The role of environmental context in nursing home admission: Assessing the experience of different health profiles / El rol del contexto ambiental en la admisión a asilos de ancianos: evaluando la influencia de diferentes perfiles de salud, Cuadernos de Trabajo Social, 14, diciembre 2015, Universidad San Sebastián (Concepción, Chile), ISSN 0719-6520, pp.121-149

The role of environmental context in nursing home admission: Assessing the experience of different health profiles

El rol del contexto ambiental en la admisión a asilos de ancianos: evaluando la influencia de diferentes perfiles de salud

Sojung Park[*]
BoRin Kim[*]

ABSTRACT

Based on the Ecological Theory of Aging and the person-centered perspective, this study examines the effect of person-environment fit on nursing home admission. To do so, we empirically identified heterogeneous group of older adults with different health conditions. Then we examined to what extent the person's differential health conditions and their environmental context affected nursing home admission, and how the effects of health conditions on long-stay nursing home admission differed older adults' physical environment contexts. Data are from seven waves of the Health Retirement Study (1998-2010). We used a two-step cluster analytical approach to identify subgroups of health limitations profiles. Hierarchical linear modeling was used to determine how health profiles and environmental factors affected the likelihood of nursing home admission controlling for socio-demographic attributes. In terms of result, four health profiles were identified: physical-sensory impaired, physically healthy-cognitively impaired, frail, and relatively healthy. The most vulnerable subgroup, frail, was more affected by the environment. Members of the frail group living at home with supportive features such as ramps, railings, and grab bars in the restroom and those who lived in a safe neighborhood, were less likely to enter a nursing home. For respondents in the physically healthy-cognitively impaired group, in-home supportive features were negatively associated with nursing home admission. For respondents in the physical-sensory impaired group, a

[*] Assistant professor, Washington University in Saint Louis, USA. Corresponding author: Sojung Park, PhD, George Warren Brown School of Social Work at Washington University in One Brookings Drive, Saint Louis, MO 63105. Email: spark30@wustl.edu. Phone number: 734-730-7740
[*] University of New Hampshire, USA Email: borin.kim@unh.edu

higher level of neighborhood safety was negatively associated with nursing home admission.We demonstrated that multidimensional health conditions of older adults can be examined in distinctive health profiles: physical-sensory impaired, physically healthy-cognitively impaired, frail, and relatively healthy. Findings regarding health profiles and the associations between person-environment profiles or fit and nursing home admission highlight the importance of understanding the effects of different contexts on aging-in–place and have important policy and intervention implications.

Key words: Environmental gerontology, Person-centered perspective, nursing home admission, health profiles

RESUMEN

Basado en la Teoría Ecológica del Envejecimiento y la perspectiva centrada en la persona, este estudio examina el efecto de la persona y el medio ambiente en forma de ingreso (admisiones) en hogares de ancianos. Para ello, hemos identificado empíricamente grupos heterogéneos de adultos mayores con diferentes condiciones de salud. Luego analizamos en qué medida las condiciones diferenciales de salud de la persona y su contexto ambiental afectaban sus probabilidades de admisión en el hogar de ancianos; finalmente, se analizó cómo los efectos de las condiciones de salud en hogares de larga duración hacían variar los contextos físicos del entorno de los adultos mayores. Los datos proceden de siete mediciones del Retirement Health Study (1998 - 2010). Se utilizó un enfoque analítico de análisis de clúster (de dos pasos) para identificar subgrupos de perfiles limitaciones de salud. Se aplicó luego una modelación lineal jerárquica (HLM) para determinar cómo los perfiles de salud y los factores ambientales afectan la probabilidad de ingreso en el hogar de ancianos de controlar por atributos sociodemográficos. En términos de resultados, se identificaron cuatro perfiles de salud: física-sensorial alterada, deteriorada físicamente sano-cognitivamente, frágil, y relativamente saludable. El subgrupo más vulnerable, frágil, fue el más afectado por el medio ambiente. Los miembros del grupo frágil que viven en casa con características de apoyo tales como rampas, barandillas y pasamanos en el baño y los que vivían en un barrio seguro, eran menos propensos a entrar en un hogar de ancianos. Para los encuestados en el grupo físicamente sano - cognitivamente deteriorados, las funciones de apoyo en el hogar se asociaron negativamente con la admisión al asilo de ancianos. Para los encuestados en el grupo deterioro físico-sensorial, un mayor nivel de seguridad del vecindario se asoció negativamente con admisión. A través de nuestro estudio demostramos que las condiciones de salud multidimensionales de los adultos mayores pueden ser examinados a través de distintos perfiles de salud y que, asimismo, los hallazgos sobre los perfiles de salud y las asociaciones entre los perfiles persona-ambiente y el ingreso en un hogar de ancianos releva la importancia de comprender los efectos de los diferentes contextos sobre el envejecimiento y tienen importantes implicaciones de política pública y de intervención.

Palabras clave: gerontología ambiental, perspectiva centrada en la persona, admisión a hogar de ancianos, perfiles de salud

I. Introduction

For older adults, remaining physically independent for as long as possible and maintaining psychological well-being are primary. It is well known that older persons' physical and/or mental health conditions are the primary determinants of their ability to continue living independently. Factors such as living arrangements, economic resources, and social support systems also affect the likelihood of long-term care in an institution (Gaugler, Duval, Anderson & Kane, 2007). A growing body of research is focusing on a range of factors influencing nursing home admission.

Two particular concerns in this line of inquiry require further investigation. The first and most understudied area in nursing home placement research is related to environmental factors, despite long consensus in gerontology that both individual and environmental factors contribute to health and well-being (Stineman et al., 2012). This is a significant gap since, viewed from the lifespan perspective, later old age is a period of particular sensitivity to the living environment. As physical and cognitive impairments and deterioration progress and pose barriers to older persons' independent living, it is important to examine to what extent environmental support can prevent or delay nursing home placement. The physical environment, such as housing characteristics and neighborhood conditions, becomes more salient in old age given the increasing number of older adults who wish to remain in their homes despite physical and mental health decline (Iwarsson, Horstmann & Slaug, 2007).

Another concern is the lack of explicit attention to potential multi-morbidity problems in old age. In addition to declining physical and cognitive health, older adults often have more than one chronic condition. Many studies have focused on the association between older adults' disability and frailty and whether they have to move

into a nursing home, but few have considered a wide range of health indicators—including various chronic illnesses and functional and cognitive health—and therefore have failed to examine the multifaceted nature of health in old age (Smith, Borchelt, Maier & Jopp, 2001). Understanding of both the prevalence of multiple conditions, potential combinations of conditions, and a sound methodology with which to study this complexity is still limited (Salug, Schilling, Iwarsson & Carlsson, 2010).

In the present study, we attempt to address these gaps by exploring older adults' health impairments and physical environments as they relate to nursing home placement. Specifically, we examine if and how physical environmental characteristic moderate differential effects of health limitations on long-term (longer than three months) nursing home stays among older adults.

II. Literature Review

Nursing Home Admission from the Ecological Theory of Aging Perspective

The Ecological Theory of Aging (ETA) posits that old age is a critical phase in the life course that is profoundly influenced by the physical environment (Wahl & Oswald, 2010) and explicitly considers aging as a person-environment phenomenon (Lawton, 1990). The theory conceptualizes the interplay between individuals and their environments in three dimensions: (a) environmental demands and resources, (b) individual competence, (c) and adaptation. *Adaptation* is the outcome of an individual's competence and environmental characteristics and the "fit" between them. When environmental demands overwhelm an individual's competencies (i.e. when the individual experiences functional frailty), the individual is less likely to age in place (Lawton, Weisman, Sloane & Calkins, 1997). *Fit* is conceptualized in ETA's environmental docility hypothesis that individuals with less ability will be affected more by similar environmental demands than individuals with more ability.

Health Profiles for Individual Competence

Many studies on nursing home admission examine individual health indicators including chronic conditions, functional limitations, psychiatric problems, cognitive function, and self- rated health (Gaugler et. al, 2007; Luppa et. al., 2009). These studies seem to share a common limitation: Whether investigating physical, mental, or cognitive health, they all examine health indicators individually. In old age, however, individuals experience a constellation of chronic and acute conditions and functional and mental impairments. Few studies have explicitly considered the heterogeneity of older adults and their constellations of health conditions. Older adults' heterogeneous health status may have important consequences (Smith et. al., 2001), including consumption of a disproportionate share of health services (Lafortune, Beland, Bergman & Ankri, 2009). A need exists to comprehensively examine the range of health conditions older adults suffer and the extent to which such heterogeneity of health status affects health service use.

Emerging research on health profiles focuses on older adults' multi-morbidity problems. Based on 17 health indicators, for example, Lafortune et al. (2009) used latent class analysis to model heterogeneity and classify community-living older adults into four different health profiles—cognitively impaired, physically impaired, cognitively and physically impaired, and relatively healthy—which are generally consistent with earlier profile research. Lafortune et, al.'s findings suggest a clear distinction along the cognitive and physical health dimensions of disability showing that older adults who are cognitively impaired and those who are very frail (both cognitively and physically impaired) are more likely to use nursing home services. Still, little research has examined the extent to which older adults' environments are associated with the effects of their complex health profiles and associated needs.

Physical Environment

Although an extensive body of knowledge on older persons' living environments has been established in recent decades, understanding of the possible effects of physical environmental factors on nursing home admission remains limited (Hwang, Cummings, Sixmith & Sixmith, 2011; Stineman et al., 2012). With the progression of aging and the onset and deterioration of health conditions, older adults spend an increasing share of time at home (Iwarsson et. al., 2007). Choi (2004) found that housing environments can moderate or exacerbate the direct negative effect of disabilities on older persons' ability to manage daily life and age in place. Accordingly, existing empirical ETA research tends to examine housing environments as related to older adults' health conditions. German (Wahl & Oswald, 2010) and Swedish (Iwarson, 2005; Iwarsson, 2007; Slaug et al., 2010) studies have demonstrated that greater limitations in older adults' daily activities were significantly related to lower housing accessibility, a construct used to examine the fit between functional limitations of the elderly and barriers in the home environment.

Few studies have explored how supportive housing environments influence older adults' ability to age in place (Hwang et al., 2011). In a rare example of such inquiry, Stineman and colleagues (Stineman, 2012) found that perceived home environmental barriers are associated with an approximately 40% increase in nursing home use among older adults. Though in-home physical features are important, the environmental perspective of aging considers diverse environmental aspects of daily life. However, very little research explores broader levels of environment (Kendig, 2003) such as neighborhood and community. Some previous studies of regional differences in nursing home admission (Coward, Horne & Peek, 1995, Dwyer, Barton & Vogel, 1994) produced inconsistent findings, and some suggested the need to investigate community context more specifically (Coward, Netzer & Mullens, 1996).

III. Methods

Research Questions

This study addresses three primary issues:

1. We hypothesize that older adults are grouped into four health subgroups similar to those that emerged in previous research: healthy, cognitively impaired, physically impaired, and frail.
2. We expect that, compared to a healthy group, more vulnerable groups will be more likely to be institutionalized in varying degrees, with the most vulnerable, the frail group, having the greatest likelihood of institutionalization.
3. We hypothesize that when there is a better fit between health limitations and environmental support, older adults will be less likely to move into nursing homes.

To our knowledge, ours is the first study in nursing home research to look into the person-environment fit of community-living elderly using the person-centered perspective.

Design and Sample

Seven waves of data (gathered between 1998 and 2010) from the Health and Retirement Study (HRS), a nationally representative biennial panel study of non-institutionalized older adults, were used in this study (Table 1). The sample was based on several criteria: First, we selected adults aged 65 years and older; second, since this study was concerned with generalizing findings for community-dwelling older adults at risk of long-term nursing home placement, we included those who have at least one Activity of Daily Living (ADL) limitation and excluded respondents who were institutionalized or unable to independently answer survey questions; and third, since

we used a lagged variable for long-term nursing home admission (longer than 90 days) to control for potential confounding effects, we further limited the sample to those who participated in two consecutive waves at least once during the study period. This resulted in a sample of 3,979 respondents and 7,991 observations over 12 years. Within the sample, 20% participated once in two consecutive waves, 24% participated twice, 20% participated three times, 16% participated four times, 12% participated five times, and 8% participated six times in consecutive waves.

The average age of participants in the sample was 77 (SD = 7.85; range 65 to 106 years), 67% were women, and 43% were married. Regarding education, 28% had high school-level education, 15% completed some college, and 11% had college degrees or higher. The majority (60%) were home-owners; 63% had no in-home support; and 11% (n=814) reported a long-term nursing home stay.

Measures

- Nursing Home Admission

A long-term nursing home stay for people with chronic disabilities should be differentiated from short-term nursing home admissions for those recovering from acute conditions (Cai, Salmon & Rodgers, 2009; Fisher et. al., 2003; Liu, McBride & Coughlin, 1994; Martikainen et. al., 2009; Muramatsu et. al., 2007; Temple, Andel & Dobbs, 2010). We constructed a variable indicating whether a respondent had a nursing home stay of longer than three months between two interviews, using information on the timing of nursing home admission and discharge. If respondents did not provide exact timing of nursing home admission and/or discharge, we imputed the month of admission and/or discharge based on (a) the season (spring=April, summer=July, fall=October, and winter=January) of the events; (b) the duration of nursing home stay; and (c) nursing home stay status in current and previous survey.

- Person-Environment

Health profile indicators. Personal competence was determined by health profiles based on a range of individually measured physical, functional, cognitive, and sensory items. A total of eight health variables were included. For *physical health*, a count of chronic health conditions (0-8) prevalent in later life was used. This count included high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, hip fracture, and arthritis. Three aspects of *functional health* were measured to examine the multidimensional concept of physical functioning (Fonda & Herzog, 2004). First, we measured mobility limitations (0-5), observing 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. Second, we counted ADL limitations (1-5) including difficulty in bathing, eating, dressing, walking across a room, and/or getting in or out of bed. Finally we measured a count of Instrumental Activity of Daily Living (IADL) limitations (0-5) such as using a telephone, taking medication, handling money, shopping, and/or preparing meals. For *cognitive health,* the summary cognitive variable of Mini-Mental State Examination (0-35) was used. The measure included 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 were measured by asking respondents to rate their hearing and vision from 1 (excellent) to 5 (poor).

Physical environment. Three aspects of physical environment were examined: in-home physical features, accessibility, and neighborhood safety. Complex skip patterns were utilized in the HRS; thus the majority of housing-related variables were only answered by new HRS respondents, those who reported moving, or those who reported making home modifications since the wave immediately preceding the interview wave. We used data from earlier waves of HRS data to assign values missing in the current wave due to survey skip patterns. In-home supportive features were assessed by a

binary indicator based on presence of any of six supportive features: ramps, railings, wheelchair access, grab bars, emergency-call button, and others. Accessibility was coded 1 (lives on one floor or in multiple story-housing with an elevator) or 0 (otherwise). For neighborhood-level indicator, safety was coded as 1 (poor) to 5 (excellent).

Control Variables

We examined a range of factors identified in previous research as predictors of nursing home admission. Dichotomous covariates included gender (0 = male, 1 = female), race (0 = white, 1 = Black, 2 = Hispanic), marital status (0 = non-married, 1 = married), family wealth (0 = negative values and 1 to 3 according to three quartiles). Education was centered at 11 years (i.e., high school graduation: range = 0 to 17+ years). Social-support resources were measured with three variables: marital status (currently married or not), child availability (child living within 10 miles), receipt of informal help from family for ADL or IADL limitations. Two environmental variables were included: home ownership (1 = yes, 0 = no) and urbanicity (0 = urban, 1 = suburban, and 2 = rural).

IV. Analytic Strategy

To obtain a health profile, we did cluster analysis to identify subgroups who experienced different health limitations. Suggested as the most rigorous method of clustering (Hair & Black, 2000), the sequential combination of two clustering techniques, hierarchical and non-hierarchical method and k-means method, were used. First, Ward's (Ward, 1963) hierarchical clustering procedure was used to evaluate the optimal number of clusters in the dataset and to produce the initial seed points for the subsequent k-means clustering. In this stage, the appropriate number of clusters (4) was confirmed prior to performing the k-means iterative partitioning procedure. Next, to maximize between-cluster differences and minimize within-cluster variance, an algorithm was used to partition individual cases into the four clusters based on their

scores on three measures. The cluster centers were iteratively updated until optimal groupings, based on Euclidean distance, were achieved. Follow-up bivariate analyses were conducted with potential correlates external to the cluster types to evaluate their validity (Hair & Black, 2000).

To estimate the likelihood of long-term nursing home admission, multivariate regressions were conducted to analyze the association of health profiles and environmental factors with nursing home admission. The data had a natural hierarchical structure, consisting of respondents nested within up to six repeated observations. To address the non-independence of observations engendered by the nesting of respondents within time, multi-level modeling was used. As the starting point for longitudinal analysis, we estimated the total constant correlation across occasions and assessed the relative magnitude of each source of variation via an intraclass correlation (ICC). The results show that for unmet needs, 35% is due to the variability between persons, while 65% is due to the remaining variation within person as a result of repeated observations.

We conducted preliminary analyses to determine the specification of fixed and random effects for change in outcomes over time (results not shown). Initially, the coefficients for time were allowed to vary at the individual level (a random slope model), but there was no evidence of complex variation at this level As a result, this study conducted analyses using multi-level models that allowed the intercepts of the models to vary by time without level-2 variables.

The analysis consists of a series of increasingly complicated nested models. Variables were entered sequentially in a model-building process. In the first model, socio-demographic controls and social support variables were entered. The final models include interaction terms for health profiles and physical environment factors in

order to evaluate the moderating effects of physical environment on nursing home admission.

V. Results

In this section, we provide health profile descriptions, followed by an explanation of the bivariate associations between the health profiles and physical and social support environments as well as covariates. We then present the results of a series of multivariate analyses for nursing home placement.

Health Profiles

Partially consistent with previous health profile research, we derived four health profiles with qualitatively different sets of health conditions (Table 2). The four profiles are: *physical-sensory impaired*, *physically healthy-cognitively impaired*, *frail*, and *relatively healthy*. The *physical-sensory impaired* profile (28% of the study population) is characterized by high levels of chronic condition impairment as well as vision and hearing impairment. The *physically healthy-cognitively impaired* group (25%) is characterized by high levels of cognitive impairment but lower levels of physical health limitations (including chronic conditions and mobility issues). The *frail* type (18%) was the smallest, but most vulnerable group, with individuals experiencing impairment across all health indicators, which clearly set them apart from other types with values of at least half a standard deviation below the sample means in all health variables criteria. By contrast, members of the *relatively healthy* group (30% of the study sample) are characterized by low levels of physical, cognitive, and sensory health limitations. This profile is defined as *relatively* healthy since all respondents within the sample experienced some level of limitation [10] marked by the presence of at least one ADL.

External Correlates of Health and Environment Profiles

Individuals in different health profiles varied on all the correlates examined (Table 3). Older adults in the *physically healthy-cognitively impaired* group were significantly older (M=79) and had the smallest proportion of women (59%). Members of the *relatively healthy* group were younger (M=76) and had the highest proportion of women (69%). Marked contrasts were observed between *frail and relatively healthy* groups in most correlates. Individuals in the *frail* group were more likely to have lower education levels, fewer financial resources, and to be non-white; those in the *relatively healthy* group were likely to have higher education levels, more financial resources, and to be white.

Only 37% of respondents in the *frail* profile were married, while the proportion of married respondents was highest (48%) in the *relatively healthy* profile. Reflecting their high level of impairment and disability, most respondents in the *frail* profile (91%) received formal or informal help for their ADL or IADL limitations and also reported the highest proportion of in-home physical supportive features and accessibility.

Person-Environment and Nursing Home Admission

Table 4 shows the hierarchical models used in this study. With socio-demographic and social support covariates controlled, the main effects of health profile were examined in model 2. The findings clearly revealed that two subgroups—*physically healthy-cognitively impaired* and *frail*—were significantly more like to be admitted into a nursing home. Those in the *frail* group were more than three times more likely than those in the reference group (*relatively healthy*) to move into a nursing home ($p<0.01$ in model 2), and members of the *physically healthy-cognitively impaired* group were close to two times more likely than the reference group to be admitted ($p<0.01$ in model 2). The main effects of the physical environmental context were also examined in model 2; interestingly, none of the three physical aspects of the environment was significantly related to the likelihood of nursing home admission.

To examine the theoretical construct of person-environment fit, we included in model 3 an interaction term between health limitation profiles and the physical environmental context to investigate the extent to which the physical environment moderates the main effect of health limitations on nursing home admission. Findings indicate that different aspects of the physical environment have moderating effects in interactions with different health subgroups. For example, the frail group is less likely to move into a nursing home when in-home supportive features (OR= 0.59, p<.01) and high levels of neighborhood safety (OR= 0.73, p<.01) are present. For respondents in the physically healthy-cognitively impaired group, in-home supportive features were negatively associated with nursing home admission (OR= 0.64, p<.1), as was a higher level of neighborhood safety (OR= 0.79, p<.05) for respondents in the physical-sensory impaired group.

Findings from models 1 through 3 consistently indicated that nursing home admission was correlated with most of the socio-demographic and social-support characteristics measured; older respondents, for example, had a higher likelihood of nursing home admission and African American older adults were more likely to be admitted into nursing homes in all three models. Those with a higher education were more likely to be placed in a nursing home in models 1 and 2, and lower levels of family assets and living in rental housing were both associated with a higher likelihood of institutionalization. In terms of social support, being married and having children nearby were both related to a lower likelihood of institutionalization.

VI. Discussion and Conclusion

For the past several decades, achieving and maintaining independence in the community, generally referred to as aging in place, has been a stated goal of many policies and programs for older adults. Long-term nursing home admission is widely

considered a risk factor for, or manifestation of, loss of independence, but only a limited number of studies within the nursing home literature examine the role of environmental factors in nursing home admission. This study makes a contribution to nursing home literature specifically, but also to aging research in general. We first drew from the environmental gerontology perspective to examine nursing home admission. Then, to address common limitations on aging in place research, we attempted to better empirically examine multi-dimensional aspects of health co- or multi-morbidity problems in old age.

Drawing from the Person-Environment fit perspective (Lawton & Nahemow, 1973), this study examined the association among health profiles, physical environmental contexts, and long-stay nursing home admission. We constructed health profiles that were fairly consistent with those found in the emerging profile studies. Our findings showed that some common health-limitation types can be robustly identified. Consistent with previous health profile research, our findings confirmed two phenomena: First, despite different sets of multiple health indicators examined in different studies, there is a clear distinction along the cognitive and physical health dimensions. Second, across the qualitatively different health profiles, there seems to be a gradient along the disability dimension (Lafortune et. al., 2009) from healthy to frail subgroups that results from the physical and cognitive impairments along the disablement process (Verbrugge & Jette, 1994).

From health and social policy perspectives, identifying health profiles and profile characteristics in a consistent manner has important implications for both gerontology research and aging-related policy and program development. It has been suggested that the members of varied health-limitation subgroups require varied levels of health and social care (Manton & Stallard, 1996) with members of the most vulnerable subgroups requiring disproportionate shares of health services (Payne, Laporte, Deber & Coyte, 2007). Our findings on characteristics of mutually exclusive health profile

subgroups support the usefulness of health profiles for identifying vulnerable subgroups to be targeted for policy or program interventions. In concert with previous research (Lafortune et. al., 2009; McNamee, 2004), findings demonstrate that the *frail* profile is not only the most vulnerable in health but also in socio-demographic characteristics and social- and physical-support environmental contexts. Older adults in this group are more likely to be women, non-white, lower-income, and to live alone, confirming the accumulated knowledge of the social determinants of health (Elo, 2009).

Interestingly, two health profiles demonstrate contrasting patterns in the physical environmental characteristics (Table 3). As might be expected, members of the *frail* group are most likely to have in-home supportive features, an accessible home, and live in safe neighborhoods, suggesting that they may have already made environmental adaptations to cope with their severe health impairments. On the other hand, individuals in the *physically healthy- cognitively impaired* group, although demonstrating the next highest risk of long-term nursing home admission, were found to have the lowest level of physical environmental support. Considering the possibility of older adults progressing across health profiles from the physically healthy but cognitively impaired to the very frail group, this finding suggests that appropriate preventive intervention programs might be more efficient if this subgroup is targeted.

We next examined the association among three components of the P-E fit perspective to determine how health profiles and physical environmental contexts are related to long-term nursing home admissions. Consistent with a previous study (Lafortune et. al., 2009), findings show that compared to the relatively healthy group, two subgroups—the *physically healthy-cognitively impaired* and *frail* profiles—are significantly associated with long-term nursing home admission (Table 4). The finding clearly suggests that cognitive impairment, but not necessarily physical impairment, is strongly related to nursing home admission. None of the three physical aspects of the

environment (in-home physical features, accessibility, and neighborhood safety) was significantly related to the likelihood of nursing home admission.

For the third research question, we examined more directly how aspects of the physical environment differentially interacted with health limitation profiles as related to nursing home admission. The P-E fit perspective suggests that the fit for successful adaptation in old age is determined by the degree to which environmental characteristics compensate for health losses or impairments. As we hypothesized, the most vulnerable subgroup, *frail*, was more affected by the environment: Members of the *frail* group living at home with supportive features such as ramps, railings, and grab bars in the restroom were less likely to be admitted to a nursing home. When they lived in a safer neighborhood, members of this group were also less likely to enter a nursing home.

In-home features were also significantly related to nursing home admission for those in the *physically healthy-cognitively impaired* group. Findings on the importance of in-home features for the *frail* and the *physically healthy-cognitively impaired* confirm a strong connection between prosthetics and mirco-level physical support at home for the highly impaired elderly whose daily activities are most restricted and who are largely confined to the home (Lawton, 1989). For the *physical-sensory impaired*, only neighborhood safety level was related to nursing home admission. Individuals in this group were less impaired and most mobile, therefore they could spend more time outside of their homes, making neighborhood safety important.

Our findings provide empirical and clinical insights for future environmental gerontology research generally and for nursing home literature specifically. Environmental perspectives on aging (Lawton, 1989) have conceptualized the diverse needs of an older adult's environment including maintenance, support, and stimulation. While empirical examination of this conceptualization is rare, this study suggests that in-

home features serve a maintenance function for the two more vulnerable subgroups of older adults, the *frail* and the *physically healthy-cognitively impaired,* while for the *physical-sensory impaired* neighborhood safety seems to be the most important. From a clinical intervention perspective, this suggests that resources for environmental support may be most effectively directed toward people with moderately severe health limitations, while resources for environmental maintenance would be most effective for those with more severe impairments. Future research should pursue an empirical examination of the different functions of diverse environmental contexts to better allocate resources for and meet the needs of vulnerable older adults in various health profiles.

Certain limitations of this current study should be acknowledged. First, although we accounted for confounding factors with a lagged variable of nursing home admission, a longitudinal analysis with multiple time observations will enhance the ability to identify and predict influencing factors of nursing home admission. For example, regarding our finding on the *frail* group, we speculate that members of the group have coped with their increasing disability by making environmental adaptations such as home modification or moving into a safer and more supportive environment. At more advanced stages of disability, however, environmental adaptations may have limited benefits (Choi, 2004). It is possible that more effective preventive intervention efforts regarding nursing home admission should be focused on the less frail elderly (Stineman, 2012). Multiple observations over time will enable an empirical investigation of this important implication for intervention.

Second, a dynamic association between personal competence and the environment underlies the P-E fit perspective. Our findings suggest a possible trajectory among older adults from healthy to frail subgroups. Given the early developmental stage of health profile research, future longitudinal research on older adults' transitions along the health profile continuum will be substantially improved by examining the

development of an individual's profile over time and observing the extent to which profile changes are associated with environmental adaptations and nursing home admission.

In sum, our study is an important contribution to the research on aging in place by beginning to identify and target the varied needs of older adults using health profile groups. We demonstrated that multidimensional health conditions of older adults can be examined in distinctive health profiles: *physical-sensory impaired, physically healthy-cognitively impaired, frail,* and *relatively healthy*. Findings regarding health profiles and the associations between person-environment profiles or fit and nursing home admission highlight the importance of understanding the effects of different contexts on aging-in–place and have important policy and intervention implications.

Note.

A list of abbreviations:

1. ETA refers to the Ecological Theory of Aging
2. HRS refers to
3. ADL refers to Activity of Daily Living (ADL) limitation
4. IADL refers to Instrumental Activity of Daily Living (IADL) limitations
5. HRS refers to the Health and Retirement Study

Ethical approval: The Health and Retirement Study is under current IRB approval by the relevant committees at the University of Michigan and the National Institute on Aging, the primary sponsor of HRS, and informed consent was obtained from all participants.

Data sharing: Our data came from seven waves of the Health and Retirement Study (1998-2010), and all the data used in this study is available in public release, available at http://hrsonline.isr.umich.edu/index.php?p=data

Acknowledgements.

No financial or material support and assistance was provided to the authors for conducting the study. The authors of the manuscripts have no competing interests.

Authors Contribution:

Sojung Park contributed to the conceptualization of the study, conducted statistical analyses, and co-wrote the manuscript. BoRin Kim contributed the initial conceptualization, prepared for data and co-wrote the manuscript. Correspondence should be addressed to Sojung Park, Ph.D, George Warren Brown School of Social Work at Washington University in One Brookings Drive, Saint Louis, MO 63105.Email: spark30@wustl.edu

VII. References

Cai, Q., Salmon, J. W., & Rodgers, M. E. (2009). Factors associated with long-stay nursing home admissions among the US elderly population: comparison of logistic regression and the Cox proportional hazards model with policy implications for social work. *Social work in health care*, *48*(2), pp. 154-168.

Choi, N. G. (2004). Stability and changes in living arrangement among unmarried older persons: The influence of housing environments. *Journal of Housing for the Elderly*, *18*(2), pp. 69-89.

Coward, R. T., Horne, C., & Peek, C. W. (1995). Predicting nursing home admissions among incontinent older adults: a comparison of residential differences across six years. The Gerontologist, *35*(6), pp. 732-743.

Coward, R. T., Netzer, J. K., & Mullens, R. A. (1996). Residential differences in the incidence of nursing home admissions across a six-year period. *The Journals of Gerontology* Series B: Psychological Sciences and Social Sciences, *51*(5), S258-S267.

Dwyer, J. W., Barton, A. J., & Vogel, W. B. (1994). Area of residence and the risk of institutionalization. Journal of Gerontology, *49*(2), S75-S84.

Elo, I. T. (2009). Social class differentials in health and mortality: Patterns and explanations in comparative perspective. *Annual Review of Sociology*, 35, pp. 553-572.

Fischer, L. R., Green, C. A., Goodman, M. J., Brody, K. K., Aickin, M., Wei, Feifei.,Phelps, L.W., & Leutz, W. (2003). Community-based care and risk of nursing home placement. *Medical care*, *41*(12), pp. 1407-1416.

Fonda, S., & Herzog, A. R. (2004). Documentation of physical functioning measured in the Health and Retirement Study and the Asset and Health Dynamics among the Oldest Old Study. *Ann Arbor, Michigan: Survey Research Center*.

Gaugler, J. E., Duval, S., Anderson, K. A., & Kane, R. L. (2007). Predicting nursing home admission in the US: a meta-analysis. *BMC geriatrics*, *7*(1), 13.

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

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

Iwarsson, S. (2005). A long-term perspective on person–environment fit and ADL dependence among older Swedish adults. The Gerontologist, *45*(3), pp. 327-336

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), pp. 3-15.

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

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

Lawton, M. P. & Nahemow, L. (1973). Ecology and the aging process. In C. Eiserdorfer & M. P. Lawton (Eds.), Psychology of adult development and aging (pp.619-674). Washington, DC: American Psychological Association.

Lawton, M. P. (1989). Environmental proactivity in older people. In V. L. Bengtson & K. W. Schaie (Eds.), The course of later life (pp. 15–23). New York: Springer.

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

Lawton, M. P., Weisman, G. D., Sloane, P., & Calkins, M. (1997). Assessing environments for older people with chronic illness. In J. A. Teresi,M. P. Lawton, D. Holmes, & M. Ory (Eds.), *Measurement in elderlychronic care populations.* New York: Springer.

Liu, K., McBride, T., & Coughlin, T. (1994). Risk of entering nursing homes for long versus short stays. *Medical Care*, 32, pp. 315–327.

Luppa, M., Luck, T., Weyerer, S., König, H. H., Brähler, E., & Riedel-Heller, S. G. (2009). Prediction of institutionalization in the elderly. A systematic review.*Age and ageing*, afp202.

Manton, K. G., Stallard, E. (1996). Changes in health, mortality and disability and their impact on long term care needs. *J Aging Soc Pol*, 7, pp. 25-52.

Martikainen, P., Moustgaard, H., Murphy, M., Einiö, E. K., Koskinen, S., Martelin, T., & Noro, A. (2009). Gender, living arrangements, and social circumstances as determinants of entry into and exit from long-term institutional care at older ages: A 6-year follow-up study of older Finns. *The Gerontologist*, *49*(1), pp. 34-45.

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

Muramatsu, N., Yin, H., Campbell, R. T., Hoyem, R. L., Jacob, M. A., & Ross, C. O. (2007). Risk of nursing home admission among older americans: does states' spending on home-and community-based services matter?. *The Journals of Gerontology* Series B: Psychological Sciences and Social Sciences, *62*(3), S169-S178.

Payne, G., Laporte, A., Deber, R. & Coyte (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, pp. 213–257.

Slaug, B., Schilling, O., Iwarsson, S., & Carlsson, G. (2010). Defining profiles of functional limitations in groups of older persons: How and why? *Journal of aging and health*, 0898264310390681.

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), pp. 715-732.

Stineman, M. G., Xie, D., Streim, J. E., Pan, Q., Kurichi, J. E., Henry-Sánchez, J. T., ... & Saliba, D. (2012). Home accessibility, living circumstances, stage of activity limitation, and nursing home use. *Archives of physical medicine and rehabilitation*, *93*(9), pp. 1609-1616.

Temple, A., Andel, R., & Dobbs, D. (2010). Setting of care modifies risk of nursing home placement for older adults with dementia. *International journal of geriatric psychiatry*, *25*(3), pp. 275-281.

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

Wahl, H.-W., & Oswald, F. (2010). Environmental perspectives on aging. In D. Dannefer & C. Phillipson (Eds.), The SAGE handbook of social gerontology (pp. 111–124). London: Sage.

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

Recibido: 15 de octubre, 2015

Aceptado: 22 noviembre, 2015

Table 1

Descriptive Statistics from the pooled HRS dataset, 1998-2010 (N=3979 individuals)

Variable	Entire Sample	1998 -2000	2000 -2002	2002-2004	2004-2006	2006-2008	2008-2010
	Means (SD), %						
Nursing home placement (%)	10.18	10.24	8.31	11.74	9.49	9.61	11.71
Lagged nursing home placement (%)	2.84	2.80	2.06	2.29	3.16	3.23	3.38
Socio-demographics							
Age (years)	77.42(7.85)	77.33(7.56)	77.20(7.69)	77.45(7.84)	77.41(8.05)	77.67(8.01)	77.44(7.81)
Women	67	69.12	69.15	67.93	65.49	65.45	63.86
Education (years)	10.83(3.74)	10.42(3.89)	10.62(3.91)	10.87(3.72)	10.95(3.66)	11.04((3.64)	11.34(3.61)
White	71.86	72.56	73.34	73.21	71.74	70.76	69.90

(%)(Reference)							
Black	17.1	16.72	16.65	16.63	17.81	17.91	16.88
Hispanic	9.4	9.04	8.39	8.75	9.05	9.95	11.21
Wealth (M)	267279	163583	206268	214613	270317	360216	363570
Home	40.83	39.28	40.35	40.66	40.69	41.04	42.74
Ownership (%)							
Urban	43.22	40.64	40.43	40.98	46.36	45.44	44.76
(Reference)							
(%)							
Suburban	24.73	28.00	28.09	27.19	21.78	21.28	22.99
Rural	32.05	31.36	31.49	31.84	31.86	33.29	32.26
Social							
Support							
Married (%)	43.86	42.64	42.48	42.95	45.62	43.99	45.19
Close Children	54.34	54.56	48.02	53.88	55.78	56.28	57.76
(%)							
ADL/IADL	58.18	48.48	59.18	58.87	62.40	60.95	58.33
support (%)							
Health							
Limitations							
Chronic	2.95(1.45)	2.63(1.41)	2.76(1.41)	2.87(1.39)	3.02(1.45)	3.12(1.460	3.20(1.50)
Conditions (M)							
Mobility	2.82(1.63)	2.76(1.65)	2.78(1.64)	2.76(1.63)	2.78(1.60)	2.97(1.59)	2.89(1.64)
Limitations							
(M)							

ADL Limitations (M)	1.48(1.29)	1.60(1.34)	1.53(1.28)	1.44(1.25)	1.45(1.31)	1.43(1.26)	1.44(1.29)
IADL Limitations (M)	1.19(1.22)	1.25(1.25)	1.11(1.17)	1.19(1.21)	1.20(1.21)	1.22(1.23)	1.17(1.24)
Vision Impairment (M)	3.44(1.41)	3.09(1.13)	3.13(1.11)	3.13(1.10)	3.23(1.12)	3.16(1.14)	3.12(1.45)
Hearing Impairment (M)	3.14(1.13)	3.47(1.43)	3.47(1.13)	3.45(1.14)	3.52(1.13)	3.41(1.13)	3.31(1.14)
Cognitive Function Limitation (M)	18.53(5.85)	18.22(6.15)	18.61(5.71)	18.55(5.70)	18.53(5.71)	18.65(5.94)	18.61(5.85)
Physical Environment							
In-home physical features (%)	38.43	24.68	32.04	38.93	43.56	44.96	46.41
Accessibility (%)	71.84	74.08	72.55	70.84	70.93	71.31	71.55
Neighborhood safety (M)	2.33(1.08)	2.52(1.13)	2.38(1.13)	2.27(1.12)	2.30(1.09)	2.34(1.20)	2.30(1.15)

Table 2.

Health Profiles Derived by Cluster Analysis: Characteristics and Distribution

Variables	**Physical-sensory Impaired**	**Physically Healthy Cognitively Impaired**	**Frail**	**Relatively Healthy**
N	2206	1959	1405	2391
%	27.6%	24.5%	17.5%	30%
# of chronic conditions (M)	**56.35**	**44.80**	52.21	47.09
Mobility limitations (M)	53.64	**39.23**	**58.22**	50.64
ADL limitations (M)	48.64	**42.50**	**64.30**	48.95
IADL limitations (M)	46.82	51.29	**62.41**	**44.51**
Cognitive function limitation (M)	48.45	**54.72**	**56.21**	**43.89**
Vision (M)	54.24	51.75	53.37	**42.64**
Hearing (M)	**55.23**	51.71	51.77	**42.72**

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 clusters) are shown in bold. Values close to peak values are indicated by an underscore.

Table 3: Health, Environment, and Background Characteristics of Older Adults

Variables	**Physical-Sensory Impairment**	**Physically Healthy-Cognitively Impaired**	**Frail**	**Relatively Healthy**	**Statistics**
n	2206	1959	1405	2391	

%	27.6%	24.5%	17.5%	30%	
Covariates					
Age (M)	76.56	79.48	78.70	75.74	F=(3, 7922)=106.04***[a]
Women (%)	66.09	58.86	74.09	68.72	$\chi^2(3)$=91.69***
Education (M)	10.34	10.64	9.59	12.15	F=(3, 7922)=172.51***
White (%)	76.67	77.59	69.61	83.64	$\chi^2(6)$=108.34***
Wealth (%, above the 50th quartile)	45.33	52.63	34.80	60.73	$\chi^2(9)$=349.39***
Home ownership (%)	57.57	61	49.47	64.74	$\chi^2(3)$=92.79***
Urban (%)	40.25	41.81	42.63	47.47	$\chi^2(3)$=27.96***
Social Support					
Married (%)	42.97	45.02	36.65	48.14	$\chi^2(3)$=47.48***
Close child nearby (%)	57.07	54.31	54.45	51.82	$\chi^2(3)$=12.60
ADL/IADL support receipt (%)	58.60	54.22	90.68	42.24	$\chi^2(3)$=880.19
Physical Environment					
In-home supportive features (%)	37.79	30.01	45.19	38.96	$\chi^2(3)$=84.38***
Accessibility (%)	71.31	70.34	76.34	70.68	$\chi^2(3)$=17.35***
Neighborhood safety (M)	3.57	3.66	3.44	3.88	F=(3,7922)=67.60***
Nursing home admission	7.43	11.64	18.67	7.26	$\chi^2(3)$=181.79***

a. The significance level of p-value= :* p<.1 ** p<.05 ; *** ; p< 0.01**Table 4. Regression Results on Nursing Home Placement by Health Profile and Physical Environment**

	Model1	Model2	Model3
	Odds ratio	Odds ratio	Odds ratio

Covariates					
Nursing home admission in previous wave	6.02	***[a]	4.93	***	4.98
Age (>77)[b]	1.04	***	1.04	***	1.04
Women	1.12		1.13		1.13
Education (>11)[c]	1.03	***	1.05	***	1.05
Black[d]	0.67	***	0.62	***	0.61
Hispanic[e]	0.38	***	0.36	***	0.36
Wealth (quartiles)[f]					
1	1.46	**	1.41	**	1.39
2	1.28	*	1.28	*	1.17
3	1.48	**	1.48	**	1.46
Home ownership	0.80	**	0.83	***	0.80
Suburban	0.93		0.95		0.93
Rural	0.92		0.90		0.90
Social Support					
Married	0.60	***	0.58	***	0.58
Close children nearby	0.84	**	0.84	**	0.83
ADL/IADL informal support receipt	1.57	***	1.34	***	1.34
Health Profile[g]					
Frail			3.11	***	11.22
Physically Healthy-Cognitively Impaired			1.96	***	3.25
Physical-Sensory Impaired			1.20		2.20
Physical Environment					
In-home supportive features			1.13		1.68
Accessibility			1.00		1.08

Neighborhood safety			0.99		1.19
Health * Environment					
Frail * In-home supportive features					0.59
Frail * Accessibility					0.64
Frail * Neighborhood safety					0.73
Physically Healthy-Cognitively Impaired * In-home supportive features					0.64
Physically Healthy Cognitively Impaired * Accessibility					0.96
Physically Healthy Cognitively Impaired * Neighborhood safety					0.87
Physical-Sensory Impaired * In-home supportive features					0.56
Physical-Sensory Impaired * Accessibility					1.25
Physical-Sensory Impaired * Neighborhood safety					0.79
Constant	0.07	***	0.05	***	0.27
Random-effects					
SD (intercept)	Estimate		Estimate		Estimate
	0.53	***	0.65	***	0.66
log likelihood	-2342.0799		-2281.0684	***[h]	-2272.6596

Note: [a] The significance level of p-value:* p<.1 ** p<.05 ; *** ; p< 0.01;[b]Age centered on the grand mean at 77; [c]Education centered on the grand mean at 11; [d &e] white= 1, [f] the highest wealth quartile=4, [g] healthy group=4 serves as reference group; [h]A significance level denotes model fit is significantly improved compared to the unconditional model. The difference between the log likelihood statistics for the two models is χ^2 distributed.