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# Impact of environmental design on psychological and physical well-being among people with Alzheimer's Disease

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## WPŁYW PROJEKTOWANIA ŚRODOWISKOWEGO NA DOBROSTAN PSYCHICZNY I FIZYCZNY OSÓB Z CHOROBAŁ ALZHEIMERA

### **Abstract:**

Rosnąca liczba badaczy oraz profesjonalistów pracujących z osobami starszymi dostrzega znaczenie fizycznych i społecznych aspektów środowiska, które przyczyniają się do dobrego samopoczucia oraz poprawy jakości życia mieszkańców domu opieki. Celem artykułu jest przegląd literatury dotyczącej wpływu projektowania środowiskowego na dobrostan psychiczny i fizyczny osób cierpiących na chorobę Alzheimera. W artykule dokonano opisu najważniejszych objawów choroby Alzheimera, a także przeglądu badań nad demencją i projektowaniem środowiskowym, zwracając szczególną uwagę na związek pomiędzy rozwiązaniami architektonicznymi a zmniejszeniem negatywnych objawów choroby Alzheimera. Wskazano na kierunki przyszłych badań mających na celu doskonalenie projektowania środowiskowego z myślą o podnoszeniu jakości opieki nad osobami starszymi w warunkach instytucjonalnych.

## **Introduction**

It is common for people to become attached to their homes. Research has shown that the majority of older adults prefer to remain in their current home and community as long as possible (Frank, 2002; Nishita, Wilber, Matsumoto & Schnelle, 2008). Remaining at home as people age has also become a goal of policy makers, service providers, caregiving staff, and family members as it can substantially reduce

the financial burden of long-term services. However, during the last few decades we witnessed significant demographic changes. With increasing number of older adults the prevalence of Alzheimer's Disease (AD) has been also observed to increase significantly in the recent years. Some individuals suffering from AD are taken care of by the family members, but for some, due to the severity of symptoms present during the course of illness, nursing home is unavoidable. The move to a new and unfamiliar place may be difficult and can cause a lot of stress for elderly. The patients with Alzheimer's disease frequently report difficulty with adjusting to the new location, and getting themselves familiar with the new surroundings. Therefore, it is important to consider a proper long-term care for aging population and a need to design places, which facilitate older adults diagnosed with AD.

This importance of environmental design is recognized by researchers from different disciplines as a factor influencing physical and psychological well-being of residents with cognitive decline. Combination of the unique knowledge and expertise of psychologists and architects provides new and exciting opportunities for multidisciplinary teams to design living space that would offer tranquility and an improved quality of life.

The major goal of this article is to review the literature relevant to the influence of environmental design on psychological and physical well-being among people with Alzheimer's disease. We focus primarily on studies, which examined how the environmental design correlates with the behavioral health outcomes. Prior to discussing research relevant to the design of nursing homes, we attempted to describe the most important characteristics of the Alzheimer's disease, including symptoms of the disease. The subsequent part reviews research on dementia and environmental design. The article includes a brief summary of recommendations to decrease the negative symptoms or improve the well-being of nursing homes' residents. The final part includes conclusions and discusses the directions for future research.

## **What is Alzheimer's Disease?**

One of the most important health concerns in Poland is the growing burden of dementia. A report undertaken by Alzheimer Europe (2012) estimated that there are approximately 500,000 Polish people diagnosed with dementia. That represents 1.31% of the total population and is slightly below the EU average of 1.55%. Most individuals with dementia live at home, cared for by family members. Given the increasing number of individuals with dementia in the years to come, reforms will be needed to ensure that older adults have access to high quality care and treatment appropriate for their needs.

Alzheimer's disease (AD) is the most common cause of dementia among older people and it is not a part of normal aging. AD is degenerative and incurable disease which worsens over time. It is estimated that 5.7 million people in the United States may suffer from the Alzheimer's disease (Alzheimer's Association, 2018). AD is usu-

ally diagnosed in individuals after the age of 60. However, it varies depending on the type of the disease. The late-onset AD (also called sporadic AD) is the most common form of Alzheimer's disease. It usually occurs after the age of 65 and accounts for about 90% of AD cases.

## Symptoms of Alzheimer's Disease

The majority of older adults, as they age, experience cognitive decline, especially memory problems, which are a normal part of aging. However, individuals diagnosed with AD experience more severe problems with their memory and these problems are irreversible. The most common early symptom of Alzheimer's is diminished short-memory. Patients have difficulty remembering newly learned information and things that happened recently. As the disease advances, the individuals experience more symptoms, including disorientation, mood and behavior changes; deepening confusion about events, time and place. They develop unfounded suspicions about family, friends and caregivers; more serious memory loss and behavior changes. Finally, they experience difficulty speaking, swallowing and walking (Neugroschl & Wang, 2011).

The Alzheimer's disease symptoms vary depending on a stage. Moreover, not every individual will experience the same symptoms or rates of the disease. In stage 1, no impairment, a person does not experience any memory problems; an interview with a medical professional does not show any evidence of symptoms of dementia. In stage 2, very mild cognitive decline, a person may be forgetting familiar words or the location of everyday objects, but no symptoms of dementia can be detected during a medical examination or by friends, family or co-workers. In stage 3, mild cognitive decline, friends, family or co-workers begin to notice difficulties. During a detailed medical interview, doctors may be able to detect problems in memory or concentration. Common stage 3 difficulties include: noticeable problems coming up with the right word or name, trouble remembering names when introduced to new people, forgetting material that one has just read, losing or misplacing a valuable object and increasing trouble with planning or organizing. In stage 4, moderate cognitive decline, an individual may experience forgetfulness of recent events, greater difficulty performing complex tasks, such as planning dinner for guests, paying bills or managing finances and may become moody or withdrawn, especially in socially or mentally challenging situations. Stage 5, moderately severe cognitive decline, includes gaps in memory and thinking. At this stage, individuals are unable to recall their own address or telephone number or the high school or college from which they graduated. They also become confused about where they are or what day it is and need help choosing proper clothing for the season or the occasion. In stage 6, severe cognitive decline, memory continues to worsen, personality changes may take place and individuals need extensive help with daily activities. In addition, individuals may lose awareness of recent experiences as

well as of their surroundings, experience major changes in sleep patterns (sleeping during the day and becoming restless at night) and have increasingly frequent trouble controlling their bladder or bowels. They also experience major personality and behavioral changes, including suspiciousness and delusions (such as believing that their caregiver is an impostor) or compulsive. The stage 7, very severe cognitive decline, is the final stage of AD. In this stage, individuals lose the ability to respond to their environment, to carry on a conversation and, eventually, to control movement. They may still say words or phrases (Alzheimer's Association, 2018).

## **Environmental design and its interests in improving residents' behavior**

One of the first researchers to examine the role of the environment on the behavior and emotions of people with dementia was M. Powell Lawton (1983), who conducted a study at the Philadelphia Geriatric Center in the 1970s. The architectural mainstream was focused on increasing staff's efficiency, rather than promoting the design of nursing homes that would improve the psychological well-being of patients with AD. The pioneering work by Lawton revealed that environment plays a significant role in treatment of individuals with dementia. The results of Lawton's study initiated other important research investigating the role of the environment. Calkins (2009) noted that the current research not only focuses on disruptive behaviors but also looks into well-being. This has been a significant shift in research.

Researchers and health-care professionals recognize the importance of both physical and social factors of the environment as contributing to well-being and improve the residents' quality of life (Kahana, Lovegreen, Kahana, & Kahana, 2003; Phillips, Ajrouch, Hillcoat-Nalletamby, 2010). However, while focusing on trying to find a cure for Alzheimer's disease, a great number of health care professionals tended to overlook the role of the physical environment and did not regard it as a component of treatment. Fortunately, this trend has changed and currently more emphasis is put on environmental techniques. Therefore, the treatment guidelines encourage health care professional to use environmental techniques as a first line of defense against the progression of illness (Tilly & Reed, 2008).

Designers are trying to apply a different approach, referred to as the person-environment fit model. In this model, the person is defined in terms of a set of competencies, whereas the environment is defined in terms of demands. Researchers realize that the behavior is the result of the interaction between the competence of the individual and the environmental press of the situation. Therefore, in this model, the sense of well-being is promoted when individuals are located in a setting that fits their needs (Iwarsson, 2005).

As mentioned earlier, most elders and their families are more comfortable with home care than with the more impersonal care received by the institution such as a

nursing home (Wilson, 2000). However, during the course of Alzheimer's disease the symptoms are sometimes so severe that the family members are not able to provide a proper and constant care. Moving from a family home to the nursing home should be a positive experience for both the family members and the affected older adult. Nursing homes offer constant care and manage problems, which their residents may experience. Moreover, the residents have a chance to socialize with other people. However, majority of older people see the fact of moving to a nursing home as a personal failure and a traumatic experience (Regnier, 1994; Davies, 2005). Taking into account the fact that this transition is difficult for the elderly and their families, the nursing homes should facilitate such a transition, be safe, more attractive, intuitive, designed to promote social relationships and have a homelike atmosphere.

## **Influence of physical environment on decreasing negative symptoms among people with Alzheimer's Disease**

The environment that we live in has an influence on our quality of life. However, the impact depends on a number of factors, such as individual's background, culture, experience and age (Brawely, 1997). Since individuals with AD are more likely to be disabled and need care, the impact of the environment on their lives is even greater than for healthy individuals. Taking into account that the health care facilities' mission is to protect patients, promote health and do no harm, the impact of environment received some considerable attention. A growing body of research indicates that there are specific environmental factors, which influence the expression of behavior of patients with AD. In this section we discuss the most common, negative symptoms associated with Alzheimer's disease such as aggressive and disruptive behavior, problems with orientation, wandering and experiencing depressive symptoms, aggressive and disruptive behavior and report research finding on the association between the symptoms and nursing home settings.

### **Aggressive behavior**

In case of Alzheimer's disease, aggression is rarely lead by personality trait, but rather caused by confusion. The existing literature on disruptive behavior suggests that aggression can be also triggered by the environment such as unit size, lack of privacy or inadequate lighting.

There is evidence that insufficient lighting plays an important role in the long-term care setting and may increase aggressiveness. For example, Elmstahl and colleagues (1997) found that low-light levels are associated with higher levels of agitation. Residents often are having problems with walking because the hallways are too dark and being unable to find the way and losing their independence often make them angry.

In the course of the disease, due memory and judgment impairment, the individuals may become frustrated or aggressive if they do not comprehend their surroundings. Brawely (1997) claimed that sensory overload is responsible for anger and agitation.

Such overload may happen if there is too much stimulation, caused by an excessive number of surrounding people, excessive noise, or too much activity. Though the reaction of the demented people can vary substantially, Brawely recommended designing smaller settings with gathering activities rather than having big rooms with numerous distractions. Smaller rooms also help to reduce the noise and number of people present in the common space.

The sense of privacy also decreases aggressive behavior. Zeisel and colleagues (2003) found that higher percentage of private rooms was associated with lower anxiety and aggression in residents with dementia. His other study indicates that the perception of the place also influences the disruptive behavior. Residents living in nursing homes, which were less institutional, expressed lower level of verbal aggression than residents living in more institutional settings (Zeisel et al., 2003).

### **Disorientation**

Brain changes associated with Alzheimer's disease lead to growing trouble with orientation, which is a common problem experienced by older adults with AD (Cohen & Weisman, 1991; Marquardt et al., 2011). People with Alzheimer's disease may lose their sense of what day it is or where they are. Due to memory impairment, the patients often look for a person or place and become frustrated when they are unable to find what they are looking for. Research on disorientation and wayfinding suggests that using name plaques, personal photographs and other door decorations, which can help to locate the rooms, may decrease the occurrence of losing orientation (Brawely, 1997).

Some design guidelines suggest that individuals should be provided with a view to accessible outdoor areas. This could help them to assess time of the day or the current season. Namazi and colleagues (1991) found that personally significant memorabilia, which are displayed in cases outside of the resident rooms, are helpful in increasing the residents' ability to find their rooms. However, their study also suggests that personally significant memorabilia are most useful only for individuals with moderate dementia and have little effect for those with advanced disease.

Most researchers pointed out that orientation is impacted by the configuration of the building (Passini, Rainville, Marchand, & Joannette, 1998). Not surprisingly, a simple dwelling arrangement is associated with better residents' orientation. Elmståhl and colleagues (1997) also indicated that individuals with dementia have better spatial orientation in facilities, which are designed around L-, H-, or square-shaped corridors. Similarly, the cluster units were found to be associated with easier acclimatization.

The size of the units also matters not only in decreasing levels of aggression but also when helping individuals to feel better oriented. In a survey research among 104 residents in several homes, higher levels of orientation were identified in "cluster" facilities (comprised of small units of resident rooms and associated common spaces), compared with larger scale "communal" facilities (common spaces separated from

resident rooms and shared by larger groups of residents). In cluster facilities, higher levels of orientation were correlated with complex decision points and longer corridors, which allowed meaningful choices between places residents used (Netten, 1989). In communal facilities, heightened orientation was associated with short corridors and simple decision points, which allowed residents to travel only short distances without prompts and did not force residents to choose between spaces they did not use.

Problems with orientation are directly related to wandering, which is one of the problems frequently experienced by people with Alzheimer's disease. According to Alzheimer's Association (2018) as many as 60% of the 5.7 million Americans with AD will display wandering behaviors at some point in the disease process. Since Alzheimer's disease mainly affects cognitive function, the short and long term memory to identify familiar landmarks may be impaired. Older adults may also experience problems with sense of time and speed to judge distance. In addition, their visual-spatial sense to recognize the direction angles and expected arrival times between landmarks is often compromised as well.

The nursing home staff frequently complains about their residents who wander around the room, or even out of the facility. Although this behavior can be attributed to trying to go home or searching for the restroom, wandering may be very unsafe, especially when a person wanders away from a supervised care or from a controlled environment and cannot be located by the staff. In addition, patients with AD are often confused and unable to ask for help once they realize that they failed to find their way back. Therefore, it is important to take precautions and prevent the individual from wandering away from the facility.

One of the most important things emphasized in the literature is that the design of the nursing home should enable older people to read their surroundings and determine their current location. Brawely (1997), for example, argues that long sequences of undifferentiated, repetitive elements are the worst features of interior design in health care facilities. In addition, the lack of windows to the outside contributes to the problems of disorientation (Rule, Milke, & Dobbs, 1992). Therefore, varying the colors and patterns of the corridors and doors is recommended for easier identification. The units should feature visible and unique landmarks and distinctive cues.

Lighting conditions are also a major environmental design feature affecting well-being of patients. Wayfinding among residents was judged as more difficult in facilities with low lighting.

## **Depression**

Depression is a serious condition and it has a significant impact on health. A large number of older adults may suffer from depression due to the age-related changes. They realize that they are more frail, have problems with health and that their social network decreases. It has been estimated that approximately 15% of community-dwelling older adults are victims of depression, but the rates are significantly

higher among residents of long term care facilities (14 to 42%; Fiske, Wetherell, & Gatz, 2009). However, the highest rate has been observed among individuals who are institutionalized. Almost 52% of the nursing home residents were diagnosed with depression (Gaboda, Lucas, Siegel, Kalay, & Crystal, 2011). It is very important to treat depressive symptoms among the nursing home residents because depression is associated with increased rates of cognitive decline, falls, malnutrition and mortality (Cesari et al., 2002).

Moving to the nursing home may be a stressful experience for many older adults. Therefore, some residents experience symptoms of depression. Research demonstrates how the design of the nursing homes may increase the depressive symptoms. For example, making the surrounding warmer and supportive can minimize the risk for depression. Home-like design can improve the well-being among residents because the transition from their home to the institution is easier and adjustment is faster. One of the solutions suggested by Calkins (2009) is to use furniture made of wood rather than metal or plastic. It is also important to note that color and pattern of wallpaper which are often monotonous and dull in institutions can decrease individuals' mood (Calkins, 2009).

Privacy can also help to reduce the depressive symptoms. Privacy represents an important consideration that is often poorly understood and addressed in nursing homes. Usually residents have to share a small room with another unrelated person. Study shows that patients in shared rooms are less likely to reveal to the clinicians everything about their health problems and are more likely to acquire infections from roommates and staff, and tend to experience sleep disturbances (Ulrich et al. 2008). Having a private room may reduce the symptoms of depression. Van Haitsma et al. (2004) found that smaller size units were associated with lower level of sadness. Light may further help to reduce the symptoms of depression. Older people need three times the amount of light as younger people to see as clearly (Calkins, 2009). As mentioned before, in addition to reducing the symptoms or even preventing the depression, the light plays an important role in decreasing the aggression and improving orientation. Therefore, the sufficient amount of light is a crucial element in the design of environment for patients with dementia.

Zeisel and colleagues (2003) found another interesting design feature may also reduce depression that residents of nursing homes. They found that if the exits were camouflaged and had silent electronic locks in oppose to alarms, the residents tended to be less depressed. This phenomenon could be accounted for by the fact that caregivers seen such environment as safer and allow residents greater independence.

## **Falls**

Due to illness and aging processes older adults are more prone to fall than younger adults because they experience problems with vision, balance, and gait. Falls can be detrimental for them and cause a lot of pain or even result in hospitalization. Gruneir

and Mor (2008) stated that even though there were numerous patient safety issues in nursing homes, falls were among the most common events. According to Center for Disease Control for Prevention, in 2014 approximately 27,000 older Americans died as a result of an unintentional fall (Bergen, Stevens, Burns, 2016). Therefore, it is important to identify the environmental factors which can lead to unintentional falls and to create a supportive, well-designed environment which can increase resident safety.

Connell and Wolf (1997) identified three main categories of causal factors for falls among the elderly, these are: personal factors (e.g., chronic disorders and neurological deficits), environmental factors (e.g., obstacles), and behavioral factors (activities and choices that can destabilize balance such as improper shoes). The falls usually happen because there is no sufficient light when a resident walks to and from bedrooms at the night, or when he or she tries to avoid temporarily hazardous conditions. Falls can also happen when the environmental demands exceed physiological abilities (e.g., a doorway threshold is higher than a regular step). The type of floor may also influence the incidence of falls. Donald and colleagues (2000) found that elderly residents in rehabilitation ward in a community hospital incurred fewer falls on vinyl surfaces as compared to carpet. Tinetti (2003) found that providing nightlights and stair rails may also reduce falls.

Some studies indicate that falls are associated with the use of bedrails and physical restraints (Hofmann, Hahn, 2014). Although nursing home staff may use bedrails and restraints to prevent residents, especially those with cognitive impairments, from getting out of bed independently and potentially harming themselves, studies show that rails may contribute to serious injury and even death by falls over, under, between, and around bedrails (Capezuti, Maislin, Strumpf, & Evans, 2002). However, in their review of studies, Healey and colleagues (2008) found that bed rails did not appear to increase the risk of falls or injury but they found that serious direct injury from bed rails were usually related to incorrect assembly. Nevertheless, it is important to emphasize that the use of physical restraints is questionable from an ethical perspective, since the devices constrict residents' dignity and autonomy and thereby harm personal integrity (Hofmann, Schorro, Haastert, & Meyer, 2015).

## **Influence of physical environment on improving functioning of people with Alzheimer's Disease**

The previous part discussed the influence of the environmental features on decreasing the negative symptoms of AD. There are also certain features of the physical environment which are associated with improving the well-being of individuals suffering from AD. Research demonstrates that by changing the design and construction, it is possible to increase social interaction, physical activity and improve the quality of sleep among older adults.

### **Social interaction**

An individual suffering from Alzheimer's disease may unintentionally withdraw from social interaction. Research demonstrates that social participation is related to the degree of privacy and control (ability to control who you interact with and when you choose to interact), (Ittelson, Proshansky, & Rivlin, 1970; Pinet, 1999). Residents in shared rooms lack privacy and tend to feel less at home in their own bedrooms. They are also more likely to spend more time in social spaces and to leave their roommate alone. These findings suggest the private rooms would allow the residents to control the degree of privacy and social interaction.

Another environmental factor, which plays an important role in encouraging residents to social interaction is the size of the facility (Nordin, Mckee, Wijk, Elf, 2017). Lemke and Moos (1989) found that smaller size nursing homes support activity for moderate- to low-functioning residents, while younger independent residents are more active in a larger facility with a more challenging programs. Research also indicates that social interaction can be supported by placing the furniture in small flexible groupings in public spaces such as lounges and waiting areas (Melin & Gotestam, 1981; Peterson, Knapp, & Rosen, 1977). In addition, finding from research on day rooms and waiting areas also showed the arranging seating side by side along room walls inhibits social interaction (Holahan, 1972; Sommer & Ross, 1958).

### **Immune system**

Living in a nursing home may increase the number of infections. Ernst and Ernst (1999) found that nursing-home residents contract more than 1.5 million infections per year and each resident faces a 5% to 10% risk per year of acquiring infections. A significant body of research demonstrates that some environmental factors are related to infection rates. For example, high rates of hospitalization among nursing-home residents were associated with poor rating of environmental quality (cleanliness, odors, noises, homelikeness, cues, and environmental quality) (Zimmerman, Gruber-Baldini, Hebel, Sloane, Magaziner, 2002). Other research revealed that the rates of cross infection were higher when residents with indwelling urinary catheters (IUC) were nursed in the same room (Fryklund, Haeggman, & Burman, 1997). This study supported the recommendation that residents should have separate rooms. Access to natural light also plays a significant role, for example, Guzowski (2000) found that patients in intensive care units recovered faster if they were in rooms with windows.

### **Sleep**

Studies show that 70% of individuals living in a long-term care setting are affected by insomnia or disturbed sleep (Johnston, 1994; Skottheim, Lövheim, Isaksson, Sandman, & Gustafsson, 2018). Problems with sleep may be dangerous for older adults because these symptoms are associated with increased mortality (Dale, Burns, &

Panter, 2001). There are some environmental factors which contribute to disturbed sleep among nursing homes' residents. Alessi and colleagues (2005) found that limited sunlight exposure, nighttime noise and lack of physical activity may cause problems with sleep. Fortunately, Rahman and Schnelle (2002) claim that some simple interventions can eliminate factors which disturb sleep in the nursing home. These interventions include individualizing nighttime incontinence-care routines, implementing a noise-abatement program, and sensitizing and educating staff about the importance of uninterrupted sleep for residents.

### **Physical activity**

Physical activity is very important for individuals with AD. It can help in prevention and treatment of chronic illnesses, a longer disability-free life expectancy, and better physiological and psychological health (Chen, Zhang, & Huang, 2016; Leveille et al., 1999). Exercising outside during the winter may be problematic, therefore; the design of the building should encourage the residents to take up physical activity even if they are indoors. Walking is very beneficial, however; the residents have to be provided with a place to walk. Regnier (1994) encourage architects to design places with gardens, which would allow the residents to walk for exercise in an environment, which resembles the outdoor garden. In addition, to promote physical activity among residents, the buildings should make the stairs more attractive. Using stairs is a natural and simple way to exercise (Regnier, 1994). Also, having automatic doors to a garden and a walking loop around the building can facilitate residents' activities (Nordin et al., 2017).

Research shows that perceived aesthetics of the neighborhood, perceived safety of walking paths in the neighborhood, convenient location and access to recreational facilities and shops play an important role in increasing the physical activity among older adults (Brownson et al., 2000; Carnegie et al., 2002). Therefore, making the surroundings of the nursing home more attractive can help in increasing the physical activity.

Improved sleep and increased physical activity can also be achieved by designing a place with a garden. Until recently, designers did not recognize the importance of the outdoor activities. However, current knowledge supports the role of the outdoor space as improving physical and psychological well-being of the nursing homes' residents. For many people contact with nature is relaxing. Moreover, gardens play an important role in stimulating the senses and encouraging social interaction. For older adults, who spend most of the day in a nursing home, walking in the garden can be a great substitute for contact with larger places. Therefore, it is important to design gardens that provide residents with a place to walk for exercise and seating areas to rest and admire the nature. According to *the Biophilia hypothesis*, people have an inherent tendency to affiliate with nature (Kellert & Willson, 1993). There are a number of mechanisms through which a contact with nature may be helpful for people with AD. Firstly, through attention restoration, contact with nature help to renew atten-

tion. Some research support the funding that contact with nature improve cognitive functioning (e.g., Berman, Jonides & Kaplan, 2008). Secondly, contact with nature can also reduce stress. People who were exposed to nature scenes were more resilient to stressors. Rodiek (2002) found that individuals who spent time on activities outdoor had a lower level of stress in comparison to these who spent time indoor. Moreover, they are able to recover more quickly than individuals without such contact (Frumkni and Fox, 2011). Interestingly, even pictures of nature can benefit patients if the real views of nature are not available (Heerwagen, 1990).

One therapeutic aspect of the garden is that it can provide sensory stimulation. They can offer a place for private conversations with family members or other residents, or just to watch nature. Furthermore, plans can trigger memories of the salient places and events. They can also be used to attract birds, butterflies and other wildlife (Regnier, 1994). In addition, the seasonal nature of the landscape allows the residents to mark time. Although the design of the outdoor varies depending on location, microclimate and availability of space, architects recognize the importance of nature and its role in improving quality of life of individuals with dementia.

## Conclusion

Progressive cognitive decline is a pervasive health problem. There is a growing interest in designing places which can improve the quality of life. Designing home care units takes more importance dues to the fact worldwide phenomenon of aging populations. With aging population, the need for well-designed nursing homes will also increase. Because this disease is related to memory loss, impaired judgment and display of a number of behavioral problems, the design of a place which helps to reduce the symptoms of the disease is very important.

From the research reviewed, it can be concluded that the nursing home physical environment has a profound impact on psychological and physical well-being of individuals with Alzheimer's disease. The abovementioned studies reveal the relationship between the environmental design of special care units' and occurrence of disruptive behavior among their residents. The results of this research work led to formulation of certain design recommendations that were found to decreasing the disruptive behaviors among residents with AD. Though some of the more detailed factors still await further validation, most researchers agree that sufficient amount of light; decreased noise and smaller units can be highly effective in reducing disruptive behavior. Given the positive role of light and calming effects of access to the view to the outside, it seems to be crucial for the nursing homes to facilitate a large number of windows. Natural daylight promotes health and well-being and therefore its amount accessing the interior should be maximized. Also, some environmental modifications have to be applied in order to reduce the incidence of falls among residents. Studies suggest that repositioning furniture, adding floor mats to cushion falls and antislip mats to improve footing and traction may be helpful (Hofmann, Powell-Cope, MacClellan, & Bero, 2003).

The presented studies showed that with changing some environmental features of the nursing homes such as providing residents with private rooms, access to the nature or sufficient amount of the daylight, the overall functioning of older adults can be improved. Calkins (2009), however, emphasizes that the results of the research should be considered with caution. The limitations of the environmental research concern the study design, replicability and generalizability. Another drawback of majority of research is that the sample size is small; in case of some study the number of participant is less than 10. Further research with a larger sample size should be conducted to confirm the findings from the existing research.

Whereas there is no simple formula on how to design places for individuals with Alzheimer's disease, research offers us solutions on how to increase the likelihood of positive outcomes. With growing understanding of the relationship between health and environment, architects can create more supportive places.

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