

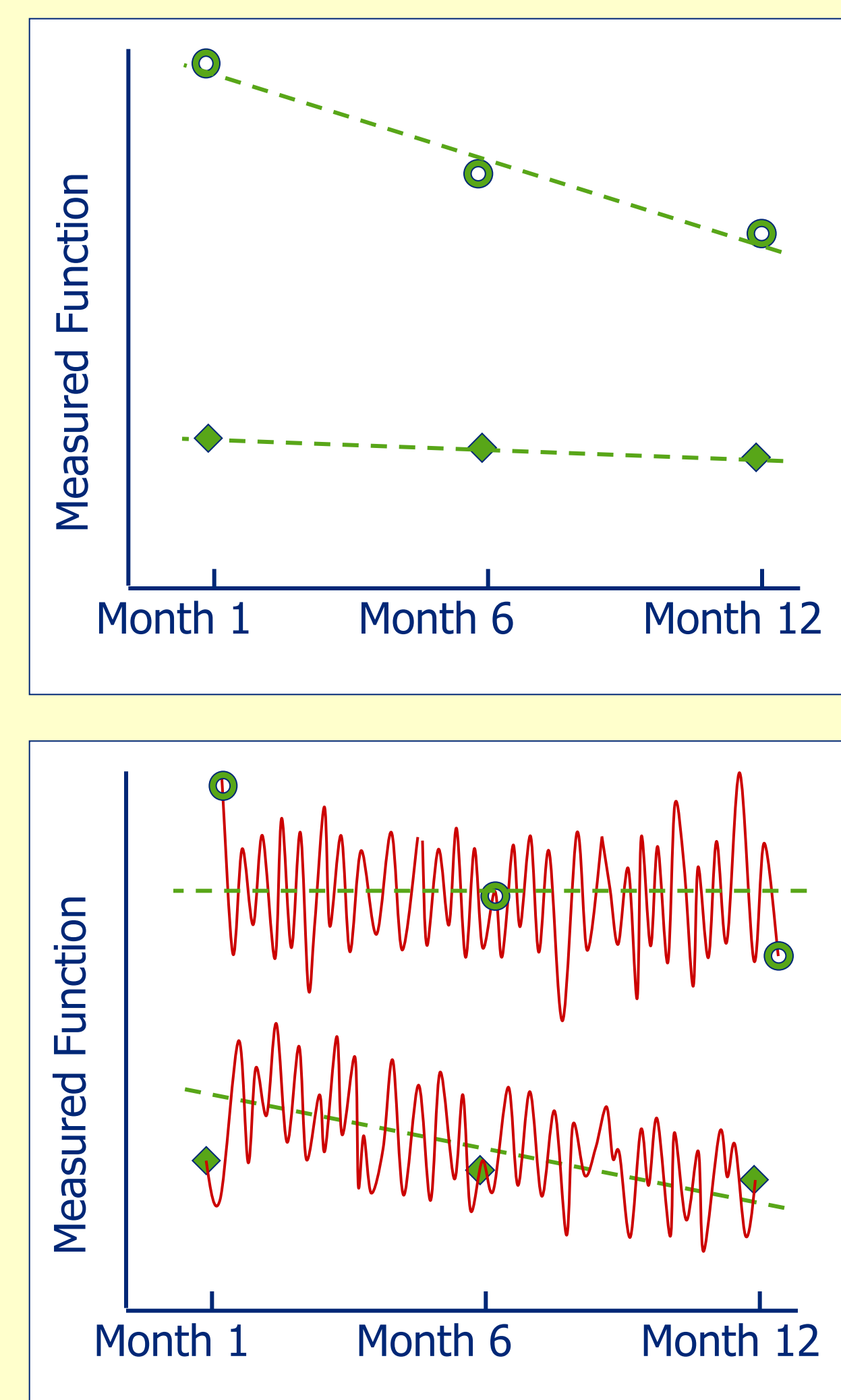
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BACKGROUND

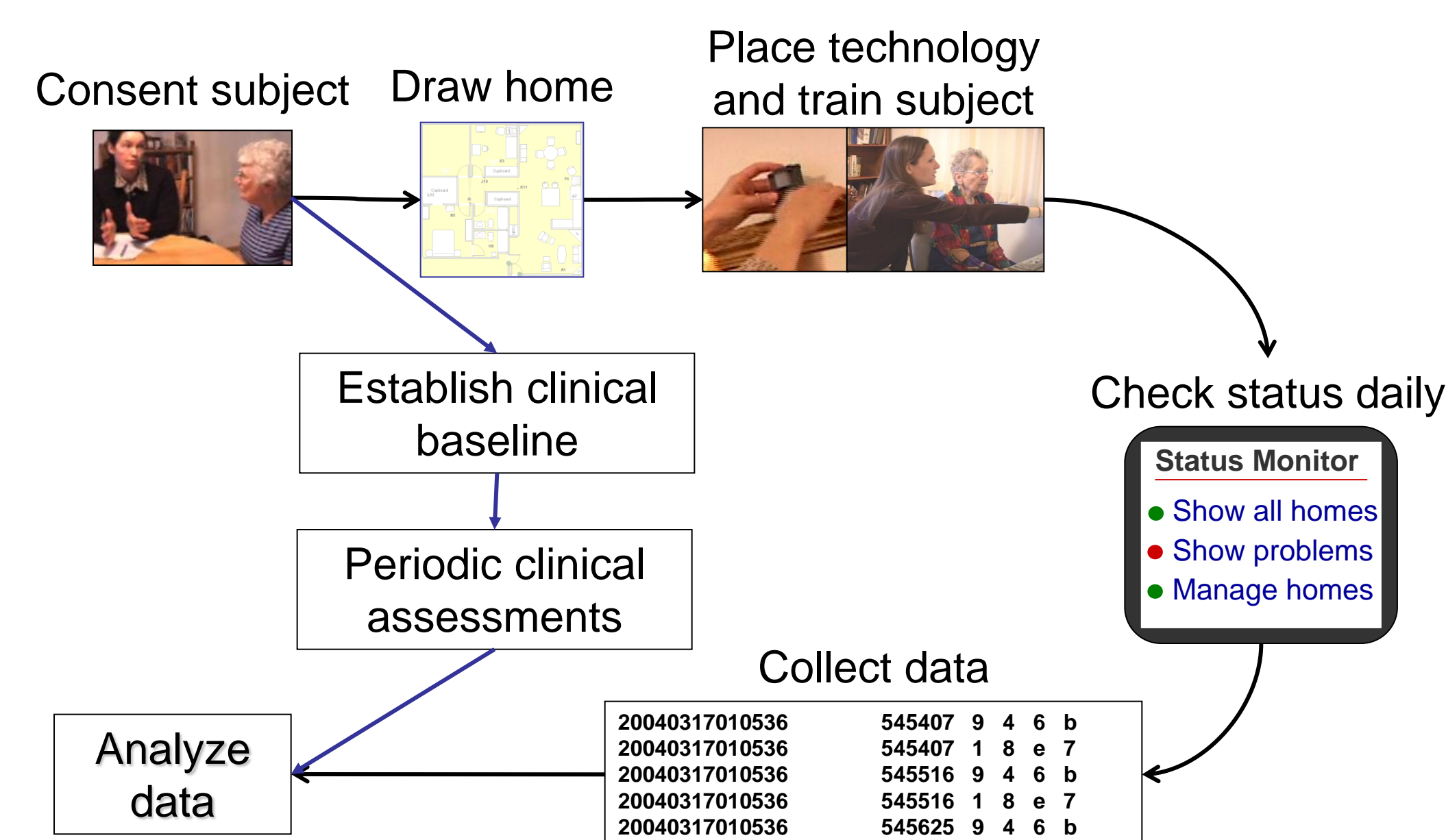
Cognitive impairment in the elderly often goes undetected or treated due to a failure to assess the patient in a timely manner. Currently, cognitive change is assessed, if at all, during a medical office visit. Because of normal variability in how a person feels on the day of a visit, and because visits are typically months or even years apart, it may take years to identify a clear trend in cognitive or motor measures that indicate the early stages of Alzheimer's disease.

Evolving sensor and other technologies now provide a means of early detection and intervention minimizing morbidity and cost. **We hypothesized that integrated, continuous and unobtrusive home monitoring of activity (motor and cognitive) could detect transitional or early signal events important for maintaining cognitive and physical health.**



METHODS

A 36-month longitudinal study using unobtrusive sensing technologies to continuously monitor physical activity and computer use for up to 300 healthy seniors in their homes. In parallel, a standard clinical assessment protocol is administered to detect incident cognitive decline. **Outcome measures include total daily activity, walking speed, weekly hours of computer use, and inter-keystroke interval** (as a surrogate for finger-tapping).



Longitudinal Cohort

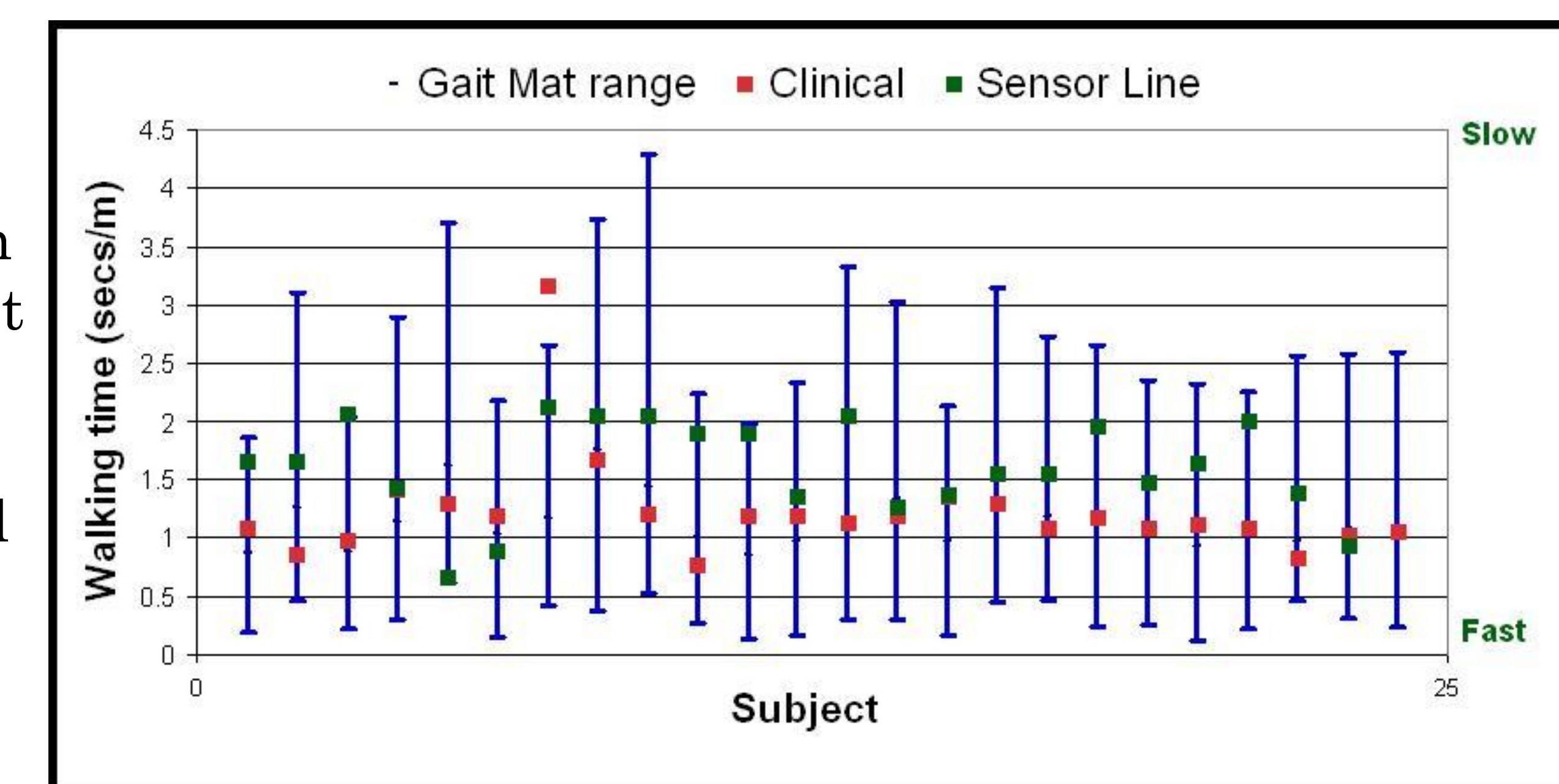
Over 300 subjects were screened; to date 236 subjects have been enrolled. Cohort characteristics are:

Age	84.1	5.1
Education	15.6	2.6 years
Sex	159 women, 77 men	
Diversity	14.8% non-Caucasian	
Living status	114 live alone	
Cognitive status		
MMSE	28.2	1.9
CDR	10% (CDR 0.5), 90% (CDR 0)	

RESULTS

Validation of Walking Speed Measures

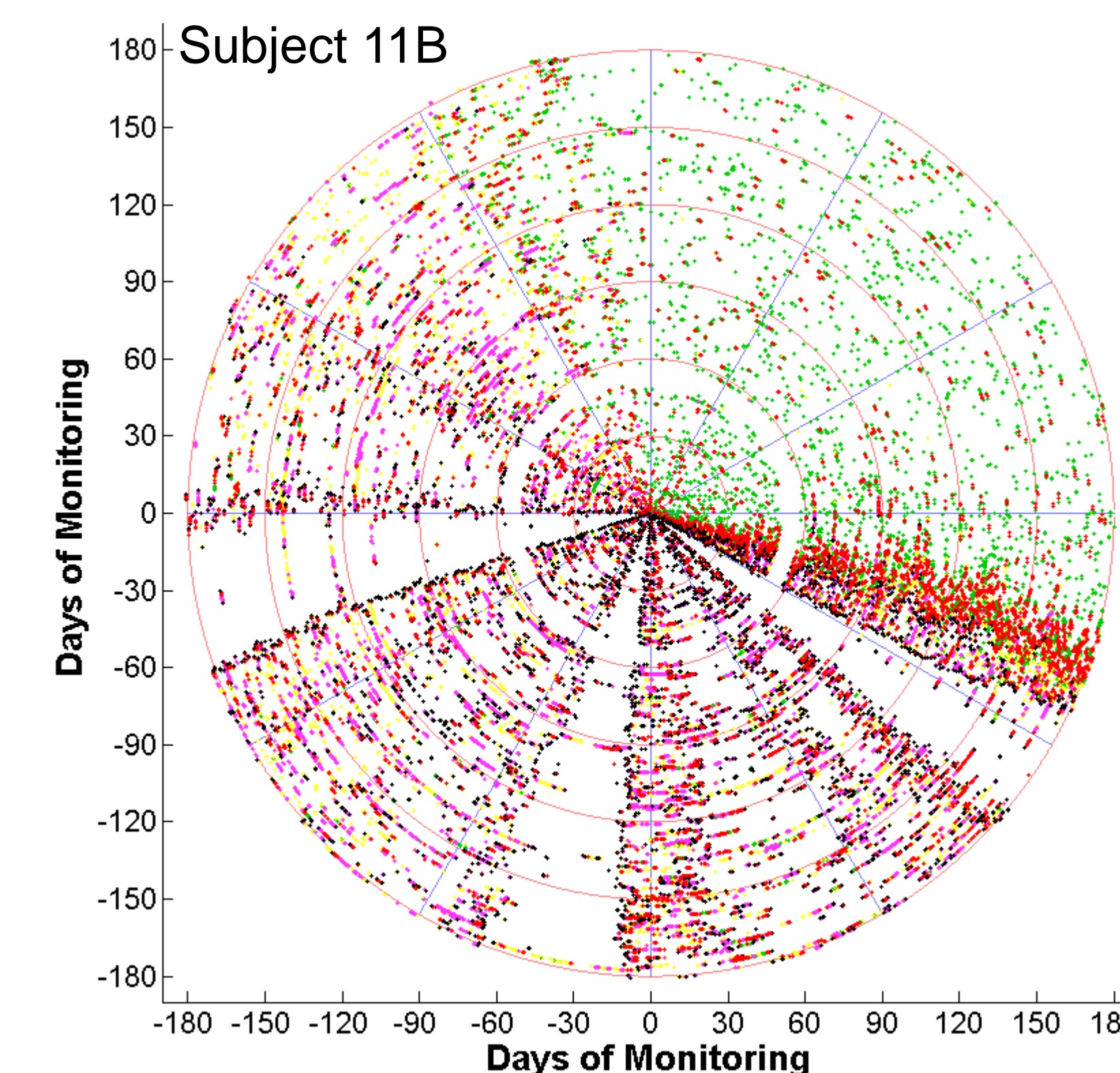
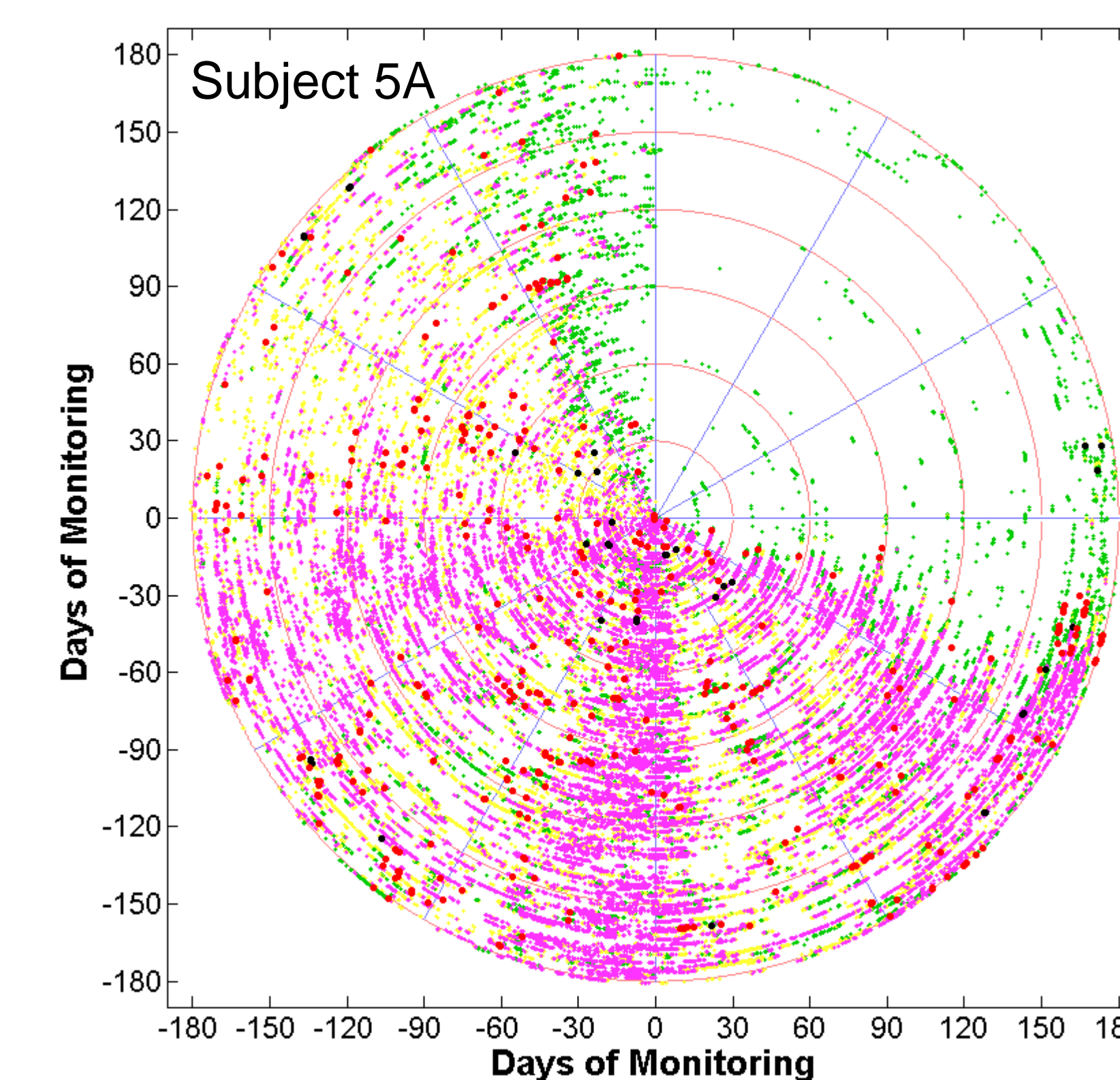
We examined the extent to which our unobtrusive measurements of gait velocity using passive infrared sensors reflects the actual gait velocity that would be observed in a clinical setting. Slow, medium, and fast gait speeds of 24 subjects were collected using a GaitRite mat (gold standard), and compared to the timed walk test (clinical standard) and the motion sensor data from the homes. In general, **our sensors in the home capture walking speeds on the slower side of "typical" for each subject; clinical time walk was on the fast side of "typical" for each subject.**



Exploration of Motion Sensor Measures

We have begun to explore the motion sensor data, which reflects patterns of movement in the home. The spiral plots to the right show motion activity for 6 months of continuous monitoring. Sensor firings on each day are plotted in concentric circles as a 24-hour clock. Each red circle represents the beginning of a month proceeding in time from the center outward. Colors represent location of activity sensor firing (green = bedroom; red = bathroom; black = front door; pink = kitchen; yellow = living room). Subject 5A lives in an apartment in the community. Subject 11B lives in a similar-sized apartment in a Continuing Care Retirement Community, where she takes her meals in a common dining room.

One can clearly see meal preparation (kitchen activity, in pink) for subject 5A and absence from the home during meals (subject 11B). However, note that the subject living in the CCRC is also much more social, as indicated by a large amount of door activity in black (leaving the apartment).



Computer use

One significant challenge for the study was training more than 200 elders on the use of a home computer. 217 participants, including 24 with MCI, have been trained to date. Of these, 191 (22 MCI) use their computer on a regular basis, logging on 2.7 1.9 days on average each week.