

Review



Dementia Friendly Buildings—Approach on Architectures

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Abstract: Dementia's escalating incidence, coupled with its economic burden, highlights the need for architectural designs and forms that benefit people living with dementia. This research explores strategies and design principles that focus on establishing supportive spaces for the prolonged autonomy, well-being, and safety of dementia patients. Contemporary research emphasizes the implementation of effective navigational techniques, via visual cues, familiar landmarks, and simplified layouts. For greater navigational signage, the intentional use of contrasting colors, textures, and lighting are recommended to demarcate functional areas within a structure. Incorporating familiar objects in personalized areas enhances treatment outcomes, e.g., reminiscence therapy leverages familiar objects, environmental cues, scents, sounds, and tactile features to trigger and retain memory. Integrating safety precautions such as slip-resistant flooring, handrails, and accessible bathrooms helps mitigate falls for the cognitively impaired. From a therapeutic perspective, this study draws attention towards incorporating gardens and outdoor spaces, which offers sensory stimulation, encourages physical activity, and fosters social engagement. Additionally, the integration of scents, sounds, and tactile features enriches the sensory experience for individuals with dementia. Through comprehensive consideration of design elements, this research highlights how intentionally crafted, dementia-friendly environments can convert spaces into empowering therapeutic settings tailored to address the unique need of this vulnerable group. This architectural approach acts as a valuable complement to the medical and therapeutic interventions in the treatment and care of people living with dementia and their families.

Keywords: dementia-friendly design; wayfinding and orientation; reminiscence therapy; therapeutic environments; building design principles

1. Introduction

The aging global population has led to a significant increase in dementia cases, posing major challenges for healthcare systems. Dementia, as defined by the World Health Organization (WHO), is a neurodegenerative disease involving cognitive decline in memory, behavior, language, and mobility, severely affecting independent functioning. The Alzheimer's Association (2021) reported a 145.7% rise in dementia cases from 2000 to

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Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/license s/by/4.0/). 2020. According to the WHO's Global Dementia Observatory (2020), a new dementia case is diagnosed every three seconds, with projections estimating an increase from 57.4 million in 2020 to 152.8 million by 2050 [1].

In the UK, approximately 900,000 individuals currently live with dementia, a number expected to grow to 1.6 million by 2040 [2]. The economic burden reflects this trend, with annual dementia-related expenditure of GBP 26 billion in 2019, projected to rise to GBP 94 billion by 2050. Globally, dementia care costs reached USD 1.3 trillion in 2019, with a significant portion borne by low- and middle-income countries [3].

An updated global overview (2024) highlights dementia-related death rates per 100,000 in the population, emphasizing disparities between countries. According to the Centre for Disease Control (2 May 2024), Finland reported the highest mortality rate (54.65 deaths per 100,000), followed by the United Kingdom (42.7 deaths per 100,000). Conversely, developing nations like Mauritania reported significantly lower rates, with only 19.76 dementia-related deaths per 100,000, due to shorter life expectancies and less advanced healthcare systems. Figure 1 illustrates these disparities, with high-income nations facing a greater dementia mortality burden, while developing countries exhibit lower rates, partly influenced by underreporting. Gender differences are notable, with females experiencing higher death rates (e.g., Finland: 55.32 vs. 52.1 per 100,000 for males) and greater caregiving stress due to prolonged emotional strain [4].



Figure 1. Top 10 countries with the highest rates of dementia (published on 2 May 2024) [4].

The necessity for dementia-friendly architectural design has emerged as a critical response to these challenges. Research indicates that thoughtfully designed environments can significantly impact the progression of dementia and enhance the quality of life for people living with dementia (PLWD). The WHO (2023) highlights that dementia's cognitive decline often results in difficulties with navigation, spatial perception, and motor coordination, leading to increased accidents and falls. Strategic design approaches in healthcare facilities, residential areas, and community spaces can effectively extend functional independence and improve care outcomes [5].

Key design elements focus on multiple domains of improvement, particularly orientation, executive function, and navigation. These include clear visual cues, recognizable landmarks, color-coded elements, minimalist aesthetics, and simplified floor plans. The strategic use of contrasting colors, textures, and lighting helps differentiate various functional areas within buildings [6]. Contemporary research evidences beneficial treatment outcomes while incorporating familiar elements within personal spaces. For example, reminiscence therapy leverages past events, experiences objects, and environmental cues to evoke pleasant memories and has been shown to augment well-being in people living with dementia (PLWD) [7].

Safety considerations are paramount in dementia-friendly design, given the higher risk of falls and accidents among individuals with cognitive impairments. Essential features include non-slip flooring, handrails, and accessible bathrooms. Secure outdoor spaces and monitoring systems provide freedom while ensuring resident safety [8]. Accessibility is addressed through wide hallways, wheelchair accessibility, and assistive technology integration [9].

The vulnerability of individuals with dementia underscores the importance of these design considerations. Research indicates that 90% of dementia cases fall within four primary clinical variants, with Alzheimer's disease and vascular dementia accounting for 80% of cases [10]. The progressive nature of these conditions leads to increased susceptibility to harm and reduced functional ability [11].

Studies have shown an escalating risk of falls, injury, and hospitalization as dementia progresses [12]. Particularly concerning is the observation that patients in moderate to advanced stages often struggle to return to their baseline functionality following hospitalization [13]. This creates a cycle of increased risk for falls, injuries, and hospital readmissions, ultimately affecting morbidity and mortality rates.

The implementation of dementia-friendly design principles offers substantial benefits for PLWD, caregivers, and healthcare providers. These principles promote independence, safety, and well-being while helping individuals maintain a better quality of life [14]. Furthermore, they can reduce the burden on caregivers and decrease overall care costs [15].

Fundamentally, purposeful design informed by cutting-edge dementia care research can turn spaces into therapeutic environments tailored to the specific requirements of this vulnerable group. This architectural approach represents an invaluable complementary tool to medical and therapeutic interventions for dementia treatment and care.

Examining yearly trends in research publications is essential for understanding the evolving nature of scientific research. Figure 2 provides an overview of yearly publications on buildings and architectures for dementia patients over the last decade. To enhance the scientific rigor of this review and avoid potential issues such as data overlap or the inclusion of low-quality reports, the analysis has been refined to include only publications indexed in the Web of Science core collection. This approach ensures the representation of high-quality research. According to the refined data, the number of publications increased from 3329 in 2015 to approximately 11,849 in 2023, highlighting growing research support for integrating dementia-friendly buildings and community spaces into broader architectural frameworks.



Figure 2. Annual publication trends of buildings and architectures for dementia patients (2015 to 2024).

1.1. Objectives of the Study

This study investigates the role of architectural and building design in addressing the complex needs of elderly individuals living with dementia. The primary objective is to explore evidence-based strategies that enhance the quality of life for this population by creating supportive, enabling, and therapeutic environments.

A key aim of the research is to address the spatial, sensory, and navigational challenges associated with dementia. The study emphasizes the importance of incorporating visual cues, landmarks, and coherent architectural features to facilitate orientation and ensure safety. These design interventions are intended to mitigate the risks of disorientation while promoting independent navigation within the built environment.

The research also focuses on enhancing sensory experiences through targeted design strategies. Lighting systems that regulate circadian rhythms, along with olfactory and tactile stimuli, are identified as critical elements for improving comfort, autonomy, and emotional well-being. These sensory-focused approaches aim to create environments that respond to the specific physiological and psychological needs of individuals with dementia.

Another central objective is to highlight the significance of personalization and familiarity in dementia-friendly spaces. By integrating elements of reminiscence therapy, such as familiar objects, home-like features, and culturally relevant designs, the study underscores the potential for architectural design to foster emotional resilience and a sense of belonging. Additionally, the inclusion of gardens and outdoor spaces designed according to dementia-friendly principles is examined as a means of promoting sensory stimulation, physical activity, and social interaction.

Finally, the research prioritizes safety and accessibility through ergonomic design and the incorporation of assistive features. These measures aim to ensure that individuals with dementia can navigate their environments with ease and independence. By addressing these multifaceted considerations, the study demonstrates how intentional architectural interventions can transform built environments into enriching, therapeutic settings that support the well-being of individuals with dementia.

1.2. Dementia-Friendly Design Guidelines

The comprehensive national dementia plans cater to guidelines that address the built environment which potentiates to improve the quality of life for PLWD. Considering the multifaceted dementia presentation, a collaborative multi-stakeholder approach is mandated to develop dementia-friendly design guidelines that extends autonomy for the PLWD, while decreasing stressors and care-burden for their families and caregivers, respectively. National guidelines provide evidence-based recommendations on designing supportive physical environments to help deliver high-quality dementia care [16]. While organizations like Alzheimer's societies offer recommendations on dementia-friendly designs, these recommendations at times conflict with the government guidelines, thus delaying the consensus for implementing design interventions and building modifications to support PLWD [17]. Considering this potential for delays, and to provide a framework for developing nations where national guidelines for dementia friendly structures may be absent, the W.H.O. strongly advocates further research on environmental design for dementia care to improve the quality of life for PLWD [18].

Table 1 provides a comparative overview of how different countries' dementia plans prioritize design considerations across three key areas: assessment/diagnosis, management, and end-of-life care. For instance, considering the assessment approach, the United Kingdom emphasizes tailored assessments to inform flexible, person-centered design approaches, while Switzerland promotes early environmental evaluation to detect design issues. New Zealand prioritizes recognizing environmental risk factors and supportive design for workforce training sites, whereas Ireland stresses the diagnostic value of environmental assessment and personalized supportive home design. Australia focuses on assessing the capacity of built environments and enabling design for community care and support services, with attention to palliative-friendly design for dementia care. Overall, Table 1 highlights varying approaches to integrating environmental considerations into dementia care planning and management across different national contexts.

| Country | Assessment/Diagnosis | Management | End-of-Life Care | Study |
|---------------------|---|--|---|-------|
| United King- dom | Tailored assessments of envi- ronmental needs, enabling flexible person-centered design | Prioritize therapeutic environments, minimize institutional settings | Dedicated guidelines for palliative-friendly design in dementia care settings | [10] |
| Switzerland | Promotes early environmental evaluation for detecting design issues | Covers enabling design for residen- tial care, supportive home modifica- tions | Palliative design integrated into guidelines | [19] |
| New Zealand | Prioritizes recognizing envi- ronmental risk factors | Emphasizes supportive design for workforce training sites, enabling design for PLWD independence | Limited guidance on pallia- tive/end-of-life design | [20] |
| Ireland | Stresses diagnostic value of en- vironmental assessment | Highlights care pathway design, personalized supportive home de- sign | Addresses environmental design for end-of-life decision-making | [21] |
| Australia | Emphasizes assessing the ca- pacity of built environments | Focuses on community care design, enabling the design of support ser- vices | Covers palliative-friendly design for dementia care | [22] |

Table 1. Comparison of national dementia guidelines.

2. Friendly Design and Structured Environment

In assessing dementia-friendly design, attention must be given to several critical aspects to ensure the environment adequately supports individuals with cognitive impairments. Wayfinding and orientation represent paramount considerations, necessitating clear signage, intuitive pathways, and prominent landmarks to aid navigation and reduce confusion. Lighting design is equally crucial, as appropriate illumination levels, strategic placement of natural and artificial light sources, and mitigation of glare and shadows contribute to a comfortable and safe atmosphere, while also influencing mood and regulating circadian rhythms. Additionally, acoustic treatments play a significant role, requiring careful consideration of sound-absorbing materials and techniques to minimize noise and create a serene environment conducive to concentration and relaxation.

Furthermore, integrating reminiscence therapy into design considerations can offer therapeutic benefits by incorporating familiar elements, such as objects, images, and sensory cues, to evoke positive memories and stimulate cognitive engagement. Safety and accessibility features are paramount, necessitating the incorporation of ergonomic furniture, non-slip flooring, and barrier-free design principles to prevent falls and promote independence. By addressing these elements of dementia-friendly design comprehensively, spaces can be customized to meet the varied needs of individuals with dementia. This fosters a supportive, empowering environment that improves their quality of life and well-being. Figure 3 illustrates the flow chart delineating the categories of evaluated components for dementia-friendly design.



Figure 3. Evaluation flow chart of evaluated categories for dementia-friendly design.

3. Wayfinding and Orientation

People with dementia, especially Alzheimer's disease, frequently encounter notable difficulties in navigating and understanding spatial layouts. These difficulties can be attributed to the neurodegeneration and cognitive impairments associated with the disease. People with dementia may struggle with key aspects of the wayfinding process, such as spatial reasoning, route planning, monitoring their progress, and directing attention to relevant environmental cues [23]. Specific deficits have been linked to impaired path integration, deficits in cognitive mapping, and difficulties with both global and analytic wayfinding strategies [24,25]. As a result, people with dementia may have trouble self-localizing, understanding route instructions, and identifying suboptimal wayfinding decisions [26].

The cognitive and behavioral consequences of these wayfinding challenges can be significant for individuals with dementia. Getting lost can pose a risk of harm, with reports indicating that up to 41% of people with dementia have gotten lost in their familiar community at least once [27]. Additionally, the distress and anxiety associated with wayfinding difficulties, particularly at decision points, can lead to agitation and disorientation [28,29]. These emotional and behavioral reactions underscore the necessity for environmental adjustments that can support the person's remaining navigational skills and reduce spatial anxiety [30].

The social repercussions of difficulties in wayfinding are significant, as heightened reliance on caregivers may result in premature institutionalization [31]. The transition from a familiar home environment to a care facility can further exacerbate orientation difficulties and spatial anxiety for individuals with dementia [32]. This underscores the importance of designing dementia-sensitive environments, not only in indoor care settings but also in the broader community and public spaces to support aging in place and overall well-being [33].

Orienting oneself is a vital component of design that accommodates individuals with dementia, given that feelings of disorientation and challenges in navigating surroundings are frequent issues encountered by PLWD. Research shows that carefully designed physical environments can support wayfinding and reduce feelings of being lost, enhancing independence and well-being for PLWD.

A key principle is incorporating prominent landmarks and memorable architectural features to serve as orientation cues along paths and decision points. Studies highlight that older adults, including those with dementia, show a preference for navigating based on salient beacon landmarks rather than metric spatial representations [34]. Distinctive visual landmarks at intersections are particularly effective for supporting route learning and wayfinding [35].

However, an overabundance of visual cues can also lead to distracting informational clutter that impedes orientation. The strategic placement, salience, and meaning of land-marks are important considerations. PLWD may have difficulty dissociating relevant from ambiguous landmarks [36], making decision points challenging to identify.

Beyond visual cues, good dementia-friendly design incorporates other orientation aids like coherent architectural differentiation and spatial layout to reduce monotony. Repetitive, long featureless corridors are consistently cited by PLWD and older adults as key sources of disorientation [37]. Instead, introducing structural variations and memorable spaces along paths can serve as reinforcing orientation nodes. The significance of floor plan designs is essential in aiding individuals with dementia to navigate and comprehend spaces more effectively. While interventions like signage and lighting contribute, they cannot fully compensate for poor architectural design. To create dementia-friendly environments, a synthesis of architectural aspects is essential. Four guidelines are proposed, namely, simplicity in navigation, visual accessibility, minimizing decision-making, and enhancing architectural legibility. These features promote successful orientation and wayfinding in nursing homes [38].

The evaluation of 14 design criteria essential for efficient navigation in care facilities is meticulously conducted, examining floor plan layouts to identify crucial architectural elements and design patterns that are influenced by the navigation abilities of seniors with dementia. Notably, floor plan configurations characterized by single linear corridors with minimal corners are proven to be more effective in facilitating successful wayfinding, while layouts featuring multiple corners are presented with challenges that impede navigation. Additionally, the pivotal role of visual accessibility in promoting confident navigation is emphasized by the research, with the significance of incorporating clear sightlines between living areas and corridors highlighted. These findings underscore the importance of careful consideration in design decision-making and suggest future research directions, including post-occupancy evaluations to validate the effectiveness of design typologies and further exploration of how architectural elements and technology integration can synergistically enhance dementia-friendly environments [39]. Table 2 summarizes notable research findings related to orientation and dementia-friendly design.

| The alignment of indoor design principles with outdoor urban environments is essential for elderly individuals affected by dementia. Well-designed outdoor environments contribute significantly to location understanding, decision-making, safety, comfort, and neighborhood access for individuals with dementia. Environmental Notable design elements such as legible layouts, clear landmarks, accessible amentities, quiet streets, adequate seating, lighting, and paving are essential for creating dementia-friendly outdoor spaces. Empirical studies are required to validate and expand upon these design principles, emphasizing a comprehensive approach across different scales and care models. A comprehensive approach to dementia-friendly environments in both indoor and outdoor stitings is crucial for promoting societal inclusivity and enhancing urban accessibility for individuals with dementia. Floor plan designs play a significant role in aiding spatial orientation for dementia patients. Signage interventions cannot fully compensate for poor architectural design in dementia-friendly environments. Cuidelines prioritize simplicity, visual access, minimal decision-making, and architectratian for and behavioral outcomes and to explore the operational necessities specific to dementia care within nursing home settings. With aging populations, evidence-based architecture for dementia care is becoming increasingly vital for creating supportive and effective environments. Flavheimer's inpation during navigational activities, coupled with dysfunction in path integration of path avigation deficits. In Alzheimer's disease. Attention influenced memory differently: healthy controls recalled highly attended objects at decision points in both studed to effective and individuals with dementia dividuals with dementia avigation deficits. In Alzheimer's disease. Attention infl | Aspect | Reco | ommendation | Study |
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Table 2. Comparative analysis of wayfinding and orientation in dementia-friendly design.

| • | Usability enhancements are necessary to tackle issues associated with aging and cogni- |
|-------------------|--|
| | tive decline, including improving visibility and delivering meaningful verbal instruc- |
| | tions for navigation cues. |
| • | Older patients and those with dementia encounter significant challenges in hospital |
| | settings, consistent with previous research findings. |
| • | Challenges include spatial disorientation, difficulties in wayfinding, and a lack of dedi- |
| Upprital docian | cated socialization spaces. |
| challenges | Providing adequate support for accompanying persons is crucial, and understanding [9] |
| chanenges | their experiences is essential for hospital design improvements. |
| • | Recommendations include involving Alzheimer's disease patients in the design pro- |
| | cess, accommodating increased visitors, and creating dementia-friendly environments |
| | to alleviate stress and disorientation among patients. |
| • | Evaluation of floor plan layouts in inpatient care facilities supports wayfinding for sen- |
| | iors with dementia by identifying crucial design criteria and optimal layout typologies. |
| • | Key architectural characteristics such as corridor width, length, articulation, visual ac- |
| | cessibility, and spatial transitions are essential for creating dementia-friendly environ- |
| Dementia- | ments. |
| friendly layouts• | Design typologies that prioritize straight corridors or continuous loops are effective in |
| | enhancing wayfinding for seniors with dementia. |
| • | Architects and healthcare professionals should prioritize spatial configurations that |
| | minimize decision points and improve visual access when designing dementia- |
| | friendly environments based on these findings. |
| • | Individuals utilize different strategies such as landmark navigation and place learning |
| | to navigate built environments effectively. |
| Cognitive map-• | Landmark navigation involves moving between identifiable landmarks, while place |
| ping strategies | learning involves mentally mapping the environment. |
| • | Visual cues are crucial in supporting both landmark navigation and place learning, fa- |
| | cilitating navigation and the formation of cognitive maps within individuals. |

4. Lighting Design

Lighting plays a fundamental role in creating dementia-friendly environments by integrating multiple elements to promote overall well-being. Customizing lighting to support visual perception enhances clarity and minimizes confusion. Synchronizing lighting with circadian rhythms improves sleep patterns and cognitive function, while the use of environmental cues provides orientation and ensures safety. Additionally, lighting that evokes a homelike atmosphere fosters comfort and a sense of familiarity, which is essential for preserving independence and reducing agitation. By incorporating these considerations into the design, lighting becomes a powerful tool in improving the quality of life for individuals with dementia, enhancing their daily experiences by promoting feelings of security and inclusion.

4.1. Visual Perception

Visual perception is a critical factor in the design of dementia-friendly lighting, as individuals with dementia often experience visual impairments and challenges in performing daily tasks. Proper lighting levels and contrast can improve visual perception, enhance safety, and support independence. In daycare centers, horizontal illuminance levels ranging from 300 to 700 lux at a standard working plane height of 0.80 m have been observed, aiding task performance up to 3 m from the window. However, dependence on natural daylight can result in inadequate lighting during the winter months, highlighting the need for supplementary lighting solutions [43]. It is important to note that lighting preferences can vary significantly among individuals, as some may experience discomfort

from excessive illumination and prefer moderate lighting levels [44], suggesting the potential benefits of personalized lighting designs. Implementing such strategies in communal settings presents challenges in balancing diverse preferences and requirements [45]. Additionally, color contrast and intuitive wayfinding cues are essential for aiding orientation in dementia-friendly design, with a focus on leveraging color and contrast to enhance navigability and comprehension, thereby promoting independence and security [46]. Strategic incorporation of these elements can enhance navigability and comprehension, promoting independence and security for individuals with dementia. Table 3 presents visual perception recommendations tailored for dementia-friendly lighting design.

Table 3. Comparative analysis of visual perception in dementia-friendly design.

| Aspect | Rec | commendation | Study |
|---------------------------------------|-----|---|-------|
| Lighting Levels | • | Maintain horizontal illuminance values between 300 and 700 lux at the working plane height (0.80 m) for visual tasks. Consider supplementary artificial lighting during winter months. A comprehensive approach to dementia-friendly environments in both indoor and outdoor settings is crucial for promoting societal inclusivity and enhancing urban accessibility for indi- viduals with dementia. | [43] |
| Personalized Lighting De- sign | • | Consider personal preferences and individualized lighting design, as some visually impaired individuals may perform better under medium light levels. | [44] |
| Color Contrast and Wayfind- ing | • | Use color contrast and intuitive wayfinding cues to differentiate spaces, aid orienta- tion, and define important architectural elements. | [46] |

4.2. Circadian Rhythms

Synchronizing circadian rhythms is crucial when designing lighting systems for dementia care, as individuals with dementia often experience disrupted sleep patterns. Appropriate lighting not only helps regulate circadian rhythms but also improves sleep quality and overall well-being. As individuals age, the need for increased light levels becomes more pronounced due to a decline in light sensitivity, which is essential for maintaining circadian rhythm alignment [47].

Being exposed to blue light is particularly important for regulating the body's circadian rhythm and stimulating the production of melatonin [48]. Hence, incorporating blueenriched lighting in environments, particularly during the daytime, can be advantageous.

Moreover, besides luminance and chromaticity, the notion of circadian stimulus (CS) has surfaced as an indicator of the light's efficacy in affecting the eye, spanning from minimal suppression of melatonin (CS = 0.1) to saturation (CS = 0.7). This measure amalgamates both the light's intensity and spectral characteristics, providing understanding into its circadian influence [49].

Dynamic lighting systems, adjustable throughout the day to meet varying care needs, are advocated in dementia care facilities [46]. This strategy is consistent with suggestions to replicate natural circadian patterns by offering more intense, bluer light during daytime and warmer light during nighttime [50]. By replicating the natural progression of light throughout the day, these systems support individuals' biological rhythms and contribute to a more stimulating and comfortable environment.

Spaces with substantial daylight input are primarily responsible for achieving high vertical illuminance and correlated color temperature values, which are essential for circadian entrainment. However, in environments where natural light is limited, it becomes essential to supplement with artificial lighting sources to maintain optimal circadian support. Balancing natural and artificial light sources is critical for ensuring consistent and

effective circadian regulation [51]. PV panels provide a sustainable, energy-efficient solution to address these challenges while also enhancing natural and artificial light integration. By harnessing solar energy, PV panels can power advanced dynamic lighting systems, ensuring consistent illumination throughout the day, even in areas with limited natural daylight [52]. These systems can deliver light intensities of 1000 lux or higher, especially during early morning hours, which has been shown to improve sleep quality and reduce agitation among dementia patients [53]. Furthermore, exposure to higher intensity artificial light in the blue spectrum has been associated with therapeutic advantages [54]. Increased illuminance levels achieved through the use of a bright light box (ranging from 2500 to 10,000 lux) have been linked to improvements in circadian rhythm robustness, mood, sleep continuity, and cognitive performance [55]. Table 4 outlines circadian rhythm entrainment recommendations for dementia-friendly lighting.

Table 4. Comparative analysis of circadian rhythms in dementia-friendly design.

| Aspect | Recommendation | Study |
|---------------------------------------|--|-------|
| Daylight and Ar tificial Light | Maximize daylight exposure to achieve high vertical illuminance and correlated color temperature values for circadian entrainment. Supplement with artificial lighting when daylight is unavailable to maintain optimal lighting conditions throughout the day. | [56] |
| Dynamic Light- ing Systems | Implement dynamic lighting systems that mimic natural circadian rhythms by adjusting light intensity and color temperature. To promote circadian health and overall well-being, employ brighter, bluer light during daytime hours and switch to warmer light during nighttime. | [33] |
| Stimulating En- vironments | Implement lighting schemes that adhere to circadian rhythms, integrating more intense, bluer light during daylight hours and transitioning to warmer light during the night. These designs can help create stimulating environments in common areas, promoting better well-being and activity levels among occupants. | [46] |
| Lighting Specifications Over- view | • Consider incorporating higher light levels and exposure to blue light to support mela- tonin production and regulate circadian rhythms, which can positively impact sleep- wake cycles and overall well-being, especially for individuals with dementia or other sleep-related disorders. | [47] |
| Optimal Light- ing Parameters | Exposure to natural light in the early morning, preferably for a duration of 2–3 h at a minimum intensity of 1000 lux, can offer advantages in regulating circadian rhythms and enhancing sleep quality, especially for individuals with dementia. Bright light boxes, with intensities ranging from 2500 to 10,000 lux, can also offer therapeutic benefits in managing circadian rhythm disorders and related sleep disturbances. | [55] |
| Light Benefits Dementia | An analysis of ten scholarly articles indicates that ambient, blue-enriched light with specified intensities ranging from 350 to 750 lux and color saturation levels between 0.375 and 0.4, administered for 10 to 12 h daily over a duration of four weeks or more, [exhibits promising potential in mitigating depressive symptoms and agitation among individuals with dementia. | [49] |

5. Reminiscence Therapy

Reminiscence therapy, a commonly employed non-pharmacological approach for individuals with dementia, entails recalling past events, activities, and experiences [7,57]. This therapy often incorporates memory prompts such as photographs, household items, or music to facilitate reminiscing [58,59]. Reminiscence therapy offers several advantages for individuals with dementia, such as preserving a sense of self-esteem, identity, and uniqueness [60]. Moreover, it has the potential to enhance psychological well-being, diminish depressive symptoms, and promote positive relationships, autonomy, and mastery of the environment [61]. The process of reminiscence is structured, involving a selection of memories, immersion in the experience, and a gradual return to the present [62].

Designing environments that are dementia-friendly is essential for facilitating reminiscence therapy. The physical setting can promote multisensory stimulation during reminiscence activities and social interactions, thereby enhancing feelings of competence, selfesteem, and relaxation [63].

Spatial layout characteristics such as openness, compactness, connectivity, and visual and physical interactivity, along with legibility and ease of understanding, are vital. It is recommended to maintain mid-size to small-scale facilities with a maximum of 10 residents to preserve a homelike environment. Mealtime interventions that promote social interaction through alterations in the dining room environment were highlighted. The importance of creating an ambient indoor setting with sufficient lighting, calming auditory cues, suitable temperature regulation, and minimized noise levels is emphasized. Additionally, providing access to therapeutic gardens or outdoor spaces can offer multisensory stimulation and opportunities for social engagement among individuals with dementia [64]. Designing environments that are dementia-friendly can facilitate the integration of reminiscence therapy, thereby improving the quality of life for individuals with dementia. Table 5 provides comprehensive recommendations for implementing dementia-friendly reminiscence therapy interventions.

Table 5. Comparative analysis of reminiscence therapy in dementia-friendly design.

| Aspect | Recommendation | Study |
|--|---|-----------|
| | • A study investigated the impact of a life review intervention on cognitive decline among residents in care homes. | |
| | • The experimental group, consisting of eight participants, exhibited substantial improvements in depression levels ($p < 0.01$) post-intervention. | |
| Life review therapy | • Additionally, a significant improvement in the recall of autobiographical memory wa observed ($n \le 0.05$) in the experimental group compared to the control group ($n = 9$) | ıs [56] |
| | These findings underscore the potential benefits of life review interventions in improving aspects of dementia care, particularly regarding emotional well-being and memory functions. | |
| | • In a randomized controlled trial involving 19 participants, a structured life review in- tervention was contrasted with assessment-only conditions, comprising 8 participant in the intervention group and 11 in the control group. | S |
| | • The intervention group exhibited significant reductions in depression levels following the structured life review, highlighting its potential as a therapeutic approach. | g |
| Dementia care | • Additionally, participants in the intervention group showed improvements in autobiographical memory, suggesting a positive impact on cognitive functions. | - [65] |
| interventions | • However, self-esteem and life satisfaction did not show significant changes between the intervention and control groups. | |
| | • Although the study had a small sample size and was conducted as a pilot, these re- sults suggest the potential advantages of reminiscence therapy, especially for individ uals with dementia. This indicates a need for further exploration through larger-scale investigations. | - |
| | • The research investigated how a reminiscence program influenced the psychosocial well-being of 101 residents with dementia living in nursing homes. | |
| Psychosocial well-being measures | • Using a randomized controlled trial design, the study compared three groups: an in- tervention group utilizing a life-story approach, a comparison group involved in friendly discussions, and a no-intervention control group. | [66] |
| | Despite conducting an overall analysis, no notable differences were found among the groups. | |

| | • | The intervention group demonstrated enhanced well-being immediately following the | |
|-----------------|-----|---|----|
| | | intervention, indicating a positive short-term effect of the life-story approach. | |
| | • | These findings suggest the potential benefits of targeted reminiscence programs for | |
| | | improving the immediate psychosocial well-being of dementia patients, emphasizing | |
| | | the need for further research and longitudinal studies to assess long-term impacts. | |
| | • | The study investigated the impact of group reminiscence with reality orientation on 24 | |
| | | patients diagnosed with vascular dementia compared to a control group. | |
| Cognitive be- | • | Positron emission tomography (PET) scans unveiled heightened brain activity in the | |
| havioral ther- | | anterior cingulate cortex of the intervention group, indicating potential improvements | |
| apy | | in social interaction and behavioral outcomes. | |
| apy | • | Group reminiscence combined with reality orientation may contribute to enhanced | |
| | | cognitive and social functioning in vascular dementia patients, emphasizing the im- | |
| | | portance of non-pharmacological interventions in dementia care. | |
| | • | Reminiscence therapy shows promise for enhancing mood, cognitive abilities, and au- | |
| | | tobiographical memory in individuals with dementia. | |
| Evidence-based | l ● | Existing evidence is constrained by small sample sizes, methodological weaknesses, | |
| therapeutic in- | | and inadequate adherence evaluation, highlighting limitations in current research. [68] | I. |
| terventions | • | It is imperative to conduct rigorous, large-scale studies that include placebo and con- | |
| | | trol conditions to determine the most effective parameters for therapeutic interven- | |
| | | tions in dementia care. | |
| | • | In dementia care, reminiscence is essential for preserving self-worth, identity, and in- | |
| | | dividuality in patients. | |
| Memory and | • | Defining reminiscence accurately is pivotal for improving its effectiveness as a psy- | |
| emotion | | chosocial intervention, particularly in dementia care settings. [60] | |
| | • | Reminiscence interventions significantly contribute to enhancing well-being and self- | |
| | | esteem, highlighting their importance in the holistic care of individuals with demen- | |
| | | tia. | |
| | • | An integrative reminiscence program, evaluated through a quasi-experimental design, | |
| | - | Derticingents in the treatment group superior and not superthy on her some and in demos | |
| Memory ther- | • | sive sumptoms celf accontance internersonal relations, autonomy, and environmental[61] | (|
| ару | | mastery after completing the 10 session program | |
| | • | In contrast, the control group did not exhibit similar levels of improvement, highlight, | |
| | • | ing the distinct advantages of integrative reminiscence therapy | |
| | • | Despite high-quality spaces such as private apartments and diping areas, the overall | |
| | • | layout of the facilities was found to impact resident activities | |
| | • | Establishing inclusive environments within residential care facilities is essential for | |
| Environmental | - | improving care standards and fostering independence among elderly individuals [63] | |
| design impact | | This plays a pivotal role in maximizing their overall well-being and quality of life | |
| | • | A strategic approach to environmental design has the potential to improve residents' | |
| | | quality of life and well-being by promoting engagement and autonomy. | |
| | • | Reminiscence therapy has shown potential benefits for individuals with dementia, yet | |
| | | its effects are variable and inconsistent. | |
| | • | Variations in cognitive function, communication, guality of life, and mood enhance- | |
| | | ments have been noted, with outcomes influenced by factors such as the setting (care | |
| | | home versus community) and the type of therapy (individual versus group). | |
| Tailoring remi- | • | Quality of life improvements are more promising in care homes, while individual | |
| niscence ther- | | therapy, such as creating life storybooks, shows potential for person-centered care. [69] | |
| ару | • | Joint reminiscence groups involving family members alongside dementia patients | |
| | | have shown smaller effects in larger studies. | |
| | • | Standardized manuals and training are crucial to develop common approaches, recog- | |
| | | nize therapy functions, and ensure effective implementation across diverse settings | |
| | | and modalities of reminiscence therapy. | |

| Evidence-based standardized protocols | A comprehensive review of 22 studies involving 1972 participants sheds light on the potential benefits of reminiscence therapy in dementia care. The results underscore the beneficial impacts of reminiscence therapy on aspects such as quality of life, communication, depression, and cognitive function in individuals undergoing this treatment. [57] These differences highlight the essential requirement for standardized methods to improve the overall efficacy of reminiscence therapy across various care settings. Enforcing standardized protocols can result in enhanced psychosocial outcomes and an improved quality of life for individuals coping with dementia. |
|--|--|
| Environmental intervention impact | Spatial design features like open layouts, small facility sizes, mealtime interventions, and therapeutic gardens play a crucial role in promoting positive social interaction and enhancing well-being among residents in dementia care facilities. These features create environments that support residents' social engagement, navigation ease, dining experiences, and access to nature, contributing to a higher quality of life in such settings. |
| Social interac- tion promotion | The research investigated how group reminiscence therapy influenced depression levels and life satisfaction among elderly veterans residing in veteran homes in Taiwan. Following an 8-week program, participants receiving reminiscence therapy exhibited marked reductions in depression levels and reported higher life satisfaction compared [59] to those in the control group. These findings highlight the potential effectiveness of reminiscence therapy as a beneficial intervention for improving mental health outcomes among institutionalized older adults. |
| Therapeutic consistency framework | A review of 22 heterogeneous studies on reminiscence therapy in dementia care revealed a lack of consistency and a clear theoretical framework. Despite identifying 13 therapy components, common elements such as "memory triggers" and "themes" did not consistently show beneficial effects. [70] The review emphasizes the importance of establishing more standardized content, delivery methods, and theoretical underpinnings for reminiscence therapy in dementia care to enhance its effectiveness. |
| Designing ther- apeutic envi- ronments | Incorporating nostalgia in dementia care home design can lead to significant psychological benefits, including improved self-esteem, social cohesion, and feelings of connectedness among residents. This approach proposes using memories and archetypical elements therapeutically to develop environmental solutions tailored to dementia care units, offering a new per-[58] spective on interventions and interior design in care homes. Utilizing nostalgia in design, care homes can potentially establish more nurturing and fulfilling environments that positively influence the well-being and quality of life of individuals with dementia. |
| Therapeutic vir tual reality de- velopment | Based on an extensive literature review, a conceptual framework named the 4Is model (Immersion, Interaction, Imagination, and Impression) has been devised for virtual re- ality reminiscence therapy in dementia care. The pilot test of Virtual Reality-Reminiscence Therapy using the 4Is model showcased its potential to enhance conditions for dementia patients, signaling a promising ave- nue for further development and application in therapeutic treatments. The 4Is model offers a structured framework for designing and implementing virtual reality interventions that target reminiscence therapy, contributing to advancements in dementia care and treatment strategies. |

6. Homelike Atmospheres

Creating a sense of comfort and familiarity is essential for developing living environments suitable for individuals with dementia. Research on housing choices and design considerations for dementia patients, based on interviews with 22 care home managers in the UK, indicates that the selection of a care facility is closely tied to the perceived ambiance of the setting. Some residents prefer a homely and tranquil environment, while others prefer a livelier atmosphere. The study's findings emphasized that a harmonious blend of appropriate care standards, a conducive atmosphere, and well-crafted design elements are essential for creating a supportive environment for individuals with dementia [72,73]

The significance of homelike characteristics in dementia-friendly design is underscored. The review emphasizes that the spatial organization of care environments should facilitate a smooth transition from public to private spaces, aiding residents in adapting more swiftly to their new surroundings. Specific design strategies, such as integrating homelike furnishings and décor in communal areas, utilizing ADL kitchen units, and creating informal activity spaces, were identified as contributing to a familiar, comfortable, and engaging atmosphere for individuals with dementia. These design elements are noted to enhance residents' sense of autonomy and independence, ultimately enhancing their overall quality of life [73].

When designing inpatient care facilities for seniors with dementia, special consideration should be paid to the arrangement of floor plans. Researchers found that a homelike spatial arrangement, including a gradual transition from public to private areas, can significantly improve wayfinding and adaptation for dementia residents. Additionally, strategically placing common areas like living rooms in visible and accessible locations along pathways can further contribute to a recognizable and easily navigable environment [39]. Table 6 presents recommendations for creating homelike atmospheres in dementiafriendly environments.

Table 6. Comparative analysis of homelike atmospheres in dementia-friendly design.

| Aspect | Recommendation | Study |
|--------------------------------------|---|-------------------|
| Atmospheric Prefer ences Analysis | The atmosphere of a care home plays a pivotal role in residents' preferences, ranging from homely and relaxed to dynamic and engaging. Creating an enabling environment for dementia residents involves integrating appropriate care levels, fostering a positive ambiance, and implementing top-notch design elements within the facility. Customizing the care home environment to align with the diverse needs and preferences of residents is crucial for fostering well-being, engagement, and quality of life among individuals with dementia A carefully designed and conducive atmosphere can enhance residents' comfort, sense of security, and overall satisfaction with their living environment in a care home softing | [72] |
| Smooth Spatial Transitions | Smooth transitions between public and private spaces facilitate better adaptation for dementia residents. Incorporating homelike furniture, ADL kitchen units, and informal activity spaces in common areas creates a familiar, comfortable, and engaging atmosphere for residents. These design components play a role in fostering a feeling of normality, autonomy and holistic well-being among individuals with dementia. The thoughtful integration of such features supports residents' daily activities, promotes social interaction, and enhances their overall quality of life in care home settings. | i- , [73] , |
| Spatial Sequencing | • A homelike spatial sequence, characterized by a gradual transition from public to private spaces, plays a crucial role in improving wayfinding and adaptation for residents with dementia. | [39] |

| | Strategically locating common areas like living rooms along this spatial sequence in visible and accessible positions enhances familiarity and legibility within the environment. These design strategies promote independence, reduce confusion, and enhance residents' sense of comfort and security in navigating their living spaces. Employing these spatial sequences and strategic arrangements can cultivate more nurturing environments for individuals with dementia, resulting in enhanced quality of life and well-being. |
|---------------------------------|--|
| Enhanced Living Environments | Studies have shown that homelike interior design in care facilities enhances residents' engagement in self-initiated activities and promotes group participation. Critical aspects like individual rooms, aesthetically pleasing interiors, garden access, and multisensory rooms were greatly appreciated by both staff members and relatives of residents. The presence of these design elements contributes to a sense of comfort, autonomy, [74] and well-being among residents, while also positively impacting the overall care experience for staff and family members. Homelike interior design not only improves the physical environment but also fosters a supportive and inclusive atmosphere that benefits residents, staff, and families in dementia care settings. |
| Improved Activity Engagement | Converting a conventional nursing home into a more homely setting resulted in heightened spontaneous interactions and self-initiated activities among residents. Residents in the homelike setting spent more time in communal areas, demonstrating higher levels of social engagement, interaction with peers, and a sense of independence. [75] The shift towards a homelike environment not only improved residents' quality of life but also fostered a more vibrant and socially connected community within the care facility. |
| Design Impact Eval uation | Research underscores the significance of homelike environments, functional modi- fications, and building layouts in nursing homes, despite their lower ranking in [76] National Health and Medical Research Council evidence assessments. |

7. Environmental Cues

Environmental cues are crucial in developing dementia-friendly settings that enhance the well-being, autonomy, and day-to-day functioning of individuals with dementia. Incorporating visual cues such as contrasting colors and clear signage, olfactory cues like familiar scents, auditory cues such as calming music, and tactile cues like textured surfaces can significantly improve the daily experiences of those with dementia. Moreover, integrating dementia-friendly principles into residential, neighborhood, and community environments promotes inclusivity and accessibility, creating a supportive ecosystem for individuals with dementia and their caregivers.

7.1. Signage

Effective signage is crucial for facilitating wayfinding, especially in environments catering to individuals with dementia, where diverse forms of support are necessary for independent navigation. One significant challenge is balancing the individuality of signage, tailored to the unique cognitive and perceptual needs of each person, with its universality to ensure broad applicability across diverse populations. Cultural variations in signage comprehension and response must also be considered during framework development [77]. Combining pictorial elements with simple, easily recognizable language, such as using the word "toilet" alongside a universal picture, enhances wayfinding effectiveness. Signage should be visually appealing and harmonious with the environment without compromising its primary purpose of facilitating wayfinding for individuals with dementia. Additionally, exploring interactive signage with audio cues or touch-sensitive displays shows promise in enhancing effectiveness [77].

Clear and legible signage featuring highly contrasted lettering and universally understood imagery, like an old-fashioned phone, minimizes confusion and promotes independence. Proper signage placement, such as mounting at eye level just above handrails, ensures visibility and recognition for individuals with dementia, further facilitating wayfinding [78].

Contrasting color schemes integrated throughout the environment play a crucial role in enhancing recognition and independence, especially concerning mobility and personal hygiene activities [79]. Clear ward signage, incorporating both text and pictures, not only assists patients in locating essential areas but also promotes independence in self-care tasks, thereby reducing reliance on staff assistance [80]. Additionally, the aesthetic appeal of dementia-friendly design elements, such as contrasting colors and identifiable memorabilia, has a positive impact on staff morale and patient interaction, contributing to a supportive and empowering environment [81].

The integration of contrasting colors and clear signage is indispensable in dementiafriendly design. Not only does it promote independence and reduce agitation among individuals with dementia in acute hospital settings, but it also significantly enhances their overall quality of life. These design considerations emphasize the significance of customized environmental interventions that address the unique requirements of individuals with dementia, thereby creating a more inclusive and supportive care environment [80]. Table 7 provides a comparative analysis of signage in dementia-friendly design, offering insights into effective strategies for enhancing wayfinding in care environments.

Table 7. Comparative analysis of signage in dementia-friendly design.

| Aspect | Recommendation | Study |
|---------------------------------|--|---------------------|
| Contrasting Colors | • Promotes recognition and independence, particularly in mobility and personal hy- giene activities. | [79] |
| Positive Staff Inter- action | • Enhances patient morale and interaction, contributing to a supportive and empowering environment. | [81] |
| Signage Evaluation Framework | Workshops held in Sydney and Edinburgh engaged 28 participants and utilized the "world café" approach as a component of a broader initiative aimed at developing a framework for evaluating signage in dementia care. Following the workshops, a three-round Delphi process involving 38 participants was implemented to refine and validate the proposed framework. The study identified unresolved issues within the framework, highlighting the need for further refinement and testing to ensure its effectiveness in assessing signage in dementia care environments. Combining workshop insights with the Delphi process allowed for a collaborative and iterative approach to developing a comprehensive and practical signage evaluation tool tailored to the needs of individuals with dementia. | [77] - - |
| Staff Feedback | Integrating five core design themes—distinct color contrasts, easily understandable signage, supportive staff interactions, reminiscence elements, and designated activity spaces—demonstrated a beneficial influence on patient engagement, well-being and daily participation. The audit scores revealed that the ward's design effectively promoted various aspects of patient care and security, reflecting the importance of thoughtful design in healthcare settings. | e 5 [80] 1 |

| | Design elements such as contrasting colors and clear signage contributed to improved wayfinding and communication, enhancing the overall patient experience and reducing stress. Positive staff interaction and the presence of memorabilia and activity rooms created a more personalized and engaging environment, fostering a sense of comfort and familiarity for patients in the ward. | |
|----------------------------|--|--|
| Cue Salience and Memory | Place learning in older adults is significantly influenced by the salience and complexity of visual cues within an environment. Salient cues play a crucial role in improving place learning curves, with complex salient cues showing greater effectiveness compared to simpler ones. On the other hand, non-salient cues may not offer adequate information for con- [42] sistent navigation and spatial orientation. The strategic and purposeful placement of salient visual cues is essential for facilitating effective wayfinding and navigation among older adults, contributing to their overall spatial awareness and independence. | |

7.2. Olfactory Cues

Olfactory cues, or the utilization of scents and fragrances, have garnered increasing attention in the design of dementia-friendly environments. Studies indicate that olfactory stimulation can elicit strong emotional responses, activate autobiographical memories, and potentially improve well-being for individuals with dementia [62]. The well-documented connection between olfaction, memory, and emotion is rooted in brain anatomy. Information from the sense of smell is initially processed by the olfactory bulb and subsequently relayed to brain areas associated with associative learning, emotions, and memory formation, such as the amygdala and hippocampus [82]. Functional magnetic resonance imaging (fMRI) studies have revealed that the amygdala exhibits heightened activation when individuals recollect memories triggered by olfactory cues in contrast to visual stimuli [62].

The immediate connection between smell and the emotional-memory regions of the brain could clarify why memories evoked by odors tend to be emotionally intense and vivid compared to those triggered by other sensory inputs [83]. Diminished olfactory function is frequently noted in individuals with dementia, often manifesting in the initial phases of the condition. This decrease is linked to cognitive decline and alterations in brain areas linked to Alzheimer's disease pathology, suggesting the potential of olfactory function as a biomarker for dementia [84]. Integrating olfactory cues into dementia-friendly design holds significant promise. By strategically introducing familiar and pleasant scents into the built environment, such as using olfactory-rich heritage items or aromatic plants [85], designers can create sensory-rich spaces that encourage reminiscence, comfort, and a sense of belonging. Additionally, incorporating olfactory experiences into object-handling sessions and reminiscence activities can further enhance the therapeutic benefits of such interventions [86].

Aromatherapy and sensory interventions benefit dementia care by leveraging olfaction's emotional and memory ties [87]. Moreover, the therapeutic potential of objects' olfactory properties is underscored, emphasizing the significance of distinctive heritage items with recognizable odors, such as shaving cream from brands like Albany [88]. Such items can spark curiosity, evoke personal memories, and facilitate meaningful conversations. Furthermore, smell is regarded as an intangible yet integral aspect of tangible heritage, fostering hedonic responses, deepening personal connections to artifacts, and enriching learning and enjoyment [43]. Table 8 illustrates a comparative analysis of olfactory cues in dementia-friendly design, highlighting their potential impact on enhancing environmental cues for individuals with dementia.

| Aspect | Recommendation | Study |
|--|---|----------------|
| Multisensory Envi- ronments | Combining olfactory stimulation with visual, auditory, and tactile elements can result in immersive multisensory experiences. These experiences can be tailored to specific themes or personal histories, enhancing engagement and sensory perception. Integrating olfactory cues as part of multisensory interventions can contribute to a more holistic and personalized approach in dementia care. These strategies harness the potency of sensory stimulation to craft meaningful an therapeutic encounters for individuals with dementia. | - [89] d |
| Aromatherapy and Environmental Fra- grancing | Controlled use of essential oils or fragrances in common areas or activity spaces can help create either a calming or stimulating atmosphere, which may influence mood and behavior positively. A study involving lavender and bergamot essential oils in a residential care facility demonstrated their calming effects on residents with dementia, leading to reduced agitated behaviors and improved sleep quality. | [90] [|
| Sleep Quality | • Lavender aromatherapy demonstrated a beneficial impact on the quality of sleep and mitigated sleep disruptions among individuals with dementia residing in long-term care facilities. | [91] |
| Olfactory-Rich Ob- jects | • Incorporating objects with distinct and recognizable odors, such as heritage items or personal belongings, can trigger curiosity, facilitate meaningful conversations, and promote personal connections | [88] |

Table 8. Comparative analysis of olfactory cues in dementia-friendly design.

7.3. Aural Cues

Auditory cues play a crucial role in dementia-friendly design, providing sensory stimulation that effectively engages individuals living with dementia, particularly in advanced stages of the condition [92]. Research has been highlighted on how audio stimulation can enhance attention, comprehension, and concentration in this population [93].

One innovative approach that utilizes auditory cues is the AMuSED (Audio and Multisensory Stimulation for Engagement and Dementia) toolkit [94]. Various audio elements such as recordable sound buttons, singalong CDs, and sound effect machines are incorporated into this toolkit. Reminiscence experiences are enhanced by combining auditory cues with visual and other sensory stimulations, and the toolkit also includes QR code cubes, recordable photo albums, and mystery boxes for a multisensory approach.

Implementing a parametric speaker in a communal area of a residential care facility to generate tailored acoustic environments for individuals with dementia resulted in a reduction in behavioral and psychological symptoms such as wandering and agitation during listening sessions. This technology provides customized auditory stimulation without disrupting other residents, showcasing benefits for both patients and caregivers alike [95].

Positive effects on reducing anxiety, inhibition, and some behavioral problems in dementia patients have also been shown by music therapy and individualized music listening [96]. Additionally, agitation during mealtimes can be reduced by clear auditory cues like clocks and signs with meal timing information [97]. Table 9 outlines recommendations for aural cues in dementia-friendly design, offering guidance on utilizing sound elements to enhance the environment for individuals with dementia.

| Aspect | Recommendation Study |
|--------------------|---|
| | • Personalized music playlists and familiar sounds greatly engage dementia patients, |
| | showcasing the effectiveness of tailored auditory interventions. |
| | • These findings underscore the potential of personalized auditory experiences in de- |
| | signing dementia-triendly environments that promote well-being and engagement. |
| Auditory engage- | • Tailored auditory interventions, such as customized music and familiar sounds, can |
| ment | substantially improve the quality of life and emotional well-being of individuals with dementia. |
| | • Incorporating personalized auditory elements in care settings holds promise for im- |
| | proving mood, reducing agitation, and fostering positive experiences among de- |
| | mentia patients. |
| | Non-pharmacological interventions like AMuSED offer innovative multisensory |
| | stimulation, including aural cues, to reduce agitation and passivity in individuals |
| | with dementia. |
| | • These interventions are designed to boost involvement and interpersonal interac- |
| T | tion, ultimately enhancing the quality of life for PLWD. |
| Innovative non- | • AMuSED and similar approaches highlight the importance of non-pharmacological [94] |
| pharmacological | strategies in managing behavioral symptoms and promoting well-being in demen- |
| | tia care. |
| | • The incorporation of multisensory stimulation, including aural cues, can lead to |
| | meaningful and positive experiences for individuals with dementia, contributing to |
| | their overall quality of life. |
| | Auditory cues like active music therapy and personalized music listening demon- |
| Limited impact | strated limited effectiveness in alleviating behavioral and psychological symptoms |
| Linned impact | among individuals with dementia, highlighting the need for additional research on [70] |
| | music-based interventions. |
| | The personalized music program MUSIC & MEMORY has been proven to decrease |
| | the utilization of antipsychotic and anxiolytic medications among long-term nurs- |
| | ing home residents diagnosed with Alzheimer's disease and related dementias. |
| | Implementation of MUSIC & MEMORY also leads to a decrease in behavioral prob- |
| | lems among these residents, contributing to an overall enhancement in the quality |
| Medication reduc- | of care provided. |
| tion | • These findings highlight the potential of personalized music programs as non-phar-[98] |
| | macological interventions to improve the well-being and management of symp- |
| | toms in individuals with Alzheimer's and related dementias. |
| | Incorporating individualized music interventions like MUSIC & MEMORY into de- |
| | mentia care protocols can lead to significant improvements in medication manage- |
| | ment and behavioral outcomes, ultimately enhancing the overall quality of life for |
| | residents. |
| Parametric speaker | • The introduction of a parametric speaker with customized music notably decreased |
| | the behavioral and psychological symptoms associated with dementia among the |
| | residents. |
| | • This method exhibits potential for enhancing the quality of life for individuals with [95] |
| | dementia while simultaneously easing the burden on caregivers. |
| | • Employing personalized music via a parametric speaker signifies a non-pharmaco- |
| | logical intervention that holds promise for enhancing outcomes in dementia care. |
| Auditory adapta- | Technology innovations enhance comprehension and emotional regulation, utiliz- |
| tions | ing audio cues tailored to individual preferences for peaceful environments and [93] |
| 10115 | task facilitation in dementia care. |

Table 9. Comparative analysis of aural cues in dementia-friendly design.

7.4. Tactile Cues

Integrating tactile components into the layout of living spaces for individuals with dementia can offer crucial hints and stimulation. The texture and designs of flooring play a substantial role in influencing the walking experience and stability of those with dementia. Utilizing small patterns and low-contrast carpets with level-loop or pile textures can decrease walking duration and accidents, as individuals with dementia tend to walk at a slower pace on pile-textured carpets. This indicates that the thoughtful selection of floor coverings can improve safety and mobility among this demographic [99].

In addition to flooring, the texture and warmth of fabrics can contribute to creating a sense of security and comfort, assisting individuals with dementia in focusing on their activities. Furthermore, interactive textiles that evoke familiar connections and incorporate advanced technologies can be more accessible to elderly individuals, whether they have cognitive impairment or not [100]. By including sensory-rich elements like textured fabrics, one can establish a familiar and captivating setting that encourages multisensory engagement for those with dementia. Scholars have highlighted the importance of combining tactile elements with other sensory aspects like sounds and familiar connections to create a deeply engaging multisensory experience [100–103].

Personalization and customization of interactive textiles also play a key role in dementia-friendly design. Customizing textiles with varied textures, material selections, and designs can maximize user satisfaction for people with dementia [103]. However, the literature also highlights the challenges associated with a highly personalized, ultra-customized approach, which may pose difficulties for scalable production [104]. Overall, the research emphasizes the importance of tactile cues and multisensory elements in creating comfortable, familiar, and engaging environments for individuals living with dementia. Table 10 outlines recommendations for tactile cues in dementia-friendly design, focusing on enhancing tactile experiences for individuals with dementia.

Table 10. Comparative analysis of Tactile cues in dementia-friendly design.

| Aspect | Recommendation | Study |
|---------------------------|---|--------|
| | • Sensory stimulation, when applied in structured and spontaneous settings along- | |
| | side care situations, proves to be a potent tool for caregivers. | |
| | • The success of sensory stimulation programs relies on thorough assessment, effec- | |
| Sensory stimulation | n tive activity planning, efficient resource management, and a deep understanding o | f [99] |
| | sensory stimulation techniques. | |
| | • Proper implementation of sensory stimulation techniques can enhance engagemen | t, |
| | communication, and overall well-being among individuals receiving care. | |
| Multisensory As- pects | • Textiles engage all primary senses, providing a rich visual experience through tex- | |
| | ture, color, and light, enhancing environmental aesthetics. | |
| | • The tactile qualities of textiles offer haptic and bodily experiences, promoting sen- | |
| | sory stimulation and tactile engagement. | [100] |
| | • Personalization of textiles allows for the integration of low-tech and high-tech ele- | |
| | ments, creating a customized sensory experience aligned with individual prefer- | |
| | ences and needs. | |
| Softness and com- fort | • Neutral, plain, soft fabrics can soften acoustics and light, creating a warm and calm | 1 |
| | atmosphere. | [101] |
| | Textiles promote feelings of safety and relaxation. | |
| Concours with als | • Sensory-rich elements like textured fabrics can create a familiar and engaging envi- | - |
| Sensory-rich ele- | ronment that promotes multisensory stimulation. | [102] |
| ments | • Tactile objects should be combined with other sensory elements. | |

| | • The creation of sensory textile objects for individuals with advanced dementia is being focused on by designers, aiming to support positive well-being and shared | |
|---------------------|--|------|
| Sensory textile | experiences. [1 | 103] |
| | • These textiles are intended to be transitional and transformational objects, provid- | |
| | ing comfort and symbolizing memories even after the person's death. | |
| | • Smart textiles are evolving beyond material properties to include service ecosys- | |
| Service integration | tems, urging collaboration among developers and providers. Ultra-personalization opportunities arise from the body's role, personalization degree, and prototyping process, enhancing well-being applications. | 104] |
| | | |

7.5. Gardens and Outdoor Spaces

The impact of gardens and outdoor spaces on the well-being of individuals with dementia in care facilities has become a focus of growing research interest. Although quantitative studies, despite their limited quality, have suggested a link between using gardens and reduced agitation levels among dementia patients, findings on the effectiveness of horticultural therapy in managing physical and verbal aggression are mixed [105,106].

Qualitative investigations have uncovered several crucial themes regarding perceptions and experiences related to gardens among individuals with dementia, their caregivers, and facility staff. These themes encompass how the garden is utilized, the types of interactions facilitated, perceived impacts and benefits, mechanisms underlying these effects, and identified challenges such as safety concerns and limited staff availability for outdoor activities [47,107].

Furthermore, there is a general agreement on the importance of incorporating dementia-friendly environment (DFE) principles into garden designs within care settings. These principles highlight elements such as orientation, accessibility, socialization opportunities, stimulating activities, sensory engagement, triggers for reminiscence, safety protocols, and sustainable practices. Adhering to DFE guidelines has the potential to amplify the therapeutic value of outdoor spaces for individuals with dementia, promoting a tranquil, interactive, and meaningful outdoor experience [108].

The gathered evidence emphasizes the beneficial effects of gardens and outdoor spaces on the well-being of individuals with dementia, especially in reducing agitation and enhancing overall quality of life [106]. Table 11 provides a comparative assessment of gardens and outdoor areas within dementia-friendly design, providing valuable insights into effective approaches for developing therapeutic and accessible outdoor environments.

| | Table 11. | Comparative | analysis of | gardens and | outdoor spaces in | dementia-friendly de | esign. |
|--|-----------|-------------|-------------|-------------|-------------------|----------------------|--------|
|--|-----------|-------------|-------------|-------------|-------------------|----------------------|--------|

| Aspect | Recommendation | Study |
|------------------|--|-------|
| | • The study on a new dementia-friendly gardens indicated a non-significant de- | |
| | crease in Neuropsychiatric Inventory scores among participants. | |
| Promote Outdoor | • Positive feedback and reduced rates of falls were observed following the imple- | [100] |
| Engagement | mentation of the garden. | [109] |
| | • Despite these positive outcomes, the usage of the garden by residents remained re- | l- |
| | atively low during the study period. | |
| | • Horticultural therapy and garden settings offer a range of benefits such as pain re- | - |
| | duction, improved attention, and stress relief. | |
| Therapeutic Gar- | • These interventions also help modulate agitation, reduce medication use, and con | [110] |
| dens | tribute to falls prevention among long-term care residents. | [110] |
| | • The combined effects of these advantages indicate a potential improvement in the | |
| | overall quality of life for individuals living in long-term care facilities. | |

| • | Integrating horticultural therapy and establishing accessible garden areas can greatly enhance the well-being and daily experiences of residents in long-term care facilities. |
|---|---|
| • Horticultural Ther- apy Utilization • | Sensory gardens and horticultural therapy demonstrate a positive impact on re- ducing agitation levels and promoting activity among dementia patients. Horticultural therapy is widely accepted and proves to be effective in enriching and stabilizing emotions, adding significant value to dementia care programs. |
| • Caregiver Well-be- ing | The study investigated the influence of horticultural therapy on depression and caregiver burden among caregivers of individuals with dementia. While depression levels slightly rose in the control group, the experimental group that received [112] horticultural therapy exhibited decreases in depression and enhancements in quality of life and caregiver burden. |
| • Nature Engagement | Garden visits positively affected mood, social interaction, depression, and agitation in dementia patients. Cognitive improvements were observed, particularly in at- [107] tention and orientation to time after garden visits. |
| • Safety Measures | Models of dementia-friendly design implemented in home, community, and long- term care settings can have a substantial impact on the well-being of individuals with dementia by tackling issues such as unsafe navigation, risk of falls, and envi- [47] ronmental stressors. These design approaches can improve safety, alleviate agita- tion, and enhance overall quality of life. |
| • Emotional Well-be- ing | The garden, with partial facilitation from the researcher during intervention ses- sions, encouraged involvement and reduced feelings of apathy among individuals with dementia residing in the Residential Aged Care Facility. Qualitative results suggested that the garden was effective in decreasing agitation levels. |
| • Therapeutic Envi- ronments | A systematic review of 16 quantitative studies examining gardening therapy and therapeutic gardens for individuals with dementia revealed favorable impacts on engagement, agitation, depression/mood, stress, and medication use. While there is[113] increasing interest in this area, further empirical evidence and comprehensive design guidelines are required. |

7.6. Socialization and Activity Spaces

Encouraging social involvement and inclusivity is a vital part of designing spaces that are dementia-friendly. Scholars emphasize the significance of nurturing social connections, interactions across generations, and community support in urban settings [114]. Engaging community members in lifelong learning, collaborative creation, and design can establish conditions that promote brain health and overall well-being for those with dementia. The design of long-term care facilities, including their accessibility, readability, and layout, also significantly impacts positive social interactions [64].

Community programs that promote socialization and activities have shown positive effects on individuals with dementia. They highlight the importance of effective social interaction agencies, welcoming environments, collaboration, communication mediation, and teamwork [115]. Living environment design can greatly affect the participation of individuals with dementia in enjoyable activities [116].

The physical setting and the range of activity areas play a crucial role in fostering social engagement among individuals with dementia. Research indicates the benefits of group exercise classes, emphasizing venue accessibility, socialization opportunities, and staff expertise in dementia care [117]. Incorporating these factors into the design process can greatly enhance the quality of life for individuals with dementia, emphasizing the significance of using evidence-based methods in developing dementia-friendly environments. Table 12 provides a comparative analysis of socialization and activity spaces in dementia-friendly design, offering insights into effective design strategies.

| | Table 12. Comparative analysis of socialization and activity spaces in dementia-mentify | design. |
|--------------------------------------|--|------------|
| Aspect | Recommendation | Study |
| | • The Leipzig study underscored the importance of urban design in reducing de- mentia risk, emphasizing aspects like social inclusion, accessibility, and local recre- | |
| Social Participation | The study advocated for community involvement in creating dementia-friendly en vironments, recognizing the potential of well-designed urban spaces to enhance brain health and overall well-being. | [109] |
| | Critical spatial design interventions that enhance positive social interaction in long term care facilities include aspects like physical environment, accessibility, and so- cial networks | - |
| Accessibility and Proximity | Other critical factors include legibility, layout, staff-resident ratios, and care philosophy within the facility. These findings provide valuable recommendations for designing long-term care facilities worldwide, with the goal of enhancing residents' quality of life and well- | [64] |
| Community-based | Community-based programs for people living with dementia (PLWD) underscore both the beneficial and challenging aspects of social activities. | |
| Programs and Socia Interactions | Positive aspects encompass efficient platforms for social interaction, naturalized surroundings, cooperation, and facilitating social signals. These elements contribute to achieving positive social outcomes and enhancing the overall well-being of PLWD participants in community settings. | [115] e |
| | • Identifying technologies through collaborative efforts and testing them in diverse living settings are pivotal steps in understanding their impact on activity participation and well-being. | - |
| ment and Activity | Evaluating now the physical environment influences these factors is equally important for designing dementia-friendly spaces. Recommendations in dementia-friendly design stress spatial considerations for socialization and activity spaces, emphasizing the need to remove barriers and promote enjoyable activities for individuals with dementia. | [116] |
| Exercise and Sociali zation | Group exercise classes for individuals with dementia offer advantages such as increased physical activity, decreased feelings of isolation, and improved mood and cognitive functioning. The success of the program was attributed to key factors such as the accessibility of the exercise venue, opportunities for social interaction, and the expertise of staff in handling individuals with dementia. | [117] |
| Dynamic Public Accessibility | Individuals with dementia show a preference for remaining in their homes and participating in public activities. Accessibility in public spaces is a dynamic experience influenced by familiarity, comfort, and individual motives. Challenges include technological, environmental, and cognitive barriers, impacting socialization and activity engagement. Designing public spaces must consider dementia experiences to enhance accessibility and support community living. | [118] |
| Virtual Reality (VR) for Dementia | Using VR helped identify barriers and improvements for dementia-friendly outdoor spaces. Iterative testing improved walk performance, although VR's limitations were noted. The study supports the use of VR in evaluating and enhancing environments for persons with dementia. | [119] |
| Inclusive Dementia Engagement | • Socialization and activity spaces for PLWD are emphasized, highlighting the need for universal accessibility in public engagement tools like open houses. | [120] |

Table 12. Comparative analysis of socialization and activity spaces in dementia-friendly design.

| Key recommendations include employing respectful communication, using clear presentation materials, and creating comfortable physical settings to enhance PLWD's participation and inclusion in community decision-making processes. The study's analysis of data from 325 participants across four countries highlighted significant variations in out-of-home participation influenced by dementia diagno- | | | |
|---|----------------------|--|-------|
| presentation materials, and creating comfortable physical settings to enhance PLWD's participation and inclusion in community decision-making processes. The study's analysis of data from 325 participants across four countries highlighted significant variations in out-of-home participation influenced by dementia diagno- | • | Key recommendations include employing respectful communication, using clear | |
| PLWD's participation and inclusion in community decision-making processes. The study's analysis of data from 325 participants across four countries highlighted significant variations in out-of-home participation influenced by dementia diagno- | | presentation materials, and creating comfortable physical settings to enhance | |
| • The study's analysis of data from 325 participants across four countries highlighted significant variations in out-of-home participation influenced by dementia diagno- | | PLWD's participation and inclusion in community decision-making processes. | |
| significant variations in out-of-home participation influenced by dementia diagno- | • | The study's analysis of data from 325 participants across four countries highlighted | ł |
| | | significant variations in out-of-home participation influenced by dementia diagno- | |
| sis and country of residence. | | sis and country of residence. | |
| • This underscores the intricate relationship between cognitive status and environ- | • | This underscores the intricate relationship between cognitive status and environ- | [101] |
| mental factors in shaping social participation. | Social Participation | mental factors in shaping social participation. | [121] |
| • The research promotes the adoption of a strengths-based approach to tackle chal- | • | The research promotes the adoption of a strengths-based approach to tackle chal- | |
| lenges encountered by older adults with dementia when engaging in community | | lenges encountered by older adults with dementia when engaging in community | |
| activities. | | activities. | |

8. Safety and Accessibility

Accessibility is another critical factor, addressing both physical and cognitive needs. Well-defined pathways, sufficient access to paths, and the absence of steps can encourage physical activity and engagement [122]. The availability of equipment like handrails, wider corridors, and accessible activity rooms also supports mobility and independence [73].

Comfort and safety are also key considerations. Flooring design is a critical component, as it plays a vital role in preventing falls and injuries. Appropriate shock absorption is essential, with a recommended vertical displacement of 3.5 mm or less during normal walking [123]. Flooring materials with an elastic modulus ranging from 0.5 to 0.9 MPa, a bottoming-out depth exceeding 5 mm, and a thickness exceeding 10 mm can offer an optimal combination of comfort and support. In addition to shock absorption, the surface of the flooring is also an important consideration. Smooth, non-porous materials like vinyl are preferred, as they are easy to clean and maintain, avoiding the accumulation of stains from spills [124]. This is particularly important in dementia-friendly environments, where spills of food, medicine, or other substances are more common. Importantly, the use of strong detergents should be avoided, as they can create annoying odors and fumes. Instead, the flooring should be designed to be easily cleaned with water or mild detergents [124].

Outdoor spaces are also an essential component of dementia-friendly design. Providing all-weather outdoor seating and accessible thresholds can also facilitate residents' use of these spaces [125]. However, it is crucial to address staff and organizational concerns about safety and visual accessibility to enable access to the outdoors. Beyond the physical design, the overall layout and accessibility of the environment are also important considerations. Principles of familiarity, legibility, and distinctiveness can also help orient and engage individuals with dementia [120].

The home environment can have a considerable impact on providing support for individuals with dementia and their caregivers. Larger home environments can promote safety, accessibility, and storage, while smaller environments may be more manageable for family caregivers [126]. Single-story dwellings with no stairs can also improve accessibility and supervision, reducing the risk of falls [127,128]. Table 13 presents safety and accessibility recommendations for dementia-friendly design considerations.

Table 13. Comparative analysis of safety and accessibility in dementia-friendly design.

| Aspect | Rec | ommendation | Study |
|----------------|-----|---|-------|
| | ٠ | Flooring materials with appropriate elasticity, stiffness, and thickness can help re- | |
| Ideal Flooring | | duce fatigue and discomfort among healthcare staff. | [100] |
| ideal Flooring | • | Effective shock absorption is crucial for minimizing falls and injuries, with a rec- | [123] |
| | | ommended vertical displacement of \leq 3.5 mm during normal walking. | |

| • | The ideal flooring attributes comprise an elastic modulus ranging from 0.5 to 0.9 MPa, a bottoming-out depth of over 5 mm, and a thickness surpassing 10 mm, unless the material is overly soft. |
|---|---|
| • Smooth, Non-Po- rous Surfaces • | Smooth and non-porous surfaces like vinyl are preferred in healthcare environ- ments for their easy cleaning and maintenance, effectively preventing stains from spills. [124] It is advisable to avoid strong detergents as they can cause unpleasant odors and fumes, which are undesirable in healthcare facilities prioritizing cleanliness and air quality. |
| • Elderly Color Per- ception | Understanding visual impairments such as altered color perception is crucial for addressing spatial difficulties among older individuals. A literature review focused on creating evidence-based knowledge aims to design [129] chromatic environments that enhance visual comfort and architectural perfor- mance for this demographic. |
| • Path Segment Selec- • tion • | The study investigated how physical environmental characteristics of path seg- ments influence walking for recreation and instrumental purposes. Path segments with specific destinations along them were favored for instrumental walking, emphasizing the importance of connectivity. For recreational walking, longer, well-connected path segments without steps and with attractive views were preferred by participants. Path segments leading to specific types of destinations were more likely to be used for walking, highlighting the influence of destination types on walking behavior. The length of path segments also played a role in recreational walking, with longer segments being preferred by walkers. |
| • Home Environment • | The research highlights the importance of home environment factors like dimen- sions, state, arrangement, and ease of access for caregivers of individuals with de- mentia, impacting their caregiving abilities. Proximity between rooms emerged as critical for observation and navigation, facil- itating the management of care responsibilities. Architectural features like property size and the presence of stairs influenced relo- [126] cation decisions among caregivers, emphasizing the necessity for adaptable living spaces. Personalization of the home environment through familiar objects and considera- tions for thermal comfort were strategies utilized to reduce confusion and improve overall well-being in individuals with dementia. |

9. Designing Optimal Spaces and Renovating Buildings

Developing dementia-friendly environments requires a methodical and deliberate approach that caters to the distinct requirements of individuals with dementia. The initial phase of this process is conducting a comprehensive needs assessment. This entails interacting with dementia patients, their families, and caregivers to gain a deeper understanding of the obstacles they encounter in their surroundings. By grasping their perspectives and needs, designers can pinpoint critical design elements that will greatly enhance the well-being and autonomy of individuals with dementia.

Optimizing wayfinding and orientation within the built environment is a crucial aspect of dementia-friendly design. This step involves incorporating prominent landmarks and architectural features that serve as intuitive navigation cues for individuals with dementia. Designers strategically place distinctive visual landmarks at decision points and intersections to aid navigation, while coherent architectural differentiation is emphasized to avoid long, repetitive corridors that can contribute to disorientation.

Enhancing sensory experiences is another critical aspect of creating dementiafriendly environments. This phase emphasizes optimizing lighting strategies to promote

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the synchronization of circadian rhythms, involving the use of blue-enriched lighting during daylight hours and warmer lighting during nighttime. Integrating olfactory cues, such as familiar and pleasant scents, along with multisensory stimulation, creates a more engaging and immersive environment for individuals with dementia, promoting positive experiences and reducing anxiety.

Personalization and familiarity are key factors in creating environments that are supportive for individuals with dementia. Designers can include elements from reminiscence therapy and integrate familiar items such as personal belongings, household objects, and sensory cues. Access to outdoor areas and therapeutic gardens designed according to dementia-friendly principles can also enhance the overall experience, offering opportunities for sensory stimulation, physical engagement, and social interaction.

Safety and accessibility are paramount considerations in dementia-friendly design. Ergonomic design and assistive features, including non-slip flooring, handrails, and accessible bathrooms, ensure a safe environment for individuals with dementia. Wide hallways, wheelchair accessibility, and assistive technology contribute to improved mobility and independence.

Through adhering to this thorough process, designers can develop environments that effectively cater to the needs of PLWD, fostering independence, mitigating anxiety and disorientation, and ultimately improving overall well-being.

Figure 4 provides a visual representation of a step-by-step design process specifically tailored for creating dementia-friendly environments. It outlines the key stages and considerations involved in designing spaces that promote cognitive well-being, accessibility, and safety for individuals with dementia. Figure 4 serves as a guide for architects, designers, and healthcare professionals to follow a structured approach in developing spaces that cater to the unique needs and challenges faced by dementia patients.

| Step 1: Needs Assessment | Engage with dementia patients, families, and caregivers. Analyze existing research on dementia needs. Identify key design considerations. |
|--|--|
| Step 2: Wayfinding and Orientation | Incorporate landmarks and architectural features. Ensure coherent architectural differentiation. Simplify navigation and minimize decision points. |
| Step 3: Enhance Sensory Experiences | Optimize lighting for circadian rhythms. Use dynamic lighting systems. Integrate olfactory and multisensory stimulation. |
| Step 4: Personalization and Familiarity | Integrate reminiscence therapy. Encourage personal memorabilia. Design residential-style living areas. |
| Step 5: Safety and Accessibility | Incorporate ergonomic design and assistive features. Provide non-slip flooring and accessible bathrooms. Balance safety and autonomy. |
| Step 6: Stakeholder Engagement | Collaborate with experts and end-users. Conduct post-occupancy evaluations. Gather feedback for continuous improvement. |

Figure 4. Step-by-step guide to dementia-friendly design.

Traditional care facilities often fail to adequately address the sensory, cognitive, and emotional challenges faced by PLWD. This oversight frequently results in disorientation, anxiety, and diminished autonomy among residents. Renovating these facilities with evidence-based principles, such as personalized spaces, enhanced wayfinding, and sensory stimulation, can transform them into therapeutic settings that promote well-being. By addressing critical issues like safety, accessibility, and social engagement, such renovations not only create supportive environments for residents but also alleviate caregiver stress and improve staff working conditions.

For instance, a study analyzing extensive renovations to a dementia care unit in the United States revealed that implementing lighting enhancements, noise reduction measures, camouflaged exits, and decentralized dining areas helped foster a homelike atmosphere. While these changes led to improved working conditions and perceived quality of life for residents, they demonstrated only limited improvements in residents' autonomy and activity levels. Although exit-seeking behaviors were reduced, aggressive and vocal behaviors persisted, underscoring the complexity of achieving significant behavioral changes through design alone [131].

Personalization of spaces has been found to significantly improve residents' behavioral, emotional, and cognitive states. However, the success of these designs depends on addressing broader systemic challenges, such as high staff turnover, insufficient activity programming, and resistance to change from families [132]. Long-term care environments often exacerbate declines in sensory perception and cognitive engagement, highlighting the importance of tailored designs that enhance navigation, social interaction, and cognitive stimulation. Innovative models, such as the household design approach, which includes resident-accessible kitchens, flexible dining arrangements, and personalized spaces, have been shown to foster a sense of home and improve overall resident outcomes [133].

Evidence-based renovations must balance safety, emotional well-being, and functionality. For example, integrating synchronized lighting strategies to align with circadian rhythms, employing multisensory elements like familiar scents and textures, and providing access to outdoor therapeutic gardens can enhance cognitive and emotional well-being. Additionally, incorporating ergonomic designs, such as non-slip flooring, handrails, and accessible bathrooms, ensures a safe environment that supports mobility and independence.

Renovating dementia-friendly buildings is not merely an aesthetic undertaking but a necessity for addressing the multifaceted needs of PLWD and their caregivers. Collaboration between architects, healthcare professionals, and researchers can further advance dementia care by designing environments that meet both therapeutic and practical requirements [132,133].

10. Conclusions

This study explores the intricacies of crafting supportive and empowering environments for individuals with dementia, who encounter difficulties navigating unfamiliar spaces due to cognitive limitations. One significant finding is the effectiveness of incorporating distinctive visual landmarks and structural variations along paths, which aids in route learning and wayfinding. By avoiding monotonous, long corridors and introducing memorable spaces as orientation nodes, individuals with dementia can experience reduced disorientation and anxiety while navigating their environment. Additionally, the study highlights the critical role of lighting design in fostering well-being. Dynamic lighting systems, aligned with natural circadian rhythms, have shown promise in enhancing visual perception and regulating sleep patterns for individuals with dementia. For example, adjusting lighting to be brighter and bluer during daytime and softer and warmer at night can meet their biological requirements, creating a home-like atmosphere that enhances their comfort and mental well-being. Furthermore, the integration of sensory experiences such as olfactory cues, auditory stimulation, and tactile components has demonstrated positive impacts. These multisensory interactions assist in triggering memories, decreasing agitation, and boosting cognitive engagement in individuals with dementia,

ultimately leading to an enhanced quality of life. Regarding safety and accessibility, the study emphasizes the importance of features like non-slip flooring, handrails, and accessible bathrooms. These elements not only mitigate risks but also promote independence and dignity among individuals with cognitive impairments, allowing them to navigate their living spaces with greater ease and confidence. The study's detailed exploration of design principles and strategies underscores the potential of intentional, dementia-friendly environments to transform the lives of individuals with dementia positively. By addressing specific needs such as wayfinding aids, lighting design, sensory stimulation, and safety features, architects and designers can create environments that optimize the well-being, safety, and independence of this vulnerable population, thereby reducing the burden on caregivers and healthcare systems.

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References

- 1. World Health Organization. *Global Status Report on the Public Health Response to Dementia;* World Health Organization: Geneva, Switzerland, 2021; ISBN 978-92-4-003325-2.
- Wittenberg, R.; Hu, B.; Jagger, C.; Kingston, A.; Knapp, M.; Comas-Herrera, A.; King, D.; Rehill, A.; Banerjee, S. Projections of Care for Older People with Dementia in England: 2015 to 2040. *Age Ageing* 2020, 49, 264–269. https://doi.org/10.1093/ageing/afz154.
- Kenne Malaha, A.; Thébaut, C.; Achille, D.; Preux, P.-M.; Guerchet, M. Costs of Dementia in Low- And Middle-Income Countries: A Systematic Review. J. Alzheimer's Dis. 2023, 91, 115–128. https://doi.org/10.3233/JAD-220239.
- 4. Despina Wilson Report: Countries with the Highest Rates of Dementia. 2024 Available online: https://worldpopulationreview.com/country-rankings/dementia-rates-by-country (accessed on 2 May 2024).
- Kirch, J.; Marquardt, G. Towards Human-Centred General Hospitals: The Potential of Dementia-Friendly Design. *Arch. Sci. Rev.* 2023, 66, 382–390. https://doi.org/10.1080/00038628.2021.1933889.
- Aasim, D.S.; Banal, D.R.; Rana, D.S.; Ahmad, D.H.; Butt, D.M. Investigating The Efficacy of Neuro-Acoustic Loop Methodology (NALM) As A Therapeutic Avenue for Dementia and Alzheimer's Disease: A Computational Approach. J. Adv. Zool. 2022, 43, 531–535. https://doi.org/10.53555/jaz.v43i1.4277.
- Saragih, I.D.; Tonapa, S.I.; Yao, C.; Saragih, I.S.; Lee, B. Effects of Reminiscence Therapy in People with Dementia: A Systematic Review and Meta-analysis. J. Psychiatr. Ment. Health Nurs. 2022, 29, 883–903. https://doi.org/10.1111/jpm.12830.
- 8. Bayat, S.; Mihailidis, A. Outdoor Life in Dementia: How Predictable Are People with Dementia in Their Mobility? *Alzheimer's Dement. Diagn. Assess. Dis. Monit.* 2021, 13, e12187. https://doi.org/10.1002/dad2.12187.
- Xidous, D.; Grey, T.; Kennelly, S.P.; McHale, C.; O'Neill, D. Dementia Friendly Hospital Design: Key Issues for Patients and Accompanying Persons in an Irish Acute Care Public Hospital. *HERD Health Environ. Res. Des. J.* 2020, 13, 48–67. https://doi.org/10.1177/1937586719845120.
- Chapman, L.; Butchard, S. Palliative Care Guidelines in Dementia 3 Nd Edition North West Coast Strategic Clinical Network. Available online: https://www.england.nhs.uk/north-west/wp-content/uploads/sites/48/2024/11/Palliative-Care-Guidelines-in-Dementia-3rd-ed-Nov-2024-PDF-VERSION-1.pdf (accessed on 21 January 2025).
- Duncan, C.; Wilkinson, E.; Jaydeokar, S.; Acton, D.J. Assessing Adherence to National Institute for Health and Care Excellence Dementia Assessment and Diagnosis Guidelines in Adults with Intellectual Disability: A Retrospective Cohort Study. *Adv. Ment. Health Intellect. Disabil.* 2024, *18*, 12–21. https://doi.org/10.1108/AMHID-07-2023-0022.
- Flanagan, J.; Boltz, M.; Ji, M. Post-Acute Rehabilitation in Persons With Dementia: Does It Make a Difference? *Innov. Aging* 2020, 4, 189–189. https://doi.org/10.1093/geroni/igaa057.611.

- 13. Schlemmer, T. Impact of Social Isolation on Dementia. *Int. J. Nurs. Health Care Res.* 2023, *6*, 1442. https://doi.org/10.29011/2688-9501.101442.
- 14. Fleming, R.; Goodenough, B.; Low, L.-F.; Chenoweth, L.; Brodaty, H. The Relationship between the Quality of the Built Environment and the Quality of Life of People with Dementia in Residential Care. *Dementia* **2016**, *15*, 663–680. https://doi.org/10.1177/1471301214532460.
- 15. Marquardt, G.; Bueter, K.; Motzek, T. Impact of the Design of the Built Environment on People with Dementia: An Evidence-Based Review. *HERD Health Environ. Res. Des. J.* **2014**, *8*, 127–157. https://doi.org/10.1177/193758671400800111.
- 16. Vinay, R.; Biller-Andorno, N. A Critical Analysis of National Dementia Care Guidances. *Health Policy* 2023, 130, 104736. https://doi.org/10.1016/j.healthpol.2023.104736.
- 17. Appel, L.; Peisachovich, E.; Sinclair, D.; Jokel, R.; Da Silva, C. SafeHome: A Serious Game to Promote Safe Environments for Persons Living with Dementia. *Cureus* **2020**, *12*, e6949. https://doi.org/10.7759/cureus.6949.
- Chowdhary, N.; Barbui, C.; Anstey, K.J.; Kivipelto, M.; Barbera, M.; Peters, R.; Zheng, L.; Kulmala, J.; Stephen, R.; Ferri, C.P.; et al. Reducing the Risk of Cognitive Decline and Dementia: WHO Recommendations. *Front. Neurol.* 2022, *12*, 765584. https://doi.org/10.3389/fneur.2021.765584.
- 19. Federal Office of Public Health (FOPH). Available online: https://www.bag.admin.ch/bag/en/home.html (accessed on 21 January 2025).
- 20. Burtis, A. New Zealand Ministry of Health. J. Consum. Health Internet 2011, 15, 379–388. https://doi.org/10.1080/15398285.2011.623588.
- Hennelly, N.; O'Shea, E. Personhood, Dementia Policy and the Irish National Dementia Strategy. *Dementia* 2019, 18, 1810–1825. https://doi.org/10.1177/1471301217729232.
- 22. Whiteford, H. The Australian Health Ministers' Advisory Council (AHMAC) and the National Mental Health Reforms. *Australas. Psychiatry* **1994**, *2*, 101–104. https://doi.org/10.3109/10398569409082056.
- Chiu, Y.-C.; Algase, D.; Liang, J.; Liu, H.-C.; Lin, K.-N. Conceptualization and Measurement of Getting Lost Behavior in Persons with Early Dementia. *Int. J. Geriatr. Psychiatry* 2005, 20, 760–768. https://doi.org/10.1002/gps.1356.
- Bierbrauer, A.; Kunz, L.; Gomes, C.A.; Luhmann, M.; Deuker, L.; Getzmann, S.; Wascher, E.; Gajewski, P.D.; Hengstler, J.G.; Fernandez-Alvarez, M.; et al. Unmasking Selective Path Integration Deficits in Alzheimer's Disease Risk Carriers. *Sci. Adv.* 2020, 6, eaba1394. https://doi.org/10.1126/sciadv.aba1394.
- 25. Stangl, M.; Kanitscheider, I.; Riemer, M.; Fiete, I.; Wolbers, T. Sources of Path Integration Error in Young and Aging Humans. *Nat. Commun.* **2020**, *11*, 2626. https://doi.org/10.1038/s41467-020-15805-9.
- Caspi, E. Wayfinding Difficulties among Elders with Dementia in an Assisted Living Residence. *Dementia* 2014, 13, 429–450. https://doi.org/10.1177/1471301214535134.
- 27. McShane, R.; Gedling, K.; Keene, J.; Fairburn, C.; Jacoby, R.; Hope, T. Getting Lost in Dementia: A Longitudinal Study of a Behavioral Symptom. *Int. Psychogeriatr.* **1998**, *10*, 253–260. https://doi.org/10.1017/S1041610298005365.
- Olsson, A.; Skovdahl, K.; Engström, M. Strategies Used by People with Alzheimer's Disease for Outdoor Wayfinding: A Repeated Observational Study. *Dementia* 2021, 20, 505–517. https://doi.org/10.1177/1471301219896453.
- 29. Davis, R.; Sikorskii, A. Eye Tracking Analysis of Visual Cues during Wayfinding in Early Stage Alzheimer's Disease. *Dement. Geriatr. Cogn. Disord.* **2020**, *49*, 91–97. https://doi.org/10.1159/000506859.
- Ruginski, I.; Giudice, N.; Creem-Regehr, S.; Ishikawa, T. Designing Mobile Spatial Navigation Systems from the User's Perspective: An Interdisciplinary Review. *Spat. Cogn. Comput.* 2022, 22, 1–29. https://doi.org/10.1080/13875868.2022.2053382.
- Bourne, S.V.; Korom, M.; Dozier, M. Consequences of Inadequate Caregiving for Children's Attachment, Neurobiological Development, and Adaptive Functioning. *Clin. Child. Fam. Psychol. Rev.* 2022, 25, 166–181. https://doi.org/10.1007/s10567-022-00386-4.
- Førsund, L.H.; Grov, E.K.; Helvik, A.-S.; Juvet, L.K.; Skovdahl, K.; Eriksen, S. The Experience of Lived Space in Persons with Dementia: A Systematic Meta-Synthesis. *BMC Geriatr.* 2018, 18, 33. https://doi.org/10.1186/s12877-018-0728-0.
- Figueiro, M.; Kales, H. Lighting and Alzheimer's Disease and Related Dementias: Spotlight on Sleep and Depression. *Light. Res. Technol.* 2021, 53, 405–422. https://doi.org/10.1177/14771535211005835.
- Bonavita, A.; Teghil, A.; Pesola, M.C.; Guariglia, C.; D'Antonio, F.; Di Vita, A.; Boccia, M. Overcoming Navigational Challenges: A Novel Approach to the Study and Assessment of Topographical Orientation. *Behav. Res. Methods* 2022, 54, 752–762. https://doi.org/10.3758/s13428-021-01666-7.
- Seetharaman, K.; Shepley, M.M.; Cheairs, C. The Saliency of Geographical Landmarks for Community Navigation: A Photovoice Study with Persons Living with Dementia. *Dementia* 2021, 20, 1191–1212. https://doi.org/10.1177/1471301220927236.

- 36. Kessels, R.P.C.; van Doormaal, A.; Janzen, G. Landmark Recognition in Alzheimer's Dementia: Spared Implicit Memory for Objects Relevant for Navigation. *PLoS ONE* **2011**, *6*, e18611. https://doi.org/10.1371/journal.pone.0018611.
- O'malley, M.; Innes, A.; Muir, S.; Wiener, J.M. 'All the Corridors Are the Same': A Qualitative Study of the Orientation Experiences and Design Preferences of UK Older Adults Living in a Communal Retirement Development. *Ageing Soc.* 2018, 38, 1791–1816. https://doi.org/10.1017/S0144686X17000277.
- Marquardt, G. Wayfinding for People with Dementia: A Review of the Role of Architectural Design. *HERD Health Environ. Res.* Des. J. 2011, 4, 75–90. https://doi.org/10.1177/193758671100400207.
- van Buuren, L.P.G.; Mohammadi, M. Dementia-Friendly Design: A Set of Design Criteria and Design Typologies Supporting Wayfinding. *HERD Health Environ. Res. Des. J.* 2022, 15, 150–172. https://doi.org/10.1177/19375867211043546.
- 40. Mitchell, L.; Burton, E.; Raman, S.; Blackman, T.; Jenks, M.; Williams, K. Making the Outside World Dementia-Friendly: Design Issues and Considerations. *Env. Plann B Plan Des.* **2003**, *30*, 605–632. https://doi.org/10.1068/b29100.
- 41. Kwan, R.Y.C.; Cheung, D.S.K.; Kor, P.P.-K. The Use of Smartphones for Wayfinding by People with Mild Dementia. *Dementia* **2020**, *19*, 721–735. https://doi.org/10.1177/1471301218785461.
- 42. Davis, R.L.; Therrien, B.A.; West, B.T. Working Memory, Cues, and Wayfinding in Older Women. J. Appl. Gerontol. 2009, 28, 743–767. https://doi.org/10.1177/0733464809332785.
- 43. Bembibre, C.; Strlič, M. Smell of Heritage: A Framework for the Identification, Analysis and Archival of Historic Odours. *Herit. Sci.* **2017**, *5*, 2. https://doi.org/10.1186/s40494-016-0114-1.
- 44. Kolberg, E.; Pallesen, S.; Hjetland, G.; Nordhus, I.; Thun, E.; Flo-Groeneboom, E. Insufficient Melanopic Equivalent Daylight Illuminance in Nursing Home Dementia Units across Seasons and Gaze Directions. *Light. Res. Technol.* **2022**, *54*, 163–177. https://doi.org/10.1177/1477153521994539.
- Wiener, J.M.; Pazzaglia, F. Ageing- and Dementia-Friendly Design: Theory and Evidence from Cognitive Psychology, Neuropsychology and Environmental Psychology Can Contribute to Design Guidelines That Minimise Spatial Disorientation. *Cogn. Process.* 2021, 22, 715–730. https://doi.org/10.1007/s10339-021-01031-8.
- 46. Evans, S.C.; Waller, S.; Bray, J. Designing Inclusive Environments for People Living with Dementia: How Much Do We Really Know? *Work. Older People* 2022, *26*, 89–96. https://doi.org/10.1108/WWOP-09-2021-0049.
- 47. Olson, N.L.; Albensi, B.C. Dementia-Friendly "Design": Impact on COVID-19 Death Rates in Long-Term Care Facilities Around the World. J. Alzheimer's Dis. 2021, 81, 427–450. https://doi.org/10.3233/JAD-210017.
- Carter, B.; Justin, H.S.; Gulick, D.; Gamsby, J.J. The Molecular Clock and Neurodegenerative Disease: A Stressful Time. *Front. Mol. Biosci.* 2021, *8*, 644747. https://doi.org/10.3389/fmolb.2021.644747.
- Jao, Y.-L.; Wang, J.; Liao, Y.-J.; Parajuli, J.; Berish, D.; Boltz, M.; Van Haitsma, K.; Wang, N.; McNally, L.; Calkins, M. Effect of Ambient Bright Light on Behavioral and Psychological Symptoms in People with Dementia: A Systematic Review. *Innov. Aging* 2022, 6, igac018. https://doi.org/10.1093/geroni/igac018.
- 50. Blume, C.; Cajochen, C.; Schöllhorn, I.; Slawik, H.C.; Spitschan, M. Effects of Calibrated Blue–Yellow Changes in Light on the Human Circadian Clock. *Nat. Hum. Behav.* **2023**, *8*, 590–605. https://doi.org/10.1038/s41562-023-01791-7.
- 51. Liu, C.-R.; Liou, Y.M.; Jou, J.-H. Ambient Bright Lighting in the Morning Improves Sleep Disturbances of Older Adults with Dementia. *Sleep. Med.* **2022**, *89*, 1–9. https://doi.org/10.1016/j.sleep.2021.10.011.
- Al-Shahri, O.A.; Ismail, F.B.; Hannan, M.A.; Lipu, M.S.H.; Al-Shetwi, A.Q.; Begum, R.A.; Al-Muhsen, N.F.O.; Soujeri, E. Solar Photovoltaic Energy Optimization Methods, Challenges and Issues: A Comprehensive Review. J. Clean. Prod. 2021, 284, 125465. https://doi.org/10.1016/j.jclepro.2020.125465.
- 53. Boyce, P. Light, Lighting and Human Health. Light. Res. Technol. 2022, 54, 101–144. https://doi.org/10.1177/14771535211010267.
- 54. Roccaro, I.; Smirni, D. Fiat Lux: The Light Became Therapy. An Overview on the Bright Light Therapy in Alzheimer's Disease Sleep Disorders. *J. Alzheimer's Dis.* **2020**, *77*, 113–125. https://doi.org/10.3233/JAD-200478.
- 55. Zhang, M.; Wang, Q.; Pu, L.; Tang, H.; Chen, M.; Wang, X.; Li, Z.; Zhao, D.; Xiong, Z. Light Therapy to Improve Sleep Quality in Older Adults Living in Residential Long-Term Care: A Systematic Review. *J. Am. Med. Dir. Assoc.* 2023, 24, 65–74.e1. https://doi.org/10.1016/j.jamda.2022.10.008.
- 56. Rossi, M. Conclusions and Possible Guidelines for Circadian Lighting Design. In *Circadian Lighting Design in the LED Era;* Springer: Cham/Geneva, Switzerland, 2019; pp. 257–277, ISBN 978-3-030-11086-4.
- O' Philbin, L.; Woods, B.; Farrell, E.M.; Spector, A.E.; Orrell, M. Reminiscence Therapy for Dementia: An Abridged Cochrane Systematic Review of the Evidence from Randomized Controlled Trials. *Expert Rev. Neurother.* 2018, 18, 715–727. https://doi.org/10.1080/14737175.2018.1509709.

- 58. Gramegna, S.M. Reminiscence and Nostalgia: Designing Feasible Solutions for Dementia Care. *Int. J. Bus. Syst. Res.* **2022**, *16*, 199. https://doi.org/10.1504/IJBSR.2022.121144.
- Ching-Teng, Y.; Ya-Ping, Y.; Chia-Ju, L.; Hsiu-Yueh, L. Effect of Group Reminiscence Therapy on Depression and Perceived Meaning of Life of Veterans Diagnosed with Dementia at Veteran Homes. *Soc. Work. Health Care* 2020, *59*, 75–90. https://doi.org/10.1080/00981389.2019.1710320.
- Dempsey, L.; Murphy, K.; Cooney, A.; Casey, D.; O'Shea, E.; Devane, D.; Jordan, F.; Hunter, A. Reminiscence in Dementia: A Concept Analysis. *Dementia* 2014, 13, 176–192. https://doi.org/10.1177/1471301212456277.
- 61. Gonzalez, J.; Mayordomo, T.; Torres, M.; Sales, A.; Meléndez, J.C. Reminiscence and Dementia: A Therapeutic Intervention. *Int. Psychogeriatr.* **2015**, *27*, 1731–1737. https://doi.org/10.1017/S1041610215000344.
- Masaoka, Y.; Sugiyama, H.; Yoshida, M.; Yoshikawa, A.; Honma, M.; Koiwa, N.; Kamijo, S.; Watanabe, K.; Kubota, S.; Iizuka, N.; et al. Odors Associated with Autobiographical Memory Induce Visual Imagination of Emotional Scenes as Well as Orbitofrontal-Fusiform Activation. *Front. Neurosci.* 2021, *15*, 709050. https://doi.org/10.3389/fnins.2021.709050.
- Nordin, S.; McKee, K.; Wallinder, M.; von Koch, L.; Wijk, H.; Elf, M. The Physical Environment, Activity and Interaction in Residential Care Facilities for Older People: A Comparative Case Study. *Scand. J. Caring Sci.* 2017, 31, 727–738. https://doi.org/10.1111/scs.12391.
- 64. Ferdous, F. Positive Social Interaction by Spatial Design: A Systematic Review of Empirical Literature in Memory Care Facilities for People Experiencing Dementia. *J. Aging Health* **2020**, *32*, 949–961. https://doi.org/10.1177/0898264319870090.
- Thorgrimsen, L.; Schweitzer, P.; Orrell, M. Evaluating Reminiscence for People with Dementia: A Pilot Study. *Arts Psychother*. 2002, 29, 93–97. https://doi.org/10.1016/S0197-4556(01)00135-6.
- 66. Lai, C.K.Y.; Chi, I.; Kayser-Jones, J. A Randomized Controlled Trial of a Specific Reminiscence Approach to Promote the Well-Being of Nursing Home Residents with Dementia. *Int. Psychogeriatr.* **2004**, *16*, 33–49. https://doi.org/10.1017/S1041610204000055.
- 67. Akanuma, K.; Meguro, K.; Meguro, M.; Sasaki, E.; Chiba, K.; Ishii, H.; Tanaka, N. Improved Social Interaction and Increased Anterior Cingulate Metabolism after Group Reminiscence with Reality Orientation Approach for Vascular Dementia. *Psychiatry Res. Neuroimaging* **2011**, *192*, 183–187. https://doi.org/10.1016/j.pscychresns.2010.11.012.
- 68. Cotelli, M.; Manenti, R.; Zanetti, O. Reminiscence Therapy in Dementia: A Review. *Maturitas* 2012, 72, 203–205. https://doi.org/10.1016/j.maturitas.2012.04.008.
- Woods, B.; O'Philbin, L.; Farrell, E.M.; Spector, A.E.; Orrell, M. Reminiscence Therapy for Dementia. *Cochrane Database Syst. Rev.* 2018, 2018, CD001120. https://doi.org/10.1002/14651858.CD001120.pub3.
- 70. Macleod, F.; Storey, L.; Rushe, T.; McLaughlin, K. Towards an Increased Understanding of Reminiscence Therapy for People with Dementia: A Narrative Analysis. *Dementia* **2021**, *20*, 1375–1407. https://doi.org/10.1177/1471301220941275.
- 71. Lau, J.S.Y.; Tang, Y.M.; Gao, G.; Fong, K.N.K.; So, B.C.L. Development and Usability Testing of Virtual Reality (VR)-Based Reminiscence Therapy for People with Dementia. *Inf. Syst. Front.* **2024**, *1*, 1–16. https://doi.org/10.1007/s10796-024-10479-w.
- 72. Hadjri, K.; Rooney, C.; Faith, V. Housing Choices and Care Home Design for People With Dementia. *HERD: Health Environ. Res. Des. J.* **2015**, *8*, 80–95. https://doi.org/10.1177/1937586715573740.
- 73. Ludden, G.D.S.; van Rompay, T.J.L.; Niedderer, K.; Tournier, I. Environmental Design for Dementia Care-towards More Meaningful Experiences through Design. *Maturitas* **2019**, *128*, 10–16. https://doi.org/10.1016/j.maturitas.2019.06.011.
- 74. Cioffi, J.M.; Fleming, A.; Wilkes, L.; Sinfield, M.; Le Miere, J. The Effect of Environmental Change on Residents with Dementia. *Dementia* 2007, *6*, 215–231. https://doi.org/10.1177/1471301207080364.
- 75. Morgan-Brown, M.; Newton, R.; Ormerod, M. Engaging Life in Two Irish Nursing Home Units for People with Dementia: Quantitative Comparisons before and after Implementing Household Environments. *Aging Ment. Health* **2013**, *17*, 57–65. https://doi.org/10.1080/13607863.2012.717250.
- 76. Anderiesen, H.; Scherder, E.J.A.; Goossens, R.H.M.; Sonneveld, M.H. A Systematic Review Physical Activity in Dementia: The Influence of the Nursing Home Environment. *Appl. Erg.* **2014**, *45*, 1678–1686. https://doi.org/10.1016/j.apergo.2014.05.011.
- Gresham, M.; Taylor, L.; Keyes, S.; Wilkinson, H.; McIntosh, D.; Cunningham, C. Developing Evaluation of Signage for People with Dementia. *Hous. Care Support* 2019, 22, 153–161. https://doi.org/10.1108/HCS-12-2018-0035.
- 78. Davis, R.; Weisbeck, C. Creating a Supportive Environment Using Cues for Wayfinding in Dementia. *J. Gerontol. Nurs.* **2016**, *42*, 36–44. https://doi.org/10.3928/00989134-20160212-07.
- 79. Utton, D. The Design of Housing for People with Dementia. J. Care Serv. Manag. 2009, 3, 380–390. https://doi.org/10.1179/csm.2009.3.4.380.
- 80. Eastham, A.J.; Cox, D. Dementia-Friendly Wards. Int. J. Health Gov. 2017, 22, 25–36. https://doi.org/10.1108/IJHG-05-2016-0027.

- Porock, D.; Bakk, L.; Sullivan, S.S.; Love, K.; Pinkowitz, J.; Barsness, S. National Priorities for Dementia Care: Perspectives of Individuals Living with Dementia and Their Care Partners. J. Gerontol. Nurs. 2015, 41, 9–16. https://doi.org/10.3928/00989134-20150710-02.
- Mori, K.; Sakano, H. Olfactory Circuitry and Behavioral Decisions. *Annu. Rev. Physiol.* 2021, 83, 231–256. https://doi.org/10.1146/annurev-physiol-031820-092824.
- Kontaris, I.; East, B.S.; Wilson, D.A. Behavioral and Neurobiological Convergence of Odor, Mood and Emotion: A Review. *Front. Behav. Neurosci.* 2020, 14, 35. https://doi.org/10.3389/fnbeh.2020.00035.
- Olofsson, J.K.; Ekström, I.; Larsson, M.; Nordin, S. Olfaction and Aging: A Review of the Current State of Research and Future Directions. *Iperception* 2021, 12, 204166952110203. https://doi.org/10.1177/20416695211020331.
- Ferdenzi, C.; Joussain, P.; Digard, B.; Luneau, L.; Djordjevic, J.; Bensafi, M. Individual Differences in Verbal and Non-Verbal Affective Responses to Smells: Influence of Odor Label Across Cultures. *Chem. Senses* 2016, 41, 37–46. https://doi.org/10.1093/chemse/bjw098.
- D'Andrea, F.; Tischler, V.; Dening, T. The Development of a Multi-sensory Intervention for People with Dementia Living in Care Homes. *Alzheimer's Dement.* 2020, 16, e043522. https://doi.org/10.1002/alz.043522.
- Huang, Y.; Yuan, X. Smellscape as a Healing Factor in Institutional Gardens to Enhance Health and Well-being for Older People with Dementia: A Scoping Review. J. Clin. Nurs. 2024, 33, 454–468. https://doi.org/10.1111/jocn.16908.
- Tischler, V.; Clapp, S. Multi-Sensory Potential of Archives in Dementia Care. Arch. Rec. 2020, 41, 20–31. https://doi.org/10.1080/23257962.2019.1675147.
- Griffiths, S.; Dening, T.; Beer, C.; Tischler, V. Mementos from Boots Multisensory Boxes—Qualitative Evaluation of an Intervention for People with Dementia: Innovative Practice. *Dementia* 2019, 18, 793–801. https://doi.org/10.1177/1471301216672495.
- 90. Xiao, S.; Wang, Y.; Duan, S.; Li, B. Effects of Aromatherapy on Agitation and Aggression in Cognitive Impairment: A Metaanalysis. J. Clin. Nurs. 2021; 00:1–15. https://doi.org/10.1111/jocn.15984.
- 91. Fung, J.K.K.; Tsang, H.W.; Chung, R.C. A Systematic Review of the Use of Aromatherapy in Treatment of Behavioral Problems in Dementia. *Geriatr. Gerontol. Int.* **2012**, *12*, 372–382. https://doi.org/10.1111/j.1447-0594.2012.00849.x.
- 92. Cohen-Mansfield, J.; Marx, M.S.; Dakheel-Ali, M.; Regier, N.G.; Thein, K. Can Persons With Dementia Be Engaged With Stimuli? *Am. J. Geriatr. Psychiatry* **2010**, *18*, 351–362. https://doi.org/10.1097/JGP.0b013e3181c531fd.
- Dixon, E.; Anderson, J.; Lazar, A. Understanding How Sensory Changes Experienced by Individuals with a Range of Age-Related Cognitive Changes Can Affect Technology Use. ACM Trans. Access Comput. 2022, 15, 1–33. https://doi.org/10.1145/3511906.
- Olorunda, E.; McCrindle, R. Connecting Past and Present Through a Multisensory Toolkit—A Non-Pharmacological Intervention for People Living with Dementia; Springer: Cham/Geneva, Switzerland, 2023; ISBN 978-3-031-31359-2.
- Nishiura, Y.; Hoshiyama, M.; Konagaya, Y. Use of Parametric Speaker for Older People with Dementia in a Residential Care Setting: A Preliminary Study of Two Cases. *Hong. Kong J. Occup. Ther.* 2018, *31*, 30–35. https://doi.org/10.1177/1569186118759611.
- Raglio, A.; Bellandi, D.; Baiardi, P.; Gianotti, M.; Ubezio, M.C.; Zanacchi, E.; Granieri, E.; Imbriani, M.; Stramba-Badiale, M. Effect of Active Music Therapy and Individualized Listening to Music on Dementia: A Multicenter Randomized Controlled Trial. J. Am. Geriatr. Soc. 2015, 63, 1534–1539. https://doi.org/10.1111/jgs.13558.
- Nolan, B.A.D.; Mathews, R.M. Facilitating Resident Information Seeking Regarding Meals in a Special Care Unit: An Environmental Design Intervention. J. Gerontol. Nurs. 2004, 30, 12–16. https://doi.org/10.3928/0098-9134-20041001-07.
- Thomas, K.S.; Baier, R.; Kosar, C.; Ogarek, J.; Trepman, A.; Mor, V. Individualized Music Program Is Associated with Improved Outcomes for U.S. Nursing Home Residents with Dementia. *Am. J. Geriatr. Psychiatry* 2017, 25, 931–938. https://doi.org/10.1016/j.jagp.2017.04.008.
- Vozzella, S. Sensory Stimulation in Dementia Care. Top. Geriatr. Rehabil. 2007, 23, 102–113. https://doi.org/10.1097/01.TGR.0000270179.23952.23.
- 100. Jakob, A.; Collier, L. Sensory Enrichment for People Living with Dementia: Increasing the Benefits of Multisensory Environments in Dementia Care through Design. *Des. Health* **2017**, *1*, 115–133. https://doi.org/10.1080/24735132.2017.1296274.
- 101. Treadaway, C.; Kenning, G. Sensor E-Textiles: Person Centered Co-Design for People with Late Stage Dementia. *Work. Older People* 2016, 20, 76–85. https://doi.org/10.1108/WWOP-09-2015-0022.
- 102. Kenning, G.; Treadaway, C. Designing for Dementia: Iterative Grief and Transitional Objects. *Des. Issues* 2018, 34, 42–53. https://doi.org/10.1162/DESI_a_00475.

- 103. Bai, Z.; Tan, J.; Johnston, C.; Tao, X. Enhancing The Functionality of Traditional Interior Textiles with Integration of Optical Fibers. *Res. J. Text. Appar.* 2012, 16, 31–38. https://doi.org/10.1108/RJTA-16-04-2012-B004.
- Vrančić, A.; Zadravec, H.; Orehovački, T. The Role of Smart Homes in Providing Care for Older Adults: A Systematic Literature Review from 2010 to 2023. *Smart Cities* 2024, 7, 1502–1550. https://doi.org/10.3390/smartcities7040062.
- Calkins, M.; Szmerekovsky, J.G.; Biddle, S. Effect of Increased Time Spent Outdoors on Individuals with Dementia Residing in Nursing Homes. J. Hous. Elder. 2007, 21, 211–228. https://doi.org/10.1300/J081v21n03_11.
- 106. Lai, R.; Foladkar, M.; Dhaliwal, G.; Kibria, A.; Gualano, R.C.; Healy, M.L. Access to a Dementia-Friendly Garden on Behavioural and Psychological Symptoms of Dementia, Falls and Psychotropic Medication Use in Residents of an Aged Care Home in Melbourne, Australia. *Australas. Psychiatry* 2023, *31*, 356–362. https://doi.org/10.1177/10398562231160363.
- 107. Liao, M.-L.; Ou, S.-J.; Heng Hsieh, C.; Li, Z.; Ko, C.-C. Effects of Garden Visits on People with Dementia: A Pilot Study. *Dementia* 2020, 19, 1009–1028. https://doi.org/10.1177/1471301218793319.
- 108. Motealleh, P.; Moyle, W.; Jones, C.; Dupre, K. The Impact of a Dementia-Friendly Garden Design on People With Dementia in a Residential Aged Care Facility: A Case Study. *HERD: Health Environ. Res. Des. J.* 2022, 15, 196–218. https://doi.org/10.1177/19375867211063489.
- 109. Detweiler, M.B.; Sharma, T.; Detweiler, J.G.; Murphy, P.F.; Lane, S.; Carman, J.; Chudhary, A.S.; Halling, M.H.; Kim, K.Y. What Is the Evidence to Support the Use of Therapeutic Gardens for the Elderly? *Psychiatry Investig.* 2012, 9, 100. https://doi.org/10.4306/pi.2012.9.2.100.
- Uwajeh, P.C.; Iyendo, T.O.; Polay, M. Therapeutic Gardens as a Design Approach for Optimising the Healing Environment of Patients with Alzheimer's Disease and Other Dementias: A Narrative Review. *EXPLORE* 2019, 15, 352–362. https://doi.org/10.1016/j.explore.2019.05.002.
- 111. Lu, L.-C.; Lan, S.-H.; Hsieh, Y.-P.; Yen, Y.-Y.; Chen, J.-C.; Lan, S.-J. Horticultural Therapy in Patients With Dementia: A Systematic Review and Meta-Analysis. Am. J. Alzheimers Dis. Other Demen 2020, 35, 153331751988349. https://doi.org/10.1177/1533317519883498.
- 112. Kim, Y.H.; Park, C.S.; Bae, H.-O.; Lim, E.J.; Kang, K.H.; Lee, E.S.; Jo, S.H.; Huh, M.R. Horticultural Therapy Programs Enhancing Quality of Life and Reducing Depression and Burden for Caregivers of Elderly with Dementia. *J. People Plants Environ.* 2020, 23, 305–320. https://doi.org/10.11628/ksppe.2020.23.3.305.
- 113. Murroni, V.; Cavalli, R.; Basso, A.; Borella, E.; Meneghetti, C.; Melendugno, A.; Pazzaglia, F. Effectiveness of Therapeutic Gardens for People with Dementia: A Systematic Review. Int. J. Env. Res. Public. Health 2021, 18, 9595. https://doi.org/10.3390/ijerph18189595.
- 114. Rohra, H.; Mann, J.; Rommerskirch-Manietta, M.; Roes, M.; Kuliga, S. *Wayfinding and Urban Research*; Journal of Urban Design and Mental Health, Tokyo; 2021; Volume 7.
- Dai, J.; Moffatt, K. Enriching Social Sharing for the Dementia Community: Insights from In-Person and Online Social Programs. ACM Trans. Access Comput. 2023, 16, 1–33. https://doi.org/10.1145/3582558.
- 116. Torrington, J. The Design of Technology and Environments to Support Enjoyable Activity for People with Dementia. *Alter.* **2009**, *3*, 123–137. https://doi.org/10.1016/j.alter.2009.01.005.
- 117. Long, A.; Di Lorito, C.; Logan, P.; Booth, V.; Howe, L.; Hood-Moore, V.; van der Wardt, V. The Impact of a Dementia-Friendly Exercise Class on People Living with Dementia: A Mixed-Methods Study. *Int. J. Env. Res. Public. Health* **2020**, *17*, 4562. https://doi.org/10.3390/ijerph17124562.
- 118. Brorsson, A.; Öhman, A.; Lundberg, S.; Nygård, L. Accessibility in Public Space as Perceived by People with Alzheimer's Disease. *Dementia* **2011**, *10*, 587–602. https://doi.org/10.1177/1471301211415314.
- 119. Van Schaik, P.; Martyr, A.; Blackman, T.; Robinson, J. Involving Persons with Dementia in the Evaluation of Outdoor Environments. *Cyberpsychol. Behav.* **2008**, *11*, 415–424. https://doi.org/10.1089/cpb.2007.0105.
- 120. Biglieri, S. The Right to (Re) Shape the City. J. Am. Plan. Assoc. 2021, 87, 311–325. https://doi.org/10.1080/01944363.2020.1852100.
- 121. Gaber, S.N.; Thalén, L.; Malinowsky, C.W.; Margot-Cattin, I.; Seetharaman, K.; Chaudhury, H.; Cutchin, M.; Wallcook, S.; Kottorp, A.; Brorsson, A.; et al. Social Citizenship Through Out-of-Home Participation Among Older Adults With and Without Dementia. J. Appl. Gerontol. 2022, 41, 2362–2373. https://doi.org/10.1177/07334648221112425.
- 122. Gharaveis, A. A Systematic Framework for Understanding Environmental Design Influences on Physical Activity in the Elderly Population. *Facilities* **2020**, *38*, 625–649. https://doi.org/10.1108/F-08-2018-0094.
- Redfern, M.S.; Chaffin, D.B. Influence of Flooring on Standing Fatigue. Hum. Factors J. Hum. Factors Ergon. Soc. 1995, 37, 570– 581. https://doi.org/10.1518/001872095779049417.

- 124. Harris, D.D.; Detke, L.A. The Role of Flooring as a Design Element Affecting Patient and Healthcare Worker Safety. *HERD Health Environ. Res. Des. J.* 2013, *6*, 95–119. https://doi.org/10.1177/193758671300600308.
- 125. van den Berg, M.E.L.; Winsall, M.; Dyer, S.M.; Breen, F.; Gresham, M.; Crotty, M. Understanding the Barriers and Enablers to Using Outdoor Spaces in Nursing Homes: A Systematic Review. *Gerontologist* 2020, 60, e254–e269. https://doi.org/10.1093/geront/gnz055.
- 126. Soilemezi, D.; Kallitsis, P.; Drahota, A.; Crossland, J.; Stores, R.; Costall, A. The Impact of the Physical Home Environment for Family Carers of People with Dementia: A Qualitative Study. *J. Hous. Elder.* 2017, 31, 303–333. https://doi.org/10.1080/02763893.2017.1335666.
- 127. Olsen, R.V.; Hutchings, B.L.; Ehrenkrantz, E. The Physical Design of the Home as a Caregiving Support: An Environment for Persons With Dementia. *Care Manag. J.* **1999**, *1*, 125–131. https://doi.org/10.1891/1521-0987.1.2.125.
- 128. Grey, T.; Fleming, R.; Goodenough, B.J.; Xidous, D.; Möhler, R.; O'Neill, D. Hospital Design for Older People with Cognitive Impairment Including Dementia and Delirium: Supporting Inpatients and Accompanying Persons. *Cochrane Database Syst. Rev.* 2019, 11, 1-16. https://doi.org/10.1002/14651858.CD013482.
- 129. Delcampo-Carda, A.; Torres-Barchino, A.; Serra-Lluch, J. Chromatic Interior Environments for the Elderly: A Literature Review. *Color. Res. Appl.* **2019**, *44*, 381–395. https://doi.org/10.1002/col.22358.
- 130. Joseph, A.; Zimring, C. Where Active Older Adults Walk. Env. Behav. 2007, 39, 75–105. https://doi.org/10.1177/0013916506295572.
- 131. Porter, M.M.; Borges, B.; Dunn, N.J.; Funk, L.; Guse, L.; Kelly, C.; Mallory-Hill, S.; Roger, K. Renovations of a Long-Term Care Center for Residents with Advanced Dementia—Impact on Residents and Staff. J. Aging Environ. 2024, 38, 109–135. https://doi.org/10.1080/26892618.2022.2151544.
- 132. Quesada-García, S.; Valero-Flores, P.; Lozano-Gómez, M. Residential Care Facilities for Users with Alzheimer's Disease: Characterisation of Their Architectural Typology. *Buildings* **2024**, *14*, 3307. https://doi.org/10.3390/buildings14103307.
- 133. Schwarz, B.; Chaudhury, H.; Tofle, R.B. Effect of Design Interventions on a Dementia Care Setting. *Am. J. Alzheimers Dis. Other Demen* 2004, *19*, 172–176. https://doi.org/10.1177/153331750401900304.

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