ISMPB

International Society for the Measurement of Physical Behaviour

JUNE 21-24, 2022

8TH INTERNATIONAL CONFERENCE ON AMBULATORY MONITORING OF PHYSICAL ACTIVITY AND MOVEMENT

KEYSTONE, COLORADO USA

ICAMPAM

KEYSTONE, COLORADO, USA 2022

ISMPB.ORG

ICAMPAM PROGRAM

Time	Tuesday, June 21	Wednesday, June 22	Thursday, June 23	Friday, June 24
	Workshops	Day 1	Day 2	Day 3
6:45 AM			JMPB Panel discussion: Getting your research published 6:45-7:45AM	
7:00 AM		Registration Desk Open 7:00AM-7:30PM	Registration Desk Open 7:00AM-6:00PM	Registration Desk Open 7:00AM-2:00PM
7:15 AM				
7:30 AM		Exhibitors 7:30AM-5:30PM	Exhibitors 7:30-6:00PM	Exhibitors 7:30AM-12:00PM
7:45 AM				
8:00 AM			Keynote - Dr. Matthew Diamond - FDA 8:00-9:00AM	Keynote - Prof. Rob Motl - University of Illinois Chicago & Dr. Faye Horak - Oregon Health & Science University 8:00-9:00AM
8:15 AM				
8:30 AM	Registration Desk Open 8:30AM-7:00PM	Welcome 8:30-9:00AM		
8:45 AM				
9:00 AM	Coffee Break 9:00-9:30AM	Hans Bussmann Lecture Prof. I-Min Lee – Harvard Medical School 9:00-10:00AM	Transition Break 9:00-9:15AM	Transition Break 9:00-9:15AM
9:15 AM			Oral Sessions 16-20 9:15-10:15AM Oral Sessions 21-25 9:15-10:15AM Oral Sessions 26-30 9:15-10:15AM	Oral Sessions 31-35 9:15-10:15AM Oral Sessions 36-40 9:15-10:15AM Oral Sessions 41-45 9:15-10:15AM
9:30 AM	Pre-Conference Workshop #1 9:30-11:00AM Pre-Conference Workshop #2 9:30-11:00AM			
9:45 AM				
10:00 AM		Coffee Break 10:00-10:30AM		
10:15 AM			Coffee Break 10:15-10:45AM	Coffee Break 10:15-10:45AM
10:30 AM		Symposium Session 1 10:30-12:00PM Symposium Session 2 10:30-12:00PM		
10:45 AM			Symposium Session 5 10:45-12:15PM Symposium Session 6 10:45-12:15PM	Oral Sessions 46-50 10:45-11:45AM Oral Sessions 51-55 10:45-11:45AM Oral Sessions 56-60 10:45-11:45AM
11:00 AM	Coffee Break 11:00-11:30AM			
11:15 AM				
11:30 AM	Pre-Conference Workshop #3 11:30AM-1:00PM Pre-Conference Workshop #2 continued 11:30AM-1:00PM			
11:45 AM				Transition Break 11:45-12:00PM
12:00 PM		Transition Break 12:00-12:15PM		Keynote - Prof. Mai Chin A Paw - Amsterdam UMC 12:00-12:45PM
12:15 PM		Lunch + Sponsor Talks 12:15-1:15PM	Lunch + ISMPB GMM 12:15-1:15PM	
12:30 PM				
12:45 PM				Keynote - Dr. Rick Troaino - National Cancer Institute 12:45-1:30PM
1:00 PM	Lunch discussion Faculty burnout: The science and solutions with Jaqueline Kerr 1:00-2:00PM Workshop Lunch 1:00-2:00PM			
1:15 PM		Transition Break 1:15-1:30PM	Transition Break 1:15-1:30PM	
1:30 PM		Keynote - Dr. Jessilyn Dunn - Duke University 1:30-2:15PM	Keynote - Prof. Steve Robinovitch - Simon Fraser University 1:30-2:15PM	Closing Remarks 1:30-2:00PM
1:45 PM				
2:00 PM	Pre-Conference Workshop #4 2:00-3:30PM Pre-Conference Workshop #5 2:00-3:30PM Pre-Conference Workshop #6 2:00-3:30PM			
2:15 PM		Coffee Break 2:15-2:45PM	Transition Break 2:15-2:30PM	
2:30 PM			Symposium Session 7 2:30-4:00PM Symposium Session 8 2:30-4:00PM	
2:45 PM		Symposium Session 3 2:45-4:15PM Symposium Session 4 2:45-4:15pm		
3:00 PM				
3:15 PM				
3:30 PM	Coffee Break 3:30-4:00PM			
3:45 PM				
4:00 PM	Pre-Conference Workshop #4 continued 4:00-5:30PM Pre-Conference Workshop #6 continued 4:00-5:30PM		Poster Session & Social Hour 4:00-6:00PM	
4:15 PM		Transition Break 4:15-4:30PM		
4:30 PM		Oral Sessions 1-5 4:30-5:30PM Oral Sessions 6-10 4:30-5:30PM Oral Sessions 11-15 4:30-5:30PM		
4:45 PM				
5:00 PM				
5:15 PM				
5:30 PM		Early Career Researcher Event 5:30-8:30PM		
5:45 PM				
6:00 PM				
6:15 PM				
6:30 PM	Opening Reception 6:30-8:00PM			
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8:30 PM				

Program subject to change

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WELCOME TO ICAMPAM

WELCOME!

After very successful ICAMPAM conferences in Rotterdam, Glasgow, Amherst, Limerick, Bethesda and Maastricht, we are proud to present this next in-person ICAMPAM conference in Keystone, Colorado.

This international conference will provide a forum for researchers to discuss the latest developments in physical behavior monitoring using wearable devices. The conference will serve as a meeting point for young scientists and renowned experts in the field of health sciences, engineering, medical services, physiology, psychology, sports sciences and more.

The organizing committee paid special attention to create a conference program where many young scientists have the opportunity to present their work. We have chosen a format where abstract presentations are an essential part of the program, next to keynote and invited speakers, symposia and workshops. This is to ensure the latest science and discoveries are covered. The relatively small-scale (around 200 participants) conference creates a great opportunity for young scientists to easily engage with renowned experts.

We are excited to host this meeting in the beautiful mountains of Summit County, the heart of Colorado's playground! We encourage you to visit the local towns of Breckenridge, Frisco, or Vail to get a flavor of living in Colorado Mountain towns. There are plenty of hiking and biking trails throughout Summit County, and for those who are more adventurous, a climb to the top of one of the local "14ers" offers amazing views of the continental divide. For those who wish for a less strenuous adventure with a scenic view, consider a gondola ride to the summit of Keystone's Mountain Peaks. We are sure you that you will have a memorable stay in our amazing backyard!

Welcome to ICAMPAM 2022 and best regards on behalf of the organizing committee,

Ed Melanson and Kate Lyden
Local Co-Hosts, ICAMPAM 2022

WELCOME ON BEHALF OF THE SCIENTIFIC COMMITTEE!

We are truly thrilled to welcome you all to ICAMPAM 2022. Despite the challenges that resulted from the COVID-19 pandemic, the quality and quantity of research related to monitoring physical behavior continue to increase and this is reflected in the conference programming. ICAMPAM features eight excellent keynote speakers, who all have been chosen based on their important contributions to our field. They are world leaders and pioneers in the study and application of the utility of ambulatory devices in clinical populations, epidemiological studies, and clinical trials. We are also pleased to note that we received many high-quality symposium submissions and abstract submissions, both in-person and virtual. Taken together, this combination promises to set the stage for a stimulating and informative conference.

It truly has taken a village to make this conference happen. The scientific committee consists of more than 20 people who helped to select keynote speakers, symposia, pre-conference workshops, and abstracts. The local organizing committee was adeptly led by Ed Melanson and Kate Lyden. They stepped up to take the lead in ensuring a safe conference environment in beautiful Keystone, Colorado. Their contribution to making this all work has been remarkable. We would also like to acknowledge and thank the staff at Podium conference management who have talked us through many contingencies and budget issues and truly made it all happen, resulting in the exciting in-person and virtual programming that you will all experience over the next few days.

Finally, we would like to thank each of you for joining us here in Keystone. We know that traveling these days is a non-trivial experience that can be somewhat challenging. Thanks for making the effort.

On behalf of the scientific committee, we wish you a great conference with lots of opportunities to talk about your science, develop new collaborations and continue to move the field forward!

Sarah Keadle and Jeff Hausdorff
Scientific Committee Leaders

WELCOME ON BEHALF OF THE SOCIETY

I am very pleased to be able to welcome you to ICAMPAM 2022 on behalf of the International Society for the Measurement of Physical Behavior (ISMPB). The challenges of the last couple of years have meant that this welcome is long overdue. While we have not met in person for three years, ISMPB has been working hard behind the scenes to continue the work of bringing together great minds from varied backgrounds to further the measurement of physical behaviour. Our principal forum to achieve this is our conference. I have always found ICAMPAM to be a rich environment for establishing collaborations and sparking new ideas. I hope that you will all take away from this meeting new information, novel ideas and strong friendships and collaborations. I look forward to catching up with as many of you as possible over the coming days.

Bronwyn Clark
President, ISMPB

ABOUT ISMPB

The International Society for the Measurement of Physical Behaviour (ISMPB) is a non-profit scientific society which focuses on the issues related to ambulatory monitoring, wearable monitors, movement sensors, physical activity, sedentary behaviour, movement behaviour, body postures, sleep and constructs related to physical behaviours. Therefore the Society specifically focuses on the objective measurement and quantification of physical behaviours which include:

- all free-living physical behaviours (including sleep) in its different forms (volumes and patterns which could give an indication of quality)
- measurements that are unrestricted, prolonged and unsupervised
- measurements of physiological responses (e.g. energy expenditure) that are directly related to physical behaviours
- a wide range of applications: clinical, public health, behavior sciences, end users etc.

The Society aims to promote and facilitate the study and applications of objective measurement and quantification of free-living physical behavior(s) and its related constructs (e.g. energy expenditure, context) using wearable devices. The Society is characterised by:

- its multidisciplinary focus; including engineering, signal analysis, physiology, medical sciences, public health, psychology, ergonomics and sports.
- bringing together people from a wide variety of backgrounds and expertise, including researchers, clinicians, therapists, signal analysts, computational scientists and commercial companies.

ISMPB hosts a biennial International Conference on Ambulatory Monitoring of Physical Activity and Movement (ICAMPAM). The first ICAMPAM Meeting took place May 21 – 24, 2008 at the Beurs-WTC Congress Center in Rotterdam, Netherlands.

The first meetings took place in Rotterdam (2008), Glasgow (2011), Amherst (2013), Limerick (2015), Bethesda (2017), Maastricht (2019) with a subsequent virtual conference held in 2021.

ABOUT ISMPB

ISMPB BOARD OF DIRECTORS

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Dr. Bronwyn Clark
School of Public Health, The University of Queensland, Australia

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Roessingh Research and Development, The Netherlands and University of Twente, The Netherlands

Elected Representatives

- **Professor Jorunn Helbostad**
  Department of Neuromedicine and Movement Science, Norwegian University of Science and Technology, Norway
- **Professor Jeff Hausdorff**
  Movement Disorders Unit at the Tel-Aviv Sourasky Medical center (TASMC), Israel
- **Dr. Sarah Keadle**
  Department of Kinesiology, California Polytechnic State University, USA
- **Dr. Dinesh John**
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- **Professor Hans Bussmann**
  Department of Rehabilitation Medicine, Erasmus MC – University of Rotterdam. The Netherlands
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- **Dr. David Bassett, Jr.**
  Professor and Interim Department Head, Exercise Physiology, University of Tennessee Knoxvillle, USA

SCIENTIFIC PLANNING COMMITTEE

Chairs:
Jeff Hausdorff
Sarah Keadle

Committee Members
David Bassett
Johannes Bussmann
Brian Caulfield
Lucy Cesnakova
Sebastien Chastin
Lorenzo Chian
Philippa Dall
Sjaan Gomersall
Andreas Holtermann
Dinesh John
Martina Mancini
Claudia Mazzà
Joanne McVeigh
Karin Pfeiffer
Jeffer Sasaki
Jennifer Schrack
Eric Shiroma
Hidde van der Ploeg
Kerri Winters

PODIUM CONFERENCE SPECIALISTS

Marischal De Armond
Brian Groos
Sharon Zwack

GENERAL INFORMATION

CONFERENCE VENUE

Keystone Conference Center
633 Tennis Club Road
PO Box 38
Keystone, CO 80435-0038
Phone: 855-322-1601
(floor plan of conference venue is page 24)

CONFERENCE REGISTRATION

In-person registration for the conference includes admission to all sessions including keynotes, symposium sessions, workshops, oral presentations and poster sessions, special panels/presentations. Also included, is the Opening Reception, lunch on Wednesday, Thursday and Friday of the conference, and tea/coffee breaks. In-person attendees may also take advantage of the ICAMPAM Virtual Conference platform (on Whova App) for all on-line programming (including access to all virtual posters) and networking and other engagement opportunities. Access will be available for 90 days.

Virtual registration for the conference includes livestream from the ICAMPAM mainstage in Shavano Peak all day Wednesday, June 22 8:30am - 5:30pm (MDT), recorded presentations from all eight ICAMPAM Keynote Speakers. Virtual attendees may also take advantage of the ICAMPAM Virtual Conference platform (on Whova App) for other on-line programming (including access to all virtual posters) and networking and other engagement opportunities. Access will be available for 90 days.

GUESTS

Guests of in-person attendees are welcome to the ICAMPAM 2022 Opening Reception in the Shavano Foyer on Tuesday, June 21 (6:30 - 8:00pm) as well as the Poster Session & Social Hour in Red Cloud Peak on Thursday, June 23 (4:00 - 6:00pm). Please sign up your guest for these events at the Reception Desk, where you will be requested to pay a $20 fee for each event.

NAME BADGES

Your name badge is your admission ticket to the conference sessions, coffee breaks, meals, and reception. Please wear it at all times. At the end of the conference we ask that you return your badge to the registration desk.

ICAMPAM Board Members, Sponsors, Exhibitors and Staff will be identified by appropriate ribbons.

COVID NOTE:

In light of the elevated infections level of the Omicron variant in Colorado, attendees are strongly encouraged to wear masks in the meeting areas.

HEALTH TIPS:

High elevation, low humidity and stronger ultraviolet rays from the sun combine to create a situation that requires special attention to your health! For recommendations on how to prevent and alleviate high altitude sickness, please see **High Country Health Care High Altitude Health Tips**.

The mountains of Colorado are among the most beautiful parts of the United States, and we hope you enjoy every minute of your visit. However, some of the very features that make this area so attractive may also cause you problems, unless you are able to recognize the symptoms and know how to prevent them. The following guidelines may assist in managing high altitude sickness:

- Increase fluid intake
- Decrease salt intake
- Moderate your physical activity and get plenty of rest
- Eat frequent small meals high in carbohydrate, low in fat and low in protein
- Reduce alcohol and caffeine intake

DRESS CODE

Dress is casual for all ICAMPAM meetings and social events.

REGISTRATION AND INFORMATION DESK HOURS

The Registration and Information Desk, located in the lobby, will be open during the following dates and times:

Tuesday, June 21	8:30am – 7:00pm
Wednesday, June 22	7:00am – 5:30pm
Thursday, June 23	7:00am – 6:00pm
Friday, June 24	7:00am – 2:00pm

CODE OF CONDUCT

By entering the virtual platform and participating in the ICAMPAM Virtual conference you are agreeing to a code of conduct. As a scientific community, ISMPB aims to provide a supportive space for scientific dialogue. We believe that scientific progress depends on the free exchange of ideas in an environment in which all participants are treated equitably and with respect. To this end, we are committed to fostering a safe and supportive community in which all scientists are able to contribute fully regardless of age, gender, race, ethnicity, national origin, religion, gender identity or expression, sexual orientation, disability or any other applicable basis proscribed by law. Harassment of any form has no place in a healthy scientific enterprise. We expect all of our members as well as other attendees at ISMPB-organized events to behave in ways that promote the supportive and productive exchange of ideas.

SPEAKER INFORMATION

For Oral Sessions, each room will be equipped with

- 1 PC laptop (if using a MAC laptop – you will need to provide your own along with appropriate connectors/dongles)
- 1 LCD projector
- 1 microphone
- 1 wireless presenter (mouse/slide advancer)

All speakers in Oral Sessions must upload their presentations as per the following schedule:

- **Wednesday presentations are due Tuesday, June 21 by 6:00pm**
- **Thursday presentations are due Wednesday, June 22 by 6:00pm**
- **Friday presentations are due Thursday, June 23 by 6:00pm**

Please see the registration desk for directions to the Speaker Ready Room.

POSTER VIEWING INFORMATION

To make the most of the ICAMPAM poster sessions – please review the following information carefully:

ALL POSTERS (both in-person & virtual) have a virtual site for viewing in the ICAMPAM 2022 Whova App; these may be accessed for 90 days from Tuesday, June 21.

VIRTUAL POSTERS VIA WHOVA

All virtual poster presenters have been asked to be available (if time zone permits) at their virtual poster during the following periods so attendees may virtually connect with them:

- **Wednesday, June 22: 12:15 - 1:15pm (MDT)**
- **Thursday, June 23: 4:00 - 6:00pm (MDT)**

Posters numbers beginning with a 'VP-' indicate this poster is only accessible virtually

('VPE-' identifies a European Time Zone)

Be sure to check the chat box of the virtual poster presenter to see if they've left a message as to their available times

IN-PERSON POSTERS

48 posters will be available for in-person attendees to review starting on Wednesday, June 22 at 10:00am in the Red Cloud Peak. In-person poster presenters will be available at their poster during the following joint Poster Session & Social Hour:

- **Thursday, June 23: 4:00 - 6:00pm (MDT)**

In-person poster presenters may also be available during coffee breaks at their posters.

If you are unable to connect with an in-person OR virtual poster presenter at any of the above times, open the poster menu in Whova (found under the agenda drop down menu) and refer to the Chat Box to see if the presenter offers any availability virtually or leave a note in the Chat Box for the presenter to connect with you either during ICAMPAM 2022 or afterwards. You may continue to use the Whova App to connect and converse for up to 90 days.

IN-PERSON POSTER INSTALLATION AND DISMANTLE

In-Person Poster presenters must set-up and remove their posters during the following times:

Set-up:	Wednesday, June 22	8:30 - 10:00am
Dedicated time:	Thursday, June 23	4:00 - 6:00pm
Remove:	Friday, June 24	10:45am - 12:00pm

Information on Poster Authors (Lead), Poster Numbers and Poster Titles begins on page 43.

CONFERENCE EXHIBITORS

Technical exhibits at ICAMPAM 2022 will be available for viewing in Red Cloud Peak Wednesday, June 22 (7:30am - 5:30pm), Thursday, June 23 (7:30am - 6:00pm) and Friday, June 24 (7:30am - 12:00pm). Attendees will have easy access to exhibitor representatives as these exhibits are located in the coffee area in proximity to the posters.

SOCIETY GENERAL MEMBERSHIP MEETING

The International Society for the Measurement of Physical Behaviours (ISMPB) general membership meeting is scheduled from 12:15 - 1:15pm on Thursday, June 23 in the Shavano Peak. All members of the society and prospective members are encouraged to attend and contribute to the meeting.

ISMPB MEMBERSHIP

Membership in ISMPB is open to everyone from around the world involved in the measurement of free-living physical behaviour.

Membership fees support the mission of ISMPB in creating a vibrant community bringing together people from a wide variety of backgrounds and expertise, including researchers, clinicians, therapists, signal analysts, computational scientists and commercial companies.

MEMBER BENEFITS

- Register for Society Meetings at reduced registration rates
- Support a vibrant and independent Society
- Become connected with leading experts in the field
- Opportunity to get involved as an ISMPB Committee member
- Vote in annual elections for the Board of Directors
- Stand for election to the Board of Directors
- Eligible for student awards at the Society Meetings (best oral and best poster)
- Access to online resources and conference proceedings
- Opportunity to post news and information on related events

MEMBER CATEGORIES

Regular / Post Doc Members ($150)
Open to any person who is engaged in research related to areas of interest of the Society.

Student Members ($75)
Open to any student enrolled in degree granting programs at institutions of higher education

The next membership term will run from October 1, 2022 to September 30, 2024.

INTERNET ACCESS

Wireless internet access is available in the Keystone Conference Center. The wireless network connection that delegates should search for on their devices is:

Network:	Keystone Conference Center
Wifi password:	ICAMPAM

VIRTUAL CONFERENCE PLATFORM WHOVA EVENT APP

PRE-REGISTRATION

If you have completed your registration for the virtual conference, please enter the platform through the ICAMPAM website, and follow the instructions.

REGISTRATION

If you wish to register and have not yet done so, please register here: https://www.confmanager.com/main.cfm?cid=3156&tid=32

Note: Registrations completed after June 17, 2021, should expect a delay to access the virtual conference platform. Registration does not provide automatic access.

CONFERENCE TIMELINES

Registration for the Virtual Conference provides one full day of livestreamed access of proceedings from Shavano Peak Meeting Room on Wednesday, June 22 (Time zone: MDT).

Recorded presentations from all ICAMPAM 2022 Keynote Speakers (posted approximately 24hrs after the presentation and available for 90 days).

Access to all virtual poster sessions (2) and to all on-line poster listings.

VIRTUAL ACCESS TO ICAMPAM 2022

ICAMPAM 2022 will be supported by Whova, the virtual event platform. This multi-faceted event app serves as a platform for attendees who cannot attend in person to experience some of the offerings at ICAMPAM 2022 and provides a means for all attendees to virtually connect and network with poster presenters, speakers, sponsors, exhibitors and other attendees.

USE THIS LINK TO ACCESS ICAMPAM 2022's VIRTUAL COMPONENT: https://whova.com/portal/webapp/icamp_202206/

You can access from your desktop or mobile device; we suggest that you bookmark this hyperlink to the conference. Google Chrome is the recommended browser. Within Whova, you may:

- Access identified livestream events on Wednesday, June 22 from 8:30am - 5:30pm MDT, recordings of keynote presentations, pre-conference workshops, keynotes and posters.
- Connect with fellow conference attendees and conference sponsors.
- Participate in chat spaces, virtual meet ups, topic groups and access messages sent to you by other attendees.

If you need assistance with Whova, please contact Whova support: support@whova.com

Q&A SESSIONS

With the virtual conference platform, you can ask questions through the Q&A function.

Technical help with the virtual conference

If you encounter any technical issues during your virtual experience, please contact Whova directly by emailing support@whova.com.

AWARDS

ISMPB will offer three student awards at ICAMPAM 2022. Sensors has generously sponsored two poster awards: one for best in-person poster and one for best virtual poster. An additional award for best Oral Presentation by a student at ICAMPAM 2022 will also be presented. In addition to the monetary prize, winners of the student awards will be invited as guests in the Physical Activity Researcher Podcast. This represents a unique opportunity to talk about ongoing research and reach a broader audience. Winners will be announced onsite at ICAMPAM 2022.

Recipients will be chosen from a panel of researchers based on several criteria including:

- **creativity and originality of research**
- **clarity of presentation**
- **level of understanding**

sensors
an Open Access Journal by MDPI

SPECIAL EVENTS

LUNCH DISCUSSION

CRESTONE III/IV
TUESDAY, JUNE 21
1:00 - 2:00PM

Faculty burnout: the science and solutions: As a burnout survivor, and public health professional, Jacqueline Kerr is on a mission to prevent burnout in others. An informal talk followed by a Q & A. Lunch will be provided. Seating is limited - registration is required. Delegate admission is included in your conference fees.

WELCOME RECEPTION

SHAVANO FOYER
TUESDAY, JUNE 21
6:30 - 8:00PM

Join us at the Shavano Foyer to meet up with old friends and be introduced to new ones!

Delegate admission to this Welcome Reception is included in your conference fees. You are welcome to bring a guest if you speak to the Registration Desk, where you will be requested to pay a $20 fee.

EARLY CAREER RESEARCH EVENT

DILLON MARINA
(departure will be from Keystone Conference Centre)
WEDNESDAY, JUNE 22
5:30 - 8:30PM

An opportunity for those at the early stage of their careers to enjoy an evening chartered boat cruise on nearby Lake Dillon while networking with other early career researchers as well as few members of the ICAMPAM board. Light snacks and beverages (alcoholic and non-alcoholic) will be provided. Attendees are advised to bring jackets and warm clothing, as the temperature on the lake may dip in the evening. Admission is included in your conference fees. **Space is limited to the first 25 individuals.**

JMPB PANEL DISCUSSION

CRESTONE I & II
THURSDAY, JUNE 23
6:45 - 7:45AM

Getting your research published: Join us for a lively discussion in which members of the JMPB editorial board share their publishing experiences both as authors and reviewers. Topics for discussion will cover the full scope of the publication journey, including: writing a solid manuscript, strategies for effective revision, and handling rejection (a normal part of academic publishing). This event should appeal to early career researchers. Seating is limited - must sign up to attend. Hosted by members of the editorial board of the Journal for the Measurement of Physical Behaviour.

POSTER SESSION & SOCIAL HOUR

RED CLOUD PEAK
THURSDAY, JUNE 23
4:00 - 6:00PM

Two hours to interact with poster presenters and mix with ICAMPAM 2022 attendees. Delegate admission to this Welcome Reception is included in your conference fees. You are welcome to bring a guest if you speak to the Registration Desk, where you will be requested to pay a $20 fee.

PRE-CONFERENCE WORKSHOPS

Tuesday, June 21

9:30 – 11:00am

Workshop 1

Location: Crestone Peak l & II

Rewards and challenges of pairing wearable monitors with criterion measures of energy expenditure

Kong Chen[1], Seth Creasy[2], Robert Brychta[1], Edward Melanson[2]
[1]*National Institutes of Health,* [2]*University of Colorado Anschutz*

The gold-standards for measuring energy expenditure (EE) under laboratory and free-living settings are whole-room indirect calorimeters and doubly labeled water (DLW), respectively. These methods of measuring EE are generally used for quantifying differences in EE within individuals or across populations and can also be used as criterion measures to develop and validate wearable activity monitors for estimating EE. Conversely, there can be added benefits of integrating wearable devices in EE studies using room calorimetry and DLW. In EE studies aimed at measuring total EE, device-based measures add a dimension of context due to the fine temporal resolution and sensitivity to detect movement intensity which can be used to parse the individual contributors to total EE. The focus of this workshop is to introduce the when, why, and how to integrate wearables to EE studies using room calorimeters and DLW. For example, wearable monitors can be utilized during room calorimetry to better inform components of EE (resting, thermic effect of feeding, activity, etc.). Doubly labeled water studies give an average estimate of total daily energy expenditure over an assessment period. Pairing wearable monitors with DLW, researchers can gain insight into day-to-day, weekday vs. weekend, or inter-day variability in physical activity which may influence overall EE.

1. Using wearable activity monitors in metabolic and nutritional studies. This talk will cover the scope of how activity monitors have been used in different types of applications such as controlled trials and natural histories.
2. Adding wearable activity monitors to whole-room indirect calorimetry studies. This talk will present the methodology of room calorimetry, and the components of daily EE that wearables can help to quantify (e.g., sleep, resting, activity, and thermic effect of feeding).
3. Adding wearable activity monitors to doubly labeled water studies. This talk will present the methodology of DLW and discuss how wearable monitors can help to measure more time-dependent physical activity levels and patterns.

Workshop 2

Location: Crestone Peak lll & lV

Using GPS data in physical behavior studies

Alexis Le Faucheur[1], Jasper Schipperijn[2]
[1]*Ecole normale supérieure de Rennes,* [2]*University of Southern Denmark*

The workshop goals and objectives are:

- To present the basic principles of working with GPS devices as well as the expected accuracy of GPS measurements.
- To demonstrate the use of GPS data for two types of research studies: i) the use of GPS to study the context in which physical activity or sedentary behavior is occurring; ii) the use of GPS with the specific aim of assessing walking during outdoor walking sessions or trips, focusing on a clinical application.
- To explain the main methodological considerations when analyzing GPS data.
- To demonstrate how available online tools can be used to process and merge GPS data with their accelerometer-based measures.

Dr Schipperijn will introduce the basics of working with GPS data and explain GPS data accuracy. He will furthermore demonstrate how GPS data, in combination with accelerometer and GIS data, can be used to assess the context in which physical behavior is occurring. Finally, he will demonstrate how GPS and accelerometer data can be processed using the Human Activity Behavior Identification Tool and Data Unification System (HABITUS).

Dr Le Faucheur together with Dr Schipperijn will introduce the basics of working with GPS data and explain GPS data accuracy. Then, he will demonstrate how GPS data can be used to assess walking during outdoor walking sessions, focusing on a clinical application. Finally, he will demonstrate how GPS speed data can be easily processed using the MAPAM web tool.

Participants will gain a deeper insight in the usefulness of including GPS data in their future studies, learn about collecting and processing GPS data, and will be introduced to tools to process and analyze GPS data.

Furthermore, we will provide links to online tools and open-source software for GPS data processing, more specifically:

- HABITUS tool to merge GPS and accelerometer data: https://www.habitus.eu
- Web platform for GPS speed signal analysis of outdoor walking session: https://mapam.ens-rennes.fr

Participants will have the opportunity to test using HABITUS and the MAPAM web tool.

11:30am – 1:00pm

Workshop 2 (continued)

Location: Crestone Peak lll & lV

Using GPS data in physical behavior studies

Alexis Le Faucheur[1], Jasper Schipperijn[2]
[1]*Ecole normale supérieure de Rennes,* [2]*University of Southern Denmark*

Workshop 3

Location: Crestone Peak l & II

Using git and GitHub to track, disseminate, and maintain your physical behavior code and data

Paul R. Hibbing[1]
[1]*Children's Mercy Kansas City*

The primary goal of this workshop is to familiarize attendees with git and GitHub, which are free-and-open-source tools being used increasingly to facilitate organization, version control, and collaboration in physical behavior research. The primary objectives are for attendees to: 1) Learn what each tool does; 2) get set up for using each tool; 3) follow along with case studies demonstrating key ways the tools can be used; and 4) engage in discussion about how the tools impact dissemination and maintenance of new physical behavior research resources, such as machine learning models and public datasets.

git/GitHub are powerful tools for managing code and data. Some physical behavior researchers have begun to use git/GitHub in their research, but many more are unsure how to get started doing so. This interactive workshop is designed to demystify git/GitHub and equip new users for a successful start in using them. It will begin with an explanation of what git/GitHub are for, followed by a tutorial to demonstrate: 1) installation and registration; 2) integration with RStudio; and 3) basic workflows. Lastly, a series of case studies will be presented to illustrate how git/GitHub can coordinate both project-level and fieldwide progress.

After the workshop, attendees will have: 1) access to git and GitHub; 2) a working knowledge of their operation; 3) examples to draw from when starting to use the tools themselves; and 4) a richer philosophy for managing and sharing the research products they create.

2:00 – 3:30pm

Workshop 4

Location: Crestone Peak lll & lV

Validating digital mobility tools: the Mobilise-D experience

Silvia Del Din[1], Björn Eskofier[2], Lisa Alcock[1], Francesca Salis[3], Encarna Micó Amigo[1], Eran Gazit[4], Cameron Kirk[1], Alma Cantu[1]
[1]*Newcastle University,* [2]*Friedrich-Alexander-Universität,* [3]*University of Sassari,* [4]*Tel Aviv Sourasky Medical Center*

Real-world monitoring of mobility and function (e.g. gait) is enabled by wearable devices including inertial measurement units (IMUs) that allow to quantify digital mobility outcomes (DMOs). While these devices and the associated DMOs are adopted more and more frequently, there is still limited awareness of how complex it is to ensure their validity and what could hinder comparability of data obtained during such assessments. In this workshop we will aim at raising this awareness by sharing the experience we gained as part of Mobilise-D, a project funded by the European Union (EU) as part of the Innovative Medicine Initiative, aiming at fostering regulatory approval and clinical adoption of DMOs.

To reach our aim we will share the complementary and multi-disciplinary experiences from a representative group of researchers involved in the project to discuss the various challenges that they encountered in association to the following activities:

- Experimental protocols for the validation of the DMOs: the Mobilise-D Technical Validation Study
  WWhen thoroughly validating a system for the estimation of real-world DMOs, the optimal trade-off between clinical and technical requirements is necessary. In Mobilise-D, balancing inclusion of multiple pathological cohorts, refence systems and centres significantly increased the complexity of the protocol. This talk will present the protocol of the Technical Validation Study, it will describe instrumentation and type of assessments used, including how acceptability and participants' opinions regarding the use of technology have been captured. It will also present solutions and challenges faced by the researchers in developing and running the study protocol.
- Identification and characterisation of gold standards for real-world applications
  This talk will outline the methods developed to characterize the gold standard solution and single sensor system used in the technical validation study. In particular, this talk will describe the reference system adopted as gold standard solutions to validate DMOs estimated from a single wearable device in real-world conditions (a wearable multi-sensing system including Inertial units, Distance sensors, and Pressure insoles: the INDIP system). The methodology and the adopted workflow to measure reference DMOs will be presented, highlighting strengths and limitations of the system. Challenges faced and solutions devised during the processing of the data collected will be presented.
- A framework to compare and select top performing algorithms for quantifications of DMOs
  Digital mobility outcomes (DMOs) can be obtained through algorithms processing a single sensor's signals. This talk will present the pipeline (set of algorithms) that has been implemented for the calculation of real-world DMOs (e.g. cadence, step-length and walking speed estimation). But what do to when multiple algorithms are proposed for the evaluation of the same DMO? How can we compare those and select the "best" algorithm for that specific DMO? In this talk, a comprehensive methodology to compare and rank algorithms, depending on the DMO of interest, will be presented and techniques to select the top performers will be indicated.
- The statistical analysis plan: how to validate DMOs?
  This talk will focus on the comprehensive statistical framework developed and implemented within Mobilise-D to evaluate DMOs criterion validity. Firstly, we will explain how the DMOs are obtained from wearable sensor assessments at lab and real-world contexts by running all available algorithms on an online platform. Considering the nature and level of aggregation of spatiotemporal DMOs and the characteristics of the reference systems, we will present the performance metrics of the analytical pipeline in multiple cohorts (e.g. healthy adults, Parkinson's Disease, Multiple Sclerosis, Proximal Femoral Fracture (PFF) and Chronic Obstructive Pulmonary Disease (COPD)).
- Interactive visualisation tools to enhance data exploration and interpretation
  How to explore and make sense of large datasets of results obtained from statistical analyses? This talk will present the design of an automatic and interactive tool enabling the visual exploration and analysis of multivariate heterogeneous data. The talk will show the use of this interactive toolbox, focusing on selective DMOs, for data exploration, visualisation of different granularities/ aggregation levels of statistical analyses, and plot generation. It will be shown how this toolbox can facilitate access of data and results interpretation in large heterogeneous datasets.

The range of topics that will be covered is highly multi-disciplinary by definition. Each participant will be able to enhance or acquire new skills that would allow them to better navigate in the field of digital health. We will present some new data and results; we will also share our direct experience and tips for overcoming possible similar challenges in future studies. The techniques and analyses presented can be "translated" and applicable to other fields and topics (other than mobility), especially in circumstances where algorithm and DMOs validation is required. We will also share a number of papers and analytical tools that have already been published and shared with the goal of promoting standardisation and adoption.

Workshop 5

Location: Castle Peak I/II

Building consensus and standards for GPS use, processing, analysis, and reporting in human health studies

Marta M. Jankowska[1], Amber L. Pearson[2]
[1]*City of Hope, Beckman Research Institute*, [2]*Michigan State University*

The use of GPS technology in physical activity and health-related research has grown exponentially over the past decades. Research that incorporates GPS is faced with several challenges and decision points throughout each phase of a study. These phases include study design, data collection, data processing, data analysis, and reporting of study results. Currently there is no research community approved set of standards to follow for utilizing and reporting on GPS data use. This makes it difficult to compare study results, as papers often omit important GPS data-related details. We will present results from a systematic review of best practices for GPS use in physical activity and human health studies to aid in discussion of developing comprehensive standards for GPS use and reporting.

Workshop goals and objectives:

TThis session will convene experts using GPS in their physical activity research to discuss key aspects for inclusion into a community approved set of standards for the use and reporting of GPS technology in physical activity and human health research. Results of a recent systematic review of best practices with using GPS data in health studies will be presented. The remainder of the session will be spent in discussion and activities for collecting expert opinions from attendees on necessary components of GPS use and reporting standards. The objective of the workshop is to collect consensus opinions for eventual publication of GPS use and reporting guidelines in physical activity and health studies.

Workshop 6

Location: Crestone Peak l & II

Clinical-research relevant outcomes from free-living Physical Behaviour data - the use of locus of activity, posture allocation and stepping behaviour to define Real World Outcomes (RWO)

Douglas Maxwell[1], David Loudon[1], Craig Speirs[1]
[1]*PAL Technologies Ltd.*

The goal of this workshop is to provoke discussion and reflection on the use of wearable sensors for the objective measurement of free-living physical behaviours for both epidemiological studies and clinical research.

In the first half of the workshop we will consider the importance of:

1. Sensor Location – where on the body can a sensor be worn and how does this impact on the outcomes that can be measured?
2. Sensor Choice - we will review common sensor characteristics (accelerometer, gyrometer, magnetometer, barometer, thermometer) and their strengths and weaknesses as wearable sensors
3. Data Classification - we will reflect on the different techniques commonly used in processing sensor data and the tools used to process data
4. Outcomes – Real world outcomes (RWO) derived from wearable sensor data and, most importantly, their clinical utility

In the second half of the workshop attendees will be provided with example datasets (they can also bring their own data) and a participant led structured discussion will be used to review these data in terms of:

- How can accelerometers be both very effective in measuring how little someone is doing (Sedentary Behaviour and sleep) and how much (Physical Activity)
- Looking beyond the commonly reported daily totals for physical activity and sedentary behaviour we will explore the challenges around defining clinically important measures of ability and participation
- Accelerometers are well suited to the quantification of stepping, the major component of daily physical activity. We will consider how the patterns of step accumulation can be used to characterise the locus of activity and as biomarkers of physical ability and how we might quantify inter-loci travel choices
- We will explore the use of a magnetometer to differentiate household versus community loci of activity based on the frequency of ambulatory direction change

Learning objectives and takeaways

1. Understand what raw data from body-worn sensors looks like and how it can be used to quantify the time spent in the primary physical activities of lying, sitting, standing and stepping
2. Appreciate how body-worn sensor data is processed and the difference between epoch and event-based analysis approaches
3. Be able to distinguish between measures of ability and participation and the clinical importance of this categorization

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4:00 – 5:30pm

Workshop 4 (continued)

Location: Crestone Peak lll & lV

Validating digital mobility tools: the Mobilise-D experience

Silvia Del Din[1], Björn Eskofier[2], Lisa Alcock[1], Francesca Salis[3], Encarna Micó Amigo[1], Eran Gazit[4], Cameron Kirk[1], Alma Cantu[1]
[1]*Newcastle University,* [2]*Friedrich-Alexander-Universität,* [3]*University of Sassari,* [4]*Tel Aviv Sourasky Medical Center*

Workshop 6 (continued)

Location: Crestone Peak l

Clinical-research relevant outcomes from free-living Physical Behaviour data - the use of locus of activity, posture allocation and stepping behaviour to define Real World Outcomes (RWO)

Douglas Maxwell[1], David Loudon[1], Craig Speirs[1]
[1]*PAL Technologies Ltd*

2022 ICAMPAM DETAILED PROGRAM

Please note that the program is subject to change.

TUESDAY, JUNE 21, 2022

8:30am - 7:00pm	Registration Desk Open *Location: Shavano Foyer*
9:00 - 9:30am	Morning Coffee *Location: Crestone Foyer*

Morning Pre-Conference Workshops

9:00 - 11:00am	**Workshop 1** **Rewards and challenges of pairing wearable monitors with criterion measures of energy expenditure** *Location: Crestone Peak I & II*
9:00 - 11:00am	**Workshop 2** **Using GPS data in physical behavior studies** *Location: Crestone Peak III & IV*
11:00 - 11:30am	Coffee Break *Location: Crestone Foyer*
11:30am - 1:00pm	Workshop 2 continued *Location: Crestone Peak III & IV*
11:30am - 1:00pm	**Workshop 3** **Using git and GitHub to track, disseminate, and maintain your physical behavior code and data** *Location: Crestone Peak I & II*
1:00 - 2:00pm	Lunch Discussion **Faculty burnout: the science and solutions** *Location: Crestone Peak III/IV* **Jacqueline Kerr** *Behavior Scientist & Burnout Survivor*

Afternoon Pre-Conference Workshops

2:00 - 3:30pm	**Workshop 4** **Validating digital mobility tools: the Mobilise-D experience** *Location: Crestone Peak III & IV*
2:00 - 3:30pm	**Workshop 5** **Building consensus and standards for GPS use, processing, analysis, and reporting in human health studies** *Location: Castle Peak I/II*
2:00 - 3:30pm	**Workshop 6** **Clinical-research relevant outcomes from free-living Physical Behaviour data- the use of locus of activity, posture allocation and stepping behaviour to define Real World Outcomes (RWO)** *Location: Crestone Peak I & II*
3:30 - 4:00pm	Coffee Break *Location: Crestone Foyer*

4:00 - 5:30pm Workshop 4 continued
Location: Crestone Peak III & IV

4:00 - 5:30pm Workshop 6 continued
Location: Crestone Peak I & II

6:30 - 8:00pm
Opening Reception
Location: Shavano Foyer

WEDNESDAY, JUNE 22, 2022

7:00am - 5:30pm Registration Desk Open
Location: Shavano Foyer

7:30am - 5:30pm Exhibits Open
Location: Red Cloud Peak

7:30am - 8:30am Morning Coffee
Location: Red Cloud Peak

8:30 - 10:00am
Welcome & Keynote Presentation
Hans Bussmann Lecture: Maximizing the utility and comparability of accelerometer data from large-scale observational epidemiologic studies
I-Min Lee *Harvard Medical School*
Location: Shavano Peak + Livestream
This lecture is in recognition of the contribution of Professor Hans Bussmann, who in 2008 organised and ran the first ICAMPAM. This meeting was so successful that it inspired others to organise subsequent highly successful ICAMPAMs. Hans' visionary and brave initiative led directly to the formation of our Society and our international journal.

10:00am - 10:30pm Coffee Break
Location: Red Cloud Peak

10:30am - 12:00pm
Symposia 1 & 2
S.1 Spatial analyses with behavioral data
Location: Shavano Peak + Livestream
Chair: **Jasper Schipperijn** *University of Southern Denmark*
Moderator: **Aaron Hipp** *University of Southern Denmark*
Participants: **Jordan Carlson** Children's Mercy Kansas City
Jing-Huei Huang *North Carolina State University*
Marta Jankowska *Beckman Research Institute*
Jasper Schipperijn *University of Southern Denmark*

S.2 Measuring sleep with wearables: The ABC's of measuring Z's
Location: Crestone Peak I & II
Chair/Moderator: **Seth Creasy** *University of Colorado Anschutz*
Participants: **John Chase** *University of Massachusetts Amherst*
Evan Chinoy *Naval Health Research Center*
Charles Matthews *National Cancer Institute/ National Institutes of Health*
Stacey Simon *University of Colorado Anschutz Medical Campus*

12:00 - 12:15pm Transition Break

12:15 - 1:20pm
Lunch with Gold Sponsor Talks and Virtual Poster Time
Location: Shavano Peak + Livestream

1:20 - 1:30pm Transition Break

1:30 - 2:15pm
Keynote Presentation
The digital physiome: Wearables for early disease detection
Location: Shavano Peak + Livestream
Jessilyn Dunn *Duke University*

2:15 - 2:45pm Coffee Break
Location: Red Cloud Peak

2:45 - 4:15pm
Symposia 3 & 4
S.3 Physical behaviours and health: New methods and insights from large epidemiologic studies using accelerometry
Location: Shavano Peak + Livestream
Chair/Moderator: **Sarah Keadle** *California Polytechnic State University San Luis Obispo*
Participants: **Kelly Evenson** *University of North Carolina Chapel Hill*
Amanda Paluch *University of Massachusetts Amherst*
Pedro Saint-Maurice *National Cancer Institute*
Qian Xiao *The University of Texas Health Science Center at Houston*

S.4 Mobility outcomes for clinical trials in cerebellar ataxia: The route from the clinic to daily life
Location: Crestone Peak I & II
Chair: **Winfried Ilg** *Hertie Institute for Clinical Brain Research*
Participants: **Fay Bahling Horak** *Oregon Health and Science University*
Winfried Ilg *Hertie Institute for Clinical Brain Research*
Vrutangkumar Shah *Oregon Health and Science University*

4:15 - 4:30pm Transition Break

4:30 - 5:30pm
Oral Sessions 1 – 3
O.1 Novel statistical approaches and applications
Location: Shavano Peak + Livestream

O.1.1 Combining compositional data analyses and ecological momentary assessment: Insights on the association between physical behavior on mood in daily life
Marco Giurgiu *Karlsruhe Institute of Technology*

O.1.2 Association of gait quality with daily life mobility: An actigraphy and global positioning system based analysis in older adults
Anisha Suri *University of Pittsburgh*

O.1.3 Unknown distributions: Modelling distributions of real-world walking speed in people with Parkinsons
Cameron Kirk *Newcastle University*

O.1.4 A fully Bayesian semi-parametric Scalar-on-Function Regression (SoFR) with measurement error using instrumental variables
Roger Zoh *Indiana University*

O.1.5 Methods to determine common periods of wear in concurrently worn activity monitors
Craig Speirs *PAL Technologies Ltd.*

O.2 Clinical applications: Knee and back pain and fatigue

Location: Crestone I & II

O.2.6 Continuous longitudinal monitoring of early physical activity recovery following knee arthroplasty
Scott Small *University of Oxford*

O.2.7 Patterns of physical activity accumulation as a potential biomarker for low back pain phenotyping
Ruopeng Sun *Stanford University*

O.2.8 Associations of digital measures of gait with sleep and fatigue: A real world feasibility study
Rana Zia UR Rehman *Newcastle University*

O.2.9 Applying the Pittsburgh Performance Fatigability Index to a 6-minute walk in older adults
Yuija (Susanna) Qiao *University of Pittsburgh*

O.3 Physical activity interventions

Location: Crestone III & IV

O.3.11 Detecting and modifying daily inactivity among adults over 60 years using an integrated two-way communication-based near-real-time sensing system: A randomized clinical trial
Diego J Arguello *Northeastern University*

O.3.12 An empirical approach to understand mHealth application engagement and its associations with daily changes in physical activity in a lifestyle intervention among US Veterans with prediabetes
Krista Leonard *Arizona State University*

O.3.13 A physical activity intervention results in higher randomness of postural control accelerations during dual-task conditions
Kayla Bohlke *University of Pittsburgh*

O.3.14 Developmental and pilot testing of the ActiveGOALS online physical activity intervention for primary care students
Bonny Rockette-Wagner *University of Pittsburgh*

O.3.15 Wear fatigue: Does device wear compliance wane over a free-living assessment period?
Samuel LaMunion *National Institutes of Health/ NIDDK*

5:30 - 8:30pm

Early Career Researcher Event

Location: Off-Site – Dillon Marina

THURSDAY, JUNE 23, 2022

6:45 - 7:45am

JMPB Panel Discussion

Getting your research published

Location: Crestone I & II

Moderator: **Philippa Dall** *Glasgow Caledonian University*
Matthew Ahmadi *University of Sydney*
David Bassett *University of Tennessee, Knoxville*
Matt Buman *Arizona State University*
Kimberly Clevenger *National Cancer Institute*
Pedro Saint-Maurice *National Cancer Institute*
Jon Sirard *University of Massachusetts Amherst*

7:00am - 6:00pm Registration Desk Open
Location: Shavano Foyer

7:30am - 8:00pm Morning Coffee
Location: Red Cloud Peak

7:30am - 6:00pm Exhibits Open
Location: Red Cloud Peak

8:00 - 9:00am

Keynote Presentation

The use of device-based monitoring of behaviour and understanding of how academic research laboratories can generate evidence that meets the needs of regulatory stakeholders

Location: Shavano Peak

Matthew Diamond *CDRH Digital Health Center of Excellence, FDA*

9:00 - 9:15am Transition Break

9:15 - 10:15am

Oral Sessions 4 – 6

O.4 Validation of devices in real world settings

Location: Shavano Peak

O.4.16 Validation of previous-day recall for estimates of duration and context in comparison to activPAL and direct observation
Charles Matthews *National Cancer Institute, National Institutes of Health*

O.4.17 Comparison of time spent in activity type from the activPAL and video-recorded direct observation
Sarah Keadle *California Polytechnic State University San Luis Obispo*

O.4.18 Validation of two deep learning methods to estimate aspects of physical activity/ inactivity from accelerometers
John Staudemayer *University of Massachusetts Amherst*

O.4.19 The acceptability of wearing an activity monitor (activPAL) on the thigh to older adults
Philippa Dall *Glasgow Caledonian University*

O.4.20 Cumulative and diurnal change in GPS-derived distance as a novel measure of community mobility in older adults
Kyle Moored *University of Pittsburgh*

O.5 Clinical 2

Location: Crestone I & II

O.5.21 Using a wrist-worn sensor to objectively monitor gait quality in people with multiple sclerosis: Initial findings
Eran Gazit *Tel Aviv Sourasky Medical Center*

O.5.22 Impact of frailty on free-living walking performance in people living with MS
Tobia Zanotto *University of Kansas*

O.5.23 Objective estimation of disability levels and physical fatigue among people with multiple sclerosis using a single sensor worn during daily-living
Amit Salomon *Tel Aviv Sourasky Medical Center*

O.5.24 Setting the building blocks for long term remote and continuous real-time monitoring of MS patients in their daily living environment using a wrist-worn smart watch
Nathaniel Shimoni *Owlytics Healthcare Ltd.*

O.5.25 Activity and rest fragmentation analysis of daily-living physical activity fluctuations among people with MS
Amit Salomon *Tel Aviv Sourasky Medical Center*

O.6 Integrated systems to assess physical behavior

Location: Crestone III & IV

O.6.26 **Assessment of activities of daily living using markerless motion capture in a virtual reality setting**
Kevin Abbruzzese *Stryker Orthopaedics*

O.6.27 **Effects on heart rate, physical activity and ambulatory blood pressure from occupational physical activity with and without lifting among farmers in Denmark**
Mette Korshøj *Holbaek Hospital*

O.6.28 **Estimation of metabolic rate during submaximal exercise using heart rate, sex, age, training status and exercise mode in participants with and without a disability**
Julia K Baumgart *Norwegian University of Science and Technology*

O.6.29 **Towards eco-design of self-powered wearable devices: analysis of available energy on the human body for lead-free piezoelectric energy harvester positioning**
Damien Horeau *ENS Rennes, SATIE*

O.6.30 **Exploring effects of central sensitization on gait in chronic low back pain by using machine learning approach**
Xiaoping Zheng *University of Groningen*

10:15 - 10:45am Coffee Break
Location: Red Cloud Peak

10:45am - 12:15pm

Symposia 5 & 6

S.5 **Harmonisation methods of accelerometery and linkage with prospective health data in the ProPASS Consortium: pooling international cohorts for individual participant meta-analyses**
Location: Crestone Peak I & II
Chair: **Matthew Ahmadi** *University of Sydney*
Participants: **Matthew Ahmadi** *University of Sydney*
Andy Atkins *University of East Anglia*
Magnus Svartengren *Uppsala University*

S.6 **Measuring the interrelationships between dietary intake and physical activity in free-living settings**
Location: Crestone Peak III & IV
Co-Chair: **Danielle Ostendorf** *University of Colorado Anschutz Medical Campus*
Co-Chair: **Sarah Purcell** *University of British Columbia Okanagan*
Participants: **Derek Havel** *University of North Carolina Greensboro*
Krista Leonard *Arizona State University*
Sarah Purcell *University of British Columbia Okanagan*
Edward Sazonov *University of Alabama*

12:15 – 1:15pm

Lunch & ISMPB GMM

Location: Shavano Peak

1:30 - 2:15pm

Keynote Presentation

Avoiding catastrophe during a fall: Insights from video capture on the landing strategies of older adults during real-life falls
Location: Shavano Peak
Steve Robinovitch *Simon Fraser University*

2:30 - 4:00pm

Symposia 7 & 8

S.7 **The CNN Hip Accelerometer Posture (CHAP) Suite: Leveraging deep learning to close the gap between thigh and hip accelerometry in the free-living measurement of sitting behavior**
Location: Shavano Peak
Chair/Moderator: **Loki Natarajan** *University of California San Diego*
Participants: **Jordan Carlson** *Children's Mercy Kansas City*
Mikael Anne Greenwood-Hick *Kaiser Permanente Washington Health Research Institute*
Paul Hibbing *Children's Mercy Kansas City*
Marta Jankowska *Beckman Research Institute*

S.8 **Continued use of established approaches to analyzing accelerometer data for the measurement of physical activity: How and why to keep it simple**
Location: Crestone Peak III & IV
Chair: **Cheryl Howe**
Participants: **Kimberly Clevenger** *National Cancer Institute*
Alexander Montoye *Alma College*
Karin Pfeiffer *Michigan State University*

4:00 - 6:00pm

Poster Session & Social Hour

Location: Red Cloud Peak

FRIDAY, JUNE 24, 2022

7:00am - 2:00pm Registration Desk Open
Location: Shavano Foyer

7:30am - 8:00am Morning Coffee
Location: Red Cloud Peak

7:30am - 12:00pm Exhibits Open
Location: Red Cloud Peak

8:00 - 9:00am

Keynote Presentation

How to select balance and gait outcomes from body-worn sensors for clinical trials on parkinson's disease issues and solutions in the measurement of physical activity and multiple sclerosis: Lessons learned and implications for other neurological diseases
Location: Shavano Peak
Fay Bahling Horak *Oregon Health and Science University*
Robert Motl *University of Illinois Chicago*

9:00 - 9:15am Transition Break

9:15 - 10:15pm

Oral Sessions 7 – 9

O.7 Measuring steps

Location: Shavano Peak

O.7.31 **Changes in brisk stepping cadence are associated with improvements in adiposity, HDL-C, and HbA1c in people with non-diabetic hyperglycaemia**
Phil McBride *University of Leicester*

O.7.32 **Device comparison of free-living steps per day: A systematic review and meta-analysis**
Amanda Paluch *University of Massachusetts Amherst*

O.7.33 **Development of an externally validated free-living step counting algorithm with deployment in the UK Biobank**
Scott Small *University of Oxford*

O.7.34 **A step towards more intuitive physical activity prescription: Validity of stepping-based metrics derived from wrist-worn accelerometry**
Ben Maylor *University of Leicester*

O.7.35 **Comparison of the performances of step counting algorithms in different physical activities**
David Gerstel *ActiGraph*

O.8 Technical challenges and considerations

Location: Crestone I & II

O.8.36 **Let the epoch length float for more reliable measurements**
Henri Vähä-Ypyä *The UKK Institute of Health Promotion Research*

O.8.37 **Comparison of a head-worn accelerometer to a hip-worn ActiGraph GT9X for classifying activity type and estimating energy expenditure**
Edward Sazonov *University of Alabama*

O.8.38 **Comparing ActiGraph CentrePoint Insight Watch, GT9X Link, and wGT3X-BT accelerometers to NHANES 2011-2014 GT3X+ devices using an orbital shaker**
Samuel LaMunion *National Institutes of Health/ NIDDK*

O.8.39 **Impact of using a 60, 80, 90, or 100 Hz versus 30 Hz ActiGraph sampling rate on free- living physical activity assessment in youth**
Kimberly Clevenger *National Cancer Institute*

O.8.40 **Interrelationships between open-source, proprietary, and machine learning-derived accelerometry metrics**
Christopher Moore *University of North Carolina at Chapel Hill*

O.9 Physical activity determinants and COVID-19

Location: Crestone III & IV

O.9.41 **Temporal patterns of sitting and non-sitting in normal-weight and overweight Brazilian office workers working from home during the COVID-19 pandemic**
Luiz Augusto Brusaca *Federal University of São Carlos*

O.9.42 **The impact of UK COVID-19 restrictions on objectively measured physical behaviour**
Alexandra Clarke-Cornwell *University of Salford*

O.9.43 **Typical day and influence of weekend on accelerometer measured physical activity**
Alexander Burchartz *Institute for Sports and Sports Science, Karlsruhe Institute of Technology*

O.9.44 **Does context matter? The association between affective states and physical behavior and its moderation by weather factors measured with ambulatory assessment**
Irina Timm *Institute of Sports and Sports Science, Karlsruhe Institute of Technology*

O.9.45 **Multiple accelerometry assessed physical behavior across 24-hour period in older adults with different levels of physical fitness: a pilot study during COVID-19 pandemic**
Jan Vindis *Palacky University Olomouc*

10:15 – 10:45am Coffee Break
Location: Red Cloud Peak

10:45 - 11:45am

Oral Sessions 10 – 12

O.10 Use of devices in children and adolescents

Location: Shavano Peak

O.10.46 **Active and sitting time precursors to mood in young adults**
Bronwyn Clark *The University of Queensland*

O.10.47 **Comparison of youth-specific cut-point and machine learning methods for classifying physical activity intensity from wrist accelerometer data**
Matthew Ahmadi *University of Sydney*

O.10.48 **An objective assessment of toddler physical activity type and context at the childcare center and home**
Cailyn Van Camp *Michigan State University*

O.10.49 **Validating youth accelerometer methods using direct observation in free-living settings**
Jon Sirard *University of Massachusetts Amherst*

O.11 Epidemiologic studies with health outcomes

Location: Crestone I & II

O.11.51 **Impact of patterns of physical activity at pre- and post-diagnosis with mortality of Asian cancer patients: Results mortality of Asian cancer patients: Results of Health Examinees-G study in Korea**
Jaesung Choi *Seoul National University*

O.11.52 **Association of profiles of objectively-measured physical activity and sedentary behavior with all-cause mortality risk in older adults**
Manasa Shanta Yerramalla *Université de Paris*

O.11.53 **The association between moderate-to-vigorous physical activity during commuting and metabolic markers**
Abolanle Gbadamosi *University of Salford*

O.11.54 **Implementation of wrist accelerometry into the National Health and Aging Trends Study (NHATS) to expand physical activity assessment in older adults**
Jennifer Schrack *John Hopkins Bloomberg School of Public Health*

O.11.55 **Multidimensional movement behavior and mortality in older adults from the Whitehall II accelerometer sub-study: A machine learning approach**
Mathilde Chen *Université de Paris*

O.12 Clinical applications 1

Location: Crestone III & IV

O.12.56 **Are physical behavior and momentary fatigue bidirectionally associated after subarachnoid hemorrhage merging accelerometry and electronic diary data**
Lianne de Vries *Erasmus University Medical Center*

O.12.57 **Gait during daily life in men treated with androgen deprivation therapy for prostate cancer: Evidence for accelerated aging?**
Deanne Tibbitts *Oregon Health and Science University*

O.12.58 **Frequency of inpatient out-of-bed activities by ActivPAL vs. Johns Hopkins highest level of mobility scale after major abdominal surgery**
Mikita Fuchita *University of Colorado*

O.12.59 **Validation of the Apple Watch and Fitbit for assessing heart rate during rest and wheelchair propulsion in able-bodied participants and wheelchair users**
Julia K Baumgart *Norwegian University of Science and Technology*

O.12.60 **Validation and ranking of algorithms for gait sequence detection in healthy controls and people with Parkinson's disease**
María Encarnación Micó Amig *Newcastle University*

11:50am - 2:00pm Box Lunch pick-up
Location: Shavano Foyer

11:45am - 12:00pm Transition Break

12:00 - 12:45pm

Keynote Presentation

"Let's dance around the world!"
Location: Shavano Peak
Mai Chin A Paw *Amsterdam UMC*

12:45 - 1:30pm

Keynote Presentation

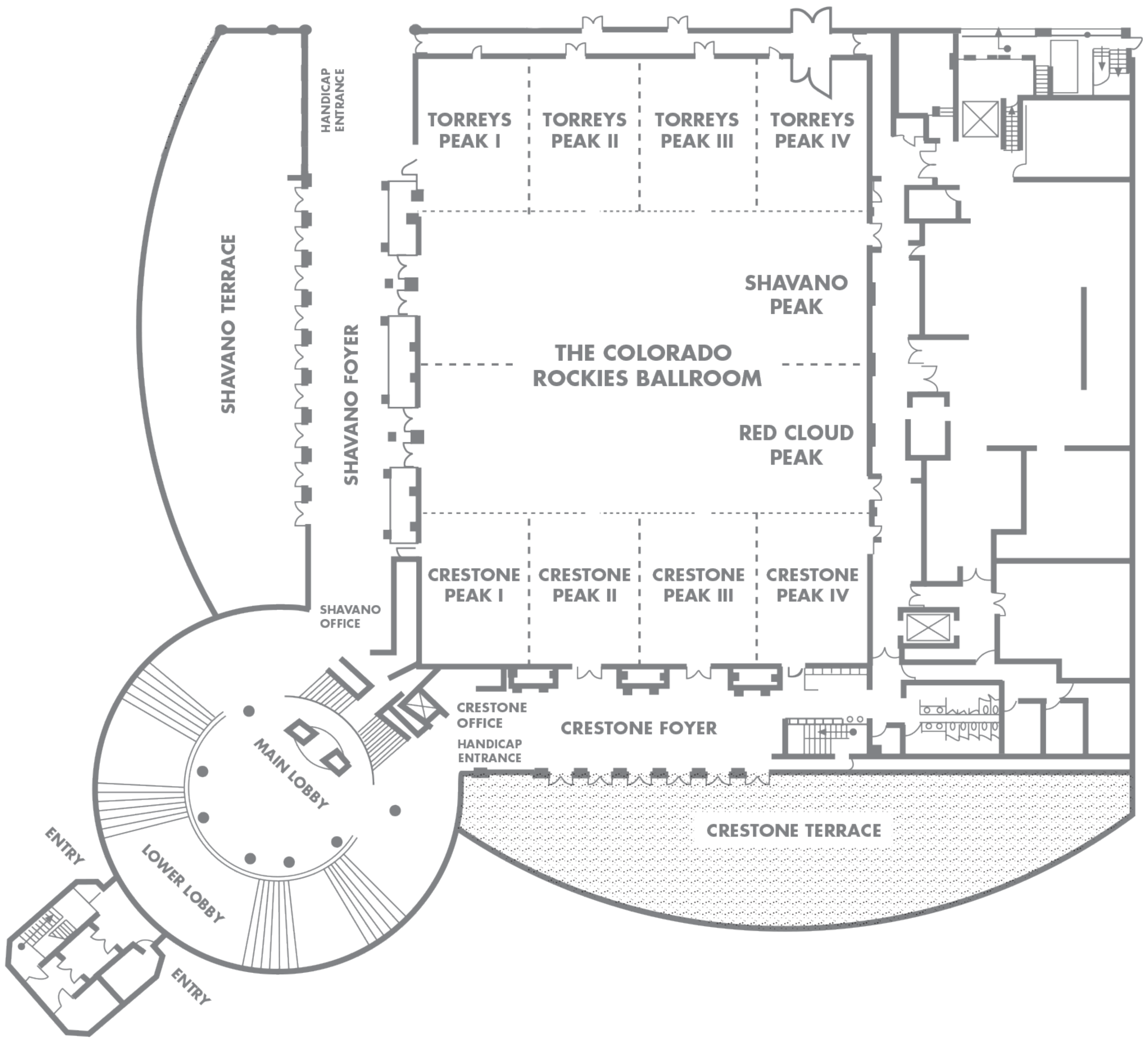
Evolution of public health physical activity applications of accelerometers; a personal perspective
Location: Shavano Peak
Richard Troiano *National Cancer Institute*

1:30 - 2:00pm

Student Awards & Closing Remarks

Location: Shavano Peak

VENUE FLOOR PLAN



See full Conference Center Map on page 61.

KEYNOTE SPEAKERS

I-Min Lee *Harvard Medical School*

I-Min Lee is Professor of Medicine at Harvard Medical School and Professor of Epidemiology at the Harvard T.H. Chan School of Public Health. She received her medical degree from the National University of Singapore and completed her MPH and ScD degrees at the (then) Harvard School of Public Health. Her primary research interest is in the role of physical activity for promoting health and well-being, and she has published more than 530 scientific articles. She is editor or co-editor of physical activity epidemiology textbooks that have been translated into the Korean and Chinese languages. She has served on national and international expert panels developing physical activity guidelines (including the inaugural 2008 US Physical Activity Guidelines) and sits on the Steering Committee of Lancet Physical Activity Series. She is Principal Investigator of one of the first large-scale epidemiologic studies using accelerometers to measure physical activity among 18,000 participants in the Women's Health Study (2011-2015) who are being followed for health outcomes.

Hans Bussmann Lecture: ***Maximizing the utility and comparability of accelerometer data from large-scale observational epidemiologic studies***

Observational epidemiologic studies form the "backbone" of our field in providing evidence showing that there is a clear relation between physical behaviors and good health and functioning. Much of what we know today, particularly for long-term health outcomes, comes from such studies. However, these studies need time to mature because the passage of time is required for health outcomes to occur. In contrast, technological advances in devices used to measure physical behavior, as well as the methodology to process the collected data, proceed at a brisk clip.

Thus, epidemiologic studies with accelerometer data from, say, a decade ago that are now accruing sizeable numbers of clinical outcomes will have employed methodology for collecting and processing accelerometer data also from a decade ago. How can such data be made current and useful so as to address important contemporary questions on the associations of physical behaviors with health outcomes? We will use the Women's Health Study as an example to illustrate how data collected a decade ago may be maximized in order to take full advantage of them, including potential transformations of the data to make them harmonizable with those from other studies.

This lecture is in recognition of the contribution of Professor Hans Bussmann, who in 2008 organised and ran the first ICAMPAM. This meeting was so successful that it inspired others to organise subsequent highly successful ICAMPAMs. Hans' visionary and brave initiative led directly to the formation of our Society and our international journal.

Jessilyn Dunn *Duke University*

Jessilyn Dunn is an Assistant Professor of Biomedical Engineering and Biostatistics & Bioinformatics at Duke University, and Director of the Duke BIG IDEAs Laboratory which is focused on biomedical data science and mobile health for digital biomarker discovery. Dr. Dunn is PI of the CDC-funded CovIdentify study to detect and monitor COVID-19 using mobile health technologies, which is built upon the team's previous infection detection work through the DARPA Prometheus and Biochronicity programs. Dr. Dunn was an NIH Big Data to Knowledge (BD2K) Postdoctoral Fellow at Stanford, an NSF Graduate Research Fellow at Georgia Tech & Emory, and a visiting scholar at the CDC and the National Cardiovascular Research Institute in Madrid, Spain. Her work has been internationally recognized with media coverage from the NIH Director's Blog to Wired, Time, and US News and World Report.

The digital physiome: Wearables for early disease detection

Digital health is rapidly expanding due to surging healthcare costs, deteriorating health outcomes, and the growing prevalence and accessibility of mobile health and wearable technologies. Recent technological advancements make it possible to closely and continuously monitor individuals using multiple measurement modalities in real time. We are collecting and integrating such wearables data with clinical information to gain a more precise understanding of health and disease and develop actionable, predictive health models for improving cardiometabolic and infectious respiratory disease outcomes. We are simultaneously developing open source data science and machine learning tools for the digital health community, including the Digital Biomarker Discovery Pipeline (DBDP), to facilitate the use of mobile device data in healthcare.

Matthew Diamond *Digital Health Center of Excellence, U.S. Food and Drug Administration (FDA)*

Matthew Diamond, MD, PhD is the Chief Medical Officer for Digital Health at the CDRH Digital Health Center of Excellence at FDA where he serves as the senior clinical expert for digital health medical devices and provides leadership for digital health policy development for emerging technologies including artificial intelligence. Prior to joining the Agency, Dr. Diamond served on leadership teams of large and small technology companies, including as CMO at Nokia, and as Medical Director at Fossil Group and the startup Misfit Wearables. Dr. Diamond served on numerous advisory boards including at the UMass Amherst Center for Personalized Health Monitoring and for NGP Capital. As Vice Chair of the CTA Health & Fitness Technology Board of Directors, he promoted public health applications of mobile technology and established an ANSI-accredited standardization committee for digital health technology. Dr. Diamond earned his MD and PhD (biophysics) from the Mount Sinai School of Medicine; he is board certified in rehabilitation medicine and sports medicine and certified in medical acupuncture. A faculty member at NYU, Dr. Diamond is passionate about helping people improve their mobility and performance through a holistic approach to rehabilitation and technology that promotes wellness.

The use of digital health technology for behavioral and physiological measures in clinical investigations of medical products

There is a global academic researcher community developing and validating methods to measure components of real-world physical behavior, gait and sleep using wearable inertial sensors and other connected technologies. Historically, this work has primarily been supported by public health researchers interested in understanding the dose response relationship between physical activity and health. There is now significant interest by those in the medical product development community to use such tools to measure real-world outcomes that are patient-centric, clinically relevant, and ecologically valid. The overarching goal of this keynote address is to accelerate digital health advancements, drive synergy and support patient focused medical product development by increasing awareness and understanding of how academic research laboratories can generate evidence that meets the needs of regulatory stakeholders.

Steve Robinovitch, Ph.D *Simon Fraser University*

Steve Robinovitch, Ph.D. is Professor in the Department of Biomedical Physiology and Kinesiology at Simon Fraser University. Steve's program on Technology for Injury Prevention in Seniors (www.sfu.ca/tips) focuses on the cause and prevention of falls and fall-related injuries in older adults. Steve received his B.A.Sc. in Mechanical Engineering from the University of British Columbia in 1988 and his Ph.D. in Medical Engineering from MIT/ Harvard in 1995. He worked as an Assistant Professor In-Residence in Orthopedics at the University of California San Francisco before joining SFU in 2000. He has published over 120 peer-reviewed papers, and is a past recipient of a Canada Research Chair, a Scholar Award from the Michael Smith Foundation for Health Research, and a New Investigator Award from CIHR.

Avoiding catastrophe during a fall: Insights from video capture on the landing strategies of older adults during real-life falls

How do older adults avoid injury during a fall? Any fall has the potential to cause catastrophic injury. Yet only about 5% of falls by older adults in long-term care result in serious injury. This talk will review evidence from video footage of over 3000 real-life falls experienced by older adults in long-term care, on how protective "safe landing" responses separate injurious and non-injurious falls.

Robert Motl *University of Illinois, Chicago*

Prof. Robert Motl has systematically developed a research agenda that focuses on physical activity and its measurement, predictors, and consequences in persons with neurological diseases, particularly multiple sclerosis (MS). Prof. Motl has generated a body of research on the validity of common physical activity measures in persons with MS. This has resulted in foundational research on quantifying differences in physical activity, particularly rates of moderate-to-vigorous physical activity, in persons with MS. These two lines of research have provided the basis for examining the outcomes of physical activity in MS, particularly beneficial adaptations in brain structure, cognition, depression, fatigue, walking disability, and quality of life. Prof. Motl has undertaken research on social-cognitive predictors of physical activity that has informed the design of behavioral interventions for increasing physical activity in MS. This agenda serves as a test-bed for application and expansion into other conditions such as spinal cord injury and Parkinson's disease.

Issues and solutions in the measurement of physical activity and multiple sclerosis: Lessons learned and implications for other neurological diseases.

This presentation will focus on the history and application of accelerometers in persons living with multiple sclerosis, and extension into other populations living with chronic diseases and conditions such as Parkinson's disease and wheelchair users.

Fay Bahling Horak *Oregon Health and Science University*

Dr. Horak is the Jay Nutt Endowed Professor of Neurology (Parkinson Center) at Oregon Health and Science University and Chief Scientific Officer of APDM Wearable Technologies, Clario. She is a fellow of the American Physical Therapy Association and neuroscientist who studies neural control and rehabilitation of balance and gait in patients with neurological disorders. Dr. Horak has quantified balance disorders in patients with Parkinson's disease, Multiple Sclerosis, Vestibular Disorders, Cancer Drug toxicity, age-related high fall risk, etc. Dr. Horak also helped start a small company, that makes body-worn, inertial sensors with software to quantify balance and gait and movement disorders via precision motion monitoring. APDM was recently acquired by Clario, the largest company that provides technology for clinical trials. Recently, her laboratory has been comparing gait and turning characteristics collected passively during natural activities in daily life with characteristics collected activity during prescribed, clinical tests. She has over 300 peer-reviewed scientific articles and has received numerous awards.

How to select balance and gait outcomes from body-worn sensors for clinical trials on Parkinson's disease

This presentation will focus on the selection of the balance and gait outcomes derived from wearable devices in clinical trials of Parkinson's disease.

Mai Chin A Paw *Amsterdam UMC*

Mai Chin A Paw dreams of a world where children grow up healthy and happy. Such a world provides plenty opportunity for active play, inspiring education and physical activities. She loves to practise yoga and yoga philosophy and dance around the world.

Let's dance around the world!

I strongly believe that diversity and inclusion in science leads to better science, more innovations and more relevant outcomes that better serves society at large. Historically, scientific research is quite WEIRD (Western, Educated, Industrialized, Rich, and Democratic[1]) and this WEIRDNESS not only applies to study samples but definitely also to researchers themselves. WEIRD research leads to WEIRD results that better serve a small privileged group of WEIRD people, widening inequalities. How does this WEIRDNESS affect measurement of physical behaviour? I believe that collaborating within our small circle of scientific friends with similar backgrounds and perspectives results in bias and hinders innovation. As a result we end up missing out on the valuable holistic viewpoint that more inclusive science would gain.

In this lecture, I am keen to share examples of how I strive to make research on measurement of physical behaviour more inclusive by linking a wide diversity of ideas, perspectives and living environments. More diversity and inclusiveness makes our collective dance more beautiful and impactful!

[1] *Henrich et al. The weirdest people in the world? BEHAVIORAL AND BRAIN SCIENCES (2010) 33, 61–135*

Richard Troiano *National Cancer Institute*

Until his recent retirement, Dr. Richard (Rick) Troiano was a Program Director in the Risk Factor Assessment Branch of the Epidemiology and Genomics Research Program in NCI's Division of Cancer Control and Population Sciences (DCCPS). Dr. Troiano promotes the validation and use of accelerometer-based devices in the assessment of physical activity in research and population surveillance. He worked with the 2011-2014 National Health and Nutrition Examination Survey (NHANES) to implement the use of devices in the survey to obtain objective measures of participants' physical activity-related movement and sleep, as well as body strength, and was the lead on inclusion of accelerometers for the first time in NHANES in 2003-2006. He is interested in promoting improved understanding of the information obtained from devices and self-reports and the analytic implications of different data sources. Dr. Troiano also supports federal efforts to promote health-enhancing physical activity, as evidenced by his service as co-executive secretary for the development of the Physical Activity Guidelines for Americans, 2nd edition. Dr. Troiano also was on detail to the Office of Disease Prevention and Health Promotion as Coordinator for the development of 2008 Physical Activity Guidelines for Americans and to the Office of the Surgeon General to support development of Step it Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities. Most recently, he served as a member of Guideline Development Group for the 2020 WHO Guidelines on Physical Activity and Sedentary Behaviour.

Evolution of public health physical activity applications of accelerometers; a personal perspective.

The use of accelerometers to assess physical activity for research and population surveillance has increased rapidly since 2000 with publications on physical activity and accelerometers increasing more than 50-fold. Accelerometer-based measures were included in multiple cohorts and population surveillance. Concurrently, device technology was rapidly evolving as was understanding of the relationship between physical activity behavior and the signal data available from accelerometer-based devices. This talk will provide an overview of significant events over this period as well as address the current challenge of bridging physical activity recommendations based on reported behavior with assessment based on device measures.

SYMPOSIA ABSTRACTS

Symposium I

Wednesday, June 22

10:30am – 12:00pm, Shavano Peak

Spatial analyses with behavioral data

Chair: **Jasper Schipperijn** *University of Southern Denmark*

Moderator: **J. Aaron Hipp** *University of Southern Denmark*

Jasper Schipperijn *University of Southern Denmark*

Detecting hotspots for physical activity using accelerometry, GPS and GIS

BACKGROUND AND AIM: Daily physical activity is not one behavior that takes place in one location; it consists of many different behaviors occurring in different locations. To get a better understanding of the correlates and determinants of physical activity behavior, knowing in which context it occurs can add valuable additional information. With the emerging of methods to combine accelerometer and global positioning system (GPS) The aim of this presentation is to explain how the process of identifying physical activity hotspots works, and demonstrate the method using examples from several studies conducted in Australia and Denmark. METHODS: Data were collected among school-children in Denmark and preschool children in Australia using an accelerometer (ActiGraph GT3X or Axivity) and a GPS (Qstarz BT-Q1000X) for 7 days (5 week days, 2 weekend days) to determine their level of activity and movement patterns. The GPS position was recorded every 15 seconds and their activity level was recorded and 100Hz and compiled into 15 second epochs. Data were merged and processed using HABITUS, an online tool available via the University of Southern Denmark. The processed data-points were imported into the geographical information software ArcGISpro, where optimized hot-spot analyses were conducted to identify the statistically significant spatial clusters of GPS points with higher or lower physical activity levels. For each hotspot, we identified the type of area, revealing the built environment characteristics of places with a significantly higher level of physical activity. RESULTS: Physical activity hotspots were identified in the outdoor areas of early care and education centers (ECEC), schoolyards, as well as neighborhoods. In neighborhoods, for schoolchildren, activity hotspots primarily consist of schoolyards, sports facilities and shared backyards between multistory social housing complexes. For preschool children, neighborhood activity hotspots were primarily in private yards, ECECs, public parks, and shopping areas. In schoolyards, activity hotspots were primarily at a ball-game areas, climbing areas, and open spaces. For ECECs, activity hotspots were in many different types of areas, but more often in open spaces and areas with large fixed-play-equipment. CONCLUSIONS: Collecting and processing accelerometer and GPS data is time-consuming, but in combination with the optimized hot-spot analysis tool in ArcGISpro, the data provides unique possibilities to identify locations where the activity level is significantly higher (or lower) than the average. Classifying built environmental characteristics of these locations reveals which type of environments are most important for physical activity, for different age groups and genders, at different geographic scales.

Jordan Carlson *Children's Mercy Kansas City, USA*

Basic integration of GPS and accelerometer data to address a range of spatially based research questions

BACKGROUND. Using Global Positioning Systems (GPS) trackers in research provides additional details about a person's activity patterns that can inform multilevel interventions. The contextual information provided by GPS can improve understanding of where activity occurs and how correlates of activity may differ by setting. This presentation covers basic tools for integrating GPS and accelerometer data and provides example data and findings related to various research questions aided by GPS. METHODS. Data were from three observational studies that included concurrent wear of ActiGraph accelerometers and GPS trackers (e.g., QStarz). In Study 1, GPS-based trip detection algorithms and consumer wearables were tested for their validity for detecting pedestrian, cycling, and vehicle trips in 34 youth and adults. In Studies 2 and 3, pre-determined activity locations (e.g., at home, at school, in parks, in the home neighborhood) were investigated in 55 children living in rural communities and 472 young adolescents living in high and low walkable urban/suburban neighborhoods, respectively. Study 3 also involved assessing location-general and locations-specific environmental and psychosocial correlates of physical activity to inform their relative role in interventions. A description of the GPS processing systems used will be provided, including ArcGIS, HABITUS (Human Activity Behavior Identification Tool and data Unification System), PALMSplusR (R package), and post-processing tools. RESULTS. The trip detection algorithms identified and correctly classified the mode of 75.6%, 94.5%, and 96.9% of pedestrian, cycling, and vehicle trips (F1s=0.84 and 0.87) and were superior to Fitbit's SmartTrack and Garmin's Move IQ. Post-processing strategies for improving GPS-based pedestrian trip classification were identified. Although about half of adolescents' overall physical activity occurred at school, when accounting for time spent in each location urban/suburban adolescents were least physically active at home (2.5 min/hour of wear time) and school (2.9 min/hour of wear time) compared to "other" locations (5.9 min/hour of wear time). Analyses for the rural children (Study 2) are pending. In Study 3, no location-general psychosocial factors were related to activity in all locations. Most location-specific environmental and psychosocial factors were associated with activity in the matching location(s) only. CONCLUSIONS. Several GPS data processing tools exist that can be implemented by researchers with introductory to intermediate geospatial expertise. Available trip-detection algorithms for GPS data have good validity in children and adults. Understanding how much time people spend in active trip modes and in physical activity in various locations can inform intervention targets for supporting overall activity. The findings regarding correlates of physical activity suggest that both environmental and psychosocial correlates of activity are often location specific.

Marta Jankowska *City of Hope, Beckman Research Institute, USA*

Comparing time-weighted spatial averaging derived measures of environmental exposures and associations with physical activity

BACKGROUND AND AIM: Time-weighted spatial averaging approaches (TWSA) for deriving environmental exposures are growing in use as deployment of Global Positioning Devices (GPS) is becoming more common in health-related studies. TWSAs measure mobility based environmental exposure while also accounting for time spent in locations, however their utility for relating environmental exposures to physical activity (PA) is unknown. Greater spatiotemporal accuracy in measurement of environmental exposures may prove important for detecting and understanding associations between PA and built environments. METHODS: Participants (N = 596; mean age = 59 years; 56% female; 42% Hispanic) from the Community of Mine study in San Diego County, USA wore hip ActiGraph GT3X+ accelerometers and Qstarz GPS devices for two weeks. Accelerometer cut points with cpm were used to classify weekly light PA (100-759 cpm) and moderate to vigorous PA (MVPA) (>759 cpm). Two TWSA activity spaces were computed for each participant's total GPS wear time (kernel density estimation - KDE, and density ranking - DR). TWSA activity spaces were used to measure exposure to three activity-related environments (walkability, recreation opportunities, and greenness). OLS regression measured TWSA exposure associations with PA outcomes, controlling for sex, age, ethnicity, and total device wear time. As a comparison, OLS regressions were also run for 1000m buffer from home exposures to the three environments. RESULTS: Participants had a weekly average of 26.8 hours of light PA and 12.5 hours of MVPA. DR measured exposure to recreation opportunities was associated with decreased MVPA (β=-17.3, 95% CI[-28.1, -6.4]), as was DR measured walkability (β=-2.4, 95% CI[-3.8, -1.1]) and greenness (β=-57.7, 95% CI[-114.5, -0.9]). DR measured exposures were not associated with light PA. KDE measured walkability exposure was associated with decreased light PA (β=-23.5, 95% CI[-45.6, -1.3]). No other associations were detected in this sample between exposures and light PA. No home buffer measured exposures were associated with PA outcomes. CONCLUSION: TWSA exposure results show a counterintuitive, but consistent relationship between increased time spent in green, walkable, and recreation opportune places with reduced PA time. In comparison, no relationships were found between PA time and home buffer exposure measures. By accounting for both the total exposure of individuals as well as the time they spend in locations, we may be better able to detect relationships between environmental exposures and physical activity through more sensitive and accurate measures of exposure. Further work will need to be done to understand the counterintuitive associations found in this study.

Jing-Huei Huang *North Carolina State University, USA*

Identifying children's play episodes using density-based clustering methods

BACKGROUND AND AIM: Play is essential to children's physical, cognitive, and social skill development. Understanding behaviors in playspaces will inform design and management that encourages the variety and enjoyment of play across communities. Accelerometers and the global positioning system (GPS) have been adopted to investigate children's play patterns. However, it is challenging to analyze play patterns as children's free play is spontaneous, creative, changes over time and across spaces, and could vary by individual. This study aims to systematically identify and characterize play episodes using density-based clustering methods, which detect children's movements that cluster together in space and time. METHODS: 324 children (5-9 years) were recruited in 12 neighborhood parks in New York City and Raleigh/Durham, NC, in spring/summer 2017-2018 to wear accelerometer and GPS for an average of 25 minutes, recording location and activity intensity of play. Caregivers reported demographic information through surveys. The dataset consisted of 38,792 points of accelerometer and GPS data joined at 15-second epochs, along with associated individual characteristics. The density-based clustering method, Multi-scale (OPTICS), identified clusters (i.e., play episodes) that consisted of at least 5 data points (≥1 minute). Identified clusters were mapped to playspaces in parks, including play areas (e.g., play structures), sport pitches (i.e., courts and fields), in-between features, and areas surrounding parks (e.g., sidewalks). RESULTS: 1,723 play episodes were identified from collected data. On average, a child's play consisted of five play episodes with a 2.94-minute duration and 17 meters/minute velocity. For each play episode, a child maintained moderate to vigorous intensity physical activity (MVPA) for 28% of the time. Of the 1,723 episodes, 20% were solely in play areas, 6% in sports pitches, 22% strictly in-between features, and 3% were outside of parks while 49% were across multiple areas in parks. Average time spent across spaces in/around parks varied by individual characteristics. Children maintaining an accelerometer average above the MVPA threshold (>573) spent more time in areas designated for play (+6%) and less time in spaces between features (-7%), compared to children less active. Girls spent more time in play areas (+5%) and between features (+4%) whereas boys spent more time in sports pitches (+10%). CONCLUSIONS: Results demonstrate characteristics of play episodes and how spaces in parks are used for children's play. Findings highlight that children's free play occurs across spaces, and not necessarily concentrated in areas designated for play, which implies the importance of spatial arrangement of various park features to the diversity and intensity of play. Advancing this methodology could provide valuable information for practitioners to better design play features and their layout that support active and meaningful play.

Symposium II

Wednesday, June 22

10:30am – 12:00pm, Crestone Peak I & II

Measuring sleep with wearables: The ABC's of measuring Z's

Chair: **Seth Creasy** *University of Colorado Anschutz Medical Campus, USA*

John Chase *University of Massachusetts Amherst, USA*

History and significance of sleep measurement

Sleep in critical for physical, cognitive, and psychological health. Sleep is simultaneously influenced by confounding life factors such as development, aging, and disease. Accurate and precise sleep measurement is crucial for our understanding of the relationships between health outcomes and life factors. Technological advancements in sleep measurement have preceded an era when sleep measurement is widely portable and accessible in clinical, research, and commercial platforms alike. In this talk, we will review the historical progression of sleep measurement from early self-report questionnaires to contemporary sleep measurement tools, including polysomnography and wearable technology (e.g., accelerometers). We will explain why the question of interest dictates what type of sleep measurement device is needed, while highlighting the strengths and limitations of common device-platform combinations. Finally, we will discuss how burgeoning technological advancements, such as the incorporation of biometric signals in portable devices, can improve our understanding of the relationships between sleep and health outcomes across the lifespan.

Stacey Simon *University of Colorado Anschutz Medical Campus, USA*

Sleep measurement in research & clinical settings

BACKGROUND AND AIM: Sleep health is a multidimensional concept consisting of a variety of factors such as duration, timing, quality, and satisfaction. Poor sleep health is endemic in individuals across the lifespan: nearly 35% of adults and 78% of adolescent report sleeping less than the recommended amount per night, and sleep complaints are one of the most common parental concerns for pediatricians. Sleep disorders such as obstructive sleep apnea and insomnia are also increasingly prevalent. Thus, the aim of this presentation is to describe measures of sleep health and discuss pros and cons, indications for use, and consideration for special populations. METHODS: A review of objective and subjective measures of sleep health frequently used in research and clinical settings will be provided. RESULTS: Laboratory-based polysomnography is the gold standard for objective sleep evaluation but is expensive, burdensome, requires trained staff to administer and score, and captures only a single night of sleep in an atypical environment. Alternative devices such as accelerometer-based wrist actigraphy, dry-EEG headbands, and peripheral arterial signaling finger-worn devices can be used in the home environment over extended periods of time but may also be costly or less accurate. CONCLUSIONS: Accurate assessment of sleep health is important for both researchers and clinicians and a number of assessment tools are available for different populations, settings, and outcomes.

Charles Matthews *National Cancer Institute, National Institutes of Health, USA*

Integrating physical activity and sleep measurements in epidemiological research

The application of accelerometry in large scale epidemiologic studies has accelerated the interest among physical activity researchers to investigate the health benefits and risks associated with the full range of behaviors occurring in the 24-hour day, including sleep, physical activity, and sedentary behavior. There are many similarities in studying sleep and physical activity using ambulatory monitors, but there are also important differences that should be considered. This presentation will describe the parallels in measuring the two behaviors as well as the important differences. Current state of the art applications of monitor-based measures of physical activity and sleep in large epidemiologic studies will be discussed, with a particular focus on key etiologic questions related to risk for developing cancer and how better assessments of sleep and physical activity may advance our cancer prevention efforts.

Evan Chinoy *Naval Health Research Center, USA*

Accuracy and utility of consumer-grade devices for measuring sleep

Recent advances in technology and demand for biometric data have led to the creation of a variety of personal consumer devices that track physiological signals and behavioral patterns, including sleep. Such devices help meet the important need for long-term, automated, real-time sleep tracking, with the added benefits of being less expensive and burdensome than standard research methodologies. Although such technologies have widespread use among the general population for everyday sleep tracking, the algorithms are often proprietary and the claims made by technology companies regarding device accuracy and utility are debated by researchers and clinicians. A related concern is that the ability of researchers to formally evaluate the validity of devices is much slower than the pace of new devices being released onto the consumer market. Despite this research gap, the number of high-quality validation studies have increased recently, helping elucidate the strengths and weaknesses of many new and popular consumer sleep-tracking devices. This includes our lab which, over the past 5 years, has conducted a series of validation studies testing many of the latest consumer sleep-tracking devices, to systematically evaluate their performance under different conditions. In general, our findings show that many, but not all, devices can track sleep-wake patterns on most nights as well as (or slightly better than) the mobile sleep assessment standard methodology, research-grade actigraphy, in healthy individuals under fixed sleep conditions in a controlled laboratory setting, as well as at home with ad libitum sleep schedules and environments. However, consumer devices still display some of the performance limitations inherent to research-grade actigraphy devices, such as low epoch-by-epoch specificity and bias toward underestimating true periods of wake - indicating that device accuracy may be lower on nights with disrupted sleep patterns. We also found that consumer devices are inconsistent in their ability to accurately classify individual sleep stages (i.e., light, deep, or rapid eye movement sleep) and to track irregular sleep schedules (e.g., naps, split sleep). Additionally, our lab has started implementing sleep-tracking devices into real-world operational military environments to evaluate their feasibility for everyday use and utility of their sleep data as inputs into fatigue management platforms to identify potential sleep issues and reduce operational risks. The continued improvement and versatility of new consumer devices strengthens their potential use cases as beneficial alternatives to standard methodologies for tracking real-world sleep patterns, though with some important considerations and limitations.

Symposium III

Wednesday, June 22

2:45 – 4:15pm, Shavano Peak

Physical behaviors and health: New methods and insights from large epidemiologic studies using accelerometry

Chair: **Sarah Keadle** *California Polytechnic State University San Luis Obispo, USA*

Pedro Saint-Maurice *National Cancer Institute, National Institutes of Health*

Sleep duration, quality, timing, and mortality risk

BACKGROUND & AIM: Most evidence describing the amount of sleep associated with a lower mortality risk comes from studies that used self-reported measures of sleep and includes limited information about other sleep dimensions like sleep quality and timing. This study examined associations between accelerometer-derived sleep duration, quality, timing, and mortality. METHODS: Data are from the UK Biobank cohort of adults aged 40-69 years (2006-2010). Approximately 6 years post baseline, 103,712 adults participated in an activity monitoring sub-study and wore an Axivity AX3 wrist-worn triaxial accelerometer over 7-days. Monitor data were processed using the R package GGIR to generate sleep duration (hours/day), sleep quality (wake after sleep onset, sleep efficiency), and sleep timing (onset, offset, midpoint) exposures. Data were linked to mortality outcomes including all-cause, cardiovascular disease (CVD), and cancer mortality assessed via National Health Service registries in UK with follow-up up to 12/31/19. We first estimated Hazard ratios (HRs, 95% CI) for sleep duration and mortality outcomes using cubic splines. Next, we computed HRs for quartiles of the sleep quality and timing exposures in relation to mortality. All models were adjusted for age, sex, race-ethnicity, education, Townsend deprivation index, employment status, lifestyle factors, chronic conditions, functional pain, and general health rating. Sensitivity analysis included examinations of heterogeneity in our sleep duration-mortality associations by demographic and lifestyle variables. RESULTS: Over an average of 5.1 years 1,762 deaths occurred (1,108 cancer, and 338 CVD deaths). Participants slept on average from 23:41 to 7:12, for about 6:42 hours/day, and were awake for 46 minutes. When compared to sleeping 7.0 hours/d, sleeping less than 6 hours per day was associated with a 14-33% higher risk for all-cause mortality ($p<0.01$; e.g., HR5 hrs/d: 1.23 [0.95, 1.61]); 28-56% higher risk for CVD mortality ($p=0.05$; e.g., HR5 hrs/d: 1.41 [0.78, 2.56]), with no clear associations for cancer mortality ($p>0.05$). Sleeping less than 6 hours/day on 3+ nights in a week was associated with a 20% increased risk for all-cause mortality (HR=1.20 [1.06, 1.36]) when compared to individuals with 0 nights of short sleep. Measures of sleep quality and timing were not associated with mortality risk ($p>0.05$). Our examinations of heterogeneity showed that sleeping < 6 hours/day was consistently associated with all-cause mortality across demographic and lifestyle subgroups except across quartiles of moderate-vigorous physical activity (pheterogeneity=0.02). CONCLUSIONS: Accelerometry measured sleep duration, but not the quality or timing of sleep were associated with mortality. These findings suggest that sleeping less than 6.0 hrs/d can increase mortality risk among men, women, young, and older adults.

Qian Xiao *University of Texas Health SPH, USA*

24-hour rest-activity patterns and health

Physical activity, sedentary behaviors and sleep are fundamental human movement behaviors organized in a 24-hour rhythmic cycle. These behaviors are orchestrated by the internal circadian timing system, and influenced by common environmental exposures (e.g., light, daily schedules and social interactions). The conventional approach to study diurnal movement behaviors focuses on measures of individual components such as physical activity intensity and volume, duration of sitting, and sleep duration and efficiency. However, However, there's been little focus on the timing and rhythmic profiles of these behaviors and movement over the 24-hour day. The highly interconnected nature of these behaviors requires an integrated and holistic approach to study the overall patterns of the 24-hour rest-activity cycle. There are various methods that have been developed for characterizing 24-hour rest-activity patterns, including both parametric and nonparametric methods. The former assumes a cosine or cosine-like shape of daily activity patterns and produces rhythmic measures such as amplitude, mesor, acrophase and overall rhythmicity. In contrast, the nonparametric methods have no underlying assumption about activity patterns and derive metrics that measure specific aspects of the rest-activity cycles, such as stability, variability/fragmentation. More recently, an alternative approach to overcome these limitations is the functional principal component analysis (fPCA), which applies flexible algorithms to fit activity data with no a priori assumptions and is able to identify overall rest-activity profiles. In this section, we will discuss different methodology for characterizing rest-activity patterns using 24-hour actigraphy data, and present two recent studies in the National Health and Nutrition Examination Survey (NHANES), focusing on 1) the associations between cosinor-based rest-activity characteristics and metabolic health; and 2) fPCA-derived rest-activity profiles among US adults. These studies demonstrate the utilization of different methodology for rest-activity measurement, highlight the importance of rest-activity rhythms in health, and identify sociodemographic and socioeconomic correlates of rest-activity patterns in the US population.

Kelly R. Evenson *University of North Carolina - Chapel Hill, USA*

Identifying multicomponent patterns of accelerometry-assessed physical activity and sedentary behavior: The Objective Physical Activity and Cardiovascular Health Study

BACKGROUND AND AIM: Latent class analysis (LCA) is a useful statistical tool to describe patterns of physical behavior (e.g., physical activity (PA) and sedentary behavior (SB)). Single component LCA has been previously applied to accelerometry to provide unique class assignments for SB and the various intensities of PA. The objective of this study was to explore multi-component LCA to integrate the full spectrum of physical behavior among women age 64 and older in a unique LCA model. METHODS: Participants were from the United States and enrolled in the Women's Health Initiative Objective Physical Activity and Cardiovascular Health Study. Overall, 6,126 women 64 to 97 years wore an ActiGraph GT3X+ accelerometer at their hip for 4-7 days of adherent wear (defined as >=10 hours/day). Using accelerometry data, we assessed time spent in SB (0-18 VM/15-s), light low (19-225 VM/15-s), light high (226-518 VM/15-s), and moderate to vigorous (MVPA) (>=519 VM/15-s). Multi-component LCA classified women based on all four metrics across time of day in 1-hour windows during time awake, averaging across adherent days. RESULTS: Mean (SD) physical behaviors in minutes/day were: 556 (99) SB, 189 (50) light low, 98 (36) light high, and 50 (34) MVPA. Optimally, 6 classes were identified for the full spectrum of physical behavior, including SB, light low, light high, and MVPA. Class assignments ranged from the highest SB and lowest MVPA (class 1) to the lowest SB and highest MVPA (class 6), both averaged across all 1-hour windows. The percent (n) from the lowest to highest class were 13.1% (805), 28.0% (1713), 21.7% (1330), 17.1% (1045), 14.0% (858), and 6.1% (375). Slower self-reported walking speed was associated with a lower class assignment ($p<0.0001$). CONCLUSIONS: Unique multi-component physical behavior patterns in free-living older women were observed using novel analysis of accelerometry. By identifying heterogenous patterns which capture a profile encompassing a range of physical behaviors, these methods can be used to find new insights into habitual patterns and intensities for targeted interventions aimed to improve health outcomes, such as enhancing aging resiliency and independence, among older women.

Amanda Paluch *University of Massachusetts Amherst, USA*

10,000 steps per day? Closing the gap between common knowledge and scientific evidence

The simplicity of steps/day as a metric makes it appealing for physical activity promotion in clinical and population settings. Summarizing the association of steps and health can advance health promotion guidelines. The Steps for Health Collaborative has compiled data from cohort studies for a meta-analysis with device-measured steps and prospective health outcomes. This presentation will discuss the process of the consortium effort and conducting a harmonized meta-analysis. Results on the associations of steps and all-cause mortality will be discussed. This meta-analysis included 15 studies, of which seven were published and eight were unpublished, including nine different step counting devices. The total sample included 47,471 adults, among whom there were 3013 deaths (10·1 per 1000 participant-years) over a median follow-up of 7·1 years ([IQR 4·3-9·9] (297,837 person-years). Quartile median steps per day were 3553 for quartile 1, 5801 for quartile 2, 7842 for quartile 3, and 10 901 for quartile 4. Compared with the lowest quartile, the adjusted HR for all-cause mortality was 0·60 (95% CI 0·51-0·71) for quartile 2, 0·55 (0·49-0·62) for quartile 3, and 0·47 (0·39-0·57) for quartile 4. Restricted cubic splines showed progressively decreasing risk of mortality among adults aged 60 years and older with increasing number of steps per day until 6,000-8,000 steps per day and among adults younger than 60 years until 8,000-10,000 steps per day. Taking more steps per day was associated with a progressively lower risk of all-cause mortality, up to a level that varied by age. The findings from this meta-analysis can be used to inform step guidelines for public health promotion of physical activity.

Symposium IV

Wednesday, June 22

2:45 - 4:15pm, Crestone Peak I & II

Mobility outcomes for clinical trials in cerebellar ataxia: the route from the clinic to daily life

Chair: **Winfried Ilg** *Hertie Institute for Clinical Brain Research, USA*

Winfried Ilg *Hertie Institute for Clinical Brain Research, USA*

Towards ecologically valid biomarkers: real-life walking and turning assessment captures subtle longitudinal and preataxic changes in cerebellar ataxia

BACKGROUND AND AIM: While manifold targeted molecular treatments for cerebellar ataxias are on the horizon, clinical and regulatory acceptance will depend on their proven effects on subject's ataxia using quantitative biomarkers. Thus, sensitive biomarkers with high relevance for patients' daily life are highly warranted. Moreover, it is hypothesised that real-world gait is more sensitive to disease-specific signatures compared to clinical settings, due to the complexity of the environments as well as the larger amount of gait data captured by wearable inertial sensors. Measures of spatiotemporal variability have been shown to allow the quantification of disease severity and capturing treatment-related improvements in ataxic gait. The transfer of variability measures to real life is hereby complicated by the fact that real-life gait is inherently far more variable and that patients are free to use various compensation strategies, thus increasing heterogeneity of walking patterns. Thus, variability measures may lose their accuracy for characterizing ataxic changes in real life. METHODS: We performed a combined cross-sectional and longitudinal (1-year interval) study in degenerative cerebellar disease including pre-ataxic mutation carriers. Gait and turning movements were assessed by three body-worn inertial sensors in (1) laboratory assessment, and (2) unsupervised real-life movements. We focused on measures of step variability in gait and measures quantifying dynamic balance during turning. RESULTS: We identified measures that allowed not only to capture the variability inherent in ataxic gait in real life, but also demonstrate high sensitivity to small differences in disease severity. Lateral step deviation and a compound measure of spatial step variability (i) categorized patients against controls with high accuracy (ii) both were highly correlated with clinical ataxia severity, with highest effect sizes in real life (r=0.76). Moreover, the turning measure LVC (lateral velocity change) allow to capture changes on dynamic balance in real life, with sensitivity to the preataxic stage (δ=0.53) and high effect size of 1-year longitudinal change (rprb=0.66). Together with good test-retest reliability (ICC=0.91) this results in low sample sizes for detecting a 50% reduction of progression by a hypothetical intervention (n=66). CONCLUSIONS: Our results prepared steps towards regulatory approval of digital-motor biomarkers as end-points for future trials, demonstrating (i) power as ecologically valid biomarkers, (ii) correlation with clinical ataxia severity and patient-reported balance confidence outcomes, (iii) sensitivity to subtle changes longitudinally, and (IV) test-retest-reliability in real-life recordings. Ilg W, et al. Real-life gait assessment in degenerative cerebellar ataxia. Neurology 2020 Thierfelder A, et al. Real-Life Turning Movements Capture Subtle Longitudinal and Preataxic Changes in Cerebellar Ataxia. Mov Disord. 2022

Fay Horak *Oregon Health & Science University, USA*

Significance and innovation in use of wearable technology for clinical trials in ataxia

Spinocerebellar ataxias (SCAs) are primarily characterized by excessive postural sway in standing and ataxic gait that reflects impaired dynamic balance control (similar to alcoholic ataxic gait). Rare neurological diseases that affect balance and gait, such as degenerative cerebellar ataxias, currently have no established treatment but now have exciting, novel drugs appearing in the therapeutic pipeline. Unfortunately, these clinical trials are hampered by clinical scale outcomes that have inadequate effect size for the size of the population with the disease. Wearable technology to quantify balance and gait have recently become feasible for large clinical trials but the most sensitive, specific, valid, reliable and responsive balance and gait metrics to serve as performance outcomes in clinical trials need to be determined. Recently, measures of ataxic gait and postural sway have shown to be sensitive to ataxia severity, including prodromal disease when neurological assessments are normal. Global initiatives are currently underway to unify assessment protocols and gait/balance measures to enable longitudinal, multicentric clinical studies. I will introduce the challenges in determining the best set of objective balance and gait outcomes for multi-site clinical trials for patients with rare diseases like SCA. I will summarize that scientific evidence is needed, how to relate concept of interest and specific outcomes to meaningful measures of health, and what are further necessary steps for regulatory approval of these gait and balance biomarkers in clinical trials. I will also summarize the benefits and challenges of measuring gait and balance in daily life versus the clinic. I will also introduce an innovative approach to establish scientific and clinical validity of an aggregated, instrumented score for ataxia monitoring fit for an ataxia clinical trial outcome.

Vrutangkumar Shah *Oregon Health & Science University, USA*

How to select the balance and gait measure for spinocerebellar ataxia

Recently, we demonstrated how quantitative assessment of the severity of ataxia-specific gait and postural sway impairments from wearable technology appropriate for multi-site clinical trials could provide sensitive performance outcome measures with high face validity to power clinical trials. We tested standing balance and gait characteristics in 150 people with spinocerebellar ataxia and 50 control subjects to identify the most sensitive and specific measures for ataxia. The ataxic patients included 40 with SARA scores <3, that is prodromal ataxia, without clinically observable balance or gait disorders in genetically determine patients with SCA 1,2,3 or 6. Standing for 30 seconds with eyes open and with feet together or apart provided the best measures of balance and gait variability from a 2-minute, natural pace walk the best gait measures. I will show how quantitative assessment of the severity of ataxia-specific gait and postural sway impairments from wearable technology could provide many potential performance outcome measures with high face validity to power clinical trials. In this talk, I will focus on how to select several balance and gait outcomes based on expert opinion on the most important clinimetrics for a clinical trial. This novel approach to selecting the best objective measure of balance and gait for cerebellar ataxia can be applied to any digital outcome for any disease.

Symposium V

Thursday, June 23

10:45am – 12:15pm, Crestone Peak I & II

Harmonisation methods of accelerometery and linkage with prospective health data in the ProPASS Consortium: pooling international cohorts for individual participant meta-analyses

Chair: **Matthew Ahmadi** *University of Sydney, Australia*

Matthew Ahmadi *University of Sydney, Australia*

Harmonisation methods of accelerometery and linkage with prospective health data in the ProPASS Consortium: pooling international cohorts for individual participant meta-analyses

A federated data platform provides a novel technological solution that can address some of the most basic challenges in facilitating the access of researchers and other health care professionals to individual level data. Federated data analysis can be used in research environments where data must be analysed but cannot physically be shared with researchers. The presentation will include information on ProPASS' collaboration with DataSHIELD, an industry partner who had developed a federated software infrastructure. The open-source structure of the platform facilitates research in settings where: 1) co-analysis of individual level data from several studies is necessary but governance restriction prevents the release of required data or renders data sharing unacceptably slow, 2) governance concerns hinder access to a single dataset, 3) researchers wish to actively share information held in their data with others but do not wish to cede control of the governance and/or intellectual property.

Andrew Atkin *University of East Anglia, UK*

The harmonisation of non-accelerometer data in ProPASS: Where we've been and where we're going

This two-part presentation will (1) summarise the methods and outcomes of the harmonisation of metabolic, anthropometric, demographic and behavioural data in ProPASS to date and (2) outline future developments to this process. Part one will describe the process and timeline for harmonisation of the non-accelerometer data, provide illustrative examples of some of the variables that have been harmonised thus far and offer some critical reflections on the process as it was implemented. Part two will outline future plans for data harmonisation in ProPASS, addressing some of the challenges outlined in part one. This will include preliminary details on a collaboration with Maelstrom Research, global leaders in the development of retrospective harmonisation methodology and software.

Magnus Svartengren *Uppsala University, Sweden*

ActiPASS - A Software for processing thigh worn accelerometer data in PROPASS

ActiPASS - A Software for processing thigh worn accelerometer data in PROPASS. Background and Aim: The PROPASS consortium consists of several cohorts which have used different brands of thigh worn accelerometers. To pool data between these cohorts there is a need for a transparent, validated and harmonized data processing procedure, that produces variables according to the PROPASS 24/7 construct of physical behaviour. The Acti-4 algorithm, that has been developed by the National Research Center of Working Life in Copenhagen, is a validated algorithm that can be used to process raw data from several brands of accelerometers. Acti-4 identifies the physical behaviours: sitting, standing, moving, walking, running, stairwalking and bicycling with high precision, but identification of sleep is lacking. We have now further developed Acti-4 to also identify lying down time and sleep from thigh worn accelerometers. These new features has been validated in field studies. Methods An already existing algorithm that uses information of thigh rotation to to differentiate lying down from sitting, developed by Lyden et al, was combined with the Acti-4 algorithm and refined. This was validated in a dataset where 47 participants wore two Axivity-AX3 devices for 7 days, one on the thigh and one on the back as a reference. The sleep algorithm was developed and optimized on a dataset consisting of 23 single-night polysomnography registrations (PSG), from 15 asymptomatic adults. Then this algorithm was validated on another dataset, in which, 71 adult males (age 57 ± 11 years) wore ambulatory PSG equipment and one Axivity-AX3 on the thigh simultaneously, while sleeping one night in their homes. Results Lying down time was identified with a sensitivity of 0.95, specificity of 0.94 and accuracy of 0.94 compared to lying down time, identified by the back accelerometer. The mean difference between the total identified lying down time/day, between the refined algorithm and the back accelerometer was +2.9 (95% limits of agreement; -135 to +141) minutes per day. Sleep was identified with a mean sensitivity of 0.84, specificity of 0.55 and accuracy of 0.80 compared to PSG. Sleep intervals were underestimated by -21 (95% limits of agreement -86 to +44) minutes. Total sleep time was underestimated by -32 (95% imits of agreement -148 to +85) minutes. Conclusions Acti4 and the added functionality to identify lying down time and sleep is now integrated into ActiPASS, that is a new streamlined, automated software for processing raw accelerometer data in large batches that fits the need for the ProPASS consortium.

Symposium VI

Thursday, June 23

10:45am - 12:15pm, Crestone Peak III & IV

Measuring the interrelationships between dietary intake and physical activity in free-living settings

Co-Chair: **Sarah Purcell** *University of British Columbia – Okanagan, Canada*
Co-Chair: **Danielle Ostendorff** *University of Colorado, Anschutz Medical Campus, USA*

Derek Hevel *University of North Carolina Greensboro, USA*

Physical activity and dietary intake measurement via ecological momentary assessment: Practical considerations and potential statistical analyses

BACKGROUND AND AIMS: Physical activity (PA) and dietary intake (DI) are repeat occurrence health behaviors that have mental and physical health implications. Yet, traditional measures of PA and DI have often been limited in the past with the use of retrospective and infrequent assessments which are prone to recall biases and often lack ecological validity. Further, patterns of PA and DI likely change across short timescales (e.g., hours), vary across different contexts (e.g., environment), and co-occur with other behaviors. Limitations of traditional measures of PA, DI, and correlates may contribute to reductions in the predictive power of theories and techniques of health behavior engagement. METHODS: Ecological Momentary Assessment (EMA) can overcome previous limitations by intensively capturing PA, DI, and correlates to elucidate how behaviors unfold across time. RESULTS: The collection of PA and DI via EMA brings many practical considerations including how to adequately capture PA and DI, the selection of assessments, participant burden, and the pairing of EMA data with other data (e.g., accelerometers). New statistical analyses can use EMA data to address new questions including how individuals differ from one another and how they differ from their usual levels. CONCLUSION: Studies of emerging and older adults' PA and emerging adults' DI behaviors will be discussed to highlight practical considerations and potential statistical analyses.

Edward Sazonov *The University of Alabama, USA*

Monitoring of energy intake and expenditure with Automatic Ingestion Monitor

BACKGROUND AND AIM: The Automatic Ingestion Monitor (AIM) is a passive food intake sensor requiring no self-report of eating episodes, just compliance with wearing the device. This talk will present our ongoing work on using the AIM for monitoring of energy intake, diet, physical activity, and energy expenditure. METHODS: Results from several completed and ongoing studies will be presented, including 1) An overview of the sensors and operation of the AIM device; 2) Online (real-time) and off-line (postprocessing) models for accurate detection of food intake in free-living and capture of images of the foods being eaten with privacy preservation; 3) Use of AIM data for estimation of energy intake in respect to weighed food records; 4) A novel method for joint recognition of physical activity and energy expenditure from the AIM data. RESULTS: The accuracy of food intake detection in free-living varied from 81.8% to 96% F1-measure in various studies. The AIM was successfully deployed in several studies, including studies in rural and urban Africa, providing reliable data on food consumption. The difference in daily energy intake estimated using sensor and food image data with respect to weighed food records were (Mean±SD) -0.45±2.60 MJ/d and 3.30±2.87 MJ/d, respectively. The accuracy of physical activity classification was 97%, while the model for energy expenditure produced a 10% mean absolute error. CONCLUSIONS: The AIM sensor shows promise as a tool for joint assessment of diet, energy intake, physical activity, and energy expenditure. Further studies are needed to refine the models used in the estimation of energy intake and expenditure.

Krista Leonard *Arizona State University, USA*

Methodological considerations in measuring physical activity, energy intake, and resting energy expenditure in the context of an adaptive prenatal weight gain intervention

Challenges associated with measuring prenatal energy balance (e.g., feasibility, misreporting) have limited our understanding of the complex interrelations of the components of prenatal energy balance and its impact on gestational weight gain (GWG) regulation in pregnant women with overweight or obesity (PW-OW/OB). PW-OW/OB are at risk for excessive GWG (i.e., >11.5 kg for overweight and >9.0 kg for obese), which is an independent predictor of adverse maternal (e.g., gestational diabetes) and infant (e.g., macrosomia) outcomes and long-term development of obesity. Evidence suggests that excessive GWG is a result of behavioral factors (i.e., high energy intake; to a lower extent, low physical activity). As such, GWG regulation trials have primarily focused on the combined effects of promoting physical activity and moderating energy intake. However, many PW-OW/OB experience unique psychosocial and physical challenges, which can make health behavior changes and subsequent regulation of GWG difficult. Our prior work as well as others have suggested that in addition to energy intake and physical activity, another component of energy balance that is physiologically regulated and contributes to GWG is resting energy expenditure (REE). The lack of evidence regarding the interrelations between the components of energy balance and GWG may party be attributed to methodological challenges such as a lack of feasible measures that can assess daily physical activity, energy intake, and REE over time, the absence of gold standard protocols for wearable devices, and inaccuracies associated with self-reported measures (e.g., overreporting of physical activity, underreporting of energy intake). The objective of this presentation is to recommend measurement strategies that aim to address these methodological issues to improve the collection of prenatal physical activity, energy intake, and REE data. Incorporating these novel measurement strategies can help future researchers answer the question of how the components of prenatal energy balance are interrelated and predict GWG regulation in PW-OW/OB in order to support long-term health for mothers and children. These measurement strategies will be discussed within the context of a longitudinal, adaptive prenatal GWG regulation intervention, Healthy Mom Zone. Dr. Leonard will provide an overview on the importance of understanding components of prenatal energy balance for predicting GWG regulation in PW-OW/OB. She will also discuss data from her research and others that use novel, practical, and cost-effective methods to improve the accuracy of measuring prenatal physical activity, energy intake, and REE via mobile health devices and validated equations. Lastly, Dr. Leonard will provide recommendations for how these measurement techniques can be utilized in future studies aimed at understanding energy balance to prevent excessive GWG.

Symposium VII

Wednesday, June 22

2:30 - 4:00pm, Shavano Peak

The CNN Hip Accelerometer Posture (CHAP) Suite: Leveraging deep learning to close the gap between thigh and hip accelerometry in the free-living measurement of sitting behavior

Chair: **Loki Natarajan** *University of California San Diego, USA*

Mikael Anne Greenwood-Hickman *Kaiser Permanente Washington Health Research Institute, USA*

The CNN Hip Accelerometer Posture (CHAP) method for classifying sitting patterns from hip accelerometers: development and initial validation in a sample of older adults

BACKGROUND & AIM: There is growing interest in using a single wearable device (e.g., hip-worn accelerometer) to measure the full spectrum of 24-h physical behavior, from sitting time and patterns to vigorous physical activity. Traditional cutpoint methods, useful for measuring activity intensity, lack the ability to accurately detect postures and postural transitions, often overestimating these transitions and underestimating prolonged sitting bouts. To overcome this limitation, we developed the Convolutional Neural Network (CNN) Hip Accelerometer Posture (CHAP) classification method. METHODS: CHAP combines a CNN with a bi-directional long short-term memory network (BiLSTM) and a Softmax output layer to predict sitting or non-sitting posture from raw hip-worn acceleration data. Initial development of CHAP leveraged data from 709 free-living older adults (age 65+ y) in the Adult Changes in Thought (ACT) study who concurrently wore hip-based ActiGraph GT3X+ and thigh-based activPAL devices for ~7 days. Non-overlapping 10 s epochs of input ActiGraph data and ground truth sitting vs. non-sitting labels from activPAL data were compiled, and first fed into CHAP's CNN layer, which automatically learned unique features of the data through repeated iterative processing in each 10 s epoch independently. Next, CNN output features were smoothed with the BiLSTM layer, which overcame the CNN's assumption of temporal independence between each 10 s epoch to automatically learn temporal features of the data. Finally, all learned features were processed by a Softmax output layer, which assigned final output behavioral classification labels by converting the refined output features from the BiLSTM into probabilities of each 10 s epoch belonging to either sitting or non-sitting behavior and selecting the label with the highest probability. CHAP-derived sitting measures, along with those from cutpoints (<100 counts/min) and an alternative machine learned algorithm (Two Level Behavior Classification [TLBC]) were validated against activPAL data. Models were developed on a training set and evaluated on a held-out test set. RESULTS: At the minute level, CHAP had higher mean classification agreement than other methods (93% vs. 74%-83%). Detection of sit-to-stand transitions was also better, with sensitivity of 83% (vs. 26% for TLBC and 72% for cutpoint) and precision of 83% (vs. 30% for cutpoint and 71% for TLBC). At the day level, CHAP predicted similar mean sitting bout duration to activPAL (15.7 versus 15.4 min) with no significant difference, whereas other methods differed considerably and significantly (9.4 min for cutpoint and 49.4 min for TLBC). CONCLUSION: CHAP showed outstanding validity for classifying sitting and non-sitting posture in a free-living sample of older adults. This dramatically increases the potential of hip-worn devices to assess sitting time, patterns, and 24-h physical behaviors. Future work will refine the CHAP method in broader age groups.

Jordan Carlson *Children's Mercy Kansas City, USA*

The CHAP data processing tools for estimating sit-to-stand transitions and sitting bout patterns from hip ActiGraph data among children and adults

BACKGROUND: Sedentary variables are commonly estimated from hip-worn accelerometer data using counts-based cut-points (e.g., 100 counts per minute [cpm]). However, cut-points do not accurately measure sit-to-stand transitions and sitting bout patterns. Improved processing/classification methods would enrich the evidence base and inform the development of more effective public health guidelines. This presentation will cover the development and evaluation of the CHAP (CNN Hip Accelerometer Posture) data scoring/classification method in children and adults. METHODS: Data were from 278 children (up to 4 time points each) ages 8-11y from the Patterns of Habitual Activity Across Seasons (PHASE) study and 1397 adults ages 35-90y from the Australian Diabetes, Obesity and Lifestyle (AusDiab) and Adult Changes in Thought (ACT) studies. Assessments involved ~7d of concurrently wearing a thigh-worn activPAL (ground truth) and hip-worn ActiGraph (test measure). Separately for children and adults, data from two-thirds of the participants were used to train a CHAP deep learning model that classified each 10-second epoch of raw ActiGraph acceleration data as sitting or not sitting, creating comparable information with the ground truth measure (activPAL). In the remaining one-third of participants, the two CHAP models (child and adult) were evaluated alongside the standard 100cpm method for hip-worn ActiGraph monitors. Performance was tested for each 10-second epoch and for participant-level total sitting time and five sitting bout variables (e.g., mean bout duration). RESULTS: CHAP-child correctly classified 10-second epochs as sitting or not sitting with a mean balanced accuracy of 87.6% (SD=5.3%) across participants. Sit-to-stand transitions were correctly classified with a mean sensitivity of 76.3% (SD=8.3). For most participant-level variables, CHAP-child estimates had a mean absolute percent error (MAPE) of ≤11% compared to activPAL, and very large correlations with activPAL (r>0.80). For the 100cpm method, most MAPEs were >30% and most correlations were small or moderate (r≤0.60). CHAP-adult showed similar performance as CHAP-child and to the previously developed older adult algorithm (CHAP-OlderAdult). Balanced accuracy for CHAP-adult was 92.6% and sensitivity for sit-to-stand transitions was 74.4%. MAPE for mean sitting bout duration was 12.2% (vs. 10.6% in children). All correlations were r≥0.78. Error was generally consistent across age, sex, and BMI groups. CONCLUSIONS: There was strong support for the validity of the CHAP-child and CHAP-adult data scoring/classification methods, which allow researchers to derive activPAL-equivalent measures of sitting time, sit-to-stand transitions, and sitting bout patterns from hip-worn triaxial ActiGraph data. Applying CHAP to existing datasets may accelerate the development of more specific public health guidelines around sitting patterns. CHAP is freely available at https://github.com/ADALabUCSD/DeepPostures.

Marta Jankowska *Beckman Research Institute, City of Hope, USA*

A comparison of the CHAP versus cut point method for measuring accelerometry derived sitting patterns as associated with metabolic syndrome in adults

BACKGROUND AND AIM: There is growing interest in assessment of how sitting behavior patterns (SPs) are associated with metabolic syndrome (MetS). However, study of associations between SPs and health outcomes may be limited by hip-based accelerometry cut point methods, which measure sedentary time (e.g., sitting and standing) rather than postural transitions (e.g., sit to stand). We used the Convolutional Neural Network Hip Accelerometer Posture (CHAP) algorithm to overcome this limitation and compare CHAP to cut point-derived SPs and their associations with MetS. METHODS: Participants (N = 583; mean age = 59 years; 56% female; 42% Hispanic) from the Community of Mine study wore hip ActiGraph GT3X+ accelerometers for two weeks and completed anthropometric measurements and blood draw. We utilized the CHAP algorithm as a measure of sitting compared with the sedentary time cut point (≤ 100 counts/min), and generated three SP measures: median bout duration (mins), time in bouts ≥ 30 mins (hrs), and daily number of breaks. MetS was defined as having at least three of five clinically measured metabolic risk factors per NCEP ATP III: increased waist circumference, elevated triglycerides, low HDL cholesterol, hypertension, and impaired fasting glucose. Binary logistic regression was used to assess SP associations with MetS, controlling for sex, age, education, ethnicity, MetS related medication use, and device wear time. RESULTS: A total of 153 participants (26%) had MetS. Cut point measured sedentary time was 8.7 hours per day, while CHAP measured sitting time was 8.6 hours per day. CHAP SPs measured fewer breaks (44.5 vs. 83.1 per day), longer median bouts (5.0 vs. 2.5 min), and more hours of time spent in bouts ≥ 30 mins (4.5 vs. 2.8). We found a significant increase in the odds of having MetS per one hour increase sedentary time (OR = 1.20, 95% CI [1.03, 1.40]) and sitting time (OR = 1.22, 95% CI [1.07, 1.38]). Increase per minute of median bout duration was associated with significant increase in odds of MetS for both sedentary (OR = 1.43, 95% CI [1.08, 1.90]) and sitting time (OR = 1.20, 95% CI [1.09, 1.30]), as was hours spent in bouts ≥ 30 mins: sedentary OR=1.16 95% CI [1.01, 1.34], sitting OR=1.17 95% CI [1.05, 1.30]. Number of daily sedentary breaks was not associated with MetS for either measure. CONCLUSIONS: In this population, CHAP measured less fragmented SPs with longer bouts and more time spent in prolonged bouts compared to SPs using cut points. Significant increase in odds of MetS was found using cut point and CHAP measures of total sitting/sedentary time, median bout duration, and hours spent in bouts ≥ 30 mins, indicating that both sedentary and sitting time are important predictors of MetS. Differences in association magnitudes, particularly for median bout length, points to behaviorally relevant intervention opportunities for increasing fragmentation of sitting bouts.

Paul Hibbing *Children's Mercy Kansas City, USA*

Deep-learned sedentary patterns and obesity in the International Study of Childhood Obesity (ISCOLE): Results from the CHAP-child model

OBJECTIVES: Sedentary behavior (SB) is associated with obesity in adults, but evidence is mixed regarding its role in pediatric obesity. The discrepant findings can potentially be resolved with the improved measures available through the newly released CNN Hip Accelerometer Posture suite, particularly the child-specific model (CHAP-child). The purpose of this study was to examine associations of SB-related metrics (derived from CHAP-child versus a traditional cut-point) with obesity-related outcomes in the International Study of Childhood Obesity, Lifestyle, and the Environment (ISCOLE). METHODS: Accelerometer data were analyzed from 5880 children in 12 countries (54% female; age 9-12 y; 129-860 per country). Participants wore an ActiGraph GT3X+ on their right hip for a median of 7 days. Data were processed using a cut-point (≤ 100 counts per minute) and the CHAP-child model. For both methods, total SB time was extracted along with mean and median SB bout duration. Standardized linear mixed effects models were fitted to compare each variable with waist circumference, body fat percentage, and body mass index z-score (BMI-z), while accounting for participant nesting within schools and countries. Model 1 was adjusted for age, sex, ethnicity, parental education, and maturity offset. Model 2 was adjusted for the same variables, plus percent of time spent in moderate-to-vigorous physical activity (MVPA%). P-values were adjusted using the Bonferroni method. RESULTS: Summary statistics (mean ± SD) were 64.1 ± 8.8 cm for waist circumference, 20.9% ± 7.6% for body fat, and 0.44 ± 1.24 units for BMI-z. In general, all standardized regression coefficients were small, and statistical significance was mixed (see Table). In Model 1, total SB time (8.7 ± 1.8 hr/day for the cut-point; 11.9 ± 1.5 hr/day for CHAP-child) had slightly stronger associations with all outcomes when using the cut-point versus CHAP-child. The opposite was generally true for mean SB bout duration (5.5 ± 2.8 min for the cut-point; 8.2 ± 3.5 min for CHAP-child) and median SB bout duration (2.1 ± 0.3 min and 2.1 ± 0.5 min, respectively). In Model 2, associations were non-significant with the cut-point, whereas with CHAP-youth the associations were significant for total SB time (body fat percentage only; β = -0.06) and median SB bout length (all outcomes; β = 0.06-0.09). CONCLUSIONS: Compared to SB pattern variables from the cut-point, CHAP-child variables showed marginally stronger associations with obesity outcomes. The strongest associations were seen for median SB bout duration, but more research is needed to examine other SB pattern variables (e.g., usual bout duration, Gini index). Accounting for MVPA% attenuated the associations for most SB-related variables. Longitudinal studies may be needed to fully characterize the impact of SB on obesity and related health outcomes.

Symposium VIII

Thursday, June 23

2:30 – 4:00pm, Crestone Peak III & IV

Continued use of established approaches to analyzing accelerometer data for the measurement of physical activity: How and why to keep it simple

Chair: **Cheryl Howe** *Ohio University, USA*

Kimberly Clevenger *National Cancer Institute, USA*

Using open-source counts and a consensus approach to facilitate continued use of established approaches to analyzing accelerometer data

BACKGROUND AND AIM: Numerous methods for characterizing physical activity participation using accelerometry have been developed and implemented in prior research. A barrier to continued use of these methods in future studies, particularly those employing other device brands, is the frequent reliance on ActiGraph counts, which until recently were generated using a proprietary algorithm. A second, and well-established issue is the 'cut-point conundrum' in which the number of available methods makes it difficult for researchers to select which approach is best to use, further limiting comparability across studies. Our purpose is to address these issues through the use of open-source activity counts and a consensus method which pools estimates from multiple classification approaches. METHOD: First, to illustrate the use of open-source counts, we calculated activity counts using data from 30 participants who wore a GENEActiv and ActiGraph GT9X on their left wrist during two laboratory visits (one structured and one simulated free-living). Second, to illustrate application of the consensus method, we used hip-worn ActiGraph GT9X data from the same 30 adults. Nine methods were used to estimate minutes of moderate-to-vigorous physical activity (MVPA), including cut-point, two-regression, and machine learning approaches using both count and raw inputs and several epoch lengths. RESULTS: At the epoch-level, open-source counts were highly correlated between the two wrist-worn monitors (r=0.96) with mean absolute differences of 764.8 ± 1229.3 counts per minute. Once collapsed to the participant level, total vector magnitude counts and minutes of MVPA were highly correlated between devices (r=0.82-0.85) with a mean absolute difference of 6.6 ± 9.2 min. For the hip-worn data, the consensus estimate was 37.3 min (Figure), with mean MVPA for the sample ranging from 32.2 to 45.4 min across the different methods. Compared to a criterion (observed activity), the consensus method had a smaller mean absolute difference (5.7 min MVPA) compared to individual methods (6.2 to 12.0 min). Additionally, the consensus method allowed for estimation of variance at the participant level; the average standard deviation across methods for an individual was 7.4 min. CONCLUSIONS: Differences between device open-source counts may be exaggerated due to the high degree of MVPA in this protocol (GENEActiv: 70.0 min, ActiGraph: 73.6 min). Recent release of information regarding ActiGraph's proprietary counts may further improve open-source count algorithms. The consensus method enables the addition/removal of methods depending on data availability or field progression while limiting variability due to convergence between estimates. We propose standardized ways of deciding which methods to include in consensus approaches to further reduce variability. Together, use of open-source counts and the consensus approach may allow us to "past proof" and "future proof" research studies.

Karin Pfeiffer *Michigan State University, USA*

Rationale for continued use of more established and simple approaches to analyzing accelerometer data

BACKGROUND AND AIM: Cut-point or regression-based approaches were the initial methods established for classifying physical activity (PA) intensity when accelerometers were first started being used to characterize PA participation. Over time, use of these methods revealed issues including 1) using propriety activity count metrics, 2) encouraging generation of population-specific methods, and 3) sparking creation of methods for multiple epoch lengths, among other issues. This proliferation of cut-points or models also led to confusion over which method to use (e.g., the 'cut-point conundrum'). More recently, the availability of raw acceleration data from research-grade accelerometers and increased focus on techniques like machine learning have given rise to increasingly complicated methods that may require resources like computing clusters, dedicated computer science collaborators, and coding knowledge. However, not all end users of accelerometer devices possess the expertise or funding to support these complicated methods. The access to and ease of use of cut-point or regression-based approaches seems to continue to drive their utilization. Further, there remains to be consensus regarding the best procedures for collecting, reducing, and analyzing data, which applies to both simpler and more complex methods. Questions remain regarding how well existing methods have been developed (e.g., if have they been validated in an independent sample) and the added benefit more complex methods might have over the simpler methods. METHODS AND RESULTS: This presentation will address the accuracy and use of these simple and complex approaches in practice. Another key element of this presentation will highlight how use of more complex methods can be an issue that does not adequately address attention to diversity, equity, and inclusion. CONCLUSIONS: This presentation establishes why simple approaches to analyzing accelerometer data are necessary and sets the stage for suggesting different methods to do so.

Alexander Montoye *Alma College, USA*

Refining existing methods and developing robust new methods to analyze accelerometer data

BACKGROUND AND AIM: Technological advances in accelerometer devices have opened possibilities for data collection, analysis, and interpretation that were unthinkable only a few years ago, and this trend is likely to continue. The research community has followed suit, exploring the capabilities of new technologies and developing innovative ways to analyze such data in order to continue to advance our understanding of how physical behaviors affect health and function. However, the development and proliferation of new analytic approaches/models has far exceeded their adoption. Recent review studies have shown the stark reality that most analytic approaches are not cross-validated, made accessible, nor used by others in research or clinical settings to analyze accelerometer data. Further development and use of existing methods, including approaches like cut-points, should be prioritized over development of new methods, unless these new methods fill a gap or demonstrate marked improvement over existing approaches and have reasonable potential for implementation. This further development includes independent sample cross-validation, validation using other device brands, settings, or populations, or improved usability for general physical activity researchers (e.g., development of software, vignettes). In the long-term, this will improve comparability across studies and make it easier for researchers to identify which approach to use. In addition to lack of usability or additional development/validation, many existing methods were developed on small, homogenous samples in laboratory-based or structured settings using a single brand/model of device. Therefore, we also posit that some of the issues that have arisen surrounding use of cut-points or regression-based models is due to the employed development protocols. METHODS AND RESULTS: We describe a framework for robust development of new methods, using the Monitor-Independent Movement Summary (MIMS) unit as an example. Robust development includes initial work on validity and reliability, validation and cross-validation of methods using adequate sample sizes and heterogeneity, and dissemination that ensures proper use in the field. CONCLUSIONS: As a research community, we have the potential to leverage technology and substantial technical and behavioral expertise to positively impact the research community and the broader population. Proper attention to balancing technological and analytic advances, robust development and testing, and user-friendly deployment will help us to fully realize this potential.

AUTHORS AND PRESENTERS

All authors (lead and additional) and presenters are listed here for easy cross-referencing to their respective abstract. The full abstract is available in the abstract's listing in the Whova Agenda.

Poster numbers are indicated as follows:

Poster Type (P = In-person; VP = Virtual) – Poster Number

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ALL POSTERS (both in-person & virtual) have a virtual site for viewing in the ICAMPAM 2022 Whova App; these may be accessed for 90 days from Tuesday, June 21.

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Rogers, Ethan	O11, P-36, P-52
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Rosso, Andrea L	O13, O2, O20, O9
Rotem, Yarden	O21, O23, O24, O25
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Saint-Maurice, Pedro F	O16, O17, P-20
Salis, Francesca	O60
Salomon, Amit	O23, O25
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Sazonov, Edward	O37
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Scherer, Elissa	P-26
Schmidt, Michael D	P-40
Schmidt, Steffen C	O43, P-47
Schmitz-Hübsch, Tanja	O23, O25, O22
Schrack, Jennifer A	O54
Schwartz, Dafna	VPE-65, VPE-68
Schweizer, Theresa	P-29
Scott, Kristy	O60
Seemann, Jens	P-28

ORAL SESSIONS

Oral Session #1

Wednesday, June 22
4:30 - 5:30pm

O.1 Novel statistical approaches and applications

Location: Shavano Peak

O.1.1 Combining compositional data analyses and ecological momentary assessment: Insights on the association between physical behavior on mood in daily life

Marco Giurgiu[1], Ulrich Ebner-Priemer[1], Dorothea Dumuid[2]

[1]Karlsruhe Institute of Technology, [2]University of South Australia

O.1.2 Association of gait quality with daily life mobility: An actigraphy and global positioning system based analysis in older adults

Anisha Suri[1], Jessie VanSwearingen[1], Emma Baillargeon[1], Breanna Crane[2], Michelle Carlson[2], Kyle Moored[1], Pamela Dunlap[1], Patrick Donahue[2], Mark Redfern[1], Jennifer Brach[1], Ervin Sejdic[3], Andrea Rosso[1]

[1]University of Pittsburgh, [2]Johns Hopkins University, [3]University of Toronto

O.1.3 Unknown distributions: Modelling distributions of real-world walking speed in people with Parkinsons

Cameron Kirk[1], Rana Zia Ur Rehman[1], Brook Galna[2], Saverio Ranciati[3], Encarna Mico-Amigo[1], Lynn Rochester[1], Alison Yarnall[1], Silvia Del-Din[1]

[1]Newcastle University, [2]Murdoch University, [3]University of Bologna

O.1.4 A fully Bayesian semi-parametric Scalar-on-Function Regression (SoFR) with measurement error using instrumental variables

Roger Zoh[1]

[1]Indiana University

O.1.5 Methods to determine common periods of wear in concurrently worn activity monitors

Craig Speirs[1], Malcolm Granat[2], David Loudon[3]

[1]University of Strathclyde, [2]University of Salford, [3]PAL Technologies Ltd

O.2 Clinical applications: knee and back pain and fatigue

Location: Crestone l & ll

O.2.6 Continuous longitudinal monitoring of early physical activity recovery following knee arthroplasty

Scott Small[1], Aiden Doherty[1], Sara Khalid[1], Andrew Price[1]

[1]University of Oxford

O.2.7 Patterns of physical activity accumulation as a potential biomarker for low back pain phenotyping

Ruopeng Sun[1], Dokyoung You[1], Anuradha Roy[1], Beth Darnall[1], Sean Mackey[1], Matthew Smuck[1]

[1]Stanford University

O.2.8 Associations of digital measures of gait with sleep and fatigue: A real world feasibility study

Rana Zia Ur Rehman[1], Diogo Branco[2], Dan Jackson[1], Meenakshi Chatterjee[3], Ahmaniemi Teemu[4], Tiago Guerreiro[2], Yannis Pandis[3], Kristen Davies[1], Victoria Macrae[5], Svenja Aufenberg[6], Emma Paulides[7], Hanna Hildesheim[8], Jennifer Kudelka[8], Kirsten Emmert[8], Lynn Rochester[1], C.Janneke van der Woude[7], Ralf Reilmann[6], Walter Maetzler[8], Wan-Fai Ng[1], Silvia Del Din[1]

[1]Newcastle University, [2]University of Lisbon, [3]Janssen Research & Development, [4]VTT, [5]NIHR Newcastle Clinical Research Facility, [6]University of Muenster, [7]Erasmus University, [8]University Medical Center Schleswig- Holstein

O.2.9 Applying the Pittsburgh performance fatigability index to a 6-minute walk in older adults

Jennifer Brach[1], Andrea Rosso[1], Kyle Moored[1], Robert Boudreau[1], Jaroslaw Harezlak[2], Nancy Glynn[1]

[1]University of Pittsburgh, [2]Indiana University

O.3 Physical activity interventions

Location: Crestone lll & lV

O.3.11 Detecting and modifying daily inactivity among adults over 60 years using an integrated two-way communication-based near-real-time sensing system: A randomized clinical trial

Diego J Arguello[1], Ethan Rogers[1], Grant Denmark[1], Gregory Cloutier[1], Carmen Castaneda-Sceppa[1], Charles Hillman[1], Arthur Kramer[1], Dinesh John[1]

[1]Northeastern University

O.3.12 An empirical approach to understand mHealth application engagement and its associations with daily changes in physical activity in a lifestyle intervention among US Veterans with Prediabetes

Krista Leonard[1], Abdullah Mamun[1], Hassan Ghasemzadeh[1], Matthew Buman[1]

[1]Arizona State University

O.3.13 A physical activity intervention results in higher randomness of postural control accelerations during dual-task conditions

Kayla Bohlke[1], Patrick Sparto[1], Mark Redfern[1], Ervin Sejdic[2], Andrea Rosso[1]

[1]University of Pittsburgh, [2]University of Toronto

O.3.14 Development and pilot testing of the ActiveGOALS online physical activity intervention for primary care patients

Bonny Rockette-Wagner[1], Gary Fischer[1], Andrea Kriska[1], Molly Conroy[2], David Dunstan[3], Sarah Deperrior[1], Reagan Moffit[1], Neel Rao[1], Kathleen McTigue[1]

[1]University of Pittsburgh, [2]University of Utah, [3]Baker Heart and Diabetes Institute

O.3.15 Wear fatigue: Does device wear compliance wane over a free-living assessment period?

Samuel LaMunion[1], Robert Brychta[1], Kong Chen[1]

[1]National Institutes of Health/National Institute of Diabetes and Digestive and Kidney Diseases

Oral Session #2

Thursday, June 23

9:15 - 10:15am

O.4 Validation of devices in real world settings

Location: Shavano Peak

O.4.16 Validation of previous-day recall for estimates of duration and context in comparison to activPAL and direct observation

Charles Matthews[1], David Berrigan[1], Pedro Saint-Maurice[1], Cami Christopher[2], Jeffrey Huang[2], Joshua Freeman[1], Shreya Patel[1], Sarah Keadle[2]

[1]National Cancer Institute, [2]California Polytenchnic State University

O.4.17 Comparison of time spent in activity type from the activPAL and video-recorded direct observation

Sarah Keadle[1], Cami Christopher[1], Alexander Tolas[1], Shreya Patel[2], Pedro Saint-Maurice[1], Charles Matthews[1]

[1]California Polytechnic State University, [2]National Cancer Institute

O.4.18 Validation of two deep learning methods to estimate aspects of physical activity / inactivity from accelerometers

John Staudenmayer[1], John Sirard[1], Robert Marcotte[1], Evan Ray[1], Tom Cook[1], Yujian Wu[1]

[1]University of Massachusetts Amherst

O.4.19 The acceptability of wearing an activity monitor (activPAL) on the thigh to older adults

Philippa Dall[1], Pedro dos Santos[1], Sebastien Chastin[1], Simon Cox[2], Ian Deary[2], Mary-Kate Hannah[3], Dawn Skelton[1]

[1]Glasgow Caledonian University, [2]University of Edinburgh, [3]University of Glasgow

O.4.20 Cumulative and diurnal change in GPS-derived distance as a novel measure of community mobility in older adults

Kyle Moored[1], Breanna Crane[2], Michelle Carlson[2], Andrea Rosso[1]

[1]University of Pittsburgh, [2]Johns Hopkins Bloomberg School of Public Health

O.5 Clinical 2

Location: Crestone Peak l & ll

O.5.21 Using a wrist-worn sensor to objectively monitor gait quality in people with multiple sclerosis: Initial findings

Eran Gazit[1], Arnon Karni[1], Keren Regev[1], Irina Galperin[1], David Buzaglo[1], Nathaniel Shimoni[2], Yarden Rotem[2], Yehudit Michaelis[2], Raz Tamir[2], Jeffrey Hausdorff[1]

[1]Tel Aviv Sourasky Medical Center, [2]Owlytics Healthcare Ltd.

O.5.22 Impact of frailty on free-living walking performance in people living with MS

Tobia Zanotto[1], Irina Galperin[2], Anat Mirelman[2], Lingjun Chen[1], Keren Regev[2], Arnon Karni[2], Tanja Schmitz-Hubsch[3], Friedemann Paul[3], Sharon Lynch[1], Abiodun Akinwuntan[1], Hannes Devos[1], Jeffrey Hausdorff[2], Jacob Sosnoff[1]

[1]University of Kansas, [2]Tel Aviv Sourasky Medical Center, [3]Universitaetsmedizin Berlin

O.5.23 Objective estimation of disability levels and physical fatigue among people with multiple sclerosis using a single sensor worn during daily-living

Amit Salomon[1], Irina Galperin[1], David Buzaglo[1], Anat Mirelman[1], Keren Regev[1], Arnon Karni[2], Tanja Schmitz-Hübsch[3], Friedemann Paul[3], Hannes Devos[4], Jacob Sosnoff[4], Raz Tamir[5], Nathaniel Shimoni[5], Yarden Rotem[5], Yehudit Michaelis[5], Jeffrey Hausdorff[1]

[1]Tel Aviv Sourasky Medical Center, [2]Tel Aviv University, [3]Charité - Universitaetsmedizin Berlin, [4]University of Kansas, [5]Owlytics Healthcare Ltd.

O.5.24 Setting the building blocks for long term remote and continuous real-time monitoring of MS patients in their daily living environment using a wrist-worn smart watch

Nathaniel Shimoni[1], Raz Tamir[1], Yarden Rotem[1], Efrat Yatziv[1], Yehudit Michaelis[1], Eran Gazit[2], David Buzaglo[2], Irina Galperin[2], Jeffrey Hausdorff[2], Keren Regev[2], Arnon Karni[2]

[1]Owlytics Healthcare Ltd., [2]Tel Aviv Sourasky Medical Center

O.5.25 Activity and rest fragmentation an alysis of daily-living physical activity fluctuations among people with MS

Amit Salomon[1], David Buzaglo[1], Irina Galperin[1], Anat Mirelman[1], Keren Regev[1], Arnon Karni[2], Tanja Schmitz-Hübsch[3], Friedemann Paul[3], Hannes Devos[4], Jacob Sosnoff[4], Raz Tamir[5], Nathaniel Shimoni[5], Yarden Rotem[5], Yehudit Michaelis[5], Jeffrey Hausdorff[1]

[1]Tel Aviv Sourasky Medical Center, [2]Tel Aviv University, [3]Charité - Universitaetsmedizin Berlin, [4]University of Kansas, [5]Owlytics Healthcare Ltd.

O.6 Integrated systems to assess physical behavior

Location: Crestone Peak lll & lV

O.6.26 Assessment of activities of daily living using markerless motion capture in a virtual reality setting

Kevin Abbruzzese[1], Andre Freligh[1], Vincent Alipit[1], Sally LiArno[1]

[1]Stryker Orthopaedics

O.6.27 Effects on heart rate, physical activity and ambulatory blood pressure from occupational physical activity with and without lifting among farmers in Denmark

Mette Korshøj[1], Mathilde Baumann[1], Michael Olsen[1], Ole Mortensen[1]

[1]Holbæk Hospital

O.6.28 Estimation of metabolic rate during submaximal exercise using heart rate, sex, age, training status and exercise mode in participants with and without a disability

Julia K Baumgart[1], Emma den Hartog[1]

[1]Princess Máxima Center for Pediatric Oncology

O.6.29 - Towards eco-design of self-powered wearable devices: analysis of available energy on the human body for lead-free piezoelectric energy harvester positioning

Damien Hoareau[1], Gurvan Jodin[1], Jacques Prioux[2], Abdo-Rahmane Anas Laaraibi[3], Ausrine Bartasyte[4], Samuel Margeuron[4], Guylaine Poulin-Vittrant[5], Maxime Bavencoffe[5], Alexis Brenes[6], Elie Lefeuvre[6], Florence Razan[7]

[1]ENS Rennes, SATIE, [2]ENS Rennes, M2S, [3]ENS Rennes, IETR, SATIE, [4]Institut femto-st, ubfc/ufc/ensmm/CNRS, [5]GREMAN UMR 7347, CNRS, [6]C2N, Université Paris Saclay, CNRS, [7]ENS Rennes, IETR

O.6.30 Exploring effects of central sensitization on gait in chronic low back pain by using machine learning approach

Michiel Reneman[1], Jone Echeita[1], Schiphorst Preuper[1], Herbert Kruitbosch[1], Egbert Otten[1], Claudine Lamoth[1]

[1]University of Groningen

Oral Session #3

Friday, June 24

9:15 - 10:15am

O.7 Measuring steps

Location: Shavano Peak

O.7.31 Changes in brisk stepping cadence are associated with improvements in adiposity, HDL-C, and HbA1c in people with non-diabetic hyperglycaemia

Phil McBride[1], Joseph Henson[1], Charlotte Edwardson[1], Melanie Davies[1], Kamlesh Khunti[1], Benjamin Maylor[1], Thomas Yates[1]

[1]University of Leicester

O.7.32 Device comparison of free-living steps per day: A systematic review and meta-analysis

Amanda Paluch[1], Eric Eberl[1], Kelly Evenson[2], Erika Rees-Punia[3], Susan Park[1], Lindsay Toth[4], David Bassett[5]

[1]University of Massachusetts Amherst, [2]University of North Carolina Chapel Hill, [3]American Cancer Society, [4]University of North Florida, [5]University of Tennessee Knoxville

O.7.33 Development of an externally validated free-living step counting algorithm with deployment in the UK Biobank

Scott Small[1], Lennart von Fritsch[1], Shing Chan[1], Andrew Creagh[1], Andrew Price[1], Sara Khalid[1], Aiden Doherty[1]

[1]University of Oxford

O.7.34 A step towards more intuitive physical activity prescription: Validity of stepping-based metrics derived from wrist-worn accelerometry

Ben Maylor[1], Charlotte Edwardson[1], Paddy Dempsey[1], Matthew Patterson[2], Tom Yates[1], Alex Rowlands[1]

[1]University of Leicester, [2]Shimmer Sensing

O.7.35 Comparison of the performances of step counting algorithms in different physical activities

Dawid Gerstel[1], Joe Nguyen[1], Rakesh Pilkar[1], Tyler Guthrie[1], Matt Biggs[1], Ali Neishabouri[1], Christine Guo[1]

[1]ActiGraph

O.8 Technical challenges and considerations

Location: Crestone l & ll

O.8.36 Let the epoch length float for more reliable measurements

Henri Vähä-Ypyä[1], Ari Mänttäri[1], Pauliina Husu[1], Kari Tokola[1], Harri Sievänen[1], Tommi Vasanakari[1]

[1]The UKK Institute for Health Promotion Research

O.8.37 Comparison of a head-worn accelerometer to a hip-worn ActiGraph GT9X for classifying activity type and estimating energy expenditure

Edward Sazonov[1], Samuel LaMunion[2], Billal Hossain[1], Scott Crouter[3]

[1]University of Alabama, [2]National Institutes of Health, [3]University of Tennessee

O.8.38 Comparing ActiGraph CentrePoint Insight watch, GT9X Link, and wGT3X-BT accelerometers to NHANES 2011-2014 GT3X+ devices using an orbital shaker

Samuel LaMunion[1], Joe Nguyen[2], Robert Brychta[1], Richard Troiano, Karl Friedl, Kong Chen[1]

[1]National Institutes of Health/National Institute for Diabetes and Digestive and Kidney Diseases [2]ActiGraph

O.8.39 Impact of using a 60, 80, 90, or 100 Hz versus 30 Hz ActiGraph sampling rate on free-living physical activity assessment in youth

Kimberly Clevenger[1], Jan Brønd[2], Kelly Mackintosh[3], Karin Pfeiffer[4], Alexander Montoye[5], Melitta McNarry[3]

[1]National Cancer Institute, [2]University of Southern Denmark, [3]Swansea University, [4]Michigan State University, [5]Alma College

O.8.40 Interrelationships between open-source, proprietary, and machine learning-derived accelerometry metrics

Christopher Moore[1], Kelly Evenson[1], Eric Shiroma[2], Carmen Cuthbertson[1], Julie Buring[3], I-Min Lee[3]

[1]University of North Carolina, [2]National Institute on Aging, [3]Brigham and Women's Hospital and Harvard Medical School

O.9 Physical activity determinants and COVID-19

Location: Crestone lll & lV

O.9.41 Temporal patterns of sitting and non-sitting in normal-weight and overweight Brazilian office workers working from home during the COVID-19 pandemic

Luiz Augusto Brusaca[1], Svend Erik Mathiassen[2], David M. Hallman[2], Nidhi Gupta[3], Dechristian França Barbieri[4], Ana Beatriz Oliveira[1]

[1]Federal University of São Carlos, [2]University of Gävle, [3]National Research Centre for the Working Environment, [4]Clemson University

O.9.42 The impact of UK COVID-19 restrictions on objectively measured physical behaviour

Alexandra Clarke-Cornwell[1], Benjamin Griffiths[1], Benjamin Maylor[2], Malcolm Granat[1], Charlotte Edwardson[2]

[1]University of Salford, [2]University of Leicester

O.9.43 Typical day and influence of weekend on accelerometer measured physical activity

Alexander Burchartz[1], Simon Kolb[1], Steffen Schmidt[1], Birte von Haaren-Mack[2], Claudia Niessner[1], Alexander Woll[1]

[1]Karlsruhe Institute of Technology, [2]German Sport University Cologne

O.9.44 Does context matter? The association between affective states and physical behavior and its moderation by weather factors measured with ambulatory assessment

Irina Timm[1], Markus Reichert[2], Ulrich Ebner-Priemer[1], Marco Giurgiu[1]

[1]Karlsruhe Institute of Technology, [2]Ruhr-University Bochum

O.9.45 Multiple accelerometry assessed physical behavior across 24-hour period in older adults with different level of physical fitness: a pilot study during COVID-19 pandemic

Jan Vindis[1], Denisa Nohelova[1], Jana Pelclova[1]

[1]Palacký University Olomouc

Oral Session #4
Friday, June 24
10:45 - 11:45am

O.10 Use of devices in children and adolescents
Location: Shavano Peak

O.10.46 Active and sitting time precursors to mood in young adults
Bronwyn Clark[1], Elisabeth Winkler[1], Marco Giurgiu[2], Markus Reichert[3], Eric Vanman[1], Fiona Maccallum[1]
[1]The University of Queensland, [2]Karlsruhe Institute of Technology, [3]Ruhr University Bochum

O.10.47 Comparison of youth-specific cut-point and machine learning methods for classifying physical activity intensity from wrist accelerometer data
Matthew Ahmadi[1], Stewart Trost[2]
[1]University of Sydney, [2]The University of Queensland

O.10.48 An objective assessment of toddler physical activity type and context at the childcare center and home
Cailyn Van Camp[1], Darcy Thompson[2], Karin Pfeiffer[1]
[1]Michigan State University, [2]University of Colorado School of Medicine

O.10.49 Validating youth accelerometer methods using direct observation in free-living settings
John Sirard[1], Robert Marcotte[1], Marcos Amalbert-Birriel[1], John Chase[1], Melanna Cox[1], Nicholas Remillard[1], Patty Freedson[1], John Staudenmayer[1]
[1]University of Massachusetts Amherst

O.11 Epidemiologic studies with health outcomes
Location: Crestone l & ll

O.11.51 Impact of patterns of physical activity at pre- and post-diagnosis with mortality of Asian cancer patients: Results from Health Examinees-G study in Korea
Jaesung Choi[1], Joo-Yong Park[1], Ji-Eun Kim[1], Miyoung Lee[1], Kyuwan Lee[1], Daehee Kang[1], Aesun Shin[1], Ji-Yeob Choi[1]
[1]Seoul National University

O.11.52 Association of profiles of objectively-measured physical activity and sedentary behavior with all-cause mortality risk in older adults
Manasa Shanta Yerramalla[1], Mathilde Chen[1], Vincent van Hees[2], Quentin Le Cornu[1], Aline Dugravot[1], Séverine Sabia[1]
[1]Université de Paris, [2]Accelting

O.11.53 The association between moderate-to-vigorous physical activity during commuting and metabolic markers
Abolanle Gbadamosi[1], Alexandra Clarke-Cornwell[1], Malcolm Granat[1]
[1]University of Salford

O.11.54 Implementation of wrist accelerometry into the National Health and Aging Trends Study (NHATS) to expand physical activity assessment in older adults
Jennifer Schrack[1], Vadim Zipunnikov[1], Vicki Freedman[2]
[1]Johns Hopkins Bloomberg School of Public Health, [2]University of Michigan

O.11.55 Multidimensional movement behavior and mortality in older adults from the Whitehall II accelerometer sub-study: A machine learning approach
Mathilde Chen[1], Vincent van Hees[2], Manasa Shanta Yerramalla[1], Mohamed Amine Benadjaoud[3], Séverine Sabia[1]
[1]Université de Paris, [2]Accelting, [3]IRSN

O.12 Clinical applications 1
Location: Crestone lll & lV

O.12.56 Are physical behavior and momentary fatigue bidirectionally associated after subarachnoid hemorrhage, merging accelerometry and electronic diary data
Lianne de Vries[1], Elisabeth de Vries[1], Marco Giurgiu[2], Fop van Kooten[1], Gerard Ribbers[1], Majanka Heijenbrok-Kal[1], Rita van den Berg-Emons[1], Hans Bussmann[1]
[1]Erasmus University Medical Center, [2]Karlsruhe Institute of Technology

O.12.57 Gait during daily life in men treated with androgen deprivation therapy for prostate cancer: Evidence for accelerated aging?
Deanne Tibbitts[1], Martina Mancini[1], Sydnee Stoyles[1], Ramyar Eslami[1], Christopher Palmer[1], Mahmoud El-Gohary[2], Fay Horak[1], Kerri Winters-Stone[1]
[1]Oregon Health and Science University, [2]APDM Wearable Technologies, a Clario company

O.12.58 Frequency of inpatient out-of-bed activities by ActivPAL vs Johns Hopkins highest level of mobility scale after major abdominal surgery
Mikita Fuchita[1], Kyle Ridgeway[2], Edward Melanson[1], Ana Fernandez-Bustamante[1]
[1]University of Colorado, [2]University of Colorado Hospital

O.12.59 Validation of the Apple Watch and Fitbit for assessing heart rate during rest and wheelchair propulsion in able-bodied participants and wheelchair users
Julia Baumgart[1], Melanie Vergeer[2], Guy Plasqui[2], Marius Lyng Danielsson[1]
[1]Norwegian University of Science and Technology, [2]Maastricht University

O.12.60 Validation and ranking of algorithms for gait sequence detection in healthy controls and people with Parkinson's disease
María Encarnación Micó Amigo[1], Martin Ulrich[2], Anisoara Paraschiv-Ionescu[3], Eran Gazit[4], Tecla Bonci[5], Francesca Salis[6], Kristy Scott[5], Stefano Bertuletti[6], Andrea Cereatti[7], Lynn Rochester[1], Claudia Mazzà[5], Silvia Del Din[1]
[1]Newcastle University, [2]Friedrich-Alexander-Universität Erlangen-Nürnberg, [3]École Polytechnique Fédérale de Lausanne, [4]Tel Aviv Sourasky Medical Center, [5]The University of Sheffield, [6]University of Sassari, [7]Politecnico di Torino

POSTER SESSIONS INSTRUCTIONS

To make the most of the ICAMPAM poster sessions – please review the following information:

ALL POSTERS have a virtual component available for viewing in the ICAMPAM 2022 Whova App; these may be accessed for 90 days from Tuesday, June 21.

VIRTUAL POSTERS via Whova

All virtual poster presenters have been asked to be available at their virtual poster during the following periods so attendees may virtually connect with them:

- **Wednesday, June 22: 12:15 - 1:15pm (MDT)**
- **Thursday, June 23: 4:00 - 6:00pm (MDT)**

Posters numbers beginning with a 'VP-' indicate this poster is only accessible virtually. ('VPE-' identifies a European Time Zone)

Be sure to check the chat box of the virtual poster presenter to see if they've left a message as to their available time.

IN-PERSON POSTER BOOTHS

48 posters will be available for in-person attendees to review starting on Wednesday 22 June in the Red Cloud Peak. In-person poster presenters are to be available at their poster during the following joint Poster Session & Social Hour:

- **Thursday, June 23: 4:00 - 6:00pm (MDT)**

In-person poster presenters may also be available during coffee breaks at their posters.

If you are unable to connect with an in-person OR virtual poster presenter at any of the above times, open the poster menu (found under the agenda drop down menu) in Whova and refer to the Chat Box to see if the presenter offers any further times of availability virtually or leave a note in the Chat Box for the presenter to connect with you either during ICAMPAM 2022 or afterwards. You may continue to use the Whova App to connect and converse for up to 90 days.

POSTER SESSIONS

In-Person Posters

P-10 A 12-week cycling workstation intervention improves cardiometabolic risk factors in healthy office workers: the REMOVE study

Terry Guirado[1], Lore Metz[1], Bruno Pereira[2], Carole Brun[1], Anthony Birat[1], Audrey Boscaro[1], David Thivel[1], Martine Duclos[2]

[1]University Clermont Auvergne, [2]Clermont-Ferrand University Hospital

P-11 24-hour compositions of physical (in)activity among office workers during the COVID-19 pandemic: a comparison between Brazil and Sweden

Luiz Augusto Brusaca[1], Leticia Bergamin Januario[2], Svend Erik Mathiassen[2], Dechristian França Barbieri[3], Rafaela Veiga Oliveira[1], Marina Heiden[2], Ana Beatriz Oliveira[1], David M. Hallman[2]

[1]Federal University of São Carlos, [2]University of Gävle, [3]Clemson University

P-12 Accelerometer-measured physical behavior as an indicator of perceived work ability

Kari Tokola[1], Henri Vähä-Ypyä[1], Harri Sievänen[1], Tommi Vasankari[1]

[1]The UKK Institute for Health Promotion Research

P-13 Digital measures of gait and turning increase discriminative ability to predict future falls in people with Parkinson's disease

James McNames, Graham Harker[1], Patricia Carlson-Kuhta[1], John Nutt[1], Mahmoud El-Gohary[2], Kristen Sowalsky[2], Martina Mancini[1], Fay Horak[1]

[1]Oregon Health and Science University, [2]APDM Wearable Technology-A Clario Company

P-14 Improving energy expenditure estimation with wearables measuring physiological signals

Wouter Bijnens[1], Kenneth Meijer[1], Guy Plasqui[1]

[1]Maastricht University

P-15 Step test assessment using markerless motion capture in a virtual reality setting

Kevin Abbruzzese[1], Vincent Alipit[1], Sally LiArno[1]

[1]Stryker Orthopaedics

P-16 The associations between patterns and changes in regular exercise behavior and the changes in clinical biomarkers related to cardiometabolic diseases

JooYong Park[1], Jaesung Choi[1], Ji-Eun Kim[1], Miyoung Lee[2], Ji-Yeob Choi[1]

[1]Seoul National University, [2]Kookmin University

P-17 Monitoring postures and motions in hospitalized patients; a review on methodological approaches

Marlissa Becker[1], Henri Hurkmans[1], Jan Verhaar[1], Johannes Bussmann[1]

[1]Erasmus University Medical Center

P-18 Moving from intention to behavior: First results of an app-based physical activity intervention with a randomized controlled trial design (i2be)

Names[1]

[1]Affiliations

P-20 Reliability of sleep midpoints assessed over 7-days using ActivPAL and sleep logs

Joshua Freeman[1], Pedro Saint-Maurice[1], Shreya Patel[1], Sarah Keadle[2], Charles Matthews[1]

[1]National Cancer Institute, [2]California Polytechnic State University

P-21 Resting heart rate as biomarker for tracking change in cardiorespiratory fitness: The Fenland Study

Justin Jeon[1], Timothy Lindsay[2], Kate Westgate[2], Ignacio Perez-Pozuelo[2], Stefanie Hollidge[2], Katrien Wijndaele[2], Kirsten Rennie[2], Nita Forouhi[2], Simon Griffin[2], Nick Wareham[2], Soren Brage[2]

[1]Yonsei University, [2]University of Cambridge

P-22 Full-day spontaneous leg movement quantity in infants at high risk for cerebral palsy

Federico Gennaro[1], Thubi H.A. Kolobe[2], Laura A. Prosser[3]

[1]University of Southern California, [2]University of Oklahoma Health Sciences Center, [3]Children's Hospital of Philadelphia

P-23 Criterion validity of activity monitors and processing methods to assess daily-life walking bouts

Adrien Chanteau[1], Antoine Meliand[1], Muriel Pressigout[1], Thomas Bourgoin[1], Romane Clouet[1], Angéline Magois[1], Alexis Le Faucheur[1]

[1]University of Rennes

P-24 Exploratory analysis: Number of days required to reliably estimate workplace physical behaviours and sedentary time using three weeks of activPAL3 objective accelerometry

Aidan Buffey[1], Brian Carson[1], Alan Donnelly[1]

[1]University of Limerick

P-25 Gait patterns during daily life differ by frailty status in older men treated with androgen deprivation therapy for prostate cancer: A cross-sectional study of passive monitoring using novel instrumented socks

Deanne Tibbitts[1], Martina Mancini[1], Sydnee Stoyles[1], Christopher Palmer[1], Ramyar Eslami[1], Mahmoud El-Gohary[2], Fay Horak[1], Kerri Winters-Stone[1]

[1]Oregon Health and Science University, [2]APDM Wearable Technologies, a Clario company

P-26 Scoping review of observational studies of adults with accelerometry measured physical activity and sedentary behavior

Elissa Scherer[1], Kennedy Peter[2], Carmen Cuthbertson[2], Stephanie Eckman[1]

[1]RTI International, [2]University of North Carolina

P-27 Using machine learning to classify sitting and sleep history from raw accelerometry data during simulated driving.

Georgia Tuckwell[1], Charlotte Gupta[1], James Keal[2], Sally Ferguson[1], Jarrad Kowlessar[3], Grace Vincent[1]

[1]Central Queensland University, [2]University of Adelaide, [3]Flinders University

P-28 Context-matched gait variability measures capture longitudinal change in real life walking in degenerative cerebellar ataxia

Winfried Ilg[1], Martin Giese[1], Matthis Synofzik[1]

[1]Hertie Institute for Clinical Brain Research - University of Tuebingen

P-29 Comparison of raw accelerometer data of three different devices using a mechanical orbital shaker

Theresa Schweizer[1], Rahel Gilgen-Ammann[1]

[1]Swiss Federal Institute of Sport Magglingen

P-30 Can a perceptual threshold be identified to distinguishing walking on flat ground from uphill and downhill?

Anna Iveson[1], Brian Ellis[1], Malcolm Granat[2]

[1]Glasgow Caledonian University, [2]Salford University

P-31 The arm activity tracker: a wearable system measuring and providing feedback on paretic arm activity in stroke patients. - Preliminary results

A.J. Langerak[1], G.R.H. Regterschot[1], R.W. Selles[1], G.M. Ribbers[1], J.B.J. Bussmann[1]

[1]Erasmus University Medical Center

P-32 A systematic scoping review on the application of latent class analysis applied to accelerometry-assessed physical activity and sedentary behavior

Annie Howard[1], Yumeng Ren[1], Chongzhi Di[2], Melissa Troester[1], Blake Anuskiewicz[3], Kelly Evenson[1]

[1]University of North Carolina, [2]Fred Hutchinson Cancer Research Center, [3]University of California

P-33 A comparison of methods for analyzing wrist worn actigraph data among older adults with dementia

John Ostrander[1], Sarah Payne[1], Adrienne Jankowski[1], Andrew Shutes-David[1], Katie Wilson[1], Edmund Seto[1], Debby Tsuang[1]

[1]Seattle Institute for Biomedical and Clinical Research

P-34 Comparison of physical activity intensity estimated by direct observation to whole room indirect calorimetry

Julian Martinez[1], John Staudenmayer[2], Edward Melanson[3], Ann Swartz[1], Scott Strath[1]

[1]University of Wisconsin, [2]University of Massachusetts Amherst, [3]University of Colorado Anschutz Medical Campus

P-35 Definition of activity counts using ActiGraph devices

Ali Neishabouri[1], Joe Nguyen[1], John Samuelsson[2], Tyler Guthrie[1], Matt Biggs[1], Jeremy Wyatt[1], Doug Cross[1], Marta Karas[3], Jairo Migueles[4], Sheraz Khan[2], Christine Guo[1]

[1]ActiGraph, [2]MGH/MIT/Harvard, [3]Harvard University, [4]Karolinska Institutet

P-36 An open-source and automated data processing and reporting pipeline for continuous wearable data in adaptive interventions

Diego Arguello[1], Grant Denmark[1], Gregory Cloutier[1], Carmen Castaneda-Sceppa[1], Charles Hillman[1], Arthur Kramer[1], Dinesh John[1]

[1]Northeastern University

P-37 Activity recognition using body-worn sensors and load-dependent injury risk in Swiss Armed Forces recruits

Rahel Gilgen-Ammann[1]

[1]Swiss Federal Institute of Sport Magglingen

P-38 Use of wearable sensors to classify activities of amputees in the real-world for improved K level assessment

Matthew Wassall[1], Sibylle Thies[1], Malcolm Granat[1], Saeed Zahedi[2]

[1]University of Salford, [2]Blatchford Prosthetics

P-39 Population activity profiles: comparison of standard time to relative time

Malcolm Granat[1], Emmanuel Stamatakis[2], Mark Hamer[3], Ben Griffiths[1]

[1]University of Salford, [2]University of Sydney, [3]University College London

P-40 Agreement among ActiGraph, activPAL, and diary measured time in bed in university students

Benjamin Boudreaux[1], Ginny Frederick[2], Patrick O'Connor[1], Ellen Evans[1]

[1]University of Georgia, [2]Mercer University

P-41 Can we use a wearable sensor to determine the locus of a person's activity?

Douglas Maxwell[1], Craig Speirs[1]

[1]PAL Technologies Ltd

P-42 Characterizing free-living physical behaviors in chronic post-stroke adults with Aphasia

Albert Mendoza[1], Jennifer Sherwood[1], Michelle Gravier[1]

[1]California State University

P-43 Validation of wearable sensors for functional assessment of TKA patients in a clinical setting

Kevin Abbruzzese[1], Jenna Lyon[1], Vanessa LoBasso[1], Jayishni Maharaj[2], David Llyod[2], Price Gallie[3]

[1]Stryker Orthopaedics, [2]Griffith University, [3]Coast Orthopaedics

P-44 Duration of Medium Cadence Stepping Bouts is Linked with Disability and Functional Mobility for People with End-Stage Knee Osteoarthritis

Hope Davis-Wilson[1], Katherine Balfany[1], Paul Kline[2], Elizabeth Juarez-Colunga[3], Edward Melanson[1], Cory Christiansen[1]

[1]VA Eastern Colorado Healthcare System, [2]High Point University, [3]University of Colorado Anschutz Medical Campus

P-45 Self-report versus accelerometer-derived measurement of physical activity in metastatic breast cancer: how do they compare?

Patricia Sheean[1], Lauren Matthews, Kathleen Jensik[2], Whitney Morelli[2], Melinda Stolley[2]

[1]Loyola University, [2]Medical College of Wisconsin

P-46 Comparison of self-reported and accelerometer measured daily sitting time in cancer survivors

Mary Hidde[1], Kate Lyden[2], Heather Leach[3]

[1]Medical College of Wisconsin, [2]KAL Consulting LLC, [3]Colorado State University

P-47 Physical activity, sedentary time, and wear time recorded by accelerometer in a nationwide sample - Results from MoMo wave 3 (2018-2020)

Alexander Burchartz[1], Leon Klos[1], Steffen Schmidt[1], Alexander Woll[1]

[1]Karlsruhe Institute of Technology

P-48 The Validity of using smart glasses to measure Spatiotemporal gait of patient with Parkinson's disease

Jacob Sosnoff[1], Kelly Lyons[1], Rajesh Pahwa[1]

[1]Kansas University Medical center

P-49 Free-living validity of energy expenditure estimates from wrist-worn ActiGraph monitors: A doubly labeled water study

Paul Hibbing[1], Gregory Welk[2], Robin Shook[1]

[1]Children's Mercy Kansas City, [2]Iowa State University

P-50 Physical Activity and Sedentary Behaviour in Children with Neck or Back Pain: An Observational Study

Anna Cooper-Ryan[1], Alexandra Clarke-Cornwell[1], Tamara Brown[1], Stephen Preece[1]

[1]University of Salford

P-51 Effectiveness of a personalised 3-mo eHealth intervention on daily steps among patients of elective cardiac procedures: a randomised controlled trial

Jari Halonen[1], Ville Vasankari[2], Sini Vasankari[3], Kari Tokola[4], Henri Vähä-Ypyä[4], Pauliina Husu[4], Harri Sievänen[4], Juha Hartikainen[1]

[1]Kuopio University Hospital, [2]Helsinki University Hospital, [3]Turku University Hospital, [4]UKK Institute for Health Promotion Research

P-52 Engagement with an Integrated Two-Way Communication Near-Real-Time Mobile Health Intervention to Motivate Adults >60y to 'Move More and Sit Less'

Diego Arguello[1], Ethan Rogers[1], Grant Denmark[1], Gregory Cloutier[1], Carmen Sceppa[1], Charles Hillman[1], Arthur Kramer[1], Dinesh John[1]

[1]Northeastern University

P-53 The impact of anti-hypertensive medication on the relationship between daily step count and blood pressure

Mark Dunlop[1], Marc Roper[1]

[1]University of Strathclyde

P-54 Locations of women's physical activity before and during the COVID-19 Pandemic

Katelyn Holliday[1], Michael Zimmerman[1], Laura Fish[1], Daniela Sotres-Alvarez[2], Truls Østbye[1]

[1]Duke University, [2]University of North Carolina at Chapel Hill

P-55 Evidence for accelerometry as a surrogate measure of infant energy expenditure

Nicholas Broskey[1], Samuel LaMunion[2], Abby Altazan[3], Leanne Redman[3]

[1]East Carolina University, [2]National Institute of Diabetes and Digestive and Kidney Diseases, [3]Pennington Biomedical Research Center

P-56 Accuracy of Consumer Grade Wearable Activity Monitors for Step Count and Heart Rate Recovery following Aerobic Exercise

Cristal Benitez[1], Andrew Gomez[1], Lindsay Toth[1]

[1]University of North Florida

P-57 Determining Clinically Relevant Gait Parameters Measured from Load Monitoring Insole Worn During Tibial Fracture Rehabilitation Using Fuzzy Inference Systems

Grange Simpson[1], Robert Hitchcock[1], Amy Cizik[1]

[1]University of Utah

P-58 Predictors of physical activity up to one year after hospitalization for COVID-19; results from the CO-FLOW study

Julia Berenschot[1], Gijs Broeren[1], Martine Bek[1], Ruben Regterschot[1], Merel Hellemons[1], Joachim Aerts[1], Gerard Ribbers[1], Majanka Heijenbrok-Kal[1], Rita van den Berg-Emons[1]

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Virtual Posters

VPE - indicates that the virtual poster presenter resides in a European Time Zone

VPE-60 Association between accelerometer-measured physical activity and motor skills in preschool-aged Finnish children

Tuomas Kukko[1], Harto Hakonen[2], Anette Mehtälä[2], Piritta Asunta[2], Arja Sääkslahti[3], Tuija Tammelin[2]

[1]Liikunnan ja kansanterveyden edistämissäätiö LIKES, [2]Jamk University of Applied Sciences, [3]University of Jyväskylä

VPE-61 Comparison of an automated algorithm applied to activPAL data for estimating time in bed with polysomnography

Tatiana Plekhanova[1], Alex Rowlands[1], Tom Yates[1], Andrew Hall[1], Melanie Davies[1], Charlotte Edwardson[1]

[1]University of Leicester

VPE-62 Daily living measures of sit-to-stand transitions and mobility across disease stages of Parkinson's disease

Jeffrey Hausdorff[1], Anat Mirelman[1], Eran Gazith[1], Nir Giladi[1], Avner Thaler[1], Jeremy Edgerton[2], Jesse Cederbaum[3]

[1]Center for the Study of Movement Cognition and Mobility, [2]Biogen, [3]Yale University School of Medicine

VPE-63 Classification of daily physical behavior in older adults using machine learning

Stine Trollebø[1], Aleksej Logacjov[1], Kerstin Bach[1], Beatrix Vereijken[1], Nina Skjæret-Maroni[1]

[1]Norwegian University of Science and Technology

VPE-64 Can wearable sensors provide insight into delirium in inpatients with Parkinson's disease? A feasibility study

Gemma Bate[1], Sarah Richardson[1], John-Paul Taylor[1], David Burn[1], Louise Allan[2], Alison Yarnall[1], Yu Guan[1], Silvia Del Din[1], Rachael Lawson[1]

[1]Newcastle University, [2]University of Exeter

VPE-65 Objective classification of Huntington's disease chorea severity during walking using a gait anomaly detection algorithm

Monica Busse[1], Lori Quinn[2], Ran Gilad-Bachrach[3], Jeffrey M Hausdorff[4]

[1]Cardiff University, [2]Teachers College, Columbia University, [3]Tel Aviv University, [4]Tel Aviv Sourasky Medical Center

VPE-66 Physiological and perceived responses to a prolonged moderate intensity walking bout in older adults

Timo Aittokoski[1], Timo Rantalainen[1], Antti Löppönen[1], Olli-Pekka Mattila[1], Lotta Palmberg[1], Kirsi Keskinen[1], Taina Rantanen[1]

[1]University of Jyväskylä

VPE-67 Using deep learning in stroke rehabilitation - A step towards individualized patient care

Sonja Georgievska[1], Yang Lui[1], Cunliang Geng[1], Michiel Punt[2]

[1]Netherlands eScience Center, [2]Hogeschool Utrecht

VPE-68 Gait detection from a wrist-worn sensor using machine learning methods: daily living study in older adults and patients with Parkinson's disease

Dafna Schwartz[1], Eran Gazit[2], Aron Buchman[3], Jeffrey Hausdorff[1]

[1]Tel Aviv University, [2]Center for the Study of Movement Cognition and Mobility, [3]Rush University Medical Center

VPE-69 Validation of low-cost measurement tools for assessing habitual physical activity in pre-schoolers: the SUNRISE study

Xanne Janssen[1], Anthony Okely[2], Mark Tremblay[3], Catherine Draper[4], Alex Antonio Florindo[5], Chiaki Tanaka[6], Denise Koh[7], Guan Hongyan[8], Hong Tang[9], Kar Hau Chong[2], Marie Löf[10], Mohammad Sorowar Hossain[11], Penny Cross[2], PW Prasad Chathurangana[12], John Reilly[1]

[1]University of Strathclyde, [2]University of Wollongong, [3]CHEO Research Institute, [4]University of the Witwatersrand, [5]University of Sao Paulo, [6]Tokyo Kasei Gakuin University, [7]Universiti Kebangsaan Malaysia, [8]Capital Institute of Pediatrics, [9]Pham Ngoc Thach University of Medicine, [10]Karolinska Institutet, [11]Biomedical Research Foundation, [12]University of Colombo

VP-80 Physical activity in community-dwelling older adults: which accelerometry measures are the most robust? A structured review

Khalid Abdul Jabbar[1], Ríona Mc Ardle[2], Sue Lord[3], Ngaire Kerse[1], Silvia Del Din[2], Ruth Teh[1]

[1]University Of Auckland, [2]Newcastle University, [3]Auckland University of Technology

VP-81 Genetic and environmental influences on features of objectively measured physical activity, sleep and Circadian rhythmicity in adolescent twins

Victoria O'Callaghan[1], Andrew Leroux[2], Vadim Zipunnikov[3], Margie Wright[4], Ian Hickie[5], Kathleen Merikangas[6]

[1]Queensland Brain Institute, [2]University of Colorado, [3]Johns Hopkins Bloomberg School of Public Health, [4]University of Queensland, [5]University of Sydney, [6]National Institute of Mental Health

VP-82 A data-informed approach to choosing measures of prolonged sedentary accumulation patterns

Paddy Dempsey[1], Bronwyn Clark[2], David Dunstan[3], Genevieve Healy[2]

[1]University of Cambridge, [2]University of Queensland, [3]Baker Heart and Diabetes Institute

CMR.

VP-83 Sleep trajectories in preschool aged children after 6 months participating in a health promotion study

Hannah J. Coyle-Asbil[1], Bridget Coyle-Asbil[1], David W.L. Ma[1], Jess Haines[1], Lori Ann Vallis[1]

[1]University of Guelph

VP-84 The preliminary impact of a family-based health behaviour intervention on physical activity and adiposity in toddlers in the Guelph Family Health Study (GFHS)

Hannah Coyle-Asbil[1], Becky Breau[1], David W Ma[1], Jess Haines[1], Andrea Buchholz[1], Lori Ann Vallis[1]

[1]University of Guelph

VP-85 Comparability of free-living physical activity classified using counts, open-source counts, euclidean norm minus one, and mean amplitude deviation in adults

Katherine McKee[1], Karin Pfeiffer[1], Amber Pearson[1], Kimberly Clevenger[2]

[1]Michigan State University, [2]National Cancer Institute

VP-86 Effect of accelerometer epoch length on physical activity and sedentary time in toddlers

Elyse Letts[1], Sara King-Dowling[2], Natascja Di Cristofaro[1], Joyce Obeid[1]

[1]McMaster University, [2]The Children's Hospital of Philadelphia

VP-87 Classifying activity intensity in children with Spina Bifida based on wrist-worn ActiGraph

Zijian Huang, Andrea Moosreiner[1], Michele Polfuss[2], Dan Ding[3]

[1]Medical College of Wisconsin, [2]University of Wisconsin, [3]University of Pittsburgh

VP-88 Determining the locations of physical activity of community-dwelling older adults: a global positioning system-based study

Yutaka Fukuoka[1], Shigeru Inoue, Hiroshi Murayama, Takeo Fujiwara, Yugo Shobugawa

[1]Kogakuin University

VP-89 What does it mean to use the mean? The impact of different data handling strategies on the percent of children classified as meeting the 24-hr movement guidelines

Christopher Pfledderer[1], Sarah Burkart[1], Roddrick Dugger[1], Hannah Parker[1], R. Glenn Weaver[1], Bridget Armstrong[1], Elizabeth Adams[1], Michael Beets[1]

[1]University of South Carolina

VP-90 Evaluation of range of motion during daily activities through knee-worn wearable sensor system after TKA surgery

Ricardo Antunes[1], Paul Jacob[2], Robert Marchand[3], Andrew Meyer[1], Emily Hampp[1], Elaine Justice[2], Kelly Taylor[3], Kelly Luttazi[3], Matthias Verstraete[1]

[1]Stryker, [2]Oklahoma Joint Reconstruction Institute, [3]Ortho Rhode Island

VP-91 Patient compliance with remote monitoring: Findings from a multi-center study

Emily Hampp[1], Ricardo Antunes[1], Robert Marchand[2], Paul Jacob[3], Andrew Meyer[1], Elaine Justice[3], Kelly Taylor[2], Kelly Luttazi[2], Matthias Verstraete[1]

[1]Stryker, [2]Ortho Rhode Island, [3]Oklahoma Joint Reconstruction Institute

VP-92 Feeling Better After TKA: Reference chart for remotely collected pain scores

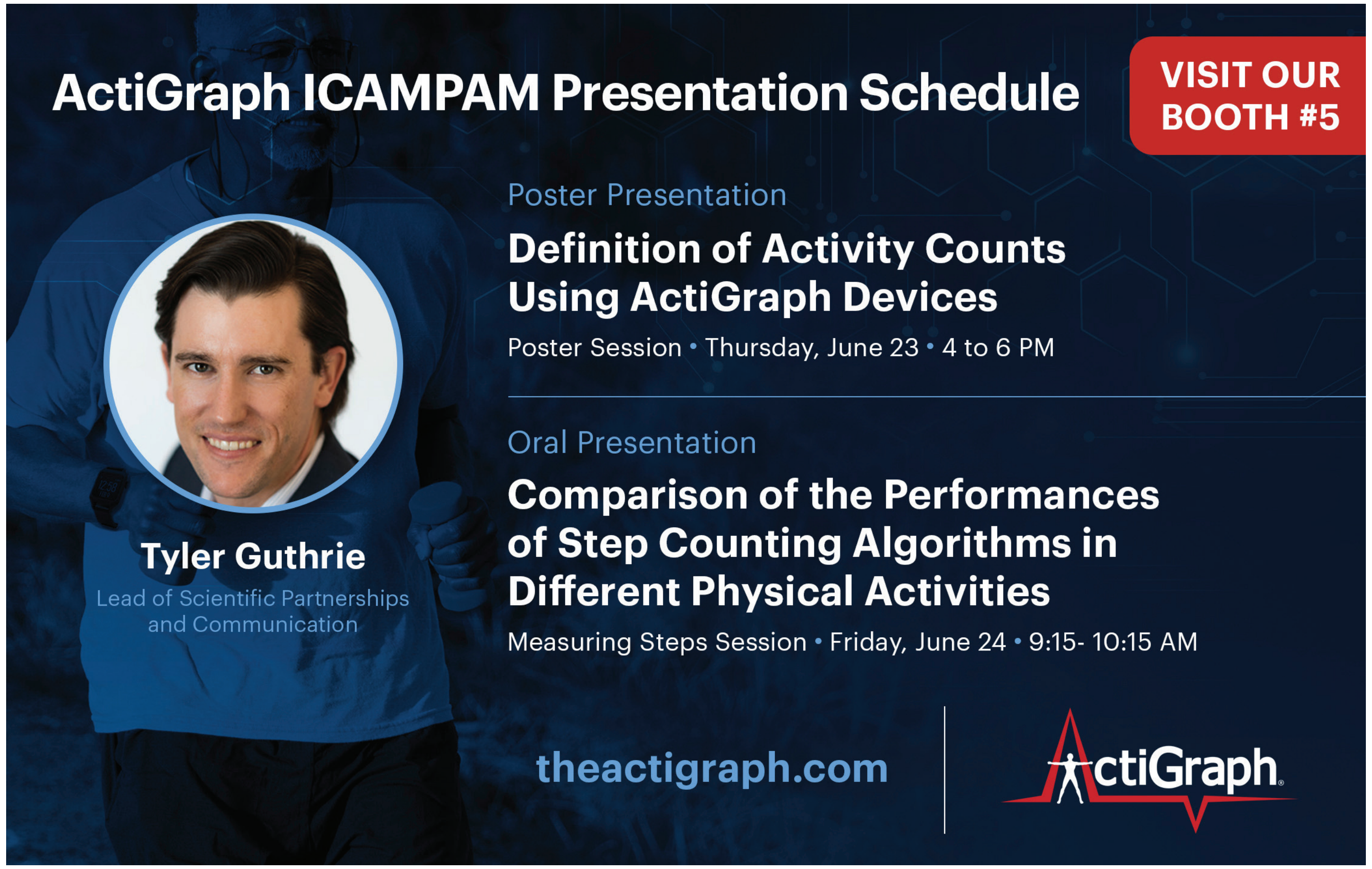
Ricardo Antunes[1], Paul Jacob[2], Robert Marchand[3], Elaine Justice[2], Kelly Taylor[3], Kelly Luttazi[3], Andrew Meyer[1], Emily Hampp[1], Matthias Verstraete[1]

[1]Stryker, [2]Oklahoma Joint Reconstruction Institute, [3]Ortho Rhode Island

VP-93 Functional, Distributional, and Dynamic Modelling for Mobile Digital Health Data

Vadim Zipunnikov[1]

[1]Johns Hopkins Bloomberg School of Public Health



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