

## Special Article

# Design Evaluation of a Communal Care Building Facility for People with Alzheimer's Disease

**Tilemachos Koliopoulos, CEng, MBA, PhD**

Laboratory Collaborator, Department of Public Health & Community Health, Technological Educational Institute (T.E.I.) of Athens, Greece.

**Fotoula Babatsikou, RN, MD, MSc, PhD**

Associate Professor of Nursing, Department of Nursing, Technological Educational Institute (T.E.I.) of Athens, Greece.

**Charilaos Koutis, MD, MSc, PhD**

Professor of Hygiene- Epidemiology & Public Health, Department of Public Health & Community Health, Director of the Laboratory of Hygiene & Epidemiology, Technological Educational Institute (T.E.I.) of Athens, Greece.

**Correspondence:** Tilemachos Koliopoulos, Department of Public Health & Community Health, Technological Educational Institute (T.E.I.) of Athens, Greece E-mail: tilkol@teiath.gr

### Abstract

In this paper a review is made for efficient building facilities for people with Alzheimer's disease. Literature review based on studies and reviews derived from international (Medline, PubMed, Cinahl, Scopus) data bases concerning social and functional problems of people with Alzheimer's disease. Were used some keywords *Alzheimer's disease, Building Design, Care, Communal Building, facilities*. Also, were used some articles (Greek National Law) by the State Printing of Greece.

An introduction is made on how Alzheimer's people are excluded from society. An evaluation is made of implementation building design solutions so that provides assistance for people mainly with Alzheimer's disease and associated dementia problems. In the end useful conclusions are presented for efficient communal building facilities for people with Alzheimer's disease.

**Key words:** Alzheimer's disease, Building Design, Care, Communal Building, Facilities

### Introduction

Alzheimer's disease (AD), also known as Alzheimer disease, or just Alzheimer's, accounts for almost 70% of cases of dementia (Burns and Iliffe, 2009; Querfurth and LaFerla, 2010; Bernejo et al., 2008). This disease is a chronic neurodegenerative disease that usually starts slowly and gets worse over time (Burns and Iliffe, 2009; NIA, 2015). As the AD advances, symptoms can include: problems with language, disorientation (including easily getting lost), loss of motivation, mood swings, not managing self-care, and behavioral issues (Burns and Iliffe, 2009; NIA, 2015; Porsteinsson et al.,

2014). The most common early symptom of AD is difficulty in remembering recent events (short term memory loss) (Burns and Iliffe, 2009). As a person's condition declines, she or he often withdraws from society and family (Burns and Iliffe, 2009). Although the speed of progression can vary, the average life expectancy following diagnosis is three to nine years (Querfurth and LaFerla, 2010; Todd et al., 2013). Gradually, bodily functions are lost, ultimately leading to death (Querfurth and LaFerla, 2010).

At present, there is no definitive evidence to support that any particular measure is effective in preventing AD. Global studies of

measures to prevent or delay the onset of AD have often produced inconsistent results. Epidemiological studies have proposed relationships between certain modifiable factors, such as diet, cardiovascular risk, pharmaceutical products, or intellectual activities among others, and a population's likelihood of developing AD. Only further research, including clinical trials, will reveal whether these factors can help to prevent AD (Gitlin et al., 2001; Gitlin et al., 2005).

Nowadays Alzheimer's people are excluded from society. Efficient design of a care communal building facility is coming to overcome this modern epidemiological case study. Two main measures are used in epidemiological studies: incidence and prevalence. Incidence is the number of new cases per unit of person–time at risk (usually number of new cases per thousand person–years); while prevalence is the total number of cases of the disease in the population at any given time (Green et al., 2002; Schnoor, 1996; NHS, 2007; Crowther, 1981; Martin, 2006; Green, 2002; Crowther, 2002).

Advancing age is a primary risk factor for the disease and incidence rates are not equal for all ages: every five years after the age of 65, the risk of acquiring the disease approximately doubles, increasing from 3 to as much as 69 per thousand person years (Di Carlo et al., 2002; Hebert et al., 2003).

There are also sex differences in the incidence rates, women having a higher risk of developing AD particularly in the population older than 85. The risk of dying from Alzheimer's disease is twenty-six percent higher among the non-Hispanic white population than among the non-Hispanic black population, whereas the Hispanic population has a thirty percent lower risk than the non-Hispanic white population (Ganguli et al., 2005; Di Carlo et al., 2002).

Prevalence of AD in populations is dependent upon different factors including incidence and survival. Since the incidence of AD increases with age, it is particularly important to include the mean age of the population of interest. In the United States, Alzheimer prevalence was estimated to be 1.6% in 2000 both overall and in the 65–74 age group, with the rate increasing to 19% in

the 75–84 group and to 42% in the greater than 84 group (Launer et al., 1999). Prevalence rates in less developed regions are lower. The World Health Organisation estimated that in 2005, 0.379% of people worldwide had dementia, and that the prevalence would increase to 0.441% in 2015 and to 0.556% in 2030 (Chmielewski and Eastman, 2014).

Other studies have reached similar conclusions (Autodesk, 2013). Another study estimated that in 2006, 0.40% of the world population (range 0.17–0.89%; absolute number 26.6 million, range 11.4–59.4 million) were afflicted by AD, and that the prevalence rate would triple and the absolute number would quadruple by 2050 (Launer et al., 1999; Bermejo et al., 2008).

### **Efficient communal building facilities for Alzheimer's people**

Since Alzheimer's has no cure and it gradually renders people incapable of tending for their own needs, caregiving essentially is the treatment and must be carefully managed over the course of the disease.

During the early and moderate stages, modifications to the living environment and lifestyle can increase patient safety and reduce caretaker burden (Gitlin et al., 2001; Gitlin et al., 2005).

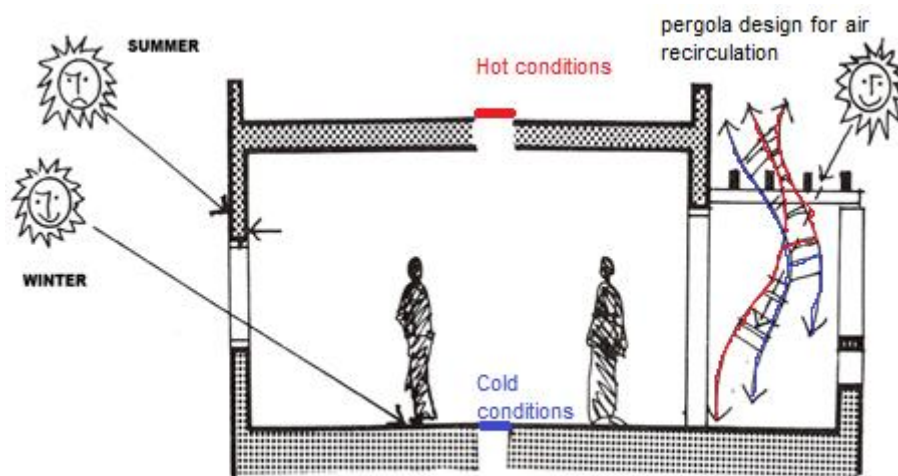
Examples of such modifications are the adherence to simplified routines, the placing of safety locks, the labelling of household items to cue the person with the disease or the use of modified daily life objects (Dudek, 2007; Rabins et al., 2007; US Dept. Health and HS, 2013). If eating becomes problematic, food will need to be prepared in smaller pieces or even pureed (Bermejo et al., 2008).

The role of the main caregiver is often taken by the spouse or a close relative. Alzheimer's disease is known for placing a great burden on caregivers which includes social, psychological, physical or economic aspects. Home care is usually preferred by people with AD and their families. This option also delays or eliminates the need for more professional and costly levels of care (Medicare, 2012; CEN, 2005; CEN, 2004).

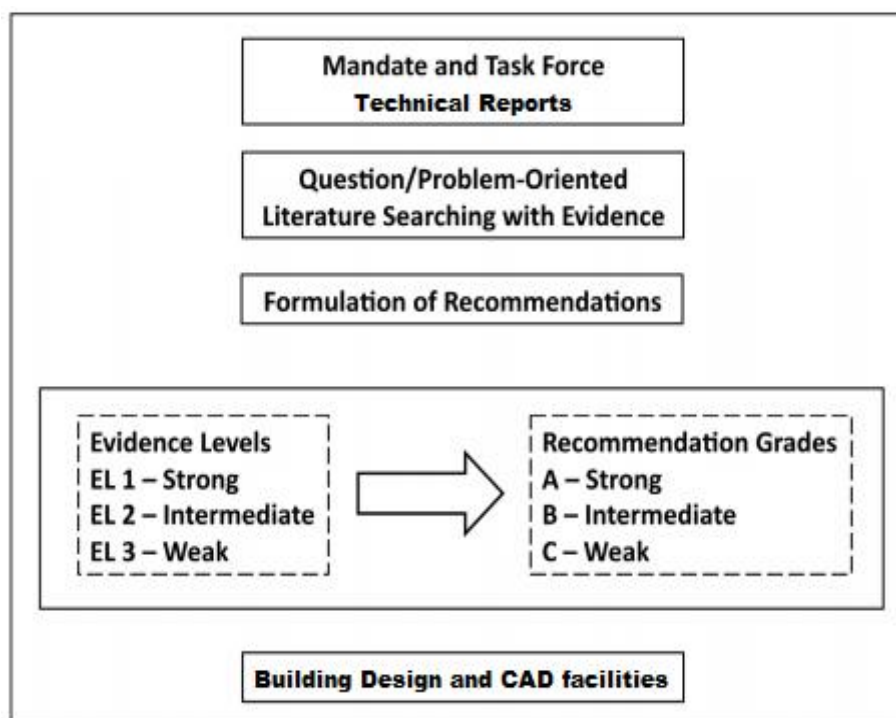
Efficient communal building facilities for Alzheimer’s people are necessary while below in figure 1 are presented the main elements in the balanced and integrated design approach to all the design objectives.



**Fig. 1. Building design approach of a care communal building facility for people with Alzheimer Disease.**



**Fig. 2. Principles of bioclimatic design approach for a care communal building facility.**



**Fig. 3. Human resources management, building design approach and CAD facilities assisting in recommendations for a better care in a communal building facility for people with AD.**

Alzheimer's Foundation of America has issued a useful guide optimal living space for people with Alzheimer's disease and related dementias (Hwang, 2014). According to figure 1 the design objectives for optimal living space for people with Alzheimer's Disease and related dementias should include accessible ways; cost effectiveness; sustainability; safe and secure conditions; functionalities; aesthetics; historic and productive conditions for people with AD in order to provide a building operational performance and in general high performance in buildings for people with AD.

The accessible ways should include arrows; signs and light colors to direct people with

AD in the right places that they want to move. The operational cost effectiveness in building design could have a great performance by the use of particular automations i.e. acoustic alerts beepers for heat protection in kitchen; automatic lighting and fixture controls providing a satisfactory performance for both sustainability and accessibility for people with disabilities. Whole building design requires a balanced and integrated approach to all the above presented design objectives. The closed or open spaces in the living rooms as well as the corridors should be functional following bioclimatic design principles in terms of natural lighting, indoor air circulation, thermal insulation and effective acoustic design, noise protection in terms of good

living conditions, like it is presented in figure 2. In this way an aesthetic design could help people with AD to have better living performance assisting in historic times in terms of sustainability and activities for productivity. Principles of bioclimatic design approach (ANSI, 2002; USEPA, 1996; Alexander, 1976; Hyde, 2008) should be applied in a care communal building facility for people with Alzheimer Disease as it is presented in figure 2.

The main aim of an efficient communal building facility is to include accessibility for old people with disabilities i.e. design of ramps in the main entrances and exits of the examining building case should exist. Also effectiveness not only in terms of low cost in building design application but also in construction management could exist by the right adoption of prefabricated constructions and design of composite steel and concrete structures in terms of cost and safety for communal building facilities (Betzaida, Vera, 2013; WHO, 2006). Also the building design should be efficient in terms of open aesthetic bright colorful spaces with good lighting and acoustic design providing very good operational group activities and instructiveness to the building users like nursing staff working with people with AD.

#### **Effective communal building design to support social events and to operate recreational activities for Alzheimer's people to be included in the society**

As there were presented the general principles of a comfortable and operational building design for a satisfactory living behavior in personal level of people with AD the next thing is the effective communal building design to support social events providing motivations for productivity. According to the literature visual hallucinations are caused when complex texture images interfere with the visual transmission pathway of an individual. Therefore, in open or closed living rooms for social and productive group activities overstimulation of the senses should be avoided, in order to prevent people with dementia from having hallucinations.

A relative study attempted to find the change in visual perceptions of the elderly with Alzheimer's disease in relation to the

textures of building materials, in order to determine what kind of texture might have the potential to cause the demented elderly to have hallucinations (Sicong et al., 2015). According to that study a total of 10 elderly people with mild dementia from Chai-Li senior care center participated in this experiment. The results showed that visual perception in the demented elderly was more influenced by textures with lines of different widths or different ranges, and textures of crossed lines, than by textures with lines of the same width and range. Hence the building design should be focused on these building materials should be made available for the reference of caregivers and building managers, in order to prevent the demented elderly from having behavior problems due to environmental design. Computer aided design principles should be applied properly for the right selection of building materials for the interiors and exteriors places (Lynette et al., 2003).

Moreover, little is known about the fate of higher level visual perception and visual mental imagery in the early stages of Alzheimer's disease (AD). A relative study, assessed these abilities in a group of mild-to-moderate AD patients using tasks selected to test specific stages of visual perception and cognition in a reasonably selective manner (Tu et al., 2015). The findings of that research indicate small, but in most cases reliable, impairments in visual perception, which are independent of degree of cognitive decline. Deficits in basic shape processing influenced performance on some higher level visual tasks, but did not contribute to poor performance on face processing, or to the profound deficit on object naming. The latter of these is related to semantic-lexical impairment.

Furthermore, the spatial disorientation is a prominent feature of early Alzheimer's disease (AD) attributed to degeneration of medial temporal and parietal brain regions, including the retrosplenial cortex (RSC). By contrast, frontotemporal dementia (FTD) syndromes show generally intact spatial orientation at presentation. However, currently no clinical tasks are routinely administered to objectively assess spatial orientation in these neurodegenerative conditions. A relative study took place where



there were investigated spatial orientation in 58 dementia patients and 23 healthy controls using a novel virtual supermarket task as well as voxel-based morphometry (VBM) (Ameen et al., 2015). In the latter study were compared performance on the task with visual and verbal memory function, which has traditionally been used to discriminate between AD and FTD. Participants viewed a series of videos from a first person perspective travelling through a virtual supermarket and were required to maintain orientation to a starting location. Analyses revealed significantly impaired spatial orientation in AD, compared to FTD patient groups. Spatial orientation performance was found to discriminate AD and FTD patient groups to a very high degree at presentation. More importantly, integrity of the RSC was identified as a key neural correlate of orientation performance. Hence the latter findings confirm that the

notion that i) it is feasible to assess spatial orientation objectively via the novel Supermarket task; ii) impaired orientation is a prominent feature that can be applied clinically to discriminate between AD and FTD and iii) the RSC emerges as a critical biomarker to assess spatial orientation deficits in these neurodegenerative conditions.

However, a useful investigation considers how spontaneous tasks have been applied alongside neuroscientific techniques to test complex forms of recognition memory for objects and their environmental features, e.g. the spatial location of an object or the context in which it is presented (Tipett, et al., 2003). According to the latter an investigation is made for the roles of the perirhinal cortex and the hippocampus in recognition memory using standard testing paradigms, and consider how these findings contribute to the ongoing debate about whether recognition memory is a single unitary process or multiple processes that can be dissociated anatomically and functionally. The importance of improving translation of animal models to humans is highlighted, with emphasis on a shift away from relying on the phenomenological experience of human subjects (Tu et al., 2015).

Based on the above the building materials and shapes in aesthetic interior and exterior design should be applied properly for self-operational and comfortable level. Moreover, selected shapes in special modified spaces should be applied properly projected on walls to test the behavior of people with AD in order to rank them in group disease categories.

In this way we can rank evidence levels for people with AD i.e EL 1 with strong AD evidence level; EL 2 with intermediate AD evidence level; EL 3 with weak AD evidence level. Computer Aided Design and building design technical reports could be applied for the selection of building materials shapes in terms of their interior and exterior design to host the group of people with particular AD evidence level.

Also interactive communication and productivity activities can be achieved among the people with AD utilizing an efficient building communal design according to their necessities in order to mandate taskforce to any relevant group-motivation activities in living rooms some days of the week in terms of practicing memory activities like making simple pottery structures; art painting; jewellery and other associated productivities by people mainly who are in the start of AD i.e. weak evidence level. The rest categories of AD should have a special daily care by the nursing staff in order to improve their behavior based on the findings of the current literature research review.

Some events every month should take place to be open to the community so as to be sold any creativity made by people with AD to the rest members of our society. The income of the latter activities could be invested in new nursery staff and modern building construction designs for the confrontation of current health problems for patients with AD, providing care to people with AD and helping them to improve their situation from higher levels to lower ones. The latter associated health services and designs could assist in a marginal benefit as an additional benefit (e.g. in units of health outcome) produced by an additional resource use (e.g. another health care intervention).

A relative questionnaire should be filled by the nursery staff based on the participants' behavior in order to make the formulation of recommendations for future improvement in interior or exterior design. Based on the above a relative chart is presented in figure 3 for human resources management, building design approach and CAD facilities assisting in recommendations for a better care in a communal building facility for people with AD.

The main questions of the relative questionnaire which should be filled by medical doctors in collaboration with nursing staff are listed below. Nursing staff is responsible to keep clear and safe the archive for the people with AD in a communal health center.

1. What problems were met with AD patient's behavior?
2. What building design facilities were useful for people with AD?
3. What building design facilities need an improvement for people with AD?
4. How many people for each category of evidence levels of AD exist?
5. What percentage of progress is met for each group category?
6. What are the recommendations for each group for people with AD?

In this way based on the above can be achieved an efficient building communal design in self or group motivation level. In this way the users will be assisted to be included in the society. Employment opportunities are coming up for nursing staff and assistive building technology for people with disabilities and AD. Future building communal designs should be focused on continuous maintenance the accessibility for disable people with AD based on the recommendations according to figure 3. Also seasonal precast structures in garden should be supported for activities in the garden of people with AD making to them the sense of a comfortable and well operative environment. Other useful principles in building design approach in a communal building facility for people with AD are presented below. A person with dementia may be at risk in certain areas of the home or outdoors. A special attention by the nursing

stuff should be taken to garages, work rooms, basements and outside areas. Even the most basic appliance or household object can become dangerous. Take precautions to help ensure these items do not become safety hazards. Preferably it is better to use appliances that have an auto shut-off feature. In general keep people with AD away from medications. Supervision of the use of tobacco and alcohol is necessary. Both may have harmful side effects and may interact dangerously with some medications.

Dementia sometimes makes it difficult for a person to decipher between colors and understand what he or she sees because of changes in vision. Changes in levels of light can be disorienting. Building design should create an even level of lighting by adding extra lights in entries, outside landings, and areas between rooms, stairways and bathrooms. The night lights should be used in hallways, bedrooms and bathrooms. In general most accidents in the home occur during daily activities such as eating, bathing and using the restroom. Therefore, special precautions should be taken at these times for people with AD. Also should be checked the temperature of water and food — it may be difficult to tell the difference between hot and cold. Moreover the installation walk in showers, and grab bars in the shower or tub, and at the edge of the vanity to allow for independent are necessary for safe movement and body motion practice. Textured stickers should be added to slippery surfaces. The application of adhesives is necessary to keep throw rugs and carpeting in place, or remove rugs completely. It is necessary also the monitoring of the hot water temperature in the shower or bath. A good consideration is the installations of an automatic thermometer, which can help patients to avoid burns.

A questionnaire for the old people of what was that useful for them or what made difficult situation in their behavior has to be recorded in order to improve existing design facilities. In this way community-based building care facilities; social services and activity programs will be provided in an effective way to an individual or family in his/her place of residence for the purpose of promoting, maintaining or restoring health or minimizing the effects of illness and

disability. These services are usually designed to help older people remain independent and in their own homes. They can include senior centres, transportation, delivered meals or congregate meals sites, visiting nurses or home health aides, adult day care and homemaker services. Community empowerment should be supported as it is an important goal in community action for health.

Community health activities and building facilities change with changing building materials technology and social values, but the goals remain the same. Also a community health information network (CHIN) is necessary having an integrated collection of computer and telecommunication capabilities that permit multiple providers, payers, employers and related health care entities within a geographic area to share and communicate client, clinical and payment information.

A successful community health could be integrated by the combination of sciences, skills and beliefs directed towards the maintenance and improvement of the health of all the people through collective or social actions. The programs, services and institutions involved emphasize the prevention of disease and the health needs of the population as a whole. In Europe the role by the governments and politicians is to involve in the E.U. Member States the application of proper legislation to operate communal health centers. In Greece exist the communal company support scheme named KOINΣEII funded by E.U capitals like EΣIIA or other E.U funding programs according to the Greek National Law 4019 in the year 2011, ΦEK 216 A/30-9-2011 (GNL, 4019, 2011). Also operational building designs and effective building energy consumption designs should exist following the relative bioclimatic design principles and applying the right construction materials for people with AD in terms of comfort ability, noise protection similar to school, lighting maintenance, safety and economy (TCG, 2010; ANSI, 2002; USEPA, 1996). A relative inspection should take place in terms of building energy consumption according to the Greek National Law 4093, 2012 (ΦEK 222 A/12.11.2012) (GNL, 4093, 2012). The legislation should support any community

activities to assist care communal building facilities for people with Alzheimer's Disease.

## Conclusions

An integrated community health center facility for people with AD needs a continuous assessment that could be achieved based on the above in order the ongoing process to evaluate the current health needs of the community so as to improve them in time according to its necessities. A life cycle analysis is useful of operational services of a communal building health center so as to cover its needs in nursing stuff and building design facilities based on patients with AD characteristic and their estimation of staying in a health center.

In general building designers of communal health center facilities need a special care in building design operational performance for low vision persons' needs as more accidents happens there. Also clinicians a better assistance should provide in lighting and accessibility guidelines to their patients. Moreover, particular facilities for disable people with AD are necessary to exist.

A successful building design of a communal health center is necessary to be realized in order people with low level AD to be included in the society. Continuous support and improvement in communal facilities for old people should exist based on the completed questionnaires by doctors and nursing stuff and the life cycle analysis results. Based on the results a continuous improvement in building design of a communal health center is necessary. Communal building facilities expansion is expected in urban areas to serve massive population of people with AD as it is becoming an increasing epidemic case.

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