ABSTRACT

WANG, XI. Optimize the Programming and Design of Assisted Living Facilities (Under the Direction of Dr. Jianxin Hu).

The changing demographics of the increasingly older U.S. population present both challenges and opportunities for urban planners, designers, architects and policy makers. In response to the increasing number of seniors who are no longer able to live on their own independently but do not require high levels of healthcare provided in a nursing home, the assisted living (AL) industry is expanding its market size in the past three decades. The overarching goal of this dissertation project is to develop programming and design strategies for promoting the success of AL businesses and enhancing the well-being of AL residents.

Study 1 focuses on conducting market demand analysis and facility scope estimation based on bed count. By applying multiple linear regression, age-specific population variables and percent of some college are in the final model developed in this study. The research findings support the hypothesis that demographic and socioeconomic factors jointly determine AL demands at the county-level and should be incorporated for senior living market prediction.

Study 2 & 3 aims to develop programming and design strategies for indoor public spaces of regular AL and special care units (SCUs), with the focus on space organization and circulation system. Four facilities in North Carolina are involved in this project as the case study sites. The researcher first conducts quantitative survey and observation by applying behavior mapping as the tool on each site. Then, built on the results of the quantitative methods and results, instruments for the qualitative interviews are developed and conducted. Design guidelines for regular AL and SCUs are then developed.
Optimize the Programming and Design of Assisted Living Facilities

by
Xi Wang

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APPROVED BY:

_______________________________  _________________________________
Jianxin Hu                   Art Rice
Committee Chair

_______________________________  _________________________________
Traci Rider                   Emily Griffith
DEDICATION

To My Parents, Wei and Charlotte
BIOGRAPHY

Xi grew up in Beijing, China. She got married to a sports marketing manager and a Kobe fan - Wei, and had their little baby Charlotte during her four years of Ph.D. study in the College of Design at North Carolina State University. Xi loves design. She received her Bachelor’s degree in Landscape Architecture from Beijing Forestry University in 2006 and her Masters in City and Metropolitan Planning from the University of Utah in 2010. Xi is interested in the areas of human behaviors and physical and sociological environment, people’s health and wellness, urban planning, and senior living community design.
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CHAPTER 1. INTRODUCTION

According to the recent projection from the U.S. Census Bureau, the oldest baby boomers - Americans born between 1946 and 1964 - will reshape America's population. Today, the number of Americans aged 65 and older is projected to more than double from 46 million to over 98 million by 2060, and this age group’s share of the total population will rise to nearly 24 percent from 15 percent (Figure 1.1) (Population Reference Bureau, 2016). The changing demographics of the increasingly older U.S. population present both challenges and opportunities for urban planners, designers, architects and policy makers.

Aging is taking place alongside decreasing health conditions that will affect the life experiences and living conditions of older people. A recent survey from National Council on Aging (2016) showed that 80 percent of senior population had at least one chronic disease, 68.4 percent of them had two or more, and 36.4 percent had four or more chronic conditions (Lochner & Cox 2013), such as hypertension (58%), arthritis (31%), depression (14%), and Alzheimer’s disease and dementia (11%). All of these health-related drawbacks can affect a person’s ability to perform their important daily living activities, restricting their engagement in life independently, and their enjoyment in their social lives.

Nowadays, a majority of older adults aged 65 and older are living at their own homes (AARP, 2011). Some seniors enjoy living independently near the city center where they can shop on foot easily and enjoy social gatherings as they desire. Some of them decide to age with their adult
children and grandchildren where they can not only stay in a home environment, experiencing family atmosphere, but also get assistances for their daily living. There is also an up trending of senior adults who choose relocating to planned multi-level retirement communities, congregate houses, or nursing homes based on their changing health conditions and needs.

1. Aging at Home

The aging U.S. population is fostering increased interest in community efforts to promote aging in place. Greenfield (2012) stated that “aging in place” refers to being able to remain in one’s current residence even when faced with increasing need for support because of life changes, such as declining health, widowhood, or loss of income. The home environment is acknowledged as being the primary context for growing old (Scheidt & Windley, 2006; Wahl & Gitlin, 2007), because older people prefer to age in place with familiar locations, people and surroundings (Frank, 2002). According to an AARP survey, nearly 90 percent of those over age 65 wanted to stay in their residence for as long as possible, and 80 percent believed their current residence was where they will always live (AARP, 2010). Yeo and Heshmati also argued that the preferred residential environment should be a place where seniors can feel stabilized and reside for a long period of time (2014).

However, the living experiences at home for the elderly are not always positive. Sixsmith and Sixsmith (2008) argued: “home can become a virtual prison or a tremendous burden; as people age, often with attendant health and functional capacity declines, managing a home environment can be problematic”. More specifically, they noted: “home in old age can be a place of negative experiences, such as isolation and loneliness… there are often significant weaknesses in terms of physical environment of the home and neighborhood, informal support, and social isolation (such as less visiting friends or attending or hosting social events), which undermine the senior’s ability to live independently.” (p. 219). Furthermore, physical and emotional stresses, and isolation are risk factors for depression, declining physical health, decreased quality of life, and uncontrolled physical environment conditions, all of which can limit the ability of older adults to age well in place. Therefore, it is important for the elderly to age in a residential environment where they can manage their lives, while being provided with physical facilities, amenities, formal supports and social services as needed in existing residential areas.
2. Aging in Planned Senior Communities

People always choose their own aging transition process, living arrangements, and long-term care services based on their physical abilities, wealth, leisure, and preferences. Aging in home settings with home care services was once the only option available in the U.S. other than institutionalization for almost 50 years in 19th century (AARP, 1993). Although the elderly prefer to age in place, many alternative senior living residences and facilities with multi-level services have become available. In the past three decades, the senior living industry has expanded and diversified in order to address the demographic changes. A series of new and matured models of senior living communities have emerged, ranging from independent living (IL) for independent and active older adults, assisted living (AL) for individuals needing assistance with two or more activities of daily living (some facilities involve special units for Alzheimer’s memory care and dementia), and skilled nursing home (NH) for individuals who need a higher degree of medical and round-the-clock personal care (Campbell, 2015). In addition, seniors can sign a long-term contract with a continuing care retirement community (CCRC), which offers at least three levels of care (IL, AL, NH), allowing them to age on the same campus (Figure 1.2).

![Figure 1.2 Aging Transition Processes.](image-url)
As one of the fastest-growing options for long-term care in the United States, AL has become increasingly appealing to investors, consumers, care providers, and advocates. Residents often enter an AL facility because their home has accessible obstacles, and provides little physical support for disabilities (Brummett, 1997). In response to the increasing number of seniors who are no longer able to live on their own independently but do not require high levels of healthcare provided in a nursing home, the AL industry is expanding its market size in the past three decades. Throughout the 1990s, AL was the most rapidly growing form of senior housing in the industry (Hawes, Phillips, Rose, Holan, & Sherman, 2003). There were an estimated 11,459 AL facilities nationwide, with approximately 611,300 beds and 521,500 residents, as of the beginning of 1998 (Hawes, Philips & Rose, 2000). Mollica (2002) estimated that there were about 33,000 facilities containing about 795,000 beds by the year 2000, which doubled the size of AL facilities in only two years in the industry. AL is not only a common alternative to tradition nursing homes, but also a more affordable setting that can provide non-institutional and home-like living environments to the frail elderly.

AL means different things to different people across the nation and world. One of the most accepted definitions of AL according to Assisted-Living Quality Coalition (1998) is:

“A congregate residential setting that provides or coordinates personal services, 24-hour supervision and assistance (scheduled and unscheduled), activities, and health related services; designed to minimize the need to move; designed to accommodate individual residents’ changing needs and preferences; designed to maximize residents’ dignity, autonomy, privacy, independence, and safety; and designed to encourage family and community involvement”.

The key characteristics of AL facilities include: 1) assistance and supervision available 24-hours a day; 2) services to meet scheduled and unscheduled needs; 3) care and services provided or arranged to promote independence; 4) an emphasis on consumer dignity, autonomy and choice; 5) an emphasis on privacy and a homelike environment (Hawes, Philips & Rose, 2000).

AL facilities provide accommodations, services and cares to different subsets of the seniors who are often characterized by a variety of chronic ailments such as arthritis, hypertension, heart disease, or hearing and visual impairments etc., and by various degrees of mental, sensory and
cognitive impairments, such as Alzheimer’s disease and related dementia. Surveys showed that the percentage of residents in AL facilities with mental and cognitive impairments was about 40-50 percent (Regnier, 2002) and about one-third of the residents (34%) had moderate to severe cognitive impairments (Hawes, Philips & Rose, 2000). This population requires extensive special daily cares and treatments. They are typically located in a designated wing, floor or building of an AL facility, separating from the residents who are physical disable but mentally intact.

In this study, the facilities that include physically and/or mentally (such as Alzheimer’s disease or other dementia) impaired elderly are called AL in a general term. The part of the AL facilities designed for the physically frail elderly only will be categorized as regular AL. The part of the AL facilities designed for those who need special Alzheimer’s disease or other dementia cares will be categorized as SCU (special-care Unit).

3. Problem Statement
The aging population and the expansion of the AL market are fueling the need for developing better programming and designing strategies for the AL facilities. Several studies had discussions on the AL industry expansion (Bowblis, 2014) and future market projection methods (Stevenson & Grabowski, 2010). These studies have identified much variation in AL supply across the states in the United States. However, the efforts to assess AL market data have primarily been at the state level (Mollica, Sims-Kastelein, O’Keefe, 2008; Mollica, Johnson-Lamarche, and O’Keefe, 2005). Few studies have examined the market variations and correlations between the AL market demand and socioeconomic characteristics beyond demographic factors, such as population and age, especially at the county level. It is thus important to establish a more comprehensive market projection model to inform the policymakers and private developers, so that they can better assess the market demand and react accordingly (Figure 1.3).

In addition, studies suggested that the AL residential model should not only combine housing and supportive services, but also meet the needs for personal care and certain nursing services (Mollica & Snow, 1996) within a home-like physical environment. In reviewing the existing literature of AL facility design, there have been a number of studies focusing on the conceptual
foundations, architecture programming and design considerations, as well as design guidance in
details from designers, architects and planners’ points of view (Hoglund, 1985; Brummett, 1997;
Perkins Eastman, 2013; Regnier, Hoglund, & Klaassen, 1993; Regnier, 1994 & 2002; Moore,
1999). However, many existing design criteria and guidelines are prescriptive, and often
contained in codes in terms of minimum square-footage requirements and other governmental
standards (Perkins Eastman, 2013). There is a lack of empirical research that assesses the indoor
space design in terms of spatial hierarchy, organization and circulation.

An unclear organization of indoor space hierarchy limits a person’s ability to independently
navigate a facility and reach desired destinations and activities (Brummett, 1997). Moreover, the
users - the senior residents (the actual “experts”) - are often excluded from the design process.
Very limited studies that made design recommendations are informed by studying the senior
residents of the AL facilities - their real experiences and perspectives towards the environment. It
is thus crucial to work directly with users of the physical environment in order to identify their
needs and perspectives, and generate effective design and programming strategies (Figure 1.3).

Figure 1.3 Research Problem Statement.
4. Research Goals and Objectives
The overarching goal of this project is to develop programming and design strategies for promoting the success of AL businesses and enhancing the well-being of AL residents.

Specifically, the Research Objectives are:

(1) Conduct market demand analysis and facility scope estimation based on bed counts. This objective will be achieved in Study 1 (Chapter 2). The Research Questions are:
   a. How to use both demographic and socioeconomic factors to predict future AL market demand in terms of bed count?
   b. How to estimate project scope (in terms of square footage and budget) based on bed count?

(2) Develop programming and design strategies for indoor public spaces of regular AL (Study 2 in Chapter 3) and of SCUs (Study 3 in Chapter 4), with the focus on space organization and circulation system. The Research Questions are:
   a. How do indoor public spaces (type, quantity, variability and size) impact the residents’ daily activities in regular AL and SCU facilities?
   b. What type of circulation pattern better supports way-finding and promotes walking or physical exercises in public spaces?

5. Significance of Study
On a community scale, this study is intended to inform urban planners, policymakers, designers, and developers to better assess the market demand and estimate project scope of AL communities; On a facility scale, this study is intended to improve the quality and effectiveness of AL programming and design to meet the needs of the elderly. The results will provide evidences and research-based design reviews and guidelines on AL market analysis, space programming and design.

6. Research Theoretical Perspective
This project, especially Study 2 and 3, will be developed on the basis of the social-ecological theories, and the foundation of physical environment assessment model of AL - the environment-behavior (E-B) model (Zeisel, Hyde, & Levkoff, 1994).
6.1. Ecological Theories

In a scientific world, the “ecology” can be viewed as a study of the relationships and interactions among organisms, and between the living things and its environment. The living organisms, the communities they build up, and other non-living components as well as their environment have dynamic interactions with each other in the system of ecology. During the past three decades, the concept and study of the social-ecological system have become more and more central to an increasingly widespread discourse on the interactions between human and its environment interactions.

In Bronfenbrenner’s ecological system theory for human development, he discussed that, as an “individual”, every person has his or her unique identifiable or combined identities and characteristics, such as sex, age, health condition and personal preference, etc. Human development is a process of change that occurs in the midst of a vibrant and complex environment and over the entire life span. Human beings are not only the partial products, but also the partial producers of their environment (Bronfenbrenner, 1979).

The fundamental concern of the ecological theories is the reciprocal relationship and mutual reciprocity between individuals and their environment. In the 1950s, Gibson’s ecological theories studied the affordance and visual perception that had very important stresses on ecological perspective within physical environments. The perception can be defined as a relationship between a living organism and its environment, and the development being changed in this relationship over the organism’s life course (Tudge, Gray & Hogan, 1997). Gibson assumed that the perceiver and the environment were inseparable, and perception of any object was simultaneously perception of the self (Jonathan, Jacquelyn & Diane 1997). His theory and approach provided an appropriate analysis of the actors in physical environment, which was very effective in explaining perceptually guided behaviors.

6.2. Social-Ecological Theories in Human Health Promotion

In the current social-ecological system studies, researchers pay great attention on the social, institutional and cultural contexts of people-environment relationships, interrelations and interactions. Many studies on human health have followed or generated insights from the social-
ecological paradigm (Stokols, 1992). It is a theory-based framework, and a set of theoretical principles, for a further understanding of the dynamic interplay, interrelationships and multilevel effects among people, groups, and their socio-physical milieus (Stokols, 1996). Stokols (1996) highlighted this theory on system processes and environmental interventions in health and illness where environmental resources and contexts may facilitate or hinder the effectiveness of targeted human health behavior changes and promotions.

The social-ecological model also encompasses a series of core underlying assumptions about the dynamics of human health and the development of effective strategies to promote personal and collective well-being (Stokols, 1992). First, the healthfulness of a situation and the well-being of its participants are assumed to be influenced by multiple facets of both the physical environment, such as geography, architecture, and technology, and the social environment such as culture, economics, and politics. Second, analyses of health and health promotion should address the multi-dimensional and complex nature of human environments. Third, as environments can be described in terms of their relative scale and complexity, the participants in those environments can be studied at varying levels ranging from individuals, small groups, and organizations to larger communities and populations etc. Fourth, the social-ecological perspective incorporates a variety of concepts derived from the systems theory to understand the dynamic interrelations between people and their environments. Finally, owing to the complexity of human environments and an explicit emphasis on multilevel and multi-method analyses of behavior, the social-ecological perspective is inherently interdisciplinary in its approach to health research and the development of health promotion programs (Stokols, 1996).

As a model to study the real-world phenomena, social-ecological theory allows the researchers to see through the human “behavioral system” where the objects are situated at the intersections of individual behavior settings and environmental fields of research; discover the ‘things’ that humans can and want to change for their environment while using their well-constructed methods of observing and their social and cultural experiences; study how those phenomena dynamics operate within and across scales, levels and systems.
6.3. Social-Ecological Theory Approaches and Applications in Design

Design is a purposeful creative action. It is the building of relations between us and our world (Banathy, 1996). The manifestation of design knowledge, thoughts, beliefs, and desires formation is gained and developed in the pursuit of the practical sciences and the humanities issues and challenges. A good design can make a difference in the quality of a person’s life and the individual’s ability to master the environment (Hoglund & Ledewitz, 1999). As designers, one of the important our jobs is to help people realize their goals and objectives, thereby meeting their needs and perspectives. By applying the social-ecology perspective in design, designers can explore the empirical evidences from multiple dimensions - physical environment, social and cultural environment, personal attributes; and multiple levels - individuals, groups, organizations. This perspective encourages us to consider the complexity of different human situations in urban planning, community design, community health promotion, neighborhood safety design, and policies making, etc.

6.4. Employing Social-Ecological Theories in Senior Community Development

In social-ecological systems, both physical and social environments are essential contexts that can function as an enabler of senior’s healthy behaviors, and also operate as a stressor in seniors’ everyday life, stopping them from pursuing better quality of life. Many AL residents may have different level of mobility, cognitive, or other frailties or impairments that make it difficult for them to travel outside of the facility (Brummett, 1997). Within the built senior community building, the resident units and rooms can provide seniors with basic living accommodations and a private space to enjoy their autonomy and privacy. Out of their unit doors, the public common spaces can be seen as the principal venues for them to have daily social interactions, interrelated relationships with others and interdependent contacts with the built environment. A senior adult, who spends the majority of time in his/ her isolated unit due to the lack of well-designed public spaces and social activities, will feel much more lonely and depressed, and have greater stresses on his/ her everyday life. As many psychologists constructed, the stress is fundamentally a relational concept signifying an imbalance between environmental opportunities and individual’s goals, and capabilities to cope with that imbalance (Stokols, 1979). Also, the lack of some enjoyable interior walking circuits and paths deny the more able residents easy access to pleasant and healthy social activities (Brummett, 1997). If residents are obstructed from access and
participation in daily social activities or events since the difficulties or impedes in their living physical environment, an increasing loss of independence, choice and quality of life may result.

As a human develops, his/her changing needs and perceptions determine how the individual experiences and interacts within and between different environment settings. If properly designed, a senior living community can contribute positively to an older person’s independence, dignity, health, and enjoyment of life. If poorly planned and detailed, it can imprison, confuse and depress (Perkins Eastman, 2013). Environments designed for older adults should match the individual’s level of functioning with environmental demands in order to facilitate positive adaptive behavior changes, health promotions and favorable outcomes (Lawton & Nehemow, 1989). Although the focus of this study is primarily on the physical environment, the social environment is also considered as a part of the holistic approach.

6.5. Assessing the Physical Environment with Environment Behavior (E-B) Model
Comparing to the institutional look of the nursing homes, the AL design features more privacy, multi-choices in accommodations, and a home-like environment to maximize residents’ dignity, autonomy, independence and their quality of life (Schwarz & Brent, 1999). With the proliferation of AL facilities, there is an increasing interest in the methods of assessing the quality of the environment. Built on the works of previous researchers (Calkins, 1998; Cohen & Weisman, 1991; Hiatt, 1991; Lawton, 1990), Zeisel, Hyde and Levkoff developed the environment-behavior (E-B) model to identify the proximal physical environment factors hypothesized to influence behavioral and other health characteristic of residents in AL, especially of those who have Alzheimer’s disease (Zeisel, et. al, 2003). This model is designed to evaluate the effects of senior living environments on residents and caregivers by making explicit the relationship between environmental influences and behavioral effects (Zeisel, Hyde, and Levkoff, 1994). In the E-B model, eight primary environment characteristics and sixteen secondary ones are identified, in which, two out of the eight primary characteristics are relevant to the features of the indoor public spaces (common space structure and walking paths), and one on ambient quality in terms of residential scale (Table 1.1).
Table 1.1. Environment-Behavior (E-B) Factor Model.

<table>
<thead>
<tr>
<th>E-B System</th>
<th>Concepts</th>
<th>Definition or Examples</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial Features</td>
<td>Common Space Structure</td>
<td>Sizes, relationships, &amp; qualities of spaces used by all residents.</td>
<td>• Quantity</td>
</tr>
<tr>
<td></td>
<td>Walking Paths</td>
<td>Circulation space residents use for wandering &amp; moving around.</td>
<td>• Variability</td>
</tr>
<tr>
<td>Ambient Quality</td>
<td>Residential Scale</td>
<td>Degree to which the size of the AL reflects a large family space and the degree to which the AL uses and homelike characteristics.</td>
<td>• Continuousness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Wayfinding</td>
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<td></td>
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<td></td>
<td>• Size</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Familiarity</td>
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</tbody>
</table>

7. Introduction to Research Methodologies

7.1. Research Design Overview

7.1.1. Study 1 - Correlational Research

The first study adopted a correlational research method. *Correlational Research* is a quantitative research method designed to investigate the extent to which variations in one factor correspond with variations in other factors based on the correlation coefficients (Stephen & Michael, 1995). This research method allows researchers to conduct statistical analyses, such as multiple regressions and correlations. It can describe the relationships among two or more variables; be used where variables are very complex and/or do not lend themselves to the experimental method and controlled manipulation; permit the measurement of several variables and their interrelationships simultaneously and in a realistic setting; examine the degrees of relationship rather than the all-or-nothing questions posed by experimental design (Stephen & Michael, 1995); and provide overall predictive strength of the identified variables and individual variables (Groat & Wang, 2013). By applying correlational research in the first study, the correlation between dependent variables (county-level occupied bed counts) and independent variables (e.g. demographic and socioeconomic factors) can be quantified, and a statistic model can be developed.

7.1.2. Study 2 and 3 - Case Study

The second and third studies were conducted by case study. *Case Study* is an approach by which an investigator explores a real-life, contemporary bounded system or multiple bounded systems over time, through detailed, in-depth data collection involving multiple sources of information
and reports a case description and case themes (Creswell, 2013). According to Yin (2014), a case study allows investigators to focus on a “case” and retain a holistic and real-world perspective. It can use "any mix of qualitative and quantitative evidence" (Yin, 2003) and be embedded into a larger mixed method research study. As Yin (2014) discussed, when comparing to other evaluation methods such as surveys, experiments and quasi-experiments, case study can capture the complexity of a case, including relevant changes over time, and attend fully to contextual conditions, including those that potentially interact with the case. Therefore, by applying case study in Study 2 and 3, the author can effectively investigate the bounded concrete entity - the planned AL senior community; collect in-depth and multi-sources of data to enhance the validity of the results; and study the AL settings or phenomena in relation to the complex dynamics in its real-life context (Groat & Wang, 2002).

7.2. Study Site and Sample Selection
In contrast to nursing homes, no federal quality standards and guidelines exist for AL facilities. AL facilities are typically regulated at the state level. The states in the U.S. vary significantly in its definitions, licensing requirements, regulations, quality standards, and monitoring and enforcement activities for AL (AARP Public Policy Institute, 2004). In some states, there are no limits on the types of facilities that may call themselves “AL” or advertise that they provide AL, regardless of the kind of services and accommodations they provide (Hawes, Philips, & Rose, 2000). Further, some states do not have a licensure category known as “AL” or include all types of residential care facilities in the category called “AL” (Mollica & Snow, 1996; Mollica, 1998; Hawes, et al., 2000). Places known as AL facilities differ widely in ownership, auspice, size, services, staffing, accommodations, and price as well (Hawes, Philips, & Rose, 2000). Any attempt to understand AL and its role in providing long-term care to the elderly is hindered by the lack of a unified definition (Hawes, Philips, & Rose, 2000). In this case, the ambiguity on the definition and lack of standardization may lead to differentiations in AL settings and may cause a bias if cases are selected from multiple states in the U.S.

In order to obtain consistent data and avoid physical differences in AL settings, North Carolina, where a rich data set is accessible and available, were considered as the geographic region for this research. In addition to availability, NC has the advantage of having mostly urban, mostly
rural and totally rural areas in one state, and about the average number of older population and AL facilities nationwide, making it geographically representative of the United States.

According to NC Division of Health Service Regulation, AL facilities are referred to as “Adult Care Homes (ACHs)”. Senate Bill 502, ratified by the 1995 General assembly, established new terminology and definitions for what were formerly called "domiciliary homes" in North Carolina. ACHs are now defined in G.S. 131D-2.1 as follows:

"Adult Care Home" is an AL residence in which the housing management provides 24-hour scheduled and unscheduled personal care services to two or more residents, either directly or, for scheduled needs, through formal written agreement with licensed home care or hospice agencies. Some licensed ACHs provide supervision to people with cognitive impairments whose decisions, if made independently, may jeopardize the safety or well-being of themselves or others and therefore require supervision. Medication in an ACH may be administered by designated, trained staff. ACHs that provide care to two to six unrelated residents are commonly called family care homes (FCHs). ACHs and FCHs are subject to licensure by the Division of Health Service Regulation.

**Study 1**

The NC Department of Health and Human Services provided the necessary data (such as occupancy rate, bed counts, etc.) for 92 (out of 100) counties in NC in 2006. Other quantitative data (such as population, income and education-level, etc.) were collected from three main sources - North Carolina Office of State Budget and Management, County Health Rankings, and US Census data.

**Study 2 & 3**

Early studies (Hawes, Philips & Rose, 2000) found that the average number of beds of AL facilities in the U.S. was 53 beds; 67% of the AL facilities had 11-50 beds; 21% had 51-100 beds’ and 12% had more than 100 beds. Larger facilities are more likely to have designated living environment and nurse staffing, and to offer more services (Hawes et al., 1995a and 1995b). Small facilities with less beds and resident capacity would not meet the study criteria related to services provided and population served. Based on regulations and facility licensures in North Carolina, the ACHs can be categorized into three scales according to the number of
beds: 1) ACHs with two to six residents (also known as FCHs); 2) ACHs with seven to twelve residents; and 3) ACHs with more than twelve residents (NC Division of Health Service Regulation, 2015). The case study sites and samples of Study 2 and 3 aimed to the ACHs with more than twelve residents (typically located within mostly urban counties in NC).

According to the dataset from DHSR (2016), there were 155 facilities and 10810 beds of ACHs serving the population aged 55 and over, compared to the 582 total adult care facilities and 36171 total adult care bed counts in NC in 2016. For Study 2 and 3, four AL facilities have been chosen from the registered ACHs in North Carolina for the data collection and comparison. The case study sites meet the following eligibility criteria 1) serve a resident population aged 55 and over; 2) have more than twelve licensed beds in adult care facilities (not in nursing homes or hospitals, see 2016 State Medical Facility Plan for more information); 3) have distinct and comparable building plan layouts (e.g. vary in public space organization, hierarchy of spaces, and circulation system design; 4) provide room and board with three meals a day, on-site supervision, social activities and help with senior’s ADLs; 5) are located within mostly urban counties (County Rurality Level, 2010) in NC in order to reduce contextual effects and differentiations to minimum.

8. Definition of Terms

Activities of Daily Livings (ADLs) - Basic ADLs refer to capacities required for personal care, including walking, dressing, bathing, using the toilet, transferring from the bed to a chair, grooming, and eating. Instrumental ADLs such as shopping, housework, transportation, using the telephone, managing finances, and managing medications, are necessary for living independently in the community (Brie, Chang, Ahalt, Chen, Conant, Landefeld, Ritchie, Yukawa, 2014). ADLs are used to measure a person’s level of independence (Perkin Eastman, 2013).

Aging in Place - Meeting the desire and ability of people, through the provision of appropriate services and assistance, to remain living relatively independently in the community in his or her current home or an appropriate level of housing. Ageing in place is designed to prevent or delay more traumatic moves to a dependent facility, such as a nursing home (WHO, 2004). Here in this study, I adopt the philosophy of aging in place in an AL context which suggests a resident could
age from relative independence (e.g., needing or wanting only meal preparation, housekeeping, and staff that can respond to emergencies) to a stage at which the resident needed help with ADLs and IADLs, and managing medications and used a wheelchair to get around on the same community campus (Hawes, Phillips, Rose, Holan, Sherman, 2003).

Alzheimer’s Disease - A neurological disease which is marked by the development of dense deposits of neurotic plaques around the nerve cells in the brain, as well as twisted strands of fiber called neurofibrillary tangles within the nerve cells. This degeneration of brain cells produces a progressive, irreversible decline in memory (especially in the ability to store new memories), the performance of routine tasks, time and space orientation, language and communication skills, abstract thinking, and the ability to learn and carry out mathematical calculations. Other symptoms include personality changes and impaired judgment. Alzheimer’s is the most common cause of dementia among older people. It is incurable, although numerous treatments have been used with varying success (Perkin Eastman, 2013).

Assisted Living Residences (ALR) - The term assisted living residences (ALR) in North Carolina includes adult care homes (ACH) and multi-unit assisted housing with services (MAHS) facilities. ACHs are licensed and MAHS register with the state. ALRs provides group housing with at least one meal per day and housekeeping services and provide personal care services directly or through a formal written agreement with a licensed home care or hospice agency. The department may allow nursing service exceptions on a case-by-case basis (NC Division of Health Service Regulation, 2015).

Built Environment - The buildings, roads, utilities, homes, fixtures, parks and all other man-made entities that form the physical characteristics of a community (WHO, 2004).

Caregiver - A person who provides support and assistance, formal or informal, with various activities to persons with disabilities or long-term conditions, or persons who are elderly. This person may provide emotional or financial support, as well as hands-on help with different tasks. Caregiving may also be done from long distance (WHO, 2004).
**Chronic Disease** - A disease which has one or more of the following characteristics: is permanent; leaves residual disability; is caused by nonreversible pathological alternation; requires special training of the patient for rehabilitation; or may be expected to require a long period of supervision, observation or care (WHO, 2004).

**Cognitive Impairment** - Damage or loss of intellectual or mental functioning. This can include impairment of short- or long-term memory; orientation as to person, place, or time; and deductive or abstract reasoning skills. Alzheimer’s disease if the most common cause of cognitive impairment in older adults (Perkin Eastman, 2013).

**Community** - A specific group of people, often living in a defined geographical area, who share a common culture, values and norms, are arranged in a social structure according to relationships which the community has developed over a period of time. Members of a community gain their personal and social identity by sharing common beliefs, values and norms which have been developed by the community in the past and may be modified in the future. They exhibit some awareness of their identity as a group, and share common needs and a commitment to meeting them (WHO, 1998).

**Dementia** - An organic mental disorder characterized by a decline in cognitive functioning severe enough to interfere with a person’s normal daily activities and social relationships. It includes loss of memory, impaired judgment and abstract thinking, and changes in personality (Perkin Eastman, 2013).

**Elderly / Seniors/ Senior Adults** - as used in this research paper, elderly / seniors/ senior adults mean (1) any person who has attained the age of 55 years or older and requires assistance with activities of daily living, housing, and services, or (2) any adult who has a primary diagnosis of Alzheimer’s disease or other form of dementia by a licensed Alzheimer’s and dementia care unit (NC Division of Health Service Regulation, 2005).

**Environment** - All that which is external to the individual, including physical, biological, social, cultural and other factors (WHO, 2004).
Frail Elderly/ Older Person - An older person in need of a substantial level of care and support (WHO, 2004).

Feasibility Study/ Analysis - An analysis of a project’s financial, market and/ or operational likelihood of success (Perkin Eastman, 2013).

Hierarchy - is the arrangement of spaces and forms to give importance or significance to things in an architectural composition. This requires establishing a compositional rule that is than broken to give a visible signal that something special has occurred; an anomaly in a normative pattern. The rule can be broken by spaces or forms that have different a size, shape or placement relative to the established rule.

Mental/ Mentally Impairment - A disorder characterized by the display of an intellectual defect, as manifested by diminished cognitive, interpersonal, social and vocational effectiveness and quantitatively evaluated by psychological examination and assessment (WHO, 2004).

Needs - This term has both a precise and an all but indefinable meaning in the context of public health. Needs are spoken of in precise numerical terms when referring to specific indicators of disease or premature death that require intervention because their level is above that generally accepted in the society or community in question. It must be explicitly stated that “needs” always reflect prevailing value judgements as well as the existing ability to control a particular public health problem (WHO, 2004).

Resident - A person living in an assisted living residence for the purpose of obtaining access to housing and services provided or made available by housing management (NC Division of Health Service Regulation, 2005).

Facility Size - Based on the number of licensed, registered, or certified residential care beds (both occupied and unoccupied) in a residential care community: small (4-10 beds), medium (11-25 beds), large (26-100 beds), and extra-large (more than 100 beds) (NCHS, 2013).
Special-care Unit (SCU) - A long-term care facility with environmental features and/or programs designed for people with dementia; these units may also provide care for persons with head injuries or serious illnesses. In this research study, SCU stands for a unit within a senior housing facility specially designed to meet the needs of residents suffering from Alzheimer’s disease or other dementias (Perkin Eastman, 2013).

Physical Therapy - therapy designed to restore or improve movement and strength in people whose mobility has been impaired by injury or disease. It can include exercise, massage, water therapy, and assistive devices (Perkin Eastman, 2013).

Programming - The architect and sponsor define the goals, needs, and functions of the project; design expectations; available budget; pertinent building codes; and zoning regulations. The architect prepares a written statement setting forth design objectives, constraint, and criteria for a project, including special requirements and systems as well as site requirements (Perkin Eastman, 2013).

Quality of Life - The product of the interplay between social, health, economic and environmental conditions which affect human and social development. It is a broad-ranging concept, incorporating a person’s physical health, psychological state, level of independence, social relationships, personal beliefs and relationship to salient features in the environment. As people age, their quality of life is largely determined by their ability to access needed resources and maintain autonomy and independence (WHO, 2004).

Wayfinding - What people see, think about, and to do find their way from one place to another. Wayfinding systems include signs, arrows, other environmental cues, or person-to-person assistance (Perkin Eastman, 2013).
CHAPTER 2. STUDY 1 - PLANNING FOR THE FUTURE: PROPOSED MODEL FOR MARKET ANALYSIS AND SCOPE ESTIMATION IN ASSISTED LIVING FACILITIES

1. Introduction

Nursing home (NH) used to be the most popular long-term care setting in the U.S. for older populations who were chronically ill and had difficulty functioning in daily activities because of their physical and cognitive disabilities (American Health Care Association, 2001; Hawes, 2001; Sahyoun, Pratt, Lentzner, Dey & Roinson, 2001; Zimmerman et al., 2003). However, in the recent three decades, assisted living (AL) has rapidly emerged as a long-term care alternative to the nursing homes. From 1999 to 2002, the number of AL facility beds in the U.S. increased from 519,905 to 1,026,397 beds, an almost one hundred percent increase (Harrington, et. al., 2005). Now 32 states and the District of Columbia have an “AL” licensing category or statute (Golant, 2004). Previous studies have attributed declining nursing home utilization to changing demographics among the elderly (Lakdawalla & Philipson, 2002) and to the growth of home and community-based care (Bishop, 1999). A general population survey found that people would prefer an AL facility to a nursing home, by a margin of six to one (Brodie & Blendon, 2001). In addition, state governments charged with planning long-term care alternatives have looked favorably on the AL facility alternative, because they view it as a more affordable long-term care solution for impaired low-income seniors, which can slow their Medicaid nursing home expenditures (National Governors’ Association, 2000; Polvka, 1997).

In summary, this growth has been a response to several factors, including the aging of the population, the preferences of the elderly, the availability of private financing for development and construction of AL facilities, and public policies aiming at constraining the use of nursing homes (Hawes, Philips & Rose, 2000). In economic terms, consumer preference can be used to justify the expansion of AL, given that individuals prefer to receive care in the least institutional - and most homelike - setting possible (Brodie & Blendon, 2001; Grabowski, Stevenson & Cornell, 2012). Thus, seniors who can no longer live at home, but do not need higher level of care or round-the-clock services, are predicted to enter an AL facility rather than a nursing home.
2. Problem Statement

From a public policy perspective, the development of the AL industry has occurred largely without the influence of government policies on market projection and financing. In addition, previous efforts to assess AL market data have primarily been at the state level (Mollica, Sims-Kastelein & O’Keefe, 2008; Mollica, Johnson-Lamarache & O’Keefe, 2005). These studies have identified much variation in AL supply across states. However, very few studies have examined potential within-state (county level) variations or correlations between AL market demand and socioeconomic characteristics beyond demographic factors, such as population and age.

For example, in North Carolina, where the AL inventory included 42,981 licensed beds in 100 counties in the fall of 2016, the principal determinant adopted by the state Health Services Regulation Division for assessing AL market demand in a county is the age of the population - the higher the age, the higher the use (DHSR, 2016). Specifically, a bed-to-population ratio is established for each age group. For instance, for age group between 65 and 74, a bed-to-population of 5.53 beds per 1000 population is adopted for all 100 counties in the state. For age group between 75 and 84, the ratio is 19.22 (DHSR, 2016). By multiplying these adopted age-specific ratios by each county’s corresponding projected age-specific population (in thousands) and adding all the products, the county’s future bed demand is projected. The demand is then subtracted from the inventory (supply). The result is the county’s surplus or deficit. Certificates of Need (CONs) are justified in the counties with deficit.

However, a study by Stevenson and Grabowski (2009) has concluded that counties with higher AL penetration tend to relate to a greater socioeconomic level, which suggests that additional factors besides age and population be considered in determining the projected market size and appropriate regulations. As they concluded, counties with higher AL penetration tend to have greater educational attainment, higher median household income and median home values, lower proportion of minorities, and within more urbanized areas. Although this study does not quantify the impact of these factors by statistical models, it implies that the projected AL market cannot be accurately assessed only based on age and population. This implication can also be demonstrated by briefly examining the data in North Carolina, where the bed occupancy rate in 2015 was below 70% in 25% of the counties, leaving more than 9000 beds unoccupied in the
State. For example, in Graham County, the number of current licensed beds as of 2017 is 23 and the projected number in three years is 47. However, the actual occupancy rate of the current beds in 2017 is only 35% (DHSR, 2016).

Moreover, these previous studies used “property” or “facility” as their data collection unit rather than using number of “beds”. This is important because AL facilities may differ greatly by their bed counts (Golant, 2004). For example, a larger facility of 80 beds is having the same statistical “weight” as a smaller facility of 40 beds. Therefore, the present study aims to apply county-level bed capacities and occupied bed counts instead of using the total number of facilities as a whole.

3. Research Goal and Objectives
The goal of this study is to promote the success of the AL businesses, which largely rely on private recourses, by informing the policymakers (e.g. North Carolina Department of Health and Human Services) and private developers to better assess the market demand and react accordingly. With the outcomes of this study, policymakers will be in a better proposition to understand the factors resulting in the disproportionate distribution of the AL facilities across the counties and to address these issues by public policies (e.g. public financing, access to service and care, etc.) to minimize the disparity.

Specifically, the Research Objectives are:
1) Objective 1: Assess the impacts of socioeconomic factors (e.g. urbanization level, education level, median household income, etc.), access to services (e.g. health care) and health outcomes (e.g. length and quality of life) on AL market demand (bed-to-population ratio); and establish a statistical model to quantify the effects of the above factors to better predict the market demand. The hypothesis is AL facilities are located disproportionately in more urbanized areas with higher social-economic status and higher level of access to services.
2) Objective 2: Develop a relation between number of beds and the total AL project scope in square footage based on empirical data collected from existing facilities, to facilitate new project scope estimation based on bed count.
4. Research Methodology

4.1. Research Design

As shown in Figure 2.1, this study will include two phases. Phase 1 aims to quantify the dependent and independent variables to analyze the future market demand as well as develop a statistical model to better quantify the correlational factors (Objective 1). Phase 2 intends to estimate the new AL project scope in square footage based on the projected bed counts (Objective 2).

![Figure 2.1 Research Conceptual Framework.](image)

4.2. Research Method, Data Collection and Results

4.2.1. Phase 1 - Market Demand Analysis (Objective 1)

No national source of longitudinal data on the supply of AL facilities is currently available (Grabowski, Stevenson & Cornell, 2012). AL facilities are typically regulated at the state level. Applicable data sources of AL, such as state licensure registries, are available across different states. According to NC Division of Health Service Regulation, AL facilities are licensed as “Adult Care Homes (ACHs)”. The North Carolina Department of Health and Human Services provided the necessary data for the year of 2006, including ACHs name, location, county-level bed capacity, county-level annual occupancy rate, total number of residents etc. Since some of the occupancy rate data are missing (there are no licensed beds in adult care facilities in eight
counties, including Alleghany county, Graham county, Hyde county, Jones county, Tyrrell county, Swain county, Perquimans county, and Pamlico county), the following county-level data are collected for each of the 92 (out of 100) counties in North Carolina:

**Variables and Data Sources:**

**Dependent Variables**
- *North Carolina Department of Health and Human Services* provided the *AL facilities* data (6 variables), including Number of Occupied Beds and Occupancy Rate etc. The data was summarized on July 31, 2015 from 2016 license renewal applications. In North Carolina, AL facilities are licensed as “Adult Care Homes (ACHs)”.  

**Independent Variables**
- *Demographic* data, such as population for selected age groups, gender, and race etc., were collected from *North Carolina Office of State Budget and Management*.
- *Urbanization* data, including Rural Population Percent and Urban Population Percent, were obtained from *U.S. Census Bureau, Population Division*.
- *Socioeconomic and health* data, including educational attainment, income, health outcomes (Length of Life and Quality of Life etc.) and health factors (Access to Exercise Opportunities, Number of Primary Care Physicians etc.), were adopted from the *County Health Rankings & Roadmaps program*, which is a collaboration between the Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute.

**Multiple Linear Regression and Statistical Approaches:**

The dataset has numerous explanatory variables and all of its variables are continuous. Therefore, model selection based on multiple linear regression (MLR) is applicable to the data. MLR is the most common form of linear regression analysis. As a predictive analysis, MLR is used to explain the relationship between one continuous dependent variable and two or more independent variables. The independent variables can be continuous or categorical. The assumptions of this analysis include: 1) regression residuals must be normally distributed; 2) a linear relationship is assumed between the dependent variable and the independent variables; 3) absence of multicollinearity is assumed in the model, meaning that the independent variables are
not too highly correlated; and 4) the residuals are homoscedastic and approximately rectangular-shaped. MLR can be used to identify the strength of the effect that the independent variables have on a dependent variable and to forecast effects or impacts of changes. This aligns with the purpose of this study, which aims to identify the strength of the effect that the independent variables (e.g. population, urbanization, etc.) have on a dependent variable (e.g. occupied bed count) and to predict the effects of the independent variable changes on the dependent variable in the future.

Jianli Lu and Chunmiao Feng, graduate students of the NCSU Statistics Department, assisted in the statistical analysis under the guidance of their faculty advisors Dr. Dennis Boos and Dr. Emily Griffith. This effort also served as the final project required in their ST 542 course and a final report was prepared in fulfillment of the course. The following procedures and results are provided in this report.

**Multicollinearity among Predictors**

Certain independent variables obviously have high correlations (e.g. education vs. income), which can inflate the variance of regression coefficients. Table 2.1 shows the variance inflation factors (VIFs) of the predictors in the full model. The values range from 2 to 14177. A value of 10 is the most recommended acceptable level of VIFs.
Plotting of pairwise correlations among the predictor and response variables partially visualize the relationship between the response and predictors and the multicollinearity among the predictor variables (Figure 2.2).

Table 2.1 Predictors in the Full Model and Their Variance Inflation Factors (VIFs).

<table>
<thead>
<tr>
<th>Predictors</th>
<th>VIFs</th>
<th>Predictors</th>
<th>VIFs</th>
</tr>
</thead>
<tbody>
<tr>
<td>P Under 35</td>
<td>5966</td>
<td>Health Behaviors Z</td>
<td>23</td>
</tr>
<tr>
<td>P 35-64</td>
<td>5843</td>
<td>Clinical Care Z</td>
<td>17</td>
</tr>
<tr>
<td>P 65-74</td>
<td>589</td>
<td>Social and Economic Factors Z</td>
<td>50</td>
</tr>
<tr>
<td>P 75-84</td>
<td>1001</td>
<td>Physical Environment Z</td>
<td>2</td>
</tr>
<tr>
<td>P 85 and Over</td>
<td>210</td>
<td>Percent Fair/Poor Health</td>
<td>43</td>
</tr>
<tr>
<td>P_Male</td>
<td>14177</td>
<td>Physically Unhealthy Days</td>
<td>26</td>
</tr>
<tr>
<td>P_Median_Age</td>
<td>10</td>
<td>Mentally Unhealthy Days</td>
<td>28</td>
</tr>
<tr>
<td>Percent White</td>
<td>41</td>
<td>Percent Physically Inactive</td>
<td>6</td>
</tr>
<tr>
<td>Percent Black</td>
<td>40</td>
<td>Percent With Access to Exercise</td>
<td>3</td>
</tr>
<tr>
<td>Percent Hispanic</td>
<td>3</td>
<td>Number of Primary Care Physicians</td>
<td>184</td>
</tr>
<tr>
<td>Percent Unemployed</td>
<td>12</td>
<td>Primary Care Physicians Rate</td>
<td>14</td>
</tr>
<tr>
<td>Eco_Med_H_Income</td>
<td>10</td>
<td>Number of Medicare Enrollees</td>
<td>45</td>
</tr>
<tr>
<td>High School Cohort Size</td>
<td>605</td>
<td>Preventable Hosp. Rate</td>
<td>7</td>
</tr>
<tr>
<td>Pct_High_School_Graduation</td>
<td>4</td>
<td>Num Households with Severe Problems</td>
<td>233</td>
</tr>
<tr>
<td>Num Some College</td>
<td>831</td>
<td>Percent Severe Housing Problems</td>
<td>4</td>
</tr>
<tr>
<td>Percent Some College</td>
<td>8</td>
<td>Number of Limited Access to Healthy Foods</td>
<td>43</td>
</tr>
<tr>
<td>Percent U_2010_Urban</td>
<td>11</td>
<td>Percent Limited Access to Healthy Foods</td>
<td>8</td>
</tr>
<tr>
<td>Length of Life Z</td>
<td>6</td>
<td>Health Care Costs</td>
<td>4</td>
</tr>
<tr>
<td>Quality of Life Z</td>
<td>29</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 2.2 Correlations between Response Variable (Occupied) and Predictor Variables.

Blue to Red indicates high positive correlation to high negative correlation. Correlation matrix is ordered according to hierarchical clustering order. There are high positive correlations between Occupied (red arrow) and predictor variables related to age-specific populations (e.g. P85 and Over), educational levels (e.g. Number of Some College and Number of high school cohort size), Medicare level (e.g. Number of primary care physicians) and health-related factors (e.g. population with limited access to healthy food and number of households with severe problems). There are higher negative correlations between Occupied and percent physically inactive etc.
For correlations among predictor variables, there are two positive correlation clusters: Box A, age-specific populations, Number of Some College, Number of High School Cohort Size and Number of Primary Care Physicians etc.; Box B, among five Z-scores, Percent physically inactive, Mentally/Physically Unhealthy days etc. There are two negative clusters: Box C, between Percent White and Percent physically inactive, Mentally/Physically Unhealthy days and Z-scores etc; Box D, between median household income and five Z-scores, Percent physically inactive, Mentally/Physically Unhealthy days, as well as between Percent of Some College and five Z-scores, Percent physically inactive, Mentally/Physically Unhealthy days.

To reduce the severe multicollinearity among the predictors, explanatory variables representing counts of specific groups of population are converted to ratios to the total population. The VIFs among the remaining predictor variables become considerably lower after the aforementioned conversions (Table 2.2).

### Table 2.2 Predictors in the Full Model after Ratio Conversion and Their Variance Inflation Factors.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>VIFs</th>
<th>Predictors</th>
<th>VIFs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio 35-64</td>
<td>24</td>
<td>Quality of Life Z</td>
<td>29</td>
</tr>
<tr>
<td>Ratio 65-74</td>
<td>49</td>
<td>Health Behaviors Z</td>
<td>23</td>
</tr>
<tr>
<td>Ratio 75-84</td>
<td>47</td>
<td>Clinical Care Z</td>
<td>19</td>
</tr>
<tr>
<td>Ratio 85 and Over</td>
<td>14</td>
<td>Social and Economic Factors Z</td>
<td>50</td>
</tr>
<tr>
<td>Ratio Male</td>
<td>2</td>
<td>Physical Environment Z</td>
<td>2</td>
</tr>
<tr>
<td>P_Median_Age</td>
<td>142</td>
<td>Percent Fair/Poor Health</td>
<td>50</td>
</tr>
<tr>
<td>Percent White</td>
<td>37</td>
<td>Physically Unhealthy Days</td>
<td>23</td>
</tr>
<tr>
<td>Percent Black</td>
<td>37</td>
<td>Mentally Unhealthy Days</td>
<td>24</td>
</tr>
<tr>
<td>Percent Hispanic</td>
<td>4</td>
<td>Percent Physically Inactive</td>
<td>6</td>
</tr>
<tr>
<td>Percent Unemployed</td>
<td>11</td>
<td>Percent With Access to Exercise</td>
<td>3</td>
</tr>
<tr>
<td>Eco_Med_H_Income</td>
<td>11</td>
<td>Primary Care Physicians Rate</td>
<td>8</td>
</tr>
<tr>
<td>Ratio High School Cohort Size</td>
<td>3</td>
<td>Ratio Medicare Enrollees</td>
<td>4</td>
</tr>
<tr>
<td>Pct_High_School_Graduation</td>
<td>4</td>
<td>Preventable Hosp. Rate</td>
<td>7</td>
</tr>
<tr>
<td>Percent Some College</td>
<td>7</td>
<td>Percent Severe Housing Problems</td>
<td>3</td>
</tr>
<tr>
<td>Percent_U_2010_Urban</td>
<td>6</td>
<td>Pet Limited Access to Healthy Foods</td>
<td>4</td>
</tr>
<tr>
<td>Length of Life Z</td>
<td>5</td>
<td>Health Care Costs</td>
<td>4</td>
</tr>
</tbody>
</table>

Corresponding to the conversions with the predictors, the response variable Number of Occupied Beds is converted to Number of Occupied Beds per quota through dividing it by the total population. Eventually, a data frame of 92 observations and 33 variables is used for the final model selection.
The Most Reliable Model Selection Method

There are multiple approaches and criteria available for multiple linear regression model selection and they often produce different results. The following combinations of approach and criterion are tested: best subsets selection, forward stepwise selection, backward stepwise elimination, bidirectional stepwise elimination and using such criterions as Akaike information criterion (AIC), Bayesian information criterion (BIC), and false selection rate (FSR) etc. Different procedure and criterion combinations often produce distinct final selected models. The combination that selects a model that fits the data just right (neither underfit nor overfit) will perform best in prediction.

The nine methods are successively applied to the same training set to select their respective final models. Then, their selected final models are used to the same corresponding test set to calculate their respective root mean squared errors (RMSEs) (Table 2.3).

<table>
<thead>
<tr>
<th>Model selection method</th>
<th>Mean RMSE for test sets</th>
<th>Total number of models selected</th>
<th>The most frequently selected model for training sets</th>
<th>Frequency of the most selected model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast FSR</td>
<td>0.001265</td>
<td>13</td>
<td>Ratio 85 and Over</td>
<td>6484/10000</td>
</tr>
<tr>
<td>Best Subsets (AIC)</td>
<td>0.001464</td>
<td>1721</td>
<td>Ratio 65-74 + Ratio 75-84</td>
<td>937/10000</td>
</tr>
<tr>
<td>Best Subsets (BIC)</td>
<td>0.001284</td>
<td>147</td>
<td>Ratio Male + Pet Some College</td>
<td>4069/10000</td>
</tr>
<tr>
<td>Forward Stepwise (AIC)</td>
<td>0.001332</td>
<td>802</td>
<td>Ratio 85 and Over + Pet Some College</td>
<td>1195/10000</td>
</tr>
<tr>
<td>Forward Stepwise (BIC)</td>
<td>0.001248</td>
<td>63</td>
<td>Ratio 85 and Over + Pet Some College</td>
<td>4937/10000</td>
</tr>
<tr>
<td>Backward Stepwise (AIC)</td>
<td>0.001552</td>
<td>3260</td>
<td>Ratio 35-64 + Ratio 65-74 + Ratio 75-84 + Length of Life Z + Physically Unhealthy Days</td>
<td>319/10000</td>
</tr>
<tr>
<td>Backward Stepwise (BIC)</td>
<td>0.001309</td>
<td>556</td>
<td>Ratio 65-74 + Ratio 75-84</td>
<td>5055/10000</td>
</tr>
<tr>
<td>Bidirectional Stepwise (AIC)</td>
<td>0.001332</td>
<td>731</td>
<td>Ratio 85 and Over + Pet Some College</td>
<td>1195/10000</td>
</tr>
<tr>
<td>Bidirectional Stepwise (BIC)</td>
<td>0.001248</td>
<td>60</td>
<td>Ratio 85 and Over + Pet Some College</td>
<td>4937/10000</td>
</tr>
</tbody>
</table>
Both forward stepwise selection with BIC and bidirectional stepwise selection with BIC have the lowest mean RMSEs (0.001248) while Fast FSR has the second lowest mean RMSE (0.001265). Because of their lowest RMSEs and high stability, forward stepwise selection with BIC and bidirectional stepwise selection with BIC are considered as the most reliable model selection methods for the data under study.

Applying forward stepwise selection with BIC or bidirectional stepwise selection with BIC to the data, the following model for bed needs in assisted living is obtained:

**Number of Beds Occupied per Capita ~ Ratio 85 and Over + Percent Some College**

Where:
- Ratio 85 and Over is the ratio of population age 85 and over to the total population;
- Percent Some College is defined, by County Health Rankings, as percentage of adults age 25-44 with some post-secondary education.

Fitting this model to the data, the output is shown in Table 2.4.

**Table 2.4 Coefficient Estimates for Proposed Model for Predicting Bed Needs in Assisted Living in NC.**

| Term                  | Estimate | Std. Error | t value | Pr(>|t|) |
|-----------------------|----------|------------|---------|---------|
| Intercept             | 0.00392  | 0.00099    | 3.96    | 0.00015*** |
| Ratio 85 and Over      | 0.05226  | 0.01802    | 2.90    | 0.00472**  |
| Percent Some College  | -0.00003 | 0.00001    | -2.37   | 0.02004*   |

Significance codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.0012 on 88 degrees of freedom
Multiple R-squared: 0.1726, Adjusted R-squared: 0.1538
F-statistic: 9.18 on 2 and 88 DF, p-value: 0.00024
Accordingly, the prediction function can be written as:

**Guideline 1-1**

<table>
<thead>
<tr>
<th>Number of Beds Occupied per Capita =</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00392 + 0.05226 × Ratio 85 and Over - 0.00003 × Percent Some College</td>
</tr>
</tbody>
</table>

Diagnostics of the model show that its standardized residuals have constant variance along the fitted values of the response (Figure 2.3) and the distribution of the residuals is approximately normal but with heavier tails (Figure 2.4 & 2.5). Moreover, partial residual plots and partial regression plots show that the predictors and the response have basically linear relationships (Figure 2.6 through 2.9). The coefficients of the newly fitted model are within the 95% confidence intervals of the coefficients of the initially fitted model. Therefore, we present results from the initial model fitting to the full data set that contained those high influential points. Therefore, the proposed model satisfies the assumptions of multiple linear regression.

![Figure 2.3 Standardized Residuals vs Fitted Values of the Response.](image)

![Figure 2.4 Normal Q-Q Plot of Standardized Residuals.](image)
Figure 2.5 Histogram of Residuals with Normal Curve.

Figure 2.6 Partial Residual Plot of Ratio 85 and Over.

Figure 2.7 Partial Residual Plot of Percent Some College.
Compared with the NC model (DHHS, 2015) that has five age groups for population, this model combines populations age 0-84 into one group and has P85 and Over as another group. The coefficients of P85 and Over in the two models are comparable. As in the NC model, both population variables in our model have positive coefficients with that of the senior population much higher. This is understandable because population, especially senior population, is the customer base of the assisted living industry.

NC model has age-specific population variables as its exclusive predictors. As a contrast, the new model uses Percent Some College to adjust the impacts of the population variables on the response. As a component of the social and Economic Factors, Percent Some College jointly determines assisted living demands at the county-level.
The new model on population scale has a higher multiple $R^2$ (0.939) than that of the NC model (0.935). Correspondingly, the new model has a RMSE of 95.3, which is smaller than that of the NC model (130.8). Therefore, the new model is more accurate in prediction than the NC model. Derived from statistical inference, the new model can produce confidence intervals for its predictions, but the NC model is empirical in nature and therefore cannot provide confidence intervals.

Age-specific population variables and Percent Some College are in the final model of this study. However, one cannot conclude that these variables are the only contributors to the number of beds needed. These population variables have extremely high VIFs and are highly correlated with many other variables. Percent Some College has a moderate VIF and low correlations with other variables but it interacts with population variables to influence the response.

4.2.2. Phase 2 - Project Scope Estimation based on Bed Counts (Objective 2)

Bed count is one of the most important factors to be determined in feasibility analyses for AL facilities, especially in the early stages of programming and design processes. Based on the market analysis discussed above, bed count can be projected in terms of maximum allowable (profitable) quota in a certain area regulated by the government. However, the actual targeted bed count for a proposed AL project is also determined by budget, siting and massing, all of which can be estimated or analyzed if the building scope (e.g. total building gross square footage) can be estimated from the targeted bed count. Therefore, based on the empirical data collected from the case study facilities, the objective in this phase is to develop correlations between bed count and building scope parameters, such as unit count, the total building gross square footage, total building net square footage, and the composition of the net square footage (e.g., private, public and administrative & support spaces).

Four AL facilities are selected for the project. They are all located in mostly urban areas in Wake County of North Carolina. The details of the facilities will be provided in Chapter 3.
**Bed Count to Building Gross Square Footage (BGSF) Estimation**

The residential space in AL facilities consists of a number of units. In the literature, studio and apartment are found to be the dominant types of resident units - 57% and 43%, respectively (Hawes, Philips & Rose, 2000). The most common type of studio is a private room with a full bathroom (42% of all single rooms), and the most common type of apartment is a one-bedroom, single occupancy apartment (14%). The four facilities studied in this project reflect this trend – the majority of the units are private studios or one-bedroom apartments. Therefore, the square footage estimation discussed below only applies to the facilities with single occupancy being the dominant unit type.

Building Gross Square Feet (BGSF) is the aggregate area of all enclosed floor areas and supporting structure and certain unenclosed areas, which support the function of the building. BGSF includes all assignable (Net) spaces, as well as the area of the exterior wall and structure; common and service spaces that are not assignable for use (e.g. public bathrooms); enclosed mechanical spaces; vertical circulation spaces including elevators, stairs, and escalators, shafts and stacks; and any other areas which make up the entire building.

Table 2.5 shows the bed count and BGSF of the four facilities, with which BGSF/ bed can be calculated:

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Bed Count</th>
<th>Total BGSF</th>
<th>BGSF/Bed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility A</td>
<td>38</td>
<td>33143</td>
<td>872</td>
</tr>
<tr>
<td>Facility B</td>
<td>90</td>
<td>54770</td>
<td>608</td>
</tr>
<tr>
<td>Facility C</td>
<td>42</td>
<td>35630</td>
<td>848</td>
</tr>
<tr>
<td>Facility D</td>
<td>104</td>
<td>78800</td>
<td>757</td>
</tr>
</tbody>
</table>

Among the four facilities, the BGSF/Bed ranges from 608 to 872 SF/Bed, with an average of 770 SF/Bed. With these data, a designer can quickly predict the approximate BGSF based on the targeted bed count.
Guideline 1-2

For facilities with single occupancy being the dominant unit type, the per-bed building gross square feet ranges from 600 to 900 SF/Bed, with an average of 750 SF/Bed

BGSF is the basis of preliminary cost estimation, which can be conducted by the following formula:

\[
\text{Total Estimated Construction Cost} = (\text{BGSF}) \times (\text{Cost per square foot})
\]

Where:

Cost per square foot is estimated by examining the historic data of similar buildings in the project area (e.g. $300 per SF).

A feasibility analysis can thus be conducted for project budget estimation and architectural solutions (e.g. sitting and massing studies of the building on the site).

*Bed Count to Residential, Public, and Support Areas Estimation*

As discussed above, a “unit” in AL facilities may contain one or more than one bed. In a facility that has all private units (one bed per unit), bed count is equal to unit count. In the case of married couple or shared unit, a unit will contain 2 beds. According to Perkins Eastman (2013), a typical resident mix in AL facilities is approximately 70-80 percent single women, 10-15 percent single men, and 5-10 percent couple.

Table 2.6 shows the bed count, unit count, indoor public space area (e.g. dining room, living room, activity room, etc.), residential area (units), auxiliary support area (e.g. administration, kitchen, laundry room, etc.) and other non-assignable area (e.g. corridor, elevator, stair, public bathroom, mechanical, etc.) of the four facilities:

Table 2.6 Bed Count, Unit Count, and Areas of Indoor Functional Components.

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Bed Count</th>
<th>Unit Count</th>
<th>Total BGSF</th>
<th>Public space/% of BGSF</th>
<th>Residentia l area/% of BGSF</th>
<th>Auxiliary area/% of BGSF</th>
<th>Non-Assignable/ % of BGSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility A</td>
<td>38</td>
<td>36</td>
<td>33143</td>
<td>3665/11%</td>
<td>18220/55%</td>
<td>4414/13%</td>
<td>6844/21%</td>
</tr>
<tr>
<td>Facility B</td>
<td>90</td>
<td>90</td>
<td>54770</td>
<td>4585/9%</td>
<td>31670/57%</td>
<td>5409/10%</td>
<td>13106/24%</td>
</tr>
<tr>
<td>Facility C</td>
<td>42</td>
<td>42</td>
<td>35630</td>
<td>3804/11%</td>
<td>15710/44%</td>
<td>3380/9%</td>
<td>12736/36%</td>
</tr>
<tr>
<td>Facility D</td>
<td>104</td>
<td>92</td>
<td>78800</td>
<td>5763/7%</td>
<td>48110/61%</td>
<td>4958/6%</td>
<td>19969/25%</td>
</tr>
<tr>
<td><strong>Average %</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>10%</strong></td>
<td><strong>55%</strong></td>
<td><strong>10%</strong></td>
<td><strong>25%</strong></td>
</tr>
</tbody>
</table>
In average, indoor public space, residential area, and auxiliary support space account for 10%, 55% and 10% of the total building gross square feet, respectively. These data can help designers quickly estimate various types of functional areas in the building program based on bed count, which provides a basis for laying out preliminary floor plans in the predesign phase.

**Guideline 1-3**

In average, the net assignable spaces of an AL facility - indoor public space, residential area, auxiliary support space account for 10%, 55% and 10% of the total building gross square feet, respectively.

---

**Building Grossing Factor Estimation**

After performing the preliminary square footage and cost estimation, a designer may start a detailed programming process, in which the Net Square Feet (NSF) of each assignable space is determined by studying precedents and/or interviewing users and owners. NSF is the area of an individual room or the usable floor area that is assigned to a function. Net square feet for each room is measured from the inside finished surface of surrounding partitions or enclosing elements and from the outline of the floor area for a space in an open area. Net areas do not include building gross square footage, such as partitions, structural elements, circulation, bathrooms, mechanical spaces, etc. Then the total building net square feet (BNSF), which is the total of NSF of all programmed spaces, is multiplied by a gross-up factor to estimate the BGSF.

The question is: what is the typical gross-up factor for AL facilities?

As shown in Table 2-6, the average percentage of total building net square feet (BNSF) is 75% (10% + 55% + 10% = 75%), which means the ratio of BGSF to BNSF is 1.3 (100% / 75% = 1.3). With these data, a designer can quickly predict the approximate BGSF based on BNSF, which is product of the programming process.

**Guideline 1-4**

In average, the ratio of the total building gross square feet (BGSF) to the total of building net square feet (BNSF) is 1.3. This is the typical gross-up factor for AL facilities and is used for estimating BGSF after BNSF is obtained from programming.
CHAPTER 3: STUDY 2 - PROGRAMMING INDOOR PUBLIC SPACES OF REGULAR ASSISTED LIVING FACILITIES

1. Introduction
As people age, chronic diseases, decreased strength and stamina, visual and hearing problems, limited mobility, cognitive impairment and less social interactions all create special needs. An aging-friendly environment can reduce the impact of these changes (The AIA Foundation, 1985). Over the last three decades, the senior living industry has expanded and diversified in order to address demographic changes and care demands. The most rapidly growing form of senior housing in recent years has been assisted living (AL) (Hawes, Philips & Rose, 2000). As a long-term care residence solution, AL provides a large array of residence homes and supportive services for those who can no longer live independently but generally do not require a high level of healthcare that is typically provided in skilled nursing homes. Within an AL facility, the resident units provide seniors with basic living accommodations and a private space to enjoy autonomy and privacy. Out of their units, the public common spaces are the primary venues for them to have daily social interactions with other residents, caregivers, families and friends, as well as interdependent contacts with the built environment. Properly designed public spaces can facilitate positive behavior changes, promote health, and better meet the special needs of the frail senior residents.

2. Literature Review
Most seniors do not want to move out of their homes if they had a choice. However, when they are faced with the circumstances that force them to move out of their homes, most of them want to avoid having to move again. Comparing to the traditional NHs, which operate by a medical model and with an emphasis on the quality of care, AL facilities tend to emphasize more on the quality of life (Regnier, Hamilton & Yatabe, 1995). AL holds the promise of meeting the special needs of the frail elderly within a more affordable and therapeutic environment than NHs. It is a combination of housing, personal services and healthcare, which responds to individual needs, promotes maximum independence, autonomy and dignity, and encourages the involvement of residents’ family, neighbors and friends (ALFA, 1996, & Regnier, 2002).
In most AL facilities, residents can move, as their health declines, from a relatively independent stage to a stage where they need more assistance, such as managing medications, using a wheelchair to get around on campus, etc. It is becoming increasingly apparent that AL facilities can provide not only home-like accommodations, but also different level of cares and services, to those who need assistance in ADLs and health care services (Pynoos & Liebig, 1995). While aging in AL presents enormous challenges in design adaptations, social managements and operations, the objective is to help residents remain in the facility as long as possible.

Many seniors relocated to an AL facility from their homes have very limited mobility and self-support abilities. An accessible and adaptable environment with services and social activities in building and on site should be provided. Mixed residential units and well-designed public spaces with clear circulation paths should also be offered to meet the needs of different residents.

Typical AL facilities provide private or semi-private living units; three meals a day; 24-hour staff to help with personal needs; daily personal care for ADLs, such as walking, dressing, bathing, using the toilet, transferring from bed to chair, grooming, and eating; various social activities; assistance with housekeeping chores; supervised medication assistance; and transportation services. Some facilities may include Alzheimer’s disease special care units (SCU) and related dementia services in separate wings or neighborhoods. (SCU is the topic of Study 3 in Chapter 4).

The assignable spaces in AL facilities can be categorized into 1) private spaces - residential studios or apartments, 2) public spaces - dining room, living room, activity room, etc., and 3) auxiliary support spaces such as kitchen, administration workroom, on-site nurse/ care station, activity/ living room, laundry room, public restroom, etc. In the past two decades, there has been an increasing number of new AL public spaces, such as private dining room, library, craft room, media room, computer lab, salon, gym, swimming pool, spa room, café, wellness center, multi-purpose room(s), etc.

In reviewing the existing literature of AL design, a number of studies discussed the conceptual foundations, architecture programming and design considerations, as well as design guidance in details from designer, architect and planner’s views (Hoglund, 1985; Brummett, 1997; Perkins
applied in the programming and design processes. Guidance and approaches from designers’ perspectives are useful, since they can be directly applied in the programming and design processes.

In addition, he proposed thirty-seven primary architectural design considerations, twenty of which focused on indoor public space design, such as refined scale, small and comfortable share spaces, living room activity spaces, deconstructed corridors, orientation, continuous and connection circulation route, etc. (Table 3.1).

Table 3.1 Design Consideration Regarding of Indoor Common Space.

<table>
<thead>
<tr>
<th>Personalizable entry</th>
<th>Deconstructed corridors</th>
<th>Refined scale</th>
<th>Stages for community interaction</th>
<th>Mailbox event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation</td>
<td>Articulated mass and form</td>
<td>Clear thresholds</td>
<td>Clear and redundant order</td>
<td></td>
</tr>
<tr>
<td>Ample and unencumbered spaces with support</td>
<td>Orienting entry</td>
<td>Continuous and connecting circulation route</td>
<td>Useful kitchenette</td>
<td>Unobtrusive reception/observation</td>
</tr>
<tr>
<td>Living room activity spaces</td>
<td>Small and comfortable shared spaces</td>
<td>Engaging activity kitchen</td>
<td>Laundry as a multi-sensory experience</td>
<td>Adaptive office connection</td>
</tr>
</tbody>
</table>

In Perkins Eastman’s book (2013), the authors discussed the design of regular AL facilities in details, addressing four major program components: resident units (unit size and mix, and unit features); common facilities serving each floor, wing, or cluster of residents (often called a house or neighborhood); common facilities serving all residents; and support spaces (p. 66).

The AIA foundation’s facility checklist and adjacency matrix (The AIA Foundation, 1985) (Figure 3-1), have also suggested the “necessary” spaces at different levels. These design guidance and approaches from designers’ perspectives are useful, since they can be directly applied in the programming and design processes.

Eastman, 2013; Regnier, Hoglund, & Klaassen, 1993; Regnier, 1994 & 2002; Moore, 1999). For example, in Brummett’s book (1997), he proposed a conceptual foundation for AL architectural design, emphasizing the “home” concept model which are embodied and realized in the interaction of activities of daily living, social activities, the physical environment, and the psyche, in a relationship where the physical environment acts as a supportive and interactive stage-like vessel.
Figure 3.1 AL Facilities Adjacency Matrix.
A group of researchers examined 2945 AL facilities nationally and found that many were lack of spaces to accommodate service functions, such as the use of wheelchairs, lifts and walkers (Hawes, Phillips, Rose, Holan & Sherman, 2003). Furthermore, a series of studies have specifically reviewed design issues related to public areas, such as dining space, circulation, building organization and scale (Brummett, 1997). For example, typical corridors in regular AL facilities are double-loaded, which resembles a “hotel”, and tends to disorient people, because the views to each end of the corridor are similar. In addition, long, repetitive and unarticulated corridors can be also confusing (Brummett, 1997), especially if they provide no rest places, designations, signs or landmarks as orienting devices. These improper designs can make walking a challenge task for many seniors, and potentially discourage them to step out of their rooms and participate in social activities or exercises in the public spaces.

3. Problem Statement
The design of the physical environment plays an important role in AL settings, since it is what supports the residents’ daily activities. Physical and cognitive impairments often affect a resident’s ability to understand the organization, orientation and circulation of a built environment (Brummett, 1997). It is crucial to provide properly designed multi-level spaces, and consider the facility as a productive, active and engaging member of the environment to enhance residents’ interaction with the environment.

As Perkins Eastman (2013) pointed out, the supply of well-planned and designed facilities had not kept up with the rapid increase in the number of physically and cognitively impaired elderly needing housing and care. Furthermore, many existing facilities do not provide attractive, supportive and affordable solutions, and many communities across North America have left the residents unsatisfied and concerned (Perkins Eastman, 2013). This presents both challenges and opportunities to urban planners, developers, and designers, who create the physical environments for supporting the elderly’s quality of life.

Although there are studies that have examined the function and use of indoor public spaces in AL (Andersson, Ryd & Malmqvist, 2014), empirical studies emphasizing on public spaces in terms of its design outcomes are rare. There is also little research on studying the AL facilities by
collecting evidences from the residents’ subjective experiences and perspectives. This paucity of research is not a new topic, as Lawton, Lebowitz and Charon (1970) commented: “The merits of physical design of a treatment setting are much discussed, but infrequently tested empirically”.

4. Research Objectives and Research Questions
This study focuses on the programming and design of indoor public spaces of regular AL facilities.

The Research Objectives are:
1) Identify and examine the effects of key physical environment characteristics on residents’ quality of life, particularly in terms of space hierarchy and circulation system;
2) Investigate users’ experiences and perspectives towards the public spaces in the facility;
3) Provide data and evidences on assessing regular AL indoor public spaces and develop programming and design strategies.

The Research Questions are:
1) RQ1: How do indoor public spaces (type, quantity, variability and size) impact the residents’ daily activities in regular AL facilities?
2) RQ2: What type of circulation pattern better supports way-finding and promotes walking and physical exercises in public spaces?

5. Research Methodology
This study is based on the social-ecological perspective and the foundation of E-B model (Zeisel, Hyde, & Levkoff, 1994). It involves two spatial categories (indoor public space structure and walking paths), one ambient quality (residential scale), and the definition of the hierarchy of indoor public spaces and circulation system.
5.1. Research Framework

Hierarchy of Indoor Public Spaces

The life in an AL facility occurs in either resident units or in public spaces. For care delivery, resident units would be the muscles in need of that care, while public spaces are the heart and lungs of the operation (Andersson, Ryd & Malmqvist, 2014).

A wing is defined as a part of a building, projecting from and subordinate to the main or central structure. The wings may directly adjoin the main building, or may be built separately and joined by a connecting structure. Each individual wing typically serves 12-20 resident units, and may allow for a small group gathering. Among the spaces that are included in the wing-level are: (1) Sitting area/ dens/ game rooms; (2) Resident kitchen with sitting area/ pantry; (3) Resident laundry; (4) Support spaces (e.g., facilities offering meals, variety of staff support etc.) (Perkins Eastman, 2013).

The public common spaces are defined as the common areas available to all residents, their invitees, and all facility staffs. Typical areas in the public spaces include: dining room, private dining room, multipurpose/ large group activity area (e.g., media room, movie theater etc.), living room/ library, café, specialized activity areas (e.g., craft room etc.), wellness center (e.g., gym, nurse exam room, etc.), spa/ assisted bathing, mail room (Perkins Eastman, 2013).

Based on the socio-ecological theoretical perspective, main factors and dimensions of the E-B model, and the definition of indoor public space hierarchy, the following conceptual framework is developed (Figure 3.2):

![Figure 3.2 Research Conceptual Framework (Study 2).](image)
5.2. Data Collection Methods

Using case study as the primary method, a series of data collection techniques are adopted:

1) In-person questionnaires to the facility manager of the selected regular AL facilities;
2) Two-rounds of field visits and on-site observations; and
3) Individual and group interviews with regular AL residents, facility staff, and caregivers (Figure 3.3).

Phase 1: Survey of Basic Facility and Resident Information

A two-pages self-completion questionnaire was filled out by the facility manager of each selected site. The goal is to obtain the basic information of the facilities, including 1) regular AL building characteristics; 2) regular AL residents’ characteristics in terms of their demographic features and physically abilities (Table 3.2). The facility floor plans and monthly activity calendars were also collected in this phase.

Table 3.2 Project Context Data Collection Contents.

<table>
<thead>
<tr>
<th>Regular AL Building Characteristics</th>
<th>Regular AL Residents’ Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Open Year</td>
<td>• Number of Residents (Total, Male, Female, Couple)</td>
</tr>
<tr>
<td>• Context of Site (Mostly Urban/Mostly Rural/Completely Rural)</td>
<td>• Age Range</td>
</tr>
<tr>
<td>• Number of Stories</td>
<td>• % Wheelchair/Walker Bound</td>
</tr>
<tr>
<td>• Number of Elevators</td>
<td></td>
</tr>
<tr>
<td>• Numbers and Types of Residential Unit</td>
<td></td>
</tr>
<tr>
<td>• Numbers and Types of Indoor Public Space</td>
<td></td>
</tr>
</tbody>
</table>
Phase 2: Observations
Two rounds on-site visits and observations - naturalistic observation (first-round) and participant observation (second-round) - were conducted. The goal is to observe how residents use different indoor public spaces during the week and weekend and what kind of behaviors occur.

The first-round of observations include non-structured naturalistic observation sessions at various times to capture a preliminary sense of space use (McKechnie, 2008) and residents’ spontaneous behaviors in natural surroundings. The naturalistic observation allows researchers to observe the flow of behavior in its own setting, which has greater ecological validity and often suggests avenues of enquiry not thought of before.

The Objectives in this round of observations are:

- Spend time on site to become familiar with the AL building, its physical environment, and the location, size and configuration of different indoor spaces and walking path(s) (if any), and facility routines;
- Conduct preliminary observations on residents’ spontaneous behaviors and routine activities in natural surroundings (e.g., activity participation, daily walking trails);
- Become acquainted with the identified “walkers” from the questionnaire and potentially find new participants who are able to transfer from place to place without assistance from others via observation;
- Correct and update, if needed, the actual use of different indoor spaces shown on the floor plans;
- Identify the needs and methods for the structured observation in the next phase.

In this phase of the observation, the researcher spent considerable time on site, but no defined structure was in place during the data collection process.

The second-round involves a series of structured participant observations (Bryman, 2008), to explore the residents’ presence in different public spaces and develop a deeper insight into their behaviors. Through direct and personal contacts with the setting and the participants in the settings, the researcher 1) is better able to understand and capture the context within which
people interact; 2) has the opportunity to learn things that people would be unwilling to talk about in an interview; and 3) can draw on personal knowledge during the formal interpretation stage of analysis (Patton, 2002).

The researcher used behavior mapping as the main observation tool and observed each facility for two days, one day during the week and one day during the weekend. The hypnosis is that the use of different public spaces may be unlike and residents may have varied behaviors in the public spaces with (weekday) or without (weekend) more staff on-site.

A mapping process followed the same designed schedule as shown below. The investigator:

1. arrived at the facility and started the observation from 8:00 am (normally breakfast time) to 5:30 pm (normally dinner time) for each observation day;
2. walked through all identified residential indoor public spaces of each facility (e.g., for facility A, in an order of lobby, mailbox room, dining room, private dining room, living space, activity space, and library, etc.) every 30 minutes (e.g., 8:00 am, 8:30 am, 9:00 am...5:00 pm, 5:30 pm);
3. recorded the total number of senior residents present in each public space (e.g., at 8:00 am, 30 people in the dining room, 3 people in the activity space, 0 people in the library) and marked their ongoing activities by using the special scoring symbols in Figure 3.4 below;
4. avoided having conversations with the residents, staff, caregivers, or nurses;
5. stood at a remote distance from the resident, staff, caregiver, and nurse, and tried not to disturb their daily activities and behaviors.
Figure 3.4 Designed Scoring Symbols for Participant Observation.

In summary, the field participant observations include 8 days and 76 hours with an average duration of 9.5 hours on each observation day at each facility. Written notes, scoring symbols and walking route were recorded on the base maps at 30-minute intervals. 160 observations were performed at four facilities. 254 senior residents - 74 males and 180 females - were involved in the participant observations.

**Phase 3: Interview**

In the third stage of the study, semi-structured individual and group interviews were conducted on-site to the residents, staff and caregivers. Compared to the quantitative methods, the qualitative interviews can gather greater details and in-depth information from the participants, understanding their experiences towards how different indoor public spaces are used and people’s perspectives on indoor public space design.

Institutional Review Board (IRB) approval was received from NC State University before conducting the on-site interviews. Participation in the interview is voluntary. Participant consent forms were collected in-person before the start of each interview. A total of 50 participants were involved in the interviews, including 31 senior residents, 15 staff members, and 4 caregivers from the four facilities.
The researcher conducted individual interviews first with on-site staff and caregivers. The participants were chosen randomly depending on who were on duty on that day. 19 staff and caregivers participated in the interviews, with an average of 5 for each facility. All of the participants have met the following qualifications:

1) work at least 3 days a week at the community;
2) work at the community over a month;
3) know well about the community spaces and the residents.

Individual and group interviews with AL residents were then conducted. All of the participants were selected by on-site staff or caregivers, since the resident participants must meet the following requirements:

1) live at the current community for over one month;
2) be able to speak and communicate with the investigator for about 30 minutes;
3) be without any mental impairment, e.g. Alzheimer's disease or other types of dementia;
4) be without vision issue and be able to see the surrounding spaces.

31 residents signed the consent forms and participated in the interviews at the end.

All of the interview questions were open-ended and they were developed from the design issues that emerged in the previous observation sessions. 46 out of 50 interviews were audio taped with interviewees’ permission. The total recording time was about 16.4 hours. 4 interviews were documented with written notes only.

6. Results and Discussions
6.1. Findings of Phase 1 - Survey of Basic Facility Information
6.1.1. Facility A

Opened in year 1999, Facility A is located within a mostly urban residential area in Wake County in NC. It includes independent living apartments and cottages, regular AL, and SCU. The regular AL is a one-story building, including residential rooms, indoor public spaces (e.g. dining room, activity room, etc.), and auxiliary support spaces (e.g. administrative offices, kitchen, laundry room etc.).
It is designed for 36 (with 38 beds) residential units - 16 studios, 18 one-bedroom units, and 2 shared rooms (with two beds maximum in each unit). There are 39 residents on site, including 9 males and 30 females (3 couples sharing rooms together). By the time of observation, the occupancy rate is 100%. The age range of the residents is between 65 and 95. About 95% of the residents use either walker or wheelchair.

The square footage of entire facility is 33,143 SF. The total areas of residential units and indoor public spaces are 18,220 and 8,150 SF respectively. The auxiliary support spaces count for 5,929 SF (Figure 3.5).

As shown in the floor plan, the resident rooms are located in two wings with dead-end double-loaded corridors connecting to the centralized public space in the front (Figure 3.6).
Eight indoor public spaces are identified for the purpose of this study: 1) lobby; 2) mailbox room; 3) dining room 4) private dining room; 5) living space; 6) library; and 7) activity space; 8) beauty salon (Figure 3.7, 3.8). The ancillary support spaces, such as public restrooms, assisted bathrooms, nurse station, kitchen, physical therapy room, laundry rooms, administrative offices, are excluded from this study.
Figure 3.7 Checklist of All Types of Indoor Public Spaces of Facility A.

Figure 3.8 Indoor Public Spaces of Facility A.
6.1.2. Facility B

Completed and opened in 1993, Facility B is located at a mostly urban area in Wake County in NC. It is a three-story building, including regular AL, and SCU as a small wing on the first floor. Two elevators, one at the front and one at the back, are the primary means of transporting residents from their rooms on the second and third floor to the centralized public spaces on the first floor. Each of the upper floors has one nurse station, one public restroom, one assisted bathroom, and one medication room. The auxiliary support spaces, such as administrative offices, conference room, kitchen, staff lounge, etc., are all located on the first floor near the main entrance (Figure 3.9, 3.10, & 3.11).
Figure 3.10 Floor Plan of Facility B (Second Floor).
Figure 3.11 Floor Plan of Facility B (Third Floor).
Repurposed from a hotel, **Facility B** has a total of 90 residential units (90 beds), including 60 studio rooms and 30 one-bedroom units in varied sizes. There are 83 senior residents, including 30 males and 53 females (one couple sharing one unit). The occupancy rate is 91%. The age range of the residents is from 65 to 95 and older. About 90% of them use either wheelchair or walker.

The total area of the building is 54,770 SF, including residential units: 31,670 SF, indoor public spaces 11,457 SF, and ancillary support spaces: 10,406 SF (Figure 3.12).

Eleven indoor public spaces are identified for the study - 9 on the first floor, 1 on the second floor, and 1 on the third floor. While all regular AL resident units are located on the second and third floors, most of the public spaces, such as lobby, living space, dining space, private dining room, sitting space, screened porch, library, beauty salon, and activity room, are on the first floor (Figure 3.13, 3.14, 3.15, & 3.16). On the second floor, there is a sitting place with sofas, tables and bookshelves that can be used as a library or a lounge. On the third floor, there is another small dining room to serve meals for the residents who have difficulties to transfer from their rooms to the first-floor dining room.
<table>
<thead>
<tr>
<th>Residential Indoor Public Spaces</th>
<th>Other Public Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobby *1</td>
<td>Public Restroom *4</td>
</tr>
<tr>
<td>Dining Room *1</td>
<td>Assisted Bathroom *2</td>
</tr>
<tr>
<td>Private Dining Room *2</td>
<td>Kitchen *1</td>
</tr>
<tr>
<td>Living Space *1</td>
<td>Nurse Station *2</td>
</tr>
<tr>
<td>Sitting Space *1</td>
<td>Physical Therapy Room *1</td>
</tr>
<tr>
<td>Library *2</td>
<td>Medication Rooms *2</td>
</tr>
<tr>
<td>Activity Room *1</td>
<td>Laundry Room (staff use only) *2</td>
</tr>
<tr>
<td>Screened Porch *1</td>
<td>Administrative Offices *6</td>
</tr>
<tr>
<td>Salon *1</td>
<td></td>
</tr>
<tr>
<td>Elevator *2</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3.13 Checklist of All Types of Indoor Public Spaces of Facility B.

![Figure 3.14 Indoor Public Spaces of Facility B (First floor).](image-url)

Figure 3.14 Indoor Public Spaces of Facility B (First floor).
Figure 3.15 Indoor Public Spaces of Facility B (Second floor).
Figure 3.16 Indoor Public Spaces of Facility B (Third floor).
6.1.3. Facility C

Facility C is the only facility that has its regular AL and SCU in two free-standing buildings. It is a family owned senior community in a mostly urban area in Wake County in NC. Opened in 1999, the regular AL is a one-story building. Most of the public spaces and auxiliary support spaces are near the front entrance. Only one activity room is embedded in the residential unit area remote from other public spaces (Figure 3.17).

Figure 3.17 Floor Plan of Facility C.
The total number of resident units is 42 (with 42 beds), which includes 14 studios and 28 one-bedroom units. There are 40 residents, including 13 males and 27 females. The occupancy rate is 95%. The age range is from 75 - 95. About 92% residents use either wheelchair or walker.

The total area of the building is 35,630 SF, including residential units: 15,710 SF, indoor public spaces: 10,798 SF, and auxiliary support spaces: 4,398 SF (Figure 3.18).

*Five* indoor public spaces - dining room, living space (with lobby), sun porch and salon near the front entrance, and the activity room embedded in the residential units at the back - are identified for the study (Figure 3.19 & 3.20).

![Figure 3.18 General Information of the Facility C.](image)

![Figure 3.19 Checklist of All Types of Indoor Public Spaces of Facility C.](image)
Figure 3.20 Indoor Public Spaces of Facility C.
6.1.4. Facility D

**Facility D** is a senior living community opened in 2000. Located at the mostly urban area in Wake County in NC, Facility D has both regular AL and SCU in a three-story building. The regular AL has its units on the second and third floors. Most of the indoor public spaces, such as dining room, private dining room, and activity room are located on the second floor. Two elevators are available, one at each side of the building (Figure 3.21, 3.22, & 3.23).

![Figure 3.21 Floor Plan of Facility D (First Floor).](image1)

![Figure 3.22 Floor Plan of Facility D (Second Floor).](image2)
Facility D has a total of 92 resident units (104 beds), including 10 studios, 70 one-bedroom, and 12 two-bedroom units. There are 92 residents - 27 males and 65 females on-site. The occupancy rate is 100%. The age range of the on-site residents is between 70 and 95 and older. 85% of them use wheelchairs or walkers.

The total area of the building is 78,800 SF, including residential units: 48,110 SF, indoor public spaces: 18,073 SF, and auxiliary support spaces: 12,248 SF (Figure 3.24).

Twelve indoor public spaces are identified in Facility D, 4 on the first floor - lobby, parlor, bistro and beauty salon; 6 on the second floor - dining room, private dining room, sun porch, activity
room, bistro and a den; and 2 dens between three unit clusters on the third floor (Figure 3.25, 3.26, 3.27, & 3.28).

Figure 3.25 Checklist of All Types of Indoor Public Spaces of Facility D.

Figure 3.26 Indoor Public Spaces of Facility D (First floor).
Figure 3.27 Indoor Public Spaces of Facility D (Second floor).

Figure 3.28 Indoor Public Spaces of Facility D (Third floor).
6.1.5. Summary

Table 3.3 summarizes the basic information of the four facilities, including opening time, number of stories, number of elevators, etc.

Table 3.3 Building Information of Four Facilities.

<table>
<thead>
<tr>
<th>General Information</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Opened</td>
<td>1999</td>
<td>1993</td>
<td>1999</td>
<td>2000</td>
</tr>
<tr>
<td>Context</td>
<td>Mostly Urban</td>
<td>Mostly Urban</td>
<td>Mostly Urban</td>
<td>Mostly Urban</td>
</tr>
<tr>
<td>Stories</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Elevator (s)</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

At the time of the study, 254 senior residents live in the four facilities, 30% being male and 70% being female. Eight couples, which count for 6% of the total population (16/254=6%), live together, either in one-bedroom or two bedroom units (Table 3.4).

Table 3.4 Population of Four Facilities.

<table>
<thead>
<tr>
<th>Number of Residents</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>39</td>
<td>83</td>
<td>40</td>
<td>92</td>
<td>254</td>
<td>100%</td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>25</td>
<td>13</td>
<td>27</td>
<td>74</td>
<td>30%</td>
</tr>
<tr>
<td>Female</td>
<td>30</td>
<td>58</td>
<td>27</td>
<td>65</td>
<td>180</td>
<td>70%</td>
</tr>
<tr>
<td>Couples</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>8</td>
<td>3%</td>
</tr>
</tbody>
</table>

The number of residential units ranges from 36 to 92 across the four facilities and the number of bed count ranges from 38 to 104. Facility B (90 beds) and Facility D (104 beds) have significantly higher capacity than Facility A (38 beds) and Facility C (42 beds). The unit type can be categorized into studio, one-bedroom and two-bedroom (Table 3.5). In general, studio and one-bedroom units are the primary unit types, although Facility D has a significant amount of two-bedrooms.

Table 3.5 Unit Types and Numbers of Four Facilities.

<table>
<thead>
<tr>
<th>General Information</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Units</td>
<td>36</td>
<td>90</td>
<td>42</td>
<td>92</td>
</tr>
<tr>
<td>Studio</td>
<td>16</td>
<td>60</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>One-bedroom</td>
<td>18</td>
<td>30</td>
<td>28</td>
<td>70</td>
</tr>
<tr>
<td>Two-bedroom</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>Total Number of Beds</td>
<td>38</td>
<td>90</td>
<td>42</td>
<td>104</td>
</tr>
</tbody>
</table>
Table 3.6 summarizes the total area and areas of various components within a facility. The percentage of each component to the total building area is also calculated.

Table 3.6 Magnitude of the Facility and Different Indoor Spaces of Four Facilities.

<table>
<thead>
<tr>
<th>Indoor Spaces Magnitude</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Building</td>
<td>33,143</td>
<td>54,770</td>
<td>35,630</td>
<td>78,800</td>
<td>100%</td>
</tr>
<tr>
<td>Indoor Public Spaces</td>
<td>8,105</td>
<td>11,457</td>
<td>10,798</td>
<td>18,073</td>
<td>28%</td>
</tr>
<tr>
<td>Private Residential Units</td>
<td>18,220</td>
<td>31,670</td>
<td>15,710</td>
<td>48,110</td>
<td>55%</td>
</tr>
<tr>
<td>Ancillary Support Spaces</td>
<td>5,929</td>
<td>10,406</td>
<td>4,398</td>
<td>12,248</td>
<td>17%</td>
</tr>
</tbody>
</table>

*#=number, SF = Square Footage

Twelve types of indoor public spaces are generalized from four regular AL facilities (Table 3.7). These spaces will be studied in greater details in the observation and interview phases in Section 6.2.

Table 3.7 Twelve Identified Residential Indoor Public Spaces from Four Facilities.

<table>
<thead>
<tr>
<th>#</th>
<th>Residential Public Spaces</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Lobby</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Mailbox Room</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Dining Room/ Space</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>Private Dining Room</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Living Space</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>Sitting Space</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>Activity Room/ Space</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>8.</td>
<td>Library</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>Beauty Salon</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Sun Porch</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>Bistro</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>12.</td>
<td>Den</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
6.2. Findings of Phase 2 and Phase 3 - Observations and Interviews

Following the surveys completed in Phase 1, two rounds of observations are conducted in Phase 2 by using behavior mapping as the primary tool. Based on findings of the observations, questionnaires are developed for interviews with residents, staff and caregivers in Phase 3 to further investigate the use of space behind the numbers.

Data collected from each identified indoor public space are analyzed and discussed in the order of “peak usage rate”, which is the peak number of people who occupied the space at a time divided by the total number of on-site residents. The order, in terms of peak usage rate from high to low, is: 1) dining room/ space; 2) living space; 3) activity room/ space; 4) lobby; 5) library; 6) beauty salon; 7) screened porch; 8) bistro; 9) private dining room; 10) sitting space; 11) den; and 12) mailbox room, in which sitting space, den, bistro, and mailbox room will be excluded from the discussion due to limited data. Public space adjacency, the efficiency of current circulation pattern, as well as other spaces mentioned in the interview will also be discussed.

6.2.1. Dining Room/ Space

Dining is one of the most common and important daily activities in regular AL. The design of the dining room is an important marketing tool and one of the site attractions aimed at prospective residents and families (Perkins Eastman, 2013). Almost all of the AL facilities provide three meals per day (Frankowski, et al, 2015) and a designated dining area for the residents. The dining room size, layout, capacity, and location are different in the four facilities.

In Facility A, the dining room is the largest public space within the centralized public space group at the front. It is surrounded by the living space, kitchen and the private dining room. Eight square tables, each with four chairs, are placed in the room. Some residents like to sit on their own wheelchair and eat. Therefore, the original chairs will be moved aside or be put in the adjacent living space outside of dining (Figure 3.29).
The dining area in **Facility B** is not enclosed with full height walls - Four pillars and low “knee walls” separate the dining area from the adjacent living space. *In this study, a space like this is named as “dining space” instead of “dining room”.* It is the largest public space on the first floor, surrounded by the lobby, private dining room, living space and kitchen. Different shapes of dining tables - circle, square, and rectangle in different sizes are provided in this space. Each table can serve 2-6 residents at one time (Figure 3.30).

The dining room of **Facility C** is the first public space that people can see when stepping into the building. It is a large and bright room with view to the front garden. Among the four facilities, this is the only dining room where the number of seats is over the maximum facility capacity (bed count). It has a total of ten square (for seating 2-4 residents) or rectangular (for seating 4-6 residents) tables (Figure 3.31).
Facility D has the largest dining room area among the four facilities. It is located on the west side of the second floor. It is connected to the sun porch, activity room and kitchen on the same side by a corridor. On the other side of the hallway, there are north elevator, public restrooms, private dining room, administrative offices and bistro. This long narrow space is furnished with eighteen standard square tables in two parallel lines, with 4 chairs at each table. Some of the chairs have already removed for wheelchair-bound residents (Figure 3.32).
Schedule

Among all the observed public spaces, dining room is the second most frequently used public space considering the total number of hours for which the space is used. During the observation period from 8:00 am to 17:30 pm, the dining rooms in the four facilities are used for 3.8 hours on average. The breakfast, lunch and dinner schedules are listed in Table 3.8 below. No residents and activities are found present in the dining rooms outside the three meal times.

Table 3.8 Three Meal Times in Dining Room (Facility A, B, C, D).

<table>
<thead>
<tr>
<th>Public Space</th>
<th>Activity</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dining Room</td>
<td>Breakfast</td>
<td>7:30 – 9:00 AM</td>
<td>7:30 – 9:30 AM</td>
<td>7:30 – 8:45 AM</td>
<td>6:30 – 8:30 AM</td>
</tr>
<tr>
<td></td>
<td>Lunch</td>
<td>11:30 AM – 13:00 PM</td>
<td>11:30 – 1:30 PM</td>
<td>12:00 – 13:00 PM</td>
<td>11:30 AM – 1:30 PM</td>
</tr>
<tr>
<td></td>
<td>Dinner</td>
<td>17:00 – 19:00 PM</td>
<td>16:30 – 18:00 PM</td>
<td>17:00 – 18:00 PM</td>
<td>16:30 – 18:30 PM</td>
</tr>
</tbody>
</table>

In Facility B and Facility D, there are two rounds for each meal. For example, lunch normally starts from 11:30 am for the first-round, and the second-round starts at 12:30 pm; first round dinner starts at 4:30 pm, and the second-round starts at 5:30 pm. Facility A and Facility C have not such arrangements.

Peak Usage Rate

Dining room is probably the only indoor public space that needs to be designed with a minimum number of seats. Peak usage rate is therefore calculated by dividing the peak number of residents present in the dining room by the total number of on-site residents.

Figure 3.33 shows the dining room peak usage rate for all four facilities. For example, in Facility A, the maximum number of residents observed in the dining room is 31, which is during lunch on a weekend day. With the total number of residents on site being 39, the peak usage rate is 79%. This means the maximum percentage of residents using the dining room at a time is 79% in Facility A. The peak usage rates of dining room in Facility B, Facility C, and Facility D, are 61%, 83%, and 58%, respectively.
Figure 3.33 Dining Room Peak Usage Rate and Usage Time (Facility A, B, C, D).

According to the observation data reported in Figure 3.36, the average peak usage rate is approximately 70% across the four facilities and the highest is 83% (Facility C). The question
is: when we determine the maximum number of seats in a dining room, should a designer use 70% of the total bed count or 83%? To be conservative, 83% should be used, which represents the “worst” case scenario. However, this might result in oversizing the space for the majority of the time.

Table 3.9 below shows the total number of seats in a dining room and the total number of beds, and their ratio in each facility. If 83% is considered as the standard, both Facility A and C exceed this standard, and therefore there should be no complaint on the lack of seats at peak times. Facility B and D are significantly lower than this standard, which is likely to result in such complaints. If 70% is considered, Facility B and D are just slightly under, in which case there should be no major complaint on the lack of seats at peak times in all four facilities, even when the facility is fully occupied.

Table 3.9 Observed Peak Usage Rate and Actual Seat Number to Bed Count Ratios.

<table>
<thead>
<tr>
<th>Dining Room/Space</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
<th>Mean%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Usage %</td>
<td>79%</td>
<td>61%</td>
<td>83%</td>
<td>58%</td>
<td>70%</td>
</tr>
<tr>
<td>Total Number of Seats/Number of Beds</td>
<td>84%</td>
<td>67%</td>
<td>105%</td>
<td>69%</td>
<td>81%</td>
</tr>
<tr>
<td>Total Number of Seats</td>
<td>32</td>
<td>60</td>
<td>44</td>
<td>72</td>
<td>-</td>
</tr>
<tr>
<td>Total Number of Beds</td>
<td>38</td>
<td>90</td>
<td>42</td>
<td>104</td>
<td>-</td>
</tr>
</tbody>
</table>

This issue is further studied by interviews, with following questions addressed to residents, staff and caregivers:

1. From the observations, the maximum number of residents using the dining room at a given time is______.
   a) Does this number sound about right?
   b) Have you experienced any case where there were more people using the space than this number?
      i. If so, when was it? and do you feel there should be more seats designed for the dining room?
Majority of the interviewees in Facility A think the current seat number meets residents’ daily dining needs, and there is no problem to find a seat whenever people come for meals. Others think one or two more 4-seat tables might be needed when 1) the facility gets all the beds filled 2) more couples share one unit; 3) residents’ family come to visit. As they shared:

- “…it could be a little bigger… because sometimes they [residents] have family member to visit, and they want them to be involved in the same [dining] room… even though they don’t come that often… but it could be a little bit bigger at least we have enough space for them… because now it kind of narrow…”;
- “For daily use, it barely enough... But when we have full capacity, or if there are any couples, it might take an additional number to use this [dining room]. More couples moving in will increases occupancy, and you have to use the overflowed dining room [the private dining room attached to the main dining room] …”.

In Facility B, more than half of people are satisfied with the current seat number and believe the two-round dining schedule works well. Others are the opposite and suggest to add more tables and seats because 1) most of the people like to eat at early time; 2) two-round dining did not work well; 3) family reserve dining room tables for meals sometimes. As some residents and staff stated:

- “…we are supposed to have two round of seating, one at 11:30 am and one at 12:30 pm [for lunch]. Everyone like to eat earlier… so I normally go there about 12:30 pm, because you will have more seats to choose and don’t need to worry about there is no seat available for you…”;
- “I think it could be bigger... because I have seen a lot of people come in 11: 30 am and the seats cannot accommodate all of them. And you have to tell them “sorry you have to wait for 12: 30 pm [the second-round] …”.
- “When you come down for meals, the dining room is full… some tables are not open and maybe reserved by others, or family coming in…”.

None of the interviewees in Facility C have complaints on the total number of seats in dining room, since “We still have some empty tables for extra people and families”, as one resident
shared. This is predictable because Facility C is the only facility that has the number of dining seats exceeding the total number of residents.

In Facility D, almost everyone complained about the lack of dining room seats and the two-round dining schedule.

- “It is always full and very crowded… Different people doing different things in different times. But sometimes, everybody wants to do the same thing at once and during other time it may be empty with nobody...”
- “…the problem is we have two rounds of seating and that never really happens. Because we are not supposed to feed everybody all at once, but the residents don’t like to wait.
- So, everybody ends up coming at 4:30 pm for dinner and you have a lack of seats for all of them… and at 5:30 pm, as people come in, they are cleaning up the place [for the 4:30 round], so it is kind of a slow flow of people coming in and eating during that an hour, and at 5:30, the dining room are pretty much clear...”;
- “…there are a lot of people complaining during the residents’ council meeting and they said there were not enough seats, and they can’t find a seat in the dining room...”;
- “There was a time, a couple of month ago, when residents came and wanted to find a seat for their meal, they just couldn’t find it… so I think the seats should base on how many residents we have, because we sometimes need more space and more seats, sometimes don’t...”;
- “People can come to eat whenever they like. Some people don’t go to the dining room, and they eat in their rooms. Some of them try to go out… we have a resident she tries to come down to eat when she feels well. But unfortunately, that doesn’t happen quite often. Some people eat very fast, the first round starts from 4:30 pm, and some people just eat and leave by 5:00 pm… so the next group comes in… but I don't think it is necessary the ratio should be one person [one bed] to [match] one seat [in the dining room] ...”.

Based on the interviews, 83% (highest usage rate observed in Facility C) appears to be a reasonable number when determining the maximum number of seats in a dining room, since no one in Facility C have any complaints on “the lack of seats”. Facility A has few complaints on the lack of seats, since its peak usage rate is 79%. More seats are “nice to have” for special
occasions. When dining seat number to bed count ratio drops to the 60% range, users certainly experienced a severe lack of seats. This has “forced” Facility B and Facility D to offer two-round dining for each meal, which, according to the interviews, is definitely not desirable.

**Guideline 2-1 Dining Room Seat Count**

To determine the number of seats in an AL dining room, one can use 85% of the total bed count as the minimum standard for programming purposes:

\[
\text{Number of dining seats} = 85\% \times \text{bed count}
\]

**Area per Seat**

If the number of seats can be estimated by the guideline above, the next question is what area per seat should be programmed, so that the space does not feel crowded. Building codes require that 15 SF/Seat be used to calculate occupancy loads for dining space in general (a space with tables and chairs). North Carolina regulations for licensing adult care homes suggests a minimum of 14 SF per resident (bed).

It is important to provide sufficient floor area for dining, however, oversizing the dining room can potentially result in a waste of resources and empty dining rooms during most of the meal times. The area of the dining rooms in the present study ranges from 835 to 2,037 SF and the number of seats ranges from 32 to 72. Therefore, the area per seat (total area/number of seats) ranges from 26 to 41 SF, with an average of 30 SF per seat (Table 3.10).

<table>
<thead>
<tr>
<th>Dining Space</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area (SF)</td>
<td>835</td>
<td>1,515</td>
<td>1,769</td>
<td>2,037</td>
<td>1,539</td>
</tr>
<tr>
<td>Number of Seats</td>
<td>32</td>
<td>60</td>
<td>44</td>
<td>72</td>
<td>52</td>
</tr>
<tr>
<td>Total Area (SF) per person</td>
<td>26</td>
<td>26</td>
<td>41</td>
<td>29</td>
<td>30</td>
</tr>
</tbody>
</table>

During the observations, no signs of crowding are noted, such as difficulty of maneuvering through the furniture, excessive noise, etc. Interviews are then conducted following the observations, with following questions addressed to both resident and staff/caregiver participants:
1. Have you ever felt (observed/heard from residents) that the dining room was (felt) crowded or too noisy?
   a) If so, explain more.
2. Approximately, what is the percentage of residents who use walkers and wheelchairs?
   a) Would you think it is necessary to have a designated area in the dining room for parking residents’ walkers, or for temporarily storing the chairs that are moved away from the tables because some residents are sitting on their wheelchairs?
3. Do you feel the furniture arrangement in the dining room (tables and chairs) is crowded, and some of the residents may have a difficult time moving around through the furniture, especially for the residents with the walker or wheelchairs?

From the interviews, in average 65% of the interviewees believe the aisle space between the sets of table and chairs is too narrow to maneuver around, especially in Facility B [71%] and Facility D [100%].

Most feedbacks are positive in Facility C. Only the residents who use large size electric wheelchairs have complained that they sometimes have difficulty to move around.

- “If you are on wheelchairs, especially on a big one… we have one at my table, she is on an electric wheelchair, and she is a big person too. So, she has to have a lot of room to maneuver around, and I think the space we have is a little bit tight for her…”.

Other diners, either with or without a walker or a regular wheelchair, think the aisle space is wide enough to support their daily transferring needs. Therefore, the 41 SF per seat provided in Facility C appears to be a proper number when sizing a dining room in AL facilities.

In the other three facilities, the common issues with dining room are:

1) In average, 91% of the wheelchair or walker bound residents find it hard to maneuver around in the aisles;
2) more residents use walkers than wheelchairs, and they prefer to keep their walkers with them while eating, which takes extra aisle space for people to pass through; and
3) *(Facility D only) the long “skinny” shape of the dining room limits the furniture layout options. Only one corridor is available in the dining room, which can cause congestions.

Almost every interviewee in **Facility A, Facility B, and Facility D** mentioned the space in the dining room was too tight for wheelchairs to maneuver, as some of them stated:

- “…the corridor is not really [wide enough] when you get wheelchairs…if you have one person who has wheelchair on this side of the table and another person right behind him with the wheelchair too… sometimes you just can’t get in or out… and if the caregivers are waiting to get somebody’s meal … you will have trouble then… it really doesn’t have enough room for the wheelchairs…and I wish there is some spot for wheelchairs with easy access…”;
- “… I feel sad because I have to ask them to move every time, it is not right… I have to tell them “I am sorry, you cannot seat in this area, because we cannot to have two wheelchairs seat at the corridor at the same time, and we cannot get through…”;
- “…you have to have a lot of wheelchairs in this kind of community [AL], you have to have enough room for them to maneuver. You can’t have the staff to maneuver because they are supposed to be serving the food. And people don’t have the same size wheelchairs or walkers, so you have to have maneuver space that is large between the tables and chairs… you have to think about building a place for people who need more spaces and help…”;

When they were asked: “Whether extra space for walkers’ “parking” or storage in or near the dining room is needed”, people had two opposite opinions. Most of the residents said they wanted their walkers right beside them, so that they were able to see and grab it whenever they need. Most of the staff and caregivers believed a special “parking” space for walkers during meal times is better, not only for safety reasons of keeping the aisles clear, but also for creating more space to serve food. They stated:

**Residents:**

- “I don’t think we need extra space for that… the problem is everybody won’t leave the dining room at the same time… some people can walk without that walker for a short
distance, but some people can’t… after we finish eating, we don’t know where our walker is…”;

• “Usually the walker people like the walkers with them in the room. I would like to have my walker close by, rather than to punch the button and wait for someone to get it for me. So, I would not like my walker taken away from me …. I don’t like that at all”;
• “…if your walker is right beside you, you can go whenever you want. If you have to wait your walker to get back to you… I can see how that will upset people…”.

Staff / Caregivers

• “… for safety reasons, we put their walkers out here [in the living space outside the dining room in Facility A]. So, the servers are able to get around the tables and serve… and the servers or staff have really good readings [on residents’ needs] and can always get it [the walkers] for them very quickly”;
• “I think it should be at least one walker parking space near the dining room. If it is not too far between the walkers and the chairs, they will be able to get it when they want without any support. But I think to have a designated area to park all the walkers could also be a hazard …”;
• “I would love to have a designated parking spot for the walkers. In another facility, we always take their walkers and park them in the living room nearby, and people can see it. They are fine with it. But here they are not fine with it. They want their walkers right next to them. They want to hold it and see it right there. Maybe design a designated parking space inside the dining room would work…”;
• “Sometimes we move them to the hall [outside], but it makes the hallway crowded. So, a designated area for the walkers would help. Because if we have some emergency or something, they have to get through the hallway, if a lot of walkers are getting in the way [in the main hallway], we have to move them…”.

In conclusion, none of the dining rooms in Facility A [26 SF /Seat], Facility B [26 SF /Seat], and Facility D [29 SF /Seat] provides enough space for residents, most of whom use walkers or wheelchairs. As in Facility C, approximately 40 SF/ seat appears to be a reasonable standard.
Guideline 2-2 *Dining Room Area per Seat*

To determine the net square footage of dining rooms based on design seat count in AL:

\[
\text{Dining room NSF} = 40 \text{ SF/ seat} \times (\text{design seat count})
\]

Guideline 2-1 suggests that the number of seats in a dining room should at least be 85% of the total bed count. Combining Guideline 2-1 and 2-2, one can estimate dining room square footage based on bed count – Dining room area / bed:

Guideline 2-3 *Dining Room Area per Bed*

To determine the net square footage of dining rooms based on bed count in regular AL:

\[
\text{Dining room NSF} = 40 \text{ SF/ seat} \times 85\% \times \text{bed count} = 35 \text{ SF/ Bed} \text{ (approximately)}
\]

*Proportion of Dining Space*

In Facility D where the shape of the dining room is long and narrow, two sets of tables are lined up in parallel (Figure 3.34). Everyone - resident, staff, caregiver, or server - has to use the only aisle in the room (red line in the map below) during meal times. This creates problems.

![Figure 3.34 Dining Room Map and Furnishing of Facility D.](image)

Some statements from Facility D are:

- “…there are a lot of people complaining during the residents’ council meeting … they can’t find a seat in the dining room, and they can’t maneuver around, and staff have hard time getting through as well because it is so narrow… only one aisle without many choices…”;
- “…The only corridor between two sets of tables is kind of hard for both residents and us [the staff/ servers in the dining room] … when wheelchair people sit back to back,
you can’t get through… when one resident wants to leave, and the servers are pushing a cart to serve the food, it could be very busy. Sometimes, some of the wheelchairs are backing out and they hit the residents behind… and people get very upset about that…”;

- “…this long skinny shape [of dining room] does not work well. I wish they can knock down the wall and have a wider and open space… more square in shape… I would definitely say that it would be better to have a wider dining room…”

Guideline 2-4 Dining Room Proportion
Dining room should be designed in a square shape or in a reasonably proportioned rectangular shape. A very long and narrow space does not work well.

Furniture Layout
The use of dining space is also influenced by furniture, such as table size and the number of seats at each table. For example, putting 10 four-seat square tables in a dining room will lead to less walking space than 5 eight-seat tables. Table 3.11 shows the table and chair settings in the four facilities. The most “popular” setting is square table with four seats. Two other options are found in Facility B and Facility C, where there are 3-seat and 6-seat tables.

Table 3.11 Tables and Seats in Dining Rooms.

<table>
<thead>
<tr>
<th>Dining Room Seats/Table</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - seats</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>4%</td>
</tr>
<tr>
<td>4 - seats</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>18</td>
<td>82%</td>
</tr>
<tr>
<td>6 - seats</td>
<td>-</td>
<td>5</td>
<td>2</td>
<td>-</td>
<td>14%</td>
</tr>
</tbody>
</table>

During the interviews, the following questions were addressed to the participants on table and seat preference:

1. **In the dining room, each table has _______ seats.**
   a) Do you feel that works well to serve the residents?
   b) Would you rather have bigger tables with more seats for each table or have smaller tables with fewer seats for each table?
   c) Do you feel there should be a combination of bigger tables and smaller tables provided in the space? or a table with four seats will work better?
In average about 63% of the interviewees prefer to have 4-seat square tables, because 1) people can have better conversations with others in a small group of four; 2) some residents have hearing problems, so sitting at bigger tables they cannot hear well. The other 37% think four to six or up to eight tables per table will be appropriate because 1) people can interact with more people; 2) when family come, bigger tables provide the opportunity for them to dine at the same table.

**Guideline 2-5 Dining Room Table Size**

Small square dining tables with four seats are preferred. When larger tables are needed for special occasions, small tables can be combined to accommodate more people.

### 6.2.2. Living Space

Besides dining room, living space is another highly used public space, where people can either relax or have social interactions and physical activities. Mostly designed as an open area without walls, a living space varies in its layouts, furnishing, location and size. The basic design idea for a living space in an AL is to create a home-like space with comfortable sofas, chairs, coffee table, TV, or warm color lamps, etc.

The main living space of **Facility A** is surrounded by the dining room, private dining room, and the main corridor connecting the front of the building to the residential units (Figure 3.35). There are seven sofas, two round small tables, two 2-person benches and a group of chairs in the living space. The chairs tend to be moved in and out of the space, so only the furniture that are not removable are shown in the plan below *(this applies to all living spaces and activity rooms in the following sections)*. Other than the scheduled group activities or events, residents can watch TV, listen to music, read books or newspapers, etc.
The living space in **Facility B** is an open area connecting with the main dining space, sitting space and lobby (Figure 3.36). It is a “non-traditional” living space with two connecting rectangular areas. In one area, there are three sofas, one table and a TV, making it a home-like living room setting. In the other area, there are three large round tables with nine chairs. Residents and staff like to call this area the “bistro” and normally use it to play puzzles or bingo games, or meet with their families.

In **Facility C**, the living space also serves as the lobby. It is a long rectangular area opened to two main corridors, and it is close to the dining room, administrative offices, and the front desk. The area is also set up as a home-like space and filled with sofas, tables, piano, TV and moveable chairs (Figure 3.37).
Facility D has no designated living room. As residents and staff mentioned in the interviews, people can use the first-floor parlor or second-floor activity room as living spaces. They can also use the two dens on the third-floor to watch TV or sit down with families. Therefore, Facility D will be excluded in this section.

**Schedule**

In the surveys conducted in Phase 1, the living space is ranked as the most “popular” public space by staff. The number of hours for scheduled group activities is 5.8 hours in average during a day. Typically, daily activities in AL take place in either living space or activity room. Approximately two thirds of daily activities are scheduled in the living space in Facility A, B and C during weekdays and weekends (Table 3.12).
Table 3.12 Scheduled Activities in Living Space (Facility A, B, C).

<table>
<thead>
<tr>
<th>Public Space</th>
<th>Date</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weekday</td>
<td>11:00 AM - Exercise</td>
<td>13:15 PM - Exercise Essentials</td>
<td>16:00 PM – Music Social</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*18:30 PM - Evening Movie</td>
<td>14:00 PM - SingFit</td>
<td>18:00 PM – Current Events with Local &amp; National News</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15:00 PM - Pumpkin Muffie Cocktail Social</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18:00 PM - Bingo with JoJo</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>11:00 AM - Exercise Video</td>
<td>10:00 AM - Pet Therapy</td>
<td>10:30 AM – Snack Time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14:00 PM – Silvertones Bell Choir Performance</td>
<td>10:45 AM - Senior Group Movement with Mark</td>
<td>11:00 AM - Easy Listening</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15:30 PM – Cary School of Music</td>
<td>13:00 PM - Shadowbox Decoration Party</td>
<td>15:30 PM - Snack Time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18:30 PM - Evening Movie</td>
<td>15:00 PM - Saturday Trivia with Open Bar</td>
<td>18:00 PM - “Lawrence Welk”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18:00 PM - Bingo with Don</td>
<td></td>
</tr>
</tbody>
</table>

*Activities marked in red color is the observed most “popular” activity which also has the peak number of residents present at one time. See next Peak Usage Rate section for more details.

**Peak Usage Rate**

Similar to the dining room study, peak usage rates are calculated from the observations (Figure 3.38). The peak usage of the living space in **Facility A** took place during the scheduled social activity at 3:30 pm on a weekend day when the facility invited a local band to perform. This event attracted not only most of the regular AL residents, but also independent living residents from the other building on the same campus. The number of people recorded at this time is 50, which is more than the total number of on-site AL residents. This occasion is eliminated because it is a rare event that does not happen very often. The next highest number is 25, which is used to calculate the peak usage rate. This number was also collected during a scheduled activity - the “Choir Performance”. Such activities are common and take place at least twice a month. Besides the scheduled group activities, people came to the living space to relax. There were over ten people recorded in the living space around 11:30 am and 17:00 pm on the weekend day when they were waiting to enter the dining room for lunch and dinner.
Figure 3.38 Living Space Peak Usage Rate and Usage Time (Facility A).

It is confirmed from the interviews that events like the big music performance mentioned above rarely happen in Facility A, as staff stated:

- “…the full house [in the living space] only happened in the special holidays in the year, like Christmas, or Thanksgiving… mainly during the holidays…then it [the living space] is pretty packed…”;

- “…for the parties that I have been witnessed here, it was not a problem to fit everybody in here [in the living space] … And it [big event] happens once a while, so I don’t think it is a problem… I don’t think we need a bigger room just for that. That is not an everyday thing, only for the holidays…”.

However, the activity coordinator mentioned that the current size of the living space actually limited the opportunity of holding such big events more frequently:

- “…I would love to see a bigger area when we have some special programs for the residents and their families. If we had a bigger space, we could do it [big events] once a month here. But we don’t have the space that can support it… so we are now just trying to do it quarterly [four times a year] … like last year’s big Christmas party, we have to use all of our rooms [dining room, living space, library, and activity space] for that…”.

For regular routine events and activities, 100% of the participants gave positive comments on this living space. All of them think the size and furnishing in this room are “just perfect, and feel like home” as one resident said. People like to watch movies, read books, and do some small group activities with the staff, such as exercise program, balloon volleyball or sing songs, etc.
which do not require table and chair settings. Several times a day, people need to pass the living space to enter the dining room, so the living space also functions as a “waiting area” while people line up before meal times, as well as a “parking lot” for storing the walkers while people eating inside the dining room.

**Facility B** offers cocktail social hours at the living space every afternoon around 15:00 pm as a routine activity. “This is the #1 social activity there, residents love it a lot…” as one staff member says. 29% is the peak usage rate observed during this event on a weekend day (Figure 3.39).

![Graph showing living space peak usage rate and usage time](image)

Figure 3.39 Living Space Peak Usage Rate and Usage Time (Facility B).

According to the activity calendar (Table 3.12) and the interview data, Facility B has most of its daily activities scheduled in the living space. As mentioned earlier, Facility B has two rectangular areas in the living space, one “traditional” living room like area and the other one filled with three tables and nine chairs (Figure 3.42). As some interviewees described, the “living room” area is used frequently for seating, watching movies, playing games, exercising, or playing piano – activities that do not require tables. In the table/chair area, people usually play Bingo or puzzles, have the cocktail social activities, or do large group activities that require tables and chairs.

Over 75% of interviewees suggested having a bigger space:

- “…they sometimes have pianist, or guitar player coming… something live [music] and people sit down there… the space is quite crowded… and sometimes they bring
reminiscence [SCU] residents there too… overflowed when they have such an activity… and sometimes people have to sit in the dining room seats…”;

- “I think we need more space… sometimes a lot of people want to watch TV, but we don’t have a lot of space for them to sit…”;
- “…it is not spacious at all, it is very tight… If we could have more space, we could have more people down there socializing with others…, instead of staying at their rooms all the time…”;
- “…it depends on what they have [the activities]. It is usually sufficient, but you know sometimes we have a big party and here is really packed…”;

50% of them wished the shape of the living space could be in a complete square and with some defined walls or doors, instead of having it “divided” into two separate areas:

- “…we have enough space, but the problem is it is too spread out. For example, if I want to do a crossword puzzles here [in the table and chair area] during the cocktail social hours, people sitting in the living room [TV area] would not be able to see, or even hear from me…it is very hard to do a large group activities for people in here sometimes…”;
- “I think it is better to have a defined area or space… maybe in more rectangular or square shape, but not long and skinny [shape], [rather than] sitting at a passing hallway… and it is hard for them to hear me…”;
- “…when I want to go there [the TV area with sofas], I am not sure where should I sit with my wheelchair. I think it would be so much better to have a separate room area for movies, activities, more enclosed, larger, more conducive to doing things…”.

In Facility C, the peak usage rate of its living space occurred around 13: 00 pm, and no activity was scheduled at that time (Figure 3.40). Some residents came out of the dining room after lunch and walked directly to the adjacent living space for napping or watching TV. The peak usage rate at that time is 38%.
From the interviews, the living space is used by residents frequently. They like to visit the space and watch TV most of the time. The number of sofas [10] and size [662 SF] of the space seem to be comfortable enough for daily use:

- “They always sit there to watch morning programs, and evening news after dinner. So, it’s kind of like their central relaxing place… they all have their own TV [in their room], but they just like to sit in the living room and watch TV there…”;
- “The living room is large and good. I think we have plenty of seats…”;
- “[It] is perfect. They use it every day. It doesn’t get crowded…”;
- “We often do many family events or family nights or we have family members coming from other cities or states, and we can accommodate all of these people as well. It’s a good size”;
- “We arrange the room when people come in for entertainment. So, we will have more space for them. I think it’s fine what it is. For the big evens, we pull the chairs out [from the dining room nearby], we push the couch back, … We sometimes have the people [in SCU] across the street to come … and we have room for that too”;

However, some staff members think the size of space should be bigger since people can barely fit in the living space for large events:

- “Yesterday we had a 30-person choir. We pushed all the chairs out [from the dining room nearby]. And it was very crowded, especially all of the residents wanted to come, but not everyone could be able to see from the far end of the living room. So, I think the size of the living room for such activity is kind of a small size…”;
“As far as big activities, we probably have them every other week. Then we have family night once a month. Their families and friends come. So, we have to use both our living room and dining room for that… and people can hardly walk. So, I think a bigger ball room would be perfect…”.

A staff member thinks this open design concept is good to encourage participations:

- “I think this open environment is good. It encourages participation. When residents see other people sitting there, they want to come and sit there as well…”.

Some, however, think this it is too open for activities sometimes, such as movie nights, etc. They think it needs more enclosed walls or doors to provide more privacy and stay away from noise:

- “The living room should have more privacy…, If you sit in the living room, and somebody [staff] wants to call some residents… there is an office [front desk reception room] right there which make too much noise. If they have the TV on… that’s very noise and distractive”;

- “I think the living room is quite open to the corridors and some of the residents’ rooms and some of our offices. When we have the choir, live music band, they complain about these [the noise in the living room]. Sometimes the TV is too loud, they complain that they cannot hear anything in their rooms. Also, the TV sometimes is too loud for our staff too, because the residents need it to be so loud to hear. Like my office and her office are right beside the living room, we feel it is overwhelming… it is just too much…”;

- “… I think some sort of a room for TV or movie that would be great, so you can sit closer to the TV. And maybe another ball room for big events”.

In conclusion, the average usage rate in the living rooms is 43%, which means 43% of the total residents used the living space at a time in average during the observations. The highest rate is 64% observed in Facility A. The suggests that, during the time of observations, the living spaces seem to be big enough to accommodate the casual and scheduled activities. However, the activity schedule in the living space is not as “predictable” as in the dining room. As revealed in the interviews, certain activities with large number of participants were not captured during the
limited observations. Therefore, the observed peak usage rates do not represent the “worse” case scenarios. For this reason, the interview data will be used for assessing the size of the living spaces.

**Area per Resident**

Based on the interview findings reported above, Facility A provides ample square footage for most daily activities. The living space in Facility B is clearly insufficient as most interviewees complained on the lack of space and crowding. Mixed responses were received for Facility C — some thought it was big enough; some thought otherwise.

North Carolina regulations for licensed adult care homes suggests, in buildings with a licensed capacity of 16 or more, there shall be a minimum of 16 SF per resident for each living room or recreational area. Table 3.13 shows the actual square footage of living space per on-site resident for all three facilities, which is consistent with the outcome of the interviews – Facility A has the highest - 21 SF per resident; Facility B has the lowest – 9 SF per resident; and Facility C is in between – 16 SF per resident, which is the same as the North Carolina Standard.

<table>
<thead>
<tr>
<th>Living Space</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Residents</td>
<td>39</td>
<td>83</td>
<td>40</td>
</tr>
<tr>
<td>Total Area of Living Space</td>
<td>822</td>
<td>782</td>
<td>662</td>
</tr>
<tr>
<td>Area of Living Space/ Resident</td>
<td>21</td>
<td>9</td>
<td>16</td>
</tr>
</tbody>
</table>

**Guideline 2-6 Living Space Square Footage per Resident**

The optimal size of the living space shall be programmed at 20 SF per resident, with a minimum of 16 SF per resident.

### 6.2.3. Activity Room/ Space

All four facilities provide an enclosed activity room or a well-defined activity space for accommodating formal group activities. Activities scheduled in the activity space normally need tables and chairs, such as Bingo, painting class, flower arranging, etc. Facility A, B, and C also
have a small kitchenette for small group activities like baking. Facility D uses its bistro room instead for such events.

The activity space in **Facility A** is also called country kitchen. The space is furnished with a small kitchenette within a bar-like counter, a microwave, a full-size oven and a refrigerator on one side, and the rest of the area is filled with five square tables and sixteen chairs. Facility A uses this space for holding social activities such as bingo, or baking class (Figure 3.41).

![Figure 3.41 Activity Space of Facility A.](image)

In **Facility B**, the activity room is located on the first floor at a remote location from other public spaces. People do not usually walk by this space, except for attending activities, using public restrooms, or picking up their mails. This room has a long rectangular table in the middle, with 8 movable chairs. Residents normally use this room to paint, arrange flowers, enjoy music, or participate in other types of small group activities (Figure 3.42).

![Figure 3.42 Activity Space of Facility B.](image)
In **Facility C**, there is a large activity room embedded in the residential unit area. This room is remote from all other public spaces centralized at the front of the building. People also called this room the “Gallery” since it is used for multi-purposes. On one side of the room, three large round tables with 15 chairs and a small kitchenette are provided for residents for bingo, baking, painting, or parties. A small area in the room is furnished with a set of sofas and bookshelves, providing a library-like space for reading or some small group activities, such as discussion group (Figure 3.43).

![Figure 3.43 Activity Space of Facility C (the “Gallery”).](image)

The activity room of **Facility D** is adjacent to the dining room on the second floor. It is a long-narrow space with a TV set, a piano, and four long foldable tables with a group of moveable chairs. Residents can unfold the tables when playing bingo games. They can also fold the tables and leave the chairs in the room when doing fitness classes, or other types of social activities, for which table is not required (Figure 3.44).

![Figure 3.44 Activity Space of Facility D.](image)
**Schedule**

The use of the activity room/ space largely depends on the daily activity and event calendar (Table 3.14). As mentioned in the “Living Space” section, most of the daily activities in Facility A, B, and C are planned in the living space, while Facility D has no living space so it uses the activity room more often to hold activities. The average number of hours for which the activity room is used for schedule events is 3.4 hours across the four facilities.

Table 3.14 Scheduled Activities in Activity Room/ Space (Facility A, B, C, D).

<table>
<thead>
<tr>
<th>Public Space</th>
<th>Date</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>14: 00 PM - Let’s Play Dominos</td>
<td>11: 30 AM – NewBee’s Lucheon</td>
<td>10: 15 AM – Morning Exercise</td>
<td>9: 30 AM – Exercise Essentials – Gentle Movements with Asha</td>
</tr>
<tr>
<td>Activity Space</td>
<td>Weekday</td>
<td>10: 00 AM – Craft Hour Home Made Terrarium Globes</td>
<td>13: 00 PM – SingFit</td>
<td>13: 30 PM – Useless Facts with Bob Discussion Group Bullying</td>
<td>15: 00 PM – The Importance of a Memoire by Tom W, Social with Craft Cocktails</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18: 00 PM – Bingo with Jessie</td>
<td>10: 00 AM – Bingo Club with jessica</td>
<td>10: 15 AM – Jazercise</td>
<td>11: 00 AM – Cranium Crunches: Winter Items Starting with…</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>13: 00 PM – SingFit</td>
<td>15: 00 PM – Music, Cocktails and Trivia Social</td>
<td>18: 00 PM – Netflix Feature: Crossfire Hurricane “The Rolling Stones”</td>
<td></td>
</tr>
</tbody>
</table>

**Peak Usage Rate**

**Facility A** did not have many scheduled events in the activity room during the two-day observations. Besides participating in a scheduled card game from 14:10 pm to 15: 20 pm during the weekday observation, residents were found to come to this place frequently, especially after the meal times, for watching TV, eating snacks, taking naps, etc. Peak usage took place in the afternoon on a weekend day with 6 residents [15%], and they were either taking the nap or watching TV (Figure 3.45).
In **Facility A**, the activity space is the closest public space to the residential rooms. Residents like to use this room as a small living space for watching TV, getting a cup of coffee, or sitting down with families or friends:

- “They use the country kitchen [activity space] quite a bit, because they have the coffee station there… especially in the morning… and they do use that area to play games or bake cakes sometimes [for the baking class] . . .”;
- “…other than the scheduled activity time, they come to relax, eat [snacks] or talk to each other . . .”

In **Facility B**, during the two-day observations, unfortunately, the researcher did not observe any residents showing up in the activity room (Figure 3.46), even when there was a scheduled activity in the weekday afternoon within the observation period.
The interviews suggest that this room was actually used frequently for small group activities:

- “…when they have good programs going on, we try to make it. I think that depends on everybody’s interests…”;
- I got involved in a lot of things. I made some friends by participating activities there … but some people just don’t want to do anything and stay in their rooms all the time…”;
- “…the most use of this room is Monday to Friday, when more staff is there…”;
- “…it is good for sit-down activities. For small group activities, it is a good place… doesn’t feel like a huge conference room. For things like cooking, crafts, it works really well…”;
- “… this room accommodates a lot of things. Sometimes, we have a family coming… and they like to watch movie together in that room…”;
- “Family can reserve this room for private dining as well… if the private dining room is booked by others… they use it more at the holidays, for birthdays. Sometimes we may have 10 birthdays in one month, sometimes no one uses it for a month…”.

In **Facility C**, the events that took place in the activity room closely followed the activity schedule. Residents showed up in the room only during the scheduled activity times. There were no residents found outside the planned group activities during the observations (Figure 3.47).

![Figure 3.47 Activity Room Peak Usage Rate and Usage Time (Facility C).](image-url)

As the staff mentioned, the residents interested in an activity and would participate regularly are typically the same group of people:

- “…we have X, Y, and Z who really like the painting class, they come here almost every week… it is sometimes hard to get other residents to come too, because we don’t want to
force them to do things they don’t like. We are trying to figure out what would be a popular activity for them to encourage them to get out of the rooms…”;
- “I stay in my room more often. Sometimes I just go to the gallery [activity room] and sit with them… sometimes I just watch … not really like the activity, but sometimes just sit down and watch for fun…”.

**Facility D** has most of its daily activities scheduled in the activity room. This room is the second largest area within the centralized zone of public spaces on the second floor. The most “popular” activity during the observations was the “Cocktail Social Hours” at 15:00 PM on a weekday. 25 residents [27%] were observed in this room as the peak number. The room appeared to be crowded by that time (Figure 3.48).

![Figure 3.48 Activity Room Peak Usage Rate and Usage Time (Facility D).](image)

Similar to other three facilities, the use of the activity room follows the social program schedule. For that purpose, this room is sufficient and has enough number of tables and chairs, even for Bingo:
- “We do Zumba in here, Bingo of course, we do exercise in here, we watch games on TV here… this is like an all-purpose room… they have a lot of activities there”;
- “A lot of time they have certain programs that are very interesting….”.  

**Area per Resident**
Similar to the living space, the pattern of use and the participation rate in the activity rooms are not as “predictable” as in the dining room. The limited observations certainly did not capture
most of the busy times. Therefore, the interviews findings will be used as the primary data to discuss the size of the activity rooms.

From the interviews, people from Facility A and Facility C have no complaints at all about the size of the activity space. In Facility A, the activity room is mostly used by the most popular game - Bingo. As staff mentioned, only a certain number of people like to play Bingo or participate in activities. Therefore, the total number of people who come to this space for activities tends to stay in a narrow range. The seat numbers and the shape of the room seem to be sufficient and appropriate.

- “…I fairly like it there, because they have something going on here, like Bingo is in here…and crafts… It seems to be ok for them because everybody gets enough room to sit... but I don’t like Bingo or cooking class very much…”;
- “Not every resident goes to the country kitchen or participates in activities… for what we have currently - Bingo, art and crafts, baking, it [the size of the space] is just fine. And they use the room every day”;
- “I think country kitchen [activity space] works very well…for social, for Bingo…but not everybody likes to do Bingo, … majority of people don’t come. But we have always had our Bingo people and they are always there, and every time we have enough seats and space for them… so you only have the same people come here over and over and over again, so I think the room is big enough for them.”.

In Facility C, 100% of the participants think the seats number and shape of the activity room are sufficient, either for scheduled activities or family gatherings:

- “The main purpose for our gallery [activity room] is to do different activities for our residents. So, most of our activities were held in the gallery. I think it’s a good location and it’s a large room. And it allows us to fit all of our residents once at the same time”;
- “… the residents and their families could reserve that rooms for birthdays, celebrations, and parties. So, it is a multi-purpose room…”;
- “I think the size is good…probably 20 or more people in there will be all fine…we had a staff celebration once in this room, and we have no problem to fit everybody in it…”.
In Facility B, some residents who like to participate in activities regularly think the size of the room is adequate:

- “Based on the activities I experienced there, I think the size is sufficient, for what we do there, … maybe other activities require more…”.

However, some staff think the room should be bigger since sometimes they could not have more than 16 people in this room or fit many wheelchair-bound residents for activities. In addition, people have hard time maneuvering around:

- “We have a lot of wheelchair people who like to participate … so this is not enough space at all. I think the layout could be a little bit more open…”;
- “… it’s good for small groups, but it’s very hard when you want to do a big group activity there…like today… we have 10 people there and 3 wheelchairs. It could fit everybody but it just took some extra time to arrange them in the room… and we were trying to get more people, but unfortunately, we don’t have that much space for all of them…”;
- I think this room could be a little bit bigger… we need these tables for activities sometimes, and sometimes we have to move them out of the way against the wall… but even you move them out of the way, you still feel crowded for some activities… like morning exercise…, we probably could only have 16 people in here… but they could not be all wheelchairs”.

Similarly, in Facility D, mixed responses were received regarding on the size of the activity room, although more negative comments were collected.

Some residents stated:

- “I think it is a good size room... different people do different activities in here…”
- “I think the activity room on the second floor is large and nice... They re-arrange the tables for certain activities…”

However, 75% of the interviewees mentioned a larger size is needed, not only for some popular activities like cocktail social hours or Bingo, but also for accommodating large events since Facility D has no living space.
• “…I think the tables and chairs in this room are pretty good. We use those for Bingo every day… sometimes I feel hard to move around because if one wheelchair sits in the aisle… and that is big… I couldn’t walk through with my large walker…so I think a wider aisle would be nice…”; 
• “… it [The size of the activity room] just makes no sense to me. We have many residents and we can just fit a max of 22 residents probably… and you cannot put them in the hall because you have the fire code, and you have to be able to walk down the hall when there is an emergency. The activity room is just not big enough…”; 
• “For the daily use, it [the size of the room] is perfect. I think the activity room is good for the residents we have here 90% of the time. We have had a couple of activities…like when children come in with violins, they were amazing, but it was so packed over there… some of the residents had to be in the hallway to listen”; 
• “…there is no space in this room for storing extra chairs or tables. So that’s why the folding tables and extra chairs take too much space where people would be… it just takes off human square footage now. If you think about how many activities we do in a day, and everything that we are accommodating… it is not enough at all…”; 
• “…the only time it gets too crowded is when they bring reminiscence residents from downstairs to participate the activity like the social hours or music performances… so then you have all three floors [both regular AL and SCU] … most of the reminiscence residents are on wheelchairs, so that take more spaces at the activity room than usual…”.

Table 3.15 shows the area of the living rooms and the number of on-site residents and their ratios.

Table 3.15 Activity Room SF/ Resident in Facility A, B, C, and D.

<table>
<thead>
<tr>
<th>Activity Room/ Space</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of On-site Residents</td>
<td>39</td>
<td>83</td>
<td>40</td>
<td>92</td>
</tr>
<tr>
<td>Total Actual Area (SF)</td>
<td>603</td>
<td>443</td>
<td>914</td>
<td>793</td>
</tr>
<tr>
<td>Area (SF) per Resident</td>
<td>15</td>
<td>5</td>
<td>22</td>
<td>9</td>
</tr>
</tbody>
</table>
The results are consistent with the findings in the interview. Facility A and C have higher ratios: 15 and 22 SF per resident, respectively; Facility B and D have the lower ratios – 5 and 9 SF per resident, respectively. Therefore, a guideline similar to the living space is recommended:

**Guideline 2-7 Activity Room Square Footage per Resident**

The optimal size of the activity room shall be programmed at 20 SF per resident, with a minimum of 15 SF per resident.

**Furnishing**

All four activity rooms are mostly enclosed, although they may not be fully separated from rest of the facility with walls and doors. A staff member from **Facility A** raised an issue on noise. There are no full height walls to make this space as an enclosed area or a room, only some knee-walls separating the space from the corridors. As she said:

- “I wish it could be more enclosed… because it is hard to talk sometimes. It is a hub to everywhere. It is so open that you got therapists talking to somebody with hearing deficits while I was calling Bingo there [in the activity room] … So, I think it should be more enclosed...”;

**Guideline 2-8 Activity Room Furnishing**

The activity room shall be an enclosed space with full height walls and doors for noise reduction. The room should be designed with tables and chairs. Folding tables and an attached table/chair storage space are desirables.

**6.2.4. Lobby**

The lobby area is the first place that people encounter of the building. It is mostly used by people entering or exiting the building, making it a hub of traffic flow. It is also an area for residents to relax and do “people watching”.

The lobby in **Facility A** [468 SF] is a well-defined living-room-like space, with two sets of sofas at the center. Two corridors connect to the lobby, one leading to SCU, the other to the centralized public spaces (Figure 3.49).
Facility B has the smallest lobby [155 SF] among the four facilities. The receptionist desk is to the right of the lobby with administrative offices behind it. There is very little furniture in the lobby, only one bench and a set of two single chairs against the walls. People can either sit on the chairs or their own wheelchairs for resting or waiting. When people walk in, they could also see the dining room and living room through a knee wall in between. The corridor by the lobby is the only way for some residents to use the elevator or to go to the centralized public spaces. Therefore, the lobby area is a busy traffic hub (Figure 3.50).

In Facility C, there is essentially no lobby. The living room is also serving the function of a lobby (see Figure 3.43 in the living space section).
**Facility D** has a similar *lobby layout* as in facility B - a front desk and two sofa chairs with one small circle table against the back wall. However, there is a *parlor* - a small sitting space with sofas – adjacent to the lobby. In addition, there is a *bistro* area connected to the parlor, offering more tables and chairs for people to stay. Therefore, the parlor and bistro areas are considered as part of the lobby area (Figure 3.51).

![Figure 3.51 Lobby & Parlor & Bistro of Facility D.](image)

**Use of Space and Size**

There are no scheduled activities in any of the lobbies and the number of people observed in the lobby areas was also low (2-5% peak usage rate across the four facilities) during the observation sessions. Therefore, the discussion on the lobby space is primarily based on interview results.

In **Facility A**, during the observations researcher noticed that residents stayed at the lobby to: 1) have a rest; 2) wait for families or friends to visit; 3) sit and chat with families or friends; 4) watch/chat with the people passing by; 5) chat with the front desk staff. All of the resident interviewees like the lobby area, and they like to visit it during the day:

- “I think it is very nice and very comfortable for people to stay and it is also very nice to sleep in…”;
- “You can sit down there, and if you are waiting for someone to pick you up, you can also sit there for them. I think it is necessary to have such a place, because it presents the warm feeling to the people coming in… when you visit and you see that [the lobby area], you will feel it is a comfortable place…”;
• “I visit there every day because I like to say good night to the girls [the staff or caregivers] … and I am going out quite often [to walk outdoor], or take the bus to go shopping, and you sit there and wait [for the bus] … it is very comfortable…”.

The staff and caregivers agreed that a well-defined lobby is needed, because they believed that it is not only a welcoming home-like space to both of the residents and their families, but also an area for staff to monitor the residents if they need any assistances:

• “The residents use it all the time… start from sunrise… and we have movie on TV [on the wall behind of the front desk] in the afternoon every day … Some of them just come here to sit and watch who is coming in or passing by”;  
• “I think our design is good… sometimes people come to visit. It [the lobby area] feels like a home and inviting….”;  
• “I like this design. Because somebody [the receptionist] is sitting at the front desk when people get in for [visiting] either AL or SCU, and it is near our offices… our residents need more eyes on them sometimes… When I hear someone, who do not come out that often as usual, I could know and check whether she is with a staff member or not… some of them have Alzheimer’s but they are not in SCU yet…so it is good for safety too…”.

Regarding the size of the lobby:

• “It is more welcoming to have someone at the front when you walk in, and it has big enough space to gather [the residents] when we go for outings. So, it is a nice space for them to sit when we are loading the bus…”;
• “I never feel crowded there…. People just come in and go so fast…”;
• “…only when we get ready for the outings, the lobby is nearly full. But it is only for a short time and that is the only time here that gets crowded. It happens about two to three times per month… it is not often at all…”;
• “Not very crowded, because the only time it is crowded is when we are gathering for outings, then the gathering space is the lobby….”;  
• “… it doesn't get full, unless they [the residents] have a hearing check. There were like six people who wait to get in, because they usually use the conference room nearby for it
[hearing check]. So, they just sit there and wait for their turn. Otherwise, I think this space is fine.”.

- “I think it is a very nice place… I think the room is fine, it is big enough, and the decoration is nice… I think it is very presentable.”.
- “it has a plenty of seats, and it is a central area for people come in…”;
- “I think the size is ok, because we [the residents] are not going there at the same time… it is never crowded”;
- “In a perfect world, it could be a little bit bigger. In that way, more people could sit and wait there…”;

In Facility B, people have different opinions on the design of the lobby. Similar to Facility A, most believe such an area is needed:

- “I think a designated room, … would be nice. They [the residents] can sit down, with a cup of coffee while waiting… or when you have visitors, it would be nice too to have a waiting area to sit down…”;
- “People kind of move fast to get on the bus. And they can wait in the living room [nearby the lobby] but it’s rare, not very often”;
- “…we put chairs there. And when people walk in, they will see the front desk immediately. They don’t have to sit and wait so much time there… kind of like a “come and go” place…”.

However, both residents and staff mentioned the congestion issue, which has to do with the size and location of the lobby:

- “…it is not that bad [too crowded in the lobby all the time], but sometimes there are a lot of wheelchairs…”;
- “During meal times, it was always crowded there. You have people coming in from outside and going out from the dining room to the front elevator. It is a pretty small space, only big enough for one wheelchair at a time…”;
- “if you have people [residents] going outing, and people [nurses] coming in for medical appointments, and maybe you get a lot of visitors … especially at 11 am to 1: 30 pm probably you would see it [the lobby area] being crowded there…”;
• “… for the outings, you may have 3 - 4 people sitting there to wait [for the bus], about twice a week… or for medical reasons. It is in a quite small size and I think it would be better if it is larger…”;
• “It is efficient, but it could be a little bit bigger …”;
• “If the space could be a little bit wider, especially when a lot of people stop by the front desk for questions…”.

As discussed earlier, in Facility D, the parlor and bistro areas are considered as part of the lobby. The observation data gathered from these spaces show that they are big enough. In the interview, most of the interviewees mentioned that the parlor and bistro were very pleasant places:

• “This facility is different from others, because it is open [between lobby and parlor and bistro areas] … They [the parlor and bistro] are nice places”;
• “The mobile residents, the ones that walk more, would go down there and get their snacks, cookies, or popcorns every day…”; “…they can sit down, they can watch the TV, they can watch the ball games…”;
• “I think this place [the bistro] is great. It’s self-serving, so it makes the residents feel independent. And it’s very welcoming…”.
• “I like this design, because when you walk in you can see everything… if someone sits there in the parlor or bistro, I can see them… then I can see if they need any help”.

The parlor and bistro are also places for small group family visits, meals or parties, medical appointments, and walk-in tours:

• “I think these space works well for the small group visit and activities…”;
• “People use it every day. We have some small family meetings, physical therapy classes…”;
• “…some residents come down for the coffee, some may bring their loved ones to have meals down there sometimes”;
• "…basically, other than the scheduled activity times, this area is for the walk-in tours…for the potential customers”.

All interviewees mentioned the size of parlor was adequate, but the bistro area could be bigger for events such as live music playing, or family parties.

- “It does not have enough room for everybody to sit. It is a good set-up with the furniture, but maybe it needs more space”;
- “…it’s adequate, but it could be bigger. Sometimes, we have live music there about once a week. The residents came down and sat on the chairs… sometimes we need more chairs…and the area gets very congested…”;
- “We used to have our “Cocktail Socials” [daily activity] down there… but that’s way too small for it now. So, we have to move it to the second-floor activity room…”;
- “When they [the residents] have some large group activities, I think that space is too small … I think if they have a large group activity like the music show, they should have it in a bigger place, like the activity room upstairs [on the second floor]”.

The interview findings suggest that a well-defined lobby is much needed for various reasons, such as relaxing, napping, people watching, serving as a holding spot before residents’ outings. The size of the lobbies in Facility A and D is adequate, but the size in Facility B is not. The lobby size is primarily driven by one of its functions – a holding space before loading residents on bus for outings. This is directly related to the total number of on-site residents. Table 3.16 shows the area of the lobby and the number of on-site residents and their ratios.

Table 3.16 Lobby SF/ Resident in Facility A, B, and D.

<table>
<thead>
<tr>
<th>Activity Room/ Space</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of On-site Residents</td>
<td>39</td>
<td>83</td>
<td>92</td>
</tr>
<tr>
<td>Total Actual Area (SF)</td>
<td>485</td>
<td>155</td>
<td>950</td>
</tr>
<tr>
<td>Area (SF) per Resident</td>
<td>12</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

The results are consistent with the findings in the interview. Facility A and D have higher ratios: 12 and 10 SF per resident, respectively; Facility B has a fairly ratio – 2 SF per resident.

**Guideline 2-9** *Lobby Square Footage per Resident*

The optimal size of the lobby shall be programmed at about 15 SF per resident, with a minimum of 10 SF per resident. This ratio is primarily driven by the lobby being used the holding space before residents’ outing trips.
6.2.5. Library

Only Facility A and Facility B have designated library spaces with bookshelves, computers, tables and chairs. The library in Facility A is located at the intersection of the two residential wings (Figure 3.52). In Facility B, the library is located toward the back of the building, attached to the sitting space near the private dining room, sun porch and salon (Figure 3.53).

![Figure 3.52 Library of Facility A.](image1)

![Figure 3.53 Library of Facility B.](image2)

**Schedule and the Use of Space**

In Facility A, only a few people were observed in the library at a time (2 residents at most). They came here to: 1) take naps; 2) meet with families or friends as a parlor; 3) read books or newspapers; 4) play puzzle; 5) hold small group staff birthday party. From the interviews, all residents, staff, and caregivers said the library was rarely used:

- “I go there occasionally to read newspapers or magazines… every once in a while, I borrow a book, but rarely sit there [in the library] …”;
- “I don’t see a lot of people using that space. Some of them use the place when they want to computer games, or email somebody… it is free for them to use…”;
- “They use the library, but not that often. Sometimes they play puzzles… read newspapers … We don't have any activity in this room. Sometimes they just get a book and go back to their rooms”;
• “Not a whole a lot of people use it [the library]. Some people do, some like to play puzzles, some read newspapers, mostly puzzles… a lot of people get the newspaper [from the library] and read it in their rooms”;
• “Some of them will come to get a book and then go to the living room, some of them take it to their rooms… so they don’t usually sit out here [in the library]”;  
• “The library is rarely used. If you think about their generation, they grew up with candles. Some of them don’t read. The residents don’t use the computer. Only sometimes the staff use it for training. So, I’d rather get all the tables and chairs out and put an exercise bike there”
• “I love to read large print books… I have very poor eye sight, but few of them [the books] have large prints. It is difficult for me to find the book that I can read there”; 
• “I love the idea to have a library on site, but I need more large print books”.

Some staff members supported the idea of having a library room, because:
• “It’s there if it is needed…”;
• “If I have some visitors and I want to sit down with them, just like what we do now, I can sit in the library…”;
• “…people don't use it very much, but if you want to do puzzle, or you want some books, you have this library to go to…”.

Due to its low use frequency and main purposes, none of the interviewees thought the size [364 SF] is too small:
• “The library is fine for what it is. It has enough room to do that [reading]”; “I think the library is fine for its size… I think it is a very manageable size”.
• “… it never gets packed. I think it is big enough, because no one wants to be there”.

Only Facility B has a scheduled activity in the library regularly - “Bridge Club”, which is a small group card game activity and needs table and chair. There were no residents observed other than during the scheduled bridge club time. During the interviews, all interviewees mentioned the library was basically used for the scheduled “Bridge Club” games:
• “They use it for Bridge Club. Sometimes people use the computers, read some books….”;
• “That’s where they play cards. That’s a private place [with closed doors]. They kind of like that”;
• “We do play Bridge there and we have 8 bridge players there … there is also a computer there, but I think only the employees use it sometimes”;
• “I have gone to the library several times, not necessarily for books… Once I had a friend coming, I wanted to reserve a room, but the big one [private dining room] was not available. So, they put me in the library down there [on the first floor]. So, I have been in that room for lunch once”;
• “I don’t go there… I got what I need [in my room]. I read newspapers [in my room] five times a week, I try to read books, I watch TV, I listen to music… Not much need to go there [the library] …”;
• “You don’t have people go there and read. If they want a certain book, they will take it and go somewhere else to read”;
• “…you have to struggle to open the door first, hold the door and then get in. So, it’s not easy and accessible for a lot of people, especially the people on wheelchairs or use walkers…”.

Most of people thought the size [203 SF] was adequate, although some wanted a bigger room:
• “…for the bridge club we have here, the library space is fine”;
• “Compared to other library [in other places], ours is two times smaller… but it still functions well for our residents, because not everybody comes”;
• “If we could have a larger room, we probably can get more people to join the game. But we don’t…”;
• “…I like Bridge. I think the space is adequate… but so many tables in there… when we have four people playing in there, it is a little bit crowded…with walkers or wheelchairs, it is very tight”;
• “I think it could use more space between the tables…”.

Guideline 2-10  Library

Library is an underused space in regular AL facilities, at least for its primary function – reading. Computers in library are also underused by the current generation of senior residents.
6.2.6. Beauty Salon

*Every facility has a beauty salon on-site.* People typically go there for their hair, nail, or mustache. The salons do not open 24/7. Residents need to make appointments with the beauticians who come to the facility and provide the service regularly.

All of four salon rooms are in rectangular shape. The average size is 223 SF with **Facility A** [149 SF], **Facility B** [256 SF], **Facility C** [178 SF], and **Facility D** [308 SF]. The salon in Facility A is small and it only has one salon chair. Larger salon rooms like Facility B, C, D have two to three salon chairs.

During the interviews, 100% of the residents, staff and caregivers said the beauty salon was a “must have”

- “I go there every other week… so I do think it is necessary to have [a salon], because it is very hard for us to have an appointment outside … you have to get transportation to take us out to somewhere else every time… I think this one is very nice and adequate…”;
- “They love it! They always ask when she comes, when she comes…and when they can get their hair done, they get very excited…”;
- “…a lot of residents can’t go out to the beauty shops or they don’t have anyone to take them outside to do their hairs or nails…”

People in Facility B, C and D have no issue with the location and the size of the salon (Figure 3.54):

- “We only have one beautician in the room one at a time… and she only takes one person at a time…and the residents don’t need to wait in line, because she [the beautician] goes to their rooms to get them when she is ready for them”;
However, in **Facility A** (Figure 3.55), the size of the salon room is relatively small [149 SF]:

- “I wish we can knock down this wall [a wall between a storage room and the salon]. The salon is more like a storage room feeling to me… I would rather have 10 more feet to add to the salon to get it bigger…”;
- “Residents have to make a right turn from the hallway and open a door to get into another hallway…”
- “That room is just so small. If you have more than one person on wheelchair, it just feels too small and crowded. I do want more space for that room …”

**Guideline 2-11  ** **Beauty Salon**

Beauty Salon is a “must have” in a regular AL. It should be programmed at 250 SF minimum to accommodate salon chair and resident’s wheelchair.
6.2.7. Sun Porch

**Facility B, C and D** have an indoor sun porch, a space connecting indoor sitting space (Facility B), living space (Facility C), and dining room (Facility D), to the outdoor courtyard. Each of the rooms is constructed with large expense of glass. Tables and chairs are typical furniture in these spaces. The average size of the sun porches is 351 SF with Facility B [290 SF], Facility C [281 SF], and Facility D [482 SF] (Figure 3.56).

![Diagram of Sun Porch Facility Layout]

Figure 3.56 Sun Porch of Facility B, C, D.

All of the observations were conducted during the winter. The average outdoor temperature was about 55 Fahrenheit during daytime. Very few residents were found in the sun porches during the observations. The peak number of people [3] found in **Facility B** was during a family visit. In **Facility C**, only 1 resident [1%] was found using the space and stayed for a very short period of time. None of the residents in **Facility D** used the sun porch in the two-day observations.

From the interviews, nearly all interviewees mentioned that the lack of climate control (air conditioning or heating) was the biggest reason that keeps the residents away.

In **Facility B**, the sun porch space has been used more frequently during the summer time for resting or small food events. As some staff mentioned:
• “We use that for parties on good weather days. But other than that, they don’t use that much...”;
• “It is rarely being used in the cold weather... some during summer time. They [the residents] drink their coffee, or read a book... sometimes we open it up because we do a cook-outs. We set up that area with a buffet... we do utilize the area from spring to October...”.

Some responses from the residents:
• “We do spend time at the front porch [not the sun porch in question]. But we don’t go to the back one [the sun porch] ... good question... I don’t know why we did not use the back porch ... just no reason... or maybe it's not popular and people don’t usually go there...”;
• “I have no reason to go in there... I have to go through double doors... but the front door [automatic door] is much easier for me [with a big wheelchair] ...”;
• “It is a nice area... but people just rarely use it. I think is it not about the location. There is no push button to get in to those double doors ... the accessibility, especially for the wheelchairs, or walkers... Smokers might be the only people passing the [sun porch] room to the outside courtyards... or maybe the cold temperature...”;
• “…the doorknobs of the porch are too heavy for me. I can’t get it open [on the wheelchair]. If I use two hands to open the door, then I will not be able to roll the wheelchair myself...”.

Residents in Facility C seem to go to the sun porch more often than the other two facilities:
• “It’s a very nice place to read in the morning... and if you have some guests or families coming, you can use that room”;
• “…they use this room for individual activities, for example, some residents like to bring their books to there and read for a little while. Sometimes they have private conversations with someone... or family sometimes use this room for a private visit”;
• “The porch area is more of a private space. It’s good for family visits, and when people need a little more privacy, maybe they want to read a book by themselves...”
sometimes. So, I think the location is good, it’s at the front, but still designed with
doors. So, people could use it when they want to be alone…”;

• “When the weather is warm outside, they will read more there, and for family visiting,
[private] conversations, etc.”.

Some residents mentioned they have no reason to use the sun porch:

• “I don’t have any needs to stop there…”;

• “I don’t go there often… only when we have something like this [the private
conversation with others such as interview]. And a lot of time, you come down in
here, someone was with their families…so you can’t use the room…”.

About the location and the size of the room:

• “…if you have your family visiting, we have very beautiful view out there … I think
the size is ok for family visit, and you can do private things there if you don’t want to
stay in your room, like reading a book”.

The sun porch in Facility D also has the accessibility issue. The door is always locked with
passcode. Residents have to ask caregivers to let them in when they want to access the room:

• “I have never seen anybody out there… we just can't get out…”;

• “…they [care manager] are supposed to unlock that door for the residents during the
day, and secure it in the night… it’s locked all the time and we have to ask for it…”;

No temperature control is another issue:

• “…they don’t have heating out there…it’s too cold out there”;

• “…unfortunately, people don't use that space that much. It is only used for certain
time in the year. Summer it might be too hot here, and winter it might be too cold. So,
they just don’t go to that room…”;

• “…unless I take them out there they won’t use it. And if you have a porch, it has to
have temperature control”.
Instead of using this sun porch on the second floor, people seem to use the front porch by the building entrance more often:

- “I’d rather to go the front [porch] …”;
- “I never use the porch [on the second floor]. I don't have any reasons to go there. I always use the front porch downstairs…”;
- “…there are certain people who go there, but again it is weather permitting…. or maybe there is nothing going on or to see in here, but at the front porch you can see people coming in and out… I know some people really like to watch the traffic…”.

### Guideline 2-12 Sun Porch

An enclosed glass sun porch is “nice to have”, but not essential. Climate control, accessibility and visual connection to people are crucial factors. 300 to 400 SF appear to be enough area for a typical AL facility.

### 6.2.8. Private Dining Room

Private dining room (PDR) is a residentially scaled and furnished space, accommodating family gatherings or smaller groups of residents (Perkins Eastman, 2013). Facility A, Facility B and Facility D provide PDR on the first floor, seating 8 - 12 people. The location of the room is either adjacent to or near the main dining room. Residents and their families can reserve this room for family private gatherings such as family dinners or birthday parties. Facility B provides a PDR on the third floor to serve meals to the residents who cannot travel too far from their rooms and need eating assistance.

The PDR of **Facility A** directly connects to the main dining room with 3 square tables and 10 chairs (Figure 3.57). During the observations, no residents used the room, but 10 staff used the room for a staff meeting in a weekday morning.
During the interviews, the interviewees indicated that the PDR was designed mainly for family meals or parties, but it could be used for staff meeting or trainings:

- “I think we only use it once with my son for his visit … other than that, no”;
- “Families do birthdays, parties, celebrations... It is really a nice room when you have conference in there too. You can have special memories with certain people there. So, you really need that space…”;
- “It depends on the day. Families may bring cakes and foods for birthdays. A lot of [staff] meetings have been held there, as you saw this morning. So, it is utilized a lot, but all the time for the dining? Not necessarily…”;
- “…they [the residents] use it maybe one to two times a month… for anything like families [visits], dinners, and celebrations. We use it for the training the staff sometimes. It is a great place… great lighting, and it is a quiet space…”.

They also mentioned PDR had been more frequently used as an extension of the main dining room when needed:

- “They use the room [PDR] when it is too full in the dining room… I have used that space before, but not quite often”;

Figure 3.57 Private Dining Room of Facility A.
• “I call that overflow space [laugh]... when you have too many people in the dining room and you don’t have enough seats, you need somebody to sit there…”;
• “[residents use the private dining room] every day, because residents have their family members to come, sometimes, it [the main dining room] is filled up, so PDR is an extension to the dining room…”;
• “the private dining connecting to the main dining room is very convenient for us to adjust and fit everybody when it is necessary”;
• “Some people really want to seat there [in the PDR] sometimes…and they can choose wherever they want to seat…”.

The number of seats [12] in the PDR seems to meet the needs of the residents. The square footage per seat is 32 [319/10 = 32], which is below the standard (40 SF/seat) provided in Guideline 2-3 for dining spaces with table and chair:
• “… the aisle between tables could be a little bit apart, because some of them have wheelchairs, sometimes we need to move the chairs for them… maybe more space for them would be better…”.

The PDR of Facility B is attached to the main dining similar to Facility A (Figure 3.58). There are one long rectangle table with ten chairs in this room. During the observation days, no residents used the room, but 5 staff had a meeting in a weekday morning. Facility B [90 residents] has a higher capacity than Facility A [38 residents]. The demands for the PDR are higher. If the PDR has been reserved for one family, other families have to use either the activity room or the library room instead:
• “I think it is necessary to have the PDR because here is their home. Their family can bring food for birthdays whenever they want…and I think families like it…”;
• “Families can reserve this room [activity room] for private dining as well, if the private dining room is booked by others. They use it more at the holidays, and for birthdays. So sometimes we may have 10 birthdays in one month, sometimes no one uses it for two weeks…”;
• “Once I had a friend coming, and I wanted to reserve a room, but the big one [the PDR] was not available. So, they put me in the library down there [on the first floor]”.

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Facility C is the only facility that does not have a PDR on-site. They typically use the “Gallery” room - the activity space - for family gatherings and celebrations. Most of the interviewees from Facility C thought it was better to have a separate private room:

- “…family can reserve for that if they want some private parties. So that is a private space for them. But in the meantime, that means the rest of us cannot use that room… I can’t get my book from that room [Gallery]…”;
- “I think it is better to have a separate family meeting room … not necessarily a PRD, but a private place for the families and parties”;
- “when families reserve it, I have to hold the activity in the living room instead… sometimes works, but sometimes, like crafts …we need tables… it’s not very convenient …”.

Facility D has the largest PDR room [420 SF] among the four facilities (Figure 3.59). It is across the hallway from the main dining room. There is a big rectangle table with eight chairs. During the two-day observations, none of the residents was observed to use the room.
Based on the interviews, the functions of the PDR in this facility are fairly similar to other facilities, except that it has also been used a chapel for individual church service and for eye-exams. Most People satisfied with the size [53 SF per seat] and the location of the room for what it has been used for:

- “The private dining room is good for about 8-10 people…”;
- “I think it is big enough, because it’s normally for one family in that room at a time. It’s private. I think it is in a good location, because it is near the kitchen which is very convenient…”;
- “We did a lot of meetings there for the staff. The space is big enough for that”.

For larger group family events, residents could also use the bigger activity room or bistro as an alternative PDR:

- “We once had a resident who brought 20 family members. So, we put them in the activity room, and we set up the tables”.

One staff questioned whether such a large AL community [with 151 beds - 104 for regular AL + 47 for SCU] should only have one PDR, especially during the holidays.

- “I think that’s nice place. The only problem would be during holidays - multiple people want to use it. For this large community, it could be a headache…”.

Figure 3.59 Private Dining Room of Facility D.
Table 3.17 shows the ratio of the number of residents per PDR for the three facilities that have PDR.

Table 3.17 Resident Number to Private Dining Room Ratio.

<table>
<thead>
<tr>
<th>Private Dining Room</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of On-site residents</td>
<td>39</td>
<td>83</td>
<td>92</td>
</tr>
<tr>
<td># of Private Dining Room</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td># of Residents / PDR</td>
<td>39</td>
<td>83</td>
<td>92</td>
</tr>
</tbody>
</table>

The results are consistent with the findings of the interview. There are concerns from both Facility B and D, where one PDR is not enough considering the high number of residents, especially during holidays. There was no such issue in Facility A. Due to the limitation of the sample size, it is difficult to estimate how many residents will warrant a PDR. However, one can reasonably assume that if the resident number is below 50, one PDR is enough; and if the resident number is over 100, two PDRs shall be provided. Two PDRs are recommended for facilities with resident number between 50 and 100.

**Guideline 2-13 Private Dining Room**

PDR is a much-needed space in regular AL. Each room shall provide table and chairs for 8 to 12 people with 40SF per seat. For facilities with less than 50 residents, one PDR is sufficient; for facilities with more than 100 residents, two PDRs shall be provided; for facilities with 50 to 100 residents, two PDRs are recommended.

6.2.9. Spaces to Add to the Existing Facility

When asked what type of public spaces that you currently don’t have but would like to add to your facility, resident participants stated the following spaces in the order from high to low preference: 1) gym; 2) swimming pool; and 3) multi-purpose room (for either movie, library, bistro, private dining, chapel). More than half of the resident interviewees mentioned a small gym with equipment do some exercises. However, most of the staff and caregiver participants were concerned with safety issues related to falls or injuries. Certain residents also expressed the interest in swimming, which is one of the most beneficial exercises for their physical and mental
health. Other people mentioned movie theater, chapel, and private dining room (if they don’t have now).

6.2.10. Spatial Adjacencies of Public Spaces
Most of the indoor public spaces in the four facilities are grouped together, either located at the front of the AL building on the first floor by the entrance (Facility A and Facility C), or on an upper floor (Facility B and Facility D, both having three levels). Only the most frequently used public spaces will be discussed in this section, including 1) dining room; 2) living room; 3) activity room; and 4) lobby. The spaces that are only used occasionally or for special purposes are not addressed here, such as mail room, beauty salon, sun porch, etc. Informed by the findings of the previous sections, the following spatial relationships are identified for discussions: 1) dining room and living room; 2) activity room and dining room; and 3) living room and lobby.

Dining Room and Living Room
All four facilities have dining room directly connect to the living room (if the large activity room is considered as a living room for Facility D). As the staff suggested, this design is very convenient since most of the daily activities are scheduled in the living room normally between two meal times. When people finish their meals, if there is an activity on the schedule, people can just stay in the living room and wait for it. Similarly, when they finish an activity in the living room, they can easily walk to the dining room for the next meal. If there is no activity in the living room, people find it easy to take a nap or watch TV in the living room before or after meal times, just like at home. As mentioned earlier, the living room is also a potential space for walker storage during meal times when needed (although most residents like to keep the walkers within their reach while dining).

Activity Room and Dining Room
Except for Facility C, the activity rooms of all other facilities are in close proximity to the dining room. Based on the interviews, people in Facility C seem to have no problem to find the activity room, which is embedded into the residential unit area. The concern is that sometimes there is too much noise from the activities, which create noise to the nearby residential units.
As a staff member in Facility D suggested, to encourage residents to leave their rooms and walk more, the public spaces – dining room, living room, activity room, etc. - should be grouped together and be away from their units:

- “...the most comfort space is your room. They only visit the public space if there is a reason for them to go. They go to the dining room because they need to eat, and they go to the activity room because they are interested in some activities there… I will have more people for activities if there is a “back to back” situation, which means they don’t need to transfer too far from one room to another… they will do that… because they are at a central all-together area… But if I have them to go to the dining room [second floor] and then to the bistro [first floor], then have the next activity back in the activity room [2nd floor], then they won’t do it… and I will lose half of them for sure…”.

**Living Room and Lobby**

According to North Carolina LICENSING OF ADULT CARE HOMES OF SEVEN OR MORE BEDS, “Each living room (and recreational area) shall be located off a lobby or corridor. At least 50 percent of required living and recreational areas shall be enclosed with walls and door”.

**Facility A** and **Facility D** align with this requirement and have no complaint about the living room location from the interviews. However, both **Facility B** and **Facility C** have their living room directly open to the lobby and main entrance of the building. Over 73% of participants from these two facilities complained about this design. Some residents mentioned that the main entrance doors are automatic doors, which will automatically open whenever people get close by. In the winter time, if people are sitting in the living room, they feel very cold there. In the summer time, it is too hot. Staff member also indicated that people in the living room tend to be distracted by the noise from the lobby:

- “... sometimes is could be noisy too… it is too close to the front desk, because people talk, sometimes loud, and of course the [front desk] lady answers the phones, or answer questions… so if you really want to concentrate on something or watch a movie there, it is kind of hard… So, if it [living room] could be a little bit further back [from lobby] maybe… It is just too near the entrance…”;
• “…I think the living room should be more enclosed, at least having a wall or something to separate it from the main entrance [and lobby].”

**Guideline 2-14  Major Public Space Adjacencies**

It is desirable to group dining, activity and living room together so that they have close proximity. This public space cluster can be close to the building entrance and lobby, but the living space needs to be visually and acoustically separated from the lobby.

**6.2.11. Circulation, Walking and Wayfinding**

Figure 3.60 shows the corridor systems of the four facilities. The corridors are colored in darker grey, public spaces in lighter grey. Except at Facility C, where there is a loop corridor system, all other three facilities have the “dead-end” condition.
The questions are:

*What type of circulation pattern better supports way-finding and promotes walking and physical exercises? Specifically, which layout - “dead-end” or “loop” corridor, better supports way-finding and promotes walking and physical exercises?*

Observations were conducted at the four facilities to record the senior residents in the hallways. By counting the total number of residents in all corridors, the peak usage rate of the hallways can be calculated in the same manner as in the previous sections (Figure 3.61). The number of residents showing up in the hallways of Facility C, which has the loop corridors, is significantly higher than Facility B and Facility D, and slightly higher than Facility A.
Figure 3.61 Hallway Peak Usage Rate and Time (Facility A, B, C, D).
A. HALLWAY

Peak Usage %

18%

7 Peak
39 Total

B. HALLWAY (1st fl)

Peak Usage %

10%

8 Peak
83 Total

B. HALLWAY (2nd fl)

Peak Usage %

4%

3 Peak
83 Total

B. HALLWAY (3rd fl)

Peak Usage %

4%

3 Peak
83 Total
To address way-finding, the following interview questions are developed:

1. **How do you feel about the current dead end/loop hallway design?**
   
a. **Do you think the current dead end/loop hallway design meet the residents’ daily transferring needs?**
   
i. **If so, have you noticed any residents walk in the hallway frequently for exercise? do you feel this design could motivate them to walk or exercise more?**
   
ii. **If not, if you were a designer, what would you recommend to change?**

2. **By reading the facility map, I noticed that the resident rooms are located on both sides of the corridor, like a hotel**
   
a. **Do you think this kind of design sometimes confuse the residents and they may have difficult to find their rooms?**
   
b. **Have you ever observed that the residents got lost possibly because of the hallway design?**

Staff members from the three “dead-end” facilities mentioned that people got lost when they came to the facility at the first time, because every hallway and unit door look exactly the same. As they mentioned:

- “When they first came, yes, it did [confuse them], but afterwards, no. It also depends on which person, they don’t pick up in the same time… somebody has dementia too… so that makes it different… most people do remember their rooms, some people you have to redirect because they have dementia, that is a big thing here [regular AL] …”;
- “…At first, when they came here, it was too overwhelming to them, and they got lost. And it’s hard to tell which room, because every room looks exactly the same…”;
- “when you take different elevators, you think you are in the right way, but you are actually not. You will be like “emmm, where am I?” … because every corridor looks the same, same wall paper and same carpet…”;
- “…sometimes …. When I started to work here, I got lost. I think it would [affect residents], especially when they are new [here], and it’s really a big community, and each hallway looks the same. So, it is very easy to get lost there…”;
- “…I think it is probably because of both [corridor design and mental issues] …”;
• “Some residents do get lost. But I think that’s caused by their memory problem. I am not sure whether the design influences that…”.

In Facility C, which has the loop corridor, the interviewees stated:
• “For our circular design, no matter where you start, you just keep going, and you still end where you started. So, you can't ever get lost…and if you need any help, you can always find someone to help you at the front…”;
• “It [the loop corridor] helps the residents, especially at certain ages. Our design - all in one level and in a circular pattern, really helps the residents find their way better. When you have elevators and stairs, it could be confusing sometimes for some people…”;
• “…this loop design could be a problem too… because the wall paper of each hallway and every room door look the same… sometimes you just keep walking and may not notice your room because they are all look the same… then you walk back to the front again…”.

For whether the loop corridor pattern encourages residents to walk more indoor, 100% of the participants from Facility C liked the design and believed the continuous hallway circulation could encourage the residents to walk more indoor when weather is too hot or cold outside:
• They have a walking club. I used to participate when I used the cane or walker. They usually walk in the loop and go outside to the courtyard in the middle and circle back around. When the weather is cold, we can walk inside in the loop, which is very nice. I think it does encourage people to walk. I think our loop hallway is an advantage [than the dead-end hallways] …”;
• “I walk 3 times there [in the loop corridor] after each meal, every day…I also like to walk with my daughter there when she comes…it’s very nice”;  
• I personally prefer to walk outside. But when the weather is too cold outside, I think so [the loop corridor would encourage me to walk inside] … I like this loop corridor inside the building. I think that’s very important to me”.

In addition, staff with years’ experiences in AL industry also believed that the loop corridor could better support residents on their daily walking and physical exercises.
• “Typically, in this environment, we encourage them to do more exercise. So, we try to do 2-3 different exercises a day. One of our activities is the “walking club”. Whether the weather is good or bad outside, we can let them walk in that circular with long enough corridors. I think it helps…”;
• “They walk more inside, because it is dangerous for some people to walk outside. They do walk in here, and it’s good for them…”.

The responses from the participants of other three facilities vary:
1) About one fifth of the interviewees do not care how the hallway is laid out, since most of them use electric wheelchair or regular wheelchair pushed by caregivers.

2) About one fifth of the people think the current dead-end design works fine, since they can walk back and forth in the hallways, which are long enough for exercise purpose:
   • “I usually walk down the hallway and come back. I don’t know if having a loop would help me… that might help somebody else…”;
   • “…most of them like to stay in their rooms, but I think here we have plenty of space for people who like to walk. They can walk this way to the end and come back”.

3) The rest three fifth of the people think a loop corridor might be a better choice and can potentially enhance residents’ indoor walking experiences:
   • “I think the loop corridor will encourage them to exercise, I know someone goes outside to walk, but if we have a better indoor walking space, they can also walk when it is cold outside or too hot”;
   • “It is nice to have it looped, because we have residents who like to walk. When it is cold outside, they walk in here [in the hallway], and they go down one hall and turn around and go to another hall. They do it multiple times. But if they have a loop, it would continue its flow. I know exercise sometimes is boring… so it is nice to have that walking loop inside to create more fun…”;
   • “… the loop corridor [promotes residents to walk and exercise more]. In that way, it can keep them walking. I don’t know whether it could encourage them to walk or exercise, but I think it could help some [residents] at night… we have some residents who are in
the lower or middle stage of dementia … and having that loop they can keep walking. With dead-end… they have to turn around”;

- “…it was very confusing when I first started because they [the corridors of two residential wings] are not connected to each other. I thought it was supposed to be a circle and you are able to walk through… but it’s not… When you get to this hall, you can’t get to that hall… I think it should to go like this [a loop]. Because when you go to the end of the hall, you have to turn around and go back and walk a long way to another hall… especially for me [a caregiver], if they call me when some emergency happens, I have to go back from one hall and run to another… circled hallway will be so much better…”;

- For an H-shape [building shape of Facility B with dead-end corridors], every time you have to go down and come back, and go down to another hall and back again… versus if you have a circle, you don’t have to back track anymore, which seems very efficient…”;

- “I think a loop corridor would be easier for them to do it [walking for exercise indoor]. We have walking club. And people walk to the dead end and don’t know what to do, and then turn around and go back. So, I like the loop. One day, it was warm outside. We just walked in the loop [loop walking track at outdoor courtyard on the second floor of Facility D], people just looped around and around, and they didn’t want to stop and come back [laugh]”;

- “Sometimes, when we have walking club, some residents walk slower than others. So, when we [residents who walk faster] turn back from the dead end, the slower ones turn as well. Then the slower ones are at the front now, so we have to wait and wait… so the loop will be so much better for sure…”.

**Guideline 2-15  Circulation Pattern**

Loop circulation pattern appears to be more effective than dead-end pattern in encouraging residents to walk and improving way-finding in regular AL. Having different treatments on hallways and doors (e.g. with different colors) is expected to help residents with way-finding as well.
CHAPTER 4: STUDY 3 - INDOOR PUBLIC SPACE DESIGN OF SPECIAL CARE UNITS IN ASSISTED LIVING FACILITIES

1. Introduction

Dementia is a mental disorder characterized by a decline in cognitive functioning severe enough to interfere with a person’s normal daily activities and social relationships (Perkin Eastman, 2013). With different types of dementia, people typically have different levels of memory loss, impaired judgment and abstract thinking. Alzheimer’s disease is one of the most common conditions of dementia among older people. It is estimated that 5.1 million Americans over the age of 65 suffer from Alzheimer’s disease, and that number is expected to increase by approximately 50 percent - to 7.7 million - in the next 20 years (Alzheimer’s Association, 2010).

There are limited medical interventions that can stabilize the condition or improve the quality of life for the elderly with Alzheimer’s disease and related dementias (WHO, 2004). They need increasingly complex care needs as they transition from paid home care to assisted living (AL) special care and skilled nursing home (NH) with higher level of care. Seniors who choose to move out of their homes usually seek a place where they can modify the environment to accommodate their needs and desires and to reflect the new lifestyle they have chosen. One of the most important innovations in senior living industry has been the development of successful models for special care units (SCUs) in an AL setting, serving seniors with Alzheimer’s disease or other forms of dementia (Perkin Eastman, 2013). AL communities with a distinct dementia SCU accounted for 64 percent of all types of residential care communities with dementia SCUs in 2003 (Park-Lee, Sengupta, Harris-Kojetin, 2013). More than one third of AL communities had dementia SCUs in 2010 (Park-Lee, Sengupta, Harris-Kojetin, 2013). Surveys also showed that the percentage of residents in AL facilities with mental and cognitive impairments was about 40-50 percent (Regnier, 2002) and about one-third of the residents (34%) were suffering from moderate to severe cognitive impairments (Hawes, Philips & Rose, 2000).

Regnier (1994) viewed this “new” AL setting as “combing the residential qualities and the friendly scale of board and care housing with professionalism and sophistication of the typical personal care setting targeted toward residents who in the past would have normally resided in
“intermediate and skilled nursing facilities” (Sanoff, 2000), especially for those who have mental disabilities and cognitive impairments. This study is primarily focus on the SCUs licensed either as freestanding senior special care facilities or within larger AL facilities as a separate special-care wing, floor or building.

2. Literature Review

A Therapeutic Home of Special Care Unit in Assisted Living Community

SCUs - also known as dementia care facilities, memory care units, residential Alzheimer’s facilities, etc. - vary its name widely in the senior living industry. Starting from 1980s, SCUs could be found in a growing number of U.S. traditional NHs, where approximately 60 percent of the residents were afflicted with dementia (Perkins Eastman, 2013). However, institutional environments did little to support residents with Alzheimer’s disease and relative dementias, which in fact became a major hindrance during their stay (Hoglund & Ledewitz, 1999). In 1999, Hoglund and Ledewitz stated that residential and nonmedical settings were the most appropriated environments for people with Alzheimer’s disease and related dementia, particularly those in the early and middle stage of the impairment.

Nowadays, more and more emerging AL facilities and similar residential care communities provide this home-like living option alternative to the traditional NHs for individuals with mental issues. Since this population require extensive special daily cares and treatments, they generally live in a designated wing, floor or building of an AL facility, separate from the residents who are physical disable but mentally intact. Many states in the U.S. require that AL communities with dementia SCUs have certain physical features, such as specially trained staff (88%), an enclosed courtyard (82%), doors with keypads or electronic keys (79%), and locked exit doors (76%) to keep them safe and secured (Park-Lee, Sengupta, Harris-Kojetin, 2013). (Figure 4.1).
The goal of specialized housing is to maximize what residents with Alzheimer’s can do so they can live in a dignified residential environment rather than institutional place (Perkins Eastman, 2013). A good design can have therapeutic effects on the behavior and quality of life for senior residents with either physical disabilities or dementia (Hoglund & Ledewitz, 1999). To move away from conventional skilled-care models, the design of SCUs in AL settings should avoid institutional symbols, objects, spaces, and configurations, such as nursing stations and institutional finishes (Perkins Eastman, 2013). As Rohde (Principal, JSR Associates, Inc.) stated: “With two decades of research on SCU settings, we can now firmly say that a carefully designed program and environment can support a higher quality of life and maintain, even extend, higher functioning with activity of daily living” (Perkins Eastman, 2013). A number of researchers have begun a process of developing more holistic models in dementia care environment research (Schward & Brent, 1999). Weisman and Calkins (1994) presented Integrative Model of Place, consisting of a complex system of relationships among four distinct dimensions: individuals with dementia, social context, organizational context and physical setting (Figure 4.2). This model laid a foundation for addressing the interdependence of the therapeutic outcomes. It also recognized the important role of the physical environment in therapeutic effects.

![Figure 4.1 Percentage of Available Features in SCUs of AL.](image)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dementia-specific activities and programming</td>
<td>91%</td>
</tr>
<tr>
<td>Doors with alarms</td>
<td>90%</td>
</tr>
<tr>
<td>Specially trained staff</td>
<td>88%</td>
</tr>
<tr>
<td>Enclosed courtyard</td>
<td>82%</td>
</tr>
<tr>
<td>Doors with keypads or electronic keys</td>
<td>79%</td>
</tr>
<tr>
<td>Locked exit doors</td>
<td>76%</td>
</tr>
<tr>
<td>Personal monitoring devices</td>
<td>35%</td>
</tr>
<tr>
<td>Closed circuit TV monitoring</td>
<td>19%</td>
</tr>
</tbody>
</table>
Alzheimer and Dementia-friendly Environment Design

Managing a dementia population requires sensitivity to several key design issues and principles (Braley, 1997; Day, Carreon, et al., 2000). SCUs distinguish themselves by offering one or more “special” features, including dementia-appropriate activities, small group size, special staff selection and training, family involvement, and specialized design (Day, Carreon & Stump, 2000; see also Berg et al, 1991). According to a survey of 31 SCUs in five states, the most typical, distinguishing environmental features of SCUs include smaller size units, fewer resident rooms, more designated private rooms, the presence of private dining rooms, separate and larger activity room, and access to the outdoors (Mathew & Sloane, 1991).

Since the early 1980s, numerous design guides - books and studies offering planning, architectural, and interior design recommendations - have been written to instruct architects, designers, and care providers on how to enhance safety and homeliness in dementia care facilities (Brawley, 1997; Calkins, 1988; Cohen & Day, 1993; Cohen & Weisman, 1991). There were also large networks of specialists in designing for dementia (Calkins, 1998; Cohen & Weisman, 1991) from architecture, planning, interior design, industrial design, etc. Several post-occupancy studies have yielded important information on designing for people with dementia (Hoglund & Ledewitz, 1999; Perkins Eastman, 2013).

In 1999, Hoglund and Ledewitz discussed the research-based planning considerations in designing for residents with dementia, which include acknowledging privacy and community, flexible rhythms and patterns, small group size, caregiver and family relationship, engaged
wandering, alternative wayfinding system, independence with security/safety, focused and appropriate stimulation, and residential qualities. Other studies also found that people with dementia residing in smaller units and public clusters would experience less anxiety and depression, and more mobility (Annerstedt, 1997; Skea & Lindesay, 1996). Design guides have suggested that units and clusters with fewer residents may reduce overstimulation among people with dementia by controlling noise and distracting, and by limiting the number of people each resident encounters (Day, Carreon & Stump, 2000). Research also showed that residents within smaller group settings, when they are engaged in daily meals or programmed social activities in public common area, are able to function better, with less agitation and stress (Perkins Eastman, 2013). They can typically cope better with a smaller activity group not larger than 10-12 people (Hoglund & Ledewitz, 1999).

Another consideration is the multi-purpose space or the activity space, which is normally designed with flexibility to hold multiple events and activities. This type of space, however, may confuse residents with dementia because they do not know how to alter their behavior to respond to the changing uses, and have trouble to adapt to alterations and transitions (Hoglund & Ledewitz, 1999). Therefore, the physical environments designed for this special group of people should include a variety of distinct rooms or spaces in different sizes, orientations, characters, and with different degrees of stimulation (Hoglund & Ledewitz, 1999), so that residents can be better associated with different daily experiences, such as dining, resting, watching television and physical exercise activities in a designated environment.

In addition, wayfinding is an important design consideration in AL facilities in general, and for SCUs in particular. (Cohen & Weisman, 1991). The wayfinding system is critical to the comfort of residents, visitors and staffs, especially those who feel insecure in their environment. For seniors, who are not as agile and facing a significant change in their lifestyle, finding their way around their environment should be effortless (Perkins Eastman, 2013). Cognitive impairment reduces common wayfinding abilities of the residents, restraining them away from associating objects and sensory stimulation with places, and from forming a clear mental map of their surroundings. There are no off-the-shelf solutions for wayfinding. According to environmental sociologist John Zeisel (Hearthstone Alzheimer Care Ltd): “For people with dementia, the
concept of wayfinding should be thought of as ‘place knowing’”. It is thus necessary to integrate various architectural and interior design tools to create designated smaller-scale spaces with clear and short circulation paths with subtle cues and visual stimulations, such as color change, artworks, familiar objects.

Wandering without apparent purpose is common among people with Alzheimer’s disease, and little is known about the physiological reasons behind it (Hoglund & Ledewitz, 1999). An indoor wandering path is a major opportunity for design intervention (Perkins Eastman, 2013). A continuous circulation that loops or forms an uninterrupted path is preferred. Discontinuous paths or paths that engage no activity or abruptly end may cause confusion, make them agitated when trying to reorient, and keep the residents from potential social connections (Brummett, 1997). Therefore, providing a continuous circulation path that connects important destinations along with or woven into the path, such as interesting activity and engagement areas, can encourage the residents to present in public common area, and provide opportunities for them to join social and physical activities.

3. Problem Statement
Therapeutic environments for the elderly share commonalities. However, research show that seniors with Alzheimer’s disease and related dementia have special needs, which must be accommodated differently by the physical environment (Perkins Eastman, 2013). Even though cognitive decline tends to reduce resident’s participation in social interactions (Hoglund & Ledewitz, 1999), they are still encouraged to spend time in the public area, have interactions with physical and social environments, and participate in social life at various degrees depending on their personality and level of impairment.

Designing AL facilities for people with cognitive impairment is relatively new (Hoglund & Ledewitz, 1999). There are no proven rules or universal designs to match residents’ various unpredictable needs and behaviors caused by “mysterious” diseases like dementia. This certainly presents great challenges in programing and designing the therapeutic environments. There is limited research on SCUs as part of the AL facilities, and even less documented research on the physical environments for people with Alzheimer’s disease and dementias (Lawton, 1987),
especially on the hierarchy of spaces and circulation system in indoor public area. It is important because there have been no clear evidences whether the hierarchy of public spaces and circulation system will impact residents’ behaviors, and in what way.

4. Research Objectives and Research Questions
This study focuses on the programming and design of indoor public spaces of SCUs for Alzheimer’s disease or other dementia within AL facilities.

The **Research Objectives** are:

1) Identify and examine the effects of key physical environment characteristics on SCU residents’ quality of life, particularly in terms of space hierarchy and circulation system;
2) Understand environment-behavior issues in SCUs, and examine the effects of these issues on resident behaviors and reactions in the public spaces;
3) Provide data and evidences on assessing indoor public spaces and develop programming and design strategies for SCUs.

The **Research Questions** are:

1) **RQ1**: What indoor public spaces (type, quantity, variability and size) impact the residents’ daily activities and wellbeing in SCUs?
2) **RQ2**: What type of circulation pattern can better support way-finding and engage wandering in public spaces of SCUs?

5. Research Methodology
The research framework of this study is also developed from the social-ecological perspective and the E-B model (Zeisel, Hyde, & Levkoff, 1994) as in Study 2. It involves two spatial categories (common space structure and walking paths), one ambient quality (residential scale), and the definition of indoor public spaces and circulation system.
5.1. Research Framework

*Hierarchy of Indoor Public Spaces*

Many AL communities include SCUs on the premises. Typically, the SCUs are located within a separate wing or floor of an AL facility with locked access for security reasons. Some of them are developed as freestanding buildings with the regular AL building on the same campus. Dividing the program into smaller scales is a common practice in SCU wings. Post occupancy evaluation studies on some early Alzheimer’s facilities reveal that a strong sense of community can be developed in those facilities where residents socialize freely at a smaller household-level (Perkins Eastman, 2013). The household model is a person-centered care model and provides smaller, family-size social groupings with shorter walking distances to common living spaces, giving residents a greater level of independence and access to more social experiences (Perkins Eastman, 2013).

In this study, the *household-level* of public spaces is defined as the small “clusters” with a small food staging area (kitchenette), a dining space, and a living room (or a small-scale activity space). According to Perkins Eastman (2013), a household typically includes 8-12 residents who share social spaces and services. Specifically, the program for the household-level of public spaces can include: 1) Dining room; 2) Living/ activity room; 3) Spa/ bathing (Perkins Eastman, 2013), 4) Small cozy spaces (e.g., den, patio, front porch).

The programming models for SCUs can have 30-50 residents in 3-5 houses (Perkins Eastman, 2013). Two or more houses can form a *neighborhood* with space for staff work and larger shared common spaces within a SCU facility. The program elements of *neighborhood-level* of spaces can include: 1) All household-level spaces; 2) Great-room (for larger group activities, e.g., music, dancing, special dinners with families, exercise, etc.); 3) Crafts room; 4) Hair care/ salon; 5) Private dining/ activity; 6) Living room/ den; 7) Staff workroom/ station (e.g., nurse station, medical supplies room, etc.) (Perkins Eastman, 2013).

Based on the socio-ecological theoretical perspective, main factors and dimensions of the E-B model, and the definition of indoor public spaces hierarchy, the following conceptual framework is developed for this study (Figure 4.3):
5.2. Data Collection Methods

Because almost all of the SCU residents have cognitive impairments, conducting a self-report or self-assessment is often impractical (Ettema, et al., 2005). Facility managers, on-site staff, resident caregivers, and “observations” are the main data source of this study. By applying case study as the research method, data are collected through:

1) In-person questionnaires to the facility manager of the selected regular AL facilities;
2) Two-rounds of field visits and on-site observations; and
3) Individual and group interviews with facility staff, and caregivers (Figure 4.4)

**Figure 4.3 Research Conceptual Framework (Study 3).**

**Figure 4.4 Data Collection Process and Methods (Study 3).**

**Phase 1: Survey of Basic Facility and Resident Information**

A two-page self-completion questionnaire was sent to the facility managers of the selected four study sites to obtain the basic information of the facilities, including 1) SCUs building characteristics; 2) SCUs residents’ characteristics in terms of their demographic features and
physically abilities (Table 4.1). The facility floor plans and monthly activity calendars were also collected in this phase.

Table 4.1 Project Context Data Collection Contents.

<table>
<thead>
<tr>
<th>SCUs Building Characteristics</th>
<th>SCUs Residents’ Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Open Year</td>
<td>• Number of Residents (Total, Male, Female, Couple)</td>
</tr>
<tr>
<td>• Context of Site (Mostly Urban/ Mostly Rural/ Completely Rural)</td>
<td>• Age Range</td>
</tr>
<tr>
<td>• Number of Stories</td>
<td>• % Wheelchair/ Walker Bound</td>
</tr>
<tr>
<td>• Number of Elevators</td>
<td></td>
</tr>
<tr>
<td>• Numbers and Types of Residential Unit</td>
<td></td>
</tr>
<tr>
<td>• Numbers and Types of Indoor Public Space</td>
<td></td>
</tr>
</tbody>
</table>

**Phase 2: Observations**

Two rounds on-site visits and observations - naturalistic observation (first-round) and participant observation (second-round) - were conducted following the surveys. The researcher was in the facilities during the first-round to be acquainted with the facility environment and residents’ behaviors. During the second-round observations, the researcher spent two days at each facility site - one weekday and one weekend day. By using behavior mapping as the main observation tool, the researcher recorded what was observed and marked the locations and activities of every resident present in the public areas.

The observations include 8 days (76 hours) with an average duration of 9.5 hours on each observation day. Data were collected at 30-minute intervals. 160 observations were performed at 4 facilities. 139 senior residents - 30 males and 109 females - were recorded in the observations.

**Phase 3: Interview**

In the third stage of the study, individual and group interviews with on-site staff and caregivers were conducted. The participants have been chosen randomly depending on who work on-site in the day. A total of 18 participants including 6 staff members and 12 caregivers were involved in the interviews. All of the participants met the following qualifications:

1) The participants were chosen randomly depending on who worked on-site during interview times.

2) worked at least 3 days a week at the community;
3) worked at the community over a month;
4) knew well about the community spaces and the residents.

All of the interview questions are open-ended. They were informed by the issues and questions raised from the observations. All interviews were audio taped with interviewees’ permission. The total recording time is about 6.2 hours.

6. Results and Discussions
6.1. Findings of Phase 1 - Survey of Basic Facility Information
6.1.1. Facility A
Facility A has the SCU attached to the regular AL in the same building. Four residential households (with 11 beds in each) form two “L-shape” neighborhoods. Each neighborhood level, has its own dining, living, nurse station, kitchenette, and public restrooms shared by two households. The great room, reflection space, salon and administrative offices are located at the center of the SCU portion of the building. Single-loaded corridors allow residents to have access to daylight and view to the outdoor courtyard in each household (Figure 4.5).

The SCU has 36 resident units (44 beds), including 28 studio rooms (one bed in one room) and 8 companion studios (with two beds in one large shared room). There was a total of 40 residents on
site at the time of the study - 9 males and 31 females. The occupancy rate was 91%. The age range of the residents was between 75 to 95. 69% of the residents used either walker or wheelchair.

The total area of the SCU is 29,296 SF, including residential units: 14,284 SF, indoor public space: 11,383 SF, and auxiliary support spaces: 3,393 SF (Figure 4.6).

There are seven types of public spaces: 1) dining space; 2) living space; 3) den; 4) salon; 5) reflection space; 6) private room; and 7) great space (Figure 4.7, 4.8). The auxiliary support spaces, including public restrooms, assisted bathrooms, nurse stations, kitchenette, laundry rooms, and administrative offices, are not part of this study.

![Diagram](image)

**Figure 4.6 General Information of the Facility A.**

<table>
<thead>
<tr>
<th>Residential Indoor Public Spaces</th>
<th>Other Public Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dining Space *2</td>
<td>Public Restroom *4</td>
</tr>
<tr>
<td>Living Space (Activity Space) *2</td>
<td>Assisted Bathroom *2</td>
</tr>
<tr>
<td>Den *4</td>
<td>Nurse Station *2</td>
</tr>
<tr>
<td>Salon *1</td>
<td>Kitchenette*4</td>
</tr>
<tr>
<td>Reflection Space *1</td>
<td>Laundry Room (staff use only) *2</td>
</tr>
<tr>
<td>Private Room *1</td>
<td>Administrative Offices &amp; Rooms *6</td>
</tr>
<tr>
<td>Great Space *1</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 4.7 Checklist of All Types of Indoor Public Spaces of Facility A.**
6.1.2. Facility B

Facility B is a three-story building including both regular AL and SCU. The latter is on the first floor as a separate wing (Figure 4.9). This small SCU is in an “I-shape” with centralized dining and living spaces between two households. Each household has either an activity room or a reflection room as the public spaces. In addition, there is a den at each end of the hallway. The administrative office, medication room, kitchen, and public restroom are located at the middle part of the SCU.
There are 25 units between the two households, including 21 small studios and 2 larger rooms which could be considered as companion rooms for accommodating two residents when needed. There were 20 residents - 5 males and 15 females - living on site at the time of the study, and the occupancy rate was 80%. The age range of the residents is from 70 to 95 and older. 82% of them use wheelchair or walker.

Figure 4.9 Floor Plan of Facility B.
The total area is 10,315 Sq. Ft, including residential units: 6,240 Sq. Ft., public space: 2,966Sq. Ft, and auxiliary support spaces: 1,109 Sq. Ft (Figure 4.10).

There are **five** types of public spaces in the SCU: living space, dining space, reflection room, activity room, and two dens (Figure 4.11, 4.12). Some public spaces, such as salon and library, are located at the regular AL area, which are shared by both regular AL and SCU residents.

![Diagram of Facility B](image)

**Figure 4.10 General Information of the Facility B.**

<table>
<thead>
<tr>
<th>Residential Indoor Public Spaces</th>
<th>Other Public Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Space *1</td>
<td>Public Restroom *1</td>
</tr>
<tr>
<td>Dining Space *1</td>
<td>Nurse Station *1</td>
</tr>
<tr>
<td>Reflection Room *1</td>
<td>Kitchen *1</td>
</tr>
<tr>
<td>Activity Room *1</td>
<td>Laundry Room (staff use only) *1</td>
</tr>
<tr>
<td>Den *2</td>
<td>Administrative Offices &amp; Rooms *2</td>
</tr>
</tbody>
</table>

**Figure 4.11 Checklist of All Types of Indoor Public Spaces of Facility B.**
6.1.3. Facility C

Facility C is the only site where the SCU is in a separate freestanding building on the same campus. It is a one-story building consisting of four households, each having 7 to 9 residents (Figure 4.13).
The building includes 32 studios (32 beds). 30 residents lived on site. The occupancy rate was 94%. The age range of the residents is from 75 to 95 and older. About 84% of them use either wheelchair or walker.

The building area is 20,635 SF, including residential units: 10,640 SF, indoor public space: 7,294 SF, and ancillary support spaces: 2,701 SF (Figure 4.14).
A total of five types of public spaces are found in Facility C. An open space at the entrance serves both the lobby and the living room in the building. The centralized dining room is a large rectangular space, serving all four households. A sun porch and a salon also serve all the SCU population. Two dens are located in the two larger households (household B and household C) to provide household-level common spaces (Figure 4.15, 4.16).
6.1.4. Facility D

Facility D has two separate neighborhoods on the first floor, with regular AL spaces in between. The larger neighborhood is called **North Side**, the smaller neighborhood - **South Side** (Figure 4.17). Each neighborhood has its own dining space, living space, bathing room, den and outdoor courtyard, etc.
North Side
The north side neighborhood consists of 24 resident units. Residential rooms and public spaces are connected with mostly single-loaded corridors, forming a central courtyard. The indoor public spaces are grouped together by the main entrance of the neighborhood (Figure 4.18). Support spaces such as offices, medication room, and storage rooms are close to the entrance as well. This neighborhood has the only “loop corridor” design among the four facilities.

Figure 4.17 Floor Plan of Facility D.
Single studios are the only unit type in this neighborhood. 23 out of 24 unit rooms (24 beds) were occupied. The occupancy rate was 96%. The age range is from 75 - 95 and older. About 65% residents use either wheelchair or walker.

The total area of the north side neighborhood is about 17,156 SF, including residential units for 7,856 SF, indoor public space for 5,056 SF, and auxiliary support spaces for 1,750 SF (Figure 4.19).
Six types of public spaces are identified, including living room/ space, dining space, activity room, TV room, reflection space, and den (Figure 4.20, 4.21).

![Diagram of Facility D - North Side](image)

**Figure 4.19** General Information of the Facility D - North Side.

<table>
<thead>
<tr>
<th>Residential Indoor Public Spaces</th>
<th>Other Public Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room/ Space *2</td>
<td>Assisted Bathroom *1</td>
</tr>
<tr>
<td>Dining Space *1</td>
<td>Medication Station *1</td>
</tr>
<tr>
<td>Activity Room *1</td>
<td>Kitchenette *1</td>
</tr>
<tr>
<td>TV Room *1</td>
<td>Administrative Offices &amp; Rooms *2</td>
</tr>
<tr>
<td>Reflection Space *1</td>
<td></td>
</tr>
<tr>
<td>Den *1</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 4.20** Checklist of All Types of Indoor Public Spaces of Facility D - North Side.
The south side neighborhood consists of two households, both in “L-shape”. All public spaces are located at the interception of the two households. Double-loaded corridors connect resident units to the public spaces (Figure 4.22).
The south side neighborhood has mostly shared rooms. There are 12 resident units (23 beds), including 1 studio, 8 companion one-bedroom units (up to 2 beds in each unit), and 3 two-bedroom units. At the time of the study, 21 residents lived in this neighborhood. The occupancy rate was 91%. The age range of the residents is from 65 to 95. 86% of them use wheelchair or walker. The total area of the south neighborhood is 11,051 SF., including residential units: 6,425 SF., indoor public spaces: 3,665 SF., and auxiliary support spaces: 961 SF. (Figure 4.23).
Five public spaces are provided in the neighborhood: living space, dining space, sun porch, reflection room, and den (Figure 4.24, 4.25).
Figure 4.25 Indoor Public Spaces of Facility D - South Side.
6.1.5. Summary

Table 4.2 summarizes the basic information of the four SCU facilities:

Table 4.2 Building Information of Four Facilities.

<table>
<thead>
<tr>
<th>General Information</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Opened</td>
<td>1999</td>
<td>1993</td>
<td>1999</td>
<td>2000</td>
</tr>
<tr>
<td>Context</td>
<td>Mostly Urban</td>
<td>Mostly Urban</td>
<td>Mostly Urban</td>
<td>Mostly Urban</td>
</tr>
<tr>
<td>Story</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Settings</td>
<td>Special Neighborhood</td>
<td>Special Wing</td>
<td>Freestanding</td>
<td>Special Neighborhood(s)</td>
</tr>
</tbody>
</table>

139 senior residents lived in the four SCUs, 22% of them being male and 78% being female. (Table 4.3).

Table 4.3 Population of Four SCUs.

<table>
<thead>
<tr>
<th>Number of Residents</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>40</td>
<td>25</td>
<td>30</td>
<td>44</td>
<td>139</td>
<td>100%</td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>2</td>
<td>10</td>
<td>7</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>Female</td>
<td>31</td>
<td>23</td>
<td>20</td>
<td>16</td>
<td>19</td>
<td>35</td>
</tr>
<tr>
<td>Couples</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The number of residential units ranges from 23 to 36 across the four SCUs and the number of bed count ranges from 25 to 47. The unit types can be categorized into four categories including studio, companion studio (with up to 2 beds), companion one-bedroom (with up to 2 beds) and two-bedroom (Table 4.4).

Table 4.4 Unit Types and Numbers of Four Facilities.

<table>
<thead>
<tr>
<th>General Information</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Units</td>
<td>36</td>
<td>23</td>
<td>32</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>Studio</td>
<td>28</td>
<td>21</td>
<td>32</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>Companion Studio (2 beds)</td>
<td>8</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Companion One-bedroom (2 beds)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Two-bedroom</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Number of Beds</td>
<td>44</td>
<td>25</td>
<td>32</td>
<td>24</td>
<td>23</td>
</tr>
</tbody>
</table>
Table 4.5 summarizes the areas of various components within a facility. The percentage of each component to the total building area is also calculated.

Table 4.5 Areas of the Facility and Indoor Spaces.

<table>
<thead>
<tr>
<th>Indoor Spaces Magnitude</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#  %</td>
<td>#  %</td>
<td>#  %</td>
<td>#  %</td>
<td>%</td>
</tr>
<tr>
<td>Total Building (SF)</td>
<td>29,296 -</td>
<td>10,315 -</td>
<td>20,635 -</td>
<td>25,645 -</td>
<td>100%</td>
</tr>
<tr>
<td>Indoor Public Spaces</td>
<td>11,383 39%</td>
<td>2,966 29%</td>
<td>7,294 35%</td>
<td>8,721 34%</td>
<td>34%</td>
</tr>
<tr>
<td>Private Residential Units</td>
<td>14,284 49%</td>
<td>6,240 60%</td>
<td>10,640 52%</td>
<td>14,213 55%</td>
<td>54%</td>
</tr>
<tr>
<td>Ancillary Support Spaces</td>
<td>3,393 12%</td>
<td>1,109 11%</td>
<td>2,701 13%</td>
<td>2,711 11%</td>
<td>12%</td>
</tr>
</tbody>
</table>

*#=number, SF = Square Footage

Ten types of public spaces are identified (Table 4.6). These spaces will be discussed in greater details in the observation and interview phases in next sections. Moreover, the space hierarchy and corridor pattern will also be examined.

Table 4.6 Ten Identified Residential Indoor Public Spaces.

<table>
<thead>
<tr>
<th>#</th>
<th>Residential Public Spaces</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>North</td>
<td>South</td>
<td>North</td>
<td>South</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Dining Room/ Space</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Living Space</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Activity Room/ Space</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>TV Room</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>Sun Porch</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>Great Space</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7.</td>
<td>Reflection Room/ Space</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>*Beauty Salon</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9.</td>
<td>*Private Room</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10.</td>
<td>Den</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
6.2. Findings of Phase 2 and Phase 3 - Observations and Interviews

The public spaces are discussed in the order of “peak usage rate” from high to low: 1) dining room/space; 2) living space; 3) TV room; 4) activity room/space; 5) den; 6) beauty salon; 7) great space; 8) reflection space; and 9) private room and sun porch (Figure 4.26).

![Peak Usage Rate](image)

**Figure 4.26 Average Peak Usage Rate of Each Public Spaces in Four Facilities.**

6.2.1. Dining Room/Space

In **Facility A**, there are two dining spaces embedded in two households - household B and household C. Surrounded by resident unit rooms, each dining space serves two connected households for 18 units and maximum 22 residents (Figure 4.27). Each dining space has fixed number of tables and seats. For example, the dining space in household B can accommodate the maximum number of residents (22) in household A and household B when they are fully occupied. The dining tables and chairs are arranged by caregivers frequently to meet residents’ seating preferences and needs. All of the tables in the two dining spaces are square shaped, either being placed individually to serve 1 to 4 four residents at each table, or combined into a larger table to serve 4 to 6 when needed.
**Facility B** has one dining room to serve two households up to 23 residents. The dining space is located in between the two households, open to the living space without any separation (Figure 4.28).

Figure 4.27 Dining Space of Facility A (Household B).

Figure 4.28 Dining Space of Facility B.
**Facility C** also has one dining space, serving all four households. The space is subdivided into three areas, with a view to the outdoor courtyard (Figure 4.29). The number of seats provided can accommodate all residents when the facility is 100% occupied.

Figure 4.29 Dining Space of Facility C.

Each neighborhood (north or south side) of **Facility D** has a large dining space to serve all residents in the neighborhood. Both dining rooms are near the main entrance and directly connect to the living space. The **north side** dining room is furnished with 5 square tables with 4 chairs at each table, and a larger table with 6 movable chairs. There is also a small kitchenette attached to the dining area with a full-size refrigerator, oven, and microwave (Figure 4.30).

Figure 4.30 Dining Space of Facility D (North-side).
The **south side** dining space is an open area adjacent to the living area without a wall in between. This area has 3 square tables, each with 4 chairs, and 2 larger tables, each with 6 chairs (Figure 4.31).

![Dining Space Diagram](image)

**Figure 4.31 Dining Space of Facility D (South-side).**

**Schedule**

Table 4.32 shows the average number of hours in use of each public space across the four facilities. Dining room is the most frequently used space.

<table>
<thead>
<tr>
<th>Usage Hours</th>
<th>Dining Room</th>
<th>Activity Room</th>
<th>Living Room</th>
<th>Hallway</th>
<th>TV Room</th>
<th>Den</th>
<th>Salon</th>
<th>Great Space</th>
<th>Reflection Room</th>
<th>Sun Porch</th>
<th>Private Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours</td>
<td>7</td>
<td>6.8</td>
<td>6.3</td>
<td>6.2</td>
<td>5</td>
<td>2.1</td>
<td>1</td>
<td>1</td>
<td>0.3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Figure 4.32 Average hours in Use of Each Indoor Public Space.**

It is not only the space to eat (Table 4.7), but also an important venue for SCU residents to interact with other residents or staff.
Table 4.7 Meal Times in Dining Room/Space (Facility A, B, C, D).

<table>
<thead>
<tr>
<th>Public Space</th>
<th>Activity</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dining Room/Space</td>
<td>Breakfast</td>
<td>7:30 AM</td>
<td>8:00 AM</td>
<td>7:30 AM</td>
<td>8:00 AM</td>
</tr>
<tr>
<td></td>
<td>Lunch</td>
<td>12:00 PM</td>
<td>11:30 PM</td>
<td>12:00 PM</td>
<td>12:00 PM</td>
</tr>
<tr>
<td></td>
<td>Dinner</td>
<td>17:00 PM</td>
<td>17:00 PM</td>
<td>17:00 PM</td>
<td>17:00 PM</td>
</tr>
</tbody>
</table>

**Peak Usage Rate**

Using the same method as in Chapter 3 (peak usage rate = peak number of residents / total number of on-site residents), the peak usage rate is calculated for the six dining spaces. As shown in Figure 4.33, the peak usage rate is relatively constant during three meal times. The highest peak usage rate (90%) was observed in two thirds of the dining spaces (Facility A-2, Facility B, Facility C, and Facility D-South), which makes the dining space one of the most popular public spaces.
Figure 4.33 Dining Room Peak Usage Rate and Usage Time (Facility A, B, C, D).
Unlike the dining rooms in regular AL, SCU facilities normally have the same number of dining seats as the total number of beds, as one caregiver stated: “We always have seats for everybody”. The question is: Is this over designed, since in average about 87% of the residents show up in the dining space at a time?

As caregivers mentioned, some residents are at severe stages of physical and cognitive impairments and they are not able to move from their beds to the dining space. However, there are some residents who are able to come to the dining room but have difficulty in self-feeding. They need assistance from caregivers or nurses to help with the meals. The observations show that in each dining space there was an average of 2 caregivers sitting with 2 to 4 residents during meal times. In this case, a couple of extra seats for the caregivers should be taken into account. Therefore, 100% of bed count can be used for determining the maximum number of seats in a dining room to cover the “worst” case scenario (when facility is full), since even though some residents may not be able to come to the dining room, some extra seats should be available for caregivers to provide eating assistance.
Guideline 3-1  

*Dining Room Seat Count*  

To determine the number of seats in an SCU dining room, one can use 100% of the total bed count as the minimum standard for programming purposes:  

\[
\text{Number of Dining Seats} = 100\% \times \text{(bed count)}
\]

*Area per Seat*  

The area of the dining rooms in SCUs ranges from 522 to 1,005 SF. Table 4.8 shows the dining room area and number of bed in each facility.

Table 4.8 Dining Square Footage and Bed Counts (Facility A, B, C, D).

<table>
<thead>
<tr>
<th>Dining Space</th>
<th>Facility A #1</th>
<th>Facility A #2</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D North</th>
<th>Facility D South</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Dining Area (SF)</td>
<td>816</td>
<td>816</td>
<td>522</td>
<td>1,005</td>
<td>740</td>
<td>715</td>
</tr>
<tr>
<td>Total Number of Beds</td>
<td>22</td>
<td>22</td>
<td>25</td>
<td>32</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Total Area (SF)/ # Beds</td>
<td>37</td>
<td>37</td>
<td>21</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
</tbody>
</table>

During the interviews, none of the participants from *Facility A* and *Facility D* had complaints on the dining room seats number, total size and aisle space. However, different opinions were obtained from *Facility B* and *Facility C*.

In *Facility B*, which has the lowest area per bed [21SF/Bed], caregivers mentioned that they had trouble to move residents in wheelchairs in aisles when they have 100% occupancy. As shown in the plan (Figure 4.34), the space is tight, especially with people in wheelchairs:

- “…before we put the table together [to make this long 10 seats table], yes, it was very crowded… sometimes we still have problem because if we have more wheelchair and walker people all sitting together, or back to back… so it should be a little bit bigger …”.
In **Facility C**, where the area per bed is about 32 SF (Figure 4.35), some areas of the dining space were reported to be always “busy”:

- “… our dining room could be a bigger. I think we have enough seats for everybody all the time. But it is a little bit too crowded on the lower area, where more wheelchair people need to be fed…”;
- “…I think some of the corridors [between tables] should be bigger because we have a lot of wheelchair people. Some aisles between tables are narrow, some of them are ok…”.

Although **Facility D** has the same level of area/bed (31SF) in the dining rooms, no complaints were heard. The **Facility A** has the highest – 37 SF/bed, where no complaints were heard either.
To be conservative, the following guideline is recommended to determine the dining room size, which is same as the standard recommended for regular AL in Chapter 3.

**Guideline 3-2 Dining Room Area per Bed**

To determine the net square footage of dining rooms based on bed count in SCU:

\[
\text{Dining Room NSF} = 35 \text{ SF/ Bed} \times (\text{Bed count})
\]

**Furniture Layout**

During the interviews, staff members recommended that smaller tables for groups of 2-4 be provided for people who prefer to eat in a smaller group to avoid too much stimulation.

**Guideline 3-3 Dining Room Table Size**

Small dining tables with four seats are preferred. When larger tables are needed, small tables can be combined to accommodate more people.

### 6.2.2. Living Space

Different from nursing homes, SCU provides more social activities to the residents. Based on the activity calendars gathered from the four facilities, 46% of the activities were scheduled in the living space (Figure 4.36) (Three meals there are counted as three activities in a day [29%]).

![Activity Schedule](image)

Figure 4.36 Activity Schedule and its Venue in Facility A, B, C, D.

In **Facility A**, similar to the dining space, two living spaces are embedded in household A and household D, for residents of each neighborhood to watch TV or rest. In addition, caregivers select one of them and use it for all on site residents’ daily group activities. The settings and
furnishings in the two living spaces are mostly the same. Each of them is surrounded by a small den area, 11 resident units, a kitchenette for staff to prepare snacks and one public restroom. The living space is furnished with a group of movable chairs and a piano. There are no tables (Figure 4.37).

![Diagram of Neighborhood/Facility-level Living Space]

Figure 4.37 Living Space of Facility A - (Household A).
(*chairs are always flexible and re-arranged for different activities)

The living space of **Facility B** shares a large area with dining between the two households. The living space is in a long narrow space (Figure 4.38). Residents have all of their daily activities in this room.
The living space in **Facility C** is located by the main entrance of the building, also serving as the lobby (Figure 4.39). The living space is a hub connecting four households and other public spaces, such as dining space, sun porch and administrative offices.

The **north side** of **Facility D** has two living spaces at two remote corners of the building. The main living space is between the dining room and activity room. It is in the middle of the centralized public spaces, holding most of the daily group activities (Figure 4.40).
The other living space is embedded into the resident units at the back of the neighborhood, providing a corner lounge for the residents nearby. Both living space are furnished with sofas and small tables. There is no TV in either space (Figure 4.41).

In the *south side* of Facility D, the living space directly connects to the dining space without walls. Sofa chairs and a TV make this area a home-like living room. People can also access the reflection room and sun porch from this space (Figure 4.42).
Schedule

Almost all daily group activities in SCUs are scheduled in the living spaces between meals (Table 4.9). Outside the group activity times, residents were observed to use the living space for chatting with other residents, taking naps, eating snacks (served by caregivers between meals), and resting.

Table 4.9 Scheduled Activities in Living Space (Facility A, B, C, D).

<table>
<thead>
<tr>
<th>Public Space</th>
<th>Date</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Space</td>
<td>Weekday</td>
<td>9: 40 AM Music &amp; Movement (A)</td>
<td>10:00 AM – Exercise Essentials</td>
<td>9: 30 AM – Music, Coffee and Reminisce</td>
<td>9: 30 AM – Brain Fit with Legacy (N &amp; S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10: 15 AM Sensory Stimulation (A)</td>
<td>13: 00 PM – Scenic Drive Fall Leaves</td>
<td>14: 30 PM – Therapy Dogs</td>
<td>9: 30 AM – News Currents Sr. (N &amp; S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13: 00 PM – Social Hour (A)</td>
<td>14: 30 PM – TGIF Giant Crossword Puzzle Social</td>
<td>10: 00 AM – Exercise Essentials: Balloon Toss (N &amp; S)</td>
<td>11: 00 AM – Brain Fit with Legacy (N &amp; S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14: 00 PM – All Associate Meeting (A)</td>
<td>15: 00 PM – Movie Social: Popcorn Fridays</td>
<td>15: 00 PM – Giant Crossword Puzzle Social</td>
<td>11: 00 AM – Bread Making (N &amp; S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15: 00 PM – Devotional (A)</td>
<td>18: 00 PM – Hot Teas and Short Stories</td>
<td>18: 00 PM – Guided Meditation and Hand massages with Flavored Water (N &amp; S)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>15: 00 PM – Rosary Group (A)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>16: 30 PM – Program w/ Caregivers (A)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>9: 30 AM – Good Morning w/ Dave (D)</td>
<td>10: 00 AM – News Currents and Coffee</td>
<td>9: 30 AM – Stretch &amp; Move</td>
<td>9: 30 AM – Exercise Essentials – Gentle Movements (N &amp; S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13: 15 PM – 7th Day Adventist Visits (A)</td>
<td>13: 30 PM – SingFit</td>
<td>11: 30 AM – Vintage TV</td>
<td>15: 00 PM – NFL Tailgating Social with Corn Hole (N &amp; S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14: 00 PM – Bingo (A)</td>
<td>14: 30 PM – Painting to Music</td>
<td>14: 00 PM – Fold and Sort</td>
<td>18: 00 PM – Netflix Feature: Andy Griffith with Facts and Trivia (S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15: 00 PM – Fall Performance of the Silvertones Bell Choir (A)</td>
<td>15: 00 PM – Chicken Soup for the Soul Social</td>
<td>18: 00 PM – Favorite Singalong Tunes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>15: 30 PM - Cary School of Music (A)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* (A) and (D) in Facility A stand for Household A and Household D. (N) and (S) in Facility D stand for Neighborhood North and Neighborhood South.
**Peak Usage Rate**

The average number of hours that the living spaces were used by the residents was 6.8 hours per day during the observations. The peak usage of the two living spaces in **Facility A** took place during the scheduled musical events, one in the morning and one in the afternoon on a weekend day (Figure 4.43). 26 residents [about 65%] were observed in living space 1 for a local band performance in the afternoon and 21 residents [about 53%] participated in the morning Old Song Singing activity in living space 2.

Before the events, staff and caregivers moved more chairs from the dining space in a same neighborhood to accommodate more residents. The residents who came late could only park their wheelchairs at the nearby den area or in the corridors. The living spaces were very crowded during both music events.

From the interviews:

- “… no matter what the stage [of dementia] is, they all like to be together, they all like to participate activities here. … and for sure they are encouraged to go. Some of them don’t,”
some of them will walk over and come back [wandering], but for the most part, almost everybody goes to the activities here [in the living space] …”;

• “…I will say 12-15 people or about half of them actively to come for every activity at most of the time… they may come for big family events, they may come for music events… We are trying not to keep them in their rooms, but unfortunately, they sometimes just sit in front of their TV…”

In addition, most of the daily activities are designed to involve the residents from all four households, and there is only one wellness director who leads the daily programs, which means one of the two similar neighborhoods living spaces has to serve the entire resident population of the facility. This deviates from the original design intent, which is to have decentralized living spaces to serve smaller groups of residents.

Besides these large musical events, the routine morning exercise is reported be the most “popular” activity that usually attracts a number of residents - about 15 to 20 to come. As the caregivers described, the seats are not enough to invite more residents. Sometimes they have to use the nearby den area:

• “I will say over half of our residents do activities every day… they are encouraged to participate [the activities] ... The rest of them… some of them stay in their rooms, some wander. Sometime some go to physical therapy or have visitors…”;

• “…I think the dining space should be the way it is now. But I do think it [the living space] should be bigger… because we put them all together - A, B, C, and D halls [households]… but we don't have enough seats and room for all of our residents… so it’s kind of crowded when they have activities together…”;

• “For some activities, I tried to pull them out to either living room. But the problem is if we put more than 12 people in the living room, we will get too crowded, because they have walkers and wheelchairs… and we don’t have that much space for everybody…”.

**Facility B** has its living and dining spaces sharing one big room. Residents tend to walk from the dining space to the TV area in the living space after meals, watching TV, taking naps, or
participating scheduled activities. The peak usage rate at the living space is about 75% when 15 people stayed in the room watching TV or taking naps before dinner (Figure 4.44).

From the interviews, both staff and caregivers mentioned residents tend to utilize the TV and sofa area more frequently than at the piano and chairs area:

- “The front part (sofa & TV area) of the living room is always busy… people want to watch TV or movies…”;
- “…they go there [sofa & TV area] right after dinner every day, they know this is the place to go… for TVs… their minds all focus on TV…”;
- “Typically, residents sit right here [sofa & TV area]. So, I present and do activities right here. I do play the piano sometimes. So, I will put chairs in a semi-circle around the piano, so we use the space over there [piano & chair area]. We sometimes have indoor soccer game or other kinds of games, like seated basketball game… and we use that space as well…”;
- “I think because the TV is there, the residents feel comfortable to sit in the couches there… sometimes they don’t want to move, even to the back of the room. But you know we have very limited space over here. If I say “come on, let’s go over there” they will say: “I can hear from there.” About 50% of people will go with me [to the back of the room]. And when people having fun, they may come eventually… I think if there were more couches back there, they would probably be more willing to go… they love the big comfortable chairs….”;
- “We don’t really use that area [piano & chair] much … since we don't have couches there, but just chairs… but it does function well if we want to play games... it is open and have
enough space… like if we want to play bowling, or people come in for some music performances, this space has very good setup… 9-10 people participated the soccer last time… not everybody wants to play, but some of them will stay there and watch”.

**Facility C** is in a similar situation to **Facility B**. Residents like to spend their after-meal hours hanging out in the living space, socializing with other residents, participating in activities or taking naps and of course watching TV and movies. The peak usage rate is about 67% when there were movies showing on TV in a weekend morning and afternoon (Figure 4.45).

![Figure 4.45 Living Space Peak Usage Rate and Usage Time (Facility C).](image)

No interview participants raised any issue on the size of the living space:

- “We use it for most of our daily activities. We tried to split them up in smaller groups… but people seem to like sitting there together. We tried to use our two back areas [dens] for activities, but people just came back to the main living room. Maybe because it is the closest area to the dining room and there is a TV… people just come there after meals…”
- “I think we have a fine size living space for everybody…they don’t all come here… some of them like to stay at their rooms…”

In the **north neighborhood** of **Facility D**, 43% residents [10 residents] were found in the main living space (living space 1) at one time as the peak number. The lounge-like living space 2 at the back had less visitors during the observations (Figure 4.46).
The caregivers mentioned during the interview that the size of the main living space is so small that sometimes residents need to sit in the adjacent spaces:

- “They use this living room and the TV room more...I think this space is good, but you do need more space, depends on what is going on... for example, if you have activities, you can’t get everyone in that room together at the same time. Everyone could fit that room, we have done that, but very crowded and can't do anything like exercises”;
- “No, we don’t have enough space for our living room. To have everyone sit in the living room, we have to have extra space... sometimes, we use the adjacent activity room ... especially for wheelchairs, if you line-up everybody [in the wheelchairs], people just can’t walk through”;
- “I don’t feel it is necessary to have a parking space for the walkers. They always want their walkers by them. And you have to think about whether they can get it when they want it, because they can’t walk without it. We keep the walkers right in front of them, so when they get up, they can grab their walkers... but sometimes it just gets too crowded with all these people and walkers...”.
The south side neighborhood of Facility D has more wheelchair bound residents and some of them use larger size specialized wheelchairs and need extra ADL assistances from the caregivers. These residents are usually “pushed” by caregivers to the living space after meals. The peak usage of the space happened in a morning group exercise around 9:30 AM, which involved 8 residents with a rate of 38% (Figure 4.47).

The interview data show that the caregivers are generally satisfied with the space:

- “They finish their meals and come from the dining room… some of them sit in here to watch TV…and we have about a half of them like to stay here every day… I think the size is ok, and we do exercise, we have snacks there too…”

To sum up, the average usage rate of all six living spaces is about 57%, which means, in average, 57% of the total residents would use the living space at a time. The highest rate is 75% observed in Facility B. Note that these participation rates in SCU are higher than those in regular AL (43% in average and 64% at peak). The reason could be that the caregivers in SCU make more efforts to encourage residents to participate and that the SCU residents have fewer choices in a locked environment. Dining and spending time in the living room seem to be the only two major things to do outside their units.

**Area per Resident**

According to North Carolina regulations, for licensed adult care homes with a licensed capacity of 16 or more, there shall be a minimum of 16 SF per resident for each living room or recreational area. Table 4.10 shows the actual square footage of living space per on-site resident
for all four facilities, which is generally consistent with the outcome of the interviews – Facility C has the highest - 32 SF per resident; the north side of Facility D has the lowest – 15 SF per resident; and others are in between.

Table 4.10 Living Space SF/ Resident in Facility A, B, and C.

<table>
<thead>
<tr>
<th>Living Space</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area of Living Space (SF)</td>
<td>816</td>
<td>532</td>
<td>966</td>
<td>344</td>
</tr>
<tr>
<td>The Number of Residents</td>
<td>40</td>
<td>25</td>
<td>30</td>
<td>23</td>
</tr>
<tr>
<td>Total Area of Living Space/ Residents</td>
<td>20</td>
<td>21</td>
<td>32</td>
<td>15</td>
</tr>
</tbody>
</table>

Note that Facility A and B provide about the same living space area per resident. It was found that the living space in A was not big enough, but no such issues were raised in B. To be conservative, we recommend 25 SF/resident as a minimum with 30 SF/resident preferred. These standards are higher than the North Carolina Standard (16 SF/resident) and those recommended for regular AL (16 minimum, 20 preferred). One of the reasons is that there is a higher activity participation rate in SCU than in regular AL, as discussed in the previous section. In addition, more residents in SCU use wheelchair and walker than in regular AL.

Guideline 3-4  Living Space Square Footage per Resident

The optimal size of the living space shall be programmed at 30 SF per resident, with a minimum of 25 SF per resident.

6.2.3. TV Room

In the north neighborhood of Facility D, there is a “TV room”. It is a home-like living room with sofas, a TV and a table with a couple of moveable chairs. It is across the corridor from the activity space and living space (Figure 4.48). The question: is it necessary to have a TV room separate from the main living space for SCU residents?
Figure 4.48 TV Room of Facility D - (North Side).

**Schedule**

According to the activity schedule, the only activity in the TV room during observation days was the “Movie Night” at 18:00 PM on the weekends (Table 4.11). However, as the staff mentioned in the interview, residents use this room to watch TV mostly every day.

<table>
<thead>
<tr>
<th>Public Space</th>
<th>Date</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>TV Room</td>
<td>Weekend</td>
<td>18:00 PM – Netflix Feature: Andy Griffith with Facts and Trivia</td>
</tr>
</tbody>
</table>

**Peak Usage Rate**

3 residents (about 13% of the total residents) were observed in the room as the peak number (Figure 4.49). All of them were wheelchair users and none of them used the sofa or chairs.

Figure 4.49 TV Room Peak Usage Rate and Usage Time (Facility D - North Side).
This is the only facility that has a designated room for TV and movies. All of the caregivers believed it is a nice place that makes the residents feel at home.

- “…I think it’s good because it provides them a chance to stay in a group setting instead of staying at their rooms alone… Everybody has his own TV at room, but we provide this place for them to watch TV, just like a home-living room…you watch TV there in the day… and when they are ready for the bed, they will go back to their rooms… just like home”;
- “…this room is kind of like a living room at home, so after they finish their meals, they can come here to watch TV or talk, or watch movies…”.

This room is also utilized for family visit or for private dining. Some small group activities such as puzzle or game playing have also been organized in this room:

- “…not everyone wants to watch it, so we just bring whoever wants the movie there… normally we have 3 or 4 people …and we have some wanderers, who might stop there, and take a look, and then go away...”;
- “…yes, we definitely have wheelchair people… we can put them behind the couch…but only 2 sometimes, so it’s not so bad…”;
- “…They play cards sometimes in this room…on this table here…sometimes, they do workout with TV… they have the Wii games there…” But for the most part, they sit on the couch and watch TV … I think the idea is to make this room like a home-like living room where you watch TV and play games…”.

**Area per Resident**

From the observations, only three people, two in wheelchairs, were found in the room watching TV. The room [369 SF – Figure 4.12] looked big enough for these residents to maneuver around.

Table 4.12 TV Room SF/ Resident in Facility D (North side).

<table>
<thead>
<tr>
<th>TV Room</th>
<th>Facility D (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of On-site Residents</td>
<td>21</td>
</tr>
<tr>
<td>Total Area of TV Room (SF)</td>
<td>369</td>
</tr>
<tr>
<td>Area (SF) per Resident</td>
<td>18</td>
</tr>
</tbody>
</table>
From the interviews, as the caregivers described, the room size seems to be a bit small:

- “…we could have 10 people there, some with walkers, some in wheelchairs. We put them on the couch [people with walkers], and the ones with wheelchairs, we roll them to the back of the couch. Every Sunday morning, they all watch church [on TV] … we could fit them all in there…”;
- “…I think it’s a nice room… but it could be more open and bigger for the wheelchairs…sometimes we get pretty tight there… so just give them some breathing room…”;
- “…I think this room needs a little more space. You can have more things to do, to have more wheelchairs in the room at the same time. Now, it is sometimes very hard to get them all in here… there is only one couch there…”;
- “… [the room gets crowded] when we have movie nights… and they love movies… we can just put most of them here. But we can’t block the door way for safety consideration. But if the room is too large, you can’t put them too far to the corner… they can’t see [the TV]”.

Guideline 3-5 TV Room Square Footage per Resident

A separate enclosed TV room is “nice to have” in a SCU facility. The optimal size of the TV room can be programmed at 20 SF per resident.

6.2.4. Activity Room/ Space

Unlike regular AL, not all SCUs have a designated activity room, as most of the daily activities and events are held in the living space. Only Facility B has a designated room as a separate activity room from the living space, and the north side of Facility D has an activity space directly attached to the main living space. As discussed in the previous chapter, activity room is typically set up for small group activities that require tables and chairs. The question is: Do SCU residents need a separate room for activities that require tables and chairs?

In Facility B, the activity room is embedded into residential household A. It is furnished with a long rectangular table with 6 chairs in the middle of the room, a small kitchenette (Figure 4.50).
In **Facility D**, the activity space at the *north side* neighborhood is basically an extension of the main living space. Residents can easily move between the two spaces. It has a similar setting as in **Facility B**, with a table and six people, a kitchenette, and a piano (Figure 4.51).

**Schedule**

Between the two facilities, there was only one activity scheduled on the calendar, which was a baking class on a weekend day in Facility B (Table 4.13).
Table 4.13 Scheduled Activities in Activity Room (Facility B, D).

<table>
<thead>
<tr>
<th>Public Space</th>
<th>Date</th>
<th>Facility B</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity Room</td>
<td>Weekend</td>
<td>10: 30 AM – Fresh Bread Baking</td>
<td>None</td>
</tr>
</tbody>
</table>

**Peak Usage Rate**

During the observations, no residents were found in the activity room in Facility B, and the room door was locked during the observations. In Facility D, 5 residents were observed in the space in a weekday morning.

According to the caregivers, both activity spaces in Facility B and Facility D are actually used daily for small group activities which requires table and chair, such as puzzles, Bingo, baking, flower arranging or craft class:

- [Facility B]: “...actually, we probably use the room every day... for baking class, story time, and water color class...and we just did “Spring Mosaic” this morning down there... maybe at least five days a week...”;
- [Facility D]: “It is more of a multi-use space...they use the activity space more [than the living space]. We do puzzles, Bingo, paintings, flower arranging... all kind of stuff there...”.

**Area per Participants**

Table 4.14 shows the area of the activity rooms and the number of on-site residents and their ratios. The area per resident ratios are significantly less than the optimal standard recommended for activity rooms in regular AL.

Table 4.14 Activity Room SF/ Resident in Facility B and D.

<table>
<thead>
<tr>
<th>Activity Room/ Space</th>
<th>Facility B</th>
<th>Facility D (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of On-site Residents</td>
<td>25</td>
<td>23</td>
</tr>
<tr>
<td>Total Area of Activity Room (SF)</td>
<td>209</td>
<td>258</td>
</tr>
<tr>
<td>Area (SF) per Resident</td>
<td>8</td>
<td>11</td>
</tr>
</tbody>
</table>
According to the caregivers during the interviews, neither activity space is big enough:

**Facility B:**
- “Normally 4-6 residents would come for activities there [in the activity room] ... we can't fit a lot of people in that room, especially when you have wheelchairs. I will say maximum 6 people in this room and that’s it. I think it depends on what the activity is, and how many people you get for that…”;
- “If the room could be bigger, I would be very happy with that. If the room could double the size, that would be great. In that case, we could have a full-size oven… but now we only have a mini one which we can only bake mini muffins on two small sheets for two times…”.

**Facility D:**
- “It [activity space] could be bigger. They paint, they do puzzles, they play Bingo… we have now over 15 residents on this side, I can’t fit 15 wheelchairs in this room. I would think we need more space for this place. Think about maneuvering the wheelchairs… the walkways are very narrow”;
- It would be nice if the space is a little bit bigger, but it also depends on how many people you bring here for the activity and what kind of activity. Sometimes we only have 4 or 5 people around the table. But if you bring in more people like 7 or 8 people with some of them using wheelchairs, this space might be a little bit crowded…”.

Both the interview data and the current room area per resident ratio suggest that neither Facility B nor Facility D has enough square footage per resident. Therefore, that same guideline proposed for activity room in regular AL (Chapter 3) is recommended for SCU:

**Guideline 3-6 Activity Room Square Footage per Resident**

A separate activity room is “nice to have” in a SCU facility. The optimal size of the activity room shall be programmed at 20 SF per resident for SCU, with a minimum of 15 SF per resident.

**6.2.5. Den**

A den is a small-scale space designed for casual activities such as resting, chatting, etc. Among the four facilities, the den areas in **Facility A**, **Facility B** and **Facility C** are all located at the
household-level. **Facility D** has a den in each of its north and south neighborhoods. The dens have similar home-like furnishing - sofas, small tables, lamp and chairs. The size of the dens ranges from 93 SF to 642 SF, with the largest area found in Facility C (Table 4.15). There are no scheduled activities in the den areas.

Table 4.15 Total Area of Den and The Household or Neighborhood Capacity (Facility A,B,C,D).

<table>
<thead>
<tr>
<th>Den</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household/ Neighborhood #</td>
<td>A  B  C  D</td>
<td>A  B  B  C</td>
<td>North  South</td>
<td></td>
</tr>
<tr>
<td>Total Area (SF)</td>
<td>129 129 129 129</td>
<td>146 146 642 642</td>
<td>93 196</td>
<td></td>
</tr>
<tr>
<td>Household/ Neighborhood Capacity</td>
<td>11 11 11 11</td>
<td>13 12 9 9</td>
<td>24 23</td>
<td></td>
</tr>
</tbody>
</table>

**Peak Usage Rate**

Except the den in the **south side** of **Facility D**, all other dens were used frequently during observations (Figure 4.52). The peak usage rate ranges from 0 to 8%, with a maximum 6 people using the space. Residents use the space for taking naps or watching other people passing by.
Figure 4.52 Den Peak Usage Rate and Usage Time (Facility A, B, C, D).
In Facility A, each den is adjacent to either the living or dining in each household. They are used more like a small resting area after meals or for family visits sometimes. As the staff suggested, it is a good small place for people who do not like big group activities and people who like to stay alone, and it has been used as an extension space of the living area.

- “I think this small place could help people who want to do one-on-one, for example, husband and wife, or small group chats. I think the den should be there, because you have some people who really want to be in a small group. I think that’s good for that. We do have people who just don’t want to be with everybody [in a large group] …”;
- “…only a few of people go there…after breakfast sometimes, to watch Netflix [TV]. And a couple like to watch Netflix [TV] after lunch every day. So, only a few of people utilize the den…and sometimes for the activity [at the living space], the den is an extension space …”.

In Facility B, the wellness staff called it the “Life Skill Space”. They added some reminiscence items such as wedding dress and American flag, trying to attract people when they are wandering down the hallways. However, as one caregiver said:
• I don't think people use that space… only one or two occasionally… to me, it is just like a place for decoration… nobody uses it… sometimes families would use it for a visit”;
• “I think that might be the location problem… it is at the end of the hallway, people do not usually go there… and we don’t have that many wanderers… we only have one resident who walks a lot… so for most residents, we have to take them there… or they don’t go there on their own…”.

There are four households in **Facility C**, but only household B and C have den areas that function as living spaces and are used for daily smaller group activities for about 3-5 people, or for family visits. As the staff described, the size of the dens [642 SF] is too small for holding daily activities as a living space but too large for the purpose of family visits. They suggested the den be smaller and embedded in each household:

• “I think these are good spaces… families walk back there with the residents and sit down...”;
• “I think the dens at B hall and C hall could be a little bit smaller… we need similar spaces for the A hall and B hall too … for people hanging out sometimes. We have the “Men’ club” each week. If we have some common space at A hall, we don’t need to move all the gentlemen from A to B [hall]...”.

The den area in the **north side** of **Facility D** is the smallest [96 SF]. It is basically a resting area along the loop corridor with three chairs and a table and some reminiscence items like the army badge and airplane models. People only stop by the space when they wander along the corridor.

During observations, the den in the **south side** of **Facility D** was used more frequently than those in other facilities. This space is located at the very front of the south neighborhood by the main entrance and between two households. Some residents like to sit there during the day and use it as a small living area away from the big group:

• “…we have some residents who really like this place. They sit there every time they finish their meals… they do not like to participate in any activities in the living room. They probably just like to sit in a quite space and take a nap…”;
• “That’s a good spot, because when people come in, they can hear the piano is playing. It’s a self-playing piano… it’s relaxing when they are sitting there. They really like it …and I think the size is ok…”.

Guideline 3-7 Design of Den

A small den (150 SF to 200 SF) is recommended at an open space at the household-level for residents who like to be alone or for family visits. The area should be furnished with sofas, coffee tables, etc.

6.2.6. Beauty Salon

Only Facility A and Facility C have a beauty salon located in the SCU area, whereas in Facility B and Facility D the SCU residents share the salon room with regular AL residents outside the SCU in the same building. Only 1-2 residents were seen in the salons during the observation hours in Facility A and Facility C. As the caregivers said, residents do need such services on-site since very few residents are able to go outside routinely, not only because they are restricted by transportation, but also few outside salons provide services to people in wheelchairs with special needs:

• “I think it [a salon room on-site] is a good idea. Otherwise they have to go outside quite often… for some of them, their family cannot come frequently… So, I think it is very convenient to have a salon in the building”;
• “…even though we do have a lot of outings to the library or restaurants, it is difficult for us to transport them to the salons very frequently… that requires a lot of bus trips for everybody…”;
• “…definitely a great idea. Some ladies love to go there...”.

The areas of the salon rooms are 94 SF and 164 SF respectively in Facility A and Facility C. The size of the salon in Facility C is sufficient to accommodate 2 residents in the room.

• “…this is room is perfect. This is big enough for me and is much bigger than another facility I am working at… and they don’t need to wait because I just go to their room and get them…normally I can do 2 or 3 in one afternoon…”.
In **Facility B** and **Facility D**, the residents share the salon rooms with the regular AL residents. The staff and caregivers believed this arrangement works just as well:

- “I think sharing the salon [with regular AL] is good. Actually, we have our hair done first [SCU residents typically do the hairs prior to the regular AL residents.]. I think what we have now is good and convenient…”.

**Guideline 3-8 Design of Salon**

A salon room is much needed in SCUs. A salon shared with regular AL residents in the same building is sufficient as well. For a salon within SCU, 200 SF is recommended.

### 6.2.7. Great Space

In Facility A, there is a “Great Space” located centrally between two neighborhoods. It is furnished with TV, sofas, table and chairs (Figure 4.53). This space is designed to hold large group activities (such as music, dancing, special dinners with families, exercises, etc.) and the room is sometimes used for staff training and caregiver support-group meeting as well (Perkin Eastman, 2013).

![Facility-level Great Space](image)

**Figure 4.53 Great Space of Facility A.**
From the observations, only 1 resident [3%] was seen using the space to watch TV. As the interviewees suggested, the space is mostly used as a family visit parlor or a space for staff meetings sometimes:

- “They don’t utilize that [great] place a lot… I only saw the “men’s group” [activity] there last time… families use it more for visits. But again, they have a lot of activities in the living room…”.

As a wellness staff member said, the size of the space [582 SF] is too small, even less than the living space in each household [816 SF], to hold large events. Therefore, the actual use of the space does not align with the original design intention:

- “…this room is horrible. It is in a good place as a lobby or parlor for the families to visit… it’s in the middle… but I don’t think the space in general is functioning very well for big events… it’s way too small for that…”.

**Guideline 3-9**  
**Great Space**

A Great Space designed for holding large events in SCU is redundant with the living space. It can be designed as a small size parlor/lobby at the entrance of a SCU for family visits, etc.

**6.2.8. Reflection Space**

Most of the SCUs have a room decorated with reminiscence items with the themes of wedding, baby, military, education, etc. to remind residents of their past. Facility C does not have such an area, but it has similar items placed in the living space and the dens.

**Peak Usage Rate**

From the observations, few residents were found in the reflection rooms during the day. The peak usage rate was recorded in **Facility A**, which is 10% when one resident had three family visitors and they sat down in the room. One resident was found in **Facility B** who likes to wander around. She stopped by the reflection room to cuddle a baby toy. No other residents were observed in these rooms.
As the staff and caregivers mentioned, residents rarely use the space. The design idea to have such a reminiscence space in SCU is very thoughtful idea, but unless the staff or caregiver take the residents to the space, few would visit the space on their own:

- “I like that place. I think that place is great… but they don’t use that place that much because they have a lot of activities in a day in this facility… they have probably four or five activities every day other than meals. So, they are always at the activities there [in the living space] … we have one resident who loves babies. She will go in there … and cuddle the baby for a while… but not very often… “;
- “… [residents use the space] only when we take them there or for one-on-one activities. But I think it is necessary to have a place like that, at least they have that choice if needed…”;
- “… it is always nice to see some of our residents to hold that baby [doll]… when they are holding the baby, they constantly rock in a rhythm… very comforting for them”;
- “They don’t use the room that as much as I would like….”;  
- “Think about the fact that we are memory care [facility], people lost some of their memories, but some of them could still remember the baby stuff… and we have wedding section over there too, and people can go back to that time when they got married…”.

Sometimes, this enclosed room is used for family visits or for some small group activities as a private place:

- “People use that room when families come to visit, and they take them to that room and talk to each other… or sometimes for one-on-one or small groups [activities], which makes me always think this is actually a parlor room… where you bring your guests in, you could have a private space to talk… and I think the size for the purpose it is used for is ok and big enough…”;
- “…that’s a nursery room… we have three residents always looking around to find [toy] babies. We also have families coming [in the reflection room], and they want to have privacy. They go in there and sit with the residents”;
- “They very rarely go there and sit alone. Their family members may take them there with the birds [in the cage]. You might see somebody sitting there alone, but it is very rare”.

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**Area of Reflection Room**

All of the interviewees believed the sizes of the reflection spaces (Facility A: 260 SF; Facility B: 210 SF; Facility D-North: 140 SF; Facility D-South: 156 SF) were adequate and big enough for the daily use, even for the small group activities normally involving 2 to 6.

- “…the reflection room is just about a good size… I typically do some small groups in here since we have the TV there… 6 people might be the most, so the wheelchair will fit in the room…”.

**Guideline 3-10 Reflection Room**

A Reflection Room is “nice to have”, although it is under-utilized and used more for small meetings rather than for reminiscence, which is what this room is designed for.

Recommended square footage is approximately 200 SF for 2 to 6 people.

**6.2.9. Spatial Adjacency of Hierarchy of Public Spaces**

There is perhaps no more diverse a population among the aging than those with Alzheimer’s and dementia (Perkin Eastman, 2013). People who stay in a SCU not only need physical assistances in walking, dressing, bathing, using the toilet, transferring from the bed to a chair, grooming, or eating, but also suffer from Alzheimer’s and other types of dementia. Dementia develops in different stages and the effects of the disease can vary greatly with the individual or even from day to day (Perkin Eastman, 2013). When residents with dementia gradually lose their abilities in remembering, reasoning, judgment, etc., they may not be able to carry out simple daily tasks.

The indoor public spaces discussed above can be organized in a hierarchy of two or three levels depending on the scale of the facility (bed count). For example, in Facility A where there are 44 beds, public spaces are clearly laid out in three levels:

- **Household level**: each household represents a small family of 11 residents, whose units are grouped together with a den, dining or living space at the center.

- **Neighborhood level**: two (or more) households form a neighborhood that shares a caregiver station, a kitchenette. A dining space and a living space that are located in households are designed to serve the population of the neighborhood.
• **Facility level:** the entire facility consists of two (or more) neighborhoods with general public spaces, such as great space, reflection room, salon, etc.

Smaller facilities, such as Facility B, C and D, may have only two levels (e.g. Facility and household levels) (Figure 4.54)

<table>
<thead>
<tr>
<th>Hierarchy</th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
<th>Facility D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility-level Spaces</td>
<td>F 1 [44]: Great Space Private Room Reflection Space Salon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighborhood-level Spaces</td>
<td>N 1 [22]: Dining Space Living Space</td>
<td>N 2 [22]: Dining Space Living Space</td>
<td>N 1 [25]: Dining Space Living Space Activity Room Reflection Room</td>
<td>N 1 [32]: Dining Space Living Space Salon Sun Porch</td>
</tr>
</tbody>
</table>

Figure 4.54 Spatial Hierarchy of SCU Facilities.

These models generally align with what has been proposed in the literature, arguing that SCU residents should live in a small-scale environment (hence the household concept) to avoid being overwhelmed or distracted by facing a large group of people in their daily lives. This concept generally works well. However, based on the findings of this study, we offer the following observations and suggestions:

1. The decentralized household-level or neighborhood-level living spaces do not work well. A centralized living space that caters the entire facility population shall be provided at the facility for holding large activities or events. For example, in Facility A, there are two small living spaces – the intent was for each living space to serve its own neighborhood population. However, in practice the facility does not use both living spaces separately at the same time. Typically, the caregiver needs to group all residents together for most activities (e.g. morning exercises) or events (e.g. musical shows) and offer them in one living space, which is not large enough. Therefore, each facility shall have a centralized living/ event space sized to cater the entire population of the facility, instead of decentralize it into small ones scattered in different parts of the facility.
2. Besides the central living space, which tends to be open with chairs only, it is desirable to provide other type of multipurpose activity spaces that are more enclosed to hold small-scale activities or meetings (e.g. card games that requires table and chair). Examples of such spaces are activity room and reflection room. These spaces shall be adjacent to the central living space at the facility level as well.

3. This group of facility level public spaces, such as living space, activity room, reflection room, etc., shall be located in close proximity of the entrance of the SCU facility. For example, in Facility D, a caregiver stated: “I think locating most public spaces near the main entrance is very nice…and you also have public spaces away from the rooms to reduce noise…”.

4. Although the recommendation is to locate them in close proximity to the entrance, this group of facility level public spaces, especially the living space, shall not be directly open to the entrance or serve as the lobby of the facility. For example, in Facility C, its living space also functions as a lobby (Figure 4.55). This has caused many issues, because seeking to escape is a typical behavior of many people with Alzheimer (Tilly, 2015).

5. Dining space and den can be decentralized and be located at each household as a “pair” to simulate the dining room and living room in a residence. This will also offer a quiet,
small-scale home-like setting serving a small group of residents (e.g. 10 residents in a household).

6.2.10. Circulation, Walking and Wayfinding

The concept of way-finding is based on the ability to connect objects and sensory stimulation with orientation to place (Weisman, 1987). A decline in orientation limits a person’s ability to perform daily activities independently. A major difficulty in any investigation of way-finding is determining a useful measure of outcome (Netten, 1989), especially for people who with Alzheimer’s diseases or other types of dementia.

Observations are conducted to record how residents navigate from one place to another by using behavior map. Residents in the four SCUs wander in the hallways more often than the regular AL residents. The average number of hours that residents showed up in the hallways is 6.2 hours and the peak usage rate is 15%, in average (Figure 4.56).
Figure 4.56 Hallway Peak Usage Rate and Time (Facility A, B, C, D).
Figure 4.57 shows the corridor systems of the four SCUs. The corridors are colored in darker grey, public spaces in lighter grey. Only the north neighborhood of Facility D has a complete loop corridor system. The other four have the dead-end condition.

Figure 4.57 Corridor Design of Facility A, B, C, and D.
It appears that the observation data do not have a significant correlation to the pattern of the circulation systems in the facilities. From the interview, the caregivers from the north side of Facility D, which has the loop corridor pattern, provided 100% positive feedbacks on how loop corridors encourage residents to walk in the building. Most of the caregivers work in both neighborhoods (North and South), so they also made comparisons between the two:

- “I think it’s a very nice. They walk more over this side [comparing to the south side dead-end corridors] … It’s better to have a loop corridor since they keep walking in the loop and feel like they are going somewhere…”;
- “I feel the dead end makes them more agitated, because they know that’s a dead end and they can’t get out. On this [north] side, at least they can pretend they are going somewhere…”;
- “…this side can keep them walking in a circle instead of trying to leave”;
- “I think the loop corridor makes them think it’s a track. I think the circle would be better, mainly because it provides a sense to them that they are walking and getting some sort of exercise, and feel like going somewhere”;
- “I personally think the circle works better. They tend to keep walking and walking and walking. It provides the opportunity for them to avoid stopping at the end of the hall and turning back or trying to get out of the door”;
- “Being in a loop is so much better than being in a dead-end… and yes, I would think it encourages them to walk”.

However, some caregivers had different opinions:

- “I will say that [loop corridor] is little bit [confusing]. On the other side [south side with dead-end corridors], they don’t really get confused about where their rooms are. Most of the memory care people have such a problem, but they typically know their room is in which hall [household]. But here, they go a complete circle, they forget, because the loop looks exactly the same …”;
- “I feel the loop is more confusing. For that side [north side with loop corridors], the residents just keep walking and will never find their rooms. But here [south side with dead-end corridors], if they go this way [pointing to one household], they find, oh, I am
in that hall, they will turn around and walk to the other hall. So, they don’t have problems finding their rooms”;

- “I think the circle could confuse them. There is a guy always asking me “where is my room…”.”

For the residents who use wheelchair, there may not have any issues on wayfinding, because they are helped by caregivers at all time when they want to go somewhere:

- “for wheelchair people, if they can’t move by themselves, we will push them to the dining room … and the ones who can walk, they just follow us”.

In the other three facilities with dead-end hallways, caregivers had different opinions too:

Some caregivers thought loop corridors would be more beneficial to the residents:

- [Facility A]: “I think it [loop corridor] is a good idea… then they can circle back around. For instance, they walk to C, D halls and they can circle back to A, B halls… and I think that provide the opportunity for them to walk”;

- [Facility B]: “We are kind of a small-scale place and the hallway is kind of short. So, I love the loop more… here, when we go walking, we have to turn around at the end of the hallway. The residents with walkers… you know they are going to like the circle. [showing how hard residents perform a full 180° turn with their walkers at the end of the narrow hallway] … that’s hard for them… so a loop would be so much better”;

- “…design it in a circle might be a good idea…especially for dementia, they always seek an exit to go out. If they can walk in a circle, that might be better, they could feel going somewhere instead of getting stuck in the building. When our people go to the end [of each hallway], they will push the door… and that happens a lot there”.

Some of them believed the straight dead-end corridor would be easier for the residents to walk and find their way:

- [Facility B]: “The hallway is fine. I think our straight hall will be better… because it is easier for them to walk… I don’t think they have ever got lost…they know which hall they are in…it’s simple, no fancy stuff”;

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• [Facility B]: “We only have one resident who often walks down the hall there… for exercise… she likes it… just walks up and down, back and forth. She might do it 2 or 3 times during my shift and she seems fine with that”.

In facility A, some staff members complained that the same corridor decorations and design not only get some residents but also themselves lost in the building. The most confusing part in Facility A is the four households are mirrored to each other in symmetry. People get confused about which household they are at and which way they should turn. They recommended to paint the households in different colors or provide other types of cues:
  • “It is really confusing… even for people who don’t have dementia. When I came here first time, I couldn’t remember which hallway is which, and it looks the same and you don’t really know which direction you should go”;
  • “I think color would help…”.

In conclusion, whether the pattern of circulation in SCU, loop or dead-end, influences walking or way-fining behaviors of the residents is not clear based on the limited findings of this study.
CHAPTER 5. CONCLUSIONS, IMPLICATIONS & LIMITATIONS

1. Conclusions & Implications

**STUDY 1 - Planning for the Future: Proposed Model for Market Analysis and Scope Estimation in Assisted Living Facilities**

The research goal of the study 1 is to promote the success of the AL businesses, which largely rely on private recourses, by informing the policymakers and private developers to better assess the market demand and react accordingly. By applying multiple linear regression, age-specific population variables and percent some college are in the final model developed in this study. The research findings support the hypothesis that demographic and socioeconomic factors jointly determine AL demands at county-level and should be incorporated as determinant factors in senior living market prediction.

In general, when programming new AL facilities in a county and estimate the project scope, the following guidelines can be referred:

<table>
<thead>
<tr>
<th>Guideline 1-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Beds Occupied per Capita = 0.00392 + 0.05226 × Ratio 85 and Over - 0.00003 × Percent Some College</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Guideline 1-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>For facilities with single occupancy being the dominant unit type, the per-bed building gross square feet ranges from 600 to 900 SF/ Bed, with an average of 750 SF/ Bed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Guideline 1-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>In average, the net assignable spaces of an AL facility - indoor public space, residential area, auxiliary support space account for 10%, 55% and 10% of the total building gross square feet, respectively.</td>
</tr>
</tbody>
</table>
The programming process and how it is informed by these guidelines are shown in the diagram (Figure 5.1) below:

In average, the ratio of the total building gross square feet (BGSF) to the total of building net square feet (BNSF) is 1.3. This is the typical gross-up factor for AL facilities and is used for estimating BGSF after BNSF is obtained from programming.

Guideline 1-4

Figure 5.1 Process of Market Analysis and Scope Estimation in AL.
**STUDY 2 - Programming Indoor Public Spaces of Regular Assisted Living Facilities**

Research study 2 aims to develop programming and design strategies for indoor public spaces of regular assisted living facilities, with the focus on space organization and circulation system. According to the research results, the following design and programming guidelines are recommended:

- **Guideline 2-1 Dining Room Seat Count**
  
  To determine the number of seats in an AL dining room, one can use 85% of the total bed count as the minimum standard for programming purposes:
  
  \[
  \text{Number of dining seats} = 85\% \times (\text{bed count})
  \]

- **Guideline 2-2 Dining Room Area per Seat**
  
  To determine the net square footage of dining rooms based on design seat count in AL:
  
  \[
  \text{Dining room NSF} = 40 \text{ SF/ seat} \times (\text{design seat count})
  \]

- **Guideline 2-3 Dining Room Area per Bed**
  
  To determine the net square footage of dining rooms based on bed count in regular AL:
  
  \[
  \text{Dining room NSF} = 40 \text{ SF/ seat} \times 85\% \times \text{bed count} = 35 \text{ SF / Bed} \text{ (approximately)}
  \]

- **Guideline 2-4 Dining Room Proportion**
  
  Dining room should be designed in a square shape or in a reasonably proportioned rectangular shape. A very long and narrow space does not work well.

- **Guideline 2-5 Dining Room Table Size**
  
  Small square dining tables with four seats are preferred. When larger tables are needed for special occasions, small tables can be combined to accommodate more people.
The optimal size of the living space shall be programmed at 20 SF per resident, with a minimum of 16 SF per resident.

**Guideline 2-6 Living Space Square Footage per Resident**

The optimal size of the activity room shall be programmed at 20 SF per resident, with a minimum of 15 SF per resident.

**Guideline 2-7 Activity Room Square Footage per Resident**

The activity room shall be an enclosed space with full height walls and doors for noise reduction. The room should be designed with tables and chairs. Folding tables and an attached table/chair storage space are desirable.

**Guideline 2-8 Activity Room Furnishing**

The optimal size of the lobby shall be programmed at about 15 SF per resident, with a minimum of 10 SF per resident. This ratio is primarily driven by the lobby being used the holding space before residents’ outing trips.

**Guideline 2-9 Lobby Square Footage per Resident**

Library is an underused space in regular AL facilities, at least for its primary function – reading. Computers in library are also underused by the current generation of senior residents.

**Guideline 2-10 Library**

Beauty Salon is a “must have” in a regular AL. It should be programmed at 250 SF minimum to accommodate salon chair and resident’s wheelchair.

**Guideline 2-11 Beauty Salon**
An enclosed glass sun porch is “nice to have”, but not essential. Climate control, accessibility and visual connection to people are crucial factors. 300 to 400 SF appear to be enough area for a typical AL facility.

**Guideline 2-12  Sun Porch**

PDR is a much-needed space in regular AL. Each room shall provide table and chairs for 8 to 12 people with 40SF per seat. For facilities with less than 50 residents, one PDR is sufficient; for facilities with more than 100 residents, two PDRs shall be provided; for facilities with 50 to 100 residents, two PDRs are recommended.

**Guideline 2-13  Private Dining Room**

It is desirable to group dining, activity and living room together so that they have close proximity. This public space cluster can be close to the building entrance and lobby, but the living space needs to be visually and acoustically separated from the lobby.

**Guideline 2-14  Major Public Space Adjacencies**

Loop circulation pattern appears to be more effective than dead-end pattern in encouraging residents to walk and improving way-finding in regular AL. Having different treatments on hallways and doors (e.g. with different colors) is expected to help residents with way-finding as well.

**Guideline 2-15  Circulation Pattern**
The hierarchy and adjacencies of the public spaces in regular AL are shown in the diagram below (Figure 5.2):

Figure 5.2 Hierarchy and Adjacencies of the Public Spaces in Regular AL.
**STUDY 3 - Programming Indoor Public Spaces of Special Care Units in Assisted Living Facilities**

Research study 3 aims to develop programming and design strategies for indoor public spaces of special care units in assisted living facilities, with the focus on space organization and circulation system. According to the research results, the following design and programming guidelines need to be considered before design public spaces in SCU for people with Alzheimer’s or dementia:

<table>
<thead>
<tr>
<th>Guideline 3-1</th>
<th><strong>Dining Room Seat Count</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>To determine the number of seats in an SCU dining room, one can use 100% of the total bed count as the minimum standard for programming purposes:</td>
<td></td>
</tr>
<tr>
<td><strong>Number of Dining Seats = 100% x (bed count)</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Guideline 3-2</th>
<th><strong>Dining Room Area per Bed</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>To determine the net square footage of dining rooms based on bed count in SCU:</td>
<td></td>
</tr>
<tr>
<td><strong>Dining Room NSF = 35 SF/ Bed x (Bed count)</strong></td>
<td></td>
</tr>
</tbody>
</table>

Small dining tables with four seats are preferred. When larger tables are needed, small tables can be combined to accommodate more people.

<table>
<thead>
<tr>
<th>Guideline 3-3</th>
<th><strong>Dining Room Table Size</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The optimal size of the living space shall be programmed at 30 SF per resident, with a minimum of 25 SF per resident.</td>
<td></td>
</tr>
</tbody>
</table>

| Guideline 3-4 | **Living Space Square Footage per Resident** |
Guideline 3-5  *TV Room Square Footage per Resident*

A separate enclosed TV room is “nice to have” in a SCU facility. The optimal size of the TV room can be programmed at 20 SF per resident.

Guideline 3-6  *Activity Room Square Footage per Resident*

A separate activity room is “nice to have” in a SCU facility. The optimal size of the activity room shall be programmed at 20 SF per resident for SCU, with a minimum of 15 SF per resident.

Guideline 3-7  *Design of Den*

A small den (150 SF to 200 SF) is recommended at an open space at the household-level for residents who like to be alone or for family visits. The area should be furnished with sofas, coffee tables, etc.

Guideline 3-8  *Design of Salon*

A salon room is much needed in SCUs. A salon shared with regular AL residents in the same building is sufficient as well. For a salon within SCU, 200 SF is recommended.

Guideline 3-9  *Great Space*

A Great Space designed for holding large events in SCU is redundant with the living space. It can be designed as a small size parlor/lobby at the entrance of a SCU for family visits, etc.

Guideline 3-10  *Reflection Room*

A Reflection Room is “nice to have”, although it is under-utilized and used more for small meetings rather than for reminiscence, which is what this room is designed for.

Recommended square footage is approximately 200 SF for 2 to 6 people.
The hierarchy and adjacencies of the public spaces in SCU are shown in the diagram below (Figure 5.3):

Figure 5.3 Hierarchy and Adjacencies of the Public Spaces in SCU of AL.
2. Research Limitations

**STUDY 1**

By using multiple linear regression with stepwise selection, the new model for predicting the number of assisted living beds needed per capita in each NC county has a higher than that of the existing NC model (0.935). The new model has a RMSE of 95.3, which is smaller than that of the NC model (130.8) as well. Derived from statistical inference, the new model can produce confidence intervals for its predictions, whereas the NC model is empirical in nature and therefore cannot provide confidence intervals. However, one cannot conclude that the predictor variables are the only contributors to bed needs. The new model is fit for bed needs of 2015. It will be an extrapolation to use this model to predict AL bed demands beyond 2015. It will be useful to refit the model by using recent data.

**STUDY 2 & 3**

Survey research provides a quantitative and numeric description for cross-sectional studies with the intent of generalizing from a sample to a population (Flowler, 2008, Creswell, 2014). Behavioral mapping is a technique used in environmental psychology and related fields for recording people’s behaviors and movements systematically as these behaviors occur in particular locations (Bechtel & Zeisel, 1987). The qualitative interviews can provide greater details and in-depth information from the participants, understanding their experiences and perspectives with regard to space utilization and design issues. In study 2 and 3, an explanatory sequential mixed method is used. The researcher first conducts quantitative survey and observation by applying behavior mapping as the tool. Built on the results of the quantitative methods, instruments for the qualitative interviews are developed. This research method allows the researcher to better understand and explain the initial quantitative survey and observation data with in-depth interview data. The four case study facilities involved in this study were all built in the 1990’s and located in the Wake County of North Carolina. The results may not be applicable to other geographic regions. The observations on each site were conducted in two days with 9.5 hours in each day, which may not span enough time to obtain a full picture of residents’ behaviors and how the spaces are used.
3. Future Studies

Many industry experts believe that assisted living will take the place of traditional nursing homes (Gimmy, Brecht, Dowd, 1998), and become one of the most successful models in the senior living industry (Perkins Eastman, 2013). An understanding of assisted living facilities begins with a clear knowledge of the needs and problems of the market and “users” - the senior residents. For future research, in order to better estimate the deficit or surplus of the number of beds within the assisted living market, the proposed model in this study could be improved by compiling multiple socioecological data from different regions and using multi-year data. We should also consider the changing needs and background of the future customers with proper space designs.
REFERENCES


Human Services, Assistant Secretary for Planning and Evaluation, Office of Disability, Aging, and Long-Term Care Policy. Washington, DC: The Urban Institute.


