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The Impact of Physical Environment in Supporting Residents of Care Facilities with Dementia: A Review of Literature

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Abstract: Dementia is a devastating condition for those afflicted and affects family members and caregivers. Progressive cognitive decline in patients suffering from dementia requires special care that often is provided in care facilities. Studies have shown that the characteristics of care environments directly affect dementia patients' quality of life by reducing their level of stress (Sloane et al., 2002). This study presents a critical systematic review of the literature on evidence-based physical environmental design and examines their implications for creating a therapeutic environment that support and improve the quality of life of residents with dementia. The environmental design attributes as well as their impact on the quality of life of residents of care facilities were discussed. The findings indicate that well-designed physical environments play an essential role in supporting residents with dementia and improve their quality of life. The findings also suggest that designers are presented with credible research evidence to address design decision for care facilities environment.

Key words: dementia, care-facilities, physical environments, and environmental design

1. Introduction

Design of the physical environment is increasingly recognized as an important aid in the care of people with Alzheimer's disease and other dementias. Facility administrators and designers now view the design of long-term care, assisted living, and other environments as more than simply decorative. Design is regarded as a therapeutic resource to promote well-being and functionality among people with dementia. This article reviews and analyzes findings from empirical research on the therapeutic impacts of design in dementia care settings. The focus of this study is to identify different elements that can positively impact the quality of life of residents in care-facilitates.

2. Indoor Elements to Consider

2.1 Wayfinding

2.1.1 Signage

In a study on signage preferred by dementia patients, participants overall preferred colored backgrounds to white backgrounds and brighter hues of magenta and light green versus purple and dark green (Brush J., Camp C., Bohach S. & Gertsberg N., 2015).

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"Use of room numbers and distinguishing colors for resident rooms and doors was associated with enhanced orientation among residents." (Day K., Carreon D., & Stump C., 2000).

Unique furnishings or items that provide "architectural differentiation" are more powerful than paint color for aiding orientation and jogging resident's memories (Weisman G. D., 1987).

Memorabilia/Shadowboxes

1) Prior to placing shadowboxes outside the residents' rooms, locating the room was more difficult, suggesting that placing personal items outside ones' door may help residents with dementia find their room (Nolan B. A., Mathews R. M., & Harrison M., 2001).
2) In a literature review, it was found that facilities featuring display cases outside residents' doors improved residents' abilities to find their room (Day K., Carreon D., & Stump C., 2000).
3) "In corridors, shadow boxes that contain salient photos and memorabilia are often coupled with unit entry doors to remind residents which unit is theirs (Weisman G. D., 1987).

2.1.2 ReferencePoints/Landmarks

Meaningful decision points, or reference points and landmarks help patients better navigate through a facility (Benbow W., 2013).

2.1.3 Exits

"Number of exit points is correlated with tendency to get lost." (Marquardt G., 2011).

Exit doors were best of camouflaged so that they were not obvious to patients (Marquardt G., & Schmieg P., 2009).

"Placing an upright mirror on the floor one foot in front of the exit door reduced the number of wanderers exiting." (Benbow W., 2013). Residents who had longer routes to take to get to their rooms tended to get disoriented more while residents in an L-Shaped floor plan had less disorientation than others (Marquardt G., 2011).

Dementia patients preferred a layout that featured little to no directional change (straight corridors and L-shaped layouts) (Benbow W., 2013).

In one study, it was found that straight circulation systems — where any alcoves or wall recesses had been eliminated — were the most successful for dementia patients compared to an L-shaped hall or a continuous path around an inside courtyard. It was also noted that people with severe dementia could only navigate simple shaped spaces and should therefore be in smaller buildings (Marquardt G., 2011).

"Where staff groups were able to naturally inhabit part of a larger open plan area, they were facilitated in completing tasks whilst still being on hand and aware of residents. Observed example included staff sitting at a table completing paperwork whilst residents undertake different activities, staff engagement with craft activity within one group whilst also being available to others, and one staff member assisting one resident to east whilst still being connected with the larger group." (Tombaugh T. N. & McIntyre N. J., 1992).

In one study, an open floor plan was considered necessary to maximize visibility between the caretaker and the resident. Minimizing clutter and having furniture that would not move if held on to suddenly for support were also considered important characteristics for homes of dementia patients (Tombaugh T. N. & McIntyre N. J., 1992).

2.1.4 Corridors/Paths

In a longitudinal study, it was found that nursing homes with more corridors caused disorientation in residents after 1 year (Marquardt G., 2011).

Another studied found that long corridors had a negative impact on dementia patients and that having direct visual access, reference points and designated “zones” were also characteristics that allowed for easier navigation of a space for dementia patients (Marquardt G., & Schmieg P., 2009).

Residents with dementia benefit from living in small scale buildings and buildings with small corridor lengths (Benbow W., 2013)

2.1.5 Color

“Each place within a nursing home should be distinct with its own distinct décor and furnishings to help distinguish what it is.” (Benbow W., 2013).

2.1.6 Lighting

“Bright even glare-free illumination has been associated with improved wayfinding and reduced depression in persons with dementia.” (Sloane P. D., Mitchell C. M., Preisser J., Phillips C., Commander C., & Burker E., 1998).

2.2 Issues to Accountfor

2.2.1 Residents

(1) Resident Satisfaction

“In the focus groups many of the dementia patients used wording that insinuated that they were forced into their particular home. Because this is often the case, it is important that patients feel like they still have choices and control within the home. Families stressed the importance of many small sit down areas where they can gather with their family when they visit the care facilities. Residents don’t respond well to being controlled in regards to what spaces they can and can’t use. Simply asking permission to go outside can be very degrading to a person with dementia. Having appropriate safety features that also allow people to move freely between spaces will be important.” It was also found that wayfinding was the primary issue that the focus groups had in their care facilities (Anthea Innes, Fiona Kelly & Ozlem Dincarslan, 2011).

Qualities that were of most important of dementia patients included having dignity through privacy and autonomy, maintaining their sense of honor and esteem (hallway lengths and how much they liked their private space and common areas in the home) and sensory elements such as visual cues, handrails, tactile stimulation and cleanliness (Bicket M., Samus Q. M., McNabney M., Onyike C. U., Mayer L. S., Brandt J., Rosenblatt A. et al., 2010).

(2) Specific Issues & Physical Limitations

1) Spatial Disorientation

Topographical disorientation is a specific type of spatial disorientation that appears to be more prevalent in Alzheimer’s patients living in living communities. Because Alzheimer’s disease damages areas of the brain that the episodic memory depends on for proper functioning, it can be difficult for AD residents to adequately perceive their environment and its spatial layout, causing disorientation (Marquardt G., 2011).

To increase self-autonomy stemming from being able to reach certain places in their environment, it was found that providing landmarks within functional activity areas such as common rooms and dining areas reduced orientation issues. It was found that entrances from corridors, shadowboxes and art also act as distinctive cues for wayfinding and spatial orientation. Repetitive elements were found to be distracting where contrasting differences were not (Marquardt G., & Schmieg P., 2009).

"Spatial systems with a high convexity, that are very open and interconnected, might account for difficulties in spatial representation and therefore lead to a higher level of dependency on a caregiver. Spatial systems with a lower convexity, that feature mainly enclosed spaces with an assigned meaning, may be more easily perceived and memorized, therefore resulting in a better level of functioning" (in regard to spatial layout of the home among older adults with dementia) (Marquardt G., & Schmieg P., 2009).

2) Wandering

Wandering, caused by hyperactivity and agitation, is defined as "apparent non-goal directed ambulation of locomotion, but is not random or purposeless" or alternately, "a disoriented activity and an aimless movement with undefined intentions." It is also pointed out that the stimuli in the path of the wanderer can influence their route taken (Margareta Halek & Sabine Bartholomeyczik, 2011)

Alzheimers patients get lost due to the brain's inability to continuously update the body's location and face direction in relation to an "orientation-free allocentric map." (Serino S. & Riva G., 2013).

Wandering behavior occurs in most people with dementia, contributing to falls and getting lost. In a longitudinal study of persons with dementia, it was found that 1/5 were considered wanderers. It was found that patients with AD are overall significantly more likely to wander than other residents (Galik E. & Resnick B., 2007).

(3) Falls

In a study measuring how contrast, wayfinding, lighting/electrical, and floor graphics positively impacted the number of falls within an ALF facility, there was a positive correlation between found accessible public spaces, sensory cues and facility size and falls among residents. The larger the facility and the more sensory cues (noise/stimulation) present, the greater number of falls (Wood-Nartker Jeanneane, Beuschel Emily & Denise A. Guerin, 2017).

A positive correlation was found between the number of environmental sensory cues and fall rates among residents living in an assisted-living facility, where sensory cues measured were vision-related questions including finishes, lighting/electrical, alarms/signals, furniture/accessories, signage/text/artwork, and color contrast; the auditory cue related to an elevator alarm, the most falls occurring in corridors and the lounge and dining areas, although the latter could be due to socialization and stimulation from high-traffic areas (Wood-Nartker Jeanneane, Beuschel Emily & Denise A. Guerin, 2017).

3. Outdoor Elements to Consider

3.1 Issues to Account for

3.1.1 Health Benefits of Spending Time Outdoors

The need to transform outdoor spaces in nursing homes is pertinent as many residents go weeks without spending time outdoors (Lois J. Cutler & Rosalie A. Kane, 2006)

It was found in one facility study of residents that increasing resident satisfaction with their outdoor spaced increased the amount of time spent outdoors and therefore improved psychological well-being (Rodiek S., Boggess M., Lee C., Booth G. J. & Morris A., 2013).

In one study, it was found that decrease in outdoor activity is a causal factor of having dementia where a decrease in indoor activity suggested a decrease in cognitive decline. This suggests that an increase in outdoor activity might improve the health of a person with dementia. It also found that elderly that had little outdoor

exposure tended to show a decrease in cognitive function more than those who were exposed to the outdoors (Rodiek S., Boggess M., Lee C., Booth G. J. & Morris A., 2013).

An ongoing study on the positive health benefits of spending time outdoors for those with dementia found that spending time outdoors can improve emotional state (reduces stress, agitation and feelings of apathy), improve physical health (sleeping patterns, skin, fitness), improve memory, attention and awareness, and can improve sense of well-being, feelings of independence, self-esteem and control. It was also found to increase social interactions. Specifically, a dementia friendly garden space and organized walkways and parks have positive benefits for those living with dementia. Accessibility and knowledge of green spaces was the most difficult challenge reported by those living with dementia [in larger community beyond a living facility, in general (Galik E. & Resnick B., 2007).

In one study on the influence of nature on the social, psychological and physical well-being, it was found that experiencing time in natured could help decrease feelings of distress and symptoms of attention fatigue. It also encouraged exercise and social interaction as well as increased feelings of self-worth in adults. Even areas that were just maintained gardens and parks or a solitary tree were viewed as "nature" (Tombaugh T. N. & McIntyre N. J., 1992).

In a study on the relationship between cognitive function in older adults and spending time outdoors, it was found that going outdoors at least once a week was associated with better cognitive function in older adults with limited physical function. Individuals with limited physical function could show further cognitive decline but not going outside at least once a week (Anthea Innes, Fiona Kelly & Ozlem Dincarslan, 2011).

There is a large amount of evidence that spending time outdoors and in natural setting diminished symptoms associated with dementia and taking part in outdoor activities helped those with dementia reconnect to memories and sense of self (Galik E. & Resnick B., 2007).

In a study on disruptive behaviors and sleep issues associated with spending time outdoors, it was found that resident who spent more time outdoor displayed less time overall creating disruptive behaviors and had less night0time sleep deprivation, where residents who used the outdoor garden the most showed the greatest improvements (Mather J. A., Nemecek D. & Oliver K., 1997)

"Lack of privacy and autonomy in the care facility were also seen as significant barriers to being outdoors. Few were concerned about the risk of skin cancer. Older people; living in intermediate care facilities have a high prevalence of vitamin D deficiency from lack of even incidental sun exposure from a lack of daily outdoor routine, where inadequate sunlight exposure at least partially contributes to this Vitamin D deficiency (Durvasula Seeta, Mason Rebecca S., Kok Cindy, Macara Monique, Parmenter Trevor R. & Cameron Ian D., 2015).

"Modified spare time activities due to increasing immobility implicates that elderly people spend less time outdoors in daylight. Hence, the lack of light results in reduced non-visual light effects with negative consequences on the affective state as well as on sleep efficiency. This can especially be observed in retirement and nursing homes." (Hubalek S., Brink M. & Schierz C., 2010).

3.1.2 Resident Satisfaction

(1) Resident Preference

"Through identifying the expectations of prospective residents, retirement village providers may better tailor facilities to the needs of their target demographic. Villages that provide outdoor living areas and support independent living in conjunction with assisted living facilities and access to medical services are likely to most appeal to prospective residents." Outdoor living areas, private areas, and a fear of losing independence and

privacy is a common fear for those faced with deciding on retirement and assisted living care (Hubalek S., Brink M. & Schierz C., 2010).

"All participants reported a high value for nature, which they perceived as essential to their well-being. For nearly half of the participants, this high value for nature influenced facility choice." (Reynolds, 2016).

"The outdoor environment at the nursing home was of great social importance. Residents chose different environments depending on how they wanted to socialize (with just family or with other residents)." Residents also reported they needed the transition outdoors to be a simple one with no obstructions or difficulties. "Residents appreciated views of great open areas that gave a sense of air and volume. They enjoyed looking at plants and wanted lawns, flowers, fully grown trees and bushes and some kind of water element and well-placed benches (Anna Bengtsson, Caroline Hägerhäll, Jan-Eric Englund & Patrik Grahn, 2015).

(2) Quality of Life

1) Self-Autonomy

Outdoor activities and spending time outdoors overall, served as a "confirmation of self through being and doing" or rather being outside and continuing desired outdoor activities like gardening and drinking coffee outdoors despite having dementia increased confirmation of self (Annakarin Olsson, Claudia Lampic, Kirsti Skovdahl & Maria Engström, 2013).

In a study created to better understand quality of life factors and outdoor usage in community-living people, quality of life in relation to barriers in the outdoor environment for elder people was examined. It was found that QoL was worse for those who experienced more barriers while navigating outdoors thus increasing fear of being outdoors. Terrain and walking paths geared towards those with a slower walking speed were also concerns (Rantakokko M., Iwarsson S., Kauppinen M., Leinonen R., Heikkinen E. & Rantanen T., 2010).

In a review of the literature, it was found that the success of outdoor nature-related activities was out of residents control in the sense that the design was a major contributing factor to enjoyment and use of an outdoor space. The most important "principles for creating enabling outdoor environments were to: make the place meaningful, make spaces relate to each other, find and support 'green' staff." (Chalfont G. E., & Rodiek, S., 2005).

2) Feelings ofImprisonment

In a study measuring good resident-facility fit and what draws prospective residents to a facility, it was found that in a facility with views to a lake, some residents felt imprisoned as they could view out to the lake but could not access the outdoors freely. In one facility, a 5-digit code was developed so that mentally fit patients could easily access the outdoors (to keep those that need assistance outdoors from being able to get out as easily i.e. cognitive disorders). The study described these feelings of imprisonment felt by residents as the "ultimate expression of poor resident-facility fit." (Pirhonen J. & Pietilä I., 2016).

3.2 Other Issues

3.2.1 Mobility/Access to Outdoors

In a study comparing characteristics of two facilities, it was found that the most frequently raised issue for both residents and their families was the need to find a staff member to get access to the outdoor areas (Stadnyk R., 2008).

"People who had more chronic conditions and slower walking speed reported more barriers in their outdoor environments and had lower QoL than those who were healthier." (Rantakokko M., Iwarsson S.,

Kauppinen M., Leinonen R., Heikkinen E. & Rantanen T., 2010).

In a resident survey, it was found that many residents were unhappy with their current outdoor areas at their living facility. They complained most often about seating, doorways, walkways and complained the most about areas being out ofreach or difficult to get to or navigate. There was a large desire for shade, social spaces, open space and elements of nature (Rodiek S., Boggess M., Lee C., Booth G. J. & Morris A., 2013).

3.2.2 Shade/Sun Exposure

Shade control is often a major issue that affects the popularity of outdoor sitting spaces (Regnier V., 2002).

3.2.3 Smoking Sections

According to a study conducted for the Green House Project, residents and visiting family members of a Florida nursing home preferred smoking areas to be designated and away from nonsmoking areas of outdoors spaces. They also preferred that smoking sections not be instantly available, but rather more discreet (Lois J. Cutler & Rosalie A. Kane, 2006)

4. Uses of Outdoor Space

4.1 Sitting

Using the garden to sit outdoors quietly, to read, or to socialize were the primary uses for the outdoor garden for residents of one care facility (Mather J. A., Nemecek D. & Oliver K., 1997).

4.2 Watching Wildlife

4.2.1 Birdwatching

By updating the usability of outdoor features for residents, the overall time spent outdoors for residents nearly tripled. Opportunities for bird watching and enjoying views to nature influenced this increase the most (Rodiek S., Boggess M., Lee C., Booth G. J. & Morris A., 2013).

4.2.2 Gardening

“Allotments, as sites for the development of communal gardening activity, were seen to contribute to the social inclusion of older people in that they offered a means of combating social isolation and promoting the development of their social networks. Allotments are, thus seen as relational spaces in which gardening, as a social activity, acts as a mechanism for overcoming social exclusion. Communal gardening activities also provided an outlet for joy and nurturing behavior among residents (those who garden became more nurturing than those who did not) (Milligan Christine, Gatrell Anthony & Bingley Amanda, 2004).

Guidelines to an AAL (ambient assisted living) Garden: “(1) It is aware of the users dynamically changing needs and the age-related changes in physical and cognitiveabilities. (2) It endorses the concept active ageing by empowering people to stay active, but obliging them to participative adjust their range of activities appropriately to their physical and cognitive abilities. (3) It encourages users to engage in preventive actions to counter physical and cognitive decline and increase well-being. (4) Including the garden into the concept of ageing in place with AAL technologies will positively affect the quality of life of older people. This way, assisted living will not force the person to become bound, i.e., restricted to indoor areas. (5) The extension to outdoor areas enables individualized physical and cognitive training at home. (6) It empowers to live independently, managing health and maintaining well-being in a personally meaningful way (C. Zschippig & T. Kluss, 2015).

“A garden is an important part of the care setting and can provide diverse sensory stimulation, including sound, color and fragrance. Outside spaces are often added to care homes as decorative features but without

thought being given to their therapeutic benefits. There is a need for more dialogue among all concerned and for more emphasis on post-occupancy evaluation, with quality of life as one of the criteria of the success of the design (C. Zschippig & T. Kluss, 2015).

"The success of outdoor nature-related activities in residential care settings is confounded by multiple factors over which the organizer has little control. The built environment, however, can be a positive presence. Complexity was increased by arranging elements in physical and visual proximity and overlapping patterns of use. The goal was place-making and spatial integration. The outcome was enjoyment of outdoor space. A number of design features were annotated on the site plan and three principles for creating enabling outdoor environments were identified: (1) Make the place meaningful. (2) Make spaces relate to each other. (3) Find and support "green" staff." It was also found that making sure the paving material on the patio area extended right up to the greenhouse door as well as eliminating a threshold and placing the potting table near the greenhouse greatly influenced its use among residents (Chalfont G. E., & Rodiek, S., 2005).

4.3 Health Benefits

Where residents may not feel fully free in choosing specific factors in their environment in senior care, having the ability to affect change through gardening and making the space more personal meaningful (Chalfont G. E., & Rodiek, S., 2005).

In a study on the use of Green Care environments in nursing homes as a tool for developing person-centered care for dementia residents, it was found that those residents of green care farms that spent more time outdoors/completing nature- related activities, engaged less often in passive/purposeless activities. It was also found that they had more active engagement, more social interaction, and overall tended to be more compelled to spend more time outdoors. Residents tended to also be more physically fit than residents of non-green care farms (de Boer B., Hamers J., Zwakhalen S., Tan F., & Verbeek H., 2017).

Decreased agitation was associated with garden use among dementia patients measured in a study regarding the impact of outdoor spaces on mental and physical health (Whear, Rebecca et al., 2014).

"The use of a wander garden has been shown to reduce agitation in residents with dementia. (A wander garden is a therapeutic garden designed to increase sensory stimulation by providing access to nature as often as possible. Research has shown that both caregivers and family members agree that the presence of a wander garden decreases inappropriate behaviors and agitation in the residents with dementia." (Rodiek S., Boggess M., Lee C., Booth G. J. & Morris A., 2013).

"Structured gardens evoked the greatest response measures in regard to effects on mood and heart function in elderly individuals] and those who spent time in the Japanese garden than in other environments had a significantly lower heart rate and lower sympathetic function." (Goto S., Gianfagia T. J., Munafo J. P., Fujii E., Shen X., Sun M., Herrup K. et al., 2017).

4.4 Physical Activity (PA)

In one study, it was found that prior to using walking paths, residents in AL communities engaged in very little physical activity. There were site-specific differences in residents with regard to self-efficacy for functional ability, functional performance, social supports for exercise from experts and from family. More research in regard to how to increase PA among this population is needed (Resnick B., Galik E., Boltz M., Vigne E., Holmes S., Fix S. & Zhu S., 2018).

In an exercise study on benefits for reducing agitation for cognitively impaired persons, it was found that exercise resulted in a statistically significant decrease in agitation (Aman Edris et al., 2009).

When asked why residents did not walk outdoors but rather walked indoors, their primary concerns were safety and bad weather. Adding handrails and shaded/protected walking paths outdoors could increase outdoor usage for physical activity. Having better transitions from indoor areas to outdoor areas could also make more residents walk outdoors (Aman Edris et al., 2009).

The need for outdoor walking paths is needed: in one study, it was found that nearly 60% of residents participated in outdoor walks being the "only activity that more than 27% of residents participated in on a weekly basis (Edvardsson D., Petersson L., Sjogren K., Lindkvist M., Sandman P. O., 2014).

"Creating outdoor spaces that encourage activity and exercise can reduce depression and sleep disorders, while also increasing the calcium levels which many elders tend to run low on. Clerestory windows and skylights help to reduce dramatic light/dark differences when transitioning from between the indoors and outdoors and can help improve with vision loss. Good design that addresses the very specific needs of AD patients should act as a 'medicine' and slow down the aging process." (E. C. Brawley, 2001).

4.5 Socialization

In a study of outdoor activity for those with dementia, when asked what they liked about walking outdoors, subjects responded saying it was primarily for social reasons and aesthetic reasons as opposed to function. Going outside was an opportunity for them to see neighbors and friends (Duggan S., Blackman T., Martyr A. & Van Schaik P., 2008).

In a study used to better understand resident and caregiver satisfaction in regard to the use of common spaces in a facility, 'resident need for social interaction' scored highest as being the most important (even over resident mobility). Clearly there is a need and desire for socialization in these facilities (Erik Andersson, 2015).

Creating front porches can act as a means for socialization and provide a way for residents to spend for time outdoors. "It is a good place for AD patients to feel safety and security, while still being encouraged to interact or observe (Louis M. R., Posner B. Z. & Powell G., 1983).

5. Design Elements to Consider

5.1 Suggestions as Per the Research

"Suggested measures for comfortable design Note that comfortable design needs to be considered in the environment as a whole so that everyone, irrespective of physical and cognitive condition, is able to use and experience the garden in its entirety. Suggested measures for inspiring design — Note that the qualities of inspiring design should be placed according to the gradient of challenge so that users can choose whether or not they wish to confront from the more challenging qualities. Six environmental qualities allowing personsto be comfortable in the outdoor environment: (1) Closeness and easy access; (2) Enclosure and entrance; (3) Safety and security: (4) Familiarity; (5) Orientation and way finding; (6) Different options in different kinds of weather. Thirteen environmental qualities supporting persons' access to nature and surrounding life: (1) Joyful and meaningful activities; (2) Contact with surrounding life; (3) Social opportunities; (4) Culture and connection to past times; (5) Symbolism/reflection; (6) Prospect; (7) Space; (8) Rich in species; (9) Sensual pleasures of nature; (10) Seasons changing in nature; (11) Serene; (12) Wild nature; (13) Refuge (Anna Bengtsson, Caroline Hägerhäll, Jan-Eric Englund & Patrik Grahn, 2015). "Features associated with increased outdoor usage were: high

accessibility, clear indoor/outdoor connections, safe paving, good maintenance, roundtrip walkways and a choice of comfortable sitting areas with appealing views. There was a strong correlation between outdoor usage, walking, physical activity, environmental satisfaction and self-reported health of the residents surveyed. Falling outdoors was a primary concern." (Rodiek S., Boggess M., Lee C., Booth G. J. & Morris A., 2013).

"To promote physical activities, environmental motivators could be addressed by fine-grained spaces with transitional-areas and inviting landscaping in the outdoor settings. Along with landscaping, the presence of transitional-areas could improve the complexity of site environments. Complexity should be considered as a means of increasing the attractiveness of site environments. As most physical activities happening on residential sites are "staying- activities" among older adults, they have a lot of time to process detail. Residential site environments should be senior-friendly and have features convenient to older adults' physical activities, such as walkable areas, continuous walking paths, and good areas for gardening. Designers should consider placing the building properly on the site, applying a relative slim ground plan along the long axis of site, making a transparent building part or other mid- spaces connecting the front and back areas around the building, and keeping some sunny areas unpaved for gardening." (Wu Y., Wang Y., Burgess E. O., Wu J., 2013).

Domains of importance for ways to improve outdoor space in long-term care setting supports according to surveys of facility residents are: (1) access to nature; (2) outdoor comfort and safety; (3) walking and outdoor activities; (4) indoor-outdoor connection; (5) and connection to the world (Rodiek S., Boggess M., Lee C., Booth G. J. & Morris A., 2013).

When given a photographic survey for choosing outdoor preferences, nearly all responses preferred 'more places to walk', 'more trees', 'benches for resting', and not feeling closed in (Rodiek S., Boggess M., Lee C., Booth G. J. & Morris A., 2013).

"In respect to outdoor spaces, courtyard preferences were as follows: Shaded areas using trees and awnings at the courtyard would allow it to be used more regularly. Spaces that enable the elderly to unintentionally exercise such as reflexology stepping stones areas. A covered pathway within the garden, or spaces provided intentionally for green exercise (gardening). Recreational spaces should also be allocated to near restrooms/toilets. As the spaces are designed for elderlies, the recreational area must have 'stop' such as 'seating', resting nodes." (Mohammad Taleghani, Martin Tenpierik & Andy van den Dobbelsteen, 2012).

5.2 Walking Paths

5.2.1 Seating Along Path

"Seating along walking paths is important in three respects: (1) It provides a rest area for those who are too tired to continue walking; (2) it affords a sense of controltothose who are unsure how far they can walk; and (3) it encourages outdoor social interactions. Among the ALFs studied, only a small number of facilities had looped walking areas; some had seating along the paths/walking areas; and a very few facilities had covered walkways or well-shaded walking areas." (Lu Z., 2010).

When benches are located 75-100 feet from one another they encourage residents to exercise outdoors (Regnier V., 2002).

5.2.2 Shaded

"Overexposure to sunlight is a major concern among some residents, especially since too much sunlight can be detrimental when combined with drugs often taken by dementia patients." (Lu Z., 2010).

5.2.3 Signage

In a study on outdoor wayfinding, one participant explained that having signs along her path was helpful for when she began thinking about other things (Sheehan B., Burton E. & Mitchell L., 2006).

In a study on outdoor wayfinding using VR options that presented the same routes with two different views, the second set of views including more way finding tools, it was found that signage may be more beneficial than landmarks for outdoor navigation for people with dementia. It was also found that if more signage was placed in outdoor environments and there was more available seating, people with dementia would be more encouraged to go outdoors (Van Schaik Paul, Martyr Anthony, Blackman Tim & Robinson John, 2008).

5.3 Fencing

A 6-ft fence is necessary for keeping dementia residents from wandering out. Often the fence design is more effective if it is opaque in places where activity off site can be viewed. Seeing activity through the fence could make dementia residents anxious and more likely to attempt escape while the opaque-ness will make residents feel less imprisoned, still being able to see somewhat beyond (Regnier V., 2002).

5.4 Gardens & WildlifeAccess

5.4.1 For Residents to Tendto

Raised flower beds allowed residents to view or tend to gardens without have to look at the ground (especially important for those with dementia). Placing bird feeders at different heights allowed residents of different heights, including those in a wheelchair to be able to reach the feeder. Residents tended to the garden throughout the year, even growing vegetables and fruit (Lois J. Cutler & Rosalie A. Kane, 2006).

Having outdoor spaces for residents to tend to by using for gardening or a place to create birdseed and replenish birdfeeders was found to be therapeutic for not just residents but staff as well (Lois J. Cutler & Rosalie A. Kane, 2006).

5.4.2 Garden to SitIn

“The dominant method of enjoying the garden spaces in this study was sitting- either sitting in the garden space or sitting indoors to view nature and/or gardenspaces

through a window view. This method of enjoying the garden in addition to low use of garden space confirmed in previous studies makes a fairly strong case for viewing gardens.” (Reynolds, 2016).

5.5 Private Porches

Creating front porches can act as a means for socialization and provide a way for residents to spend for time outdoors. “It is a good place for AD patients to feel safety and security, while still being encouraged to interact or observe.” (Louis M. R., Posner B. Z. & Powell G., 1983).

“Porch spaces are located outside but are covered and connected to the building edge and can be comfortable even when it is raining. Screened porches or 3 season unconditioned porches provide additional protection against insects. Private patios and balconies Private patios and balconies directly connected to a resident’s unit are very popular in northern Europe. US nursing homes rarely provide them and US assisted living residences do not commonly include them. Fears about security and elopement have discouraged their use in the US. Rarely has this been considered a problem in northern Europe where in general, they are less risk aversive.” (Regnier V., 2002).

6. Conclusions

Understanding how design elements influence functional abilities in older people living with dementia is important if we are to create healthcare facilities spaces that promote health, healing, and well-being, while reducing the risk for harm and injury. This paper summarizes the findings of empirical research projects that investigate different environmental factors in healthcare facilitates that can impact the quality of life of residents with dementia.

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