J. KAYE (Convener). Intelligent systems for assessment of aging changes (ISAAC): Deploying unobtrusive home-based technology. Gerontechnology 2010;9(2):121; doi:10.4017/gt.2010.09.02.107.00 **Participants**: *J. KAYE (USA), T. HAYES (USA), H. JIMISON (USA), M. PAVEL (USA),* and *K. WILD (USA).* **ISSUE** A challenge in aging care and research is to reliably assess behavior and clinical status across interrelated domains (cognitive, physical, social, physiological, environmental). Current assessment strategies often rely on sparsely spaced queries from questionnaires or in-person examinations, which depend on recall of events or brief snap-shots of function that may poorly represent a person's typical state of function. The development of ambient home assessment environments has begun to provide the opportunity to assess change continuously, unobtrusively and in real-time. However, scaling this approach out to the community has been challenging; little data exists beyond small short-term studies. **STRUCTURE** This symposium will present the results of Intelligent Systems for Assessment of Aging Changes (ISAAC), an ongoing, longitudinal study of over 200 seniors now followed in their homes with an ambient assessment platform for up to 30 months. Findings will be presented in the context of the major causes of loss of independence, cognitive impairment and problems with mobility. Three themes will be addressed in five presentations: (i) Progress toward determining if continuous, unobtrusive monitoring of motor and cognitive activities detects cognitive decline in seniors living in typical community settings; (ii) Development of novel algorithms and assessment techniques for detecting motor and cognitive change in these community settings, and testing evolving sensor technology; and (iii) Changes in attitudes, perceptions and beliefs about ambient assessment among multiple stakeholders. **CONTENT** After a brief introduction to the ISAAC project by Jeffrey Kaye, Tamara Hayes will summarize the utility of continuous, long-term, home-based monitoring of activity patterns to assess clinical status in healthy and cognitively impaired participants. Holly Jimison will provide a framework for using computer game interactions to monitor cognitive status over time. Misha Pavel will discuss the development of methodologies and algorithms to detect salient aging change over multiple time scales. Katherine Wild will discuss the perceptions and acceptance of elders of unobtrusive, home-based monitoring through analysis of four domains (maintaining independence, detecting life events, sharing information, and privacy). Following these presentations, there will be an open discussion with the conference attendees led by Jeff Kaye, focusing on future capabilities and effective, wide-scale deployment of unobtrusive home-based platforms. **CONCLUSION** A community-deployed research platform provides an effective method for cognitive and functional assessment using continuously acting, unobtrusive technologies, bringing the locus of assessment into the daily flow of home life. The long-term potential of this developing paradigm is to see a convergence of clinical and technological capabilities into the mainstream of assessment and care. In this way, we hope to achieve true proactive health and personalized medicine based on an individual's real-time, real-world data.

Keywords: dementia, mild cognitive impairment, in-home assessment

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J. KAYE. Overview of the intelligent systems for assessment of aging changes (ISAAC) study. Gerontechnology 2010;9(2):122; doi:10.4017/gt.2010.09.02.108.00 **Purpose** The symposium will review results to date of the ISAAC study, a longitudinal study of early cognitive and motor changes leading to loss of independence among seniors living independently in their homes. This presentation provides the background and context for the subsequent symposium presentations. **Method** An ambient assessment platform consisting of passive IR motion and contact sensors strategically placed around the home, and monitored personal computers (for instance, keyboard and mouse use, time on the computer in applications and game playing) was installed in the homes of over 200 seniors for up to 30 months. Subjects were continually assessed across a range of key outcomes including total activity, gait speed, outings, night-time behaviors, and home computer interactions. On-line queries were obtained with regard to life events such as vacations, doctor visits, medication changes or falls. Custom software was built to remotely monitor the status of the technology in the homes as well as "push or pull" data as needed. Data were analyzed across multiple time domains and home locations. In addition, changes in attitudes, perceptions and beliefs about ambient assessment were obtained through focus groups and surveys conducted during the course of the longitudinal monitoring, asking both the resident as well as other stakeholders, as to their views on the use of technology for home-based assessment and interventions to support independent living. **Results & Discussion** The recruitment and enrollment process proceeded over a 12-month period. Over 300 subjects have been screened, and 260 subjects enrolled, which includes being assessed in person, trained on personal computer operation (a subset are not able to learn computer use) and having the technology platform installed in their homes (personal computer, printer, broadband connection, motion and contact sensors). The majority consented to have blood drawn for apolipoprotein E genotyping. Cohort characteristics are: mean age=84.0±5.1; Women:Men=182:78; 123 living alone; non-Caucasian=21.5%; mean educational level (years)=15.6 ±2.6; mean Mini-Mental State Examination score=28.2± 2.0; 16% with mild cognitive impairment (MCI). The cohort has now been assessed continuously for up to 38 months (range 17-38). Drop-out rates continue to be low (<7%). Through the weekly on-line life-event questionnaires, over 1500 life-events have been recorded. Measures of means, medians and variances in total activity, daily walking speed, time on computer, and in certain applications, were reliably collected and sources of error identified. These data will be more specifically used in the subsequent presentations to show that this community-deployed research platform provides an effective method for cognitive and functional assessment using continuously acting, unobtrusive technologies, bringing the locus of assessment into the daily flow of home life. The potential to inform multiple stakeholders about important events over time, ranging from falls to the development of MCI, is great in the long-term for providing optimal real-time assessment and care.

Keywords: dementia, mild cognitive impairment, in-home assessment, technology and aging
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T. HAYES. Unobtrusive assessment of activity patterns associated with mild cognitive impairment. Gerontechnology 2010;9(2):122-123; doi:10.4017/gt.2010.09.02.109.00 **Purpose** Prevention, or delay, of dementia onset is contingent upon the ability to detect early, meaningful, cognitive change during the life course. Timely recognition of cognitive decline preceding dementia can have remediable causes, such as medication complications or illness, that, when recognized, can be addressed to avoid irreversible damage. Recent studies suggest that changes in both mobility and in more complex day-to-day-tasks can be indicative of early decline. Furthermore, the best markers of cognitive decline may not necessarily be a person's performance at any single point in time, but rather trends over time and the intra-individual variability of change in function. We examined the use of continuous, long-term, and unobtrusive home-based monitoring of activity and walking speed to assess neurological function in healthy and cognitively impaired elders. **Method** We used unobtrusive passive infrared motion sensors to capture ongoing activity in the homes of community-dwelling seniors and to examine the relationship between motor activity and mild cognitive impairment (MCI). First, an ISAAC cohort pilot group of 14 octogenarians living independently and alone in a community was assessed. Measures of walking speed and total activity within the home over multiple timescales were analyzed according to whether subjects had MCI or not. A larger sample of 88 seniors

living alone from the ISAAC cohort was subsequently analyzed over a one year period to examine the trajectory of walking speed, total activity and the variability in these measures. **Results & Discussion** In the pilot study, continuous activity data from a six-month period was analyzed. The coefficient of variation (CoV) in the mean walking speed was twice as high in the group of elders with MCI (0.147±0.074) as compared to the healthy group (0.079±0.027). In the second study, subjects were grouped according to whether they had MCI (MCI), amnestic MCI (aMCI) or were cognitively intact (CI). Mean walking speed was 51.4 cm/sec in aMCI subjects, 51.6 cm/sec in MCI subjects, and 56.7 cm/sec in CI subjects. Analysis of over 1,000,000 walks from this second cohort revealed further differences in walking speed variance between cognitively impaired and cognitively healthy seniors. Three trajectories were identified that best described the CoV in walking speed over time: low variability at baseline and over time (low variability group); higher variability at baseline that was stable over time (moderate variability group); and high variability at baseline with increasing variability over time (high variability group). MCI subjects were significantly more likely to be in the high variability than in the low variability group (OR=1.41, p=0.012). These results suggest that, continuous assessment of activity patterns in the home identifies change in daily activity that may serve as a marker for cognitive decline and future development of MCI. The approach shows promise for use in clinical trials and gerontology research in general, as well as for providing on-going health maintenance.

Keywords: dementia, mild cognitive impairment, cognitive aging, in-home assessment
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H. JIMISON. Home-based monitoring of computer use to detect aging change. Gerontechnology 2010;9(2):123-124; doi:10.4017/gt.2010.09.02.110.00 **Purpose** Older adults are the fastest growing demographic of new computer users in the United States. Survey results from the Pew Internet and American Life Project[1] indicate that 22% of American adults over the age of 65 use the Internet. Seniors in this group are even more likely than other Internet users to go online and check email each day[1]. In addition, nearly 35% of seniors who use a computer have played a game online, comparable to 39%, the average rate of computer game play for other age groups. Given this rapid growth of computer use by users at risk for cognitive problems, as well as the current large use of computers by the advancing wave of baby boomers, the unobtrusive monitoring of computer interactions in the home provides us with a previously untapped resource of potential diagnostic and monitoring information for cognitive health. **Method** As part of the ISAAC cohort study[2], we analyzed computer usage data for 77 study participants in single-person households who all used computers and had complete neuropsychological testing results. The mean age of the participants in this group was 84.4±4.4 years, with the majority being female (87%). Our primary outcome of interest was weekly activity on the computer. We also measured the average length of sessions on the computer, specific application usage, and used keyboard and mouse data to infer motor speed measures for each participant[3]. The study participants also had our suite of cognitive computer games with embedded assessment algorithms available on their computers[4]. For the subset of participants who routinely played those games, we also had more direct assessments of cognitive performance. **Results & Discussion** The majority of the participants used the computer at least 2 hours per week, with some having typical daily usage of several hours. However, many had low computer use over the 2.5 year observational period. We will discuss the correspondence of our measures of overall computer activity, the cognitive metrics from the computer games, and the keyboard and mouse measures with the standard neuropsychological assessments.

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M. PAVEL. Fusion algorithms for home-based technology development. Gerontechnology 2010; 9(2):124; doi:10.4017/gt.2010.09.02.111.00 **Purpose** Ubiquitous and continuous sensing of multiple domains of information in the home, to detect relevant change, presents several challenges to identifying meaning trends and outcomes. Ideally, to take advantage of these rich data streams, efficient algorithms for fusion of the data are needed. Here we present several examples of approaches to algorithm development and data analysis from the ISAAC cohort study using continuous activity and motion data collected over several years[1,2]. **Method** The general approach to most of the inference problems, is to first develop computational models of the phenomena that provide a quantitative link between the observed data and the parameter of interest. For example, in the case of gait velocity measurement, the observations consist of individual firings of passive infrared sensors as the elder walks across the sensor path. These observed events are interpreted as measurements of the elder's instantaneous location perturbed by temporal and spatial noise. These simple model-based assumptions then justify the development of optimal inference strategies. In a similar manner, computational models of cognitive functions are used to process and interpret elders' interactions with computers and computer games. For example, individual moves in the game, similar to the card game called 'Concentration', can be used to estimate a parameter that characterizes the capacity of working memory. Most of the approaches to the analysis of behavioral data and the corresponding algorithms depend on the ability to fuse multiple streams of data. **Results & Discussion** A variety of data analyses based on the computational models have been applied to the data from the ongoing longitudinal ISAAC cohort study as well as other data. The results of these analyses are unique in at least two ways: (i) that they represent in-vivo characterization of behaviours and (ii) each participant is his own control, i.e., his characteristics are compared to his own historical data. For example, we will demonstrate our ability to infer gait velocity variability over time for individuals and compare these to the measurements obtained in clinical settings. Despite the variability within and across participants, we will demonstrate the stability of the resulting estimates, for instance, gait velocity and working memory over time.

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K. WILD. Unobtrusive in-home monitoring of cognitive and physical health: Reactions and perceptions of older adults. Gerontechnology 2010;9(2):124-125; doi:10.4017/gt.2010.09.02.112.00 **Purpose** Unobtrusive, home-based monitoring is becoming a more widely utilized method for detecting aging changes in older adults since assessment occurs in the daily activity of a person in their home environment[1]. Computers and home monitoring technologies are taking a prominent role, yet little is known concerning the attitudes of older adults toward monitoring. We examine the monitoring needs and expectations of older adults through focus groups and analysis of qualitative data on perceptions about home and computer monitoring[2,3]. **Method** We enrolled 23 older adults and 16 family members or friends in six focus groups, three with older adults and three with family or friends. The average age of the participants was 80.6

years; the mean age of family members or friends was 71.5 years. The focus groups were conducted over two days and incorporated examples of home-based monitoring devices and data output. Participants were asked to consider if the data displayed information that was meaningful to them, and how and to whom they would disseminate such information[2]. We also developed a technology survey for use by participants in projects sponsored by ORCATECH. The survey assessed the following domains: frequency and type of computer use; subjects' attitudes toward monitoring for detecting changes in behavior and functioning; attitudes regarding sharing of monitoring information; and concerns about privacy. The survey was administered to 158 persons in the ISAAC study with a median age of 84 years at the baseline visit[3]. **Results & Discussion** Results from the focus groups revealed four dominant themes: maintaining independence, detecting cognitive decline, sharing of information, and the balance between privacy and usefulness of monitoring[1]. The results of the survey showed that over half of the subjects used their computer daily, most often for email correspondence and playing games[3]. Participants thought monitoring for health changes was important, although about two-thirds reported being concerned that their information could be exploited. Participants were willing to have their activity information shared with their doctor (90%), however, they were more reluctant to share information concerning their computer activity (76%)[3]. Participants with normal cognition were more likely to be concerned about who might have access to their information than the cognitively impaired. The results of our focus group and survey have important implications for managing and controlling the growing use of computers and other technologies for researchers studying older adults. The elderly represent major stakeholders in the movement to provide technological solutions to detect cognitive and physical decline among this population. In order to progress with technological advances in this field, an understanding of the needs and perceptions of older adults is necessary in order to provide ethical and useful tools to enhance their assessment and care.

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