

Enhancing Senior Living: The Impact of Ergonomics and Landscaping on Interaction

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Abstract— With the rise in the elderly population, the design of living environments for older adults has become increasingly important. This research paper explores how ergonomic design and landscaping strategies can improve the safety, comfort, and overall quality of life for elderly individuals, particularly in retirement homes and community-based living. The study draws on peer-reviewed literature, case studies to understand how age-related physical and cognitive changes influence the daily experiences of seniors at home. Key areas of focus include physiological decline, challenges related to movement and balance, and the importance of design adaptations in the entrance and kitchen spaces. The paper also emphasizes how outdoor areas—when designed with care—can enhance mental well-being, social interaction, and encourage routine activities among older adults. By combining interior design elements with accessible and sensory-rich landscapes, this research highlights practical solutions for creating senior-friendly environments that support independence, health, and emotional well-being.

Index Terms— Senior living, Ergonomic design, Landscaping, Social interaction

I. INTRODUCTION

In recent years, the number of elderly people has increased significantly, especially in cities. This rise is due to better healthcare and longer life expectancy. As people grow older, they often face various physical and emotional challenges. These may include joint pain, poor balance, reduced vision, slower movement, loneliness, and even depression. Many older adults also feel disconnected from their surroundings when they are no longer able to participate in regular activities or interact with others easily. Unfortunately, most traditional houses are not designed to support these age-related changes. Narrow doorways, slippery floors, hard-to-reach shelves, and lack of outdoor space can make everyday life uncomfortable and even unsafe for the elderly.

This is why the need for senior-friendly spaces is growing. These spaces should not only protect older

adults from falls or injuries but also support their overall lifestyle. A good design should help elderly residents move easily, engage with others, feel mentally relaxed, and remain independent for as long as possible. The goal is not just to keep them safe, but also to help them enjoy life with comfort and dignity. Two important design elements that can help achieve this are ergonomic design and landscaping. Ergonomic design is all about shaping the physical environment—such as furniture, walking paths, bathrooms, and doorways—to fit the physical needs and limits of older people. For example, using non-slip tiles, placing grab bars in bathrooms, or having chairs with proper height and armrests can make daily tasks much easier and safer.

On the other hand, landscaping plays a different but equally important role. A well-designed outdoor area can provide fresh air, sunlight, and a calm, pleasant space to relax or socialize. Gardens, walking paths, shaded benches, and flowering plants can improve mental well-being and encourage elderly people to step outside and talk with others. These natural spaces are not only beautiful—they also help reduce stress, lower blood pressure, and create chances for friendly interactions.

When ergonomic design and landscaping are used together in senior living environments, they create a space where older people can live more comfortably, safely, and happily. Such environments support healthy aging by reducing physical risks and increasing opportunities for activity and companionship.

II. LITERATURE STUDY

This research is based on an in-depth review of scholarly articles, academic journals, and real-life case studies sourced from credible platforms such as ResearchGate, MDPI, Taylor & Francis, SpringerOpen, and the National Institutes of Health

(NIH). These platforms were selected to ensure the use of peer-reviewed and academically trusted content. The study focuses on how ergonomic design and landscaping features influence senior living environments by analysing documented examples, diagrams, and expert insights. Although no field surveys or primary data collection were conducted, the paper relies on secondary data that provides a reliable and well-supported foundation for understanding the subject. This approach helps gather practical ideas and tested strategies from existing research that can be applied to real-life design scenarios.

2.1 Importance of Ergonomic Design in Senior Living

As people grow older, their physical abilities start to change. Common challenges include poor balance, weak joints, muscle stiffness, and reduced eyesight. These limitations can make everyday tasks—such as walking, sitting, climbing stairs, or using the kitchen and bathroom—more difficult and risky. This is where ergonomic design becomes very important. Ergonomics focuses on making spaces and objects easier and safer for people to use, based on their physical needs and comfort levels.

According to Zuo et al. (2021), ergonomic design in senior living should include key features such as:

- Handrails in bathrooms and corridors to provide support while walking or getting up from a seated position.
- Anti-slip flooring to reduce the risk of falls, especially in wet areas like bathrooms and kitchens.
- Shelves and counters at reachable heights, so seniors don't have to bend down too much or stretch dangerously.
- Proper lighting, especially in hallways, stairs, and bathrooms to help people with reduced vision move around confidently.
- Wide doorways and pathways to accommodate wheelchairs or walkers and avoid crowding.

These thoughtful changes make a big difference in daily life. Seniors who feel safe and comfortable in their homes are more likely to move around, stay active, and interact with others. It also reduces their dependence on caregivers and increases their confidence to carry out daily tasks on their own.

2.1.1 Physiological Decline in the Elderly

As people grow older, their bodies naturally go through physical changes that can make daily tasks more difficult, especially within their homes. Aging often increases the challenges presented by everyday environments, as people experience a gradual decline in strength, flexibility, and coordination. Researchers have studied how aging affects different parts of the body, and this section summarizes some of the most common age-related physical changes.

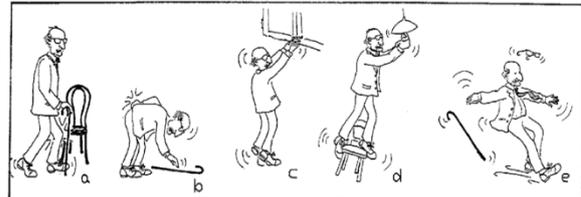


Figure 1 Home risks for ageing people: (a) to shove, (b) unpleasant bend, (c) to stretch, (d) to lose balance, (e) to slip.

Source: https://www.researchgate.net/figure/Home-risks-for-ageing-people-a-to-shove-b-unpleasant-bend-c-to-stretch-d-to_fig1_222259858

2.1.2 Muscle strength

One of the common physical changes that come with aging is a decrease in muscle strength. This occurs because bones become less dense and the body experiences a shift in composition—losing muscle while gaining fat. As a result, older adults may find it more difficult to carry out physical tasks like lifting objects, standing for extended periods, or walking long distances.

2.1.3 Posture and Seating

Posture also becomes more of a concern as people age. Simple actions like sitting and standing can lead to stress on joints and muscles. Older adults tend to spend a lot of time sitting, which can provide better body support but may also lead to discomfort or stiffness if done for long hours. To reduce discomfort from long-term sitting, adjustable chairs with proper backrests and armrests are recommended.

Standing for too long may cause back or leg pain, so providing grab bars or handles around the home can offer support and reduce strain. In resting positions, like lying in bed, prolonged inactivity can lead to muscle weakening. To help with this, features like adjustable beds and bedside tables with sliding trays and compartments can make rest more comfortable and encourage limited movement when possible.

2.1.4 Movement and Balance

As people age, muscle response becomes slower, and recovery after physical activity takes longer. This

decline affects coordination, making simple actions like bending, reaching, or balancing more difficult to perform (Katyarmal, S., Wyndham-West, M., & Khan, S.2023) The loss of muscle strength and joint flexibility makes it harder for elderly individuals to perform routine movements with the same control and safety as younger individuals.

Tasks such as lifting, pushing, or pulling can lead to strain in the arms, shoulders, and lower back, often resulting in discomfort or injury if done without proper support These movements can be particularly risky in spaces not designed with ergonomics in mind.

Another common challenge is increased body sway, which refers to involuntary shifts in posture while standing. This condition, often observed in older adults, significantly reduces stability and increases the risk of falling (Wolfson et al., 1992; Tinetti & Williams, 1997). As a preventive measure, many seniors rely on mobility aids such as walking canes or walkers to improve their balance and confidence while moving around (Brawley, 1997)

By recognizing these physical limitations and incorporating supportive design features—such as grab bars, stable surfaces, and furniture at proper heights—environments can be made safer and more comfortable for elderly users.

2.2 Home Design Solutions for Elderly People

Many older adults spend a significant amount of time in their homes, which makes it essential that their living spaces are designed to support both their physical safety and mental well-being (Katyarmal, Wyndham-West, & Khan, 2023). As people age, certain common features in homes—such as poor lighting, uneven floors, slippery areas, and storage that is hard to access—can become hazardous due to reduced mobility, impaired vision, and slower reaction times (Mitty, 2012).

Apart from physical challenges, elderly individuals often face memory problems or confusion, especially when their environment is disorganized, unfamiliar, or lacks visual clarity. To help with this, homes should be designed in a way that is easy to understand and navigate. Using open layouts, clear labels, and noticeable visual contrasts can support better orientation and reduce the chances of confusion (Brawley, 1997).

Specific areas like the kitchen and entrance require special design considerations, as they are used

frequently and carry higher risks. These areas should include features like non-slip surfaces, accessible furniture, motion-sensor lighting, and grab bars. Storing everyday items such as medication or kitchenware within reach helps reduce the need for bending or overreaching. Carman (2020) points out that such thoughtful designs not only improve physical safety but also promote a calm and stress-free atmosphere.

Overall, when living spaces are thoughtfully adjusted to meet the unique needs of aging individuals, it supports their independence and helps them live with greater confidence and security. These design improvements can lower the chances of injury and enhance their overall quality of life.

2.2.1 The entrance

The entrance area can be a high-risk zone for older adults, as it often presents hazards that may lead to falls or accidental injuries. To create a safer space, it is important to study common movement patterns of elderly individuals. Based on these observations, furniture should be positioned along the walls or in corners to prevent collisions and leave clear walking space. Using rounded edges and soft materials is recommended to minimize injury in case of accidental contact with surfaces.

Design improvements may include features such as a bench or seat placed near the entrance, offering a resting point for seniors when returning home. Installing a grab-bar or supportive handle next to the door can also help with balance and stability while entering or exiting.

Additional smart solutions include:

1. A key storage box installed near the door, which helps avoid the risk of locking issues in emergencies. Leaving keys in the lock can block access from the outside, while completely removing them may lead to forgetfulness.
2. A built-in cane holder on the door for easy access and secure storage of walking aids.
3. A coat rack with multiple adjustable hooks at varying heights, allowing seniors to hang items without overstretching or bending, thus reducing the risk of imbalance or strain.

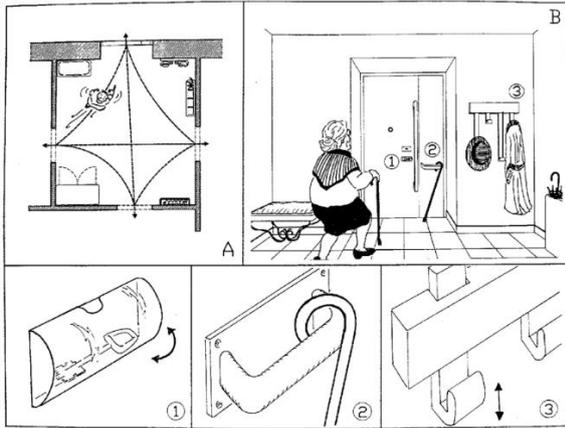


Figure 2 Solutions to reduce risks for ageing people in the entrance.

Source: https://www.researchgate.net/figure/Home-risks-for-ageing-people-a-to-shove-b-unpleasant-bend-c-to-stretch-d-to_fig1_222259858

2.2.2 The Kitchen

In the kitchen, elderly individuals are not only at risk of falling or physical strain but also face dangers such as burns and scalds. To reduce these hazards, kitchen spaces must be carefully designed to align with the physical limitations and movement patterns commonly seen in older adults.

A key consideration is the placement of storage areas. To avoid unnecessary reaching or bending, shelves should be installed at heights that are easy to access. Typically, the most comfortable and safe shelf height for seniors is around 1600 mm. For cabinets placed above counters—where access requires reaching farther—this should be reduced to around 1400 mm. Likewise, very low storage, especially below 300 mm from the floor, should be avoided to reduce the need for deep bending, which can lead to imbalance and falls (BSI, 1969, as cited in Zuo et al., 2021).

When planning the kitchen layout, the positioning of appliances plays an important role in reducing physical stress. For example, placing ovens at a raised height—above the level of the counter—helps prevent strain from bending (Pinto et al., 1996). In addition, stove tops can be equipped with heat-resistant barriers along the edges to stop hot food or liquids from spilling. These safety guards should also be easy to detach for cleaning (Pinto et al., personal communication, as cited in Zuo et al., 2021).

Window design is another aspect to consider. Windows that slide vertically are safer for older users because they eliminate the need to climb onto chairs or use stools while cleaning, which can lead to dangerous falls (Carman, 2020).

The kitchen table should also contribute to stability and safety. Fixing it firmly to the floor provides a reliable support for those who may need help standing. Additionally, the table legs should be designed so they do not extend outward, as protruding edges may become tripping hazards (Mitty, 2012).

Finally, all appliances should be simple and user-friendly. Clear, large buttons and visible on/off indicators are essential. To enhance safety further, especially for those who may be forgetful, automatic shut-off features are highly recommended to prevent overheating or fire risks (Brawley, 1997).

By applying these thoughtful design strategies, kitchen spaces can become safer, easier to use, and more comfortable for elderly individuals, helping them maintain their independence and confidence while reducing the risk of everyday accidents.

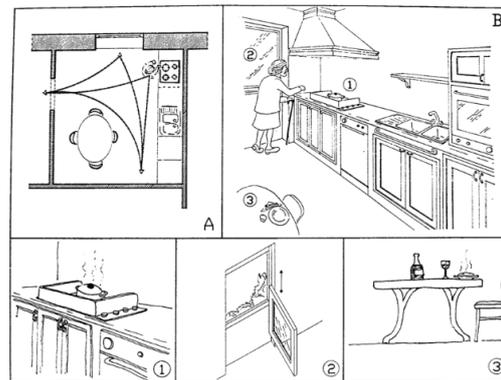


Figure 3 Solutions to reduce risks for ageing people in the kitchen.

Source: https://www.researchgate.net/figure/Home-risks-for-ageing-people-a-to-shove-b-unpleasant-bend-c-to-stretch-d-to_fig1_222259858

2.3 Landscaping and Its Role in Senior Wellness

While landscaping is often seen as a way to make a space more attractive, in the context of senior living, it plays a much deeper and more meaningful role. Well-designed outdoor environments can greatly impact the emotional, physical, and mental health of older adults. These spaces go beyond aesthetics—they become tools for healing, relaxation, movement, and social connection.

Outdoor features like gardens, walking trails, patios, courtyards, and shaded seating areas help reduce feelings of isolation and encourage elderly residents to spend time outside. Spending time in nature has been linked to lower levels of stress and anxiety, improved mood, and better cognitive function. Even a short walk among greenery or sitting near flowers

can make a person feel calmer and more connected to their surroundings (Carman, 2020).

Key Benefits of Landscaping in Senior Communities

- **Stress and Mood Management:**
Green spaces have been shown to reduce levels of cortisol, the stress hormone, and improve mood and cognitive alertness in seniors (al, 2014)). Exposure to sunlight also plays a role in regulating circadian rhythms and enhancing sleep quality (Mitty, 2012).
- **Sensory Stimulation:**
Therapeutic landscapes are often designed with multi-sensory features—fragrant plants, colorful flowers, and textured surfaces—which help activate sensory responses. This is especially beneficial for individuals with dementia or other cognitive conditions (Carman, 2020).
- **Memory and Relaxation:**
Natural elements such as flowers, herbs, and water features can trigger positive emotional memories, contributing to a calming atmosphere. A sense of familiarity within these spaces improves orientation and can reduce episodes of confusion (Whear et al., 2014).
- **Encouraging Daily Routines:**
Elderly people are more likely to follow a healthy daily routine when outdoor spaces are safe, accessible, and comfortable. Activities like morning walks, gardening, or group chats become part of their everyday lifestyle, supporting physical mobility and emotional well-being

Design Elements That Support Senior Wellness

To maximize the health benefits of landscaping for older adults, certain features should be included in the design:

- **Shaded Seating Areas:**
Pergolas, trees, or garden umbrellas provide cool resting spots. Seating should be ergonomic, with armrests and back support to assist those with limited mobility.
- **Flat, Non-Slip Pathways:**
Walkways should be wide, well-lit, and made from non-slip materials. Curved paths can add interest while helping residents walk longer distances safely (al, 2014).

- **Rest Stops:**
Strategically placed benches along walking routes allow seniors to pause and rest, especially those with joint pain or fatigue (Carman, 2020).
- **Raised Garden Beds:**
These enable older residents to participate in light gardening without bending or kneeling, supporting joint comfort and encouraging sensory interaction.
- **Visual Accessibility and Wayfinding:**
Clear path markings, signage, and distinct planting areas can help older adults, especially those with dementia, navigate the outdoor space with more confidence (Mitty, 2012).
- **Safe Lighting:**
Soft, glare-free lighting along pathways and entrances enhances visibility during evening hours and reduces fall risks (Carman, 2020).
- **Social Corners:**
Outdoor tables and benches arranged in small groups foster community interaction and casual conversations, which are essential for mental stimulation and emotional health (Whear et al., 2014).
- **Nature-Interactive Features:**
Elements like butterfly gardens, bird feeders, or small water fountains invite residents to engage with the natural world, even passively, which contributes to improved mood and reduced anxiety (Carman, 2020).

III.CASE STUDY

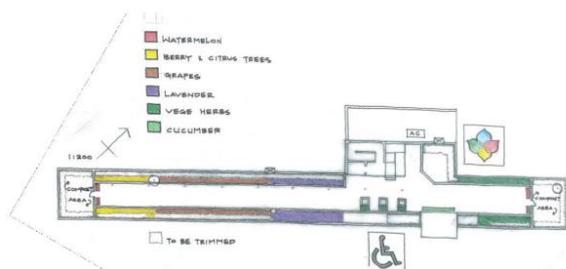
1. Therapeutic sensory stimulation garden for a residential care facility, Nozomi-no-Sato, Japan

TSSG is based on the concept of eight sensory stimulation senses that can enhance garden users' functional capacity. These eight are the five conventional senses of sight, smell, hearing, taste, touch, and three supra-senses of space, emotion, and spirituality. The stimulation of these senses can improve many functions in the older population, including memory, emotion, spirituality, activities of daily living, social interaction, recreational activities, and participation, making life more promising and exciting.

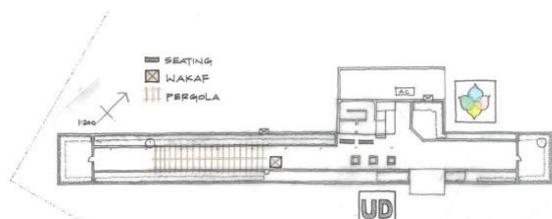


Figure 4 Eight senses stimulation. (source: Zaliha & Hussein 2017)

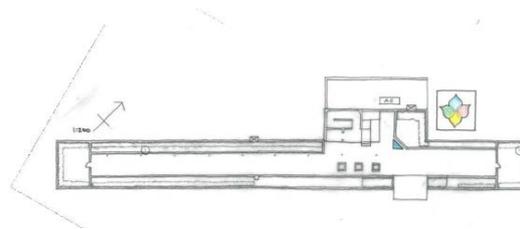
Team members' roles include contributions towards implications on the healing process as one of the outcomes of a completed TSSG; residents requested to go to the garden, and family members asked to go. Care workers also took residents who chose to be outdoors for rehabilitation activities such as gardening, walking, and wheeling exercises. In addition, an intergenerational activity had been initiated between toddlers of the organization's creche and the residents. It will be made a regular activity in future. The local welfare council has suggested everyday activities in the TSSG for their Older Persons' Social Withdrawal program. Local schools are keen to organize voluntary activities for the residents and the community.



Phase 1: Planting



Phase 2: Structure



Phase 3: Water

Figure 5 Proposed landscape design drawings for the TSSG in phases.

The following were added during the implementation of the TSSG garden project:

- i) Universal-designed planter box
- ii) Universal-designed bench with a new armrest installed
- iii) Universal design stool for use in the low-lying planter areas
- iv) The vegetable planter beds were horizontally aligned for easy reach
- v) The vine supports were low enough for the grapes to be reached from wheelchair height
- vi) Garden tools with long handles were light for ease of use by older persons.



Figure 6: Before implementation, the authors measured the flower bed to transform it into an accessible, structured planter.



Figure 7: After implementation, an accessible, structured planter caters to wheelchair users and other disabilities in the TSSG.



Figure 8: The new bench with new armrests installed.



Figure 9: Portable stool for sitting during gardening activities



Figure 10: Different heights of planter boxes that cater to different users as an example of successful use of and design of TSSG.

(Source:

https://www.researchgate.net/figure/Different-heights-of-planter-boxes-that-cater-to-different-users-as-an-example-of_fig7_366635473)

IV. CONCLUSION

This study shows that combining ergonomic design with landscaping can make a big difference in improving the lives of elderly people. Ergonomic changes like safer flooring, proper furniture, and easy-to-reach spaces help reduce accidents and support daily activities. At the same time, having

well-planned outdoor areas encourages seniors to relax, stay active, and connect with others. Together, these improvements create safer, more comfortable, and more social environments where seniors can live more independently and happily. Future senior living spaces should focus on both indoor safety and outdoor enjoyment to meet the real needs of aging individuals.

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