

## Evaluation and Integration of an Automatic Fall Prediction System

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<b>Organization:</b>	University of South Florida
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**Target Population:** Elderly\*

**Summary:** Falls among the elderly are a significant cause of morbidity, mortality, and increased end-of-life health care costs. Reducing the occurrence of falls can greatly improve patients' quality of life. This study seeks to develop a means to relate health and medication changes to falls and to provide measures to predict the risk of falls for elderly residents in assisted living facilities (ALF).

This project recruited 50 volunteer residents from two ALF facilities. Baseline standardized gait and balance (SGB) assessments were completed. The velocity, direction, and duration of the volunteer's daytime movements in common areas of congregate living settings will be tracked for 12 months by a movement tracking system (MTS) via radio frequency identification devices. Prospective and retrospective fall histories will be evaluated to determine the relationship of SGB and a measure of movement variability called "tortuosity," (Fractal D) derived from MTS data.

During the study interval, a complete evaluation of participant medications will be conducted, with particular emphasis on identifying and recording the number of psychoactive and non-psychoactive medications that each participant is prescribed. Each participant's activities of daily living (ADL) status will be measured at the time of enrollment, along with 12-month retrospective data from fall incident records. To the extent possible, information about the causes of falls will be obtained from ALF nursing staff using a fall assessment scale developed at the James A. Haley Veterans Administration Veteran's Integrated Service Network (VISN8) Patient Safety Center of Inquiry. This instrument will also be used to collect the 12-month prospective fall data. Medications, ADLs, and residents' history of falls will be treated as covariates in the regression analysis predicting fractal dimension and prospective falls.

The study team hypothesizes that SGB varies significantly with MTS tortuosity measures, allowing tortuosity to be used as a proxy for SGB assessments while yielding improved fall predictions.

### Specific Aims:

- Evaluate the relationship between conventional fall-risk assessment measures using performance on SGB tests and Fractal D movement tortuosity measures obtained through the MTS. **(Ongoing)**
- Evaluate tortuosity changes preceding a fall. **(Ongoing)**
- Gather requirements for a software module to perform online fall-risk assessment in community-based settings. **(Ongoing)**

**2010 Activities:** Recruitment materials were finalized and the equipment located in the two ALF research sites was upgraded to the latest standards of software and firmware to enhance reliability of the results. Subject identification and recruitment was started at both research sites. The team completed recruitment activities and the planned recruitment target of subjects was met.

As of September, all enrolled subjects provided both standardized gait and balance assessments and had generated Mini Mental State Examinations (MMSE) scores. The data from the gait and balance assessments is being prepared for formal analysis by project staff. Preliminary analyses were carried out on the gait and balance measures collected at each assisted living facility.

Fractal D data was collected on 60 subjects. The first set of subjects will complete 12 months of monitoring in February 2011. The team anticipates completing data collection in June 2011 with the targeted 50 subjects.

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**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2010):** Significant progress has been made and the project is ahead of schedule. Budget spending is roughly on target. Future tasks will focus on data collection and analysis.

**Preliminary Impact and Findings:** The mean age of the participants was 73.5 years (SD=12.2). The youngest was 37, the oldest 94. The youngest participant was almost 20 years younger than the next youngest participant. Partly because of the young age of the 37-year-old participant and partly because of the requirement that participants be able to undergo the SGB, the average age for this subset of participants was below the average for previously-published data for these two facilities. The average MMSE score was 18.8 (SD=6.95), on a 0 to 30 scale for which '0' is the lowest. The range and average MMSE scores were similar to previously reported results for participants in these ALFs.

Twenty (57.2 percent) participants ambulate independently. Of those who use assistive devices, one (2.9 percent) uses a cane, 12 (34.3 percent) use rolling walkers, and three (8.6 percent) use wheelchairs. The relatively even split between the 57 percent fully-ambulatory participants and those using mobility aids will be an important basis for classifying participants in future analyses when evaluating the SGB data. The 35 participants collectively generated more than 11 million positional data points. The number of paths ranged widely, from 48 to 4,987, yielding a total of 46,139 Fractal D scores. The Pearson product moment correlation between Fractal D and total MMSE was -0.46,  $n=35$ ,  $p=0.006$ .

In the present analysis, the negative correlations between the two subscales and Fractal D were the same value -0.442,  $n=35$ ,  $p<0.008$ . In both analyses, none of the correlations between the other subscales and Fractal D was statistically significant. The average Fractal D scores of the independent ambulators and those using aids such as canes, walkers, and wheelchairs were 1.27 and 1.26, respectively. The difference was not statistically significant ( $t=0.554$ ,  $df=33$ ,  $p=0.587$ ).

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**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

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\* AHRQ Priority Population