Neighborhood Effects on Residential Living Arrangements among Older Adults

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Abstract

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In 2010, the population of older adults – those age 65 or older – numbered 40.4 million in United States, and was rapidly growing. By 2030, there will be about 72.1 million older adults in the U.S. The rapid aging of the American population brings up questions of how to provide housing for an aging society. Older adults can choose from a variety of senior- and non-senior specific housing options, but a substantial proportion report preferences to live independently in their own home for as long as they are able. Not every older adult has an equal chance of remaining in their own home, and some of these inequalities play out at the neighborhood level. However, most previous research of the determinants of living arrangements among older adults is limited to individual- and household-level predictors. Few studies have incorporated ecological variables even though there are theoretical reasons to believe that neighborhood characteristics are also important. This dissertation attempts to fill the gap in the research literature, while also contributing to policy discussions surrounding long-term housing options for older adults. I utilize quantitative methods that rely on approximately twenty years of longitudinal data from the Panel Study of Income Dynamics, combined with neighborhood-level data from the US Census Bureau, to explore questions of how neighborhood characteristics affect the likelihood of independent community-dwelling versus moving to age-segregated senior

housing among older adults. Collectively, the findings indicate that the physical and social environment of the neighborhood exert important impacts on living arrangements among older adults, including a neighborhood's urban, suburban, or rural location; walkability; geographic access to health care; and proximity to family support. Currently, there are few effective policies to help older adults retain residential independence that focus on making neighborhood changes, but the findings suggest there may be several avenues for policy intervention, such as expanding older adults' access to services, and rethinking the structure and design of neighborhoods so that they are more viable living options through the life course and into old age.

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CHAPTER 1

Introduction

Housing an Aging Society

One of our most basic needs as humans, young or old, is adequate housing. This need perhaps reaches a critical point at older ages, when individual health and functional mobility begin to decline, and aspects of one's environment that never used to be problematic present new challenges. Not long ago, most older adults eventually moved in with one of their children (Smith 1982). Today, co-residing with children is relatively rare, and living independently, whether with a spouse, domestic partner or (increasingly) on one's own, is the dominant living arrangement among older adults (US Administration on Aging 2011). Yet some older adults are more likely to maintain an independent living arrangement than others. Some of this difference represents personal preference, but some of it represents underlying inequalities, including inequalities in race, socioeconomic status, social support, and access to high-quality housing and neighborhoods.

Concerns about adequate housing among older adults are becoming even more critical as the population of older adults in the United States continues to grow. The population of older adults – those age 65 or older – numbered 40.4 million in 2010, an increase of 5.4 million, or 15.3% since 2000 (US Administration on Aging 2011). Older adults represented 13.1% of the US population in 2010, or over one in every eight Americans. The older population will continue to grow substantially in the future (see Figure 1.1). The older population will grow rapidly between the years 2010 and 2030 when the "baby boom" generation reaches age 65. By 2020,

the older population is projected to increase to 55 million (a 36% increase for that decade). By 2030, there will be about 72.1 million older adults, over twice their number in 2000.

Housing an aging society presents unique challenges that have attempted to be addressed by the range of housing options available to older adults. Consider the variety of housing options (known by a variety of terminology) now available: retirement communities, active adult communities, senior citizen's apartment complexes, continuing care retirement communities, assisted-living facilities, residential care, board and care, congregate care, adult care homes, alternative care facilities, adult foster care facilities, sheltered housing, nursing homes, and so on.

For some older adults, these senior-specific housing options are considered second to living independently in their own home, or aging-in-place. Several studies have reported that living independently in a community-based setting is the preferred housing option among older adults, and that many older adults desire to age-in-place (Lachman, Ziff, and Spiro 1994; Hodge 2008; Keenan 2010). Older adults offer a variety of reasons for wanting to age-in-place, including living in the comforts of a familiar dwelling; strong feelings of attachment, control, and independence; maintaining continuity with their pasts; and keeping the equity in their dwelling if they own their home, usually the major source of their net worth (Golant 2008). One must be careful not to overstate preferences for independent community-dwelling among older adults, since these studies are based on samples of older adults currently living independently, which likely biases the results upward. However, based on these studies and the distribution of where older adults actually live, it is not presumptuous to say that a substantial portion, perhaps even a majority, of older adults seem to desire to remain independent community-dwelling for at least as long as they are able.

A number of housing programs have cropped up in the last decade in order to support the aging-in-place option, including designated "Villages" and Naturally Occurring Retirement Communities. The relatively new "Village" concept connects older adults who are aging-in-place with neighbors and local resources. Generally members pay an annual fee (the average is about $600) in return for services such as transportation, yard work, and bookkeeping (Thomas 2011). Help comes from a mix of paid employees and volunteers, such as younger neighbors or youth groups doing community service. The goal is to provide older adults with assistance similar to what they would receive at a retirement community, but without having to uproot their household. Naturally Occurring Retirement Communities (or NORCs) is a demographic description of neighborhoods that were not originally designed for older adults, but have large proportions of residents age 65 and older, generally because the residents have aged-in-place. Many NORCs have developed supportive service programs that provide residents with services like transportation, recreational and educational activities, and health care management through partnerships with local organizations, residents, health and social service providers, and other community stakeholders. NORC programs are generally supported by a mix of public and private funding, and like Villages, their main goal is to help older adults maintain independence and remain in their homes as they age. In reality, most adults age 65 and older in the United States do not live in senior-specific housing, or in designated Villages or NORCs. They live in typical American neighborhoods, often neighborhoods they have lived in for a decade or more.

Why Study Residential Independence?

With so many older adults already living independently in traditional communities, why is more research on the topic necessary? The answer to whether studying residential independence is a worthy research endeavor depends on whether helping older adults remain independent is an important policy goal. I think that it is for three reasons: preferences for independent community-dwelling are strong, there is substantial inequality in the fulfillment of preferences to remain independent, and there are benefits to retaining older adults in traditional communities.

First, as already mentioned, there is a strongly-held preference among a substantial portion of older adults in the U.S. for remaining in their own home as long as they are able. According to a recent poll directed by the AARP, nearly three-quarters (73%) of respondents *strongly agreed* with the statement "what I'd really like to do is stay in my current residence for as long as possible" (Keenan 2010). More than one-tenth (13%) said they *somewhat agreed* with the statement. Only one-tenth of respondents *strongly disagreed* (5%) or *somewhat disagreed* (4%) with the statement. Four percent were neutral, neither agreeing nor disagreeing. Similarly, two-thirds of respondents *strongly agreed* with the statement "what I'd really like to do is remain in my local community for as long as possible," and another one-fifth said they *somewhat agreed* with the statement. Due to the study design, these findings must be interpreted with caution. The study included persons age 45 and older, so it is possible that their residential preferences will change as they age. Respondents in the study were also those currently living independently, who may hold stronger preferences for remaining independent than older adults currently living in senior housing. Even if we could adjust the results for these biases (there is no study that I am

aware of that has), we would still likely find that a substantial portion of older adults hold strong preferences for remaining in their current residence, making the fulfillment of these preferences a worthy policy goal.

Second, even though the majority of older adults in the U.S. currently live in a traditional community setting, the distribution of those living independently is not random. Underlying inequalities in socioeconomic status and health determine, in part, which older adults remain independent community-dwelling and which move to senior housing. Financial stressors like increases in property taxes and utility costs are associated with an increased likelihood of moving to senior housing (Sabia 2008), possibly because lower-income households are less able to weather these additional costs than higher-income households. Furthermore, increased home equity and greater financial resources are positively associated with aging-in-place (Sabia 2008). In terms of health, previous research has established that individuals in worse health are less likely to remain at their current residence compared to those in better health (Silverstein and Zablotsky 1996; Panter and Lee 2009). The likelihood of being in good or poor health is, in itself, driven by underlying inequalities in race and ethnicity (Hummer 1996), socioeconomic status (Feinstein 1993; Elo and Preston 1996), and sex (Case and Paxon 2005; Preston and Wang 2006). And just because an individual is in good health does not mean they cannot be affected by health inequalities, as the death of a spouse is another major catalyst of relocation to senior housing (VanderHart 1998). Some of the inequalities in socioeconomic status and health likely play out at the neighborhood level. Individuals with lower socioeconomic status and worse health often live in more disadvantaged areas (Cattell 2001; Squires and Kubrin 2005), and neighborhood disadvantages may further contribute to differential rates of remaining in one's own home.

Third, retaining older adults in age-integrated, traditional communities may be beneficial to neighborhoods and communities. Older adults tend to be more active in community institutions and more likely to devote time to volunteering than younger adults (Putnam 2000). Furthermore, older adults provide "eyes-on-the-street" (Jacobs 1961), a customer base for neighborhood businesses, and a presence in public spaces during working hours when the neighborhood may otherwise be abandoned. Therefore, the movement of older adults into age-segregated housing may deplete neighborhoods of a valuable resource.

By focusing my research on independent community-dwelling, my intent is not to take attention away from other housing options. The needs and preferences of older adults are extremely varied and are likely to change as they age. Differing needs and preferences can best be addressed by providing older adults with a variety of housing options, from senior citizen housing complexes that provide recreation and transportation, to assisted-living facilities that provide on-site medical care, to in-home care options that allow older adults to age-in-place. Geographer and gerontologist Stephen Golant (2008) made an important argument that among policy makers there is an "irrational exuberance" for aging-in-place, which has misdirected resources away from other senior housing options. Furthermore, Golant (2008) argued that many older adults would have a better quality of life if they would relocate from their long-time home to housing that provides more care. While I agree that aging-in-place is not necessarily the best option for some older adults, the reality is that many older adults are going to choose this option anyway. Already there is much research on what makes a good assisted-living facility (Schwarz and Tofle 1999; Golant and Hyde 2008; Zimmerman, Sloane, and Eckert 2011) or retirement community (Harrigan, Raiser, and Raiser 1998; Suchman et al. 2001; Trolander 2011), but

relatively less research has focused on how to better design the traditional, age-integrated neighborhood to be a viable living option through the life course and into old age.

Reestablishing a Research Agenda

Decisions to either remain living independently in the community or relocate to senior housing are influenced by a host of important predictors. Collectively, previous research findings indicate that moves to senior housing are influenced by age, as one might expect, but also race, income, education, and most importantly, family composition, widowhood, and health (Silverstein and Zablotsky 1996; VanderHart 1998; Ermisch and Jenkins 1999; Robison and Moen 2000; Longino, Perzynski and Soller 2002; Akamigbo and Wolinsky 2007; Sabia 2008; Wilmoth 2010). Assistance-seeking moves (such as those to nursing homes or to retirement communities that provide continuing care) are more strongly determined by living alone and prior health than amenity-driven moves (Silverstein and Zablotsky 1996; Wilmoth 2010). Some studies also acknowledge important features of the home environment (meaning the actual dwelling), including homeownership, individuals' satisfaction with the home, home modification and home repairs, and the presence of hazards and environmental barriers to functioning (e.g., risk factors for falls, etc.) (Connell 1996; Clemson, Roland, and Cumming 1997; Connell and Sanford 1997; Gitlin et al. 2001; Stuck et al. 2002; Gitlin 2003).

By in large, this line of research has focused on individual-level and household-level predictors. The information garnered from this research has made its way into policy discussions and practices. A vast number of organizations seek to support older adults who want to age-in-place, including the AARP (formerly The American Association of Retired Persons), the

National Aging in Place Council, and the National Association of Area Agencies on Aging. These organizations provide countless articles and "how-to" booklets on living independently, and often seek to connect older adults who want to age-in-place with local service providers. For example, in conjunction with the AARP, the National Association of Home Builders offers a service to help individuals find a "Certified Aging-in-Place Specialist" who can help outfit their home for long-term needs. The federal and state governments are also involved in aging-in-place initiatives. Some Area Agencies on Aging offer home repair and home modification services on a sliding scale or free of charge. Funding for home modifications is also available from the US Department of Housing and Urban Development's (HUD) Community Block Development Grants, the US Department of Agriculture's Rural Development Home Repair Loan and Grant Programs, the Plan for Achieving Self Support program from the Social Security Administration, and the US Department of Veterans Affair's Specially Adapted Housing Grants Program. In addition, individuals who pay for home modifications out of personal savings may be eligible for Internal Revenue Service deductions for medical expenses.

Much less research and policy practice goes beyond the individual and the household, to examine neighborhood features that fulfill older adults' long-term needs. For some answers, we can look to the large and growing area of research concerned with so-called "neighborhood effects", or the impact of neighborhood characteristics on the well-being and life outcomes of neighborhood residents. Based on this research, it is well established that neighborhoods have both positive and negative impacts on the well-being of residents (Diez-Roux 2011; Sampson, Morenoff, and Gannon-Rowley 2002; Kawachi and Berkman 2003; Galster 2012), and that certain neighborhood characteristics impact well-being above and beyond individual characteristics. A number of neighborhood characteristics play a role, including neighborhood

disadvantage (Malmstrom, Sundquist, and Johansson 1999; Kawachi and Berkman 2000), concentrated affluence (Cagney, Browning, and Wen 2005), residential stability (Duncan, Brooks-Gunn, and Aber 1997; Ross, Reynolds, and Geis 2000; Cagney et al. 2005), racial and ethnic heterogeneity (Guest, Kubrin, and Cover 2008), and urban/suburban/rural location and urban sprawl (McLaughlin and Jenson 1998; Duany, Plater-Zyberk, and Speck 2000; Frumkin 2002). Most of these studies do not focus specifically on older adults, but the larger implications, that neighborhoods affect well-being, apply to younger and older ages alike.

Underlying the evidence on neighborhood effects is the question of *how* neighborhood characteristics come to impact outcomes for older adults. This question is not entirely new. In 1980, Powell Lawton published *Environment and Aging*, summarizing over a decade of research in the area and establishing his ecological theory of aging. According to the theory, older adults engage in a process of adaptation to their environment (see Figure 1.2). Each environment makes a behavioral demand on the individual, called *environmental press*. The individual's behavioral response depends on their *competence*, including their physical health, sensory and motor capabilities, cognitive skills, and personality. The outcome represents the *adaptation level* between the environmental press of the situation and a person's ability to respond. In situations where the individual successfully adapts to the environmental press, the outcome is adaptive behavior. But an environment's press can be too high or too low for a senior's competence, producing maladaptive behaviors, either stressful or boring outcomes, and a reduced sense of well-being.

The central premise of the ecological theory of aging is that individual characteristics interact with environmental characteristics to affect outcomes for older adults. The arguments of the ecological theory of aging are very much in line with the stress-threshold theoretical model

of residential mobility, which is based around the core argument that people do not consider moving unless they experience residential stress, derived from the mismatch between individual needs and environmental characteristics (Wolpert 1965; Brown and Moore 1970; Speare 1974). Neither the stress-threshold model nor the ecological theory of aging specify what characteristics of neighborhoods and individuals are most important for determining residential outcomes among older adults. Rather, they leave the answer to this question open-ended, but provide useful frameworks for building hypotheses and understanding observed results.

In the field of gerontology, this line of research spawned its own sub-field, known as *environmental gerontology*, which has produced many permutations and add-ons to Lawton's original theory. In 2008, Gerald Hodge revisited Lawton's ecological theory of aging, updating the theory and applying it specifically to older adults' residential independence. According to Hodge (2008), residential independence centers on security of housing, which is maintained by security of health, security of income, access to transportation, and community support in the form of physical and social support systems (see Figure 1.3). Hodge stressed transportation, neighborhood safety, site topography, and the availability and accessibility of services, stores, recreation, and public gathering places as features of the community that create *enabling environments* for older adults.

Despite the development of the ecological theory of aging beginning with Lawton, carried forward by environmental gerontologists, and briefly picked up again by Hodge, very little empirical research actually tests the theoretical claims. In an article describing the state of the field, Wahl and Weisman described environmental gerontology as being "high in conceptual aspiration ("world views"), but low with regard to making research and application-productive use of its theoretical achievements" (2003: 616). The neighborhood effects literature has

produced stronger empirical evidence documenting links between neighborhood structure, neighborhood processes, and individual outcomes, but the neighborhood effects literature does not focus specifically on older adults and is not grounded in the same theoretical traditions. Furthermore, research in the fields of environmental gerontology and neighborhood effects for the most part remain separate lines of inquiry, even though the opportunity for integrative research between the two is high. Therefore, a main goal of this study is to bring the two lines of research together, by re-establishing the research agenda originally set forth by Lawton and his ecological theory of aging, and grounding it with empirical insights from prior research on neighborhood effects and original research findings.

Objectives of the Current Project

The central research question of this study is: *how do neighborhoods impact residential living arrangements among older adults?* This research question is necessarily broad but inevitably difficult to resolve, because there are so many possible answers. In the following chapters, I take a bite out of this research question by investigating the impact of three neighborhood characteristics in particular, urban category/urban sprawl, proximity to family support, and geographic access to health care. I assess the impact of these neighborhood characteristics on the likelihood of remaining independent community-dwelling or moving to senior housing for a nationally-representative sample of older adults drawn from the Panel Study of Income Dynamics.

One of the main goals of this project is to contribute to the research literature on aging and neighborhood effects. Many of the proposed theoretical links between neighborhood

conditions and outcomes for older adults remain untested using empirical analyses. This research will make a significant contribution by investigating the effects of neighborhood processes and mechanisms (like transportation, distance to family members, and geographic access to health care) in addition to neighborhood structural characteristics (like population size, poverty rate, and age distribution), while at the same time adjusting for individual-level and household-level explanations of moves to senior housing. To do so, I rely on approximately twenty years of detailed longitudinal data on the same individuals and follow them as they transition into and out of various living arrangements. The use of longitudinal data allows me to address several methodological challenges that often plague cross-sectional neighborhood studies, including endogeneity between independent and dependent variables and biases produced by the differential selection of individuals into certain neighborhoods.

A second goal of this project is to contribute to policy discussions surrounding long-term housing options for older adults. My goal is not to promote aging-in-place (or any other housing option) as a one-size-fits-all strategy for housing older adults. Rather, I view a best case scenario as one in which older adults have access to a range of housing options that they can draw upon to suit their specific needs and preferences. One area where there is little research and subsequently little policy action is in the environmental (or neighborhood) context that supports the aging-in-place option, and this is where I seek to make my policy contribution. Much of the aging-in-place policy action focuses on making dwellings suitable for the long-term through housing modifications, but little action is focused on making neighborhoods more "accessible". My research helps to shed light on which neighborhood characteristics matter most for which populations. This information can be used to spend public and private dollars more wisely and efficiently.

A third goal of this project is to contribute to public discourse about aging, housing options, and how (and whether) we should be designing neighborhoods for the life course. Many older adults express a desire to remain in their own home for as long as possible, but not everyone is equally able to fulfill this preference. It may be worth thinking about whether and how this preference can be fulfilled while still giving older adults a high quality of life. This may involve rethinking societal attitudes about housing the aged, and rethinking how we design neighborhoods. Neighborhoods are often designed with a younger population in mind, and some neighborhoods (especially planned communities) are built without important features like sidewalks, space (and zoning) for retail establishments, and variety of housing sizes and types. Neighborhoods like these may suit the needs of younger adults, but become increasingly problematic as people age. Increasingly, there is wider agreement that neighborhood features like sidewalks, retail, and housing variety create environments that are not only better for older adults, but beneficial for everyone. More recently, some cities and neighborhoods, especially in suburban areas, are attempting to "urbanize" by adding in some of the aforementioned features and densifying development (Ehrenhalt 2012). But, the design of neighborhoods remains an ongoing conversation, and this study seeks to include the needs of older adults within the discussion.

Overview

To address the central research question, I develop hypotheses and test them using a variety of statistical methods that rely on longitudinal survey data from the Panel Study of Income Dynamics (PSID) combined with neighborhood data from the US Census Bureau.

Chapter 2 describes in detail the data, the measurement of the variables, and the statistical methods used. I provide background information on the PSID and discuss my strategy for selecting the sample of older adults age 65 and older that I use for analysis. I also describe the data sources for the neighborhood variables which come from a variety of products provided by the US Census Bureau, including the Decennial Census, the American Community Survey, the Economic Census Zip Code Statistics, and the Census TIGER/Line geographic data. I also provide definitions of terms that are used frequently throughout the study, including definitions of *independent community-dwelling* and *senior housing.* Finally, I describe how individual, household, and neighborhood variables are measured and operationalized throughout the remaining chapters, and discuss my strategies for statistical analysis.

Chapter 3 presents the first empirical research question – *how does living in the suburbs influence older adults' likelihood of living independently as they age versus moving to senior housing?* Underlying this research question is the fact that the U.S. is a predominately suburban nation, but increasingly, the benefits of suburban living are being called into question. The aging of the suburbs has led to concerns that suburban neighborhoods undermine older adults' ability to live independently as they age, especially if the neighborhoods exhibit qualities of suburban sprawl. But in order to demonstrate a "neighborhood effect" of living in the suburbs, individual-level determinants of residential transitions need to be ruled out. In Chapter 3, I test whether older adults in suburban neighborhoods are more likely to transition out of independent community-dwelling and into retirement communities and assisted-living facilities compared to urban and rural older adults, net of individual characteristics like age, socioeconomic status, race and ethnicity, family composition, and health. In addition, I test whether this "suburban disadvantage" can be explained by characteristics of suburban sprawl, like automobile

dominance, lack of services, and lack of alternative housing options. Results of multivariate logistic regression models indicate that suburban older adults are more likely to move to senior housing than urban or rural older adults, despite individual differences. Poor street connectivity and lack of services in suburban neighborhoods contribute to the vulnerability of older adults who wish to remain living independently. In addition, rural older adults are especially likely to remain independent community-dwelling compared to other older adults, above and beyond other individual and neighborhood attributes.

Chapter 4 focuses on the next empirical question – *how does proximity to one's family members influence the likelihood of remaining independent community-dwelling versus moving to senior housing?* Furthermore, can increased levels of family support explain the positive association between rural location and living independently identified in Chapter 3? Decades of research have shown that social ties and social support are positively and causally related to mental health, physical health, and longevity, especially support provided by close kin (spouses, partners, and children). We already know from previous research that being married and living with other family members contributes to residential independence, but what about external family support? To examine the effects of external family support, I empirically test how distance to children and distance to other relatives impacts the likelihood that older adults move to senior housing. To do so, I estimate the effect of family support on residential mobility while adjusting for other predictors of moves to senior housing, including, most importantly, marital status and the number of people residing in the same household as the older adult. I also adjust for age, socioeconomic status, race/ethnicity, housing characteristics, and health. Overall, I find that distance to adult children is an important predictor of maintaining residential independence, although this relationship does not explain why rural older adults are especially likely to remain

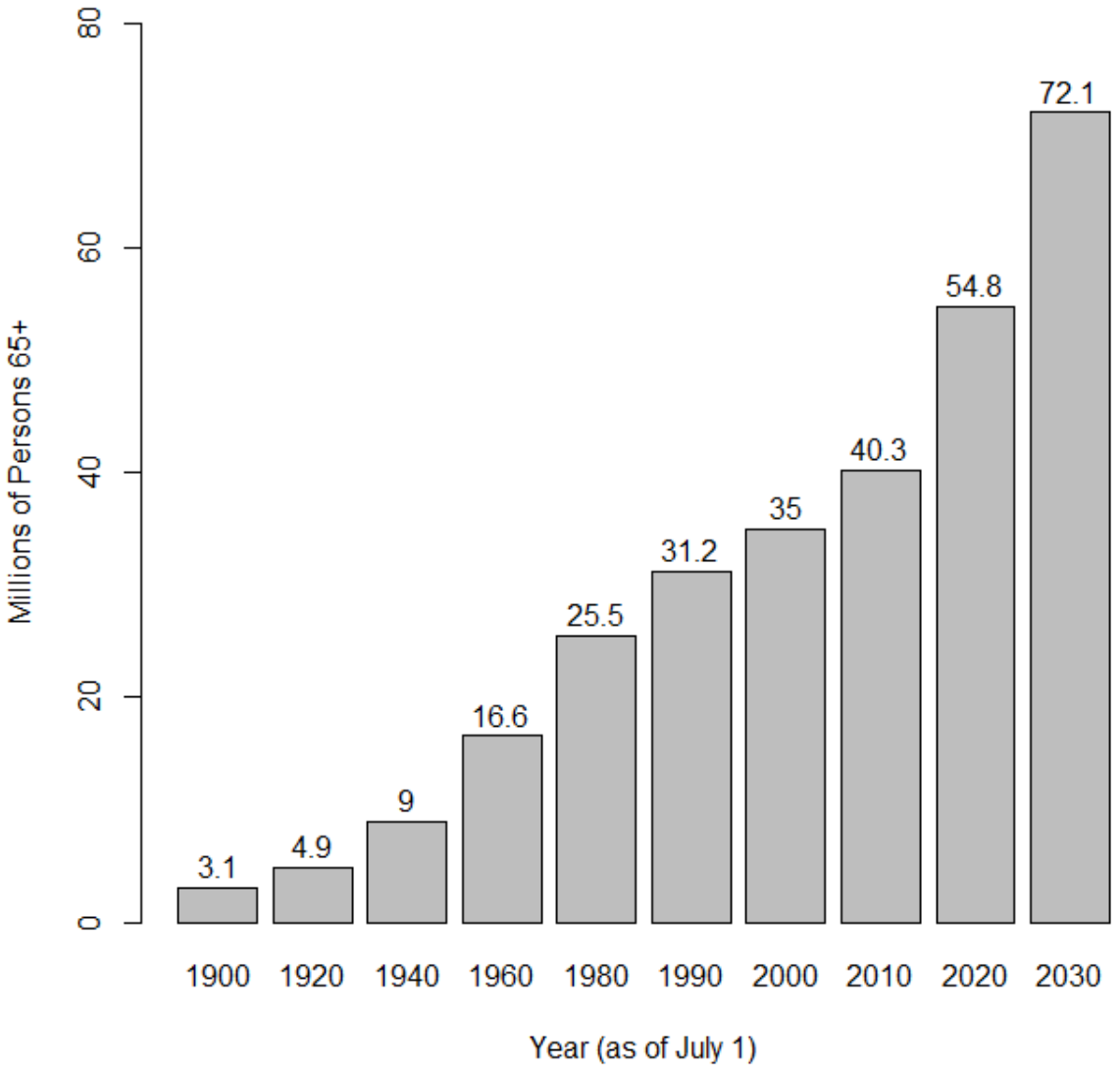
independent. Understanding the role of family support is potentially more salient than ever, since older adults today have fewer children and smaller and more spread out kin networks than in the past. The implications of the findings suggest that policies seeking to help older adults remain independent as they age may benefit from focusing their resources on older adults who do not have adult children residing nearby.

Chapter 5 examines one final research question – *how do geographic access to health care services and individual health status impact residential independence among older adults?* I present two theoretical frameworks for specifying relationships between the focal variables. The "sequential effects" framework argues that geographic access to health care affects individual health, which in turn, affects residential mobility. The "person-environment fit" framework argues that geographic access to health care and individual health status interact to jointly determine residential mobility. The results are most consistent with the person-environment fit framework, and suggest that more limited geographic access to health care prompts moves to senior housing only among older adults who are already in poor health. The findings highlight how the impact of some environmental factors depends on individual characteristics, so it is important to take both into account. The policy implications suggest that efforts to expand geographic access to health care would be most effective if they targeted neighborhoods with a high density of older adults with chronic health conditions.

Finally, in Chapter 6 I summarize and discuss the theoretical and policy significance of the findings. I discuss potential alternative explanations and study limitations, and describe future avenues of research for those interested in studying neighborhood effects on residential living arrangements among older adults.

FIGURES

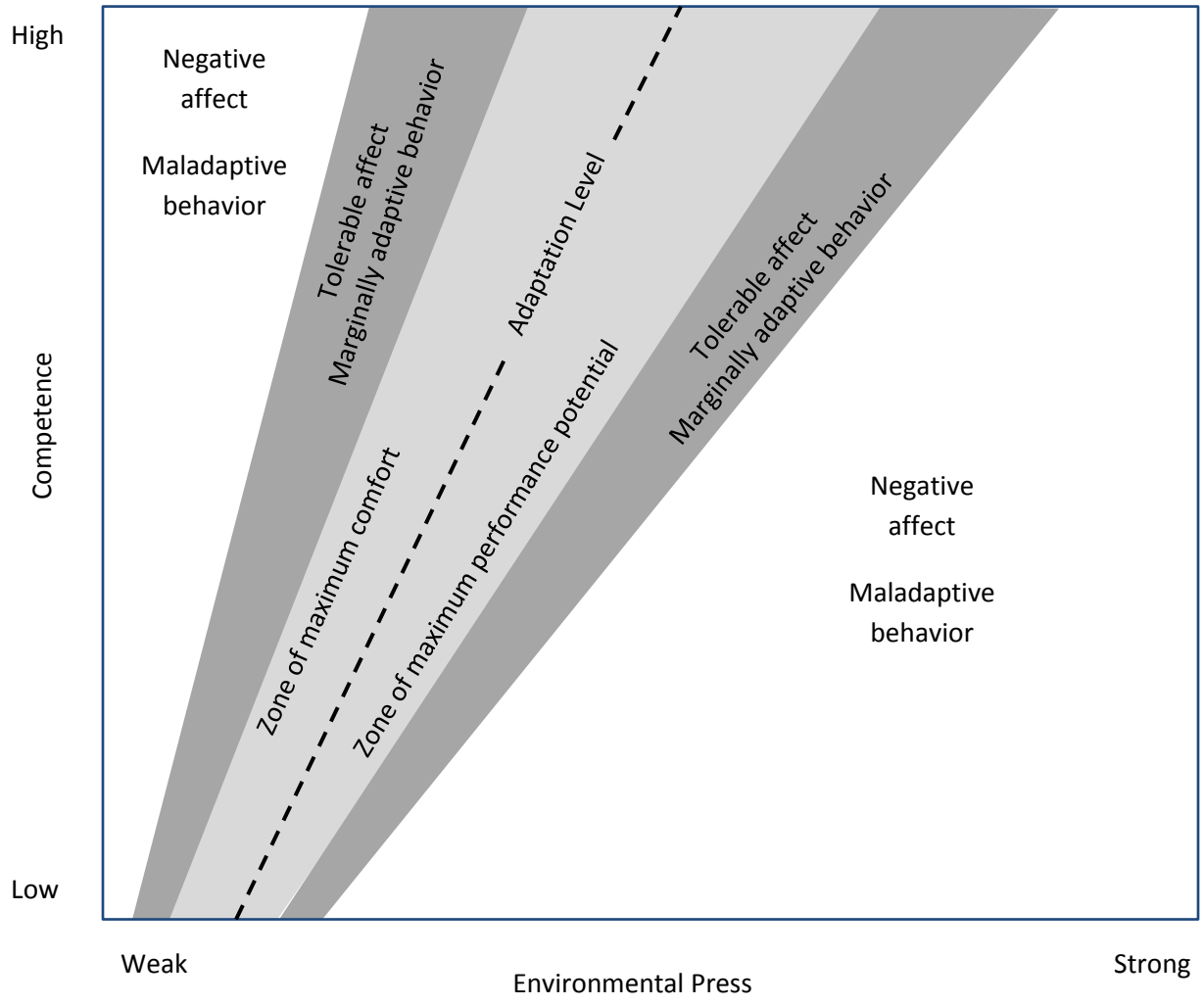
Figure 1.1: Number of Persons Age 65+, 1900-2030 (numbers in millions)



Note: Increments in years are uneven

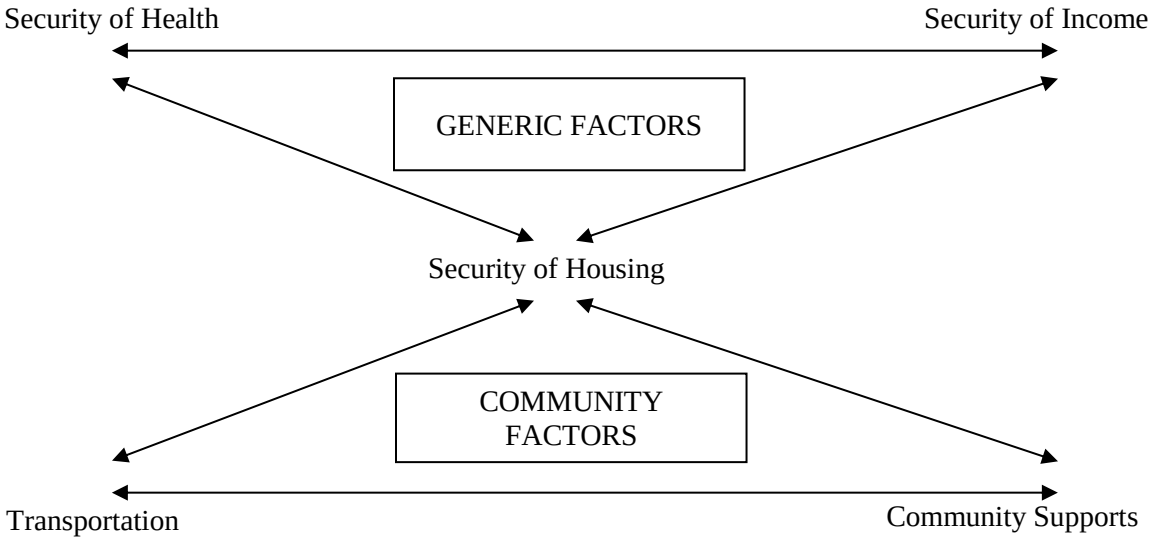
Sources: Projections for 2010 through 2030 are from Table 12. Projections of the Population by Age and Sex for the United States: 2010 to 2050 (NP2008-T12), Population Division, U.S. Census Bureau; Release Date: August 14, 2008. The source of the data for 1900 to 2000 is Table 5. Population by Age and Sex for the United States, 1900 to 2000, Part A. Number, Hoobs, Frank and Nicole Stoops, U.S. Census Bureau, Census 2000 Special Reports, Series CENSR-4, Demographic Trends in the 20th Century. The data for 2010 are from the U.S. Census Bureau Decennial Census.

Figure 1.2: Lawton's Ecological Theory of Aging



Source: Reproduced from Figure 1-4 page 12 in M. Powell Lawton. 1980. *Environment and Aging*. Monterey, CA: Brooks/Cole Publishing.

Figure 1.3: Hodge's Model of Factors Involved in Assuring Older Adults' Independence



Source: Reproduced from Figure 1.1, page 21 in Hodge, G. 2008. *The Geography of Aging: Preparing Communities for the Surge in Seniors*. Montreal, Quebec, McGill-Queen's University Press.

CHAPTER 2

Data and Methods

A Quantitative Approach

One of the elements lacking in the literature researching the links between neighborhoods and residential outcomes among older adults is a solid body of empirical evidence. Filling the empirical gap is one of the main objectives of this project. In this project, I rely on a quantitative approach, meaning that I rely on a large-scale, nationally-representative sample of older adults and statistical methods to generate and evaluate the evidence. In doing so, the results of this study are generalizable to almost all older adults in the United States. An alternative, qualitative approach might rely on ethnographic data, possibly utilizing in-depth observations of particular neighborhoods or conducting interviews with older adults. A lot can be learned from a qualitative approach, because it provides an in-depth and detailed look into older adults' everyday lives (for an excellent qualitative study describing how older adults think about and approach housing and living arrangements as they age, see Klinenberg, 2012). Sacrificing this detail is one of the main limitations of a quantitative approach. For example, the measures of neighborhood built environment utilized in this study are not nearly as detailed as the measures available in other, smaller-scale neighborhood studies (for a review of these studies, see Lin and Moudon 2010). However, these detailed studies tend to have a small geographic scope and the results cannot be generalized to a larger population. Thus, in this study I sacrifice some of the detail in order to capture a larger and more representative picture of older adults' experiences with housing as they age, compared to most prior studies.

Data

This study draws on data from the Panel Study of Income Dynamics (PSID) for the survey years 1990 to 2009. The PSID is a nationally-representative longitudinal study of US families that began in 1968 and has continued to follow individuals from families in the core sample every year, whether or not they were living in the same household or with the same people. Data were collected on individuals and the family units in which they reside, and cover a wide range of economic, social, and psychological measures. Although the PSID does not focus specifically on older adults, I chose this data set over other datasets like the Health and Retirement Study and the Wisconsin Longitudinal Study because of the availability of block group geo-codes for individuals as well as their kin.

For this study, I selected all PSID respondents age 65 and older at any time between 1990 and 2009 and designated as a household head or wife during the survey year, resulting in a sample of 2,298 respondents. The ages of PSID respondents range from 65 to 104 years old, and all members of the sample were living independently at the outset. This selection impacts the representativeness of the sample; conclusions cannot be drawn about older adults who moved to senior housing prior to age 65. All results incorporate sampling weights in order to account for the sampling strategy utilized by the PSID. I use the year-specific "combined core-immigrant sample individual longitudinal weight" provided by the PSID, which is nonzero for PSID sample members associated with core or immigrant response families. Individuals from the Latino sample are not analyzed.

To make full use of the longitudinal information, I structured the data as a series of person-intervals, each referring to the interval between successive PSID interviews, resulting in a sample of 13,335 person-intervals for analysis. Structuring the data in this way allows multiple moves by the same individual to be captured over time, for example, an individual may move between independent community dwellings before making a move to senior housing. Once individuals make a first move to senior housing, person-intervals after that move are excluded from the analysis since the experience of living in senior housing is likely to influence future migration decisions. All covariates are time-varying, with the exception of a few individual characteristics that do not tend to vary over time among older adults (race/ethnicity, years of schooling, and number of children). In order to capture household and neighborhood characteristics prior to a move, variables were lagged by one survey interval.

In order to characterize respondents' neighborhoods, the geographic identifiers for PSID respondents' census block groups in each survey year were merged with aggregate data from various US Census Bureau sources. All block group boundaries were standardized to the year 2000. Neighborhood data were interpolated with a linear model for years when the US Census Bureau had data gaps. Variables and their data sources are listed in Table 2.1.

The 1990 and 2000 Decennial Censuses and the 2005-2009 American Community Survey were used to characterize population size and density, socioeconomic disadvantage, residential stability, racial and ethnic heterogeneity, urban/suburban/rural location, urban sprawl, transportation options, and region of the country for block groups containing PSID respondents.

The prevalence of local businesses and services are characterized at the level of zip codes using data from the 1992, 1997, 2002, and 2007 Economic Census Zip Code Statistics. The Economic Census is conducted by the US Census Bureau every five years on an establishment

basis, which means that a company operating at more than one location is required to file a separate report for each establishment. The establishment is assigned a separate industry classification based on its primary activity. Establishments were classified according to the Standard Industrial Classification (SIC) system before 1997 and according to the North American Industry Classification System (NAICS) in 1997 and later years. Because of this change, data from 1992 are not necessarily comparable with data from 1997 and after. This mostly affects higher level industry groupings, which I do not use. The industry groupings examined in this study include only those that are comparable over time.

The 1990, 2000, and 2010 Census TIGER/Line Shapefiles are used for spatial data on geographic boundaries for census blocks, census block groups, and zip codes. TIGER/Line Shapefiles are provided by the Census Bureau and are designed for use with geographic information system (GIS) software. Using GIS, census blocks and zip codes were overlaid on block group boundaries to determine which census blocks were contained within each block group, and which block groups were contained within each zip code.

Definitions of Residential Living Arrangements

The dependent variables measure whether the older adult moved to senior housing versus remained independent community-dwelling, as well as the type of senior housing for those who made a move. *Independent community-dwelling* is defined as living in a private home headed by the respondent or the respondent's spouse or permanent domestic partner in a community-based setting. *Senior housing* includes five types of housing identified in the PSID survey: retirement communities, senior citizens' housing complexes, nursing homes, homes for the aged, and adult

foster care facilities. To test whether results differ depending on the type of senior housing, I categorize housing types into two groups: housing that provides more personal care (nursing homes, homes for the aged, and adult foster care facilities), referred to collectively as *assisted-living facilities*, and housing that is age-segregated but provides limited or no care (retirement communities and senior citizens' housing complexes), referred to collectively as *retirement communities*. In the PSID sample of older adults, 2,251 individual respondents (or 98%) remained independent community-dwelling for one or more survey intervals (summing to a total of 12,977 person-intervals) (see Table 2.2). The category of those who remained independent community-dwelling includes some individuals who eventually made a move to senior housing. Of those who made a first move out of independent community-dwelling and into senior housing, 221 respondents (or 9.6% of the total sample) moved to a retirement community and 137 respondents (or 6% of the total sample) moved to an assisted-living facility.

The addition of a potential care provider to the home, such as a family member or a paid provider, will not be considered a transition out of independent living. Previous research has found that most coresidence of parents and children in parents' homes is motivated by children's economic instability and marital status, and not by parental health (Aquilino 1990; Hotz, McGarry, and Wiemers 2010). The availability of support from household members will be captured with a variable for number in the family unit, and the household's ability to pay for in-home care will be captured by income and savings. In addition, moves to a family member's home are not analyzed in this study because there are too few in the PSID to provide a large enough sample for analysis. In general, rates of moving in with relatives are quite low (only about 7% of older adults live in the home of an adult child) (Taylor et al. 2010).

Neighborhood-Level Predictors

The focal independent variables in this study are neighborhood-level predictors of moves to senior housing. Like many previous studies of neighborhood effects, I investigate the effects of population size, poverty, and racial/ethnic heterogeneity. I go beyond previous studies by also including neighborhood characteristics that may be particularly meaningful for older adults: urban/suburban/rural location, transportation and mobility options, affordable housing, age structure, region of the country, and access to local services of various types.

Urban category – measured as the urban, rural, or suburban location of the block group – is classified as whether the block group is inside a principal city of a metropolitan area (referred to as *urban*), inside a census-defined rural area[1] (referred to as *rural*), or outside of a metropolitan principal city but not in a rural area (referred to as *suburban*). There are many other ways of defining urban, suburban, and rural neighborhoods, but the chosen classification scheme has the benefit of being succinct, so that each category has a hearty sample of PSID respondents, while still reflecting the most important differences between types of neighborhoods.

Neighborhood transportation and mobility is captured with two variables. The first is the percent of neighborhood residents that take public transit to work. This captures the availability of alternative transportation options and the degree of automobile dominance in the neighborhood. The second is the mean area in square miles of blocks within the block group. Block boundaries are generally set by streets, and mean block area captures whether street segments are short or long, which influences the walkability and scale of the neighborhood. Data on public transit use were drawn from the 1990 and 2000 Decennial Census and the 2005-

[1] Census-defined rural areas encompass all territory outside of an urban area comprised of a densely settled core of census tracts and/or census blocks with at least 2,500 people. For more information see U.S. Census Bureau (2013): "2010 Census Urban and Rural Classification and Urban Area Criteria".

2009 ACS, and data for block area were drawn from the 1990, 2000, and 2010 Census TIGER files.

Residential stability and affordable housing is represented by the percent of housing units that are owner-occupied, median gross rent, median year built, and percent of units that lack complete kitchen facilities. All housing characteristics were drawn from the 1990 and 2000 Decennial Censuses and the 2005-2009 ACS.

Neighborhood services are tabulated for zip codes and include the total number of commercial/service establishments, and the number of six specific types of establishments/organizations: grocery stores, drug stores, health services, social services, residential services, and religious organizations. Data were drawn from the 1992, 1997, 2002, and 2007 Economic Census Zip Code Statistics, and all block groups within the same zip code have the same values. Grocery stores include supermarkets, other grocery stores, and convenience stores (NAICS 4451; SIC 5410) and drug stores include pharmacies and drug stores (NAICS 44611; SIC 5910). Health services (NAICS 621, 622, and 623; SIC 80) include offices of physicians and health practitioners, hospitals, and home health care services. Social service establishments include "Individual and Family Services" (NAICS 6241; SIC 832) and "Social Services" (NAICS 6242; SIC 8390) and examples include disability support groups, non-medical home care for the elderly, senior citizens activity centers, adult community centers, meal delivery programs, and senior citizens advocacy organizations. Residential services (NAICS 623; SIC 8050 and 8360) include assisted-living facilities and other residential care facilities. Finally, religious organizations (NAICS 81311; SIC 8661) include, for example, churches, temples, mosques, and other places of worship.

Additional neighborhood variables include block group population size, poverty rate, racial/ethnic distributions (percent non-Hispanic white, percent non-Hispanic black, percent Hispanic of any race, and percent other racial/ethnic group), percent of the population that is 65 and older, and region of the country, using data from the 1990 and 2000 Decennial Census and the 2005-2009 ACS.

Means and standard deviations for the neighborhood predictors are reported in Table 2.3, separately by residential outcomes among older adults. A few key neighborhood differences between older adults who remained independent community-dwelling and movers to senior housing can be identified. First, the descriptive findings reveal that persons who remained independent community-dwelling were less likely to have lived in suburban areas in the previous survey interval (32%) compared to persons who moved to retirement communities or assisted-living facilities (both about 41%). Furthermore, persons who remained independent community-dwelling were more likely to have lived in rural areas (46%) compared to movers to retirement communities (35%).

Second, persons who remained independent community dwelling lived in neighborhoods with greater proportions of homes that were single-family (68%), compared to movers to retirement communities (60%). On the one hand, it may seem counterintuitive that residents of neighborhoods that consist primarily of single-family homes would be most likely to stay, because these neighborhoods lack smaller apartments or condominiums - types of housing that appeal to many older adults. On the other hand, high rates of single-family dwellings are positive indicators of residential stability.

Compared to those who remained independent community-dwelling, movers to retirement communities started out in neighborhoods with a greater proportion of older adults.

On average, 15% of the population were older adults in neighborhoods of those who remained independent, compared to 17% in neighborhoods of those who moved to retirement communities.

Finally, those who remained independent community-dwelling may also have access to a greater number of resources that help them maintain independence, compared to movers to retirement communities. On average they have access to more grocery stores (2.2 per 100 total establishments), drug stores (0.81 per 100 total establishments), and churches (2.9 per 100 total establishments) in their zip code.

Individual-Level and Household-Level Covariates

Models are estimated net of individual and household predictors drawn from the 1990 to 2009 PSID. Individual predictors include age, sex, marital status (permanent cohabitors are counted as spouses), race/ethnicity, years of schooling, employment status (currently employed, retired, or other[2]), number of children (ever born to the respondent), whether the individual's health status is fair or poor[3], and distance (in miles) to the respondents' closest child and closest other relative (among those not currently residing with the respondent). Household predictors include annual total family income from all sources in 2000 inflation-adjusted dollars[4], total family savings in 2000 inflation-adjusted dollars[5], number of people currently residing in the family unit, whether someone in the family owns the home, whether the residence is a single-

[2] "Other" employment status includes those who identified themselves as homemakers, unemployed, or unable to work because they are disabled.
[3] Health status is reported by the household head for all household members.
[4] Total family income includes total money income for all family members from taxable income, transfer income, and social security income.
[5] Total family savings includes total money for all family members in checking or savings accounts, money market funds, certificates of deposit, government bonds, Treasury bills, private annuities, and IRAs.

family home, and number of years (over the previous ten years) the family has lived in the same dwelling. I also include a variable for length of the survey interval, to account for the PSID's shift from annual to biennial interviews after 1997. Missing values for individual and household predictors were imputed with multiple imputation using chained equations (White, Royston, and Wood 2011).[6]

Means and standard deviations for individual-level and household-level variables by residential outcomes are reported in Table 2.4. On average, individuals who remained independent community-dwelling were 75 years old, whereas those who moved to retirement communities were older (77 years) and those who moved to assisted-living were older yet (83 years). Those who remained independent community-dwelling were more evenly split between male and female (58% female), whereas the percent female was 66% of those who moved to retirement communities and 73% of those who moved to assisted-living. Individuals who remained independent community-dwelling or moved to retirement communities seem to be more advantaged than those who moved to assisted-living in terms of education, family income, and savings. For instance, those who remained independent community-dwelling had family income of about $43,000 per year, whereas those who moved to retirement communities had about $35,000 and those who moved to assisted-living had about $20,000. Compared to individuals who remained independent community-dwelling, movers to retirement communities and assisted-living seem to have less social support. Movers to senior housing were less likely to be married and more likely to be divorced or widowed. On average, they also had fewer children and lived with fewer people in the family unit. Movers to senior housing may be less entrenched

[6] Variables with imputed values include race/ethnicity, years of education, employment status, number of children, type of housing unit, homeownership, health status, and distance to children and other relatives. Following White, Royston, and Wood (2011), all covariates and outcomes from the analysis model are included in the imputation model.

in their neighborhood, because they have lower rates of owning their home, are less likely to live in single-family homes, and have lived an average of fewer years in the neighborhood. Finally, movers to assisted-living were more likely to report fair or poor health (63%), compared to movers to retirement communities and those who remained independent community-dwelling (31%).

Analytical Strategy

The general analytical estimation approach uses a discrete-time logit model predicting moves out of independent community-dwelling and into senior housing. The predictor variables include time-varying covariates at the individual and neighborhood levels. Only covariates that do not change, including sex, race/ethnicity, and number of children are effectively time-fixed covariates. Consistent with standard practice in longitudinal analysis, time-varying independent variables are lagged by one survey interval on the assumption that changes in covariates in the previous interval may affect the probability of the event occurring in the current interval. Once individuals experience the event (i.e., move to senior housing), they are no longer considered at risk of experiencing a first move to senior housing and are no longer included in the sample.

There are two sources of non-independence of observations: the data contain multiple observations of the same individuals over time, and may contain multiple observations for two individuals (i.e. a head and a wife) who live in the same household. To adjust for the non-independence of observations, all regression models report robust standard errors, which utilize a Huber-White covariance adjustment. Robust standard errors were chosen over multilevel models as the means to deal with non-independence of observations because the substantive interests of

this study do not lie in explaining variation in residential outcomes among the same individual over time, or among individuals in the same household. Instead, I treat non-independence as statistical noise that is removed from the results with robust standard errors.

This study views moves among older adults as a two-step process that first involves the decision to move away from independent community-dwelling and second involves the choice of a senior housing destination. In Chapters 3 and 4, I estimate two models: a first stage model predicting moves to senior housing, and a second stage model predicting the choice of destination among those older adults who moved to senior housing. The second stage model includes a Heckman correction (the inverse Mills ratio, also called the hazard function) (Heckman 1976; Berk 1983) for the selection of individuals into the mover category, generated by the model in the first stage of analysis. Three variables – whether the respondent owns their home, whether it is a single-family dwelling, and how many years (over the last decade) they have lived in the same dwelling – are included in the first-stage regression equation as "exclusion restrictions" (Bushway, Johnson, and Slocum 2007). These three variables affect the selection process (moving to senior housing versus remaining independent community-dwelling), but they do not affect the choice of a senior housing destination (and are therefore omitted from the second-stage regression equation). Implementing these exclusion restrictions reduces problems with collinearity and model identification introduced by the Heckman's correction factor in the second-stage model.

The data and methods described in this chapter are used to investigate various neighborhood effects on residential living arrangements among older adults. I turn now to the empirical analyses of these data. Chapter 3 begins with a look at how urban/suburban/rural

location and urban sprawl contribute to the likelihood of continuing to live independently in one's own home versus moving to age-segregated senior housing.

TABLES

Table 2.1: Study Variables and Data Sources

Indicator	Variable(s)	Data Source(s)
Residential Outcomes	Remained independent community-dwelling Moved to senior housing	Panel Study of Income Dynamics, 1990-2009
Individual-Level and Household-Level Characteristics	Age Sex Race/ethnicity Education Income Savings Employment Marital Status Number of children Number in family unit Homeownership Single-family home Years in residence over last 10 years Fair/poor health Distance to kin	Panel Study of Income Dynamics, 1990-2009
Block group urban category	Urban, suburban, rural	Decennial Census 1990, 2000; ACS 2005-2009
Transportation/ mobility in block group	% take public transit Mean block area	Decennial Census 1990, 2000; ACS 2005-2009 Census TIGER Shapefiles, 1990, 2000, 2010
Residential stability and affordable housing in block group	% owner-occupied % single-family homes Median rent Median year built % lacking complete kitchens	Decennial Census 1990, 2000; ACS 2005-2009
Age structure in block group	% age 65 and over	Decennial Census 1990, 2000; ACS 2005-2009
Population size in block group	Total population	Decennial Census, 1990, 2000, ACS 2005-2009
Poverty	% poor	Decennial Census 1990, 2000; ACS 2005-2009
Racial/ethnic heterogeneity in block group	% non-Hispanic white % non-Hispanic black % Hispanic (any race) % other	Decennial Census 1990, 2000; ACS 2005-2009
Region	Northeast, Midwest, South, West	Decennial Census 1990, 2000; ACS 2005-2009
Services in zip code	# commercial/service establishments (estb.) # grocery stores / 100 estb. # drug stores / 100 estb. # health services / 100 estb. # residential services / 100 estb. # social services / 100 estb. # religious organizations / 100 estb.	Economic Census Zip Code Statistics, 1992, 1997, 2002, 2007

Table 2.2: Sample of PSID Older Adults by Residential Outcomes

	Remained Independent Community-Dwelling	Moved to a Retirement Community	Moved to an Assisted-Living Facility	Total
N (%) of respondents	2,251 (97.95%)	221 (9.62%)	137 (5.96%)	2,298 (100%)
N (%) of person-intervals	12,977 (97.32%)	221 (1.66%)	137 (1.03%)	13,335 (100%)

Note: The number of respondents who remained independent community-dwelling, moved to a retirement community, and moved to senior housing do not sum to the overall total (2,298) because respondents can be represented in more than one category (i.e. they could have remained independent community-dwelling for one or more survey intervals, and moved to a retirement community in another survey interval).

Table 2.3: Means and Standard Deviations of Block Group Characteristics by Residential Outcome [a]

		Remained Independent Community-Dwelling		Moved to a Retirement Community			Moved to an Assisted-Living Facility		
		Mean / %	SD	Mean / %		SD	Mean / %		SD
Urban category	Urban	21.16 %	--	24.10 %		--	16.48 %		--
	Suburban	32.45 %	--	41.25 %	**	--	40.96 %	*	--
	Rural	46.40 %	--	34.65 %	***	--	42.57 %		--
Transportation /mobility	% take public transit	3.22	8.48	4.27	*	11.31	2.06		3.69
	Mean block area	0.11	0.24	0.09		0.21	0.11		0.18
Residential stability and affordable housing	% owner-occupied	71.22	20.22	69.53		22.34	67.42		22.58
	% single-family homes	67.86	26.27	59.43	***	29.89	62.10		25.94
	Median rent	634.83	289.95	654.29		281.06	594.97		259.89
	Median year built	1962.39	37.11	1965.66		15.60	1963.30		15.49
	% lacking complete kitchens	1.11	2.01	0.93		1.93	1.25		1.78
Age structure	% age 65 and over	15.06	7.86	17.13	***	12.76	14.42		7.00
Services in zip code	# commercial/service establishments (estb.)	575.83	485.19	705.67	***	536.19	627.50		568.67
	# grocery stores /100 estb.	2.20	1.88	1.81	**	1.60	1.90		1.49
	# drug stores /100 estb.	0.81	0.56	0.70	**	0.50	0.76		0.54
	# health services /100 estb.	6.74	4.15	7.06		5.21	6.82		4.68
	# residential services /100 estb.	1.03	0.89	1.04		0.81	1.17		1.17
	# social services /100 estb.	0.95	1.06	0.88		0.98	1.01		1.23
	# religious organizations /100 estb.	2.90	2.10	2.54	*	2.17	2.91		2.09
Population size	Total population	1538.62	1177.16	1919.43	***	1508.30	1704.75		1893.08
Poverty	% poor	11.76	10.88	11.25		10.88	12.88		12.18
Racial/ethnic heterogeneity	% non-Hispanic white	80.50	25.49	80.55		24.57	82.01		22.37
	% non-Hispanic black	9.21	21.09	7.67	*	18.77	8.09		19.56
	% Hispanic (any race)	6.04	13.66	6.61		12.31	5.76		11.19
	% other	1.89	2.81	2.20		3.16	1.83		2.09

[a] Table reports results of two-tail tests that means for those who remained independent community-dwelling are different than means for those who moved to retirement communities or assisted-living facilities. Significance levels for the two-tail test are: * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2.3 (continued) [a]

		Remained Independent Community-Dwelling		Moved to a Retirement Community		Moved to an Assisted-Living Facility	
		Mean / %	SD	Mean / %	SD	Mean / %	SD
Region	Northeast	21.96%	--	19.64%	--	19.99%	--
	Midwest	28.45%	--	29.50%	--	37.18%	--
	South	31.50%	--	26.93% **	--	31.13%	--
	West	18.08%	--	23.93% **	--	11.69%	--
N of respondents		2,251		221			
N of person-intervals		12,977		221			

[a] Table reports results of two-tail tests that means for those who remained independent community-dwelling are different than means for those who moved to retirement communities or assisted-living facilities. Significance levels for the two-tail test are: * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2.4: Means and Standard Deviations of Individual and Household Characteristics for Older Adults by Residential Outcome [a]

	Remained independent community-dwelling		Moved to a retirement community		Moved to an assisted-living facility	
	Mean / %	SD	Mean / %	SD	Mean / %	SD
Age	74.48	6.75	77.24 ***	7.38	83.20 ***	7.91
Female	58.03 %	--	65.49 %	--	72.74 % **	--
Race/Ethnicity						
White, non-Hispanic	87.30 %	--	90.12 % *	--	85.43 %	--
Black, non-Hispanic	8.02 %	--	5.20 % *	--	7.13 %	--
Hispanic, any race	1.97 %	--	3.37 %	--	2.55 %	--
Other	2.67 %	--	1.30 %	--	4.89 %	--
Years of schooling	11.86	3.22	12.29	2.86	10.75 ***	3.06
Family income (in 2000 inflation-adjusted dollars)	43,013.03	58,769.43	35,025.10	32,682.02	20,443.69 ***	23,270.35
Savings (in 2000 inflation-adjusted dollars) [b]	74,894.86	251,101.40	77,231.71	206,703.70	54,939.95 *	164,567.50
Employment status						
Retired	66.98 %	--	75.32 %	--	68.28 %	--
Working	13.55 %	--	8.38 %	--	3.72 % **	--
Other	19.46 %	--	16.30 %	--	27.95 % *	--
Marital status						
Married	47.32 %	--	33.89 % **	--	13.55 % ***	--
Widowed	43.82 %	--	51.29 % *	--	69.36 % ***	--
Divorced	6.22 %	--	11.35 % *	--	9.36 %	--
Never married	2.64 %	--	3.47 %	--	7.72 %	--
Number of children	3.04	2.21	2.92	2.19	2.62 *	2.19
Number in family unit	1.85	0.76	1.60 ***	0.56	1.35 ***	0.65
Own home	87.85 %	--	71.27 % ***	--	64.05 % ***	--
Single-family home	80.20 %	--	60.69 % ***	--	65.96 % ***	--

[a] Table reports results of two-tail tests that means for those who remained independent community-dwelling are different than means for those who moved to retirement communities or assisted-living facilities. Significance levels for the two-tail test are: * $p < .05$, ** $p < .01$, *** $p < .001$.

[b] Mean values for savings are estimated after removing one outlying respondent, who had savings greater than $10,000,000. All respondents, including the outlier, are included in other descriptive statistics and subsequent analyses.

Table 2.4 (continued) [a]

	Remained independent community-dwelling		Moved to a retirement community		Moved to an assisted-living facility	
	Mean / %	SD	Mean / %	SD	Mean / %	SD
Years in residence over last 10 years	8.34	3.12	6.53 ***	4.12	7.52 ***	3.87
Fair/poor health	30.86 %	--	27.98 %	--	62.74 % ***	--
Distance to closest child (miles)	2.89	2.23	3.57 ***	2.20	3.46 **	2.05
Distance to closest other relative (miles)	1.95	3.34	2.54 ***	2.87	2.55 *	3.14
N of respondents	2,251		221		137	
N of person-intervals	12,977		221		137	

[a] Table reports results of two-tail tests that means for those who remained independent community-dwelling are different than means for those who moved to retirement communities or assisted-living facilities. Significance levels for the two-tail test are: * $p < .05$, ** $p < .01$, *** $p < .001$.

CHAPTER 3

Stranded in the Suburbs? Suburbanization, Sprawl, and Residential Independence among Older Adults

Introduction

A single-family home set on a large lot in the suburbs is a ubiquitous symbol of the "American Dream". This dream became relatively easy to achieve for every white, middle-class citizen beginning in the 1950s, as a result of a housing construction boom combined with increased accessibility of mortgage credit (Jackson 1985). From 1940 to 2000, the U.S. underwent a suburban housing craze that funneled millions away from central cities and into the suburbs (Hobbs and Stoops 2002). Only recently have the benefits of suburban living been called into question. Architects and urban planners have been a major source of criticism of the traditional suburban style of development, especially planners associated with the "New Urbanism" movement (Duany, Plater-Zyberk, and Speck 2000). The suburban critique has reached other substantive areas as well, including public health (Frumkin 2002) and sociology (Putnam 2000; Squires 2002). Living in low-density suburbs that are automobile-dominated and lack sidewalks and nearby stores, schools, and workplaces has been linked to deleterious outcomes including obesity (Frank 2000; Berrigan and Troiano 2002; Frumkin 2002; Vandegrift and Yoked 2004), stress-related health problems (Koslowsky, Kluger, and Reich 1995), social isolation and civic decline (Putnam 2000), and economic and racial segregation (Haar 1998; Squires and Kubrin 2005).

Suburbs that were once composed predominately of young families have been rapidly aging. The 65-and-over population grew by 20 percent in suburbs from 1990 to 2000 and again

from 2000 to 2010, but by less than 5 percent in central cities in each decade (Frey 2003; Frey 2001). To date, there is little quantitative research on the effects of suburban location on older adults, although there is plenty of speculation. Dunay and Platzer-Zyberk, two founding members of the "New Urbanism" perspective, have argued that older adults who settle in the suburbs often "have no choice but to *re*-retire into homes for the elderly," because their social and physical needs are out of reach (2000:123). Duany and Platzer-Zyberk go so far as to characterize the suburban elderly with contentious words like "stranded" and "victims" (2000:115). Similarly, public-health scholar Howard Frumkin has stated that suburban neighborhoods "offer few options for older adults once their children have grown up", thereby contributing to an inability to remain in a single neighborhood through the life cycle (2002:117).

Suburbs are perceived as less hospitable locations for older adults compared to urban and rural locations because they sometimes lack physical resources, lower-maintenance housing options, and social support (Laws 1993; Duany et al. 2000; Frumkin 2002), but there is little empirical evidence to support (or reject) this claim. One study found that non-metropolitan older adults were more likely to be living independently than metropolitan older adults (McLaughlin and Jensen 1998), but further research that goes beyond metropolitan and non-metropolitan distinctions is necessary. In addition, suburban critiques may understate challenges faced by non-suburban residents. High housing costs can be a barrier to living independently for older adults in central cities, and older adults often comprise a significant proportion of the population displaced by inner-city gentrification (Laws 1993). Rural older adults tend to be disadvantaged in terms of health, economic status, and access to services (Krout and Coward 1998), all of which may hasten moves to senior housing. Thus, an empirical question remains – are suburbanites more likely than urban or rural residents to lose residential independence as they age?

To answer this question we might look to the neighborhood effects literature, which has established a robust, yet not fully understood, link between neighborhood context and a number of individual life outcomes (for a comprehensive review of the neighborhood effects literature, see van Ham et al. 2012). Most studies of neighborhood effects have focused on the general population, children and adolescents, or working-age adults, whereas relatively few have focused specifically on older adults. However, neighborhoods may matter more for older adults compared to younger adults, because older adults tend to be more tied to the neighborhood.

To demonstrate a "neighborhood effect" of living in the suburbs, individual-level determinants of residential transitions need to be ruled out. An individual-level interpretation would say that any effect of living in the suburbs is not an effect of location at all, but rather, is due to the fact that suburban residents are somehow different from urban and rural residents. In this chapter, I use approximately twenty years of longitudinal data from the Panel Study of Income Dynamics to test whether older adults in suburban neighborhoods are more likely to move out of independent community-dwelling and into senior housing, net of individual characteristics like age, family composition, socioeconomic status, housing characteristics, and health. In addition, I investigate which characteristics of suburban neighborhoods have the greatest influence on the likelihood of making a residential transition, with particular focus on qualities associated with suburban sprawl – automobile dominance, lack of affordable housing options, and lack of services.

Residential Transitions from an Individual Perspective

Residential relocation is an important life-course event for older adults, and is a recurring decision-making process (Litwak and Longino 1987; Bean et al. 1994). From a policy perspective, there is interest in the distinction between aging in a community setting and relocation to senior housing, defined as age-segregated housing in retirement communities and assisted-living facilities targeted to individuals aged 65 and older. In 2009, 1.5 million Americans (or 4.1% of the population 65 years and older) lived in institutional settings such as a nursing home (US Administration on Aging 2011). This percentage increases dramatically with age, ranging from 1.1 percent for persons 65 to 74 years, to 3.5 percent for persons 75 to 84 years, and 13.2 percent for persons age 85 and older (US Administration on Aging 2011). Another 2.4 percent lived in senior housing with at least one supportive service available to residents (US Administration on Aging 2011). There are no reliable estimates of the number of Americans who live in other types of senior housing, such as retirement communities and senior citizen housing complexes that provide limited or no care, because these housing types are extremely varied and unlike nursing homes, adult family homes, and assisted-living facilities, they do not require a state license.

Previous studies of the determinants of relocation to senior housing have almost exclusively focused on individual and household predictors. This body of research has identified a host of individual characteristics that influence moves to senior housing, including age, race, income, education, homeownership, and most importantly, family composition, widowhood, and health (Silverstein and Zablotsky 1996; VanderHart 1998; Ermisch and Jenkins 1999; Robison

and Moen 2000; Longino, Perzynski, and Stoller 2002; Akamigbo and Wolinsky 2007; Sabia 2008; Wilmoth 2010).

Only two recent studies have incorporated ecological variables into models predicting moves to senior housing. Using data from the Health and Retirement Study, Sergeant, Ekerdt, and Chapin (2010) did not find significant effects of neighborhood characteristics on moves to a nursing home. Only individual level-predictors – older age and an overnight stay in a health facility – were statistically significant predictors of moves to a nursing home. However, the authors' neighborhood measures were limited to the respondent's perception of neighborhood safety and the physical condition of the respondent's home, and did not include measures of community-based services and resources. Using data from the Panel Study of Income Dynamics, Sabia (2008) found that homeowners in smaller cities and sparsely populated regions and those who knew more of their neighbors were less likely to move, whether to senior housing or another neighborhood (Sabia 2008). In addition to focusing only on homeowners, the study was limited because the neighborhood variables were measured as time-constant covariates even though it would have been more appropriate to measure them as time-varying characteristics. Unfortunately, most of the neighborhood variables were measured in the 1972 or 1975 wave of the PSID, well before many of the respondents made a residential move (Sabia 2008). Consequentially, the neighborhood characteristics included by Sabia (2008) may not have accurately measured the conditions of the area of current residence. Therefore, it remains unclear whether and to what extent prior neighborhood context influences moves to senior housing.

Neighborhood Hypotheses

Critics of the suburban-style of development have speculated that suburban older adults have more difficulty living independently as they age (Duany et al. 2000; Frumkin 2002). There is limited empirical evidence to support this claim, but it would be consistent with empirical research finding negative effects of suburban location on other aspects of health and well-being (Koslowsky et al. 1995; Frank 2000; Berrigan and Troiano 2002; Vandegrift and Yoked 2004). A negative effect of suburban location is only supported if it persists above and beyond individual and household characteristics, as expressed in the first hypothesis:

H1: Suburban older adults are more likely to move to senior housing versus remaining independent community-dwelling compared to urban and rural older adults, net of individual age, family composition, socioeconomic status, housing characteristics, and health.

The main reason suburbs have been characterized as inhospitable locations for older adults is because they sometimes exhibit qualities of sprawl – a pattern of urban development that is exemplified by low density, separated land uses, and automobile dominance (Ewing, Pendall, and Chen 2002; Gillham 2002). Sprawled neighborhoods are polar opposites of the neighborhoods described by Jane Jacobs in her seminal work *The Death and Life of Great American Cities.* Jacobs (1961) observed that neighborhoods with mixed land use, short blocks, and high population density were lively, well-used, and walkable. Such neighborhoods are thought to be well-designed for older adults (Ivery, Akstein-Kahan, and Murphy 2010; Lehning, Scharlach, and Wolf 2012). In many US cities, a disproportionate number of better-off older

adults have moved to such neighborhoods in order to realize the benefits of retiring in a mixed-use, pedestrian-friendly environment (Masotti et al. 2006), highlighting a potential social inequality – the ability to live independently at an older age may be an exclusive privilege of the urban upper class.

Sprawled environments can be especially difficult environments to navigate for older adults who do not drive. It has been argued that urban older adults do not face the same mobility challenges, because housing and shopping are more likely to be in close pedestrian proximity and public transportation is more available, and older adults do not have to rely on driving to reach their needs (Duany et al. 2000). Indeed, Sergeant, Ekerdt, and Chapin (2010) found that having no driver in the household increased the odds of older adults moving from the neighborhood to another community-based dwelling. Besides connecting neighborhood residents to the resources they need, walkable neighborhoods promote regular physical activity and have positive externalities for health (Frank et al. 2001).

Resources such as shops, grocery stores, pharmacies, and community centers are also lacking in sprawled neighborhoods. According to statistics I will present later in the chapter, this point still remains true despite the fact that many businesses have suburbanized and some sprawling communities have built shopping centers that provide access to varied services. Having access to few of these commercial and social resources, or having them be of low quality, may adversely affect older adults. A multitude of these resources in and around the neighborhood puts older adults' basic necessities like groceries and prescriptions in closer reach, while also providing local destinations for older adults' to patronize. In fact, having local destinations like shops and restaurants protected older adults from mortality during the 1996 Chicago heat wave (Klinenberg2002; Browning et al. 2006), further supporting Jane Jacobs's

(1961) theory that commercial activity and mixed land use provide benefits for neighborhood residents.

Finally, sprawled suburban neighborhoods are often composed of a single housing type and tenure and do not provide the flexibility to change residences as older adults age and housing needs change. It is for this reason that Stephen Golant has argued there is too much exuberance from policy makers and practitioners for *aging-in-place* (aging in the same home). According to Golant (2008), a generic aging-in-place strategy does not serve the entire population of older adults, especially low-income homeowners who are more likely to occupy dwellings that are overly costly, in poor condition, and do not suit their needs. Golant (2008) argued that many low-income homeowners would have a better quality of life if they relocated to more appropriate housing that is smaller and easier to manage and that provides care when needed. Due to limited housing alternatives, older adults in neighborhoods with a preponderance of single-family homes, a lack of rental housing, and a lack of affordable housing in good condition may be less likely to remain living independently.

Neighborhood transportation, services, and affordable housing options are related phenomena that reinforce each other. For instance, neighborhoods with many commercial establishments tend also to be lively and walkable, creating ample opportunities for social gathering and interactions. Lively neighborhoods promote safety and interpersonal contact, and give people a sense of connection to their neighbors (Jacobs 1961). Of course, neighborhoods that have all the best physical and social features are likely to be highly-valued, expensive locations that are only accessible to the wealthiest subset of older adults. Furthermore, neighborhood transportation, services, and affordable housing may be influenced by a similar set of structural variables, including neighborhood population size, poverty rates, age structure, and

region of the country. These same structural variables may also independently influence the duration of independent community-dwelling. For instance, poor neighborhoods may not only lack public transportation or grocery stores, they may also have high crime rates – motivating older adults to leave the neighborhood for senior housing. And region may influence access to public policies and social systems that affect mobility options and services for older adults. Therefore, these structural characteristics are important control variables. The proposed effects of neighborhood characteristics associated with suburban sprawl on moves to senior housing are expressed in the second hypothesis:

H2: Older adults are more likely to move to senior housing versus remaining independent community-dwelling when they live in neighborhoods that lack transportation and mobility options, affordable housing options, and services, net of neighborhood population size, poverty rate, age structure, and region of the country, as well as individual age, family composition, socioeconomic status, housing characteristics, and health.

In addition, if suburban neighborhoods are less hospitable locations for older adults due to their sprawled development style, then the characteristics of sprawl should account for the relationship between suburban location and an increased likelihood of moving to senior housing, as expressed in the third hypothesis. The third hypothesis provides a test of the extent to which neighborhood characteristics like transportation/mobility, affordable housing, and services are associated with both suburban location and the likelihood of moving to senior housing.

H3: Suburban older adults' increased likelihood of moving to senior housing compared to urban and rural residents is explained by a lack of transportation and mobility options, affordable housing options, and services, net of neighborhood population size, poverty rate, age structure, and region of the country, as well as individual age, family composition, socioeconomic status, housing characteristics, and health.

Data, Variables, and Measurement

I test the hypotheses in multivariate logistic regression models predicting moves to senior housing among older adults. Data on individual and household characteristics were drawn from the Panel Study of Income Dynamics (PSID) for the survey years 1990 to 2009, and combined with neighborhood data from multiple sources. For this study, I utilized the full sample of PSID respondents age 65 and older and designated as a household head or wife during any survey year between 1990 and 2009. The sample consists of 2,298 unique respondents, who contribute a combined total of 13,335 person-intervals for analysis.

The dependent variable is a move out of an independent, community-based dwelling and into senior housing. The reference group, those who remained independent community-dwelling, includes movers between independent community-dwellings and non-movers. About 3.4% of those who remained independent community-dwelling moved in the previous survey interval.

To test whether results differ depending on the type of senior housing, I also estimate a second model predicting destination choice among movers to senior housing, where destinations are categorized into two groups: housing that provides more personal care (nursing homes, homes for the aged, and adult foster care facilities), referred to collectively as *assisted-living*

facilities, and housing that is age-segregated but provides limited or no care (retirement communities and senior citizens' housing complexes), referred to collectively as *retirement communities*. Of the 2,298 respondents who started off in independent community-dwellings, 221 moved to a retirement community and 137 moved to an assisted-living facility during the nineteen-year observation period.[7] Moves to retirement communities were at one point primarily characterized as amenity-driven moves (Walters 2000), but today the lines between amenity-oriented communities and assistance-oriented communities have become blurred as retirement communities have increasingly added supportive services to their packages. Even though the distinctions between senior housing categories are blurred, I expect individual characteristics like family composition, marital status, and health to differentiate movers to assisted-living facilities versus movers to retirement communities. However, I do not distinguish between assisted-living facilities and retirement communities in my original hypotheses because there is no evidence to suggest a priori that neighborhood predictors differ between these two types of senior housing.

The focal independent variable is measured as the urban, rural, or suburban location of the block group (definitions of each are provided on page 25).[8] A lack of transportation and mobility options, affordable housing options, and services in the neighborhood are used to represent suburban sprawl. Transportation and mobility is captured with two variables. The first is the percent of block group residents that take public transit to work. This captures the availability of alternative transportation options and the degree of automobile dominance in the

[7] In addition, 287 individuals died before ever moving to senior housing. To test the implications of this right-censoring of the dependent variable, I estimated multinomial logistic regression models predicting moves to retirement communities, moves to assisted-living facilities, or mortality versus remaining independent community-dwelling. When including the additional category for mortality, results for retirement communities and assisted-living facilities do not differ from the results of a models that do not include mortality as an outcome.

[8] I present results in Table A.1 in Appendix A comparing six alternative definitions of urban, suburban, and rural block groups in order to test the sensitivity of the results to the chosen definition. In each model, the reference category has been set as the most urban category for the purposes of comparison. Results are very similar when comparing the alternate models to the chosen model.

neighborhood. The second is the mean area in square miles of blocks within the block group. Block boundaries are generally set by streets, and mean block area captures whether street segments are short or long, which influences the walkability and scale of the neighborhood. Characteristics of the housing stock include percent owner-occupied units, median gross rent (in 2000 inflation-adjusted dollars), median year built, and percent of units that lack complete kitchen facilities in the block group. Neighborhood services are tabulated for zip codes and include the total number of commercial/service establishments, and the number of six specific types of establishments: grocery stores, drug stores, health services, social services, religious organizations, and residential services (definitions and SIC/NAICS codes for each are provided on page 26). Including residential services addresses the possibility that the local supply of assisted-living facilities influences mobility choices among older adults. The local supply of retirement communities is not measured, because retirement communities and senior citizens' housing complexes are not tabulated in the Economic Census Zip Code Statistics.

Additional neighborhood variables include block group population size, poverty rate, racial/ethnic distributions (percent non-Hispanic white, percent non-Hispanic black, percent Hispanic of any race, and percent other racial/ethnic group), percent of the population that is 65 and older, and region of the country.

Models are estimated net of several individual and household predictors drawn from the PSID. Individual predictors include age, sex, race/ethnicity, years of schooling, employment status (currently employed, retired, or other), marital status, number of children, and whether the individual's health status is fair or poor, compared to excellent or good. Household predictors include annual total family income from all sources, number of people currently residing in the family unit, whether someone in the family owns the home, whether the residence is a single-

family dwelling, and the number of years (over the previous ten years) the family has lived in the same dwelling. I also include a variable for length of the survey interval, to account for the PSID's shift from annual to biennial interviews after 1997. Missing values for individual and household predictors were imputed with multiple imputation (additional details of the imputation model and more detailed descriptions of the variables are provided on pages 25 to 30).

Results

Differences in Residential Outcomes and Neighborhood Characteristics by Urban Category

Figure 3.1 displays the percent of residents that moved to senior housing, retirement communities, and assisted-living facilities separately by urban category. The results indicate that a greater percentage of suburban residents moved to senior housing compared to urban and rural residents. Almost 3.5% of suburban residents moved to senior housing, versus 2.6% of urban residents and 2.2% of rural residents. Furthermore, the difference between the percent of suburban and rural residents that moved to senior housing is statistically significant ($p < 0.05$). This difference primarily arises from differential rates of moving to retirement communities. Nearly 2.2% of suburban residents, but only 1.2% of rural residents, moved to retirement communities (this difference is statistically significant at $p < 0.05$).

One possible explanation for the elevated rates of moving to senior housing among suburbanites is that suburban neighborhoods differ from urban and rural neighborhoods in ways that make living independently more challenging. Several key differences between urban, suburban, and rural neighborhoods are reported in Table 3.1. Not surprisingly, public

transportation is most available in urban block groups, where the average block is also smaller in area. Urban block groups had the lowest rates of homeownership (57%) compared to suburban (74%) and rural (76%) block groups, and also had a lower share of units that were single-family and an older housing stock. Median rent was highest in suburban block groups ($765/month) compared to urban block groups ($660/month) and rural block groups ($530/month), possibly reflecting the lower availability of rental housing in suburbs compared to urban areas. In sheer numbers, urban block groups had the most commercial and service establishments within their zip code, including the most of each specific type of establishment, whereas rural block groups had the least. But as a share of the total number of establishments, suburban zip codes tend to have fewer grocery stores (1.6 grocery stores for every 100 total establishments) than either urban or rural block groups. They also had fewer drug stores (0.73 per 100 establishments), health services (7.93 per 100 establishments), social services (0.72 per 100 establishments), religious organizations (2.07 per 100 establishments), and residential services (0.94 per 100 establishments).

At least some of the differences in transportation, housing, and services across urban, suburban, and rural block groups may be due to differences in population size, poverty, racial/ethnic heterogeneity, age structure, and region. For instance, suburban block groups had a lower poverty rate (8.0%) than either urban (17%) or rural (12%) block groups. Urban block groups had the greatest racial/ethnic diversity in terms of the greater percentage of residents that were non-white. Urban block groups also had the smallest share of the population that was 65 and older, whereas the percentage of older adults was similar in suburban and rural areas.

The results provide mixed support for the argument that suburban older adults are more likely to move to senior housing than urban and rural residents, and that characteristics of

suburban neighborhoods associated with suburban sprawl contribute to this difference. But does the relationship between moving to senior housing and urban, suburban, and rural location still hold after adjusting for additional individual and household characteristics? The next section presents results that address this question.

Individual Determinants of Moving to Senior Housing

Table 3.2, Model 1 presents coefficients from a logistic regression model predicting moves to senior housing with block group urban categories and individual/household control variables. In support of the first hypothesis (H1), block group urban category is a significant predictor of independent community-dwelling despite adjusting for a host of individual and household characteristics. The biggest differences in the odds of moving to senior housing are between suburban and rural residents. The odds of moving to senior housing versus remaining independent community-dwelling are almost 40 percent lower ($e^{-0.487} = 0.614$; $p < 0.01$) for rural residents compared to suburban residents, but the difference between suburban and urban residents is not statistically significant ($e^{-0.313} = 0.731$; $p > 0.05$).

Effects of the individual and household variables are consistent with previous research (Silverstein and Zablotsky 1996; Wilmoth 2010). The odds of moving to senior housing increase with age, such that each additional year older increases the odds of moving to senior housing by 7 percent ($e^{0.072} = 1.07$; $p < 0.001$). The odds of moving to senior housing also increase for households with lower incomes, fewer people living in the family unit, people who do not own their home, and people who do not live in a single-family dwelling. Furthermore, being in fair or poor health increases the odds of moving to senior housing; the odds of moving are 40 percent

higher ($e^{0.333} = 1.40$; $p < 0.05$) for individuals in fair or poor health versus good or excellent health.

More than adjusting for the differential selection into senior housing, the individual and household variables are also adjusting for differential selection into urban, suburban, and rural neighborhoods. Age, sex, race/ethnicity, marital status, family composition, education, employment status, homeownership and housing characteristics are all predictive of whether an individual resides in an urban, suburban, or rural block group (see results presented in Table A.2 in Appendix A). By including these characteristics as control variables, we can be more confident that differences in the odds of moving to senior housing across urban categories are not simply an outcome of differential selection processes into urban, suburban, or rural neighborhoods. Of course, this strategy does not perfectly substitute for a formal modeling of selection into different types of neighborhoods, since unexplained heterogeneity in the selection process may still be somewhat present. But, by including the major predictors of selection into urban, suburban, and rural neighborhoods, we can be more confident that the observed results are not heavily distorted by selection bias.

Finally, although the results presented in Table 3.2, Model 1 do point towards a "suburban disadvantage" when it comes to the likelihood of independent community-dwelling (at least compared to rural residents), it remains unclear what neighborhood features contribute to this disadvantage. The effects of specific neighborhood features, and whether they account for the "suburban disadvantage", are explored in the next section.

Neighborhood Determinants of Moving to Senior Housing

Table 3.2, Model 2 builds on Model 1 by adding in additional neighborhood characteristics. The results shed more light on the neighborhood characteristics that create enabling environments for older adults to remain independent community-dwelling. Note that the model does not include every neighborhood variable described in Table 3.1. Several variables were dropped because they did not have statistically significant relationships with moves to senior housing and did not improve the overall model fit.[9]

The second hypotheses (H2) specified that the characteristics of suburban sprawl (lack of transportation/mobility, affordable housing options, and services) would be associated with an increased likelihood of moving to senior housing, net of other structural neighborhood characteristics (population size, poverty rate, age structure, and region). The hypothesis is supported for transportation/mobility and services but not for affordable housing options. Older adults are more likely to move to senior housing versus remaining independent community-dwelling when they live in neighborhoods with larger blocks, possibly reflecting the increased difficulty of walking to destinations in neighborhoods where the streets are less connected and each block is farther apart. For each additional square mile added onto the average block, the odds of moving to senior housing are 30 percent greater ($e^{0.266} = 1.30$; $p < 0.05$). Keep in mind, however, that one square mile represents a huge change, since in the total sample of older adults,

[9] Variables that were tested but not included in the final model include, at the individual-level, family savings; and at the block-group level, percent single-family homes, median year built, percent of housing units lacking complete kitchen facilities, number of grocery stores in zip code, number of health services in zip code, number of religious organizations in zip code, percent non-Hispanic white, percent non-Hispanic black, percent Hispanic (any race) and percent other racial/ethnic group. Omitting these variables does not alter the substantive results. In addition, I also tested several interactions, including interacting urban category with family income, and urban location with driver status. Neither of these interactions was statistically significant and omitting them from the final model does not alter the substantive results.

the average block in respondents' block groups was 0.107 square miles. Older adults are less likely to move to senior housing when the neighborhood has more drug stores, net of the total number of establishments and other independent variables. Each additional drug store in the zip code decreases the odds of moving by 7 percent ($e^{-0.069} = 0.933$; $p < 0.05$), possibly because older adults with greater access to drug stores have an easier time filling prescriptions and purchasing other daily necessities.

Collectively, these results suggest that to some extent, neighborhoods that lack services and street connectivity make it difficult for older adults to remain independent community-dwelling. However, the case that suburban sprawl has a negative impact on older adults' independence is hardly overwhelming. Table 3.2, Model 2 indicates that the likelihood of moving to senior housing is unaffected by the percent of residents who take public transportation (even if the model also controlled for the ability to drive[10]), suggesting that access to public transportation is not a key motivation for moves to senior housing. It may be that even with greater access to public transportation, older adults are not especially likely to utilize it. And even though sprawled neighborhoods often lack affordable housing options, the neighborhood housing variables are not significant predictors of losing residential independence. Given the significant, negative effects of individual homeownership and duration in residence on the odds of moving to senior housing, the type of housing currently occupied by the individual may be much more important than whether they have alternative types of housing in their local area. It may be that once it becomes necessary to move from their long-time home, older adults are more likely to move to senior housing than seek local alternative housing options. In addition, based on the sprawl explanation we might have expected older adults in the West and South to be more

[10] In a model that controls for whether the respondent is a usual driver, the effect of being a driver is not a significant predictor of moves to senior housing. In addition, the coefficients and statistical significance of the transportation/mobility neighborhood variables are similar to the results in Table 3.2, Model 2.

likely to lose residential independence, because metropolitan areas in the West and South are newer and have a greater reputation as sprawled (think for example, of Atlanta, Phoenix, and Los Angeles). However, the results for region are inconsistent with this sprawl argument.[11]

In addition, moves to senior housing are predicted by several variables that have little association with the suburban sprawl explanation. Moves to senior housing are more likely for individuals who live in block groups with large populations. This is consistent with previous findings that many moves to senior housing (especially to retirement communities) are amenity-driven and individuals often seek retirement locations in exurbs and less populous locations (Walters 2002). It is also consistent with the fact that a net 6.1 percent of respondents switched from urban to suburban or rural block groups when moving to a retirement community (see Table A.3 in Appendix A).

The odds of moving to senior housing are also greater in block groups that have greater percentages of older adults. Recall from the descriptive statistics that urban neighborhoods had the lowest percent age 65 or older, while suburban and rural neighborhoods were about equal. Local age structure may be important because older adults tend to spend more time interacting with neighbors (Cornwell, Laumann, and Schumm 2008) and rely more heavily on neighbors for social support than do younger age groups (Shaw 2005). On the one hand, we might have expected that living in a neighborhood with many older adults would promote residential independence, because the increased ability to interact with people of a similar age may stave off feelings of loneliness and social isolation (McPherson, Smith-Lovin, and Cook 2001). On the other hand, older adults' independence may be undermined in neighborhoods with high percentages of older adults, because a lack of age diversity may contribute to a lack of important

[11] Regional differences are also not significant ($p > .05$) in models that do not control for block group characteristics.

"bridging" types of social ties (Granovetter 1973). The results are consistent with the latter explanation.

The results presented in Table 3.2 provide weak support for the third hypothesis (H3), which specified that the "suburban disadvantage" could be accounted for by characteristics of suburban sprawl. The difference between living in a suburban versus an urban block group in the odds of moving to senior housing was relatively close to statistical significance in Table 3.2, Model 1 ($\beta = -0.313$, $t = 1.79$), and is strongly attenuated in Model 2 ($\beta = -0.180$, $t = 0.191$). The attenuation of the coefficient provides some evidence that the characteristics of sprawl explain the urban-suburban difference. The coefficient for living in a rural versus a suburban block group started off statistically significant in Table 3.2, Model 1, but the introduction of neighborhood characteristics associated with suburban sprawl in Model 2 does not attenuate the suburban-rural difference. In fact, the difference becomes stronger in magnitude and increases in statistical significance (the coefficient for rural in Table 3.2, Model 1 is -0.487, $p < 0.01$; and in Table 3.2, Model 2 it is -0.609, $p < 0.001$).[12] The implications of this persistent rural effect are discussed in the concluding paragraphs, along with implications of the other results.

Determinants of Destination Choice among Movers to Senior Housing

As a final check on the findings reported above, I estimated a model to test whether the predictors of moving to senior housing are the same despite the choice of senior housing

[12] Comparing coefficients across differently specified logit models may be confounded by the problem of rescaling (see Karlson, Holm, and Breen 2012). To address the problem of rescaling, I estimated the reduced coefficients for urban ($\beta = -0.246$; $p > 0.05$) and rural ($\beta = -0.393$; $p < 0.01$) in Model 2, using the KHB method developed by Karlson, Holm, and Breen (2012). The reduced Model 2 coefficients can be compared more accurately to the Model 1 coefficients for urban ($\beta = -0.313$; $p > 0.05$) and rural ($\beta = -0.487$, $p < 0.01$). The substantive results are the same whether I utilize the full or reduced coefficients.

destination type. Prior research suggests that the predictors of moving to retirement communities differ from the predictors of moving to assisted-living facilities (Silverstein and Zablotsky 1996; Wilmoth 2010), although it is not clear whether the difference in predictors operate at both the individual/household- and the neighborhood- level. Table 3.3 reports results of a logistic regression model predicting moves to assisted-living versus retirement communities among movers to senior housing. The model includes a Heckman correction (inverse Mill's ratio) based on the first-stage regression presented in Table 3.2, Model 2, in order to adjust for selection into the category of movers to senior housing. In general, the results indicate that most of the differences in the odds of moving to assisted-living versus a retirement community are found at the individual and household level and not at the neighborhood level. For instance, the odds of moving to an assisted-living facility instead of a retirement community among movers to senior housing are greater for individuals who are older, are in the "other" race/ethnic category versus white, non-Hispanic; have fewer years of education; are not married; and are in fair or poor health. The results for marital status and health in particular are consistent with previous research that finds that living alone and prior health are important determinants of assistance-seeking moves (Silverstein and Zablotsky 1996; Wilmoth 2010).

The only neighborhood-level characteristic that distinguishes moves to retirement communities and assisted-living facilities is region of the country. Older adults living in the Midwest are more likely to move to assisted-living instead of retirement communities, compared to older adults in the West. There are several possible explanations for this difference. Assisted-living facilities may be more prevalent in the Midwest, although this explanation is somewhat circumvented by the fact that the local supply of assisted-living facilities (represented by the number of residential services in the zip code) is controlled for in the regression model. It may

also be that older adults in the Midwest are more likely to "hold-out" for moves to assisted-living, meaning that they continue to live independently past the age when older adults in other regions tend to move to retirement communities, and make their first move to senior housing at an older age when assisted-living is the more likely choice. In sum, the results indicate that although neighborhood characteristics predict moves to senior housing versus remaining independent community-dwelling, the choice of a senior housing destination is primarily an individual/household-level, and not a neighborhood-level, process.

Discussion and Conclusions

The U.S. is a predominately suburban nation, but the benefits of suburban living have increasingly been called into question (Koslowsky et al. 1995; Haar 1998, Frank 2000; Putnam 2000; Berrigan and Troiano 2002; Frumkin 2002; Vandgrift and Yoked 2004; Squires and Kubrin 2005). The aging of the suburbs (Frey 2003; Frey 2011) has led scholars to question the effects of suburban location on older adults' ability to live independently as they age, especially in neighborhoods that exhibit the qualities of suburban sprawl (Duany et al. 2000; Frumkin 2002). While several previous studies have researched the determinants of living independently in conventional housing versus relocation to senior housing (Silverstein and Zablotsky 1996; VanderHart 1998; Ermisch and Jenkins 1999; Robison and Moen 2000; Longino et al. 2002; Akamigbo and Wolinsky 2007; Sabia 2008; Sergeant et al. 2010, Wilmoth 2010), very few have incorporated ecological variables into the analysis. Given the importance of neighborhoods for other aspects of health and well-being among older adults (Balfour and Kaplan 2002; Klinenberg 2002; Cagney, Browning, and Wen 2005; Browning et al. 2006; Rogowski, Freedman, and

Schoeni 2006; Cagney and Browning 2008), I posited that neighborhoods also play an important role in the ability of older adults to live independently in a community-based dwelling.

This paper set forth three hypotheses which were tested in multivariate logistic regression models using detailed longitudinal data from the Panel Study of Income Dynamics combined with neighborhood data from the US Census Bureau. First, I hypothesized that older adults in suburban neighborhoods were more likely to move to senior housing versus remain in an independent community dwelling compared to older adults in urban or rural neighborhoods, net of individual age, family composition, socioeconomic status, housing characteristics, and health. Results of the logistic regression model provided support for this hypothesis. Not surprisingly, older age was a positive predictor of moving to senior housing, as was income, education, family composition, living in a single-family home, and health. But above and beyond these individual and household characteristics, the odds of moving to senior housing versus remaining independent community-dwelling were highest for suburban seniors.

Second, I hypothesized that neighborhood characteristics associated with suburban sprawl: lack of transportation/mobility options, lack of affordable housing options, and lack of services, would increase older adults' likelihood of moving to senior housing. Because these characteristics are likely influenced by other aspects of the neighborhood which may have independent effects on moves to senior housing, neighborhood models also adjusted for population size, poverty rate, age structure, and region. I found partial support for the second hypothesis. A lack of services (in particular, drug stores), did increase the odds that older adults moved to senior housing. In addition, living in block groups with larger individual blocks, on average, also increased the odds of moving to senior housing. I found no support for the idea that increased options for affordable housing alternatives in older adults' neighborhoods increased

their duration of independent community-dwelling. These results suggest that neighborhood interventions should not primarily be focused on providing alternative housing options for older adults, contrary to the recommendations of Golant (2008). Rather, neighborhood interventions would be better off focusing on increasing access to local services and improving the walkability and connectivity of the neighborhood.

Another interesting finding was that living in neighborhoods with greater representation of older adults was not protective against moving to senior housing. This seems counterintuitive from a social resources perspective positing that greater representation of older adults in the neighborhood is a benefit, because it creates opportunities for older adults to interact with others of a similar age. But, the results are consistent with an alternative perspective which sees greater representation of older adults as a disadvantage, because age-segregation may lead to a lack of important "bridging" types of social capital.

A potential concern is that some of the independent variables may be predicting the decision to move in general rather than to senior housing specifically. This selection effect is somewhat circumvented by the fact that the comparison group of older adults who remained independent community-dwelling includes both movers and non-movers. Even so, the majority of those who remained independent community dwellers were non-movers – on average 96.6 percent per survey interval. To address the potential selection effect, I estimated logistic regression models that predicted moving in general rather than moving to senior housing specifically (results are presented in Table A.4 in Appendix A). In addition to predicting moves to senior housing; rural location, age, number in the family unit, homeownership, years in residence, and health status all predict moving in general. The effects of these characteristics on moving in general are weaker than their effect on moving to senior housing. However, their

effects on senior housing need to be interpreted with caution, since they represent both the effect of moving to senior housing and moving in general. Several other predictors are unique to moves to senior housing, including living in a single-family home and family income. Perhaps most importantly, the neighborhood characteristics that predicted moves to senior housing (mean block area, number of drug stores, population size, and percent 65+) do not also predict moving in general. In other words, the increased odds of moving to senior housing in neighborhoods with larger blocks, fewer drug stores, larger populations, and a greater proportion of older adults are not driven by an increased propensity of older adults in these types of neighborhoods to move in general.

Another potential concern is that the models may have failed to include other important features of communities like crime rates, as well as the nature of the respondents' homes. Regarding crime, it is certainly possible that older adults in neighborhoods with high crime rates have a greater difficulty accessing the resources they need to remain independent, especially if the respondents are afraid to leave their homes. Crime in the neighborhood may also cause their health to decline if they do not get enough physical activity because they are afraid to leave their home, or if they experience negative physical and psychological effects from stress. Both of these processes could increase older adults' likelihood of moving to senior housing. It is therefore unfortunate that crime data were not available for the sample of PSID respondents. However, several neighborhood characteristics that are predictive of crime – urban category, population size, and poverty rates – were included in the analysis and somewhat make up for the inability to include direct measures of crime. It is also unfortunate that the PSID did not contain more detailed information regarding respondents' homes, for example, whether the home is one or multiple floors, is in need of repair, or has been modified to increase accessibility for older

adults, especially since these are important predictors of moving to senior housing (Connell 1996; Clemson, Roland, and Cumming 1997; Connell and Sanford 1997; Gitlin et al. 2001; Stuck et al. 2002; Gitlin 2003). Again, some of these characteristics are likely correlated with variables included in the regression models, including whether it is a single-family dwelling and whether the respondent owns the home. Perhaps more importantly, there is little evidence to suggest that adjusting for crime and the nature of the respondent's home would somehow influence the other neighborhood results by, for example, reducing or eliminating the effect of block size or access to drug stores.

A key contribution of this study was to show that neighborhoods, and not only individual and household characteristics, are important determinants of residential transitions among older adults. However, additional questions remain to be addressed in future research. First, this study did not explore the role of health in great depth, even though health has been identified as a very important predictor of moves to assisted-living in this and other studies (Silverstein and Zablotsky 1996; Wilmoth 2010). By simply controlling for individual health, one would miss the important ways that neighborhood environment may operate through health status to influence the duration of independent community-dwelling. Future research should explore these health-environment interactions in greater detail. For example, we might hypothesize that specific types of diminished health, such as inability to operate a car, will interact with the features of the neighborhood, such as automobile dominance, to increase the odds of moving to senior housing.

Second, despite controlling for a wide range of individual, household, and neighborhood characteristics, the final analytical model still identified differential odds of moving to senior housing among suburban and rural older adults. Net of individual and neighborhood characteristics, rural residents had lower odds of moving to either retirement communities or

assisted-living facilities than suburban residents. How can this persistent difference be explained? One possibility is that this difference reflects differential family support. This study accounted for family support in a limited way – by controlling for number of children, number of people living in the household, and marital status. But, perhaps rural older adults live in closer proximity to their children or to other members of their family than do suburban older adults. By following individuals from the same family over time, even as they move out and establish their own households, the PSID provides a unique opportunity to investigate the role of kin location in residential transitions of older adults, and is a ripe avenue for further research.

The results presented in this paper show that there is some truth to the idea that older adults become "stranded in the suburbs," but only partially due to suburban sprawl. A lack of services and large blocks does leave older adults more vulnerable to losing independence. But so does living in areas with large populations and a high concentration of older adults. Furthermore, rural older adults appear to be the most likely to remain independent community-dwelling, even though they, like suburbanites, have more limited access to commercial establishments and neighborhoods are not as walkable as in urban areas. What are the implications of these findings?

First and foremost, these findings show that neighborhood environment is an important determinant of living independently. These geographic differences may be especially relevant given the current demography of the US population. Older adults are a growing segment of the population, and the older adult population itself is growing older. Older adults today have fewer children than older adults in the past, and may therefore have less family support. With a larger older adult population and declining family support, neighborhood environments may become increasingly important. In addition, this study suggests that future development to make

neighborhoods friendlier for older adults should be concentrated in suburban neighborhoods. Policy interventions that increase access to services like drug stores and walkable neighborhoods are likely to be beneficial for older adults who wish to remain independent community-dwelling. These place-based policy interventions are likely to be more successful in increasing older adults' duration of independent community-dwelling than encouraging older adults to relocate to more "senior-friendly" neighborhoods, since building large concentrations of older adults within single neighborhoods may actually undermine their ability to remain independent.

TABLES

Table 3.1: Means and Standard Deviations of Block Group Characteristics by Urban Category

	Urban			Suburban		Rural		
	Mean		SD	Mean	SD	Mean		SD
Transportation/mobility								
% take public transit	8.950	***	0.378	3.252	0.094	0.588	***	0.027
Mean block area	0.011	***	0.0003	0.017	0.0003	0.215	***	0.005
Affordable housing								
% owner-occupied	56.683	***	0.534	73.760	0.351	75.924	***	0.197
% single-family homes	52.036	***	0.753	69.673	0.469	73.346	***	0.253
Median rent	660.719	***	5.680	765.382	5.617	530.178	***	3.378
Median year built	1955.892	***	0.324	1962.824	0.226	1965.212	***	0.718
% lacking complete kitchens	1.390	***	0.054	0.485	0.020	1.420	***	0.030
Services in zip code								
# total establishments (estb.)	816.360	**	12.402	784.980	7.494	323.823	***	4.879
# grocery stores / 100 estb.	2.606	***	0.053	1.626	0.016	2.398	***	0.027
# drug stores / 100 estb.	0.888	***	0.014	0.725	0.007	0.838	***	0.009
# health services / 100 estb.	7.958	***	0.119	7.934	0.067	5.336	***	0.045
# social services / 100 estb.	1.223	***	0.021	0.721	0.010	0.976	***	0.018
# religious organizations / 100 estb.	2.547	***	0.038	2.066	0.023	3.629	***	0.033
# residential services / 100 estb.	1.135	***	0.021	0.936	0.013	1.052		0.013
Population size								
Total population	1395.698	***	17.340	1578.672	17.432	1595.654		22.555
Poverty								
% poor	16.599	***	0.297	8.017	0.152	12.203	***	0.127
Racial/ethnic heterogeneity								
% non-Hispanic white	61.673	***	0.728	81.991	0.350	88.110	***	0.239
% non-Hispanic black	19.929	***	0.685	6.507	0.248	6.121		0.193
% Hispanic (any race)	12.001	***	0.450	6.295	0.216	3.151	***	0.107
% other	6.396	***	0.179	5.207	0.115	2.618		0.086
Age structure								
% age 65 and older	14.810	***	0.166	15.154	0.147	15.186		0.111
Region								
Northeast	22.30%	***	--	25.88%	--	18.89%	***	--
Midwest	23.34%	***	--	33.00%	--	27.83%	***	--
South	31.91%	***	--	23.00%	--	37.15%	***	--
West	22.45%		--	18.12%	--	16.13%	***	--
N of respondents	659			734		1,101		
N of person-intervals	3,375			3,911		6,049		

Note: Table reports results of two-tail tests that means for urban and rural residents are different than means for suburban residents. Significance levels for the two-tail test are: * p < .05, ** p < .01, *** p < .001.

Table 3.2: Logistic Regression Models Predicting Moves to Senior Housing among Older Adults

	Moved to senior housing vs. remained independent community-dwelling					
	Model 1			Model 2		
	β		(robust s.e.)	β		(robust s.e.)
Block Group Urban Category (ref=suburban)						
Urban	-0.313		(0.179)	-0.180		(0.191)
Rural	-0.487	**	(0.144)	-0.609	***	(0.164)
Individual Characteristics						
Age	0.072	***	(0.009)	0.072	***	(0.010)
Female (1=yes)	0.014		(0.143)	0.044		(0.142)
Race/Ethnicity (ref=white, non-Hispanic)						
Black, non-Hispanic (1=yes)	-0.299		(0.251)	-0.184		(0.269)
Hispanic, any race (1=yes)	0.437		(0.435)	0.700		(0.465)
Other (1=yes)	-0.194		(0.420)	-0.122		(0.431)
Family income (ln)	-0.136	*	(0.055)	-0.158	**	(0.051)
Years of schooling	0.030		(0.019)	0.022		(0.020)
Employed (1=yes)	-0.350		(0.251)	-0.331		(0.253)
Married (1=yes)	-0.293		(0.177)	-0.323		(0.179)
Number of children	-0.025		(0.030)	-0.029		(0.030)
Number in family unit	-0.271	*	(0.105)	-0.272	*	(0.108)
Own home (1=yes)	-0.446	*	(0.182)	-0.653	***	(0.186)
Single-family home (1=yes)	-0.335	*	(0.166)	-0.263		(0.172)
Years in residence over previous 10 years	-0.102	***	(0.016)	-0.096	***	(0.017)
Fair/poor health (1=yes)	0.333	*	(0.131)	0.389	**	(0.137)
Length of survey interval	0.583	***	(0.125)	0.544	***	(0.129)
Block Group Characteristics						
Transportation/mobility						
% take public transit				-0.008		(0.012)
Mean block area (sq miles)				0.266	*	(0.135)
Affordable housing options						
% owner-occupied				0.006		(0.004)
Median gross rent (in $1,000s)				-0.102		(0.282)
Services						
# commercial establishments (in 1,000s)				0.241		(0.163)
# drug stores				-0.069	*	(0.028)
# social services				-0.004		(0.016)
# residential services				0.019		(0.011)
Population				0.115	***	(0.033)
% poor				0.008		(0.008)
% age 65+				0.029	***	(0.008)
Region (ref=West)						
Northeast				0.073		(0.220)
Midwest				0.245		(0.183)
South				-0.223		(0.190)
Constant	-6.630	***	(1.057)	-7.332	***	(1.086)
N of respondents	2,298			2,298		
N of person-intervals	13,335			13,335		

*p<0.05; **p<0.01; ***p<0.001

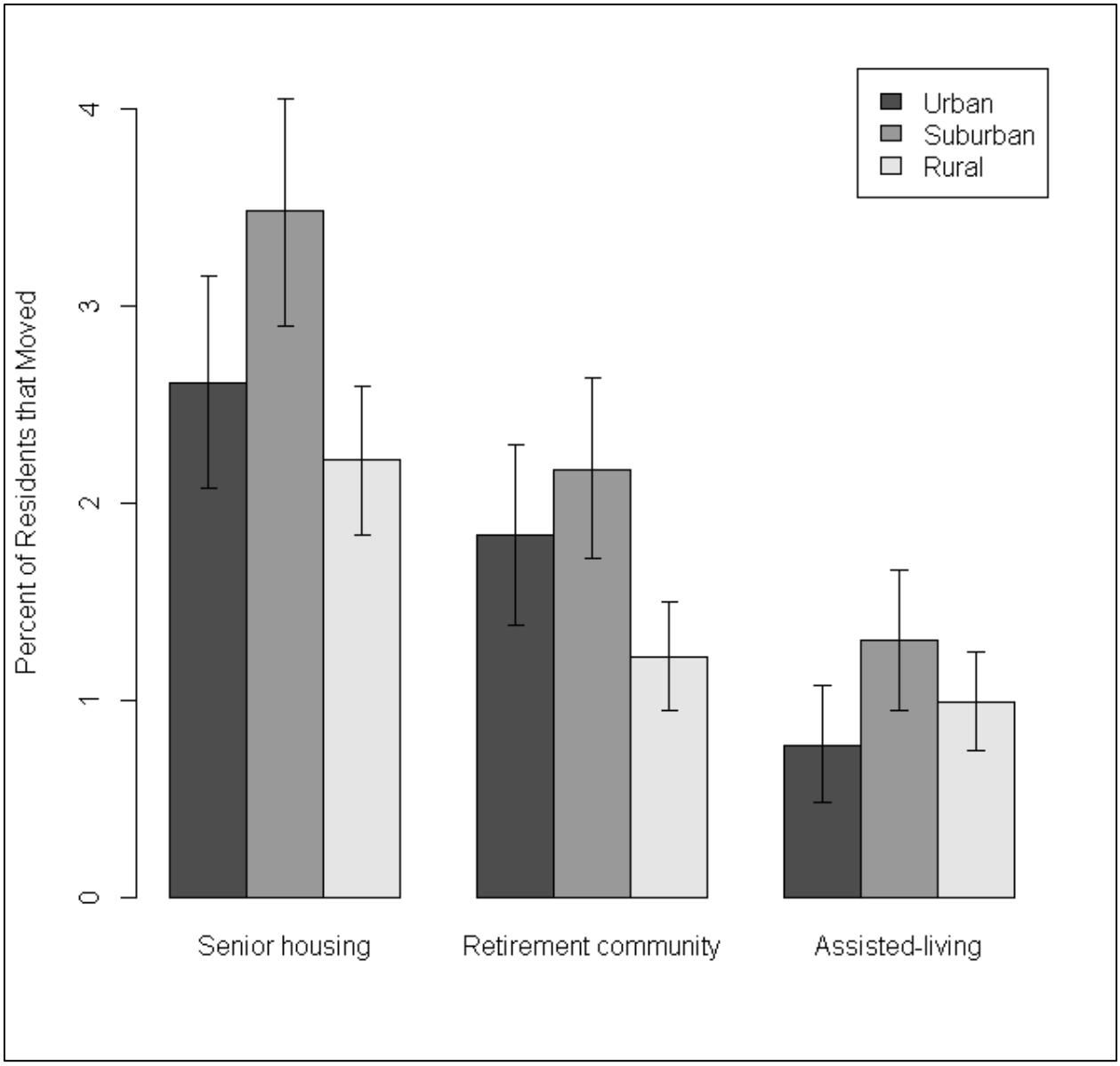
Table 3.3: Logistic Regression Models of Destination Choice among Movers to Senior Housing

	Moved to an assisted-living facility vs. a retirement community		
	B		(robust s.e.)
Block Group Urban Category (ref=suburban)			
Urban	-0.639		(0.454)
Rural	-0.090		(0.485)
Individual Characteristics			
Age	0.110	***	(0.028)
Female (1=yes)	-0.463		(0.371)
Race/Ethnicity (ref=white, non-Hispanic)			
Black, non-Hispanic (1=yes)	0.346		(0.613)
Hispanic, any race (1=yes)	0.216		(0.737)
Other (1=yes)	2.721	**	(0.887)
Family income (ln)	-0.384		(0.207)
Years of schooling	-0.202	**	(0.070)
Employed (1=yes)	0.711		(0.634)
Married (1=yes)	-1.129	*	(0.480)
Number of children	-0.141		(0.089)
Number in family unit	-0.068		(0.280)
Fair/poor health (1=yes)	1.677	***	(0.347)
Length of survey interval	0.501		(0.374)
Inverse Mills ratio	0.097		(0.300)
Block Group Characteristics			
Transportation/mobility			
% take public transit	-0.056		(0.031)
Mean block area (sq miles)	-0.743		(0.943)
Affordable housing options			
% owner-occupied	-0.003		(0.011)
Median gross rent (in $1,000s)	0.594		(0.760)
Services			
# commercial establishments (in 1,000s)	0.179		(0.614)
# drug stores	-0.027		(0.073)
# social services	0.002		(0.038)
# residential services	-0.019		(0.033)
Population	0.097		(0.132)
% poor	-0.004		(0.019)
% age 65+	-0.020		(0.019)
Region (ref=West)			
Northeast	0.599		(0.637)
Midwest	1.122	*	(0.528)
South	0.834		(0.546)
Constant	-4.437		(3.700)
N of respondents	358		
N of person-intervals	358		

*p<0.05; **p<0.01; ***p<0.001

FIGURES

Figure 3.1: Percent of Residents that Moved to Senior Housing, Retirement Communities, and Assisted-Living Facilities versus Remaining Independent Community-Dwelling, by Urban Category



CHAPTER 4

A Family Affair? The Effect of Distance to Kin on Independent Community-Dwelling among Olde r Adults

Introduction

Living independently, whether alone or with a spouse or domestic partner, is by far the dominant living arrangement among older adults. In 2010, about 32 million or 79 percent of adults age 65 or older lived alone or with a spouse (US Administration on Aging 2011). Most of these older adults are aging-in-place, as older adults have very low rates of migration, whether short or long distance. The remaining 21 percent lived with other relatives, in institutional settings such as nursing homes, and in other types of senior housing. How are so many older adults able to maintain an independent residence even in advanced age? Proponents of the aging-in-place perspective have generally focused on the importance of neighborhood services and programs to increase the affordability of housing and in-home care (Stevenson et al. 2000; Summer 2003; Shirk 2006; Sabia 2008). Indeed, the analyses presented in Chapter 3 revealed that neighborhood features like walkability and the supply of local retailers support living independently in old age, even after adjusting for key individual and household differences like socioeconomic status, race and ethnicity, family composition, and health status.

But focusing on neighborhood resources does not portray the whole picture. Take for instance, the finding from Chapter 3 that rural older adults are more likely than either urban or suburban older adults to live independently, even though, compared to urban and suburban areas, rural neighborhoods tend to lack transportation, services, and housing options. Clearly, this positive effect of rural location on living independently cannot be explained by a neighborhood

resources perspective – so what, then, is the missing piece of the puzzle? In this chapter, I argue that familial support, operating through distance to kin, plays an important role in older adults' ability to live independently as they age. I also test whether the effect of distance to kin is most pronounced in rural areas, while also addressing the possibility that processes of selection into rural areas are at play.

Understanding the effects of family support on residential independence among older adults is also an important endeavor from a policy perspective. Today, older adults have fewer children than in the past, which limits their access to a major source of familial support as they age. If family support is an important determinant of residential independence, older adults who have few kin and who desire to remain independent may be at a stark disadvantage. Once these disadvantages are identified, policy makers can formulate more effective plans for addressing them. They might, for example, create policies that focus on expanding access to neighborhood resources (like services and sidewalks) in areas where many older adults have few kin, in order to help compensate for the lack of family support.

Independent Community-Dwelling: Individual Determinants and Neighborhood Resources

In 2010, 14.9 million or 85% of older men and 17.1 million or 74% of older women lived alone or with their spouse (US Administration on Aging 2011). Most of these independently-living older adults are aging-in-place, since older adults are less likely to change residences than other age groups. For instance, from 2009 to 2010, only 5.8% of older adults moved as opposed to 16.9% of the under-65 population. Older adults who migrate may move to another independent community-dwelling, they may move in with relatives, or they may transition into a

wide range of senior housing options that include retirement communities, senior citizen's housing complexes, assisted-living facilities, and nursing homes.

Previous studies of the determinants of relocation to senior housing have almost exclusively focused on individual and household predictors. This body of research has identified a host of individual characteristics that influence moves to senior housing among older adults, including age, race, income, education, homeownership, and most importantly, family composition, widowhood, and health (Silverstein and Zablotsky 1996; VanderHart 1998; Ermisch and Jenkins 1999; Robison and Moen 2000; Longino et al. 2002; Akamigbo and Wolinsky 2007; Sabia 2008; Wilmoth 2010). A growing body of research has begun to incorporate ecological variables in models predicting independent community-dwelling (Sabia 2008; Sergeant et al. 2010). Using data from the Panel Study of Income Dynamics, Sabia (2008) found that homeowners in smaller cities and sparsely populated regions and those who knew more of their neighbors were less likely to move, whether to senior housing or another neighborhood (Sabia 2008). However, in addition to focusing only on homeowners, the study was limited in ways that muddled the evidence for neighborhood effects (see page 43 for a discussion of the limitations of this study). In Chapter 3, I used data from the Panel Study of Income Dynamics to improve upon Sabia's (2008) analysis by focusing on all older adults (not only homeowners) and more accurately measuring neighborhood characteristics. Results indicated that local services and street connectivity were important predictors of moves to senior housing – consistent with what I refer to in this chapter as a "neighborhood resources" perspective. More specifically, older adults who lived in neighborhoods with more local services like drug stores and where the average block size was smaller were less likely to transition from independent community-dwelling to senior housing.

Although the evidence from Chapter 3 and the study by Sabia (2008) both find support for the importance of neighborhood resources, both identified a curious finding. Even after adjusting for a host of neighborhood and individual/household predictors, Sabia (2008) found that homeowners in smaller cities and sparsely populated regions were less likely to move. The same rural effect was also identified in Chapter 3. The rural effect is puzzling because rural locales are not particularly rich in neighborhood resources like services, housing options, and walkabilty. The persistent rural effect is likely being influenced by an omitted variable. In this chapter, I investigate whether that omitted variable is familial support, operationalized by distance to kin. I argue that closer proximity to kin has a positive effect on independent living in all locales, while also testing whether the effect is especially pronounced in rural areas. It is also possible that the persistent rural effect on independent living may be explained by differential selection of older adults who live independently into rural areas. Perhaps the characteristics of rural adults are associated with a greater ability to live independently, or perhaps those who are unable to live independently tend to out-migrate to urban or suburban areas. In the following analysis, I weigh the evidence for selection processes against the role of familial support.

The Role of Familial Support and Distance to Kin

Decades of research show that social ties and social support are positively and causally related to mental health, physical health, and longevity (Hughes and Gove 1981; Cohen and Wills 1985; Kessler, Price, and Wortman 1985; Seeman et al. 1987; House, Landis, and Umberson 1988; House, Umberson, and Landis 1988; Berkman 1996; Thoits 1995; Seeman 1996; Kawachi and Berkman 2000; Uchino 2004; Cohen and Janicki-Deverts 2009; Ertel,

Glymour, and Berkman 2009; Umberson and Montex 2010; Thoits 2011). The theoretical mechanisms through which social ties and social support enhance health and well-being are described in detail by Thoits (2011). Social support typically refers to the functions performed for the individual by a network member, the most frequently mentioned functions being emotional (demonstrations of love, caring, encouragement, and sympathy), informational (provisions of facts or advice), and instrumental assistance (supplying behavioral or material assistance). All three types of social support may be offered by kin to help older adults maintain residential independence, but instrumental support may be the most important. Indeed, Thoits (2011) presents evidence that instrumental support (i.e., financial aid or help with practical tasks) from primary group members (i.e., close family) is most effective in alleviating the harmful effects of stress.

A potential criticism of operationalizing social support with distance to kin is that it does not capture support actually *received* by an individual. However, it turns out that received support has weak and often contradictory effects on well-being and mortality, whereas perceived support has stronger and consistently positive effects on health (Uchino 2004; Bolger and Amarel 2007; Uchino 2009). This may be because received support is typically assessed with reference to a particular stressful occurrence or a short period of time, whereas perceived support captures generalizations about the availability of support that have emerged from receipt of support, both large and small, over many years of a person's life (Thoits 2011). Often, smaller, frequent acts of support are effectively invisible, but they reduce individuals' psychological distress substantially (Bolger, Zuckerman, and Kessler 2000; Bolger and Amarel 2007). These daily support networks may only become visible when they are enacted during particularly stressful events, such as a sudden illness or injury (Thoits 2011).

Of course, having kin in close proximity does not necessarily guarantee high perceived support, but statistics show that older adults do tend to rely on kin, especially those in close proximity, as their strongest source of potential support. In part, this is because older adults tend to be more comfortable turning to close kin than to others. When serious needs arise, older adults are likely to turn to spouses and partners first (if available) for emotional and instrumental assistance, and then to other close kin (mainly children) (Hogan and Eggebeen 1995; Thoits 2011). Even older adults with particularly strong networks of friends and neighbors that have been fostered over many decades tend to turn to kin (even if they live farther away) rather than friends and neighbors when serious needs arise (Klinenberg 2012).

Older adults' reliance on support from kin may also be due in part to the fact that compared to younger adults, the social networks of older adults tend to be kin-dense, increasingly so with age (Cornwell et al. 2008; Waite and Das 2010). Although older adults' social networks tend to become smaller and more focused on kin, age has a curvilinear relationship with the volume of contact with one's remaining social ties: such engagement drops in one's late 50s and mid-60s, flattens out in the late 60s to early 70s, and actually increases among those in their mid-70s to mid-80s (Cornwell et al. 2008). Data from the International Social Survey Programme's special module on social networks show that in the United States, about 70% of women and 50% of men report frequent contact with their adult children, and about 40% of women and 30% of men report frequent contact with adult siblings (Murphy 2008). Furthermore, about 66% of all contact with primary relatives was face-to-face, and frequent contact with one type of relative was positively related to frequent contact with other types as well (Murphy 2008).

Individual characteristics like race and education impact the size of social networks as well as the volume of contact. According to data from the National Social Life, Health, and Aging Project, black respondents, Hispanic respondents, those who never married and those who are widowed are likely to have small networks (Cornwell et al. 2008). Retirees, those with a college education, and those with children have larger networks. Volume of contact with network members is greater among those who are women, black, and Hispanic, as well as among those who are still employed, widowed, in poor health, and with less education.

One particular interest of this chapter is to test whether distance to kin can explain the positive effect of rural location on residential independence, and whether the effect of distance to kin is stronger in rural areas. For many, thinking about rural families conjures up an image of a large, tight-knit, multi-generational family. However, Lichter and Brown (2011) argue that the characterization of rural residents as having a strong sense of family is merely a common conception – a rural stereotype – and empirical evidence tends to support their claim. Data from the General Social Survey indicate that personal relationships of rural residents are more intense and multiplex than those of urbanites (Beggs, Haines, and Hurlbert 1996), but the differences are fairly small and effect sizes decline with the introduction of socioeconomic controls. The reality, Lichter and Brown (2011) argue, is that rural family life looks remarkably similar to family life in urban areas today.

But the important point for this analysis is not whether rural older adults' networks look different from those of urban and suburban residents, but whether, compared to other older adults, rural residents rely more heavily on kin networks, and are more negatively impacted when kin live far away. Rural older adults are often characterized as disadvantaged in terms of community and individual resources (Glasgow 1993; McCulloch and Kivett 1995). According to

Glasgow (1993), small community size, population dispersion, geographic isolation, limited public sector resources, and the concentration of economic resources in a small number of business and industry sectors contribute to economic hardships, inadequate supportive resources, and small social networks for older adults in rural locales. Glasgow (1993) noted two ways these limitations affect well-being: (a) by reducing the effective social and economic responses possible from the public sector, including adequate access to proximate health care, public transportation, and formal social services; and (b) by frequently limiting older adults' access to helpers within their informal network. Taking these two points combined suggests that rural older adults may need to rely more on close kin to maintain residential independence, as the substitutes for close kin are few and far between. In addition, rural older adults may be more negatively impacted the farther away they are from kin.

Hypotheses

This paper sets forth five hypotheses that describe the proposed relationships between distance to kin and the likelihood that older adults move to senior housing versus remain independent community-dwelling. The first hypothesis posits that older adults who live closer to their kin are more likely to remain independent community-dwelling, because of their greater access to social support. One could also posit that older adults with kin nearby may be less likely to remain independent, because they are more likely to move in with family members. However, rates of moving in with relatives are in general quite low (only about 7% of older adults live in the home of an adult child) (Taylor et al. 2010), and due to a limited sample size in the PSID, older adults who move in with relatives are not included in this analysis.

H1: Older adults with kin at closer distances are less likely to move to senior housing and more likely to remain independent community-dwelling.

Previous research suggests that older adults are more likely to rely on children for social support and help with daily activities than more distant relatives (Hogan and Eggebeen 1995; Thoits 2011), suggesting that distance to children will be more strongly tied to the independence of older adults than distance to other relatives. This is expressed in the second hypothesis.

H2: The effect of distance to kin on moving to senior housing is larger for distance from children than distance from other relatives.

The findings from Chapter 3 and Sabia's (2008) analyses both identified a negative effect of living in a rural location on the likelihood of moving to senior housing. That is, rural older adults are more likely to remain independent community-dwelling than urban or suburban older adults, even though rural areas tend to lack the neighborhood resources that facilitate independence. One explanation is that the previous analyses did not account for distance to kin, which helps to explain why older adults in rural areas are more likely to remain independent community-dwelling than others. This potential explanation is expressed in the third hypothesis.

H3: The effect of distance to kin accounts for the negative relationship between moving to senior housing and rural location.

Going a step further, previous research also suggests that rural older adults may compensate for the lack of neighborhood resources by relying more heavily on kin for support than do urban and suburban older adults, and are more strongly impacted when kin live far away. This suggests an interactive effect of distance to kin and living in a rural location, which is expressed in the fourth hypothesis.

H4: The effect of distance to kin on moving to senior housing is stronger in rural locales.

A lack of a significant interaction between distance to kin and rural location would not support the fourth hypotheses, and would suggest that distance to kin has an equal impact in urban, suburban, and rural locales, although it may still add to our understanding of differential rates of independence across types of residential areas. However, if the coefficient for rural location and its statistical significance is unaffected when distance to kin is included in the model, this would suggest that distance to kin does not even add to our understanding of the positive effect of rural location on independence, as suggested by the third hypothesis. Instead, the positive effect of rural may be explained by some other omitted variable, or, by differential selection into rural areas of older adults more likely to remain independent.

Older adults who decide to move away from independence have a variety of residential destinations to choose from, including retirement communities and assisted-living facilities. These destinations differ in the amount of supportive services available to residents and are likely preceded by distinct needs and motivations. In particular, moves to retirement communities tend to be amenity-driven moves, and may not be as strongly motivated by the availability (or lack thereof) of kin support in the origin neighborhood. Moves to assisted-living-

facilities, on the other hand, tend to be assistance-seeking moves, and may be more strongly prompted by a lack of kin support. The distinct effects depending on destination are expressed in the fifth hypothesis.

H5: Among those who move away from independence, distance to kin is a significant predictor of moving to an assisted-living facility versus moving to a retirement community.

In contrast, if there is no differential effect of distance to kin based on whether the older adult moves to a retirement community or an assisted-living facility, then we can conclude that while kin support may influence the decision to move, it does not influence the choice of destination. The choice of destination may therefore be entirely due to other factors, such as age, income, and health status.

Data and Variables

Data on individual and household characteristics were drawn from the Panel Study of Income Dynamics (PSID) for the survey years 1990 to 2009. The PSID is a unique and rich dataset which is nicely suited to this analysis because it provides block group geo-codes for individuals as well as their kin. For this study, I selected all PSID respondents age 65 and older at any time between 1990 and 2009 and designated as a household head or wife during the survey year, resulting in a sample of 2,298 unique respondents. All members of the sample were living independently at the outset. Records were retained for respondents for every survey

interval in which they were interviewed (as long as they were age 65 or older and had not yet lived in senior housing), resulting in a sample of 13,335 person-intervals for analysis.

Dependent Variables. The dependent variables are whether the older adult moved to senior housing versus remained independent community-dwelling, as well as the type of senior housing for those who made a move. Senior housing types are categorized into two groups: retirement communities and assisted-living facilities.

Independent Variables. The focal independent variable, distance to kin, represents distance in miles to the kin member who is nearest to the older adult (but does not live in the same household), separately for children and other kin members (which includes siblings, aunts/uncles, cousins, nieces/nephews, and grandchildren). Parent-child relationships are provided by the PSID in the Parent Identification data file; the initial parent-child relationship is used to infer relationships to other kin members (i.e. two individuals who have the same parents listed in the file are inferred to be siblings, etc.). Distance represents distance from the centroid of the respondent's census block group to the centroid of the closest kin's census block group. Respondents and kin who live in the same census block group have a distance of zero. Number of children (ever born) is included for each respondent to account for the availability of children. In addition, not all respondents have children or kin members with census block group location information provided by the PSID. Some kin members may have been lost to follow-up, or the respondent may simply not have any kin of that type. Distance values for respondents without children or other kin are set to the overall mean, and I include a dummy variable for whether there was no locational information for the respondents' children or other kin.[13]

The geographic identifier for the PSID respondent's census block group in each survey year was merged with aggregate data from the US Census Bureau in order to characterize the

[13] Substituting missing values in this way does not alter the substantive interpretations drawn from the analysis.

urban, suburban, or rural location of the block group. Block groups are classified as *urban, suburban, or rural* based on the typology described on page 25.

Models are estimated net of individual and household predictors drawn from the 1990 to 2009 PSID. Individual predictors include age, sex, marital status (permanent cohabitors are counted as spouses), race/ethnicity, years of schooling, employment status (currently employed, retired, or other), number of children, and whether the individual's health status is fair or poor compared to excellent or good. Household predictors include annual total family income from all sources in 2000 inflation-adjusted dollars, number of people currently residing in the family unit, whether someone in the family owns the home, whether the residence is a single-family home, number of years (over the previous ten years) the family has lived in the same dwelling, and region of the country. I also include a variable for length of the survey interval, to account for the PSID's shift from annual to biennial interviews after 1997. Missing values for individual and household predictors were imputed with multiple imputation (additional details of the imputation model and more detailed descriptions of variables are discussed on pages 25 to 30).

Analytical Strategy

I first present descriptive results that report average distances to kin among different categories of older adults, including movers and non-movers to senior housing and those who live in urban, suburban, or rural locales. Then, I present results from multivariate logistic regression models. This analysis views moves among older adults as a two-step process that first involves the decision to move away from independent community-dwelling and second involves the choice of a senior housing destination. In the first stage of the multivariate analysis I estimate

a logistic regression model predicting moves to senior housing. The reference group, those who remained independent community-dwelling, includes movers between independent community-dwellings and non-movers. About 3.4% of those who remained independent community-dwelling moved in the previous survey interval. Thus, it could be argued that the model predicting moves to senior housing conflates the predictors of moving away from independence with the predictors of moving in general. I address this by interpreting the meaning of the variable coefficients cautiously, and presenting an alternative model which predicts moves in general in Table B.1 in Appendix B. In the second stage of the multivariate analysis I estimate a logistic regression model predicting the choice of destination among those older adults who moved to senior housing. This model includes a Heckman correction (inverse Mills ratio) for the selection of individuals into the mover category, generated by the model in the first stage of analysis. All regression models report robust standard errors, which utilize a Huber-White covariance adjustment to account for non-independence of observations. Variables are entered into successive regression models; Model 1 reports results of the base model that does not include the effect of distance to kin, Model 2 adds distance to kin variables, and Model 3 adds the interaction effects.

Results

Distance to Kin Averages

Figure 4.1 reports mean and median values for distance to kin, separately for distance to the respondent's closest child and the respondent's closest other relative. Among all older adults

with at least one child with location information in the PSID, the mean distance to their closest child was about 124 miles, whereas the median was 4.5 miles. Among all older adults with at least one other relative with location data in the PSID, the mean distance to their closest other relative was 29.5 miles, whereas the median was 7.4 miles. The large difference between the mean and the median suggests a substantial right-skew in values of distance to kin; the mean is being pulled up by respondents whose closest child or other relative lives far away. For the majority of respondents, kin tend to live in fairly close proximity at distances that are well under the mean, suggesting that the median is a more appropriate measure.

The data represented in Figure 4.1 lend some initial support to the proposition that distance to kin is related to the ability of older adults to live independently. Older adults who remained independent community-dwelling on average lived about 2.9 miles closer to their nearest child and 4.7 miles closer to their nearest other relative (based on the medians) than those who moved to senior housing, suggesting that increased access to kin support may be positively related to living independently. Comparing across the graphs, we find that older adults tended to live in closer proximity to their children than to other relatives (based on the medians), which may help to explain why older adults tend to rely more on children than other relatives (Hogan and Eggebeen 1995; Thoits 2011). This study posits that distance to kin explains the negative effect of living in rural locations on moving to senior housing, but the data presented in Figure 4.1 suggest this may only apply when rural residents are compared to suburban residents. Rural residents tend to live in closer proximity to their kin than suburban residents, but farther from their kin than urban residents. But again, this does not negate the possibility that the effect of kin is stronger in rural locales, as suggested by the fourth hypothesis. Finally, older adults who moved to assisted-living tended to live closer to their kin than movers to retirement communities.

However, it is difficult to interpret these results, as the effect of distance to kin on the likelihood of moving to either type of senior housing is better determined by the multivariate regression models discussed in the following sections.

Determinants of Moves to Senior Housing

Table 4.1 reports coefficients of the logistic regression models predicting moves to senior housing versus remaining independent community-dwelling. Results of the base model (Model 1) are consistent with previous research of the predictors of residential transitions among older adults (Sabia 2008). Rural location is a significant, negative predictor of moving to senior housing. The odds that rural residents move to senior housing are 36.3% lower ($e^{-0.451} = 0.637$; $p < 0.01$) than suburban residents. By adjusting the reference group (results not shown), we would see that there is no statistically significant difference between urban and rural residents. The likelihood of moving to senior housing is also affected by the number of individuals living in the family unit. For each additional family member living in the household, the odds of moving to senior housing are 23.4% lower ($e^{-0.266} = 0.766$; $p < 0.05$), suggesting that live-in support improves older adults' ability to remain independent community-dwelling. The likelihood of moving to senior housing increases with age and decreases with higher income, owning one's home, living in a single-family home versus another type of dwelling, and a longer duration of residence. In addition, older adults in fair or poor health have a higher likelihood of moving to senior housing compared to those in good health.

Several of the independent variables may also predict moving in general, rather than moving specifically to senior housing. For example, living in a rural area is a negative predictor

of moving to senior housing and moving in general, although the effect on moving in general is not as strong as the effect on moving to senior housing (results of a logistic regression model predicting moving in general among older adults are reported in Table B.1 in Appendix B). Fewer people in the family unit, older age, fewer years in residence, and being in fair or poor health also increase the likelihood of moving to senior housing and moving in general, but their effect is stronger on moves to senior housing. Owning one's home also impacts both types of moves, but homeownership is a stronger (negative) predictor of moving in general compared to moving to senior housing. Several other variables affect only one type of move; total family income is a negative predictor of moving to senior housing but is not a significant predictor of moving in general, whereas education and region of the country affect moving in general but not moves to senior housing.

Table 4.1, Model 2 adds the effect of distance to kin. Distance to kin is represented in thousands of miles, and a term for distance squared is included to account for a non-linear relationship.[14] The coefficient for distance to the respondent's nearest child indicates that when respondents live in the same neighborhood as their nearest child (i.e., distance equals zero), each additional mile farther from their nearest child increases an older adult's odds of moving to senior housing by 0.20% ($e^{1.969/1000} = 1.002$; $p < 0.01$). However, the squared term ($\beta = -0.803$; $p > 0.05$) indicates that the effect of distance to children on the likelihood of moving does not increase linearly. The non-linear effect of distance to the respondent's nearest child is graphed in Figure 4.2. Here we see that the predicted probability of moving to senior housing increases with distance to children up until about 1,000 miles, after which the effect of distance evens out and

[14] I estimated alternative models incorporating logged distance and a term for distance cubed. Logged distance was statistically significant, but contributed to a worse overall model fit than utilizing distance squared. The term for distance cubed was not statistically significant and contributed to a worse overall model fit than utilizing distance squared.

may even begin to decline (note that at greater distances the 95% confidence interval around the effect of distance is much wider than at shorter distances). Distance to children is also a significant predictor of moving in general in addition to moving to senior housing (see results in Table B.1 in Appendix B), but the relationship is stronger for moves to senior housing.

The results presented in Table 4.1, Model 2 indicate that the effects of distance from children and distance from other relatives are not equivalent. Net of distance to children, the other measures of family support, and the other variables in the model, the coefficient for distance to the respondent's nearest other relative is not statistically significant (β= -1.146, $p > 0.05$). Considering the statistical significance of the coefficient for distance to children and the non-significance of the coefficient for distance to other relatives, it is fair to say that distance to children is a more important determinant of remaining independent community-dwelling than distance to other relatives. This finding provides additional empirical support for arguments that older adults rely more heavily on children than other relatives for help with daily tasks and stressful events (Hogan and Eggebeen 1995; Thoits 2011).

The results presented in Table 4.1, Model 2 do not support the proposition that distance to kin explains the negative effect of rural location on moving to senior housing. Compared to the coefficient for rural location in the Model 1 (β = -0.451, $p < 0.01$, s.e. = 0.146), the coefficient for rural location in Model 2 is virtually equivalent (β = -0.431, $p < 0.01$), as is the standard error (s.e. = 0.146).[15] So while distance to children does impact residential outcomes for

[15] Comparing coefficients across differently specified logit models may be confounded by the problem of rescaling (see Karlson, Holm, and Breen 2012). To address the problem of rescaling, I estimated the reduced coefficient for rural (β = -0.404; $p < 0.01$) in Model 2, using the KHB method developed by Karlson, Holm, and Breen (2012). The reduced Model 2 coefficients can be compared more accurately to the Model 1 coefficient for rural (β = -0.451; $p < 0.01$). The substantive result, that the relationship between residential mobility and living in a rural block group versus a suburban block group is not attenuated by distance to kin, is the same whether I utilize the full or reduced coefficients.

older adults, there is no evidence that rural older adults rely more heavily on kin for support than do urban or suburban residents.

In addition, adjusting for distance to children and other relatives reveals relationships for several other family support variables in Table 4.1, Model 2 that were not significant in Model 1. Results indicate that those who are married (or permanently cohabiting) and those who have more children, in addition to those who live in larger family units, have a lower likelihood of moving to senior housing. Note that the coefficients are increased just enough for these variables to cross the threshold into statistical significance ($p < 0.05$), although the differences in coefficients compared to Model 1 are marginal. The slight suppression of the effects of marital status and number of children in Model 1 may have occurred due to their correlations with distance to kin. Distance to children and other relatives are negatively correlated with being married, number of children, and number in the family unit (correlation coefficients among the family support variables are reported in Table B.2 in Appendix B).

Table 4.1, Model 3 incorporates interactions between distance to the respondent's nearest child and the respondent's urban or rural (versus suburban) location. The interaction effects focus on distance to children, since, according to the results in Model 2, distance to children is a more important driver of moves to senior housing than distance to other relatives.[16] The interactions between distance to nearest child and urban or rural location are not statistically significant ($p < 0.05$), indicating there is no difference in the relationship between distance to children and the likelihood of moving to senior housing based on urban, suburban, or rural location. The coefficient for rural indicates that when respondents live in the same neighborhood as their nearest child (distance equals zero), the odds of moving to senior housing are 46% lower

[16] I also estimated models incorporating interactions between distance to nearest other relative and block group urban category, but these interaction effects are not significant ($p > 0.05$), and excluding them from the model does not alter the substantive results.

in rural areas compared to suburban areas ($e^{-0.613} = 0.542$, $p < 0.01$). However, there is no evidence that the effect of distance increases more rapidly in rural areas than in urban or suburban locations (based on the non-significant coefficients for the distance to kin – urban category interactions).[17]

Since the negative effect of rural location on moving to senior housing is not explained by distance to kin (i.e. the coefficient for rural in Table 4.1, Model 2 remained statistically significant), to what extent might it be explained by selection? Table 4.2 reports the percentage of respondents age 55 and older that moved between rural and suburban neighborhoods by the respondent's eventual residential outcome. The percentages show some evidence of differential selection into and out of rural areas. For instance, whereas only 5.3% of respondents who remained independent community-dwelling (they never moved to senior housing during the study period) out-migrated from rural areas into suburban areas, larger percentages of respondents who eventually moved to a retirement community (6.9%) or an assisted-living facility (10.5%) out-migrated from rural areas into suburban areas. In addition, 13.7% of those who remained independent community-dwelling migrated into rural areas from suburban areas, compared to only 10.8% of those who eventually moved to a retirement community and 9.1% of those who eventually moved to an assisted-living facility. Thus, there is some evidence that individuals more likely to remain independent community-dwelling selectively migrated into rural areas, whereas those who were more likely to move to senior housing selectively out-migrated from rural areas. Some of this selection effect is accounted for in the regression models by including control variables that predict rural, suburban, or urban location; including sex,

[17] When switching the referent group to urban (results not shown), the urban-rural difference in the interactions is still not statistically significant, although it does come close. The coefficient of the interaction between rural (compared to urban) and distance to children is 2.83 ($t = 1.55$; $p = 0.07$), and the coefficient of the interaction between rural (compared to urban) and distance to children squared is -1.58 ($t = 0.88$, $p = 0.07$).

race/ethnicity, income, marital status, number of children, number in the family unit, homeownership, housing type, education, and employment status (a model predicting urban, suburban, and rural location is reported in Table B.3 in Appendix B). However, unobserved variables may also impact urban, suburban, and rural location, and therefore a selection effect cannot be ruled out.

Determinants of Moves to Retirement Communities or Assisted-Living Facilities

The second-stage regression model provides a test of differential effects of distance to kin on the type of senior housing chosen by older adults who moved away from independent community-dwelling. Table 4.3 reports results of the logistic regression model predicting moves to an assisted-living facility versus a retirement community among older adults who moved to senior housing. The regression model includes a Heckman correction (inverse Mill's ratio), based on the final model in the first stage of the regression analysis (Table 4.1, Model 3), in order to adjust for selection into moving to senior housing versus remaining independent community-dwelling.[18] The results indicate that distance to kin is not related to whether mobile respondents moved to an assisted-living facility or a retirement community (based on the non-significance of the coefficients for distance to nearest child, distance to nearest other relative, and their squared terms). In fact, the model identifies only a few differences among those who moved to each type of senior housing. The likelihood of moving to assisted-living increases with age; each additional year older increases the odds of moving to an assisted-living facility instead of a retirement community by 12% ($e^{0.116} = 1.123$, $p < 0.001$). In addition, those in the "other"

[18] In the interest of limiting the number of predictor variables due to the small sample size, region of the country is not included as a control variable in the final model. Excluding region of the country does not substantially alter the model results.

racial/ethnic category (which includes Asians, white Hispanics, and those of another race or two or more races) are more likely than those who are white, non-Hispanic to move to assisted-living facilities versus retirement communities. Some researchers have suggested that access to different types of senior housing and cultural norms about senior housing differ by race (Akamigbo and Wolinsky 2006; 2007). Although this research mostly focuses on differences between blacks and whites, it may help to explain the observed effect of race. In addition, older adults with more years of schooling are less likely to move to an assisted-living facility and more likely to move to a retirement community. Finally, older adults in fair or poor health are almost 5 times as likely to move to an assisted-living facility than to a retirement community ($e^{1.557}$ = 4.745), supporting the idea that moves to assisted-living are more strongly preceded by poor health than amenity-driven moves (Silverstein and Zablotsky 1996; Wilmoth 2010), and suggesting that even though the lines between different types of senior housing are increasingly blurred, there are still noticeable distinctions when it comes to the provision of health care.

Discussion and Conclusions

The majority of American adults age 65 and older live independently in a traditional community, whereas about 20% of older adults live in less-independent settings, such as with relatives, in retirement communities, or in assisted-living facilities. A growing body of research has identified predictors of the type of housing occupied by older adults. Individual and household characteristics, including age, race, income, education, homeownership, and most importantly, family composition, widowhood, and health are all influential predictors of remaining independent community-dwelling or moving to age-segregated senior housing

(Silverstein and Zablotsky 1996; VanderHart 1998; Ermisch and Jenkins 1999; Robison and Moen 2000; Longino et al. 2002; Akamigbo and Wolinsky 2007; Sabia 2008; Wilmoth 2010). Factors related to the neighborhood, including local services and transportation, are also important determinants of living independently. But even though this prior research acknowledges the importance of family support in determining older adult residential choices, few studies have been able to incorporate the role of external family support – support from kin members that do not reside in the same household as the older adult. This study contributes to the existing research by examining external family support, by drawing on rich data from the Panel Study of Income Dynamics to investigate the role of distance to kin on older adults' ability to remain independent community-dwelling.

This paper set forth five hypotheses that describe relationships between distance to kin and the likelihood of moving to senior housing. The first hypothesis specified that older adults with kin at closer distances would be less likely to move to senior housing and more likely to remain independent community-dwelling. The results lend support to the first hypothesis – not only do older adults who move to senior housing tend to live, on average, farther from their closest child, each additional mile farther from their nearest child (up until about 1,000 miles) increases a individual's odds of moving to senior housing. After 1,000 miles, the effect of distance evens out and possibly even declines. This non-linear effect suggests that beyond 1,000 miles, the impact of distance to children on moving to senior housing does not increase any further; living 2,000 miles from one's nearest child does not increase the likelihood of moving to senior housing any more than living 1,000 miles away. Unlike distance to children, distance to other kin does not significantly impact the odds of moving to senior housing. This finding lends support to the second hypothesis and is consistent with previous research concluding that older

adults are more likely to rely on children for social support and help with daily activities than more distant relatives (Hogan and Eggebeen 1995; Thoits 2011).

Two hypotheses focused on relationships between rural location and distance to kin. The third hypothesis posited that the effect of distance to kin would account for the negative relationship between moving to senior housing and rural location. The results did not support this hypothesis – introducing distance to kin into the regression model did not reduce the magnitude or significance of the rural coefficient, suggesting that distance to kin does not explain the lower likelihood of moving to senior housing for rural residents compared to suburban residents. And in contrast to the fourth hypothesis, there were no significant interactions between urban, suburban, or rural location and distance to kin on the odds of moving to senior housing. Thus, distance to kin has a similar impact on the odds of moving to senior housing despite whether the older adult lives in a rural, urban, or suburban neighborhood.

One explanation for the persistent rural effect is that it is due to selection. I presented evidence indicating that older adults who remained independent community-dwelling engaged in selective migration out of suburban areas and into rural areas. Furthermore, older adults who eventually moved to senior housing were more likely than older adults who remained independent to make the opposite move, out-migrating from rural areas into suburban areas. The combined impact of selective in- and out-migration from rural areas in the years leading up to a residential transition may mean that older adults more apt to remain independent are over-represented in rural areas. Adjusting for several important predictors of rural location, including sex, race/ethnicity, socioeconomic status, and family composition certainly helps to minimize the selection bias, but it cannot be completely ruled out. Unobserved factors that influence both rural location and the propensity to move to senior housing may play a role, but it is difficult to

imagine what these factors might be. Perhaps individuals with personalities that highly value independence may be more likely to live in rural areas *and* to avoid moves to senior housing, thereby accounting for the rural effect.

Another (perhaps more likely) explanation for the persistent rural effect is that unobserved features of rural communities account for the negative relationship between rural location and moving to senior housing. For example, it is possible that rural residents simply have fewer housing options other than remaining in their home, compared to urban and suburban older adults. Rural older adults may have to move greater distances in order to access senior housing options, and the disruption in social networks and lifestyle that come with longer-distance moves may make remaining in their home the easiest option.

The final hypothesis posited that among those who moved to senior housing, distance to kin would be a significant predictor of moving to an assisted-living facility rather than a retirement community. The results do not support this hypothesis; while kin support does influence the decision to move to senior housing, there is no evidence that it influences the choice of destination. The choice of destination appears to be due to other factors including age, race, education, and perhaps most importantly, health status.

Overall, this study's findings show that distance to children is an important factor in determining an older adult's ability to remain living independently. However, this study is not without a few potential criticisms. First, one might argue that external family support would be better measured with data reporting actual received help, rather than measuring it indirectly with distance to kin. But measures of received support have weaknesses as well; as previously discussed, received support has weak and often contradictory effects on well-being and mortality because it may not accurately capture the small, frequent acts of support that are so important for

reducing distress (Bolger et al. 2000; Uchino 2004; Bolger and Amarl 2007; Uchino 2009). Perceived support is a more consistent measure, but studies that ask older adults about perceived support are rare. Although distance to kin is an indirect measure of perceived support, it remains a reasonable measure to capture the concept of external family support, and the statistical relationships that emerge between distance to kin and residential independence are consistent with theory and expectations for how perceived family support should operate.

Of course, there are other ways to measure external family support rather than with distance to the respondent's closest child and closest other relative. Perhaps it is also important to consider the average distance to all of the respondent's children and relatives, in order to get a sense of whether the respondent's family is mostly nearby or spread out. Or, perhaps it is important to consider the number of children and relatives that live within close proximity, since they may share the caregiving responsibilities. To address this concern, I conducted sensitivity analyses that incorporated each of these proposed measures, and results were similar to the results for distance to nearest kin. And while long-distance caregiving is on the rise (Koerin and Harrigan 2003; Bledsoe, Moore, and Collins 2010), several studies have documented that children who live nearest to the older adult are most likely to provide the majority of care (Stoller, Forster, and Duniho 1992; Matthews and Rosner 1998). The sensitivity analyses lend some additional confidence to the findings, but there are still other ways to conceptualize external family support. For example, one could also conceive of distance as being a factor of the time it takes to drive between two locations. Comparing results that rely on different conceptualizations of distance is an interesting topic for future research.

It might also be important to consider characteristics of kin other than their geographic location. For instance, the likelihood of moving to senior housing may not only be influenced by

the proximity of an older adult's closest child, but also the sex, marital status, income, age, and employment status of that child, as well as the family composition of the child's household. For example, children of older adults who have children of their own living at home may have less time to dedicate to caring for aging parents than those without parental responsibilities. Similarly, previous research finds that daughters spend more time as caregivers for aging parents than sons, and women are more likely than men to cut back on work hours or quit their jobs because of their caregiving duties (Bookman and Kimbrel 2011). Future research seeking to more fully understand how distance to kin influences decisions to move to senior housing could benefit from incorporating sex, family composition, and other key characteristics of kin.

Overall, this study demonstrated that distance to kin, primarily distance to adult children, is an important predictor of maintaining residential independence or moving to senior housing. However, distance to children is certainly not the only important predictor of residential independence. Distance to kin, age, health, family composition, income, housing characteristics, characteristics of the neighborhood, and the respondent's individual propensity to move all come together to influence the decision of whether and when to stay or transition to senior housing. Understanding all of the factors that contribute to this process of transition can help us understand the differential residential outcomes for older adults. Finally, policies seeking to help older adults maintain residential independence as they age will need to consider the role of distance to kin, and may benefit from focusing their resources on older adults who do not have adult children residing nearby.

TABLES

Table 4.1: Logistic Regression Models of Residential Transitions among Older Adults

	Moved to Senior Housing vs. Remained Independent Community-Dwelling					
	Model 1 – Base Model		Model 2 – Distance to Kin		Model 3 – Interactions	
	β	(robust s.e.)	β	(robust s.e.)	β	(robust s.e.)
Block Group Urban Category (ref=suburban)						
Urban	-0.289	(0.178)	-0.290	(0.179)	-0.230	(0.221)
Rural	-0.451 **	(0.146)	-0.431 **	(0.146)	-0.613 **	(0.178)
Distance to Kin						
Distance to nearest child (1,000s/miles)			1.969 **	(0.646)	1.728 *	(0.840)
Distance to nearest child squared			-0.803 *	(0.355)	-1.008 *	(0.394)
Distance to nearest other relative (1,000s/miles)			-1.146	(4.353)	-0.740	(4.394)
Distance to nearest other relative squared			-8.114	(15.956)	-10.007	(15.737)
No kin with location data (1=yes)			-0.426	(0.256)	-0.456	(0.259)
Distance to Kin Interactions						
Urban x distance to nearest child					-1.274	(1.526)
Urban x distance to nearest child squared					1.122	(0.831)
Rural x distance to nearest child					1.551	(1.047)
Rural x distance to nearest child squared					-0.461	(0.585)
Individual/Household Characteristics						
Age	0.073 ***	(0.009)	0.083 ***	(0.010)	0.083 ***	(0.011)
Married (1=yes)	-0.282	(0.174)	-0.351 *	(0.176)	-0.380 *	(0.176)
Number of children	-0.033	(0.029)	-0.074 *	(0.034)	-0.077 *	(0.034)
Number in family unit	-0.266 *	(0.104)	-0.251 *	(0.105)	-0.251 *	(0.104)
Race/Ethnicity (ref=white, non-Hispanic)						
Black, non-Hispanic (1=yes)	-0.262	(0.257)	-0.184	(0.257)	-0.184	(0.259)
Hispanic, any race (1=yes)	0.502	(0.434)	0.534	(0.437)	0.571	(0.441)
Other (1=yes)	-0.170	(0.425)	-0.078	(0.438)	-0.036	(0.435)
Family income (ln)	-0.140 **	(0.054)	-0.145 **	(0.054)	-0.148 **	(0.054)
Years of schooling	0.031	(0.019)	0.019	(0.019)	0.019	(0.019)
Employed (1=yes)	0.031	(0.019)	-0.357	(0.252)	-0.356	(0.254)
Own home (1=yes)	-0.482 *	(0.182)	-0.531 **	(0.182)	-0.532 **	(0.183)
Single-family home (1=yes)	-0.339 *	(0.172)	-0.300	(0.171)	-0.298	(0.171)
Years in residence over previous 10 years	-0.103 ***	(0.017)	-0.105 ***	(0.017)	-0.105 ***	(0.017)
Fair/poor health (1=yes)	0.341 **	(0.131)	0.374 **	(0.132)	0.379 **	(0.132)

*p<0.05; **p<0.01; ***p<0.001

Table 4.1 (continued)

	Moved to Senior Housing vs. Remained Independent Community-Dwelling					
	Model 1 – Base Model		Model 2 – Distance to Kin		Model 3 – Interactions	
	β	(robust s.e.)	β	(robust s.e.)	β	(robust s.e.)
Length of survey interval	0.577 ***	(0.125)	0.499 ***	(0.128)	0.502 ***	(0.128)
Region (ref=west)						
Northeast	-0.110	(0.208)	-0.073	(0.210)	-0.057	(0.212)
Midwest	0.212	(0.176)	0.253	(0.182)	0.261	(0.185)
South	-0.176	(0.181)	-0.225	(0.182)	-0.206	(0.186)
Constant	-6.650	(1.024)	-6.975 ***	(1.053)	-6.861 ***	(1.063)
N of respondents	2,298		2,298		2,298	
N of person-intervals	13,335		13,335		13,335	

*p<0.05; **p<0.01; ***p<0.001

Table 4.2: Origin and Destination Neighborhoods for Moves between Independent Community-Dwellings by Eventual Residential Outcome for PSID Heads and Wives Age 55+

		Eventual Residential Outcome		
		Always Remained Independent Community Dwelling[a]	Moved to a Retirement Community	Moved to an Assisted-Living Facility
Prior Moves between Independent Community-Dwellings				
Origin Neighborhood	Destination Neighborhood			
Rural	Suburban	5.3 %	6.9 %	10.5 %
Rural	Rural	9.1 %	11.5 %	11.8 %
N of person-intervals with rural origin neighborhoods[b]		9,773	631	468
Suburban	Rural	13.7 %	10.8 %	9.1 %
Suburban	Suburban	8.1 %	11.5 %	9.1 %
N of person-intervals with suburban origin neighborhoods[b]		6,026	716	337
Urban	Rural	5.7 %	9.3 %	6.1 %
Urban	Suburban	5.8 %	9.3 %	12.1 %
N of person-intervals with urban origin neighborhoods[b]		5,362	493	183

[a] In this table, the category of respondents who remained independent community dwelling are those who never, in any PSID survey interval during the study period, moved to senior housing.
[b] Represents the total number of person-intervals for movers and non-movers between independent community-dwellings

Table 4.3: Logistic Regression Model of Destination Choice among Movers to Senior Housing

	Moved to an Assisted-Living Facility vs. a Retirement Community		
	β		(robust s.e.)
Block Group Urban Category (ref=suburban)			
Urban	-0.847		(0.430)
Rural	-0.138		(0.386)
Distance to Kin			
Distance to nearest child (1,000s/miles)	0.713		(2.086)
Distance to nearest child squared	-1.048		(1.554)
Distance to nearest other relative (1,000s/miles)	-2.118		(37.835)
Distance to nearest other relative squared	52.381		(446.727)
No kin with location data (1=yes)	-0.786		(0.418)
Individual/Household Characteristics			
Age	0.114	***	(0.028)
Married (1=yes)	-0.808		(0.447)
Number of children	-0.156		(0.089)
Number in family unit	-0.044		(0.286)
Race/Ethnicity (ref=white, non-Hispanic)			
Black, non-Hispanic (1=yes)	0.066		(0.543)
Hispanic, any race (1=yes)	0.025		(0.796)
Other (1=yes)	2.946	***	(0.836)
Family income (ln)	-0.385	*	(0.194)
Years of schooling	-0.209	***	(0.073)
Employed (1=yes)	0.878		(0.644)
Fair/poor health (1=yes)	1.551	***	(0.321)
Length of survey interval	0.361		(0.365)
Inverse mills ratio	0.008		(0.276)
Constant	-3.764		(3.213)
N of respondents	358		
N of person-intervals	358		

*p<0.05; **p<0.01; ***p<0.001

FIGURES

Figure 4.1: Mean and Median Distance to Closest Child and Closest Other Relative among Older Adults

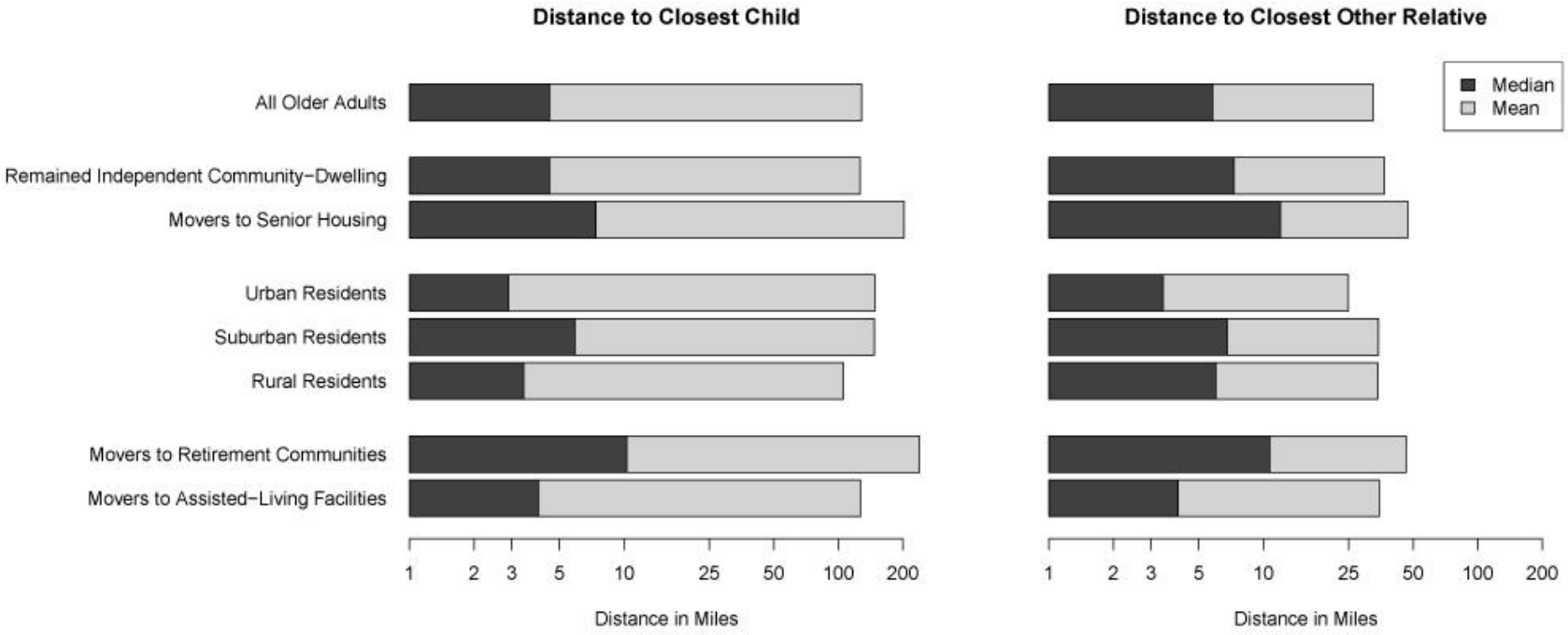
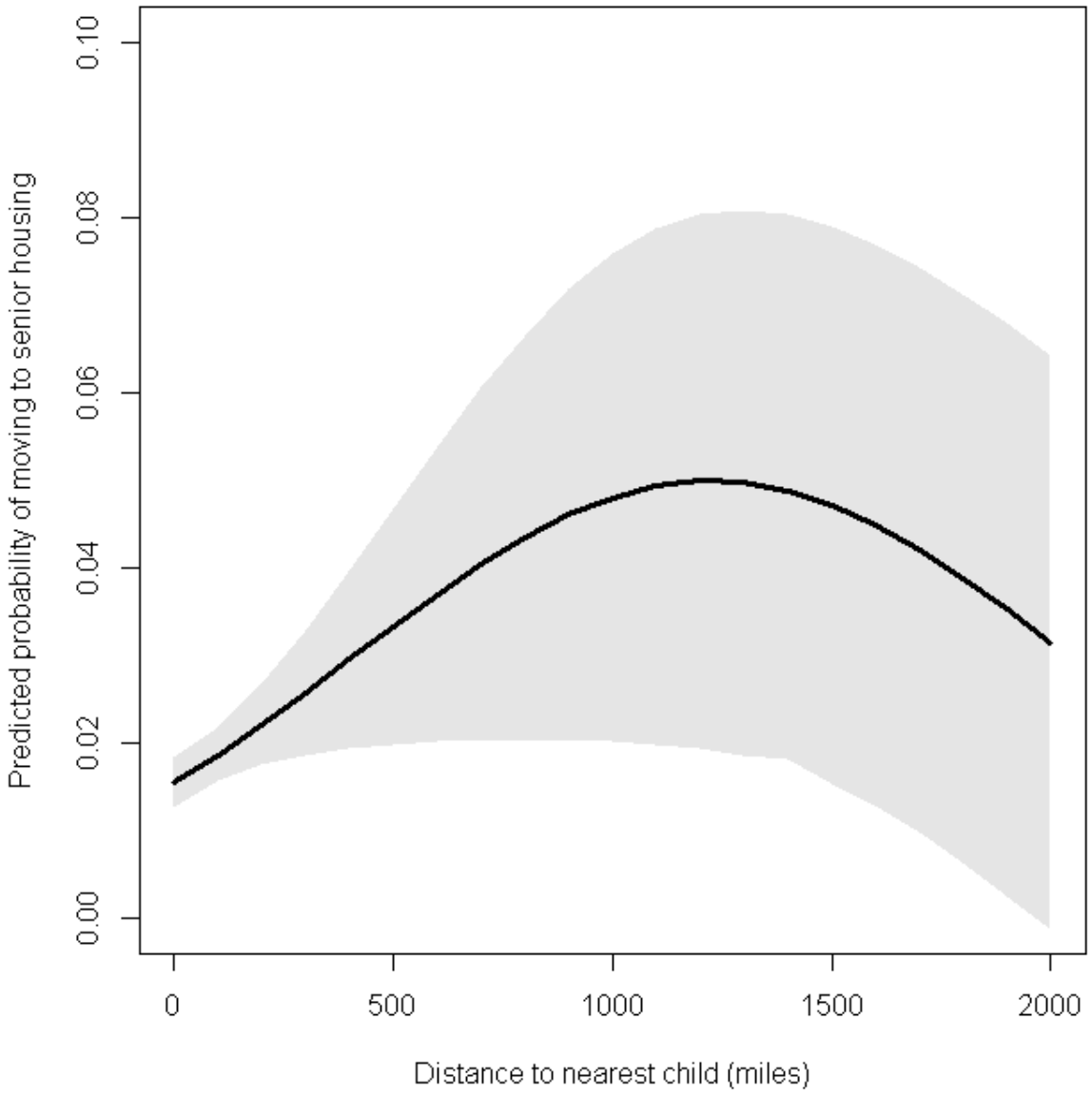


Figure 4.2: Marginal Predicted Probability of Moving to Senior Housing by Distance to Nearest Child, with 95% Confidence Intervals[a]



[a] Shaded areas represent 95% confidence intervals. All other covariates are held at their mean values.

CHAPTER 5

Chronic Health Conditions, Disability, and Geographic Access to Health Care: Implications for Residential Independence among Older Adults

Introduction

Research into the predictors of independent community-dwelling has identified important effects of health (Silversten and Zablotsky 1996; VanderHart 1998; Ermisch and Jenkins 1999; Robison and Moen 2000; Longino et al. 2002; Akamigbo and Wolinsky 2007; Sabia 2008; Wilmoth 2010), and these effects are also found in the sample of PSID older adults examined in Chapters 3 and 4. It is well established that individuals in worse health are less likely to remain independent community-dwelling and more likely to move to retirement communities or assisted-living facilities, especially the latter. However, little research has been dedicated to understanding how access to health care within local neighborhoods enters the relationship between individual health and residential outcomes.

Research of neighborhood effects on health suggests a sequential relationship – access to health care in the local neighborhood impacts health status which, in turn, affects one's ability to remain independent community-dwelling. In contrast, the theory of person-environment fit (Lawton and Nahemow 1973) suggests that current health may interact with access to health care to jointly determine residential outcomes for older adults. For instance, older adults who are in poor health and have limited access to health care may be more likely to lose residential independence than older adults who have equally poor health but better access to health care. Testing relationships between access to health care and poor health hinges on how "poor health" is measured in the sample population. This study utilizes objective measures of health, including

diagnoses of chronic health conditions and reported difficulties with activities of daily living (ADLs), to examine the health-environment link and its impact on residential outcomes for a sample of older adults from the PSID.

The findings of this study have important policy implications. The findings highlight the importance of geographic access to health care for policy programs and initiatives seeking to promote residential independence among older adults. These programs and initiatives must decide how to allocate limited amounts of resources, and understanding the links between geographic access to health care, individual health, and residential mobility can aid in using these resources most effectively. For example, is expanding older adults' geographic access to health care likely to erase some of the inequalities in residential outcomes for older adults? And which older adults are most in need of increased access to health care? Should policies invest in expanding geographic access for all individuals, or should they focus their resources on individuals who are already in poor health?

Neighborhoods, Health, and Access to Health Care

It is well established that neighborhoods have both positive and negative impacts on the health of residents (Diez-Roux 2001; Kawachi and Berkman 2003). Studies have shown relationships between neighborhood residence and a number of health outcomes that pertain to older adults, including self-rated health (Malmstrom, Sundquist, and Johansson 1999; Patel et al. 2003; Wen, Hawkley, and Cacioppo 2006), cardiovascular disease and coronary heart disease (Diez-Roux et al. 1997; Sundquist, Malmstrom, and Johansson 2004), cognitive functioning

(Aneshensel et al. 2011), and physical functioning and disability (Balfour and Kaplan 2002; Bowling and Stafford 2007; Freedman et al. 2008).

Research identifying the links between neighborhood characteristics and health outcomes has primarily focused on characteristics of neighborhoods such as socioeconomic status and social ties and networks (Berkman and Glass 2000; Kawachi and Berkman 2000; Browning and Cagney 2003; Cagney and Browning 2008). In doing so, this research has shown that certain neighborhood characteristics impact health above and beyond individual characteristics. A small subset of these neighborhood-health studies focuses on access to health care at the neighborhood level (Kirby and Kaneda 2005; Kirby and Kaneda 2006; Kirby 2008; Bell et al. 2013). Collectively, these studies show there are geographic disparities in the availability, quality, and utilization of health care that are not explained by individual-level characteristics alone, but arise from neighborhood patterns of socioeconomic and racial segregation.

Encompassing geographic access in our understanding of access to health care represents a more recent departure from previous research, which in the past mostly viewed health care access as hinging on individual characteristics like income, health insurance coverage, educational attainment, and race (Center for Health and Economics Research 1993; Collins, Hall, and Neuhaus 1999; Brown, Wyn, and Teleki 2000; Institute of Medicine 2001). Of all the barriers to accessing health care, geographic availability is not the only, or necessarily even the most important factor. But studies show that geographic access does matter for health care utilization and health outcomes. For instance, increased distance to health care services is associated with reduced utilization of the health care system (Haynes 2003; Hiscock et al. 2008) and increased geographic inequalities in health status (Haynes 2003; Korda et al. 2007; Hiscock et al. 2008).

Theoretical Perspectives for the Influence of Health Care Access on Mobility

Sequential Effects

One theoretical framework for understanding the link between geographic access to health care, health, and residential outcomes for older adults views these factors as following each other in a direct sequence, such that geographic access to health care impacts health, which, in turn, impacts residential outcomes. A heuristic conceptual model depicting sequential effects is presented in the top panel of Figure 5.1. The sequential effects framework suggests that living in an area with plentiful access to health care resources leads to better health among older adults, because older adults with better access are more likely to see a physician, get earlier diagnoses for health problems, and have an easier time filling prescriptions and receiving follow-up care. In turn, good health promotes a longer duration of independent community-dwelling. In contrast, living in an area with limited health care access theoretically leads to worse health outcomes, because older adults may be more likely to delay or skip doctor's appointments, they may decline specialized care that requires too much travel, and they may have a hard time filling prescriptions. As a result of worsened health, older adults' ability to live independently is jeopardized, and moves to retirement communities and assisted-living facilities are more likely to follow.

Complicating the entire sequential effects model is an underlying implicit selection process whereby individual health determines, in part, neighborhood location and geographic access to health care (Kirby, Taliaferro, and Zuvekas 2006). The bidirectional relationship

between geographic access to health care and individual health is represented in Figure 5.1 by the double arrows. The double arrows suggest that, while geographic access to health care affects individual health, individual health also determines peoples' proximity to health care. For example, individuals who know they have chronic health conditions may move to certain neighborhoods to be closer to a physician or a hospital. Disentangling the bidirectional relationship is an important part of showing that geographic access to health care impacts future health status, and in turn, residential mobility. Doing so requires longitudinal data (available in the PSID) to explore how geographic access to health care leads to *changes* in health status, adjusting for prior health status.

Person-Environment Fit

There is another theoretical framework for understanding connections between geographic access to health care, health, and residential outcomes which draws on the theory of person-environment fit. In general, models of person-environment fit seek to explain how well people interact with and adapt to their living environments (Lawton and Nahemow 1973; Lawton, Windley, and Byerts 1982; Lawton 1983; Lawton 1998; Cvitkovich and Wister 2001; Edwards et al. 2006). A heuristic conceptual model applying the person-environment fit framework to health care access and mobility is presented in the second panel of Figure 5.1. Lawton and Nahemow's (1973) conceptualization of person-environment fit posits that well-being is maximized when an individual's competence is matched to their environmental demands. Competence can refer to a host of personal and individualistic factors including age, financial status, personality traits, and health. Environmental factors can refer to a variety of

contextual attributes, including neighborhood characteristics, housing type and structure, and even social context. A major component of person-environment models is the inclusion of interactions of personal or individualistic factors with environmental/collective factors (Phillips et al. 2010). In the heuristic conceptual model (second panel of Figure 5.1), the interactive effect of geographic access to health care and individual health status is represented by the dotted lines. The degree to which individual and environmental factors are mismatched is thought to lead to stress, maladaptive behaviors, and worse overall outcomes.

The arguments of the person-environment fit framework are also supported by theoretical developments in the residential mobility literature. Similar arguments are made in the stress-threshold model, the core argument of which is that people do not consider moving unless they experience residential stress, derived from the mismatch between individual needs and environmental characteristics (Wolpert 1968; Brown and Moore 1970). According to Speare (1974), the decision to move is preceded by residential dissatisfaction stemming from this residential stress (Speare 1974).

The person-environment fit framework has been applied to a vast number of research questions, including at least one study focusing on residential outcomes for older adults (Hays et al. 2004). In that study, Hays and colleagues (2004) found that individual genetic markers (in this case, a gene signifying susceptibility for Alzheimer's disease) interacted with environmental characteristics (including infrequent social interaction and geographic discontinuity[19]) to increase the risk of nursing home entry. Although older adults with and without the genetic marker started out in similar living situations and social contexts, those with the marker had more difficulty

[19] Geographic discontinuity refers to situations in which the geographic context of the respondents' birthplace (either urban or rural) does not match the geographic context of their current residence (Hays et al. 2004).

adapting to their environment as time went on and developed more cognitive problems, prompting nursing home entry.

By applying the person-environment fit model to health status and geographic access to health care, we would expect an interactive effect of the two, such that the impact of geographic access to health care depends on the health status of the individual. From this model, we would predict that individuals in worse health are better matched to an environment that provides easy access to health care. This match allows older adults with certain chronic conditions, for example diabetes or chronic high blood pressure, more convenient access to resources that help them manage and care for their condition. In contrast, those with limited access to health care in their local area but equally poor health may be unable to cope with the mismatch between individual needs and environmental characteristics. The environmental demands requiring them to travel long distances for care and/or settle for inadequate care in their local area may produce stress, dissatisfaction with their current living situation, and further declines in health that prompt entry into retirement communities and assisted-living facilities. Theoretically, geographic access to health care would have little bearing on the likelihood of independent community-dwelling for older adults in good health, because for them, convenient access to health care is not yet a pivotal need.

Hypotheses

The two frameworks for understanding the relationship between health and environment yield distinct hypotheses that are both testable using the sample of older adults from the PSID. The first framework suggests a sequential relationship between geographic access to health care,

health, and residential outcomes such that access affects health which, in turn, affects the likelihood of remaining independent community-dwelling versus moving to senior housing. From this framework we can draw the following hypotheses:

H1: Among older adults, limited geographic access to health care at time t - 1 leads to an increased likelihood of moving to senior housing at time t + 1.

H2: Among older adults, the relationship between geographic access to health care at time t – 1 and moves to senior housing at time t + 1 is attenuated by changes in individual health at time t.

The person-environment fit framework suggests instead that geographic access to health care and health combine to jointly determine residential outcomes, through an interaction effect. From this framework we can draw the following hypothesis:

H3: Older adults with limited geographic access to health care at time t are more likely to move to senior housing at time t + 1 if they are in poor health than if they are in good health at time t.

Although this study is set up as a test of two separate frameworks, the frameworks are not necessarily at odds with one another, as it is possible to find support for both. Support for both would indicate that greater geographic access to health care is a positive predictor of health, and that more convenient access may help prevent declines in health that prompt entry into

retirement communities and assisted-living facilities. At the same time, once individuals fall into poor health (which could happen for many reasons including but not limited to reduced geographic access to health care), geographic access to health care may become all the more important in determining residential outcomes. Although these two theoretical frameworks are not mutually exclusive, they do produce two very different calls to policy action. The first framework suggests that policies seeking to help older adults retain residential independence should consider investing in expanding geographic access to health care for all individuals, in order to promote better health and prevent health declines. The second framework suggests that resources expanding geographic access to health care should be focused on neighborhoods that already have many older adults in poor health, where the individual-environmental mismatch is at its most critical point.

Data

Data on individual and household characteristics were drawn from the Panel Study of Income Dynamics (PSID). For this study, I selected all PSID respondents age 65 and older at any time between 1999 and 2009 and designated as a household head or wife during the survey year, resulting in a sample of 1,211 respondents. Questions about diagnoses of chronic health conditions and difficulties with ADLs have been included in the PSID only since 1999. All members of the sample were living independently at the outset. To make full use of the longitudinal information, I structured the data as a series of person-intervals, each referring to the interval between successive PSID interviews, resulting in a sample of 4,053 person-intervals for analysis. Structuring the data in this way allows multiple moves by the same individual to be

captured over time. However, once individuals make a transition to senior housing, person-intervals after that move are excluded from the analysis since the experience of living in senior housing is likely to influence future migration decisions. All results incorporate sampling weights in order to account for the sampling strategy utilized by the PSID.

Variables

Dependent Variable. The dependent variable is whether the older adult moved to senior housing versus remained independent community-dwelling. Senior housing includes retirement communities (defined as retirement communities or senior citizens' housing complexes) and assisted-living facilities (defined as nursing homes, homes for the aged, or adult foster care facilities). The senior housing category represents a wide range of housing options available to older adults, but each type of senior housing has in common that it represents a departure from living in an independent dwelling within a traditional, age-integrated community. Although there are distinctions in the amenities and provision of care available in each of these varied housing types, the 1999 to 2009 PSID sample does not provide a large enough sample size for separate analyses by senior housing type. The final sample is made up of 1,211 individuals, including 96 individuals who moved out of independent community-dwelling – 52 to a retirement community and 44 to an assisted-living facility.

Independent Variables. The first set of focal independent variables consists of two objective measures of health status. The first is whether the respondent has ever been diagnosed by a physician with any of nine chronic health conditions – arthritis, asthma, cancer, diabetes, high blood pressure, heart attack, lung disease, mental loss, or stroke. Respondents who have

ever been diagnosed with one or more of these chronic health conditions are coded as 1 and those who have never been diagnosed with a chronic health condition are coded as 0. The second objective measure is whether the respondent reported having difficulty doing certain activities by themselves and without special equipment at the time of the interview. These activities of daily living (ADLs) included bathing, dressing, eating, getting in or out of bed, walking, getting outside, and using the toilet. In addition, whether the respondent had difficulty driving is measured with a proxy variable – whether the respondent was the usual driver of any of the household's vehicles. Although the driving measure does not follow the same structure as the other ADL variables, I opted to include it in the models because the ability to drive may be an important factor determining residential outcomes.[20]

Responses to the health questions were provided by the household head for both themselves and their spouse or domestic partner. It is possible that bias is introduced into the health measures for the spouses/partners due to the reliance on proxy responses. Studies assessing proxy bias in the PSID have demonstrated that the degree of closeness between the proxy and the respondent matters (Wagmiller 2009). In this study, the bias is likely to be minimal because the proxies are spouses or domestic partners, and studies find that reports from spouse proxies are more accurate than those from other proxies and are similar to what would have been reported by the target respondents themselves (Elliot et al. 2008).

The second set of focal independent variables consists of two measures of geographic access to health care in the respondent's local area, defined as their zip code. The geographic identifier for PSID respondents' census block groups in each survey year was used to identify zip codes, which were then merged with aggregate data from the US Census Bureau's Economic

[20] To test the sensitivity of the results to including the driving measure, I also estimated results where I did not include the ability to drive as an additional ADL. The substantive results are similar whether or not driving is included.

Census Zip Code Statistics. Two types of health care resources are assessed – the number of drug stores and pharmacies (NAICS 44611; SIC 5910), and the number of health services including offices of physicians and health practitioners, hospitals, and home health care services (NAICS 621, 622, and 623; SIC 80). To adjust for the fact that drug stores and health services are more prevalent in more commercial areas, values are expressed as the number of each per 100 establishments of any type.

The focal relationships are estimated while controlling for individual and household predictors drawn from the PSID and measured in the survey interval before moves to senior housing were observed. Individual predictors include age, sex, marital status (permanent cohabitors are counted as spouses), race/ethnicity, years of schooling, employment status (currently employed, retired, or other), and number of children ever born to the respondent. Household predictors include annual total family income from all sources in 2000 inflation-adjusted dollars, number of people currently residing in the family unit, whether someone in the family owns the home, whether the residence is a single-family home, number of years (over the previous ten years) the family has lived in the same dwelling, and region of the country. Health insurance is an important covariate of health status, but is not included in the regression models because 100% of the individuals who moved to senior housing had health insurance. Missing values for individual and household predictors were imputed using multiple imputation (additional details of the imputation model and more detailed descriptions of variables are discussed on pages 25 to 30).

Models are also estimated net of additional neighborhood characteristics that also predict moves to senior housing, in order to test whether the relationships between geographic access to health care, health, and residential mobility exist above and beyond other neighborhood factors.

Neighborhood characteristics include whether the census block group is urban, suburban, or rural, the block group's total population, poverty rate, percent of residents that are age 65 and older, region of the country, and the number of residential services in the zip code (more detailed descriptions of the variables are provided on pages 25 to 30). Residential services include assisted-living facilities and other residential care facilities, and are included in the model in order to adjust for the possibility that older adults with greater access to senior housing in their local area are more likely to move out of independent living.

Analytical Strategy

I first present descriptive results that report means and percentages for health status variables, including the percent of older adults that have ever been diagnosed with each chronic health condition and were experiencing difficulty with each of the ADLs at the time of the interview. The means and percentages are tabulated separately for older adults who remained independent community-dwelling and those who moved to senior housing.

Next, I present two sets of multivariate logistic regression models predicting moves to senior housing versus remaining independent community-dwelling. The first set of regression model test the first two hypotheses, which posit that geographic access to health care impacts subsequent health status, which impacts subsequent moves to senior housing. To test this claim, it is important to be cautious about the temporal ordering of variables so that the causal chain is properly specified. Therefore, geographic access to health care is measured at time $t - 1$, prior to the measurement of health status. Health status is measured as the *change* in health status between time $t - 1$ and time t, adjusting for health status at the starting point. Change is measured

with dummy variables describing increases in health problems – increases in chronic health conditions are coded as 1 if the older adult went from having no chronic health conditions to having one or more (coded 0 otherwise), and increases in difficulty with ADLs are coded as 1 if the older adult went from having no difficulties to having one or more (coded 0 otherwise). Measuring changes in health provides a better test of the second hypothesis than simply measuring health at time *t* (or *t* – 1), because of the bidirectional (i.e. endogenous) relationship between health status and geographic access to health care. The outcome variable, moves to senior housing, is measured at the time of the subsequent interview two years later. One potential weakness of this model is that it presumes there is a relatively quick reaction to a change in health status (within two years). This model does not capture longer lags between a change in health status and a residential adjustment. Unfortunately, the PSID does not provide a large enough sample of movers to senior housing over many survey years in order to test the sensitivity of the chosen temporal lag. Because of the temporal lags, a full set of variables is not observed for each individual until they have been in the survey for three intervals, reducing the number of person-intervals analyzed in the first set of regression models to 3,158 (or 1,087 unique respondents).

Temporal ordering is not as imperative in the second set of regression models, which test the third hypothesis. Both geographic access to health care and health status are measured at the same point in time (time *t*), in order to investigate their joint effects on the likelihood of subsequent moves to senior housing. All regression models report robust standard errors, which utilize a Huber-White covariance adjustment to account for non-independence of observations.

In all regression models, the outcome variable represents moves to senior housing. The reference group, those who remained independent community-dwelling, includes movers

between independent community-dwellings and non-movers. About 3.4% of those who remained independent community-dwelling moved in the previous survey interval. Thus, it could be argued that the model predicting moves to senior housing conflates the predictors of moving away from independence with the predictors of moving in general. I address this by interpreting the meaning of the variable coefficients cautiously, and presenting an alternative model which predicts moves in general in Appendix C, Table C.1.

Results

Differences in Health and Geographic Access to Health Care by Residential Outcomes

Table 5.1 reports means, percentages, and standard deviations for the health variables, separately by residential outcomes for older adults. Previous research of the predictors of residential outcomes among older adults suggests that older adults who remain independent community-dwelling had better overall health than movers to senior housing (Silverstein and Zablotsky 1996; Wilmoth 2010). The results presented in Table 5.1 lend further support to this claim. The first row of Table 5.1 shows that 88% of older adults who remained independent community-dwelling during the survey interval had been previously diagnosed with one or more chronic health conditions, but even more – 97% – of older adults who moved to senior housing had been diagnosed with a chronic condition (this difference is statistically significant at $p < 0.01$). Recall that observations represent person-intervals, so the category of respondents who remained independent community-dwelling includes some individuals who eventually made a transition to senior housing. The mean number of chronic conditions ever diagnosed was similar

among movers and non-movers to senior housing, with both groups experiencing just over two chronic conditions on average. In part, similarity in the number of chronic conditions among movers and non-movers may be related to a lag between the diagnosis of a health condition and residential adjustments (i.e. individuals may live with chronic conditions for many years before they eventually move to senior housing). The most common chronic conditions – high blood pressure and arthritis – were diagnosed at similar rates among movers and non-movers to senior housing. Among both groups, high blood pressure was diagnosed in nearly 60% of older adults and arthritis was diagnosed in close to 50% of older adults. Although movers and non-movers to senior housing had similar rates of diagnosis of many of the chronic conditions, two major differences are apparent. Movers to senior housing experienced higher rates of heart attack and heart disease than did older adults who remained independent community-dwelling. Among older adults who moved to senior housing, 3% more were diagnosed with a heart attack and 4% more were diagnosed with heart disease compared to older adults who remained independent community-dwelling (these differences are statistically significant at $p < 0.05$). These differences suggest that diagnoses of serious heart conditions may be an important catalyst (or at least, a more *immediate* catalyst) prompting entry into retirement communities and assisted-living facilities. Individuals who moved to senior housing also had higher rates of mental loss (9.9%) than those who remained independently community-dwelling, but this difference fell just short of being statistically significant (the p value of the one-tail test = 0.053).

The second panel in Table 5.1 shows differences in difficulty with ADLs at the time of the interview between older adults who remained independent community-dwelling and movers to senior housing. There is a fairly large difference in the percent of older adults who had one or more ADL difficulties, depending on whether or not they moved to senior housing. Whereas

40% of respondents who remained independent community-dwelling during the survey interval had at least one difficulty, 50% of movers to senior housing had at least one difficulty (this difference is statistically significant at $p < 0.001$). However, the difference in the average number of difficulties experienced by each group was not statistically significant ($p < 0.05$). When it comes to difficulties with specific ADLs, the one difference that can be identified with confidence is in the rates of difficulty getting in and out of bed. The remaining ADLs were experienced at similar rates among movers to senior housing and those that remained independent. About 9% of those who remained independent community-dwelling had difficulty getting in and out of bed, whereas the rate is double that – close to 18% – among movers to senior housing. Difficulty with this daily task could be one motivation for moving to senior housing among older adults. Getting in and out of bed is the third-most common type of difficulty experienced by older adults. The most common, difficulty driving, is experienced by a similar percentage of older adults (25% - 27%), despite their residential outcomes. The second-most common, difficulty walking, is experienced by about 20% of all older adults.

The third panel of Table 5.1 reports the mean number of health care establishments in respondents' zip codes by residential outcomes. The theoretical arguments presented in this paper suggest that older adults with greater geographic access to health care will be more likely to remain independent community-dwelling, compared to those with less access. However, the descriptive results do not identify differences in geographic access to health care among movers and non-movers to senior housing. Both groups have access to just over seven health services and one drug store or pharmacy for every 100 total establishments in their zip code. These findings are based on a sample of 3,957 person-intervals for non-movers and 96 person-intervals for movers to senior housing, so it is possible that with a larger sample size, statistically

significant differences may be identifiable. Furthermore, it is difficult to distinguish from these bivariate results the complex relationships between health, geographic access to health care, and residential outcomes. The association between proximity to health care services and residential mobility may be suppressed by other differences (such as health status) between those who remained independent community-dwelling and those who moved to senior housing. Two theoretical arguments and hypotheses have been presented, and in the following sections, they are tested in a multivariate framework.

Models of Sequential Effects

Table 5.2 reports results of a multivariate logistic regression model testing the predictions of the first and second hypotheses, which described a sequential relationship such that geographic access to health care leads to better or worse health which, in turn, affects the likelihood of moving to senior housing. Table 5.2, Model 1 reports results of a regression equation that excludes the health status variables. The health status variables are added into the second regression equation, presented in Table 5.2, Model 2, in order to test for mediating effects of health. The results of the first equation do not support the claim of the first hypothesis that greater geographic access to health care promotes independent community-dwelling. The number of health services ($\beta = 0.004$, $p > 0.05$) and the number of drug stores ($\beta = 0.276$, $p > 0.05$) in the respondents' zip code do not have statistically significant relationships with the likelihood of moving to senior housing versus remaining independent community-dwelling, net of other individual, household, and block group characteristics. When changes in health status by the following survey interval are entered into the regression equation, the results are hardly

affected (see of Table 5.2, Model 2). Although the theoretical argument stated that geographic access to health care would be followed by changes in health status (for example, limited access should lead to worse health), results of the regression model do not support this claim. According to the first hypothesis, we should see a statistically significant relationship between geographic access to health care and residential mobility when individual-level health status is not controlled, and according to the second hypothesis, we should see an attenuation of that relationship when individual-level health is entered into the model. But, the coefficient for geographic access to health care, which was not significant to begin with in Model 1, is changed little in Model 2 ($\beta = 0.012$, $p > 0.05$ for health services; $\beta = 0.246$, $p > 0.05$ for drug stores).[21] We should also see a significant relationship between changes in health status during the preceding survey interval and the likelihood of moving to senior housing. However, the relationships between changes in health status and residential outcomes, although in the hypothesized directions, are not statistically significant ($\beta = 1.275$, $p > 0.05$ for increased chronic conditions; $\beta = 1.246$, $p > 0.05$ for increased difficulty with ADLs). The coefficients likely represent conservative estimates of the effects of health on residential mobility, because the temporal lags of the variables presume that residential adjustments happen relatively quickly (within two years). But as it stands, this analysis does not provide statistical support for the first or second hypotheses.[22] This lack of support may imply that geographic access to health care is

[21] Comparing coefficients across differently specified logit models may be confounded by the problem of rescaling (see Karlson, Holm, and Breen 2012). To address the problem of rescaling, I estimated the reduced coefficients for geographic access to health services ($\beta = 0.068$; $p > 0.05$) and geographic access to drug stores ($\beta = 0.163$; $p > 0.05$) in Model 2, using the KHB method developed by Karlson, Holm, and Breen (2012). The reduced Model 2 coefficients can be compared more accurately to the Model 1 coefficients for geographic access to health services ($\beta = 0.004$; $p > 0.05$) and geographic access to drug stores ($\beta = 0.276$; $p > 0.05$). The substantive result, that the relationship between geographic access to health care and residential mobility is not attenuated by individual health status, is the same whether I utilize the full or reduced coefficients.

[22] I also estimated two additional models with different specifications for chronic conditions in order to test the sensitivity of these results. First, given the earlier evidence that residential adjustments to heart attacks and heart disease might be more immediate, I estimated a regression model predicting moves to senior housing with diagnoses

not a major factor affecting health status and ultimately, residential independence among older adults. The implications of these results and what they mean for policy action are discussed further in the concluding section. Next, I turn to the results testing the third hypothesis.

Models of Person-Environment Fit

Table 5.3 presents results of a multivariate logistic regression model testing the third hypothesis, which draws on the theory of person-environment fit, and posits interaction effects between health status and geographic access to health care. Table 5.3, Model 1 presents a regression model that includes interactions between the measures of geographic access to health care and the first measure of health status – whether the respondent has ever been diagnosed with a chronic health condition. The results of Model 1 in Table 5.3 lend support to the person-environment fit model and the third hypothesis. The statistical interaction between the number of health services in the respondent's zip code and whether they have been diagnosed with a chronic health condition is statistically significant ($p < 0.05$), suggesting that the relationship between health status and the likelihood of independent community-dwelling depends on geographic access to health care, above and beyond the other individual, household, and neighborhood characteristics that are controlled for in the regression model. The interaction between chronic health conditions and number of health services is graphed in Figure 5.2. In

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of these heart conditions, adjusting for the same individual, household, and neighborhood control variables. In this model, changes in whether the respondent had a heart condition did not predict moves to senior housing, and did not attenuate the relationship between geographic access to health care and moves to senior housing. Second, given that some chronic conditions are more debilitating and less treatable that others, I estimated a regression model predicting moves to senior housing with diagnoses of only the most serious conditions (cancer, diabetes, heart attack, heart disease, lung disease, mental loss, and stroke), again adjusting for the same individual, household, and neighborhood control variables. In this model, changes in whether the respondent had a serious chronic condition did not predict moves to senior housing, and did not attenuate the relationship between geographic access to health care and moves to senior housing.

Figure 5.2, the lines represent the predicted probability of moving to senior housing at different values for health services when all other covariates are held at their means, and the shaded areas represent the 95% confidence intervals around the predicted probabilities.

The interaction effect between geographic access to health care and health status reveals a relationship that is complex, but consistent with the third hypothesis. First, Figure 5.2 shows that the predicted probability of moving to senior housing peaks among older adults who have been diagnosed with a chronic health condition and live in a geographic area with no health services. These older adults (those with one or more chronic conditions and no health services in their zip code) have a predicted probability of moving to senior housing that is 0.025, which is higher than any other group of older adults (those with greater access to health care and those with no chronic conditions).

Second, among older adults with one or more chronic health conditions, the likelihood of moving to senior housing declines as the number of health services in the zip code increases. Referring to the coefficients in Table 5.3, Model 1 shows that each additional health service (per 100 total establishments) in the zip code reduces the odds of moving to senior housing by 6.3% ($e^{0.095 - 0.160} = 0.937$) among older adults with chronic health conditions. To further illustrate the difference, consider a few examples. The predicted probabilities graphed in Figure 5.2 reveal that older adults with one or more chronic conditions and 10 health services per 100 establishments in their zip code have a predicted probability of moving to senior housing that is nearly half that of otherwise comparable older adults with one or more chronic conditions and no health services in their zip code ((0.025 – 0.014) / 0.025 = 0.44). And older adults with one or more chronic conditions and 30 health services per 100 establishments in their zip code have a predicted probability of moving to senior housing that is nearly zero.

Finally, the interaction coefficients also indicate that the likelihood of moving to senior housing is greater for older adults with a chronic condition than for older adults with no chronic conditions, when geographic access to health care is limited. However, the difference between those with and without chronic conditions is reduced and eventually becomes non-significant under conditions of greater geographic access to health care. We can see this in the coefficient for chronic health conditions presented in Table 5.3, Model 1 ($\beta = 2.102$, $p < 0.05$), which describes the difference in the intercepts between those with and without chronic conditions when the number of health services is zero. We can also see this in Figure 5.2, where the solid line is substantially higher than the dotted line when the number of health services equals zero, and the 95% confidence intervals do not overlap. However, the difference between those with chronic conditions and no chronic conditions is not significant for all values of health services, as apparent by the overlapping confidence intervals in Figure 5.2, starting at values of about 10 health services per 100 total establishments. Above approximately 15 health services per 100 total establishments, those with and without chronic health conditions both have a predicted probability of moving to senior housing that is not statistically significantly different from zero.

In fact, at all values of health services, the predicted probability of moving to senior housing for those with no chronic conditions is fairly low. In Table 5.3, Model 1, we can see that the slope of the regression line for individuals with no chronic conditions is positive, but the standard error is large ($\beta = 0.095$, *s.e.* = 0.053). The uncertainty surrounding this slope can be better seen in Figure 5.2 by the large 95% confidence interval surrounding the dotted line. Furthermore, the majority of respondents with no chronic conditions are at the lower end of the distribution of number of health services (where the slope is not sharply positive). On average, those with no chronic conditions have access to 6.9 health services (per 100 total establishments)

in their zip code, and only 11 out of 458 respondents with no chronic conditions have more than 15 health services in their zip code. From this evidence, we can conclude that the relationship between number of health services and the probability of moving to senior housing among older adults with no chronic conditions is very uncertain, unlike the relationship among older adults with one or more chronic conditions which is clearly negative and statistically significant at lower values of health services. A potential implication of these findings is that geographic access to health care matters most for determining residential outcomes among older adults in worse health. In addition, expanding geographic access to health care may have diminishing returns when the number of health services is already high.

As mentioned earlier, one concern about these findings is that they may predict moves in general rather than moves to senior housing specifically. To address this concern, I estimated the same logistic regression equations predicting moves in general; results are presented in Table C.1 in Appendix C. The results indicate that the primary focal independent variables, the interactions between geographic access to health care and chronic health conditions, are not statistically significant predictors of moving in general. Moving in general is predicted by age, marital status, race, education, homeownership, years in residence, and region, so one must be cautious when interpreting the effects of these variables on moves to senior housing. However, we can be confident that the variables testing the person-environment fit model do in fact predict moves out of independent community-dwelling and into senior housing, and not just moving in general.

A second test of the person-environment fit model is presented in Table 5.3, Model 2, which includes interactions between the measures of geographic access to health care and the second measure of health status – whether the respondent had difficulty with one or more ADLs. In this regression model, the interactions between geographic access to health care and health

status (as measured by difficulty with ADLs) are not statistically significant ($p < 0.05$). These results do not provide support for the third hypothesis. Rather, they suggest that difficulty with ADLs may not be the most salient aspect of health when it comes to predicting residential outcomes. Potential reasons why chronic conditions predict moves to senior housing, but difficulty with ADLs do not predict moves, are discussed in the following section.

Discussion and Conclusions

Along with age, family composition, and socioeconomic status, health is a well-established and important predictor of moves out of independent community-dwelling and into senior housing (Silverstein and Zablotsky 1996; VanderHart 1998; Ermisch and Jenkins 1999; Robison and Moen 2000; Longino et al. 2002; Akamigbo and Wilinsky 2007; Sabia 2008; Wilmoth 2010). Increasingly, studies are also identifying important neighborhood predictors of moves to senior housing (Sabia 2008; Sergeant et al. 2010), but geographic access to health care has for the most part been left out of these studies, even though geographic access to health care is an important predictor of other aspects of health and well-being (Haynes 2003; Korda et al. 2007; Hiscock et al. 2008). Therefore, an important question has yet to be examined – does greater access to health care at the neighborhood level increase older adults' ability to live independently, and if so, is this because greater access prevents declines in health among older adults, because it allows older adults already in worse health easier access to the care they need, or both? To investigate this question, this study utilized multiple measures of health status and geographic access to health care to test two theoretical frameworks that describe relationships between health, geographic access to health care, and residential outcomes among older adults.

The first theoretical framework focused on sequential effects, arguing that geographic access to health care affects health, which, in turn, impacts older adults' ability to remain independent community-dwelling. The hypotheses arising from this theoretical framework posited that among older adults, geographic access to fewer health care resources leads to an increased likelihood of moving to senior housing, and that this relationship is mediated by individual health status. Statistical support for these hypotheses would present itself in a statistically significant relationship between geographic access to health care and residential mobility when individual-level health is not controlled, and the attenuation of that relationship when health status is entered into the regression equation. However, this statistical support is not found in the logistic regression models. But even the lack of support for the first and second hypotheses has important implications. The results suggest that geographic access to health care does not have a major effect on residential independence among older adults, and does not operate through health status. Residential outcomes among older adults may be more strongly preceded by other aspects of neighborhoods that promote good health, such as street connectivity and sidewalks (Li et al. 2005; Freedman et al. 2008); and proximity to services and parks (Giles-Corti and Donovan 2002; Li et al. 2005), grocery stores (Kubzansky et al. 2005), and alcohol and fast food outlets (Britt et al. 2005; Lopez 2007).

The second theoretical framework drew on the theory of person-environment fit, and posited that the combination of health status and geographic access to health care is an important predictor of moves to senior housing. I hypothesized that older adults in poor health and who have limited geographic access to health care would be especially likely to move to senior housing, compared to other older adults. Support for this hypothesis was found in the interactions between diagnoses of chronic health conditions and the number of health services in

respondents' zip codes. These results suggest that when it comes to residential outcomes among older adults, geographic access to health care matters most for those who need it most. The probability of moving to senior housing was highest among older adults with chronic conditions and no health care services in their zip code. The addition of just one health care service would reduce the odds of moving to senior housing by 6.3%. At 15 health services per 100 establishments, the probability of moving to senior housing is nearly zero, even for those with a chronic condition. These results highlight the important effect of geographic access to health care for those with chronic conditions, but geographic access to health care does not matter equally for everyone. For older adults with no chronic conditions, geographic access does little to affect their odds of moving to senior housing, which are already quite low to begin with.

There are many ways to measure health status, and one strength of this study is that it utilized two separate measures of health status – diagnoses of chronic conditions and difficulty with ADLs. All of the statistically significant results centered around diagnoses of chronic conditions, which leaves one to wonder why difficulty with ADLs was not also a predictor of moves to senior housing. Even though the rates of reporting at least one ADL difficulty differed among those who remained independent community-dwelling and those who moved to senior housing, the regression results suggest that difficulty with ADLs may not be the most salient aspect of health when it comes to predicting residential outcomes. Part of this may be related to the way the ADL questions were asked in the PSID. Respondents were asked whether they have difficulty with various ADLs by themselves and without special equipment (with the exception of difficulty driving, which was proxied by whether the respondent is a usual driver). Therefore, these questions did not take into account that many ADL difficulties can be managed with special equipment. For example, difficulty walking may be quite manageable with the use of a

cane, walker, or wheelchair, and by outfitting the respondent's residence to be accessible to those with difficulty walking. Research into disability among older adults has found that with special equipment, many adults can overcome difficulties with various tasks and do not consider themselves "disabled" at all (Wolf, Hunt, and Knickman 2005). Results predicting residential outcomes might be different if the ADL questions asked older adults whether they have difficulty with ADLs, even with the help of special equipment or other individuals. Similarly, the measure of respondents' driving ability could be improved by asking respondents whether they limit the number of trips, the time of day they drive, or their choice of destinations because of health-related reasons.

Despite potential weaknesses in the measurement of difficulties with ADLs, this study did uncover some interesting findings about how individual and environmental characteristics combine to affect outcomes for older adults. Collectively, the results of this study have important policy implications. Increasingly, neighborhood-level interventions are being considered as part of policies seeking to promote independent community-dwelling and aging in place among older adults (for example, see The National Aging in Place Council, 2014). Expanding geographic access to health care is one such intervention that needs to be applied cautiously in order to make the best use of limited resources. The results suggest that expanding geographic access to health care, as a uniform strategy, will probably not do much to help older adults retain residential independence. To be more effective, expanding geographic access to health care should be targeted efforts that focus on neighborhoods with a high density of older adults with chronic health conditions, and neighborhoods that do not already have more than 10 to 15 health services per 100 total establishments. These targeted efforts would not only provide the maximum

benefit, they would also have the potential to reduce inequalities in residential outcomes for older adults.

TABLES

Table 5.1: Percentages, Means, and Standard Deviations for Health Variables by Residential Transitions

	Remained Independent Community-Dwelling		Moved to Senior Housing		
	% / Mean	SD	% / Mean		SD
1. Chronic Health Conditions					
Ever diagnosed with one or more chronic health conditions	88.0 %	(32.5)	97.0 %	**[a]	(17.1)
Number of chronic health conditions	2.25	(1.59)	2.33		(1.40)
Ever diagnosed with…					
Arthritis	52.9 %	(49.9)	49.6 %		(50.0)
Asthma	7.8 %	(26.8)	4.4 %		(20.6)
Cancer	20.2 %	(40.2)	18.6 %		(38.9)
Diabetes	18.1 %	(49.4)	13.8 %		(36.5)
High blood pressure	57.8 %	(49.4)	59.4 %		(49.1)
Heart attack	14.2 %	(35.9)	17.2 %	*	(37.7)
Heart disease	22.2 %	(41.6)	26.2 %	*	(44.0)
Lung disease	9.4 %	(29.2)	10.7 %		(31.0)
Mental loss	5.1 %	(22.0)	9.9 %		(29.9)
Stroke	12.0 %	(32.4)	15.8 %		(36.5)
2. Difficulty with Activities of Daily Living (ADLs)					
Has difficulty with one or more ADLs	39.5 %	(48.87)	50.5 %	*	(50.01)
Number of difficulties	0.77	(1.35)	0.92		(1.37)
Difficulty with…					
Bathing	6.7 %	(25.0)	8.9 %		(28.4)
Dressing	4.5 %	(20.7)	7.5 %		(26.3)
Eating	1.0 %	(10.1)	1.0 %		(9.9)
Getting in/out of bed	9.1 %	(28.8)	17.8 %	**	(38.3)
Walking	21.1 %	(40.8)	19.9 %		(39.9)
Getting outside	6.8 %	(25.2)	6.8 %		(25.1)
Using the toilet	3.0 %	(16.9)	3.1 %		(17.4)
Driving[b]	24.5 %	(43.02)	27.0 %		(44.41)
3. Geographic Access to Health Care					
Number of health services per 100 establishments	7.28	(5.61)	7.01		(4.08)
Number of drug stores per 100 establishments	0.69	(0.52)	0.71		(0.53)
N of respondents	1186		96		
N of person-intervals	3957		96		

[a] Table reports results of a one-tail test that means for chronic conditions and ADLs for those who remained independent community-dwelling are smaller than means for movers to senior housing. The table also reports results of a one-tail test that means for number of health services and drug stores for those who remained independent community-dwelling are larger than means for movers to senior housing. Significance levels of the one-tail test are: * $p < .05$, ** $p < .01$, *** $p < .001$.

[b] Difficulty driving is measured with a proxy variable – whether the respondent was not the usual driver of any of the household's vehicles.

Table 5.2: Logistic Regression Models Predicting Moves to Senior Housing with Sequential Effects of Geographic Access to Health Care and Individual Health Status

	Moved to Senior Housing vs. Remained Independent Community-Dwelling					
	Model #1			Model #2		
	β		(robust s.e.)	β		(robust s.e.)
Geographic Access to Health Care						
# health services per 100 estb. in zip code at time $t-1$	0.004		(0.031)	0.012		(0.032)
# drug stores per 100 estb. in zip code at time $t-1$	0.276		(0.247)	0.246		(0.253)
Change in Health Status						
Increased chronic health conditions from time $t-1$ to time t (1=yes)	--			1.275		(1.093)
Chronic health condition at time $t-1$ (1=yes)	--			1.246		(0.886)
Increased difficulty with ADLs from time $t-1$ to time t (1=yes)	--			0.154		(0.445)
Difficulty with ADLs at time $t-1$ (1=yes)	--			0.192		(0.298)
Individual/Household Characteristics						
Age	0.039	*	(0.018)	0.035		(0.018)
Married (1=yes)	-0.319		(0.359)	-0.306		(0.052)
Number of children	0.032		(0.052)	0.035		(0.052)
Number in family unit	-0.389		(0.246)	-0.423		(0.247)
Race/Ethnicity (ref=white, non-Hispanic)						
Black, non-Hispanic (1=yes)	-0.904		(0.683)	-0.946		(0.678)
Hispanic, any race (1=yes)	0.523		(0.650)	0.573		(0.657)
Other (1=yes)	-1.507	*	(0.751)	-1.513	*	(0.751)
Family income (ln)	0.046		(0.140)	0.059		(0.139)
Years of schooling	0.138	**	(0.042)	0.139	**	(0.042)
Employed (1=yes)	-0.537		(0.412)	-0.502		(0.417)
Own home (1=yes)	0.234		(0.428)	0.228		(0.420)
Single-family home (1=yes)	-0.233		(0.353)	-0.222		(0.356)
Years in residence over previous 10 years	-0.126	***	(0.031)	-0.120	***	(0.031)
Block Group Characteristics						
Urban Category (ref=suburban)						
Urban	0.480		(0.363)	0.487		(0.357)
Rural	-0.646	*	(0.324)	-0.603		(0.327)
Population	0.089		(0.050)	0.084		(0.050)
% poor	0.013		(0.013)	0.012		(0.013)
% older adults	0.004		(0.022)	0.005		(0.022)
# residential services in zip code at time $t-1$	0.019		(0.121)	0.037		(0.117)
Region (ref=West)						
Northeast	-0.230		(0.412)	-0.269		(0.412)
Midwest	0.203		(0.330)	0.167		(0.332)
South	-0.911	*	(0.403)	-0.949	*	(0.407)
Constant	-7.399	***	(2.083)	-8.599	***	(2.242)
N of respondents	1087			1087		
N of person-intervals	3158			3158		

*p<0.05; **p<0.01; ***p<0.001

Table 5.3: Logistic Regression Models Predicting Moves to Senior Housing with Interactions between Geographic Access to Health Care and Individual Health Status

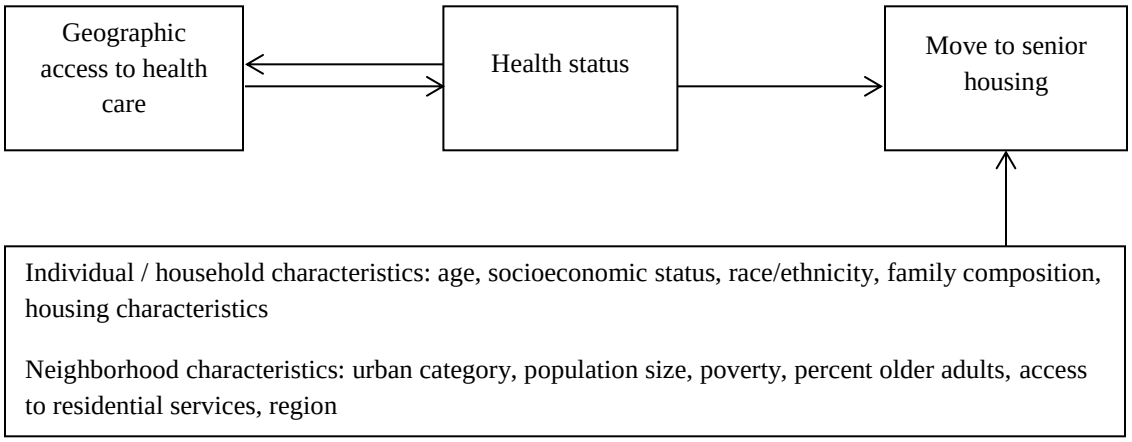
	Moved to Senior Housing vs. Remained Independent Community-Dwelling					
	Model #1			Model #2		
	β		(robust s.e.)	β		(robust s.e.)
Geographic Access to Health Care						
# health services per 100 estb. in zip code	0.095		(0.053)	-0.079		(0.089)
# drug stores per 100 estb. in zip code	-1.244		(1.201)	0.119		(0.336)
Health Status						
Chronic health condition (1=yes)	2.102	*	(0.989)	1.235	*	(0.610)
Difficulty with ADLs (1=yes)	0.257		(0.252)	-0.428		(0.795)
Access to Health Care – Health Status Interactions						
# health services * chronic health condition	-0.160	*	(0.066)	--		
# drug stores * chronic health condition	1.397		(1.219)	--		
# health services * difficulty with ADLs	--			0.093		(0.099)
# drug stores * difficulty with ADLs	--			-0.001		(0.434)
Individual/Household Characteristics						
Age	0.044	**	(0.017)	0.044	**	(0.016)
Married (1=yes)	-0.319		(0.324)	-0.305		(0.325)
Number of children	0.079		(0.049)	0.076		(0.047)
Number in family unit	-0.517	*	(0.248)	-0.549	*	(0.245)
Race/Ethnicity (ref=white, non-Hispanic)						
Black, non-Hispanic (1=yes)	-0.506		(0.546)	-0.431		(0.545)
Hispanic, any race (1=yes)	0.335		(0.679)	0.641		(0.648)
Other (1=yes)	-1.861	*	(0.766)	-1.706	*	(0.741)
Family income (ln)	0.109		(0.130)	0.089		(0.127)
Years of schooling	0.150	***	(0.042)	0.142	**	(0.041)
Employed (1=yes)	-0.635		(0.386)	-0.600		(0.379)
Own home (1=yes)	-0.288		(0.367)	-0.134		(0.370)
Single-family home (1=yes)	-0.095		(0.311)	-0.186		(0.316)
Years in residence over previous 10 years	-0.108	***	(0.029)	-0.107	***	(0.029)
Block Group Characteristics						
Urban Category (ref=suburban)						
Urban	0.256		(0.306)	0.299		(0.302)
Rural	-0.902	**	(0.274)	-0.833	**	(0.294)
Population	0.096	*	(0.039)	0.092	*	(0.043)
% poor	0.003		(0.012)	0.002		(0.013)
% older adults	0.008		(0.018)	0.006		(0.019)
# residential services in zip code	0.025		(0.105)	0.056		(0.107)
Region (ref=West)						
Northeast	-0.259		(0.356)	-0.322		(0.374)
Midwest	-0.067		(0.304)	-0.130		(0.314)
South	-0.488		(0.323)	-0.550		(0.316)
Constant	-9.730	***	(2.507)	-8.415	***	(2.198)
N of respondents	1211			1211		
N of person-intervals	4053			4053		

*p<0.05; **p<0.01; ***p<0.001

FIGURES

Figure 5.1: Heuristic Conceptual Frameworks of the Influence of Health Care Access on Residential Mobility among Older Adults

1. Sequential Effects



2. Person – Environment Fit

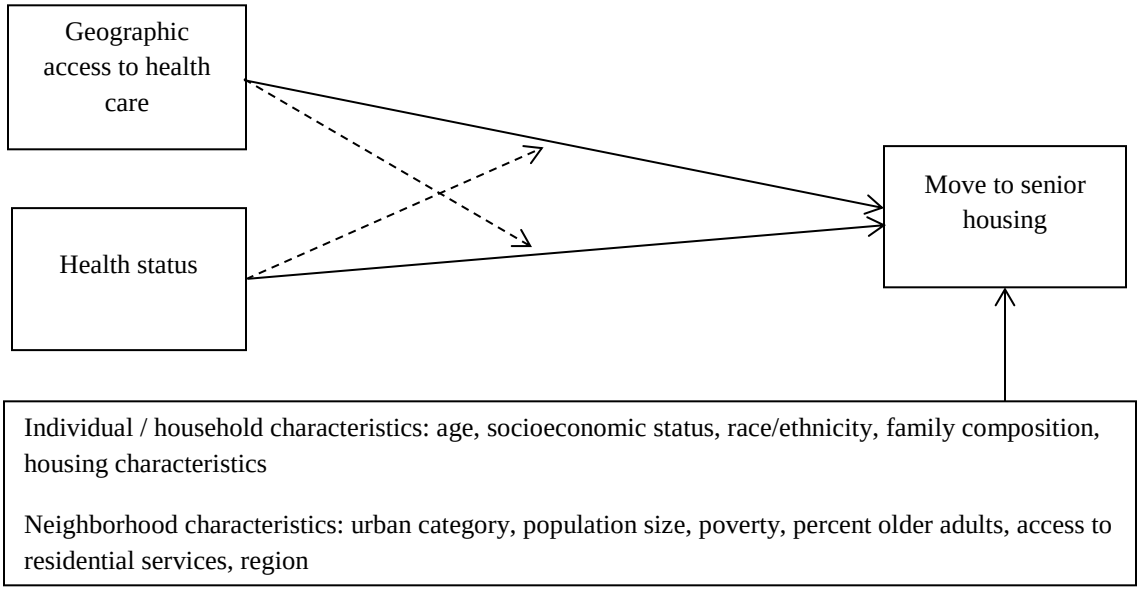
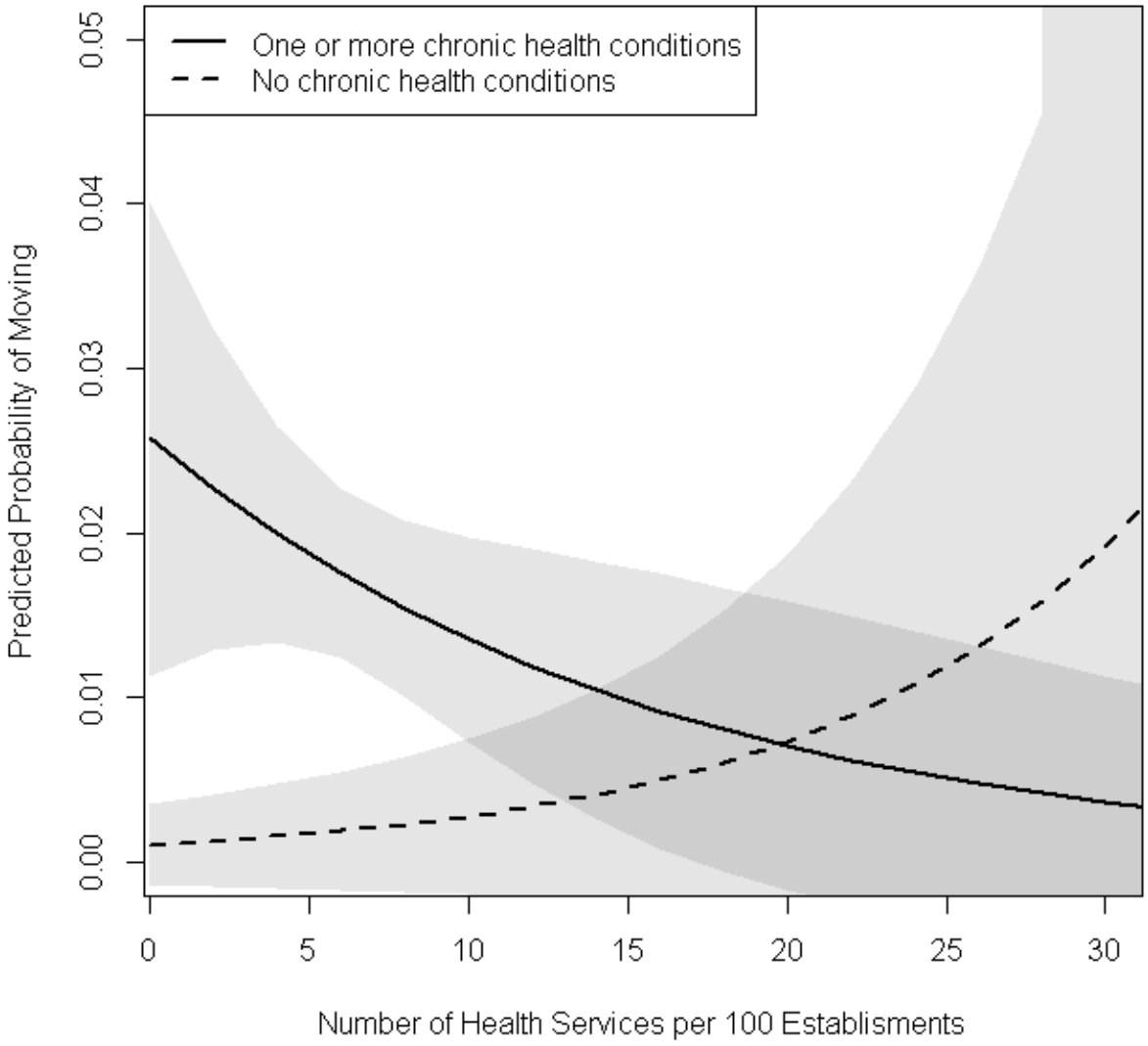


Figure 5.2: Marginal Predicted Probability of Moving to Senior Housing by Number of Health Service Establishments in Zip Code, with 95% Confidence Intervals [a]



[a] Shaded areas represent 95% confidence intervals. All other covariates are held at their means values.

CHAPTER 6

Conclusions: Evidence of Neighborhood Effects on Residential Living Arrangements among Older Adults

Summary and Discussion of Main Findings

This project has examined in-depth the relationships between neighborhood environment and adjustments in residential living arrangements among older adults. I utilized a longitudinal framework relying on approximately twenty years of data on the same individuals, as they transitioned out of independent community-dwelling and into senior housing. The research questions guiding each chapter of the dissertation reflected ideas and concepts about neighborhood effects, and interactions between individuals and their neighborhood environments. Overall, findings about individual-level determinants of residential mobility and living arrangements were consistent with previous research, and the findings about neighborhood-level determinants represent novel contributions to the study of environments and aging.

Consistent with prior research, the likelihood of moving to senior housing versus remaining independent community-dwelling increased with age, but was lower for older adults who had higher incomes, lived with more people in the family unit, owned their home, and had lived in their home for a longer duration. Moreover, moves to senior housing were more likely among older adults in fair or poor health compared to those in good or excellent health. And among movers to senior housing, individuals who were older, unmarried, and in fair or poor health were more likely to choose assisted-living facilities over retirement communities as their senior housing destinations. That age, health, and marital status were stronger predictors of

moves to assisted-living is consistent with arguments that moves to retirement communities tend to be more amenity-driven whereas moves to assisted-living tend to be driven by the provision of care (Silverstein and Zablotsky 1996; Wilmoth 2010). The consistencies between the individual-level predictors of moves to senior housing in this study and in previous research (Silverstein and Zablotsky 1996; VanderHart 1998; Ermisch and Jenkins 1999; Robison and Moen 2000; Longino, Perzynski and Soller 2002; Akamigbo and Wilinsky 2007; Sabia 2008; Wilmoth 2010) lend some initial validity to the overall findings.

Most previous research on the determinants of residential outcomes among older adults has not moved beyond the individual level, as studies in this area have only just begun to incorporate ecological variables (Sergeant et al. 2010; Sabia 2008). The lack of ecological studies of residential outcomes in later life represents a problematic gap in the literature, because it is well-established in other areas of research that neighborhoods matter for other aspects of health and well-being (Diez-Roux 2011; Sampson, Morenoff, and Gannon-Rowley 2002; Kawachi and Berkman 2003; Galster 2012). One of the main goals of this project was to identify features of neighborhoods that matter for older adults. The evidence of neighborhood effects uncovered in this project represent novel contributions that have the potential to influence future research and policy surrounding residential outcomes in later life. The main findings regarding neighborhood effects are summarized below.

The Urban/Suburban/Rural Divide and the Effects of Sprawl

First, this study found in Chapter 3 that the likelihood of moving to senior housing varied across urban, suburban, and rural neighborhoods. More specifically, the odds of moving to senior

housing were highest among suburban seniors, and suburban seniors were the least likely to remain independent community-dwelling as they aged. The lower rates of independent living in the suburbs supports arguments made by several critics of the suburban-style of development that suburbs are "inhospitable" locations for older adults because they often lack walkable neighborhoods, transportation, and physical and social resources (Laws 1993; Duany et al. 2000; Frumkin 2002). Many suburbs have begun to transform themselves by adding in these features (Ehrenhalt 2012), but many more are still characterized by the features of sprawl.

To further test arguments that the features of sprawl impact residential independence, Chapter 3 also examined the role of specific neighborhood characteristics. The findings indicated that two aspects of sprawl in particular created environments that inhibited residential independence among older adults. The first was large blocks. The underlying explanation for this finding is that larger blocks make the neighborhood less walkable, by increasing distances between destinations, encouraging driving over walking, and emptying the streets of pedestrians making walking feel less safe and more isolating (Jacobs 1961). The importance of walkability supports Hodge's (2008) theoretical arguments that transportation is one facet of the community that creates security of housing for older adults. Perhaps unanticipated by Hodge's theory, walkability was more important for older adult independence than public transportation. Although theoretically unexpected, this finding is consistent with reports from older adults. In a poll recently conducted by the AARP, nearly half of older adults in the sample said that being somewhere where it is easy to walk was *extremely* or *very important* for their ability to continue living in their same home and community, whereas only one-fifth of respondents reported that being near transit (bus or rail) was *extremely* or *very important.* Thus, it is the very localized

characteristics of neighborhoods (i.e. characteristics of the blocks right outside the individual's home) that seem to matter most.

The second characteristic associated with sprawl that played a significant role in older adult residential independence was the lack of neighborhood services, particularly, drug stores. On their own, these multi-purpose stores where older adults can fill prescriptions and purchase daily necessities seem to facilitate independence. But, the effect of drug stores also likely represents a bigger picture, indicating that neighborhoods that provide access to physical resources and services, especially those that are particularly salient to older adults, facilitate independence.

One finding that proved difficult to explain was the persistent, positive association between living in a rural area and residential independence. Rural older adults had the lowest likelihood of moving to senior housing compared to urban and suburban residents, and they were the most likely to remain independent community-dwelling. This finding was remarkably consistent across all analyses, no matter what other variables were included in the model. I explored multiple explanations for this so-called "rural effect", including the possibility that rural adults lived in closer proximity to family members who could provide support, and that older adults who were more likely to remain independent were more likely to select rural residences. However, no convincing explanation of the rural effect emerged, and the question of why rural older adults are more likely to remain independent community-dwelling remains to be answered in future research.

Effects of Proximity to Kin

According to theoretical arguments made by Lawton (1980) and Hodge (2008), it is not only neighborhood structure and access to physical resources that matter for older adults, but also the social environment. Decades of research has established that social ties and social support are positively and causally linked to mental health, physical health, and longevity, and older adults may be even more reliant on social networks than younger adults for help with daily needs (Thoits 2011). Although the important functions of social support are well-documented, no prior empirical study has examined whether support from family members who live in separate households helps older adults maintain residential independence as they age. In Chapter 4, I relied on detailed geographic data for older adults and their kin afforded by the PSID to test the effect of proximity to adult children and other relatives. The results provided strong evidence that residential outcomes are influenced by proximity to family members, in particular, adult children. The farther older adults lived from their closest child (up to about 1,000 miles), the more likely they were to transition out of independent community-dwelling and into senior housing.

I also hypothesized that the effect of kin would be stronger in rural areas compared to urban or suburban areas, based on prior studies demonstrating that kin networks of rural residents were more intense and multiplex compared to more urban residents (Beggs, Haines, and Hurlbert 1996), but these expectations were not borne out in the data. The empirical results were more in line with the arguments of Lichter and Brown (2011), who have said that rural family life looks remarkably similar to family life in urban areas today.

The evidence that family support influences residential independence is particularly interesting considering that the structure of the American family has been changing. Declining fertility rates mean that older adults in the future will have fewer children and smaller kin networks compared to older adults in the past. Given these changes, will our theoretical understanding of the role of family support need to change? Perhaps the relationship will become stronger, and the divide between those who have access to family support and those who do not will become increasingly stark. Or, perhaps the relationship between family support and residential outcomes will weaken, if alternative types of support (such as interventions to increase walkability and access to physical resources) are increased in order to mitigate the effect of declining family support, or if we establish ways of purchasing and delivering instrumental support.

Effects of Geographic Access to Health Care

The findings for walkability, physical resources, and proximity to kin support the ideas put forth by Lawton (1980), Speare (1974), and Hodge (2008) that environmental characteristics are important determinants of residential mobility. But the core of their theoretical arguments centered on the interaction between environmental and individual characteristics. A test of person-environment interactions was presented in Chapter 5, which investigated whether the effect of geographic proximity to health care depends on individual health status. The findings supported Lawton's theory of person-environment fit and as well as related stress-threshold models (Spreare 1974). Older adults in the direst circumstance – those that were in poor health and lived in a neighborhood with limited access to health care – were more likely to lose

residential independence and move to senior housing than other older adults. These findings highlight how understanding neighborhood effects sometimes involves understanding the interplay between individual and environmental characteristics. Not every feature of the environment will create the same sort of impact on every older adult; instead, for some environmental features, it is the combination of the two that matters most. A similar framework could be applied to explore other person-environment interactions. For example, perhaps access to public transportation matters only for those who cannot drive, or proximity to kin matters most for individuals who live alone. Additional tests such as those would further strengthen the evidence for theories of person-environment fit and contribute to explanations of residential mobility.

Contributions

Research and Methodological Contributions

The main research contribution of this project was to move the study of residential mobility among older adults beyond the individual and household level, by incorporating the neighborhood context. Collectively, the findings demonstrated that neighborhood context matters for outcomes related to health and well-being, even in old age (and perhaps even more so compared to younger ages). Furthermore, the significance of the person-environment interactions suggest that models predicting residential mobility of older adults may be misspecified if they do not consider the effects of neighborhood context alongside individual characteristics.

This project also made an important methodological contribution by teasing apart the predictors of moving to retirement communities versus assisted-living facilities. Several studies have predicted moves to one or the other (Akamigbo and Wolinsky 2006; Sergeant et al. 2010), without considering that individuals are first "selected" into the category of individuals who choose to move to senior housing, before deciding upon a senior housing destination. As a result, the empirical findings of these studies may be inaccurate because they do not account for selection bias. Chapters 3 and 4 addressed the selection effect by first modeling moves to senior housing, and then incorporating a correction for selection bias in a second model predicting senior housing destination choice. The findings indicated that unlike the decision to move to senior housing, the decision to move to a retirement community versus an assisted-living facility was not driven by neighborhood characteristics. Thus, the influence of neighborhood characteristics seems to be limited to the decision of whether or not to move. The choice of a destination (a retirement community versus an assisted-living facility) is primarily an individual-level process that is driven especially by age, health, and marital status.

Finally, this study made an important methodological contribution by comparing the predictors of moving to senior housing to the predictors of moving in general. Studies that only predict moves to senior housing without also predicting moving in general are limited in the conclusions that can be drawn from their results (Silverstein and Zablotsky 1996; Akamigbo and Wolinsky 2007). We cannot be certain from the results of these studies that the important determinants of moving to senior housing are not, in fact, actually just predicting greater overall mobility. By comparing the results of models for movers to senior housing to models for all movers, I found that several variables predicted both types of moves – rural location, age, number in the family unit, homeownership, years in residence, health status, and distance to kin

– but the relationships were stronger for moves to senior housing. Thus, the effects of these variables on moves to senior housing need to be interpreted with caution. For example, any study claiming that homeownership decreases the likelihood of moving to senior housing would be correct, but they should also mention that in part, this effect is due to the fact that homeowners are less likely to move in general. I also identified several predictors that were unique to senior housing – living in a single-family unit, family income, block size, and geographic access to drug stores and health services. By considering both types of mobility simultaneously, this study was able to make a greater contribution to understanding differences in residential outcomes among mobile older adults.

Policy Implications

Beyond the contributions to research and methodology, this project also made contributions to policy and practice surrounding housing for older adults. First, if a policy goal is to help older adults remain in their homes, the overall findings suggest that we may need to rethink structures for providing financial assistance to older adults in the U.S. The main sources of financial assistance, Social Security and Medicare, currently do not support aging-in-place as a long-term housing option. The average Social Security monthly payment ($1,294 in 2013) is not nearly enough to cover all of an individual's needs, plus pay for options to make living at home easier like home modifications and in-home care. Older adults with supplemental income will fare better, but Social Security is the major source of income for most older adults (US Social Security Administration 2014).

Medicare is the main provider of health insurance for Americans aged 65 and older, but the rules about what costs are covered currently discourage aging-in-place. Medicare does not cover the costs of home health care if the person needs more than part-time or "intermittent" skilled nursing care (care for 7 days a week, or more than 8 hours a day over a period of 21 days), making institutionalization (which is covered) the more attractive option, at least financially, for individuals who need frequent skilled nursing care (US Department of Health and Human Services 2014). For individuals who need assistance but require less intensive care, Medicare does not cover "basic custodial care" like meals delivered to the home, homemaker services like shopping, cleaning, and laundry; and personal care like bathing, dressing, and using the bathroom. Basic custodial care is also not always covered at an assisted-living facility or nursing home either. But, to the extent to which forgoing basic custodial care in order to save on costs eventually creates more serious health problems that require skilled nursing care, the structure of Medicare actually encourages institutionalization. Older adults seeking financial assistance for remaining in their homes currently need to rely on supplementary funding programs like the USDA's Home Repair Loan and Grant Program and Medicare's specialized "Program for All-Inclusive Care for the Elderly", which are only available in very limited geographic areas, and only to select individuals. To better align policy practices in the U.S. with older adults' residential preferences, a better solution may be to change Medicare rules to provide funds for a wider variety of housing and care options.

Another avenue for policy intervention is at the neighborhood level. The findings show that neighborhood features matter for residential outcomes among older adults, above and beyond individual finances, and other individual characteristics like race, socioeconomic status, and health. Most existing supports for older adult residential independence focus on home

modification and repair, even though the environment outside the home matters as well. Attempts to expand access to physical resources like drug stores and health care services would be beneficial to older adults. This is, in part, what programs like "Villages" and Naturally-Occurring Retirement Communities attempt to provide. But so far, these programs have only been implemented on a small scale in a select number of neighborhoods. Additional funding for these programs could be used to expand them to more geographic areas and a greater number of older adults.

Of course, not all the predictors of moves to senior housing are equally amendable to policy intervention. Family support and proximity to kin is one area in which policy intervention is very unlikely. The trend towards smaller families in the U.S. and the rising number of childless older adults will become an interesting dilemma for residential independence. The impact of declining family support may be able to be mitigated by expanding neighborhood supports for older adults. For example, perhaps programs like Villages and Naturally Occurring Retirement Communities could waive or reduce the annual fee for older adults without children (or at least, without children in close proximity).

Thinking on a grand scale, older adults could perhaps benefit the most from rethinking how we, in the U.S., design neighborhoods from the get-go. Interventions like Villages and Naturally Occurring Retirement Communities are primarily attempting to replicate a "village" or "community" feel in places where it does not exist. But, we already know of many neighborhood features that create the "village" feel naturally – small blocks, mixed-use zoning, diversity of housing, and spaces for recreation and public gathering. Neighborhoods with these features are likely to benefit older adults while also creating positive externalities for residents of all ages. Furthermore, they are neighborhoods that fulfill the needs of multiple life stages, so that

individuals can remain in the same neighborhood as they age rather than moving to a new location and disrupting their lives and social networks. Rather than intervening in neighborhoods on a case-by-case basis, the most impact could probably be made by taking a step back and thinking about the bigger picture – designing neighborhoods for all stages of life.

Study Limitations

No research is without its limitations, and this study is no exception. One of the major difficulties in this and other studies of neighborhood effects is the problem of selection. The basic problem of selection bias is that we do not know that neighborhood differences in individual outcomes are the result of neighborhood factors, rather than the differential selection of individuals into certain neighborhoods (Sampson, Morenoff, and Gannon-Rowley 2002; Ludwig et al. 2008). Almost every neighborhood study identifies selection bias as a research limitation. Selection bias can best be overcome with experimental study designs, such as the Moving to Opportunity study. But in observational studies such as this one, the options for dealing with selection bias are less ideal. The approach I used was to control for individual variables that are known to correlate with the outcome of interest (moving to senior housing) and potentially with the choice of a neighborhood, including age, race and ethnicity, marital status, family composition, education, employment, homeownership, and health. The extensive list of controls, coupled with the fact that I do not think there are strong theoretical reasons to expect that residential living arrangements are strongly endogenous with an older adults' initial choice of neighborhood, leads me to believe that any remaining selection effect is small.

Another limitation of this study is the potential for omitted variable bias. There are two potentially interesting characteristics of the home environment that were omitted from the study because they were not measured in the PSID. First, this study could have benefitted from additional measures of respondents' home environments, for example, whether the home is single or multiple stories, whether it includes features (like ramps or wider doorways) that make it accessible to people with difficulty walking, and whether the home is in good condition or needs repair. It is unfortunate not to have these measures because they may be associated with neighborhood characteristics (for example, urban/suburban/rural location) and also with the likelihood of independent community-dwelling. Although direct measures would have been preferable, the omission of these variables is unlikely to have substantially affected the results because the regression models include variables that are likely to predict the omitted home environment variables, such as homeownership, family income, and whether the home is single or multi-family. Similarly, this study could have benefitted from direct measures of whether the older adult is receiving in-home care from a family member, a friend, or a paid provider. Again, the omission of these variables is unlikely to have substantially affected the results, since variables that are likely to predict in-home care are included in the regression models (including the number of individuals in the family unit, number of children, and family income). But again, direct measures would have been preferable.

A final limitation is that this study was unable to examine an interesting group of older adults – those that decided to transition out of independent community-dwelling and moved in with a family member (usually an adult child). This is a relatively rare living arrangement in the U.S., as less than 7% of all adults age 65 and older live in the home of an adult child (Taylor et al. 2010). Today, even when an older adult is unmarried or becomes widowed, they are much

more likely to live on their own than to move in with family members (Klinenberg 2012). Nevertheless, older adults who move in with family would be an interesting group to include in the sample, not only because including them would increase the representativeness of the study, but also because it would be interesting to see if moving in with family is preceded by the same neighborhood-level catalysts as moving to senior housing.

Future Research

The findings of this study leave open several questions for future research, some of which can be addressed with additional analyses of older adults in the PSID, and some that will require alternative data sources or new data collection. The first question that would be interesting for future research is: *what neighborhood or individual characteristics can explain the persistent finding that rural residents are less likely to move to senior housing than urban or suburban residents?* The rural effect was a consistent finding across chapters, and could not be explained by variables in the model, including a variety of neighborhood characteristics and measures of family support. What, then, explains the rural effect? As previously suggested, it may be a supply-side effect. In other words, if there are fewer senior housing options in rural areas, rural older adults may opt to stay in their current residence rather than undergo a long-distance move to senior housing. I somewhat addressed this possibility by including a control measure for the number of residential services (which includes assisted-living facilities) in respondents' zip codes. But, the supply-side argument could be explored further with data on the geographic availability of retirement communities. It may be difficult to obtain retirement community data on a national scale, since housing that falls into the category of "retirement communities" is

extremely varied and does not require a state license to operate. But, researchers might begin by exploring this question in a localized area for which data could be more easily obtained.

Future research could also ask: *what other characteristics of neighborhoods matter for residential independence among older adults?* The characteristics in this study are not necessarily the only important features of neighborhoods that matter for older adults. Future research could look into how crime in the neighborhood affects independence. For example, older adults who are fearful of crime in their neighborhood may be afraid to leave their homes, which could lead to social isolation, declines in health, and eventually, earlier moves to senior housing. Equally difficult to obtain as crime data, but equally worthwhile to study, would be interactions between neighbors. For example, older adults who live in neighborhoods where the neighbors regularly check in on one other, do favors for each other, and spend time socializing may be at an advantage when it comes to maintaining residential independence. Neighbor social networks may even help to explain why duration in residence was consistently an important predictor of moves to senior housing in this analysis.

Another question for future research is *what are the long-term, cumulative effects of neighborhood environment on residential independence in old age?* Such a study would describe how long-term exposure to neighborhoods that lack physical resources, family support, or are otherwise disadvantaged contributes to residential outcomes at older ages. Cumulative models could be compared to the results of this analysis to see how the effect of cumulative exposure compares to exposure over only the past one or two years. Doing so would build a greater understanding of the length of time it takes for neighborhood effects to be realized, and answer questions such as: is residential independence most affected by characteristics of respondents'

current neighborhoods, or is the sum of all the years of exposure to certain neighborhood conditions more important?

Lastly, it would be interesting for future research to ask: *what are the implications of age-segregated senior housing on conventional neighborhoods and communities?* I have argued that older adults are a potential resource for their communities, so what is the impact on communities when this resource is taken away? Future research could compare communities that have retained their older adult population with those that tend to lose their older adult population. Are those that keep their older adults somehow better off? Do the additional "eyes-on-the-street" help prevent crime, and do the additional consumers help keep small businesses alive? Do older adults tend to facilitate social connections between neighbors? These questions could be addressed in a quantitative or qualitative fashion, or perhaps a combined approach.

Concluding Remarks

Collectively, the findings indicate that where you live matters for residential outcomes as you age, and is an especially important concern if you desire to remain living independently in a conventional neighborhood for as long as possible. Both the physical and social environment of the neighborhood exert important impacts that affect one's chances of living independently or moving to age-segregated senior housing. Currently, there are few effective policies to help older adults retain residential independence, but there are potential avenues for intervention. Future research on the topic of housing among older adults is needed to further understand the links between neighborhood environment, individual and household characteristics, and impacts of age-segregated senior housing on conventional communities. In building up this research, it is

important to keep in mind that older adults are a diverse group with a variety of needs and preferences that are likely to change as they age, and may even change with each generation. Therefore, research in this area needs to be on-going, and should study independent community-dwelling alongside all of the other senior and non-senior specific housing options. For it is in providing housing options, equal access to those options, and equality in the ability to fulfill one's residential preferences, that would represent a truly successful model of housing an aging society.

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APPENDIX A

Supplementary Analysis for Chapter 3

Table A.1: Logistic Regression Models Predicting Moves to Senior Housing among Older Adults, by Alternative Definitions of Block Group Urban Category

	Moved to senior housing vs. remained in independent community-dwelling		
Model	β		(robust s.e.)
1. Metro principal city/suburb/rural (ref=metro principal city) - *chosen model*			
Suburban	0.325	*	(0.163)
Rural	-0.145		(0.163)
Age	0.093	***	(0.008)
Constant	-10.627	***	(0.661)
2. Metro/micro/non-core (ref=metro county)			
Micropolitan county	-0.280		(0.216)
Non-core county	-0.110		(0.151)
Age	0.092	***	(0.008)
Constant	-10.522	***	(0.650)
3. Rural-urban continuum code (ref=RUCC=1)			
RUCC=2	-0.281		(0.162)
RUCC=3	0.075		(0.183)
RUCC=4	-0.278		(0.153)
Age	0.094	***	(0.008)
Constant	-10.572	***	(0.664)
4. Urban area/urban cluster/rural (ref=urban area)			
Urban cluster	-0.378		(0.307)
Rural	-0.373	**	(0.124)
Age	0.092	***	(0.008)
Constant	-10.342	***	(0.651)
5. Population density of block group	-0.002		(0.005)
Age	0.092	***	(0.008)
Constant	-10.529	***	(0.649)
6. Distance from principal city	-0.278		(0.372)
Age	0.092	***	(0.008)
Constant	-10.462	***	(0.655)
N of respondents	2,298		
N of person-intervals	13,335		

*p<0.05; **p<0.01; ***p<0.001

Table A.2: Multinomial Logistic Regression Model Predicting Block Group Urban Category for Older Adults Living in an Independent Community-Dwelling

	Urban block group vs. suburban block group			Rural block group vs. suburban block group		
	β		(robust s.e.)	β		(robust s.e.)
Individual Characteristics						
Age	0.024	***	(0.005)	-0.007		(0.004)
Female (1=yes)	0.381	***	(0.067)	-0.139	*	(0.056)
Race/Ethnicity (ref=white, non-Hispanic)						
Black, non-Hispanic (1=yes)	2.103	***	(0.106)	0.270	**	(0.099)
Hispanic, any race (1=yes)	0.882	***	(0.177)	-0.926	***	(0.194)
Other (1=yes)	0.325		(0.181)	-0.116		(0.146)
Family income (ln)	0.132	*	(0.053)	-0.286	***	(0.036)
Marital status (ref=married)						
Divorced (1=yes)	-0.105		(0.127)	0.049		(0.110)
Widowed (1=yes)	-0.458	***	(0.073)	0.064		(0.059)
Never married (1=yes)	1.067	***	(0.203)	0.431	*	(0.190)
Number of children	-0.094	***	(0.142)	-0.023	*	(0.011)
Number in family unit	0.072		(0.050)	0.093	*	(0.039)
Own home (1=yes)	-0.146		(0.095)	0.509	***	(0.084)
Single-family home (1=yes)	-0.846	***	(0.076)	0.356	***	(0.066)
Years in residence over previous 10 years	0.028	*	(0.011)	-0.063	***	(0.008)
Fair/poor health (1=yes)	-0.022		(0.069)	0.073		(0.053)
Years of schooling	-0.031	**	(0.012)	-0.073	***	(0.009)
Family savings (ln)	0.013		(0.009)	-0.011		(0.007)
Employment status (ref=working)						
Retired (1=yes)	0.127		(0.090)	0.250	**	(0.072)
Other (1=yes)	0.006		(0.111)	0.277	**	(0.089)
Length of survey interval	-0.255	***	(0.063)	0.087		(0.049)
Constant	-2.685	***	(0.673)	4.118	***	(0.485)
N of respondents	2,298					
N of person-intervals	13,335					

*p<0.05; **p<0.01; ***p<0.001

Table A.3: Means and Standard Deviations for Block Group Urban Category in Origin and Destination Neighborhoods by Type of Residential Transition

	Remained independent community-dwelling		Moved from independent community-dwelling to retirement community		Moved from independent community-dwelling to assisted-living	
	Mean	SD	Mean	SD	Mean	SD
Block group urban category (origin)						
Urban (1=yes)	0.212	0.004	0.241	0.032	0.165	0.038
Suburban (1=yes)	0.324	0.005	0.413	0.037	0.410	0.047
Rural (1=yes)	0.464	0.005	0.346	0.035	0.426	0.047
Block group urban category (destination)						
Urban (1=yes)	0.210	0.004	0.180	0.028	0.164	0.037
Suburban (1=yes)	0.323	0.005	0.481	0.037	0.433	0.048
Rural (1=yes)	0.467	0.005	0.339	0.035	0.404	0.046
N of respondents	2,251		221		137	
N of person-intervals	12,977		221		137	

Table A.4: Logistic Regression Models Predicting All Moves among Older Adults with Block Group Urban Category and Block Group Characteristics

	Moved vs. did not move					
	Model 1			Model 2		
	β		(robust s.e.)	β		(robust s.e.)
Block Group Urban Category (ref=suburban)						
Urban	-0.003		(0.129)	0.142		(0.135)
Rural	-0.344	**	(0.110)	-0.357	**	(0.132)
Individual Characteristics						
Age	0.023	**	(0.008)	0.024	**	(0.008)
Female (1=yes)	0.105		(0.105)	0.112		(0.105)
Race/Ethnicity (ref=white, non-Hispanic)						
Black, non-Hispanic (1=yes)	-0.427	*	(0.181)	-0.245		(0.198)
Hispanic, any race (1=yes)	0.331		(0.286)	0.490		(0.291)
Other (1=yes)	-0.090		(0.252)	-0.205		(0.256)
Family income (ln)	-0.056		(0.050)	-0.071		(0.047)
Years of schooling	0.053	**	(0.016)	0.043	*	(0.017)
Employed (1=yes)	0.037		(0.146)	0.059		(0.146)
Married (1=yes)	-0.223		(0.124)	-0.216		(0.125)
Number of children	0.037		(0.020)	0.034		(0.020)
Number in family unit	-0.189	**	(0.071)	-0.192	**	(0.071)
Own home (1=yes)	-0.815	***	(0.125)	-0.936	***	(0.129)
Single-family home (1=yes)	-0.129		(0.122)	-0.172		(0.133)
Years in residence over previous 10 years	-0.086	***	(0.013)	-0.073	***	(0.014)
Fair/poor health (1=yes)	0.291	**	(0.101)	0.366	***	(0.102)
Length of survey interval	0.843	***	(0.096)	0.853	***	(0.100)
Block Group Characteristics						
Transportation/mobility						
% take public transit				-0.027	***	(0.007)
Mean block area (sq miles)				0.108		(0.154)
Affordable housing options						
% owner-occupied				0.001		(0.003)
Median gross rent (in $1,000s)				0.252		(0.213)
Services						
# commercial establishments (in 1,000s)				0.099		(0.130)
# drug stores				-0.029		(0.019)
# social services				0.012		(0.011)
# residential services				-0.005		(0.010)
Population				0.047		(0.033)
% poor				-0.0002		(0.006)
% age 65+				-0.004		(0.006)
Region (ref=West)						
Northeast				-0.240		(0.163)
Midwest				-0.224		(0.143)
South				-0.592	***	(0.151)
Constant	-4.330	***	(0.793)	-3.986	***	(0.845)
N of respondents	2,298			2,298		
N of person-intervals	13,335			13,335		

*p<0.05; **p<0.01; ***p<0.001

APPENDIX B

Supplementary Analysis for Chapter 4

Table B.1: Logistic Regression Models Predicting All Moves among Older Adults with Distance to Kin

	Moved vs. did not move					
	Model 1 – Base Model			Model 2 – Distance to Kin		
	β		(robust s.e.)	B		(robust s.e.)
Block Group Urban Category (ref=suburban)						
Urban	-0.177		(0.123)	-0.177		(0.124)
Rural	-0.319	**	(0.100)	-0.306	**	(0.101)
Distance to Kin						
Distance to nearest child (1,000s/miles)				0.974	**	(0.360)
Distance to nearest child squared				-0.295		(0.154)
Distance to nearest other relative (1,000s/miles)				3.349		(2.627)
Distance to nearest other relative squared				-16.576		(8.882)
No kin with location data (1=yes)				-0.247		(0.157)
Individual/Household Characteristics						
Age	0.037	***	(0.007)	0.035	***	(0.007)
Married (1=yes)	-0.178		(0.111)	-0.203		(0.112)
Number of children	0.004		(0.021)	0.008		(0.021)
Number in family unit	-0.225	**	(0.068)	-0.218	**	(0.068)
Race/Ethnicity (ref=white, non-Hispanic)						
Black, non-Hispanic (1=yes)	-0.168		(0.168)	-0.138		(0.276)
Hispanic, any race (1=yes)	0.437		(0.274)	0.376		(0.276)
Other (1=yes)	0.003		(0.241)	-0.032		(0.246)
Family income (ln)	-0.067		(0.045)	-0.076		(0.044)
Years of schooling	0.033	*	(0.014)	0.029	*	(0.014)
Employed (1=yes)	-0.031		(0.140)	-0.032		(0.142)
Own home (1=yes)	-0.852	***	(0.118)	-0.855	***	(0.119)
Single-family home (1=yes)	-0.226		(0.116)	-0.184		(0.118)
Years in residence over previous 10 years	-0.099	***	(0.012)	-0.099	***	(0.012)
Fair/poor health (1=yes)	0.326	***	(0.093)	0.348	***	(0.093)
Length of survey interval	0.685	***	(0.090)	0.712	***	(0.090)
Region (ref=west)						
Northeast	-0.463	**	(0.141)	-0.398	**	(0.143)
Midwest	-0.166		(0.120)	-0.123		(0.123)
South	-0.424	**	(0.122)	-0.461	***	(0.123)
Constant	-3.779	***	(0.727)	-3.800	***	(0.729)
N of respondents	2,298			2,298		
N of person-intervals	13,335			13,335		

*p<0.05; **p<0.01; ***p<0.001

Table B.2: Correlations among Family Support Variables

	Married	Number of children	Number in family unit	Distance to nearest child (ln)	Distance to nearest other relative (ln)
Married	1.000				
Number of children	-0.034	1.000			
Number in family unit	0.312	0.253	1.000		
Distance to nearest child (ln)	-0.051	-0.398	-0.136	1.000	
Distance to nearest other relative (ln)	-0.051	-0.375	-0.131	0.794	1.000

Table B.3: Multinomial Logistic Regression Model Predicting Block Group Urban Category for Older Adults Living in an Independent Community-Dwelling

	Urban block group vs. suburban block group			Rural block group vs. suburban block group		
	β		(robust s.e.)	B		(robust s.e.)
Individual Characteristics						
Age	0.024	***	(0.005)	-0.007		(0.004)
Female (1=yes)	0.381	***	(0.067)	-0.139	*	(0.056)
Race/Ethnicity (ref=white, non-Hispanic)						
Black, non-Hispanic (1=yes)	2.103	***	(0.106)	0.270	**	(0.099)
Hispanic, any race (1=yes)	0.882	***	(0.177)	-0.926	***	(0.194)
Other (1=yes)	0.325		(0.181)	-0.116		(0.146)
Family income (ln)	0.132	*	(0.053)	-0.286	***	(0.036)
Marital status (ref=married)						
Divorced (1=yes)	-0.105		(0.127)	0.049		(0.110)
Widowed (1=yes)	-0.458	***	(0.073)	0.064		(0.059)
Never married (1=yes)	1.067	***	(0.203)	0.431	*	(0.190)
Number of children	-0.094	***	(0.142)	-0.023	*	(0.011)
Number in family unit	0.072		(0.050)	0.093	*	(0.039)
Own home (1=yes)	-0.146		(0.095)	0.509	***	(0.084)
Single-family home (1=yes)	-0.846	***	(0.076)	0.356	***	(0.066)
Years in residence over previous 10 years	0.028	*	(0.011)	-0.063	***	(0.008)
Fair/poor health (1=yes)	-0.022		(0.069)	0.073		(0.053)
Years of schooling	-0.031	**	(0.012)	-0.073	***	(0.009)
Family savings (ln)	0.013		(0.009)	-0.011		(0.007)
Employment status (ref=working)						
Retired (1=yes)	0.127		(0.090)	0.250	**	(0.072)
Other (1=yes)	0.006		(0.111)	0.277	**	(0.089)
Length of survey interval	-0.255	***	(0.063)	0.087		(0.049)
Constant	-2.685	***	(0.673)	4.118	***	(0.485)
N of respondents	2,298					
N of person-intervals	13,335					

*p<0.05; **p<0.01; ***p<0.001

APPENDIX C

Supplementary Analysis for Chapter 5

Table C.1: Logistic Regression Models Predicting All Moves with Interactions between Geographic Access to Health Care and Individual Health Status

	Moved vs. did not move			
	Model #1		Model #2	
	β	(robust s.e.)	B	(robust s.e.)
Geographic Access to Health Care				
# health services per 100 estb. in zip code	0.024	(0.037)	-0.001	(0.023)
# drug stores per 100 estb. in zip code	-0.564	(0.492)	0.074	(0.188)
Health Status				
Chronic health condition (1=yes)	0.750	(0.523)	0.851 **	(0.280)
Difficulty with ADLs (1=yes)	0.396 **	(0.146)	0.435	(0.318)
Access to Health Care – Health Status Interactions				
# health services * chronic health condition	-0.017	(0.039)	--	
# drug stores * chronic health condition	0.460	(0.506)	--	
# health services * difficulty with ADLs	--		0.025	(0.032)
# drug stores * difficulty with ADLs	--		-0.332	(0.252)
Individual/Household Characteristics				
Age	0.031 **	(0.011)	0.032 **	(0.011)
Married (1=yes)	-0.443 *	(0.179)	-0.443 *	(0.179)
Number of children	0.033	(0.033)	0.031	(0.033)
Number in family unit	-0.211 *	(0.104)	-0.220 *	(0.104)
Race/Ethnicity (ref=white, non-Hispanic)				
Black, non-Hispanic (1=yes)	-0.264	(0.300)	-0.214	(0.297)
Hispanic, any race (1=yes)	0.893 **	(0.327)	0.917 **	(0.322)
Other (1=yes)	0.005	(0.305)	0.033	(0.305)
Family income (ln)	-0.084	(0.075)	-0.086	(0.076)
Years of schooling	0.061 *	(0.026)	0.062 *	(0.026)
Employed (1=yes)	0.026	(0.202)	0.024	(0.204)
Own home (1=yes)	-0.652 **	(0.199)	-0.616 **	(0.199)
Single-family home (1=yes)	0.094	(0.195)	0.077	(0.194)
Years in residence over previous 10 years	-0.085 ***	(0.019)	-0.086 ***	(0.019)
Block Group Characteristics				
Urban Category (ref=suburban)				
Urban	-0.052	(0.205)	-0.039	(0.206)
Rural	-0.359	(0.166)	-0.352	(0.168)
Population	0.050	(0.037)	0.049	(0.037)
% poor	-0.004	(0.009)	-0.004	(0.009)
% older adults	0.009	(0.009)	0.008	(0.010)
# residential services in zip code	0.047	(0.079)	0.053	(0.080)
Region (ref=West)				
Northeast	-0.651 **	(0.211)	-0.664 **	(0.212)
Midwest	-0.534 **	(0.190)	-0.555 **	(0.189)
South	-0.742 ***	(0.194)	-0.761 ***	(0.195)

*p<0.05; **p<0.01; ***p<0.001

Table C.1 (continued)

	Movers vs. did not move			
	Model #1		Model #2	
	β	(robust s.e.)	B	(robust s.e.)
Constant	-3.687 **	(1.288)	-3.884 **	(1.212)
N of respondents	1,211		1,211	
N of person-intervals	4,053		4,053	

*p<0.05; **p<0.01; ***p<0.001