This study assessed how landscape design influenced outdoor usage at assisted living facilities. After evaluating 68 randomly selected facilities in diverse climates, and surveying 1,560 residents and staff, several landscape features were found to be strongly associated with outdoor usage.

Because contact with nature is known to have significant health benefits, well-informed landscape architects may contribute to public health by improving the well-being of frail elderly residents in long-term care settings.

**Methods**

**Overview**

This study compared the objectively rated qualities of facility outdoor space with the outdoor usage levels of residents, to see if they spent more time outdoors in places with better-rated environments. At 68 randomly selected facilities, landscape features were rated using an evaluation tool based on previous research. Resident and staff survey results (N=1560) were compared with environmental ratings.
Facilities and Climate Regions
This study focused on assisted living, where most residents are still able to access the outdoors independently. Only facilities with 50+ residents were included, because problems with outdoor access were expected to be greater in institutional-size settings. To account for the effect of climate on outdoor usage, research was carried out in three distinct climate zones, chosen from the 10 primary emerging megapolitan regions of the US (13-14). In each area, approximately 20 facilities were randomly selected within a two-hour driving diameter in each region’s main city: Houston, Chicago, and Seattle. This resulted in 68 facilities, ranging from dense urban settings to outlying suburbs and towns.

Evaluating the Outdoor Environment
The main design concepts (hypotheses) tested in this study were derived from previous research and “best-practice” guidelines published by experienced landscape architects, architects, gerontologists and care providers (5-19); these sources generally agreed on the main environmental qualities that influence outdoor access for older adults. A set of core design concepts was extracted from the most commonly cited issues, and developed into a checklist-based evaluation tool. To maintain the reliability of the findings, the same team of trained researchers evaluated all sites, rating about 2+ spaces per facility.

Evaluation Tool
To test the design concepts, researchers evaluated the “usability” of each feature from the resident’s perspective. Thus, instead of rating a walkway as a physical object, it was rated according to how easily an elderly resident could navigate that walkway. Each of the core design concepts was evaluated by rating a cluster of environmental features that appeared to be the main elements embodying that concept. Each feature was rated on a scale of 1 to 10, with 1 being “an extremely poor example,” 5 being “average” and 10 being “the best that could be expected in this type of setting.” In pre-testing, the evaluation tool was found to have very high agreement between different raters (inter-rater reliability tests found Cronbach’s alpha and intraclass correlation coefficients in the mid 90s; higher than .70 is typically considered adequate reliability). In addition to 63 rated environmental features, several additional environmental elements and qualities were measured directly, such as the presence of an automatic door opener, light levels, or decibels of sound in an outdoor area.

Surveys
Resident surveys were developed to capture outdoor usage and landscape preferences; staff surveys were used to help confirm the resident surveys. After testing several pilot versions, the final surveys each had about 40 questions, with additional write-in responses. Residents (N=1128) completed surveys independently in small group settings, while staff (N=432) completed surveys individually. The average age of residents was about 84 years, with 79 percent women and 21 percent men. The average staff age was about 44, with 89 percent women and 11 percent men. Although staff members were of diverse race and ethnicity, residents were predominantly Caucasian, which is typical of assisted living in the U.S.

Analysis
Methods
Because all residents from a facility shared the same environmental conditions, an analysis method for clustered data was used in STATA (the Huber-White robust covariance estimator). As factor analysis did not lead to significant results, individual audit items were analyzed separately and only those items significant at the level of 0.10 were retained. The final model initially included all possible variables of interest in a linear regression model and used a backwards stepwise approach. At each step, the variable with the highest p-value (the lowest statistical significance) was removed from the model, until the significance levels of all the remaining regression coefficients were 0.10 or lower. While a significance level of 0.10 was used to develop the statistical model, when the analysis was complete, all the environmental features shown in the Results section below were highly significant (at the 0.01 level).

Controls
Aside from questions relating to the main outcomes, a number of personal variables were considered that might influence outdoor usage: gender, age, health, vision, history of falls, mobility, assistance needed with daily activities, urban vs. rural background, and attitudes and preferences about the outdoors. These items were included in the survey, and tested for their significance in the model; those found to be significant were controlled for in the analysis. This allowed each of the rated landscape features to be considered separately, to see how they influenced outdoor usage.

Results
Overview
The study found that the amount of time residents spent outdoors was substantially influenced by several landscape features evaluated by the core design concepts. There was also strong correlation between outdoor usage, levels of walking and physical activity, environmental satisfaction, and the self-reported health of residents.

Main Findings
Overall, this study found that many of the main features that have long been considered important by researchers and design practitioners, such as safe paving, good seating and strong indoor-outdoor connections, are actually measurably related to the outdoor usage of elderly residents, when all other factors are controlled for. The large number of residents used in this study provided enough statistical power to isolate each environmental feature and determine its relationship to resident behavior. In addition to being highly significant, the magnitude of many of these effects is quite large, when shown in a controlled statistical projection. Images 8-9 show the landscape features found to have the strongest correlation with behavior; these are grouped by magnitude of effect. The features shown in Image 8 were found to increase outdoor usage up to 3.5 times; and the features in Figure 9 had an even stronger impact on outdoor usage. Several other features also increased outdoor usage to a lesser extent.
Discussion

Importance of Findings
Collectively, these findings show that the quality of the outdoor environment is strongly linked to important health-related measures and behaviors. For example, Image 8 shows that the feature with lowest impact (‘the outdoors can be reached entirely by paved walkways’) still increases the amount of time spent outdoors substantially—by an additional 51 minutes per week. Anyone working with older adults in residential care settings knows how hard it is to influence habits such as outdoor usage or physical activity, and this would be a substantial improvement. Image 9 shows that the environmental feature with the highest impact (‘the outdoor area has good views of birds and wildlife’) is associated with a nearly 10-fold increase in outdoor usage - from 118 minutes per week to 1,032 minutes per week. This is the equivalent of going from about 27 minutes per day to nearly two and a half hours per day, which would be a radical change. As a statistical projection with all other variables held constant, this model does not reflect what would necessarily happen in actual experience, with multiple variables operating in each case. Nonetheless, these results suggest that the qualities of the landscape are likely to have a significant and powerful impact on outdoor usage in long-term care settings. Although some features considered important were not found to be significant, this may possibly be due to correlations among similar features that canceled each other out in the statistical model.

Other Variables Influencing Outdoor Usage
Several other factors were found to be significant and were controlled for in the analysis. Age was negatively correlated with outdoor usage, and people using walkers or wheelchairs spent less time outdoors. Women and men had roughly equal outdoor usage, but people with pets spent considerably more time outdoors. People who reported they “cared very much about being outdoors,” “felt more free outdoors than indoors,” and/or “preferred to walk outdoors rather than indoors,” also spent more time outdoors. Surprisingly, people spending more time outdoors were also more worried about falling outdoors; this might be due to having more opportunities to notice existing hazards and barriers in the environment.

Future Studies
Further research could build upon this study, using structured interviews, behavior mapping, and design interventions that measured the difference in outdoor usage between an existing environment in which one of the landscape features had been modified.

Application to Landscape Architecture Practice
In a society with diminishing resources and a rapidly aging population, it is increasingly important to find cost-effective ways to promote and maintain health in older adults. Landscapes that promote healthy behavior have the advantage of being relatively permanent and inexpensive after initial investment. Unlike programmed activities that require the ongoing cost and availability of staff to provide continued services, the environment can provide health-promoting opportunities on an ongoing basis, at the cost of basic upkeep and maintenance. These findings can help landscape architects design outdoor environments that support the actual needs of residents, and can also help convince decision makers to increase budgets for user-friendly landscape design and improvements. Although this study was conducted in assisted living, most of the concepts also apply to other levels of care such as nursing facilities, senior apartments and CCRCs (continuing care retirement communities). The core design concepts have been incorporated into a DVD-based educational program (20) which is now available to practitioners. The evaluation tool used in this study is being further developed for use by design practitioners and administrators, and will soon be available as well.

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Susan Rodiek, Architecture
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Adam Panter, Architecture
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External Experts
Clare Cooper Marcus, UC Berkeley
Lois Cutler, University of Minnesota
Teresa Hazen, Legacy Health, Portland, OR
David Kamp, Dirtworks, New York, NY
Jack Carman, Design for Generations, LLC
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