Differential Aging-In-Place

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Social Work and Psychology)
in The University of Michigan
2014

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ABSTRACT

This three-essay dissertation explores components of aging–in-place among adults living alone aged 65 and older using nationally representative data from the Health and Retirement Study (HRS). Drawing on the Person-Environment Fit and Person-Centered perspectives, the overall goal is to examine the extent to which three dimensions of aging-in-place, namely the environment, the older individual, and individual agency (efficacy), are inter-related in order to enable independent living among this subgroup of older persons. Together, these three components help to characterize the heterogeneity of the life contexts and personal resources of older adults who live alone and are aging-in-place.

The first paper explored to what degree the environment and health subgroups are associated with subjective well-being among older adults living alone. Through clustering analysis, the four health subgroups of sensory-cognitive impaired, physically impaired, frail, and healthy were identified. The intersection of these health subgroups with three environmental contexts that reflect different levels of physical and social support were examined. The frail group was more likely to show depressive symptoms if they lived in a physically average and socially unsupported environment. The sensory-cognitive impaired group was more likely to report depressive symptoms when they lived in a physically-unsupported but socially-supported environment.

The second paper asked if changes in depressive symptomatology over time are mediated by changes in perceived control. The findings confirm a stronger negative influence of membership in a vulnerable health subgroup on perceived control, which in turn affects depressive symptoms over time. Among the environmental contexts, only greater social support was associated with a decrease in depressive symptoms over time via perceived control.

The third paper extended the empirical examination of proposals drawn from the Person-Environment Fit perspective. I asked how much environments moderate the effects of health profiles and low socioeconomic status on mortality risk. The results show that for individuals in the sensory-cognitive impaired and physically impaired groups, broader social network was

associated with an increased risk of death. In addition, the study revealed that older adults living alone with low socioeconomic status who live in a senior housing environment had a reduced risk of death.

CHAPTER I

INTRODUCTION

1.1 Purpose of the Dissertation

Achieving physical and psychological independence is a life-time developmental task. In old age, this task involves efforts to remain physically independent for as long as possible and maintain psychological well-being as well. Aging-in-place is a concept that integrates age-related processes at the individual, environmental and societal levels. Generally speaking, aging-in-place refers to individuals growing older in a "home". This "home" can refer to a wide range of living environments within in residential settings, surrounding neighborhoods, and broader communities (Black, 2008). This concept reflects a strong preference by older adults (Cutchin, 2003; Rowles, 1993), and it has been suggested that it is in fact the best option for older people to remain in the homes in which they have resided for most of their lives (Pastalan, 1999). In addition, the concept of aging-in-place has been increasingly adopted in social policies and programs designed to address the rising costs of long-term care.

Although aging-in-place in general benefits individuals and society, it is important to recognize that among older adults who are aging-in-place there may be subgroups at risk due to multiple limitations or deteriorating health and who have varying levels of support needs going unmet by their living environment. Such subpopulations may live in a place that compounds their risks by contributing to a decline in their health and well-being (Krause, 1993). This perspective derives from the environmental gerontological perspective. Old age is viewed as a critical phase in the life course that is profoundly influenced by the nature of the physical and social environment. Lawton (1980), for example, suggests that it is important to consider the dynamic relationship between the health of a person and changes in their environment since new constellations of risks for adaptations in old age may emerge.

The goal of this dissertation is to seek a better understanding of differential vulnerable subgroups of older adults aging-in-place. As an overarching guiding theoretical framework, I draw upon a life course-life span developmental perspective. A contextualized understanding of the aging process and outcomes is at the theoretical core of a life course and life span perspective (e.g. Baltes, 1987; Carp, 1967; Dannefer, 1992). Despite the firmly established significance of context in aging, it often remains unclear specifically what constitutes the context (Wahl & Lang, 2004). To gain a theoretically driven focus on what constitutes and how to understand the developmental context, as a specific theoretical perspective I draw from the Person-Environment Fit perspective (Lawton, & Nahemow, 1973) and Person Centered perspective (Magnusson, 1998; Smith & Baltes,1997). As a vulnerable subgroup of older adults, I focus on the elderly who are living alone in the community.

1.2 Significance of the Dissertation Topic

This dissertation focuses on aging-in-place among older adults living alone as an exemplar of the person-environment dynamics proposed in environmental gerontology. Despite global demographic changes resulting in an increasing number and proportion of elderly living alone (Webber, Fox, & Burnette, 1994; Davis, Moritz, Neuhaus, Barclay, & Gee, 1997; Lichtenberg, MacNeill & Mast, 2001), the knowledge regarding this subpopulation is fairly limited. Most previous research compares the elderly who live alone with married or partnered people and finds that the status of living alone renders them vulnerable in terms of their physical and psychological health (Gaymu & Springer, 2010; Freedman, 1996 ; Pearlman & Crown, 1992; Rudberg, Sager, & Zhang, 1996). However, the elderly living alone are unlikely to be a homogenous group. Very little research has attempted to examine the potential heterogeneity of this growing subgroup. The identification and examination of differentially vulnerable groups among the elderly living alone will contribute to expanding our knowledge about older adults and ultimately serve as an important stepping stone toward building more efficient and effective service programs and policy.

With a focus on older adults living alone, the overall goal is to examine the extent to which three dimensions of aging-in-place, namely the environment, the older individual, and individual agency (efficacy), are inter-related in enabling independent living. Guided by an

environmental gerontological perspective, there are two overarching foci in this research. First, an emphasis is put on the place(s) in which older adults' daily lives are embedded. 'Place' here refers to a range of different living environments, including traditional private homes, planned living facilities such as senior housing, and nursing homes. Recent developments indicate that decisions concerning where to live in old age and whether to age-in-place are taken by both older adults who live in the community and those who choose planned living environments. Planned living environments include facilities that allow seniors to live independently within a structured complex, assisted living facilities and a Continuing Care Retirement Complex (CCRC). To date, research on planned living facilities such as senior housing remains fairly limited. The process of aging-in-place within senior residential facilities are likely to differ from those of community living older adults, since residential care environments both offer and restrict social opportunities (Eckert, Carder, Morgan, Frankowski, & Roth, 2009). The environment of senior housing may be unique in that daily living experiences are shaped by both its physical features and its social relational characteristics within the housing community. Therefore the senior housing environment might represent an empirical example of the intertwined living space of physical and social environment (Wahl & Lang, 2004).

1.3 Organization of the Dissertation

My dissertation will consist of three empirical papers reporting secondary analyses of the Health Retirement Study (HRS), a nationally representative longitudinal study of older adults aged 50 and older in the U.S.

Three empirical papers

The first study explored the association between the subjective well-being of people 65 and older who live alone in different environments with a variety of health limitations. Specifically, this study addresses three research questions. First, drawing on the Person-Environment fit perspective and on the person-centered perspective, I asked if different health-limitation subgroups and environmental subgroups can be identified and understood. Second, I asked if people in these health and environment subgroups manifest different socio-demographic characteristics, and if the prevalence of residency in senior housing varies across these health and

environment profiles. Third, I explored the extent to which environment and health subgroups are associated with subjective well-being among older adults living alone.

In the second paper, I explored the associations among the environmental subgroups and health subgroups, and individual agency as related to subjective well-being among living-alone older adults over time. Specifically, this paper poses two research questions. First, I asked to what extent different health limitation subgroups and environmental subgroups predict depressive symptoms over a four-year period. Second, I empirically tested one further theoretical aspect of the person-environment fit model, individual agency (efficacy), using a measure of perceived control. I investigated the degree to which the association among environment, health, and perceived control at baseline predict changes in depressive symptoms over a four-year period.

In the final paper, I attempted to conduct the most rigorous possible test of the P-E Fit framework. I followed the trajectory of mortality of older adults living alone over a six-year period. This paper features two research questions. First, I asked to what extent additional aspects in the person dimension (SES) and environment dimension (senior housing residency) predict mortality over a six-year period. Second, I looked into how much the environmental context moderates the effect of health limitations and SES on the mortality risk of elders living alone.

1.4 Data

To address these research questions, I made use of the Health and Retirement Study (HRS), a national longitudinal study that conducts surveys every two years on more than 22,000 adults aged 51 and older. Sub-samples used in this study are derived from the Rand HRS data file (version L), which is a cleaned and easy-to-use version of data from eleven waves of HRS data (1992 2010). The Rand HRS data file was merged with raw data from the original HRS files when the Rand HRS file did not include the variables used in this study (i.e., Housing related data and Psychosocial Leave-Behind Participant Lifestyle Questionnaires). Each of the three chapters will have somewhat unique analytic samples. Detailed descriptions of the sample, measures, and analytic plan are discussed in each chapter.

CHAPTER II

HETEROGENEITY OF HEALTH AND ENVIRONMENT PROFILES OF OLDER ADULTS LIVING ALONE: ASSOCIATION WITH SUBJECTIVE WELL-BEING

2.1 Introduction

Aging-in-place is a concept that integrates age-related processes at the individual, environmental and societal levels. In general, aging-in-place refers to individuals growing older within a "home" that includes a wide range of potential living environments in residential settings, surrounding neighborhoods, and broader communities (Black, 2008). This concept reflects the strong preference of older adults (Cutchin, 2003; Rowles, 1993) and it has been suggested that it is best for older people to remain in their homes in which they have resided for the majority of their lives (Pastalan, 1999). In addition, the concept of aging-in-place has been increasingly adopted in societal policies and programs designed to address the rising costs of long-term care.

Although aging-in-place broadly benefits individuals and society, it is important to recognize that among older adults who are aging-in-place there may be subgroups who are at risk due to multiple limitations or losses in health and who manifest varying levels of support needs going unmet by their living environment. Such subpopulations may live in a place that magnifies their risks by contributing to a decrease in their health and well-being (Krause, 1993). This proposal derives from the environmental gerontological perspective. Old age is viewed as a critical phase in the life course that is profoundly influenced by the nature of the physical and social environment. Lawton (1980), for example, suggests that it is important to consider the dynamic relation between the health of a person and changes in their environment since new constellations of risks for adaptations in old age may emerge.

This study aims to discover ways to identify older individuals who are aging-in-place but may be at risk for a lack of subjective well-being. In particular, it focuses on one vulnerable

subgroup of older adults: the elderly who live alone. A large number of older adults currently reside alone, approximately 30%, and the proportion has been and will continue to rise (Webber, Fox, & Burnette, 1994; Davis, Moritz, Neuhaus, Barclay, & Gee, 1997) and is becoming an increasingly normative part of the aging process (Lichtenberg, MacNeill & Mast, 2001). Despite this clear demographic shift, the body of knowledge on this subpopulation is fairly limited. Existing research findings suggest that older adults living alone are more vulnerable in terms of health and well-being compared to couples: they show a higher number of limitations in daily living tasks such as Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL), worse physical and mental health (Gaymu & Springer, 2010; Rudberg, Sager, & Zhang, 1996), and are more likely to be institutionalized (Freedman, 1996; Pearlman & Crown, 1992).

There are two main concerns in the existing aging-in-place literature related to older adults living alone. First, while the association between subjective well-being and health in general among older adults has been extensively studied, most of the findings apply to older adults as a whole, not specifically to older adults living alone. Second and more importantly, there is little theoretically-based research that examines the health and well-being of older adults living alone (Lichtenberg et al., 2000). In order to address these gaps, this study aims to explore the association between the subjective well-being of people older than 65 who live alone and various health limitations and their environment.

2.1.1 Conceptual background

I draw upon two perspectives, the Ecological Theory of Aging (ETA) perspective and a person–centered perspective. The ETA perspective conceptualizes the interplay between individuals and their environments based on three dimensions: environment, individual competence, and adaptation (Lawton & Nahemow, 1973). Adaptation is viewed as the outcome determined by the "fit" between an individual's own competencies, (i.e., the cognitive and/or physical capacity to meet his or her own needs), and the demands and/or resources of their shifting environments. ETA theory suggests that optimal adaptation occurs when there is a fit between competencies and the environment. In other words, a good fit between a person and his/her environment should lead to greater well-being than would a less optimal fit (Thomese & van Groenou, 2006). Specifically, the "fit" is conceptualized in the *environmental docility hypothesis* of ETA, which suggests that individuals with less ability will be impacted more by

the same environmental demands than would be individuals with greater levels of ability. In research on this concept to date, older adults' competence has been operationalized using variable-centered approaches. Models have examined the relationships between separate dimension of health, such as functional and cognitive health.

A person-centered approach (Magnusson, 1998; Smith & Baltes, 1997) emphasizes the totality of individuals and views their developing contexts as integrated and interconnected. It advocates the consideration of multiple-indicator information at the person or subgroup level (Gerstorf, Smith, & Baltes, 2006). This perspective guides us to examine the totality of individuals with diverse and possibly multiple aspects in terms of their environment and health, thereby enabling the identification of more vulnerable sub-groups of older adults. A person-centered perspective can serve as a critical guide for research on the heterogeneity of health status among older adults. It can also help to structure and describe aspects of heterogeneity that cannot easily be revealed through standard applications of function-oriented research (Bergman, Magnusson, & El-Khouri, 2003). Typically, researchers pursuing this strategy have used cluster analysis, which generates information on differences in the level, variability, and shape of profiles within a given sample in order to empirically classify individuals into homogeneous subgroups (Gerstorf et al., 2006). Members in a subgroup share commonalities in the subgroup-defining constructs, but differ from members of other groups (Bergman et al., 2003).

2.1.2 Health profiles of person competence

Research based on the Person-Environmental (P-E) fit perspective has conceptualized a range of health indicators as person competence. Thomese and van Groenou (2006) investigated the relations between changes in health and adaptations to social and physical environments. They operationalized person competence as the degree of functional disability over time as change in the capacity for performing daily activities. Wahl and colleagues (1999) examined person competence through older adults' vision loss or mobility limitations. In Byrnes et al. (2006)'s study, person competence was examined in terms of mental and physical functions.

These studies seem to share a common limitation. Whether investigating physical, mental, sensory or cognitive health, they all examined health indicators individually. In old age, individuals experience a constellation of chronic, acute conditions and functional and mental impairments (Karlamangla, Tinetti, Guralnik, Studenski, Itle, & Reuben, 2007). The

heterogeneity of older adults with different sets of health problems has important consequences for their perceived well-being, but only a few studies examine a wide range of health indicators (Smith, Borchelt, Maier & Jopp, 2001). Subgroups of different health limitations would require different health and social care (Manton & Stallard, 1996) and the most vulnerable subgroups take up disproportionate shares of health services among sub-groups of older adults (Payne, Laporte, Deber, 2007). The multi-dimensional understanding of health in old age (Portrait, Lindeboom, Deeg, 2000) and the concept of classification of older adults into subgroups with varying degree of health and wellness is not new (Lafortune, Beland, Bergman, & Ankri, 2009). However, knowledge and empirical research on the coexistence of multiple health limitations is extremely limited (Slaug, Schwelling, Iwarsson, & Carlsson, 2010).

Portrait et al. (1999) maintained that virtually all aspects of the complex health concept can be empirically examined using multiple indicators spanning several areas, such as physical, cognitive, sensory (hearing and vision), and chronic conditions. Recognizing that several types of health problems exist and different degrees of impairment are possible within these types (Portrait, et al., 2000), a limited amount of research has attempted the classification of the health status of older adults with multiple health conditions. Some earlier studies focused on particular subgroups of older adults, such as residents in nursing homes (Manton, Cornelius, Woodbury, 1995) or older persons who are enrolled in long term care and chronic care programs (Wieland, Lamb, & Wang, 2000), in order to identify clinically meaningful health profiles in older populations. Alternatively, they focused on particular aspects of health such as functional disability and depression items (Lamb, 1996) to derive six profiles: functionally and emotionally healthy, functionally healthy with some depressive symptoms, some strength problems, severely depressed, mobility problems and functionally frail. More recently, certain studies focused on community-dwelling older adults. McNamee (2004) studied community-dwelling older adults and derived five profiles of health impairment using multiple health indicators, including physical (e.g. chronic conditions), functional, and cognitive health problems. These profiles are termed, *physically frail*, *mentally frail (suffering from dementia), physically frail and mildly cognitive impaired*, and *healthy*. A study by Lafortune et al. (2009) focused on community-living older adults by looking into the four different health profiles of *very frail, cognitively impaired, physically impaired*, and *relatively healthy.*

This emerging research on health profiles among community dwelling older adults suggests two phenomena: despite different sets of multiple health indicators examined in different studies, there is a clear distinction along the cognitive and physical health dimensions. Also, across the qualitatively different profiles, there appears to be a gradient along the disability dimension (Lafortune et al., 2009) from the healthy group to the most frail group as a consequence of physical and cognitive impairment, as suggested by the disablement process (Verbrugge & Jett, 1994). To the best of our knowledge, no study has looked into the extent to which health profiles are associated with subjective well-being among older adults. Also, no research has yet to examine the extent to which older adults' environmental contexts are associated with the impact of health profiles on their subjective well-being.

2.1.3 Environment

Older adults' strong preference for independent living in their current residence is well known. The concern is that increasing numbers of older adults remain living in their homes while facing declines in physical and mental health (Iwarsson et al., 2007). The relationship between daily living behavior and housing environment can be seen as a chain of interactive cause-and-effect cycles (Lawton, 1970), resulting in varying levels of health and well-being. Considerable empirical research on aging-in-place has emphasized the importance of physical features in housing (Wahl, Fange, Oswald, Gitlin, & Iwarsson, 2009). Studies have found that in-home features such as special railings, wheelchair accessibility, and/or bathroom fixtures are significantly related with functional health (Rochette, Desrosiers, & Noreau, 2001; Murphy, Nyquist, Straburg, & Alexander, 2006).

From the perspective of Person-Environment Fit, existing environmental research seems to share several areas for strengthening. The first concern that stands out in most existing P-E research is that it tends to examine only limited aspects of health outcomes, such as Activity of Daily Living (ADL) skills. Few studies have attempted to examine multi-dimensional aspects of the health conditions of older adults. Second, despite the importance of the home environment in the daily lives of older adults, the environmental perspective of aging requires the examination of multiple aspects of the environment in which an individual is situated in daily life. In ETA, the environment is conceptualized as encompassing various domains and levels involving the physical, personal (social relational), suprapersonal (organizational) and social (societal or

cultural) environments (Lawton, 1999). However, much of the previous empirical research on aging-in-place focused on the level of home and housing (Hwang, Sixsmith, & Sixsmith, 2011) and does not focus on older adults, even though older adults are particularly susceptible to the characteristics of their local environments (Clarke & Nieuwenhuijsen, 2009). There has been a paucity of research that includes a more macro level of environment, such as neighborhood and urban-rural divide, that is significant in the structuring of the experience of aging (Kendig, 2003). A number of studies focusing on the socioeconomic aspect of neighborhood have examined the association between neighborhood and various outcomes including depression, cognitive impairment, and subjective well-being (cf. Yen, Michael, Perdue, 2009). There have been only rare studies done that include the neighborhood-level environment along with housing characteristics. Similarly, an accumulating body of research looks at urban-rural differences in the health and well-being of older adults (Wahl, 2005).. However, only an extremely limited number of studies have examined regional differences from the P-E fit perspective.

A dichotomy can be identified in the research on living environments. In the P-E fit perspective, the living environment is viewed as the totality of the life space in which older adults are embedded. Living environments do not simply refer to a location or physical feature of living; they also represent a key social context for the aging process. Therefore, the physical and social environment are not disparate entities, but rather conceptually interconnected. However, there has been a lack of integrative examination of the physical and social contexts of living environment, with most research tending to focus on the physical aspects of living environments. In the ETA, social aspects of the environment are conceptualized as personal environment and examined through a person's number of children, close friends and other associates. Empirically, however, the bulk of the existing research tends to focus on the physical aspects of the living environment and there has been a paucity of integrative examination of the physical and social contexts of the living environment (Wahl & Lang, 2004). Accumulated research on social relations has demonstrated the importance of living arrangements with children, relationships with friends and/or community participation in the health and well-being of older adults

Whether it be physical or social characteristics of the living environment that involve varying aspects of the environment, as in the case of health profile research, the person-centered perspective can serve as a useful theoretical and empirical tool for examining the environmental contexts of older adults with a meaningful classification of environment that encompasses

multiple aspects of the environment. In social relations research, the person-centered perspective has long been applied in such a way that related studies have examined social support relations with children, friends and others in an attempt to derive subgroups of different social relational patterns. Within environmental gerontological research, there is as yet no existing research that applies a person-centered perspective to comprehensively examine various aspects of the physical environment, including in-home features, accessibility, neighborhood conditions and urbanicity, and, more importantly, various social relations. Most significantly, empirical testing of the ETA model involves all three aspects of aging-in-place. In practice, most P-E research has tended to focus on either the environmental or person dimension or the association between the person and the environment (cf. Wahl et al., 2009). There has been a lack of attention paid to the comprehensive examination of three components of aging-in-place, including the person, the environment, and the fit between the two. Centrally, there is little research that examines how the three components are associated with subjective well-being.

2.1.4 Research questions

Based on the preceding discussion, this study addresses three primary questions. First, I ask if different health limitation subgroups and environmental subgroups can be identified and interpreted. In order to empirically examine the multidimensionality of the conception of both person and environment, I draw upon the person-centered perspective to consider a comprehensive range of characteristics in the two dimensions of the P-E perspective. For the person dimension, I examine physical, cognitive, sensory and functional health. For the environmental dimension, I examine both the physical and social environment. For physical environmental characteristics, in-home features, accessibility, subjective evaluation of housing condition, neighborhood condition, and region are taken into consideration. For the social environment, relations with children and friends as well as social engagement are examined. To the best of my knowledge, this is the first research to look into health profiles and environment profiles of the elderly living alone. Still, based on earlier health profile research on various groups of the elderly that produced largely consistent profiles, I generally expected clearly differentiated groups of health status, such as physically impaired, cognitively impaired, and healthy groups.

Second, I examined the socio-demographic characteristics of older adults living alone in subgroups of health and the environments. Additionally, I examined differences in senior housing residence across health and environment profiles. Recent developments indicate that decisions concerning where to age and whether to age in place may occur for older adults living in the community, as well as for those who select planned living environments such as independent living, assisted living and CCRC (Continuing Care Retirement Complex) for seniors (Antonucci, Ajrouch, & Park, in press). To date, research on planned living facilities such as senior housing remains fairly limited.

Third, I explore how associated the environment and health subgroups are with subjective well-being among older adults living alone. Specifically, as a way to examine P-E fit, I investigate both the main effects of health and the environment on outcome. I look into to the degree to which environment moderates the impact of health on the outcome. For subjective well-being, depressive symptoms of older adults living alone are examined. Since this is the first attempt to identify profiles based on living environment, I did not set up specific hypotheses. Still, I broadly hypothesized that older adults living alone who belong to a health profile of more limitations and reside in less supportive environments would be more likely to be depressed. Based on the *environmental docility hypothesis*, it is expected that individuals with more health limitations will have a higher level of subjective well-being if they live in more supportive environment.

2.2 Methods

2.2.1 Data and sample

Data from the 2006 Health and Retirement Study (HRS) are used in this study. The sample was drawn based on several criteria. First, I selected older adults aged 65 years and older and living alone. Second, respondents who are institutionalized or unable to independently answer the survey questions were excluded.

The final sample totaled 2956 individuals. The average age of participants was 77 (*SD* = 8.03: range 65 to 104 years), 75% were women. For age cohort comparisons, I formed three groups: the young-old group, aged 65 to 74 years (46%; *n* =1362); the old-old, aged 75 to 84

(34%; *n* = 997); and the oldest, aged 85 and above (20%; *n* = 597). Thirty four percent of the sample had more than 12 years of education. Eighty two percent of the sample was White and17% currently resided in senior housing. Eighteen percent reported depressive symptomatology. Table 1 presents individual characteristics of health and environmental characteristics.

2.2.2 Measures

Drawing upon the person-centered perspective, I attempted to identify different profiles in health and environment through the application of k-means cluster analysis.

Health profile indicators

Personal competence was examined in the form of health profiles based on a range of individually-measured health status. Eight health variables were included. A count of chronic health conditions (0-8) prevalent in later life was used. Theses eight conditions are high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, hip fracture and arthritis. Three aspects of health were measured to examine the multidimensional concept of functioning (Fonda & Herzog, 2004); a count of mobility limitations (0-5) was measured according to whether or not the respondent had difficulty walking several blocks, walking one block, walking across the room, climbing several flights of stairs and climbing one flight of stairs. A count of Activities of Daily Living (ADL) (0-5) included difficulty with bathing, eating, dressing, walking across a room, and getting in or out of bed. Instrumental Activities of Daily Living (IADL) limitations include using a telephone, taking medication, handling money, shopping, and preparing meals. For cognitive health, the summary cognitive variable of Mini-Mental State Examination (0-35) was used. This measure includes immediate and delayed word recall, serial 7 backwards count, object identification, date naming, and President and Vice President naming. Higher scores indicate higher cognitive functioning. For sensory health, hearing and vision capacity are measured by asking subjects to rate their corrective hearing and vision from 1 (excellent) to 5 (poor).

Environment

Physical environment indicators. Five aspects of the physical environment were examined: in-home supportive features, accessibility or barriers in housing, self-rated satisfaction with housing and neighborhood conditions, and urbanicity. HRS utilizes extensive skip patterns

for housing-related variables. In general, only new respondents or those who indicated moving and/or making a home modification are asked to provide new information about housing characteristics. Data on housing characteristics were collected from earlier waves of the study (five HRS waves from 1996 to 2004 and AHEAD 1993 and 1995 waves). After hierarchically assigning values for the housing environment variables for those who entered the study prior to 2006, a binary indicator variable was created based on six supportive features. These are the presence of ramps, railings, wheelchair access, grab bars, emergency call button and others. For accessibility, three variables were used to create a binary variable indicating the presence of difficulty in getting into and around the house: accessibility was coded as 1 if a respondent has all living space on a single floor, lives in one story-building, or a multi-story building with an elevator. Self-rated condition of housing was measured on a 5-point scale ranging from 1 (poor) to 5 (excellent). For neighborhood level indicator, safety of neighborhood was coded as 1 (poor) to 5 (excellent). For residential region, urban areas are coded 1, and nonurban areas coded 2.

Social environment indicators. Three aspects of social support environment were examined: a binary indicator measured whether a respondent has children living nearby (no= 0, yes=1), a close friend living nearby (0/1), and frequency of social engagement in the community measured on a 6-point scale ranging from 1 (less than once a year or never) to 6 (three or more times a week).

Outcomes

Depressive symptomology. Depressive symptoms were measured by eight items from the abbreviated version of the Center for Epidemiologic Studies Depression Scale (CES-D). Six of the nine CES-D items indicate the presence of depression, and three indicate its absence. Six of the nine indicators measured whether the respondent experienced any of the following negative sentiments over the preceding week: depression, everything being an effort, restless sleep, feeling alone, feeling sad, and could not get going. Three items measured the experience of feeling happiness, feeling enjoyment of life, and feeling a great amount of energy. These three items are reverse coded. A binary indicator variable was created to indicate the presence of depressive symptomology. Respondents who reported less than three depressive symptoms were coded as 0, otherwise coded as 1.

Covariates

Age cohort groups were coded 1 for those aged 65-74, 2 for 75-84, and 3 for 85 years and above. Current marital status was coded as 0 (never married), 1 (widowed), or 2 (divorced/separated). Gender was coded 1 for women and 0 for men. For wealth and income, RAND HRS imputed composite variables for total household wealth and income were used. The composite dollar values of the both variables were coded as quartiles (1= lowest, 4= highest). Education was centered at 12 years (i.e., high school graduation: range=0 to 17+ years). Additionally, I included residency in senior housing. For age-segregated senior housing residency, as in the case of housing characteristic variables, values for senior housing (0/1) were hierarchically assigned from earlier waves of the study (five HRS waves from 1996 to 2004 and AHEAD 1993 and 1995 waves).

2.2.3 Analysis

Analyses for the three research questions were performed in Stata Version 13 and M–plus 7. Specifically, cluster analysis was performed to examine the initial research question regarding the nature and range of health and environmental profiles that might be identified. For each dimension, the range of variables to be clustered was standardized to T-scores in order to eliminate effects stemming from scale differences (Hair & Black, 2000). Two clustering techniques were used (hierarchical and k-means) following the procedures described by Fiori and colleagues (2006). First, a hierarchical clustering procedure using Ward's (1963) minimum-variance method was undertaken to determine the ideal number of clusters prior to the k-means by iteratively partitioning procedure being performed to provide the optimal four-cluster solution. The k-means approach was selected due to its ability to manage large samples. This technique uses an algorithm to partition individual cases into a pre-specified number (k) of clusters based on their scores on three measures, in a manner that maximizes between-cluster differences and minimizes within-cluster variance. The cluster centers are iteratively updated until optimal groupings are achieved based on Euclidean distance. Follow-up bivariate analyses are conducted with potential correlates external to the cluster types in order to evaluate their validity. Specifically, chi-square and univariate tests are undertaken to determine differences in age, gender, marital status, education, senior housing residence, and household wealth and income. The subjective well-being outcome, depressive symptoms was regressed on the health

and environmental subgroups in order to examine their main and interaction effects after the effects of covariates were controlled.

2.3 Results

I first describe the characteristics of the health profiles revealed by the cluster analyses and report differences between the health profiles on background variables that are not entered into the cluster analysis. Then, I present the results of a series of logistic regressions that examine the differential unique associations of the health profile and the environments with depressive symptomatology.

2.3.1 Health profiles

Partially consistent with preceding health profile research, I derived four health profiles with qualitatively different sets of health conditions. Table 2.1 summarizes the membership distribution among older adults living alone and the defining characteristics of these four health-limitation types. The four profiles have been termed *sensory-cognitive impaired*, *physically impaired*, *frail*, and *healthy*. The sensory-cognitive type (28% of the study population) is distinguished by a high level of impairment in terms of vision and hearing, as well as in cognitive functioning. Contrastingly, individuals in this group show a lower level of impairment in physical and functional health. The physically impaired profile (23%) is characterized by high levels of impairments in chronic conditions and mobility limitations, while showing an average level of health across all other criteria. The frail type (9%) makes up the smallest portion of the sample. Older adults in this group are those impaired across all health indicators, clearly set apart from other types with values of at least half a standard deviation below the sample means in all health variables criteria. Contrastingly, members of the healthy group (38%) are distinguished by low levels of limitations in physical, cognitive and sensory health. In functional health, members of this group have the lowest levels of limitations compared to other groups.

2.3.2 Environment profiles

To the best of my knowledge, this is the first attempt to identify environment types involving both physical and social environmental characteristics. I found that older adults in the

sample are embedded in three different types of environments: physically average- socially unsupported, physically unsupported-socially supported, and physically supported –socially above average. Table 2-2 summarizes the characteristics of each environmental type. In the physically average-socially unsupported type, the physical characteristics of the environment all hover around an average level of support, while socially they are not in supportive environments. The members of this group tend not to have close friends living nearby, and neither are they actively engaged in social functions within the community. On the other hand, in the physically unsupportive-socially supportive type, older adults appear to be embedded in a rather contrasting blended environment in terms of its social and physical characteristics. Physically, the members of this group reported that they lack supportive in-home features and have a level of accessibility that is also below average. Lastly, for the physically supportive–socially above average group, older adults live in an environment that is both physically and socially supportive. Physically, this environment type is characterized by a high level of in-home support features and accessibility. Also, compared to other environment types, older adults in this environment type express a relatively higher level of housing satisfaction. Socially, members in this environment reported a higher than average level of social support in terms of close friends and active social engagement.

Table 2.1: Participant Characteristics in the 2006 HRS (N=2956)

Background		**Health**		**Environment**	
Age (*M*)	76.75(8.03)	Chronic Conditions (M)	2.32 (1.29)	**Physical Environment**	
% of age 65-74	46	Mobility Limitations (M)	1.46 (1.57)	Presence of features (%)	31
% of age 75-84	34	ADL Limitations (M)	0.38 (0.87)	Accessibility (%)	67
% of age over 85	20	IADL Limitations (M)	0.30 (0.78)	Housing condition (M)	3.67 (1.03)
% Women	75	Vision Impairment (M)	2.99 (1.02)	Neighborhood condition (M)	3.80 (1.07)
% 12> yrs school	34	Hearing Impairment (M)	2.83 (1.08)	Urban (%)	48
% Never married	7	Cognitive Function (M)	20.99 (5.37)	**Social Environment**	
% Widowed	69			Close Children (%)	54
% Divorced	24			Close Friend (%)	71
Wealth (M)	$351373			Frequency of engagement (M)	4.11 (1.97)
Income (M)	$35178				
Senior housing(%)	17				

Table 2.2.1: Health Profiles Derived by Cluster Analysis

Variables	Sensory Cognitive Impairment	Physically Impaired	Frail - Disabled	Healthy
n	827	688	277	1119
%	28%	23%	9%	38%
Physical Health				
# of chronic conditions (*M*)	47.29	58.43	55.36	45.38
Mobility limitations (*M*)	45.96	59.20	64.71	44.27
Functional Health				
ADL limitations (*M*)	46.50	50.91	72.47	46.33
IDAL limitations (*M*)	47.90	48.76	73.08	46.39
Cognitive Health				
Cognition function (*M*)	45.21	49.83	41.37	55.78
Sensory Health				
Vision (*M*)	53.91	51.63	58.15	43.91
Hearing *(M)*	55.48	51.49	55.60	43.59

Notes: The scales are the means standardized to an overall mean of 50 and a standard deviation of 10. Means approximately half a standard deviation above or below the mean (representing peaks of the clusters) are shown in bold.

Table 2.2.2: Environment Profiles Derived by Cluster Analysis

Variables	Physically average-Socially unsupportive	Physically Unsupportive-Socially supportive	Physically supportive-Socially above average
n	736	1403	735
%	25%	47%	25%
Physical Environment			
Presence of features (%)	47.66	43.26	64.85
Accessibility (%)	48.45	46.88	55.46
Housing satisfaction (M)	49.02	49.12	52.80
Neighborhood condition (M)	48.55	50.18	51.28
Urban (%)	50.94	49.72	49.46
Social Environment			
Children (%)	50.80	49.31	50.62
Friend (%)	34.17	56.31	53.90
Frequency of engagement (M)	41.65	52.58	53.40

Notes: The scales are the means standardized to an overall mean of 50 and a standard deviation of 10. Means approximately half a standard deviation above or below the mean (representing peaks of the clusters) are shown in bold.

2.3.3 External correlates of the health and environment profiles

For the health profiles, individuals in different health profiles varied on all the correlates examined (see Table 2.3). Older adults in the frail group are significantly older (*M*=82) and members of the healthy group are younger (*M*=74) compared to those in all other groups. Across all health types, women comprised the majority, resembling the overall distribution of the sample as a whole. Interestingly, in the sensory-cognitive impaired group, men made up a relatively higher proportion (32%) in comparison to other groups. In terms of race, the sensory-cognitive and frail group included a relatively higher proportion of African American elderly. The frail and healthy groups contrast with each other in several respects. The frail group includes the highest proportion of the widowed (77%), while the healthy has the smallest (67%). In terms of income and wealth, the former has the smallest proportion below the 50% quartile (29 and 39%), and the latter group has the largest (63% and 65%). In terms of senior housing residence, the two groups continue this same pattern of contrast. In the frail group, 25% reside in senior housing, while among the healthy group only 12% live in such housing. Also, members of the frail group reported the highest proportion of depressive symptomatology with 45%, while the healthy group contains only 9%.

On the environment profiles, the three environments also varied on all correlates except income. Individuals in the physically supported-socially above average type are the oldest (M=79) among the environmental types and are more likely to be widowed (79%). Their proportion of senior housing residence was the highest at 36%. Members of this group have the lowest proportion of depressive symptomatology (18%).

2.3.4 Person-environment and depressive symptomatology

Sociodemographics

Table 2.4 shows the hierarchical models used in this study. Findings from models 1 through 4 consistently indicated that depressive symptomatology was correlated with most sociodemographic characteristics. Compared to the young-old group (>64 and <75), the old-old and the oldest groups are found to be less likely to be depressed (b=.75, p<.05, b= .59, p<.001 in model 4). The more educated are less likely to report depressive symptoms (b=.95, p<.05 in model 4). Compared to Whites, African American older adults are more likely to be depressed (b=1.34, p<.05 in model 4). Compared to the highest income quartile, the two lowest income

groups are more likely to be depressed (b=1.72, p<.01, b= 1.48, p<.05 in model 4). Interestingly, among the elderly living alone, living arrangement is not significantly associated with depressive symptomatology. In all the models, compared to the never-married group, neither the widowed nor the divorced/separated is associated with depressive symptoms. Also, residence in senior housing is not significantly related to outcome.

Health profiles and environment Profiles

With socio-demographic covariates controlled, the main effects of health profiles are examined starting from model 2. The findings clearly revealed that all three health profiles are significantly related to depressive symptoms, except in the final model. Compared to the reference group (healthy group), those in the frail group are 4.7 times more likely to be depressed (p<0.001) and members of the physically impaired group are 2.4 times more likely to be depressed (p<0.001). The main effects of the environment are examined in models 3 and 4. Interestingly, compared to the physically supportive-socially above average environment, the physically average-socially unsupportive environment was only marginally more significantly related to the likelihood of being depressed (b=1.29, p<0.1 in model 3), and the effect disappeared in the final model, model 4.

As an attempt to examine the theoretical construct of the person-environment (P-E) fit, in model 4 the interaction term between health profiles and the environments are included in order to investigate the extent to which the environment moderates the main effect of health on depressive symptomatology. For health profiles, the healthy group was used as a reference. For environment, the physically supportive-socially above average environment was used as a reference. Interestingly, the findings indicate that environment has differential moderating effects in interactions with different health subgroups. The frail group is 2.6 times more likely to have depressive symptoms when living in a physically average and socially unsupportive environment (p<.001 in model 4). For the sensory-cognitive impaired group, members are 2.1 times more likely to show depressive symptoms when they live in a physically unsupportive but socially supportive environment (p<001 in model 4).

Table 2.3: Health, Environment and Background Characteristics of Older Adults Living Alone

	Health Profiles				Statistics	Environment Profiles			Statistics
Health / Covariates	Sensory Impairment	Physically Impaired	Frail-Disabled	Healthy		Physically average-Socially unsupported	Physically Unsupported-Socially supported	Physically supported-Socially above average	
Age (*M*)	78.05	77.57	81.38	73.97	F(3, 2907)=94.02 ***[a]	75.49	76.02	79.10	F(2, 2871)=48.08 ***
Men (%)	32	22	22	23	x^2(3)=31.53****	25	28	21	x^2(2)=12.76****
12> yrs school (M)	11	12	11	13	F(3, 2900)=78.90 ***	12	12	12	F(2, 2864)=2.45 *
African American (%)	19	13	19	11	x^2(6)=39.36****	16	16	11	x^2(4)=19.47****
Widowed (%)	71	72	77	67	x^2(6)=39.47****	62	67	79	x^2(4)=53.18****
Divorced (%)	22	24	16	28		30	26	16	
Wealth (%, above the 50th quartile)	46	42	39	65	x^2(9)=209.27****	46	53	49	x^2(6)=22.61****
Income (%, above the 50th quartile)	44	46	29	63	x^2(9)=219.92****	50	51	48	x^2(6)=6.77
Senior housing (%)	15	21	25	12	x^2(3)=44.13****	11	10	36	x^2(2)=235.18****
Well-being Symptomatology (%)	14	23	45	9	x^2(3)=220.60****	21	15	18	x^2(2)=12.65***

Table 2.4: Person-Environment and Depressive Symptomatology

Depressive Symptomatology	Model 1		Model 2		Model 3		Model 4	
	Odds ratio		Odds ratio		Odds ratio		Odds ratio	
Covariates								
Age								
Old old (> 74 and < 85)	0.832		0.723	**	0.721	**	0.722	**
The oldest (> = 85)	0.853		0.544	****	0.551	****	0.554	***
Women	1.046		1.033		1.023		1.018	
Education (>12)	0.93	***	0.957	**	0.953	**	0.953	**
White	1.363	**	1.463	**	1.447	**	1.443	**

Wealth								
1	1.717	**	1.384		1.323		1.317	
2	1.049		0.908		0.893		0.898	
3	1.042	***	1.063		1.055		1.053	
Income								
1	1.967	***	1.627	**	1.661	***	1.705	***
2	1.515	**	1.430	**	1.422	**	1.440	**
3	1.217		1.149		1.147		1.171	
Senior housing	0.886		0.817		0.833		0.845	
Health profile								
Frail			7.992	****	7.700	****	4.761	****
Physically impaired			2.888	****	2.860	****	2.457	****
Sensory impaired			1.609	**	1.586	***	1.044	
Environment profiles								
Physically average - Socially supported					1.316	*	0.988	
Physically unsupported - Socially supported					0.904		0.655	
Health * Environment								
Frail * Physically average - Socially unsupported							2.666	**
Frail * Physically Unsupported - Socially supported							1.501	
Physically impaired * Socially unsupported							1.298	
Physically impaired * Socially supported							1.142	
Sensory Impaired * Socially unsupported							1.145	
Sensory Impaired * Socially supported							2.143	**
Constant	0.085	****	0.055	****	0.055	****	0.068	****
Log likelihood	-1183.2114		-1112.2585		-1108.0679		-1101.1922	
LR $\chi 2$ (df)	101.00		242.90(17)		251.28(19)		265.03	
$\Delta\chi^2$	---		141.91 (3)	**	8.38(2)	**	13.75(6)	**
N	2657		2657		2657		2657	

2.4 Discussion

Drawing on the Person-Environment (P-E) fit perspective and person-centered approach, this study aimed to identify both discernible subgroups of health limitations and subgroups of living environment and determine to what extent different living environments moderate the effects of a range of health conditions on depressive symptomatology. To the best of my knowledge, this is the first P-E research focusing on older adults living alone using a person-centered approach to look at well-being. The findings will contribute to the extremely limited knowledge on the well-being of older adults living alone, particularly in terms of the role of the environment.

Applying a person-centered perspective and clustering analysis to both the person and the environment, I found different subgroups of health and environment among older adults living alone. In terms of health, the findings indicate that older adults living alone can be grouped into health profiles including sensory-cognitive impaired, physically impaired, frail, and healthy. This range of health profiles appears to be fairly consistent with earlier studies that largely tend to find frail, cognitively impaired, physically impaired, and healthy groups (Lafortune et al., 2009). One interesting finding from this research is that I identified a sensory-cognitive impaired profile. Given that the examination health profiles is at a very early stage, it is too early to tell if the identification of this subgroup is a better reflection of the prevalence of health limitations considering that previous research found sensory impairment and cognitive impairment to be highly correlated, or if this subgroup is unique to the elderly who live alone. More research is needed to determine if this is a more refined category. This study is the first attempt to derive subgroups of environment. Therefore, compared to other profile research such as studies on health profiles and social network types, the three environmental profiles identified in this study should not be viewed as firm categories of the environment of older adults living alone. Rather, future research should be pursued to replicate our initial attempt to empirically examine the environmental contexts of the elderly.

The clear emergence of health subgroups among the elderly living alone provides an important implication for research on this group. A large proportion of individuals (38%) are found to be fairly healthy across all dimensions of health, including physical, functional, cognitive and sensory health. In contrast, the frail elderly living alone, although the smallest

group (9%), is the most vulnerable group of older adults. Individuals in this subgroup are older, made up of a larger proportion of African Americans and the widowed, and tend to be in lower income and wealth groups. A near-majority of this group (45%) reports depressive symptoms. The concentration of risk factors in this subgroup suggests that a focused research and policy development effort may be extended by identifying which characteristics of the environment may compensate for their most-impaired health status and other living conditions, even for this most vulnerable group of older adults. For example, accumulated research on nursing home admissions has demonstrated that along with the set of other risk factors, the status of living alone is significantly associated with long-term care institutionalization. By focusing on the elderly living alone, the findings further suggest we can still identify additional sub-groups of the elderly among those living alone who are especially vulnerable to different health impairments.

The Person-Environment Fit perspective suggests that the fit for successful adaptation in old age is determined by the degree to which characteristics of the living environment compensate for losses or impairments due to health. For the third research question, I asked about the extent to which different environments moderate different health impairments of the subgroups identified. I found that for the two health subgroups of frail and sensory-cognitive, they are differently affected by environments in terms of depressive symptoms. These findings clearly underscore the need for the simultaneous examination of the physical and social environments, suggesting that different aspects of environment affect different subgroups of older adults living alone. The first major finding regards the sensory-cognitive impaired profile. For the elderly living alone in this group, they are more likely to be depressed if they live in a physically unsupportive but socially supportive environment. It appears that due to the nature of the limitations or losses among older adults in this health profile, a compensating role of the environment for this group is more pronounced for the physical environment rather than the social environment. Findings from previous studies seem to partially support this differential effect of the physical and social aspects of the living environment. For example, while sensory impairment was considered to affect loneliness, a component of psychological well-being (Wahl & Tesch-Romer, 2001), for older adults with sensory impairment social environment in term of social relations was not significantly different from those with no impairments (Reinhart, 1996). For this group, a better fit for their psychological adaptation therefore lies in the physical aspects of the living environment.

Although it was not my intention to examine it in this research, I would speculate that the reason behind the lack of a significant effect for social support in the environment on this group's psychological well-being might be related to a sense of autonomy. Maintaining physical and psychological independence is a primary goal in later years. It is possible that a sense of control may be heightened by the ability to cope with loss by means of the physical features of the environment. In other words, for this subgroup, physically supportive features rather than social supportive characteristics may enhance their sense of personal control in adapting to their losses and impairments in sensory and cognitive function. In the P-E fit literature, the concept of personal control is considered to precede adaptive behavior or affects (Oswald & Wahl, 2013). In this study it may promote better subjective well-being. Lawton (1985) describes how community-dwelling frail elders create "control centers" within their homes as a technique to cope with their severely limited health conditions in a place that provides a view of the house entrance and sidewalk, as well as easy access to a telephone and television. The existence and utilization of the physical features of the home help them to maintain or improve their sense of security and control, thereby enabling them to maintain psychological autonomy. As such, personal control or agency is assumed in the P-E relation literature, but to date the role of personal control has rarely been examined directly in empirical research, under the assumption that the adaptation represented in the process of relocation lies within the individual's active role, or agency (Oswald & Rowles, 2006). An emerging theoretical and empirical body of research incorporates the psychological construct of control to better examine the process of adaptation (Oswald, Wahl, Schwelling, & Iwarsson, 2007). Future research may attempt to empirically examine the mediating role of psychological constructs tapping into a sense of individual agency.

The second finding concerns the frail group. Frail older adults living alone are more likely to be depressed if they live in a physically and socially less-supportive environment. This finding of itself may be somewhat predictable, given their highly impaired health status. However, awareness of how to develop living environments that are both physically and socially supportive holds important policy and program implications for vulnerable subgroups of the elderly living alone. Several findings in bivariate analyses provide interesting suggestions as related to senior housing in this regard: both in the frail group and physically supportive and socially above-average environment group, the relative proportions of residing in senior housing are highest (25% and 36%, respectively). Also, although not significant, it was an intriguing

trend that those living in senior housing seemed to be less depressed, something that is in clear contrast to the findings of previous research indicating this in general (Gonyea, & Bachman, 2008). To date, research on planned living facilities such as senior housing remains fairly limited and no research has yet been conducted to investigate person-environment dynamics as related to the well-being of older adults. Research on planned living facilities such as senior housing is still fairly limited as well and no existing research has been published looking at the person-environment dynamic in terms of its relation to the well-being of older adults.

Taken together, these findings offer an important suggestion for future research on the role of senior housing in terms of P-E adaptation. During this research, I did not directly test any differential effect of residence in senior housing on the well-being of the elderly living alone. The P-E fit perspective suggests that older adults living at home and suffering from severe competence losses can adapt to environmental problems in terms of behavior and affects (Oswald et al., 2007). The observations from our data raise two important questions: First is an empirical question that requires future research in order to tease out the role of senior housing residence for the most vulnerable group of elderly. Is living in senior housing for the most frail elderly living alone a manifestation of behavioral adaptation as suggested by the P-E perspective in the way that some people choose to relocate into more supportive environment (Wahl et al, 2004). Another question worthy of pursuit is whether the finding that senior housing with the highest proportion of support in the physical and social environments is where residents are less depressed reflects a successful psychological adaptation or not.

In addition to a specific organizational model of living environment such as housing planning, one can also consider the implications for community intervention strategies regarding the types of programs that can enhance the physical and social environment for the most vulnerable older adults. The problem of social isolation among the elderly living alone has been well researched. Currently, some programs exists (e.g. Senior Corps) that are designed to alleviate such social isolation in an effort to improve their independent living. One way to better help the frail group identified in our research may be the creation of a program in which community workers provide regular visits to frail older adults living alone. Such a program could train community workers not only in formal in-home therapy services, but also provide training on barrier reductions that could lead to reductions in self-care and mortality services (Stineman et al., 2012).

2.5 Limitations

Certain limitations of this current analysis should be acknowledged. I believe a longitudinal investigation would further enhance profile research on aging-in-place in key respects. Underlying the P-E fit perspective is a dynamic association between personal competence and the environment. Generalizations about health profile and environment profile as a construct of aging-in-place, as well as its influence on subjective well-being, would be substantially improved if I were able to look into the developmental process of the profiles of individuals over time and observe whether nor not changes in these profiles led to or are a result of changes in subjective well-being. In particular, it is well known that older adults tend to maintain a high level of subjective well-being of socio-demographic and health conditions, commonly known as the well-being paradox (Diener, Suh, Lucas, & Smith, 1999). Still, longitudinal research on subjective well-being is fairly limited, particularly from the person-environment (P-E) fit perspective. I believe a longitudinal examination of the extent to which health, environment, and changes in the fit between the two affect well-being would provide an important contribution to research on well-being.

Another limitation is concerned with the indicators of environment profiles. Trajectories from other profile research have shown that continued efforts to derive profiles based on more refined indicators result in the confirmation or modification of the profiles identified in earlier studies. In my study, I used a relatively small set of indicators for social and physical environment. It is hoped that future research will utilize a more refined set of such indicators to determine to how well the environmental types can be replicated. As a related matter, attention needs to be paid to the finding that among the five physical environmental indicators, in-home physical features and accessibility are largely the determining factors in establishing environmental clusters. While this finding confirms the importance of the two physical characteristics shown in the previous environmental gerontological studies (Gitlin, 2003), future research is needed to examine if the lack of a discriminating role of more broader level of physical environment such as neighborhood and urbanicity is limited to older adults living alone, or it has to do more with a lack of sophistication in the characteristics of the indicators.

Lastly, additional limitations regard the continued efforts to identify subgroups of older adults. My research focuses on the elderly who live alone as an example of vulnerable subgroups

of the elderly. Accumulated research on aging-in-place has revealed that older people's social relational environments intersect with gender and race over their life course (Antonucci, Ajrouch, & Park, in press). Under the P-E fit perspective, future research can examine the effects of larger social forces such as cohorts, gender and culture in the person-environment dynamic.

Despite these limitations, by providing evidence of the heterogeneity of the health and living environments of older adults living alone, these finding demonstrate that aging-in-place has benefits, but also costs in terms of well-being. Given that this study is the first attempt to identify profiles of the elderly living alone, it is hoped that further profile research will make a contribution to designing more effective support services or programs to meet the particular priorities of specific profiles of these older adults.

CHAPTER III

THE ROLE OF PERCEIVED CONTROL IN MAINTAINING WELL-BEING OVER TIME: A PERSON-ENVIRONMENT (P-E) FIT PERSPECTIVE

3.1 Introduction

Aging-in-place has become the focus of aging policy and research and a high priority among older adults in the U.S. amid a dramatic increase in the elderly population (Cutchin, 2003; Rowles, 1993; Scharlach, 2012). Generally, aging- in-place refers to individuals growing older in a "home," with the definition of such a home encompassing a wide range of living environments in residential settings, surrounding neighborhoods, and broader communities (Black, 2008). It is suggested that society will also benefit from helping older adults remain in their homes, as compared to being institutionalized, as it would reduce the related financial burden. Although aging-in-place is generally expected to benefit both individuals and society, researchers have begun to ask if it benefits all elderly persons universally (Byrnes, Lichtenberg, & Lysack, 2006). It is important to recognize that among older adults who are aging-in-place, there may be subgroups who are at risk due to multiple limitations or losses in health. Such subpopulations may reside in a place that enhances their risks by contributing to declines in their health and well-being (Krause, 1993).

With a dual focus on aging and the broader environment, the Person-Environment (P-E) fit perspective, particularly environmental press theory (Lawton & Nahemow, 1973) has guided much of the theoretical and empirical research on aging-in-place over the last few decades. Under the P-E fit perspective, aging-in-place is conceptualized as the consequence of the fit between individuals and their environments (Lawton, 1990). The core theoretical assumption is that there are unique combinations of personal needs and resources and environmental characteristics that determine an individual's adaptation (Wahl, Iwarsson, & Oswald, 2012). The P-E perspective thus suggests there may be subgroups at risk of maladaptation depending on a mismatch between a person's needs and the varying levels of support in the environment. P-E fit

research findings have been extensively applied to the design of a variety of residential environments such as nursing homes and neighborhood planning (Lawton, 1990).

Despite substantial advances in P-E fit research, many questions remain about the pathways or mechanisms leading to optimal adaptation as theorized in the P-E fit perspective. One proposed pathway is through the individual's sense of control or self- efficacy. The P-E fit perspective proposes that a mismatch between a person's needs and the available environmental support may frustrate that individual's autonomy, which may in turn manifest as a reduced sense of control or self-efficacy (Lawton, 1990; Oswald & Wahl, 2013; Scheidt & Norris-Baker, 2003). Although perceived control has been conceptualized as a construct independent of Person and Environment, empirically there has been little research that illuminates the ways in which the personal and environmental contexts and the fit between the two are translated into well-being. Findings of non-P-E fit research have suggested a potential association among person, environment and individual agency as related to adaptation. For example, studies have shown that declines in physical health and disability are associated with a lower sense of control among older adults (Dunkle, Roberts, & Haug, 2001) and worse health and lower functioning have been linked with a poor and worsening level of subjective well-being (Antonucci & Akiyama, 1997; Smith, Borchelt, Maier, & Jopp, 2002). To date, there is little research on P-E fit that comprehensively examines the components of aging-in-place of person, environment and perceived control and well-being.

This study follows from the first dissertation paper that identified subgroups in Person and Environment and examined the fit between these two dimensions for older adults who live alone and are aging-in-place. Building on those findings, the present study aims to contribute to existing P-E research on aging-in-place in several ways. First, by conceptualizing perceived control as an outcome of P-E fit, this study examines the association between Person, Environment, and perceived control. Second, it explores direct and indirect effects of Person, Environment and control on subjective well-being in adults aged over 65 who live alone. Perceived control here is conceptualized as a process of the P-E dynamic in aging-in-place. A comprehensive understanding of the dynamic among these components of aging-in-place will provide an important contribution to P-E fit research.

3.1.1 Person-Environment (P-E) and perceived control

As a psychological resource, perceived control refers to an individual's belief that he/she has the ability to change certain aspects of their lives and the environment in which they live (Bandura, 1989; Pearlin & Schooler, 1978; Skaff, 2007). It has been proposed as an important predictor in psychological adaptation (Baltes & Baltes, 1986; Rodin, & Langer, 1980; Schulz, Heckhausen, & O'Brien, 1994). From the P-E fit perspective, perceived control is one aspect of psychological adaptation in old age and is determined by the dynamic between two dimensions of aging-in-place: Person and Environment.

Focusing on declines and losses in health with aging, it has been suggested that aging has a detrimental effect on an individual's sense of control (Skaff, 2007). In old age, people may be vulnerable to a reduced sense of control as a result of declining abilities and physical strength (Mirowsky, 1995; Schulz et al., 1994.). Findings from existing research on perceived control among older adults are inconsistent, however. Some studies show that control decreased with aging (Dunkle et al., 2001; Wolinsky, Wyrwich, Babu, Kroenke, & Tierny, 2003), whereas other studies found no age difference (Lachman & Prenda-Firth, 2004). Also, much of the research used cross-sectional data (Skaff, 2007).

The role of the living environment as a source of experiences either enhancing or inhibiting the sense of control has also been well researched (Avorn & Langer, 1982; Rodin & Langer, 1980). The findings suggest that particular environments provide experiences leading to changes in perceived control (Banzinger & Roush, 1983; Langer & Rodin, 1976; Rodin & Ranger, 1977). As experimental research, most of these studies have manipulated conditions in the environment and were conducted in the context of an institutional environment. Although such experimental studies shed light on the association between environment and perceived control, the role of perceived control between the environment and adaptation was not directly examined (Welch & Ist, 1995), but rather was assumed as a consequence from modifications to the environment such as control over timing and duration of residential visits (Schulz & Hansua, 1983). Research on social support for the non-institutionalized elderly has also reported that various forms of social supportive environments (e.g., caring for and appreciating the other, empathy, providing help) have been linked to perceived control (Antonucci, 2001).

Taken together, previous studies have demonstrated an important association between the physical and social aspects of living environments and perceived control. From the P-E fit

perspective, however, their foci are on only a single dimension of aging-in-place, the environment, and not necessarily aimed at an empirical examination of the heterogeneity of aging-in-place which may be determined from both aspects, Person and Environment. An emerging theoretical and empirical body of research has been incorporating perceived control in order to better examine the process of adaptation. Oswald and his colleagues (2003) incorporated a sense of control theory into the P-E fit perspective. As a domain-specific control in the area of housing, they developed a construct of housing-related control belief. Their empirical findings on community-dwelling older adults showed that housing-related control beliefs mediated the impacts of housing accessibility, the P-E construct, and problems on the level of Activities of Daily Limitation (ADL) (Oswald, Wahl, Shwelling, Iwarsson, 2007). This study demonstrated that the relationship between housing and health outcomes in old age is not only due to increased environmental challenges (housing accessibility problems) but also due to individual attitudes of older persons (Oswald et al., 2007). Although the examination of environment was confined to physical characteristics, this study was a rare example that explicitly focused on the P-E fit and perceived control.

3.1.2 Perceived control and subjective well-being

A considerable amount of research has been conducted using different constructs of control (Baltes & Baltes, 1986; Lachman, 2011, for a summary). Perceived control has been established as a foundational element in psychological well-being (Rodin, Schooler, & Schaie, 1990; Thompson, 1981; White, 1959). Cross-sectional, longitudinal, experimental studies on autonomy, a concept related to perceived control, consistently suggest that losses in autonomy may pose harmful consequences, including increased morbidity and mortality (Schulz & Wright, 2007, for a review), whereas enhancements to autonomy may improve health status, psychological well-being, and activity level (See Sikorska-Simmons, & Wright, 2007, for a review). Perceived control shows strong associations with better mental health (Mirowsky & Ross, 1992; Krampe, Hautzinger, Ehrenrich, & Kroner-Herwig, 2003). In disability adjustment research, the role of perceived control is also consistently recognized (Tompson, Sobolew-Schubin, Galbraith, Schwankovsky, & Cruzen, 1993). Conceptualized as a dynamic process involving interaction between individuals' diseases and their personal or environmental resources (Verbrugge & Jette, 1994), the role of perceived control is emphasized in most

disability adjustment research as a mediator leading to better affective outcomes (Schulz et al., 1994).

Despite the well-researched positive role of a sense of control as a psychological resource, research on psychological theory of control has demonstrated that control may not be universally beneficial for all elderly persons (O'Connor & Vallerand, 1994). Opportunities, or certain characteristics of environment providing choice and control, are found to be differentially associated with adaptation among individuals depending on their level of function or the nature of their perceived control (Reich & Zautra, 1990; Timko & Moos, 1989). For example, a high sense of control may not be universally good for all elderly individuals, but it could in fact be a "double-edged sword" (Kunzann, Little, & Smith, 2002). It may be beneficial when conditions are modifiable, but dysfunctional when the conditions are uncontrollable (Clarke & Smith, 2011). Much research about perceived control distinguishes between a sense of personal mastery (internal control) and perceived constraints (e.g. external control). Although these are in fact related, the two dimensions may be differentially correlational to the outcomes of aging-in-place. Skinner's (1996) twofold conceptualization of the personal with mastery and constraint is a way to capture the phenomenon that many older adults maintain a sense of mastery over time but increase in acknowledging constraints along with growing environmental challenges and declining health conditions. However, most previous studies focused on one of the dimensions and only rare studies have examined the older adult population using the two subscales of perceived control.

These findings are clearly in line with the P-E fit perspective that proposes psychological adaptation will differ depending on the degree of fit between the environment and the person. The P-E fit perspective suggests that perceived control may be both a consequence determined by the fit between the Person and the Environment, and also the antecedent influencing other adaptions such as subjective well-being. To date, however, there have been few attempts to examine the role of perceived control as a mediator of well-being and adaptation among older adults who live alone in the community.

3.1.3 Research questions

This study focused on subgroups of older adults living alone with different health and environmental contexts and asks if changes in depressive symptomotology over time are

mediated by changes in their perceived control. It follows from the first paper in which four subgroups of health limitations were identified: sensory-cognitive impaired, physically impaired, frail, and healthy. This study poses two research questions: (1) To what extent are health subgroups and environmental contexts associated with changes in perceived control? Given that this is the first empirical attempt at studying perceived control from the P-E perspective, I did not set out specific hypotheses. I generally expected that there would be a negative association between more vulnerable health subgroups (e.g. frail group) and the environment and perceived control and a positive association between better health groups and environmental characteristics and perceived control. (2) Does perceived control mediate the influence of health and environment on depressive symptomatology over time? No hypotheses are developed due to the exploratory purpose involving the mediating role. Still, it was generally expected that mediation effects of perceived control would differ by health subgroups and the environment. In pursuit of these questions, two related aspects of perceived control are examined: perceived constraint and perceived mastery.

3.2 Methods

3.2.1 Data and sample

Participants are drawn from the 2006 and 2010 waves of the Health and Retirement Study (HRS). The HRS is a national longitudinal study that conducts surveys every two years on more than 22,000 older adults and their spouses. In each wave of the HRS, a rotating 50% of the core panel participants are randomly preselected for an enhanced face-to-face interview and received the Psychosocial and Lifestyle questionnaire.

In this study, the 2006 and 2010 HRS surveys are referred to as Time 1 and Time 2. The initial sample derived from the 2006 wave and used in first paper focused on older adults who are non-institutionalized, aged 65 years and older, and living alone (N=2956). From this original sample, 298 people who died by 2010 were excluded. In addition, 65 cases were dropped because information was not attainable in 2010 for several reasons (i.e. institutionalization, refusal of participation or others). The final sample was N=1107. Table 3.1 presents descriptive

statistics of the sample, including means and standard errors. The average age was 75.91, 77% were women, 81% were White, and the average years of education was 12.05.

3.2.2 Measures

Health profiles

In the first paper, seven health variables were used to derive health subgroups of elderly who live alone in the community. The measures include a count of chronic health conditions (0-8) prevalent in later life, a count of mobility limitations (0-5), a count of activities of daily living (ADL) (0-5), instrumental activities of daily living (IADL), cognitive health measured by the summary cognitive variable of Mini-Mental State Examination (0-35), and sensory health including hearing and vision capacity.

Based on clustering methods, four health profiles with qualitatively different sets of health conditions were derived. The four profiles were termed sensory-cognitive impaired, physically impaired, frail, and healthy. The sensory-cognitive type (28% of the study sample) is distinguished by a high level of impairment in terms of vision and hearing, as well as in cognitive functioning. Contrastingly, individuals in this group show a lower level of impairments in physical and functional health. The physically impaired profile (21%) is characterized by high levels of impairments in chronic conditions and mobility limitations, while showing an average level of health in all other criteria. The frail type (8%) makes up the smallest portion of the sample. Older adults in this group are those impaired across all health indicators, clearly set apart from other types with values of at least half of a standard deviation below the sample means in all health variables criteria. Contrastingly, members of the healthy group (43%) are distinguished by low levels of limitations in physical, cognitive and sensory health. In functional health, members of this group have the lowest levels of limitations compared to other groups.

Environment

Physical environment indicators. Two aspects of the physical environment are examined: in-home supportive features and neighborhood condition. HRS utilizes extensive skip patterns for housing-related variables. In general, only new respondents or those who indicated moving and/or making a home modification are asked to provide new information about housing characteristics. Data on housing characteristics were collected from earlier waves of the study (five HRS waves from 1996 to 2004 and AHEAD 1993 and 1995 waves). After hierarchically

assigning values for the housing environment variables for those who entered the study prior to 2006, a binary indicator variable was created based on six supportive features. These are presence of ramps, railings, wheelchair access, grab bars, emergency call button and others. For neighborhood level indicator, safety of neighborhood was coded as 1 (poor) to 5 (excellent).

Social environment indicators. Two aspects of social environment are examined, contact frequency with children, friends and family, and perceived social support with children, friends and family. For contact frequency, respondents are asked how often they had contact with their children by email, phone and face-to face. For each of the three types of contact, responses are given on a six-point scale ranging from 0 (less than once a year or never) to 5 (three or more times per week). The three contact measures are averaged for use as a composite contact variable. Perceived support was measured with three questions including "how much can you rely on them if you have a serious problem?" Responses are given on a four-point scale ranging from 0 (not at all) to 4 (a lot). The three measures are averaged for use as a composite contact variable.

Perceived control

Two measures of perceived control, personal mastery and perceived constraints are used in this study. Perceived mastery represents one's perception of his or her ability to achieve goals (Lachman & Weaver, 1998; Ward, 2011). The measure included five statements such as "When I really want to do something, I usually find a way to succeed at it" and "What happens to me in the future mostly depends on me." Perceived constraints represent one's perception of barriers that limit or interfere with the achievement of goals and include the operation of luck or fate (Pearlin, & Schooler, 1978). The five statements in this measure included "Other people determine most of what I can and cannot do" and "What happens in my life is often beyond my control." For both measures, scores are the mean of responses to five Likert-scaled statements (1=strongly disagree; 6=strongly agree). Higher scores indicate more perceived mastery and less perceived constraint. For perceived mastery, the internal consistency score was .89 at Time 1 (2006) and .90 at Time 2 (2010). For perceived constraints, it was .86 at Time 1 (2006) and .88 at Time 2 (2010).

Depressive symptomology

Depressive symptoms are measured by eight items from the abbreviated version of the Center for Epidemiologic Studies Depression Scale (CES-D) at Time 1 (2006) and Time 2

(2010; alpha = .81 for both waves). Six of the eight CES-D items indicate the presence of depression, and two indicate its absence. Six of the eight indicators measured whether the respondent experienced any of the following negative sentiments over the preceding week: depression, everything being an effort, restless sleep, feeling alone, feeling sad, and could not get going. Two items measured the experience of feeling happiness and feeling enjoyment of life. The eight items are summed to form a depressive symptom score ranging from 0 to 8. A higher score indicates greater depressive symptoms.

Covariates

Age was measured as a continuous variable. Current marital status was coded as 0 (never married), 1 (widowed), or 2 (divorced/separated). Gender was coded 1 for women and 0 for men. For wealth and income, RAND HRS imputed composite variables for total household wealth and income are used. The composite dollar values of both variables are coded as quartiles (1= lowest, 4= highest). Education was measured in five categories (1=less than high school, 5=college and above). White was coded 1 and 0 for non-white. For residential region, urban area was coded 0, suburban area, 2 and rural area 3.

3.2.3 Analysis

Figure 3.1 illustrates the conceptual model on aging-in-place showing health profile and the environmental influence on depressive symptoms over time through perceived controls. To address the research questions, I undertook a path analysis in two steps in order to estimate the direct, indirect (through changes in perceived control), and total impact of the health profiles and the environmental contexts on the changes of depressive symptoms. In the first step, I first examined the impact of health profile and environmental characteristics (Time1) on perceived control over four years of time (Tine 2). Second, I examined the full conceptual model, including the potential mediating effect of perceived control (Time 2) in the relationship between health, environment (Time 1) and depressive symptoms (Time 2). For each of the perceived controls, perceived mastery and perceived constraint, I estimated two models.

A path analysis using structural equation models was used for several reasons. First, it facilitates a simultaneous estimation of the direct, indirect, and total effects on depressive symptoms. Second, it can account for the potential correlated error within each domain (e.g. physical environment and social environment) by setting specific indicators to be freely

correlated with each other. Analyses were conducted with Mplus 7.0 using full-information maximum likelihood (FIML) to handle missing data. Two criteria were used to assess the model fit of the structural model: the Comparative Fit Index (CFI) and the root mean square error of approximation (RMSEA). Values close to .95 for CFI, .06 for RMSEA suggest good fit for the model (MacCallum & Austin, 2000). Although generally used as a primary standard by which to assess the model fit, the $\chi 2$ goodness-of-fit test is sensitive to sample size (Kline, 2011), so I used CFI and RMSEA. In order to evaluate the magnitude and significance of mediated effects, the significance test of indirect effects was conducted using the Sobel test (Preacher & Hayes, 2008). This study investigates the indirect effects of perceived loss of control at Time 2 in the pathway from health and environment at Time 1 to depressive symptoms at Time 2.

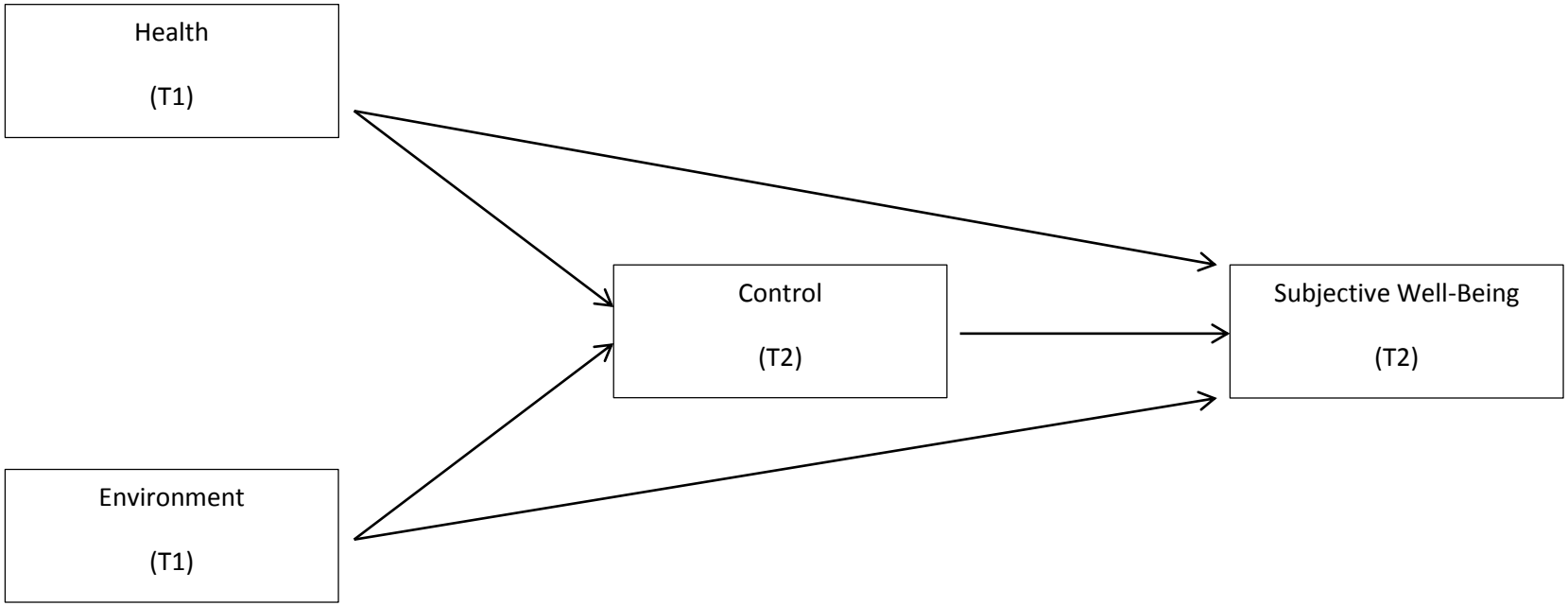

Figure 3.1: A Conceptual Model of the Role of Perceived Control in Well-Being

3.3 Results

3.3.1 Sample characteristics

Table 3.2 shows bivariate analyses among the study variables in the conceptual model. Older adults living alone with different health profiles varied on perceived control and depressive symptoms. Individuals in the frail group had significantly higher perceived constraint and lower mastery (e.g. *M*=3.61 for constraint, *M*=3.47 for mastery at T2) and members of the healthy group had the lowest constraint (*M*=2.00 at T2) and highest mastery (*M*=4.86 at T2) compared to those in all other groups. Similarly, the frail group had the highest level of depressive symptoms (*M*=3.34 at T2) and the healthy group had the lowest depressive symptoms (*M*=1.16 at T2). For the environment contexts, the four environmental characteristics are also significantly related with both perceived control and depressive symptoms. Generally, higher social support, more frequent contact with family and friends, and better neighborhood condition are associated with lower constraint and higher mastery. Interestingly, the presence of in-home features was associated with higher control, lower mastery and higher depressive symptom.

Table 3.1: Background Characteristics and Components of P-E Fit of Older Adults

Background		Health Profiles		Environment	
Age (*M*)	75.91(7.43)	Frail (%)	8	*Physical Environment*	
Women (%)	77			Presence of features (%)	31
School years (M)	12.05 (3.05)	Physically impaired (%)	21		
				Neighborhood safety (M)	3.79 (1.05)
White (%)	81	Sensory-Cognitive Impaired (%)	28	*Social Environment*	
Widowed (%)	70			Support (M)	3.18 (0.56)
Divorced	24	Healthy (%)			
Income (M)	40004.83			Contact frequency (M)	2.07 (1.08)
Wealth (M)	305164.50				
Urban (%)	42				

Perceived Control		Subjective Well-being	
T1 Perceived constraint(M)	2.32 (1.22)	Depressive symptoms (M) (T1)	1.87 (2.12)
T1 Perceived mastery (M)	4.66 (1.13)	Depressive symptoms (M) (T1)	1.73 (2.02)
T2 Perceived constraint(M)	2.43 (2.32)		
T2 Perceived Mastery (M)	4.55 (1.17)		

Notes: Numbers in parenthesis are SD.

Table 3.2: Bivariate Comparisons of Health Profile Groups and Environment Contexts: Perceived Control and Well-being

	Health Profiles				Statistics	Environmental Contexts			
Health / **Covariates**	Sensory Impairment	Physically Impaired	Frail - Disabled	Healthy		Social support	Contact frequency	In-home features	Neighborhood condition
Perceived Control									
Perceived Constraint (T1)(M)	2.41	2.60	3.39	1.96	F=(3, 942)=35.95 ***[a]	-0.22***	-0.18***	0.11***	-0.15***
Perceived Constraint (T1)(M)	4.65	4.51	3.84	4.88	F=(3, 945)=18.56 ***[a]	0.19***	0.09***	-0.03***	0.12***
Perceived Constraint (T2)(M)	2.70	2.72	3.61	2.00	F=(3, 827)=27.94 ***[a]	-0.21***	-0.12	0.10***	-0.15***
Perceived Mastery (T2)(M)	4.46	4.30	3.47	4.86	F=(3, 826)=37.17 ***[a]	0.15***	0.04	-0.10***	0.05
Subjective Well-being									
Symptomatology (T1)(M)	1.92	2.33	3.95	1.21	F=(3, 1094)=53.22 ***[a]	-0.15***	-0.08***	0.08***	-0.14***
Symptomatology (T2)(M)	1.75	2.80	3.34	1.16	F=(3, 1010)=37.26 ***[a]	-0.17***	-0.03	0.05	-0.13***

3.3.2 P-E predictors of change in perceived control

Table 3.3 presents the results of the main effect model for perceived control. Separate analyses were conducted for perceived constraint and perceived mastery. In Model 1 on perceived constraint at T1, the results indicated that compared to the healthy group, all three health sub groups had higher constraints (e.g. $\beta = .217$, $p < .0001$ for frail group). More social support, more frequent contact, and better neighborhood condition are related with lower constraint. Analyses on mastery showed similar pattern of association between health subgroups and mastery: compared to the healthy group, all other less vulnerable subgroups in health had higher mastery. Interestingly, in terms of environmental context, only social support was significantly related to higher mastery ($\beta = .170$, $p < .05$). In Model 2, changes in personal control over time were examined. The results showed that all health subgroups had increases in perceived constraint four years later (e.g. $\beta = .072$, $p < .05$ for the frail group). Among environmental contexts, higher social support and better neighborhood condition at T1 was significantly associated with higher perceived constraint later ($\beta = -0.10$, $p < .05$; $\beta = .029$, $p < .05$ respectively). The pattern of long-term association between healthy profiles and mastery was largely consistent with that of constraint. Interestingly, however, among environmental contexts, only social support at T1 predicted change in mastery at T2 ($\beta = .069$, $p < .05$).

Table 3.3: Structural Equation Model Predicting Changes in Perceived Control

	Model 1		Model 2		Model 1		Model 2	
Predictors	Perceived Constraint (T1)		Perceived Constraint (T2)		Perceived Mastery (T1)		Perceived Mastery (T2)	
Health Profiles								
Frail	0.217	***	0.118	**	-0.198	***	-0.188	***
Physically impaired	0.134	***	0.103	**	-0.096	**	-0.119	***
Sensory-cognitive impaired	0.077	*	0.123	***	-0.048		-0.103	**
Environment								
Social support	-0.166	***	-0.100	**	0.170	***	0.069	*
Contact frequency	-0.143	***	-0.016		0.006		0.012	
In-home features	0.056		0.019		0.001		-0.038	
Neighborhood safety	-0.101	**	-0.056	*	0.065		0.004	
Covariates								
Age	0.076	*	0.175	***	-0.055		-0.136	***
Women	0.018		0.012	*	-0.044		-0.011	
Less than high school	-0.003		-0.043		-0.008		0.049	
High school	-0.075		0.006		0.037		0.035	
Some college	0.009		-0.030		-0.032		0.023	
College and above	-0.064		-0.068		-0.008		0.028	
Never married (ref.)								
Widowed	0.056		-0.074		0.071		-0.112	
Divorced	0.001		-0.073		0.021		-0.104	
Income (1st) quartile (ref.)								
2nd quartile	-0.004		-0.108	**	0.032		0.052	
3rd quartile	-0.122	**	-0.097	*	0.100	*	0.030	
4th quartile	-0.110	*	-0.067		0.040		0.039	
Wealth (1st) quartile (ref.)								
2nd quartile	0.004		-0.012		-0.032		0.081	*
3rd quartile	-0.008		0.007		0.015		0.055	
4th quartile	-0.016		0.032		0.044		-0.004	
White (ref.)								
Non- white	0.099	**	0.014	*	-0.033		-0.078	*
Rural (ref.)								
Suburban	0.024		0.014		0.047		0.030	
Urban	0.015		0.019		-0.017		-0.028	
Perceived Constraint (T1)			0.414	***				
Perceived Mastery (T1)							0.355	***
Constant	2.436		0.256				3.769	
R^2	0.182	***	0.331	***			0.267	

3.3.3 P-E predictors of change in well-being: Role of perceived control

The conceptual model on aging-in-place (Figure 3.1) illustrates the proposal that health profile and the environment influence depressive symptoms over time through perceived control. Accordingly, I decomposed the effects of the main components of aging-in-place into total, direct, and indirect effects in order to demonstrate the mediating effects of perceived control. Separate analyses are conducted for perceived constraint and perceived mastery. Perceived

control at Time 1 and Time 2 are included to examine whether they mediate the effects of health profile and environmental contexts on depressive symptoms over time. This model simultaneously estimated the direct and indirect impact of health profile and the environment through perceived control (Table 3.4).

Table 3.4: Final Structural Equation Model of Health, Environment, and Perceived Control on Depressive Symptoms (N = 1107)

	Dependent variables			
	Perceived Constraint (T2)	Depressive Symptoms(T2)	Perceived Mastery (T2)	Depressive Symptoms (T2)
Health Profiles				
Frail	0.072 *	0.070 *	-0.138 ***	0.068 *
Physically impaired	0.106 **	0.111 **	-0.122 ***	0.122 ***
Sensory-cognitive impaired	0.131 ***	0.026	-0.116 **	0.035
Environment				
Social support	-0.101 **	-0.062 *	0058	-0.076 **
Contact frequency	-0.039	0.035	0.027	0.015
In-home features	-0.066	0.009	-0.046	0.014
Neighborhood safety	0.029 *	0.014	0.023	-0.008
Covariates				
Age	0.155 ***	-0.040	-0.128 ***	-0.026 *
Gender	0.016	0.063 *	0.003	0.069
Less than high school	-0.041	-0.022	0.037	-0.024
High school	0.016	-0.042	0.026	-0.037
Some college	-0.011	-0.046	0.018	-0.036
College and above	-0.047	-0.015	0.018	-0.028
Never married (ref.)				
Widowed	-0.054	-0.061	-0.131	-0.082
Divorced	-0.056	-0.003	-0.122	-0.033
Income (1st) quartile (ref.)				
2nd quartile	-0.104 **	0.020	0.062	0.016
3rd quartile	-0.093 *	0.027	0.037	0.017
4th quartile	-0.069	-0.012	0.048	-0.020
Wealth (1st) quartile (ref.)				
2nd quartile	0.007	0.034	0.078	0.055
3rd quartile	0.031	-0.026	0.047	-0.009
4th quartile	0.065	0.020	-0.019	0.033
White (ref.)				
Urban (ref.)				
Non- white	0.013	-0.063 *	-0.076 *	-0.065 *
Suburban	0.018	0.011	0.028	0.023
Urban	0.021	0.023	-0.049	0.018
Predictors				
Perceived Constraint (T1)	0.406 *	0.043		
Perceived Constraint (T2)		0.186 ***		
Perceived Mastery (T1)			0.351 ***	-0.170

Perceived Mastery (T2)							-0.012	***
Depressive Symptoms (T1)			0.457	***			0.471	***
Constant	0.398	***	0.687	***	3.743	***	1.891	***
R^2	0.356	***	0.385	***	0.260	***	0.379	***
CFI		0.998				0.989		
RMSEA		0.053				0.085		

Note. All coefficients are standardized. *p < .05, **p < .01, and ***p < .001.

Table 3.5: Impact of Perceived Controls on Depressive Symptoms: Direct and Indirect Effects

	Perceived Constraint				**Perceived Mastery**			
Variables	Direct		Indirect		Direct		Indirect	
Health Profile								
Frail	0.07	*	0.013	*	0.068	*	0.023	**
Physically impaired	0.11	***	0.020	**	0.122	***	0.021	**
Sensory-cognitive Impaired	0.026		0.024	**	0.035		0.020	**
Environment								
Social Support	-0.062	*	-0.019	*	-0.076	**	-0.010	
Contact Frequency	0.035		-0.007		0.015		-0.005	
In-home features	0.014		0.005		0.014		0.008	
Neighborhood Safety	0.000		-0.012		-0.008		-0.004	

The results indicated that higher perceived constraints was significantly related with an increase in depressive symptoms over time (β = 0. 186, p < .001). Among health profile groups, membership in the sensory-cognitive impaired group was not significantly associated with changes in depressive symptoms compared to the healthy group. Considering the environmental context, only social support was significantly related with long term depressive symptoms when controlling for changes in perceived constraints (β = -0.062, p < .05). Results from models on mastery showed a consistent pattern of association with the models on constraint: Higher mastery was significantly associated with less depressive symptoms (β = -0.012, p < .001). All vulnerable health groups except the sensory-cognitive impaired group influence changes in depressive symptoms. Only social support predicted a decrease in depressive symptoms over time (β = -0. 076, p < .01).

Table 3.5 presents the direct and indirect effects of health profiles and the environment on depressive symptoms through perceived controls. Figure 3.2 focuses on the mediating effect of perceived controls. Frail and physically impaired groups both directly and indirectly influenced depressive symptoms over time (e.g. $\beta = .070$, $p < .05$ for direct and $\beta = .013$, $p < .05$ for the indirect effect among the frail group). Interestingly, for the sensory-cognitive impaired group, no direct effect was found. However, this group has a positive influence on depressive symptoms through perceived constraint. The members of this health subgroup reported more depressive symptoms over time, but only through perceived constraints ($\beta = .024$, $p < .01$). As for the environment, the results indicate that only social support has both direct and indirect influence on depressive symptoms over time. Those with higher social support reported a decrease in depressive symptoms over time. The positive effect of higher social support negatively influence depressive symptoms over time ($\beta = -0.062$, $p < .05$), and it also has an indirect effect on depressive symptoms via perceived constraint ($\beta = -0.019$, $p < .05$). The results of analyses on mastery show a largely consistent pattern of long term association between health profiles and depressive symptoms. Frail and physically impaired groups both directly and indirectly influenced depressive symptoms over time (e.g. $\beta = .068$, $p < .05$ for direct and $\beta = .203$, $p < .01$ for indirect effect in frail group). For the sensory-cognitive impaired group, there is no effect. No mediating role of mastery was found on any of the environmental contexts.

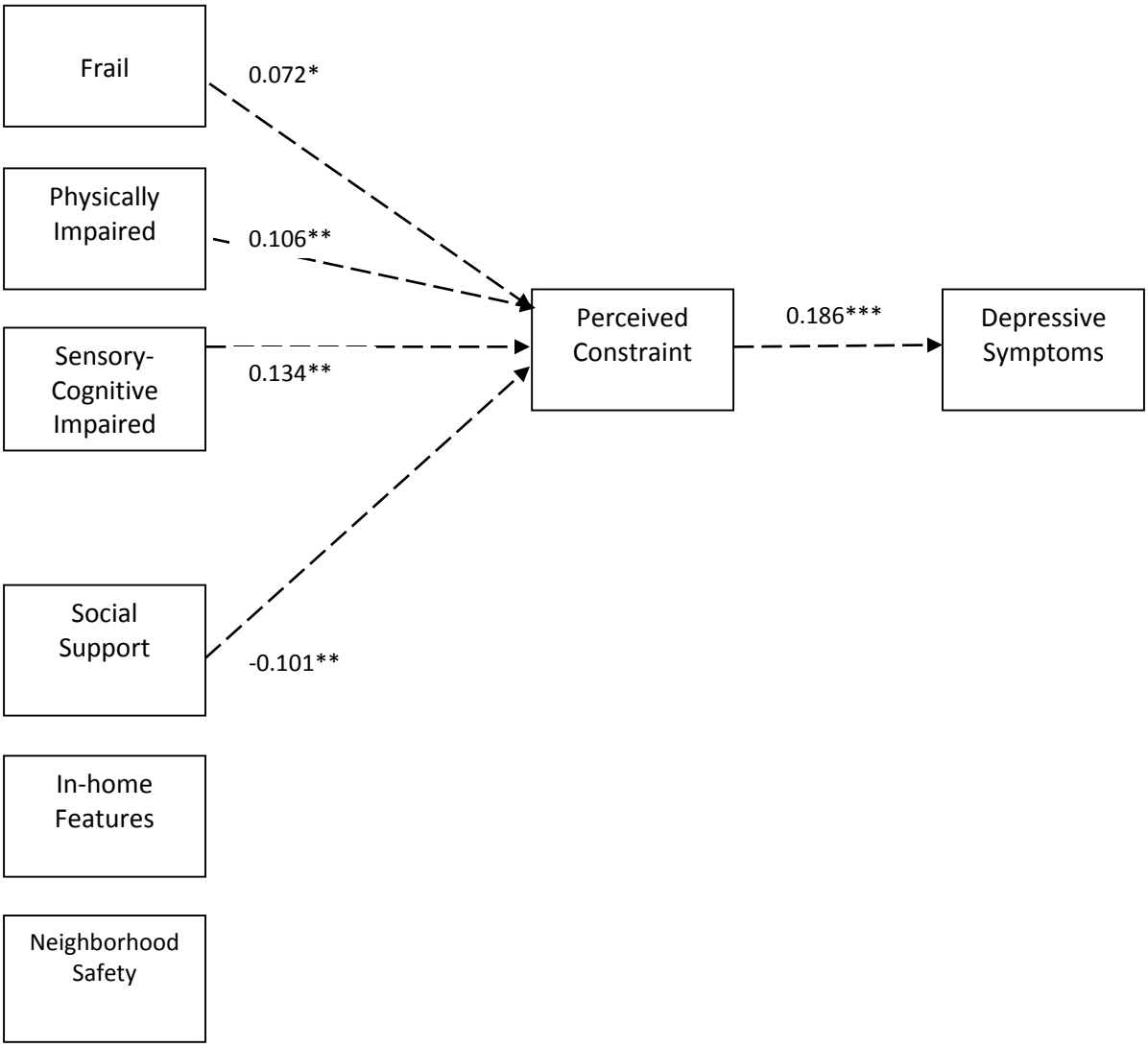

Figure 3.2.1: Impact of Perceived Constraint on Depressive Symptoms: Mediating Effects

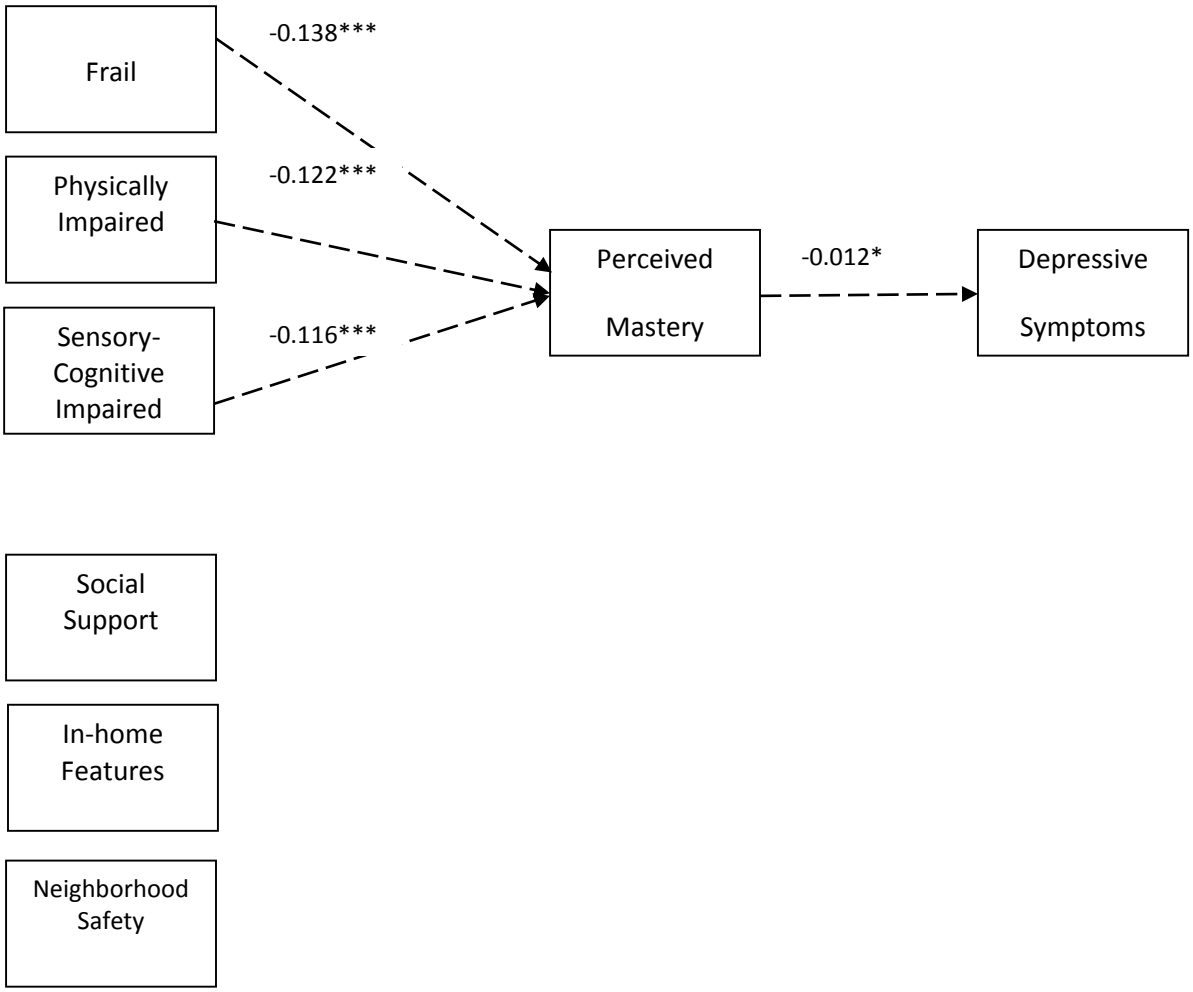

Figure 3.2.2: Impact of Perceived Mastery on Depressive Symptoms: Mediating Effects

3.4 Discussion

Drawing on the Person-Environment (P-E) fit perspective, this study examined components of aging-in-place for older adults who live alone. For the Person dimension, the four health profiles identified in the first paper are utilized. For the Environment dimension, both physical and social environmental characteristics are examined. The analyses focused on a mediating role of perceived control in the dynamic association of health, environment and depressive symptoms among older adults. Also, additional attention was given to changes in perceived control and depressive symptoms over time. The rationale for the focus on perceived control was that this construct indicates adaptations that may reflect a mechanism underlying successful aging-in-place. To the best of my knowledge, this is the first P-E research that has attempted a comprehensive examination of diverse components of aging-in-place in a longitudinal perspective using a nationally representative sample of older adults.

For the first research question, perceived control was conceptualized as an outcome of P-E relation and I asked to what extent health subgroups and environmental contexts are associated with perceived control over time. Findings from bivariate and multivariate analyses show that perceived control is significantly associated with both health and environment and are also affected by them over time. As for health, as hypothesized, compared to the healthy group, the other health profiles are differentially vulnerable to changes in perceived control. For example, membership in the frail group most strongly predicts an increase in perceived constraint and a decrease in mastery over time. Consistent with the longstanding assumption concerning the malleability of perceived control (Skaff, 2007) and much of the empirical research, this finding confirms that the subgroup with the greatest level of health losses with multiple illnesses and disability had greatest loss in perceived control.

Whereas there has been extensive research on health and control among older adults, there is surprisingly little research that examines to what degree the social and physical characteristics of living environments affect perceived control. Analyses related to environmental contexts provide some interesting findings. The results of the models on perceived constraint indicated that of the four environmental characteristics, perceived social support and neighborhood condition affect constraint over time, but there was no association between in-home features and contact frequency. While the positive effect of social support on perceived control was consistent with the predictions of social relational theory (Antonucci,

2001), the present study finding that contact frequency was not significant, requires further empirical and theoretical inquiry in future. The findings of this study indicate that perceived social support affects perceived control, but not the structural aspect of social support or contact frequency. An accumulation of studies on social relations in old age has shown the importance of the multi-dimensional nature of social environment to the physical and mental health of older adults (Antonucci, & Akiyama, 1995; Cheng, Lee, Chan, & Leung, 2009; Fiori, Smith, & Antonucci, 2007; Litwin, 2010). To date, there have been few studies that attempt to disentangle the association between diverse aspects of social relations (e.g. structural, functional, quality; actual, perceived) and control. In the association between social relations and perceived control, the findings of this present study suggest the importance of the perceived aspect of social relation. Future study should investigate to what extent the quality and/or functional aspects of social relation along with structural aspect are related to perceived control. As another possible explanation, socio-emotional selectivity theory suggests that changes in social relations (e.g. a decrease in social network) in old age may be a reflection of coping or adaptive behavior by older adults as they opt for being in smaller but more supportive social relations (Carstensen, Isaacowitz, & Charles, 1999). As this theory emphasizes the role of cognitive efforts which involve the subjective aspect of adaptive behavior, it might be the case that the degree of social support perceived by older adults is a better predictor of perceived control and subjective well-being, but not necessarily frequency of contact with members in a social network. Also, research on social relations in old age has emphasized the multidimensional aspects of social relations, including not only structural aspects such as contact frequency, but also quality of social relations (Antonucci & Akiyama, 1987; Bosworth & Schaie, 1997). So far, knowledge of how much various aspects of social relation of older adults affect perceived control as an outcome of P-E relations needs further investigation. The differential effect (or no effect) of diverse aspects of the social environment on perceived control may contribute to an enhanced understanding of mechanisms of adaptation in later life.

The findings on the physical environment are also interesting. Other than studies on institutional environments such as nursing homes in relation to perceived control (Baltes, 1996; Langer, & Rodin, 1976), there are few studies on the effect of various physical environmental contexts and control. The positive effect of supportive neighborhood environment on perceived control seems to be supported by previous research. However, there have been no findings at all

on in-home features on perceived control. This is particularly interesting in consideration of the salience given by the P-E perspective to the physical features of the living environment in relation to autonomy and perceived control in later years (Lawton, 1990) and the significant finding on in-home features that serve in a compensating role for the frail and sensory-cognitive impaired groups (in the first paper). It may be the case that micro-level physical characteristics such as in-home supportive features are the manifestation of a proactive environmental adaptation to deal with declines in health condition. Therefore, in order to better examine the possible role of in-home features, future research may pursue an examination with a longitudinal design of how health and environmental adaptation, such as home modification or relocation to a supportive environment, interact with one another to affect perceived control.

Another interesting finding concerns the differential pattern of association between constraint and mastery. In the bivariate analyses, all environmental supportive characteristics are negatively associated with constraint and positively related with mastery. However, when controlling for all other confounding factors, much of the explained effect disappeared for mastery. It was not the goal of this study to disentangle differences or similarities between constraint and mastery, but the clear disparity in the effect of environment suggests an important implication for future theoretical and empirical research on perceived control.

The construct of control has been variously conceptualized in several different models and theories, in some of which mastery is differentiated from personal control (see Mallers et al., 2013 for a summary), and some studies attended to the difference between mastery and constraints (Lachman & Prenda-Firth, 2004). Relatedly, theoretical models on control that theorize how individuals adapt to challenges to control, in other words models on the mechanism of control development over life course (Heckhausen & Schulz, 1995), and limited research have begun to utilize a composite measure of personal mastery and constraint (Gerstorf, Rocke, Lackman, 2010). To date, there has been little empirical examination of such conceptualizations. Future research should pursue inquiries in this area.

Having established perceived control as the outcome of P-E relation, for the second research question I examined perceived control as a process within the P-E dynamic. Specifically, I examined a mediating role for perceived control in the association among health, environment and depressive symptomatology overtime. As expected, the mediation effect of perceived control varies by health subgroup and environment. Compared to the healthy group,

there are mediation effects of perceived control (both constraint and mastery) for more vulnerable health profiles in predicting an increase in depressive symptoms over time. This finding confirms the negative influence of health subgroups on perceived control, which in turn affects depressive symptoms over time. In general, subgroups in health had significant direct and indirect (mediated by perceived control) association with depressive symptoms. However, it is interesting that the sensory-cognitive group had an indirect effect only; members in this group reported more depressive symptoms over time compared to the healthy group, but only through perceived control (both constraint and mastery). Given that health profile research is in an early developmental stage (Lafortune, Beland, Bergman, & Ankri, 2009), it is worth future research effort looking into why this particular health subgroup is strongly associated with loss of personal control while not necessarily directly related with depressive symptoms.

Among environmental contexts, the results indicate that only social support had a significant effect on perceived control and depressive symptoms over time. Also, only social support was associated with fewer depressive symptoms via perceived constraint, but not mastery. In the earlier analyses in this study, social support, contact frequency and neighborhood were all associated with perceived control at T1, but this influence disappeared over time. These findings seem to suggest that environmental contexts by themselves are not necessarily strong predictors of subjective well-being. The lack of environmental influence on subjective well-being is contrasting in comparison with that of health subgroups. This finding provides two implications for future research. First, this study is among the few that have empirically tested the theorized pathway from social relation via personal control to well-being in old age (Antonucci, 2001). Future research should look at more refined aspects of social support environment as suggested by social relational research including structural and functional aspects of social relations among older adults. The second implication concerns the lack of effect of environmental context. As the first empirical examination of the pathway of aging-in-place under the P-E fit perspective, this study conceptualizes perceived control as an outcome and process of P-E fit. While such efforts may be innovative, the lack of environmental context might suggest that a more accurate illumination of P-E fit might lie in the interface between Person (health profile in this research) and Environment as related to perceived control and depressive symptoms. To the extent that the impact of losses and declines in health determines perceived control and well-being, the independent effect of environmental context might be subdued. This

study did not directly examine the fit between health and the environment, with perceived control instead being viewed as a proxy outcome of P-E fit. Therefore, future research may attempt to directly examine the extent of the moderation of environmental contexts on the influence of health among older adults.

3.5 Limitations

Certain limitations of this current analysis should be acknowledged. I believe a longitudinal investigation would further enhance P-E research on aging-in-place in key respects. Underlying the P-E fit perspective is a dynamic association between personal competence, the environment, personal control and well-being. Generalizations about the associations of these components of aging-in-place would be substantially improved if we are able to look into changes in health profiles and environmental characteristics over time and observe whether or not changes lead to or are a result of changes in personal control and subjective well-being. Also, while this study looked at changes in control and depressive symptoms over time, the period was limited to two time points due to data availability. Using longitudinal data with a complete set of the study variables in more than three waves would provide a fuller picture of the causal relationships of the proposed mediation model in this study.

Another limitation is concerned with the indicators used for the environment. In this study, a small set of indicators for social and physical environment are used due to the limited availability of more refined measures in the HRS data. As mentioned earlier, succeeding research often is able to utilize a more refined set of indicators for physical environment. For example, many in environmental gerontological research examined various aspects of physical environment, including as satisfaction with housing condition as a subjective dimension of the housing environment and accessibility in and outside of housing as an objective aspect of the environment (Hwang, Sixsmith, & Sixsmith, 201l; Wahl, Fange, Oswald, Gitlin, Iwarsson, 2009; Rochette, Desrosiers, & Noreau, 2001; Murphy, Nyquist, Straburg, & Alexander, 2006), reflecting the importance of immediate home and housing environmental influence in later years given that older adults' everyday lives are mostly spent in the home setting.

Lastly, an additional limitation regards a possible variation by age cohorts and social stratification factors in the association among the components of aging-in-place. Theoretical and empirical research has strongly established heterogeneity within older adults by age cohorts in

the aging process and adaptations (Baltes & Smith, 2003) (young old and the oldest old). However, this study did not explicitly focus on possible differences by age groups. Also, previous research on aging-in-place showed that older people's living environments and personal control intersect with gender and race over their life course (Antonucci, Ajrouch, & Park, in press; Clarke & Smith, 2011; Peralin & Skaff, 1966; Pudrovska, Schieman, Perarlin, & Nguyen 2005) Future research should examine the effects of larger social forces such as cohorts, gender and culture in the person-environment dynamic.

CHAPTER IV

PERSON-ENVIRONMENT FIT AND SURVIVAL IN OLDER ADULTS LIVING ALONE

4.1 Introduction

There is increasingly an expectation that older adults will be able to age-in-place and that levels of institutionalization will remain stable over the coming decades and the duration of institutionalization will be compressed. Generally, aging- in-place refers to individuals growing older within a "home," which refers to a wide range of living environments in residential settings, surrounding neighborhoods, and broader communities (Black, 2008). Despite substantial advances in P-E fit research on aging-in-place, there are areas that call for further investigation. In particular, there is much to be learned about the association between the numerous different contexts of aging-in-place. Existing empirical research tends to focus on relocation or institutionalization as an outcome of aging-in-place. However, recent developments indicate that decisions concerning where to age and whether to age in place may occur among older adults living in a traditional, private home within the community, as well as those who elect to live in a senior living facility (i.e. independent living facilities, Continuing Care Retirement Complex, and assisted living facilities).

In addition to being aware of the place of residence, it is also important to consider the capacity of the person who is aging-in-place and whether they live alone or with others. This is the basis of the Person-Environment (P-E) fit perspective of aging (Lawton, & Nahemow, 1973). The core theoretical assumption is that there are unique combinations of personal needs and resources and environmental characteristics that determine an individual's adaptation (Wahl, Iwarsson, & Oswald, 2012). Although aging-in-place is believed to benefit older adults in general, there may be subgroups at risk due to insufficient personal, health, and/or financial

resources to utilize the available support from their physical and social living environments (Golant, 2003; Lehning, Smith, Dunkle et al., 2012; Scharlach, 2011).

Following the first paper of the dissertation, the present study examines the association between the Person dimension, the Environment, and mortality in older adults living alone. Older adults who live alone in the community are believed to be vulnerable to mortality (Commonwealth Fund, 1992). The extent of the vulnerability, however, likely differs in terms of health status, income, and place of residence (e.g. senior housing or private home). A more comprehensive understanding of the dynamic among these components of aging-in-place will offer an important contribution to the goal of P-E fit research as it aims at better identifying more vulnerable subgroups of older adults and ultimately designing for them policy and intervention programs.

4.1.1 Morbidity, SES and mortality in older adults living alone

As aging- in- place research aims to help older adults to continue to live in their place independently as long as possible, death, or possibly premature death, of older adults could be the ultimate outcome. Aging and mortality have long been the focus of investigation (Riggs, 1992) and in gerontological research in particular, an examination of mortality risks in old age has become increasingly important due to public policy implications, given population aging and the resulting associated increase in the need for medical care, social services, and long–term care (Parker & Thorslund, 2007). At a general population level, mortality has decreased in elderly age groups due to improvements in living conditions, better control of infectious diseases, and medical advancements. Within an elderly population, even subgroups of older people who were once considered to have a very high mortality risk (e.g. people who live alone or have low SES) now seem to be surviving for longer periods (Rosen & Haglund, 2005).

In the past, knowledge about decreasing trends in mortality was assumed to provide a good indicator of the health of the elderly. This assumption began to be put to the test, however, with the subsequent understanding that health is a multidimensional concept (Crimmins, 2004, 1991; Verbrugge & Jette, 1994). Given the complex interplay between morbidity and mortality (Parker & Thorslund, 2007), how to better measure morbidity in old age is important for studying mortality. In old age individuals have a constellation of chronic and acute conditions, as well as functional and mental impairments. Few studies have explicitly considered

heterogeneous subgroups of older adults characterized by specific sets of health conditions. The different facets of health are intercorrelated, but need not necessarily be strongly related (Lawton & Lawrence, 1994). The multi-dimensional understanding of health in old age (Portrait, F., Lindeboom, M., Deeg) and the idea of the classification of older adults into subgroups with varying degree of health and wellness is not new (Lafortune, L., Beland, F., Bergman, H, & Ankri, 2009). Emerging research on health profile focuses on the multi-morbidity problem of older adults. Based on 17 health indicators, Lafortne et al. (2009) used latent class analysis to model heterogeneity and classify community living older adults into four different health profiles including, *cognitively impaired, physically impaired, cognitively and physically impaired* and *relatively healthy* groups, which are generally consistent with earlier profile research (Manton, Cornelius, Woodbury, 1995; McNamee, 2004; Portrait, Lindeboom, & Deeg, 2000; Wieland, Lamb, Wang, 2000).

Despite increasing interest in the examination of multi-dimensional health in old age, empirical research on the coexistence of multiple health limitations is remains highly limited (Slaug, Schwelling, Iwarsson, & Carlsson, 2010). The first and second papers of this dissertation research identified distinct health profiles and environmental contexts that characterize older adults who live alone in the community and how these health profiles and environments independently and together are associated with subjective well-being. However, no study to date has looked into the extent to which health profiles and environmental contexts are associated with mortality among older adults who live alone. Accumulated research has documented the inverse relation between socioeconomic status (SES) and mortality at the general population level. Low SES status has been linked with higher mortality (cf. Crimmins, Preston, & Cohen, 2011). Most existing research has controlled for marital status. Few studies have focused on SES differences within the subpopulation of older adults who live alone.

4.1.2 Environment and mortality in the P-E perspective

In examining mortality risk as an outcome of P-E fit, this research focuses on two areas of environment in P-E fit research that require further investigation. One involves social aspects of environment in relation to mortality. In the P-E fit perspective, the physical and social environments are not disparate entities, but instead are conceptually interconnected. Empirically, however, the bulk of the existing research tends to focus on the physical aspects of the living

environment and there has been a paucity of integrative examinations of the physical and social contexts of the living environment (Wahl & Lang, 2004). Research on social relations has established a link between various aspects of the social relation environment (e.g. social network and social support) and a reduced mortality risk (Giles, Glonek, Luszcz, & Andrews, 2005; Litwin, 2006; Sugisawa, Liang, & Liu, 1994; Yasuda et al.,1997). To date, no known P-E fit research has examined what aspects of the physical and social environments are associated with mortality risk among older adults.

The second area of the environment in P-E research is concerned with different living environments. Much of the discourse on aging-in-place has been developed in the context of the traditional home. But recent developments indicate that decisions concerning where to age and whether to age in place may occur among older adults living in the community, as well as for those who choose senior living facilities. Such alternative living environments are increasingly popular, and it is estimated that 12 million American older population currently reside in senior housing (Blechman, 2008). One common purpose of such housing care arrangements is to help older persons to age in place, and they are often seen as a bridge between fully independent living in a traditional private home and long-term institutional care living. Senior living facilities are not intended to serve as nursing homes. Still, there has been a clear trend that not only are existing residents aging-in- place, but new residents are moving in at advanced ages. The number of residents 85 and over in independent senior housing is growing at a fast rate (Filed et al, 2002), leading to an overall increase in frailty among residents due to chronic illness and disability, which in turn increases their need for health and supportive services.

The process of aging-in-place at senior residential facilities is likely to differ from that experienced by community living older adults since residential care environments both provide and restrict social opportunities (Eckert, Carder, Morgan, Frankowski, & Roth, 2009). The senior housing environment may be unique in that daily living experiences are shaped by both its physical features and the social relational characteristics within the housing community. Therefore the senior housing environment might represent an empirical example of an intertwined living space of the physical and social environment (Wahl & Lang, 2004), or the "socio-physical" environment as suggested by Canter & Craik (1981). Much of the existing research on aging-in-place focuses on older adults in traditional homes, raising the concern that this knowledge base cannot be generalized to older adults living in senor living environments

(Parmelee & Lawton, 1990), especially those who live alone. Still, accumulating research on senior housing has examined physical and mental health (Liu & Lapane, 2009; McLaren, Turner, Gomez, McLachlan, Gibbs, 2013; Adams & Roberts, 2010; Gonyea & Bachman, 2008), the social relational environment among the residents and their social networks (Street & Burge, 2012; Kemp, Ball, Hollingsworth, & Perkins, 2012), and health and health behavior (Gaines, Poey, Marx, Parrish, Resnick, 2013).

There have been few attempts to compare the survival of older adults who live alone in senior living facilities with those in traditional homes. One study compared the pattern of functional health status of comparable groups of older adults (low-income) living in private homes and in an affordable assisted living facility (Fonda, Clipp, & Maddox, 2002). The findings of this study suggest that the health status of residents in assisted living is generally similar and in some aspects better, suggesting that a senior living facility for the low-income elderly is comparatively beneficial. In another study, chronic conditions and functional health were compared between CCRC residents and their community-dwelling peers (Young, Fan, & Parrish, 2009). Their finding indicated that CCRC residents had a higher disease prevalence and more functional disabilities. To date, there has been no study that directly compares two groups of seniors living alone in different living environments drawn from nationally representative data, let alone one that examines their mortality risk.

4.1.3 Research questions

This study focused on subgroups of older adults living alone with different health and environmental contexts. It follows from the first paper in which four subgroups of health limitations are identified: sensory-cognitive impaired, physically impaired, frail, and healthy. This two main research questions are posed: First, I ask to what extent the two dimensions of aging-in-place, Person (health profile and SES) and the Environment (social network and senior housing residency) affect mortality. Given that this is the first empirical attempt at studying the mortality of older adults living alone from the P-E perspective, I did not set out specific hypothesis. Still, I generally expected that compared to the healthy group and higher SES group, membership in the more vulnerable health subgroup (e.g. frail group) and the lower SES group would predict higher risks of mortality. I expected that older adults living in senior housing and individuals with low levels of social network would be more likely to die. Second, I ask to what

extent P-E fit influences the mortality of older adults living alone. As a method to investigate P-E fit, I examined the degree to which environmental contexts moderate the impact of health and disadvantaged location (i.e. low SES) on mortality. It is broadly hypothesized that compared to the healthy group, older adults living alone in more vulnerable health profiles would be less likely to die over time when they reside in a supportive living environment.

4.2 Methods

4.2.1 Data and sample

Four biennial waves of data (2006-2012) from the Health and Retirement Study (HRS) Data were used in this study. The sample was drawn based on several criteria. First, I selected older adults aged 65 years and older who live alone. Second, since this study was interested in generalizing findings for the community-dwelling older adult population, respondents who were institutionalized or unable to independently answer survey questions were excluded. Of the 2956 who lived alone in the community in 2006, I excluded those who had no information on senior housing residency (n=181), those who had no information on death in 2012 (n=201) for analyses of mortality through the six- year follow-up examination and other missing information on covariates. At the time of writing, only the early release of the 2012 HRS data was available, which was used in this analysis. These early release data did not include information on date of death. The final analytic sample was 2531 participants.

The average age of participants in 2006 was 76 (*SD* = 7.99: range 65 to 104 years), 74% of whom were women. Seventy two percent of the sample had more than 12 years of education. Eighty three percent of the sample was White and 17% resided in senior housing. Of the 2531 participants at the baseline, approximately 31% of older adults living alone died and 69% (n=1752) were still alive at the end of study period, and therefore censored.

4.2.2 Measures

The key measures used in the analysis include the health profiles, income and environmental characteristics at the baseline (2006) and vital status in 2008, 2010 and 2012. Also, a range of socio-demographics and control variables at the baseline are included.

Health profiles

In the first paper, seven health variables were used to derive health subgroups of elderly living alone in the community. The measures included a count of chronic health conditions (0-8) prevalent in later life, a count of mobility limitations (0-5), a count of activities of daily living (ADL) (0-5), instrumental activities of daily living (IADL), cognitive health measured by the summary cognitive variable of Mini-Mental State Examination (0-35), and sensory health including hearing and vision capacity. Based on clustering methods, four health profiles with qualitatively different sets of health conditions were derived. These four profiles are sensory-cognitive impaired, physically impaired, frail, and healthy. The sensory-cognitive type (28% of the study sample) is distinguished by a high level of impairment in terms of vision and hearing, as well as cognitive function. Contrastingly, individuals in this group show a lower level of impairments in physical and functional health. The physically impaired profile (24%) is characterized by high levels of impairments in chronic conditions and mobility limitations, while showing an average level of health across all other criteria. The frail type (9%) made up the smallest portion of the sample. Older adults in this group are those impaired across all health indicators, clearly set apart from other types with values of at least half a standard deviation below the sample means in all health variables criteria. In contrast, members of the healthy group (39%) are distinguished by low levels of limitations in physical, cognitive and sensory health. In functional health, members of this group have the lowest levels of limitations compared to other groups.

SES (Income)

In this research, the RAND HRS imputed composite variable for total household income was used. Considering that older adults are often asset-rich and cash-poor (Rendall & Speare, 1995), I focused on household income, which includes a range of incomes from Social Security, SSI, public assistance, pension and retirement income, interest, dividends, rents, royalties, and income from estates and trusts. A final SES measure was created with a binary indicator (1=lowest tertile group, 0= higher income group).

Environment

Senior Housing residency. Residency in senior housing was queried through a binary question (0/1) in each wave of the HRS. However, the HRS utilizes extensive skip patterns for housing-related variables. In general, only new respondents or those who indicated having moved are asked to provide new information about housing environment. Data on senior housing

was aggregated across earlier waves of the study (five HRS waves from 1994 to 2004 and AHEAD 1993 and 1995 waves), and updated with information on new move-ins in 2006. After filling in all missing information on residency, a final binary indicator was used for senior housing residency.

***Social Environment Indicator*.** Accumulated research on social relations has examined various aspects of the social environment, including size, contact frequency, and/or functions. In this research, as a parsimonious measure of social environment, the size of social network was applied. The network size indicator variable was created from three binary questions asking if participants had close children, friends and family living nearby. A continuous variable was created (0= have none, 3= have all of them).

Mortality after the 2006 baseline

Death information was obtained from the AHEAD/HRS and HRS Tracker File, which contains information on vital status as verified through the National Death Index (NDI). The dependent variable is coded 1 (known to have died between the earlier and the follow-up interview), or 0 (not known to have died during the time interval between the biennial interviews).

Covariates

Age was recorded in years at the time of the baseline survey. Age cohort groups were coded as 1 for aged 65-74, 2 for 75-84, and 3 for 85 years and above. Current marital status was coded as 0 (never married), 1 (widowed), or 2 (divorced/separated). Gender was coded 1 for women and 0 for men. For wealth, the RAND HRS imputed composite variable for total household wealth was used. The composite dollar values of wealth variables are coded in tertiles (1= lowest, 3= highest). Education was centered at the mean years of 12. Race was coded 1 for White and 0 for non-white. Two environmental contexts that are known to be associated with mortality of the elderly are included. For residential region, urban area was coded 1, suburban area, 2 and rural area 3. For neighborhood level indicator, safety of neighborhood was coded as 1 (poor) to 5 (excellent).

4.2.3 Analysis

Given the limitations of the data for the entire study period (unavailability of information on the exact timing of death for year 2012), I undertook discrete-time hazards modelling for

survival analysis. Time was measured by the reinterview wave number (i.e. 1 for 2006, 2 for 2008, 3 for 2010, and 4 for 2012). Hazards ratios less than one indicate reduced hazards (risk) compared with the reference group. Individuals who did not die during the study period were censored at 2012 (the last reinterview).

There were two steps in the analytic approach. First, I examined mortality occurrence among older adults living alone over the six-year follow- up period by key dimensions of aging-in-place: health profiles, SES, senior housing residency and social support. Also, bivariate analyses were conducted with socio-demographic correlates as related to the key dimensions. Next, the hazards models were estimated adjusting for the health profile, the environmental characteristics, the P-E fit (interaction between the health and the environment) along with covariates. The mortality risk was estimated using a complementary log-log link, rather than logistic, since the results are closely comparable to those produced by a continuous time proportional hazard model (Allison, 1995; Singer & Willett, 2003). I adopted a sequential approach to building the hazards models, adding each set of variables at a time in order to estimate the additive effects of covariates, the health, and the environment. Data were analyzed using Stata 13.

4.3 Results

4.3.1 Sample characteristics

Table 4.2 presents the characteristics of participants by baseline risk of death at each survey over the three time points in a six-year period. Among the four health profiles, the rate of death in the frail group was the highest (from 10% in 2006 to 5% in 2012) which contrasts with a relative increase of the proportion of the healthy group (from 34% in 2006 to 47% in 2012). The physically impaired group showed a steady decrease in numbers, while the sensory-cognitive impaired group maintained its relative proportion. Individuals in the low income group showed a slightly higher level of death over time (from 33% in 2006 to 31% in 2012) compared to the higher income group (from 67% in 2006 to 69% in 2012). In terms of environmental contexts, the social network level stayed steady among those who survived over time with a slight increase (from 1.54 in 2006 to 1.57 in 2012). The proportion of senior housing residents decreased (from 17% in 2006 to 14% in 2012).

At the baseline examination, individuals in different health profiles and income groups varied on all the correlates examined (see Table 4.1). Older adults living alone in the frail group were significantly older (*M*=81) and members of the healthy group were younger (*M*=74) compared to those in all other groups. Across all health types, women made up the majority, resembling the overall distribution of the sample as a whole. Interestingly, in the sensory-cognitive impaired group, men comprised a relatively higher proportion (33%) in comparison to other groups. In terms of race, the sensory-cognitive and frail-disabled group included a relatively higher proportion of African American elderly. The frail and healthy groups contrast in several aspects. The frail group had the highest proportion of the widowed (77%), while the healthy included the smallest (63%). In terms of SES (income) groups, the individuals in the lowest income group were clearly more vulnerable in many aspects: they were older, had lower levels of education, tended to be African American and had the largest proportion below the 30% tertile (29 and 39%) of wealth, and tended to live in neighborhoods perceived to be less safe. In terms of environmental contexts, interestingly the frail and the healthy groups showed the same level of support (*M*=1.50). The physically impaired group marked the highest level (*M*=1.61), followed by the sensory-cognitive impaired group (*M*=1.57). These two groups show a relatively higher proportion of senor housing residency (22% and 26%), while among the healthy group, the smallest proportion (13%) of the members lived in a senior housing. The lowest income group stands out for the highest level of social support (*M*=1.60) and also the highest proportion of senior housing residency (23%).

Table 4.1: Socio-Demographics by Health and SES among Older Adults Living Alone in 2006

	Health Profiles				Statistics	SES (Income level)			Statistics
Health	Sensory Impaired	Physically Impaired	Frail - Disabled	Healthy		Low	Middle	High	
Covariates									
Age (*M*)	78	77	81	74	F (3, 2527)=77.71 ***[a]	77	77	75	F=(2, 2538)=10.95 ***[a]
	(8.39)	(7.80)	(8.58)	(6.70)		(8.20)	(7.87)	(7.81)	
Women (%)	67	76	77	76	χ^2 (3)=27.75***	81	75	67	χ^2 (2)=44.01***
High school and above (%)	49	67	60	86	F(3, 2523)=73.77 ***[a]	52	73	86	F=(2, 2524)=265.64 ***[a]
White (%)	78	85	76	87	χ^2 (3)=37.41***	74	86	88	χ^2 (2)=72.29***
Widowed (%)	69	71	77	63	χ^2 (6)=36.80***	65			χ^2 (4)=16.67**
Wealth lowest 30%	36	41	54	21	χ^2 (6)=165.42***	60	27	12	χ^2 (4)=640.72***
Neighborhood safety	3.66	3.71	3.5	4.06	F(3, 2527)=33.46***	3.55	3.83	4.05	F=(2, 2528)=48.60***
	(1.08)	(1.09)	(1.18)	(0.94)		(1.15)	(1.01)	(0.96)	
Urban (%)	46	48	43	51	χ^2 (6)=19.62**	44	47	53	χ^2 (4)=26.10***
Environment									
Social support	1.57	1.61	1.51	1.50	F(3, 2528)=2.18	1.60	1.56	1.14	F=(2, 2528)=5.50**
(M, SD)	(.86)	(.83)	(.87)	(.83)		(.85)	(.84)	(.83)	
Senior housing (%)	17	22	26	13	χ^2 (6)=33.45***	23	16	12	χ^2 (2)=39.78 ***

Note: [a] The significance level of p-value: * p<.05; **; p< 0.01; *** p< 0.001.

Table 4.2: Health, Environment, Social Network, Senior Housing and Survival of Older Adults Living Alone

Survey Period Survived (N, %)	2006 (Baseline) N=2531	2006-2008 N=2299 (91%)	2008-2010 N=1953 (77%)	2010-2012 N=1752 (69%)
Variable				
Health Profile (N, %)				
Sensory-Cognitive Impaired	702 (28%)	642 (28%)	554 (29%)	494 (28%)
Physically Impaired	611 (24%)	530 (23%)	409 (21%)	346 (20%)
Frail-Disabled	248 (10%)	189 (8%)	121 (6%)	94 (5%)
Healthy	981 (34%)	946 (41%)	874 (45%)	822 (47%)
SES (N, %)				
Low income (lowest 30%)	844 (33%)	764 (33%)	623 (32%)	548 (31%)
Non-low income	1687 (67%)	1535 (67%)	1330 (68%)	1204 (69%)
Environment				
Social support (M, SD)	1.54 (.84)	1.55 (.85)	1.56 (.84)	1.57 (.85)
Senior housing (%) residence	17 (%)	16 (%)	15 (%)	14 (%)
Deceased		232	576	785

4.3.2 Results

Results from the regression analyses are displayed in Table 4.3. Across all models (Model 1 thru Model 4), most socio-demographics had no influence on mortality risk among older adults living alone, with the exception of age cohort and gender. As expected, health profiles had strongly significant effects on risk of death in all models. Compared to the healthy group, the frail group had a more than three times higher of risk of death (HR=3.65, $p < 0.001$), followed by the physically impaired group (HR=2.61, $P < 0.01$ in Model 2), and sensory-cognitive impaired (HR=1.46, $p < 0.001$ in Model 2). The low SES group had an increased risk of death (HR=1.24, $p < 0.05$ in Model 2). In Model 3, the effects of environmental contexts on death risk are examined. Not surprisingly, greater social networks reduced the risk of death (HR=0.88, $P < 0.01$) and living in senior housing increased the risk of death (HR=1.34, $p < 0.001$).

In the final model, Model 4, interaction between health profiles, SES and social network and senior housing residency were examined. The results reveal that for the physically impaired and sensory-cognitive impaired group, more social support was associated with a higher risk of death (HR=1.29, $p < 0.05$, and HR=1.41, $p < 0.01$). Living in senior housing had no significant effect on death risk among the health profiles. However, for the low SES group, senior housing residency featured a significant effect on their risk of death. Compared to the high SES group, individuals with low SES status living in senior housing had a reduced risk of death (HR=0.70, $p < 0.05$).

Table 4.3: Discreet Time Survival Models for Morality among Older Adults Living Alone, 2006-2012 (N=6826 Person-Year Records)

	Mortality Outcome Over 6-year period			
	Model 1 Hazard	Model 2 Hazard	Model 3 Hazard	Model 4 Hazard
Covariates				
Age				
Old old (> 74 and < 85)	1.94 ***	1.77 ***	1.76 ***	1.75 ***
The oldest (=> 85)	4.41 ***	3.40 ***	3.33 ***	3.28 ***
Women	0.62 ***	0.58 ***	0.58 ***	0.57 ***
Education (=>12)	0.98	1.00	1.00	0.99
White	1.16	1.17	1.13	1.14
Widowed	1.08	1.05	1.10	1.10
Divorced	0.89	0.87	0.91	0.90
Wealth				
2nd tertile	1.52	1.18	1.09	1.09
3rd tertile	1.17	1.06	1.06	1.09
Neighborhood safety	0.99	1.04	1.04	1.03
Suburban	0.86	0.84	0.85	0.85
Rural	0.90	0.84 *	0.91	0.92
Health Profile				
Frail		3.65 ***	3.62 ***	3.20 ***
Physically impaired		2.61 ***	2.60 ***	1.80 **
Sensory impaired		1.46 ***	1.46 ***	0.84
SES				
Lowest 30%		1.24 *	1.23 *	1.54 **
Environment				
Social support			0.88 **	0.75 **
Senior housing residency			1.34 ***	1.55 *
Interaction				
Frail * Social support				1.21
Physically impaired * Social support				1.29 *
Sensory-cognitive impaired * Social support				1.41 **
Frail * Senior Housing				0.90
Physically impaired * Senior housing				0.99
Sensory-cognitive impaired * Senior housing				1.17
Lowest 30% SES * Social support				0.90
Lowest 30% SES * Senior housing				0.70 *
Constant	0.05 ***	0.03 ***	0.03 ***	0.04 ***

4.4 Discussion

Based on the premise that aging-in-place would vary for differentially vulnerable subgroups of older adults living alone depending on their respective needs/resources and living environment characteristics, this study draws on the P-E fit perspective to examine both the person and environmental context in aging-in-place and examined mortality risk of older adults living alone in the community. It extended the empirical examination of the P-E fit model. Specifically, in addition to identified subgroups of health limitations for the Person dimension, it focuses on the low SES group of older adults as an additional vulnerable subgroup of older adults. For the Environment dimension, this study focused on residency in senior housing as compared to a traditional private home environment. To the best of our knowledge, this is the first P-E research to look at mortality of older adults with an extended focus on vulnerability (health and SES) and different living environments.

As hypothesized, the health profiles of older adults living alone are strongly associated with increased mortality risks. After accounting for socio-demographics and other covariates, the frail and physically-impaired groups showed an increased risk of dying. The high level of risk among the frail is not surprising considering that individuals in this profile experience the severest level and extent of health problems in this study. Interestingly, the effect of the sensory-cognitive impaired group on death risk found in the earlier models disappeared in the final model when interaction terms with environmental contexts were considered, which suggests that for this subgroup, the effect of health limitations may not be deterministic by themselves, but would depend on the characteristics of the living environment. Given both that this study is the first research to look at mortality risk among the elderly living alone from the P-E perspective and also the early stage of health profile research, future research should continue to pursue the effects of different health subgroups on death risk. As another aspect of the Person dimension in the P-E fit model of aging-in-place, I examined SES status among older adults living alone. Consistent with accumulated research findings (Bassuk, Berkman, & Amick, 2002), that individuals with low SES are more likely to die, the results of this study clearly showed that individuals with low SES are also most vulnerable in all the social stratification factors (i.e. age, gender, race and education) examined in this study.

For the Environment dimension, two aspects of the living environment were examined: social network environment and residency in senior housing. Not surprisingly, greater social

network was associated with reduced risk of death. On the other hand, living in senior housing showed an increased risk. As with the case of health profile research, research on senior housing environment is in general fairly restricted. Some limited descriptive research findings indicate that senior housing residents have a higher level of physical and mental health problems, and in this research the findings indicate that senior housing residents are more vulnerable in health (i.e. a higher proportion in the physically impaired and frail groups) and SES. However, an independent effect of senior housing residency was found in this study after controlling for all health and other covariates. Some research has indicated that older adults move into a senior residential facility for several main reasons, including actual and perceived health concerns, being widowed, and/or a desire not to burden their children. As an exploratory attempt to look at the senior housing environment as compared to traditional private homes, this study used one indicator variable of residency in senior housing. However, in reality, senior housing encompasses a broad category that often suffers from a lack of definition. Speculatively, it may be possible that it is the social and psychological factors in senior housing, not necessarily the services and features provided in the senior housing environment, that play a role in a pathway affecting outcome of aging-in-place, including death. It would be an important area for future research to examine the reasons for moving into senior housing or changes in social support relations within the housing and to what extent they affect outcomes of aging-in-place.

The Person-Environment fit perspective suggests that aging individuals, even those with limited resources and capability, can have an optimal outcome if environmental characteristics support them in a way that compensates for limitations or lack of resources. To empirically examine the fit between the Person and Environment, I asked about the extent to which environments moderate the effects of health profiles and low SES status on mortality risk. Interestingly, for individuals in the sensory-cognitive impaired group and physically impaired group, greater social support was associated with an increased risk of death. Considering that the association under examination is at the baseline time (year 2006), this finding seems to be related to an important phenomena. The results from bivariate analyses indicate that both the sensory-cognitive impaired and the physically impaired group have a higher level of social support than the frail group, while more members of the frail group tend to live in a senior housing. It appears that individuals in the sensory-cognitive impaired and physically impaired groups have a relatively higher number of people within their social support network nearby as sources of

support, given their health problems. On the other hand, for the most vulnerable health group, individuals in the frail group might have moved into a senior housing in response to their severe health problems. Under such circumstances, a cross-sectional examination of the role of social support for the sensory-cognitive impaired and physically impaired groups in relation to risk of death might be misleading. The significant association between health subgroups and social support is a reflection of the fact that members in these profiles are in need of social support at the baseline and the effect of social support on increased mortality risk might be spurious. That is, for these health profiles, other factors might come into play as related to their death risk, for example a decrease in the social network that they had at baseline. In addition, according to health transition research, it is possible that individuals in these two health profiles became part of the frail group over the years due to advances in losses and disabilities in health. It is important that future research looks into changes in social network and health profile over time.

Another interesting interaction effect was found between SES and the senior housing environment. The findings reveal that older adults living alone with low SES who live in a senior housing environment are less likely to die over time. This finding on a positive effect of living in senior housing among low-SES elders has several important implications for research and policy in the future. These elders had a higher level of social support and the largest proportion of the sample (23%) residing in senior housing, and only residence in senior housing moderates the effect of their socio-demographic disadvantage on their risk of death. The positive effect of senior living facilities among low-SES elders is consistent with Fonda et al. (2001)'s study findings, which also suggest a comparative benefit of senior living facilities for low-income elderly in terms of health. As mentioned earlier, individuals with low SES in this study are the most vulnerable subgroup of older adults in the community, indicating that their low SES appears to be a manifestation of inequality accumulated thru demographic and developmental processes over their life course (Elder & Shanahan, 2006). It seems possible that living in senior housing for this most vulnerable subgroup of elders may provide them with different opportunities compared to their peers in the community, which might in turn serve as a compensating mechanism that can partially counter the risks accumulated from their early disadvantages (Ferro, Shippee, & Schafer, 2009), in this research, their risk of death. By incorporating a life course perspective, specifically the theoretical concept of cumulative inequality into the P-E perspective, future research can better empirically examine why and how

each dimension of P-E fit helps vulnerable subgroups of older adults in the community age in place.

From a policy perspective, a demonstrated effect of senior housing for vulnerable subgroups of elders in the community is important. Across the country, approximately two million low-income seniors reside in subsidized or affordable residential facilities (Institute for the Future of Aging Services, 2009). Affordable senior housing is an emerging field that has received an increasing amount of attention as a component of long-term care policy and programs for low-income older adults. However, to date, the literature tends to focus on either anecdotal information on various models or on largely descriptive empirical studies pointing out the benefits of senior housing living (Institute for the Future of Aging Services, 2009; Pynoos et al., 2004). Despite support for such options being provided by a number of advocacy groups, research findings that explore the benefits of living in such an environment are far from conclusive, and the impact of supportive housing remains largely untested (AAHSA, 2010). The findings of this research provide important initial empirical evidence that senior housing for low SES elders helps them age in their place by preventing premature death. As discussed earlier, the findings on senior living environment should be interpreted with caution due to the limitations of the data in the present research. Accumulating literature has examined such housing arrangements, and they have been referred to by a variety of labels including service-enriched housing, affordable supportive housing, affordable residential care (assisted living), affordable congregate housing with services, affordable housing plus services, assisted living in subsidized housing, residential supportive services programs (SSP), and service-coordinated housing (Golant 2008). With pertinent data available, continued future research efforts should aim at empirically examining different types of senior housing.

4.5 Limitations

One limitation is concerned with the indicators of the environment. In this study, I used the limited aspect of the social support environment. However, future research should look at more refined aspects of social network environment as suggested social relational research, including structural elements such as contact frequency and functional aspects of social relations among older adults.

An additional limitation is concerned with the possible variation by age cohort and social stratification factors in the association among the components of aging-in-place. Theoretical and empirical research has strongly established the heterogeneity among older adults by age-cohort in terms of the aging process and adaptations (Baltes & Smith, 2003) (young old and the oldest old). However, this study did not explicitly focus on possible differences by age group. Relatedly, previous research on aging-in-place showed that older people's living environments and personal control intersect with gender and race over their life course (Antonucci, Ajrouch, % Park, 2013 forthcoming; Clarke & Smith, 2011). Future research should examine the effects of larger social forces such as history-cohorts, gender and culture in the person-environment dynamic.

Despite these limitations, by providing initial evidence of the different mortality risks of older adults living alone by SES and senior residential environment, this research demonstrated that aging-in-place is differential for subgroups of the vulnerable elderly and, more importantly, it showed how the constraints and disadvantages of having vulnerability may be compensated by the moderating role of the living environment. Given that this study is the first attempt to utilize health profiles and SES of the elderly living alone to identify vulnerable subgroups of the elderly, future research should pursue continued investigations into other outcomes of aging-in-place.

CHAPTER V

CONCLUSION

5.1 Summary of Findings

Drawing on the Person-Environment (P-E) fit perspective, this dissertation has explored components of aging–in- place among older adults living alone aged 65 and older, and investigated the extent to which each aspect is associated with adaptations independently and jointly in their old age. Across three chapters of investigation into P-E fit, this dissertation was designed with an overarching goal of empirical examination and extension of the theoretical promise of the P-E fit by focusing on different aspects of Person and Environment, as well as adaptation in both cross-sectional and longitudinal perspectives. The findings provide important insight toward an enhanced understanding of aging-in-place for a group of vulnerable elders, those who live alone. In this chapter, key findings are summarized, along with their implications for theory, research and practice. The chapter concludes with a discussion of limitations and directions for future research.

First, Chapter 2 (the first paper) examined different health limitation subgroups and environmental subgroups can be identified and interpreted. I explored the extent to which environment and health subgroups are associated with subjective well-being among older adults living alone. Specifically, I examined both the main effects of health and environment on outcomes, then, as a method to examine P-E fit, I looked into the degree to which the environment moderates the impact of health on an outcome. For subjective well-being, depressive symptoms of older adults living alone were examined. Cluster analysis identified four health limitation subgroups: sensory-cognitive impaired, physically impaired, frail, and healthy. Three different types of environmental contexts were found: physically average- socially unsupported, physically unsupported-socially supported, and physically supported–socially above average**.** The frail group was the oldest and more likely to live in senior housing. Compared to the healthy groups, the frail group was more likely to have depressive symptoms if

they lived in a physically average and socially unsupported environment. The sensory-cognitive impaired group was more likely to report depressive symptoms when they lived in a physically-unsupported but socially-supported environment. The findings about the heterogeneity of both health limitations and environment profiles and those on the association between various person-environment profiles in combination (fit) and depression have important policy and intervention implications.

The Chapter 3 (the second paper) built upon Chapter Two. This study focused on subgroups of older adults living alone in different health and environmental contexts and asked if changes in depressive symptomotology over time are mediated by changes in perceived control. It followed from the first paper in which four subgroups of health limitations were identified: sensory-cognitive impaired, physically impaired, frail, and healthy. I examined a mediating role of perceived control in the association among health, environment and depressive symptomatology over time. As expected, the mediation effects of perceived control varied by health subgroups and the environment. Compared to the healthy group, there were mediation effects of perceived control (both constraint and mastery) for more vulnerable health profiles in predicting an increase in depressive symptoms over time. This finding confirms the negative influence of membership in more vulnerable health subgroups on perceived control, which in turn affects depressive symptoms over time. Among the different environmental contexts, the results indicate that only social support had a significant effect on perceived control and depressive symptoms over time. In addition, only social support was associated fewer less depressive symptoms via perceived constraints, but not with mastery.

Finally, Chapter 4 (the third paper) expanded the empirical examination of the P-E fit in this dissertation by including SES in the Person dimension and focusing on senior housing residence in the Environment. I explored how much the two dimensions of aging-in-place, namely person (health profile and SES) and the environment (social network and senior housing residency) affect mortality. I investigated the extent to which environments moderate the effects of health profiles and low SES status on mortality risk. The result show that for individuals in the sensory-cognitive impaired group and those in physically impaired group, more social support was associated with an increased risk of death. This finding reveals that for older adults living alone with low SES, when they live in a senior housing environment, they are less likely to die over time.

5.2 Implications for Theory and Research

The findings from this dissertation expand our understanding of the differential aging-in-place of older adults living alone by focusing on their P-E fit. A number of implications for theory and research are found among the three papers. The first concerns the utilization of the person-centered perspective in P-E fit research. With the overarching goal of better identifying vulnerable sub groups of older adults, the consistent focus cutting across the three papers was a person-centered perspective (Magnusson, 1998; Smith & Baltes,1997). This perspective guides us to respectively examine the totality of individuals with diverse and possibly multiple aspects of environment and health, thereby enabling identification of more vulnerable sub-groups of older adults. Drawing on the person-centered perspective, four health profiles of older adults living alone derived from a clustering approach were examined in the Person dimension in P-E fit model. This theoretical combination of the P-E fit and person-centered perspectives and its empirical application through a clustering method provides a mechanism for the examination of the degree to which environmental support or lack of support can compensate for the varying losses and declines in health among older adults living alone.

The second involves the conceptual interconnectedness of the environment. In the first paper, the specific focus was on how to better empirically examine the interconnectedness of the living environment composed of physical and social environments. In the P-E fit perspective, the living environment is viewed as the totality of the life space in which older adults are embedded. Living environments do not simply refer to a location or physical feature of living; they also represent a key social context for the aging process. Therefore, the physical and social environments are not disparate entities, but instead conceptually interconnected (Wahl & Lang, 2004). Drawing on the person-centered perspective as both a theoretical and empirical guide, I empirically identified discernible environmental profiles of older adults, particularly those who live alone, and examined the association between the health profiles, the environment profiles and the fit (through the interaction between the two).

As a way to extend the empirical examination of the P-E fit, the second paper maintained two foci. The P-E fit perspective proposes that a mismatch between a person's need and the received environmental support may frustrate that person's sense of autonomy, which may in turn be manifested in a reduced sense of control or self-efficacy (Lawton, 1990; Oswald & Wahl,

2013; Scheidt & Norris-Baker, 2003). The exacerbated feelings of powerlessness or loss of perceived control may leave them even more vulnerable to a risk of reduced well-being and health. Although perceived control has been conceptualized as a construct independent of Person and Environment, empirically, there has been little research that illuminates the ways in which the personal, environmental context and the fit between the two are translated into well-being. The developmental perspective has long recognized the importance of the role of control belief in later adulthood when the ratio of losses begins to increase relative to gains (Baltes & Baltes, 1986) and a theoretical model of development of control belief has recently been developed. By attempting to empirically incorporate personal control in the dynamic of health profiles and environmental contexts, I believe this paper contributes to not only empirical P-E research, but also to developmental psychological research in general.

Despite the multi-dimensional conceptualization of Person and Environment relation in the P-E fit, the extent of empirical examination has been somewhat limited. With an overarching goal of identifying and examining subgroups of older adults living alone, the focus in the third paper was to further extend P-E fit research in two regards. First, it turned attention to another strong social stratification factor, SES along with health profiles in the person dimension in an attempt to better examine the more vulnerable subgroups of older adults living alone in terms of health limitations and SES status. For the environment dimension, it looked at senior housing residence. The life course perspective emphasizes the importance of historic and period effects on the developmental trajectory in an individual's life. Despite demographic changes (an increase in the number and proportion of older adults living alone) and the related housing environment in terms of the emergence of diverse housing choices for the elderly, empirical research on this new living environment has not been a component of P-E fit research in general. As an initial attempt at empirical investigation of its role in adaptation for the elderly living alone using nationally representative data from the HRS, this paper contributes to research on senior housing in general, and in particular provides much-needed research into senior housing care for the vulnerable elderly.

5.3 Implications for Practice and Policy

As components of differential aging-in-place, this dissertation examined the physical and social environment and perceived control. For outcomes of aging-in-place, it looked at the

subjective well-being and mortality risk of older adults living alone. The findings of this dissertation provide important implications for practice and policy.

The first concerns the finding of the four health subgroups. Consistent with previous health profile research, I showed that some common health limitation types can be identified in a quite robust manner. More importantly, across the qualitatively different profiles, there appears to be a gradient along the disability dimension (Lafortune et al., 2009) from the healthy group to the most frail subgroup as a consequences of physical and cognitive impairment, as suggested by the disablement process (Verbrugge & Jett, 1994) in old age. It is a meaningful finding that the pattern of change in health among older adults living alone seems to mirror that of the elderly who are coupled. The life course and life span perspective (Elder & Shanahan, 2006; Fuller-Iglesias, Smith, & Antonucci , 2010) suggests that aging individuals experience varying developmental characteristics of transitions and trajectory of health status over their lifetimes. The identification of health profiles and illumination of the characteristics of the subgroups in a consistent manner provide important implications in gerontology research as well as for policy and program development in aging. Specifically, In the first paper, the findings show that the frail elderly living alone, although comprising the smallest (9%) among the four identified profiles, is the most vulnerable group of older adults in terms of all known social stratification factors, including minority status, widowhood, and low SES. Not surprisingly, this most vulnerable group is substantially more likely to be depressed compared to other health profiles. The concentration of risk factors in this subgroup suggests that a focused research and policy development effort could be made for this group by identifying which aspects of the environment could compensate for frailty. The finding suggests that frail older adults living alone are more likely to be depressed if they live in a physically and socially less-supportive environment. Given the ongoing demographic changes, the need for health and social care for this most vulnerable subgroup of the elderly will continue increasing. In part, the emergence of ever-more diverse care delivery mechanisms including PACE and assisted living facilities have been put in place to deal with the complex care needs of the elderly in general. One important implication from the findings of this dissertation is that an enhanced effort may focus on identifying subgroups of the vulnerable elderly in terms of person and environment and how well their P-E fit can be reflected in better designing and delivering coordinated care services. Relatedly, it has been established that this subgroup of elderly consumes a disproportionate share of health services (Lafortune,

Beland, Bergman, & Ankri, 2009) and accumulated research on nursing home admissions has demonstrated that along with the set of other risk factors, the status of living alone is significantly associated with long-term care institutionalization. By focusing on the elderly living alone, the findings further suggest that we can still identify additional sub-groups of the elderly among those living alone who are particularly vulnerable to a range of health impairments.

The other major findings are in regard to the sensory-cognitive impaired profile. For the elderly living alone that fall into this group, they are more likely to be depressed if they live in a physically unsupportive but socially supportive environment. For this group, a better fit for their psychological adaptation therefore lies in the physical aspects of their living environment. The implications for community intervention strategies can be considered regarding what kind of programs would enhance the physical and social environment for this most vulnerable subgroup of older adults living alone. The problem of social isolation among the elderly living alone has been well researched. Currently, some programs exist (e.g. Senior Corps) that are designed to alleviate social isolation as a way to improve independent living. One way to better help the frail group identified in our research may be the creation of a program in which community workers provide regular visits to frail older adults living alone. Such a program could train the community workers not only in formal in-home therapy services, but also provide training on barrier reductions that can in turn lead to a reduction in self-care and mortality services (Stineman et al., 2012).

In the second paper, mediation effects of perceived control for more vulnerable health profiles were found in terms of predicting an increase in depressive symptoms over time. This finding confirms the negative influence of health subgroups on perceived control, which in turn affects depressive symptoms over time. Also, perceived social support and neighborhood condition can affect constraint over time, and social support particularly affects changes in depressive symptoms through perceived control. These results suggest that vulnerable subgroups of older adults (i.e. the frail group) with low levels of perceived control can be targeted for an intervention program and policy to maintain or enhance their well-being. The prevalence of major depression in adults aged 65 and older ranges from 1% to 5% in the United States, while clinically significant depressive symptoms are found in approximately 8% to 16% of community-dwelling seniors (Blazer, 2003). Understanding of depressive symptoms among the elders would be enhanced if we could take into account the multi-morbidity of elders, possibly

by utilizing profiles of health limitations as identified in this dissertation. The development of treatment services and programs for elders with mental challenges could also benefit from these research findings on the role of environment. Profiles of social relations, social network types or a social network scale (e.g. the Lubben Social Network Scale) have been applied in practice and clinical settings as related to mental health issues. To date, the explicit incorporation of an environmental gerontological perspective into the research on mental health among older adults has been rare.

The findings provide important initial empirical evidence that senior housing for low SES elders helps them age in place by preventing premature death. This finding suggests a possible positive effect among low SES elders of living in senior housing and provides several important implications for research and policy in the future. From a policy perspective, a demonstrated effect of senior housing on vulnerable subgroups of elders in the community is important. Across the country, approximately two million low-income seniors reside in subsidized or affordable residential facilities (IFAS, 2009) and affordable senior housing has been the focus of an increasing amount of attention as a component of long-term care policy and programs for low income older adults. Given the early stage of research in this subfield of long term care in general and the broad definition of senior housing used in this dissertation, future research efforts should aim to examine various types of senior housing care models for the low-income elderly.

5.4 Limitation

My first concern involves a theoretical conception and empirical use of personal agency. The P-E fit theoretical proposal is that the proper fit between resources and constraints affects an individual's action potentials (Wahl & Lang, 2004), and the active role of an individual, personal agency, is at the core of its theoretical assumption on aging-in-place. In this dissertation, my ultimate goal of identifying subgroups of vulnerable elderly living alone has led me to emphasize one aspect of the P-E fit perspective. Although I empirically tested the role of personal control, conceptualized as personal agency, in so doing I drew upon one side of the theoretical coin of the P-E fit perspective, *the environmental docility hypothesis* that tends to emphasize the passive role of an individual whose aging process is influenced by his or her environmental challenges. The P-E fit's core theoretical premise would be better actualized if we used a dynamic conceptualization of personal agency. I studied differential aging-in-place since it is important to

identify vulnerable subgroups among the elderly who are apparently aging in place but are left ignored and at risk of greater vulnerability in celebration of an uncritical acceptance of the universal benefit of aging in place. In so doing, I believe it is of equal or greater importance to recognize a possible pitfall into which I might stumble: my emphasis on vulnerability based on *the environmental docility hypothesis*, if not applied with caution, could end up contradicting or selling short the theoretical and empirical promise of the P-E fit which aims to be applied to real world-problem solving efforts for vulnerable elders. A pendulum of emphasis in aging research might have begun to slowly swing back again from a mono-dimensional understanding of aging-in-place to differential aging-in-place, but I should guard against overemphasizing the vulnerability of the elderly to the extent that it is a misguided use of the P-E fit theory.

As part of the effort not to fall into focusing solely on the vulnerability of elders, I believe I can examine the heterogeneous nature of adaptation in later life. There are a number of pathways both to living a long life and to a personal sense of well-being. Adaptation in the P-E fit is conceptualized into two areas: behavioral and affect. Across the three papers of this dissertation, the primary focus tends to fall on the psychological adaptation of older adults living alone (i.e. subjective well-being). An explicit focus on behavioral aspects in adaptation strengthens P-E fit research, considering its long-standing emphasis on applying research findings to the solving of real-life problems. For example, I can extend my research on the P-E fit of elders living alone through enriched research on social engagement and environmental adaptations (i.e. home modification, relocation). In that way, I can empirically test one of the P-E fit perspective's core theoretical hypothesis, *the environmental proactivity hypothesis* which explicitly brings in an individual's proactive role in later life by arguing that the aging individual is not simply on the receiving end of environmental challenges and constraints, but actively engages, adjusts, and adapts to the environment.

The second concern is related to how to measure the interconnectedness of the living environment. From the outset, the emphasis of this dissertation was on the totality of such living environments. Although it is meaningful that I attempted the empirical examination of environmental subgroups consisting of both physical and social characteristics, such subgroups do not capture the complex and dynamic manner in which the social and physical environments interact with one another, or how that interspace is associated with the proactive adaptation of aging individuals. A conceptual tool is needed in order to empirically tease out the transactional

process of the living environment, some of which have been developed by environmental developmental researchers, such as Social-Physical Place Over Time (SPOT) (Wahl & Lang, 2004). In this dissertation, doing so was not my priority research question, but I was not able to utilize such a measurement tool due to data limitation. I believe it to be a promising area for future research if such a dynamic conceptualization of environment could be utilized.

The third concern involves how we study "fit" in the P-E relation. This question is related to the time-old epistemological debate between the transactional and interactional approaches to understanding the P-E relation. By following the majority of empirical P-E research, this dissertation pursued a more interactional approach which conceives the statistical interaction between personal and environmental characteristics to be equivalent to the conceptual fit that emerge from the person and the environment. There is no doubt the transactional route of thinking has expanded conceptual and theoretical models for understanding multi-dimensional, contextualized human development. However, faced with empirical challenges in measuring the complexity of P-E relations, the proponent of the P-E fit perspective Lawton himself later observed that for empirical research, an interactional approach may be more practical (Lawton, 1990). As in the case of emphasis having shifted from the curse of nursing home institutionalization to the potential ignoring of vulnerable subgroups of elders among those who are aging in place, this shift of emphasis from transactional to interactional thinking in the examination of P-E fit requires a cautious approach in empirical research. At an extreme end of the sophisticated empirical inquiry into interactions between person and environment, the results of countless interaction terms in empirical research being used to such a degree that they lose practical utility. Therefore, theoretically driven but parsimonious concepts for examining the P-E relation should always guide my research. To that end, I believe that I should aim at conducting a mixed-method effort in my future research.

Other limitations should be acknowledged. I believe a longitudinal examination of key constructs in this dissertation research will enhance P-E research on aging-in-place. Underlying the P-E fit perspective is a dynamic association between personal competence and the environment. Generalizations about health profile and environmental context as a construct of aging-in-place and its influence on various outcomes of aging-in-place would be substantially improved if I were able to look into changes in respective aspects in the Person and Environment dimensions. Another limitation is concerned with indicators of environment. Across the three

studies, I used a limited aspect for the social support environment. However, future research should examine more refined aspects of the social support environment as suggested by social relational research including structural aspects such as contact frequency and functional aspects of social relations among older adults.

Lastly, one additional limitation regards possible variation by age cohorts and social stratification factors in the association among the components of aging-in-place. Theoretical and empirical research has strongly established heterogeneity within older adults by age cohorts (young old and the oldest old) in the aging process and adaptations (Baltes & Smith, 2003) However, this study did not explicitly focus on possible differences by age group. Relatedly, previous research on aging-in-place showed that older people's living environments and personal control intersect with gender and race over their life course (Antonucci, Ajrouch, Park, 2013 forthcoming in 2014; Clarke & Smith, 2011). Future research should examine the effects of broader social forces such as history-cohorts, gender and culture in the person-environment dynamic.

Despite these limitations, these papers contribute to our understanding of the different characteristics and vulnerabilities of the subpopulation of people over age 65 who live alone and age-in-place. The findings on heterogeneity of the elderly living alone can serve as important background knowledge for practice and policy in aging. Empirical identification of the health subgroups of the elderly living alone suggests that the knowledge and methods of health profiling can be used as an assessment tool in practice. Research-supported knowledge on subgroups of the elderly living alone will enable social work practitioners to monitor the process of their clients' aging-in-place and ultimately serve as policy advocates in developing and expanding programs to support differential but successful aging-in-place in traditional private homes and senior living facilities.

BIBLIOGRAPHY

Adams, K. B., Roberts, A. R. (2010). Reported coping strategies and depressive symptoms among African American and White residents of congregate housing. *Journal of Gerontological Social Work*, 53(6), 473-495.

Allison, P. D. (1984). Event History Analysis: Regression for Longitudinal Event Data. Beverly Hills, CA: Sage Publications.

American Association of Homes and Services for the Aging (2010). Affordable Senior Housing with Services Programs and Models. Paper presented at National Summit on Affordable Senior Housing with Services, Washington, DC.

Antonucci, T. C. (1990). Social support and social relationships. In R. H. Binstock & L.K.George (Eds.). Handbook of aging and the social sciences (3rd ed., pp.205-226). San Diego, CA: Academic Press.

Antonucci, T. C. (2001). Social relations: An examination of social networks, social support, and sense of control. In J. E. Birren & K.W. Schaie (Eds.), *Handbook of the psychology of aging (pp. 427-453)*. San Diego, CA: Academic Press.

Antonucci, T. C. Birditt, K. S. & Akiyama, H. (2009). Convoys of social relations, an interdisciplinary approach, In Handbook of Theories of Aging, V. L. Bengston, D.Gans, N.M. Putney, & M. Silverstein, Eds., pp. 247-260, Springer, New York, NY, USA, 2nd edition.

Antonucci, T. C., Ajrouch, K., Park, S. (In press). Aging and Social Capital, In Pachana & Laidlaw (Ed)., Handbook of Clinical Geropsychology:International Perspectives. Oxford: *Oxford University Press.*

Avorn, J. , & Langer, E. (1982). Induced disability in nursing home patients: A controlled trial. Journal of the American Geriatrics Society, 30, 397–400

Baltes, M. M., (1996). The many faces of dependency in old age. Cambridge, UK: Cambridge University Press.

Baltes, M. M., & Baltes, P. B. (Eds). (1986). The psychology of control and aging. Hillsdale, NJ: Erlbaum.

Baltes, P. B. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. Developmental Psychology, 23, 611-626.

Baltes, P. B., & Baltes, M. M. (1990). Psychological perspectives on successful aging: The model of selective optimization with compensation. In Successful aging: Perspectives from the behavioral sciences (pp. 1–27). New York: Cambridge University Press.

Baltes, P., & Smith, J. (2003). New frontiers in the future aging: From successful aging of the young old to the dilemmas of the fourth age, Gerontology, 49, 12-135.

Bandura, A. (1989). Regulation of cognitive processes through perceived self-efficacy. *Developmental Psychology*, *25*, 729–735. doi:10.1037/0012-1649.25.5.729

Banzinger, G., & Roush, S. (1983). Nursing homes for the birds: A control-relevant intervention with bird feeders. The Gerontologist, 23, 527–531. doi:10.1093/geront/23.5.527

Bassuk, S. S., Berkman, L. F., & Amick, B. C. (2002). Socioeconomic status and mortality among the elderly: findings from four US communities. *American Journal of Epidemiology*, 155(6), 520-533.

Belchman, S., Bernard, M., Kingston, P., & Nettleton, H. (2000). Lifestyles of belief: Narrative and culture in a retirement community. *Ageing & Society*, 20, 649-672.

Bergman, L. R., Magnusson, D., & El-Khouri, B. M. (2003). *Studying individual development in an interindividual context: A person-oriented approach*. Mahwah, NJ: Erlbaum.

Black, K. (2008). Health and Aging-in-Place: Implications for Community Practice. *Journal of Community Practice*, 16(1). P 80-94.

Blazer, D. (2003). Depression in late life: Review and commentary. The Journals of

Borrell L. N., Diez Roux A.V., Rose K, & Catellier D., Clark B. L. (2004). Neighborhood characteristics and mortality in the Atherosclerosis Risk in Communities Study. Int J Epidemiol, 33(2):398–407.

Byrnes, M., Lichtenberg, P.A., Lysack, C. (2006). Environmental press, aging-in-place, and residential satisfaction of urban older adults. *Journal of Applied Sociology/Sociological practice*, 23(2), 50-76.

Canter, D. V., & Craik, K. H. (1981). Environmental psychology. *Journal of Environmental Psychology*, 1, 1-11.

Carp, F. M. (1967). The impact of environment on old people. *Gerontologist*, 7, 106-108.

Carp, F. M. (1987). Environment and aging. In D. Stokols & I. Altman (Eds.), *Handbook of environmental psychology* (Vol. 1, pp.330-360). New York: Wiley.

Carstensen, L. L. (1993). Motivation for social contact across the life span: A theory of socioemotional selectivity. In J.E. Jacobs (Ed.) Nebraska symposium on motivation: 1992, Developmental Perspectives on Motivation, Vol. 40, (pp. 209–254). Lincoln: University of Nebraska Press.

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. American Psychologist, 54, 165-181.

Cheng, S., Lee, C. K., Chan, A.C., Leung, E.M., & Lee, J. (2009). Social network types and subjective Well-being in Chinese older adults. *Journal of Gerontology: Psychological Science*, 64B (6), 713-722.

Chiu,T. I., Spencer, G. A.(2009). Functional health status among rural and urban older adults in Taiwan: the effect of personal control and social control. International Journal of Older People Nursing, 203-210.

Choi, N.G. (2004). Stability and Changes in Living Arrangement Among Unmarried Older Persons, *Journal of Housing For the Elderly*,18(2), 69-89.

Clarke, P., NieuInhuijsen, E. R. (2009). Environments for healthy ageing: A critical review. *Maturitas*, 64(1), 14-19.

Commomwealth Fund Commission on Elderly People Living Alone: Improving the Well-Being of Elderly People Living Alone: The Unfinished Agenda. Baltimore, Md: Commonwealth Fund; 1992.

Crimmins, E. M. (2004). Trends in the health of the elderly. *Annual Review of Public Health*, 25, 79-98.

Crimmins, E. M., Preston, S. H., & Cohen, B. (Eds.). (2011). International differences in mortality at older ages: Dimensions and sources. National Academies Press.

Cutchin, M. (2003). The process of mediated aging-in-place: A theoretically and empirically based model. *Social science and medicines*, 57(6), 1077-1190.

Dannefer, D. (1992). On the conceptualization of context in developmental discourse: Four meanings of context and their implications. In D.L. Featherman & R.M. Lerner & M. Perlmutter (Eds.), Life-span development and behavior (Vol.11, pp.83-110). Hwellsdale, NJ: Erlbaum.

Davey Smith G., Hart, C., Watt, G., Hole, D., Hawthorne, V. (1998). Individual social class, area-based deprivation, cardiovascular disease risk factors, and mortality: the Renfrew and Paisley Study. *J Epidemiol Community Health*, 52(6):399–405.

Davis, M.A., Moritz, D. J., Neuhaus, J.M., Barclay, J.D., Gee, Lauren (1997). Living arrangements, changes in living arrangements, and survival among community dwelling older adults. *American Journal of Public Health*, 87(3), 371- 377.

Dunkle, R., Roberts, B., Haug, M. The oldest old in everyday life: Self perception, coping with change, and stress. New York: Springer.

Eckert, J. K., Carder, P. C., Morgan, L. A., Frankowski, A. C., & Roth, E. G. (2009). *Inside assisted living: The search for home*. Johns Hopkins University Press.

Elder, G. H., Jr., & Shanahan, M. J. (2006). The life course and human development. In Lerner, R.M. (Ed.). In Lerner, R. M. (Ed), *Theoretical models of human development. Volume 1 of the Handbook of Child Psychology* (6th ed.). W. Damon & R. M. Lerner, Editors-in-chief. Hoboken, NJ: John Wiley & Sons.

Fange, A., & Iwarsson, S. (2005). Changes in ADL dependence and aspects of usability following housing adaptation. *American Journal of Occupational Therapy*, 55, 641-648.

Felton, B. J.,& Revenson, T. A. (1984). Coping with chronic wellness: A study of wellness controllability and the influence of coping strategies on psychological adjustment. Journal of Consulting and Clinical Psychology, 52(3), 343–353.

Field, E. M., Walker, M. H., Orrell, M. W. (2002). Social networks and health of older people living in sheltered housing, *Aging & Mental Health*, 6(4), 372-386.

Fiori, K. L., Smith, J., & Antonucci, T. C. (2007). Social network types among older adults: A multidimensional approach. *Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 62, B*(6), 322-330.

Fonda, S. J., Clipp, E., & Maddox, G. L. (2002). Patterns in functioning among residents of an affordable assisted living housing facility. *The Gerontologist*, 42(2), 178-187.

Freeman, V. A. (1996). Family structure and the risk of nursing home admission. Journal of Gerontology: Social Sciences, 51B, 2, S61-9.

Fuller-Iglesias, Smith, J., & Antonucci, T.C. (2009). Theories of aging from a life-course and lifespan perspective. In *Annual Review of Gerontology and Geriatrics*. New York, NY: Springer.

Gaines, J. M., Poey, J. L., Marx, K. A., Parrish, J. M., & Resnick, B. (2011). Health and medical services use: A matched case comparison between CCRC residents and National Health and Retirement Study samples. *Journal of Gerontologicl Social Work*, 54, 768-802.

Gaymu, J. & Springer, S. (2010). Living conditions and life satisfaction of older Europeans living alone: a gender and cross-country analysis. *Ageing & Society*, 30, 1153-1175.

Gerontology. Series A, Biological Sciences and Medical Sciences, 58(3):249–265.

Gerstorf, D., Smith, J., & Baltes, P. (2006). A systemic-wholistic approach to differential aging: longitudinal findings from the Berlin Aging Study. *Psychology and Aging*, 21(4), 645-663.

Giles, L. C., Glonek, G. F. V., Luszcz, M. A., & Andrews, G. R. (2005). Effect of social networks on 10 year survival in very old Australians: The Australian Longitudinal Study of Aging. Journal of Epidemiology and Community Health, 59, 574–579.

Gitlin, L.N. (2003). Conducting research on home environments: lessons learned and new directions. *The Gerontologist*, 43(5), 628-637.

Golant, S. M. (2003). Conceptualizing time and behavior in environmental gerontology: A pair of old issues deserving new thought. *The Gerontologist*, 43(5), 638-648.

Golant, S. M. (2008). Affordable clustered housing-care: A category of long-term care options for the elderly poor. *Journal of Housing for the Elderly*, 22 (1-2), 3-44.

Gonyea, J. G. & Bachman, S. S. (2008). Correlates of psychological distress among older residents of urban public housing, *Journal of Loss and Trauma*, 13, 243-260.

Hair, J. H.Jr, Black, W.C. (2000). Cluster analysis. In Grimm, L.G. & Yarnold, P.R. (eds), *Reading and understanding more multivariate statistics*. American Psychological Association, Washington DC, 147-205.

Hoenig, H., Landermann, L. R., Shipp, K. M., & George, L. (2003). Activity restriction among wheelchair users. *Journal of the American Geriatric Society*, 51, 1244 – 1251.

Hwang, E., Cummings, L., Sixsmith, A. & Sixsmith, J. (2011). Impacts of home modifications on aging-in-place. *Journal of Housing for the Elderly*, 25, 246-257.

Institute for the Future of Aging Services, IFAS (2009). Affordable Senior Housing Communities and Health–Related Services. [Online]. Available: www.LeadingAge.org.

Iwarsson, S., Horstmann, V. & Slaug, B. (2007). Housing matters in very old age- yet differently due to ADL dependent level differences. *Scandinavian Journal of Occupational Therapy*. 14(3), 3-15.

Iwarsson, S., Isacsson, A., Lanke, J. (1998). ADL dependence in the elderly population living in the community: the influence of functional limitations and physical environmental demand. *Occupational Therapy International*, 5(3), 173–193

Kahana, E. (1982). A congruence model of person-environment interaction. In M.P. Lawton, P.G. Windley, & T. O. Byerts (Eds.), *Aging and the environment*: Theoretical approaches (pp.97-121). New York: Springer.

Karlamangla, A., Tinetti, M., Guralnik, J., Studenski, S., Itle, T., & Reuben, D. (2007). Comorbidity in older adults: Nosology of impairment, diseases, and conditions. *Journal of Gerontology*, 62a, 296-300.

Kemp, C. L., Ball, M. M., Hollingsworth, C., & Perkins, M. M. (2012). Strangers and friends: Residents' social careers in assisted living. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *67*(4), 491-502.

Kendig, H. (2003). Directions in Environmental Gerontology: A Multidisciplinary Field. *The Gerontologist*. 43(5), 611-615.

Kline, R. B. (2011). Principles and practice of structural equation modeling. Guilford Press, New York.

Krampe, H., Hautzinger, M., Ehrenrich, H., & Kroner-Herwig, B. (2003). Depression among elderly living in senior citizen homes: Investigation of a multifactorial model of depression. Zeitschrift fur Klinische Psychologie und Psychotherapie, 32, 117–128.

Krause, N. (1993). Neighborhood deterioration and social isolation in later life. *International Journal of Aging and Human Development*. 36, 9-38.

Kunzmann, U., Little, T., Smith, J. (2002). Perceiving control: a double-edged sword in old age. *Journal of Gerontology*, *Psychological Sciences*, 57B, 6, 484-491.

Lachman, M. E.,& Prenda-Firth, K. M. (2004). The adaptive value of feeling in control during midlife. In O. G. Brim, Jr., C. D. Ryff, & R. C. Kessler (Eds.), How healthy are I?: A national study of Well-being at midlife (pp. 320–349). Chicago: University of Chicago Press.

Lachman, M., Neupert, S., & Agrigoroaei, S. (2011). The relevance of control beliefs for health and aging. In: K. W. Schaie & S. L. Wwellis (Eds.), Handbook of the psychology of aging. (7th ed., pp. 175–190). New York: Elsevier.

Lachman, M.E. (2006). Perceived control over aging-related declines: Adaptive beliefs and behaviors. *Current Directions in Psychological Science*, 15, 282-286.

Lafortune, L., Beland, F., Bergman, H, & Ankri. (2009). Health state profiles and service utilization in community-living elderly. *Medical Care*, 47(3). 286-294.

Lamb, V.L. (1996). A cross-national study of quality of life factors associated with patterns of elderly disablement. *Soc.Sci.Med*. 42(3). 363-377.

Langer, E. J., & Rodin, J. (1976). The effects of choice and enhanced personal responsibility for the aged: A field experiment in an institutional setting. Journal of Personality and Social Psychology, 34 (2), 191–198.

Lawton, M. P. (1982). Competence, environmental press, and the adaptation of older people. In M. P. Lawton, P. G. Windley, & T. O. Byerts (Eds.), *Aging and the Environment* (pp. 33–59). New York: Springer.

Lawton, M. P. (1983). Environment and other determinants of Well-being in older people. *The Gerontologist*, 23(4), 349-357.

Lawton, M. P. (1990). Residential environment and self-directedness among older people. *American Psychologist*. 45(5), 638-640.

Lawton, M. P. (1990). Residential environment and self-directedness among older people. *American Psychologist*. 45(5), 638-640.

Lawton, M. P. (1999). Environmental taxonomy: Generalizations from research with older adults. In S. Friedman & T. Wachs (Eds.), Measuring environment across the life span: Emerging methods and concepts (pp. 91-124). Washington, D. C.: American Psychological Association.

Lawton, M. P. & Nahemow, L. (1973). Ecology and the Aging Process. Eiserdorfer, C. and Lawton, M.P. (Eds.) *Psychology of Adult Development and Aging*. Washington, DC: American Psychological Association.

Lawton, M. P. & Simon, B. (1968). The ecology of social relationships in housing for the elderly. *The Gerontologist*, 8,108-115.

LeClere F. B, Rogers R. G, Peters K. (1998). Neighborhood social context and racial differences in women's heart disease mortality*). J Health Soc Behav*, 39(2):91–107.

Lehning, A., Smith, R., Dunkle, R. E. (2014). Age-Friendly Environment and self-rated health: An exploration of Detroit elders. *Research on Aging*, 36(1), 72-94.

Lichtenberg, P. A., MacNewell, S. E., Mast, B.T. (2001). Environmental press and adaptation to disability in hospitalized live-alone older adults. *The Gerontologist*, 40(5), 459-556.

Litwin, H., & Shiovitz-Ezra, S. (2006). Network type and mortality risk in later life. The Gerontologist, 46(6), 735-743.

Liu, S. Y. & Lapane, K. L. (2009). Residential modifications and decline in physical function among community-dwelling older adults. *The Gerontologist*, 49(3), 344-354.

MacCallum, R. C. &. Austin, J. T. (2000). Applications of structural equation modeling in psychological research, *Annual Review of Psychology*, 51, 201-226.

Magnusson, D., & Hakan, S. (2006). The Person in context: A holistic-interactionistic approach. In W. Damon (Series Ed.) & R.M. Lerner (Volume Ed.*)* In W. Damon (Series Ed.) & R. Lerner (Vol. Ed.*). Handbook of Child Psychology: Vol 1: Theories of Human Development: Contemporary Perspectives* 6th Ed. (pp. 685-759). New York: Wiley

MaLaren, S., Turner, J., Gomez, R., & McLachlan, A., Gibbs, P.M. (2013). *Aging and Mental Health*, DOI: 10.10080/13607863.2013.805402.

Manton K. G, Cornelius E. S, Woodbury M. A. (1995). Nursing home residents: a multivariate analysis of their medical, behavioral, psychosocial, and service use characteristics. *J Gerontol A Biol Sci Med Sci*, 50, 242–251.

Manton, K. G., Stallard, E. Changes in health, mortality and disability and their impact on long term care needs. *J Aging Soc Pol*, 7, 25-52.

McNamee, P. (2004). A comparison of the grade of membership measure with alternative health indicators in explaining costs for older people. *Health Econ*, 13, 379-395.

Miller, L. M. S., & Lachman, M.E. (1999). The sense of control and cognitive aging: Toward a model of mediation processes. In T. M. Hess & F. Blanchard-Fields (Eds.), *Social Cognition and aging* (pp.17-41).

Mirowsky, J. (1995). Age and sense of control. *Social Psychology Quarterly*, 58, 31-43.

Mirowsky, J., & Ross, C. E. (1992). Age and depression. *Journal of Health and Social Behavior*, 33, 187-205.

Murphy , S. L. , Nyquist , L. V. , Strasburg , D. M. , & Alexander , N. B. (2006). Bath transfers in older adult congregate housing residents: Assessing the person-environment interaction. *Journal of the American Geriatrics Society, 54* , 1265 – 1270 .

O'Connor, B. P. & Vallerand, S. L. (1994). Motivation, self-determination, and person-environment fit as predictors of psychological adjustment among older adults. *Psychology and Aging*, 9, 189-194.

Oswald, F., Wahl, H. W., Schilling, O., & Iwarsson, S. (2007). Housing-related control beliefs and independence in activities of daily living in very old age. *Scandinavian Journal of Occupational Therapy*, *14*(1), 33-43.

Oswald, F., Wahl, H.-W., Schwelling, O., Nygren, C., Fänge, A., & Sixsmith, A. (2007). Relationships between housing and healthy aging in very old age. *The Gerontologist*, 47, 96–107.

Parker, M. G., Thorslund, M. (2007). Health trends in the elderly population: getting better and getting worse. *The Gerontologist*, 47(2), 150-158.

Parmalee, P., & Lawton, M. P. (1990). The design of special environments for the aged. In J.Birren & K.W.Schaie(Eds.), Handbook of the psychology of aging (pp.464-488). New York: Academic Press.

Pastalan, L. A. (1990). Aging in Place: The Role of Housing and Social Supports, The Haworth Press, Binghamtom, NY, USA, 1990.

Payne, G., Laporte, A., Deber R, et al. (2007). Counting backward to health care's future: using time-to-death modeling to identify changes in end-of-life morbidity and the impact of aging on health care expenditures. *Milbank Q*. 85, 213–257.

Pearlin, L. I., & Schooler, C. (1978). The structure of coping. Journal of Health and Social Behavior, 19, 2–21. doi:10.2307/2136319

Pearlman, D. N., & Crown, W. H. (1992). Alternative sources of social support and their impacts on institutional risk. The Gerontologist, 32, 527-535.

Penninx, B. W., van Tilbury, T., Boeke, A. J. P., Deeg, D. J. H., Kriegsman, D. M., & van Eijk, J. T. M. (1998). Effects of social support and personal coping resources on depressive symptoms: Different for various chronic diseases? Health Psychology,*17*(6), 551–558.

Portrait, F., Lindeboom M., Deeg D. (1999). Health and mortality of the elderly: the Grade of Membership method, classification and determination. *Health Econ*, 8, 441-457.

Preacher, K. & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behavior Research Methods, 40(3):879–891.

Prohaska, T. R., Keller, M. L., Leventhal, E. A., & Leventhal, H. (1987). Impacts of symptoms and aging attrition on emotions and coping. *Health Psychology*, 6, 495-514.

Pynoos, J., Feldman, P. H., Ahrens, J. (2004). Linking Housing and Services for Older Adults: Obstacles, Options, and Opportunities (Eds.). New York: The Haworth Press.

Reich, J. W., & Zautra, A. J. (1990). Dispositional control beliefs and the consequences of a control-enhancing intervention. *Journal of Gerontology*, 45, P46-P51.

Rein, D.B. (2005). A matter of classes: stratifying health care populations to produce better estimates of inpatient costs. *Health Res Educ Trust*, 40:1217–1233.

Reinhardt, J. P. (1996). The importance of friendship and family support in adaptation to chronic vision impairment. *Journal of Gerontology: Psychological Science*, S1, P268-p278.

Rendall, M. S. & Speare, Jr. A. (1995). Elderly poverty alleviation through living with family. *Journal of Population Economics*, 8(4), 383-405.

Riggs, J. E. (1992). Aging and mortality: manifestations of natural 'non-selection'. Mechanisms of Ageing and Development, 62, 127-135.

Rochette, A., Desrosiers, J., & Noreau, L. (2001). Association between personal and environmental factors and the occurrence of handicap situations following stroke. Disability and Rehabilitation, 23, 559 – 69.

Rodin, J. (1989). Sense of control: Potentials for intervention. Annals of the New York Academy of Psychological and Social Sciences, 503, 29-42.

Rodin, J., & Langer, E. J. (1977). Long-term effects of a control-relevant intervention with the institutionalized aged. Journal of Personality and Social Psychology, 35, 897–902.

Rodin, J., & Langer, L. (1980). Aging labels: The decline of control and the fall of self-esteem. Journal of Social Issues, 36, 12–29.doi:10.1111/j.1540-4560.1980.tb02019.x

Rodin, J., Schooler, C., & Schaie, K,W. (1990). (Eds). Self-Directness: Cause and effects throughout the life course. Hwellsdale, N.J.: Lawrence Erlbaum.

Rosen, M., Haglund, B. (2005). From healthy survivors to sick survivors: Implications for the 21st century. *Scandinavian Journal of Public Health*, 33(2), 151-155.

Rowles, G. D. (1993). Evolving images of place in aging and 'aging-in-place', *Generations*, 17, 65-70.

Rubenstein, L. Z. (1999). The importance of including the home environment in assessment of frail older people. *Journal of the American Geriatrics Society*, 47, 111-112.

Rudberg, M. A., Sager, M. A., & Zhang, J. (1996). Risk factors for nursing home use after hospitalizations for medical wellness. *Journal of Gerontology: Medical science*, 51A, M189-M194.

Scharlach, A. (2012). Creating aging-friendly communities. *Ageing Int,* 37, 25-38. DOI 10.1007/s12126-011-9140-1

Scheidt, R. J., & Norris-Baker, C. (2004). The general ecological model revisited: Evolution, current status, and continuing challenges. In H.-W. Wahl, R. Scheidt, & P. G. Windley (Eds.), Aging in context: Sociophysical environments. *Annual Review of Gerontology and Geriatrics*, 2003 (pp. 35–48). New York: Springer.

Schulz, R., & Hansua, B. H. (1978). Long-term effects of control and predictability-enhancing interventions: Findings and ethical issues. Journal of Personality and Social Psychology, 36, 1194–1201. doi:10.1037/0022-3514.36.11.1194

Schulz, R., Heckhausen, J., & Obrien, A. (1994). Control and the disablement process in the elderly. Journal of Social Behavior and Personality, 9, 139.

Seeman, T. E. & Crimmins, E. (2000). Social environment effects on health and aging: integrating epidemiologic and demographic approaches and perspectives, *Annals of the New York Academy of Sciences*, 51(1), 71-84.

Sikorska-Simmons, E., & Wright, J. D. (2007). Determinants of resident autonomy in assisted living facilities: a review of literature. *Case Management Journals*, 8, 187-193.

Singer, J. D., & Willett, J. B. (2003). Applied longitudinal data analysis. New York: Oxford University Press.

Skaff, M. M. (2007). Sense of control and health. In C.M. Aldwin, C.L. Park, & A. Spiro (Eds.), *Handbook of health psychology and aging* (pp. 186- 207). Guilford Press.

Skinner, E.A. (1995). Perceived control, motivation, and coping. Thousand Oaks, Calif.:

Slaug, B., Schwelling, O., Iwarsson, S., & Carlsson, G. (2011). Defining profiles of functional limitations in groups of older persons: how and why? *Journal of Aging and Health*, 23(3), 578-604.

Smith, J., Borchelt, M., Maier, H., Jopp, D. (2001). Health and Well-being in the young old and oldest old. *Journal of Social Issues*, 58(4), 715-732.

Smith, M. H., Anderson, R., Bradham, D. D., Longino, C.F. (1995). Rural and urban differences in mortality among Americans 55 years and older: analysis of the National Longitudinal Mortality Study. *The Journal of Rural Health*, 11(4), 274-285.

Smith,J., Baltes, P.B.(1997). Profiles of psychological functioning in the old and oldest. *Psychology and Aging*, 12, 458-472.

Stineman, M. G., Xie, D., Streim, J.E, Pan, Q., Kurichi, J. E., Henry-Sanchez, J. T., Zhang, Z., Saliba, D. (2012). Home accessibility, living circumstance, stage of activity limitation, and nursing home use. *Arch Phys Med Rehabil*, 93, 1609-1616.

Street, D., & Burge, S. W. (2012). Residential context, social relationships, and subjective well-being in assisted living. *Research on Aging*, *34*(3), 365-394.

Sugisawa, H., Liang, J., Liu, X. (1994). Social networks, social support, and mortality among older people in Japan. *Journal of Gerontology: Social Sciences*, 49 (1), S3-S13.

Thomése, F., van Groenon M. B. (2006). Adaptive strategies after health decline in later life: increasing the person-environment by adjusting the social and physical environment. *Eur J Ageing*, 3, 169-177.

Thompson, S. C. (1981). A complex answer to a simple question: Willl it hurt less if I can control it? *Psychological Bulletin*, 90, 89-101.

Thompson, S. C., Sobolew-Shubin, A., Galbraith, M. E., Schwankovsky, L., & Cruzen, D. (1993). Maintaining perceptions of control: Finding perceived control in low control circumstances. *Journal of Personality and Social Psychology*, 64(2), 293–304.

Timko, C., & Moos, R. H. (1989). Choice, control, and adaptation among elderly residents of sheltered care settings. *Journal of Applied Social Psychology*, 19, 636-655.

Verbrugge, L. M., & Jette, A.M. (1994). The disablement process: *Social Science and Medicine*, 38, 1-14.

Wahl, H-W, Fange, A., Oswald, F., Gitlin, L. N., Iwarsson, S. (2009). The home environment and disability –related outcomes in aging individuals: what is the empirical evidence? *The Gerontologist*, 49(3), 355-367.

Wahl, H-W. (2005). Ageing research along the urban-rural distinction: old questions and new potential. *Eur J Ageing*, 2, 131-136.

Wahl, H-W., Iwarsson, S., & Oswald, F. (2012). Aging Well and the environment: toward an integrative model and research agenda for the future. *The Gerontologist*. Vol.0, No.0,1-11.

Wahl, H-W., Oswald, F., Zimprich, D. (1999). Everyday competence in visually impaired older adults: A case for person-environment perspective. *The Gerontologist*, 39 (2), 140-149.

Wahl, H-W., Tesch-Romer, C. (2001). Aging, sensory loss, and social functioning. In N.Charness, D.Park, & B.Sabel (Eds.), *Aging and communication: Opportunities and challenges of technology* (pp.108-126). New York: Springer.

Wahl, H.-W ., & Lang, F. R.(2004). Aging in context across the adult life course: integrating physical and social environmental research. In H.W.Wahl, R.J.Scheidt, P.G.Windley and K.W.Schaie (Eds.). Annual Review of Gerontology and Geriatrics (New York:Springer), pp.1-33.

Ward, J. H. (1963). Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association*, 58, 236-244.

Ward, M. M. A (2011). Sense of control and sociodemographic differences in self-reported health in older adults. *Qual Life Res*, DOI 10.1007/s11136-011-0068-4.

Webber, P. A., Fox, P., & Burnette, D. (1994). Living alone with Alzheimer's disease: effects on health and social service utilization patterns. *The Gerontologist*, 34 (1), 8-14.

Welch, D. C. & Ist, R. L. (1995). Self-efficacy and mastery: its application to issues of environmental control, cognition, and aging. *Developmental Review*, 15, 150-171.

White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review*,66,297-333.

Wieland, D., Lamb, V., Wang, H. (2000). Participants in the Program of All-Inclusive Care for the Elderly (PACE) demonstration: developing disease-impairment-disability profiles. *The Gerontologist*, 40, 218-227.

Winkleby, M., Cubbin, C., Ahn, D,. (2006). Effect of cross-level interaction between individual and neighborhood socioeconomic status on adult mortality rates. Am J Public Health, 6(12):2145_53.

Wolinsky, F. D.,Wyrwich, K.W., Babu, A. N., Kroenke, K.,&Tierny,W.M. (2003). Age, aging, and the sense of control among older adults:Alongitudinal reconsideration. *Journals of Gerontology: Psychological Sciences and Social Sciences, Series B*, 58(4), S212–S220.

Yasuda, N., Zimmerman, S. I., Hawkes, W., Fredman, L., Hebel, J. R., & Magaziner, J. (1997). Relation of social network characteristics to 5-year mortality among young-old versus old-

old White women in an urban community. *American Journal of Epidemiology*, 145, 516–523.

Yen, I, H., Michael, Y.L., Perdue, L. (2009). Neighborhood environment in studies of health of older adults. *Am J Prev Med*, 37(5).

Young, Y., Fan, M-Y.,& Parrish, J.M. (2009). Self-reported chronic conditions and functional limitations: A comparison study between a continuing care retirement community and the longitudinal study on aging (LSOA II) populations, *Hallym International Journal of Aging*, 11(2), 107-118.