PTFA 1.33 ± 0.26 Nm/kg REF 0.97 ± 0.19 Nm/kg $p < 0.000$).

CONCLUSIONS: For adequate clearance, REF functionally shorten the trailing limb via an increased hip and knee flexion. PTFA are unable to use this “folding mechanism”. PTFA show therefore a greater pelvis and trunk anterior tilt and a more extended hip intrailing limb swing, which may lead to greater sound side moments.

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P45: DEVELOPING EVIDENCE-BASED GUIDELINES FOR FUNCTIONAL ELECTRICAL STIMULATION CYCLING IN SPINAL CORD INJURY

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PURPOSE: To describe a project aimed at developing international evidence-based guidelines for functional electrical stimulation (FES) cycling for people with spinal cord injury (SCI).

METHODS AND RESULTS: The scope and purpose of the project was established using a scoping review on FES exercise in neurological conditions that was discussed during a consultation workshop (<http://cancon2018.com>) and a multidisciplinary meeting with FES users and experts. The next step is conducting a systematic review in accordance with the established scope and purpose of the project, i.e. FES cycling in SCI. The review will be discussed in 2019 with international expert panels including researchers, practitioners and FES cycling users to reach consensus about the guidelines. Further consultation on values and preferences of FES cycling users will be sought via surveys and/of focus groups. The last step of the guideline development process is presenting the guidelines in a scientific peer-reviewed manuscript, which can then be assessed by an independent Appraisal of Guidelines for Research and Evaluation (AGREE) consultant. With the guideline manuscript ready, the dissemination and implementation processes in various countries can be rolled out as discussed during the expert meetings.

CONCLUSIONS: This project has the capacity to set the first-ever international standards for the use of FES cycling by people with SCI and their health care professionals.

P46: EUROPEAN DISSEMINATION OF SPINAL CORD INJURY EXERCISE GUIDELINES

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PURPOSE: International scientific evidence-based exercise guidelines for adults with spinal cord injury (SCI) have recently been published (Martin Ginis et al, 2018, Spinal Cord). The international team who produced this work included 29 researchers, clinicians, community organisation representatives and people with SCI. From this larger

group, a network of European partners has been established. The purpose of this study is to describe the dissemination of the guidelines across Europe.

METHODS AND RESULTS: The dissemination process was coordinated by a knowledge broker (JWvdS). Bilingual SCI experts from Germany, Italy, the Netherlands, Sweden and Switzerland translated the text of two English-written documents into their respective language: the scientific guidelines with the accompanying 'preamble' and an infographic describing the process of guideline development. The SCI experts ensured the translations matched the cultural nuances and clinical practice of the countries currently involved, whilst liaising with the knowledge broker to ensure the scientific integrity of the guidelines. A design team used these translated texts to produce translated PDF versions of the original documents. Subsequently, the broker liaised with the bilingual SCI experts to publish descriptive articles for national medical journals and consumer/patient journals. These translated resources are being collated onto a centralised website, which will include links to the national articles (when published).

CONCLUSIONS: The collaborative process has led to more consistent dissemination of guidelines across Europe and provided greater clarity around the development of the guidelines. This has enhanced the trust that end-users have in the guidelines, which is an essential component for the next knowledge translation step: effective implementation. The described process, for which a knowledge broker is essential, can serve as a template for international guideline dissemination.

P47: EVERYDAY USE OF LOWER LIMB ORTHOTICS AND QUALITY OF LIFE IN SUBJECTS WITH NEUROMUSCULAR DISEASE

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PURPOSE: The following study was designed to investigate the frequency and duration of orthotic use in everyday life. Additionally patient satisfaction and quality of life was determined. Related factors like gait impairment and type of orthotics were considered.

METHODS: 45 Patients with neuromuscular gait disorders using lower limb orthotics and the ability to walk at least 30 m with or without walking aids were included. At the first appointment (T1) users underwent a physical examination testing for range of motion, strength, deformities and spasticity. Temperature sensors (OrthoTimer, GER) were implemented in all independently used parts of the orthotic concept. Values between 29 - 38.5 °C were rated as 'use-time'. After 90 days (T2) Temporo-spatial-parameters were measured. Depending on orthotic concept different conditions were captured (e.g. dynamic ankle foot orthosis (DAFO) with/ without shank adaption). Orthotics were tested with the related shoes and compared to barefoot and shoed walking. Quality of life was determined via CP CHILD [1] and DISABKIDS [2]. Satisfaction with orthotics was rated via QUEST [3].

RESULTS: Output of temperature sensors illustrate that AFOs have been used the longest time per day. Patients walking with orthotics with removable shank adaptations had the highest values in speed and cadence. Patients who used only DAFOs had higher ratings considering quality of life, whereas patients with removable adaptations were most satisfied.

CONCLUSION: Long term monitoring provides insights in individual daily habits, daily demands and environmental factors. This insight helps determining and designing orthotic concepts, and points out that not necessarily the smallest concepts were the most accepted or beneficial ones.

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P48: SELF-PERCEIVED GAIT STABILITY MODULATES THE EFFECT OF DAILY-LIFE GAIT-QUALITY ON FALLS IN OLDER ADULTS

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PURPOSE: Quality of gait during daily life activities and perceived gait stability are both independent risk factors for future falls in older adults. We investigated whether perceived gait stability modulates the association between gait quality and falling in older adults and aim to replicate our findings in an ongoing cohort.

METHODS: We used two prospective cohorts of older adults over 65 years of age, the FARAO (N = 272) and the ongoing VIBE (N < 286) cohort. One-week daily-life trunk acceleration data was collected. Sample entropy (SE) of the 3D acceleration signals was calculated to quantify daily life gait quality. To quantify perceived gait stability, the level of concern about falling was assessed using the Falls Efficacy Scale International (FES-I) questionnaire and step length, estimated from the accelerometer data. A fall calendar was used to record fall incidence during a six-month follow up period. Logistic regression analyses were performed to study the association between falling and SE, step length or FES-I score, and their interactions.

RESULTS: From the FARAO cohort we showed that high (i.e., poor) SE in vertical direction was significantly associated with falling. FES-I scores significantly modulated this association, whereas step length did not. Subgroup analyses based on FES-I scores showed that high SE in the vertical direction was a risk factor for falls only in older adults who had a high (i.e. poor) FES-I score. The VIBE cohort is still ongoing and preliminary results will be presented at the congress in relation to the results from the FARAO cohort.

CONCLUSION: Perceived gait stability may modulate the association between gait quality and falls in older adults such that an association between gait quality and falling is only present when perceived gait stability is poor.

P49: BIOMECHANICAL EFFECTS OF A CARBON FIBRE FOOT WITH A PRONOUNCED RANGE OF MOTION ON RAMPS

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PURPOSE: Walking on inclines is a challenging task for amputees using a conventional prosthetic carbon fibre foot. 3D gait analyses were conducted in transtibial amputees investigating the biomechanical effects of a novel foot with a mechanical pivot unit (ProFlex, Össur, IS) while walking on ramps.

METHODS: Data of 23 unimpaired persons (REF) and 14 patients with transtibial amputation (PTTA) were included in the study. Kinematics and kinetics were calculated using Plugin Gait Model (Vicon, GB). Additionally the "Sole Angle" (angle between foot and ramp) was calculated. Participants negotiated an instrumented ramp (2 force plates, AMTI, USA, 8,5m x 0.8m; 10°). PTTA underwent the protocol twice using two different feet (VA/ Variflex and PF/ ProFlex, Össur, IS) in a randomized order (cross-over-design). They had two weeks to adapt to each prosthetic foot prior measurements. Patients' feedback was determined using the PEQ in both, PF and VA. Parameters were analysed using Wilcoxon signed-rank tests for paired samples (p<0.05).

RESULTS: Ankle range of motion was in PF significantly greater than in VA. Angular velocity of "Sole Angle" was significantly greater in PF compared to VA and closer to REF Data in both, ramp up and down. Peak Knee flexion at loading response was in VA similar to REF and in PF significantly lower, correspondingly external extending knee moments were in PF higher (ramp up). PEQ ambulation scale for uphill and downhill walking showed significant improvements by 20% using PF.

CONCLUSION: The principal task of a prosthetic foot is to restore a functional lever arm. Results indicated that a rigid lever arm might not always be beneficial. However flexibility of the PF did not lead to reduced knee extending moments while ascending the ramp, the early foot flat and the adequate adaptation to the incline indicated a sufficient support during ramp walking. The findings were supported by PEQ results.

P50: HEALTH AND INJURY MONITORING IN DISABLED ATHLETES

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PURPOSE: Apart from the regular burden of an injury, injuries further limit a disabled athlete's – already restricted – daily life. As such, it is of special importance to provide preventive measure against injuries in disabled athletes. There is, however little known about the patterns of sports related injury and their consequences in disabled athletes. For this reason, a health complaints registration based on the OSTRC questionnaire was developed for disabled athletes (HIDMA). This study pilot-tested HIMDA for validity and feasibility.

METHODS: A total of 12 wheelchair rugby athletes were monitored prospectively over a 10-week period using HIMDA. Sports participation, health complaints (illnesses and injuries), and the consequences of health complaints were self-registered weekly.

RESULTS: A total of 17 health problems were registered, including 4 illnesses, 3 acute injuries and 10 overuse injuries. Only in 10 out of 13 reported injury cases the athletes indicated themselves to be injured. Consequently, the HIMDA overestimated the number of health complaints. However, feasibility of the HIMDA for disabled athletes is good. Overuse injuries represent the greatest burden on the wheelchair rugby athletes, because of the large number of cases and the relatively long duration. The most common location for all injuries was the shoulder

CONCLUSION: The HIMDA is valid in documenting the patterns of illness and injury in a group of disabled athletes during normal training and preparation phases. However, the definition of an injury should be clarified in disability sports. Overuse injuries represent the greatest burden on wheelchair rugby athletes, with the shoulder as most common location.

P51: DERMATOGLYPHIC AND SOMATOTYPIC PROFILE OF THE BRAZILIAN PARALYMPIC FOOTBALL FIVE-A-SIDE NATIONAL TEAM

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INTRODUCTION: The knowledge of genetic markers and morphological variables in the Paralympic Football Seven-a-Side are important since it can guide the training and enable the maximum potentiality of the athletes.

Objective: The objective of the present study was to analyze the dermatoglyphic and body composition characteristics of athletes of the Brazilian Paralympic Football Five-A-Side National Team.

MATERIALS AND METHODS: A descriptive cross-sectional study was carried out with a sample composed of 13 athletes (27.0 ± 6.5 years, 71.7 ± 7.4 kg) from the Brazilian Paralympic Football Five-A-Side National Team who participated in Rio 2016 Paralympic Games. The dermatoglyphic data collection was obtained using the protocol proposed by Cummins and Midlo. The methodology proposed by Heath-Carter was used to determine the somatotype.

RESULTS: The study showed a high frequency of Loop design (L) (66.2%) and low average TRC (97.4 ± 28.6) and DI (10.0 ± 2.5). Goalkeepers, setters and pivots obtained a higher frequency of Loop (L) followed by Arch (A) with reduction of Whorl values (W). Between wings, there was a predominance of Loop (L) followed by Whorl (W) with reduction of the Arch (A). As for the somatotype in the different tactical positions at play, the study found that the fixed (2.6-4.4-2.4) and pivots (2.2-5.6-2.3) presented the balanced mesomorphic profile and the goalkeepers (3.2-5.8-1.6) and wings (3.2-5.7-1.6) the meso-endomorphic.

CONCLUSION: The Brazilian Paralympic Football Five-A-Side National Team has genetic predisposition for the development of speed and strength. Wings also have genetic predisposition for resistance. The somatotypic profile presented by the athletes indicates predominance of the muscular component by the paralympic soccer team of 5, in all positions.

P52: DYNAMIC PARAMETERS OF FORWARD PROPULSION COULD BE USED FOR MANUAL WHEELCHAIR USERS' CLASSIFICATION

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PURPOSE: Biomechanical studies of manual wheelchair (MWC) propulsion yield large amounts of kinematic and dynamic data that can only be analysed and interpreted by specialists. Up to now, only a few of them have attempted to extract relevant information from these data to form homogeneous groups or clusters of subjects in order to help their use by clinicians. However, most of these authors used a few discrete kinematic parameters for clustering subjects, and only then used some dynamic data for analysing the characteristics of the groups obtained at the former step. In the present study, relevant mechanical information has been extracted from dynamic data recorded with an instrumented MWC (FRET-2) and then used to group subjects in homogeneous clusters, which have been compared to clinical injury levels.

METHODS: Time series of axial moments produced by MWC users at both rear wheels of the FRET-2 during straight forward propulsion have been split in elementary propulsion cycles. On each cycle, some parameters have been computed (i.e. cycle duration, push time, maximal and minimal values of axial moment, angular impulse) and used to form five clusters of cycles labelled by capital letters (A, B, C, D, E). All cycles produced by all subjects have then been replaced by the letters of the clusters to which these cycles belonged. This symbolic representation of propulsion cycles has then been used to group subjects in three categories reflecting their motor abilities.

RESULTS: The comparison between subjects' motor abilities and injury levels revealed that the former did not match the latter, thus demonstrating that injury levels are not precise enough for inferring motor abilities of most subjects.

CONCLUSION: Injury levels appear to be not relevant enough for classifying MWC users according to their motor abilities. Symbolic representation is a proven and efficient method for identifying which mechanical parameters are relevant for studying wheelchair propulsion.

P53: SIMULATING THE MANUAL WHEELCHAIR ROTATIONAL AND TRANSLATIONAL BEHAVIOR DURING FREE MOVEMENT, FOLLOWING A ROTATIONAL IMPULSE

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PURPOSE: The purpose of this study was 1) to create a mechanical model, assessing MWC rotational and translational movements following a rotational impulse and taking into account MWC geometry, material and inertial settings, such as anteroposterior load distribution, wheel material, geometry and positioning, etc. , 2) To compare the modelled MWC behavior, especially angular deceleration, to real experiments for various MWC settings.

METHODS: For each trial, the rotation of a MWC, loaded with fixed additional masses and moving on a plane surface, was initiated by the experimenter. Then, the MWC was released and its free movement, a combination of linear and angular changes, was observed using an optoelectronic system. Various series of trials were conducted, changing the MWC settings (load distribution, castor wheels, geometry, etc.). The MWC movement was modelled through mechanical equations, linking linear and angular accelerations to geometric, material and inertial settings of the MWC. MWC kinematics were computed through the model for the duration of the movement. Ground material, wheel material, geometry and trajectory were used to compute the wheel rolling and turning resistances used in equations. Real and simulated decelerations were compared.

RESULTS: A model of MWC free rotation and translation movement was created. Personalized wheel rolling and turning resistances allowed better representation of the real movement.

CONCLUSION: Simulation of free moving MWC allowed linking its settings to its rotational and translational behavior. It may have applications on energetic characterization, MWC setting optimization, therapist training or realistic virtual reality MWC training.

P54: MUSCLE ACTIVITY AND SPASTICITY DURING BOCCIA THROWING IN ATHLETES WITH CEREBRAL PALSY

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PURPOSE: The purpose of this study was to investigate the muscle activity and spasticity during Boccia throwing in different throwing tasks and starting positions of the arm.

METHODS: The muscle activity (EMG) of six arm muscles of five participants was measured during nine different underhand throwing conditions. These nine conditions consisted of three different tasks executed from three different starting positions of the arm. Based on the underhand throwing technique, the muscle activity of two antagonist muscles in the shoulder, two in the upper arm and two in the forearm was measured. The EMG data were used to identify spasms during throwing in Boccia athletes with cerebral palsy.

RESULTS: We observed significantly more spasms in the conditions where the range of motion of the arm before the throw is greater compared to the conditions where the range of motion is decreased ($P=0.02$). Furthermore,

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spasticity is significantly more frequently present in the forearm compared to the shoulder and upper arm muscles ($P=0.002$).

CONCLUSIONS: The results seem to indicate that different throwing tasks do not but different starting positions of the arm do influence the number of spasms. It is also evident that spasticity is more frequently present in the forearm compared to the shoulder and upper arm muscles in athletes with cerebral palsy during Boccia throwing.

P55: COMPUTATIONAL MODELING OF IMPAIRED MOVEMENTS AND RESTAURATION THERE-OF

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PURPOSE: The restauration of impaired movements requires highly individualized treatments. Therefore, it is essential to have diagnostic tools that can be used to not only demonstrate the special requirements of a patient but also to develop individualized therapies or assistive technology to restore the impairments. Computational models can help to improve diagnoses but also to predict the outcome of possible interventions or assistive technologies.

METHODS: We have developed a so-called mixed dynamics musculoskeletal three-dimensional model. It can be used to calculate the inverse dynamics of a measured movement, i.e. the net-torques and net-forces at the joints, but also the optimized muscular activation of the complex muscular system acting at a specific joint. Based on that, we calculate the absolute forces at that joint, and by changing several properties, e.g. muscular forces, activation patterns, or assistive technologies, we predict their possible influence on specific impairments.

RESULTS: Based on selected examples, the possibilities and limits of these computational models will be presented.

CONCLUSIONS: Modern computational models will become an important tool to support people with specific impairments and to develop assistive technologies or individualized interventions.

P56: FEASIBILITY OF THE TALK TEST WITH CYCLING IN FRAIL ELDERLY PATIENTS DURING ORTHOPAEDIC GERIATRIC REHABILITATION

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Aerobic exercise may favour outcomes of orthopaedic geriatric rehabilitation (OGR) but knowledge on exercise responses in these frail patients is limited. This study aimed to assess whether graded cycling exercise (GCE) combined with the Talk Test (GCE-TT) is feasible to determine adequate and safe exercise intensities in patients during OGR.

Twenty-six OGR patients (57-95 yrs) performed a sub-maximal GCE-TT on a wheel-chair based cycle ergometer until they could no longer speak comfortably. Seventeen of these subjects also performed the GCE with gas exchange measurements (GCE-GE) to obtain the ventilatory threshold (VT), based on VO_2 and VCO_2 measurements. Subjective measures of discomfort, work load (watts), and Heart Rate (HR) was monitored during both tests.

During the GCE-TT ~70% of the patients ($N=18$) were able to reach an intensity where comfortable speaking became equivocal (EQ), a relevant marker of adequate and safe aerobic exercise. Reasons for early termination of the test were related to musculoskeletal discomfort/pain, not willing to continue or problems with the dual task (talking and cycling). No cardiorespiratory events occurred during the tests. VT responses could, however, be detected in only 5 participants (primarily due to early termination of the test). Workload nor HR at EQ (36 ± 14 watt, 119 ± 14 bpm) were significantly different from VT (40 ± 6 watt, 102 ± 11 bpm), $P=0.285$. Strong correlations were found between workload at EQ and VT ($r=0.97$, $P=0.005$). In addition, HR at EQ and VT tended to be significantly related ($r=0.82$, $P=0.089$).

In conclusion, GCE-TT seems feasible for patients in OGR and may be preferred over GCE-GE to determine adequate and safe exercise intensities in patients during OGR. Difficulties are mostly related to musculoskeletal rather than to cardiorespiratory problems. Further research is necessary to determine the validity and reliability of the test in these patients.

P57: WE12BFIT! IMPROVING PHYSICAL FITNESS AND LIFESTYLE PHYSICAL ACTIVITY IN 7-12 YEAR OLD CHILDREN WITH DCD

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AIM: To describe the effectiveness of We12Bfit!, a family focused intervention to increase physical fitness (PF), motivation for physical activity (PA) and to improve lifestyle PA in children with DCD.

PARTICIPANTS: The intervention was evaluated in 19 children aged 7-12, with DCD recruited from rehabilitation centers and schools for special education.

METHODOLOGY: During the intervention the participants engaged in a ten week group training, twice a week for one hour. Exercises focused on improving cardiorespiratory fitness (CRF), muscle strength and anaerobic power. Six weeks into the training sessions a family-focused lifestyle PA intervention was added, which ended 12 weeks after the last training session. Motivation for PA was targeted through application of behaviour change strategies. Effectiveness was assessed at three instances (T0 before the training, T1 after the training, T2 after the lifestyle intervention) using 20 meter Shuttle Run Test, Muscle Power Sprint Test and Hand Held Dynamometry. Training intensity was monitored with heart rate monitors. The lifestyle intervention was evaluated using interviews with participants and coaches.

RESULTS: Preliminary analysis revealed significant improvements in CRF from T0 to T1. Positive trends were found for mean power, elbow flexion, knee flexion, however significance of the effects was not retained after Bonferroni correction. Handgrip strength, elbow and leg extension did not improve significantly. From T1 to T2 PF seemed to stabilize as there were no significant differences. During the interviews parents indicated that they were able to meet the goals they set (e.g. finding a suitable sport, increasing active transportation). In addition, they stressed that the training intervention was of particular value in increasing their child's self-esteem, perseverance and participation in PA. We12Bfit! has the potential of improving PF and participation in activities in children with DCD.

P58: ACTIVITY PROFILES DURING WHEELCHAIR TENNIS: EFFECTS OF DIVISION, RESULT AND SCORE MARGIN

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PURPOSE: To compare the activity profiles of elite wheelchair tennis (WT) during match-play for men, women and quad divisions and to explore how result and score margin affect these profiles.

METHODS: Activity profiles of seventeen of the top 8 ranked WT players from the men's (n = 7), women's (n = 6) and quad (n = 4) divisions were monitored during the NEC Wheelchair Tennis Masters 2017 using a radio frequency-based indoor tracking system (ITS) and inertial measurement units (IMU). Data were collected from 22 matches, resulting in 73 individual sets of data. Data were analysed with regards to the result of each set (win/loss) and margin of the result (small ≤ 3 ; large > 3 games differential). Distance, mean and peak speed and the time spent in fixed speed zones were analysed by the ITS. Acceleration, rotational velocity and rotational acceleration and direction of turns were quantified by the IMU.

RESULTS: Activity profiles were elevated during men's matches compared to both women's and quads and for women's matches compared to quads for most parameters. Few differences in activity profiles were observed between winning and losing sets. Alternatively, independent of result, distances covered, peak speed, time spent and number of high-speed activity (HSA) performed were significantly greater during sets with small score margins ($p \leq 0.035$). Significant interactions between result and score margin were also observed for a number of parameters. Trivial to small differences (effect sizes [ES] ≤ 0.3) in mean speed, time spent and number of HSA performed were revealed when losing, regardless of margin, whereas large increases (ES ≥ 1.3) were revealed when winning by a small compared to large margin.

CONCLUSION: Activity profiles differ according to division and are typically elevated during sets with a small score margin in WT players, which should be taken into consideration by coaches and practitioners when monitoring and planning players physical training loads.

P59: KINEMATIC ANALYSIS OF EXPERIENCED AND INEXPERIENCED 0.5-POINT WHEELCHAIR RUGBY ATHLETES

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PURPOSE: To describe and compare the performance 3D kinematics between two wheelchair rugby players (WCR) with the same sports classification but different levels of experience.

METHODS: Two spinal cord injured, 0.5 WCR players (1 International (EXP) and 1 National (DEV)) volunteered for the study. Each player performed two sub-maximal speeds (4 & 6 km·h⁻¹) and a 15s sprint on a dual-roller wheelchair ergometer in their rugby wheelchairs. Forty-eight retroreflective markers were attached to each participant and the chair. 10 VICON cameras were used to track the marker trajectories. Joint angles were calculated using MATLAB.

RESULTS: For EXP the relative propulsion phase at 4 km·h⁻¹ was 51.4% and decreased to 28.3% during the sprint. Whereas the propulsion phase was similar for the DEV during both the 4 km·h⁻¹ and sprinting (38.2% and 39.6% respectively). EXP achieved a faster maximal speed than DEV (14.8 vs. 12.3 km·h⁻¹), while adopting a higher push rate during 15s all-out sprint (32 vs. 28 pushes). EXP showed better acceleration with peak speed being achieved after 4.9s after 11 pushes, while DEV took 10.7s to reach to the peak speed and almost twice as many pushes (n=20). At the first push of the sprint EXP displayed 11% greater shoulder extension (62.4°) than his other pushes (-31.8-46.7°), yet DEV showed similar range of flexion-extension angle at all time (-40.9-45.4°). EXP showed smaller adduction-abduction angle (11.5-41.1°) than DEV (25.8-50.0°). EXP pushed mostly at pronated position (-30.2--11.8°), whereas DEV used greater pro-supination (-15.4-14.9°).

CONCLUSIONS: Experience clearly influences the performance and propulsion kinematics of WCR players. Push rates were higher and greater shoulder extension was displayed by EXP than DEV at the first push of sprint, yet smaller shoulder range of movement were evident once the wheelchair is accelerated.

P60: AMSTERDAM SPINAL CORD INJURY (AMS-SCI): DESIGN OF A LONGITUDINAL COHORT STUDY

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INTRODUCTION: Monitoring patients during and after rehabilitation is important for individual rehabilitation treatment and at the group level for research and management purposes. The first test can be used to assess the physical and psychological status of the patient, which gives direction for treatment and a prognosis of the future status. The aim of the Amsterdam Spinal Cord Injury (AMS-SCI) cohort study is sustainable implementation of standardized tests in SCI rehabilitation to evaluate the treatment individually and on a group level.

METHODS: All patients with SCI admitted to the rehabilitation center are included in AMS-SCI. Patients are measured at admission (T0) and discharge (T1) of inpatient rehabilitation and 1-year after discharge (T2). At all test occasions levels of physical (e.g. respiratory function, walking or wheelchair skills) and psychological (e.g. quality of life) functioning are determined. Length of inpatient rehabilitation stay and discharge destination are registered at T1.

RESULTS: After 5 years of inclusion, 349 patients with SCI are tested at T0; 243 patients are tested at T1 and 51 patients are tested at T2.

CONCLUSIONS: Standardized monitoring of patients with SCI in a rehabilitation center is helpful for evaluation of rehabilitation treatment. Furthermore, specific research questions can be answered with the group data.

CLINICAL MESSAGE: Monitoring patients by measuring outcomes provides a signal for action to evaluate and adjust the treatment.

P61: EXPERIENCED SEATING-RELATED PROBLEMS AND ASSOCIATION WITH PERSONAL, LESION AND WHEELCHAIR CHARACTERISTICS IN PARAPLEGIA AND TETRAPLEGIA

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STUDY DESIGN: Cross-sectional study (ALLRISC)

OBJECTIVE: To compare experienced sitting-related health and stability problems between persons with paraplegia (PP) and tetraplegia (TP) and to investigate associations with personal, lesion and wheelchair characteristics as well as satisfaction with seating posture.

SETTING: Dutch multicenter cohort study.

SUBJECTS: Wheelchair-users with Spinal Cord Injury (SCI) living in the community for ≥ 10 years after SCI (N=264).

METHODS: A self-report questionnaire on seating was developed. Sitting-related problems and satisfaction with sitting posture were compared between participants with PP and TP using Chi-square, t-tests and logistic regression analyses.

RESULTS: Thirty-three percent reported sitting to be tiring (regularly to always), 28% reported sitting to be painful, 29% pressure ulcers and 8% instability in sitting and 33% during reaching. Except for instability during reaching, no differences in occurrence of sitting-problems were found between the TP and PP-group. Among all characteristics, 'lack of support in the wheelchair' associated with all sitting-problems within PP. Persons with TP appeared more dissatisfied with their sitting posture than PP: 51% vs 36% ($p=0.022$) and respectively 51% and 47% thought sitting posture could be improved ($p=0.670$). Pain and instability were associated with dissatisfaction.

CONCLUSIONS: Sitting-related pain, fatigue, pressure ulcers and instability during reaching as well as dissatisfaction with sitting posture were frequently reported by persons with chronic SCI. Especially in persons with PP, sitting problems appeared to associate with experienced lack of support in the wheelchair and seating. Therefore, an accurate hands on assessment -wheelchair/seating-user-fitting and stability check may contribute to prevention of sitting related-problems.

P62: HANDCYCLING CLASSIFICATION: A FIRST LOOK INTO THE CURRENT CLASSIFICATION SYSTEM

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PURPOSE: According to the International Paralympic Committee, paralympic classification must minimize the impact of impairment on performance through an evidence-based system. However, current handcycling classification is mostly based on expert opinion. The aim of this study was to explore whether average race speed is different between sport classes.

METHODS: Official Time trial results of men's H1-H5 classification from the Union Cycliste Internationale's Championships Greenville 2014, Nottwil 2015 and Pietermaritzburg 2017 were used. Distances were 8.3km for H1 and 16.6km for H2-H5 in Greenville; 14km for H1-H2 and 15.5km for H3-H5 in Nottwil; and 15.5km for H1-H2 and 23.3km for H3-H5 in Pietermaritzburg. Average speed was calculated from race results. Kruskal-Wallis tests with pairwise comparisons were conducted to compare the average speed of the top 10 athletes between classes on each separate championship.

RESULTS: There were no significant differences between the consecutive classes H1-H2 ($p = 1.00$ in Greenville and Pietermaritzburg; $p = .296$ in Nottwil;), H3-H4 ($p = 1.00$ for all events), and H4-H5 ($p = 1.00$ for all events). H2-H3 showed significant differences only in Greenville ($p = 0.021$) with median speed in H3 being 7.2 km/h faster than in H2, but not in the remaining events ($p = 1.00$ in Nottwil; and $p = .173$ in Pietermaritzburg). Differences in median speed were less than 2 km/h in all events between H3-H4 and H4-H5, having H4 and H5 the same median speed in Pietermaritzburg (34.89 km/h).

CONCLUSION: The consecutive classes H1-H2, H3-H4, and H4-H5 showed comparable race speed in all championships, while H2-H3 only showed a significant difference in Greenville. The potential confounding of different variables (e.g. inclination, length, handbike type) does not allow us to make strong assumptions only based on speed as a performance measure. However, our results stress the need for a stronger research into the current handcycling classification system.

P63: AUTOMATIZED, STANDARDIZED AND PATIENT-TAILORED PROGRESSIVE WALKING ADAPTABILITY

TRAINING: A PROOF-OF-CONCEPT STUDY

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PURPOSE: Walking adaptability may be improved by treadmill training with augmented reality, such as on the C-Mill. However, therapists have to be well versed in operating this instrumented treadmill to attune training to the specific needs and abilities of individual patients. We therefore developed a standardized, automatized and patient-tailored progressive walking adaptability training protocol, called C-Gait. C-Gait consists of a baseline assessment involving seven walking-adaptability tasks and a decision-algorithm to automatically update training content and execution parameters based on patients' performance and perceived challenge. The aim of this proof-of-concept study was to evaluate content and construct validity of the baseline assessment, as well as the feasibility, acceptability and clinical potential of C-Gait training.

METHODS: 24 healthy adults, 12 healthy elderly and 28 persons with gait and/or balance deficits (GD) performed the baseline assessment; the GD group received 10 C-Gait training sessions over a 5-week period and also performed post-training and retention tests (baseline assessment and walking-related clinical measures).

RESULTS: The content and construct validity of the baseline assessment were evidenced by significant differences over groups, no-to-moderate correlations with walking-related clinical measures, and limited correlations between walking-adaptability tasks. C-Gait training yielded significant progression in training content and execution, with considerable between-patient variation and minimal overruling by therapists. C-Gait training was well-accepted and led to improvements in walking adaptability and general walking-related clinical measures, which prevailed at retention.

CONCLUSIONS: C-Gait appeared valid and offers automatized, standardized and patient-tailored walking-adaptability training, which is feasible, well accepted, and with good potential for improving both task-specific and generic measures of walking.

P64: RESTORATION OF ELBOW EXTENSION BY TENDON TRANSFER: EFFECT ON WHEELCHAIR MOBILITY

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PURPOSE: Patient satisfaction after a reconstructive elbow extension surgery is high. However, the full biomechanical effect of this procedure related to wheelchair propulsion is essentially unknown. Analysis of biomechanical parameters may shed light on the interplay changes due to this surgery and could identify possible benefits or risk factors related to mobility. The aim of this study was to investigate the effects of a surgical elbow extension reconstruction on wheelchair propulsion characteristics in persons with tetraplegia.

METHODS: One participant with tetraplegia was measured before and six months after elbow extension reconstruction. The surgical procedure undertaken was the deltoid-to-triceps transfer technique, in which the insertion of the posterior deltoid was connected via a tendon graft to the triceps tendon. At both time points the participant performed wheelchair propulsion on the treadmill with a speed of 0.56m/s and a power output of 15W. During wheelchair propulsion the applied forces were measured with an instrumented wheel during 30s while kinematics were recorded. Propulsion characteristics were analyzed over all complete pushes.

RESULTS: While propelling at the constant power output, the total mean applied push force (pre 49N, post 38N) and peak applied push force (pre 67N, post 58N) decreased and was exerted in a more effective direction, represented by the higher fraction effective force (pre 62%, post 73%). The patient could apply the propulsion force over a longer push angle (pre 66°, post 74°), which resulted in a lower push frequency (pre 52 pushes/min, post 47 pushes/min).

CONCLUSIONS: The surgical intervention did lead to a more effective force production during wheelchair propulsion. The lower applied forces as well as the longer and less frequent pushes after the tendon transfer are related to lower peak load on the upper extremity and are likely related to a lower risk for overload injury of the shoulder.

P65: METABOLIC COST OF DAILY ACTIVITIES IN PEOPLE WITH LOWER LIMB AMPUTATION - A STUDY PROTOCOL

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PURPOSE: People with lower limb amputation (LLA) have higher metabolic costs for walking compared to able bodied persons. A more proximal amputation and a faster walking speed are factors increasing these metabolic costs. For other activities of daily living (ADL) relevant data is very limited. To create an individualized evidence-based rehabilitation program for patients with a LLA, understanding the metabolic cost of multiple ADL, in the context of peak physical capacity, is a requirement. Based on these individualized data, the relative metabolic costs of ADL can be determined and help to set functional and realistic goals of exercise and training activities to improve physical capacity.

METHOD: A search process took place where literature is searched about the remaining functionality and ADL which are representative for people with a LLA. Besides that, discussions have taken place with rehabilitation specialists.

RESULTS: A protocol is developed which consists of ten different -standardized- components of physical fitness and the metabolic costs standardized- ADL. Tests will be conducted over two days. Day 1: a health questionnaire, Range of Motion test (ROM), strength test, Berg Balance Scale, VO₂-peak test (including resting metabolism). Day 2: 6-Minutes Walking Test (6MWT), Timed Up & Go Test (TU>), Stairclimbing test (SCT), submaximal cycling test, Glitter ADL-Test and the Floor Transfer Test (FTT). During these tests, data on (relative) oxygen uptake, energy cost, perceived exertion and heartrate will be determined.

CONCLUSION: A protocol was developed to obtain individualized (relative) metabolic cost of standardized ADL in LLA. Next, this protocol will be tested in LLA on feasibility, reliability and validity.

P66: MACHINE LEARNING METHODS TO IDENTIFY GAIT PATTERNS OF GERIATRIC PATIENTS WITH AND WITHOUT COGNITIVE IMPAIRMENT

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PURPOSE: The purpose of this study was to automatically identify gait patterns of geriatric patients with and without cognitive impairment using non-linear machine learning.

METHODS: Geriatric out-patients with (n=72, age: 80.8 ±5.98) and without cognitive impairment (n=115, age: 79.7 ±5.68) participated in the study. Cognition was assessed by the Mini Mental State Examination. Trunk accelerations were measured with a 3D accelerometer (DynaPort® MiniMod, McRoberts BV and iPod touch 4G, iOS 6, Apple Inc.; sample frequency ±100 Hz) during three minutes of walking. From the 3D accelerometer signals 23 dynamic gait variables were calculated related to gait pace, stability, regularity, variability and regularity. A Kernel (polynomial and Gaussian kernel functions) Principle Component Analysis (KPCA) was applied to extract underlying gait features and reduce the dimensionality of the data. Thereafter, a non-linear classification Support Vector Machine approach (SVM) was compared with Artificial Neural Networks (ANN).

RESULTS: KPCA reduced gait data dimensions efficiently from 23 dimensions to five dimensions, explaining 100 % of the variance, and representing gait features in pace, synchronization, regularity, and variability. Preliminary analyses showed that classification accuracy of SVM (83%) and ANN was similar and both could identify gait of geriatric patients with and without cognitive impairment. However, ANN is sensitive to parameter selection. With regard to SVM, different kernel functions resulted in similar classification performance with less parameter influence. Compared with ANN, SVM performed better with the type of data used in the present study.

CONCLUSIONS: Cognitive impairment affects specific gait features that can be identified by non-linear approaches like KPCA in combination with SVM. Based on gait dynamics representing the quality of the gait, participants with and without cognitive impairment could be labeled automatically.

P67: COLLABORATION BETWEEN PSYCHOMOTOR THERAPY AND HUMAN MOVEMENT SCIENCES; A LITERATURE REVIEW IN MENTAL HEALTH CONTEXT

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PURPOSE: In the multidisciplinary collaboration between human movement, rehabilitation and mental health sciences, psychomotor therapy (PMT) has clinical as well as research opportunities to offer.

METHOD: PMT is a body and movement oriented therapy, well established in Dutch mental healthcare, rehabilitation practice, programmes for adapted physical activity, and intellectual disability nursing. PMT integrates physical activity and psychological meaning in observation and treatment of a wide variety of disorders.

RESULTS: The current study shows an example of PMT research in mental health care for elderly with personality disorders, using expertise of Human Movement Sciences at the Groningen University. These disorders need more specific attention in cases where problematic personality traits persist with ageing.

At the University Medical Centre Groningen an intervention has been developed combining a psychological and psychomotor approach, following the principles of Schema Focussed Therapy (SFT). Based on promising clinical experiences, a multicentre randomised controlled trial is ongoing to study the effectiveness of the intervention. Also, qualitative interviews are prepared to shed light on possible working mechanisms of PMT.

DISCUSSION: In search for previous evidence, a narrative review has been conducted. The results indicate that very little is known about the effect of body and movement oriented therapy combined with psychological treatment for this target group. The sparsity of findings underlines the necessity of research and innovation in the treatment of elderly with personality disorders. Our hypothesis is that the 'learning by doing' approach of PMT enriches the experiential part of SFT, which may contribute to better and more sustainable treatment outcomes. Expanding the research collaboration between PMT and Human Movement Sciences may be a fruitful undertaking in finding new treatment directions in various fields of health care.

P68: EXTENDED CARDIAC REHABILITATION IMPROVES AEROBIC CAPACITY AND FATIGUE: THE OPTICARE RANDOMIZED CONTROLLED TRIAL

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PURPOSE: To investigate effects of two novel behavioral lifestyle interventions integrated into cardiac rehabilitation on aerobic capacity, fatigue, and participation in society and to explore mediating effects of physical activity and sedentary behavior.

METHODS: In the OPTICARE trial, 914 patients with acute coronary syndrome (ACS) were randomized to 1) 3 months of standard cardiac rehabilitation (CR-only); 2) CR-only with additional face-to-face physical activity group counseling sessions plus 9 months of after-care with general lifestyle group counseling (CR+F); or 3) CR-only plus 9 months of after-care with individual, general lifestyle telephone counseling sessions (CR+T). Aerobic capacity (6-minute walk test), fatigue (Fatigue Severity Scale), and participation in society (Utrecht Scale for Evaluation of Rehabilitation-Participation) were measured at randomization, 3 months, 12 months, and 18 months.

RESULTS: Generalized estimating equation analysis revealed favorable intervention effects for CR+F (compared to CR-only) in aerobic capacity up to 12 months ($B = 12.49$ m; 95% confidence interval [CI], 0.53 to 24.46; $P = .041$) and in prevalence of fatigue until at least 18 months (odds ratio [OR] = 0.47; 95% CI = 0.26 to 0.84; $P = .010$). No additional improvements were seen for participation in society. No intervention effects were found for CR+T. Exploratory analysis showed that improvements in aerobic capacity in CR+F were mediated by improvements in physical activity. No mediating effects were found for improvements in fatigue.

CONCLUSIONS: Extending cardiac rehabilitation with a face-to-face behavioral group intervention was successful in sustaining aerobic capacity gains for up to 12 months and for reaching long-term goals for improvements in fatigue. The benefits in aerobic capacity seem to be mediated by improvements in daily physical activity. A telephonic behavioral intervention provided no additional benefits.

P69: DEVELOPMENT OF A RESTING ENERGY EXPENDITURE EQUATION IN INDIVIDUALS WITH CHRONIC SCI FOR AN APPLICATION

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PURPOSE: Approximately up to 69% of the individuals with spinal cord injury (SCI) are either overweight or obese. Therefore, maintaining or a transition towards a healthy body mass is clinically relevant and crucial to reduce the risk of developing weight-related secondary complications. Providing insight in the total daily energy expenditure (TDEE) could support this. Estimation of the resting energy expenditure (REE), which determines up to 70% of the TDEE, is necessary in order to determine TDEE. Therefore, the purpose of this study is to develop a SCI-specific REE estimation equation for people with a chronic SCI based on demographic, anthropometric and clinical characteristics.

METHODS: Forty individuals with chronic SCI performed a 30 minutes REE measurement with indirect calorimetry after at least five hours of fasting. Demographic (age, sex), anthropometric (height, body mass, waist circumference) and clinical characteristics (lesion level and completeness, time since injury) were assessed. The lowest average energy expenditure (EE) over five minutes was used as REE and a variability less than 15% in mean oxygen uptake (VO₂) and carbon dioxide production (VCO₂) was used as indication for steady-state gas exchange. A multiple regression model was performed to generate an estimation equation with the best fit.

RESULTS: Data collection is currently ongoing and will be available and presented in December. Main outcome parameter will be REE in kcal/day.

DISCUSSION: The new SCI-specific REE estimation equation will be integrated in an existing E-Health application for able-bodied individuals to enhance health and fitness.

CONCLUSIONS: With these results an E-Health application can be adapted for individuals with chronic SCI to estimate REE and TDEE. In future research the effect of this E-Health application on health and fitness will be tested in an intervention study including individuals with chronic SCI.

P70: FEASIBILITY OF OBJECTIVE ARM-HAND ACTIVITY FEEDBACK APPLIED VIA A WRIST-WORN DEVICE IN STROKE PATIENTS

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PURPOSE: To develop a wrist-worn activity tracker that stimulates arm-hand use after stroke by objective feedback, we evaluated the feasibility of different forms of feedback applied via a wrist-worn activity tracker in stroke patients.

METHODS: Six stroke patients (5 males, 1 female; age: 58.2±18.2 yrs; 1 month - 5 years post stroke) participated in this pilot study. A semi-structured interview was performed to evaluate the feasibility of vibrotactile feedback and visual feedback applied via a wrist-worn activity tracker on the more affected arm. During the interview participants wore an activity tracker on the wrist of the more affected arm. To evaluate the feasibility of vibrotactile feedback, participants experienced for approximately ten seconds a series of short lasting vibrotactile triggers. Visual feedback was evaluated by showing fictitious activity feedback on the display of the wrist-worn activity tracker.

RESULTS: Five out of six patients were able to feel the vibrotactile trigger applied to the more affected arm. These five patients also accepted the vibrotactile trigger. All six patients were able to read and understand the fictitious activity feedback shown on the display of the wrist-worn activity tracker. Furthermore, all patients preferred the combination of vibrotactile and visual feedback over a single form of feedback.

CONCLUSIONS: The results of this pilot study indicate that vibrotactile feedback and visual feedback applied via a wrist-worn activity tracker are feasible in stroke patients and should be combined to stimulate arm-hand use after stroke.

P71: EFFECT OF DIFFERENT HEEL ROCKER PROFILES ON LOWER-LIMB JOINT BIOMECHANICS AND PLANTAR PRESSURE

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PURPOSE: The purpose of this study was to investigate adaptations in lower-leg biomechanics and plantar pressures during walking with different heel rocker profiles.

METHODS: Ten participants participated in this study. An experimental shoe with a total of 12 different heel rocker profiles and one control setting were fabricated. Profiles were adjusted on three parameters: apex position (at lateral malleolus (LM) and more posterior at 0.5x and 0.75x LM-heel length), apex angle (-10°, 0 and +10°) and rocker radius (small, large). Kinematics, kinetics and plantar pressures were recorded simultaneously.

RESULTS: Preliminary results show a decrease in ankle plantarflexion, dorsiflexion moment and negative ankle power during loading response when apex position is more anterior and rocker radii are increased. No effect of apex angle on foot inversion/eversion angle was noticed. Plantar pressure profiles reveal a decrease in peak pressure on the posterior heel regions with a more anterior apex position. Effects of apex angle and rocker radius on pressure profiles are less clear and needs more analysis.

CONCLUSIONS: A more anterior apex position and a larger rocker radius clearly reduce sagittal plane ankle range of motion, dorsiflexion moment and negative power during loading response. Peak plantar pressures in posterior heel regions is decreased when the apex position is placed more anterior. No conclusions about the effects of different apex angles on in kinetics, kinematics and plantar pressure can be drawn yet because of inconsistent results.

P73: EFFECTS OF A PEDIASUIT ADAPTED PROTOCOL IN THE MOTOR FUNCTION OF CHILDREN WITH CEREBRAL PALSY

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PURPOSE: The purpose of this study was to verify if the PediaSuit Method in a semi-intensive adapted format is effective to increase the motor function of children with Cerebral Palsy.

METHODS: Longitudinal study in which eight children with CP was classified by the Gross Motor Function Classification System (GMFCS) and underwent the gross motor function assessment using the Gross Motor Function Measure (GMFM) before the intervention with the PediaSuit Method. This method is described by an intensive format, where the child is attended wearing the suit five times a week, during three hours, in a period of one month. Meanwhile, based on the politics of the attendance of the Rehabilitation Center where the study was made, this intervention was adapted to the therapy wearing the suit once a week, during three hours, but followed in a period of four months. This adaptation was made to complete the 80 hours of intervention with the suit, required by the traditional configuration of the method. After this semi-intensive follow-up, the children were assessed again through the GMFM.

RESULTS: The GMFCS showed that 75% of the sample had score III, and the other 25% divided into II and IV, 12,5% each. Even the raw score showing increase in every section of the GMFM, there was no statistic difference between the assessment before and after the intervention according to the Student's t-Test (lying and rolling (p=0,16), sitting (p=0,15), crawling and kneeling (p=0,09), standing, walking (p=0,44), running and jumping (p=0,39).

CONCLUSIONS: There are some quality-based benefits about this semi-intensive adapted protocol of the PediaSuit Method. However, the classic application of the method in a short and intensive period seems to bring more benefits to the motor repertoire of the children with CP.

P74: AEROBIC EXERCISE AND COACHING TO IMPROVE PHYSICAL FITNESS IN NEUROMUSCULAR DISEASES: I'M FINE STUDY PROTOCOL

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BACKGROUND: In individuals with neuromuscular diseases (NMD), symptoms of muscle weakness, fatigue and pain may lead to reduced physical activity and a sedentary lifestyle, which negatively impact on physical functioning. The lack of individualization of previously studied physical activity programs likely contributes to the inconclusive overall evidence regarding exercise in NMD. Consequently, the optimal training approach and strategies to preserve a long term active lifestyle remain unclear. Therefore, the personally-tailored physical activity program I'M FINE was developed for individuals with slowly progressive NMD, combining aerobic training to improve physical fitness and coaching to preserve an active lifestyle.

PURPOSE: To evaluate the efficacy of the I'M FINE program on the physical fitness of individuals with slowly progressive NMD, and to evaluate the efficacy of this program on preserving an active lifestyle.

METHODS/DESIGN: A multicenter, assessor-blinded, randomized controlled trial will be conducted. Patients with post-polio syndrome (N=30), Charcot-Marie-Tooth disease (N=30), or other slowly progressive NMD (N=30) with a request for help indicative of impaired physical fitness due to physical inactivity will be randomized to the intervention or control group, receiving usual care. The intervention consists of a home-based 6-month polarized aerobic exercise program. Target intensity will be based on the patient's anaerobic threshold. The coaching program involves 8-12 individual sessions to identify and focus on individual beliefs aiming to promote a physically active lifestyle. At baseline, post-intervention, and at 6- and 12-months follow-up, peak oxygen uptake, daily activity, and other secondary outcomes (e.g. quality of life, metabolic syndrome markers) will be assessed.

DISCUSSION: The results will give insight in the efficacy of the I'M FINE program on physical fitness and an active lifestyle of individuals with slowly progressive NMD.

P75: THE USE OF AN INERTIAL MEASUREMENT UNIT TO ASSESS THE SHANK-TO-VERTICAL ANGLE IN HEALTHY INDIVIDUALS

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PURPOSE: Can the Shank-to-Vertical Angle (SVA) be accurately assessed during standing and walking using an Inertial Measurement Unit (IMU) on the shank in healthy adults?

METHODS: Twelve healthy participants were recorded during standing still and barefoot walking with a 3D motion capture system (3D-GA) and simultaneously with IMUs on the shank. Two different procedures were evaluated to determine the SVA by the IMU: an IMU-to-body alignment (IMU-B) and an IMU-to-posture alignment (IMU-P). For the IMU-B alignment, the IMUs were anatomically placed at two different locations: anterior, in line with the tibial tuberosity and midline of the ankle (frontal alignment; fIMU), and lateral, in line with the lateral epicondyle and lateral malleolus (sagittal alignment; sIMU). For the IMU-P alignment, IMU orientation of both fIMU and sIMU were set to zero when subjects were asked to stand straight. The SVA of the 3D-GA was used as gold standard and defined as the angle between the line connecting the knee and ankle joint centres relative to the vertical in the global sagittal plane. Correlation (r) and repeatability coefficients (RC) were calculated for the SVA between the IMUs and the gold standard during standing with slightly bended knees and in midstance during walking.

RESULTS: The mean (SD) SVA measured by 3D-GA was 7.4° (1.9°) and 10.2° (1.4°) during standing and walking, respectively. The fIMU-B had the highest r-value (r=0.95) and lowest RC (2.6°) during standing. The other r-values during standing ranged from 0.61 to 0.54. During walking, r-values varied between 0.48 and 0.32, with the lowest RC found in the sIMU-B (4.7°).

CONCLUSION: A single IMU anatomically aligned at the anterior side of the shank can accurately assess the SVA during standing with an accuracy within 3°, when compared to 3D-GA. Although IMUs seem a promising method to use for orthotic alignment, the method needs to be further optimized to assess the SVA during walking.

P76: PROPULSION BIOMECHANICS OF MANUAL WHEELCHAIR USERS WITH UPPER LIMB PAIN

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Rotator cuff injuries, carpal tunnel syndrome and other overuse injuries in the upper limbs are very common in manual wheelchair users (MWUs). Because of the high dependence of MWUs on the upper limbs, these injuries can have significant disadvantages to their quality of life. Propulsion technique is a key component in causing overuse injuries and can therefore be important for preventing or reducing injuries. This review aims to bundle information about propulsion biomechanics in MWUs with upper limb pain or injuries and to distinguish a pattern of causality to help clinicians in the development of rehabilitation for these patients. A literature search using PubMed was conducted to find relevant literature. Articles were included for this review if they included a measure for pain or a grouping system based on the presence of pain. The reported pain needed to be in the area of the upper limbs, including the shoulder. Reviews and non-English articles were excluded from this study. A total of nine articles were included, seven of which studied shoulder injury and two examined wrist injury. Because intervention studies about this topic have not been conducted and are difficult to perform, a causal relationship

cannot be established with certainty. However, theoretic explanation given in the articles was examined. Propulsion forces not contributing to forward movement were suggested to cause injuries. Contradictory results were reported for motor variability. However, increasing variability without overstraining other muscle groups is suggested to reduce upper limb pain, while minimizing risk for future injury. Further research should be conducted to develop alternative propulsion techniques or propulsion aides for MWUs with upper limb pain.

P77: PRACTICE-BASED SKILL ACQUISITION OF PUSHRIM-ACTIVATED POWER-ASSISTED WHEELCHAIR PROPULSION VERSUS REGULAR HANDRIM PROPULSION IN NOVICES

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BACKGROUND: Regular handrim wheelchair (RHW) propulsion is straining for the upper extremities and wheelchair users often experience overuse problems. A recent advancement in wheelchair technology that could assist users is the pushrim-activated power-assisted wheelchair (PAPAW). PAPAWs are challenging to control, yet it is unclear how people learn to use a PAPAW. The purpose of this study is to examine early skill acquisition through practice in PAPAWs and compare it with RHWs.

METHODS: Twenty-four able-bodied novices were randomly allocated to either the RHW group or the PAPAW group. The experiment consisted of five sessions with three blocks of 4 min steady-state practice at 1.11 m/s and 0.21 W/kg. Finally, a transfer to the other mode was made. Data were collected with a drag-test, breath-by-breath spirometry, and a motion capture system. The last minute of each four-minute block was used for analysis. A mixed analysis of variance (ANOVA) was used to compare group, time, and interaction effects.

RESULTS: Both groups improved their (assisted) mechanical efficiency, reduced their stroke rate, right-left and forward-backward deviation on the treadmill, and had a lower rate of perceived exertion (RPE) over time. (Assisted) mechanical efficiency was higher for the PAPAW group than for the RHW group and RPE was lower. However, left-right and forward-backward deviation was also found to be higher in the PAPAW group.

CONCLUSIONS: At the group level the energetic cost of RHW and PAPAW propulsion can be lowered through low-intensity practice in novice users. The PAPAW is more 'efficient' than the RHW given the reduced energy requirement of the user from the motor assist, but more difficult to control. Future studies on PAPAWs should focus on the control needs of the user and their interaction with the power-assist technology.

P78: FROM WAITING TO TRAINING: FEASIBILITY OF PRE- AND POSTOPERATIVE REHABILITATION FOR CARDIAC SURGERY PATIENTS

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PURPOSE: This retrospective observational study aimed to determine the feasibility, defined in terms of the accessibility, compliance, training load and safety of the Heart-ROCQ program, consisting of pre- and postoperative (in- and outpatient) rehabilitation. The Heart-ROCQ program was hypothesized to be feasible.

METHODS: The study included 41 patients scheduled for open heart surgery at the University Medical Centre Groningen, the Netherlands and followed the Heart-ROCQ program. Outcome measures were percentage of eligible patients following the program, compliance to follow the training sessions, training load of bicycle and strength training and safety of the program.

RESULTS: Of the eligible patients 64% followed the program. During the pre- and postoperative outpatient phase, approximately 69% of the strength and 79% of the bicycle training sessions were followed. Significant increases in training load were seen within each rehabilitation phase. Compared to the last preoperative session, training load of the last postoperative session was significantly lower for strength training, but not significantly different for bicycle training. Regarding safety, there were no reports of serious adverse events.

CONCLUSIONS: The Heart-ROCQ program was feasible in terms of accessibility, compliance and training load. Patients awaiting for cardiac surgery were able to safely exercise preoperatively, increase the training load before surgery and regain it postoperatively.

P79: GLOVE TYPES AND SPATIOTEMPORAL VARIABLES OF WHEELCHAIR RACER ACCORING PARALYMPIC SPORTS CLASSIFICATION IN 100M SPRINT.

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PURPOSE: First, to investigate the preference of Glove Type(GT) preference for wheelchair racing players according to Paralympic Sports Classification(PSC) and Gender(G). Second, to investigate the Spatiotemporal Variables(SV) characteristics according to the GT during a 100m wheelchair race.

METHOD: We used the internet broadcasts for the data collection. Based on the finals, 359 people were observed in 48 races. We recorded their PSC, GT, G, official time(OT), and stroke count(SC) directly by eye. After the data processing, this study analyzed 250 data. GT preference was defined as the distribution of Hard Glove(HG) and Soft Glove(SG) users among the total number of people. SV were calculated using average speed of 100m(S), Stroke frequency(Sf) and Stroke length(Sl) using the OT and SC.

RESULT: In both male and female, the lower impaired, the more SG preference increased. On the other hand, HG preference showed a decreasing tendency. T33, T34, and T51 showed overwhelming preference for SG in all groups regardless of G. One particular result is the G difference. In most groups, male preferred SG and female preferred HG. Distribution of GT(SG:HG)= Male: t33(89:11) t34(100:0) t51(95:5) t53(71:29) t54(84:16) Female: t34(100:0) t52(10:90) t53(82:18) t54(35:65)

The results of analysis of SV according to GT showed statistically significant difference only in T54. Male T54 indicate differences in all variables of S(SG>HG, U=42) Sf(SG<HG, U=46). Female T54 indicate differences only in Sf(SG<HG, U=66). The S and Sl did not indicate difference. In addition, SG and HG showed different propulsion strategies regardless of G. Sf is relatively high for HG, and Sl is high for SG.

CONCLUSION: GT preference characteristics were confirmed by G and PSC. In addition, the T54 confirmed the characteristics of the propulsion strategies for each GT. In conclusion, this study suggests the choice of GT, which is suitable for G and PSC characteristics.

P80: CAPTURING PHYSICAL PERFORMANCE IN DAILY WHEELCHAIR MOBILITY: WHAT 'REAL LIFE DATA' TO MEASURE?

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PURPOSE: For longitudinal studies of persons with spinal cord injury (SCI) in interaction with their actual environment, Real Life Data (RLD) on Physical Performance (PP) is desired. This case study evaluates options to capture PP in daily wheelchair mobility. Wearable sensors enable the collection of RLD, but new methods, algorithms and additional information might be required to link to existing knowledge.

METHODS: One experienced participant in a manual wheelchair followed two distinct routes (standard or wheelchair-friendly) at the Swiss Paraplegic Center, from halfway to top of the campus hill. An instrumented wheelchair (SmartWheel, Out-Front, USA) measured wheel angle, forces and torques at the rim. An inertial sensor (IMU, Movea Inc., France) was fixed and aligned to wheelchair frame, trunk and wrist. GPS location was recorded with a smartphone. For comparison of the two routes, the following variables were measured or derived: Track Descriptives (TD); distance, speed, acceleration, inclination, altitude gain, and PP; force and torque exerted on the rim, power output (PO).

RESULTS: Data processing is ongoing at time of abstract deadline. Results will be presented in a cross table showing the distinct data sources versus respective derived variables like TD and PP for the two routes.

(PRELIMINARY) DISCUSSION: Considering TD, the resolution of generic GPS signals and online mapping tools like Google Maps is not adequate. Additional detailed geographical models can increase this resolution. The use of an accelerometer to calculate distance, speed and PO is prone to error and heavily depending on filter characteristics. The use of a simple rotary encoder on the wheel axis will increase the resolution and accuracy of most TD considerably.

CONCLUSION: Current wearable technology is promising in capturing daily mobility, but it is advised to use smart combinations of data sources. Additional environmental detail might increase resolution and accuracy of PP and TD.

P81: HANDCYCLING IN AN MRI: A NEW PLATFORM TO UNDERSTAND LOCAL METABOLIC CHANGES BECAUSE OF TRAINING

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INTRODUCTION: Mechanical efficiency (ME) improves as a result of low-intensity interventions. However, underlying working mechanisms at the level of individual muscles, their local energy metabolism and coordination have been neglected so far. The aim of this research was therefore on the changes in muscle activation, force production, ME, and local muscle metabolism as a result of a three-week handcycle-like practice intervention.

METHODS: A newly developed MR-compatible handcycle allowed for a multitude of measurement tools. 6 participants completed 80 minutes of handcycling training. During the first pre- and post-test measurements of EMG, force production and gas exchange were performed. During the second pre- and post-test phosphocreatine depletion, phosphomonoester accumulation and pH were determined using ³¹P-Magnetic Resonance Spectroscopy (³¹P-MRS).

RESULTS: The participants used three different strategies to propel the handcycle; pushing, pulling or a mixture of both. On a group level no significant improvements in terms of muscle activation were observed. Individually all participants were found to require a reduced muscle activation. Furthermore, absolute force production and variation of the force signal was reduced. In terms of ME an overall significant improvement was found. There were no significant changes in terms of local muscle metabolism.

CONCLUSIONS: Through 80 minutes of motor learning improvements in terms of propulsion technique and mechanical efficiency were observed. Contrary to our expectations, the above improvements were not found to be related to significant changes in local muscle metabolism. Interestingly, several different strategies were observed and appeared to remain the same for nearly all participants over the intervention. The current study proved the feasibility of dynamic metabolic measurements during a cyclic upper body task in combination with several additional relevant parameters.

P82: THE IMPLEMENTATION OF $\dot{V}O_2$ KINETICS TO EVALUATE TRAINING EFFECTS IN CANCER PATIENTS

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PURPOSE: Oxygen uptake ($\dot{V}O_2$) kinetics can be used to measure exercise capacity. A constant work rate (CWR) test at moderate intensity measuring $\dot{V}O_2$ on-kinetics may be more suitable for a deconditioned patient population and a valuable source of information on training effects in addition to the regular exercise tests. The main goal of this study was to compare the sensitivity of $\dot{V}O_2$ on-kinetics during a rest-to-submaximal exercise transition to the regular variables measured in an incremental cardiopulmonary exercise test (CPET): ventilatory threshold (VT), $\dot{V}O_{2peak}$ and peak work rate (WR_{peak}) to exercise induced changes, and to evaluate the usefulness of $\dot{V}O_2$ on-kinetics in determining an improved exercise capacity with respect to CPET in cancer patients.

METHODS: Ten cancer patients (7 females) with a variety of cancer types aged between 39 and 64 years were enrolled in a 12-week rehabilitation program, in which they performed combined cycle-ergometer and strength training for two times a week. At initial and final evaluations, $\dot{V}O_2$ on-kinetics were measured breath-by-breath during a CWR test of moderate intensity, and $\dot{V}O_{2peak}$ and VT were measured with a CPET.

RESULTS: Comparisons between pre- and post-intervention showed large effect sizes for $\dot{V}O_{2peak}$ ($r = .59$) and oxygen uptake at VT ($r = .56$). $\dot{V}O_2$ on-kinetics did not change after the training program.

CONCLUSION: The current results suggest that $\dot{V}O_2$ on-kinetics is not more sensitive to exercise-induced adaptations compared to $\dot{V}O_{2peak}$ and VT. However, $\dot{V}O_2$ on-kinetics did increase in eight of the ten subjects, and can serve as a source of information on training progress, especially when other information is lacking due to a non-maximal CPET or an unreliable VT

P83: CHANGES IN BODY COMPOSITION IN PEOPLE WITH RECENT SPINAL CORD INJURY DURING INPATIENT REHABILITATION

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PURPOSE: Tracking the changes in body composition in individuals with spinal cord injury (SCI) during inpatient rehabilitation can be of great value to provide them with good advice and guidelines regarding diet and exercise. The purpose of this study was to investigate 1) changes in body composition indicated by body mass index (BMI), waist circumference (WC), body fat percentage (BF%) and lean body mass percentage (LBM%) in individuals with recent SCI during their first inpatient rehabilitation from admission to discharge and 2) the differences of these body composition changes over time in different age, gender, lesion level and motor completeness groups.

METHODS: This study was based on AMsterdam Spinal Cord Injury (AMS-SCI) cohort study which included 59 persons with SCI. Patients were measured at admission (T0) and discharge (T1) of inpatient rehabilitation (median of the time period: 61 days). Height was registered at T0, while body mass (weight scale), WC (tap measure), BF% and LBM% (Bioelectric Impedance Analysis) were measured at T0 and T1.

RESULTS: No significant changes in BMI (T0: 25.46±5.06; T1: 25.38±4.90), WC (T0: 94.04±13.75; T1: 93.38±12.73), BF% (T0: 28.09±10.25; T1: 27.58±10.13) and LBM% (T0: 71.91±10.25; T1: 71.91±11.08) were found during inpatient rehabilitation in individuals with recent SCI. When taking personal or lesion characteristics into account, no significant interaction effects were found.

DISCUSSION/CONCLUSION: In contrast to our expectations, no significant changes in body composition in individuals with recent SCI during inpatient rehabilitation were identified. This may be caused by the relatively short period of time between admission and discharge or the different changes in body composition between paralyzed parts and normal parts. It may also be a reason that these people were taken good care during inpatient rehabilitation so the changes in body composition didn't show the unfavorable trend.

P84: PROBE-DESIGN: HEART REHABILITATION IN PATIENTS AWAITING OPEN-HEART SURGERY PREVENTING COMPLICATIONS AND IMPROVING QUALITY OF LIFE

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PURPOSE: The objective of the Heart-ROCQ PROBE study is to assess the effectiveness of a combined pre- and post-operative multidisciplinary cardiac rehabilitation (CR) programme (the Heart-ROCQ programme) as compared to care as usual in patients awaiting cardiac surgery (CS). We hypothesize that the Heart-ROCQ programme is beneficial to improve quality of life (QoL) and to reduce post-operative complications, readmissions and major adverse cardiac events (MACE).

METHODS: After informed consent 350 patients are randomized to the Heart-ROCQ programme or usual care. The Heart-ROCQ programme consists of a preoperative optimization phase during the waiting time (3 times p/week, > 3 weeks), a post-operative in-patient phase (3 weeks) and an outpatient CR phase (2 times p/week, 4 weeks). During each phase, patients receive multidisciplinary (e.g. physical, dietary, psychological, and smoking cessation) treatment. Usual care consists of a 6 to 12 weeks post-surgery outpatient CR programme with education and physical therapy. The primary outcome, which is evaluated blinded by an end-point committee, is a composite weighted score of QoL, surgical complications, readmissions to hospital and MACE. Secondary outcomes are length of stay, atrial fibrillation, surgical re-explorations, physical and psychological health and work participation. An economic evaluation is also performed. In addition, physical activity, weight, waist to hip ratio and smoking behaviour are measured. Data is collected by means of questionnaires, physical tests and physical activity monitoring at six time points: at the beginning and end of the waiting time, at the time of discharge from the hospital, and after 3, 7 and 12 months after surgery.

DISCUSSION: The Heart-ROCQ PROBE study is the first prospective randomized, open blinded end-point (PROBE) trial to provide data on the effectiveness of a combined pre- and post-operative multidisciplinary CR programme in elective cardiac surgical patients.

P85: STIMULATING PHYSICAL ACTIVITY IN HARD-TO-REACH PHYSICALLY DISABLED PEOPLE; SYSTEMATIC DEVELOPMENT OF A COMMUNITY-BASED INTERVENTION

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PURPOSE: Physically disabled people participate less in physical activity (PA) than healthy people. Most existing PA interventions are rehabilitation- or school based, limiting their reach. The current study aims to develop a community-based intervention for stimulating PA in hard-to-reach physically disabled people.

METHODS: Intervention Mapping (6 steps) was used for systematically developing a PA intervention. Health related quality of life (HRQoL) of physically disabled people was measured using the RAND-36. Requirements on an intervention were investigated using qualitative research among experts and physically disabled people.

RESULTS: HRQoL was poorer in physically disabled people compared to healthy people (step 1). Since experts expressed no need for a new intervention, the existing intervention "Activity coach" (Dutch: Beweegcoach) was adapted to the requirements of experts and the target population. Within the adapted intervention, "Activity coach+", participants will be reached by a network of intermediate organisations. Participants will have a physical assessment by physiotherapists, and will be individually guided to organised or non-organised activities by an activity coach. Participants will monitor and set goals for daily PA using an activity tracker. Participants will be coached one year (step 4). Activity coaches were trained and network meetings were organised to support adoption and implementation (step 5). Activity coach+ is implemented in community March 2017, and will be evaluated using a mixed-method design. PA will be objectively monitored, and health effects will be evaluated using questionnaires and physical assessments after 0, 2, 4, 6 and 12 months. Experiences with the intervention will be determined using qualitative research (step 6).

CONCLUSION: Activity Coach+ included a community-based intervention for stimulating both organized and non-organized PA in hard-to-reach physically disabled people, and is currently under evaluation.

P86: EFFECTIVENESS AND FEASIBILITY OF ACTIVITY COACH+; A PHYSICAL ACTIVITY INTERVENTION IN HARD-TO-REACH PHYSICALLY DISABLED PEOPLE.

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PURPOSE: Physically disabled participate less in physical activity (PA) compared to healthy people. Existing PA interventions are mainly performed in rehabilitation-, school- or primary healthcare settings, limiting their reach. Systematic development applying Intervention Mapping resulted in the community-based intervention Activity Coach+, aiming to stimulate both organised and non-organised PA in hard-to-reach physically disabled people. The purpose of this study was to test effectiveness and feasibility of Activity Coach+.

METHODS: Activity Coach+ was implemented in community, and evaluated using a longitudinal study including measurements at baseline, and after 2, 4, 6 and 12 months. PA behaviour was measured using the Activ8 accelerometer and the adapted SQUASH questionnaire. Body mass index (BMI), waist circumference, systolic blood pressure, hand grip force, 10 metre walk test, 6 minute walk test and Berg Balance Scale were measured to assess health changes. Bio psychosocial health was assessed using the RAND-36, Exercise Self-Efficacy Scale, Fatigue Severity Scale and IMPACT-S questionnaire. Data was analysed using non-parametric Friedman tests.

RESULTS: Currently, results of the first four months after implementation of Activity Coach+ are present. During the first four months, 29 hard-to-reach physically disabled people participated in Activity Coach+, of whom two dropped out. PA behaviour did not change within the first four months. BMI ($p=.004$), 10 metre walk test ($p=.001$), 6 minute walk test ($p=.020$), dynamic balance ($p=.014$) and vitality (RAND-36) ($p=.049$) increased over time after implementation of Activity Coach+. A relevant trend was found for the increase of hand grip force ($p=.055$).

CONCLUSION: Activity Coach+ was found feasible in a community setting. First indications for effectiveness of Activity Coach+ in hard-to-reach physically disabled people were provided. Long-term effectiveness of Activity Coach+ will be presented at the conference.

P87: MOVING TOWARDS AN EXERCISE & MOVEMENT-FRIENDLY ACADEMIC HOSPITAL: THE UMCG LIFESTYLE NAVIGATOR

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PURPOSE: A substantial part of the UMCG hospital patients have unhealthy lifestyles. These lifestyles negatively affect treatment and health outcomes. In exploiting the relation between hospital and patient, the UMCG Lifestyle Navigator, a questionnaire-based intervention on four topics (physical activity & exercise, nutrition,

smoking and stress) was developed and tested. This intervention is aimed at making participants aware of the importance of a healthy lifestyle to prevent lifestyle-related diseases. Ultimate goal is to integrate lifestyle counseling into the daily routine of health care professionals.

METHODS: During the first phase of the intervention, a pilot with the UMCG Lifestyle Navigator was executed at the outpatient clinics of Rehabilitation, Plastic Surgery, Orthopedics, Traumatology, Diabetes and Sports Medicine. A mobile desk was manned in the waiting room at which participants could go through the UMCG Lifestyle Navigator, helped by a lifestyle consultant. Currently, in the second phase, this lifestyle check is positioned in a central location in UMCG, open for all patients, visitors and staff. The answers to the questionnaire lead to a printed algorithm based tailor-made and personalized lifestyle advice. In addition, printed information (brochures) and digital information (instructional films) are offered.

RESULTS: 300 participants visited the Mobile Lifestyle Navigator during the pilot phase. Evaluation showed an increase in awareness of the importance of a healthy lifestyle by 74%. The results of the UMCG Lifestyle Navigator at the central location will be available by the end of this year.

CONCLUSIONS: The UMCG Lifestyle Navigator can play an important role in increasing awareness of the importance of a healthy lifestyle. With UMCG's main focus on complex care, attention for lifestyle is of great importance. The spreading numbers of lifestyle-related diseases will be positively influenced by the UMCG's approach of 'Lifestyle as a medicine'.

P88: THE NEXT STEPS OF THE RESPECT COHORT STUDY: CONNECTING REHABILITATION PRACTICE AND SCIENCE

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PURPOSE: This study describes the next steps of the study "Rehabilitation Sports and Active lifestyle" (ReSpAct). This Dutch prospective cohort study among >1700 patients with a physical disability or chronic disease started in the year 2012. A follow-up study (ReSpAct 2.0) will be launched in September 2018. The primary aim of this study is to gain a better understanding of the heterogeneity in patients' physical activity behaviour up to six years after rehabilitation.

METHODS: Patients enrolled in the ReSpAct-study received tailored physical activity counseling during and after rehabilitation and were followed up to one year after rehabilitation. For ReSpAct 2.0, patients (n=±1200) will be asked to participate in an additional follow-up measurement six years after rehabilitation. Physical activity will be measured using both self-report and objective methods. Perceived fatigue and pacing characteristics will be determined in the context of physical activity, well-being and participation. Rehabilitation stakeholders, as the potential knowledge users, will be engaged in different stages of the study using an integrated knowledge translation approach. Successes and challenges related to this approach are being identified throughout the study.

RESULTS: The majority of the patients showed a semi-active stable or active stable physical activity pattern in the year after rehabilitation. Data collection of the six years follow-up measurement will start in 2019. A partnership between ReSpAct-researchers and rehabilitation stakeholders has been created to conduct and disseminate this study together.

DISCUSSION: This study will provide new insights into patients' physical activity behaviour 6 years after rehabilitation. The insights will inform the optimization of physical activity promotion strategies during and after rehabilitation. By engaging stakeholders in the study, we hope that the findings will be relevant and useful for both rehabilitation practice and science.

P90: VIABILITY OF MYOCONTROLLED ASSISTIVE TECHNOLOGY FROM A MOTOR COORDINATION PERSPECTIVE

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PURPOSE: Current-day rehabilitation often uses myocontrolled assistive technology (AT) in upper limb prostheses or electric wheelchairs. Myocontrol is the control of AT through electromyography (EMG) signals derived from the action potentials produced by the muscles (the myosignals). Since myocontrolled AT often lacks functionality, its viability is critically examined using insights of motor coordination.

METHODS: This is a position paper following the style of a narrative review focusing on upper-limb prosthetics. The strategy employed is to take knowledge of motor coordination in the natural situation (i.e., no AT used), and examine whether the requirements of the myosignal in this natural situation meets the requirements of myocontrolled AT.

RESULTS: In upper-limb prosthetics myosignals of muscles in the stump are used to control a prosthetic arm/hand system using direct control or via pattern recognition. For both types of control the myosignals need to be accurate regarding movement intent and consistent over repetitions of the same intent. Motor coordination knowledge is used to assess these notions' viability. First, myocontrol assumes the myosignal to drive the movements. However, muscle activations compensate for external forces. Hence, myosignals have a different role than assumed in myocontrol. Second, myocontrol requires myosignals to be consistent over repetitions. However, due to the abundance of muscles in natural task performance myosignals can be variable over repetitions of performing the same task.

DISCUSSION: These insights into natural motor coordination reveal that myosignals might have properties that differ from what is required for good myocontrol. It will be discussed whether exploiting motor coordination principles related to the abundance of muscles in the detection algorithms of myocontrolled AT could improve functionality.

CONCLUSION: Myocontrolled AT might be improved when taken into account knowledge of motor coordination.

P91: HOW CAN WE ORGANIZE THE HANDBIKEBATTLE IN OTHER COUNTRIES FOCUSING ON CULTURE, ORGANIZATIONAL STRUCTURE, MARKETING?

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PURPOSE: The HandbikeBattle is a handcycling mountain race among 12 Dutch rehabilitation centers with teams of ex-patients. A previous study showed interest by Norway, Switzerland and Germany to organize the HandbikeBattle event. The aim of the present feasibility study was to focus on the culture, organizational structure and marketing.

METHODS: A qualitative research was performed including in-depth interviews together with reviewing the literature. The research area was the Netherlands, Norway and Switzerland.

RESULTS: Both Norway and Switzerland are not part of the European Union and have their own cultural characteristics and their own way to organize handcycling. The country that compares best with the Netherlands is Switzerland. Handcycling is completely integrated within the cycling union of the Netherlands and Switzerland. In Switzerland handcycling is the most popular sport for persons with a physical disability. The Schweizer Paraplegiker- Vereinigung (SPV) is the umbrella organization for people with a Spinal Cord Injury (SCI) and offers care and (financial) support. In Norway the support is limited. The largest rehabilitation centers for SCI are located in Trondheim (Norway) and Nottwil (Switzerland). In Norway and Switzerland the HandbikeBattle will focus on SCI, because this is the largest disability group for the event (Gunderson, 2015).

DISCUSSION: The foundation for handcycling events in the Netherlands aims for the best continuity within their organization. The current organization of the HandbikeBattle is a non-profit organization and is doing close to nothing in the field of marketing. The Dutch rehabilitation centers as well as the Dutch cycling union support the promotion of handcycling within the Netherlands.

CONCLUSION: There are no compatible events like the HandbikeBattle in Norway or Switzerland. The best chance of success for organizing the HandbikeBattle will be in Switzerland.

P92: DIFFERENCES BETWEEN OXYGEN CONSUMPTION AND GROUND REACTION FORCES DURING SELF-PACED AND FIXED-SPEED TREADMILL WALKING-PILOT STUDY

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BACKGROUND: The increased use of self-paced treadmill walking (SPTW) requires an overview of biomechanical differences between SPTW and fixed speed treadmill walking (FSTW). Current literature suggests that kinetic and kinematic differences are negligible¹. However, it was found that the variability of energy exchange between subject and belt was higher during the braking phase in SPTW². It is therefore hypothesised that SPTW might induce a higher oxygen(O₂) consumption and fore-aft ground reaction forces (GRF) for braking and propelling the body are altered. To our knowledge, no studies have assessed the differences in O₂ consumption between both conditions.

PURPOSE: To identify differences in O₂ consumption and peak fore-aft GRF during SPTW and FSTW in healthy adults.

METHODS: Seven healthy participants performed two bouts of walking on an instrumented treadmill with embedded forceplates (CAREN, Motek). The first bout consisted of five minutes SPTW; the second bout consisted of five minutes FSTW in which the speed was set to the mean SPTW-speed. O₂-consumption and CO₂-production gasses were measured via indirect calorimetry (Omnicol, Maastricht University), GRF were measured continuously.

RESULTS: Mean O₂ consumption was 986 and 993 ml/O₂/min, mean maximal braking forces were -60.31 and -58.68 N/kg and maximal propulsion forces were 9.54 and 8.48 N/kg for SPTW and FSTW, respectively. No significant differences were found for all parameters.

DISCUSSION: It was hypothesised that SPTW would induce a higher O₂ consumption due to the increased variation in energy exchange between subject and the belt². However these findings imply that O₂ consumption and peak fore-aft GRF in SPTW and FSTW are comparable. Insight into mechanical work for propelling the centre of mass could give more insight into the relation between energetic demand and biomechanical output in SPTW.

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P93: FEASIBILITY OF VIGOROUS TRAINING INTENSITY WITH A RESISTANCE TRAINING PROGRAM FOR ADULTS WITH INTELLECTUAL DISABILITY

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PURPOSE: Adults with an intellectual disability (ID) have a higher risk of cardiovascular disease (CVD). Resistance training (RT) could potentially lower CVD risk in adults with ID. In order to effectively reduce CVD risk, it is necessary to train large muscle groups with a progressive overload at vigorous intensity. Therefore, the aim of the study is to assess the feasibility of obtaining a vigorous training intensity for adults with ID with CVD risk factors, following a progressive resistance exercise training (PRET) program.

METHODS: Twenty-four adults (23-76 years, 11 men) with a mild or moderate ID with at least one CVD risk factor (diabetes, hypertension, dyslipidaemia, and/or overweight/obesity) exercised twice a week for one hour, for 24 weeks. The PRET program consisted of a whole-body workout of seven exercises. After a familiarization phase, we tried to increase the training intensity from novice level (50% of 1RM) to vigorous intensity (75-80% of 1RM), at the participants own pace.

RESULTS: Nineteen participants (23-75 years, 9 men) finished the 24-week training program. Two participants dropped out due to adverse events, not related to the program, and three dropped out because they did not want to continue training. Eleven participants reached the 75-80% training intensity, four participants reached 60-70% and four participants stayed at novice level (50%).

DISCUSSION: Though it was feasible for eleven adults with ID to train at vigorous intensity, for eight adults training at vigorous intensity was not feasible to achieve within 24 weeks. Identifying reasons for success and failure to achieve training at vigorous intensity is important to increase the feasibility of the program with the potential to reduce CVD.

CONCLUSION: The results from this study can be used as a practice based outline for future intervention studies and/or in daily practice when conducting health programs at both individual and group level for adults with ID.

P94: THE IMMEDIATE INFLUENCE OF IMPLICIT MOTOR LEARNING ON GAIT IN STROKE PATIENTS

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INTRODUCTION: Gait is one of the most practiced activities within stroke rehabilitation. The main aim was to investigate specific immediate gait changes caused by different implicit motor learning strategies, and to assess patient experience associated with each strategy.

METHOD: Participants were randomly allocated to one of three implicit strategies: analogy instructions, environmental constraints, and action observation. Data was analysed (3D-motion analysis) within groups comparing gait before and during the intervention. Patient experiences were assessed by questionnaire.

RESULTS: In analogy learning (n=19) three of four analogies led to small but significant changes in velocity (d=.088 m/s), step height (affected-side d=.006 m) and step width (d=-.019 m) on a group level. Environmental constraints (n=17) led to significant changes in step width (d=-.040 m). For the action observation strategy (n=20), no significant changes were found. At an individual level, results showed wide variation in the magnitude of changes. Overall, participants found it easy to walk while using different strategies and experienced some changes of their gait pattern.

CONCLUSION: Analogy instructions and environmental constraints can lead to specific changes in gait and were in general experienced as feasible by the participants. However, within each strategy, the responses of the patients varied considerably

P95: THE EFFECT OF ASSIST-AS-NEEDED SUPPORT ON ENERGY EXPENDITURE DURING ROBOTIC GAIT TRAINING OF STROKE PATIENTS

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PURPOSE: Effectiveness of robotic gait training in rehabilitation of stroke patients remains inconclusive. A reason could be that the current robotic gait trainers do not initiate motor learning principles enough. To encourage active participation of the patient and therefore motor learning, assist-as-needed support strategies have been implemented in the robotic gait trainer LOPESII. Aim of the current study was to examine the effect of assist-as-needed support on energy expenditure.

METHODS: Ten chronic stroke patients completed three 6-minute walking trials in LOPESII, with zero-support, AAN-support for stiff knee gait and complete-support. The amount of guidance force given during the AAN-support and complete-support was depending on gaining the reference peak knee flexion angle. Metabolic parameters were measured and compared between support conditions.

RESULTS: Although two patients showed a clear elevation in energy expenditure during the zero-support and AAN-support compared to the complete-support, no significant differences in net metabolic power were observed overall.

CONCLUSION: no evidence was found that AAN-support asks a higher active participation of the participant using AAN-support during robot gait training with LOPESII. More research has to be done after the effect of amount of guidance force and interaction forces.

P96: THE PIE=M PROJECT; DEVELOPMENT OF A TOOL TO ENFORCE EXERCISE AS MEDICINE IN HOSPITAL CARE

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PURPOSE: Physical inactivity, has led to an increase in the prevalence of lifestyle-related chronic diseases on a global scale. There is a need for more awareness surrounding the preventive and curative role of a physically active lifestyle in healthcare. The prescription of physical activity in clinical care has been advocated worldwide through the 'exercise is medicine' (E=M) paradigm. However, E=M currently has no position in general routine hospital care, which is hypothesized to be due to attitudinal and practical barriers to implementation. This study aims to create an E=M tool to reduce practical barriers to enforcing E=M in hospital care.

METHODS: Firstly, this project will perform qualitative research to study the current implementation status of E=M in clinical care as well as its facilitators and barriers to implementation among clinicians and hospital managers. Secondly, an E=M tool towards application of active lifestyle interventions will be developed, based on a prediction model of individual determinants of physical activity behavior and local big data, which will result in a tailored advice for patients on physical activity and motivation. Thirdly, the feasibility of implementing E=M-tool, as designed within this project, will be investigated with a process evaluation, conducting a pilot-study which will integrate the tool in routine care in at least four clinical departments in two Dutch hospitals.

RESULTS: Results will, firstly, give insight in the current implementation status of E=M and in factors that influence the actual E=M implementation; Secondly, a E=M tool will be designed providing a tailored E=M prescription for patients as part of clinical care; Thirdly, an implementation strategy will be described of the E=M tool for clinical practice.

CONCLUSION: This project envisages an extensive continuation of research on the implementation of E=M, supports the mutual decision making process of lifestyle referral of clinicians and provides insights which can be used to assist in implementing physically active lifestyle prescription in the medical curriculum.

P97: THE SHOULDER DISORDER SCREENING FOR WHEELCHAIR MARATHON RUNNERS

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PURPOSE: Wheelchair marathon lasts for a long time and high intensity exercise. It places a heavy burden on the shoulders. The purpose of this study is to investigate prevalence of shoulder pain of wheel chair marathon athletes and pathological changes of their shoulders with ultrasonography.

METHODS: 86 wheelchair runners competing in the Oita International Wheelchair Marathon were examined. They were interviewed to collect their characters and symptomatic shoulder pain, and underwent a shoulder ultrasonographic examination.

RESULTS: Mean age was 47.4 years old, mean height was 165.3cm and mean body weight was 58.5kg. Runners had experienced wheelchair marathon for mean 15.7 years. Causes of disorder were Cervical cord injury(14persons), thoracic cord injury(38persons), lumber cord injury(15persons), and others(19persons). 44 runners (51.2%) had shoulder pain. 32 shoulders (37.2%) had abnormal findings by B mode ultrasound examination. Symptomatic shoulder numbers were 59 (34.3%). Symptomatic and ultrasonographic finding shoulders were 21 (25.0%). On the other hand, asymptomatic and no ultrasonographic findings on their shoulders were 91 (52.9%). The odds ratio of ultrasonographic findings for Symptomatic shoulder was 2.28 (95% confidence intervals: 1.12-4.63).

CONCLUSIONS: This examination found that many wheelchair athletes had shoulder pain and the athletes with shoulder pain have a tendency to have ultrasonographic abnormalities findings.

P98: WHICH FACTORS ARE IMPORTANT WHEN PEOPLE WITH A PHYSICAL DISABILITY START WITH ORGANIZED SPORTS?

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BACKGROUND: Compared with the general population, people with a physical disability are less active and a higher percentage does not meet the Dutch Norm for Healthy Exercise (NNGB) (Lindert and Breedveld., 2013). Despite the positive effect of exercise programs, this target group is not able to participate at a sport organization (Martin Ginis et al, 2016). The aim of this study is to investigate the differences in perceived obstacles, social

support, self-efficacy and demographic factors between people with a physical disability that do and do not participate in (organized) sports.

METHOD: 623 people with spinal cord injury, amputation, brain injury or neuromuscular disease were invited to participate in this study. Differences in social demographic data, sports frequency, attitude, self-efficacy, social support and perceived thresholds for sports between participants who do and do not play sports, and sports participants who are members of a sport organization and sports participants who are not member, were examined with a T - test and logistic regression analyses.

RESULTS: Of the 218 respondents, 173 individuals completed the questionnaire in full. Member of a sports organization participated on average twice as much in sports as non-members. The non-sports group had a lower self-efficacy and experienced more barriers to exercise. Participants who were members of a sports club had more social contacts and less need for help in finding a suitable sports activity than participants who were not members of a sports club.

DISCUSSION: The group that does not sport has a lower self-efficacy, experiences more thresholds and needs more support. In addition, members of sports organizations sports twice as much as the group who are not members of a sport organization and they value social contacts more. Follow-up studies are needed to better examine the relationships and to explore the role of the various components of social support more thoroughly.

P99: EVALUATING LEGACY TO DEVELOPING SPORT POLICY IN THE MEDICAL AND HEALTH ASPECTS

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This manuscript explores the creation of a framework for understanding medical and health legacies and the subsequent establishment of policy related to sustainable development of these legacies for nations participating in the Paralympic Games. With the definitions of medical legacy being medical care for Paralympians', and health legacy as 'public health care' for people with or without a disability, the proposed framework includes the inputs of a positive and planned legacy (also known as "heritage") and outputs as tangible and/or intangible legacies. From the second inputs onwards, it sets out policy for intermediary and final outcomes. The method is a combination of top-down and bottom-up approaches which are respectively applied to inputs and outputs in order to develop a feasible way in evaluating the nature of legacy both pre and post-event. Ultimately, the framework is expected to help us understand the flow of impacts or benefits from medical care provided for athletes with disability to long term public health. It is illustrated by a diagram showing the medical and health legacies over several Paralympic Games.

Keywords: *medical legacy, health legacy, legacy evaluation, the Paralympic Games, Japan*

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