Early Ambulation and Length of Stay in Older Adults Hospitalized for Acute Illness

There are no therapeutic guidelines regarding ambulation for older adults hospitalized for acute illness. The importance of early ambulation to recovery in other patient populations is well established. For example, time to ambulation after hip fracture surgery is a predictor of complications such as prolonged length of stay (LOS). In the present study, we examined the association between ambulation and LOS in geriatric patients admitted for acute illnesses. We hypothesized that increase in ambulation within the 48 hours after admission would predict LOS after adjusting for risk factors.

Methods. Patients 65 years or older admitted to an Acute Care for Elders unit were studied. A Step Activity Monitor (SAM) was placed on patients at admission, and participants were instructed to walk as usual. Data were collected over 4 months in 2009. Patients with an orthopedic surgical diagnosis or a contraindication to wearing the SAM (eg, bilateral leg infection or severe edema) were excluded. Patients (N = 162) who spent 2 or more days in hospital were included in the analysis. Institutional review board approval was obtained.

The SAM is a pager-sized accelerometer attached at the ankle. It will not record leg movements in bed and has been shown to be 98% accurate in clinical populations. Steps were recorded in 1-minute intervals synchronized to a 24-hour clock, resulting in a temporal series of 1,440 observations per day.

Total steps were summed for each 24-hour day. A step change score was calculated using the difference in step totals between the first and second day. Mean daily steps increased their walking by 600 steps or more from the first to second day vs those who did not. Statistical analyses were performed using SAS version 9.2 software (SAS Institute Inc, Cary, North Carolina). Testing was 2-sided, and P < .05 was considered significant.

Results. Mean (SD) age was 77.4 (7.7) years; 35.7% were women; mean (SD) body mass index was 26.5 (6.5) (calculated as weight in kilograms divided by height in meters squared); and 21.4% reported a fall in the past year. Reasons for admission included cardiopulmonary (30.8%), infections (25.2%), and gastrointestinal (16.4%), neurologic (6.2%), and other (21.4%) complications. The all patient refined diagnosis related group severity of illness classification was minor (10.6%), moderate (43.8%), major (36.2%), and extreme (9.4%). Mean (SD) LOS was 6.1 (2.9) days (range, 4–26 days).

Prior to admission, 52.8% were independent ambulators, 35.2% used a cane or walker, and 12.0% required assistance. Patients averaged 662.1 (SD, 784.9) steps per day. Mean (SD) body mass index was 26.5 (6.5) (calculated as weight in kilograms divided by height in meters squared); and 21.4% reported a fall in the past year. Reasons for admission included cardiopulmonary (30.8%), infections (25.2%), and gastrointestinal (16.4%), neurologic (6.2%), and other (21.4%) complications. The all patient refined diagnosis related group severity of illness classification was minor (10.6%), moderate (43.8%), major (36.2%), and extreme (9.4%). Mean (SD) LOS was 6.1 (2.9) days (range, 4–26 days).

Physician activity orders at admission were “as tolerated” (53.0%), “ambulate with assist” (16.6%), and “bed rest” (29.6%).

Patients averaged 662.1 (SD, 784.9) steps per day. Mean (SD) number of steps for the first complete day was 300 to 599 steps; 600 to 1000 steps; and more than 1000 steps. Adjacent deciles in the range –100 to 100 steps were combined. The unadjusted mean difference in length of stay between those who increased their step total by 600 steps or more from the first to second complete day of hospitalization and those who did not was 1.73 days (95% confidence interval, 1.02 to 3.93 days); after adjusting for demographics and clinical characteristics (see “Methods” section), the difference was 2.13 days (95% confidence interval, 1.02 to 3.93 days).

Figure. Unadjusted step total change scores and step change score deciles by length of stay. Bars are mean length of stay for change score deciles: −300 steps or less; −300 to −100 steps; −100 to 0 steps; 0 to 99 steps; 100 to 299 steps; 300 to 599 steps; 600 to 1000 steps; and more than 1000 steps. Adjacent deciles in the range –100 to 100 steps were combined. The unadjusted mean difference in length of stay between those who increased their step total by 600 steps or more from the first to second complete day of hospitalization and those who did not was 1.73 days (95% confidence interval, 1.02 to 3.93 days); after adjusting for demographic and clinical characteristics (see “Methods” section), the difference was 2.13 days (95% confidence interval, 1.02 to 3.93 days).

Increased their walking by 600 steps or more from the first to second day vs those who did not. Statistical analyses were performed using SAS version 9.2 software (SAS Institute Inc, Cary, North Carolina). Testing was 2-sided, and P < .05 was considered significant.

©2010 American Medical Association. All rights reserved.
creased their step total by 600 steps or more and those who did not was 1.73 days (95% confidence interval, 0.60-2.85). After adjusting for demographic and clinical characteristics, the difference between groups was 2.13 days (95% confidence interval, 1.05-3.97).

We compared the 32 patients who increased their walking by 600 steps or more with all other patients. No significant differences existed by age, diagnosis, presence of tubing and/or monitoring equipment, fall history, number of comorbidity conditions, or illness severity. They were more likely to be men (P < .02) and independent ambulators (P < .01) and have an admitting order of “ambulate with assist” (P = .03).

**Comment.** Patients who increased their walking by at least 600 steps from the first to second 24-hour day were discharged approximately 2 days earlier than those who did not. Results suggest accelerometers may be useful in creating clinical thresholds for ambulation in hospitalized persons. These thresholds may not be excessively high; 600 steps correspond to approximately 12 minutes of slow walking. A limitation of the study is the possibility of reverse causation. Patients who increased their step count may have been less ill. This possibility should be explored in future studies. In conclusion, level of ambulation during the first 48 hours after admission was linked to LOS in geriatric patients. These results may inform future research investigating ambulation as an intermediate measure to health outcomes like functional status, service use, and LOS.

Steve R. Fisher, PT, PhD
Yong-Jang Kuo, PhD
James E. Graham, PhD, DC
Kenneth J. Ottenbacher, PhD, OTR
Glenn V. Ostir, PhD

**Author Affiliations:** Division of Rehabilitation Sciences (Drs Fisher, Graham, and Ostir), Division of Rehabilitation Sciences, Sealy Center on Aging (Dr Ottenbacher), and Division of Geriatrics, Department of Internal Medicine, Sealy Center on Aging (Drs Kuo and Ostir), University of Texas Medical Branch, Galveston.

**Correspondence:** Dr Fisher, Division of Rehabilitation Sciences, University of Texas Medical Branch, UTMB 301 University Blvd, Galveston, TX 77555-0460 (sfisher@utmb.edu).

**Author Contributions:** Dr Fisher had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Fisher, Kuo, and Graham. Acquisition of data: Fisher and Ostir. Analysis and interpretation of data: Fisher, Kuo, and Ottenbacher. Drafting of the manuscript: Fisher and Ostir. Critical revision of the manuscript for important intellectual content: Fisher, Kuo, Graham, Ottenbacher, and Ostir. Statistical analysis: Fisher and Kuo. Obtained funding: Ottenbacher and Ostir. Study supervision: Ostir.

**Financial Disclosure:** None reported.

**Funding/Support:** This work was funded in part by grants R01 AG031178, P30 AG017231-03, and K12 HD055929 from the National Institutes of Health.

**Role of the Sponsor:** The funding organization had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript.


**COMMENTS AND OPINIONS**

**Platelet Inhibition and Cancer Promotion**

I

n their interesting commentary, Floyd and Serebruany suggest how the potent platelet inhibitor, prasugrel, might promote cancer, as was seen in a large prospective trial. They postulate that platelets might inhibit in situ cancer from disseminating by trapping tumor cells in capillaries, and potent platelet inhibition limits this mechanism. However, recent data suggest other plausible causes for this association.

It has been shown in rodents that the platelet inhibitor, clopidogrel, increases the regulatory T-cell (Treg) pool and also increases splenic-derived endothelial progenitor cells. An increase in Tregs might impair host antitumor immune responses; indeed, Treg numbers in many solid tumors have correlated inversely with patient survival. In addition, it has become evident that endothelial progenitor cells promote tumor angiogenesis and are found more frequently in the peripheral blood and tumors of patients with more invasive disease.

Therefore, chronic platelet inhibition might promote cancer by enhancing Treg and endothelial progenitor cell numbers and function, leading to diminished host antitumor immunity and increased tumor angiogenesis. Furthermore, elderly subjects are more likely to harbor micrometastatic foci of tumor cells that might proliferate and disseminate as a result of this therapy. Finally, we encourage additional prospective studies on the long-term safety of potent platelet inhibition, particu-