THE IMPACT OF ASSISTIVE TECHNOLOGY DEVICE USE ON THE PARTICIPATION LEVELS AND LIVING ARRANGEMENT DECISIONS OF OLDER ADULTS

by

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ABSTRACT

JUDITH ELLEN WALSH. The impact of assistive technology device use on the
participation levels and living arrangement decisions of older adults.
(Under the direction of DR. JENNIFER L. TROYER)

Using a nationally representative sample of older adults, this dissertation examines the use of assistive technology devices (ATDs) designed to aid with mobility and sensory functioning and to improve one’s capacity to perform activities of daily living. It measures the impact of ATDs on the participation levels and living arrangement decisions of those needing help. Although the use of these devices has been found to improve functionality, their effectiveness in relation to further outcomes has not been affirmed. The first essay considers whether an individual's ATD use has a positive impact on active participation in activities such as visiting family and friends, attending religious services, joining clubs, going out for enjoyment and volunteering.

Another advantage of improved physical functioning would be the older individual's ability to remain in his or her home, as opposed to transferring to a residential care setting. Little research has examined the determinants of living in residential care, versus in the community, and none has examined the use of ATDs in this choice. The second essay considers correlations between living arrangements and the use of ATDs. Finally, the third essay considers whether using assistive devices is associated with a lower probability of living in a residential care environment, controlling for many other health, social and economic factors.

DEDICATION

To my mom, Mary Chew, who has long been my inspiration...

To my son, Patrick, whom I hope I have inspired...

To my family and dear friends in the real world who patiently waited for me to get my life back...

and

Finally, to Dave, who knows that I could never have made it through this wonderful journey without him.

I love you all!

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As with any important endeavor, the four year-experience of earning a PhD can leave one feeling somewhat egocentric. As you gain the knowledge and experience that might change the world, you must also forego valuable time with family and friends who often need you. So I would be seriously remiss if I didn't thank those who helped me come to grips with this dilemma including my dear friend and carpool buddy Ada. I am amazed there are any global problems remaining to be solved. To MJ, my frequent lunch companion and tennis player extraordinaire, thanks for helping to bring sense to the world of academia. Thanks to all of the classmates at the University of North Carolina at Charlotte who have offered their advice and kind support in getting through the dissertation process. I wish you all success and happiness!

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INTRODUCTION

Data from the U.S. Administration on Aging (AoA, 2012) show a change in the demographics of the American population that has been accelerated since 2010 by the aging of the baby boomer generation, and which could significantly increase Americans' health and long-term care costs. Older adults, those aged 65 and over, now number over 43 million or 13.7% of the total U.S. population and are projected to reach 72.8 million by the year 2030. In that same time period, and perhaps more critically, the portion of that group over age 85 will increase by 10.6% (U.S. Census Bureau, 2012 & 2013, see Appendix A).

Aging is often accompanied by increased risk of certain diseases and disorders with large proportions of older Americans reporting a variety of chronic health conditions such as hypertension, arthritis and presbycusis (high frequency symmetric hearing loss). These chronic conditions can result in symptoms that affect the functioning of the mind and body, and ultimately lead to problems in performing basic mental and physical actions (Verbrugge and Jette, 1994). As a result, the proportion of those who need help with activities of daily living (ADLs) and instrumental activities of daily living (IADLs) increases significantly with age. For example, according to the AoA (2012) the number of those who report needing help with bathing increases from 6% at age 65 to 24% at age 85. Similarly it estimates that 17% of all individuals age 65 report needing assistance with walking, but this figure climbs to 46% of those over age 85.

This aging trend has considerations for long-term system and support costs. According to a report from the American Association of Retired Persons (Redfoot, Feinberg & Houser, 2013) in 2010, there were 7.2 potential informal caregivers (described as those aged 45-64 or the average age of caregivers) for every person age 80-plus. By 2030 however, that caregiver ratio is expected to become 4 to 1 and by 2050, when all boomers will themselves be in late life, the ratio drops to less than 3 to 1. This care gap could mean more people having to turn to institutional care, with higher costs for remaining family members and society, in the form of Medicare and Medicaid, which have become major payors for both health care and long-term care costs. While overall costs for health and personal care services offered in the home and in residential care communities have risen 38.4% since 2005, the Centers for Medicare & Medicaid Services (CMS) report that their combined expenditures for these same services have risen by 47.9% (Centers for Medicare & Medicaid Services, Office of the Actuary, National Health Statistics Group). This represents a sizable burden on the American taxpayer. The ideal solution would be to improve the long-term health of our citizenry, but in the interim, policymakers should search for options that focus on reducing task demand to reduce disability and improve the independence of older Americans.

The use of Assistive Technology Devices (ATDs) could represent both a temporary and long-term policy solution and could alleviate some of the burden on these publicly-funded programs. ATDs are tools that help people with physical limitations perform activities they might otherwise be unable to perform. Verbrugge and Sevak (2002) have shown the efficacy (the reduction in task difficulty for performing basic actions) of assistive devices use. But while use of these devices has been found to improve functionality, their effectiveness in relation to other outcomes has not been affirmed. As described in the following section, the World Health Organization's International Classification of Functioning, Disability & Health Framework (ICF) indicates that improved functionality may come to fruition through active participation in social activities. Social Capital Theory suggests that this social integration leads to improved overall health, as well as other individual and societal benefits (Scheffler et al., 2010).

In this dissertation, the first essay examines the ties between the use of assistive devices, for those with mobility or sensory impairments or those who need help in performing critical daily activities, and participation by older adults in five separate types of social activities. The use of hearing aids emerges as an important predictor of how likely people are to participate in the selected social activities.

The literature suggests that the disablement process affects living arrangement decisions as well (Reinardy and Kane, 2003; Verbrugge and Sevak, 2002). As a buffer against disability, the use of ATDs could also be a factor when deciding whether an older adult remains at home or transitions to some type of residential care community. In the past, as someone grew older and started needing help with everyday tasks, it was a signal that it was time to move in with family or go to a nursing home. Today there are many more choices for those who need some care. The use of ATDs may facilitate individuals maintaining their independence and "aging in place," defined by the U.S. Centers for Disease Control and Prevention’s (CDC) Healthy Places Terminology (2013) as "the ability to live in one's own home and community safely, independently, and comfortably, regardless of age, income, or ability level."

In the second essay we describe these newer forms of residential care and their relationship with ATD use. More precisely, we consider the theoretical determinants of choosing to transition to residential care (other than a traditional skilled nursing facility) and find contrasts between the descriptive statistics of those in residential care and those that remain in the community. Finally, in the third essay, two years of data from a nationally representative sample of older adults are used to specifically analyze the effect of ATD use on the probability of living in residential care, while controlling for a series of environmental, social support, economic and health factors. The results show that although most mobility devices are positively associated with residing in residential care, the use of a cane is linked with remaining in the community.

Besides being preferred by older Americans, aging in place may offer another benefit: cost savings. The National Aging in Place Council estimates that care can cost on average $86,000 annually per person in a nursing home, $60,000 for someone in assisted living and $23,000 for someone aging in place at home. The Council's executive director Marty Bell insists that if enough people could be taught to age in place, and if the option was available to them, it could bolster the sustainability and strength of the Medicaid and Medicare program (American Public Health Association, 2013).

Paying for the health and long-term care of older Americans is a key issue facing U.S. policymakers today. These articles show that certain assistive technology devices, particularly hearing aids, can contribute to an increase in many forms of community participation by which we hope to reap the health benefits associated with Social Capital.

The ICF: A New Paradigm of Disability

As a person ages, physical limitations often inhibit his or her ability to function. The individual may become unable to perform activities of daily living (ADLs) or instrumental activities of daily living (IADLs), and may disengage from society putting them at greater risk of isolation. In the past these limitations may have led to the person being described as disabled. In 2001 the World Health Organization (WHO) developed the International Classification of Functioning, Disability & Health Framework (ICF) to provide a standardized language to define and measure health and disability within a new paradigm (World Health Organization, 2001). In the ICF, disability is not construed simply as a medical problem "correctible" only through professional treatment, nor is it merely a socially created problem unattributed to the individual, but rather disability is described in a biopsychosocial model that synthesizes the concepts of both the medical and social models of disability (World Health Organization, 2002). Disability is an interaction between features of the person and the overall context in which the person lives, therefore some aspects are almost entirely internal to the person, while others are almost entirely external. Drawing attention to the importance of one's environmental context in determining limits on activities and restrictions on participation is one of the strengths of the ICF (Wade & Halligan, 2003). These environmental factors can act as limiting barriers (such as transportation problems) or facilitators (like social networks or personal caregiving) to effect physical ability and activity participation.

The following diagram is one representation of the model of disability that is the basis for the ICF.

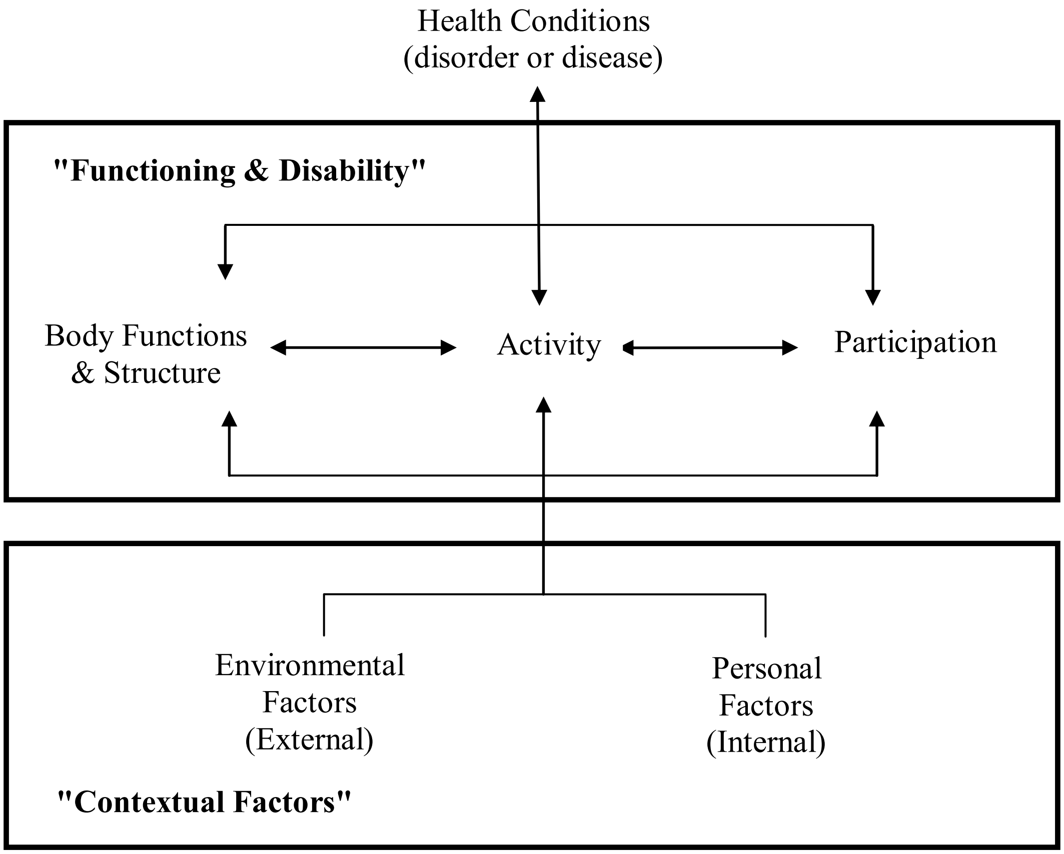

Figure 1.1: Model of disability for the WHO International Classification of Functioning, Disability & Health Framework (ICF)
World Health Organization, 2002

The ICF framework consists of two domains as outlined in bold above. The components of the first encompass the domain of Functioning and Disability with "Functioning" used as the umbrella term referring to all bodily functions and structures, activities and participation and "Disability" indicating the level of *impairment* of functioning, *limitations* on activities and *restriction* of participation. The second domain consists of the internal and external Contextual Factors which will be described below.

As can be seen in the previous diagram, in the ICF Functioning and Disability are viewed as outcomes of interactions between both underlying Health Conditions and the second domain, Contextual Factors.

Body functions are the physiological functions of body systems and would include functions such as seeing, feeling pain and remembering. Body structures are the associated anatomical parts of the body such as the eye, a hand or the brain. Impairments in functioning would be described as significant detriment to body function or body structure, such as loss of vision or a detached retina.

Activities refer to the execution of a task or an action by an individual, and participation to one's involvement in a life situation. It is interesting to note that in earlier classifications being unable to perform a task was called a “disability,” but in the ICF it is now referred to as a “limitation on activities performed.” For example, a person may have difficulty walking under normal circumstances, but may be able to walk slowly with a cane. The loss of body function therefore does not mean that person is disabled, merely limited in his functionality.

Environmental Factors are those physical and social factors that the individual operates within, including the physical environment, communication and other assistive devices, any personal care they receive and the support network available. It also entails societal level items such as transportation and education systems, governmental agencies, and laws and regulations.

Personal Factors are distinct from one’s health condition and include such things as gender, age, race/ethnicity and education. Although not explicitly coded in the application of the ICF, these items are included as context in the framework.

The bottom line is that disability is no longer considered merely a function of one's health conditions, but also of the contextual factors which may act either as facilitators of or barriers to improved mobility and sensory functioning. This ability or inability to function may, in turn, determine one's ability to perform the activities that would allow one to participate in civic, religious, or family events. According to the WHO, the aim of rehabilitation should be to maximize function and minimize limitation of activity and restriction on participation resulting from an underlying impairment. Assistive Technology Devices are designed for just that purpose.

Assistive Technology Devices and their Use

Typical strategies to cope with functional limitations include the use of personal assistance, assistive devices or a combination of the two. The use of both formal and informal care giving assistance has been researched extensively and includes a number of studies to determine the impact of assistive technology when used along with personal care (Agree et al., 2005; Taylor & Hoenig, 2004). These show that the use of assistive technology has become relatively more prevalent in attempts to meet the needs of this country's older population (Cornman, Freedman and Agree, 2005). In fact, Verbrugge and Sevak (2002) found evidence that people with moderate to severe disability were more likely than those with mild disability to use assistive equipment without personal care. They theorize that persons with disability often strive for autonomy in their situation and that using only assistive devices allows for more self-sufficiency than device use combined with personal assistance.

As used in the following essays, assistive technology devices (ATDs) are tools that help an older person with limitations to perform physical activities that might otherwise be difficult or impossible for them. They include low- to high-tech solutions ranging from walkers to motorized scooters, and items such as magnifying glasses and sound amplification devices. They also include modifications to the home that can be as simple as grab bars in the bathroom or more sophisticated modifications such as stair lifts and elevators. This research will focus on ATDs in three distinct categories: mobility devices, sensory devices and devices that aid with the performance of ADLs.

Mobility Assistive Equipment are a commonly used type of ATD to facilitate transfers, walking and wheeled mobility, and the performance of mobility-related ADLs. Examples of these devices include canes (the most basic unit), walkers (pick-up, wheeled and seated varieties), self-propelled wheelchairs (used by those unable to ambulate a reasonable distance) and power mobility devices such as motorized wheelchairs and scooters. It is rare that a single private or public insurer will pay 100% of the cost of these mobility devices although Medicare Part B may cover up to 80% of the cost if a) the healthcare practitioner provides a written prescription and b) the purchase meets a 9-point, function-based Clinical Criteria for Mobility Assistive Equipment coverage (CMS, 2009). In addition to mobility limitations, this criteria also considers other conditions such as the existence of cognitive or sensory impairments, availability of caregivers and one's physical environment. Although Medicaid has the distinction of being the largest overall payor of long term services and supports and care, funding for all types of ATDs through 1915(c) HCBS waivers are unevenly distributed across states. While there has been a rise in the number of Medicaid participants receiving ATDs, this growth has not kept pace with the growth of Medicaid waiver programs overall (Kitchener et al., 2008).

Although mobility devices are generally accepted as improving balance control and are thought to have a direct physical and psychological effect on the health of the user, some evidence indicates a high prevalence of difficulty with use, discomfort, pain and even injury due to disrupting balance control by diverting other attentional mechanisms such as vision (Bateni and Maki, 2005).

Sensory Device use is also quite prevalent among those over age 65. Vision and hearing limitations not only make communication difficult, but they also impede mobility and restrict one's ability to perform ADLs and instrumental activities of daily living (IADLs). Despite their importance, correctional lenses and routine eye exams are not covered by Medicare (or for that matter by many Medicare Advantage and private insurance plans) unless it is for one pair of conventional eyeglasses or contact lenses furnished subsequent to cataract surgery with insertion of intraocular lenses. Hearing aids and examinations for hearing aids are likewise not covered by Medicare (CMS, 2013). “Dual eligibles” (those enrolled in both Medicaid and Medicare) may be entitled to payment for eyeglasses and hearing aids but, again, subject to individual states' program eligibility and payment limits.

Devices that Assist with ADLs include feeding devices, dressing aids, and bathing and toileting assists.

- Feeding - Besides providing adequate nutritional intake, eating is also the most social of all ADLs. It is estimated that 24% of those aged 85 and older cannot feed themselves independently (Brummel-Smith and Dangiolo, 2009). Devices in this category include lightweight utensils with large handles, cutlery with plastic hand straps, rubberized placemats, and cups with anti-splash lids or dual handles.

- Dressing - Our choice of clothing contributes to our self-identity and being unable to dress (remaining in nightclothes and slippers, for example) may lead to isolation for those who are unable to perform this activity. There may be several reasons for this problem including pain, decreased range of motion and inability to make decisions about what to wear. Dressing aids include buttonhooks, zippers with grab loops, Velcro fasteners, etc. Although they are usually inexpensive, without advice some people may not realize they are available or how to obtain and use them.
- Bathing - Obviously difficulty with bathing is associated with a high incidence of falls and increased odds of hospitalization and admission to skilled nursing facilities. If individuals adapt by not bathing, it also has repercussions for one's social engagement and participation. Modifications to the bath may include grab bars, bath benches, rubber mats, or a walk-in or wheelchair accessible shower (the last of these being an expensive modification).
- Toileting - Devices include raised toilet seats and grab bars. Problems with toileting are similar to those for bathing.

In the first of three articles, we will now investigate the overall importance of societal participation for older adults and the role that these assistive devices may play in encouraging participation in social activities among those in this group.

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Introduction and Significance

Although particularly important to aging adults, societal participation and civic engagement in the form of volunteering, religious participation, membership in social organizations, and even visiting with friends and family is often not possible because of debilitating physical or mental conditions. As noted by a myriad of popular and academic literature, civic engagement and community participation as well as the resulting social capital, are vital for a society to be safe, healthy, happy and prosperous. For example, Parker (1996) studied the relationship between enjoyable leisure-time activities among older adults and their satisfaction with life, and found participants who rated their life satisfaction as normal to high also had a high rate of leisure participation. Hull (1990) demonstrated that participating in leisure activity could improve mood, memory, task performance, helping behavior, socialization, self-concept and health. Coleman (1993) looked at the effect of engaging in social activities and found it had positive effects on both physical and mental health that became particularly apparent when people were experiencing stressful circumstances. Continuing along this line of research, Coleman and Iso-Ahola (1993) suggested that it was the social support of leisure activity that helped an individual cope with the ill effects of the stressful life wrought by living with physical or mental disabilities. As we will address further in the following pages, without social interaction we cannot develop and nurture the cultural norms of trustworthiness and reciprocity that allow individuals, communities and organizations to operate most efficiently.

Without some assistance, be it personal care, social support or assistive technology, many seniors do not reap the benefits provided by social capital, especially those that relate to good health. This inefficiency could be adding to the increasing public and private spending for health and long-term care for older adults. Given the importance of civic engagement, this first essay extends the discussion of the World Health Organization's International Classification of Functioning, Disability and Health (ICF) to explain how Assistive Technology Devices (ATD) could enable those with functional limitations to become or remain active members of their larger community. Logistic analysis of a nationally representative dataset finds that in some cases the use of certain devices by those who need them translates to a higher level of social participation, implying the garnering of Social Capital and improved health.

Quite a large body of literature exists on the use of assistive devices, much of it focusing on the individual's predisposition for using such devices, including health and other personal factors and indicators of his or her subjective well-being (Forbes, Hayward and Agwani, 1993; Scherer et al., 2011). McCreadie and Tinker (2005) focus on the acceptability of ATDs to older people and their findings suggest a complex model of acceptability in which a "felt need" for assistance is as important as satisfaction with the device's quality, availability and its cost. Others study the relationship between the use of ATDs and personal care use and find that device use has potential as a partial substitute for various other social and healthcare interventions (Agree et al., 2005; Taylor and Hoenig, 2004). Verbrugge and Sevak (2002) sample individuals with various levels of impairment and find that not only are those with greater needs more likely to utilize assistive devices, but these devices are effective in improving the individual's functioning by reducing task demand. While it appears there have been declines in the overall chronic disability rate among older Americans during the 1990s, it is not clear whether the decline was due to improved health or a rising prevalence of assistive equipment use among older populations (Spillman, 2005).

The WHO's 2001 International Classification of Functioning, Disability and Health (ICF) emphasizes the importance of what people actually do, as opposed to what they are capable of doing. Following the ICF, recent literature has called for research that measures the impact on outcomes beyond the mere enhancement of functional capabilities (Scherer and Glueckauf, 2005). One measure considered the most meaningful outcome in the rehabilitation literature is the impact on one's daily activities and participation in community life (Cooper et al., 2011). By improving one's capacity to perform and facilitating independence, assistive technology offers the person with limited functionality the potential to acquire a sense of autonomy and meaningful connection to the community (Scherer et al., 2005).

Although assistive devices can bridge the gaps between the limitations imposed by disability and the ability to be active in the community, their use is no guarantee of participation. Improved functionality may surely be a major prerequisite for involvement, but participating in an activity is a function of other factors, as well. A theoretical model recently developed by Amelia Bucur and Marilena Blaj (2011) considers self-interest, usefulness and acceptability of conditions as measurable indicators of participation in a planned action. Our research therefore considers whether the individual is interested in a particular activity, as well as other environmental and social support variables as controls.

If successful, the increased independence gained through the use of ATDs could remove much of the need for help from other persons, and might reduce the demands of disability care on both families and public programs for older adults with disabilities (Spillman, 2005). On the other hand, lack of individual financial resources to purchase these aids represents an environmental barrier that could result in social disparity. With limited government resources, it becomes important to evaluate particular devices, since some will have larger impacts than others. For example this study finds that the use of hearing aids among those with hearing difficulty is a significant predictor of the probability of participation in most activities. We now formalize the research questions and hypotheses, highlight the importance of gaining social capital through participation in the community, and empirically demonstrate the extent to which particular devices advance participatory activity among older adults in five types of social activities: visiting with family and friends, participating in religious services, joining clubs and attending meetings, going out for enjoyment and performing volunteer work.

Research Question/Statement of Hypotheses

Research Question:

Does the use of assistive devices for help with mobility and sensory impairments and for assistance with activities of daily living affect the likelihood of older adults' participation in various social endeavors, and if so to what extent?

Hypotheses:

H1: The use of mobility devices (in particular canes, walkers, wheelchairs and scooters) among older adults with mobility impairments will have a positive impact on their likelihood of participation in the forms of visiting friends and family, attending religious services, being involved in club activities, going out for enjoyment and volunteering.

H2: The use of sensory devices (namely, hearing and vision aids) among older adults with sensory impairments will have a positive impact on their likelihood of participation in the forms of visiting friends and family, attending religious services, being involved in club activities, going out for enjoyment and volunteering.

H3: The use of devices to aid with activities of daily living (such as eating, bathing, toileting and dressing devices) among older adults with ADL difficulties will have a positive impact on their likelihood of participation in the forms of visiting friends and family, attending religious services, being involved in club activities, going out for enjoyment and volunteering.

Theoretical Foundations

Social Capital Theory

In *Democracy in America*, Alexis de Tocqueville recognized an equality among the American people that led to a "society of one single mass" within which there existed no true aristocracy, but rather a blending of social ranks. He claimed that in early nineteenth century America anyone (as long as he was a white male) "... can have the right to enjoy the same pleasures, enter the same professions, meet in the same places; in a word, to live in the same way and to seek wealth by the same means..." (2003, page 588). In other words, the existence of equality extends beyond the realm of politics, taking root in civil society as well. Lacking a powerful ruling class, Americans had to band together in associations directed harmoniously and methodically toward reaching a common goal. Tocqueville cautioned against governmental control, saying "The only way opinions and ideas can be renewed, hearts enlarged and human minds developed is through the reciprocal influence of men upon each other... which is what associations alone can achieve." (2003, page 598).

Frequent interaction between members of society creates an inherent norm of generalized reciprocity with an expectation that folks will reward good deeds done to them by doing good deeds of their own. A society characterized by this concept of reciprocity runs more efficiently than a distrustful one since there is a mutual benefit for all parties leading to socially desirable outcomes (Putnam, 2000). This connection among individuals, through norms of reciprocity and trust was first coined as "social capital" in the early twentieth century by a West Virginia educator named L.J. Hanifan and has since been formerly theorized and applied within many disciplines including political science, sociology and economics. Joseph Coleman, a prominent American sociologist, popularized the concept of social capital in the 1980s and 1990s as a bridge between social context theory and the economic theory of independent rational choice (Coleman, 1988). Harvard Public Policy professor Robert Putnam has built on the early work of Coleman, and has truly brought the notion of social capital and the importance of civic engagement to the forefront, in scholarly journals and to mainstream audiences through his best-selling book *Bowling alone: The collapse and revival of American community* (Putnam, 2000).

Social capital (SC) has been described as the norms, networks and mutual trust of civil society that facilitates cooperative action among citizens and institutions (Perkins & Long, 2002) and is gained through changes in relations among people or organizations that effect behavior (Coleman, 1988). There are individual, organizational and community benefits put forth by the social capital theory. The trust inherent in social interaction allows for smooth conduct of business and social transactions (Putnam, 2000). Although not referring to SC directly by name, Elinor Ostrom's work (2008) suggests a similar theory of collective action for dealing with the problems of common pool resources whereby individuals organize themselves voluntarily to retain the residuals of their own efforts. Frequent interaction with others also broadens our experiences making us more empathetic towards and tolerant of other races, religions and cultures. Individually we benefit from contacts made and the increased flow of information and advice available when we join a social group, visit with friends and family, or mingle after a church service. This could lead in turn to further civic activity as we try to use this new information to organize others toward the public good. Social capital therefore represents resources for our success in the form of emotional, practical and economic support that we may not have as individuals.

One of the greatest positive impacts of this social integration has been its apparent association with individual health status (Berchet & Jusot, N.d.; Scheffler et al., 2010). At the community level health and wellbeing can be improved through the diffusion of health information, the introduction of healthy behavioral norms, promotion of access to local services and healthy psychological and emotional support from peers. Visiting with loved ones provides opportunities for informal, spontaneous assistance which is so much a part of everyday life that its contribution to improved health is often not recognized (Israel, 1985). Religious attendance too has been shown to have a strong impact on improving poor health behaviors, as well as sustaining good mental health and emotional well-being through increased social relationships (Strawbridge et al., 2001). There have been many published studies and meta-analyses that show evidence that individuals who are socially disconnected are more likely to die earlier (House, Landis, & Umberson, 1988; Holt-Lunstad, Smith & Bradley, 2010), self-report poorer health (Kawachi et al., 1999), and even commit suicide (Emile Durkheim, 1966). In their review for the World Health Organization, Marmot and his colleagues write that "the most effective actions to achieve greater health equity at a societal level are actions that create or reassert societal cohesion and mutual responsibility." (2012, page 1012).

Wotjyla's Theory of Participation

To the Thomistic philosopher Karol Wojtyla, who would later become Pope John Paul II, man was more than a mere object in this world, but was distinct from other things because of his deliberate actions and his spirituality (Wojtyla, 1993a). Man is not fulfilled simply by completing these deliberate actions, but by the fact that it makes him good when the act is morally good. This can never happen in isolation, but only through co-existence with others. What begins as an interpersonal "I-You" relationship develops through communication, responsibility and trust into a social "We" relationship in which both parties experience the other as a person. The real common good becomes something that creates opportunities for each party to fulfill himself within the community (Mejos, 2007).

Wojtyla saw human alienation as the biggest threat to this relationship because it inhibits any possibility of friendship or other spontaneous powers of community (Wojtyla, 1993b) and he points to his theory of participation as the antidote. Mejos interprets Wojtyla's meaning of participation as "the way in which, in common acting, the person protects the personalistic value of his own acting and participates together in the realization of common action and its outcomes" (Mejos, 2007, page 79). It represents an opportunity for the person to realize self-fulfillment as well as fulfillment of community goals and allows for a vast array of experiences leading to a deeper understanding of self and others. Through participation, Pope John Paul II called on all of humankind to make positive contributions to this world. The rest of this essay examines whether the use of assistive aids encourages and sustains participation among older adults.

Methodology

Data Source

Traditional measures of disability which focus on one's ability to perform ADLs are valuable for tracking populations, but do little to guide us towards solutions in reducing disability and maximizing health and independent functioning. As previously noted, the ICF shifts the focus of rehab from medical cause to impact (Bachmann et al, 2010). In line with this new disability measurement protocol, a new database from the National Health and Aging Trends Study (NHATS) includes items that not only support the scope of traditional measures of functioning, but expand on it by including items to measure participation (through assistive devices), as well as restrictions in valued activities (Freedman et al., 2011). The main distinction in the data is among persons living in residential care settings that are nursing homes, residential care settings other than nursing homes, and all other community settings. Since only a Facility Questionnaire to staff (FQ) was administered whenever a sample person was determined to live in a nursing home, data pertinent to our study are not available on them and nursing home residents are excluded.

The NHATS is a nationally representative sample of individuals aged 65 and older, drawn from the Medicare enrollment file. It oversamples persons at older ages and Black individuals. It is a relatively new survey currently consisting of two waves with study participants first interviewed in 2011 and then again in 2012. Annual re-interviews are planned in order to document change over time. For comparison, this model will consider those in the original interview who also appeared in the second year, representing a balanced panel referred to as the full sample. This leaves N ≈ 6,050 in each wave for a total of 12,100 total observations clustered by wave.

Subsample Selection

In testing the three hypotheses, we consider the effect of the use of assistive devices on one's participation in various social activities, allowing for a number of confounding items. The hypotheses are premised on need and the use of any assistive device by one who has no potential for benefit would be irrelevant. Therefore, we limit our subsamples to three groups of older adults (those 65+) each corresponding to a separate hypothesis: a) those having actual or perceived problems with mobility, b) those with sensory problems and c) those experiencing problems performing ADLs. The first round of data asked specific questions of the respondent to quantify this element, such as "Do you have any problem going outside without the help of another person **or** special equipment?" A positive response to these questions would indicate that the individual should be included in the group who had a problem with mobility. Similar questions were asked relating to problems performing ADLs and IADLs.

Unfortunately these questions were screener questions for the National Long-Term Care Survey (NLTCS) and were not repeated in round two, so we develop another way to derive need for mobility and sensory devices and for devices to help with ADL functional limitations. Cornman, Freedman and Agree (2005) find that differing definitions of functioning used in disability studies may distort the interpretations of the effect of device use on functionality. We therefore take care to include a potentially sizeable group that the authors describe as a pre-clinical disability category, which includes those who may use a device as a prophylactic measure (to prevent a fall for example).

Problems with Mobility

Using original round one data, we cross-tabulate variables that measure one's level of difficulty performing a task by themselves with an indicator for whether they used a device to perform a specific task. As an example, we present the following cross-tabulation, on which we have highlighted those ultimately included in the subsample.

TABLE 1.1: Example of cross-tabulation to derive "mobility problem" variable

	Go Outside Using Device				
Goes Outside By Self	No Use	Did Use	DKRF	Didn't Do	Total
Did Not Do	98	477	1	0	576
Did/No Difficulty	4,977	949	3	0	5,929
Did/With Difficulty	376	591	0	0	967
Did/DK Difficulty	1	1	0	0	2
DKRF Did	1	0	1	0	2
Not Done	0	0	0	133	133
Total	5,453	2,018	5	133	7,609

For the purpose of this study, we assume that all 2,018 individuals who used a device when they went outside would have difficulty doing so without it and that we also need to add those who did not use a device and did not go outside or did so with difficulty. This left only 4,977 people who had no problem going outside without the help of another person or special equipment. Since these numbers do not perfectly reconcile with the answers to the screener question, we abandon the screener questions and use the same methodology for rounds one and two. We use additional cross-tabulations for similar series of questions asked about moving about inside one's home and getting out of bed to develop "Need" variables for those categories and combine them into one variable that measures a problem with mobility if there is a problem in any of the three categories.

Sensory Problems

The data allow us to perform a similar process to develop variables for both vision and hearing problems. For vision, the survey asked three questions of sample persons to determine if they used a vision aide, namely "Do you wear glasses or contacts to help you see things at a distance?", "Do you wear glasses or contacts to help you see things close up?" and "In the last month did you use other vision aids such as a magnifying glass to see things close up?" We generate a variable to represent using a vision aid which is populated by those who had answered positively to any of the previous three questions. The survey also asked three questions to determine if the person could see well with their vision aid if they used one: if they could recognize someone across the street, watch television across the room, and read newspaper print.

TABLE 1.2: Example of cross-tabulation to derive "sensory problem" variable

	Used Vision Aid				
Recognizes across Street	Yes	No	Inapp.	DKRF	Total
Yes	6,555	435	0	2	6,992
No	478	63	0	1	542
DKRF	21	6	0	2	29
Missing	0	0	46	0	46
Total	7,054	504	46	5	7,609

Again, we assume that the 7,054 who used vision aids to see things at a distance could not have done so without them and also that those who did not use a device but could not see well enough to recognize someone (63) may benefit from device use. This left only 435 people without a problem recognizing someone across the street without assistance. We combine results from similar cross-tabulations for watching television and reading the newspaper into one variable measuring a problem with vision.

There was only one question asking respondents if they used a hearing device: "In the last month did you use a hearing aid?" Again three questions asked if the person could hear well with the use of their hearing aid if they used one. These asked "Do you hear well enough to use the telephone?", "...carry on a conversation in a room with a radio or television playing?", and "...carry on a conversation in a quiet room?" Again we run cross-tabulations of using a hearing aid with each of the three hearing ability variables, and generate a variable representing a problem with hearing if there was a problem with any of the three hearing categories without assistance.

Problems Performing ADLs

NHATS includes separate derived variables for "uses a device while..." eating, bathing, toileting and dressing, as well as some that measure difficulty in doing so without help. Through cross-tabulation we identify those in the data who had no difficulty performing the ADL and did not need a device to do so and generate four separate variables, one for each activity.

In testing for all three hypotheses, we limit our analyses to only those for which a problem associated with that particular hypothesis was indicated.

Empirical Approach

This study seeks to determine links between the use of assistive devices to aid with mobility and sensory impairment and to aid with problems performing ADLs and the participation of older adults. First, the analysis provides descriptive statistics, by wave, on all participation measures, the key explanatory variables of ATD use, and all control variables for the full sample of respondents present in both waves of the study, and then tests to measure significant changes between the waves. Next, using just the subsamples of those who would benefit from device use, independent t-tests are used to compare the mean participation levels of those who used particular types of devices and those who did not use the device. A logistic regression model is used to establish a relationship between a binary outcome variable and a group of predictor variables. In this case the outcomes of interest are binary and simply measure whether or not the observed individual participates in a certain type of social activity. For each of the three subsample groups just described, we run logistic regression models, one pertaining to each type of participation activity. Two different analytical approaches are used which we describe here.

Logistic Regression with Random Effects Models

The first analyses compare the probability of participation in an activity for those who currently use ATDs and those who do not use them, controlling for a variety of confounders. A logistic regression model with random effects is used to obtain average marginal effects, intended to show how the probability of participation is expected to change as each key independent variable changes from 0 to 1, holding all other variables constant (Williams, 2012). Random effects are used when the unobserved, unit-specific effect is assumed to be uncorrelated with the explanatory variables. Standard errors are calculated to determine the significance of the relationships.

We also considered conditional logistic regression analyses, which are analogous to an analysis similar to a fixed effects logistic regression model to look at the effect of ATD use on the probability of participation in an activity. Fixed effects models are useful if you suspect that you have unobserved, individual-specific, time-invariant characteristics which affect the dependent variable and are correlated with one or more explanatory variables. If ignored, the coefficients on the explanatory variables that are correlated with the unit-specific effect may be biased. Fixed effects models work by holding constant the average effects of each individual and as such rely on within-group variation to identify the coefficients. Conditional logistic analysis differs from ordinary logistic regression in that the data are grouped at the individual level and the likelihood of the outcome is calculated relative to each person. In attempting to execute the conditional logistic model, we discovered that it dropped many observations because there were no changes in the dependent variable, leaving us with an inadequate sample size. Therefore, results from the conditional logistic regression models are not reported.

The logistic regression with random effects analyses use the following model:

$$\Pr(Part_{it} = 1|\mathrm{x}_{it}) = \Phi\,(\beta_1 ATD_{it} + \beta_2 Barrier_{it} + \beta_3 Interest_{it} + \beta_4 Environ_{it} + \beta_5 SocSup_{it} + \beta_6 ADL_{it})$$

where Φ represents the cumulative logistic distribution function. $Part_{it}$ is a dichotomous variable that represents participation (by individual *i* in period *t*) in a chosen social activity including visiting family or friends, attending religious services, participating in club meetings, going out for enjoyment, or doing volunteer work. The main explanatory variables of interest are included in the vector ATD_{it} that indicates the existence of assistive technology device use, as operationalized by a dichotomous indicator for the use of each type of device: cane, walker, wheelchair, scooter, or a device to facilitate with hearing, vision, eating, bathing, toileting or dressing. Each model includes only the ATDs pertinent to the individual's functional limitation. For example, in testing Hypothesis 1, *ATD* includes only those variables indicating the use of a cane, walker, wheelchair or scooter. $Barrier_{it}$ contains items that represent potential barriers to participation such as health and transportation problems pertaining directly to the measured activity, and $Interest_{it}$ indicates whether the person finds each activity important. $Environ_{it}$ refers to a large vector of personal environment factors such as one's age and gender, level of education and residential status. $SocSup_{it}$ measures the availability of social support for the individual, as well as his perception of his social environment, and includes items for family status, level of personal care, and perceptions of community. ADL_{it} is also a vector and its items are a measure of one's ability to perform other activities of daily living.

First Difference Models

We also estimate all models using the first difference estimator, which differences away any unobserved individual-specific, time-invariant factors. Liker et al. (1985) suggest it as a useful tool under a number of circumstances that are relevant to our analysis, namely where unmeasured and time-invariant explanatory variables may be correlated with the observed variables and secondly when the measures of a change in the variables from the first to second period may be a more reliable measure than the measure of the variable in only one time period. Since this regression's assumptions of a normal distribution for the dependent variable and homogeneous error variance are violated when applied to a binary dependent variable, we estimate this model to check for differences between this approach and the random effects logistic regression results.

Dependent Variables - Participation Measures

Our research question asks whether using assistive technology devices would encourage older adults to participate in various activities. Some activities are the kind through which individuals gain Social Capital, such as visiting with family and friends, attending club meetings and doing volunteer work. Others provide an essential measure of emotional well-being and improved quality of life, such as attending religious services and going out for enjoyment. For each type of activity (visiting in person with friends or family not living with you either at your home or theirs, attending religious services, participating in clubs, classes or other organized activities, going out for other enjoyment, and volunteering), NHATS asks the sample person a series of questions regarding each activity, including whether or not they engaged in the activity in the last month. These dichotomous responses serve as the five dependent variables.

Key Explanatory Variables - Use of Assistive Devices

For those with functional limitations, ATDs have been shown to be effective in improving the individual's functioning by reducing task demand (Verbrugge and Sevak, 2002), improving one's capacity to perform and offering the person with limited functionality the potential to acquire a sense of autonomy and meaningful connection to the community (Scherer et al., 2005). Although it is important to recognize that ATD use in general improves functionality, from a policy perspective it is equally essential to determine which types of devices have the largest impact. As a proxy for meaningful connection to the community, adult participation levels can be measured as a function of different types of ATD use, which represent the key explanatory variables.

Those sampled were asked directly if they had used a mobility device with the question "In the last month have you used a cane, walker, wheelchair or scooter, yes or no?" They were further queried to see which particular mobility device was used, providing dichotomous variables for the use of each device. Similar questions were also asked of hearing aid or hearing device use and glasses, contacts or other vision devices for distance or close-up vision. Finally they were asked questions on device use for self-care activities, such as "In the last month did you ever use adaptive utensils to help you eat or cut your food?" and comparable questions regarding toileting, dressing and bathing.

Control Variable Measures

Consistent with the World Health Organization’s ICF (2002), social engagement is contingent on external factors, some that foster it, such as personal assistance, support networks and ATDs, and others that serve as inhibitors to participation. *Barrier* represents health and transportation issues that are two such examples of possible barriers to social activity. NHATS includes items for both in the sequence of questions on participation where they asked, for each type of activity, “In the last month did your health or functioning ever keep you from {activity}?” and “In the last month did transportation problems ever keep you from {activity}?” This strand of questions also provides categorical indicators of *Interest* in whether the person finds each activity important. The respondents were asked “How important is it to {activity}, would you say very important, somewhat important or not so important?”

Environ refers to a large vector of standard personal environment factors such as one’s categorical age, gender, race/ethnicity, level of education, and household income. A dummy variable is used to identify whether respondents live in their own home or another type of residential care that offers a range of supportive services for older adults. Given that physical and cognitive health are necessary to be able to participate, self-reported measures of current health and an indicator of whether the individual has been diagnosed with dementia are also included.

Gottlieb (1983) defines social support as “…verbal and non-verbal information or advice, tangible aid or action that is proffered by social intimates or inferred by their presence and has beneficial or behavioral effects on the recipients.” Here the vector *SocSup* includes a number of variables that are in concert with these themes and tend to encourage or discourage participation among older people. They include marital status, number of children, and average hours of caregiving received. Social support literature also reveals that persons who maintain contact with at least one confidant report better mood, greater life satisfaction, and better health than those without such a strong tie (Gottlieb, 1985). Therefore, we have included a variable derived in the NHATS data that indicates whether or not the person "has no one to talk to." In addition, the survey ascertains the respondents' perceptions of their community by asking whether the respondent "strongly agrees", "somewhat agrees" or "does not agree" with the following three statements: that people in their community know each other well, that they are willing to help each other, and that they can be trusted.

A*DL* is a vector whose items are a measure of whether or not the individual has a problem performing an activity of daily life without relying on either human assistance or device use. One is considered to have mobility problems if they had problems with either getting out of bed or a chair, going outside, or moving around the house. Problems with hearing and vision are measured separately, as are problems with eating, bathing, toileting and dressing. Because the variable is used as a screening variable to develop subsamples, only problems with activities outside of those aided by the ATD of interest are included as controls. For example when measuring the effect of sensory devices for those who need them, only problems with mobility and with the four ADLs are used in the model.

Results

Descriptive Statistics

Table 1.3 shows the percentage of all those observed in both waves one and two, who participated in each activity.

TABLE 1.3: Descriptive statistics for outcome variables
full sample of individuals in wave 1, remaining in wave 2

	Wave 1		Wave 2			
	%	n	%	n	Diff.	Signif
Participate in Activity (%) (*Part*)						
Visits Family & Friends	86.3	6,051	87.3	6,049	1.0	
Attends Religious Services	59.8	6,053	58.2	6,046	(1.6)	
Join Clubs/Attend Meetings	36.8	6,052	36.9	6,046	0.1	
Goes Out for Enjoyment	75.0	6,051	75.3	6,052	0.3	
Does Volunteer Work	24.6	6,052	23.0	6,050	(1.6)	*

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012
*p < .05, **p < .01, ***p < .001

The highest participation levels are shown for those visiting with family and friends, at over 86% for both waves. Over three-quarters of the people in the study enjoyed things such as going out for dinner or to a movie or play, although this is largely correlated with marital status and age. Only 69% of those who were unmarried went out for enjoyment, compared to over 81% of married people, and by age the percentage varies from 83.7% of those age 65-69 to 60.3% of those over 90. Religious involvement is down slightly in the second wave, but the change is not statistically significant. Though averaging around 58 - 60% for all age groups in the two waves, it peaks for those between 74 and 79, who report 64.2% participation. It also varies by ethnicity with a larger portion of Black, non-Hispanics in the 65-69 age range (72.5%) indicating they attend religious services. The table also tells us that for those individuals who remain in the study there is little statistical difference from the first wave to the second in participation levels other than in doing volunteer work, which also decreases significantly among older members of the population, from a high of 29.4% of the 65-69 population to only 12.4% among the oldest in the sample.

Table 1.4 gives descriptive statistics of ATD use (the main explanatory variables) and indicates that there are some significant changes in the device use of individual respondents from one wave to the next, the most prominent being increases in the use of walkers, wheelchairs, and bathing and toileting devices.

Mobility devices are used by 29% of the sample population in the first wave, but device use increases significantly to over 32% in wave two. The majority use canes and walkers, with less frequent use of wheelchairs and scooters, although the percentage of the sample using wheelchairs did increase by 1.1%. Walker use as a percentage of the population is up a very significant 2.4%.

TABLE 1.4: Descriptive statistics for key explanatory variables
full sample of individuals in wave 1, remaining in wave 2

	Wave 1		Wave 2			
	%	n	%	n	Diff.	Signif
Use Assistive Device (%) (*ATD*)						
Any Mobility Device	29.0	6,052	32.3	6,055	3.3	***
Cane	20.5	6,055	21.0	6,054	0.5	
Walker	14.0	6,055	16.4	6,055	2.4	***
Wheelchair	7.0	6,055	8.1	6,055	1.1	*
Scooter	2.5	6,055	2.5	6,055	0.0	
Any Hearing Device	13.7	6,037	14.6	6,036	0.9	
Any Vision Device	94.1	6,014	93.4	5,994	(0.7)	
Any Eating Device	0.8	6,052	0.8	6,042	0.0	
Any Bathing Device	39.3	6,038	42.3	6,038	7.0	**
Any Toileting Device	42.9	6,040	46.4	6,036	3.5	***
Any Dressing Device	3.4	6,052	3.6	6,050	0.2	

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012
*p < .05, **p < .01, ***p < .001

The use of eyeglasses or contacts is very common among those sampled, at over 93% in both waves. This is consistent with other national samples that indicate that as people get older, their use of visual aids grows rapidly (CDC, 2011). Although loss of hearing is also very prevalent among older adults, hearing device use is rarer in the sample, with only a slight and non-significant increase in wave two. Device use for assistance with daily activities varies greatly. Less than 1% claim they are using eating devices and approximately 3.5% use devices to help with dressing but a much larger percentage use grab bars and other bathroom accessories to help with toileting and bathing. This use also increases significantly in wave two.

Table 1.5 provides descriptive statistics for the remainder of the variables. As you can see, many more people in both waves of the sample named their health (10 - 15%), rather than transportation (1 - 5%) as a barrier to participating in all types of activity. While this number increases slightly in wave 2, the changes are not statistically significant. All but approximately 12% feel that visiting family and friends is at least somewhat important, fewer attached importance to attending religious services (≈ 75%) and going out for enjoyment (≈ 77%), and 46.6% of wave one respondents and 48% of wave two respondents feel that participating in clubs is not important at all. There is but one significant difference in these opinions between the two waves.

A majority (58%) of the respondents are female and the sample is evenly distributed by age, other than there being fewer people in the 85-89 and over 90 age groups. Far more people are living in the community (94.8%) than in residential care and this percentage changes little in wave two. Approximately 27% of those surveyed report poor/fair health in both waves, but the incidence of being diagnosed with dementia increases dramatically in wave two (2.3% increase, $p < .001$). The percentage working for pay decreases from 15.1% to 13.3% and this is also significant ($p < .01$).

The percentage of respondents still driving is quite high in both waves, although it decreases from 70.6% to 67.1% in wave two ($p < .001$).

NHATS derives a particularly pertinent measure of Social Support that indicates whether the sample person "has no one to talk to" and the data show that 6.5% fall into this category in the first wave. By the second wave, this number drops to 4.7% ($p < .001$). Also along the lines of Social Support, a majority agree to some extent with all three positive statements about their community and the only one that shows significant change is a wave-to-wave decline in those who agree that members of their community knew each other well.

A large percentage of those surveyed, had problems with vision (over 95%) in both waves. For those needing help with ADLs, toileting, bathing and dressing show significant increases in the second wave. Most of the confounding items that show significant changes from the first to the second waves represent progressions related to aging and include those diagnosed with dementia (increases by 2.3%, $p < .001$), those working for pay (decreases by 1.8%, $p < .01$), those still driving (down 3.5%, $p < .001$) and a slightly significant decrease in those who were married.

TABLE 1.5: Descriptive statistics for control variables
full sample of individuals in wave 1, remaining in wave 2

	Wave 1		Wave 2			
	% or Mean	n	% or Mean	n	Diff.	Signif
Barriers to Participation (*Barrier*)						
Health Prevents (%)						
Visiting Family & Friends	9.6	6,049	10.0	6,048	0.4	
Attending Religious Services	14.6	6,051	15.1	6,043	0.5	
Participating in Clubs & Meetings	10.9	6,051	11.1	6,044	0.2	
Going Out for Enjoyment	10.6	6,048	11.3	6,047	0.7	
Doing Volunteer Work	11.1	6,052	11.4	6,048	0.3	
Transportation Prevents (%)						
Visiting Family & Friends	4.0	6,054	4.6	6,055	0.6	
Attending Religious Services	4.1	6,054	4.6	6,055	0.5	
Participating in Clubs & Meetings	3.3	6,054	3.5	6,054	0.2	
Going Out for Enjoyment	3.5	6,054	3.9	6,053	0.4	
Mean Number Other Limits	1.3	6,049	1.3	6,045	0.0	
Finds Activity Important (%) *(Interest)*						
Visiting Family & Friends						
Not Important	12.8	6,040	12.1	6,033	(0.7)	
Somewhat Important	25.9		26.5		0.6	
Very Important	61.3		61.4		0.1	
Attending Religious Services						
Not Important	24.8	6,043	25.3	6,026	0.5	
Somewhat Important	17.6		17.7		0.1	
Very Important	57.6		57.0		(0.6)	
Participating in Clubs						
Not Important	46.6	6,048	48.0	6,028	1.4	
Somewhat Important	23.8		23.6		(0.2)	
Very Important	29.6		28.4		(1.2)	
Going Out for Enjoyment						
Not Important	22.0	6,048	23.7	6,040	1.7	*
Somewhat Important	34.4		34.1		(0.3)	
Very Important	43.6		42.2		(1.4)	

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012
*p < .05, **p < .01, ***p < .001

TABLE 1.5: Descriptive statistics for control variables (continued)
full sample of individuals in wave 1, remaining in wave 2

		Wave 1		Wave 2			
		% or Mean	n	% or Mean	n	Diff.	Signif
Environmental Factors (*Environ*)							
Gender (%)	Male	41.6	6,055	41.6	6,055	0.0	
	Female	58.4		58.4		0.0	
Age (%)	65-69	19.0	6,055	15.1	6,055	(3.9)	
	70-74	21.0		20.7		(0.3)	
	75-79	20.2		20.6		0.4	
	80-84	19.8		20.0		0.2	
	85-89	12.1		14.1		2.0	
	90+	7.9		9.5		1.6	
Race/Ethnicity (%)							
	White, non-hispanic	69.6	6,002	69.6	6,002	0.0	
	Black, non-hispanic	21.9		21.9		0.0	
	Other, non-hispanic	2.7		2.7		0.0	
	Hispanic	5.8		5.8		0.0	
Living Arrangement (%)							
	Residential Care	5.2	6,055	5.9	5,991	0.7	
	Community	94.8		94.1		(0.1)	
Diagnosed with Dementia (%)		5.0	6,051	7.3	6,051	2.3	***
Self-reported Current Health (%)							
	Poor/Fair	26.7	6,052	27.1	6,049	0.4	
	Good	32.4		33.1		0.7	
	Very Good/Excellent	40.9		39.8		(1.1)	
Highest Education (%)							
	Less than H.S. Diploma	26.2	6,000	26.2	6,000	0.0	
	High School Diploma	27.1		27.1		0.0	
	Some College	24.2		24.2		0.0	
	Bachelor's Degree	12		12		0.0	
	Advanced Degree	10.5		10.5		0.0	
Works for Pay (%)		15.1	6,053	13.3	6,051	(1.8)	**
Mean Family Income		49,608	6,055	n/a			
Still Drives (%)		70.6	6,055	67.1	6,054	(3.5)	***

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012
*p < .05, **p < .01, ***p < .001

TABLE 1.5: Descriptive statistics for control variables (continued)
full sample of individuals in wave 1, remaining in wave 2

	Wave 1		Wave 2			
	% or Mean	n	% or Mean	n	Diff.	Signif
Social Support Factors (*SocSup*)						
Marital Status (%)						
Married or Living with Partner	50.2	6049	48.3	6054	(1.9)	*
Single, Divorced, Separated, or Widowed	49.8		51.7		1.9	
Number of Children (%) None	9.4	6055	15.1	6055	(3.9)	
1	12.0		20.7		(0.3)	
2-4	56.7		20.6		0.4	
5+	21.9		20.0		0.2	
Feels like no one to talk to (%)	6.5	6,055	4.7	6,055	(1.8)	***
Community know each other well (%)						**
Do Not Agree	19.2	5,944	17.5	5,940	(1.7)	
Agree a Little	38.9		38.6		(0.3)	
Agree a Lot	41.9		43.9		2.0	
Community helps each other (%)						
Do Not Agree	9.5	5,894	9.2	5,870	(0.3)	
Agree a Little	33.7		32.6		(1.1)	
Agree a Lot	56.8		58.2		1.4	
Community can be trusted (%)						
Do Not Agree	10.1	5,808	10.2	5,767	0.1	
Agree a Little	29.0		27.2		(1.8)	
Agree a Lot	60.9		62.6		1.7	
Avg. hours care-giving rec'd/mo.	88.3	6029	88.0	6049	(0.3)	
Problem performing without help^{+} (*ADL*)						
Problem with Eating (%)	6.1	6,055	6.7	6,055	0.6	
Problem with Bathing (%)	16.0	6,055	17.7	6,055	1.7	*
Problem with Toileting (%)	45.2	6,055	48.2	6,049	3.0	**
Problem with Dressing (%)	19.0	6,055	20.6	6,055	1.6	**
Problem with Hearing (%)	24.1	6,035	24.4	6,035	0.3	
Problem with Vision (%)	95.4	6,013	95.0	5,994	(0.4)	
Problem with Mobility^{++} (%)	41.9	6,055	43.2	6,055	1.3	

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012
+ help entails human assistance or device use ++ mobility includes getting out of bed or chair, going outside or moving around house, *p < .05, **p < .01, ***p < .001

Bivariate Analysis

Next, using only a subsample of those who might benefit from device use, bivariate correlations and independent probability tests are used to compare the participation rates of those who used particular types of devices and those who did not. The results in Table 1.6 indicate that there is a highly significant difference between these two groups in the mean participation rates for many of the activities. The use of mobility aids, such as canes, walkers, wheelchairs and scooters appears to be negatively associated with participation in all of the sampled activities. Those currently using a mobility device are less likely to report current participation for every activity and the differences are highly significant ($p <.001$) with the exception of joining clubs and attending meetings. Those who used a device to aid with mobility, for example, are less apt to go out for enjoyment by over 11 percentage points.

As opposed to mobility devices, most other types of assistive devices sampled are positively correlated with participation in social activity. The largest and most consistently significant differences occur with the current use of aids to help with sensory problems ($p < .001$). Among those who needed vision aids, for example, 37.6% of those who wear glasses or contacts joined clubs and attended meetings, vs. 15.5% of those that did not wear them. When asked about going out for enjoyment 76.3% of those with vision aids had gone out for enjoyment in the last month, while for those that did not use them, less than half that percentage went out. It is noteworthy to point out that vision aids are commonly used among older adults. In this subsample for example, 94.3% needed help with vision and approximately 98.5% of them wear vision-correcting aids.

TABLE 1.6: Difference in participation rates with and without device use subsample of those in need of device only

		Used device	Did not use device	Diff	Sig.
Mobility Aid	Visits Family & Friends	79.0	84.2	(5.2)	***
n ≈ 5,148	Attends Religious Services	49.8	58.6	(8.8)	***
	Join Clubs/Attend Meetings	27.2	28.9	(1.7)	
	Goes Out for Enjoyment	59.8	71.4	(11.6)	***
	Does Volunteer Work	11.1	20.4	(9.3)	***
Vision Aid	Visits Family & Friends	87.1	72.0	15.1	***
n ≈ 11,423	Attends Religious Services	59.6	43.7	15.9	***
	Join Clubs/Attend Meetings	37.6	15.5	22.1	***
	Goes Out for Enjoyment	76.3	38.1	38.2	***
	Does Volunteer Work	24.4	4.8	19.6	***
Hearing Aid	Visits Family & Friends	88.6	77.3	11.3	***
n ≈ 2,921	Attends Religious Services	61.5	48.8	12.7	***
	Join Clubs/Attend Meetings	44.1	23.2	20.9	***
	Goes Out for Enjoyment	79.6	60.2	19.4	***
	Does Volunteer Work	27.7	15.2	12.5	***
Eating Device	Visits Family & Friends	70.2	75.4	(5.2)	
n ≈ 762	Attends Religious Services	49.5	42.5	7.0	
	Join Clubs/Attend Meetings	23.2	18.3	4.9	
	Goes Out for Enjoyment	48.4	47.2	1.2	
	Does Volunteer Work	6.4	9.1	(2.7)	
Bathing Aid	Visits Family & Friends	79.0	75.8	3.2	
n ≈ 2,022	Attends Religious Services	47.3	41.1	6.2	**
	Join Clubs/Attend Meetings	22.1	19.0	3.1	
	Goes Out for Enjoyment	56.6	49.6	7.0	**
	Does Volunteer Work	7.7	6.9	0.8	
Toileting Aid	Visits Family & Friends	84.8	75.4	9.4	***
n ≈ 5,620	Attends Religious Services	56.3	49.0	7.3	*
	Join Clubs/Attend Meetings	34.8	24.0	10.8	***
	Goes Out for Enjoyment	69.9	60.7	9.2	**
	Does Volunteer Work	20.9	13.5	7.4	**
Dressing Aid	Visits Family & Friends	84.7	78.3	6.4	**
n ≈ 2,387	Attends Religious Services	50.8	48.4	2.4	
	Join Clubs/Attend Meetings	26.5	22.5	4.0	
	Goes Out for Enjoyment	64.6	56.4	8.2	**
	Does Volunteer Work	13.6	9.0	4.6	**

* p < .05, ** p < .01, ***p < .001

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012

Hearing devices on the other hand are not as commonly used even though their use appears highly correlated with higher levels of participation. The subsample includes approximately 2,921 individuals who indicate that they had hearing problems from which they might benefit from the use of hearing aids. Of these, 1,709 or roughly 59% had used them in the month before they were surveyed. Those wearing the aids are significantly (all $p < .001$) more likely to visit with family and friends (11.3 percentage points), attend religious services (12.7 percentage points), join clubs (20.9 percentage points), go out for enjoyment (19.4 percentage points) and do volunteer work (12.5 percentage points).

The use of devices that aid with eating show barely any significant differences in the mean participation levels of those who used them and those who did not. Likewise the use of dressing and bathing aids is only mildly correlated with participation, but toileting aids appear to be more closely and positively associated with participation in all types of measured social activity, particularly with joining clubs (10.8 percentage points higher, $p < .001$) and visiting family and friends (9.4 percentage points higher, $p < .001$).

Logistic Regression with Random Effects Model Results

Results of the first set of logistic regression analyses, which consider the association of existing ATD use and current participation levels, are shown in Tables 1.7 through 1.9. With some notable exceptions, the effect of assistive technology device use on participation levels among older persons does not appear to be overwhelming. For example, there is little evidence that whether or not an individual uses any assistive device explains why he socializes with family and friends or goes to the movies or to dinner. As shown in Table 1.7, relating to the first hypothesis, when mobility devices have a significant impact it is generally negative, even when controlling for a number of other factors. Most prominently, the use of walkers is shown to detract from the likelihood that an individual participates in many social activities. Using a walker decreases the probability of attending religious services by over 5 percentage points ($p < .001$), of joining a club by 4.4 percentage points ($p < .01$) and of volunteering by 2 percentage points ($p < .05$). Wheelchair utilization is also negatively associated with the probability of attending religious services ($p < .05$). The use of a motorized scooter did increase the probability that an individual would join a club or participate in club meetings ($p < .05$), but has no significant impact on one's participation in any of the other listed activities. Remembering that our subsample includes only those who had a physical need for such devices, these results run quite contrary to the first hypothesis, which presumed a positive impact of mobility device use on participation among older adults.

TABLE 1.7: Logistic regression with random effects:
Average marginal effects of device use and other factors on the probability of participation for those with mobility problems ^

	Participation Activity				
	Visit	Rel. Serv.	Join Clubs	Out Enjoy	Volun.
Uses Assistive Device ***(ATD)***					
Cane	-0.002	0.020	0.010	-0.017	-0.014
Walker	0.002	-0.055 ***	-0.044 **	-0.001	-0.020 *
Wheelchair	-0.007	-0.044 *	-0.022	-0.035	-0.023
Scooter	-0.029	0.037	0.050 *	0.025	0.030
Barrier Prevents Participation ***(Barrier)***					
Health Prevents	-0.076 ***	-0.113 ***	-0.025	-0.166 ***	-0.016
Transport. Prevents	-0.022	-0.108 ***	-0.064 **	-0.041	n/a
Finds Activity Important ***(Interest)***					
Somewhat Import.	0.245 ***	0.374 ***	0.291 ***	0.393 ***	n/a
Very Import.	0.330 ***	0.804 ***	0.695 ***	0.517 ***	n/a
Social Support Factors ***(SocSup)***					
Married	-0.003	0.010	-0.014	0.022	-0.009
Children 1	-0.015	-0.005	-0.018	0.041	-0.013
2-4	0.030	0.008	-0.005	0.059 **	-0.013
5+	0.048 *	0.021	-0.005	0.061 *	-0.007
Has noone to talk to	-0.120 ***	-0.073 *	-0.027	-0.074 *	0.007
Community:					
Knows each other well					
Agree a Little	0.014	0.005	0.037 *	-0.017	0.007
Agree a Lot	-0.005	-0.017	0.029	-0.063 **	0.020
Helps each other					
Agree a Little	0.012	0.028	0.025	0.051	0.041 ***
Agree a Lot	0.008	0.040	0.017	0.072 **	0.025 *
Can be trusted					
Agree a Little	0.031	0.003	0.014	-0.020	0.027 *
Agree a Lot	0.052 **	0.007	0.010	0.033	0.012
Avg. hours care/mo.	0.000	0.000	0.000	0.000	0.000 *
# Observations	4,535	4,536	4,542	4,540	4,546

^ Mobility includes getting out of bed or chair, going outside or moving around house.

*p < .05, **p < .01, ***p < .001

n/a indicates question not asked of this activity

TABLE 1.7: Logistic regression with random effects (continued):
Average marginal effects of device use and other factors on the probability of participation for those with mobility problems ^

	Participation Activity				
	Visit	Rel. Serv.	Join Clubs	Out Enjoy	Volun.
Problem performing without help $^{++}$ *(ADL)*					
Vision	0.013	0.046	0.001	0.033	-0.003
Hearing	-0.021	-0.005	0.020	-0.004	0.025 **
Eating	-0.023	0.014	-0.006	-0.023	-0.002
Bathing	0.013	0.170	-0.019 *	0.003	-0.036 ***
Toileting	0.012	-0.004	0.017	0.001	0.020 *
Dressing	-0.007	0.033 *	-0.026 *	-0.026	-0.018 *
Environmental Factors *(Environ)*					
Living in Resid. Care	0.005	0.132 ***	0.099 ***	-0.047 *	0.022
Male	-0.022	-0.036	-0.029 *	-0.036 *	-0.018
Age 70-74	-0.037	0.033	-0.005	0.004	-0.012
75-79	-0.026	0.044	-0.006	-0.022	0.003
80-84	-0.032	0.050	0.027	0.010	-0.004
85-89	-0.024	0.039	0.041	-0.001	-0.023
90+	-0.042	0.020	0.026	-0.016	-0.023
Race/Ethnicity (White, non-Hispanic ref.)					
Black, non-Hisp.	-0.031 *	0.046 *	-0.012	-0.061 **	0.001
Other, non-Hisp.	-0.058	0.067	0.064	-0.001	-0.044 ***
Hispanic	-0.057 *	0.052	-0.041	-0.088 **	-0.032 **
Diag. with Dementia	0.038 *	-0.026	0.039	0.020	-0.047 **
Self-reported Current Health (poor ref.)					
Good	0.002	0.048 **	0.035 **	0.035 *	0.026 ***
V. Good/Excellent	-0.006	0.042 *	0.032 *	0.024	0.042 ***
Highest Education					
H.S. Diploma	0.053 ***	0.078 ***	0.027	0.026	0.017 *
Some College	0.038 *	0.061 **	0.067 ***	0.078 ***	0.025 **
Bachelor's Degree	0.030	0.104 ***	0.095 ***	0.071 **	0.065 **
Advanced Degree	0.049	0.108 ***	0.137 ***	0.054	0.155 ***
Works for Pay	0.049 *	0.113 ***	0.063 **	0.083 **	0.041 **
Still Drives	0.052 ***	0.088 ***	0.065 ***	0.097 ***	0.063 ***
# Observations	4,535	4,536	4,542	4,540	4,546

^ Mobility includes getting out of bed or chair, going outside or moving around house.

$^{++}$ help entails human assistance or device use. * p < .05, ** p < .01, *** p < .001.

In Table 1.8 vision devices, though commonly used, are shown only to have significant positive impact on the probability of going out for enjoyment. The table shows that using vision aids increases the probability of going out for enjoyment by 5.1 percentage points when compared to those not using these vision aids ($p < .05$). Conversely, the use of hearing aids among those with sensory impairments shows consistently positive and quite significant results in three cases. The table illustrates that those who currently use a hearing aid have a significantly higher probability of attending religious services (3 percentage points greater, $p < .01$), joining clubs and attending meetings (3.1 percentage points greater, $p < .01$) and volunteering (5.6 percentage points greater, $p < .001$) than those not using a hearing device. The high significance associated with hearing aid use makes it possible to at least partially accept the second hypothesis that the use of sensory devices has a positive impact on many types of participation among older adults.

TABLE 1.8: Logistic regression with random effects:
Average marginal effects of device use and other factors on the probability of participation for those with sensory problems ^

	Participation Activity				
	Visit	Rel. Serv.	Join Clubs	Out Enjoy	Volun.
Uses Assistive Device *(ATD)*					
Any Vision Device	0.004	0.019	-0.013	0.051 *	0.020
Any Hearing Device	0.014	0.030 **	0.031 **	0.021	0.056 ***
Barrier Prevents Participation *(Barrier)*					
Health Prevents	-0.048 ***	-0.084 ***	-0.041 **	-0.121 ***	-0.051 **
Transport. Prevents	-0.011	-0.085 ***	-0.085 ***	-0.032 *	n/a
Finds Activity Important *(Interest)*					
Somewhat Import.	0.199 ***	0.483 ***	0.384 ***	0.355 ***	n/a
Very Import.	0.256 ***	0.900 ***	0.819 ***	0.451 ***	n/a
Social Support Factors *(SocSup)*					
Married	0.003	0.019 *	-0.001	0.019 *	-0.017
Children 1	0.009	-0.002	0.003	0.035 *	-0.016
2-4	0.032 **	0.014	0.016	0.039 **	-0.006
5+	0.035 **	0.015	0.015	0.039 **	-0.003
Has noone to talk to	-0.061 ***	-0.032 *	-0.023	-0.057 ***	-0.013
Community:					
Knows each other well					
Agree a Little	0.010	0.003	0.026 *	-0.008	0.023
Agree a Lot	0.008	0.002	0.015	-0.030 **	0.048 **
Helps each other					
Agree a Little	0.014	0.028 *	-0.006	0.024	0.035
Agree a Lot	0.015	0.035 *	-0.006	0.039 *	0.040 *
Can be trusted					
Agree a Little	0.014	0.004	0.020	-0.017	0.030
Agree a Lot	0.020 *	-0.001	0.020	0.013	0.014
Avg. hours care/mo.	0.000	0.000 *	0.000 *	0.000	0.000 **
# Observations	10,549	10,549	10,556	10,556	10,562

*p < .05, **p < .01, ***p < .001
n/a indicates question not asked of this activity

TABLE 1.8: Logistic regression with random effects (continued):
Average marginal effects of device use and other factors on the probability of participation for those with sensory problems ^

	Participation Activity				
	Visit	Rel. Serv.	Join Clubs	Out Enjoy	Volun.
Problem performing without help $^{++}$ ***(ADL)***					
Mobility $^{\wedge}$	-0.019 **	-0.017	-0.012	-0.007	-0.053 ***
Eating	-0.014	-0.004	-0.005	-0.015	0.032
Bathing	0.005	-0.023 *	-0.026 *	-0.006	-0.075 ***
Toileting	0.003	-0.002	0.014	0.005	0.019
Dressing	-0.001	0.014	-0.024 *	-0.017	-0.058 ***
Environmental Factors ***(Environ)***					
Living in Resid. Care	0.017	0.083 ***	0.080 ***	-0.035 *	0.056 *
Male	-0.022 ***	-0.039 ***	-0.024 **	-0.017	-0.047 ***
Age 70-74	-0.019 *	0.010	0.003	-0.017	-0.003
75-79	-0.026 **	0.026 *	0.002	-0.036 **	0.037
80-84	-0.037 ***	0.025 *	0.020	-0.019	-0.018
85-89	-0.032 **	0.013	0.040 *	-0.032 *	-0.039 *
90+	-0.051 ***	-0.006	0.020	-0.046 **	-0.053 *
Race/Ethnicity (White, non-Hispanic ref.)					
Black, non-Hisp.	-0.024 **	0.030 **	-0.040 ***	-0.055 ***	-0.007
Other, non-Hisp.	-0.037 *	0.030	-0.009	-0.041	-0.096 ***
Hispanic	-0.032 *	0.040 *	-0.042 *	-0.057 **	-0.087 ***
Diag. with Dementia	0.024 *	-0.014	0.046 *	0.015	-0.091 *
Self-reported Current Health (poor ref.)					
Good	0.039	0.031 **	0.014	0.030 **	0.054 ***
V. Good/Excellent	0.012	0.037 ***	0.031 **	0.040 ***	0.087 ***
Highest Education					
H.S. Diploma	0.020 **	0.055 ***	0.048 ***	0.033 **	0.038 ***
Some College	0.018 *	0.056 ***	0.089 ***	0.057 ***	0.088 ***
Bachelor's Degree	0.026 *	0.091 ***	0.112 ***	0.059 ***	0.076 ***
Advanced Degree	0.031 **	0.094 ***	0.157 ***	0.079 ***	0.271 ***
Works for Pay	0.001	0.016	0.035 **	0.024 *	0.042 **
Still Drives	0.035 ***	0.068 ***	0.057 ***	0.063 ***	0.144 ***
# Observations	10,549	10,549	10,556	10,556	10,562

$^{\wedge}$ Mobility includes getting out of bed or chair, going outside or moving around house.

$^{++}$ help entails human assistance or device use. * p < .05, ** p < .01, *** p < .001.

Of all devices used by those with ADL limitations, Table 1.9 shows that current use of bathing devices has significant and positive effects on the greatest number of activities ($p < .05$) Bathing device use is positively associated with a greater probability of visiting family and friends (by 1.7 percentage points), attending religious services (by 2.8 percentage points), joining clubs (by 2.1 percentage points) and participating in volunteer activities (by 2.3 percentage points). Those who use toileting devices are also 3.6 percentage points more likely to be volunteering ($p<.05$) than those who had toileting problems but did not use an assistive device. Those who used eating devices, however are less likely to volunteer than those who do not use them. These instances of a greater probability of participation among those using devices lend some limited support to uphold our third hypothesis.

Tables 1.7 through 1.9 show that other variables are shown to have far stronger and more significant effects on participation levels, than device use. Health and transportation issues are likely to have significant negative impacts on one's propensity to participate in all activities, while finding the activity important has a very positive one ($p < .001$ among all sampled groups, for all activities). Other environmental factors such as continuing to drive are positively associated with more participation in all activities ($p < .001$) and living in residential care is strongly associated ($p < .001$) with attending religious services and joining clubs. Increasingly higher academic achievement is consistently associated with higher rates of participation, most significantly in activities besides visiting family and friends. Being male is generally shown to reflect decreased participation with varying degrees of significance, but particularly for those who have sensory difficulties. Also, having an ethnicity other than White is generally associated with lower probability of participation, with the exception of attending religious services where Blacks and Hispanics report higher attendance than Whites. Blacks in particular are significantly less likely than Whites to participate in visiting family and friends, joining clubs and going out for enjoyment in all of the subsamples. Other non-White, non-Hispanics (which include Asians, Pacific Islanders, Native Hawaiians and American Indians) are far less probable to volunteer than Whites. Having good health is shown to be a clear indicator of increased participation for all activities except for visiting family and friends, while being diagnosed with dementia interferes only with volunteering ($p < .01$).

The effect of social support on activity participation is inconsistent. Family status (particularly having two or more children) is positively significant only to one's inclination to visit family or go out for enjoyment. Having no one to talk to is significantly and negatively associated with visiting family and friends ($p < .005$ for all subsamples), attending religious services ($p < .05$) and going out for enjoyment. In general, one's perceptions of community are most often a positive influence on his or her probability of participation, though not always significantly so.

TABLE 1.9: Logistic regression with random effects:
Average marginal effects of device use and other factors on the probability of participation for those with ADL problems

	Participation Activity				
	Visit	Rel. Serv.	Join Clubs	Out Enjoy	Volun.
Use Assistive Device ***(ATD)***					
Any Eating Device	-0.033	0.020	0.007	-0.060	-0.138 *
Any Bathing Device	0.017 *	0.028 *	0.021 *	0.012	0.023 *
Any Toileting Devic	0.019	-0.027	0.016	0.004	0.036 *
Any Dressing Device	0.028	-0.013	-0.030	0.010	-0.021
Barrier Prevents Participation ***(Barrier)***					
Health Prevents	-0.068 ***	-0.105 ***	-0.043 **	-0.153 ***	-0.062 ***
Transport. Prevents	-0.014	-0.093 ***	-0.089 ***	-0.048 *	n/a
Finds Activity Important ***(Interest)***					
Somewhat Import.	0.191 ***	0.428 ***	0.347 ***	0.353 ***	n/a
Very Import.	0.263 ***	0.850 ***	0.770 ***	0.467 ***	n/a
Social Support Factors ***(SocSup)***					
Married	-0.008	-0.001	0.005	0.013	-0.016
Children 1	0.003	0.018	0.003	0.043	-0.032
2-4	0.033 *	0.014	-0.002	0.047 *	-0.004
5+	0.040 **	0.029	-0.001	0.052 *	-0.008
Has noone to talk to	-0.080 ***	-0.037	7.000	-0.059 *	-0.013
Community:					
Knows each other well					
Agree a Little	0.012	0.002	0.026	-0.012	0.005
Agree a Lot	0.006	-0.005	0.021	-0.049 **	0.036 *
Helps each other					
Agree a Little	0.005	0.032	0.010	0.045 *	0.042 *
Agree a Lot	0.002	0.057 *	0.009	0.062 **	0.039
Can be trusted					
Agree a Little	0.040 *	-0.003	0.014	-0.013	0.031
Agree a Lot	0.047 **	-0.018	0.005	0.022	0.018
Avg. hours care/mo.	0.000	0.000	0.000	0.000	-0.001 *
# Observations	5,740	5,745	5,745	5,748	5,753

*p < .05, **p < .01, ***p < .001
n/a indicates question not asked of this activity

TABLE 1.9: Logistic regression with random effects (continued):
Average marginal effects of device use and other factors on the
probability of participation for those with ADL problems

		Participation Activity				
		Visit	Rel. Serv.	Join Clubs	Out Enjoy	Volun.
Problem performing without help [++] ***(ADL)***						
Mobility [^]		-0.027 *	-0.028 *	-0.035 **	-0.025	-0.053 ***
Vision		-0.007	0.037	0.003	0.030	-0.010
Hearing		-0.022 *	0.002	0.008	-0.010	0.048 ***
Environmental Factors ***(Environ)***						
Living in Resid. Care		0.002	0.087 ***	0.079 ***	-0.050 *	0.037
Male		-0.022 *	-0.021	-0.027 *	-0.019	-0.017
Age	70-74	-0.014	0.011	-0.008	-0.017	-0.004
	75-79	-0.033 *	0.021	-0.002	-0.031	0.002
	80-84	-0.034 *	0.004	0.013	-0.015	-0.029
	85-89	-0.023	-0.001	0.028	-0.023	-0.042
	90+	-0.046 *	-0.028	0.009	-0.036	-0.059 *
Race/Ethnicity (White, Non-Hispanic ref.)						
Black, non-Hisp.		-0.030 **	0.038 **	-0.033 *	-0.073 ***	0.000
Other, non-Hisp.		-0.072 *	-0.001	-0.007	-0.003	-0.103 ***
Hispanic		-0.054 *	0.024	-0.044	-0.074 **	-0.050 *
Diag. with Dementia		0.034 *	-0.021	0.046 *	0.010	-0.104 **
Self-reported Current Health (poor ref.)						
Good		0.006	0.043 **	0.030 *	0.045 ***	0.065 ***
V. Good/Excellent		-0.002	0.047 **	0.039 **	0.044 **	0.080 ***
Highest Education						
H.S. Diploma		0.031 **	0.066 ***	0.043 **	0.025	0.053 ***
Some College		0.014	0.058 ***	0.080 ***	0.061 ***	0.081 ***
Bachelor's Degree		0.025	0.108 ***	0.112 ***	0.086 ***	0.128 ***
Advanced Degree		0.024	0.100 ***	0.120 ***	0.051 *	0.192 ***
Works for Pay		0.024	0.016	0.043 *	0.050 *	0.047 **
Still Drives		0.050 ***	0.077 ***	0.061 ***	0.088 ***	0.127 ***
# Observations		5,740	5,745	5,745	5,748	5,753

[^] Mobility includes getting out of bed or chair, going outside or moving around house.

[++] help entails human assistance or device use. * p < .05, ** p < .01, *** p < .001.

First Difference Model Results

Despite some indication of significant increases in the use of assistive devices over the two waves of data, changes in the general levels of participation over the same period appear negligible (see descriptive statistics in Tables 1.4 and 1.3 respectively). To examine a correlation in the dynamic nature of these behaviors, we employ a linear probability model with a first differences approach. These results are shown in Table 1.10 (subsample of those with mobility problems), Table 1.11 (those with sensory problems) and Table 1.12 (those needing help with ADLs). Note that in these tables, a small number of variables (gender, education, children and race) are omitted since there is no within-group variance in the variable between waves.

Table 1.10 shows that, similar to the previous analysis, the use of some mobility devices decreases the probability that the individual will choose to participate in a number of activities. For example, when a person went from not using a walker to using one, the probability of visiting with friends and family, going out for enjoyment and volunteering does not change, but the probability that he will attend religious services decreases by over five percentage points ($p < .05$) and the probability that he will join a club decreases by 4.7 percentage points ($p < .05$). Likewise the use of a cane leads to a decrease in volunteering (3.2 percentage points, $p < .05$) On the other hand, a positive change in scooter use is positively associated with an increase in joining clubs and volunteering ($p < .05$).

TABLE 1.10: First difference models:
Effects of a change in device use and other factors on the
change in participation for those with mobility problems^

	Participation Activity				
	Visit	Rel. Serv.	Join Clubs	Out Enjoy	Volun.
Uses Assistive Device *(ATD)*					
Cane	-0.008	-0.017	-0.019	-0.008	-0.032 *
Walker	0.044	-0.056 *	-0.047 *	0.018	-0.019
Wheelchair	-0.014	-0.060 *	-0.030	-0.043	-0.001
Scooter	-0.062	0.053	0.085 *	0.088	0.070 *
Barrier Prevents Participation *(Barrier)*					
Health Prevents	-0.056 **	-0.071 ***	0.001	-0.139 ***	-0.005
Transport. Prevents	0.027	-0.095 ***	-0.041	0.044	n/a
Finds Activity Important *(Interest)*					
Finds Important	0.143 ***	0.130 ***	0.203 ***	0.165 ***	n/a
Social Support Factors *(SocSup)*					
Married	0.004	-0.098	-0.053	-0.022	-0.034
Has noone to talk to	-0.073 ***	-0.057	-0.011	0.004	0.061 *
Community Knows Each Other Well					
Agrees	0.017	0.001	0.002	0.033 *	-0.002
Community Helps each other					
Agrees	-0.012	0.010	-0.001	-0.001	-0.017
Community Can be trusted					
Agrees	-0.001	0.006	0.012	0.007	0.001
Avg. hours care/mo.	0.007 **	0.000	0.000	0.002	0.000
# Observations	2,116	2,119	2,124	2,124	2,128

^ Mobility includes getting out of bed or chair, going outside or moving around house.
*p < .05, **p < .01, ***p < .001. n/a is not asked of this activity
Note: The following categories were omitted because of no within-group variance:
Children, Male, Race/Ethnicity, Highest Education & Income

TABLE 1.10: First difference models (continued):
Effects of a change in device use and other factors on the
change in participation for those with mobility problems^

	Participation Activity				
	Visit	Rel. Serv.	Join Clubs	Out Enjoy	Volun.
Problem performing without help ^^ ***(ADL)***					
Vision	0.056	0.035	0.046	0.065	0.032
Hearing	-0.012	-0.025	-0.035	-0.042	0.046 *
Eating	-0.023	-0.004	-0.001	-0.010	0.007
Bathing	0.009	-0.009	-0.038 *	0.017	-0.031
Toileting	0.017	0.015	-0.003	0.005	0.037 *
Dressing	-0.015	0.040 *	-0.008	-0.047 *	-0.030 *
Environmental Factors ***(Environ)***					
Living in Resid. Care	-0.067	0.175 **	0.271 ***	-0.116	0.027
Age	0.003	0.001	0.003	-0.002	0.005
Diag. with Dementia	0.089	-0.007	0.078	-0.007	-0.019
Self-reported Current Health (poor ref.)					
Good	0.003	0.010	-0.010	0.013	0.005
Works for Pay	0.017	0.028	0.012	0.169 ***	-0.039
Still Drives	0.013	0.071 *	0.123 ***	0.064	0.083 ***
# Observations	2,116	2,119	2,124	2,124	2,128

^ Mobility includes getting out of bed or chair, going outside or moving around house.

^^ help entails human assistance or device use.

* p < .05, ** p < .01, *** p < .001.

Note: The following categories were omitted because of no within-group variance:
Children, Male, Race/Ethnicity, Highest Education & Income

We see from Table 1.11, that the impact of changes in sensory device use on changes in participation is minimal. The only significant p-values concern a positive association between new vision aid use and an increased likelihood of going out for enjoyment ($p < .05$).

TABLE 1.11: First difference models:
Effects of a change in device use and other factors on the
change in participation for those with sensory problems

	Participation Activity				
	Visit	Rel. Serv.	Join Clubs	Out Enjoy	Volun.
Use Assistive Device ***(ATD)***					
Any Vision Device	-0.039	-0.037	0.004	0.081 *	0.015
Any Hearing Device	-0.008	0.022	-0.042	0.043	0.004
Barrier Prevents Participation ***(Barrier)***					
Health Prevents	-0.050 **	-0.062 ***	-0.013	-0.142 ***	-0.016
Transport. Prevents	0.032	-0.106 ***	-0.081 **	0.010	n/a
Finds Activity Important ***(Interest)***					
Finds Important	0.116 ***	0.144 ***	0.242 ***	0.150 ***	n/a
Social Support Factors ***(SocSup)***					
Married	-0.010	-0.035	-0.063	-0.030	0.015
Has noone to talk to	-0.052 *	-0.014	-0.030	-0.008	0.006
Community Knows Each Other Well					
Agrees	0.014	0.004	0.000	-0.001	-0.002
Community Helps each other					
Agrees	-0.006	0.007	-0.009	0.016	-0.008
Community Can be trusted					
Agrees	-0.001	0.000	0.010	-0.001	0.001
Avg. hours care/mo.	0.007 ***	0.000	0.000	0.001	0.000
# Observations	4,929	4,926	4,934	4,934	4,940

* $p < .05$, ** $p < .01$, *** $p < .001$. n/a is not asked for this activity.

Note: The following categories were omitted because of no within-group variance: Children, Male, Race/Ethnicity, Highest Education & Income

TABLE 1.11: First difference models (continued):
Effects of a change in device use and other factors on the
change in participation for those with sensory problems

	Participation Activity									
	Visit		Rel. Serv.		Join Clubs		Out Enjoy		Volun.	
Problem performing without help ^^ ***(ADL)***										
Mobility ^	-0.018		-0.015		-0.020		0.020		-0.043	**
Eating	-0.018		-0.013		0.000		0.005		0.028	
Bathing	0.009		-0.014		-0.017		0.003		-0.022	
Toileting	0.005		0.001		-0.013		-0.006		0.002	
Dressing	-0.004		0.028	*	-0.017		-0.030		-0.037	*
Environmental Factors ***(Environ)***										
Living in Resid. Care	-0.037		0.122	**	0.216	***	-0.093		0.069	
Age	0.000		-0.002		-0.001		0.000		-0.002	
Diag. with Dementia	0.048		-0.032		0.022		-0.035		-0.033	
Self-reported Current Health (poor ref.)										
Good	0.006		0.010		-0.002		0.015		0.007	
Works for Pay	-0.025		0.001		0.020		0.035		0.012	
Still Drives	0.024		0.097	***	0.087	***	0.053	*	0.074	**
# Observations	4,929		4,926		4,934		4,934		4,940	

^ Mobility includes getting out of bed or chair, going outside or moving around house.
^^ help entails human assistance or device use.
* p < .05, ** p < .01, *** p < .001.
Note: The following categories were omitted because of no within-group variance:
Children, Male, Race/Ethnicity, Highest Education & Income

Finally in Table 1.12, considering those who require assistance to perform ADLs, we note only one effect of a change in the use of devices to help with eating, bathing, toileting or toileting on any type of participation, and that is a negative effect of an increase in the use of a dressing device on religious service attendance.

TABLE 1.12: First difference models:
Effects of a change in device use and other factors on the
change in participation for those with ADL problems

	Participation Activity				
		Rel.	Join	Out	
	Visit	Serv.	Clubs	Enjoy	Volun.
Uses Assistive Device ***(ATD)***					
Any Eating Device	-0.056	0.036	0.042	-0.051	-0.052
Any Bathing Device	0.010	-0.018	0.010	0.003	0.021
Any Toileting Device	0.002	0.029	-0.011	-0.006	0.023
Any Dressing Device	-0.002	-0.052 *	-0.001	-0.008	-0.030
Barrier Prevents Participation ***(Barrier)***					
Health Prevents	-0.061 **	-0.068 ***	-0.022	-0.142 ***	-0.006
Transport. Prevents	0.010	-0.085 **	-0.044	0.016	n/a
Finds Activity Important ***(Interest)***					
Finds Important	0.122 ***	0.122 ***	0.210 ***	0.151 ***	n/a
Social Support Factors ***(SocSup)***					
Married	0.040	-0.067	0.008	-0.007	-0.013
Has noone to talk to	-0.060	-0.029	-0.019	0.014	0.027
Community Knows Each Other Well					
Agrees	0.012	-0.011	-0.005	0.008	-0.010
Community Helps each other					
Agrees	0.008	0.020	0.008	-0.002	-0.017
Community Can be trusted					
Agrees	-0.004	-0.004	0.012	0.004	0.000
Avg. hours care/mo.	0.007 **	0.000	0.000	0.001	0.000
Problem performing without help ^^ ***(ADL)***					
Mobility ^	0.002	-0.017	-0.041 *	0.034	-0.045 *
Vision	0.048	0.034	-0.003	0.038	-0.008
Hearing	-0.028	-0.028	-0.024	-0.034	0.048
# Observation	2,708	2,712	2,712	2,714	2,718

*p < .05, **p < .01, ***p < .001. n/a is not asked for this activity.

Note: The following categories were omitted because of no within-group variance:
Children, Male, Race/Ethnicity, Highest Education & Income

TABLE 1.12: First difference models (continued):
Effects of a change in device use and other factors on the change in participation for those with ADL problems

	Participation Activity									
	Visit		Rel. Serv.		Join Clubs		Out Enjoy		Volun.	
Environmental Factors ***(Environ)***										
Living in Resid. Care	-0.031		0.126	*	0.204	***	-0.127	*	0.025	
Age	0.002		-0.004		-0.001		0.006		0.006	
Diag. with Dementia	0.068		-0.031		0.091		-0.046		-0.048	
Self-reported Current Health (poor ref.)										
Good	-0.005		0.006		-0.009		0.016		0.009	
Works for Pay	-0.022		0.023		0.013		0.066		0.000	
Still Drives	0.011		0.090	***	0.102	***	0.059		0.073	**
# Observations	2,708		2,712		2,712		2,714		2,718	

^ Mobility includes getting out of bed or chair, going outside or moving around house.

^^ help entails human assistance or device use.

* p < .05, ** p < .01, *** p < .001

Note: The following categories were omitted because of no within-group variance:
Children, Male, Race/Ethnicity, Highest Education & Income

Looking beyond the key variables of interest, Tables 1.10, 1.11 and 1.12 show that changes in other factors contribute to one's propensity to participate. Moving into residential care indicates a very positive impact on joining clubs and attending religious gatherings for individuals with mobility and sensory problems as well as for those with ADL limitations. Interestingly, neither a change in the diagnosis of dementia nor a change in reported health status has any apparent impact on a change in participation level. Working for pay continues to be positively associated with going out for enjoyment among those with mobility problems (p < .05), but not for those with sensory problems or who need help with ADLs. Among all subsample groups, continuing to drive has a positive and somewhat significant influence on all activities, with the exception of visiting family and friends.

Health barriers remain a significant problem for participation for all groups, particularly when it comes to visiting with family, attending religious services and going out for enjoyment, while transportation barriers have a significant and negative impact on religious activity ($p < .01$) and on joining clubs only for those with sensory problems ($p < .01$). Finding the activity important remains the most significant indicator for the likelihood of all types of participation with very highly significant results for all groups (most $p < .001$). In this analysis, changes in most social support variables have only minor impact on the probability of participation. A positive change in the feeling that one has nobody to talk to has a significant and negative effect on the probability of visiting family and friends ($p < .001$), but a positive effect on the probability of volunteering ($p < .05$), at least for those with mobility issues. The effect of a change in the average amount of monthly caregiving on visiting family and friends is the most significant of the variables in the social support category. An increase of 10 hours of care per month, for example, would increase the probability of visiting with others by 7 percentage points for those who need help with mobility ($p < .01$) and sensory problems ($p < .001$), as well as for those who have difficulty performing activities of daily living ($p < .01$). The perception that one's community is willing to help are associated with a greater likelihood of volunteering among those with mobility problems ($p < .005$) and of attending club meetings for those needing help with ADLs ($p < .005$).

Discussion and Policy Implications

Of the five activities, this study reveals the highest participation rates occur for visiting with family and friends, which is to be expected as social support literature has shown for years that people will first go to natural helpers such as family and friends for advice, emotional and informational support and help with daily tasks (Cohen, 2004; Gottlieb, 1983). Still, most people want to do things for themselves, and how they choose to do so depends on the extent of their limitations, their personal preferences and goals, their social environment, and whether they feel that device use supports or undermines their sense of personal identity (Gitlin, Luborsky and Schemm, 1998). ATDs can facilitate independence and improve self-esteem for individuals with physical, sensory or mobility problems by enabling them to get around on their own, care for themselves and interact with others. Presumably this independence would also allow them to engage in situations of daily life, such as visiting family and going out for enjoyment, attending religious services, joining clubs of interest and volunteering to help others.

Our study however shows a dichotomy in its two biggest revelations. On the one hand, it indicates that some devices such as hearing aids are influential in encouraging participation in many activities, but that mobility devices in particular are sometimes associated with less social activity. For example, results show an apparent negative impact of wheelchairs and walkers on attending religious services, joining clubs and volunteering. Although ATDs are designed to improve the health and psychosocial functioning of those who use them, sometimes their use may seem unsuitable for the individual and could, in itself, represent a barrier to participation. Haggblom-Kronlöf and Sonn's qualitative study of older adults (2007) describes a "contradiction" in the range of responses towards the social aspects of assistive device use. They found acceptance, but also uncertainty, embarrassment and vulnerability among the users of assistive devices outside the home in a social context.

Public, social and personal consequences of device use, such as lowered prestige, stigma and being viewed as a dependent person, may make someone think twice about using mobility devices in particular. Wheeled mobility devices, such as wheelchairs, for example, are highly visible signs of disability (in fact, the literal international symbol for handicap) and while their use may enable an individual to leave home, at the same time, it may be a reminder of diminished ability and make the individual self-conscious about participating in social activity. Despite more accessible buildings, housing, and recreational facilities as mandated by the Americans with Disabilities Act (ADA), participation in society is still challenging for people who use mobility devices, and users of these devices make fewer trips outside the home, and engage in fewer activities than people without disabilities (Harris, 2007).

Hearing devices are a different matter, and are by far the most significant positive ATD predictor of participation in our study, as users are more likely than non-users to attend religious services, join clubs, and volunteer. Hearing serves a number of functions. It enables spoken communication, provides an alarm for potentially injurious events, allows one to orient oneself, and serves an aesthetic function as in the appreciation of music or the voices of loved ones (Tesch-Römer, 1997). Presbycusis, or hearing loss which occurs mostly in older age, may therefore have a profound impact on the person's social, functional, and psychological wellbeing. Power and Hyde (2002) describe how people who are hard-of-hearing often report feeling lonely or isolated when they are unable to communicate with others, and this feeling of isolation may be subconsciously reinforced by friends, family, or care-givers in response to the increased effort required to communicate. Although results of empirical studies concerning a correlation between presbycusis and social integration are equivocal (Tesch-Römer, 1997), a study of nursing home residents by Resnick, Fries and Verbrugge (1997) associates more severe hearing impairment with low social engagement.

There is no cure for age-related hearing loss and many older people just accept hearing impairment as part of the aging process, but hearing aids can improve hearing function in most cases. It has been estimated that only one in five older people with hearing problems seek assistance due to negative attitudes about hearing impairment and hearing aids, lack of knowledge of the options to treat hearing impairment, and problems accessing audiological services (Howarth and Shone, 2006). Much of this access problem is likely financial. Although Medicare Part B will cover a diagnostic hearing or balance exam if a doctor orders it, Medicare will not cover routine hearing exams, hearing aids, or exams for fitting hearing aids (Centers for Medicare & Medicaid Services). Only thirty-two of the fifty U.S. states provide Medicaid benefits for hearing aids, generally covered more frequently for children than for adults, and often after a large co-pay (The Henry J. Kaiser Family Foundation, 2010). Since the data used in this study do not include the state in which the sample person lives, we cannot determine the extent of the individual's Medicaid coverage, nor can we assess the availability of devices, or trained personnel to assist with them.

Sometimes the use of a device to address one problem may negatively impact another physical limitation, so while we account for multiple functional limitations, future studies should consider the effect of using multiple devices. Also, Demers et al. (2008) tell us that the likelihood for changes in life circumstances, abrupt or subtle, encourage taking a longitudinal approach to studying ATD use and its outcomes. Two waves of data, one year apart, are really insufficient to ascertain what the true longer-term effects of using assistive devices may have on participation. For example a change in use may have been precipitated by a recent event, such as a fall, a stroke or the start of physical therapy that might, in itself, have had a profound effect on one's ability and inclination to participate. Also, for many devices there is a "learning curve" during which an individual may opt not to participate in activities. We look forward to future waves of NHATS data which will allow us to follow the trajectories of both device use and participation. Finally, while this study indicates that good hearing and communication abilities are important in allowing for increased participation, it does not go further in gauging the social capital gained, or measuring improved health and lower healthcare costs.

The Centers for Disease Control and Prevention (Dillon et al., 2010) estimate that one out of four older Americans is hearing-impaired and that approximately 70% of them could potentially benefit from using a hearing aid, but do not use one. This means that the hearing and communication needs of many go unmet and lost are any benefits of the social capital they may have gained through increased participation. We hope this essay has raised an awareness of the importance of auditory rehabilitation, and the need for increased public funding of affordable hearing aids for our older population.

DESCRIPTIVE ANALYSIS OF THE DETERMINANTS OF THE LIVING ARRANGEMENT DECISIONS OF OLDER PEOPLE

Introduction and Significance

From *Decision,* by Ruth Margolin-Silin (Silin, 2009):

> Do I go or do I stay? Should I wait another day?
> The house is so comfy, I love it quite clearly.
> My things and my treasures I'm devoted to dearly.
> My books and my paintings, my living room chairs,
> My oversized bed and my tables in pairs.
> So many memories over the years,
> So many laughs, a sprinkling of tears.
> ...
> The railing outside is shaky and loose.
> Some shingles have fallen from off of the roof.
> The basement's a mess, I'm developing stress
> And I still can't decide: Is it no? Is it yes?...

Most practitioners and researchers in the field of gerontology agree that as people age they would prefer to remain in an environment that is familiar and allows as much independence in activity as is possible (Castle, 2011). Interestingly, this desire to remain in their current residence for as long as possible becomes even more prevalent as age increases. A 2000 study showed that 83 percent of those surveyed age 55 to 64 wished to remain in their home as long as possible, while 92 percent of those age 65 to 74 and 95 percent of those age 75 and over wished to do so (AARP, 2000). Keeping people in their communities has also become popular with policy makers and health providers as it avoids the more costly option of institutional care (Wiles et al., 2011). However, as Margolin-Silin's poem points out, the decision to stay at home or to move to a residential setting is never easy for either the individual or her family. While independence and autonomy are important, so are the safety, security and cleanliness of the aging person. Ultimately if the determination is made that one needs care beyond what she can provide for herself, today's older adult confronts options very different from those of previous generations who were destined to enter a nursing home or to move in with family. Traditionally, Medicaid, as the largest payer of formal long-term care services, had funded predominantly institutional care, such as a nursing home. But the disability rights movement has long challenged this institutional bias of publicly provided long-term care, saying it limits personal autonomy and segregates residents from the general community. In 1999, the U.S. Supreme Court ruled that states have an obligation to administer services in a "less restrictive" setting if found appropriate to, and not opposed by, the affected individual (Olmstead v. L.C., 1999). This ruling led to the development of more programs that financed nursing home alternatives (Grabowski, Stevenson and Cornell, 2012) and over the past several decades there have been a proliferation of assisted living communities and more government-funded home and community-based service (HCBS) programs.

Although today's options for formal care have grown to encompass far more than traditional skilled nursing facilities, the availability of informal caregivers appears to be shrinking. According to a report from the American Association of Retired Persons (Redfoot, Feinberg & Houser, 2013), the ratio of potential caregivers for every person age 80-plus will drop from 7.2 to 1 in 2010, to 4 to 1 by 2030. By 2050, when all boomers will themselves be in late life, the ratio is estimated to be less than 3 to 1. So for individuals wishing to remain in their community, more formal personal care or the use of assistive devices may be required to substitute for the informal care they might have previously received. These alternatives, while providing those with disabling conditions the opportunity to continue to live at home, may not be available to all, due to disparities in publicly funded state programs. We might ask then, if one's living arrangement in later life is really a choice, or whether financial circumstances sometimes force the outcome. From a policy perspective, when considering how to allocate taxpayers' dollars to this issue, it is important to explore what determines why some people choose residential care when most prefer to remain at home.

In the past, researchers have focused on predicting the risk factors of nursing home “admission” and the compensatory processes that might prevent it. Many have shown it likely that there is a close link between health status of older adults and later life housing decisions (Charles & Sevak, 2005). Brown and Abdelhafiz (2011), for example found that most of the patient-related risk factors for nursing home admission were based on an underlying decline in physical and/or cognitive function. Others have adopted Anderson’s famous framework of access to medical care and its predisposing, enabling, and need characteristics (Hancock et al., 2002). Increasing age, along with cognitive and physical impairment, has been the leading indicator, but family structure has also been identified as key to the risk of nursing home admission (Freedman, 1996). Household income and home ownership have also been considered, with the latter consistently shown as reducing the likelihood of nursing home entry (Hancock et al., 2002; McCann, Grundy & O’Reilly, 2012). An analysis by Reinardy and Kane (2003) though, revealed some differences in the preferences of nursing home and assisted living residents, and they stress that despite the expansion of living arrangement options, researchers had only recently begun to examine the health and social circumstances leading to a move from one's home into residential care other than a nursing home.

This paper begins by exploring the current options for formal long-term care support and examining the literature to date for possible determinants of how individuals and their families make the choice of whether or not to utilize residential care. Drawing on data from a nationally representative sample of older Americans, we compare the descriptive statistics of those living in residential care with those remaining in their community, both independently and with others, and conduct bivariate analysis to seek correlations between relevant factors and the type of arrangement in which the individual lives.

Research Questions

The pertinent research questions are:

- What long-term care options are currently available to older adults who do not require the services of a skilled nursing facility?
- What has the literature revealed as the main determinants of moving from community to residential care?
- Based on these determinants, how do those currently living in residential care differ significantly from those living independently, or from those living with others, in the community?

Please not a Nursing Home!
Growth in Home and Community-Based Services

It is estimated that total long-term service and support expenditures (including skilled nursing facilities and home health care plans) in the United States approached $230 billion in 2012. This is an increase of over $97 billion or 73.7% in the ten-year period since 2002 (CMS, 2013a). Nursing home use, however, has not kept pace with either the growth in the aging population or with this sizeable increase in total expenditures for long-term care services (Ng, Harrington & Kitchener, 2010). Whereas spending for institutional care for older adults and those with physical disabilities had represented 78.4% of Medicaid's total long-term care spending in 2002, it now accounts for less than 62% (CMS, 2013b).

Skilled nursing facilities, or nursing homes as they are known, are often hospital-like settings designed for people who may be bed-ridden and/or require a great deal of medical care. Although it is possible that this lag in nursing home utilization is due to a general improvement in population health, it is also likely that many years of highly publicized poor nursing home quality have given them an undesirable reputation. Despite a growing movement to inject a culture change towards more person-centered care, the result is that, even among those who depend on Medicaid, fewer people are choosing to enter skilled nursing facilities as they age.

One reason this is possible is because of Title XIX of The Social Security Act, which authorizes multiple waiver and demonstration authorities allowing states flexibility in operating Medicaid programs. One of these programs, Section 1915(c), Home and Community-Based Services (HCBS) Waivers, allows long-term care services to be delivered in one’s home or in community settings, and is the Medicaid alternative to providing comprehensive long-term services in an institutional setting. Community, within this definition, refers to living in the home of a caregiver, a family member, a board and care home, an assisted living residence or senior living community. These waivers allow states to provide certain services to particular populations, such as the aging and disabled. Home and community-based waiver services may include case management, homemaker services, home health aide services, personal care services, adult day health services, habilitative services, respite care, day treatment, and other services that are cost-effective and necessary to avoid institutionalization (Kaiser, 2011).

As of 2009, 48 states and the District of Columbia were offering some form of HCBS 1915(c) waivers (Ng and Harrington, 2012). Unfortunately these long-term supports for non-institutional care for older adults and those with physical disabilities vary widely by state. Data compiled from 2011 CMS-64 quarterly reports show them ranging from 91.9% of New Mexico's total Medicaid long-term care expenditures for this group to a paltry .7% of Rhode Island's, with only 7 states spending over 50% of their total on non-institutional care (CMS, 2013b). Even when available, waivers are subject to enrollment caps and budget constraints, and there are often large and long waiting lists for services of HCBS waiver programs in many states. Fortunately, provisions of the Patient Protection and Affordable Care Act of 2010 will allow states options to take advantage of more HCBS funding. For example, the act extended the Money Follows the Person program for five years and instituted the State Balancing Incentive Program that allows for federal incentive payments to states that are currently spending less than 50% of their Medicaid long-term system and supports dollars on HCBS (Kaiser, 2011).

Living Arrangement Options

Beyond the health and personal care services provided by Medicare, Medicaid and HCBS waivers, individuals still have to choose the physical environment in which they are most comfortable and that best suits their particular needs. There are many different types of living arrangements available to senior citizens today in which they can receive levels of care ranging from full medical care in a skilled nursing facility to no care, living independently in their own home. This paper focuses on living arrangements other than nursing homes, and uses two descriptive categories of living arrangement: "community" and "residential care." Unlike the definition used by CMS in describing HCBS, in this study **Community** entails living either independently in one's own home (alone or with a partner) or living with others, possibly in an intergenerational household, but not in a managed environment. We have already indicated that people prefer the familiarity of their own home, but there are possible benefits of living with others as well. Net family housing costs may be shared among generations, interaction with children and grandchildren often increases, and literature suggests that family members may provide some types of informal care more effectively (Hopp, 1999). Offsetting these benefits are the problems of decreased independence and loss of privacy for the individual and increased stress on the entire household.

The second type of living arrangement in the study is termed **Residential Care**. Following the definition from the national Health and Aging Trend Study (Kasper and Freedman, 2014), a residential long-term care setting refers to 1) a retirement community that "has an area the resident can move to if care is needed, and offers help with medications or self-care, or offers meals" or 2) a freestanding or attached home such as “group home/board and care/supervised housing” or “assisted living facility or continuing care retirement community.” A comprehensive overview of living arrangement options can be found in Silin’s (2009) work, *Nursing Homes and Assisted Living: The Family’s Guide to making Decisions and Getting Good Care.* The following sections, describing the options available to older adults and their families, pull heavily from his work.

Independent Living with Home Health or Personal Care

This congregate care is the most basic of the living arrangements distinguished from remaining in one's community. The resident may have a studio or small apartment, which they occupy alone or with a spouse. The underlying goal of many of these communities is to eliminate the potential social isolation faced by people who remain alone in their home. There is usually a dining room in which one or more communal meals are served. Some light services such as housekeeping and laundry are usually provided, as are recreational and transportation services. Generally residents are expected to be self-sufficient, and the residence is not required to provide any type of personal care, nor are they licensed to do so. When a resident can no longer perform ADLs (eating, bathing, dressing or toileting) or has difficulty even with instrumental activities of daily living (such as housecleaning, shopping and paying their bills) he may choose to have a personal care service or informal caregivers come into his home. Likewise, residents may opt to receive home health care for the purpose of “promoting, maintaining or restoring” a level of health that would enable them to maintain an independent living style (Eckert et al., 2009).

Assisted Living Facilities

Sometimes older people who are still in reasonable health but needing help with ADLs will move into what is known as an assisted living residence, in lieu of continuing in-home personal care services. Keren Brown Wilson in Oregon and Paul and Teresa Klaasen of Virginia are often credited with the birth of assisted living as a distinct option to nursing home life (Eckert et al., 2009). In the 1980s, both envisioned a homelike environment that supported the resident's independence, privacy, dignity, individualism and choice. Today, twenty-nine states and the District of Columbia include provision of assisted living concepts such as privacy, autonomy and decision making in their regulating standards (U.S. DHHS, 2007), but since they are subject to state, and not federal regulation, there is much diversity in what constitutes an assisted living facility (ALF)[1]. Although originally designed as a social, rather than medical model, in some states they are allowed to provide nursing care, particularly if they have specific dementia care units, and in some cases it is hard to distinguish them from a nursing home. Others have a more homelike setting with residents often having their own room or apartment. The main differences between assisted living and independent living arrangements is that ALFs monitor the residents and provide help with personal care needs (such as dressing, bathing, toileting and grooming) and with moving around. In some states they may be allowed to dispense medications. Residents can usually remain in ALFs until the need for receiving medical care becomes too great or their mental faculties decline to the point where more focused care is needed.

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[1] For an in-depth look at individual state terminology and regulation , see DHHS "Residential Care and Assisted Living Policy" retrieved from http://aspe.hhs.gov/daltcp/reports/2007/07alcom1.pdf.

The costs of assisted living services also vary widely by facility, and many still cater to those with higher economic means. Although some states now offer HCBS Assisted Living Waivers that allow for the provision of typical HCBS services for those residing in licensed ALFs, the cost of rent, meals and other amenities is not covered. The growth in the number of homes and residents has been dramatic, although hard to pin down. One source approximated the number of assisted living facilities at 11,276 in 2007 (Grabowski, Stevenson and Cornell, 2012) but by 2009 other sources, including the Assisted Living Federation of America estimated that between 36,000 and 38,000 ALFs existed in the U.S. (Castle, 2011), with approximately 975,000 individual units nationwide (Stevenson and Grabowski, 2010). Many states use the term "assisted living" generically to cover virtually every type of group residential care on the continuum between home care and nursing homes, but for others the term still represents a unique model of residential care that differs significantly from other types.

Family Care Homes

Also known as adult family homes, and regionally as board and care homes, family care homes are typically smaller than assisted living facilities, in more of a home-like setting, and very often are located in residential neighborhoods and rural areas. Statutes in some states include a threshold of two to six residents to define an adult family care home (U.S. DHHS, 2007). Unlike in assisted living facilities, the owners typically live with the residents they serve, providing what Richard C. Ladd, former Director of the Oregon Senior and Disabled Services Division often referred to as a “bed and breakfast” atmosphere (Kane, Chan and Kane, 2007). Some evidence has suggested that people with dementia do well in this small, familiar setting, sometimes leading to relocation to a family care home from other types of adult care, such as assisted living, as their dementia worsens (Kane, Chan and Kane, 2007). Care homes, like other types of residential care, must usually be licensed to provide services, however, the level of care allowed varies dramatically by state. At the extreme, residential care centers may use their own discretion to admit those requiring very high levels of assistance, and even to provide skilled nursing services. But in many instances states develop discharge triggers to regulate the type of medical treatments that can and cannot be provided by the home and when a resident must be discharged to a facility licensed to offer higher levels of care (U.S. DHHS, 2007).

Continuing Care Retirement Communities

Continuing care retirement communities (CCRCs) provide multiple levels of care on the same campus. Residents may enter independently and turn to assisted living to provide help with daily tasks such as bathing or dressing, or even to 24-hour nursing care as the health need arises. In theory, CCRCs embody a general sense of community and peace of mind, especially for couples that prefer to remain together even if one of them may eventually need more care. The popularity of these communities in the United States has exploded, particularly in the last decade, growing to over 2,000 communities with an estimated 640,000 residents (Shippee, 2012). Still, they are usually marketed to older adults who are financially secure and entrance fees could be high depending on how luxurious the facility, the size and type of housing unit, and how much future care is covered. For example, a resident might opt for “life care” wherein they would pay a large entrance fee (which, according to AARP (2010), can range from $100,000 to a $1 million) and a set monthly fee that does not increase when additional healthcare is needed. Or they may choose a modified, pay-as-you-go plan with lower upfront costs and monthly payments that increase commensurate with service levels. CCRCs may offer an option to the resident to buy the unit, or to enter into a contract with the right to live in a unit until he or she dies, but there is a risk as entry fees are typically not refundable should the resident die or choose to leave the community.

Retirement Communities

Forms of retirement communities have existed since the 1950s when businessmen like Harry Kem and Ross Cortese and corporations such as Del Webb in Arizona opened large-scale housing developments that offered "modest units in an amenity-rich environment" (Glass and Skinner, 2013, page 64) designed for active adults over the age of 50. Glass and Skinner (2013) settle on a broad definition of a retirement community as an aggregation of housing units within clearly demarcated geographic boundaries, that has been intentionally planned exclusively for older people, and that offers some level of common services. The community contains many types of shared common space to promote interaction and recreational activities. It may offer some supportive services, such as light housekeeping, but does not offer personal care. While a general description is available, there are various types of communities that can fall under this category. For example, the Del Webb model has come to be known as a "leisure-oriented retirement community" or LORC, but senior apartments that fit the above criteria, including Section 202 supportive housing for the elderly, can also be considered retirement communities.

Sometimes a community not originally designed for seniors evolves into one with a significant proportion of older residents, either because they have lived there for a long period and wish to age in place or have migrated-in seeking access to its amenities, culture or services. These have become known as "naturally occurring retirement communities" or NORCs. They may be housing-based (located in a single apartment building or housing complex) or neighborhood-based, but in each case there are geographic membership boundaries which allow for a local, neighborhood focus that is as much about activities and services as physical location. Resident councils arrange for these through a network of local merchants who understand the needs of area residents and offer them discounted products and services (United Hospital Fund, 2013).

Elder Self-Directed Intentional Communities

In contrast, the concept for this very new living arrangement is that residents choose proactively, well before they retire, how to age and with whom they will grow old. Similar to in an intergenerational housing environment, the community is planned, owned, maintained and managed by the residents themselves, who share in its upkeep and in many daily social activities together. Thus far in the United States, there are at least six elder self-directed intentional communities from California to Virginia. In the current model, several individually owned housing units are oriented around a common open area and a common house and facilities, with a community design that offers easy access for all levels of physical ability. They are purported to be close-knit collaborative efforts in which neighbors socialize and mutually support each other into their later years, but since the concept is relatively young, the success of this radical “do-it-yourself” approach is yet unproven.

The aforementioned approaches and how they fall into the scheme of residential care, including nursing homes, are shown in Figure 2.1 which follows:

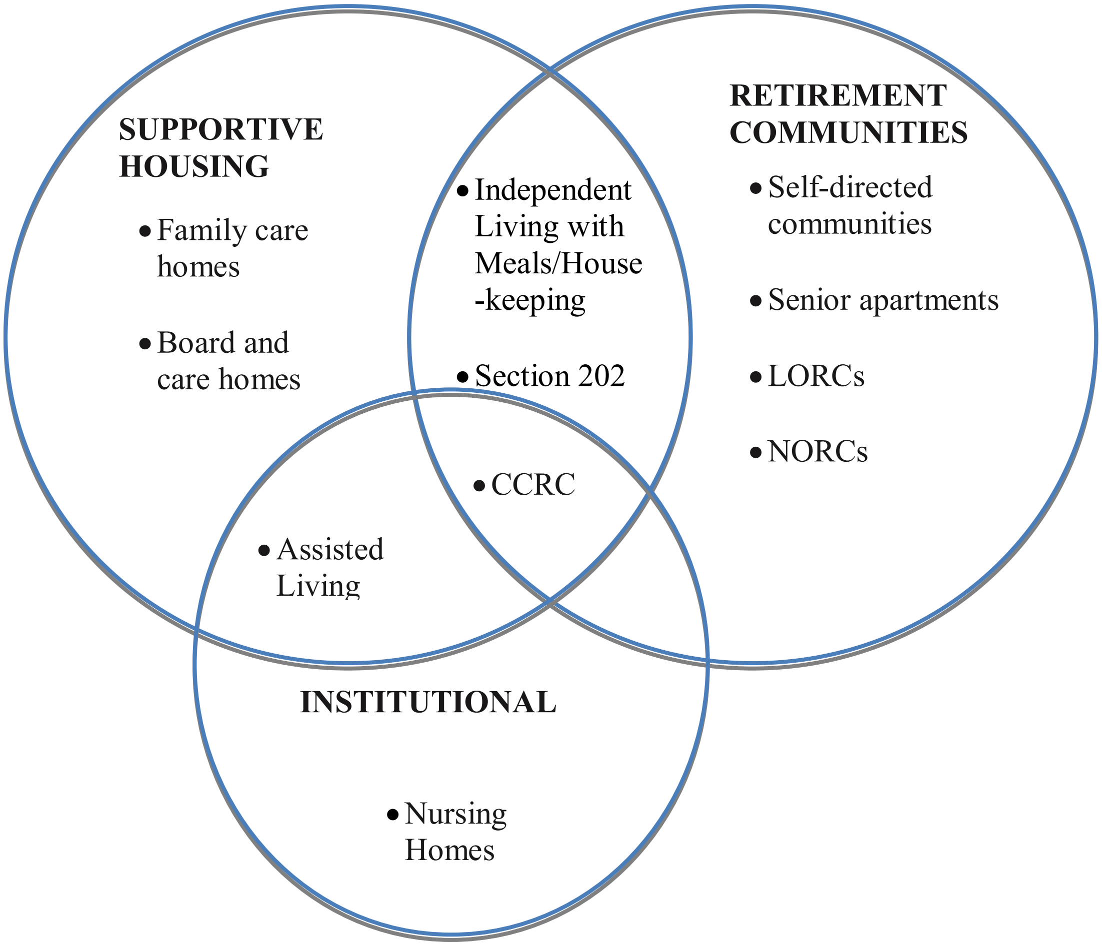


FIGURE 2.1 Conceptualization of relationship between retirement communities, supportive residential housing, and institutional housing
Modified from Glass and Skinner (2013).

Literature Review

Just as with admission to a nursing home, the reasons to leave the community and move into residential care are as personal and diverse as the individual himself. On the one hand residential care can provide a safe, supportive environment for those who can no longer live comfortably in their own homes, but it is also often viewed reluctantly as it represents the aging person giving up previous lifestyles and possessions. Wiles et al. (2011) conduct focus groups of older people to find what "aging-in-place" meant to them. Surprisingly they discover that most of those they interviewed were not familiar with the term and some even thought that it meant being "trapped" in a place. Rather than just the physical environment, they find that what was important to those in their study was the "warmth" of their current environment, a social connection and interaction with the community, along with a feeling of being secure in their surroundings. This makes it rather obvious that for some, successful aging can take place in a residential care community, as well as in one's home. One complication in trying to determine the factors that might influence whether or not an individual moves to residential care is that the lines between community and residential care are often blurred in the data and ensuing empirical studies. For example, the more prevalent strand of living arrangement literature considers one's "household composition," namely whether the individual is living independently or amongst others. The second strand is more focused on the physical environment in which the person resides than with whom they are residing.

Until about 2000, most work focused on nursing home admissions, but with the proliferation of other types of care, particularly assisted living facilities, government and academic studies began looking for the factors contributing to their growth. It is natural that they would begin by considering the risk factors found to effect admission to a nursing home, and indeed many did find considerable overlap in the characteristics of those who entered a nursing home and assisted living. For example, one DHHS study (Waidmann and Thomas, 2003) considers the differences in determinants of nursing home and assisted living entry to ascertain whether assisted living facilities can truly be considered an alternative to traditional nursing facilities; whether they serve individuals with similar profiles, or whether an entirely different set of factors leads individuals to move to these settings. The study uses variables structured along Andersen's 1983 model of health services use, particularly predisposing factors such as gender, age, race and, since it indicates availability of caregivers, family structure; enabling factors to determine the resident’s wherewithal to afford care, which include education, income and region; and finally, the needs factors measuring functional and health conditions. The authors conclude that there is a great deal of similarity, with the risk factors merely being more acute for nursing home admittance than other types of transitions. Reinardy and Kane (2003) employ a qualitative study to examine the individuals' circumstances prior to transition to assisted living and nursing homes in Oregon. Besides noting some slight demographic variations between the two groups, they find that the most significant differences are in intensity of need. Generally, the nursing home residents are found to need more help with ADLs, and are more likely to have recently moved from an acute care hospital or assisted living facility on the recommendation of a medical doctor.

Measures of personal financial security have been considered as a factor in evaluating living arrangement choices, but much of the existing literature considers the likelihood of a person living with others or living alone, and far less look at the likelihood that an individual will remain in the community or turn to residential care. For example, Engelhardt, Gruber and Perry (2005) find that for elderly widows and divorcees and for those with a high school education or less, the likelihood of living with others is very sensitive to income, however they do not consider whether this occurs in residential care or in the community. Hoerger, Picone and Sloan (1996) do not consider residential care communities such as assisted living at all in their study of the impact of receiving a public subsidy like Medicaid on the likelihood of someone a) living independently, b) living in an intergenerational household in the community, or c) living in a nursing home. Of the 411 articles, books and other studies considered in a systematic review of all literature on assisted living between 1989 and 2004 (Kane, Chan and Kane, 2007), only four tried to examine income as a predictive measure. Perhaps this is because income, as the authors admitted, is a "notoriously difficult" variable to measure accurately.

The same systematic review of assisted living communities (Kane, Chan and Kane, 2007) includes 16 studies that examined the effects of the individual's overall functioning on their placement, 14 that considered limitations with activities of daily living such as bathing (14 studies), dressing (13 studies), mobility (nine studies), and personal hygiene (five studies), and others that analyzed functional limits in performing instrumental activities of daily living. The authors point out that approaches to measuring functional dependence vary by study and are sometimes based on the resident's capacity to perform the function and sometimes on whether they received assistance to do so. The authors provide the percentage of individuals in their sample that required assistance with ADLs and instrumental ADLs, but do not mention that any of the studies included in their review specifically examined the quantity of caregiving received.

Often the availability of unpaid caregivers can influence the housing situation of older adults (Weeks, Keefe and Macdonald, 2012). Although conventional wisdom would suggest that informal care provided in the home by family or others might serve as a substitute for a move to institutional (Hays, Pieper and Purser, 2003) or residential care (Heiss, Hurd and Börsch-Supan 2005), there is some evidence that the receipt of this care, and its correlation with unobserved negative health conditions, actually increases the possibility of leaving the community (Charles and Sevak, 2005).

Heiss, Hurd and Börsch-Supan (2005) suggest a number of health and economic status indicators that are closely related with the living arrangements and well-being of the oldest-old which they recommend be studied jointly using a life trajectory approach. For health measures, they utilize the presence of health conditions and overall self-perception of health and economic status as indicated by wealth quartiles which consist of a number of variables like income and assets, intergenerational transfers (financial and time), housing, insurance and pensions. As with other studies, their data (AHEAD waves from 1993 – 1999) define "living arrangement" only as being in a nursing home, living alone or with others.

Methodology

Data Source

This analysis uses a new database from the National Health and Aging Trends Study (NHATS), a nationally representative sample of individuals ages 65 and older, drawn from the Medicare enrollment file. The database was designed to accommodate the scientific study of functioning in later life, and as such offers detailed information on participants' physical and cognitive capacity, how activities of daily life are carried out, and the participant's social, physical, and technological environment. Information on the individual's economic status and well-being, and aspects of early life is also collected. A main distinction in the data is among persons living in residential care settings that are nursing homes, residential care settings other than nursing homes, and in community settings. In the NHATS user guide, all of the living arrangement options described in section 2.4 can constitute residential care, with the exception of nursing homes, which are categorized separately. As shown previously in Figure 2.1 independent living, if located within congregate care and offering meals, is a form of supportive housing, as are family care homes. By definition, participants designated as being in residential care could also be located in assisted living facilities or retirement communities such as LORCs, NORCS, senior apartments or self-directed intentional communities as described. Since only a Facility Questionnaire to staff was administered whenever a sample person was determined to live in a nursing home, data pertinent to our study are not available on them and nursing home residents are excluded from the subsequent analyses.

The data include many variables to measure items which the literature has identified as potential factors related to one's living arrangement choices, such as measures of a household's income and assets, whether they receive Medicaid, home ownership, housing costs as a percentage of total income, individual and environmental factors, and descriptors of health and cognitive impairment. The NHATS data also include items which have previously not been linked extensively to living arrangements decisions, but which theoretically could be a factor, such as the need for and use of assistive devices which could improve functioning and allow the individual to remain in his or her home.

Empirical Approach

This study compares three distinct groups; those living in residential care other than a nursing home ("residential care"), those living in the community alone or with spouse only ("community independent"), and those who have remained in the community but are residing with someone other than just a spouse ("community with others"). Choosing from a large list of covariates, we compare the descriptive statistics for the residential care group first with those who are living independently in the community, and then with those who are living in the community with others, and use mean comparison and proportion tests to measure the significance of these differences. Next we compare these two sets of differences to see if the characteristics of those living in residential care are more closely associated with those living with others in their community than with those living independently. This descriptive piece will inform the analysis in the next essay, in which we will consider specifically whether the use of assistive technology devices is a significant factor in the living arrangement choices of older adults.

Description of Variables

Our summary of the literature reveals multiple categories that might highlight the differences between individuals living independently in the community and those who have chosen a move to another type of living arrangement. For example, in addition to basic environmental characteristics such as gender, age and race, social support and a social connection to one’s community are important. The individuals’ physical and cognitive health needs and functional limitations are of great consequence in the decision, but the literature tells us that we must also consider one's family structure, availability of caregivers, and the use of adaptive devices. The choice of living arrangement may be a financial one; we consider the economic resources which might allow the individual options, such as assets, income, housing ownership, insurance, whether or not they receive public subsidies and some economic well-being indicators. Finally the literature indicates that not enough has been done to examine the satisfaction and emotional well-being markers of older adults, particularly how they factor into living arrangement decision. The NHATS data include many variables that operationalize these factors, and we include these and some participation measures with the descriptive statistics and comparisons.

As will be outlined in the following tables, we place the variables into six distinct categories based on the literature. The groups are Environmental Factors, Social Support Resources, Health & Functioning, Economic Resources, Emotional Well-Being and Participation. Most of the items are straightforward responses to a direct question, but there are some exceptions. For example, variables measuring whether or not the respondent has problems with mobility, hearing, vision or performing various activities of daily living were developed using cross-tabulations of one’s level of difficulty performing a task by themselves with an indicator for whether they used a device to perform the task (see Walsh, N.d.).

Individuals are determined to be in one of three groups (living in residential care, living in the community alone or with spouse, or living in the community with those other than spouse) using a variable derived by combining two variables from the NHATS data. The first identifies whether the individual lives in the community or in residential care other than a nursing home and the second whether the individual lives alone, with spouse or partner only, with spouse or partner and others, or with others only. For the purpose of this study "residential care" refers to all of those from the first variable determined to be in residential care and community breaks down into "community independent" (those who replied they lived alone or with spouse or partner only) and "community with others" (those who indicated they lived with spouse or partner and others or with others only). The descriptive statistics shown in the following tables indicate that for most of the variables measured, there are significant differences between those living in residential care and in the community, particularly with those who are living there independently. The majority of the variables in the table are displayed as a percentage of the total in each group, however many of the economic resource indicators are displayed as means, as are measures of the number in one’s social network and the hours of caregiving an individual receives each month.

Results

Environmental Factors

Observation of the environmental factors in Table 2.1 shows that males represent less than 30% of the residential care population compared to 45.6% of those living in the community, independently and 35.1% of those in the community residing with others. These differences are statistically significant ($p < .01$). Older age is also associated with being in residential care, with a much greater percentage of those living in the community being under the age of 85. Only 18.2% of those living independently in the community and 24.3% in the community with others are age 85 or older. In contrast, 56.6% of those living in residential care are age 85 or older. These differences in proportions are statistically significant (p < .001) in both comparisons.

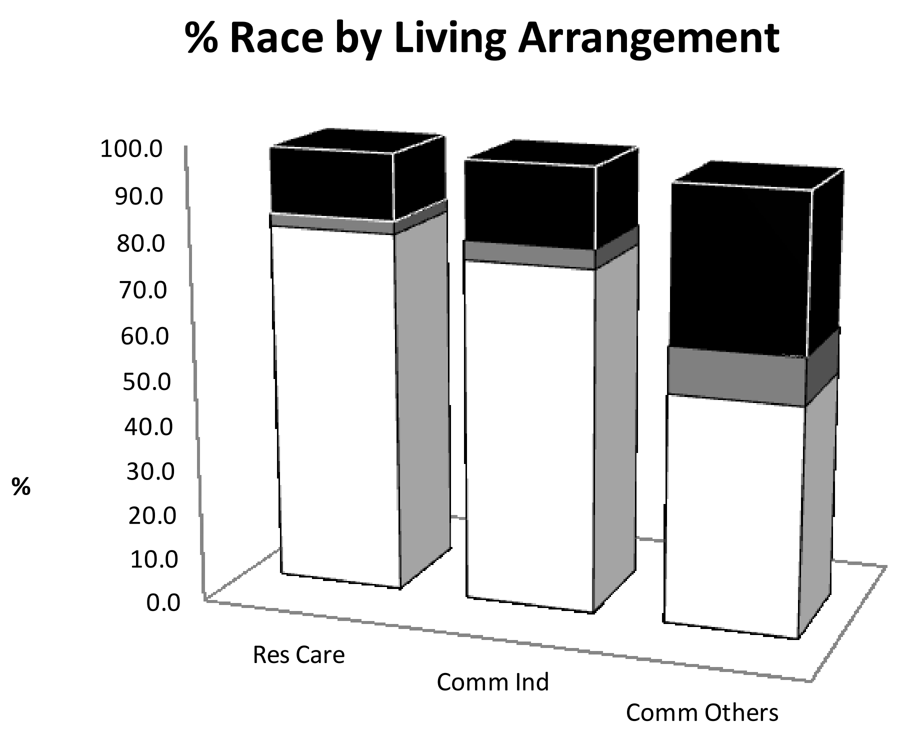
We collapse highest education level into two categories; the first having a high school diploma or less, and the second having at least some college education. When comparing education levels between those in residential care and those living independently in the community, the differences are neither large nor significant. But a far larger proportion of those in the community and living with others have a high school diploma or less (65%) compared to those in residential care (51.6%) This difference was highly significant (p < .001). Though expected, there are no noticeable differences between the groups in the census division in which individuals resided, and these results are not displayed in Table 2.1.

TABLE 2.1: Differences in environmental factors between those in residential care and those living independently in community and with those living in community with others

		Residential Care n = 764		Community Independent n = 9,002		Community With Others n = 3,804		Res Care vs. Comm Ind	Res Care vs. Comm With Others
		% or Mean	n	% or Mean	n	% or Mean	n	Diff.	Diff.
Gender (%)	Male	29.6	226	45.6	4,105	35.1	1,335	-16.0 ***	-5.5 **
	Female	70.4	538	54.4	4,897	64.9	2,469		
Age (%)	65-69	3.8	763	18.4	9,002	16.6	3,804	-14.6 ***	-12.8 ***
	70-74	8.8		22.4		19.3		-13.6 ***	-10.5 ***
	75-79	11.4		21.2		19.7		-9.8 ***	-8.3 ***
	80-84	19.4		19.8		20.1		-0.4	-0.7
	85-89	24.1		12.0		13.8		12.1 ***	10.3 ***
	90+	32.5		6.2		10.5		26.3 ***	22.0 ***
Highest Education (%)									
	HS Diploma or Less	51.6	746	49.7	8,919	65.0	3,759	1.9	-13.4 ***
	At Least Some College	48.4		50.3		35.0			
Race/Ethnicity (%)									
	White, non-hispanic	80.0	761	75.6	8,971	50.4	3,789	4.4 **	29.6 ***
	All Other	20.0		24.4		49.6			

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012
Significance levels ** = p < .01, *** = p < .001

There are also significant differences in the overall race/ethnicity make-up of the groups. The percentage of the population that is White, Non-Hispanic in residential care is 80%. That is only 4.4 percentage points higher than the percentage of Whites living independently in the community (p < .01), but almost a full 30 percentage points higher than the percentage of Whites living in the community with others (p < .001). Figure 2.2 shows that the offsets are among Blacks and Hispanics with higher proportions of each living in the community, than in residential care.



	Res Care	Comm Ind	Comm Others
■ Black, non-hispanic	14.6	17.2	34.2
▨ Hispanic	2.8	4.3	10.3
□ White, non-hispanic	80.0	75.6	50.4

FIGURE 2.2: Living arrangement by race

Social Support Factors

Table 2.2 shows that many of the social support variables also register statistically significant differences when comparing those living in residential care with those living independently or with others in the community. Those living in residential care are far less likely than their community counterparts to be married ($p < .001$) and are significantly more likely to have no children. The proportion with no children among those in residential care is almost twice as high as those living independently and almost three times as great as it is for those living with others in the community (both $p < .001$). On average, those in residential care also receive far fewer hours of monthly caregiving ($p < .001$), particularly as compared to those who are living in the community with others. Although there are no discernible difference in the number of people in their social network, those in residential care are slightly more likely to feel they had no one to talk to than community dwellers living both independently ($p < .01$) and with others ($p < .05$). On the other hand they are more likely than those in the community to feel positively about others in their immediate neighborhood. In response to three questions about their community, those in the study were coded as agreeing with statements if they answered that they agreed either "a little" or "a lot". Those in residential care agree more often than those in the community that their community knows each other well ($p < .001$) and they are more likely than those living with others in the community to agree that those in the community help each other ($p < .001$) and can be trusted ($p < .05$).

TABLE 2.2: Differences in social support factors between those in residential care and those living independently in community and with those living in community with others

	Residential Care n = 764		Community Independent n = 9,002		Community With Others n = 3,804		Res Care vs. Comm Ind	Res Care vs. Comm With Others
	% or Mean	n	% or Mean	n	% or Mean	n	Diff.	Diff.
Marital Status (%)								
Married or Equiv.	20.8	761	58.7	8,996	33.4	3,804	-37.9 ***	-12.6 ***
Single, Div. or Widowed	79.2		41.3		66.6			
No. of Children (%) None	17.2	764	9.8	9,002	6.2	3,804	7.4 ***	11.0 ***
1	12.3		11.7		12.9		0.6	-0.6
2-4	54.6		58.9		53.4		-4.3 *	1.2
5+	15.9		19.5		27.6		-3.6 *	-11.7 ***
Feels no one to talk to (%)	8.1	764	5.7	9,002	5.2	3,804	2.4 **	2.9 *
# in social network (mean)	1.8	346	1.9	4,921	1.9	1,729	-0.1	-0.1
Hour care rec./mo. (mean)	50.4	763	74.6	8,996	139.1	3,804	-24.2 ***	-88.7 ***
Comm. know each other well (%)								
Agree	89.2	722	81.9	8,873	79.2	3,720	7.3 ***	10.0 ***
Do Not Agree	10.8		18.1		20.8			
Comm. helps each other (%)								
Agree	93.2	726	91.5	8,785	87.6	3,665	1.7	5.6 ***
Do Not Agree	6.8		8.5		12.4			
Comm. can be trusted (%)								
Agree	89.0	701	91.2	8,643	85.9	3,606	-2.2	3.1 *
Do Not Agree	11.0		8.8		14.1			

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012
Significance levels * = p < .05, ** = p < .01, *** = p < .001

Health and Functioning Factors

Table 2.3 compares the health and functional limitations of those currently residing in residential care other than a nursing home and the groups residing in the community. We can see that a greater portion of those living in residential care have been diagnosed with dementia, but that this difference is not as stark for those living with others ($p < .01$) when compared to those living independently ($p < .001$). It is interesting to note that those living independently are more likely to rate their health as good to excellent when compared to those in residential care, ($p < .001$). However there is little difference in self-reported health when comparing those in residential care to those living in the community with others.

The finding noted above of similar self-reported health for those in residential care and those living in the community with others appears to be contradicted however when one looks at the percentage in each group that experience problems with mobility, sensory functioning, and performing activities necessary to daily living. In all categories with the exception of vision, a much higher percentage of those in residential care report having problems. Problems with mobility and toileting in particular exhibit drastic differences between the groups. For example, at 73.7%, the percentage of the total residential care group with mobility problems is more than twice as great as the percentage of those living independently and 20.7% greater than that of the group living with others. A similar pattern emerges looking at those who have a problem with toileting. In the other problem categories, the differences are of a lesser magnitude, but remain highly significant nonetheless ($p < .001$).

TABLE 2.3: Differences in health and functioning factors between those in residential care and those living independently in community and with those living in community with others

	Residential Care n = 764		Community Independent n = 9,002		Community With Others n = 3,804		Res Care vs. Comm Ind	Res Care vs. Comm With Others
	% or Mean	n	% or Mean	n	% or Mean	n	Diff.	Diff.
Diag. with Dementia (%)	15.6	762	3.5	8,997	11.7	3,802	12.1 ***	3.9 **
Self-reported Health (%)								
Poor/Fair	32.8	760	24.4	8,995	36.1	3,803	8.4 ***	-3.3
Good to Excellent	67.2		75.6		63.9			
Problem performing without help (%) $^{+}$								
Prob. with Mobility $^{++}$	73.7	764	35.5	9,002	53.0	3,804	38.2 ***	20.7 ***
Prob. with Hearing	39.8	756	23.2	8,983	23.4	3,787	16.6 ***	16.4 ***
Prob. with Vision	94.9	742	95.6	8,955	93.7	3,762	-0.7	1.2
Prob. with Eating	14.3	764	4.6	9,002	10.6	3,804	9.7 ***	3.7 **
Prob. with Bathing	34.4	764	11.9	9,002	24.1	3,804	22.5 ***	10.3 ***
Prob. with Toileting	78.1	764	42.5	8,996	50.0	3,804	35.6 ***	28.1 ***
Prob. with Dressing	36.5	764	16.1	9,002	27.7	3,804	20.4 ***	8.8 ***
Does Not Perform IADLs By Self (%)								
Laundry	53.6	764	35.8	8,995	48.6	3,804	17.8 ***	5.0 *
Shopping	63.2	761	39.1	8,999	59.0	3,804	24.1 ***	4.2 *
Preparing Meals	66.7	764	28.8	8,996	44.7	3,804	37.9 ***	22.0 ***
Banking	54.2	757	32.2	8,983	46.9	3,795	22.0 ***	7.3 ***
Uses Assistive Device (%)								
Any Mobility Device	65.7	763	24.7	9,001	39.3	3,803	41.0 ***	26.4 ***
Cane	25.3	764	18.7	9,002	25.8	3,803	6.6 ***	-0.5
Walker	45.7	764	11.2	9,002	19.8	3,804	34.5 ***	25.9 ***
Wheelchair	19.5	764	4.6	9,002	12.5	3,804	14.9 ***	7.0 ***
Scooter	6.0	763	1.9	9,002	3.2	3,804	4.1 ***	2.8 ***
Any Hearing Device	25.0	755	14.1	8,985	10.6	3,789	10.9 ***	14.4 ***
Any Vision Device	91.9	743	94.7	8,956	90.7	3,761	-2.8 **	1.2
Any Eating Device	1.8	763	0.5	8,991	1.3	3,798	1.3 ***	0.5
Any Bathing Device	74.2	658	39.2	8,014	38.2	3,316	35.0 ***	36.0 ***
Any Toileting Device	75.6	659	40.7	8,003	47.5	3,325	34.9 ***	28.1 ***
Any Dressing Device	5.0	762	3.1	8,997	4.2	3,801	1.9 **	0.8

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012

Significance levels * = p < .05, ** = p < .01, *** = p < .001

$^{+}$ "help" entails human assistance or device use. $^{++}$ mobility includes getting out of bed or a chair, going outside or moving around the house. IADLs are Instrumental Activities of Daily Living

A similar pattern emerges for those who report they do not perform instrumental activities of daily living (IADLs) by themselves. The differences between those in residential care and those living independently are the most striking ($p < .001$ for all four IADLs). Fifty-three percent of those in residential care do not do their own laundry vs. 35.8% of those living independently who do not do so, and the numbers are similar for shopping (63.2% vs. 39.1%), cooking (66.7% vs. 28.8%) and banking (54.2% vs. 32.2%). Significant differences also exist when comparing those in residential care to those living with others in the community. The proportion of those in residential care that do not prepare their own meals is 22 percentage points higher than the percentage of those living in the community with others ($p < .001$). The differences between these two groups remain significant, although not quite as striking when looking at those who do not do their own banking (7.3 percentage points greater for those in residential care, $p < .001$), laundry (5.0 percentage points greater than those in residential care, $p < .05$) and shopping (4.2 percentage points greater than those in residential care, $p < .05$).

Finally, those in residential care appear far more likely to be users of assistive devices, particularly when compared to individuals living alone or with a spouse in the community. When compared with those living with others, the differences are less dramatic, but still statistically significant in a number of cases. Using a mobility device is one such case. Overall, 65.7% of those in residential care report using some type of mobility device (a cane, walker, wheelchair or scooter) while only 39.3% of those living in the community with others report doing so. An equal percentage of both groups report using a cane, and the biggest discrepancy appears in the use of walkers, which appear far more prevalent in residential care ($p < .001$). There are also significant differences between the portion of the three populations using bathing ($p < .001$) and toileting ($p < .001$) devices.

Economic Resource Factors

In reviewing Economic Resources (Table 2.4), we find that home ownership among those in residential care is uncommon. Less than 1% of those residing in this type of living arrangement own a home vs. more than 80% of those living independently in the community and approximately 60% who reside in the community with others. There are obvious differences between the groups when it comes to owning assets other than one's home, but the only significant one shows that those in residential care have higher average net worth ($p < .001$) than those living with others in the community. There is no significant difference in net income between these two groups, although the average family income for those in residential care is approximately 58.8% of that earned by those who are independent in the community ($p < .05$). A higher percentage of those in residential care receive financial assistance from their family than those who are independent, however there is no such difference between them and those living with others in their community. Similarly, a significantly greater proportion of those living in the community provide financial help to their family ($p < .001$).

Table 2.4 shows some significance in the differences between the groups when making comparisons of insurance coverage and the receipt of government subsidies. We find that those in residential care are more apt to have long-term care insurance for assisted living than those living with others ($p < .001$), but are less likely to have insurance that provides for home health services than those living independently. They do not differ from those who live with others when it comes to receipt of Medicaid benefits, but the rate of coverage by Medicaid is 11.2 percentage points higher for those living in residential care than for those living independently in the community.

Those in residential care have considerably less credit card debt than those in the community, both living alone or with others (p < .001). On a percentage basis, those living in residential care have less than half of the medical debt as those who live with others in the community.

TABLE 2.4: Differences in economic resource factors between those in residential care and those living independently in community and with those living in community with others

	Residential Care n = 764		Community Independent n = 9,002		Community With Others n = 3,804		Res Care vs. Comm Ind	Res Care vs. Comm With Others
	% or Mean	n	% or Mean	n	% or Mean	n	Diff.	Diff.
Owns Home (%)	0.4	764	80.4	8,910	60.1	3,759	-80.0 ***	-59.7 ***
Total Worth * (mean)	58.6	412	129.2	5,116	15.8	2,051	-70.6	42.8 ***
Family Income * (mean)	33.1	412	56.2	5,116	30.9	2,051	-23.1 *	2.2
Fin. Help fr. family (%)	12.0	725	6.0	8,740	12.5	3,690	6.0 ***	-0.5
Fin. Help to family (%)	20.9	729	33.4	8,688	31.0	3,670	-12.5 ***	-10.1 ***
Covered by Medicaid (%)	23.3	721	12.1	8,822	24.0	3,708	11.2 ***	-0.7
Has LTC ins for AL (%)	12.8	759	12.6	8,897	6.5	3,763	0.2	6.3 ***
Has LTC ins for HH (%)	8.7	759	14.2	8,897	8.3	3,763	-5.5 ***	0.4
Has Credit Card Debt (%)	6.8	719	16.0	8,560	21.2	3,591	-9.2 ***	-14.4 ***
Has Medical Debt (%)	5.2	752	7.1	8,915	11.1	3,752	-1.9	-5.9 ***
Rec. Food Stamps (%)	9.8	356	7.6	8,843	11.3	3,742	2.2	-1.5
Rec. Gas Assist (%)	3.6	357	7.2	8,839	8.0	3,738	-3.6 *	-4.4 **

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012
Significance levels * = p < .05, ** = p < .01, *** = p < .001
Mean values for total worth and family income are reported in thousands of dollars.
LTC stands for long-term care, AL for assisted living and HH for home health care

Satisfaction and Emotional Well-Being

While respondents in all three categories self-reported generally positive measures of satisfaction and emotional well-being, Table 2.5 shows that there are significant differences, which tend to favor those living in the community over those in residential care. Respondents were asked how often they felt a series of emotions (cheerful, bored, full of life and upset), which we recode as a binary variable measuring if they "rarely" felt the emotion (a response of never or rarely) or "regularly" if they responded otherwise. Those in residential care are more likely to report that they feel bored regularly ($p < .01$), and feel full of life less often ($p < .001$) than both groups living in the community did. A significantly greater percentage of those living independently report that they rarely felt upset ($p < .001$) and felt cheerful most of the time ($p < .001$) compared to those in residential care. However for these two variables there is no significant difference in the proportions when comparing those in residential care to those in the community living with others.

Finally when comparing responses to a number of statements that might impact their satisfaction with life, those in the community are more likely than those in residential care to agree that life has meaning ($p < .001$), that they are content with their living situation and that they adapt well to change. Those in residential care are more likely than those in the community to agree that others are responsible for making their choices. This is especially true when compared to those living independently in the community. When asked whether they had given up on trying to improve their life, 37.3% of those living in residential care agreed that they had, vs. only 26.8% of those living independently in the community ($p < .001$) and 30.8% of those living in the community with others ($p < .01$).

TABLE 2.5: Differences in emotional well-being factors between those in residential care and those living independently in community and with those living in community with others

	Residential Care n = 764		Community Independent n = 9,002		Community With Others n = 3,804		Res Care vs. Comm Ind	Res Care vs. Comm With Others
	% or Mean	n	% or Mean	n	% or Mean	n	Diff.	Diff.
How often Feels Cheerful (%)								
Regularly	93.8	631	96.4	8,600	95.6	3,204	-2.6 ***	-1.8
Rarely	6.2		3.6		4.4			
How often Feels Bored (%)								
Regularly	42.9	629	29.9	8,594	36.4	3,207	13.0 ***	6.5 **
Rarely	57.1		70.1		63.6			
How often Feels Full of Life (%)								
Regularly	80.9	629	90.0	8,578	87.9	3,196	-9.1 ***	-7.0 ***
Rarely	19.1		10.0		12.1			
How often Feel Upset (%)								
Regularly	33.7	628	27.1	8,588	35.0	3,206	6.6 ***	-1.3
Rarely	66.3		72.9		65.0			
Life has Meaning (%)								
Agree	94.2	623	98.2	8,558	97.3	3,187	-4.0 ***	-3.1 ***
Do Not Agree	5.8		1.8		2.7			
Has Given Up on Improving Life (%)								
Agree	37.3	619	26.8	8,542	30.8	3,181	10.5 ***	6.5 **
Do Not Agree	62.7		73.2		69.2			
Likes Living Situation (%)								
Agree	92.7	629	96.9	8,585	95.2	3,202	-4.2 ***	-2.5 **
Do Not Agree	7.3		3.1		4.8			
Others Make Their Choices (%)								
Agree	43.0	625	25.8	8,554	36.2	3,188	17.2 ***	6.8 **
Do Not Agree	57.0		74.2		63.8			
Find Ways to Do For Themselves (%)								
Agree	98.1	627	98.9	8,588	98.2	3,197	-0.8 *	-0.1
Do Not Agree	1.9		1.1		1.8			
They Adapt Well to Change (%)								
Agree	84.7	629	88.9	8,563	88.1	3,190	-4.2 **	-3.4 *
Do Not Agree	15.3		11.1		11.9			

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012

Significance levels * = p < .05, ** = p < .01, *** = p < .001

Participation Factors

TABLE 2.6: Differences in participation factors between those in residential care and those living independently in community and with those living in community with others

	Residential Care n = 764		Community Independent n = 9,002		Community With Others n = 3,804		Res Care vs. Comm Ind	Res Care vs. Comm With Others
	% or Mean	n	% or Mean	n	% or Mean	n	Diff.	Diff.
Participates (%)								
Visit Family & Friends	82.1	726	88.5	8,994	82.0	3,802	-6.4 ***	0.1
Attend Religious Serv.	59.7	757	59.3	8,997	55.0	3,804	0.4	4.7 *
Part. in Clubs & Mtgs	44.4	757	39.0	8,997	25.3	3,801	5.4 **	19.1 ***
Go Out for Enjoyment	61.6	760	79.4	8,997	65.8	3,802	-17.8 ***	-4.2 *
Volunteer Work	19.0	762	26.1	8,996	16.1	3,801	-7.1 ***	2.9 *
Health Prevents (%)								
Visit Family & Friends	15.2	759	8.2	8,992	14.1	3,801	7.0 ***	1.1
Attend Religious Serv.	19.6	757	12.6	8,993	21.3	3,802	7.0 ***	-1.7
Part. in Clubs & Mtgs	18.2	757	9.6	8,993	14.5	3,801	8.6 ***	3.7 **
Go Out for Enjoyment	19.4	759	9.4	8,993	15.1	3,799	10.0 ***	4.3 **
Volunteer Work	18.9	761	9.6	8,994	14.5	3,798	9.3 ***	4.4 **
Transportation Prevents (%)								
Visit Family & Friends	10.4	763	3.2	9,001	6.2	3,804	7.2 ***	4.2 ***
Attend Religious Serv.	9.6	763	3.2	9,002	6.3	3,803	6.4 ***	3.3 ***
Part. in Clubs & Mtgs	6.7	764	2.6	9,001	4.9	3,803	4.1 ***	1.8 *
Go Out for Enjoyment	10.4	762	2.7	9,002	4.8	3,803	7.7 ***	5.6 ***

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012
Significance levels * = p < .05, ** = p < .01, *** = p < .001

In Table 2.6 we see that as a group, individuals living independently in the community are more likely than those in residential care to visit with family (6.4 percentage points higher, p < .001), go out for enjoyment (17.8 percentage points, p < .001), and volunteer (7.1 percentage points, p < .001). These highly significant results are not as apparent when comparing those in residential care to those in the community and living with others. As an example, the latter group is actually less likely than those in residential care to attend religious services ($p < .05$), join a club (19.1 percentage points less, $p < .001$) and do volunteer work ($p < .01$). In addition, transportation and health issues prevent a higher percentage of those in residential care from participating in the listed activities. The magnitude of these variations are particularly evident when comparing those in residential care to those who are living independently, but some differences between those in residential care and those living with others are significant as well.

Discussion and Policy Implications

In many ways, those living in residential care differ significantly from those living in the community. Taken in general terms, those living independently in the community are younger, more likely to be married and more likely to have any children than those in residential care. The group living independently in the community feels they are in better physical health, and due to fewer problems with mobility and sensory issues, they are better able to function when it comes to performing ADLs/IADLs. This comes as no surprise since Kane, Chan and Kane (2007) showed that many studies have pinpointed declines in health and reduced ADL functioning as key indicators of transferring to assisted living. Because they have less need for assistive devices, they are less likely to use them. They are far less likely to have been diagnosed with dementia. Perhaps because of their desire and ability to function independently, they are not as familiar with or trusting of their community as those living in residential care. The economic differences, such as greater rate of home ownership and the higher average income of those living independently, put them in a position to give financial help to their family and take less in return. All of this leads them to report a higher sense of autonomy and more positive emotional well-being.

Demographically, those in residential care also look very little like their peers living in the community with others. Those in the community and living with others are far younger, more racially mixed, and are less educated than those in residential care. They are also more likely to be married and have children. They are less likely to have been diagnosed with dementia (although more so than those living independently), but they do not purport to be in significantly different health than those in residential care. Individuals living in the community with others have fewer problems with mobility, hearing and performing ADLs than those in residential care, and are less likely to use devices to assist with these tasks. Those in the community are more likely to perform IADLs by themselves, but this could be because those in residential care are utilizing services that they are already paying for. Individuals living in the community with others do report receiving far more care per month than those in residential care, however we suspect this could result from a difference in how those in community and in residential care define receiving extraordinary care. While approximately 60% of those living in the community with others own their own home, they have the lowest net worth and income of all three living arrangement groups and are most likely to have credit card and medical care debt. Despite this, they are more likely to report that they provide financial help to family. This may be because they are contributing their pensions to common household expenditures. Those living with others in the community are also less likely to have long-term care insurance that covers assisted living care than those living in residential care, although the groups have similar levels of home health coverage.

These statistics indicate significant differences when comparing those in residential care to those in the community demographically and in terms of cognitive and physical functioning. But obviously, the calculating of "significant differences" is but the first step towards the development of sound long-term care policy that helps people with their long-term care planning.

A 2013 Harris interactive poll revealed that many Americans still believe that public programs such as Medicare will provide their comprehensive coverage for long-term services and supports. By the time they discover this is not true, it is too late for future planning. The Medicare.gov website may clearly state that Medicare Part A only covers certain skilled nursing care services for a maximum of 100 days, but not many young people bother to consult the Medicare.gov website. Like any preparation, long-term care planning is most effective when conducted over time.

The Community Living Assistance Services and Supports (CLASS) Act was established within the 2010 Patient Protection & Affordable Care Act (ACA) to give working adults just such an opportunity to plan for future long-term care needs. It was a national voluntary insurance program targeted at working adults that was intended to provide a basic cash benefit to those who met minimum work requirements and fell victim to physical or cognitive functional limitations. It would have allowed such individuals to purchase non-medical services and supports such as home health care and adult day care. The demise of the Act was due in part to the fact that it tried to do too much, too soon. It became apparent that paying premiums (that were not to be underwritten and were sometimes to be subsidized) into the program for a minimum of five-years would not be enough to support an individual in long-term care for an extended period. The Act was dismantled when the Department of Health and Human Services determined it was not financially self-sustainable, as was required.

The irony in the existing funding for the provision of long-term care is that even as public expenditures continue to grow rapidly, individuals face increasing personal financial risk, as well. This has led policymakers to search for answers in the private long-term insurance market (Brown and Finkelstein, 2011). Between 7 and 9 million Americans, including more than 15 percent of those older than 65 with incomes over $20,000, now have private long-term care insurance, paying total premiums of roughly $10 billion (AHIP, 2007). Premiums are high as insurers have struggled to calculate the potential costs for a population that is living longer, but with increasingly expensive needs. One dilemma for long-term care insurers is that younger, healthier individuals have little interest in paying such high premiums now for care in the distant future and do not buy long-term care insurance.

Even if premiums were low it is questionable whether even rational younger Americans would be quick to buy long-term care policies because of the many uncertainties involved in making that decision. From a personal perspective, individuals are unsure of their own longevity and future long-term care needs (for example, whether they will retain physical and cognitive functionality, and whether there will be informal caregivers available). Also, changes in the organization and delivery of long-term care will likely continue, leaving no guarantee that the type of care that people choose to buy today will be covered by these plans in the future. Another concern is that of counterparty risk. If long-term care insurers are unable to handle the aggregate risk of rising long-term care utilization and costs, they would be forced to raise premiums drastically or could even become insolvent (Brown and Finkelstein, 2011). In addition, the overall state of the U.S. economy remains generally uncertain, raising questions concerning things like the future value of their home and savings, or whether social insurance programs such as Social Security and Medicare will be around to support them when they reach retirement.

Still many state governments, disturbed by an impending avalanche of Medicaid claims for long-term care, implored policymakers to find a compromise position in which they could team with the private insurance industry to share the risk (Alper, 2006). In 1987, the Robert Wood Johnson Foundation launched its Partnership for Long-Term Care initiative, offering funding to states to develop strategies for public-private partnerships in the area of long-term care insurance. After a tumultuous start, the initiative gained momentum after 2006 when George W. Bush signed into law a bill that removed restrictive Medicaid requirements, particularly the language from the 1993 Omnibus Budget Reconciliation Act that specifically required states to recover assets from the estates of persons who had received services under Medicaid (Alper, 2006). This allowed all 50 states to implement a partnership plan. To date, at least 39 states have sanctioned private insurance plans that partner with the state's Medicaid programs designed to encourage individuals, many of whom would otherwise become dependent on Medicaid, to purchase private long-term care insurance (Brown and Finkelstein, 2011). These policies are tax-qualified, meaning their premiums and benefits are eligible for federal tax deduction. The plans are also required to offer protection against inflation to enhance the affordability of future care. Lastly, they are designed to provide asset protection from the typical Medicaid spend-down requirements should the term of the private policy expire. Most states have adopted a program with a "dollar-for-dollar" credit, whereby policyholders (and their estates) are able to keep non-housing assets equal to the amount of the maximum lifetime benefits that they purchased.

The partnership plans have been described as a "win-win-win" situation for individuals, insurers and state and federal treasuries (Alper, 2006), but as with any insurance program, long-term care plans are most effective for both the individual and the insurer when they are purchased well before they will be needed. These government-sponsored solutions appear to have much merit, but states have lacked the resources to successfully market them. In addition, without a broad client base, insurers are not able to develop a viable cost-effective product and will lose interest in participating in such programs. Since part of the appeal of these programs is that they will ultimately result in savings to the Medicaid program, federal funding should be made available to the states in order that they may advance the message of their availability. Since, under qualified programs, states cannot recoup the Medicaid benefits from the individual’s estate, much of the benefit accrues to the family of the policyholder. It would be beneficial if marketing efforts were targeted to this younger audience. Not only would this make them aware of future options for their own life plan, it would provide the tools for them to encourage their parents to consider the policies as well. Federal assistance should also be given to encourage more states to develop such programs, possibly as part of the rebalancing effort for long-term services and supports as outlined in the ACA.

The goal to "age in place" is consistent with theories based on Kantian ethics that stress the concept of self-determination and a universal urge to be the causal agent of one's own life. Formulating and carrying out a life plan may mean living on one's own for as long as possible, but it also involves putting together a cohesive plan to pay for one's future. Still this view of self as a "pure cognizer - a reflective agent engaged in practical reason" doesn't consider the desires, aversions and emotions that also go into making a decision such as whether to remain in one's home or move to a residential care setting (Christman, 2011). Sometimes the determinants are out of the individual's control and there truly comes a point at which it is no longer viable for him or her to remain in the community, even with those he or she loves. The notion that "aging in place" must take place in one's home has been debunked in recent literature (Wiles et al., 2011, Johansson et al., 2013) with an increasing focus on themes of environment, social context and personal identity (Rowles and Bernard, 2013). Rather than a physical location, environmental gerontologists refer to "home" as a place where one feels safe from the outside world; a place in which the individual can relax, let down his guard, and possess a sense of belonging. As Maya Angelou said "The ache for home lives in all of us, the safe place where we can go as we are and not be questioned" (Rowles and Bernard, 2013, page 3). Ideally, there is no reason why this cannot take place in all forms of residential care. For the past two decades, advocates of nursing home culture change have worked tirelessly to develop a person-centered approach to improve the quality of care and quality of life of these residents. This drive to improve quality and change public perception of all forms of residential care should expand and continue. This paper has examined the characteristics of individuals in the community and compared them to those of individuals in residential care. Future research should identify the qualities of remaining in the community that make it so desirable, in order to find ways to emulate it in the residential care setting.

ASSISTIVE TECHNOLOGY DEVICE USE AND THE LIVING ARRANGEMENT DECISIONS OF OLDER PEOPLE

Introduction and Significance

Most practitioners and researchers in the field of gerontology agree that as people age they would prefer to remain in an environment that is familiar and allows as much independence in activity as is possible (Castle, 2011). Interestingly, this desire to remain in their current residence for as long as possible becomes even more prevalent as age increases. A 2000 study showed that 83 percent of survey respondents age 55 to 64 wished to remain in their home as long as possible, while 92 percent of those age 65 to 74 and 95% of those age 75 and over wished to do so (AARP, 2000). Unfortunately, failing health and limited functionality sometimes make it difficult for an individual to remain at home. Brown and Abdelhafiz (2011) found that most of the patient-related risk factors for nursing home admission were based on an underlying decline in physical and/or cognitive function.

The disability rights movement has long challenged the institutional bias of publicly provided long-term care, saying it limits personal autonomy and segregates residents from the general community. In 1999, the Supreme Court's Olmstead ruling found that states have an obligation to administer services in a less restrictive setting that is appropriate to the individual's needs. This led to the development of more programs that financed nursing home alternatives (Grabowski, Stevenson and Cornell, 2012). Over the past several decades changes such as an increase in the number of assisted living facilities and more government-funded home and community-based service (HCBS) programs are providing even those with disabling maladies options for additional choices in living arrangements. Only recently have researchers begun to examine the determinants of moving from one's home into residential care other than a nursing home. For instance, Engelhardt and Greenhalgh-Stanley (2010) have considered the effect of formal home health care on living arrangements, while Charles and Sevak (2005) measured the effects of informal family caregiving. The World Health Organization’s International Classification of Functioning, Disability and Health (ICF) explains how assistive technology devices (ATDs) can also enable those with functional limitations to remain independent members of society, but to date they have not been associated in the literature with living arrangement decisions.

Although there exists a large body of literature on the use of assistive devices, much of it focuses on the individual's predisposition for using such devices, including health and other personal factors and indicators of their subjective well-being (Scherer et al., 2011). Some has been written on whether these devices have been effective in improving the individual's physical functioning (Cornman, Freedman and Agree, 2005) and has found that assistive technology can improve one's capacity to perform and facilitate independence.

Self-determination theory identifies autonomy as one of the three innate psychological needs that, if satisfied, allows for optimal growth and functioning. It has been described as the universal urge to be the causal agent of one's own life, however Ryan et al. (2011) point out that although this inner motivation is inherent in humans, it does not occur without some nurturing from one's social environment. In promoting autonomy, the use of assistive technology devices might substitute for, or at least be a complement to, formal or informal care, and could conceivably make it possible for the individual to remain in her home as she ages. But to date the literature on ATDs has not addressed the possible role of these devices in the living arrangement decision. In the previous article we identified a number of covariates that were shown to be individually correlated with being in a residential care environment, other than a nursing home, including assistive device use. Next, we examine whether the use of ATDs decreases the probability that individuals live in a residential care setting, controlling for other environmental, social support, health and economic variables.

Literature Review

Unlike an earlier clinical definition of disability, which was based solely on an individual's physical impairment, the currently prevailing concept is one derived not only from an individual's physical functioning (now known as the underlying disability), but also by the demands of the task to be performed and the accommodations that an individual makes to accomplish the task (Cornman, Freedman and Agree, 2005; Freedman et al., 2008). If accommodations are effective in reducing the task demand and allowing the individual to perform, we can say that while the underlying disability may remain, residual disability has been resolved (Freeman et al., 2008). Accommodations may come in a number of forms including the receipt of formal or informal personal care, or the use of assistive devices.

Economists have adopted Gary Becker's (1981) family decision-making model to look at a number of aspects of family life, such as household living arrangements. For example, Pezzin, Kemper and Reschovsky (1995) used Becker's model as a theoretical foundation for examining publicly funded home care as a substitute for informal, unpaid care. They suggest that a family coordinates its consumption and production decisions based on the family's tastes, desire for other goods and leisure, and the older family member's functionality. This functionality, in turn, is conditional on the level of disability and some sort of compensatory long-term care, described by the authors as formal care or informal care. We contend that a third compensatory strategy, the use of assistive devices should now be included in any analysis of this type.

Verbrugge and Sevak (2004) consider assistive devices along with personal care when they hypothesize that symptoms of disability (specifically tiring quickly, taking a lot of time to accomplish tasks and being in pain) are less likely for equipment users than for those receiving personal assistance to accomplish tasks. In direct opposition to their hypothesis however, they find that equipment users are 9 - 13% more likely to have symptoms than those using personal assistance or those using both. In their discussion they reason that giving away part or all of a task to another person may relieve symptoms swiftly, but if the individual is actively engaged, as when using equipment only, what one gives up in symptom relief, he may gain in self-sufficiency.

Agree et al. (2005) argue however that previous studies of older adults in the community that considered the substitution of assistive technology for personal care were limited in that that they didn't address the highly interdependent nature of decisions involving assistive technology and formal and informal care. They utilize a reduced-form modeling approach and estimate the three outcomes (informal personal care, formal personal care and the use of assistive devices) as functions of the same combination of exogenous health, resource, access and demographic factors. Using a 1994-1995 Supplement on Disability to the National Health Interview Survey, they isolate a sample of adults aged 65 years and over who reported underlying difficulty with one or more ADLs. They identify items within this group that increase the likelihood of using assistive technology while decreasing the hours of formal and informal care and consider these as conditions under which assistive devices could be considered a substitute for each type of care. The authors conclude that assistive technology use is a supplement rather than a substitute for formal care. Although they recognize the endogenous nature of assistive device use and personal care, their methods do not specifically address this issue.

Cornman, Freedman and Agree (2005) find that differing definitions used in disability studies may distort the interpretations of the effect of device use on functionality. In comparing 6 national surveys they determine that those surveys which restrict questions on device use only to those reporting difficulty with daily activities exclude a potentially sizeable group that fall into what the authors describe as a pre-clinical disability category that includes those who may use a device as a prophylactic measure (using a cane to prevent a fall, for example). They suggest that studies measuring the effectiveness of device use for daily tasks should include this group who may have become so successful at adapting to the task with a device that they do not associate it with difficulty.

The availability of unpaid caregivers has been shown in the literature to influence one's housing situation (Weeks, Keefe and Macdonald, 2012), however ties between assistive technology devices and living arrangements remain loose. Agree et al. (2005, page S272) suggest that "the use of assistive technology in addition to personal services could potentially improve the quality of care and thus defer functional declines and institutionalization, which would also reduce public and private expenditures." In 1973,

M. Powell Lawton and Lucille Nahemow wrote of ecology and the aging process, and developed a framework for the adaptation of man to his surroundings. They postulate that individuals seek congruence between their capability and the demands of their environment. When the individual finds a match there is satisfaction with that setting and optimum performance within it, however, if demand exceeds capability, there is inadequate performance, stress and dissatisfaction. Likewise, capability exceeding demand leads to boredom and atrophy. Newcomer et al. (2005) use this person-environment approach to look at older adults with disabilities, to assess whether their choice of living quarters impacts the prevalence of unmet needs, as a proxy for the mismatch between capability (measured by physical and cognitive abilities and economic resources) and environment (physical features, services offered and social resources). Among other interesting conclusions, they find that persons using special equipment had a lower risk of unmet need, indicating a setting that matches well with one's capabilities.

The use of assistive devices to aid with mobility and performance of daily activity has risen substantially in the past 25 years and it is now estimated that one out of three adults over the age of 65 is now using at least one such device (Pressler and Ferraro, 2010). Much of the research done to evaluate the effect of increases in the level of functional disability on the incidence of moves from independent into supportive housing has found a complex relationship between ADL limitations and these moves. Newcomer et al. (2002) find that the likelihood of a move increases as the limitations advance to "moderate" but decreases as they become "severe" (Newcomer et al., 2002).

Studies have shown that disability and health status have a major impact on the use of assistive devices (Mathieson, Kronenfeld and Keith, 2002) and it is widely recognized that this assistive device use reduces task demand (Verbrugge and Sevak, 2002) and facilitates functional independence (Pressler and Ferraro, 2010; Cornman, Freedman and Agree, 2005; Scherer et al., 2005). However, research on the complex issue of whether this increased self-sufficiency enables people to stay in the community if they choose remains sparse. In an effort to fill this research gap, the rest of this chapter evaluates the relationship between being in residential care and the use of assistive devices for those who either indicated they have a problem with a task or who use a device to assist.

Theoretical Foundations - Autonomy

Since Socrates and the early days of Greece, the concept of self or "soul" have played a major role in philosophy and morality theories (Cornford, 1960) . Much of this theory, particularly from the Western perspective, is based on the fundamental assumptions that all persons are moral agents responsible for their own choices, and that they will tend to pursue the goals, domains and relationships that support the satisfaction of their needs (Richards, 1981). In modern society, this tenet has become embodied in the term autonomy, which can be described as the desire to decide for oneself and pursue a course of action for one's life. Richards (1981) tells us that autonomy is contingent in part on capacities that allow individuals to pursue higher-order plans of action (vs. just "first-order" instincts). These capacities enable them to establish priorities and schedules from which to achieve their goals and allow them to choose which desires to pursue and which to abandon.

Autonomy is one of three essential components identified by self-determination theory (SDT) that allow for optimal function and growth (Ryan et al., 2011). While a longing for vitality, societal integration and health is inherent in humans it can only be realized if the appropriate nurturing is attainable and will wither if it is withheld. Self-determination theory terms this nurturing as "autonomy support" (Vansteenkiste and Sheldon, 2006). Although SDT has typically been used in psychological, rather than physiological applications, the SDT process model shows that both autonomy and feeling competent in carrying out the plan can predict a variety of outcomes. As stated earlier in this paper, many people have a rational desire to remain living in their homes for as long as possible, but their ability to do so is contingent on the autonomy brought about through competence. In this case the "autonomy support" that might allow for this competence could come from the use of assistive technology devices.

Research Question/Statement of Hypotheses

Research Question:

To what extent is the use of assistive devices for help with mobility and sensory impairments and for assistance with activities of daily living associated with the probability of living in residential care, when controlling for disability level and formal and informal care?

Hypotheses:

H1: The use of mobility devices, particularly canes, walkers, wheelchairs and scooters among older adults with mobility impairments will be associated with a lower probability of living in a residential care environment.

H2: The use of sensory devices such as hearing and vision aids among older adults with sensory impairments will be associated with a lower probability of living in a residential care environment.

H3: The use of devices to aid with activities of daily living (eating, bathing, toileting and dressing devices) among older adults with ADL difficulties will be associated with a lower probability of living in a residential care environment.

Methodology

Data Source

Traditional measures of disability which focus on one's ability to perform ADLs are valuable for tracking populations, but do little to guide us towards solutions in reducing disability and maximizing health and independent functioning. As previously noted in the introductory material, the ICF shifts the focus of rehab from medical cause to impact (Bachmann et al, 2010). In line with this new disability measurement protocol, a new database from the National Health and Aging Trends Study (NHATS) includes items that not only support the scope of traditional measures of functioning, but expand on it by including items that measure the use of accommodations (such as assistive devices), to accomplish tasks and maintain functional independence (Freedman et al., 2013). NHATS is a nationally representative sample of individuals ages 65 and older, drawn from the Medicare enrollment file. The main distinction in the data are among persons living in residential care settings that are nursing homes, residential care settings other than nursing homes, and all other community settings. Since only a Facility Questionnaire to staff (FQ) was administered whenever a sample person was determined to live in a nursing home, data pertinent to our study, particularly on whether or not an individual used assistive technology devices, was not available on them and nursing home residents are excluded from the subsequent analyses.

The NHATS is a relatively new survey currently consisting of two waves with study participants first interviewed in 2011 and then again in 2012. Annual re-interviews are planned in order to document change over time. For comparison, this model will consider those in the original interview who also appeared in the second year, representing a balanced panel referred to as the full sample. After removing those observations with missing values and rebalancing the panels, we are left with N = 4,425 in each wave for a total of 8,850 total observations clustered by wave.

Subsample Selection

In testing the three hypotheses, we consider the effect of the use of assistive devices on living in a residential care environment, allowing for a number of confounding items. The hypotheses are premised on need and the use of any assistive device by one who has no potential for benefit would be irrelevant, therefore we limit subsamples to three groups of older adults, each corresponding to a separate hypothesis: a) those having problems with mobility, b) those with sensory problems and c) those experiencing problems performing ADLs. We use the same methodology used in Article 1, and include those in a pre-clinical disability category as described by Cornman, Freedman and Agree (2005).

Empirical Approach

Assistive devices are often used to aid with mobility and sensory impairment, and by those who have problems performing ADLs. This study seeks to determine if there are correlations between the use of these assistive devices and the living arrangements of older adults, distinguished as living in the community or living in residential care as defined by the criteria in Article 2, section 2.6.1. We provide descriptive statistics on living arrangements, the key explanatory variables of ATD use, and all control variables for the full sample of respondents present in both waves of the study, with comparison tests to measure significant differences between the waves.

Next, for the entire population, and then by subsample, we compute the percentage of those that use each device who are currently living in residential care and the percentage of those who do not use the device and are currently living in residential care. We contrast these percentages for device users and non-users with the percentage of the total sample population in residential care, and then use bivariate analyses to find significant differences in the percentage in residential care for those that use a device and those that don't.

As our outcome of interest, being in residential care, is binary we use a random effects logistic regression model to establish a relationship between living in residential care and ATD use, controlling for a large group of predictor variables. The analysis uses the following model:

$$\Pr(\mathit{ResCare}_{it} = 1|\mathrm{x}_{it}) = \Phi\,(\beta_1 \mathit{ATD}_{it} + \beta_2\,\mathit{Environ}_{it} + \beta_3 \mathit{SocSup}_{it}$$

$$+ \beta_4 \mathit{Function}_{it} + \beta_5 \mathit{Econ}_{it}$$

where $\mathit{ResCare}_{it}$ is a dichotomous variable coded as “1” if individual i is residing in residential care (other than a nursing home) in period t and Φ represents the cumulative logistic distribution function. The main explanatory variables of interest are included in the vector ATD_{it} that indicates the existence of assistive technology use, as operationalized by a dichotomous indicator for the use of each type of device: cane, walker, wheelchair, scooter, or a device to assist with hearing, vision, eating, bathing, toileting or dressing. Each model includes only the ATDs pertinent to the individual's functional limitation. For example, in testing Hypothesis 1, *ATD* includes only those variables indicating the use of a cane, walker, wheelchair or scooter. $Environ_{it}$ refers to a vector of personal environment factors such as one's age and gender, level of education and race/ethnicity. $SocSup_{it}$ measures the availability of social support for the individual, as well as their perception of their social environment, and includes items for family status, level of personal care, measures of one's social network, and perceptions of community. $Function_{it}$ includes an indicator of dementia diagnosis, self-reported health, measures of whether the individual has problems with ADLs and IADLs. $Econ_{it}$ represents a large vector of items measuring the individual's economic status, such as home ownership, family income, generational transfers, Medicaid and LTC insurance coverage and whether or not the individual has debt.

The random effects logistic regression model is used when the unobserved, unit-specific effect is assumed to be uncorrelated with the explanatory variables. When the key variables do not vary much over time, other estimation models, such as fixed effects models, may provide imprecise estimates, and researchers are "forced to use random effects estimation in order to learn anything about the population parameters" (Wooldridge, 2003, pg. 326). We calculate average marginal effects to show how the probability of being in residential care is expected to change for a unit change in each explanatory variable. Standard errors are calculated to determine the significance of the relationships. As a robustness check, the models are also estimated using a linear probability model with fixed effects.

Dependent Variable - Residential Care

For purposes of this study, an individual is said to be living in residential care, if his or her living arrangement meets the definition set in the National Health and Aging Trends Study (Kasper and Freedman, 2014), namely a retirement community that “has an area the resident can move to if care is needed, and offers help with medications or self-care, or offers meals” or “assisted living facility or continuing care retirement community”. As outlined in Article 2, this would include those individuals living in congregate care even if independently, those in supportive housing such as family care homes, those in assisted living facilities and continuing care communities, and those in many forms of retirement community. The variable is binary with a code of "1" if in residential care and "0" otherwise, which is an indicator that the individual is living in the community, either alone, with their spouse, or with others.

Key Explanatory Variables - Use of Assistive Devices

Those sampled were asked directly if they had used a mobility device with the question "In the last month have you used a cane, walker, wheelchair or scooter, yes or no?" They were further queried to see which particular mobility device was used, providing dichotomous variables for the use of each device. Similar questions were also asked of hearing aid or hearing device use and glasses, contacts or other vision devices for distance or close-up vision, which we combined into two binary variables, one for the use of a hearing device and another for the use of a vision aide. Finally those in the survey were asked questions on device use for self-care activities, such as "In the last month did you ever use adaptive utensils to help you eat or cut your food?" and comparable questions regarding toileting, dressing and bathing. All questions answered "yes" are coded as "1" indicating device use.

Control Variable Measures

A review of prior literature and the descriptive statistics in Article 2 point to a number of factors that have a potential relationship with one's living arrangement and we include these as control measures. For example, when comparing those in residential care and the community, we found statistically significant differences in their environmental factors (*Environ)* such as gender, age, level of highest education and race/ethnicity. These variables are all reported in a binary format with the exception of age, which is categorical.

We examine the amount of formal or informal caregiving received and a number of other social support variables that reveal differences between the two groups in the vector *SocSup.* Particularly relevant were marital status (those in the community are more likely to be married), whether the individual had any children, the amount of caregiving he or she received in the last month and binary indicators of whether he or she agreed with three positive statements about their community.

Since studies have shown that declines in health and reduced ADL functioning are key indicators of transferring to assisted living, we include variables to measure health and functioning in the vector called *Function.* In addition to binary variables that indicate a diagnosis of dementia and self-reported health ("poor/fair" or "good to excellent"), we include assessments of whether or not the individual performs various IADLs by themselves. We also control for the existence of mobility and sensory problems and problems performing ADLs, using a derivation method described in

Article 1, section 1.4.2. One is considered to have mobility problems if they had problems with either getting out of bed or a chair, going outside, or moving around the house. Problems with hearing and vision are measured separately, as are problems with eating, bathing, toileting and dressing. Because the variable is used as a screening variable to develop subsamples, only problems with activities outside of those relieved by the ATD of interest were included as controls. For example when measuring the effect of sensory devices for those who need them, only problems with mobility and with the four ADLs were used in the model.

The choice of living arrangement may be constrained by economic factors and so we consider the economic resources that might allow for choice in a vector titled *Econ*. These variables include an indicator of home ownership, whether or not the individual gives or received financial assistance from family, and whether or not they have coverage from Medicaid or long-term care insurance. Other measures, such as net worth and family income and whether the individual has debt are also considered.

Results

Descriptive Statistics

Table 3.1 offers descriptive statistics for both the outcome variable and key explanatory variables for all respondents who are in both waves of the sample (n = 8,850). It shows that the great majority of those in the study are living in the community and that this statistic does not vary significantly between waves one and two.

TABLE 3.1: Descriptive statistics for outcome and key explanatory variables
Full sample of balanced panel, waves 1 and 2

	Wave 1	Wave 2		
	%	%	Diff.	Signif
Living Arrangement (%) (ResCare)				
Residential Care	4.2	5.0	0.8	
Community	95.8	95.0	(0.8)	
Use Assistive Device (%) (*ATD*)				
Any Mobility Device	26.7	29.9	3.2	**
Cane	19.8	20.4	0.6	
Walker	12.0	14.9	2.9	**
Wheelchair	5.6	6.7	1.1	*
Scooter	2.4	2.2	(0.2)	
Any Hearing Device	13.5	14.6	1.1	
Any Vision Device	94.6	93.8	(0.8)	
Any Eating Device	0.7	0.7	0.0	
Any Bathing Device	39.2	42.1	2.9	**
Any Toileting Device	41.8	45.1	3.3	**
Any Dressing Device	3.0	3.5	0.5	
Observations	4,425	4,425		

Notes: Data Source: National Health & Aging Trends Study, 2011-2012
*p < .05, **p < .01, ***p < .001

The table also gives descriptive statistics of ATD use (the main explanatory variables) and indicates that there were some significant changes in device use of individual respondents from one wave to the next, the most prominent being increases in the use of walkers (p < .01), wheelchairs (p < .05), and bathing and toileting devices (p < .01). Mobility devices were used by 26.7% of the sample population in the first wave, but device use increased significantly to almost 30% in wave two. The majority used canes and walkers, with less frequent use of wheelchairs and scooters, although the percentage of the sample using wheelchairs did increase by 1.1%. Walker use as a percentage of the population was up a very significant 2.9%.

The use of eyeglasses or contacts is very common among those sampled, at over 93% in both waves. This is consistent with other national samples that indicate that as people get older, their use of visual aids grows rapidly (CDC, 2011). Although loss of hearing is also very prevalent among older adults, hearing device use was rarer in the sample, with only a slight and non-significant increase in wave two. Device use for assistance with daily activities varies greatly. Less than 1% claim they are using eating devices and approximately 3.5% use devices to help with dressing but a much larger percentage use grab bars and other bathroom accessories to help with toileting and bathing. This use also increased significantly in wave two ($p < .01$).

Descriptive statistics for the remainder of the variables appear in Table 3.2, which shows that a majority (56.8%) of the respondents were female and that the sample was evenly distributed by age, with a lower percentage in the 85-89 and over 90 age groups. White, non-Hispanic was the dominant racial category representing 69.6% of the sampled population. More than half of the total population (53.3%) had a high school diploma or less.

There was little significant variation in the classic social support variables for individuals between wave one and wave two. Whereas 52.5% of them were married in the first wave, only slightly more than 50% were still married in the second wave. A large majority of them (79.8%) had parented two or more children. The percentage of the group that felt they had no one to talk to decreased substantially in wave two from

5.4% of the population to 3.8% ($p < .01$). There was little significant difference in their perception of community from wave one to two.

There were also some significant differences in the group of health and functioning factors. Although the difference in the percentage of those who were diagnosed with dementia was significantly higher in wave 2 ($p < .01$), average self-reported health remained relatively unchanged, with approximately 74% reporting good to excellent health in both waves. An overwhelming majority of those surveyed had some problems with vision (≈ 95%) in both waves. Fewer people reported having problems with toileting, however the proportion of individuals with toileting problems increased significantly in wave 2, from 43.7% of the population to 46.6% ($p < .01$). The percentage of those who were not doing their own banking also increased significantly ($p < .05$).

Article 2 found significant differences in the economic resources of those in the community and in residential care but Table 3.2 shows that there are but a few significant differences between wave 1 and wave 2. Information on income and assets are not available in wave two. However a smaller percentage of the population still owned their own home, and a larger percentage retained long-term care insurance that covered assisted living (2.2 percentage points more, $p < .01$) and home health care (3.4 percentage points more, $p < .001$).

TABLE 3.2: Descriptive statistics for control variables
Full sample of balanced panel, waves 1 and 2

		Wave 1	Wave 2		
		% or Mean	% or Mean	Diff.	Signif
Environmental Factors (*Environ*)					
Gender (%)	Male	43.2	43.2	0.0	
	Female	56.8	56.8	0.0	
Age (%)	65-69	19.0	15.1	(3.9)	
	70-74	21.0	20.7	(0.3)	
	75-79	20.2	20.6	0.4	
	80-84	19.8	20.0	0.2	
	85-89	12.1	14.1	2.0	
	90+	7.9	9.5	1.6	
Race/Ethnicity (%)					
	White, non-hispanic	69.6	69.6	0.0	
	Black, non-hispanic	21.9	21.9	0.0	
	Other, non-hispanic	2.7	2.7	0.0	
	Hispanic	5.8	5.8	0.0	
Highest Education (%)					
	Less than H.S. Diploma	26.2	26.2	0.0	
	High School Diploma	27.1	27.1	0.0	
	Some College	24.2	24.2	0.0	
	Bachelor's Degree	12	12	0.0	
	Advanced Degree	10.5	10.5	0.0	
Social Support Factors (*SocSup*)					
Marital Status (%)					
	Married or Living with Partner	52.5	50.6	(1.9)	
	Single, Div. or Widowed	47.5	49.4	1.9	
Number of Children (%)	None	8.5	8.5	0.0	
	1	11.7	11.7	0.0	
	2-4	57.7	57.7	0.0	
	5+	22.1	22.1	0.0	
Feels like no one to talk to (%)		5.4	3.8	(1.6)	**
Avg. hours care-giving rec'd/mo.		88.6	88.6	0.0	
Observations		4,425	4,425		

Notes: Data Source: National Health & Aging Trends Study, 2011-2012
*p < .05, **p < .01, ***p < .001

TABLE 3.2: Descriptive statistics for control variables (continued)
Full sample of balanced panel, waves 1 and 2

	Wave 1	Wave 2		
	% or Mean	% or Mean	Diff.	Signif
Social Support Factors (*SocSup*) (cont.)				
Agrees with Statement (%)				
Community know each other well	82.9	85.1	2.2	
Community helps each other	91.5	92.2	0.7	
Community can be trusted	90.4	90.9	0.5	
Health & Functioning Factors (*Function*)				
Diagnosed with Dementia (%)	4.3	6.3	2.0	**
Self-reported Current Health (%)				
Poor/Fair	25.5	25.8	0.3	
Good to Excellent	74.5	74.2		
Problem performing without help #				
Problem with Mobility # # (%)	39.3	40.2	0.9	
Problem with Hearing (%)	23.4	23.9	0.5	
Problem with Vision (%)	95.7	95.2	(0.5)	
Problem with Eating (%)	4.8	5.6	0.8	
Problem with Bathing (%)	13.9	15.3	1.4	
Problem with Toileting (%)	43.7	46.6	2.9	**
Problem with Dressing (%)	17.5	18.4	0.9	
Does not Perform IADLs by Self				
Laundry (%)	38.2	39.6	1.4	
Shopping (%)	42.1	43.6	1.5	
Preparing Meals (%)	32.4	34.2	1.8	
Banking (%)	33.6	35.6	2.0	*
Observations	4,425	4,425		

Notes: Data Source: National Health & Aging Trends Study, 2011-2012
help entails human assistance or device use # # mobility includes getting out of bed going outside or moving around house, *p < .05, **p < .01, ***p < .001

TABLE 3.2: Descriptive statistics for control variables (continued)
Full sample of balanced panel, waves 1 and 2

	Wave 1	Wave 2		
	% or Mean	% or Mean	Diff.	Signif
Economic Resources (*Econ*)				
Owns Home (%)	74.5	73.1	(1.4)	
Total Worth (mean, $000)	103.7	n/a		
Family Income (mean, $000)	49.6	n/a		
Fin. Help from Family (%)	75.7	77.8	2.1	
Fin. Help to Family (%)	33.8	35.5	1.7	
Covered by Medicaid (%)	15.0	16.1	1.1	
Has LTC ins. For AL (%)	11.7	13.9	2.2	**
Has LTC ins. For HH (%)	12.6	16.0	3.4	***
Has credit card debt (%)	17.3	16.9	(0.4)	
Has medical debt (%)	8.7	8.0	(0.7)	
Observations	4,425	4,425		

Notes: Data Source: National Health & Aging Trends Study, 2011-2012
LTC stands for long-term care, AL for assisted living and HH for home health care
*p < .05, **p < .01, ***p < .001

Bivariate Analysis

In this case, bivariate analysis is designed to examine whether the proportion of those using a device that live in residential care differs significantly from the proportion of those not using the device that are in residential care, and comparing both to the proportion of the total population that are in residential care (4.6% of the entire sample). Table 3.3 shows that in most cases, a greater percentage of those using the device are concurrently in residential care than of both those not using the device and the total sample. For example, only 4.6% of the total sample population are in residential care, but 9.7% of those using a mobility device are in residential care vs. only 2.6% of those who do not use a mobility device (a 7.1 percentage point difference in the portion who are in residential care, $p < .001$). When considering the entire population, a significantly greater portion of those who use any type of device (with the exception of vision aides) are in residential care when compared with those not using the device.

Next we refine our study to the subsamples of individuals experiencing problems and find that some significant differences persist. Among those who require help with mobility, those who use a mobility device are generally more likely to reside in residential care than those who do not use the device. This is not the case for those needing help and using a cane, who are less likely than those not using a cane to live in residential care ($p < .001$).

For those that need vision and hearing aids, there does not appear to be a statistical relationship between their use and residential care status. There is a positive and significant relationship between the use of bathing devices and residential care status ($p < .01$).

TABLE 3.3: Percentages of Those in Residential Care

Type of Device	% of Total in res care	% of those using device in res care	% of those not using device in res care	Diff	Sig.
Entire Population (n = 8,850)					
Any Mobility Aid	4.6	9.7	2.6	7.1	***
Cane	4.6	5.3	4.4	0.9	**
Walker	4.6	14.2	3.1	11.1	***
Wheelchair	4.6	11.2	4.2	7.0	***
Scooter	4.6	13.6	4.4	9.2	***
Vision Aid	4.6	4.6	4.1	0.5	
Hearing Aid	4.6	8.5	4.0	4.5	***
Eating Device	4.6	14.3	4.5	9.8	**
Bathing Device	4.6	8.6	1.8	6.8	***
Toileting Device	4.6	7.9	2.1	5.8	***
Dressing Device	4.6	7.6	4.5	3.1	**
Mobility Problem Only (n = 3,520)					
Any Mobility Aid	8.0	9.9	3.9	6.0	***
Cane	8.0	5.3	10.6	(5.3)	***
Walker	8.0	14.5	4.8	9.7	***
Wheelchair	8.0	11.4	7.4	4.0	**
Scooter	8.0	13.9	7.7	6.2	**
Sensory Problem Only					
Vision Aid (n = 8,446)	4.6	4.6	5.6	(1.0)	
Hearing Aid (n =2,091)	7.9	8.5	6.9	1.6	
Problems with ADLs Only					
Eating Device (n = 462)	9.3	14.3	8.5	5.8	
Bathing Device (n = 1,293)	9.4	11.8	6.0	5.8	**
Toileting Device (n = 3,998)	7.8	7.9	5.2	2.7	
Dressing Device (n = 1,587)	8.2	7.6	8.3	(0.7)	

*p < .05, **p < .01, ***p < .001

Notes: Data Source: National Health & Aging Trends Study, 2011-2012

Logistic Regression with Random Effects Results

Table 3.4 shows the results of separate logistic regressions to determine if the use of assistive devices for help with mobility and sensory problems and problems performing ADLs are associated with the probability of living in residential care, when controlling for a host of other confounding variables. We measure this correlation first on the full sample, and then we check for relationships between applicable device use and living arrangement within those groups who have a particular need.

We hypothesize that the use of various forms of assistive device is associated with a lower probability of living in residential care. Table 3.4 shows that for both the full sample and those with mobility problems, the use of a cane has a negative and statistically significant association with being in a residential care environment ($p < .001$). For those who would benefit from a mobility device, the use of a cane decreases the probability of living in residential care by 3.5 percentage points. Alternatively, those individuals using all other types of mobility devices are more likely to be in residential care. Scooters are associated with a higher probability of residing in residential care in both the full sample and the sample of those in need of assistance with mobility ($p < .05$)

In our sample, devices to aid with hearing and vision problems are not found to be statistically associated with being in residential care. However, a number of devices designed to aid with activities of daily living are related to an older adult's living arrangement. For individuals that have difficulty bathing independently, as well as for those in the full sample, using a bathing device to assist with that task is positively related to being in residential care. In the entire sample, the probability of living in residential care is 1.3 percentage points higher for those that use a bathing device ($p < .001$). When limiting the analysis to those who have problems with ADLs, the use of a bathing device increases the probability of living in residential care by 2.2 percentage points ($p < .001$). The use of a dressing device is negatively associated with residing in residential care for those who have a problem and need help with dressing. We obtain similar results when we execute a linear probability model with fixed effects however those results are not shown.

Several environmental factors are related to the probability that an older adult lives in residential care. As shown in Table 3.4, the association of age with living arrangement is clear and pertinent for all groups excepting those with mobility problems, with an increasing probability of being in residential care as one gets older. Also highly significant is race ($p < .001$), with non-Whites less likely than Whites to live in a residential care setting. Those with education greater than a high school diploma are significantly more likely to be in residential care ($p < .001$) than those with a high school diploma or less.

Many social support variables are highly correlated with residential care living as well, particularly having children. Having at least one child reduces the probability that an individual will reside in residential care significantly for all groups. For all groups studied, the feeling that those in their community know each other well is related to a higher probability of living in residential care ($p < .05$).

Although there are a few health and functioning variables found to be associated with living arrangements in our sample, being diagnosed with dementia and self-reported health both appear to have very little impact on the probability of living in residential care. The functionality problem that represents the largest and most significant increase in the probability of being in residential care is a problem with toileting. For those who have a combination of toileting and mobility problems, there is a 2.8 percentage point increase in the probability of living in residential care ($p < .01$). A problem with toileting also increases the probability of being in residential care for those who also have problems with hearing or vision (by 1.5 percentage points, $p < .001$). Not preparing one's own meals actually decreases the probability that one would be living in a residential care setting for all groups ($p < .01$)

Lastly, we look at the association between economic resources and living in residential care. For all groups studied, owning one's home greatly decreased the probability of being in residential care (by at least 11.9 percentage points, $p < .001$). Having insurance that covers assisted living is positively associated with living in residential care for all groups other than those with mobility issues. The results are particularly significant for those experiencing problems with ADLs where those having insurance for assisted living are 3.3 percentage points more likely to reside in residential care than those who do not have insurance for this type of care ($p < .01$). Having insurance for home health services, however, is not significantly relevant to living in residential care. We find that having credit card debt decreases the probability of living in residential care for certain groups ($p < .05$). Interestingly, having Medicaid coverage is not significantly associated with living in residential care.

TABLE 3.4: Logistic regression with random effects:
Average marginal effects of device use and other factors on the probability of living in residential care

		Full Sample	Mobility Need	Sensory Need	Problem with ADLs
Uses Assistive Device (*ATD*)					
Cane		-0.017 ***	-0.035 ***		
Walker		0.005	0.014		
Wheelchair		0.005	0.003		
Scooter		0.017 *	0.027 *		
Hearing Device		0.000		0.003	
Vision Device		0.014		0.003	
Eating Device		0.000			0.013
Bathing Device		0.013 ***			0.022 ***
Toileting Device		0.000			0.007
Dressing Device		-0.011			-0.019 *
Environmental Factors (*Environ*)					
Male		-0.003	-0.005	-0.005	-0.007
Age	70 - 74	0.004	0.017	0.003	0.013
	75 - 79	0.007 *	0.011	0.008 *	0.016 *
	80 - 84	0.011 **	0.025	0.013 ***	0.022 **
	85 - 89	0.022 **	0.032	0.023 ***	0.037 ***
	90+	0.034 ***	0.052 *	0.038 ***	0.065 ***
Race Non-White		-0.019 ***	-0.032 **	-0.024 ***	-0.031 ***
Education more than H.S.		0.022 ***	0.037 ***	0.025 ***	0.042 ***
Social Support Factors (*SocSup*)					
Married		0.005	-0.004	0.005	0.005
Children	1	-0.019 ***	-0.030 *	-0.021 **	-0.032 **
	2-4	-0.012 **	-0.027 **	-0.014 **	-0.024 **
	5+	-0.013 **	-0.026 **	-0.016 **	-0.029 **
Has no one to talk to		0.002	0.013	0.004	0.007
Avg. hours care/mo.		0.000 ***	0.000 ***	0.000 ***	0.000 ***
Agrees with Statement about Community					
Know each other well		0.011 *	0.018 *	0.015 **	0.021 *
Helps each other		0.006	0.018	0.005	0.011
Can be trusted		-0.001	0.003	0.002	0.003
# Observations		8,850	3,520	8,512	4,568

*p < .05, **p < .01, ***p < .001

TABLE 3.4: Logistic regression with random effects (continued):
Average marginal effects of device use and other factors on
the probability of living in residential care

	Full Sample	Mobility Need	Sensory Need	Problem with ADLs
Health & Functioning Factors (*Function*)				
Diagnosed with Dementia	0.002	0.020	0.007	0.007
Good Self-Rep. Health	0.004	0.005	0.001	0.000
Problem performing without help #				
Problem with Mobility # #	0.006		0.004	0.013
Problem with Hearing	0.002	0.006		0.008
Problem with Vision	-0.017	0.033 *		0.013
Problem with Eating	0.002	0.005	0.005	
Problem with Bathing	0.000	0.004	0.003	
Problem with Toileting	0.012	0.028 **	0.015 ***	
Problem with Dressing	0.000	-0.009	-0.003	
Does not Perform IADLs by Self				
Laundry	-0.001	0.006	0.001	0.006
Shopping	0.001	0.006	0.001	0.006
Preparing Meals	-0.013 ***	-0.029 **	-0.018 ***	-0.035 ***
Banking	0.002	0.007	0.002	0.000
Economic Resources (*Econ*)				
Owns Home	-0.119 ***	-0.200 ***	-0.138 ***	-0.210 ***
Fin. Help from Family	-0.005	0.001	0.000	-0.001
Fin. Help to Family	-0.001	-0.002	0.000	-0.002
Covered by Medicaid	0.001	0.001	0.001	-0.003
Has LTC ins. For AL	0.015 *	0.032	0.016 *	0.033 **
Has LTC ins. For HH	-0.002	0.010	-0.002	0.001
Has credit card debt	-0.010 **	-0.014	-0.010 *	-0.014
Has medical debt	-0.003	-0.004	-0.003	0.000
# Observations	8,850	3,520	8,512	4,568

Notes: Data Source: National Health & Aging Trends Study, Waves 1 & 2, 2011-2012
help entails human assistance or device use ## mobility includes getting out of bed or chair, going outside or moving around house, *p < .05, **p < .01, ***p < .001

Discussion and Policy Implications

Our study finds that the use of a cane to aid with ambulation is strongly and negatively associated with the probability of living in residential care, while other mobility devices are either not a factor, or suggest an increase in the probability of living in residential care. A cane offers the ability to maneuver on steps which a wheelchair, scooter or even a walker cannot do. Many private homes have multiple floors, narrow door jams, etc. that must be navigated; when this becomes too difficult individuals may have to relocate to another more accessible setting. Canes are also the most likely device to be used when an older adult may still be able to walk, but is not steady on her feet. Falls have also been found to have an extremely negative impact on one's ability to remain in the community (Leland, Porell and Murphy, 2011). Canes are a way for the individual to steady themselves, take some control over this pre-disability condition and to maintain independence. In this study, we control for mobility problems, but not for recent falls. Future studies looking at living arrangements should consider the effect of recent falls on the probability of living in residential care.

There is no support for the second hypothesis that devices to help with sensory related ailments reduce the probability of living in residential care. In our study, neither vision nor hearing devices have any significance when we analyze their effect on the probability of being in residential care. One explanation might be that the prevalence of vision problems is so great, as is the extent to which it is corrected through vision aids. Over 95% of our sample indicate they had some problem with vision, whether it be reading, viewing the television or recognizing someone across the street, and over 98% of those with a problem use a device to correct it. With such a high percentage of the population having vision problems, the use of vision aids is socially acceptable in American society. The use of hearing aids is surprisingly less common, despite the fact that the ability to hear is vital to physical and psychological well-being. Power and Hyde (2002) describe how people who are hard-of-hearing often report feeling lonely or isolated when they are unable to communicate with others, and this feeling of isolation may be subconsciously reinforced by friends, family, or care-givers in response to the increased effort required to communicate.

Contrary to our third hypothesis, we find that the use of eating and toileting devices have no significant impact on whether one lives in residential care. While there is a mildly significant negative association between dressing device use and being in residential care, we discover that for those who need help with bathing, the use of assistive devices for those tasks actually appears to increase the probability that an individual will reside in a residential care community. When help is needed for bathing, informal caregivers may not be able to provide the level of care required to assist with this task or a parent may be reluctant to allow their own child to assist with a personal task as sensitive as bathing or toileting (Bonsang, 2009). In such cases more formal personal care might be required to enable an individual to stay in the community, and an option would be to choose residential care.

Some items that we had assumed would be indicators of higher probability of being in residential care were not. Although being diagnosed with dementia has been shown as a key risk factor of institutionalization (Brown & Abdelhafiz, 2011), in our study it was significant only in the subsample needing mobility help. Likewise having good self-reported health did not appear to make much difference in the probability of living in residential care. It is well known that poor health and a decline in physical functionality contribute to needing institutional care (Brown and Abdelhafiz, 2011), so perhaps, in our study, reports of self-health are not important after controlling for other measures of functionality. Surprisingly in looking at those that are not performing instrumental activities of daily living on their own, we find that those who are not preparing their own meals are less likely to be living in residential care. It is important to note that these IADL performance variables are not indicators of whether the individual has the ability to perform, only that they do not do so. It is possible that the individual is simply performing the tasks that he routinely performed throughout his life. Although our study does not find gender significant to the probability of living in residential care, the data show there are considerably less men in residential care than women. Future work could segment the population by gender to identify other factors which might influence the choice of living arrangement differently for men than for women.

Finally we come to the role that economic resources play in determining residential care status. A limitation of this study is that the income and asset questions from the first wave of the study are not repeated in the second. Despite the fact that Article 2 shows significant differences when comparing the mean total net worth and mean family income of those in residential care and in the community, including them as factors would have eliminated by half the number of observations available for study. We did control for a number of economic variables as proxies. We find, logically, that owning one's home is a strong incentive to remain in the community, even for people experiencing problems with mobility, hearing and vision, and having problems with

ADLS. Bivariate findings from Article 2 indicate that those in the community receive more financial help from, and provide less help to, their family than their community counterparts, but when we control for other factors, neither getting nor giving financial assistance to others significantly impacts the probability of being in residential care.

Unlike Hoerger, Picone and Sloan (1996) who find evidence that direct subsidies for nursing home care significantly affect the choice of whether to live in a nursing home or in the community, we find no such association when we broaden the outcome to look at residential care types other than a nursing home. In our sample, being covered by Medicaid does not significantly affect the probability of being in residential care. This may be an indication that more state Medicaid programs are covering home and community-based care than in previous times, but it is impossible to pursue this further without knowing the states in which our population resides. Although having non-governmental long-term care insurance for home health services also has no significant effect on living arrangement, having long-term care insurance that covers assisted living costs significantly increases the probability of living in residential care. Having credit card debt decreases the probability of being in residential care. The combination of not owning their own home, obtaining insurance to cover their long-term care needs, and maintaining no credit card debt might indicate that those in residential care are more financially secure.

Our study is limited in several respects. We use the National Health and Aging Trends Study; while it contains many factors not previously available to those conducting disability studies (Freedman et al., 2013), it currently consists of two waves, conducted only one year apart. An ideal study would examine the effect of a change in device use on a change in the probability of living in residential care. However there are only 36 instances of a change in residential care status among the 4,425 individuals who remained from wave one to wave two. We feel this is not a large enough sample upon which to conduct meaningful analysis. We are confident that future study of more waves of data will provide more variation in the dependent variable.

Like Agree et al. (2005) we recognize that assistive device use does not always precede movement into residential care, and acknowledge that we have an issue of endogeneity/simultaneity with our key variables of interest and our dependent variable. One way to overcome this problem would be to use an instrumental variable approach that is appropriate for non-linear models, such as a two-stage residual inclusion model (Terza, Basu and Rathouz, 2008). In such an approach, an instrumental variable is chosen to isolate the part of the endogenous explanatory variable that is uncorrelated with the error term. Unfortunately finding good quality instruments is sometimes difficult. In this case a useful instrument for assistive device use might be eligibility for a Medicaid waiver that pays for its use, but since coverage varies by state, and location is not included in the data, we cannot determine if the individual is eligible for a Medicaid waiver that would cover device use.

Despite these limitations this work makes valuable contributions to the literature on assistive devices and their potential to improve the quality of life of older adults with physical needs. Our review of the literature shows few studies on assistive device use that consider specific types of device use independently for populations with particular, task-specific needs. One notable exception is the 2005 study by Agree et al. that considers the circumstances under which assistive technology substitutes for personal care. Their study is retrospective and uses 10 year old data from the 1994 - 1995 National Health Interview Survey Disability. The results of other research, however, show that levels of functioning and disability in the U.S. are not static.

After a decline in the 1980s and 1990s, Freedman et al. (2012) find that the prevalence of later-life limitations has been flat since 2000. But, they also note that for adults about to enter the 65 and older group the percentage with one or more activity limitations was increasing. The authors viewed this as an indication that more detailed measures of disability and functioning were needed. They were among the group that designed the National Health and Aging Study specifically to provide measures to assess the disablement process, including physical and cognitive capacity, the use of accommodations and the capacity to perform activities (Freedman et al (2011). Ours is one of the earliest studies to use this new database in an empirical analysis. Although only two waves of data are currently available, at least three more waves are planned. In the future, we will be able to replicate our study to fully exploit the longitudinal properties of the NHATS data, and examine whether the use of ATDs has an impact on a transfer to residential care.

Unlike much of the prevailing literature on assistive devices, that is restricted to mobility device use (Taylor and Hoenig, 2004; Demers et al. 2008), we broaden our analysis to consider devices used to help with sensory problems and activities of daily living. We are able to show that there is no correlation with being in residential care for hearing or vision devices, however this does not diminish the importance of these devices for other purposes. The same holds true for other devices that benefit those needing help with activities of daily living. The improved functionality made possible through the use of such devices enables older adults to maintain more control of their lives, whether it be in residential care or at home in their community.

Finally, in response to the escalating needs of an aging population, the growth in choices of residential long-term care setting other than a nursing home has burgeoned. Despite the public and private financial consequences, however there is still a paucity of high quality studies to support an individual's reasons for selection of this type of care. More work is needed to develop models of residential care that fully address the contemporary issues that we face as we age.

CONCLUSION

In the 1960s Medicaid and Medicare improved the accessibility of medical care, and nursing home care for older Americans became a more standard practice. This funding drove government regulation of these facilities which stipulated that Medicaid dollars be spent only for medical care and promulgated a strict medical model in these facilities providing little incentive to enhance the individual's emotional well being (Thorn, 2002). Since then there has been a distinct tension in health and social policy between community and residential care living. Many in the field of gerontology emphasize health over illness and living at home, rather than in an institution.

Medical advances have certainly made it possible to live for many years after the onset of chronic illness, but there is more at stake than lengthened life. Long-term care policy needs to address the "active life expectancy" of the population which refers to the interaction of aging and disability and is the average amount of time people can expect to live without limitations (Laditka, 1998). The greater the age or the higher the disability level, the lower the active life expectancy. There is nothing we can do about age, but we can improve the disability factor. In line with long-term system and support policies that reduce institutionalized living, providing public funding for assistive technology devices makes sense.

Although we find that most ATDs are not a significant factor in whether one lives in a residential care setting when controlling for many other variables, they can still offer improved functionality and make it possible for a person to maintain some control of his life. In addition, many devices, such as hearing aids and bathing devices have a positive impact on the probability of participation in many activities which would bring about increased social capital and health benefits. For most people, better health and improved functionality improve active life expectancy and enhance independence which results in what Laditka (1998) calls a "dual payoff" for individuals and society as a whole, as improved morbidity will allow individuals to continue being active in social, political and economic activity.

Recently, we have come to realize that not everyone can remain in their home as they age, and that in some cases people remain in a community setting for too long, jeopardizing their health and safety (Duffy and Duffy, 2002). Some older people have no family to care for them or prefer not to live with them. The right residential care community can actually provide an individual with a sense of responsibility and relieve the burden of depending on others, while allowing her the chance to participate in activity and avoid loneliness.

A recent conceptualization of residential care embodies a model of housing and services making it about much more than just the physical context in which one lives, but also about the services and the care, and the consumer's right to refuse both (Hill & Gregg, 2002). In all of these aspects, the ideal environment should emulate the home. Contextually, design is critical to avoid the appearance and feel of an institution. Some efficiencies in service delivery could be sacrificed to make it more appealing to residents (i.e. making snack foods available at all times). Care, by necessity, must usually be more restrictive than at home, however these residences can optimize choice and freedom by asking residents whether they prefer to receive some services.

Medical services for all older adults are certainly not adequately funded, but this constraint pales in comparison to the limited funding currently available for other aspects of daily life associated with an increased active life expectancy, such as their living expenses. We need policy that recognizes the need for mid-level, long-term care solutions and stresses a combination of both health and social policy with supports that are available in assisted living or continuing care retirement communities that provide for a smooth transition from a minimal care setting to a more intensive care environment as needed.

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APPENDIX A: 2012 ESTIMATE AND 2015 TO 2060 PROJECTIONS OF THE POPULATION OF THE UNITED STATES BY SELECTED AGE GROUPS

Resident Populations as of July 1, Numbers in thousands

	2012	**2015**	**2020**	**2025**	**2030**	**2035**
Total All Ages	**313,914**	**321,363**	**333,896**	**346,407**	**358,471**	**369,662**
Under 5 years	19,999	21,051	21,808	22,115	22,252	22,516
Under 18 years	73,728	74,518	76,159	78,190	80,348	81,509
5 to 13 years	37,009	36,772	37,769	39,511	40,366	40,790
14 to 17 years	16,719	16,695	16,582	16,565	17,730	18,203
18 to 64 years	197,041	199,150	201,768	203,166	205,349	210,838
18 to 24 years	31,360	30,983	30,028	30,180	30,605	32,125
25 to 44 years	82,826	84,327	88,501	91,833	93,878	95,013
45 to 64 years	82,855	83,839	83,238	81,152	80,865	83,700
65 years and over	43,145	47,695	55,969	65,052	72,774	77,315
85 years and over	5,887	6,306	6,693	7,389	8,946	11,579
100 years and over		78	106	143	168	188

	2040	**2045**	**2050**	**2055**	**2060**
Total All Ages	**380,016**	**389,934**	**399,803**	**409,873**	**420,268**
Under 5 years	23,004	23,591	24,115	24,479	24,748
Under 18 years	82,621	84,084	85,918	87,744	89,288
5 to 13 years	41,190	41,936	42,951	43,969	44,758
14 to 17 years	18,427	18,558	18,852	19,296	19,782
18 to 64 years	217,675	224,562	230,147	234,819	238,947
18 to 24 years	33,199	33,680	33,967	34,469	35,239
25 to 44 years	96,078	98,725	101,609	104,331	106,303
45 to 64 years	88,398	92,157	94,570	96,020	97,404
65 years and over	79,719	81,288	83,739	87,309	92,033
85 years and over	14,115	16,512	17,978	18,201	18,187
100 years and over	230	310	442	564	690

Source: U.S. Census Bureau, Population Division

2012 Annual Estimates of the Resident Population for Selected Age Groups and Sex for the United States: Released June 2013

2015 - 2060 Projections of the Population by Selected Age Groups and Sex and Sex for the United States (NP2012-T2): Released December 2012

APPENDIX B: NATIONAL HEALTH AND AGING TRENDS STUDY SURVEY QUESTIONS DEPICTING OUTCOME VARIABLES AND EXPLANATORY VARIABLES OF INTEREST

Questions are taken directly from NHATS Round 1 Data Collection Instruments and derived variable information from NHATS User Guide, Rounds 1 and 2 Final Release. Both are available in their entirety at https:// www.NHATS/org.

<u>Outcome Variables Article 1</u> * Participation (PA)

These questions reflect participation in activities that are elective but valued. Freedman et al. (2011) confirmed the reliability of the participation measures in the form of a scale; reliability of individual items varies.

CODES	1 YES
	2 NO
	REFUSED
	DON'T KNOW

pa1vistfrfam R1 PA1 EVER VISIT FRIENDS FAMILY
In the last month, did {you/SP} ever visit in person with friends or family not living with {you/him/her}, either at {your/his/her} home or theirs?

pa1attrelser R1 PA5 EVER ATTEND RELIG SERVCES
In the last month, did {you/SP} ever attend religious services?

pa1clbmtgrac R1 PA9 CLUB MEETINGS GRP ACTIVES
In the last month, {besides religious services,} did {you/SP} ever participate in clubs, classes, or other organized activities?

pa1outfrenjy R1 PA13 EVER GO OUT FOR ENJOYMNT
In the last month, {besides participating in club or group activities,} did {you/SP} ever go out for enjoyment? This includes things like going out to dinner, a movie, to gamble, or to hear music or sea a play.

pa1voltrwork R1 PA19 EVER DO VOLUNTEER WORK
In the last month, did {you/SP} ever do volunteer work?

APPENDIX B: (continued)

Outcome Variables Article 3 * Living Arrangements (RE)

The derived variable (r1dresid) for residential status has four values (only those with values 1 or 2 were used in this study):

1 SP resides in community and an SP interview was completed
2 SP resides in residential care (not nursing home) and an SP interview was completed
3 SP resides in residential care (not nursing home) but only an FQ interview was completed
4 SP resides in nursing home and by design only an FQ interview was completed

If home is described as free-standing or single home attached:

ht1placedesc R1 HT3 PLACE BEST DESCRIPTION
Which of these best describes this place?

CODES 1 PRIVATE RESIDENCE
2 A GROUP HOME, BOARD AND CARE, OR SUPERVISED HOUSING (coded as residential care)
3 ASSISTED LIVING FACILITY OR CONTINUING CARE RETIREMENT COMMUNITY (coded as residential care)
4 RELIGIOUS GROUP QUARTERS
91 OTHER

ht1retiresen R1 HT4 RETIRMNT CMMTY SEN HOUSIN
I have recorded that {you live/SP lives} in {a detached house/a row house, townhouse, or duplex/a mobile home or trailer/a multi-unit building/OTHER} {that is {a private residence/a group home/an assisted living facility or CCRC /a religious group quarters/OTHER}}.
Is {your/ {his/her}} home part of a retirement community or a senior housing community?

If coded as yes (and if not already coded as residential care), code as residential care if the answer is yes to at least one of the following questions:

ht1diffareun R1 HT5 DIFF AREAS UNITS TO MOVE
Does the place {you live/SP lives} have different areas or units that {you/{he/she}} can move to if {you need/{he/she} needs} care – like assisted living, a special unit for memory care, or a nursing home?

APPENDIX B: (continued)

ht1helpmedbd R1HT6 HELP W MEDS BATH DRESSING
Does the place {you live/SP lives} offer help with medications or with activities such as bathing or dressing?

ht1meals R1HT7 MEALS FOR RESIDENTS
Does the place {you live/SP lives} offer meals for residents?

Explanatory Variables of Interest Articles 1 and 3

* Mobility Device Use (MD)

CODES 1 YES
2 NO
REFUSED
DON'T KNOW

md1canewlker R1 MD1 USED CANE WALKER WHLCHAIR
In the last month, {have you/has SP} used a cane, walker, wheelchair, or scooter, yes or no?

md1cane R1 MD2 USED A CANE
In the last month, which did {you/SP} use?
a cane?
If 1 is selected, set CANE flag = 1 (yes)

md1walker R1 MD3 USED A WALKER
In the last month, did {you/SP} use a walker?
IF NEEDED: This includes standard walkers without wheels, rolling and wheeled walkers, and rollators.
If 1 is selected, set WALKER flag = 1 (yes)

md1wheelchar R1 MD4 USED A WHEELCHAIR
DISPLAY INSTRUCTIONS: Display image of wheelchair.
In the last month, did {you/SP} use a wheelchair?
IF NEEDED: This includes manual, power, electric, or motorized wheelchair.
If 1 is selected, set WHEELCHAIR flag = 1 (yes)

md1scooter R1 MD5 USE A SCOOTER
DISPLAY INSTRUCTIONS: Display image of scooter.
In the last month, did {you/SP} use a scooter?
IF NEEDED: This includes electric or power scooters that are used for travel.
If 1 is selected, set SCOOTER flag = 1 (yes)

APPENDIX B: (continued)

Flag variables set in MD Section

fl1cane R1 F MD SP USES CANE
fl1walker R1 F MD SP USES WALKER
fl1wheelchr R1 F MD SP USES WHEELCHAIR
fl1scooter R1 F MD SP USES SCOOTER

* Sensory Device Use (SS)

ss1heringaid R1 SS3 HEARING AID USED

In the last month, {have you/has SP} used a hearing aid or other hearing device?

CODES	1 YES
	2 NO
	7 DEAF
	REFUSED
	DON'T KNOW

ss1glasseswr R1 SS7 WEARS GLASSES CONTCTS

{Do you/Does SP} wear glasses or contacts to help {you/him/her}see things at a distance?

CODES	1 YES
	2 NO
	7 BLIND
	REFUSED
	DON'T KNOW

ss1glasscls R1 SS10 WEAR GLS CONTCS SEE CLOS

{Do you/Does SP} wear glasses or contacts to help {you/him/her}see things close up?

CODES	1 YES
	2 NO
	REFUSED
	DON'T KNOW

ss1othvisaid R1 SS11 USED OTHER VISION AIDS

In the last month, did {you/SP}use other vision aids such as a magnifying glass to help {you/him/her} see things close up?

IF NEEDED: Vision aids include things like a magnifying glass, large-print books, and other tools to help people with vision impairments.

CODES	1 YES
	2 NO
	REFUSED
	DON'T KNOW

APPENDIX B: (continued)

* Self-Care Device Use (SC)

Eating:

sc1eatdev R1 SC1 EVER USE ADAPTED UTENSILS
In the last month, did {you/SP} ever use adapted utensils to help {you/{him/her}} eat or cut {your/{his/her}} food?
IF NEEDED: Adapted utensils include things like easy-to-grip silverware, knives that rock, and plates with high sides.

CODES 1 YES
2 NO
7 ALWAYS FED THROUGH IV OR TUBE
REFUSED
DON'T KNOW

Bathing:

sc1showrbat1 R1 SC7 SP SHOWERED
sc1showrbat2 R1 SC7 SP TOOK BATHS IN A TUB
sc1showrbat3 R1 SC7 SP WASHED SOME OTHR WAY
In the last month, how did {you/SP} usually clean {yourself/{himself/herself}}? By taking a shower, bathing in a tub, or washing up some other way?
IF NEEDED: Do not include whirlpool bath {you take/{he/she} takes} for therapy. SELECT ALL THAT APPLY:

CODES 1 SHOWERED
2 TOOK BATHS IN A TUB
3 WASHED UP SOME OTHER WAY
REFUSED
DON'T KNOW

If more than one response:

sc1prfrshbth R1 SC8 PREFER SHOWR BATH OR OTHR
In the last month, which did {you/SP} do most often: {showering/ taking baths/ washing up some other way}?

CODES 1 SHOWERING
2 TAKING BATHS
3 WASHING UP SOME OTHER WAY

If 1 or 2 is selected:

sc1scusgrbrs R1 SC9 HOW OFTEN USE GRAB BARS

APPENDIX B: (continued)

In the last month, did {you/SP} use grab bars every time {you/{he/she}} {showered/took a bath}, most times, sometimes, rarely, or never?
IF NEEDED: A grab bar is designed to help you steady yourself. It may be attached to the wall or built into the shower or tub. Do not include towel racks.

CODES 1 EVERY TIME
2 MOST TIMES
3 SOMETIMES
4 RARELY
5 NEVER
REFUSED
DON'T KNOW

sc1shtubseat R1 SC10 HOW OFTEN USE SHOWR TUB SEAT
In the last month, did {you/SP} use grab bars the shower or tub seat every time {you/{he/she}} {showered/took a bath}, most times, sometimes, rarely, or never?
IF NEEDED: A shower or tub seat is a chair, stool, or bench used in the shower or bathtub. Some seats are placed in the shower or tub, others are built in.

CODES 1 EVERY TIME
2 MOST TIMES
3 SOMETIMES
4 RARELY
5 NEVER
REFUSED
DON'T KNOW

Toileting:

IF NEEDED: These questions may seem a bit personal, but they are very important for research on aging and health trends.

CODES 1 YES
2 NO
REFUSED
DON'T KNOW

sc1usvartoi1 R1 SC16 SP USED PORTABLE COMMODE
In the last month, {have you/has SP} ever used a portable commode, portable urinal or bedpan?

sc1usvartoi2 R1 SC16 SP USED PADS UNDERGMT
In the last month, {have you/has SP} ever used disposal pads or undergarments to help prevent accidentally wetting or soiling {your/{his/her}} clothes?

APPENDIX B: (continued)

sc1usvartoi3 R1 SC16 USED GRABBARS FR TOILET

In the last month, {have you/has SP} ever used grab bars around the toilet? IF NEEDED: A grab bar is designed to help you steady yourself. It may be attached to the wall or part of a frame that goes over the toilet. Do not include towel racks.

sc1usvartoi4 R1 SC16 USED RAISED TOILET SEAT

In the last month, {have you/has SP} ever used a raised toilet or raised toilet seat? IF NEEDED: This includes a toilet seat that is elevated higher than usual, either because the toilet or the seat is raised, or a set with arms that fits over the toilet. Do not include portable commodes, portable urinals or bedpans.

Dressing:

sc1dresdev R1 SC22 USE SPECL ITEMS TO DRESS

In the last month, did {you/SP} use any special items to get dressed, such as button hooks, reacher or grabber, or clothes that are designed to get on and off easily?

CODES	1 YES
	2 NO
	REFUSED
	DON'T KNOW