

Designing for the Elderly: Comfort, Health and Well-Being

Islam M. Obeidat, Ph.D.

Department of Design- Fine Arts College- Yarmouk University

Saif M. Obeidat, Ph.D.

Department of Interior Design- College of Arts - Philadelphia University

Abstract:

Designing elderly units is an essential component of interior design that provides functional and aesthetic qualities for the elderly in the built environment. A plethora of designs in the residence include design that is utilized to accommodate the elderly through elements of physical and mental comfort.

Due to a lack of available current research on a direct relationship of the effect of design on elderly behavior and design, this research paper addresses designing elderly residential units according to effects on elderly well-being. The purpose of this research is to address and support designing elderly units to affect elderly well-being; through the evaluation of journal articles that discuss the elderly's well-being impacted by design. The question presented in this research is whether designing elderly residential units has an effect on elderly behavior, which eventually impacts the elderly feeling of well-being.

The research methodology used a credible scholarly journal articles written between 1997 and 2011; and was reviewed keeping the relation of elderly behavior to the design of residential units in mind. Also, a design project for elderly care unit was developed upon findings from the review of literature.

In the findings, while design may directly affect the elderly in a noticeable way, there is also evidence from research that indicates that elderly people are in fact influenced by design. When designing for elderly people; a variety of spaces, comfort, safety, and relaxation are important components of design that can aid in creating and preserving the well-being of the elderly. Designers need to produce design products, systems, and services that are usable to the elderly and people with disabilities in care units. The physical environment, when designed to be self-evident (easily understood and easy to get around in), can help compensate for the physical and mental losses of the elderly.

Keywords

- Elderly
- Interior design
- Residential environments
- Care Home Layout

Paper received 15th September 2015 ·accepted 6th November 2015 ·published 1st of January 2016

Introduction

Since many elderly individuals spend most of their time in care units, it is important to understand the psychosocial and environmental factors associated with well-being in the built environment. Interior designers should consider the well-being of elderly people living in care home units and investigate factors that impacted their enjoyment of the environment.

Designing residential units for older adults is an essential component of interior design that provides functional and aesthetic qualities for the elderly in the built environment. Many residence designs include design that is utilized to accommodate the elderly through elements of physical and mental comfort. Good design is achieved when the design is useable by the majority of residents and is aesthetically pleasing, ergonomically sound, and produces the intended psychological outcome of well-being.

Prior research on environments for elderly people has focused on design elements and behavioral outcomes. Because behaviors and environments are complex, there may be a need for a more

holistic approach to research and design for the elderly care unit. Many negative behaviors associated with elderly people may be responses to environments design rather than symptoms of aging. Quality of life for elderly people in residential units may depend largely on the physical environment to maintain autonomy, and to control every day activities in these places. The following study addresses designing elderly residential units according to effects of elderly behavior, safety, and comfort.

Research Problem

Approximately 80% of elderly households own their homes in Jordan. The elderly population (65 or older) in the Jordan is expected to double between 2000 and 2025. Due to this growth, more safe, accessible, and adaptable housing will be needed across the country to allow individuals the opportunity to age in place. In Jordan, roughly 5% of people over 65 years of age live in residential care facilities. Also, in Jordan, home care layouts have recently become more uniform, offering little gradation of space. However, previous research indicates that privacy is important to older



residents and gradation of space may support their quality of life.

Past research shows that small improvements in quality of life for older residents can have a relatively great impact.

Research Question

The question presented in this study addresses whether designing elderly residential units has an effect on human behavior, which eventually impacts elderly well-being.

Research Methodology

The methodology of conducting research for this study involved the thematic approach, in which credible peer-reviewed articles published between 1997 and 2011 and was reviewed keeping the relation of elderly' behavior to the design of residential units in mind. The review focused on evidence of interventions that improved the quality of elderly care units as seen in related to two broad categories: 1) activities of daily living and 2) psychosocial and behavioral characteristics.

Research Objectives

The objective of this paper is to address, support, or refute whether the design of elderly living units affects elderly behavior in residential environments by the evaluating journal articles that discuss elderly behavior, safety, relaxation and comforts they are impacted by unit design. The aim of this study is 1) to determine whether investment in the physical design of an elderly care unit is an essential component towards raising the quality of life and well-being for residents, and 2) to ensure the development of a residential care unit in which the physical design would fit the daily activity pattern in a coordinated way at different levels of design development, and 3) to allow the incorporation of design solutions based on daily activities for elderly residents.

Findings

Information retrieved from journal articles indicates a correlation between the design of elderly residential units and elderly behavior. In some cases design influences the behavior of some individuals, depending on the occupants' cultural and personal preferences. The evidence used to support the relation of design and elderly people is shown through function, behavior and performance.

Difficulties of Aging in Homes for the Elderly

The proportion of the U.S. population that is 65 years and older has been increasing in recent years and is predicted to continue to increase in the near future due to the large Baby Boomer population (Frey, 1999). Most Americans over 55 years of age prefer to remain in their homes as they age (Bayer & Harper, 2000); however, some elderly individuals will choose to live in care units with

suitable design instead of their prior homes. Also, the elderly do not want to recognize their physical limitations and discomfort; nor do they want to accept design that may label them as disabled (Sherman & Combs, 1997). Understanding the wider scope of aging-in-place issues that affect the elderly population, including the physical, psychological, and environmental factors that inform their decisions, may help in meeting their needs (Ahn & Goss, 2006).

Designers should recognize the factors that influence elderly people's perceptions about remaining in their homes. Elderly people should be educated about universal design, technology, and services that may improve their quality of life (Sherman and Combs, 1997). Designers must pay attention of the physical, social, and psychological support services in the community available to the elderly and their families. Also, they must provide housing options for the elderly to meet their needs. Designers should know the characteristics and circumstances of the elderly who perceive they can continue to live at home and they should know the characteristics of those that do not so that they can help develop housing to meet their needs.

Care Home Layout Affects Elderly Residents

The gradation of space (i.e., a developed range of private and public spaces) within elderly care homes impact the residents' quality of life (Barnes, 2006). Designers should provide a variety of spaces in care homes (e.g., quiet, stimulating, appropriate for small groups) to support residents in maintaining personal space and engaging in a variety of behaviors. Also, care home residents may experience a higher quality of life and engage in more active behavior when the layout includes numerous public, semiprivate, and private spaces. Residents who spend more daytime in their rooms (e.g., not in care home lounges) may be more likely to experience a sense of control over their environment and to engage in active behaviors, regardless of their level of dependence on caregivers.

Elderly and Disabled People in Virtual Design

Designers and manufacturers need to produce products, systems, and services that are usable to aging populations and people with disabilities around the world. There is a need for design tools, which are cost-effective, convey complex user information, and allow for design creativity (Gyi, et al., 2004). Designers should consider using emerging information and virtual technologies that improve usability testing of design for elderly people and people with disabilities early in the design process. Design clearance widths and heights using the 99th percentile population measurement data should be used rather than the

easily accessible, commonly used 95th percentile data to accommodate more users. Existing anthropometric data formats may not be user friendly and may not adequately inform designers of dimensional requirements for complex, everyday tasks.

Designing Alzheimer's Units

The physical environment, when designed to be self-evident (easily understood and easy to get around in), can help compensate for the physical and mental losses of the elderly. The challenging behaviors associated with Alzheimer's disease are often controlled by methods that may adversely affect quality of life (e.g., physical restraints, medication). A combination of medication, care, and the designed environment may have the greatest potential for improving the quality of life for those living with Alzheimer's disease or other forms of dementia (Zeisel et al., 2003).

Designers should include a calm, structured environment with places for resident social activities. They must modify the resident's living space to compensate for the degeneration of motor and association skills. Also, they must control exits from a resident's room or home into the larger community. Designers ought to decrease visibility of dangerous doors (exit to outdoors); increase visibility and attractiveness of safe doors (entry to room) to reduce confusion, which in turn reduces frustration and increases independence. Pathways should be created that are continuous and have social or visual interest areas along them and a destination (without being a dead end) to encourage resident walking instead of wandering. Two to three social areas with different aesthetic looks and functions should be provided so residents are stimulated, see diverse interiors, and are less bored. Designers should design quiet, private areas for residents that have the ability to be personalized, such as a bedroom/sitting room or small areas in a community space to help them maintain calm and trigger memories through personalized space (Zeisel et al., 2003).

Interior components should be used that have a residential aesthetic to create a sense of familiarity and security such as small scale furnishings, wall coverings, and lighting fixtures. They have to incorporate handrails, non-slip flooring, and high-rise toilets into the space so residents can do things by themselves, thereby supporting safety and promoting independence. Finally, they must develop comprehensible design solutions that are not extreme (a color scheme that is too dull or too bright) but that promote the residents' interest.

Air Quality in Homes of the Elderly

According to Coelho et al. (2005), designers should know that building characteristics (e.g., presence of carpet, need for renovation, garbage

chutes in apartments, and gas stoves) may be associated with poor health among the elderly. Also, they should know that many habits of the elderly (e.g., drying laundry in living rooms, spending a lot of time in the kitchen) may create health risks. Designers must be aware that inadequate ventilation (e.g., unclean screens, furniture placed over air vents, returned air from oven hoods) and the inability of elderly to perform cleaning tasks (e.g., reaching ventilation screens for cleaning) may contribute to pollution in their homes.

Improving Home Safety for Older Adults

Understanding the approaches to injury prevention that is most effective in increasing safety among older adults is crucial for designing successful intervention programs in the future (Valente, et al., 1998). Environmental conditions in the homes of older adults should be evaluated through the use of safety to encourage changes in behavior.

Designers should pay special attention to hazards in the bedroom and bathroom as these are the two most unsafe locations in the home. They must provide fire extinguishers, smoke detectors, flashlights, and post a list of emergency numbers to improve emergency safety conditions in homes of older adults. Also, they have to remove obstacles such as furniture, rugs, and electrical cords from traffic paths in the home and repair porches and steps to prevent falls. Hot water temperature should be reduced to prevent scald injuries. Designers must use non-skid flooring and bath strips to reduce slipping, encourage the use of step stools to reach high items and prevent falls, and recommend sitting a safe distance from space heaters to prevent injuries from fire (Valente, et al., 1998).

Safety Precautions for the Elderly

Successful prevention strategies for elderly people who had fallen previously included professionally supervised balance and strength training exercise, reducing home hazards, and discontinuing psychotropic medication (Tinetti, 2003). Designers should reduce hazards in the home that may contribute to falling (e.g., remove rugs, use non-slip bathmats, reduce glare from lighting, and add hand rails to stairs). Adjustable beds that may reduce drops in postural blood pressure by elevating the head should be provided. Also, they must provide an emergency system or telephone on the floor, especially for people who live alone or are at risk of falling. Designers have to consult with a physical therapist and the elderly individuals to develop strategies that reduce the risk of falling (e.g., avoid environmental hazards, be aware of side effects of medication use). They must accommodate the use of assistive devices (i.e., canes and walkers) in the home.

Lighting Standards for Elderly Care Units

The design of the 24-hour lighting scheme was created on the basis of providing high circadian stimulation during the day and low circadian stimulation at night, acceptable visual conditions during the day; and nightlights that do not disrupt sleep quality but promote safety (Figueiro, 2008). Blue light can improve sleep efficiency for older people with and without Alzheimer's disease; however, it is not always appropriate or comfortable in occupied spaces. A lighting scheme that considers both circadian rhythms and a supportive visual environment for older adults is needed. Designers should realize that a properly designed lighting scheme, such as the one proposed in this study, may be beneficial to sleep patterns of older adults with and without Alzheimer's diseases. However, such a scheme may also use a significant amount of energy. They should create quantitative lighting solutions that consider circadian sleep patterns and visual comfort and safety rather than solely qualitative solutions (e.g., bright or dim; cool or warm). Also, they should provide exposure to daylight (e.g., sun rooms, patios, courtyards) in senior centers and spaces for older adults to increase time of exposure to acceptable lighting.

Elderly and Home Control Systems

Smart technology could increase independence and security among vulnerable populations (e.g., the elderly, people with disabilities) (Petersen, et al., 2001). Designers must recognize that the older population may use traditional media sources (e.g., television, magazines, newspapers) to obtain information as opposed to new technologies (e.g., Internet). Age may influence perceptions of residential technologies among older populations. Residential technology products that are easy to use, functional, and reasonably priced and that are conducive to aging-in-place, meeting the changing needs of the elderly over time should be specified. Designers should consider increasing housing value by adding smart technology (e.g., lighting controls and dimmers). Also, they should increase market share by making smart technology available to new homebuyers.

Residential Satisfaction of the Elderly

Researchers have identified various characteristics that can be used to predict elderly persons' preferences or satisfaction with their housing, neighborhood, and community. However, satisfaction is a complex concept; elderly persons' satisfaction is determined by the relevance of various features or characteristics (i.e., the congruence of their person-fit with their environment) (Kahana, et al., 2003).

Results

Designers must develop an understanding of the person-environment fit framework to understand

and help predict residential satisfaction. Characteristics of the person, the environment, and the person-environment fit (i.e., congruence) are critical in predicting residential satisfaction. Personal characteristics include age, gender, race, education, and personality. Environmental characteristics include physical amenities and aesthetics, resource amenities, safety, stimulation or peacefulness, homogeneity or heterogeneity, and interaction or solitude. When these environmental characteristics were present in the neighborhood, they were shown to be relevant to the residential satisfaction of the elderly.

The role of interior design is a critical factor to a facility's success as an appropriate setting for the aging. For instant:

- The incorrect mounting height for an appliance or handrail can make it unusable.
- An incorrectly shaped handrail, especially one that is too narrow, can be hard for an arthritic handgrip.
- Some floor patterns with strong contrast can be perceived as a hole or step impeding mobility for those with restricted vision.
- Inappropriate use of flooring materials can generate slips and falls, which become a common cause of injury and death among the elderly.
- A poor selection of lighting fixtures can create glare that can effectively blind residents.
- Many chairs and couches are too deep or do not have arms that permit a frail person to rise from them without assistance.
- The wrong carpet will trap stains and colors created by incontinence.

These are just some of the hundreds of interior design issues that a sensitive, informed interior design can overcome. Therefore interior and environmental designers are uniquely qualified to create supportive, livable environments for older persons that are functional, healthy and safe. There are also interior factors that should be considered when designing interior spaces to meet the needs of older populations:

- Installing evenly distributed non-glare lighting with appropriate foot-candle levels specific to tasks by area.
- Providing contrast between the horizontal and vertical planes to provide better visual discrimination that will improve the sense of balance. For example, a corridor whose floor and wall finishes were a similar color and value were perceived by the residents of one facility.
- Acoustics should be considered when designing and selecting finishes; chosen materials that reduce background noise for improved hearing

- at social gatherings.
- Flushing transitions from one flooring material to another are vital. Plan for slab recesses to reduce trip hazards.
 - Avoiding sharp corners or edges in millwork, wood trim, furniture, hardware, and other interior elements.
 - Choosing flooring products that have patterns without high contrast and with colors close in value. Otherwise there is a potential for vertigo and falls.
 - Selecting textiles and wall coverings with easily recognizable patterns that will not be perceived as objects, faces, or any other objects.
 - Colors should be specified that should not be so dark that they would perceive as black or so subtle that they appear dreary to the aging eye.
 - Choosing floor finishes that are not slippery or have a high-gloss appearance.
 - Installing carpets with fiber construction and moisture-barrier backing systems appropriate for the aging population with incontinence.
 - Limiting use of mirrors on walls to create the illusion of space, as this can cause confusion and disorientation.
- The physical effects of the aging process can be addressed by selecting furniture that meets the following criteria:***
- Proper dimensions: seat height 18-19 inches, seat depth 20 inch maximum, arm height 25-26 inches; style of arm: the arms must extend to the front of the seat so that they will support the weight of residents who lean on them in order to stand or sit unassisted.
 - Density and firmness: The cushions must be supportive so that the bottom of the seat will not sink much lower than the height of the occupant's knee.
 - Upholstery issues: To address incontinence, the current trend in upholstery is a woven material known as Crypton, which is sealed to repel stains and prevent the passage of moisture through to the cushion. This can be an attractive alternative to stiff and sticky vinyl upholstery. Upholstery materials that made out of nylon have the same protective top layer as the traditional vinyl material, but are soft and supple like leather.
 - Chairs for dining should have cross support stretchers to prevent the legs from loosening due to the constant pushing and pulling from residents sitting at and rising from the table. Casters can be added to the front legs to reduce the stress on the structure of the frame and assist the resident when pulling up to the table. For safety reasons, however, casters should be placed on the front legs only.
 - Appropriate weight: Furniture to be placed in rooms with multiple functions and flexibility, such as stackable chairs, need to be light enough for the occupant to move while still providing a safe stable frame with arms that will not tip over when the seated person tries to rise. Tables that fold need to have mechanisms that lock in place for stability without any sharp edges or movable parts that can cut and pinch when set in place. All these results can be summarized in the following (see Table: 1):

Table 1: Manifestation, environmental issues and problem in designing elderly unite:

Issue	Problem	Design Solutions
Mobility	<ul style="list-style-type: none"> • Stairs generate some issues for the users who use mobility assistive devices. • Falling is a serious issue for elderly • Insufficient room in entryways and hallways for Walkers and wheelchairs users • Stairs create multiple falls and challenges for people who use mobility assistive devices. • Many fall injuries. 	<ol style="list-style-type: none"> 1. Seniors users should live in ground floor, with less use of stairs. 2. Using ramps near entrances. Using handrails in all need area 3. Suitable floor plan enough accessible spaces ADA requirements 4. Standards products rails or bars mechanical storage shelves 5. Old people should live in ground floor, with less use of stairs. 6. Using ramps near entrances. 7. Using handrails in all need area 8. All services and utility areas should be in ground floor
Stability	<ul style="list-style-type: none"> • Using dim lighting is problem for people who have limited vision, and using indirect lighting causes shadows that affect depth perception. • Using smooth surfaces • materials can cause people who these kind of surfaces fear always of falls • The use of interior elements such as rugs can cause losing stability for the elderly users 	<ol style="list-style-type: none"> 1. Using propitiate direct lighting in stairways, corridors and entranceways. 2. Nonslip surfaces materials 3. on floors, bathrooms, bathtubs should be selected 4. Avoid throw rug 5. Should use nonslip surfaces on floors, bathrooms, bathtubs, and ramp

	<ul style="list-style-type: none"> • Smooth surfaces cause falls • Wet Surfaces are slippery. • People with these kind of surfaces fear always of falls 	<ol style="list-style-type: none"> 6. Using handrails in hallways and bathrooms 7. and entrance ways. 8. Using a proper direct lighting in stairways, corridors 9. Provide railings and other supports to stabilize people
Grip	<ul style="list-style-type: none"> • Use a globe door handles pose a challenge for people who lack strength or dexterity. • Using toggle- and twist-type light switches require manual dexterity 	<ol style="list-style-type: none"> 1. Should use a lever door handles 2. Using rocker light switches
Heights	<ul style="list-style-type: none"> • Inappropriate heights for interior element such as windows • Inappropriate heights of shelving units generate more energy efforts for elderly • Use shelving units make energy for elderly • Electrical outlet with standard height may not suitable for elderly with wheelchairs to reach 	<ol style="list-style-type: none"> 1. Half-height partitions and windows permit users to see into adjacent spaces. Adjustable shelving and brackets, and should follow standards of zone of continent reach of the users
Ergonomic	<ul style="list-style-type: none"> • Poor ergonomic design can cause pain, discomfort and injury 	<ol style="list-style-type: none"> 1. Provide design element that are ergonomically decreasing the level of stress when use design elements
Vision	<ul style="list-style-type: none"> • Vision problems • Stress • Bad mood • No control • Visual cues • Falls 	<ol style="list-style-type: none"> 2. deep counters 3. increase lighting levels 4. contrast and avoid sudden changes in light levels 5. washed-out colors 6. Clear view 7. No objectives on stairs or corridors 8. No angles, distances, and surface textures
Lighting	<ul style="list-style-type: none"> • Poor lighting and poor selection of colors could generate vision issues • Using lighting as element of visual identification system • Lighting affected human ability to see and work effectively 	<ol style="list-style-type: none"> 1. Warm fluorescent or incandescent light provided more home-like atmosphere. 2. Full-spectrum lighting that comes close to natural sunlight recommended. 3. Compact fluorescent or halogen lamps needed for task lighting. 4. Indirect lighting needed for work areas. 5. Dimmers for control of lighting in elderly settings recommended
Wayfinding Cognitive	<ul style="list-style-type: none"> • Lost • Stress • a dark mat in front of a door may appear to be a deep hole • visual cliffing 	<ol style="list-style-type: none"> 1. easily accessible routes 2. tactile maps 3. directional signage 4. carefully consider structural and layout 5. tripping over objects 6. avoid using architectural features that become obstacles
Hearing	<ul style="list-style-type: none"> • Noise • difficulty recognizing words • Bad listening performance 	<ol style="list-style-type: none"> 1. carefully consider structural and layout 2. seating arrangements and lighting systems must provide clear lines of sight to interpreters

Design Project

Design plays two roles in alleviating stress for elderly. One is through enabling comfort and welfare of care units that provide health, and the other is through the design of environments that improve elderly people’s lives.

An elderly room unit design project was developed to address the specific elements of

particular design in a care facility for elderly residents. Renovations an elderly care unit designed as a typical form for an elderly resident’s room. This design project (See figure: 1-16) was used to answer a fundamental question: how was the bedroom, bathroom, sitting area and hallways in the elderly care unit designed to give direct insight about place-centered behavioral activity.



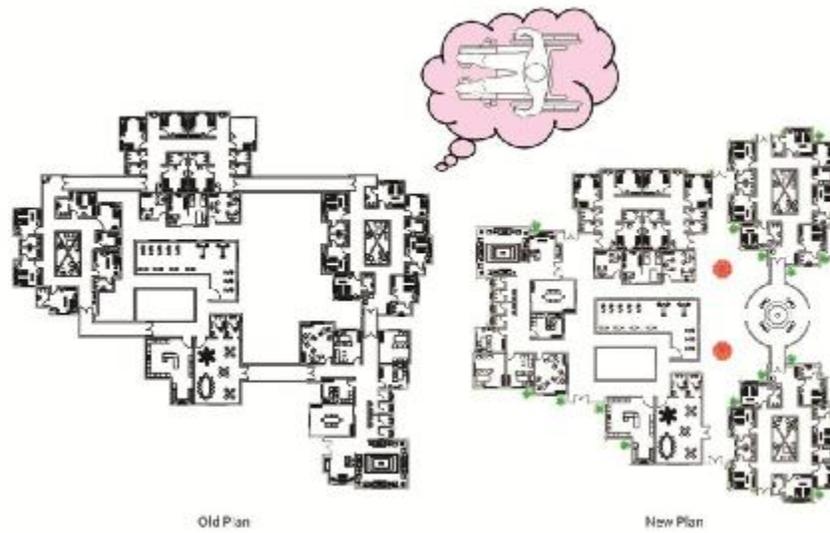


Figure 1: Existing building plan and new arrangement plan.

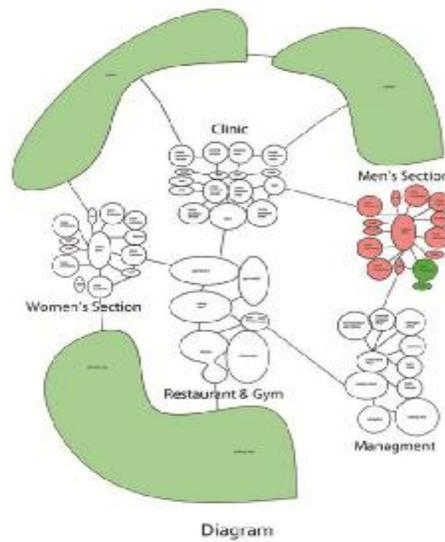


Figure 2: Diagram for whole elderly building departments

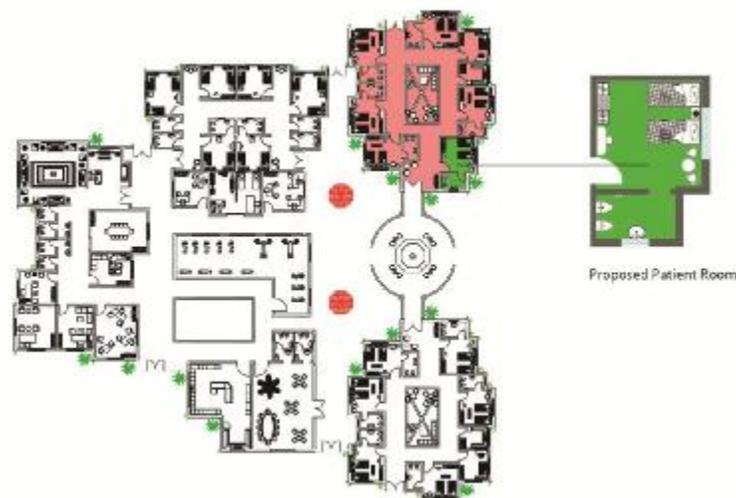


Figure 3: Proposed patient room from elderly building.

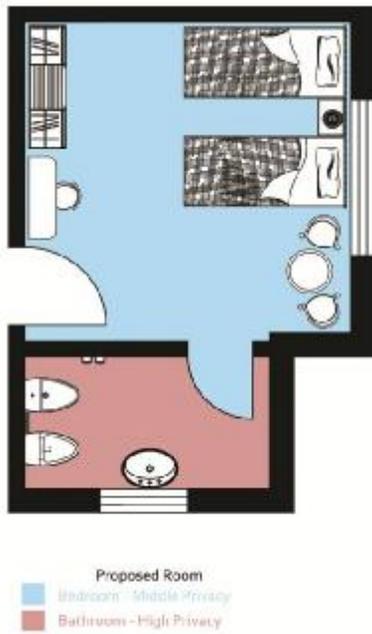


Figure 4: Privacy levels in patient room.

Women's Unit Design



Figure 5: Women's unit floor plan.

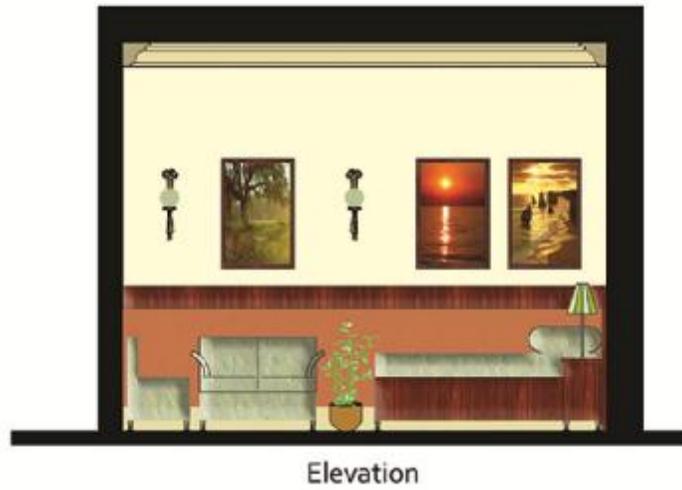


Figure 6: Women's unit elevation.



Figure 7: Women's Unit proposed perspectives.

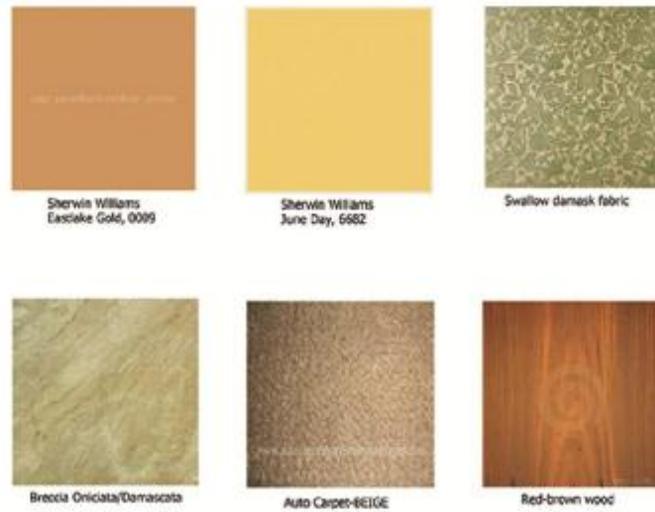


Figure 8: Women's Unit interior materials.

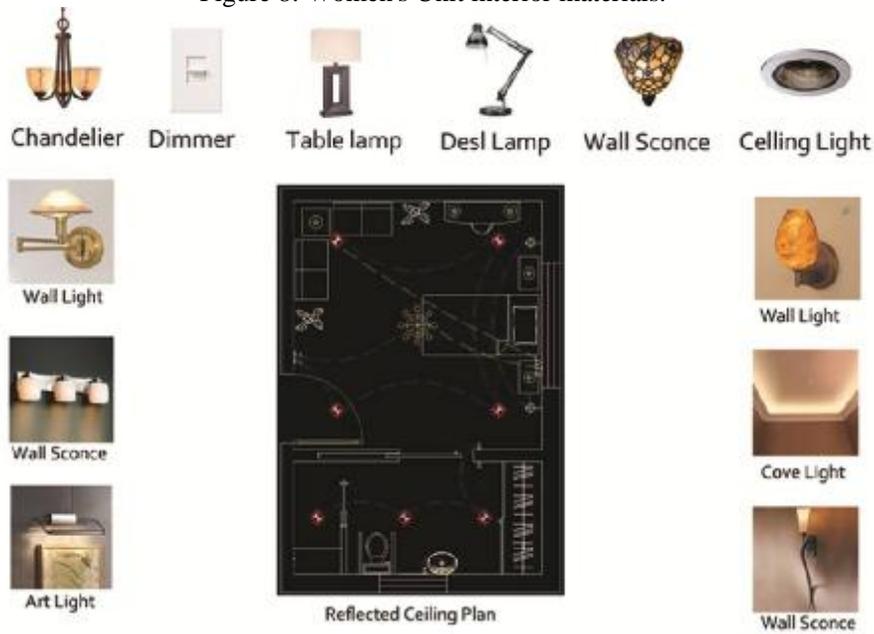


Figure 9: Women's Unit lighting plan & lighting fixtures.



Perspective

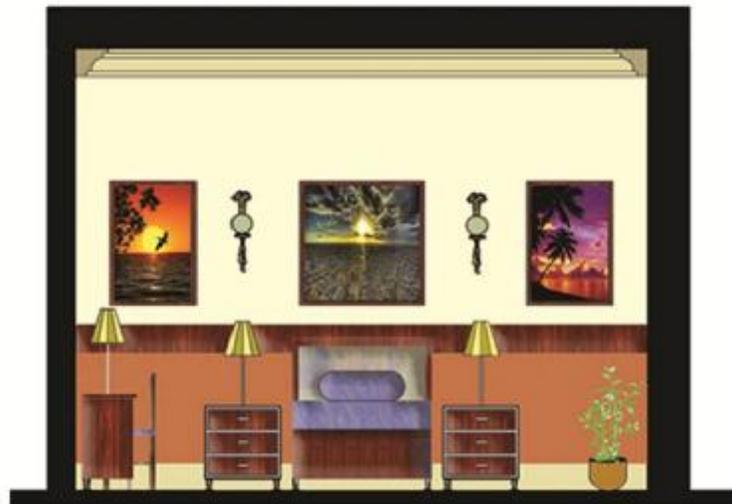
Figure 10: Women's unit proposed furniture perspective.



Floor Plan

Figure 11: Men's unit floor plan

Men's Unit Design.



Elevation

Figure 12: Men's unit elevation.



Figure 13: Women's Unit proposed perspectives.

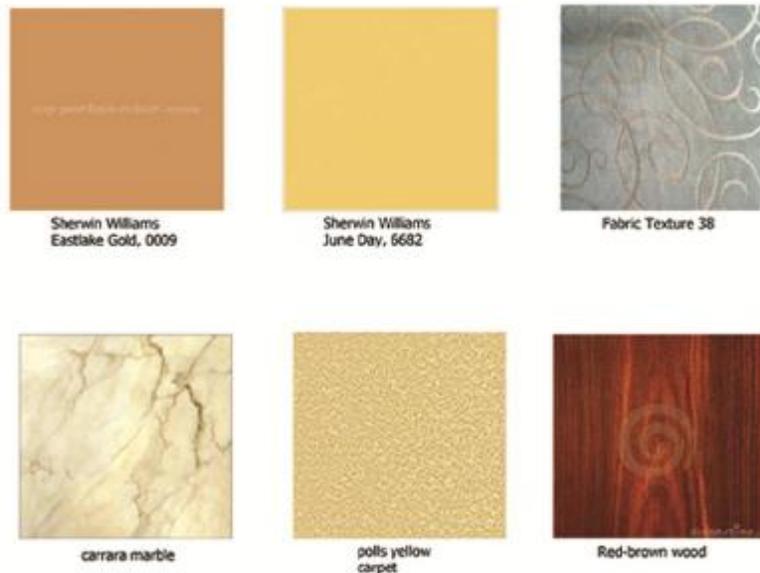


Figure 14: Men's Unit interior materials.



Figure 15: Men's Unit lighting plan & lighting fixtures.



Figure 16: Men's unit proposed furniture perspective.

Conclusion

In conclusion, evidence from research indicates that elderly people are in fact influenced by design. It is pertinent that designers are aware of the impact that the built environment has on its occupants. When designing for elderly people, a variety of spaces, comfort, safety, and relaxation are important components of design that aid in creating and preserving well-being. Designers need to produce products, systems, and services that are usable to elderly and people with disabilities in care units. The physical environment, when designed to be self-evident (easily understood and easy to get around in), can help compensate for the physical and mental losses of the elderly.

This study reaffirms our understanding of designing the physical environment, and the ways it affects the behavior, performance and activities of residents in an elderly care facility. However,

any modification in the design of the environment needs to be orchestrated with appropriate activities of residents to achieve the full potential of a physical design based on environment characteristics and human needs.

Elderly unit design should allow residents to experience continuities with self and environment: a private room, some of the individual's own belongings, and access to relationships and activities associated with self and environment.

As this study offers insight on designing elderly home units, additional research should be addressed in order to generate a more complete overview of elderly homes units that demonstrates behavior in their residential units. Due to a lack of available current research on a direct relationship between elderly behavior and design, this literature review only provides the basics for the beginning of an in-depth review of theories of designing elderly residential environments, units,

and elderly behavior. Further research needs to be conducted to form a more complete understanding of elderly' behavior in the built environment.

References

1. Ahn, M., and Goss, R. (2006). The Relationships between the Desire to Age in Place and Attitudes Toward Residential Technology. *Housing and Society*, 33(1), 95-115.
2. Barnes, S. (2006). Space, Choice and Control, and Quality of Life in Care Setting for Older People. *Environment and Behavior*, 38(5),589-604.
3. Coelho, M., et al. (2005). Indoor Air Pollution in Old People's Homes Related to Some Health Problems: A Survey Study. *Indoor Air*, 15(4), 267-274.
4. Figueiro, G. (2008). A Proposed 24 Hour Lighting Scheme for Older Adults. *Lighting Research and Technology*, 40(2), 153-160.
5. Gyi, D., et al. (2004). Representing Older and Disabled People in Virtual User Trials: Data Collection Methods. *Applied Ergonomics*, 35(5), 433-451.
6. Kahana, E. et al. (2003). Person, Environment, and Person-Environment Fit as Influences on Residential Satisfaction of Elders. *Environment and Behavior*, 35(3), 434-453.
7. Petersen, T., et al. (2001). Analysis of the Value of Home Automation Systems. *Facilities Journal*, 19(13/14), 522-530.
8. Sherman, S., and Combs, E. (1997). Characteristics Related to Elderly Persons' Perceived Difficulty of Remaining in Their Current Homes. *Family and Consumer Sciences Research Journal*, 26(1),59-74.
9. Tinetti, M. (2003). Preventing Falls in Elderly Persons. *The New England Journal of Medicine*, 348(1), 42-47.
10. Valente, J., et al. (1998). Description of a Model Rural, Older Adult Injury Prevention Program for the Home. *Housing and Society*, 25(1), 53-66.
11. Zeisel, J. (2000). Environmental Design Effects on Alzheimer Symptoms in Long Term Care Residences. *World Hospitals and Health Services*, 36(3), 27-31.
12. Zeisel, N., Silverstein, N., Hyde, J., Levkoff, S., Lawton,M., and Holmes, W. (2003). Environmental Correlates to Behavioral Health Outcomes in Alzheimer's Special Care Units. *The Gerontologist*, 43(5), 697-711.