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HOUSING DESIGN STANDARDS FOR THE AGING IN PLACE FOR PEOPLE WITH INTELLECTUAL DISABILITIES

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HOUSING DESIGN STANDARDS FOR THE AGING IN PLACE FOR PEOPLE WITH INTELLECTUAL DISABILITIES

A THESIS APPROVED FOR THE
COLLEGE OF ARCHITECTURE

BY

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This thesis is committed to God (Proverbs 16:3). I dedicate it to my husband, my son, my family, and my friends. I always appreciate their consistent support and devotion.

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Abstract

Providing an appropriate domestic environment for elderly people with intellectual disabilities can be meaningful toward improving their independence and increasing their opportunities to age in place. Literature has documented that one's lifestyle and preference are impacted by one's domestic environment. Conceptually, this study seeks to contribute toward the knowledge body about the unique needs of people with intellectual disabilities and what factors contribute to increasing independence of people with intellectual disabilities and their satisfaction to ones' homes. Practically, the study purposes to provide design standards that not only secure users' safety and convenience but also their psychological well-being. With these standards in place, those with unique challenges might be suited to live their later life in a homelike environment that maximizes their dignity, privacy, independence, and autonomy. The study's sample involves 51 participants with intellectual disabilities residing in South Korea. Two correlations are analyzed: correlations between living environments and independence of people with intellectual disabilities and correlations between living environments and their desire of aging in place. Caregivers who know the participants well completed measures of participants' living environment, independence, and desire to age in place. The correlational study identified 20 domestic environmental factors that need to be prioritized when designing housing for people with intellectual disabilities. Two domestic environmental factors were found to have positive correlations with both independence and desire to age in place: layout of the kitchen and lights of indoor space. Three significant and positive correlations were found between domestic environment and independence of people with intellectual disabilities: storage spaces,

clear width and maneuvering clearance of entrance; and ranges in the kitchen. 15 domestic environmental factors are positively correlated with desire to age in place: ramps of accessible route, general attribute of the entrance, appliances of the kitchen, bathtubs, layouts, and heating systems in the bathroom, beds, closets, and general attributes of the bedroom, doors, electric equipment, windows, floors, walls, and furniture in indoor common area. The study's results are meaningful as they contribute to not only academic knowledge pertaining the relationship between environmental attributes and human behaviors, but also for the practical advantages in developing pleasant domestic environment for people with intellectual disabilities.

Keywords: housing design guideline, aging in place, independent life, people with intellectual disabilities, domestic environment

Introduction

Background

The physical and mental needs of elderly people with Intellectual Disabilities (ID) are more challenging and unique compared to elders who do not suffer from these disabilities. The independent lives of people with ID are significantly dependent upon their domestic environments in which they conduct activities of daily living. In fact, there has been evidence that people with ID can be more independent if provided adequate environments (Wehmeyer & Palmer, 2003; Schwarz, Chaudhury, & Tofle, 2004). However, current domestic environments and systems for people with ID have some problems.

First, current living environments intended for people with ID are rarely designed to support their independence. Service providers do not design houses suitable for people with ID, rather they use existing houses, designed for people without ID, to accommodate them and that are not congruent for their particular needs. (Wilkinson, Kerr, Cunningham, & Rae, 2004). Thus, people with ID are asked to adapt to existing houses which are designed without attention of their basic needs and as a result are in dire need of being remodeled for congruency fit.

In addition to incongruent housing, current governmental approaches to housing for people with disabilities are too universal to meet the unique needs of people with ID. To be specific, governments have implemented some projects to remodel housings for people with ID, however, often the government in question never sought the individuals about their specific needs are and only provided generic components that would be fit

for a broad spectrum of individual needs. As a result, people with ID have shown low satisfaction to the governments' efforts (Lee, Jang, & Park, 2015).

Lastly, elderly people with ID have few opportunities for aging in place though their life expectancy has been prolonged (P. Janicki, Dalton, Michael Henderson, & Davidson, 1999). These elderly populations are likely to lose their dignity, privacy, independence, and autonomy because they usually experience dislocation from their familiar environments due to limited options. (Wilson, 1995; Tofle, 1999; Shaw, Cartwright, & Craig, 2011)

The totality of these issues reveal the study's significance for the investigating the distinctive needs of people with Intellectual Disabilities and their recommended living environments. Most importantly, existing housing design standards have played a pivotal role in ensuring the decency of domestic environments. Therefore, developing new housing design standards based on practical evidence of how one's domestic environments influence one's behaviors are useful to consider in supporting independent lives of people with ID.

Purpose of Study

The background reveals it is necessary to create housing design standards that support the unique needs and environmental preferences of elderly people with intellectual disabilities (ID). In order to develop designed standards that support to provide opportunities those with intellectual disabilities to age in place, it is crucial to gain knowledge about what factors contribute to independence for people with ID. This study aims to understand the unique needs of elderly people with ID, which design standards are especially important to support their lifestyles and desire to age in place,

provide design standards that not only secure users' safety and convenience but also their psychological well-being, and ultimately broaden the meaning of aging in place to embrace diverse groups including people with ID.

Research Questions and Approaches

The following research questions are intended to contribute toward the creation of housing design standards that suit elderly people with Intellectual Disabilities (ID):

- which specific housing design standards are significant to promote independent life for people with Intellectual Disabilities (ID)?
- which specific housing design standards contribute most to the desire of people with Intellectual Disabilities (ID) to age in place? and
- how can the research's identified housing design standards be prioritized in order to promote independent life for people with Intellectual Disabilities (ID) as well as their desire to age in place?

To answer these questions, a correlational study has been designed. Two correlations to be identified through the analysis are: correlations between living environments and independence of people with ID and correlations between living environments and their desire to age in place. The independence and the desire to age in place are closely related; in fact, one's desire to age in place is likely to increase when one is able to live independently. However, it is useful to investigate these two variables separately since these indicate different factors. To be specific, one's independence is related with one's objective lifestyle, while one's desire is associated with one's subjective preferences. By analyzing two different variables, the study aims to create adjusted housing design standards that provide not only with physical assistances but

also psychological assistances. The study uses a survey questionnaire to gain evidence of how current living environments influence lifestyles and behaviors of people with ID. The factors will hypothesize how several specific environmental attributes might significantly have positive impacts on the independence of people with ID as well as their desire to age in place. In addition, with these outcomes some housing design standards could be prioritized to support people with ID.

Research Contribution

The study seeks to provide additional data pertaining to environment attributes theory that contribute to one's preferred lifestyle. Responding to current problems as stated in the previously presented background, the study would also bring practical benefits not only for people with Intellectual Disabilities (ID) but also service providers including private and public sectors. First by contributing toward the congruent domestic environment for elderly people with ID, the study will support their independent lives. Second, by providing information on prioritized design standards, the government will benefit in developing and remodeling housing for people with ID, maximizing the effect with limited resources. Finally, this study can provide enhanced opportunities for people with ID to age in place.

Thesis outline

In the first chapter, the following information is presented: the study's background, purpose; achievement intent, research questions and approaches; the opportunity to solve the questions, and its significance.

In the second chapter, past and present literature is reviewed focusing on current approaches to aging in place for people with Intellectual Disabilities (ID), current

housing design standards, and unique needs for independent life of people with ID and recommended domestic environments. The findings of the literature review are also discussed.

In the third chapter, research methodologies are described, including variables, scoring scales, participants, confidentiality, reliability and validity, and summary.

In chapter four, the results of the study are illustrated. The descriptive statistics for the participants' demographic characteristics, the results of two correlation analyses, and summary are presented.

The last chapter suggests a categorization of the housing design standards for people with ID into three levels: mandatory, recommended, and reference items. The last chapter also discusses the limitations of this study and future research needs.

Figure 1 shows the outline of this research with key points.

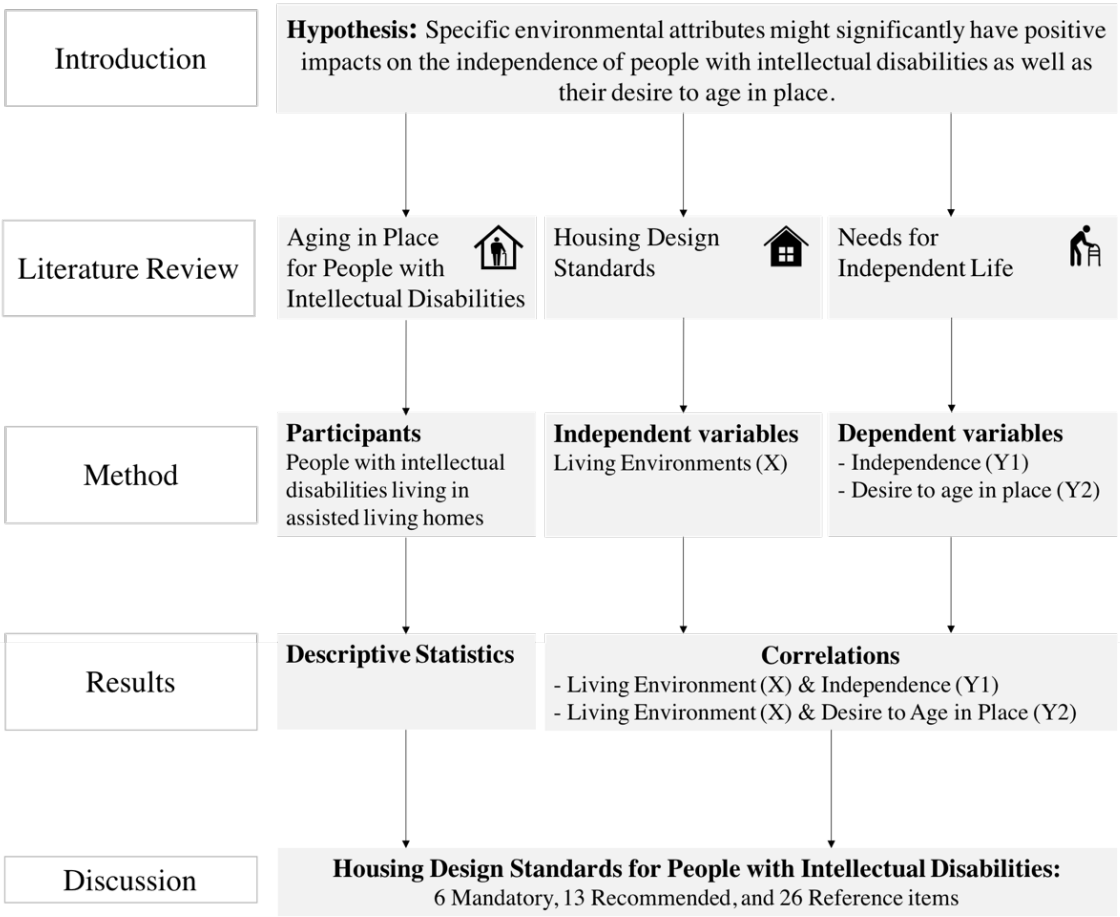


Figure 1. Thesis Outline, (Yi, 2017)**.**

Literature Review

The literature review of this study consists of four parts that aim to achieve the following purposes:

- **Aging in Place for People with Intellectual Disabilities (ID):** an overview of trends and limitations of current services for people with ID in terms of aging in place is provided.
- **Housing Design Standards:** the contents of current housing design standards are reviewed.
- **Needs for Independent Life and Recommended Environments:** unique needs and recommended domestic environments for people with ID are explored.
- **Conclusion**: the gaps and connections between previous studies and this study are described.

Aging in Place for People with Intellectual Disabilities

Aging in place, which supports elderly people's independent living in their own home throughout their life span, has been a guiding principle as the world experiences population aging. The concept of aging in place is understood with the contributions of various housing typologies, policies, and services.

Currently, not only has there been a significant increase in the proportion of elderly people in the population, but there have also been growing numbers of elderly people with ID. Responding to an increase in the aging population of people with ID, the United Nations General Assembly argued that individuals with ID should benefit equally as age-related policies and practices evolve ("The Larnaca resolution," 1998). Additionally, knowledge about the health and social issues for this group has increased,

so policies and services have been further developed (Janicki & Ansello, 2000; C. Bigby, 2004; Davidson, Prasher, & Janicki, 2008).

However, elderly people with ID still have few opportunities to age in place in their own home or other accommodations that support their independent living. Depending on the level of finance and care needed by individuals, people with ID may choose one of the following options: living in the same home with community-based aged care services (an aging in place approach), moving to a small group home within the same community or same disability service (an in-place progression approach), moving to nursing facilities that provide long-term care (C. Bigby, 2004). Likewise, these populations are usually dislocated from familiar locality, possessions, friends, or family once transitions occur (Shaw, Cartwright, & Craig, 2011). Thus, they are likely to experience the loss of their independence and autonomy (Wilson, 1995; Shaw, Cartwright, & Craig, 2011). Governments, disability service providers, and advocacy groups have strongly argued the principle of aging in place should apply to the disability community (Christine Bigby, 2008).

Trends

Trends in current approaches to the concept of aging in place for people with Intellectual Disabilities (ID) contain large institutional setting to small community-based setting, assisted living homes, home and community-based services, and support of housings for people with ID.

Large institutional setting to small community-based setting

For a better application of aging in place in disability sector, research on living environments of people with ID has focused on comparison of quality of life outcomes in publically operated institutions versus in small community-based settings (Table 1).

Table 1

Large Institutions vs. Small Residential Settings

	Large institutions	**Small residential settings**
Positive	• Accessibility to health care	• Higher level of adaptive behavior development and maintenance • Greater daily living skills
Negative	• Loss of dignity, privacy, independence, and autonomy • Exposure to a variety of infectious disease • Tuberculosis, hepatitis B, Helicobacter pylori	• Engage in tobacco use • Other substance abuse, • Violent behavior • High-risk sexual activity • Deconditioning, dental disease, obesity, hypertension, diabetes caused by sedentary lifestyles

Adapted from Beange, McElduff, & Baker, 1995; Cambridge, 1996; Crampm, Grundy, Perinpanayagam, & Barnado, 1996; Lemaitre et al., 1996; Böhmer et al., 1997; Christian & Poling, 1997; Hymowitz, Jaffe, Gupta, & Feuerman, 1997; Pack, Wallander, & Browne, 1997; H. Evenhuis et al., 2001; Woodman, Mailick, Anderson, & Esbensen, 2014.

Advantages of residents in large institution include that people with ID can be monitored and can promptly get services and health care, while disadvantages involve an increased risk for exposure to a variety of infectious diseases, including tuberculosis (Lemaitre et al., 1996), hepatitis B (Crampm, Grundy, Perinpanayagam, & Barnado, 1996), and Helicobacter pylori (Böhmer et al., 1997). On the contrary, adults with ID, who moved into community settings, show greater improvement in adaptive behavior and had more opportunities to perform activities of daily living independently

(Woodman, Mailick, Anderson, & Esbensen, 2014). Meanwhile, people with ID living in the community may engage in tobacco use (Hymowitz, Jaffe, Gupta, & Feuerman, 1997), other substance abuse (Christian & Poling, 1997), violent behavior (Pack, Wallander, & Browne, 1997), and high-risk sexual activity (Cambridge, 1996). These are not the only issues, as sedentary lifestyles can also cause deconditioning, dental disease, obesity, hypertension and diabetes (Beange, McElduff, & Baker, 1995).

There is a tendency towards community living of elderly people with ID and to divide big residential facilities into smaller units. The studies indicate that the shift towards smaller, more diverse residential settings is apparent (Tichá et al., 2012). Actually, there has been rapid growth in the number of people with ID who live in settings with fewer than 6 residents; 29% in 1988 (Salmi, Scott, Webster, Larson, & Lakin, 2010) to 75% in 2011 (Larson, Ryan, Salmi, Smith, & Wuorio, 2012). Along with this increase in small residences, the number of people with ID living in their own home doubled from 1998 to 2011 (Larson et al., 2012). These trends are positive because exposure to recurrent relocations may lead to emotional, affective, and behavior problems for people with ID (Hamilton, Sutherland, & Iacono, 2005).

Assisted living homes

Aging in place has been conceptualized in the disability sector through assisted living homes. Assisted living aims to provide elderly people the personal and health-related services that they require to age in place in a homelike environment that maximizes their dignity, privacy, independence, and autonomy (Wilson, 1995; Tofle, 1999). Assisted living homes meet the high support needs of elderly people with ID

more effectively than facilities, in terms of individualized support and participation (Walker & Walker, 1998; Bigby, Fyffe, Bigby, & Fyffe, 2007).

Adequate in-home services and policies have been developed to make individuals stay within their original living environment as long as they can. For example, in-home services not only include care services such as management of medication and assistance with the activities of daily living, but also involve non-care based services like recreational activities and administration of household activities. Additionally, health screening policies, which make it mandatory for general practitioners in the community to care people living in assisted living settings, have established and supported aging in place (H. M. J. Schrojenstein Lantman-de Valk et al., 1997).

Home and community-based services

Home and community-based services (HCBS) offer opportunities to receive services in one's own home or community rather than institutions or other isolated settings (Sonnega, Robinson, & Levy, 2017). Disability service providers and state governments have developed various initiatives, particularly around issues of retirement and adapting services. This services include education and training, joint service planning and cross-sector partnerships at a local level, small-scale pilot programs, and organizational policies in non-government organization (Christine Bigby & others, 2000; Christine Bigby, Balandin, Fyffe, McCubbery, & Gordon, 2004; Dew & Griffin, 2002). Most initiatives have been locally based, small in scale, short-term, and usually funded from the organizations' existing resources (Christine Bigby, 2008).

Support of housing

Governments have addressed the importance of providing housing for people with disabilities to support their aging in place. For instance, governments put an effort to renovate the housing for people with disabilities. (Ministry of Health & Welfare, 2012). Also, policies have supported with making intellectually disabled individuals' homes to a group home managed by governments or non-government accommodation services (Anderson, 2005). However, governmental supports are limited, but it is primarily service provider organizations that support aging in place of people with ID. They provide services through their in-house policies, informal organizational practices, and staff culture within the limits of their existing resources (Wilkinson et al., 2004). Further government supports are expected to be encouraged because existing resources of provider organization are limited and unlikely to be sustainable as the number of older people with ID increases.

Limitations

The government policies that address issues of aging in place, especially for people with ID, have been slow to develop. This is due to the following reasons: difficulties in defining elderly people with ID, challenges in combining disability and aged care sectors, unmet needs for accommodation supports, and policy intention without implementation strategies.

Define elderly people with Intellectual Disabilities

When it comes to chronological age, people aged 65+ are defined as elderly people in most countries, or people aged 60+ by the United Nations (UN), people aged 50+ by the World Health Organization (WHO) (H. Evenhuis et al., 2001). However,

people with ID are likely to experience premature aging on average in 10 to 15 years early, and go through secondary disability conditions that demand unique supports (Bigby, 2010). These facts have caused problems that mid-old people with ID are hardly supported by governmental policies or services. Several studies defined elderly people with ID as those aged 40+, 50+, or 65+ to deal with this issue, yet it has not been translated into policy in many countries (Bigby, 2008).

Interface between policy in the disability sectors and the aged care sector

People with ID have distinctive patterns of aging, but their needs reflect complex a combination of disability-related and age-related changes. It is important to thoroughly discern unique needs of people with ID and apply them to improve their environments. Thus, the interface between the aged and disability sectors are encouraged in developing policies for elderly people with ID (Bigby, 2008).

Unmet needs for accommodation supports

Previous research indicates an incidence of ID in developing is more higher relative to developed regions (Miles, 1997). Along with this tendency, greater life expectancy will result in a growing population of elderly people with ID in developing regions. Consequently, a high level of unmet need for disability accommodation supports has been addressed. Most developing countries rely on large institutions or residential aged care facilities which are a poor match to the needs of people with ID (Bigby, 2008). In addition, some large institutional facilities offered by the private for-profit sector—such as boarding houses and pension-only supported residential services––exhibit a poor quality of the environment (Bigby, 2008).

Intention without implementation strategies

Current research has suggested specific or special arrangements will be required to meet the needs of people with ID (Andrews, 2001). In this context, the governments indicated a policy intention to include elderly people with ID in aged care services and to support cross-sector planning and partnerships. However, no systematic development has eventuated yet; for instance, firm policies that actually provide mechanisms to support aging in place and define reasonable expectations, or stipulate systems that have responsibility for funding this strategy (Christine Bigby, 2008).

Housing Design Standards

The primary approaches to aging in place for people with ID have been related to providing appropriate domestic environments. It is because those adequate environments are associated with not only better outcomes and lower costs but also users' quality of life involving greater choices, autonomy, and independence. Housing design standards have been developed to ensure the decent quality of domestic environments for disabilities.

The Barrier-free movement in 1950s and the Disability Rights Movement in the 1970s caused changes in public policies and design practices (Story, Mueller, & Mace, 1998). In 1961, the American National Standards Institute (ANSI) published the first accessibility standard and attempted to implement it into federal guidelines in 1984 (Story et al., 1998). The Americans with Disabilities Act of 1990 (ADA) was signed into law to prohibit discrimination in access to places of public accommodation, services, programs, and telecommunications. Based on the ADA act, the ADA Standards for Accessible Design Standards were issued in 1991 ("Americans with

Disabilities Act," 2015). In this background, ten housing design guidelines for people with disabilities have been developed in South Korea since 2000 (Table 2).

Table 2

Housing Design Guidelines in South Korea

Guideline	**Publisher**	**Type of Publisher**	
		Public	**Private**
Facilities for Disabled People Guideline: Apartment	The Seoul Institute	o	
Barrier-free Housing Guideline	Korea Disabled People's Development Institute	o	
Living Environment Renovation for Disabled People or Seniors	Korea Agency for Infrastructure Technology Improvement, and Ministry of Land, Infrastructure and Transport	o	
Domestic Environment Manual for Disabled People in Rural Area	Korea Disabled People's Development Institute	o	
Housing Renovation for Elderly People with Disability	Citizen Association for Facilities for the Disabled		o
Barrier-free Design Manual	Korea Land and Housing Corporation	o	
Domestic Environment Manual: Physical Disabilities	Korean Disabled People Welfare Association		o
Domestic Environment Manual: Sight Impairment	Korean Disabled Persons Welfare Association		o
Domestic Environment Manual: Hearing Impairment	Korean Disabled Persons Welfare Association		o
Housing Renovation Manual for Elderly People with Physical Disabilities	Citizen Association for Facilities for the Disabled		o

Adapted from B. Kim & Lee (2015)

Previous studies have analyzed 1910 items from these ten existing housing guidelines for people with disabilities and classified them into nine spaces and 71 categories through content analysis (B. Kim & Lee, 2015). The nine spaces include accessible route, entrance, living room/corridor, kitchen, bathroom, bedroom, laundry room, unity room, and indoor common area (Appendix A).

Needs for Independent Life and Recommended Environments

Characteristics Shared with Intellectually Abled Elders

People with ID share age-related changes with intellectually abled elders, such as age-related disease, sensory impairments, and functional decline. Studies on the physical health status of elderly people with ID have been conducted via various methodology, including surveys (Sutton, 1993), interviews (Cooper, 1999), medical chart reviews (Kapell et al., 1998), questionnaires (Hand, 1994; Schrojenstein Lantman-de Valk et al., 1997), and medical assessments (Beange, McElduff, & Baker, 1995; Heleen M. Evenhuis, 1995a; Heleen M. Evenhuis, 1995b; H. M. Evenhuis, 1997). The results of these studies indicate elderly people with ID are likely to mature earlier than most and be more vulnerable to age-related disease, sensory impairments, and functional decline than general populations.

Age-related disease

People with ID show higher rates of age-related diseases than that of the general population, for example, non-atherosclerotic heart disease (Kapell et al., 1998; Cooper, 1999), mobility impairment (H. M. Evenhuis, 1997), thyroid disease (Kapell et al., 1998), psychotropic drug polypharmacy (H. van Schrojenstein Lantman-de Valk et al., 1997), and deaths due to pneumonia (P. Janicki et al., 1999).

Sensory impairments

As people age, they experience impairment in sensory function, including sight, hearing, smell, taste, and touch (Christenson, 1990). However, the resulting impairment of visual and hearing loss is more severe than the general population (H. van Schrojenstein Lantman-de Valk et al., 1997).

Functional decline

Functional decline due to aging includes affective disorders, delirium, and undiagnosed medical conditions (Heleen M. Evenhuis, 1995a; Heleen M. Evenhuis, 1995b; Heleen M. Evenhuis, 1997; Thorpe, 1999; Chicoine, McGuire, & Rubin, 1999). Furthermore, due to communication difficulties, medical and mental health disorders may present atypically.

Characteristics Distinctive from Intellectually Abled Elders

Not only are these shared common issues with elderly people in general, but the other factors are also related to syndromes or associated developmental disabilities, which demand additional or unique support for healthy aging for people with Intellectual Disabilities (ID) (H. Evenhuis et al., 2001).

Syndrome-specific conditions

People with specific syndromes constitute a significant portion of the population with ID. Common syndromes associated with ID include Down syndrome, Fragile X syndrome, and Prader Willi syndrome. People with Down syndrome exhibits high risk for specific endocrinological infectious, dermatologic, oral health, cardiac, musculoskeletal and other organ system disorders (Marino & Pueschel, 1996), high rates of disorders of the special senses of vision and hearing (Da Cunha & Moreira, 1996), epilepsy (McVicker, Shanks, & McClelland, 1994), and dementia (Zigman, Schupf, Sersen, & Silverman, 1996; Devenny et al., 1996). Fragile X syndrome exhibits relatively high rates of musculoskeletal disorders (Davids, Hagerman, & Eilert, 1990), early female menopause (Conway, Payne, Webb, Murray, & Jacobs, 1998; Murray, Webb, Grimley, Conway, & Jacobs, 1998), epilepsy (Ribacoba, Salas, Fernández,

Fernández, & Moral, 1995), and visual impairments (Maino, Wesson, Schlange, Cibis, & Mainoh, 1991). Prader Willi syndrome is prone to high rates of cardiovascular disease and diabetes (Lamb, Johnson, Opitz, Reynolds, & Ledbetter, 1987). These syndrome-related disorders more severely cause not only declines in physical but also in cognitive, and psychological abilities. Thus, the syndrome-related primary or secondary disorders lead people with ID to demand unique needs for their independent life.

Associated developmental disabilities

A significant number of persons with Intellectual Disabilities (ID) exhibit associated developmental disabilities that reflect central nervous system compromise such as cerebral palsy, epilepsy, and autism (Evenhuis et al, 2001). The symptoms of cerebral palsy include poor coordination, stiff/weak muscles, and tremors (FASA, 1998). Epilepsy involves loss of consciousness, sensory disturbance, and abnormal electrical activity in the brain (Desai, Ribbans, & Taylor, 1996; Jancar & Jancar, 1998). Autism causes difficulty in communicating, social interaction, and using language and abstract concepts (Totsika et al, 2010). People with ID, and those associated developmental disabilities that result from central nervous system that is compromised, need supplementary supports for their sensory functions including vision, hearing, swallowing, and speaking problems, as well as secondary disorders.

Recommended Environment

Based on the characteristics of people with Intellectual Disabilities (ID), previous studies have addressed needs for independent living for people with disabilities or seniors. There has been evidence that people with ID can be more independent if provided the appropriate support (Wehmeyer et al., 2003). Researchers

identified the needs for independent life of people with ID as follows: Wister (1985) has identified planning and preparing meals, cleaning, maintaining personal hygiene, using minor first aid, and upholding financial responsibilities (Wister, 1985); Yeager (1996) has determined communication skills, a reliance on others, disorientation, and assistance with daily living (Yeager, 1996); Marilyn M. Hazen & Suesetta McCree (2001) have recognized assistance with sensory, balance, mental performance, and psychosocial skills; Jungers (2010) has mentioned friendships and retaining autonomy (Jungers, 2010); and DiGennaro Reed et al. (2014) have listed personal safety, assistance with household skills and daily living skills, medical condition, mobility, and free from running or wandering away (DiGennaro Reed et al., 2014). These identified needs that promote independent living for people with disabilities or seniors have showed overlaps between some factors. Therefore, the study has categorized these needs into physical ability, cognitive ability, and psychosocial ability (Table 3).

Table 3

Needs for Independent Living for People with Disabilities or Seniors

	Physical Ability	**Cognitive Ability**	**Psychosocial Ability**
	Assistance with sensory, balance, daily living skills, health check and maintenance	Mental performance, free from memory loss, disorientation, running or wandering away	Friendships, communication skills, autonomy, dealing with loneliness
Wister (1985)	o		
Yeager (1996)	o	o	o
Marilyn M. Hazen & Suesetta McCree (2001)	o	o	o
Jungers (2010)			o
DiGennaro Reed et al. (2014)	o	o	o

In the following section, the physical, cognitive and psychosocial needs are illustrated with their related domestic environment recommendations.

Physical need

Physical ability is significantly related to the ability to perform activities of daily living (ADLs), such as transferring (walking), bathing, personal hygiene (grooming), dressing, self-feeding, and toileting (Williams et al., 2014). Performing ADLs is directly linked to the ability of elderly people with ID to continue their independent life in their own home. Elderly people with ID especially require assistance with their sensory function and balance for their independent life (Hazen & McCree, 2001).

Sensory function. Impairment in sensory function increases with aging (Christenson, 1990). Numerous sight changes, hearing impairment, decline in ability to detect scents and taste, as well as loss of sensitivity are related to primary aging. Table 4 illustrates the problems caused by decline in sensory function and related domestic environments.

Table 4

Sensory Problems and Related Home Environments

	Problems	**Related home environments**
Sight	• Less light reaches the photoreceptors in the retina • Eye becomes opaque, scatters light, and possesses less tolerance for the glare	• Lights, brightness • Materials that prevent glare • Color contrast for absence of ambiguity • Layouts of appliances
Hearing	• Hearing loss caused by diverse factors • Can't be aware of emergency	• Alarms (emergency, doorbells, smoke detectors) • Materials that improve acoustical properties

		• Equipment that minimizes noises
Smell/Taste	• Decline in ability to detect scents • May not smell overheating, smoke, or gas fumes • May not notice spoiled food	• Electrical outlets • Kitchen appliances
Touch	• Loss of sensitivity • Lessened ability to maintain body temperature and lessened temperature sensitivity	• Various textures • Water faucets • Automatic thermometers

Note. Adapted from Heckheimer, 1989; Christenson, 1990; Mortgage, Centre, & Maltais, 1992

Balance. Body position in space is an important factor for people with ID, since fear of falling results in restriction of activity, which in turn results in questioning of their ability to live independently in their own home (Brummell-Smith, 1990). Table 5 illustrates problems caused by decline in balance and related domestic environments.

Table 5

Balance Problems and Related Home Environments

	Problems	**Related home environments**
Balance	• Decreased ability to recognize change of the center of gravity • Difficult to change position by weight shifting • Quick change of body position can cause dizziness or hypotension • Incidents of falling	• Stability of furniture/appliances • Grab bars • Clearance radius • Doorways • Stairs/ramps/permitted change in level • Materials (non-slippery) • Electrical outlets

Note. Adapted from Brummell-Smith, 1990

Cognitive needs

Cognitive ability includes learning, memory, and problem-solving activities. When doing these activities, elderly people with ID are likely to need more time for

input or perform disorientation (Hazen & McCree, 2001). Disorientation in mental performances can lead to memory loss or wandering, which can be barriers to independent living (Yeager, 1996). Table 6 illustrates problems caused by deterioration in mental performance and related domestic environments.

Table 6

Cognitive Problems and Related Home Environments

	Problems	**Related home environments**
Cognitive	• More time for input • Memory loss • Wandering or running away	• Signage easy to identify • Reminders • Environments that promote exercise

Note. Adapted from Atchley & Barusch, 1991

Psychosocial needs

People with ID are vulnerable to social isolation. Ability to maintain and develop friendships and retain confidence and autonomy may strengthen independence of people with ID (Hazen & McCree, 2001). Table 7 describes the psychosocial problems and related domestic environments.

Table 7

Psychosocial Problems and Related Home Environments

	Problems	**Related home environments**
Psychosocial	• Loss of confidence • Loneliness caused by the death of a close loved one, health decline, hopelessness, and discrepancy between desired and available relationships • Loss of autonomy	• Social-gathering spaces

Note. Adapted from Walton, Shultz, Beck, & Walls, 1991; Jungers, 2010

Literature Review Summary

This study has reviewed the literature on current approaches to aging in place for people with Intellectual Disabilities (ID), current housing design standards, the unique needs of people with ID who want to live independently, and recommended domestic environments based on those needs. These are the findings of the literature review and the connections to this study.

In terms of trends in current approaches to aging in place for people with ID, service providers have emphasized the support of housing. It is because previous studies have shown evidence that lifestyle of people with ID and their preferences are significantly impacted by domestic environments (Schwarz, Chaudhury, & Tofle, 2004; DiGennaro Reed et al., 2014). However, the effectiveness of the approaches used has been limited due to a lack of resources and strategies. Another inhibitor to the success of these efforts is the variety of preferred domestic environmental settings for residents with a variety of types and levels of disabilities (Ministry of Health & Welfare, 2012). Thus, there is a need to consider different levels and types of disabilities in supporting housing for people with disabilities, so this study will focus on the people with ID who can independently live in their own home with assistance.

In terms of the current housing design guidelines, housing design guidelines for people with general disabilities in South Korea have been developed based on the concept of barrier-free design and universal design (Ostroff, 2011). These concepts are meaningful for building environments that are accessible to everyone, but they require further considerations for users who demand unique needs. In fact, current housing design standards rarely consider the mandatory standards for people with ID. Therefore,

the study attempts to prioritize housing design standards for this group in order to maximize the effectiveness of developing or remodeling housing to accommodate them with limited resources.

In terms of the recommended domestic environment, practical evidence is needed. Previous studies investigated the needs for independent life of people with ID and recommended living environments. However, using only literature review has the limitation of providing practical advice for specific regions or countries, instead of a general range of information. Thus, there is a need for additional studies that provide practical evidence. This study intends to provide evidence-based standards by conducting a survey that asks about the current living environment and actual needs and preferences of people with ID.

In the following chapter, the research method of the study is presented. The chapter is divided into two sections: the first section describes the research procedure including variables, measurement, confidentiality, reliability and validity of the study, and the following section illustrates participants containing sampling procedures and sample size.

Method

Research Procedure

The purpose of the correlation study is to investigate what specific independent variable of design standards contribute to dependent variables of independent life of people with Intellectual Disabilities (ID) and their desire to age in place. Also, the study seeks to prioritize the identified items. The study hypothesizes that some standards might be more significantly related to positive behavior outcome for people with ID than others. To determine these potential relationships, the quantitative study analyzes the two correlations between environmental settings and human behaviors or preferences (Figure 2):

- Correlations between the achievement of housing design standards (X) and people with independent life of people with ID (Y1); and
- Correlations between the achievement of housing design standards (X) and desire of people with ID to age in place (Y2)

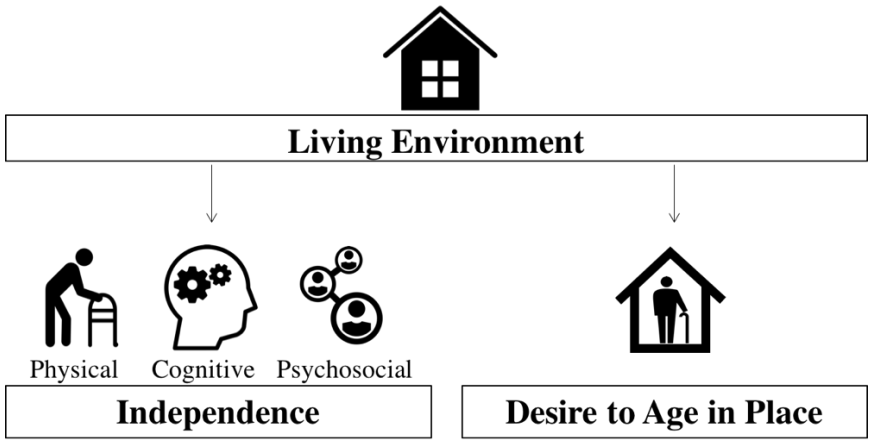


Figure 2. Correlations between Living Environment and People with Intellectual Disabilities, (Yi, 2017).

Through these correlational analyses, the identified items that have significant and positive relationship with independence or desire to age in place are also prioritized according to the strength of correlations. This quantitative research method is selected since the findings are easy to be generalized by using real data. Based on these generalized evidence, this study aims to provide practical recommendations on housing design to related industries.

Variables

In the correlational study, one independent variable and two dependent variables are considered: the independent variable includes design standards (X), and the dependent variables are independence of people with ID (Y1) and their desire to age in place (Y2).

Independent variables: design standards (X)

Through a literature review on the current housing design guidelines, a series of independent variables is created. Previous study classified the items in the current housing design guidelines into 9 spaces and 71 categories (Appendix A) (B. Kim & Lee, 2015). Based on this categorization, this study removed repeated categories and extracted 9 spatial dimensions in a total of 45 items that are relevant to domestic environment (Table 8). Each variable is evaluated by respondents based on the following questions: "Is it safety-oriented?", "Is it accessible?", "Is it supportive?", "Is it adaptable?", and "Is it communicable?"

Table 8

Independent Variables: Design Standards Relevant to Living Environment

Space	Variables	Descriptions
A. Accessible Routes	A1. Ramps	general, handrails, clear width, slope
	A2. Materials	slip-resistant materials, floor finishes
	A3. General	locations, sizes, wayfinding
	A4. Walking surfaces	connections
	A5. Parking spaces	identification signs, vehicle spaces, access aisle
	A6. Clearances	clear width, passing spaces
B. Entrance	B1. Storage spaces	wheelchair spaces, general storage spaces
	B2. Clear width and maneuvering clearances	clear opening, moving area
	B3. Telephones	locations
	B4. General	locations, sizes
C. Living Room/Corridor	C1. General	circulations, layouts, compositions, wheelchair turning spaces
	C2. Hallways	finishes, width, grab bars
D. Kitchen	D1. Counters	height, shape, layouts, equipment, knee and toe clearance, work areas
	D2. Equipment	water supply and drainage, exhaust hoods, fire alarm systems
	D3. Sinks	height, shape, equipment, kitchen faucets, knee and toe clearance
	D4. Ranges	height, layout, safety-oriented, knee and toe clearance
	D5. Kitchen installation	stability, safety
	D6. Tables	shape, size, installation
	D7. Storage spaces	usability, height, shape
	D8. Appliances	refrigerator/freezer, safety-oriented
	D9. Layouts	size, location, clearance
E. Bathroom/ Toilet	E1. Shower compartments	floor, seats, size and clearance, grab bars, closet, faucets
	E2. Closets	location, size, materials, finishes, supportiveness, moving areas
	E3. Bathtubs	floor, seats, grab bars, bathtub faucets, installation
	E4. Toilets	size, flush controls, grab bars, clearance

	E5. Sinks	mirror, height, grab bars, towel rack, cabinetry, faucet, drain
	E6. Layouts	size, location, clearance
	E7. Heating systems	water, air
F. Bedroom	F1. Beds	accessibility, shape, size, moving areas
	F2. General	locations, sizes, moving areas
	F3. Closets	materials, finishes, supportiveness, moving areas
G. Laundry Room	G1. Work spaces	washing machines, dryers
	G2. Materials	electrical outlets, floor finishes
	G3. Layouts	furniture, equipment, working area
	G4. General	locations, sizes, moving areas
H. Indoor Common Area	H1. Grab bars	stairways, walking surfaces
	H2. Permitted changes in level	platform lifts, doorways, hallways, stairways, floor surfaces, ramps
	H3. Doors	types, size, handle, width, maneuvering clearances
	H4. Electric equipment	switches, electrical outlet controllers
	H5. Windows	size, height, frames, window locks
	H6. Lights	brightness, lamps, night lights
	H7. Floors	materials, finishes
	H8. Walls	wall finishes materials
	H9. Furniture	layouts, size, shape, finishes, reach ranges, knee and toe clearance
	H10. Emergency Alarms	locations

Accessible route (A). Accessible route indicates the areas from the parking space to the entrance of the home. The categories include ramps, materials, general, walking surfaces, parking spaces, and clearances (Figure 3).

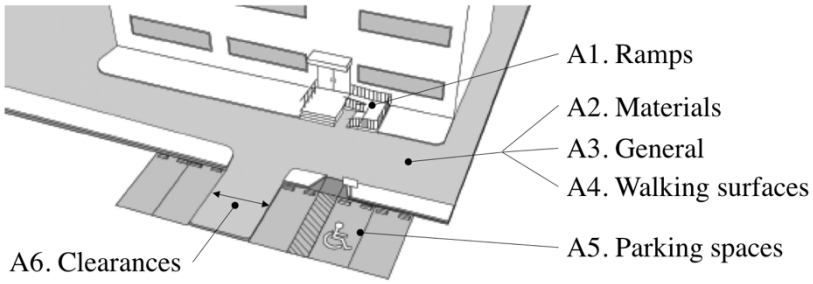


Figure 3. Variables Relevant to Accessible Routes.
Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Entrance (B). Entrance is the area just inside of the main door, which residents are facing at first when entering home. To evaluate entrance area, the following factors are considered: storage spaces, clear width and maneuvering clearances, telephones, and general attributes (Figure 4).

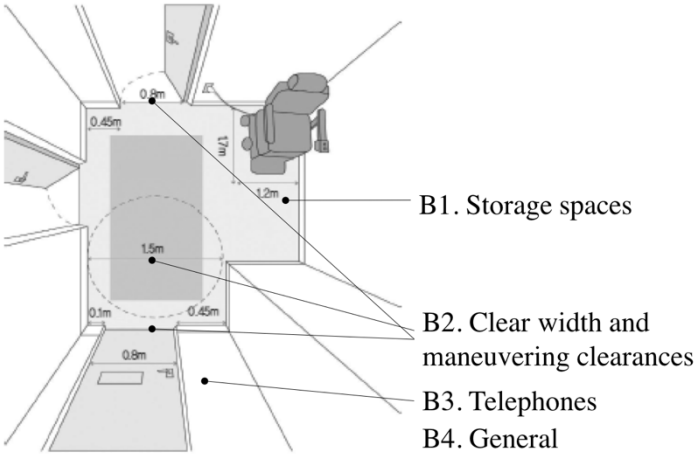


Figure 4. Variables Relevant to Entrance.
Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Living room and corridor (C). A living room and corridor may function as a place for relaxing and socializing, as well as a connector to other rooms or areas at home. Making assessment of a living room and corridor, two categories are considered:

the general attributes which evaluate circulations, layouts, compositions, and wheelchair turning spaces; and hallways which access finishes, width, installation of grab bars (Figure 5).

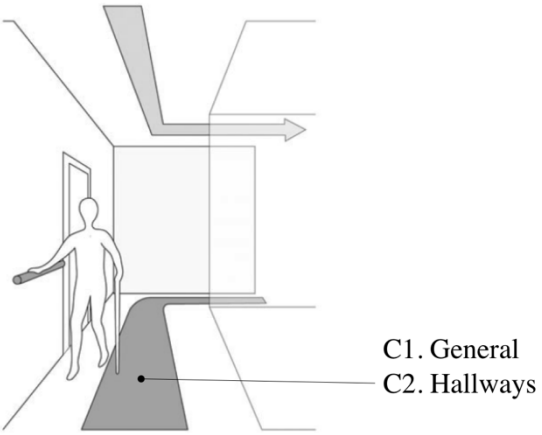


Figure 5. Variables Relevant to Living Room/ Corridor.
Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Kitchen (D). A kitchen is associated with daily living activities of cooking and food preparation. Kitchen design is a significantly related with user's safety since a kitchen is typically equipped with ranges, sink with hot and cold running water, and other electric appliances and equipment. This study takes the following categories into account to rate the living environment: counters, equipment, sinks, ranges, installation, tables, storage spaces, appliances, and layouts (Figure 6).

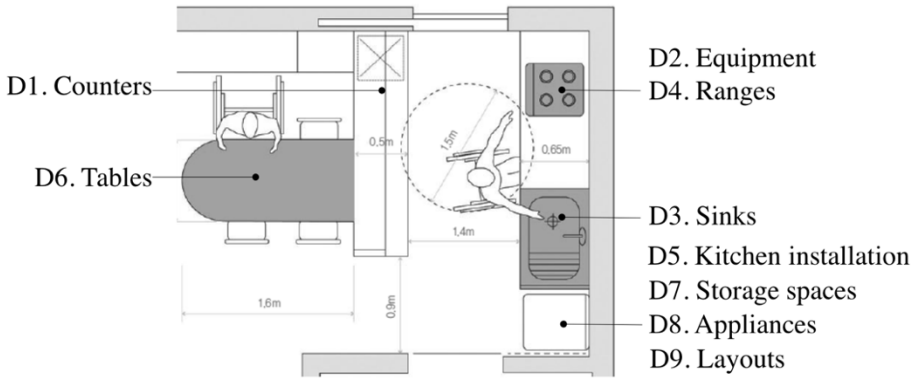


Figure 6. Variables Relevant to Kitchen.
Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Bathroom (E). A bathroom is a space for personal hygiene activities. Along with a kitchen, a bathroom design is also significant in terms of user's safety. The activities in the bathroom are usually related to the use of water, so there are possibilities of falling or fainting accidents. To measure this space, shower compartments, closet, bathtubs, toilets, sinks, layouts, and heating systems are considered (Figure 7).

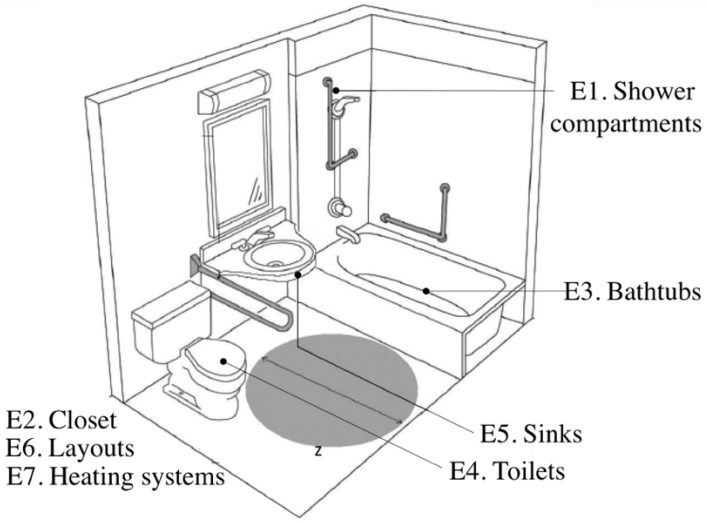


Figure 7. Variables Relevant to Bathroom.
Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Bedroom (F). A bedroom is a private space where residents sleep. Personal taste and characteristics are likely to be reflected in one's bedroom though furniture and other items. The variables in this study include beds, general, and closets (Figure 8).

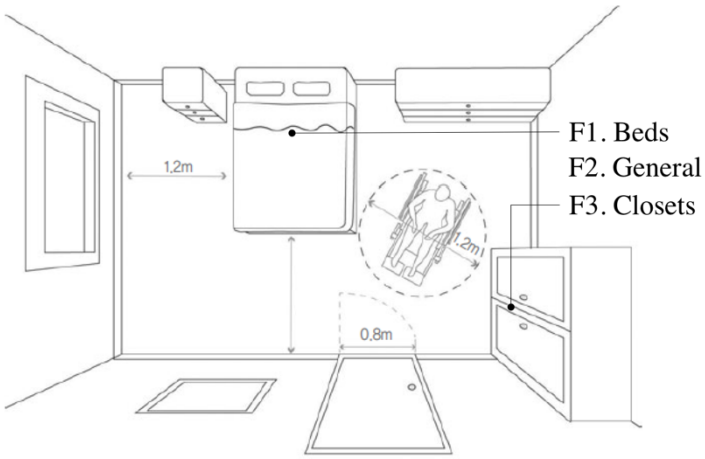


Figure 8. Variables Relevant to Bedroom.
Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Laundry room (G). A laundry room generally contains a washer and a dryer. In some countries, the drying rack is used to dry clothes instead of a dryer, and it may require additional working spaces. The categories that access the laundry room include work spaces, materials, layouts, and general (Figure 9).

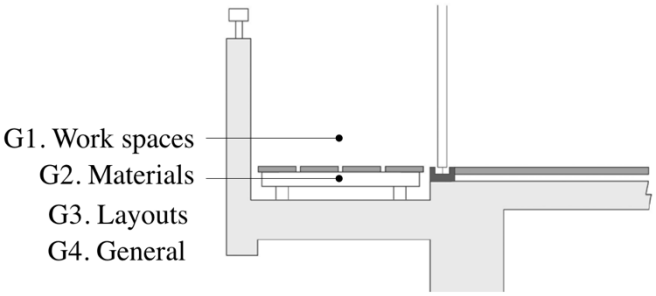


Figure 9. Variables Relevant to Laundry Room.
Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Indoor common area (H). Some physical attributes are not limited to a certain space, but they apply to indoor common areas. The items contain grab bars, permitted changes in level, doors, electric equipment, windows, lights, floors, walls, furniture, and emergency alarms (Figure 10).

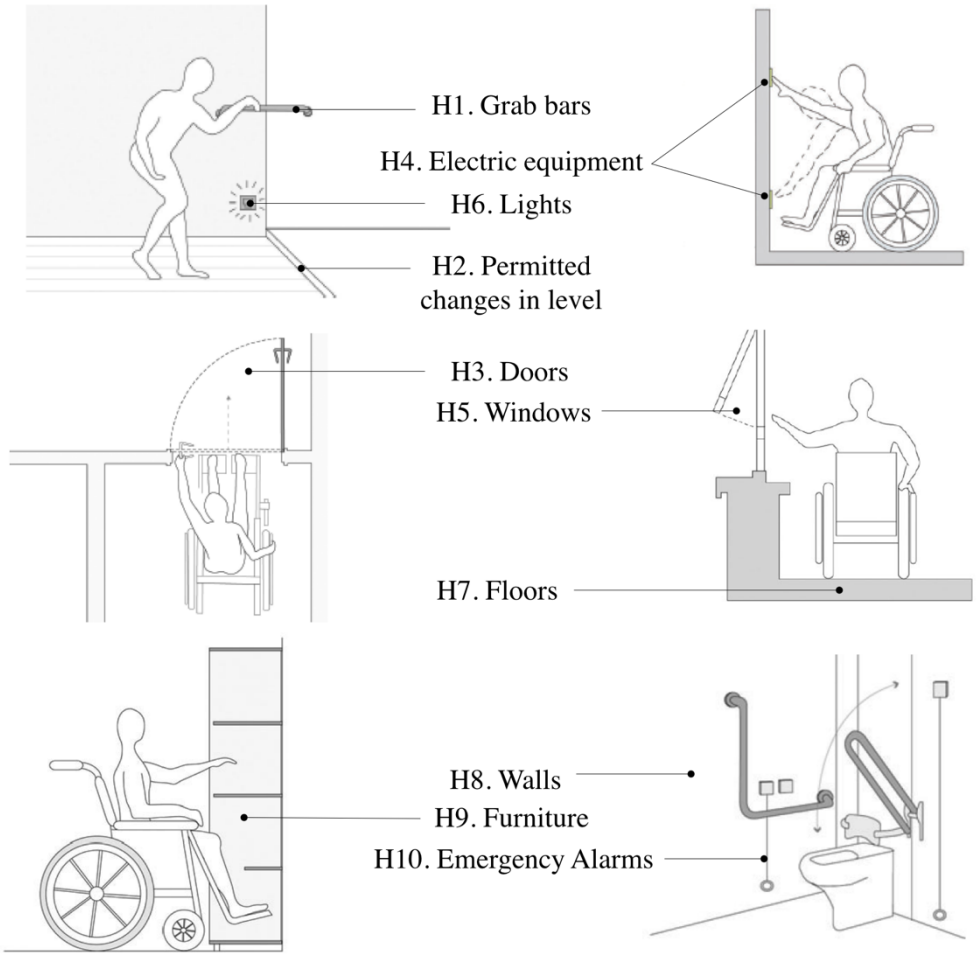


Figure 10. Variables Relevant to Indoor Common Area
Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Dependent Variables: Independence (Y1)

How independent an individual with ID is not easy to be assessed. It requires more subtle and indirect measurement. Based on the literature review on the needs for

independent life of people with ID, the level of independence is measured by three items: physical, cognitive, and psychosocial ability.

Physical ability (Y_{11}). Physical ability is constructed to measure the quality of being able to perform activities of daily living. The considered items consist of daily living skills including transferring, walking or wheelchair, stair climbing, bathing, personal hygiene, dressing, self-feeding, toileting, as well as health check/maintenance, sensory functions, and balance.

Cognitive ability (Y_{12}). Cognitive ability constructs mental performances of acquiring knowledge and understanding through thought and senses (Hazen & McCree, 2001). Poor performances in cognition may result in problems, such as memory loss, disorientation, running or wandering away. Cognitive ability contains learning, remembering, reasoning, problem-solving, and paying attention.

Psychosocial ability (Y_{13}). Psychosocial ability is associated with motivational constructs that are affected by psychological and social contexts, including an ability to appropriately perceive emotional states and link these to the social environments (Dixson, Worrell, Olszewski-Kubilius, & Subotnik, 2016). The relevant items include communication skills, relationship with others, and ability to retain confidence and autonomy.

Dependent Variables: Desire to Aging in Place (Y2)

The desire to continue one's independent life in one's own home is an outcome of various factors that are interconnected. For example, one's desire will be affected by individual's preferences, satisfaction with life in current living environment, the level of finance, and the needs of health care.

Measures

The survey is designed to answer three demographic questions, as well as to rate one independent and two dependent variables. Table 9 illustrates the scoring scale that assesses each variable.

Table 9

Variables and Scales

Variables	**Demographic items**		
	Gender	Age	Length of residency
Scale	1: Male / 0: Female	Continuous	Continuous

Variables	**Independent Variables**	**Dependent Variables**	
	Living Environment (X)	Independence (Y1)	Desire to Aging in Place (Y2)
Scale	0 to 10	0 to 10	1: Yes / 0: No

Demographic questions

The three demographic items include gender, age, and length of residency. The gender is dichotomous, or nominal, variable which has only two categories, 1= male or 0= female. Age and length of residency are continuous variables that are possible to take on any value.

Independent and dependent variables

The 0-to-10 scoring scale, or an 11-point scale, is used to rate living environment (X) and independence of people with ID (Y1). For rating living environment (X), the scale ranges from 0 = very poor to 10 = very excellent. For rating independence (Y1), the scale ranges from 0 = dependent to 10 =independent. This study uses the 0-to-10 scale since it has been statistically proven to have some advantages (Intelligence, 2014). First, an 11-point scale has true mid-point 5, indicating 0-4

negative and 6-10 positive. Second, an 11-point scale increases the variability and differences in responses compared to a 5- or 7-point scale, making it continuous variable. Third, respondents are familiar with the scale, so the meaning of 10 are likely to be consistent across countries.

The study treats the desire of people with ID to age in place (Y2) as a nominal variable, which answers are 1= 'yes, I want to live in my current house as long as possible,' or 0= 'no, I don't'. This is because that it is hard for caregivers to discern a level of desire of those who are decisional impaired.

Confidentiality

To protect identity of participants, the aggregated data via survey were transferred via a secured network connection, coded and protected with a password. The following three demographic identifiers were asked: gender, age, and the length of residency. However, the confidentiality of survey participants was maintained since they were assigned unique identification numbers. Data retention will be held for three years from the completion of research and then will be appropriately destroyed.

Reliability and Validity

Reliability is the stability or consistency of the results of study (Twycross A & Shields L, 2004). In other words, research that are reliable means the research findings can be repeatable. This study used statistical tools to measure reliability. The Cronbach's alpha test is used for internal reliability coefficient.

Validity of the research indicates an instrument is accurately measuring what it is supposed to (Heale & Twycross, 2015). It is about the question of the research are well-constructed using established standards and methods. In this study, the possible

factors that influence independent life for people with ID were explored and identified by previous studies (Hazen & McCree, 2001; Jungers, 2010; Yeager, 1996; DiGennaro Reed et al., 2014). The literature review has already determined the unique needs for independent life of people with ID and one's independent life is influenced by his/her living environment (Hazen & McCree, 2001). The correlation study was designed based on previous results and further identify relationships between people with ID and their living environment focusing on the housing design standards.

Participants

Sampling procedures

This study focuses on the cases of assisted living homes in South Korea. Survey respondents were caregivers who know people with Intellectual Disabilities (ID) well and are caring for people with ID. The University of Oklahoma Institutional Review Board (IRB) reviewed and granted permission to this study. Once permission was granted, caregivers were recruited through the flyer sent via e-mail to organizations that had provided assisted living homes for people with ID. The information on the purpose of study, timeline, benefits/risks, confidentiality, and instructions for survey completion were provided to organizations for review and approval before distributing the survey. Eight organizations were approved to distribute the survey to the staff of caregivers in their organizations. The caregivers were asked to rate intellectually disabled people under their supervision and their living environments.

Sample size

Among received responses, the responses that rated the item using no more than three of the number options given were excluded; for example, the survey was designed

to rate items using 11-point scoring scale, but some respondents only used the values '0', '5', and '10', or '0' and '10' when evaluating the items. The result reflects a distortion when these 2- or 3-value scoring responses were used to analyze the correlations along with 11-point scoring scale. Those responses resulted in the tendency of weakened correlations between variables (Figure 11).

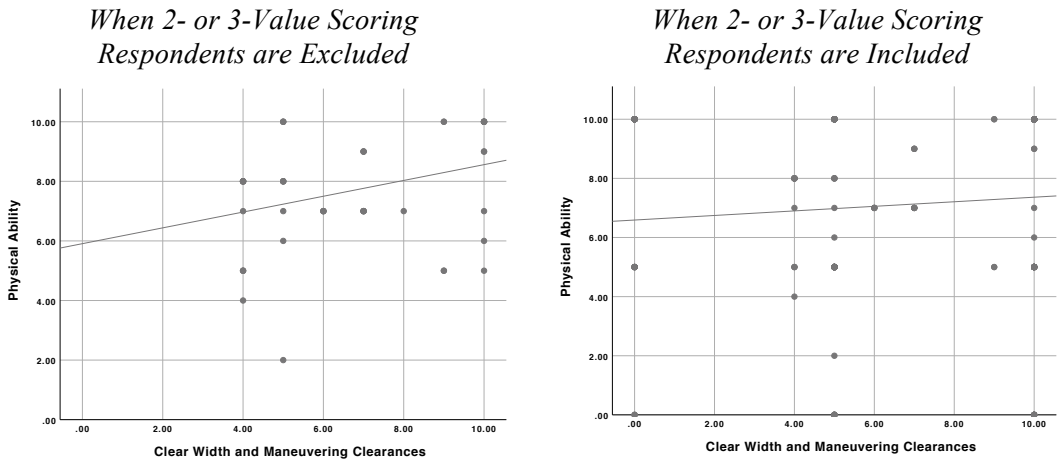


Figure 11. Impact of the Excluded Respondents

Finally, the determined sample size of 51 was relatively small and would contribute to the distribution shape of scatterplots in Figure 11, but it was statistically adequate to generalize outcomes for the group of people with ID.

Method Summary

The chapter has presented the study's purpose and the effectiveness of correlation study for this research. Independent and dependent variables are set based on the previous literature. To be specific, independent variables include 45 domestic environmental items from the current housing design standards in South Korea. One dependent variable is independence which consist of physical, cognitive, and psychosocial abilities, and the other dependent variable is desire to age in place. These

variables are measured by caregivers through a 0 to 10 scoring system or a 'yes' or 'no' question. Caregivers are recruited by flyers sent to organizations which are providing assisted living homes for people with ID, and finally, the sample size is determined as 51. Three demographic identifiers have also been asked, including gender, age, and the length of residency, however, participants are protected by assigning identification numbers, coding the data and keeping the data with passwords. the study ensures reliability by using statistical tool. Also, the validity is achieved through being consistent with previous studies that pertain significant environmental impacts on human behaviors.

In the following chapter, the study's results are presented.

Results

This quantitative correlation study aims to investigate the relationship between people with Intellectual Disability's (ID) living environment and their independence or desire to age in place:

- correlations between the achievement of housing design standards (X) and the independent lives of people with ID (Y1), and
- correlations between the achievement of housing design standards (X) and the desire of people with ID to age in place (Y2)

The resulting data was aggregated between September 11th and October 17th of 2017. The survey was completed by the caregivers who are caring for people with ID and have sufficient knowledge on them. Caregivers have provided information on 51 people with ID participants and their current domestic environments. The Statistical Package for the Social Sciences (SPSS) 25.0 has been used to compute descriptive and correlational statistics. Descriptive statistics calculates the variable's means, standard deviations, ranges, frequency, and total numbers. For the correlational analyses, Spearman rho (ρ) correlation coefficient was calculated to evaluate the monotonic relationship between two continuous variables. Spearman rho (ρ) correlation is appropriate to be used in the study over other methods since the variables are ranked values by a 0 to 10 scoring system.

Descriptive Statistics

The Statistical Package for the Social Sciences (SPSS) 25.0 has been used to analyze descriptive statistics for continuous variables (means, standard deviations,

interquartile ranges, and total numbers), and for categorical variables (frequency, percentiles, and total numbers).

Demographic Characteristics

Demographic data for three variables was aggregated for gender, age, and length of residency. Study participants were people with Intellectual Disabilities (ID) living in assisted homes in South Korea. The participants consisted of 43 (84%) males and 8 (16%) females. Participants' ages ranged from 17 to 94, and their mean age was 36 years (SD = 12.06). Participants had lived in the current homes from two to 40 years, on average 14 years (SD = 11.32). According to the literature review, people with ID mature relatively early, in 10 to 15 years, and they experience more challenging changes as they age (Bigby, 2010). Thus, individuals aged 40+, 50+, or 65+ can be defined as elderly (Bigby, 2008). When reflecting on this fact, the participants, on average, can be categorized as facing old age. Table 10 illustrates the responses to demographic questions.

Table 10

Descriptive Statistics: Demographics

Characteristics	Value
Gender	
Male	43 (84%)
Female	8 (16%)
Age (years)	36 (17 - 94)
Length of residency (years)	14 (2- 40)

Note. Categorical data are provided as 'frequency (percentile)', and continuous data as 'mean (interquartile range)'. N = 51

Living Environment (X)

The 45 items that are relevant to the living environment of people with ID have been rated by caregivers. Appendix B provides full account of descriptive statistics for

the assessment. All outcomes provide a minimum value that ranges from 0 to 5 and a maximum value of 10. The greatest mean score of 8.94 has been associated with Appliances in Kitchen. The highest mean scores of levels two through five includes layouts of bathroom (M = 8.41), sinks in kitchen (M = 8.31), kitchen installation (M= 8.22), kitchen equipment (M = 8.14), and kitchen storage spaces (M = 8.13). Meanwhile, the lowest rank items one to five were emergency alarms (M = 3.55), storage space at the entrance (M = 4.98), layouts of laundry room (M = 5.49), permitted changes in level (M = 5.67), and bathtubs (M= 5.73).

Independence (Y1)

Table 11 shows the descriptive statistics for the evaluation of the independence. Caregivers have rated independence of people with ID in terms of their performance at their current home. The independence has been measured by three items: physical, cognitive, and psychosocial ability. The mean of physical ability is 7.69 (SD = 1.87), ranging from 2 to 10. In terms of cognitive ability, the mean is 6.10 (SD = 2.09) ranging from 0 to 10, which is the lowest level. Last, for the psychosocial ability, the mean is 6.37 (SD = 2.44) ranging from 0 to 10. This result of values, over mid-point 5, shows the participants are relatively independent so that they are already equipped with the ability to conduct independent life if they are under adequate domestic environment.

Table 11

Descriptive Statistics: Independence of People with Intellectual Disabilities

Variables	Mean	Std. Dev.	Min.	Max.	N
Independence					
Physical Ability	7.69	1.87	2	10	51
Cognitive Ability	6.10	2.09	0	10	51
Psychosocial Ability	6.37	2.44	0	10	51

Desire to Age in Place (Y2)

Table 12 describes the answers to the question regarding the desire to age in place. Respondents have been asked by the question, "Does she/he want to live in current residence as long as possible?" To this question, 32 (63%) participants have answered 'yes,' and 19 (37%) have answered 'no.'

Table 12

Descriptive Statistics: Desire to Age in Place

Variables	Value
Desire to Age in Place	
Yes	32 (63%)
No	19 (37%)
Total	51(100%)

Note. Data are provided as 'frequency (percentile)'.

Correlation

Based on the aggregated data, Spearman's rho (ρ) correlation coefficient was computed to assess the significance and strength of the relationships between variables. The analysis investigated the relationships between the 45 living environmental variables, independence of people with ID, and their desire to age in place. Appendix C provides full description of the correlation analysis.

The value of *p* is used to determine the significance of correlations. The *p*-value is understood in the following manner: the smaller the p-level is, the more significant the relationship is (Howell, 2012). This study has identified significant correlation at two levels: at the 0.01 level (when $p \leq .01$) and at the 0.05 level (when $p \leq .05$). When p-value is greater than .05 ($p > .05$), this study determined there is no significant correlation. Among 45 items that are relevant to living environments, 18 significant relationships were found with desire to age in place. Also, six items are significantly

related to physical ability, 18 items with cognitive ability, and 16 items with psychosocial ability. Table 13 shows the level of significance determined by the value of *p*, as well as the number of relationships in the result of this study. These significant correlations were classified according to the strength of correlation in the next stage.

Table 13

Significance of Correlation

Significance of Correlation	***p*-value**	**Correlation with Living Environment**			
		Independence			**Desire to Age in Place**
		Physical	**Cognitive**	**Psychosocial**	
Significant	** $p \leq .01$	0	14	12	14
	* $p \leq .05$	6	4	4	4
Not Significant	$p > .05$	39	27	29	27

The correlation coefficient (*r*) is used to describe the degree of relationship between two variables. The value of *r* is interpreted in the following manner: values near 0 means low correlation and values near ±1 indicate strong correlation (Howell, 2012). The positive value illustrates when one value increases the other value increases as well, while the negative value describes the inverse relationship that as one variable increases the other variable decreases (Howell, 2012). Positive and negative correlations are considered at three levels in this study, according to the absolute *r*-values, which is the distance the *r*-value is from zero: the absolute *r*-values between 0.0 to 0.3 have weak correlations, from 0.3 to 0.5 have moderate correlations, and above 0.5 have strong correlations. Table 14 gives guideline on the strength of the relationship corresponding to the correlation coefficient value (*r*) and shows the frequency of relationships in the result of this study. Among these correlations, this study focuses on positive correlations: 6 strong, 13 moderate, and 3 weak correlations.

Table 14

Strength of Correlation

Strength of Correlation	Correlation Coefficient, *r*	Correlation with Living Environment			
		Independence			Desire to Age in Place
		Physical	Cognitive	Psychosocial	
Strong	$0.5 < r \leq 1.0$	0	0	0	6
Moderate	$0.3 < r \leq 0.5$	4	0	1	9
Weak	$0.0 < r \leq 0.3$	1	0	0	2
No correlation	$r = 0.0$	0	0	0	0
Weak (Negative)	$-0.3 \leq r < 0.0$	1	3	2	0
Moderate (Negative)	$-0.5 \leq r < -0.3$	0	14	11	1
Strong (Negative)	$-1.0 \leq r < -0.5$	0	1	2	0
Total Significant Relationships		6	18	16	18

Through Spearman's rho (ρ) correlation analysis, the significant and positive correlations were identified. In other words, the living environment items in these relationships significantly have positive impacts on the independence of people with ID or their desire to age in place. The specific items that are have significant positive relationships are presented in the next section: (1) between living environment and independence, as well as (2) between living environment and desire to age in place.

Correlations between Living Environment and Independence (X-Y1)

The significant correlations between living environment and independence of people with ID have been presented into three levels: strong ($0.5 < r \leq 1.0$, $p \leq .05$), moderate ($0.3 < r \leq 0.5$, $p \leq .05$), and weak ($0.0 < r \leq 0.3$, $p \leq .05$) correlations.

Significant/Strong Correlations between Living Environment and Independence ($0.5 < r \leq 1.0$, $p \leq .05$)

There was not any significant and strong correlation between living environmental items and independence of people with ID.

Significant/Moderate Correlations between Living Environment and Independence (0.3 < r ≤ 0.5, p ≤ .05)

The significant and moderate correlations represent *p*-values no more than 0.5, and *r*-values ranging from 0.3 to 0.5. Five significant and moderate correlations between living environment and independence are identified (Table 15). As the storage spaces at entrance area were adequately equipped, increased physical ability ($r = .306$, $p \leq .05$, n = 51), as well as psychosocial ability (r = .408, $p \leq .01$, n = 51). Clear width and maneuvering clearances of entrance was significantly related with physical ability ($r = .316$, $p \leq .05$, n = 51). There were positive correlations between ranges in kitchen and physical ability ($r = .327$, $p \leq .05$, n = 51), also, between layout of kitchen and physical ability ($r = .327$, $p \leq .05$, n = 51).

Table 15

Significant and Moderate Correlations between Living Environment and Independence (0.3 < r ≤ 0.5, p ≤ .05)

Living Environment		**Independence**	***r***
Items	**Descriptions**		
B. Entrance			
B1. Storage spaces	- general storage spaces, wheelchair spaces	Physical Psychosocial	.306* .408**
B2. Clear width and maneuvering clearances	- clear opening, moving area	Physical	.316*
D. Kitchen			
D4. Ranges	- height, layout, safety-oriented, knee and toe clearance	Physical	.327*
D9. Layouts	- size, location, clearance	Physical	.327*

*. Correlation is significant at the 0.05 level (2-tailed)
**. Correlation is significant at the 0.01 level (2-tailed)

Significant/Weak Correlations between Living Environment and Independence (0.0 < r ≤ 0.3, p ≤ .05)

The significant and weak correlations are formed by *r*-values that ranges from 0.0 to 0.3, and *p*-values no more than 0.5. Table 16 shows one correlation between two variables: lights in indoor common area and physical ability ($r = .279$, $p \leq .05$, n = 51).

Table 16

Significant and Weak Correlations between Living Environment and Independence (0.0 < r ≤ 0.3, p ≤ .05)

Living Environment		Independence	*r*
Items	**Descriptions**		
H. Indoor Common Area			
H6. Lights	- brightness, lamps, night lights	Physical	.279*

*. Correlation is significant at the 0.05 level (2-tailed)

Correlations between Living Environment and Desire to Age in Place (X-Y2)

The significant correlations between living environment and the desire of people with ID to age in place have been presented into three levels: strong ($0.5 < r \leq 1.0$, $p \leq .05$), moderate ($0.3 < r \leq 0.5$, $p \leq .05$), and weak ($0.0 < r \leq 0.3$, $p \leq .05$).

Significant/Strong Correlations between Living Environment and Desire to Age in Place (0.5 < r ≤ 1.0, p ≤ .05)

The significant and strong correlations consider variables whose *r*-values ranging between 0.5 and 1.0, and *p*-values no more than 0.5. Table 17 displays the results. Six domestic environmental items were related with desire of people with ID to age in place: general attribute of entrance ($r = .542$, $p \leq .01$, n = 51), heating system of bathroom ($r = .536$, $p \leq .01$, n = 51), beds ($r = .543$, $p \leq .01$, n = 51), general attribute of

bedroom (r = .566, $p \leq .01$, n = 51), closets in the bedrooms (r = .564, $p \leq .01$, n = 51), and furniture in indoor common area (r = .654, $p \leq .01$, n = 51).

Table 17

Significant and Strong Correlations between Living Environment and Desire to Age in Place (0.5 < r ≤ 1.0, p ≤ .05)

Living Environment Items Related with Desire to Age in Place		*r*
Living Environment	**Descriptions**	
B. Entrance		
B4. General	- locations, sizes	.542**
E. Bathroom		
E7. Heating System	- water, air	.536**
F. Bedroom		
F1. Beds	- accessibility, shape, size, moving areas	.543**
F2. General	- locations, sizes, moving areas	.566**
F3. Closets	- materials, finishes, supportiveness, moving areas	.564**
H. Indoor Common Area		
H9. Furniture	- layouts, size, shape, finishes, reach ranges, knee and toe clearance	.654**

**. Correlation is significant at the 0.01 level (2-tailed)

Significant/Moderate Correlations between Living Environment and Desire to Age in Place (0.3 < r ≤ 0.5, p ≤ .05)

The significant and moderate correlations represent r-values ranging between 0.3 and 0.5, and p-values at most 0.5. Nine environmental factors had positive impacts on the desire of people with ID to age in place. The more appropriately the kitchen was equipped with appliances, the stronger the desire to age in place was (r = .439, $p \leq .01$, n = 51). Adequate bathtub design was significantly related to participants' desire to age in place (r = .314, $p \leq .05$, n = 51). Also, there was a correlation between layout of bathroom and desire to age in place (r = .414, $p \leq .01$, n = 51). The desire to age in place was also significantly influenced by six items in indoor common area: doors (r = .451, $p \leq .01$, n = 51), electric equipment (r = .433, $p \leq .01$, n = 51), windows (r = .471,

$p \leq .01$, n = 51), lights ($r = .468$, $p \leq .01$, n = 51), floors ($r = .397$, $p \leq .01$, n = 51), and walls ($r = .499$, $p \leq .01$, n = 51). Table 18 is the results of this analysis.

Table 18

Significant and Moderate Correlations between Living Environment and Desire to Age in Place ($0.3 < r \leq 0.5$, $p \leq .05$)

Living Environment Items Related with Desire to Age in Place		*r*
Items	**Description**	
D. Kitchen		
D8. Appliances	- refrigerator/freezer, safety-oriented	.439**
E. Bathroom		
E3. Bathtubs	- floor, seats, grab bars, bathtub faucets, installation	.314*
E6. Layouts	- size, location, clearance	.414**
H. Indoor Common Area		
H3. Doors	- types, size, handle, width, maneuvering clearances	.451**
H4. Electric Equipment	- switches, electrical outlet controllers	.433**
H5. Windows	- size, height, frames, window locks	.471**
H6. Lights	- brightness, lamps, night lights	.468**
H7. Floors	- materials, finishes	.397**
H8. Walls	- wall finishes materials	.499**

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Significant/Weak Correlations between Living Environment and Desire to Age in Place ($0.0 < r \leq 0.3$, $p \leq .05$)

The significant and weak correlations represent *r*-values ranging between 0.0 and 0.3, and *p*-values at most 0.5. Two environmental items were related with the desire to age in place. An increase in adequate installations of ramps was related with an increase in desire of age in place ($r = .285$, $p \leq .05$, n = 51). Layout of kitchen also significantly related with desire to live in one's own home as long as possible ($r = .298$, $p \leq .05$, n = 51). These results are presented in Table 19.

Table 19

Significant and Weak Correlations between Living Environment and Desire to Age in Place ($0.0 < r \leq 0.3$, $p \leq .05$)

Living Environment Items Related with Desire to Age in Place		*r*
Items	**Descriptions**	
A. Accessible Routes		
A1. Ramps	- general, handrails, clear width, slope	.285*
D. Kitchen		
D9. Layouts	- size, location, clearance	.298*

*. Correlation is significant at the 0.05 level (2-tailed)

Results Summary

The results of descriptive analysis showed participants, with average age of 36, could be considered as facing old age. When it comes to assessment of independence, scoring values over mid value of 5 revealed the participants are relatively independent. Last, when it comes to desire to age in place, 63% of participants answered they wanted to continue their independent life in their own home as long as possible.

Through the correlation analysis, six significant and positive correlations have been identified between living environment and independence of people with ID. Five of them were associated with physical ability, one with psychosocial ability, but no living environmental items were significantly and positively related with cognitive ability. Also, 17 living environmental items were proven to have significant and positive relationship with desire of people with ID to age in place.

Discussion

The presented study sought to answer three research questions: what specific housing design standards are significant to promote independence of people with Intellectual Disabilities (ID)? what standards contribute most to their desire to age in place? and how can the identified standards be prioritized? Correlational analyses between people with ID and their living environment were conducted to answer the questions. As a result, the first question was answered that five items are correlated with independence of people with ID, especially their physical or psychosocial ability. For the second question, 17 items have been proven to have significant correlation with desire of people with ID to age in place. For the third question, the identified items are categorized into three levels, according to the strength of correlation. Table 20 presents the 5 and 17 living environmental items that contribute to independence or desire to age in place along with the strength levels.

Based on these findings, the chapter suggests housing design standards for people with ID. Also, the limitations and the needs of future studies have been discussed.

Table 20

Living Environments that Contribute to Independence/Desire to Age in Place

Living Environments that Contribute to Independence (5)			**Living Environments that Contribute to Desire to Age in Place (17)**		
Entrance	Storage spaces	.306*	Accessible routes	Ramps	.285*
	Clear width and maneuvering clearance	.316*	Entrance	General	.542**
Kitchen	Ranges	.327*	Kitchen	Appliances	.493**
	Layouts	.327*		Layouts	.298*
Indoor Common Area	Lights	.279*	Bathroom	Bathtubs	.314*
				Layouts	.414**
				Heating Systems	.536**
All identified environmental items that contribute to independence are correlated to physical ability. However, storage spaces of the entrance are also related with psychosocial ability (r = .480, $p \leq .01$, n = 51). Layouts of the kitchen and lights of the indoor common area have positive correlation with both independence and desire to age in place.			Bedroom	Beds	.543**
				Closets	.564**
				General	.566**
			Indoor Common Area	Doors	.451**
				Electric Equipment	.433**
				Windows	.471**
				Lights	.468**
				Floors	.397**
				Walls	.499**
				Furniture	.654**

Note. N = 51.
**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

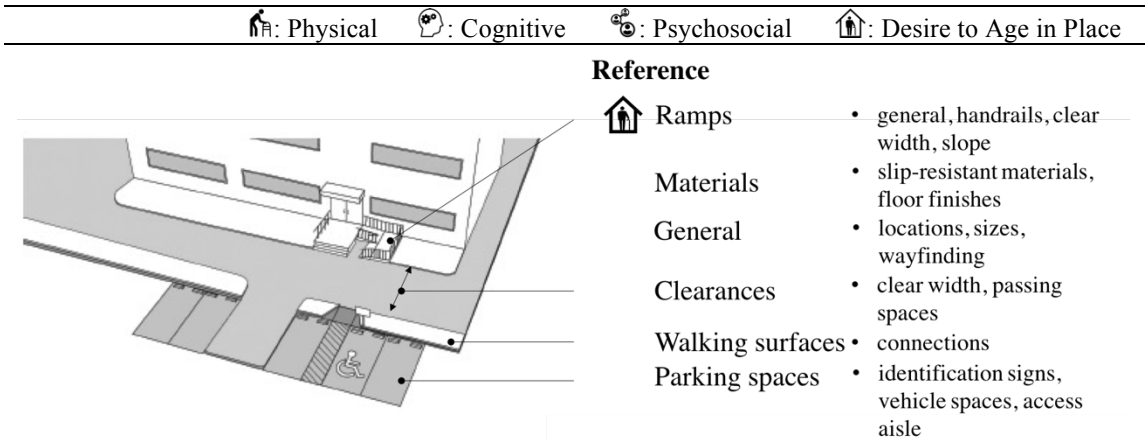
Recommendation

The housing design standards for people with Intellectual Disabilities (ID) are categorized at three levels: mandatory, recommended, and reference. The provided design standards have the same but re-organized items with currently existing housing design guidelines in South Korea; however, the suggested standards are different since the items are prioritized. The study has prioritized existing housing design standards for people with disabilities into three levels based on the correlational analysis: the mandatory items indicate standards that have significant, positive, and strong

correlations with independence of people with ID or their desire to age in place; the recommended items are those that have significant, positive, and moderate correlations; and the reference items are those that have significant, positive, and low correlations or don't have any significant relationship. Figures 12 to 19 illustrate mandatory, recommended, and reference housing design standards for people with ID according to domestic spaces: accessible route, entrance, living room, kitchen, bathroom, bedroom, laundry room, and indoor common areas.

Accessible routes

All six items were categorized as reference items: ramps, materials, general, clearances, walking spaces, and parking spaces. Among these six items, the ramps are the only item proven to have a relationship with desire to age in place (Figure 12).



Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Figure 12. Housing Design Guidelines for People with Intellectual Disabilities: Accessible Routes.

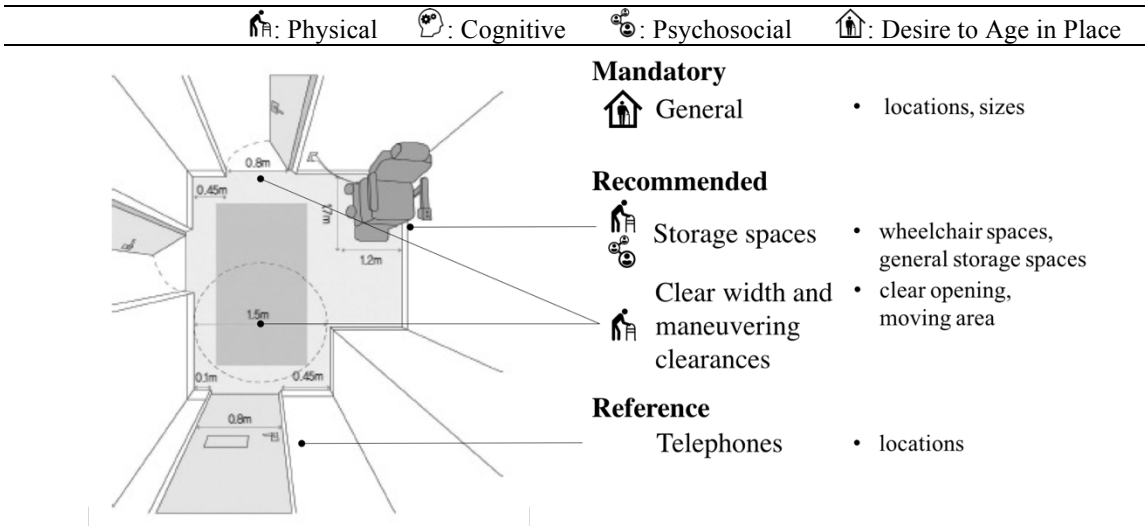
Ramps

The appropriate installation of ramps is related with the desire of people with ID to live in their current home as long as possible. The use of ramps is one of primary strategies to deal with changes in level and increase mobility. Current barrier-free

design guidelines require maximum slope from 1:12 to 1:18, recommend minimum width, and the use of handrails, slip-resident materials, roofs, and foot lights (I. Kim et al., 2011).

Entrance

Four items were categorized under this group and are as follows: general attributes of entrances as mandatory, storage spaces and clear width and maneuvering clearances as recommended, and the locations of telephones as reference (Figure 13).



Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Figure 13. Housing Design Guidelines for People with Intellectual Disabilities: Entrance.

General attribute

The locations and sizes of entrances are highly related with desire of people with ID to age in place. Appropriate location and size of entrances are encouraged in order to include enough storage spaces and areas for clear width and maneuvering clearances.

Storage spaces

The storage spaces are related with not only physical but also psychosocial ability of people with ID. The storage spaces include wheelchair spaces and general

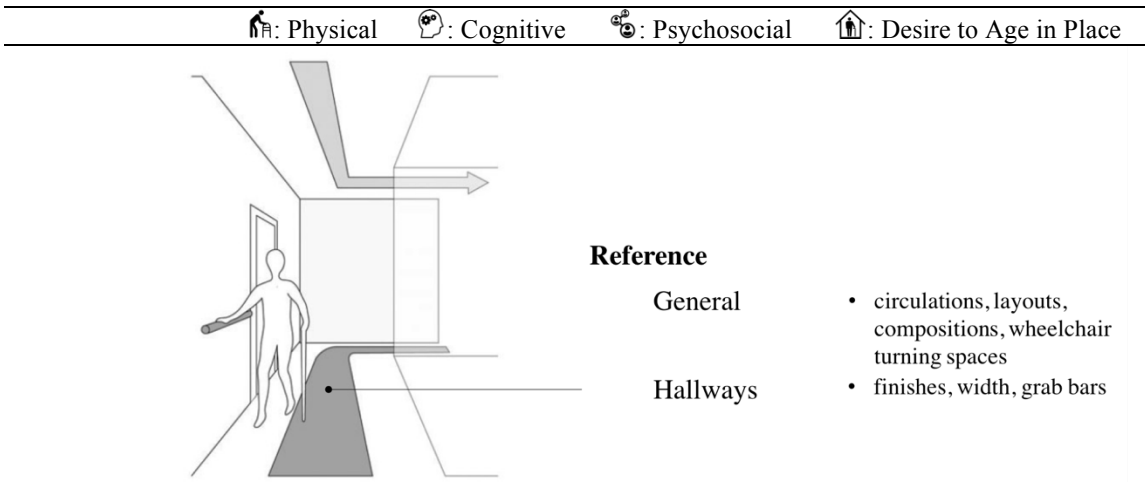
storage spaces for other items. This space is also recommended to be equipped with chairs or grab bars that help people with ID conduct daily activities, such as putting on and taking off shoes (I. Kim et al., 2011).

Clear width and maneuvering clearances

Sufficient moving area is recommended for doors since it has a positive correlation to the physical ability of people with ID. Minimum maneuvering clearances at doors vary depending on approach direction and types of door, however, it is essential to secure enough space for wheelchair users (I. Kim et al., 2011).

Living Room/ corridor

Two items in the living room and the connecting corridor were categorized as reference items: general attributes and hallways (Figure 14). No significant relationship is found between domestic environment items in the living room and the independence or desire of people with ID to age in place.

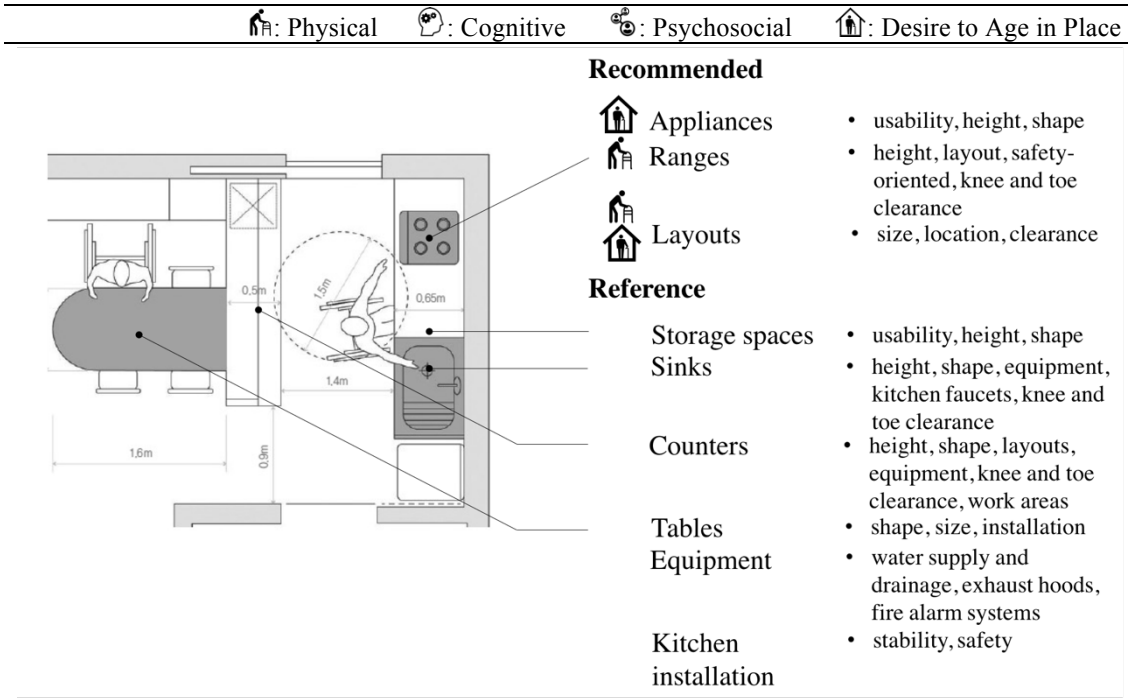


Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Figure 14. Housing Design Guidelines for People with Intellectual Disabilities: Living Room/ Corridor.

Kitchen

Three domestic environmental items in the kitchen were recognized as recommended items: appliances, ranges, and layouts (Figure 15). The kitchen has been the most desired area to be remodeled by disabled residents; however, the satisfaction after the renovation has been low due to the lack of information about the needs of people with ID (Kwon, Choi, & Ha, 2001).



Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Figure 15. Housing Design Guidelines for People with Intellectual Disabilities: Kitchen.

Appliances

Appliances are related with desire to age in place. The use of appliances, including microwaves, dishwasher, refrigerator and freezer, is relatively consistent even assuming the residents don't cook. All appliances are recommended to be located where users can reach and to be easy to handle. Especially, both refrigerator and freezer need to be easily reached (I. Kim et al., 2011).

Ranges

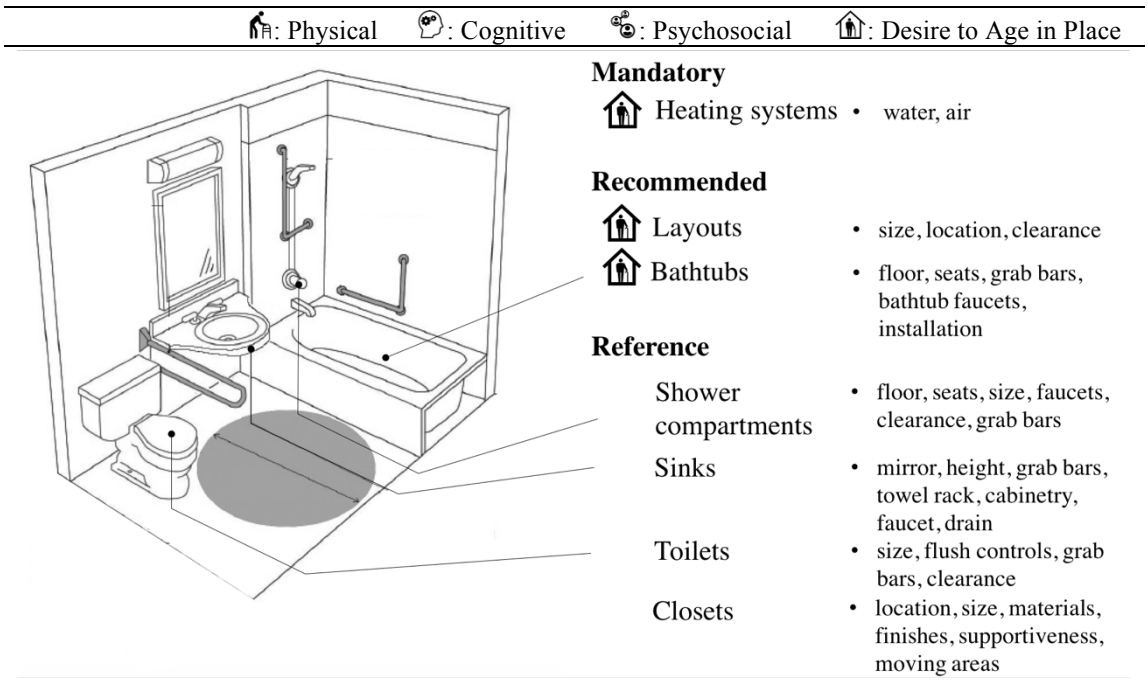
Safe, accessible ranges are positively correlated to the physical ability of people with ID. Safety is a primary factor to live independently. The use of fire is likely to cause accidents leading to burn injury, so electric ranges are recommended (I. Kim et al., 2011). The heights of ranges need to be the same with those of conjunct counters or sinks to make it easy to move heavy cooking ware (I. Kim et al., 2011).

Layouts

Appropriate layout of the kitchen positively influences not only physical ability but also desire to age in place. The types of layout include single line, L-shape, parallel, U-shape, island, etc. According to the activities in kitchen and dining area from preparing food to eating, the layout is recommended to be counters, sinks, ranges, and table, respectively (I. Kim et al., 2011). These features are encouraged to have the same appropriate height and the appropriate size to allow users to move the least (I. Kim et al., 2011; Oh, 2001).

Bathroom

Three items in bathroom were highlighted for people with ID: heating system as mandatory items, layouts and bathtubs as recommended items (Figure 16). The bathroom has been addressed as the most dissatisfied space by residents (Cho & Soh, 2010).



Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Figure 16. Housing Design Guidelines for People with Intellectual Disabilities: Bathroom

Heating systems

Heating system is highly related with desire to age in place. Current disabled residents asked the support of adequate heating system in bathroom (Oh, 2001). Maintaining appropriate water and air temperatures is significant to seniors since their temperature sensitivities are lessened (Christenson, 1990). Consistent temperature of bathroom with other indoor areas has advantages not only for users to make it easy to maintain body temperature but also to keep environment pleasant and free from mold or slippery surfaces (I. Kim et al., 2011).

Layouts

Layout of bathroom is related with desire to age in place. A majority of people with disabilities are dissatisfied with their living environment, and the most constraining

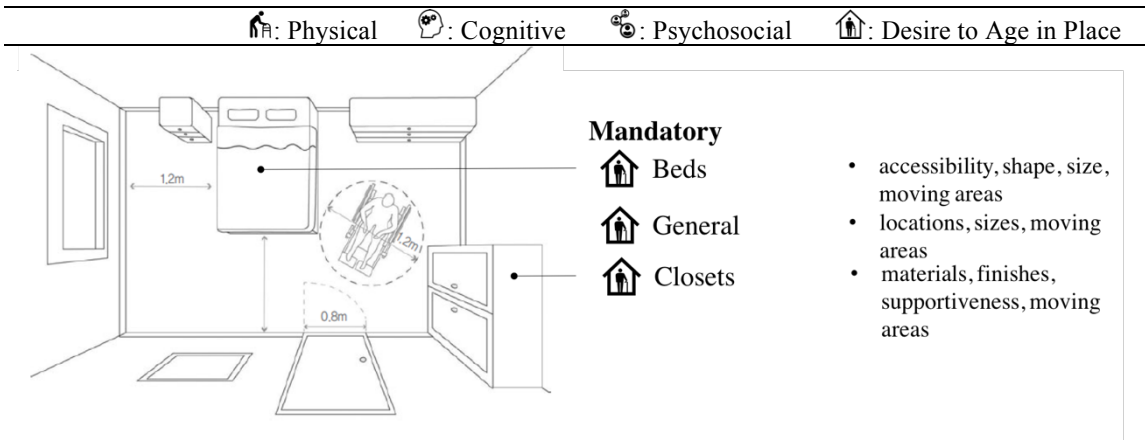
factor was the size of bathroom (Oh, 2001). Moving area with a minimum clear width of 1.2m is recommended (Oh, 2001).

Bathtubs

Appropriate bathtubs are positively correlated to desire to age in place. Previous studies reveal that people with disabilities identified the bathtub as the primary element needing renovation (G. Kim et al., 2009; Cho & Soh, 2010). Bathtubs can be made accessible and supportive by lowering heights and using additional chairs or grab bars (I. Kim et al., 2011).

Bedroom

All three items are categorized as mandatory items: beds, general attributes, and closets (Figure 17). Previous studies show disabled women tend to request to remodel their bedroom more than disabled men (Cho & Soh, 2010).



Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Figure 17. Housing Design Guidelines for People with Intellectual Disabilities: Bedroom.

Beds

Beds are strongly correlated to desire to age in place. Beds need to be designed considering appropriate height, size, and materials. Telephones, remote controllers, and

alarms are encouraged to be near the bed area for people who have limited mobility (I. Kim et al., 2011).

General attributes

Proper size and location of the bedroom is highly correlated with desire to age in place. The size of the bedroom is encouraged to have moving areas (at least 1.2m*1.2m) without any barriers to allow access for wheelchair users (I. Kim et al., 2011). The location of the bedroom is recommended to be proximate with other functional rooms like the bathroom (I. Kim et al., 2011).

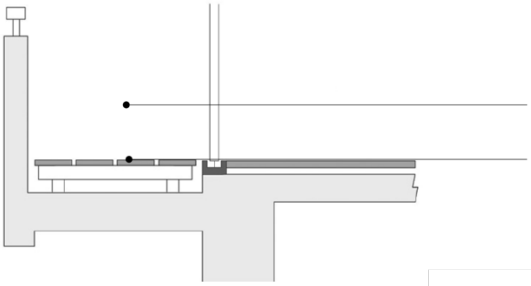
Closets

Closets are also thoroughly correlated with desire to age in place. All objects in closets need to be within reaching area (I. Kim et al., 2011). Some indicators or transparent materials of drawers or containers can improve the cognitive ability of people with ID to discern objects inside the closet (Hazen & McCree, 2001).

Laundry room

All four items are categorized as reference items: general attributes, work spaces, materials, and layouts (Figure 18). There is no significant correlation between items in laundry room and independence or desire of people with ID.

: Physical : Cognitive : Psychosocial : Desire to Age in Place



Reference

General	• locations, sizes, moving areas
Work spaces	• washing machines, dryers
Materials	• electrical outlets, floor finishes
Layouts	• furniture, equipment, working area

Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

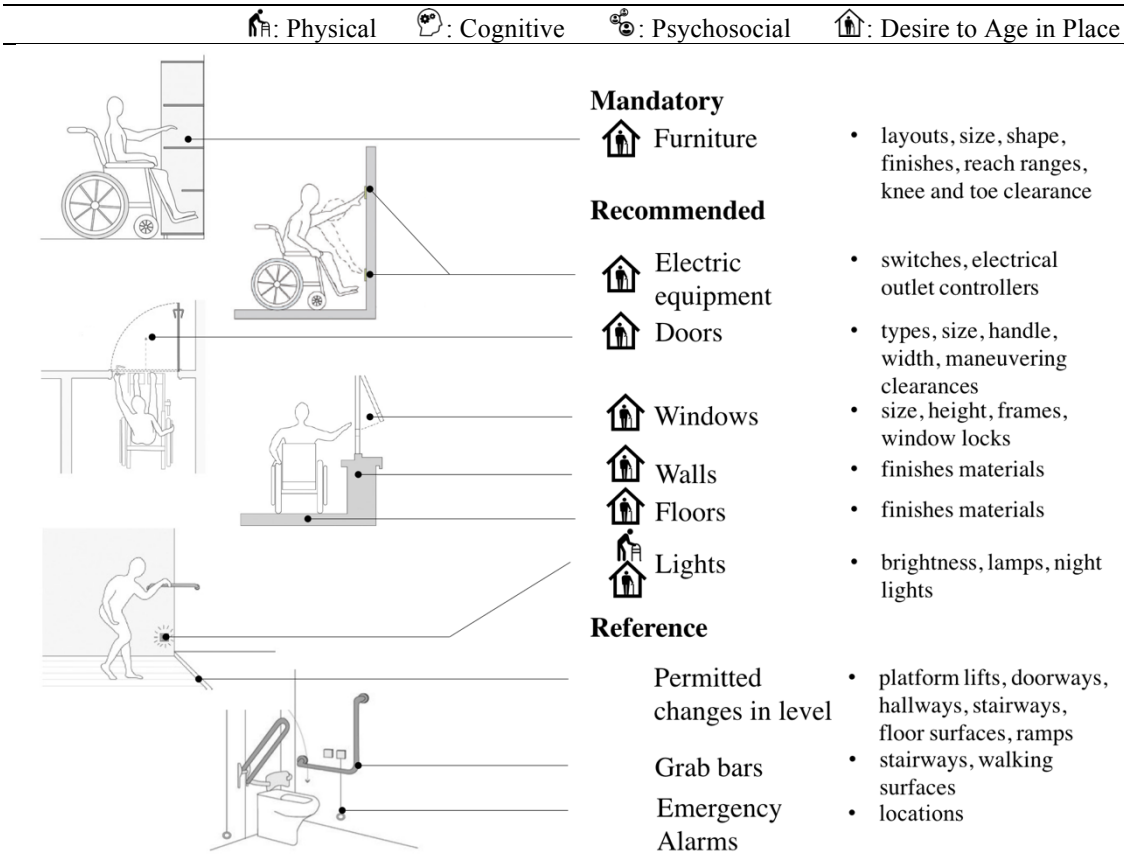
Figure 18. Housing Design Guidelines for People with Intellectual Disabilities: Laundry Room.

Indoor common area

Among ten items, the following items have been emphasized as mandatory or recommended items; to be specific, the mandatory item is furniture, and recommended items include electric equipment, doors, windows, walls, floors, and lights (Figure 19).

Furniture

Furniture is highly correlated with desire to age in place. People are likely to use furniture to express personal taste and characteristics, and this activity increases satisfaction of life (Cox, 2016). Not only for users' basic safety, but also for their improved quality of life, furniture plays a primary role. Also, it is required to be accessible and useful through appropriate size, shape, materials, and knee and toe clearance (I. Kim et al., 2011).



Adapted from "Barrier-free Housing Guideline", by Kim et al., 2011*, Korea Disabled People's Development Institute.*

Figure 19. Housing Design Guidelines for People with Intellectual Disabilities: Indoor Common Area.

Electric equipment

Electric equipment is correlated with desire to age in place. Inappropriate location of outlets and switches can bother residents' independence (Kwon et al., 2001; Oh, 2001). It is also important to secure safety by using non-conducting materials (I. Kim et al., 2011).

Doors

Doors are correlated with desire to age in place. Door design needs to include clear width, maneuvering clearance, and adequate handles (I. Kim et al., 2011). Signage on the door should be easy to discern and is recommended to use figures or shapes,

rather than numbers or letters. Also, automatic door locks have been proven to improve the satisfaction of the domestic environment (Cho & Soh, 2010).

Windows

Windows were correlated with desire to age in place. Windows are important as a connector to outdoor environment. Frequent direct or indirect contact with the outdoor environment positively influences the physical and mental health of the elderly (Folden, 1990; Shimada et al., 2010). The following factors should be considered when installing windows: locations, heights, sizes, window locks, and frames.

Walls

Walls are correlated with desire to age in place. The opportunity for interaction with diverse texture stimulate senior's tactile perception and delay the aging process (Hazen & McCree, 2001). Apparent changes in color or pattern in different rooms will help cognitive awareness of people with ID (I. Kim et al., 2011).

Floors

Floors are correlated with desire to age in place. Materials of floors are encouraged to be slip-resident and easy to clean (I. Kim et al., 2011). Inadequate floor surface was one of the major barriers to independent living. Nonslip floor in the bathroom was especially significant in preventing accidents of falling (Kwon et al., 2001; Oh, 2001).

Lights

Lights are correlated with not only physical ability but also desire to age in place. Elderly people with ID experience changes in sight. It is necessary to provide evenly distributed and adequate brightness. Night lights or motion-sensitive lights can

increase visual orientation (Hazen & McCree, 2001). Also, remote-controlled lights are proven to improve the satisfaction of living in the current house (Cho & Soh, 2010).

Limitations and future study

This study has offered knowledge pertaining to the contribution of environmental factors on lifestyles or behaviors. Besides the academic advantages, this study is also expected to bring practical benefits, for instance, in creating a domestic environment that fits unique needs of elderly people with Intellectual Disabilities (ID) and supports their independent life, in bringing better outcomes of governmental practices of developing and remodeling housing for people with ID, and in increasing the opportunity for people with ID to age in place. However, this study needs improvements and support by additional studies. In the next section, limitations of this study and direction to future study are discussed in terms of research scope, sample, method, and analysis of this study.

Research scope

Other factors but the current housing design standard items can influence independence or desire to age in place. This study set the independent variables as items in current housing design standard items. Current housing design guidelines respond relatively well to users' physical needs. It might be because the decline in physical function is a universal experience for elderly people, including elderly people with Intellectual Disabilities (ID). The current housing design guidelines can be a good baseline for a housing design guideline for people with ID in terms of users' safety and convenience. However, current housing design guidelines are rarely related with users' cognitive or psychosocial needs. It might be because the difficulties in mental

performance are more severe for people with ID than for intellectually abled people. Therefore, the environmental factors excluded in the current design standards, such as colors, indicators, or social-gathering spaces, as well as non-environmental factors that can positively influence independence or desire to age in place, like financial costs, social class, or genders, should be further explored.

The domestic environment and the community environment should cooperate for users' psychosocial needs and higher satisfaction in their lives. This study has focused only on the domestic environmental factors. However, when people's physical and safety needs are fulfilled, they are likely to require a higher level of needs, such as a feeling of belonging, respect, or self-esteem. At domestic levels, resources like social interactions that promote these feelings are limited. Thus, future studies should explore the programs or services at the community level associated with the concept of aging in place to support intellectually disabled individuals' higher needs.

Sample

The study has limitation in sample size and its characteristics. The determined sample size of 51 is relatively small, but the number is proven to be statistically significant to generalize the outcomes. To increase the reliability and validity of the study, increased sample size will be useful to represent total elderly population with ID. When it comes to the characteristics of sample, the mean age of 36 can be interpreted as those facing old age, but still younger to represent the targeted population. Also, the proportion of male participants (84%) to female participants (16%) shows quite identifiable gaps. When assuming there might be differences between male and female,

this study might tend to represent males' lifestyles or preferences. Further studies are required to discuss on gender differences.

Method

The use of a 0 to 10 scoring scale showed limitations in providing diverse survey responses. This study has used a 0 to 10 scoring scale to assess the participants' level of independence and their living environments. It has been expected that an 11-point scale would yield more diverse responses than a 5-point or a 7-point scoring scale. However, respondents are likely to limit two or three scores to evaluate the items. For example, the respondents only used the values '0', '5', and '10', or '0', and '10' in evaluating items. The reasons why the respondents used 2- or 3-value scoring scale might be because the 51 living environmental variables that the participants are required to answer were relatively subjective; also, the participants might have felt overwhelmed by the number of questions. To create better outcomes, subjective and abstract items need to be translated into objective and concrete items, or the number of questions could be minimized by narrowing down the research scope.

Indirect measures by caregivers can be doubtable. Indirect measures are used when direct measures of the outcome are unobservable or unavailable. Some researchers have cast doubt on the reliability of indirect measures, particularly when measuring residents' preferences (Voelker et al., 1990; Stancliffe, 1995; Perry & Felce, 2003). Meanwhile, other researchers are supportive for indirect measure (Schalock & Keith, 1993; McVilley et al., 2000). For instance, Schalock and Verdugo (2002) mentioned “the measurement of one’s life from another person’s perspective might be useful in some instances, such as where people are not able to speak for themselves and

others make life decisions on their behalf, but such measurements should be clearly identified as another person's perspective" (2002, p.271). In the study, caregivers might have difficulties in evaluating independence of people with ID or their desire to age in place since it is hard to actually know people's personal experiences. People with ID have limitations in communication, so caregivers who have known them for sufficient time can be the best people to represent the participants. If possible, it is encouraged to develop methods to reduce the gaps between thoughts of caregivers and those of people with ID.

Analysis

Future investigation is required for the negative correlations in order to identify which specific standards bother independent life or desire to age in place. This study has explained the significant and positive correlations between the living environment of people with ID and their independence or desire to age in place. However, the results of correlation analysis include significant and negative correlations as well (Table 14). Figure 20 is an example of the negative correlation between the appliances in the kitchen and cognitive ability of people with ID. Those items can be interpreted as factors that have negative impacts on independence of people with ID or desire to age in place. Otherwise, there are possibilities that the negative correlations were caused by the respondents' bias; to be specific, caregivers might want to present a living environment provided by their organization favorably, while they tend to underestimate functional status of people with ID. Further investigation on negative relationships between people with ID and their environment are encouraged.

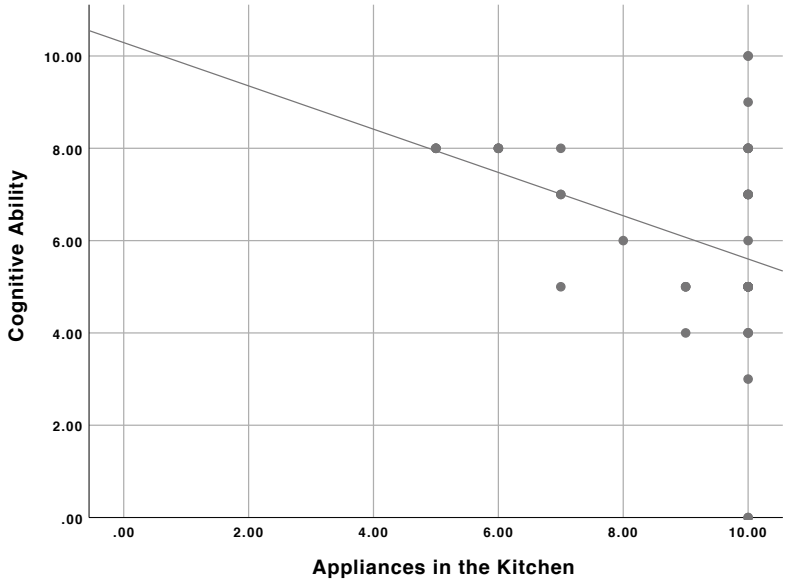


Figure 20. Example of Negative Correlation.

Quantitative research method provides weak foundation for explaining why. This quantitative correlational study identified the domestic environmental factors that positively impact on lifestyles and behaviors of people with ID. However, these results don't explain why these factors are significant. Therefore, qualitative phenomenological study using interviews of people with ID, or their caregivers, may offer further insight into housing design factors with plausible reasons.

Discussion Summary

The correlational study has provided supportive evidence for the research's hypothesis that several specific environmental settings might positively influence independence of people with Intellectual Disabilities (ID) as well as their desire to age in place. The study has identified 20 domestic environmental factors that can be prioritized in designing housing for people with Intellectual Disabilities (ID) in order to have a positive impact toward their independence or desire to age in place.

The study's result is meaningful because it contributes to academic knowledge pertaining to the relationship between environmental attributes and human behaviors. Not only the theoretical consequences, but the study also brings practical advantages in developing a pleasant domestic environment for people with ID. The recommended housing design standards are deviate from currently existing housing design guidelines in prioritizing the items for independence or preference of people with ID. Public or private service providers will benefit when determining the primary items in designing or remodeling housing for people with ID with limited resources. Furthermore, people with ID are expected to show increased satisfaction with their homes and have more opportunity to age in place. However, the study has some limitations in scopes due to the possibilities of other unknown factors, sample size and its characteristics, different methodologies regarding scoring scale and indirect measures, and analysis due to lack of explanations on negative correlations and alternative understandings.

The relationship between environment and human behavior still needs to be investigated to create positive built-environment. The focus on the group of elderly people with ID may seem a small portion of diverse population groups, but the growing number of these population and accordingly increased demands reveals the necessity. The study seeks to provide baseline to maximize their autonomy and cultivate their virtue. Further studies are also imperative to continue to understand a variety of population in need and their environment.

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Appendix A: Housing Design Guideline Contents

Table A. Current Housing Design Guideline Contents in South Korea

A. Accessible Routes	
1	Ramps: General, Handrails, Clear Width, Slope
2	Floor and Ground Surfaces: (Slip-resistant) Materials, Floor Finishes
3	Accessible Routes: General, Wayfinding, Clear Width
4	Doors, Doorways, and Gates: Features, Types, Maneuvering clearances, Handles, Operable parts
5	Permitted Changes in Level: Hallways, Stairways, Floor or Ground surfaces
6	Handrails: Stairways, Walking Surfaces
7	Clearances: Clear Width, Passing Spaces
8	Parking Spaces: Identification signs, Vehicle Spaces, Access Aisle
9	Walking Surfaces
10	Lights: Brightness, Footlights
B. Entrance	
1	Doors, Doorways, and Gates: Clear Width of Doorways, Handles, Operable parts
2	Permitted Changes in Level: Platform Lifts, Stairways/Floor Surfaces/Ramps
3	Clear Width and Maneuvering clearances
4	Furniture: Chairs, Closet
5	Storage Spaces: Wheelchair Spaces, General Storage Spaces
6	General
7	Location of Telephones
8	Lights: Brightness, Footlights
9	Floor: Surfaces Slip-resistant Materials
10	Wall: Installation, Wall Finishes Materials
11	Grab Bars
C. Living Room/Corridor	
1	Electric Equipment: Location of Remote control/Light Switches/ Electrical Outlet, Telephone, Fire Alarm Systems, Assistive Listening Systems, Automatic Teller Machines
2	Furniture: General, Layout, Finishes, Closet, Chairs, Desks, Reach Ranges, Knee and Toe Clearance
3	Permitted Changes in Level: Doorways, Hallways, Floor or Ground surfaces, Ramps, Platform Lifts
4	Lights: Brightness, Footlights
5	Doors: Materials, Finishes, Size
6	Grab Bars: Installation
7	Hallways: Finishes, Width, Grab Bars
8	Windows: Height/Frames/Handles, Installation
9	Floor: Finishes
10	General: Circulation, Layout, Composition, Wheelchair Turning Space
D. Kitchen	
1	Storage Spaces: Usability, Height, Shape
2	Sink: Height, Shape, Equipment, Kitchen Faucets, Knee and Toe Clearance

3	Range or Cooktop: Height, Layout, Safety-oriented, Knee and Toe Clearance
4	Electric Equipment: Switches, Electrical Outlet Controllers
5	Counters: Height, Shapes, Layout, Equipment, Knee and Toe Clearance, Work Areas
6	Kitchen Installation
7	Equipment: Water Supply and Drainage, Exhaust Hood, Fire Alarm Systems
8	Appliances: Refrigerator/Freezer, Safety-oriented
9	Clear Floor: Floor Finishes Materials
10	Layout
11	Lights: Brightness, Footlights, Lamps
12	Table: Shape and Size, Installation
E. Bathroom/Toilet	
1	Bathtubs: Floor, Seats, Grab Bars, Bathtub Faucets, Installation
2	Toilet: Size, Flush Controls, Grab Bars, Clearance
3	Shower Compartments: Floor, Seats, Size and Clearance, Grab Bars, Closet, Faucets
4	Sink: Mirrors, Height, Grab Bars, Towel Rack, Cabinetry, Faucets, Drain Kit
5	Floor: Permitted Changes in Level, Material
6	Doors: Types, Size, Handle, Width
7	Layout: Size, Location, Clearance
8	Lights: Brightness, Sensor, Lamps
9	Heating System
10	Emergency Alarm
11	Closet
F. Bedroom	
1	Closet: Materials, Finishes, Supportiveness, Moving Area
2	Doors: Types, Handle, Safety, Accessibility
3	Beds: Accessibility, Shape, Size, Moving Area
4	Windows: Size, Height, Frame, Window Lock
5	General: Supportiveness, Size, Location, Moving Area
6	Electric Equipment: Switches, Electrical Outlet
7	Lights: Brightness, Lamps
8	Desks, Tables: Size, Shape
9	Floor: Materials, Finishes
G. Laundry	
1	Work Space: Washing Machines, Dryers
2	Location
3	Materials and Finishes: Floor, Electrical Outlet
4	Permitted Change of Level
5	Balcony
6	Windows: Window Lock, Size, Height, Accessibility
H. Unity Room	
1	General: Accessibility, Closets
I. Indoor Common Area	
1	Electric Equipment

2	Floors
3	Furniture
4	Permitted Change in Level
5	Grab Bars
6	Doors
7	Lights
8	Walls
9	Emergency Alarms

Note. The categories are written in decending order of the number of sub-categories. Adapted from Kim & Lee, 2015

Appendix B. Descriptive Statistics

Table B. Descriptive Statistics: Living Environment

Variables	Mean	Std. Dev.	Min.	Max.	N
A. Accessible Routes					
A1. Ramps	7.04	2.87	2	10	51
A2. Materials	7.18	2.67	3	10	51
A3. General	7.76	2.48	3	10	51
A4. Walking surfaces	7.61	2.27	4	10	51
A5. Parking spaces	6.29	3.26	0	10	51
A6. Clearances	7.31	2.38	4	10	51
B. Entrance					
B1. Storage spaces	4.98	3.51	0	10	51
B2. Clear width and maneuvering clearances	6.71	2.33	4	10	51
B3. Telephones	6.84	2.96	2	10	51
B4. General	7.90	2.05	4	10	51
C. Living Room/Corridor					
C1. General	6.75	2.20	3	10	51
C2. Hallways	7.22	2.57	1	10	51
D. Kitchen					
D1. Counters	7.89	1.63	5	10	51
D2. Equipment	8.14	1.79	5	10	51
D3. Sinks	8.31	1.83	5	10	51
D4. Ranges	8.10	2.16	4	10	51
D5. Kitchen installation	8.22	1.86	5	10	51
D6. Tables	7.67	2.09	4	10	51
D7. Storage spaces	8.14	1.94	5	10	51
D8. Appliances	8.94	1.74	5	10	51
D9. Layouts	8.08	1.92	5	10	51
E. Bathroom/ Toilet					
E1. Shower compartments	7.78	1.90	5	10	51
E2. Closets	7.49	2.83	0	10	51
E3. Bathtubs	5.73	2.70	0	10	51
E4. Toilets	7.84	1.91	5	10	51
E5. Sinks	7.49	2.25	5	10	51
E6. Layouts	8.41	1.81	5	10	51
E7. Heating systems	8.10	2.00	5	10	51
F. Bedroom					
F1. Beds	7.76	2.44	0	10	51
F2. General	8.02	2.09	4	10	51
F3. Closets	8.02	1.97	5	10	51
G. Laundry Room					
G1. Work spaces	7.20	2.08	4	10	51
G2. Materials	7.25	2.10	5	10	51

G3. Layouts	5.49	3.04	0	10	51
G4. General	6.90	2.01	4	10	51
H. Indoor Common Area					
H1. Grab bars	7.53	2.86	0	10	51
H2. Permitted changes in level	5.67	3.21	0	10	51
H3. Doors	7.53	2.69	2	10	51
H4. Electric equipment	7.67	2.53	3	10	51
H5. Windows	7.16	3.02	2	10	51
H6. Lights	7.63	2.44	4	10	51
H7. Floors	7.57	2.61	3	10	51
H8. Walls	8.10	2.44	3	10	51
H9. Furniture	7.76	2.07	5	10	51
H10. Emergency Alarms	3.55	4.24	0	10	51

Appendix C: Correlational Statistics

Table C. Correlation between living environment and independence/desire to age in place

Variables	Desire to Age in Place	Independence		
		Physical	Cognitive	Psychosocial
A. Accessible Routes				
A1. Ramps	**.285***	-.071	-.288*	-.532**
A2. Materials	.106	-047	-.196	-.440**
A3. General	-.107	-.123	.015	-.391**
A4. Walking surfaces	-.188	-.290*	-.098	-.426**
A5. Parking spaces	.164	-.135	-.233	-.365**
A6. Clearances	.255	.035	-.162	-.435**
B. Entrance				
B1. Storage spaces	-.315*	**.306***	.181	**.480****
B2. Clear width and maneuvering clearances	.122	**.316***	-.110	.103
B3. Telephones	-.047	.260	-.118	.062
B4. General	**.542****	-.023	-.441**	-.224
C. Living Room/Corridor				
C1. General	.125	.023	.027	-.160
C2. Hallways	.133	-.182	-.181	-.534**
D. Kitchen				
D1. Counters	-.072	.230	-.038	.011
D2. Equipment	-.027	.117	-.272	-.141
D3. Sinks	-.080	.210	-.098	-.038
D4. Ranges	.004	**.327***	-.002	.006
D5. Kitchen installation	-.201	.167	-.079	-.072
D6. Tables	.016	.222	-.181	.001
D7. Storage spaces	.004	.160	-.272	-.101
D8. Appliances	**.439****	.095	-.356*	-.244
D9. Layouts	**.298***	**.327***	-.059	.059
E. Bathroom/ Toilet				
E1. Shower compartments	-.001	.180	-.234	.014
E2. Closets	.105	.125	-.004	.111
E3. Bathtubs	**.314***	-.223	-.458**	-.386**
E4. Toilets	-.051	.242	-.198	.081
E5. Sinks	-.007	.248	-.195	.097
E6. Layouts	**.414****	.142	-.444**	-.258
E7. Heating systems	**.536****	.209	-.530**	-.307*
F. Bedroom				
F1. Beds	**.543****	-.084	-.374**	-.194
F2. General	**.566****	.103	-.405**	-.265
F3. Closets	**.564****	.070	-.411**	**-.278***

G. Laundry Room				
G1. Work spaces	.140	-.205	-.287*	-.362**
G2. Materials	.093	.062	-.102	-.230
G3. Layouts	.261	.017	-.160	-.140
G4. General	.134	-.070	-.280*	-.384**
H. Indoor Common Area				
H1. Grab bars	.247	-.027	-.048	-.426**
H2. Permitted changes in level	.047	-.260	-.087	-.304*
H3. Doors	**.451****	.260	-.385**	-.128
H4. Electric equipment	**.433****	.212	-.417**	-.148
H5. Windows	**.471****	.106	-.448**	-.139
H6. Lights	**.468****	**.279***	-.387**	-.155
H7. Floors	**.397****	.208	-.367**	-.154
H8. Walls	**.499****	.172	-.358**	-.264
H9. Furniture	**.654****	.070	-.411**	-278*
H10. Emergency Alarms	-.001	.180	-.234	.014

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)
N = 51

Appendix D: Informed Consent Form for Social Science Research

D.1.English Version

Online Consent to Participate in Research

Would you like to be involved in research at the University of Oklahoma?

I am Yeji Yi from the College of Architecture and I invite you to participate in my research project entitled "*Housing Design Standards for the Aging in Place for People with Intellectual Disabilities*". This research is being conducted at assisted living homes for people with intellectual disabilities in South Korea. You were selected as a possible participant because you are a caregiver who knows people with intellectual disabilities well and caring for people with intellectual disabilities living in assisted living homes. You must be at least 18 years of age to participate in this study.

Please read this document and contact me to ask any questions that you may have BEFORE agreeing to take part in my research.

What is the purpose of this research? The purpose of this research is to provide housing design guidelines for aged people with intellectual disabilities.

How many participants will be in this research? About 240 caregivers for people with intellectual disabilities will take part in this research.

What will I be asked to do? If you agree to be in this research, you will be asked to (1) rate the people with intellectual disabilities' level of independence at home, (2) rate their desire of aging in place in current home, and (3) rate current group home in which the people with intellectual disabilities are living in.

How long will this take? Your participation in the online survey will take 10-15 minutes.

What are the risks and/or benefits if I participate? There are no risks from being in this research. This study will contribute to creating living environment that responds to people with intellectual disabilities' needs and support their independent life.

Will I be compensated for participating? You will not be reimbursed for your time and participation in this research.

Who will see my information? In research reports, there will be no information that will make it possible to identify you. Research records will be stored securely and only approved researchers and the OU Institutional Review Board will have access to the records.

Data are collected via an online survey system that has its own privacy and security policies for keeping your information confidential. Please note no

assurance can be made as to the use of the data you provide for purposes other than this research.

Do I have to participate? No. If you do not participate, you will not be penalized or lose benefits or services unrelated to the research. If you decide to participate, you don't have to answer any question and can stop participating at any time.

Who do I contact with questions, concerns or complaints? If you have questions, concerns or complaints about the research or have experienced a research-related injury, contact me at

Yeji Yi- Phone: +82-9252-9160, Email: yeji.yi@ou.edu

Professor David Boeck- Work: +1(405) 325-2266, Email: dlb@ou.edu

You can also contact the University of Oklahoma – Norman Campus Institutional Review Board (OU-NC IRB) at 405-325-8110 or irb@ou.edu if you have questions about your rights as a research participant, concerns, or complaints about the research and wish to talk to someone other than the researcher(s) or if you cannot reach the researcher(s).

Please print this document for your records. By providing information to the researcher(s), I am agreeing to participate in this research.

○ I agree to participate
https://ousurvey.qualtrics.com/jfe/form/SV_6QXstKmd0hulcQR

○ I do not want to participate http://www.shako.net/yeji/rl/

This research has been approved by the University of Oklahoma, Norman Campus IRB.

IRB Number: 8455 **Approval date:** 09/11/2017

D.2.Korean Version

연구 참여를 위한 온라인 동의서

안녕하세요? 미국 오클라호마 대학교 건축대학에 재학중인 이예지입니다. "지적장애인의 에이징 인 플레이스*를 위한 주거디자인 가이드라인 연구" 라는 연구를 진행중입니다. (*지적장애인들이 원한다면 현재 거주중인 곳에서 독립적으로 노후에 살 수 있도록 돕는 개념). 지적 장애인에 대한 지식이 풍부하며, 현재 지적장애인을 돌보고 있는 분을 대상으로 설문을 부탁 드리고자 합니다. 설문 응답 연령은 만 18 세 이상입니다.

이 문서를 보시고 문의사항이 있으시면 연구에 참여하시기 전에 연락 주시기 바랍니다.

연구 목적: 고령 지적장애인을 위한 주택 설계 가이드라인 제공 입니다

연구 참가자 수: 그룹홈에 거주 중인 지적장애의 보호자 240 분이 참여할 예정입니다.

질문 받으실 내용: 이 연구에 동의하시면 (1) 함께 거주 중인 지적장애인의 독립성 정도에 대한 평가, (2) 그분들이 노후에도 현재 거주하는 곳에서 살기를 희망하는 정도에 대한 평가, (3) 현재 거주 중인 거주 환경에 대한 평가를 하게 될 것입니다.

예상 소요시간: 온라인 설문 조사는 10-15 분이 소요됩니다.

연구 참여에 대한 불이익 / 이익: 이 연구는 참여에 대한 불이익이 없습니다. 이 연구는 지적 장애인의 요구에 부응하고, 그들의 독립생활을 지원하는 생활환경을 조성하는 데 기여할 것입니다.

연구 참여에 대한 보상: 이 연구 참여에 따른 귀하의 시간과 노력은 금전의 형태로 상환되지 않습니다.

연구 기록에 대한 열람: 연구 기록에는 귀하를 식별할 수 있는 정보가 없습니다. 연구 기록은 안전하게 보관되며 승인 된 연구원과 오클라호마대학교 검토위원회에서만 기록에 접근할 수 있습니다.

연구 기록은 귀하의 개인정보를 보호하기 위해 개인정보보호 및 보안 기능이 구현된 온라인 설문 조사 시스템에 저장됩니다. 이 연구 이외의 목적으로 귀하가 제공한 데이터의 사용에 관해서는 어떠한 보증도 할 수 없습니다.

필수 참여 여부: 반드시 참여하시지 않으셔도 됩니다. 이 연구에 참여하지 않는 것에 따른 어떤 불이익도 발생하지 않습니다. 참여하기로 결정한 후에도 반드시 질문에 답할 필요가 없으며, 언제든지 참여를 중단할 수 있습니다.

문의사항, 불편신고: 연구에 대한 문의사항이나 우려되는 부분, 또는 보완해야 할 사항이 있거나 또는 연구와 관련해 상해가 발생한 경우는 다음의 연락처로 연락 바랍니다.

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또한 연구 참여자로서의 귀하의 권리에 관한 질문, 우려 사항 또는 불만 사항에 대해 연구원이 아닌 다른 사람에게 이야기하고 싶거나 연구원에게 연락할 수 없는 경우 다음 연락처로 연락 바랍니다.

University of Oklahoma - Norman Campus Institutional Review Board (OU-NC IRB) / 전화번호: +1 (405) 325-8110 / 이메일: irb@ou.edu

이 연구는 오클라호마 대학교 Norman Campus IRB 의 승인을 받았습니다.

IRB Number: 8455 **Approval date: 09/11/2017**

Appendix E: Survey

E.1.English Version

Part 1. People with Intellectual Disabilities

Please answer the questions about people under your care, who have intellectual disabilities.

1. How many are people with intellectual disabilities sharing the current group home?

2. Please answer the general questions about people with intellectual disabilities who are living in this group home.

Questions	People with intellectual disabilities			
	1	2	3	4
2-1. Gender	M/F	M/F	M/F	M/F
2-2. Age				
2-3. How long has he/she lived in the current house?				
2-4. Does she/he want to live in current residence as long as possible?	Y/N	Y/N	Y/N	Y/N
2-5. Please rate people with intellectual disabilities' independent life at home (0: dependent ~ 100: independent)				
a. Physical Ability (transferring, walking or wheelchair, stair climbing, bathing, personal hygiene, dressing, self-feeding, toileting)				
b. Cognitive Ability (mental performance, free from memory loss, disorientation, running or wandering away)				
c. Psychosocial Ability (communication skills, relationship with others)				

Part 2. Living Environment

Please rate the current domestic environment, in which people with intellectual disabilities are living, in terms of each standard. * The following questions might be helpful in guiding your assessment: 'Is it supportive?', 'Is it adaptable?', 'Is it communicable?', 'Is it safety-oriented?', and 'Is it accessible?'

	Design standards and description	Rating (0: very poor ~ 5: average ~ 10: very good)
	A. Accessible Routes	
A1	**Ramps**: General, Handrails, Clear Width, Slope	
A2	**Floor and Ground Surfaces:** (Slip-resistant) Materials, Floor Finishes	
A3	**Walking Surfaces:** Continuity, Clearance	
A4	**Accessible Routes:** Location, Wayfinding, Clear Width	
A5	**Parking Spaces**: Identification signs, Vehicle Spaces, Access Aisle	
A6	**Clearances:** Clear Width, Walkways	
	B. Entrance	
B1	**Storage Spaces**: Wheelchair Spaces, General Storage Spaces	
B2	**Clear Width and** Maneuvering clearances	
B3	**Location of Telephones**	
B4	**General:** location, size	
	C. Living Room/ Corridor	
C1	**General**: Circulation, Layout, Composition, Wheelchair Turning Space	
C2	**Hallways**: Finishes, Width, Grab Bars	
	D. Kitchen	
D1	**Counters**: Height, Shapes, Layout, Equipment, Knee and Toe Clearance, Work Areas	
D2	**Equipment:** Water Supply and Drainage, Exhaust Hood, Fire Alarm Systems	
D3	**Sinks**: Height, Shape, Equipment, Kitchen Faucets, Knee and Toe Clearance	
D4	**Ranges or Cooktops**: Height, Layout, Safety-oriented, Knee and Toe Clearance	
D5	**Kitchen Installation**	
D6	**Tables:** Shape, Size, Installation	
D7	**Storage Spaces**: Usability, Height, Shape	
D8	**Appliances:** Refrigerator/Freezer, Safety-oriented	
D9	**Layouts:** Counters, Sinks, Ranges or Cooktops	

E. Bathroom/ Toilet		
E1	**Shower Compartments:** Floor, Seats, Size and Clearance, Grab Bars, Closet, Faucets	
E2	**Closets:** Size, Location	
E3	**Bathtubs**: Floor, Seats, Grab Bars, Bathtub Faucets, Installation	
E4	**Toilets**: Size, Flush Controls, Grab Bars, Clearance	
E5	**Sinks**: Mirrors, Height, Grab Bars, Towel Rack, Cabinetry, Faucets, Drain	
E6	**Layouts**: Size, Location, Moving Area	
E7	**Heating System**	
F. Bedroom		
F1	**Beds**: Accessibility, Shape, Size, Moving Areas	
F2	**General:** Supportiveness, Size, Location, Moving Areas	
F3	**Closets**: Materials, Finishes, Supportiveness, Moving Areas	
G. Laundry/ Balcony		
G1	**Work Space**: Washing Machines, Dryers	
G2	**Materials and Finishes**: Floor, Electrical Outlet	
G3	**Location of Balcony**	
G4	**Location of Laundry**	
H. General (Anywhere at home)		
H1	**Grab Bars**: Stairways, Walking Surfaces	
H2	**Permitted Changes in Level**: Platform Lifts, Doorways, Hallways, Stairways, Floor Surfaces, Ramps	
H3	**Doors**: Types, Size, Handle, Width**,** Maneuvering clearances	
H4	**Electric Equipment**: Switches, Electrical Outlet Controllers	
H5	**Windows**: Size, Height, Frame, Window Lock	
H6	**Lights:** Brightness, Lamps, Night Lights	
H7	**Floors**: Materials, Finishes	
H8	**Walls:** Materials, Finishes	
H9	**Furniture:** Locations, Size, Shapes, Finishes, Reaching areas, Knee and Toe Clearance	
H10	**Emergency Alarms**	

E.2.Korean Version

1. 지적장애인에 관한 질문

현재 귀하께서 돌보고 있는 지적장애인에 대한 질문입니다.

1. 현재 주거에 함께 살고 있는 지적장애인은 몇 명인가요?

2. 지적장애인에 관련된 일반적인 질문입니다.

질문	지적장애인			
	1	2	3	4
2-1. 성별	남/여	남/여	남/여	남/여
2-2. 나이				
2-3. 현재 주거에 거주한 기간을 적어주십시오.				
2-4. 노후에도 현재 주거에서 계속 거주하고 싶나요?	예 /아니오	예 /아니오	예 /아니오	예 /아니오
2-5. 지적장애인이 현재 주거에서 생활하는데 있어서의 독립성 정도를 평가해 주시기 바랍니다. (0= 비독립적 , 5= 평균, 10= 독립적)				
가. 신체 능력 (이동, 걷거나 휠체어 이용, 계단 오르기, 목욕하기, 개인 위생, 옷 갈아입기, 스스로 식사하기, 화장실 이용 등)				
나. 인지 능력 (지적 능력, 기억력, 방향감각, 길 찾기 등)				
다. 사회 능력 (커뮤니케이션 능력, 타인과의 관계 등)				

2. 거주 환경에 관한 질문

지적장애인이 거주하는 현재의 주거 환경을 각 항목에 따라 평가해 주십시오. (0= 열악함, 5= 평균, 10= 우수함) * 각 항목에 대해 다음 요소를 고려하여 평가하시기 바랍니다 '사용성(조작의 기능성, 편리성)이 좋은가?', '수용성(사용상의 융통성, 옵션 제공)이 좋은가?', '커뮤니케이션 효율성(단순, 직관적)이 있는가?', '안전한가?', '접근성(손에 닿기 좋은, 용이한 접근)이 좋은가?'

설계 기준 및 설명		평가 (0 = 열악함, 5 = 평균 10 = 우수함)
'주출입구까지의 접근로'에 관한 항목입니다.		
A1	경사로: 손잡이 유무, 유효폭, 기울기	
A2	재질과 마감: (미끄럼 방지) 재질, 바닥 마감 방법	
A3	보도: 연속성, 차도와 분리	
A4	접근로: 위치, 유도, 출입구폭	
A5	주차: 주차표시, 유효 공간, 보도와의 연결	
A6	유효폭: 너비, 걷는 공간	
B. '현관'에 관한 항목입니다.		
B1	수납공간: 휠체어 수납공간, 수납일반	
B2	유효폭 및 활동공간	
B3	인터폰 위치	
B4	현관 일반: 위치, 크기	
C. '거실 및 복도'에 관한 항목입니다.		
C1	일반: 동선, 배치, 구조, 휠체어 이동 공간	
C2	복도: 복도 마감재, 너비, 손잡이 설치	
D. '주방 및 식당'에 관한 항목입니다.		
D1	작업대: 높이, 형태, 배치순서, 부엌용품, 하부공간, 활동공간	
D2	설비: 급배수 시스템, 배기후드, 화재방지시스템	
D3	개수대: 높이, 형태, 부엌용품, 주방 수도꼭지, 하부공간	
D4	가열대: 높이, 배치순서, 안전성, 하부공간	
D5	부엌 설치	
D6	식탁: 형태, 크기, 설치일반	
D7	수납공간: 용이성, 높이, 형태	
D8	가전제품: 냉장고, 가전제품 안전성	

D9	준비대, 개수대, 작업대, 가열대 배치순서	
E. '화장실 및 욕실'에 관한 항목입니다.		
E1	샤워부스: 바닥, 보조의자, 크기 및 활동공간, 손잡이, 수납, 수도꼭지	
E2	수납장: 위치, 크기, 재질과 마감, 조작성, 활동공간	
E3	욕조: 바닥, 보조의자, 안전손잡이, 욕조샤워기	
E4	대변기: 형태, 물내리기, 안전손잡이, 활동공간	
E5	세면대: 거울, 높이, 안전손잡이, 수건걸이, 수납, 수전형태, 배수	
E6	배치: 크기, 위치, 활동공간	
E7	난방설비	
F. '침실'에 관한 항목입니다.		
F1	침대: 접근성, 형태, 크기, 활동공간	
F2	일반: 유용성, 크기, 위치, 활동공간	
F3	수납장: 위치, 크기, 재질과 마감, 조작성, 활동공간	
G. '베란다 및 세탁공간'에 관한 항목입니다.		
G1	세탁 공간: 건조대, 세탁기	
G2	재질과 마감: 바닥재질, 콘센트 재질	
G3	발코니 위치 및 크기	
G4	세탁 공간 위치 및 크기	
H. '주거공간 전체'에 해당하는 일반적인 항목입니다.		
H1	안전손잡이: 계단, 보행로	
H2	단차제거: 리프트 사용, 현관, 복도, 계단, 바닥표면, 경사로	
H3	문: 형태, 크기, 손잡이, 너비, 활동공간	
H4	전기설비: 스위치, 콘센트	
H5	창문: 크기, 높이, 창틀, 잠금장치	
H6	전등: 조도, 보조등, 야간등	
H7	바닥: 재질, 마감	
H8	벽: 재질, 마감	
H9	가구: 배치, 크기, 형태, 마감, 손 닿는 범위, 하부공간	
H10	비상벨: 위치	