

# Active Living through Interior Design: Senior Residential Environments and Affordable Assistive Technologies

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## EXECUTIVE SUMMARY

### PURPOSE OF STUDY

The purpose of this project was to:

1. Explore older adults' initial perceptions and attitudes toward currently available interior design features and ambient assistive technologies that would support active living at their homes in relation to their age, gender, educational attainment, and current health and physical activity levels;
2. Provide design guidelines and policy-level recommendations for healthy residences that support active lifestyles of older adults who would like to age in place; and
3. Obtain preliminary data by identifying gaps between existing technologies and current and future needs of older adults to guide the design and construction of a transportable mock-up for further data collection and community education.

### RESEARCH SUMMARY

While most older adults of varying income and ability levels prefer to age in place, the majority of residences lack the necessary design features to support independent living. Beyond the need to modify and adapt homes of the growing

senior population for basic safety reasons, such as preventing falls, residential environments should also promote healthy lifestyle behaviors among older populations, such as getting regular physical activity, which could reduce the chronic disease burden in this population, and improve their overall health. One approach to promoting physical activity and less sedentary behavior is "active living," defined as integrating any form of physical activity into daily routines. Since older adults spend a majority of their time indoors, and tend to have reduced mobility and agility compared to younger groups, examining the interior built environment and design factors that would support active living in their homes has great potential. This includes promoting healthy lifestyle behaviors for physical and mental health, and preventing (or at least slowing) the onset of a chronic condition.

This study addressed how environmental modifications and interior applications of electronic and non-electronic assistive technologies can support active living of older adults of varying income levels, going beyond basic accessibility factors. Through a survey conducted online and in-person at various sites with a diverse group of older adults (n = 130), and a focus group study preceded by a hands-on educational session (n=15), we examined seniors' initial perceptions and attitudes toward currently available interior design

features and ambient assistive technologies that would support active living at their homes. The focus group discussions identified the barriers to adoption, gaps between existing technologies, and current and future needs of seniors for active living. The findings underscore the necessity of affordable, less complex technologies at home. In addition, they demonstrate how older adults are willing to invest in safety-enhancing technologies that would support independent and active living at home even if such technologies are not the most affordable options. Privacy concerns and return on investment emerged as the most significant barriers to high-tech assistive technologies, highlighting distrust in technology and financial concerns as underlying factors for older adults' technology acceptance at home.

## IMPLICATION HIGHLIGHTS

- **Educate and encourage.** Designers should promote the benefits of assistive technologies for active living and independently aging in place to their clients. Attitudes and intentions to use change when people are knowledgeable about their options, and learn about how technology can improve safety and independence at home.
- **Engage and accommodate.** Designs and products should be tailored to individual needs, and engaging older adults in the design process will help design places that will accommodate current and future needs. Interior design professionals can propose custom applications of ambient assistive technologies to better respond to user needs and preferences.
- **Keep it simple and affordable.** Interior designers need to be cognizant of functionality and complexity of the design products and technologies as well as the preferences and abilities of the users. Low-tech, affordable products that can support physical activity and reduce sedentariness will be more easily adopted by seniors.

- **Advocate.** Interior designers can advocate for disadvantaged groups regarding financial assistance programs and policy-level changes, as well as educate lower-income older adults on financial assistance options through national, state, and other programs.



## ACTIVE LIVING AT HOME THROUGH INTERIOR DESIGN

### BACKGROUND

Health-related building standards, such as the WELL Building Standard, v.2.1 (2018), already encourage the implementation of design strategies and technologies in the built environment to support physical activity and reduce sedentariness. One approach to promoting physical activity and less sedentary behavior is “active living,” defined as integrating any form of physical activity into daily routines, such as household activities, taking the stairs, or gardening, as well as participating in more traditional forms of physical activity (Sallis, et al, 2006). However, most research on barriers to, and opportunities for active living, has been at the neighborhood and urban scale, examining walking and bicycling, or addressing accessibility factors in interiors. Since older adults have reduced mobility and spend a majority of their time indoors, examining the interior design factors and assistive technologies that would support active living in their homes has the potential to uncover new ways that interior environments can promote healthy behaviors.

While accessibility-oriented features dominate the current research on the interior-scale environmental factors of homes and residential environments in supporting or inhibiting seniors' active living and sedentary behavior, there is a "lack of quality research that goes beyond prototype development or descriptive research, and examines the relationship of assistive technologies and active living" (Ahrentzen & Tural, 2015, p. 595). The main goal of this study was to fill this research gap, and address how environmental modifications and interior applications of electronic and non-electronic assistive technologies can support active living of older adults of varying income levels, going beyond basic accessibility factors.

## METHODOLOGY

Data were collected using the following tools:

- A survey questionnaire with visuals (photographs and short videos) and brief textual information that explained the use, benefits, and cost ranges of active living features, and
- A focus group study following a presentation on active living features and hands-on exploration of select assistive technologies.

The survey design was based on a modified version of the Technology Acceptance Model (TAM) framework to predict user acceptance of any technology, based on perceived usefulness, perceived ease of use, and perceived affordability factors (Davis et al, 1989; Orillaza, Orillaza & Barra, 2014). The survey incorporated previously validated questions from TAM questionnaires and national health surveys. The survey categories for active living were defined: (1) by developing a database for active living supportive design features and assistive technologies through existing listings, literature, and assistive technology websites, and (2) through the use of AbleData database, maintained by the Department of Health & Human Services' (HHS), National Institute on

Disability, Independent Living, and Rehabilitation Research (NIDILRR), and its product categories.

The survey questionnaire included 12 low-, medium-, and high-tech features with a variety of cost ranges, and representative of the 4 selected active living categories—housekeeping, environmental controls, safety and security, and environmental adaptations. Additionally, we inquired about a comprehensive smart home/home automation system.

In this study, we recruited 130 participants using three different approaches:

1. Virginia Tech Center for Gerontology Older Adult Research (OAR) registry (n=77) to complete the online survey,
2. NRV Agency on Aging lunch program (n=38) to complete the self-administered survey at community meal sites, and
3. Warm Hearth Village (n=15) to complete the same self-administered survey following a hands-on education session, and to participate in a focus group to help clarify older adults' attitudes and potential use of home design features and technologies identified in the survey.

We chose these sites because the people they serve include non-institutionalized adults living independently who represent diverse age and socioeconomic groups within the older adult population. Specifically, enrollees in the OAR registry represent individuals who have high educational attainment and use the internet, yet represent diverse socioeconomic backgrounds. Their participation was useful in that it allowed the research team to learn if the survey was effective when conducted online. The participants in the lunch program tend to have low fixed incomes, yet represent individuals of great age (i.e., 90+ years) and varying mobility and other physical disabilities, while remaining cognitively intact. The potential participants in the focus group were also likely to represent a wide range of age, income, and physical ability levels. We provided an incentive to all participants for their time and input.

## KEY FINDINGS

The following are the highlights from the survey results:

- **Predictors of attitude toward active living products:** Age, income, IADL independence, and having an internet connection at home are statistically significant predictors of attitude for most products and design features.
- **Predictors of intention to use:** Among the TAM factors, perceived usefulness is the most consistently significant predictor of future intentions to use these products. Perceived affordability is particularly significant for high-tech, smart products.
- **Attitudes toward active living supportive assistive design features:** Older adults' attitudes are most positive toward affordable, low-tech features, such as non-slip ice carpet and amber night-lights. Attitudes toward less affordable safety-related/IADL-supportive features, such as stove fire prevention devices and sensor-based switches, were also quite positive—a possible indication that older adults can be more willing to invest in less-affordable design features if they perceive that those products will provide increased safety and IALD independence.
- **Perceptions of smart technologies and home automation:** The attitudes and intention to use smart home technologies were less positive compared to low- and medium-tech categories, as they received the lowest perceived affordability scores. However, as expected, the results differed among the lower-income/meal site participants, and the other groups.
- **Methods of information delivery:** The differences in attitudes toward and intentions to use were not statistically significant for different data collection methods—online, in-person at meal sites, and in-person after the hands-on education session. However, between-group comparisons indicated a difference in intentions to use certain design features, for example vertical mobility and smart assistive devices, among the online group

and the in-person group who participated in the education session and the focus group. This points to the potential impact of community education by seeing and testing the actual design products in shaping older adults' perceptions and attitudes toward design features that may help them to independently and actively age at home.

The following themes emerged from the analysis of the focus group data regarding the factors that most influence community-dwelling older adults' attitudes and intention to use active living assistive features:

- **Fear of falling:** Older adults tended to evaluate and discuss the presented assistive technologies from a fear of falls framework: whether the product may help prevent future falls, or whether it poses a fall risk. Some examples of how fear of falls shapes attitudes and intentions include whether an ice carpet would prevent falls or pose a tripping hazard; whether someone would need to replace LED bulbs less frequently—leading to a decreased risk of falls from a step ladder; and whether pull-down shelving would prevent a fall from a step stool when one tries to reach upper kitchen cabinets or holiday decorations from less frequently used upper storage units.
- **Accessible storage:** For community dwelling adults, having sufficient and accessible storage seems to be of great significance. Whether this is related to increased material possession attachments with age or downsizing and moving to continuing care communities, being able to store and safely reach their belongings surfaced as a priority and a problem in older adults' current homes.
- **Aesthetics/unobtrusiveness:** Older adults value how others view their homes. Comments such as “having a regular look,” “being able to store away [halfsteps],” or “collapse the handrail to look like a regular one” highlight the cultural judgments regarding independence and dependence, or having or not having a disability. Thus, acceptance for assistive technologies for aging in place relates to cultural attitudes toward disability, as well as aesthetic aspects of designs.

- **Person-environment fit:** While older adults “like[d] the concept” for several assistive technologies, they emphasized the need to adapt the designs for varying physical abilities of users. For example, they underscored how certain vertical mobility assistive devices (stair-steady handrail or half steps) would not be functional if they are installed only on one side of the stairs for people who are weaker on one side of the body.
- **Technology inconveniences/skepticism:** Older adults worry about the problems technology may cause in their homes, such as not being able to complete the tasks due to technology failure. Another issue is the rapid changes in technology and the fear that an investment made in smart technologies today that may be obsolete in just a few years.
- **Privacy concerns:** Smart technologies are perceived as a treat to personal privacy and security. Aware of the recent privacy breaches of major companies, some older adults are cynical about smart home devices. “Until they get industry standards for security systems, I will run the other way,” one participant said.
- **Return on investment:** Another factor influencing older adults’ decisions to incorporate smart home technologies is whether they would get a return on investment at resale. Even the older adults with higher incomes have financial worries for the future, and thus are hesitant in investing in technologies that would not necessarily “pay off.” As one participant who recently went through selling a property stated, “When you do things like this, there is a smaller and smaller market. People want you to have nifty things like this, and very high-end finishes, but are not willing to pay for it.”

## PRESENTATIONS

- Tural, E., Brossoie, N., Renard, H., & Tucker, L. (2019, March). *Take the Stairs: Exploration of Older Adults’ Intention to Use and Attitudes Toward Vertical Mobility Assistive Design Features* Paper accepted for presentation at the 2019 Interior Design Educators Council (IDEC) Annual Meeting, Charlotte, NC.
- Tural, E., Brossoie, N., Tucker, L., Renard, H., & Meaney, K. (2018, June). *Design and assistive technologies for active living at home: a survey of community-dwelling older adults*. Paper presented at the Environmental Design Research Association (EDRA49) Conference, Oklahoma City, OK.
- Tural, E., Obeidat, L., Wagner, M. (2018, March). *Supporting active living at home through interior design: older adults’ acceptance of interior design features and assistive technologies*. Paper presented at the 2018 Interior Design Educators Council (IDEC) Annual Meeting, Boston, MA.



## RESEARCH BIO

**ELIF TURAL, PHD** is a design educator and researcher that has a multidisciplinary design background with degrees in architecture, interior architecture, environmental design, and planning. Her work focuses on design factors for active living with a focus on senior residential environments, and health aspects of green and affordable housing.

**LISA M. TUCKER, PHD** has been a practicing interior designer and architect for 20 years with a specialization in sustainability and historic preservation. She is a professor at Virginia Tech and teaches courses on biophilic and sustainable design and upper level design studios, and is the program chair and graduate program coordinator for Interior Design.

**NANCY BROSSOIE, PHD** is a senior research faculty member at the Center for Gerontology with a research interest in the concepts of aging in place and livable communities. She is a founding member of the Aging in Place Leadership Team of the NRV (AIP) to promote area housing options and housing programs that support older residents' ability to remain in their homes for as long as possible.

**HELENE RENARD** is an associate professor of interior design at Virginia Tech's School of Architecture + Design, a registered architect, and practicing artist and designer. She holds a Bachelor of Architecture degree from The Cooper Union and a Master of Architecture degree from Cranbrook Academy of Art.

**KATHLEEN MEANEY** is an assistant professor of graphic design at Virginia Tech. She is a designer and educator whose writing has been published through the AIGA, UnderConsideration, Icograda, and Design Observer.