

# Emerging Technologies for Aging in Place

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## INTRODUCTION

Extraordinary societal changes in the United States have taken place from both human and technological perspectives. Life expectancy continues to increase, due to improvements in both medical care and technology. Older adults, 65 years plus, comprise about 12.4% of the United States population with about one in every eight Americans being in this age group (U.S. Administration on Aging, 2002). By 2030, the percentage will have increased to 20% of the total population representing twice the number as in 2000. Those 85 years and older represent the fastest growing group (He, Sengupta, Velkoff, & DeBarros, 2005).

Older adults in the United States not only are living longer, but many are staying longer in their homes before entering institutionalized care. Compared to past generations, an unprecedented number of adults sixty years and older are aging in place. In 1985, there were approximately 5.5 million functionally disabled elderly living in their communities and an additional 1.3 million living in nursing homes. Each of these figures is projected to double to 10.1 million and 2.5 million; respectively, by 2020 (Manton, 1989). This is significant from both individual and national perspectives in terms of the burden of skyrocketing healthcare costs.

The U.S. Bureau of the Census (Fields & Casper, 2001) has reported that more than 55% of older adults live at home with their spouse. The number of adults living *without* a spouse increases with age, with about 50% of women aged 75 years and older living alone at home. Many older adults prefer to age in place rather than in an assisted living facility (Riche & MacKay, 2005), citing independence and social interaction as being critical to their well-being (Hirsch, Forlizzi, Hyder, Goetz, Kurtz, & Stroback, 2000). Complicating the choice to age in place are health and other personal limitations that necessitate continuous care. About seven million older adults over 65 years are estimated to have

mobility or self-care limitations (U.S. Administration on Aging, 2002).

Similar to other nations, the United States faces a critical challenge in dealing with an aging population that has unprecedented life expectancies. Emerging technologies offer the hope of allowing older adults to remain in their homes longer by empowering individuals to manage daily activities while dealing with chronic health conditions and age-related diseases. These technologies increasingly target a home environment whereby on a regular basis an individual can obtain assistance in performing daily living activities, stay connected to family and friends, manage medication, and be monitored for health-related changes. As important as these assistive technologies are for individuals and families, their potential for positively impacting the United States economy by changing the model of healthcare delivery is equally huge.

## BACKGROUND

Recent advances in “assistive technologies” offer older adults the ability to function independently and to age with dignity in their homes and communities. The U.S. Administration on Aging (2005) formally defines an assistive technology as being any service or tool that helps the elderly or disabled perform activities they have always done, but must now do differently. Assistive technology includes communication equipment, computer access, tools for independent living, education, and mobility aids, among others. Table 1 provides a summary of current and emerging assistive technologies.

The availability of assistive technologies for an older adult often determines whether he or she is able to live independently or must move to an institutionalized environment. The National Council on Disability (1993) found that 80% of older adults who used assis-

Table 1. Types of assistive technologies with emerging trends

Type	Assistive Technology
Adaptive Switches	Devices that are used to adjust home systems, including air conditioners, computers, answering machines, and power wheelchairs among others. Emerging technologies include “smart homes” with sensing systems that manage the overall home environment.
Communication Aids	Technology that promotes social interaction, telecare, and other types of communication to promote functional independence. Emerging technologies include the use of Personal Digital Assistants (PDAs), personal computers, and tablets to connect an older adult to an external support system of family, friends, or healthcare personnel.
Computer Accessibility Devices	Software or hardware that supports computer and Web accessibility. This includes screen reader devices, specially designed keyboards, and others. Emerging technologies include user-interface designs of computer, handheld, and mobile devices that promote universal access.
Home Modifications	Construction or modifications that allow an older adult to overcome a physical barrier that might impede living at home. Emerging technologies are illustrated by sensor devices in the floors to detect falls.
Independent Living Aids	Technology that allows an older adult to function independently in the home. Grab bars in bathrooms and hallways are more traditional illustrations of this type of technology. Emerging technologies include medication management (e.g., talking medicine cabinet), and electronic prompts (e.g., close refrigerator), among others.
Mobility Aids	Technology that supports an older adult being mobile within and external to the home environment. Emerging technologies include Global Positioning Systems (GPS) built into mobile devices as a means of identifying a person’s location outside the home.

tive technology were able to reduce their dependence on others. Assistive technologies not only support the aging adult, but also the family and friend caregivers. Most often, technologies that increase the independence of an older adult will decrease the time required for caregiving assistance (Mann, 2001). Assistive technology and home modifications have also been found to provide caregivers immediate relief from burden, reduce their stress, and help them provide care more easily and safely (Gitlin, Corcoran, Winter, Boyce, & Hauck, 2001). This is significant from an aging in place perspective, given that many adults with chronic conditions and age related diseases are cared for by an aging spouse may also suffer from a chronic medical condition.

Many of the emerging technologies are being developed to be used in both home and community environments. They provide an opportunity to improve independence, and safety thus promoting aging in place initiatives (Tran, 2004). Some research efforts are building on existing technologies in order to take advantage of communication and information infrastructures. The Internet along with online information sources, for example, offer a means for older adults to engage in lifelong learning and healthcare management thus promoting quality of life while aging in place. Recent

advances in wireless and wired communication provide the technology for home monitoring systems, social interaction, and the potential for virtual support systems linking an older adult to geographically dispersed family and friends. Emerging areas of technology include artificial intelligence and robotics with the opportunity of providing intelligent feedback to the elderly living at home.

## EMERGING TECHNOLOGIES

Two types of technologies are being developed currently that promote aging in place depending on the *category of impairment* associated with the individual. (Refer to the definitions in Appendix A of this article for a description of the three levels of impairment). Becker and Webbe’s (2006b) Buddy Coordinated Healthcare System, and Scott and Gabrielli’s (2005) Ho’alauna (“Good Neighbor”) Tablet projects focus on older adults who have mild or moderate levels of impairment. The underlying concept is to utilize technology to promote independent functioning in both home and community environments. These projects are considered “noninvasive” in that the individual has control over data gathering and dissemination using the proposed technologies (Becker & Webbe, 2006a).

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