H. THOMPSON (Convener). Non-obtrusive technologies to support shared decision making in gerontology. Gerontechnology 2010;9(2):167; doi:10.4017/gt.2010.09.02.118.00
Participants: *G. DEMIRIS (USA), S. THIELKE (USA), K. WILAMOWSKA (USA), O. ZASLAVSKY (USA),* and *B. REEDER (USA).* **ISSUE** To date, efforts have addressed a single aspect of older adults' health, focusing on one or more specific functional, physiological, social, spiritual or cognitive parameters. Methodologies are lacking that address the holistic and multidimensional assessment of health and wellness. The assessment of health, which is multidimensional in nature, is a critical component in maintaining a high level of well-being and independence for older adults. Identifying problems while they are still small can provide a window of opportunity for interventions that will alleviate problem areas before they become catastrophic. **CONTENT** The challenge is to assess and integrate various data sources that provide a comprehensive assessment of older adults' well-being and customize assessment based on individual needs. Technology applications may enable non-obtrusive monitoring and assessment of physiological, functional, cognitive or other parameters. Another challenge is to explore how to best visualize and display information about wellness without burdening health care professionals with large amounts of data but rather enhance clinical decision making. We will be discussing approaches to capture, integrate and analyze data sets from different sources and address the challenges of obtrusiveness and privacy considerations. We will discuss shared decision making that includes both formal and informal caregivers, as well as the older adults, in the decision making process as informed and empowered participants. **STRUCTURE** George Demiris will provide a conceptual framework of wellness for older adults and shared decision making, and discuss current experience with the HEALTH-E project in Seattle that uses diverse technologies (including a telehealth kiosk, a gait assessment platform and brain training software) to capture and visualize older adults' wellness in an independent retirement community. Stephen Thielke will present how real-time geospatial range can be utilized by researchers and clinicians to objectively measure functional status and assist with symptom management. Katarzyna Wilamowska will discuss a novel imaging analysis approach that when used longitudinally provides insight into patterns of well-being. Oleg Zaslavsky will discuss the role of technology in assessing and predicting frailty in community dwelling older adults. Blaine Reeder will discuss how current work presented in this symposium can inform the design of built environments for older adults to promote wellness and highlight public health policy implications. Following the individual presentations, Hilaire Thompson will lead a discussion focusing on trends in technology use for shared decision making. **CONCLUSION** Technology can empower older adults and enhance the decision making process by increasing access to information and our understanding of wellness. Technology should be designed to minimize obtrusiveness and address privacy concerns, following actual needs and meaningful clinical models of care.
Keywords: wellness, shared decision making, visualization, function, frailty
Address: University of Washington, Box 357266, Seattle, WA, USA;
E: hilairet@uw.edu

G.DEMIRIS, H. THOMPSON. Using technology to capture and analyze wellness: the HEALTH-E project. Gerontechnology 2010;9(2):168; doi:10.4017/gt.2010.09.02.119.00 **Purpose** Halbert Dunn defined wellness as *"an integrated method for functioning which is oriented toward maximizing the potential of which the individual is capable. It requires that the individual maintains a continuum of balance and purposeful direction within the environment where s/he is functioning*[1]*"*. Older adults decline at varying rates in the areas of mobility, cognition and the senses as well as with the progression of chronic disease. To assist them in retaining independence, the emphasis is on predicting and if possible, minimizing, such losses. Numerous efforts have been developed to address a single aspect of older adults' health focusing on one or more specific functional, physiological, social or cognitive parameters. In order to capture and understand wellness, however, a holistic approach is required. Within the HEALTH-E (Home based Environmental and Assisted Living Technologies for Health Elders) Project at the University of Washington we utilize an integrated monitoring system that consists of several existing telehealth technologies (including a telehealth kiosk, cognitive and gait assessment software and hardware) to assess the physiological, cognitive, functional, spiritual and social wellness of older adults. Our interdisciplinary team consists of researchers in nursing, informatics, engineering and computer science, design and medicine. Our aim is to increase our understanding of older adults' wellness, allow for identification of trends and patterns and ultimately support aging in place. **Method** Data collection takes place within a 'living laboratory', namely a community room within an independent retirement community in Seattle, Washington where the telehealth kiosk (incl. peripherals to capture vital signs and a screen for completion of selected questionnaires and self-report), the gait assessment system and a laptop with the cognitive function assessment and brain fitness software are installed. Residents of the facility visit the living laboratory weekly to participate in the scheduled assessment sessions. **Results & Discussion** Synthesis methods applied on the resulting data sets include pattern discovery, sequence prediction, and methods for organizing and integrating diverse data. We use novel graphical and visual methods to summarize and integrate the data and ultimately represent older adults' wellness in meaningful ways for both older adults and health care professionals. Data from the two system components (telehealth kiosk and cognitive assessment) are assessed for skew in distributions and missing data using Frank Harrell's *describe* function in the Hmisc library for R Statistical Computing. Variable clustering allows for the identification of highly correlated data and removal of redundant information for future modeling and prediction. We identify differences in the clustering patterns (for instance,. functional parameters) based on longitudinal trends. To assess the interdependencies between the correlation patterns in the physiological, cognitive, social and functional components, we utilize partial least squares (PLS) regression. As a follow-up, we are currently conducting focus groups with health care professionals to assess their information needs that inform the visualization of complex and diverse data sources to best capture, synthesize and present older adults' wellness in order to enhance clinical decision making.

References

1. Dunn HL. High-level wellness. Virginia: Beatty; 1961

Keywords: wellness, telehealth, cognitive assessment, data integration

Address: University of Washington, BNHS Box 357266, Seattle WA, 98195, USA;
E: gdemiris@u.washington.edu

S. THIELKE, H. THOMPSON, S. PATEL, K. JOHNSON, M. HARNISS. Real-time geospatial range for geriatric assessment. Gerontechnology 2010;9(2):168-169; doi:10.4017/gt.2010.09.02.120.00
Purpose What people do is strongly linked to where they are and where they go, and measuring location and movements can inform a great deal about how people function in their natural environments. Novel microprocessor technologies, using portable sensors, can gather such data. Such technologies have the potential to alter how patients, clinicians, and researchers measure and interpret functioning, allowing better assessments of health status and more targeted treatments for disabling health conditions. Such measurements are especially important for the care of adults who are frail or at risk for frailty. One of the key challenges in applying the concept of frailty in clinical settings is that it is a composite, multifactorial, and

often subjective, diagnosis based on measuring and scaling multiple domains[1,2]. Multiple factors make it challenging to quantify degree of frailty at any point in time, and to track changes in it over time. We propose that one meaningful proxy for functional status, which can be measured, summarized, and interpreted in clinical and research settings, is the range of geographic space which individuals cover in their natural living environments[3,4]. More precise measurements of location over time will enable clinicians and researchers to understand better the real-time functioning of vulnerable older adults. **Method** Clinically, geospatial range can help accomplish several important ends: (i) to estimate global level of functioning and health status of a patient; (ii) to determine the patient's global ability to perform self-care, especially around navigating the built environment and acquiring basic goods and services; (iii) to identify the need for additional assistive care; (iv) to measure the effects of treatments on functioning; (v) to alert patients, family members, clinicians, and caregivers about episodes of significant functional decline; and (vi) to clarify the environmental context of adverse events, in particular falls. **Results & Discussion** Our ongoing work is indicating that the ability to measure and summarize, in real time, the geospatial range of vulnerable elders, might thus greatly enhance clinicians' ability to provide patient-centered care, tailor treatments and recommendations to needs, and continually reassess status and prognosis.

References

1. Fried LP, Walston J. Frailty and failure to thrive. In Hazzard WR, editor, Principles of Geriatric Medicine and Gerontology. New York: McGraw Hill; 1998; pp 1387-1402
2. Rockwood K, Mogilner A, Mitnitski A. Changes with age in the distribution of a frailty index. Mechanisms of Ageing and Development. 2004;125(7):517-519
3. Baker PS, Bodner EV, Allman RM. Measuring life-space mobility in community-dwelling older adults. Journal of the American Geriatric Society 2003;51(11):1610-1614
4. Peel C, Sawyer Baker P, Roth DL, Brown CJ, Brodner EV, Al-Man RM. Assessing mobility in older adults: The UAB Study of Aging Life-Space Assessment. Physical Therapy 2005;85(10):1008-1119

Keywords: frailty, assessment, functional status, sensor, global positioning system

Address: University of Washington, Psychiatry and Behavioral Sciences, Box 358280, Seattle, WA, USA; E: sthielke@uw.edu

K.M. WILAMOWSKA. Photos for wellness. Gerontechnology 2010;9(2):169;
doi:10.4017/gt.2010.09.02.121.00 **Purpose** Whether a clinical specialist is meeting a patient, or a layperson is observing a loved one or friend, we are able to quickly glimpse the state of health of our subject. It is in this vein that we can use a non-invasive and relatively easy and user-friendly method for potentially automatically assessing wellness. Although the method could potentially be used for instant state-of-health feedback, its real strength lies in its use longitudinally to provide insight into patterns of well-being. **Method** Participant data in the form of color photographs and short wellness questionnaires are collected regularly over the span of several months. Given control (healthy) images for the participants, multiple computer vision approaches, for example Eigenfaces[1] or Fisherfaces[2] are used to generate a well-image for each participant. These well-images are then used as a baseline with which to assess the wellness of the participants over time. **Results & Discussion** One of the greatest benefits to this approach is that it uses data gathering technology that is well known to participants of any age, namely a camera. Sensitivity and specificity of this method are checked by measuring the ability of the system to distinguish between control days and poor wellness days. So that the method maybe robust to long term use, the well-image can be easily recalibrated over time. This novel approach to wellness assessment may enhance our ability to routinely monitor the well-being of older adults in numerous settings.

References

1. Turk M, Pentland A. Eigenfaces for Recognition. Journal of Cognitive Neuroscience 1991; 3(1):71-86
2. Belhumeur P, Hespanha J, Kriegman, D. Eigenfaces vs. Fisherfaces: recognition using class specific linear projection. IEEE Transactions on Pattern Analysis and Machine Intelligence 1997;19(7):711-720

Keywords: wellness, computer vision, frailty

Address: University of Washington, Box 357266, Seattle, WA, USA; E: kasiaw@uw.edu

O. ZASLAVSKY, H. THOMPSON, G. DEMIRIS. Use of technology to assess frailty. Gerontechnology 2010;9(2):170; doi:10.4017/gt.2010.09.02.122.00 **Purpose** Frailty is increasingly recognized as a geriatric syndrome that is highly prevalent, distinct from disability and co-morbidity, and potentially modifiable[1]. This construct has been in geriatric literature for more than three decades, gradually making the transformation from the mere definition of the phenomenon to the distinct medical syndrome with its own etiology, symptoms and pathophysiological mechanisms. However, a commonly accepted operational definition of frailty is far from being achieved. So far, the 'Frailty Task Force' of the American Geriatric Society has determined the best operational definition to be the working definition of frailty based on the secondary data analysis of the Cardiovascular Health Study (CHS)[2]. The CHS research group has proposed the 'phenotypic definition' of frailty based on the presence of three or more of the following indicators: slow walking speed, low physical activity, unintentional weight loss, self-reported exhaustion, and muscle weakness. This frailty phenotype was independently associated with worsening mobility, incidence of falls and hospitalizations, and mortality in a large cohort of community-living older adults[3]. Although this frailty phenotype has been validated and modified for use in several published reports, limitations remain that challenge its generalizability and usefulness in the clinical setting[2]. In addition, numerous researchers purport that it is not satisfactory to define frailty in the physical domain alone, since there are several other socio-cognitive and biological factors that have been recognized as part of the frailty state[4]. The purpose of our paper is to address the following research questions using the systematic review approach: (i) what are the main clinical domains that have been integrated into the operational definitions of frailty across multiple studies, (ii) what are the main analogies and the differences in evaluating physical vulnerability based on these clinical domains, (iii) and how can IT technologies help clinicians in crossing the gap between multiple operational definitions of frailty, eventually leading to the unified and standardized approach that can inform clinical practice? **Method** To address these questions a systematic search of PubMed from 1968 through June 2009 was performed using several combinations of the medical subject headings (MeSH) 'frail elderly', 'geriatric assessment', 'diagnosis/diagnostic', 'questionnaire' and 'measure'. **Results & Discussion** Initial search yielded 2689 publications. 2573 references were discarded on a review of the abstract. Sixty-two articles were relevant to the study purposes and full texts of these were retrieved. Each article was reviewed to determine its fit with established criteria; the final analysis entailed eleven references. Based on synthesis of these studies we will discuss the potential role of technologies in assessing, monitoring and predicting frailty.

References

1. Rothman MD, Leo-Summers L, Gill TM. Prognostic significance of potential frailty criteria. Journal of the American Geriatric Society 2008;56(12):2211-2116
2. Lang PO, Michel JP, Zekry D. Frailty Syndrome: A Transitional State in a Dynamic Process. Gerontology 2009; 55(5):539-549
3. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, Seeman T, Tracy R, Kop WJ, Burke G, McBurnie MA and the Cardiovascular Health Study Collaborative Research Group. Frailty in older adults: Evidence for a phenotype. Journals of Gerontology Series A. Biological Science and Medical Science 2001;56(3):M146-156
4. Levers MJ, Estabrooks CA, Ross Kerr JC. Factors contributing to frailty: literature review. Journal of Advanced Nursing 2006;56(3):282-291

Keywords: frailty, assessment, information technology, systematic review
Address: University of Washington, Box 357266, Seattle, WA, 98195, USA;
E: oleg.zaslavsky@fulbrightmail.org

B. REEDER, G. DEMIRIS. Informing the design of built environments to promote wellness: A public health perspective. Gerontechnology 2010;9(2):170-171; doi:10.4017/gt.2010.09.02.123.00 **Purpose** Smart home applications refer to residential settings equipped with information technology infrastructure that enables passive monitoring of residents' well-being and even a proactive response to residents' needs, safety and independence. As technology advances, there are a growing number of smart home systems that utilize diverse tools including sensor technologies, to increase our understanding of residents' activities of daily living, social interactions and well-being. Early research in smart home technology has shown that it has the

potential to be effective in improving health care outcomes for older adults. The continuous rise in health care costs continues to make finding ways to reduce the cost of care for members of aging populations a priority for informal caregivers, health care providers and policy makers. Historically speaking, low-income and marginalized populations have borne a greater cost of disease burden with lower quality health outcomes. In recent years, there has been a renewed interest in restoring the relationship between public health practice and community planning. **Method** Systematic analysis of available literature and policies. **Results & Discussion** Some studies suggest a correlation between improved housing and improved health on both the household and neighbourhood levels[1]. Assistive technology can help seniors age in place but one study has shown that a lack of standards between properties can cause the costs of housing adaptations to vary dramatically[2]. Evidence-based health impact assessments have been developed to measure the effectiveness of housing interventions[3]. We submit that smart home research conducted in conjunction with community planning has the potential to reduce the cost of care, improve health outcomes and equalize health inequities between demographic groups for aging populations at local and national levels. We believe that these goals can be reached through the development and mass-production of smart home technology to create a built environment that allows a greater number of people to age in place. Toward this end, we outline recommendations for smart home designers to engage public health policy makers in the research process through consideration of long-term community planning and modification of building codes to implement standardized smart home technologies in the built environment.

References

1. Northridge M, Sclar E, Biswas P. Sorting out the connections between the built environment and health: A conceptual framework for navigating pathways and planning healthy cities. Journal of Urban Health 2003;80(4):556-568
2. Lansley P, McCreadie C, Tinker A. Adapting the homes of older people: a case study of costs and savings. Building Research & Information, 2004;32(6):468-483
3. Thomson H, Petticrew M, Douglas M. Health impact assessment of housing improvements: incorporating research evidence. Journal of Epidemiology and Community Health 2003;57(1):11-16

Keywords: smart homes, public health informatics, aging in place, built environment

Address: Biomedical and Health Informatics, University of Washington, Box 357240, 1959 NE Pacific Street, HSB I-264,Seattle, WA 98195-7240, USA; E*:* breeder@u.washington.edu