HOW DO WE MOVE FROM GADGETS TO ECOSYSTEMS?

S. Johnston, *Aging 2.0, San Francisco, California*

In the light of the increasing need to scale new tech-enabled care models, Stephen Johnston will talk about what it takes to build an innovation ecosystem for aging, using examples drawn from the Aging2.0 global chapter network. He will also highlight some examples of innovative technologies and show how to succeed they need to be paired with user-centric design, which puts the individual at the center of decision making, as well as innovative business models, many of which are introducing technology companies into the healthcare continuum.

AGING AND TECHNOLOGY—TURNING RESEARCH INTO REAL-WORLD IMPACT

A. Sixsmith, *Gerontology, Simon Fraser University, Vancouver, British Columbia, Canada*

AGE-WELL is a Canadian research network that aims to help older people to maintain their independence, health and social participation through accessible technologies. While these are compelling arguments for public and private investment in this area, there are still a number of key challenges in turning the research outputs into real world products and services. This talk will explore and evaluate some of these challenges and will discuss AGE-WELL's approach to strengthen efforts in this sector.

TRANSFORMING PARADIGMS FOR AGEING POPULATIONS: NEW ECOSYSTEMS FOR TECHNOLOGY AND INNOVATION

A. Ross, *Centre for Health Development, World Health Organization, Kobe, Hyogo, Japan*

Central to ensuring the continued functional capacities, social engagement, and independence of older persons, and meeting their specific needs, are diverse assistive health and information/communication technologies. Yet many obstacles can prevent equitable access to or use of the most basic of these technologies. A few include not including older persons in design, ignoring affordability and appropriateness (environment, culture) considerations, literacy levels, or not planning for how technology can be integrated into the home and health/social care systems. A new ecosystem must engage multiple stakeholders and disciplines. For example, innovators, producers, regulators, and financiers must work together to identify the nature and role of health technology assessments & evaluations, which government will use to make resource allocation decisions in finite environments. The WHO Kobe Centre leads work in exploring various technological innovations and related issues for ageing populations, persons with disabilities and health systems; and the relationship to planning for sustainable universal health coverage.

SESSION 4595 (SYMPOSIUM)

MORE THAN COUNTS AND CUTPOINTS: INNOVATIONS IN ACCELEROMETRY DERIVED METRICS FOR OLDER ADULTS

Chair: J. Schrack, *Johns Hopkins University*

Co-Chair: V. Zipunnikov, *Johns Hopkins Bloomberg School of Public Health*

Discussant: T. Harris, *NIA/Intramural Research Program, Bethesda, Maryland*

The advent of wearable devices has introduced a new layer of complexity to assessing physical activity and mobility in older adults. These devices collect and produce data with an unprecedented level of detail that can be managed, analyzed, and interpreted in multiple dimensions. This symposium focuses on new methodology to analyze and interpret accelerometry data in older adults using data from participants of the Baltimore Longitudinal Study of Aging, the Developmental Epidemiological Cohort Study, the Women's Health Initiative, and the National Health and Nutritional Examination Survey. We will discuss methods to assess and interpret physical activity in older adults using methodologies beyond daily summaries, including: (i) analyzing raw activity data to determine stride-to-stride gait variability, (ii) summarizing raw accelerometry metrics into an activity index that is comparable across studies and devices, (iii) discriminating between patterns of driving a car versus ambulating, (iv) demonstrating how heart rate defines individual differences in physiological intensity of daily activities, and (v) examining circadian rhythms of activity in relation to mortality. Collectively, these presentations will address the potential of objective activity monitors to further our understanding of physical activity and mobility in an aging population. Further development and application of the methodology presented in this symposium will: (i) provide a new level of detail to analyses of daily activity, (ii) ultimately transform the way data is utilized across research disciplines, (iii) be widely used in the implementation of prevention efforts, and (iv) contribute to efforts to optimize interventions that extend healthy aging and improve longevity.

STRIDE VARIABILITY MEASURES DERIVED FROM WRIST AND HIP-WORN ACCELEROMETERS

J. Urbanek², J. Harezlak¹, N.W. Glynn³, T. Harris⁴, C. Crainiceanu², V. Zipunnikov², 1. *Indiana University School of Medicine, Department of Biostatistics, Indianapolis, Indiana*, 2. *Johns Hopkins Bloomberg School of Public Health, Department of Biostatistics, Baltimore, Maryland*, 3. *University of Pittsburgh, Center for Aging and Population Health, Department of Epidemiology, Graduate School of Public Health, Pittsburgh, Pennsylvania*, 4. *Laboratory of Epidemiology, Demography, and Biometry, National Institute on Aging, Bethesda, Maryland*

Many epidemiological and clinical studies use accelerometry to objectively measure physical activity using the activity counts, vector magnitude, or number of steps. These measures use just a fraction of the information in the raw accelerometry data as they are typically summarized at the minute level. To address this problem we define and estimate two gait measures of temporal stride-to-stride variability based on raw accelerometry data: Amplitude Deviation (AD) and Phase Deviation (PD). We explore the sensitivity of our approach to on-body placement of the accelerometer by comparing hip, left and right wrist placements. We illustrate the approach by estimating AD and PD in 46 elderly participants in the Developmental Epidemiologic Cohort Study (DECOS) who wore accelerometers during a 400 meter walk

test. We also show that AD and PD have a statistically significant association with the gait speed and sit-to-stand test performance.

AN ACTIVITY INDEX FOR RAW ACCELEROMETRY DATA AND ITS APPLICATION IN OLDER ADULTS

J. Bai¹, C. Di², L. Xiao³, K.R. Evenson⁴, A. LaCroix⁵, C. Crainiceanu¹, D.M. Buchner⁶, 1. *Department of Biostatistics, Johns Hopkins University, Baltimore, Maryland*, 2. *Fred Hutchinson Cancer Research Center, Seattle, Washington*, 3. *North Carolina State University at Raleigh, Raleigh, North Carolina*, 4. *University of North Carolina – Chapel Hill, Chapel Hill, North Carolina*, 5. *University of California, San Diego, La Jolla, California*, 6. *University of Illinois at Urbana-Champaign, Champaign, Illinois*

Accelerometers have been widely deployed in public health studies in recent years and research has mainly focused on summarized metrics provided by accelerometers manufactures, such as the activity counts (AC). Such measures do not have a publicly available formula and can vary by device manufacturer. To address these problems, we developed the activity index (AI), a new metric for summarizing raw tri-axial accelerometry data, and compared the AI to AC's performance for distinguishing various types of activities and estimating energy expenditure. The analysis was conducted using data from the Women's Health Initiative, in which tri-axial raw acceleration data and energy expenditure were collected at the same time. ROC analyses indicated that AI better distinguished between different types of activities than AC. AI better associated with METs as well. The proposed AI provides a transparent and reliable way to summarize densely sampled raw acceleration data.

PHYSICAL EXERTION AND ACTIVITY: AGE AND RELATIVE EFFORT IN THE BALTIMORE LONGITUDINAL STUDY OF AGING

A. Leroux¹, J. Schrack¹, J. Fleg³, E.M. Simonsick², V. Zipunnikov¹, S.A. Studenski², L. Ferrucci², C. Crainiceanu¹, 1. *Johns Hopkins University Bloomberg School of Public Health, Baltimore, Maryland*, 2. *National Institute on Aging, Baltimore, Maryland*, 3. *National Heart, Lung, and Blood Institute, Bethesda, Maryland*

Commonly used measures of physical activity (PA) fail to account for heterogeneity in maximal capacity between individuals. Utilizing the concept of heart rate reserve, we estimated minute level physical exertion (PE) among BLSA subjects with at least 3 days of Actiheart data ($n = 411$). Subjects' average time spent in each of sedentary, light, moderate and vigorous PE was associated with age adjusting for demographics, chronic conditions, and PA. Despite a significant decline in total PA with age ($p < 0.001$), time spent in moderate and vigorous PE is positively associated with age in both women ($p_{\text{moderate}} < 0.001$, $p_{\text{vigorous}} < 0.001$) and men ($p_{\text{moderate}} = 0.137$, $p_{\text{vigorous}} = 0.222$). Chronic conditions are also generally associated with increased average PE. Our results suggest that individuals with decreased capacity are, on average, engaging moderate and high relative intensity activities at a rate comparable to, or higher than, that of healthier individuals.

AUTOMATIC CAR DRIVING DETECTION USING RAW ACCELEROMETRY DATA

M. Straczekiewicz², J. Urbanek³, W. Fadel¹, C. Crainiceanu³, J. Harezlak¹, 1. *Biostatistics, Indiana University Fairbanks School of Public Health, Indianapolis, Indiana*, 2. *AGH University of Science and Technology, Krakow, Poland*, 3. *Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland*

Measuring physical activity using wearable devices has gained popularity in older populations. Raw data collected from them is summarized as "activity counts", which combine information of human activity with environmental vibrations. Driving is a major sedentary activity that can artificially increase these counts. Thus, it is important to identify periods of driving and quantify the bias induced by driving in activity counts. To address these problems, we propose a Detection Algorithm of Driving via Accelerometry (DADA), which is based on short-time Fourier transform applied to the raw accelerometry data identifying the frequencies' ranges specific to car driving. We test DADA's performance on data collected using wrist-worn ActiGraph devices in an experiment conducted on 24 subjects. The median AUC for predicting driving periods was 0.94. The activity count bias induced by driving per unit of time was on average equal to 16% of the average activity counts generated during walking.

TOTAL PHYSICAL ACTIVITY AND ITS CIRCADIAN ALLOCATION ARE INDEPENDENT PREDICTORS OF MORTALITY

V. Zipunnikov, D. Dey, A. Leroux, J. Di, J. Urbanek, J. Schrack, C. Crainiceanu, *Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland*

We examine whether the distribution of physical activity during the day acts as an independent predictor of mortality in National Health and Nutrition Examination Survey 2003–2006. Time of day analyses were conducted using 12 time windows of 2 hours represented by the percentage of the total log-transformed activity count (pTLAC) spent in each. In models adjusted for age, sex, race/ethnicity, education, body mass index, comorbidities, and the total log-transformed activity count, a higher percentage of total physical activity between 10am–12pm (HR: 0.96, $p\text{-value} = 0.003$) and a lower percentage of total physical activity between 8pm–4am (HR: 1.03, $p\text{-value} < 0.01$) were significantly associated with lower risk of mortality. These findings help define patterns of physical activity that are beneficial to health, and hold significant implications for future interventions aimed at increasing physical activity and enhancing sleep quality.

SESSION 4600 (SYMPOSIUM)

IAGG SECRETARIAT: THEORETICAL AND POLICY PERSPECTIVES FOR HEALTHY AGING

Chair: Y. Lee, *Ajou University School of Medicine, Suwon, Korea (the Republic of)*

Co-Chair: D. Lee, *Seoul National University College of Medicine, Korea (the Republic of)*