

Evidence Based Practice Review

Ageing in Place with Dementia:

Modifications and Design Innovations for the Home

**PEER
REVIEWED**

Authored by
Sima Alizadeh

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Abstract

Background: Most people living with dementia prefer to remain in their own homes for as long as possible. The domestic environment plays a critical role in supporting safety, independence, and wellbeing, yet cognitive and functional changes associated with dementia can make ordinary homes increasingly challenging. Design innovations—including architectural modifications, environmental design strategies, and assistive technologies—have the potential to support ageing in place, but the evidence base is diverse and fragmented across disciplines.

Objectives: To map and synthesise existing evidence on home-based design innovations that support ageing in place for people living with dementia, and to identify key themes, barriers, and gaps to inform practice, policy, and future research.

Search Methods: A scoping review was conducted using pre-specified Population–Concept–Context criteria (Population: people living with dementia; Concept: environmental, architectural, and design-related interventions, including assistive technologies; Context: private domestic dwellings).

Data Collection and analysis: Thirty-five full-text publications were reviewed in full. Data were charted into a structured extraction table and analysed using design-focused thematic synthesis.

Results: Twenty-three studies met the inclusion criteria, comprising empirical intervention studies, qualitative and mixed-methods research, scoping and systematic reviews, and design-led research. The strongest and most consistent evidence related to low-cost home modifications were associated with reduced falls risk and improved usability, in particular bathroom adaptations, grab rails, lighting improvements, and circulation safety. Assistive and smart-home technologies showed potential benefits for safety and daily functioning, but evidence was heterogeneous and highly dependent on usability, personalisation, and support. Cross-

cutting themes included balancing safety with autonomy, preserving familiarity and “home-ness”, cognitive accessibility, professional involvement, and implementation barriers such as cost, access to services, and workforce capacity.

Authors Conclusions: Evidence supports prioritising practical, low-cost, and adaptable home modifications to enable people with dementia to age in place safely and with dignity. While digital and smart-home technologies are promising, further standardised evaluation and economic analysis are required. Policy and practice should focus on improving early access to home assessment, embedding dementia-inclusive design in housing systems, and supporting scalable demonstration and implementation initiatives.

Keywords

dementia; Alzheimer; ageing in place; aging in place; home; housing; design; environmental modification; assistive technology; smart home; innovation

Contribution of Authors

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The following Specialist Review Panel members provided their expertise and feedback for this document:

Dr Konstantina Vasilakopoulou	Royal Melbourne Institute of Technology (RMIT)
Deborah Hammond	Occupational Therapy Australia (OTA)

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List of Abbreviations

ADL	Activities of Daily Living
AIHW	Australian Institute of Health and Welfare
AT	Assistive Technology
CASP	Critical Appraisal Skills Programme
GPS	Global Positioning System
HEAP-R	Home Environmental Assessment Protocol–Revised
HOME FAST	Home Falls and Accidents Screening Tool
HVAC	Heating, Ventilation, and Air Conditioning
ICF	International Classification of Functioning, Disability and Health
IDDS	Inclusive Design for Dementia Standard
IDEAL	Improving the Experience of Dementia and Enhancing Active Life
JBİ	Joanna Briggs Institute
MMAT	Mixed Methods Appraisal Tool
MMSE	Mini-Mental State Examination
NCC	National Construction Code
NICE	National Institute for Health and Care Excellence
ONS	Office for National Statistics
OT	Occupational Therapist / Occupational Therapy
PCC	Population–Concept–Context
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PRISMA-ScR	PRISMA Extension for Scoping Reviews
PwD	People with Dementia
QoL	Quality of Life

RCT	Randomised Controlled Trial
UK	United Kingdom
USA	United States of America
WHO	World Health Organization

Background

Ageing in Place, Dementia, and the Role of the Home

Population ageing is a defining demographic trend in Australia and internationally, accompanied by a substantial raise in the number of people living with dementia (World Health Organization, 2025; Yin et al., 2025). Dementia is a progressive condition associated with changes in cognition, perception, mobility, behaviour, communication and function, with substantial impacts on individuals, families, communities and health systems (Shah et al., 2024). In Australia, dementia represents a major and growing health and social issue, and national reporting highlights its increasing prevalence and system impacts (AIHW, 2025; Dementia Australia, 2024; Htun et al., 2025). Despite these challenges, most people living with dementia express a strong preference to remain in their own homes for as long as possible rather than moving into institutional care, consistent with broader ageing-in-place goals (AIHW, 2008; Evans et al., 2019; Runge et al., 2009). Supporting ageing in place is therefore a central objective of contemporary health, housing, and aged-care policy.

The home environment occupies a critical position in this context and can be both protective and risky for people living with dementia. Homes provide familiarity, emotional security, and continuity of identity, which are particularly important for people experiencing cognitive change (Newton et al., 2023; van Hoof et al., 2010). Familiar surroundings, personal belongings, and established routines can support orientation, reduce anxiety, and enable ongoing participation in everyday life (Davis & Weisbeck, 2016; Margot-Cattin et al., 2021; Marquardt et al., 2014). Conversely, dementia-related cognitive and functional changes can make common dwelling features difficult or hazardous. Features such as bathroom layouts, stairs, poor lighting, complex or confusing circulation routes, visual clutter, inaccessible or poorly designed bathrooms, and a lack of environmental cues for navigation can increase falls risk, restrict independence in activities of daily living (Dalvand et al., 2024; Davis & Weisbeck, 2016; van Hoof et al., 2010), contribute to caregiver burden, and precipitate unplanned transitions to residential care (Newton et al., 2023).

As dementia progresses, households often face difficult decisions about when and how to modify the home (Newton et al., 2023; Struckmeyer, 2019). Interventions that improve safety may inadvertently disrupt familiarity or contribute to an institutional feel, undermining a person's sense of home (Marquardt et al., 2014; Soilemezi et al., 2019; van Hoof et al., 2010). These tensions highlight the importance of design approaches that balance risk management with autonomy, dignity, and wellbeing.

Design Innovations to Support Living at Home with Dementia

Over the past two decades, research and practice have increasingly focused on environmental and design-based strategies to support people living with dementia at home. These strategies encompass a broad range of interventions, including architectural modifications (such as bathroom adaptations, grab rails, flooring, and circulation

improvements) (e.g., Allen, 2018; Dalvand et al., 2024; Soilemezi et al., 2019), environmental adaptations (such as lighting, contrast, colour, cueing and wayfinding supports, and sensory design) (e.g., Davis & Weisbeck, 2016; Marquardt, 2011; van Hoof et al., 2010), and assistive or smart-home technologies embedded within the domestic environment (e.g., Cornelius et al., 2025; Schneider et al., 2024; Tiersen et al., 2021; Wang et al., 2025) (Figure 1).



Figure 1. Domains and disciplines of design innovations to support ageing in place with dementia

Evidence suggests that well-targeted home modifications can reduce hazards and support functional independence (Dalvand et al., 2024; Newton et al., 2023; Park et al., 2023), while qualitative research highlights the role of design in shaping autonomy, identity, and everyday experience for people living with dementia (Soilemezi et al., 2019; van Hoof et al., 2010; Zhang et al., 2025). Alongside low-cost and low-tech adaptations, digital and smart-home technologies are increasingly promoted as tools to enhance safety, monitor risk, and support daily activities (Cornelius et al., 2025; Schneider et al., 2024; Tiersen et al., 2021; Wang et al., 2025). However, uptake and sustained use of such technologies remain uneven, with outcomes shaped by usability, personalisation, and access to ongoing support (Henderson et al., 2020; Ma et al., 2022; Martin & Jones, 2025; Nauha et al., 2018).

While there is a growing body of work in this area, the evidence base is dispersed across architecture, housing studies, occupational therapy, gerontology, nursing, engineering, and human–computer interaction. It also spans diverse evidence types, from empirical studies and reviews to design guidelines and grey literature. As a result, the evidence base is fragmented, making it difficult for designers, service providers, and policymakers to interpret what is known, what is implementable in real homes, and where evidence gaps remain (e.g., Newton et al., 2023; O'Malley & Croucher, 2005; Soilemezi et al., 2019). Design-relevant insights are not always synthesised in ways that support translation into policy or practice.

Gaps in the Current Evidence Base

Despite growing interest in dementia-friendly home design, several gaps persist. First, much of the dementia design literature has focused on institutional settings, limiting its direct

applicability to private homes. Second, studies vary considerably in how they conceptualise and evaluate home design innovations, with many prioritising physical safety outcomes over autonomy, participation, or quality of life. Third, evidence on assistive and smart-home technologies is heterogeneous, with relatively few robust or long-term evaluations in real-world domestic settings.

There is also limited synthesis of barriers and facilitators affecting implementation, such as cost, housing tenure, access to professional advice, and workforce capacity. Without a consolidated overview, opportunities to embed dementia-inclusive design principles into mainstream housing systems and home-modification programs remain constrained.

Rationale for a Scoping Review

A scoping review is appropriate where a topic is multidisciplinary, evidence is heterogeneous, and the purpose is to map the scope and characteristics of available knowledge rather than estimate pooled effectiveness. This review follows recognised scoping review guidance and reporting standards to enhance transparency and reproducibility (Peters et al., 2020).

Aim, Objectives, and Review Questions

Aim

The aim of this scoping review is to map and synthesise existing evidence on home design innovations that support ageing in place for people living with dementia in domestic dwellings, and to identify themes and gaps to inform design practice, service delivery, policy development, and future research.

Objectives

The review seeks to:

- Identify and map design innovations, adaptations and technologies that enable people with dementia to age in place safely and comfortably.
- Explore principles, strategies and environmental features that support autonomy, safety and wellbeing at home.
- Identify barriers and facilitators influencing implementation in real-world homes.

- Highlight gaps and implementation challenges relevant to designers, service providers and policymakers.

Review questions

1. What home design innovations have been implemented or proposed to support people with dementia ageing in place?
2. Of those environmental, architectural, and technological design elements, which contribute to safety, independence, and quality of life at home?
3. What evidence exists regarding the effectiveness, usability, and user experience of these design features?
4. What barriers and facilitators influence implementation in domestic settings?
5. What gaps remain in the current evidence base?

Methods

Study Design and Reporting

This study was conducted as a scoping review in accordance with the Joanna Briggs Institute (JBI) methodology and guidance for scoping reviews and is reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) checklist ([Peters et al., 2020](#); [Tricco et al., 2018](#)).

A scoping review approach was selected because the topic spans multiple disciplines and includes diverse forms of evidence ([Arksey & O'Malley, 2005](#); [Peters et al., 2020](#)). This methodology is particularly appropriate where study designs and evidence types are heterogeneous and require mapping across disciplines rather than meta-analytic pooling ([Munn et al., 2018](#); [Tricco et al., 2018](#)). The purpose of the review was to map the extent, nature, and characteristics of available evidence rather than to assess intervention effectiveness or conduct meta-analysis.

Population–Concept–Context Framework

Eligibility criteria were guided by the JBI Population–Concept–Context (PCC) framework ([Peters et al., 2020](#)).

- **Population:**
People living with dementia (any type or stage) residing in the community, and where relevant their informal carers or household members.
- **Concept:**
Home design innovations intended to support living at home, including architectural modifications, environmental design strategies, home modifications, assistive technologies, smart-home systems, wayfinding and sensory design, and other adaptations that influence interaction with the home environment.
- **Context:**
Private dwellings and community housing. Studies conducted solely in

hospitals or residential aged-care facilities were excluded unless findings were explicitly transferable to private homes.

Eligibility Criteria

Inclusion criteria

Studies were included in this review if they focused on people living with dementia in domestic or community housing settings, examined environmental, architectural, or technological design features related to the home, reported empirical findings, reviews, design case studies, standards, or relevant grey literature, and were published in English from 2010 onwards (Table 1).

Exclusion criteria

Studies were excluded from this review if they focused exclusively on institutional settings with no relevance to private homes, examined purely clinical, pharmacological, or psychosocial interventions without an environmental or design component, reported laboratory-only studies or technologies not integrated into the home environment, were opinion pieces without substantive evidence, and were published prior to 2010 (unless historically significant) and not in English (unless translation available) (Table 1).

Table 1. Inclusion and Exclusion Criteria

Criteria	Include	Exclude
Population	People with dementia living at home (including mild–moderate dementia)	Institutional settings (nursing homes, hospitals)
Concept	Environmental, architectural, or technological design features	Purely clinical, pharmacological, or psychological interventions
Context	Domestic or residential homes or community housing	Laboratory-only or hospital-based settings
Evidence types	Peer-reviewed research (qualitative, quantitative, mixed), design case studies,	Opinion pieces without data, unrelated health-only studies

	reports, guidelines, theses, and grey literature	
Timeframe	From 2010 onward (to capture recent design innovations)	Older than 2010 unless historically significant
Language	English	Non-English (unless translation available)

Information Sources and Search Strategy

A comprehensive search was undertaken to identify peer-reviewed journal articles, theses, design standards, and relevant grey literature (including dementia organisations and housing/design bodies) using search terms combining dementia and home-based design innovations. Google Scholar was selected as the primary search platform because the topic spans architecture, housing, health, and design disciplines, and relevant evidence is frequently published outside conventional biomedical databases. Search results were screened using predefined inclusion and exclusion criteria. Search terms included combinations of:

*(dementia OR Alzheimer) AND (“ageing in place” OR “aging in place” OR home OR housing) AND (design OR architecture OR “environmental modification” OR “assistive technology” OR “smart home” OR innovation).**

Reference lists of key sources were also examined to identify additional potentially relevant records.

Study Selection Process

Screening occurred in multiple stages:

1. **Google Scholar screening yield:** The Google Scholar search returned 96 records.

2. **First screening (titles and rapid abstract scan):** 41 records were progressed as candidate studies.
3. **Second screening (abstract assessment):** After careful abstract review, 35 records were included for full-text screening.
4. **Full-text assessment:** Full texts of 35 studies were assessed against the PCC eligibility criteria.
5. **Inclusions/exclusions at full text:** 23 studies met inclusion criteria and were included in the scoping review; 12 studies were excluded at full-text stage for one or more of the following reasons: were not dementia-focused, did not address home-based context, and/or the concept was not environmental/architectural/technological design features relevant to the home.

A PRISMA-ScR flow diagram (Figure 2) summarises the selection pathway (Tricco et al., 2018).

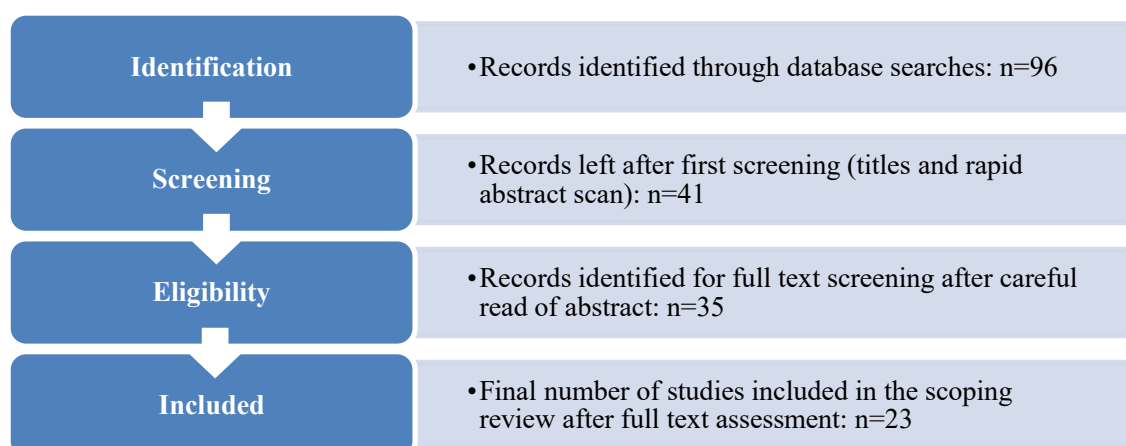


Figure 2. PRISMA flow diagram of the study selection process

Data Charting

Data were extracted using a structured charting form aligned with JBI scoping review guidance. For each included study, the following data were extracted (Table 2):

- Citation details (author(s), year, title, country)
- Study type and setting

- Population and sample characteristics
- Study aim
- Design features or innovation focus
- Methods
- Outcomes reported and benefits
- Key findings
- Barriers and facilitators
- Study limitations

Where information was not reported, this was recorded as “not stated.”

Data Synthesis

Consistent with scoping review methodology, no formal quality appraisal was undertaken, and no meta-analysis was conducted. Extracted data were synthesised descriptively and through design-focused thematic synthesis and organised into thematic groupings reflecting types of design **innovations** and cross-cutting implementation considerations. Evidence was grouped by **innovation type** and implementation issues, with study type and evident methodological constraints (e.g., small samples, pilot designs) noted in the evidence table (Table 2).

Results are presented narratively and in tabular form (Table 2) to support transparency and translation to policy and practice.

Results

Overview of Included Studies

Following full-text assessment of 35 publications, 23 studies met the inclusion criteria and were included in this scoping review. Together, these studies examined a wide range of environmental, architectural, and technological interventions. These studies

were synthesised to identify design innovations that support ageing in place for people with dementia (PwD) in domestic settings. The included evidence base was heterogeneous and interdisciplinary, comprising:

- **Empirical intervention studies**, including one randomised controlled trial and several quasi-experimental or longitudinal studies evaluating home modifications and falls prevention (e.g., [Dalvand et al., 2024](#); [Yeni & Yilmaz, 2022](#)).
- **Qualitative and mixed-methods studies** exploring how people living with dementia and their carers adapt home environments and experience assistive technologies (e.g., [Allen et al., 2019](#)).
- **Systematic and scoping reviews** addressing home modifications, assistive technologies, smart-home systems, and the role of housing in dementia care (e.g., [Cornelius et al., 2025](#); [Martin & Jones, 2025](#); [Newton et al., 2023](#); [Soilemezi et al., 2019](#); [Struckmeyer & Pickens, 2015](#)).
- **Conceptual and design-focused research** that translated research and expert consensus into dementia-friendly housing principles relevant to domestic settings (e.g., [Balocating-Dunn, 2025](#); [van Hoof, 2010](#); [van Hoof et al., 2010](#)).
- **Guidelines, standards, and grey literature** (e.g., [Grey et al., 2015](#); [Moore et al., 2017](#)).

Most empirical studies focused on older adults with dementia living in private dwellings, sometimes within broader cohorts of older people or people with disability. Reviews varied in scope; some were dementia-specific, while others addressed ageing in place more broadly but included dementia-relevant findings. The included literature was predominantly from high-income countries, particularly the United Kingdom and United States of America.

Detailed characteristics of included studies are presented in Table 2 (Evidence Extraction Table).

Table 2. Evidence Extraction: Detailed Characteristics of Included Studies

ID	Bibliography details (Authors/ Year/ Title/ Country)	Study Type & Setting	Population & Sample Characteristics	Aim	Design Features / Innovation Type	Methods	Outcomes / Benefits	Key Findings	Barriers / Facilitators	Study Limitation(s)
1	Marquardt et al. (2011) A Descriptive Study of Home Modifications for People with Dementia and Barriers to Implementation USA	Type: Observational descriptive cross-sectional analysis (from an RCT cohort) Setting: Private homes and Community-dwelling (single-family, apartments, townhouses) in Baltimore	82 older adults with dementia living at home; mean age 84.5; 62% women; dementia severity: mild 44%, moderate 38%, severe 17%	To describe home environmental features, safety issues, and health-related modifications among community-dwelling elders with dementia; also to characterise behaviour/ orientation and caregiver wishes and acceptance regarding modifications	Home modifications and environmental design features: entrance/step railings, ramps, interior stair lifts; bathroom safety (grab bars, walk-in shower, shower seat); removal of rugs/clutter; moving bedroom downstairs; signage/labels; additional day/night/automatic lighting; locks/exit control/door chimes; stove safety; alarm systems; assistive tech	Home walkthrough and assessment by an architect using an assessment developed for the study (observation + simple house plan sketch) and an 8-item caregiver questionnaire; participants drawn from MIND at Home Phase 2 RCT; assessments at baseline or 9-month visit	Described prevalence of environmental obstacles, modifications implemented/considered, falls locations, wayfinding/wandering abilities, caregiver wishes, acceptance of suggested changes, and use of assistive technologies	Many hazards unaddressed despite risk. Steps (inside/outside) and lack of handrails common; only 23% had bathrooms with ≥3 key safety features; 12% homes very cluttered; 57% reported ≥1 fall in past 2 years (most in bedrooms); cognitive-supportive mods (e.g., signs/labels) less implemented than physical-safety mods; assistive	Barriers: Awareness and cost; lack of knowledge on how to implement, time constraints, anticipated non-acceptance by the person with dementia Facilitators: Recommendations from professionals (OT/PT/study team) and caregiver recognition	Convenience sample limits generalisability; prior study advice may have increased modifications; overall use of home modifications still low; findings may not represent the general population

					(emergency call buttons, baby monitors)			technology use was rare (mainly emergency call buttons); exit control used mainly in moderate stages; professional advice (OT/PT/study team) often prompted modifications		
2	Martin and Jones (2025) A scoping review of how people living with dementia perceive and use assistive technology to support everyday activities in their homes UK	Type: Scoping review Setting: Domestic homes / community dwelling (explicitly excludes care homes, living labs, and institutions)	PwD living at home Evidence synthesis of 13 studies; total participants across included studies: 168 people living with dementia and 136 carers	To explore how people living with dementia perceive and use assistive technology in everyday home-based activities and to identify barriers and facilitators to adoption and ongoing use	Assistive technologies used in homes: telecare and monitoring systems (e.g., sensors, alarms), GPS and wayfinding tools, electronic reminders (day clocks, pill dispensers), communication technologies (phones, tablets, videoconferencing), digital platforms for	Systematic database search (CINAHL, Medline, ASSIA, PsycINFO, PubMed); PRISMA-ScR framework; PCC framework; qualitative thematic analysis; consultation exercise with 3 people living with dementia	Identifies how assistive technology supports daily activity, independence, participation in ADLs, safety, communication, and maintenance of identity for people living with dementia at home	Acceptance linked to usability & familiarity (People living with dementia accept and use AT when it supports meaningful activities); individualised strategies and ongoing support are critical; AT use can maintain identity, autonomy, and personhood; AT can also result in	Barriers: Complexity stigma, self-perception and confidence in learning technology, cost, lack of information, insufficient support, usability and functionality issues, cognitive fatigue, unintended negative consequences	No quality appraisal; review excludes non-English studies; limited representation across all dementia stages; two included papers derived from the same dataset; findings may not generalise beyond

					leisure and ADLs			unintended negative outcomes	Facilitators: Positive attitudes to technology, person-centred assessment, meaningful activities, routines, repetition, training, family/carer support	home settings
3	van Hoof (2010) Ageing-in-place: The integrated design of housing facilities for people with dementia Netherlands	Type: Doctoral thesis (mixed-methods research programme ; design research) Setting: Housing for ageing (Community-dwelling and private homes; domestic housing)	PwD living at home and family carers; sample sizes vary across constituent studies (not consistently specified in summary)	To investigate how architectural , indoor environmental, and technological housing features support ageing-in-place for people with dementia and their carers, and to propose an	Integrated housing, environmental & technological design, combining: architectural home modifications; indoor environmental design (lighting, thermal comfort, acoustics); building services (HVAC); assistive and	Multi-method approach including literature review; qualitative interviews; focus groups and case studies; observations of existing homes; behavioural observations; physiological measurements; clinical-controlled	Design principles for autonomy (identifies how integrated architectural and technological design can support ADLs, safety, wellbeing, behavioural regulation, caregiver burden reduction, and delayed	Supportive housing design (integrated design) can improve usability and reduce behavioural problems, improve safety and comfort, support ADLs, and enable ageing-in-place; indoor environment (especially lighting and climate) has significant	Barriers: Mixed settings; lack of structurally available dementia-specific home modifications; limited policy and funding support for home adaptations; dominance of institutional-focused research; ethical and	Limited generalisability due to variation in methods across studies; many findings derived from European context; limited empirical testing in real-world existing homes; conceptual

		(explicit focus on own home rather than institutional settings)		integrated conceptual home design	ambient intelligence technologies; conceptual dementia-supportive home design	trials on lighting; design study producing a conceptual dementia-supportive dwelling	institutionalisation)	influence on behaviour and wellbeing; existing housing stock insufficiently adapted for dementia	privacy concerns with ambient intelligence; limited implementation in existing housing stock Facilitators: Integrated building–healthcare framework; evidence-based design; policy emphasis on ageing-in-place	design not fully implemented or evaluated in practice
4	Struckmeyer (2019) Aging in Place with Dementia: A Single Case Study USA	Type: Qualitative single case study Setting: Private domestic home (community-dwelling)	n = 1 dyad: caregiver spouse (male, 87) and person with dementia (female, 85) living at home	To explore what home modifications caregivers consider and implement for spouses with dementia to promote safe ageing in place, and how decisions	Home modifications and adaptations including physical modifications (removal of throw rugs, widened steps, improved lighting, removal of bathroom door, night lights), and	In-home semi-structured interview; guided home walk-through; observation using the Home Environmental Assessment Protocol–Revised (HEAP-R); qualitative coding and	Supports safe ageing in place; increased home safety; identification of previously unrecognised hazards through structured assessment	Home modifications were both physical and temporal; decisions to modify the home were influenced more by adverse events (e.g., falls) than by professional recommendations; professional recommendation	Barriers: Procrastination/ lack of motivation; delayed action until adverse events; reliance on caregiver judgement rather than professional advice Facilitators:	Single case (n=1) limits transferability; no member checking; findings not generalisable

				about modification s are made	temporal/enviro nmental strategies (daily routines, verbal cues, touch cues)	thematic analysis		s were sometimes delayed or ignored; structured home assessment identified additional risks beyond interview alone	Caregiver awareness and education; background knowledge; active lifestyle; use of structured assessment tools	
5	Balocating-Dunn (2025) An Inclusive Design for Dementia Standard: Enabling Future Home Adaptations in the UK UK	Type: Doctoral thesis; mixed-methods design research Setting: Mainstream domestic housing in the UK (new-build and existing homes; non-institutional)	Multiple participant groups across studies: Study 1 n=59 housing professionals; Study 2 n=35 retired homeowners (with and without dementia); Study 3 n=18 retired homeowners (with and without dementia);	To address the absence of a dementia-inclusive building standard for mainstream UK housing and develop a design standard enabling future home adaptations to support people with dementia	Development of an Inclusive Design for Dementia Standard (IDDS) for housing, covering: spatial layout; stairs; ground-floor toilet/wet room; level access entrances; wider halls; ground-floor bedrooms; assistive technology; lighting and windows; acoustics; private outdoor	Multi-stage research programme: review of UK Building Regulations (Part M / ADMv1); literature review; questionnaires ; semi-structured interviews; thematic analysis; iterative standard development (IDDS v1.0 → v2.0) with	Provides a structured, dementia-inclusive housing design standard to support independence, safety, accessibility, usability, and ageing in place; aims to future-proof housing stock for cognitive decline	Identifies a major gap in UK housing standards regarding dementia; stairs and bathroom access are key challenges; mainstream accessibility standards insufficient for cognitive impairment; inclusive design must address cognitive, emotional, and functional needs; IDDS proposes explicit dementia-	Barriers: Absence of dementia-specific housing standards; inconsistent interpretation of Building Regulations; lack of dementia awareness among housing professionals; uncertainty about compliance requirements Facilitators: Inclusive design framework;	Not all recommendations empirically tested in real homes; findings primarily UK-specific; standard development rather than outcome evaluation; qualitative emphasis limits generalisability

			people with dementia included as participants		space; future-proofed adaptability of homes	participant feedback		specific housing requirements	stakeholder engagement; lived-experience input; iterative feedback; alignment with ageing-in-place policy goals	
6	Nauha et al. (2018) Assistive technologies at home for people with a memory disorder Finland	Type: Experimental field study (mixed-methods evaluation) Setting: Home environment and assisted living facility (MemoryHelp apartment); includes real private homes	9 people with a memory disorder: 5 in assisted living (MemoryHelp apartment) and 4 living at home; caregivers: 8 nurses and 3 family caregivers	To assess whether assistive technologies support caregivers and care staff, and whether they support the independence and security of people with memory disorders	Assistive technologies and home-based systems: fall alarms, bed alarms, GPS safety bracelet, web-chat tablet, motion and carpet alarms, reminder devices, motion-activated lighting, calendar clocks, talking photo album, therapy apron/cube, weighted blanket	Experimental testing of devices; questionnaires on utility and usability; caregiver diaries; logged device data; MMSE at baseline; COPE Index for family caregivers in home setting	Some AT supported caregiving work and safety; simple devices perceived as most useful; GPS enabled continued independent walking; calendar clocks and talking albums well accepted	Simple AT and alarms were most useful; GPS bracelet improved safety and independence; short-range alarms supported supervision at home; complex systems had low usability; multiple false alarms common	Barriers: Technical failures, false alarms, poor sound quality, complex interfaces, connectivity issues, battery charging burden Facilitators: Simplicity, reliability, ease of use, relevance to daily routines	Small sample size; short test periods per participant; mixed settings; independence outcomes not fully evaluable; multiple devices tested simultaneously may have caused confusion
7	Henderson et al. (2020)	Type:	Quantitative analyses	To investigate	Assistive technologies	Scoping review to	Examines relationships	Majority of participants used	Barriers:	Secondary analysis

	Assistive technology and home modifications: outcomes for people living with dementia and their carers, service use patterns and costs UK	Secondary data analysis of longitudinal cohort (IDEAL study) with scoping review Setting: Community-dwelling private homes (explicitly excludes care homes)	focused on 1,141 people living with dementia and their carers living at home across three waves (2014–2018); full IDEAL cohort at Wave 1: 1,537 people with dementia and 1,277 carers	how assistive technology and home modifications relate to outcomes for people living with dementia and their carers over time, using theory-driven analyses	and home modifications including: mobility aids and modifications (sticks, rails), ADL equipment (bath, shower, toilet adaptations), safety/falls-related devices, memory aids, limited use of electronic AT (sensors, GPS)	identify theoretical frameworks; advisory board consultation; secondary quantitative analyses of IDEAL cohort data using ICF model; latent class analysis; path modelling of AT use, outcomes, service use, and costs	between AT use, functional independence, social connectedness, falls, service use, and carer outcomes (health, quality of life, social connectedness)	some AT (63–68%); AT for mobility and ADLs more common than electronic AT; greater AT use associated with greater functional limitations; no difference in functional independence or social connectedness between AT users and non-users; AT use associated with history of falls; small positive association between AT use and carers' health	Limited uptake of electronic AT; AT use reflects existing disability rather than preventing decline; lack of measures for autonomy Facilitators: Availability of low-tech home modifications; configuration of AT packages tailored to needs	limits causal inference; autonomy not measured; electronic AT under-represented; AT measured largely as low-tech aids; outcomes limited to available IDEAL measures
8	Davis and Weisbeck (2016) Creating a Supportive Environment Using Cues	Type: Narrative literature review (synthesising eight empirical	People with dementia/Alzheimer's disease, mild cognitive impairment	To review and integrate existing evidence on how specific cue characteristics	Use of salient visual/environmental cues to support wayfinding, including: colourful objects,	Structured literature search (ProQuest Medical, PubMed, CINAHL, 2000–2015);	Evidence that salient, colourful, familiar and distinctive cues improve wayfinding accuracy;	Visual and environmental cues support wayfinding and reduce confusion; people with dementia	Barriers: Long indistinct corridors, low-contrast interiors, abstract/non-salient cues,	Limited number of eligible studies (n=8); many small sample sizes; most research

	for Wayfinding in Dementia USA	studies on cues for wayfinding in dementia) Setting: Home and facility settings including older adult residential environments (assisted living, skilled nursing facilities, independent living), and virtual reality simulations mimicking such settings	experiencing wayfinding difficulties, and healthy older adults; sample sizes in included studies ranged from n=3 to n≈171 (combined across all virtual and real-world studies).	cs within built environments shape wayfinding performance in older adults with and without dementia.	familiar/personalised cues, portraits, memory boxes, large easily visible icons, bold and distinctive landmarks, cues placed at rooms and key decision points.	inclusion/exclusion screening; synthesis of empirical evidence on cue properties (colour, familiarity, salience, location).	cues help residents identify rooms; improve route-learning; reduce disorientation; can support independence, safety, and environmental “knowing.”	are impaired in wayfinding but retain ability to learn with environmental support; colourful and familiar cues enhance recognition and memory more than abstract cues; cues placed at key decision points (e.g., hallway intersections) are most effective; personally meaningful cues (photos, memory boxes) improve room identification; built environments often lack distinctiveness and therefore hinder wayfinding.	poor lighting, complex layouts, cognitive decline affecting cue encoding. Facilitators: Colour, familiarity, salience, large/bright cues, personalised room markers, placement of cues at decision points, simplified environments.	conducted in controlled or virtual environments rather than real-world built environments; limited evidence for later-stage dementia; review excluded non-visual cues and broader architectural features.
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9	Moore et al. (2017) Dementia-friendly housing guide: Guidance on delivering a dementia-friendly approach to housing – from planning and design to management and adapting UK	Type: Practice guideline / sector guidance document Setting: Domestic and mainstream housing, including owner-occupied, private rented, housing association homes; explicitly excludes care homes	People living with dementia and those affected by dementia (including carers); no primary sample size (guidance document)	To guide housing providers, designers, planners, landlords, and managers in creating and adapting housing that enables people affected by dementia to live well and independently	Dementia-friendly housing design and adaptation principles: layout and circulation; lighting; signage and wayfinding; colour and contrast; flooring; bathrooms and kitchens; entrances; outdoor access; assistive technology (telecare, reminders, sensors); future-proofed adaptations	Evidence-informed guidance drawing on policy documents, research literature, stakeholder consultation, lived-experience input, and case studies; includes checklists and practice examples	Supports independence, safety, wayfinding, usability, wellbeing, and ability to remain living at home; promotes adaptable and future-proof housing	Two-thirds of people with dementia live in mainstream housing; small, low-cost adaptations can significantly improve quality of life; dementia-friendly design benefits a wide range of users; housing sector plays a critical role in ageing in place	Barriers: Lack of dementia awareness in housing sector; insufficient adaptations; regulatory minimum standards; funding knowledge gaps; stigma Facilitators: Training (Dementia Friends); checklists; Disabled Facilities Grants; inclusive design standards; stakeholder collaboration	Not an empirical research study; no primary outcome evaluation; evidence synthesised from secondary sources and practice examples
10	van Hoof et al. (2010) Environmental Interventions and the Design of	Type: Narrative literature review with supplement	Older adults with dementia living at home; informal	To synthesise design goals, principles, and	Extensive catalogue of home-based environmental interventions: home	Literature review (books, peer-reviewed articles, reports) up to 2009;	Supports ageing in place; improved safety, orientation,	Identifies that most people with early-moderate dementia live at home; the home environment is	Barriers: Limited empirical evidence for home-based interventions;	Most evidence drawn from institutional studies; limited

	Homes for Older Adults with Dementia: An Overview Netherlands	ary focus groups Setting: Private domestic homes (primary focus); literature also includes assisted living and institutional settings for transferable evidence	caregivers; no primary sample size (review-based); focus group participants were representatives of patient and aged-care organisations (number not specified)	environmental interventions that support PwD living at home, linking user needs with specific home design solutions	modifications (HM), assistive devices (AD), object modifications (OM), task simplification (TS) across toileting, bathing, dressing, sleeping, cooking, eating, safety, wayfinding, memory support; design goals for dementia-friendly homes	supplementary focus group sessions (2006); synthesis structured using the WHO ICF framework; tabulated presentation of interventions by activity/function	usability, independence in ADLs; reduced caregiver burden; non-pharmacological support for dementia care at home	under-researched; many low-tech, low-cost modifications can meaningfully support daily functioning and safety; evidence base is fragmented and largely institutional	housing stock constraints; costs and funding complexity; lack of awareness among caregivers Facilitators: Caregiver involvement; occupational therapy input; low-tech adaptations; early implementation; alignment with daily routines	systematic evaluation of interventions in private homes; heterogeneity of interventions; many studies with small samples
11	Newton et al. (2023) Exploring the contribution of housing adaptations in supporting everyday life for people with dementia: a scoping review	Type: Scoping review (JBI methodology) Setting: Community-dwelling, mainstream and specialised	13 included studies; total participants across included studies: 140 people with dementia and 367 carers (note: 11	To explore how housing adaptations contribute to supporting everyday life for PwD living at home, including types of	Housing adaptations to the permanent physical environment: bathroom adaptations (walk-in showers, grab rails, non-slip flooring), stairs and circulation (handrails, stair	Systematic scoping review guided by Joanna Briggs Institute; PCC framework; searches across 8 databases; PRISMA-ScR reporting; thematic	Positive impacts on safety, independence, usability of the home, carer wellbeing, reduced burden, improved confidence and peace of mind;	Most adaptations address physical limitations and safety rather than cognitive support; decisions are shaped by professional advice and trial-and-error; adaptations can support dignity, independence,	Barriers: Lack of information, uncertainty about timing, carer resistance, unsuitability of housing (size, tenure), cost/affordability.	Scoping review does not appraise study quality; evidence base dominated by carers' perspectives; limited longitudinal data; majority of

	UK	housing; explicitly excludes care homes	unique participant datasets due to overlap)	adaptations, decision-making, barriers/enablers, and impacts	lifts, ramps), entrances and outdoor access, flooring changes, room reconfiguration (downstairs toilets/bedrooms), environmental adjustments (colour/contrast), safety-related adaptations	analysis (Braun & Clarke) of findings mapped to four review questions	adaptations particularly effective when implemented early	and carer self-efficacy	Facilitators: Occupational therapy input, professional advice, online peer support, early implementation, adequate space and resources	included studies from USA; limited UK evidence
12	Allen (2018) Exploring the use of home adaptation and related information for people with dementia living in domestic dwellings UK	Type: Doctoral thesis (mixed-methods; qualitative dominant) Setting: Domestic dwellings / private homes	Study 1: 10 dyads (PwD and a co-resident carer) interviewed in their own homes; Study 2: 214 people with close family/friends completed an information survey; Study 3: 58 practitioner	To explore how people with dementia and those they live with use and perceive home adaptation, how information is accessed and used, and how uptake of home adaptation	Home adaptations and environmental design features including changes to colour, lighting, sound, temperature; stairs, bathrooms, flooring, wayfinding; task and behavioural adaptations; assistive technologies; information delivery	Three-study design: (1) qualitative in-home interviews; (2) survey of information accessibility and preferences; (3) practitioner vignette questionnaire; thematic analysis; development of a Home Adaptation in Dementia	Proactive home adaptation can prevent crisis, reduce carer burden, and support independence; early, tailored information increases uptake of adaptations; environmental changes can mitigate dementia symptoms	Home adaptation is often reactive rather than proactive; maintaining familiarity is critical; people with dementia and carers value professional advice but experience gaps in access and consistency	Barriers: Lack of early information; variability in practitioner knowledge; crisis-driven referral pathways; cost and housing constraints; potential negative impact of unfamiliar technology. Facilitators: Early diagnosis-linked	Single-country context (UK); qualitative sample relatively small for Study 1; practitioner knowledge self-reported; findings may not generalise beyond similar health and housing systems

			s completed a vignette questionnaire	can be improved in domestic dwellings	pathways for home adaptation	framework and Optimal Home Adaptation Phase (OHAP)			information; occupational therapy input; individualised advice; evidence-based design guidance	
13	Park et al. (2023) Home Modification on Favorite Activity and Self-Efficacy Among Older Adults with Dementia USA	Type: Quantitative observational study (secondary data analysis) Setting: Community-dwelling / domestic homes	273 older adults living with dementia in the community; subgroup comparison : 145 with functional limitations, 129 without	To examine the impact of home modification on affective (self-efficacy) and behavioural (engagement in favourite activities) outcomes among older adults with dementia	Home modifications (type not itemised in abstract); environmental adaptations to support person–environment fit	Secondary analysis of two waves (2018–2019) of the National Health and Aging Trends Study (NHATS); multi-group structural equation modelling guided by the ecological model of ageing	Engagement in favourite activities; self-efficacy	Home modification was positively associated with engagement in favourite activities, particularly physically demanding activities, among people with dementia with functional limitations ($p < 0.01$); no significant association with self-efficacy	Not stated	Limited detail on types of home modifications ; observational design; causality cannot be inferred; abstract-level reporting only
14	Struckmeyer and Pickens (2015) Home Modifications	Type: Scoping review (systematic scoping)	17 peer-reviewed studies included; participants	To synthesise existing evidence on home	Home modifications across physical, cognitive, and social	Structured scoping review methodology; searches of	Improved safety, daily function, participation, and caregiver	Three dominant themes: (1) central role of caregiver training and involvement;	Barriers: Caregiver resistance or limited knowledge; lack	Limited number of databases searched; no quality

	for People with Alzheimer's Disease: A Scoping Review USA	review of peer-reviewed literature) Setting: Domestic home environment (explicit focus on people with Alzheimer's disease living at home; institutional settings excluded)	across studies include people with Alzheimer's disease and their caregivers; individual study sample sizes ranged from 2 to 171	modifications for people with Alzheimer's disease living at home and to identify gaps to inform future research	environments, including: structural changes (grab bars, ramps, lighting, locks); assistive technology (low- and high-tech); task-level cognitive cueing and simplification; social/environmental strategies involving caregiver supervision and routines	PubMed, CINAHL, PsycINFO, and Google Scholar (1994–2014); independent screening by two reviewers; narrative synthesis and tabulated mapping of study characteristics and themes	self-efficacy; support for ageing in place; reduced caregiver strain when training and follow-up were provided	(2) importance of a client-centred, collaborative approach; (3) need for a broad range of environmental modifications (physical, cognitive, social) tailored to disease stage	of standardised assessment tools; underutilisation of devices; changing needs as disease progresses. Facilitators: Caregiver training, professional collaboration, follow-up visits, early implementation	appraisal (scoping review); small sample sizes in included studies; limited evidence on later stages of Alzheimer's disease and people living alone
15	Allen et al. (2019) How people with dementia and their carers adapt their homes: A qualitative study UK	Type: Qualitative study (Interpretative Phenomenological Analysis) Setting: Domestic dwellings /	10 dyads (10 people with dementia; 10 informal carers) living together at home; dementia types included Alzheimer's disease,	To explore how people with dementia and their carers adapt their homes, identify barriers to adaptation, and examine how	Home adaptations across four categories: additive (e.g. labels, grab rails), subtractive (e.g. removing clutter, simplifying floors), behavioural (routine	Semi-structured in-home interviews; audio-recorded; thematic analysis using IPA; reflexive diary; interviews 20–90 minutes	Supports continued independent living; maintains familiarity and identity; small adaptations reduce falls risk and support daily activities; highlights potential for	Most adaptations were small-scale and reactive; physical-safety adaptations more common than cognitive/behavioural ones; maintaining familiarity strongly shapes decisions; people can adapt to changes if	Barriers: Lack of knowledge about home adaptation benefits; poor signposting of information; desire to maintain familiarity; perceived lack	Small sample; limited to mild–moderate dementia; single UK region (West Midlands); dyadic interviews may have constrained disclosure;

		private homes	vascular, frontotemporal, Lewy body; mild–moderate stages	information about home adaptation is accessed and used	changes, prompts), transformative (lighting changes); predominantly low-cost, self-derived modifications		earlier adaptation	introduced at the right time	of credibility of advice sources. Facilitators: Self-initiated problem solving; occupational therapy input (when accessed); simple, low-cost changes; early-stage capacity to adapt	findings not statistically generalisable
16	Evans et al. (2019) Making Homes More Dementia-Friendly through the Use of Aids and Adaptations UK	Type: Pilot intervention study with mixed methods (quantitative longitudinal evaluation + qualitative case studies) Setting: Domestic homes /	510 people assessed; 382 received aids/adaptations; 101 people with dementia consented to full evaluation; age range 36–98 years (mean ~80); majority	To evaluate the impact of providing aids and adaptations on the wellbeing of PwD and their families living at home	Low-cost aids and home adaptations informed by dementia-friendly design: dementia clocks (day/night, digital); noticeboards/whiteboards; touch-activated and motion-sensor lighting; key locators; memo-minders; signage; contrasting	Longitudinal evaluation at baseline, 3 months, and 9 months using validated wellbeing measures (ONS wellbeing items; SWEMWBS); descriptive statistics; comparator data from UK population; in-depth in-home	Maintenance or improvement of wellbeing; increased satisfaction with accommodation; reduced loneliness at follow-up; support for independence and quality of life for PwD and carers	Relatively inexpensive aids can support wellbeing and independence for people with dementia living at home; benefits varied by aid type; clocks, whiteboards, and lighting most valued; carers play a critical role in successful use; professional skills and cross-sector	Barriers: Over-sensitive or confusing devices (e.g., memo-minders, 24h clocks); limited involvement of people with dementia in selecting aids; usability issues. Facilitators: Simple, familiar, low-tech aids; carer support; flexibility in aid	No control group; attrition at follow-up (36 participants at 9 months); pilot design limits causal inference; multiple aids provided simultaneously make attribution difficult

		community-dwelling private housing	living with a carer		toilet seats; GPS trackers; large-button phones; bedside lights	case studies; stakeholder interviews; thematic analysis		collaboration improved	selection; non-means-tested access; professional assessment	
17	Yeni and Yilmaz (2022) Nurse-led home modification interventions for community-dwelling older adults with dementia and their impact on falls prevention Turkey	Type: Quasi-experimental intervention study (single-group, pre-post design) Setting: Domestic homes / community-dwelling private housing	42 older adults with dementia (≥65 years) living at home with family members and their family caregivers (n=42)	To investigate the effects of nurse-led home-modification interventions on falls prevention among older adults with dementia living at home and to raise awareness among families and healthcare professionals	Low-cost home modifications focused on fall prevention: grab bars (toilet, bathroom), anti-slip tape (hallway, bathtub), lighting improvements (≥75W bulbs), furniture anchoring, furniture replacement, decluttering and clearing walking paths; nurse-led environmental risk assessment and education	Three nurse-led home visits over 6 months (baseline, 3 months, 6 months); home safety inspections using validated tools (DENN Fall Risk Assessment Scale; Home Environment Risk Factors for Falls Assessment Form); family training using a fall-prevention booklet; statistical analysis with SPSS	Significant reduction in number of falls over 6 months; increased implementation of home modifications; improved home safety awareness among family members	Falls significantly decreased in the second 3-month period compared with the first (p=0.002 and p=0.000); almost half of families implemented recommended modifications; homes with modifications experienced fewer falls; bathrooms and toilets were the most common fall locations	Barriers: Financial constraints limiting extent of modifications; memory loss requiring repeated reinforcement; lack of prior caregiver education. Facilitators: Nurse-led education; repeated home visits; low-cost, easy-to-implement adaptations; family involvement	No control group; small sample size; single-city setting; relatively short follow-up (6 months); modifications dependent on household finances

18	Zhang et al. (2025) Research on Home Environment Design to Improve the Autonomy of Elderly People with Dementia China	Type: Qualitative empirical design research (field study + design framework development) Setting: Domestic homes / community-dwelling private housing	20 older adults with mild dementia living at home (ages 60–94; male:female ≈1:1); living arrangements: with children (n=10), with spouse (n=5), living alone (n=5)	To construct a mental model of the home environment for PwD and propose evidence-informed design principles to improve autonomy and quality of life at home	Home environment design principles based on mental model theory: visual and auditory cues; lighting; signage; colour and material contrast; simplified layouts; route planning; barrier-free design; assistive devices; storage and furniture reconfiguration; integration of smart home technologies	Field observations and in-home behaviour recording; MMSE screening (scores 21–26); Kawakita Jiro (KJ) method; affinity diagramming; mental task tower and mental space modelling; qualitative synthesis into design principles	Improved autonomy, self-care ability, safety, orientation, usability of home environments; reduced caregiver burden; enhanced quality of life and confidence	Home autonomy is supported when environments align with users' mental models; three key mental spaces identified: information perception, environmental cognition, and environmental shaping; design should balance safety with autonomy—over-restriction reduces independence	Barriers: Limited sample size; regionally concentrated sample; cultural and housing diversity not fully captured; focus limited to mild dementia. Facilitators: User-centred mental model approach; multisensory cues; familiarity-based design; barrier-free and controllable environments	Small sample size; single geographic region (Changsha, China); excludes people with moderate–severe dementia; limited consideration of regional and cultural housing variation
19	Tiersen et al. (2021) Smart Home Sensing and Monitoring in Households With	Type: Qualitative, multi-phase user-centred design study	Phase 1: 9 people with dementia + 9 caregivers (home visits); Workshops	To investigate stakeholder needs and inform the design and implementation of smart	Smart home sensing and monitoring systems: environmental sensors (doors, beds, appliances),	Iterative user-centred design comprising 9 substudies: semi-structured interviews, home visits,	Identifies functional, psychosocial, ethical, and environmental needs; informs more patient-centred smart	Demonstrates value of participatory design in smart home development; highlights need for alignment with	Barriers: Privacy concerns, consent and ethics, technology anxiety, low	Small qualitative samples; early adopters over-represented; limited

	Dementia: User-Centered Design Approach UK	Setting: Domestic homes participating in smart home trials; community-dwelling households	: 35 dyads (PwD + caregivers); Additional stakeholders: clinicians, OTs, service managers (numbers vary by substudy); Phase 3: 10 caregivers + 2 PwD	home sensing and monitoring systems for households affected by dementia	physiological sensors (pulse oximeter, thermometer), smartwatches, tablet-based cognitive assessments and chatbots; focus on design of monitoring systems rather than physical home modification	workshops, focus groups, personas, thematic analysis (NVivo); participatory and value-sensitive design framework	home monitoring design; supports autonomy, safety, and potential clinical decision-making	routines, gradual introduction, and respect for autonomy and privacy; personas illustrate diverse home and care contexts	digital literacy, alert fatigue, fluctuating cognition, limited infrastructure. Facilitators: Caregiver involvement, user-centred design, tailoring to routines, clinician oversight, gradual onboarding	inclusion of people with moderate–severe dementia; no effectiveness or outcome evaluation; technology trial context
20	Dalvand et al. (2024) The effectiveness of home modifications on the risk of falling in older adults with dementia: A randomized clinical trial Iran	Type: Single-blind randomized controlled trial Setting: Community-dwelling private homes (explicitly excludes nursing homes)	44 older adults with mild dementia initially randomized (22 intervention, 22 control); 40 completed the trial (20 per group); age ≥65	To investigate whether modifying the home environment reduces the risk of falling in older adults with dementia living at home	Comprehensive home modifications addressing environmental fall risks: flooring and loose mats, lighting (rooms, corridors, stairs, bathroom, outdoor paths), grab rails (bath/shower, stairs), bathroom/toilet	Balanced block randomisation; intervention delivered by trained occupational therapist; HOME FAST used at baseline, 1, 2, and 3 months; control group received routine occupational	Significant reduction in fall risk scores over 3 months in the intervention group; no change in control group	Home modifications significantly reduced fall risk ($p < 0.001$); greatest improvements related to securing floor coverings and installing accessible grab rails; bathrooms, toilets, stairs, and	Barriers: COVID-19 restrictions affecting access; modifications tailored only to mild dementia; financial and housing constraints implied. Facilitators:	Only mild dementia included; short follow-up (3 months); single-city sample; no behavioural intervention component; conducted during COVID-19

					safety, furniture arrangement, clutter removal, stair edges, ramps/rails, night lighting, kitchen access, footwear recommendations	therapy without home modification; statistical analysis using t-tests and chi-square		lighting were key risk areas	Occupational therapist-led assessment, structured tool (HOME FAST), targeted environmental changes	
21	Soilemezi et al. (2019) The Role of the Home Environment in Dementia Care and Support: Systematic Review of Qualitative Research UK	Type: Systematic review of qualitative studies Setting: Domestic homes and community dwellings (private housing and supported accommodation; non-institutional focus)	40 qualitative studies (reported across 42 papers); total participants n=1,145 including people with dementia (n≈372), informal carers (n≈653), and professionals (n≈120)	To synthesise qualitative evidence on how people with dementia and their carers experience the home environment and to identify environmental barriers and facilitators to effective dementia care at home	Environmental and home-based strategies: housing layout, size, accessibility, lighting, stairs vs single-level design, bathrooms, privacy and retreat spaces, decluttering, furniture rearrangement, visual cues and signage, sensory cues, low- and high-tech assistive devices, behavioural and	Systematic search of 12 databases (1970–2013); PRISMA-style screening; CASP quality appraisal; thematic synthesis using NVivo; validation workshop with carers and practitioners	Identifies how home environments support or hinder safety, independence, comfort, caregiving, and ageing in place for PwD	Three overarching themes: (1) Home as a paradox (safety vs comfort; familiarity vs adaptation; risk vs independence); (2) There is no magic formula (ongoing, personalised and improvised adaptations); (3) Adapting physical space, objects and behaviour (transformative, behavioural, subtractive and	Barriers: Tension between safety and homeliness; fear that adaptations disrupt familiarity; privacy loss; stigma and institutional feel; cost and housing constraints; technology complexity. Facilitators: Personalised, flexible adaptations;	Heterogeneity and variable quality of included studies; many primary studies lacked methodological detail; findings largely based on self-report; literature up to 2013 only; limited cultural and ethnic reporting

					improvisational home adaptations			additive strategies)	familiarity-based design; low-cost and improvised strategies; visual cues; accessible layouts; professional guidance when tailored	
22	Grey et al. (2015) Universal Design Guidelines: Dementia Friendly Dwellings for People with Dementia, their Families and Carers Ireland	Type: Design guideline / practice guidance (evidence-informed, non-empirical) Setting: Domestic dwellings (new build and retrofit; houses and apartments)	People with dementia, families and carers; no sample size (guideline document)	To provide practical, dementia-specific Universal Design guidance for the design and retrofit of domestic dwellings to support PwD and their families to live at home for as long as possible	Comprehensive environmental and architectural design guidance for dementia-friendly homes based on Universal Design principles: location and approach; entrances and circulation; room-by-room guidance (living areas, kitchens, bedrooms, bathrooms); lighting,	Evidence-informed guideline development drawing on literature review, stakeholder consultation, and national/international case studies; illustrative floor plans, diagrams, and design scenarios provided (e.g., pages 16–21 showing typical	Intended benefits include prolonged ageing in place, improved independence, safety, orientation, wellbeing, and support for carers	Provides a structured, scalable framework for designing or retrofitting dementia-friendly dwellings; emphasises participatory design, familiarity, personalisation, calm environments, visual access, unobtrusive safety, and adaptability over time; explicitly links design to	Barriers: Potential cost and disruption of higher-scale interventions; risk of disorientation during major retrofits if not managed sensitively. Facilitators: Low-cost early interventions; stakeholder engagement; phased adaptations; Universal	Not an empirical research study; no outcome evaluation or effectiveness data; literature review methods not fully detailed; guidance published in 2015

					acoustics, colour and contrast; wayfinding and visual access; outdoor spaces; safety systems; assistive technologies; five scales of intervention from low-cost signage to structural redesign	dwelling layouts and features)		autonomy and quality of life	Design framework	
23	Cornelius et al. (2025) Wearable Technology, Smart Home Systems, and Mobile Apps for the Self-Management of Patient Outcomes in Dementia Care: Systematic Review UK	Type: Systematic review (PRISMA-guided; PROSPER O-registered) Setting: Mixed settings: independent living homes, adult day care, care	24 included studies; adults with dementia (predominantly Alzheimer disease); total reported participants across primary studies ≈92 where specified; carers included in	To synthesise and critically appraise evidence on digital self-management technologies for PwD, focusing on QoL, behaviour, accessibility, and study quality	Digital self-management technologies: wearables (smartwatches, pendants, GPS soles), smart home systems (sensors, robots, prompting systems), mobile apps; technology-focused rather than architectural or	Systematic search of 9 databases (2013–2023); narrative synthesis; outcome mapping using NICE QS184 and Nursing Outcomes Classification; quality appraisal using MMAT, CASP, and a	Potential benefits for self-management, cognition, self-care, health behaviours, managing distress, and supporting carers; cost-effective compared with institutional care	Most studies targeted neurocognition, self-care, and health behaviours; evidence for QoL improvement is limited and heterogeneous; accessibility issues common; effectiveness remains uncertain due to small samples	Barriers: Complex setup, poor usability, limited training, digital literacy gaps, privacy/ethical concerns underreported. Facilitators: Caregiver involvement, tailored training, simplified interfaces, use of widely available	High heterogeneity; small samples; limited dementia subtype diversity; lack of blinded RCTs; inconsistent outcome measures; many studies not home-exclusive

		homes, nursing homes, assisted living, hospital units	many studies		physical home modifications	custom framework		and unblinded designs	consumer devices	
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Findings are first presented as a descriptive mapping of intervention types, followed by a design-focused thematic synthesis that integrates cross-cutting patterns across the same evidence base.

Types of Home Design Innovations Identified (Descriptive Mapping)

Across the included studies, home design innovations clustered into six interrelated domains. This section presents a descriptive mapping of intervention types; interpretive patterns across these domains are synthesised in Section 3.3.

Home modifications and physical adaptations

Home modifications were the most consistently examined intervention type across empirical studies and reviews. Common adaptations included bathroom and kitchen modifications (e.g. level-access showers, grab rails, non-slip flooring, and improved, evenly distributed lighting), access and circulation changes (ramps, handrails, removal of steps, and improved stair safety), and general safety adaptations focused on hazard reduction, removal of tripping hazards, decluttering, lighting improvement, and flooring changes to improve contrast and reduce glare (Dalvand et al., 2024; Marquardt et al., 2011; Park et al., 2023).

Randomised and quasi-experimental studies demonstrated that targeted home modifications were associated with reduced falls risk, improved functional performance, and enhanced perceived safety for people living with dementia (Dalvand et al., 2024; Yeni & Yilmaz, 2022). Longitudinal observational studies in broader older populations further supported the role of home modifications in shaping disability trajectories, with dementia recognised as a high-risk subgroup.

Non-digital assistive technologies and low-tech aids

Several studies examined non-digital or low-tech assistive devices, including memory aids, reminders and cueing tools, orientation clocks and calendars, labelling systems for cupboards, rooms, and appliances, simple communication aids, monitoring and safety alert devices, and cooking safety systems (e.g., [Nauha et al., 2018](#)). Evidence suggested that these aids could support daily activities and reduce caregiver burden when well matched to the person's cognitive abilities and routines ([Martin & Jones, 2025](#)). However, inconsistent uptake and abandonment were common when aids were poorly explained, overly complex, or not embedded into everyday practices.

Smart-home and sensor-based systems

A growing subset of studies focused on digital assistive technologies and smart-home systems, including passive motion, door, and bed sensors; systems for detecting wandering, daily routines, night-time activity, or falls; integrated platforms combining sensors, wearables, and mobile applications for carers; and environment-embedded cognitive support systems (e.g., [Cornelius et al., 2025](#); [Tiersen et al., 2021](#)).

User-centred design studies highlighted that co-design with people living with dementia and carers improved acceptability and fit ([Tiersen et al., 2021](#)). Systematic and scoping reviews reported promising potential benefits, particularly for safety monitoring and caregiver reassurance. However, evidence was heterogeneous, often based on small-scale pilots with short follow-up periods, and raised unresolved concerns regarding privacy, autonomy, data governance, and the digital divide.

Wayfinding, orientation, and sensory design

Several empirical and design-focused studies examined environmental cues and sensory strategies, including the use of colour contrast and spatial markers,

distinctive doors or frames, high-contrast signage and environmental cues, clear visual access to key destinations (such as bathrooms and kitchens), predictable circulation pathways, avoidance of visual dead-ends, and control of lighting, glare, and acoustic noise. Findings consistently suggested that clear visual cues, predictable layouts, and reduced sensory clutter support orientation and reduce confusion (Allen et al., 2019; Davis & Weisbeck, 2016). While many examples originated from institutional settings, principles were explicitly translated to domestic environments and incorporated into dementia-friendly housing guidance.

Dementia-friendly and universal design guidelines

Several guidance documents and proposed standards consolidated evidence and expert consensus into practical recommendations for home environments. These included dementia-friendly housing guides, inclusive design standards enabling future home adaptation, universal design guidelines incorporating dementia-specific considerations, and recommendations relating to layout, lighting, and material selection (e.g., Grey et al., 2015; Moore et al., 2017). Although these documents were not empirical studies, they synthesised existing research and professional practice into actionable design criteria for designers, housing providers, and policymakers.

Activity and engagement-focused environmental strategies

A smaller group of studies examined activity-focused modifications, including tailoring environments to enable preferred activities (e.g., cooking or gardening), adjusting storage and spatial organisation to support routines, creating clearly defined activity zones within the home, and enabling autonomy, self-efficacy, and meaningful occupation. Evidence from small intervention studies indicated that such strategies could enhance self-efficacy, confidence, and engagement in meaningful activities, extending benefits beyond risk reduction (Park et al., 2023).

Design-focused Thematic Synthesis (Interpretive Results)

Drawing on the same body of evidence, a design-focused thematic synthesis was undertaken to identify recurring patterns that cut across intervention types and illuminate how dementia-friendly home design operates in practice. Nine interrelated themes were identified.

Theme 1: The home as a dynamic system—adaptation is continuous rather than episodic

Across the evidence, dementia-friendly home design was characterised as an ongoing, iterative process rather than a one-off retrofit. Qualitative syntheses and lived-experience studies showed that adaptations evolve in response to changing cognitive and functional needs, emerging risks, and caregiver capacity (Allen et al., 2019; Allen, 2018; Soilemezi et al., 2019). Adaptations were frequently incremental and improvised, rather than planned as comprehensive redesigns, with changes often triggered by adverse events such as falls. Reviews and case-based evidence emphasised that effective homes are those that can be recalibrated over time, balancing safety, independence, and familiarity as dementia progresses (Newton et al., 2023; Struckmeyer, 2019; Struckmeyer & Pickens, 2015; van Hoof et al., 2010).

Theme 2: Safety interventions dominate practice, but autonomy and meaningful activity are critical outcomes

Physical safety—particularly falls prevention—was the most common design driver in empirical studies. Interventions targeting bathrooms, stairs, circulation, and lighting demonstrated measurable reductions in falls risk in both quasi-experimental and randomised designs (Dalvand et al., 2024; Yeni & Yilmaz, 2022). However, qualitative and review evidence consistently showed that autonomy, identity, and meaningful activity are equally important outcomes of home design (Martin & Jones, 2025; Soilemezi et al., 2019; van Hoof et al.,

2010). Modifications that supported engagement in preferred activities and daily routines delivered benefits beyond risk reduction, highlighting the need to evaluate home design using dual outcomes: safety and participation/autonomy (Park et al., 2023; Zhang et al., 2025).

Theme 3: High-impact zones in the home—bathrooms, stairs/circulation, lighting, and clutter

There was strong convergence across study types regarding high-risk and high-yield locations for intervention. Bathrooms and toilets, stairs and thresholds, poorly lit circulation routes, and cluttered pathways were repeatedly identified as sources of falls risk and functional difficulty (Dalvand et al., 2024; Yeni & Yilmaz, 2022). Intervention trials and descriptive studies demonstrated that targeted modifications in these zones—such as grab rails, anti-slip surfaces, improved lighting, and furniture reconfiguration—can substantially improve safety and usability, supporting prioritisation of zone-based modification packages (Marquardt et al., 2011; Moore et al., 2017; Struckmeyer, 2019).

Theme 4: Familiarity versus change—preserving “home-ness” while improving safety

A recurrent theme was the tension between introducing safety-driven changes and maintaining familiarity (Allen et al., 2019; Allen, 2018). People living with dementia and carers frequently delayed or carefully negotiate home modifications because of concerns about preserving familiarity, identity, and the domestic character of the home (Allen et al., 2019; Struckmeyer, 2019). Qualitative syntheses described the home as a paradox in which familiarity supports orientation and wellbeing, yet change is necessary to manage risk (Soilemezi et al., 2019). Successful design approaches favoured incremental, domestic-looking adaptations, continuity of visual and material cues, and staged implementation to minimise disorientation.

Theme 5: Cognitive accessibility as a design objective

Beyond physical modification, the evidence framed cognitive accessibility—the ease with which a person can perceive, understand, and use their environment—as a core design goal ([Struckmeyer & Pickens, 2015](#)). Studies described additive strategies (labels and cues), subtractive strategies (removing clutter), behavioural strategies (routines and prompts), and transformative strategies (lighting and layout changes) that simplify task environments and support wayfinding and daily activities ([Soilemezi et al., 2019](#); [Struckmeyer & Pickens, 2015](#); [van Hoof et al., 2010](#)). Contemporary design research further articulated cognition-aligned principles, positioning cognitive supports as integral to home design rather than ancillary aids ([Zhang et al., 2025](#)).

Theme 6: Low-cost, low-tech adaptations are widely adopted and effective

Across the evidence base, simple and low-cost adaptations were the most commonly implemented and often the most valued ([Nauha et al., 2018](#)). Lighting improvements, rails, decluttering, signage, clocks, and whiteboards featured prominently and were associated with perceived benefits to safety, independence, and wellbeing ([Allen et al., 2019](#); [Soilemezi et al., 2019](#); [van Hoof et al., 2010](#)). Evaluations of aids and assistive technologies showed a preference for straightforward, familiar solutions over complex systems, underscoring the feasibility and scalability of dementia-friendly design through practical, affordable measures ([Evans et al., 2019](#); [Nauha et al., 2018](#)).

Theme 7: Technology in the home—benefits depend on personalisation, usability, and support

Home-based assistive technologies were reported to support safety and daily functioning, but their effectiveness was highly contingent on personalisation, usability, and caregiver involvement ([Martin & Jones, 2025](#)). Cohort and field studies indicated that electronic assistive technologies were less commonly

used than basic aids and often reflected existing need rather than preventive adoption ([Henderson et al., 2020](#); [Nauha et al., 2018](#)). Where benefits were reported, they were linked to technologies that aligned with daily routines and imposed minimal cognitive burden ([Struckmeyer & Pickens, 2015](#); [Tiersen et al., 2021](#)), positioning technology as conditional rather than universally beneficial.

Theme 8: Professional involvement improves targeting, yet many adaptations remain reactive

Evidence from intervention studies showed that professionally led home assessments and modifications—particularly nurse-led and occupational therapy-led approaches—can reduce falls risk and improve home safety ([Dalvand et al., 2024](#); [Yeni & Yilmaz, 2022](#)). However, qualitative studies revealed that many adaptations are self-initiated and occur reactively after crises, reflecting gaps in early information and referral pathways ([Struckmeyer, 2019](#)). Reviews highlighted the value of anticipatory guidance and staged planning to avoid crisis-driven changes ([Struckmeyer & Pickens, 2015](#); [van Hoof et al., 2010](#)).

Theme 9: The need for dementia-inclusive standards and future-proofed housing

Design-led research and reviews identified a gap between general accessibility standards and the specific needs of people living with dementia ([Balocating-Dunn, 2025](#); [van Hoof, 2010](#)). Included studies proposed dementia-inclusive housing standards and integrated design frameworks that embed adaptability, cognitive accessibility, and unobtrusive safety into mainstream housing ([Balocating-Dunn, 2025](#); [van Hoof, 2010](#)). The synthesis supports a shift from reactive, crisis-driven, or unplanned retrofitting toward dementia-ready dwellings capable of accommodating future adaptation with minimal disruption ([van Hoof, 2010](#); [van Hoof et al., 2010](#)).

Synthesis summary

Taken together, the included studies depict dementia-friendly home design as a longitudinal, person-centred process that integrates physical safety, cognitive accessibility, and preservation of familiarity. High-impact, low-cost adaptations in key zones deliver clear benefits, while autonomy, activity, and wellbeing emerge as essential design outcomes alongside safety. Technology can enhance support when carefully matched to routines and capabilities, but simple environmental changes remain foundational. Overall, the evidence highlights the importance of early, staged, and professionally supported adaptation within adaptable, dementia-inclusive housing.

To consolidate this synthesis, the convergence of evidence across the nine design themes is summarised in a design-focused thematic heat-map (Table 3), which illustrates the relative strength and density of support for each theme across the included studies. Colour intensity indicates the density of evidence supporting each theme (dark = high convergence; medium = moderate; light = low).

The heat-map demonstrates high convergence for treating the home as a dynamic, evolving system (T1), balancing safety with autonomy and meaningful activity (T2), prioritising high-impact zones such as bathrooms, stairs, circulation routes and lighting (T3), preserving familiarity and “home-ness” during change (T4), and implementing low-cost, low-tech adaptations (T6). These themes show strong, multi-study support across empirical, qualitative, and review evidence, indicating that they represent the most robust and actionable design knowledge for supporting ageing in place with dementia.

By contrast, moderate convergence was observed for cognitive accessibility (T5), technology fit and usability (T7), and professional involvement in home adaptation (T8). While these themes are recurrent and conceptually well supported, the heat-map highlights uneven empirical testing and variability in implementation. Low convergence was evident for dementia-inclusive housing

standards and future-proofed design (T9), which remain largely design-led and under-evaluated in domestic settings.

Collectively, the heat-map reinforces a key synthesis insight: the strongest evidence clusters around physical safety, low-cost adaptation, and experiential familiarity, while cognitive accessibility and future-proofed standards remain under-evaluated despite strong conceptual support. This pattern underscores the need for future research to extend evaluation beyond immediate safety outcomes toward longitudinal, system-level, and design-embedded interventions.

Table 3. Design-focused Thematic Heat-map Synthesis of Home Design Innovations Supporting Ageing in Place for People Living with Dementia in Domestic Settings

Theme	Convergence	Evidence density (ID of included studies)	Interpretation
T1. Home as a dynamic system		3, 4, 10, 11, 12, 14, 15, 18, 21	Strong agreement that adaptation is iterative and staged
T2. Safety vs autonomy & activity		10, 13, 14, 15, 16, 18, 21	Clear shift beyond safety-only design
T3. High-impact zones		1, 4, 9, 10, 11, 14, 17, 20, 21	Most empirically robust theme (falls & usability)
T4. Familiarity vs change		3, 9, 12, 15, 18, 21	Central experiential tension
T5. Cognitive accessibility		9, 10, 14, 15, 18, 21	Well-supported conceptually; limited intervention testing
T6. Low-cost / low-tech adaptations		1, 6, 9, 10, 11, 14, 15, 16, 17	Highly feasible, widely adopted
T7. Technology fit & usability		2, 6, 7, 9, 14, 16	Conditional benefits only
T8. Professional involvement		11, 14, 17, 20	Improves outcomes, but uneven access

Theme	Convergence	Evidence density (ID of included studies)	Interpretation
T9. Dementia-inclusive standards	■	3, 5, 9, 10, 18	Primarily design-led, limited empirical testing

High convergence (■■■■) = Strong, multi-study support across methods
 Moderate convergence (■■■) = Recurrent but uneven support
 Low convergence (■) = Limited or design-led evidence only

Outcomes Measured, Reported Benefits, and Key Findings

Outcomes most frequently evaluated across studies included:

- Safety and falls-related outcomes** (falls frequency, injuries, hazards, near-miss events): Studies consistently found that home modifications reduce fall risk and improve hazard awareness (Dalvand et al., 2024).
- Functional independence** (performance of activities of daily living, mobility, self-care): Improvements in activities of daily living were reported in several modification and assistive technology interventions (Henderson et al., 2020; Marquardt et al., 2011).
- Quality of life, engagement, and self-efficacy** (confidence, emotional wellbeing, sense of security): Qualitative studies highlighted enhanced confidence and reduced anxiety when homes were adapted to individual needs (Allen et al., 2019).
- Caregiver outcomes** (burden, stress, confidence, perceived support): Carers reported reduced stress when environmental cues or monitoring systems supported routine tasks (Henderson et al., 2020; Tiersen et al., 2021).
- Usability and acceptability of technologies** (satisfaction, adherence, and qualitative user feedback): Smart-home interventions frequently faced usability challenges, highlighting the need for simple and intuitive design (Cornelius et al., 2025; Tiersen et al., 2021).

In addition to the above-mentioned reporting, smart-home and digital technology studies also examined monitoring reliability, user experience, and privacy and autonomy concerns.

The synthesised findings include the strongest quantitative evidence related to falls and safety, with empirical studies demonstrating that home modifications can significantly improve safety and reduce falls risk for people living with dementia while enhancing independence. Designs that improve wayfinding, sensory clarity, and environmental cueing reduce confusion and promote autonomy. Also, person-centred design and co-design with people with dementia improve usability and uptake of innovations.

Qualitative and observational studies highlighted benefits in confidence, autonomy, and reduced caregiver strain, though these outcomes were less consistently measured. Evidence for assistive and smart-home technologies show promising but inconsistent impacts due to variability in design, complexity, and user capability. Early intervention and supportive services facilitate successful implementation, while system fragmentation and high costs remain major barriers.

Barriers and Facilitators

Commonly reported barriers included upfront cost of modifications and funding constraints ([Henderson et al., 2020](#); [Marquardt et al., 2011](#)), poor guidance and fragmented service pathways ([Allen, 2018](#); [Newton et al., 2023](#)), technical complexity and usability issues of technology systems ([Tiersen et al., 2021](#)), housing tenure constraints, particularly in rental properties ([Moore et al., 2017](#)), limited digital literacy, stigma associated with assistive technology, and privacy concerns ([Cornelius et al., 2025](#)), lack of coordinated policy support.

Key facilitators included professional assessment and support (e.g., occupational therapist involvement, nurse-led models) ([Henderson et al., 2020](#); [Marquardt et al., 2011](#); [Yeni & Yilmaz, 2022](#)), co-design with users and carers involvement ([Tiersen et al., 2021](#)), availability of clear guidelines and standards

(Grey et al., 2015; Moore et al., 2017), funding support, interdisciplinary collaboration, and early identification, intervention, and proactive planning.

Evidence Gaps and Study Limitations

Evidence gaps and study limitations identified across the literature included limited robust evaluation of multi-component interventions, under-representation of diverse housing contexts and populations, and short-term, small-scale evaluations of smart-home technologies (Dalvand et al., 2024; Newton et al., 2023; van Hoof et al., 2010). Common limitations included small sample sizes, especially in qualitative and prototype studies, heterogeneous outcome measures, limited longitudinal follow-up, and the lack of dementia-specific subgroup analysis in broader ageing studies (Newton et al., 2023; Tiersen et al., 2021; van Hoof et al., 2010). There was also limited involvement of people living with dementia in design processes, a lack of standardised outcome measures and economic evaluations, insufficient evaluation of cost-effectiveness, and technology studies often limited to prototypes or short pilots (Cornelius et al., 2025; Newton et al., 2023; Tiersen et al., 2021).

Discussion

This scoping review synthesised evidence from 23 home-based studies examining design innovations that support people living with dementia to age in place. The findings demonstrate that the home environment plays a pivotal role in enabling safety, independence, and meaningful engagement, but that implementation remains uneven and constrained by systemic barriers.

Home Modifications as Foundational Infrastructure for Safe Ageing in Place

Evidence from trials, observational studies, and scoping reviews indicates that well-designed home modifications is the most robust and actionable intervention that can materially reduce fall risks and improve functional outcomes for older

people with dementia (Dalvand et al., 2024; Yeni & Yilmaz, 2022). Interventions such as bathroom adaptations, improved lighting, handrails, and removal of hazards are relatively well-established and consistently demonstrated benefits (Marquardt et al., 2011; Struckmeyer, 2019), and should be viewed as core infrastructure for ageing in place.

However, studies also show that such modifications are not universally accessed, even when need is evident, and access remains inconsistent, often delayed until after adverse events (Struckmeyer, 2019). Delays in assessment, complex eligibility criteria, and limited funding or awareness result in missed opportunities to prevent harm. Integrating home assessment and modification into routine dementia care pathways represents a key opportunity for early intervention and may help address this gap.

Promise and Pitfalls of Assistive and Smart-home Technologies

Assistive, digital, and smart-home technologies represent a rapidly expanding area of innovation, but the evidence base is less mature and remains heterogeneous and largely pilot-based compared with traditional home modifications (Cornelius et al., 2025; Tiersen et al., 2021). Scoping and systematic reviews highlight promise in areas such as night-time movement monitoring and fall detection, wandering detection and door sensors, environmental prompts, reminders and cognitive support, and remote reassurance for carers (Nauha et al., 2018; Newton et al., 2023). Pilot studies often show feasibility under research conditions, particularly for monitoring and caregiver reassurance, but long-term adoption and real-world effectiveness are rarely examined in depth (Cornelius et al., 2025; Tiersen et al., 2021).

Many systems are technically complex and poorly aligned with the cognitive and sensory capacities of people with dementia, reinforcing that technologies are most effective when simple, reliable, and embedded within everyday routines (Nauha et al., 2018; Tiersen et al., 2021). A key message is that technology must be embedded in, and not imposed upon, the home environment; co-

design, simplicity, and reliability are critical, as without these, technologies can become an additional burden or source of frustration for both people with dementia and their carers, highlighting the need for careful ethical consideration (Cornelius et al., 2025; Tiersen et al., 2021).

Core Design Principles for Dementia-friendly Homes

Across empirical studies, reviews, and guidelines, a set of recurring design principles for dementia-friendly domestic environments was identified (Soilemezi et al., 2019; van Hoof et al., 2010). These include clarity and simplicity—such as simple layouts, clear sightlines to key destinations, and avoidance of overly complex or cluttered spaces—and visibility and cueing through visual access to important rooms, clearly distinguishable doors, and the use of signage, colour, and contrast for orientation (Davis & Weisbeck, 2016; Marquardt, 2011). Consistency and familiarity were also emphasised, including the preservation of familiar objects, routines, and places, and cautious introduction of new technologies or modifications (Allen et al., 2019; Soilemezi et al., 2019).

A supportive sensory environment, with adequate and even lighting, reduction of glare and shadows, control of noise, and careful use of colour and texture, was highlighted as essential (Marquardt et al., 2014; van Hoof, 2010). Safety without undermining autonomy was another recurring principle, with environmental strategies that reduce risk while still allowing freedom of movement and engagement in daily activities (Soilemezi et al., 2019). These principles—clarity, visibility, familiarity, sensory comfort, and safety without undue restriction—align with universal design concepts but require explicit attention to cognitive accessibility, not only physical accessibility (Grey et al., 2015).

Barriers, Equity, and Implementation Challenges

The review highlights significant equity and implementation challenges, with cost, housing tenure, workforce capacity, and fragmented policy environments shaping who benefits from design innovations ([Marquardt et al., 2011](#); [Newton et al., 2023](#)). People with lower income, unstable housing, or limited access to services may not benefit from available design innovations, and tenancy restrictions can limit structural changes for renters ([Aitken et al., 2023](#)). Technology solutions may assume broadband access, digital literacy, and sustained technical support, limiting uptake among some households ([Cornelius et al., 2025](#); [Schneider et al., 2024](#)).

Policies and programs that only fund certain categories of modifications or technologies, or that rely on complex application processes, risk leaving many families behind ([O'Malley & Croucher, 2005](#)). Without coordinated health–housing policy approaches, many households remain unable to access effective interventions ([Soilemezi et al., 2019](#)). Interdisciplinary collaboration between health, housing, design, technology, and social care is essential to ensure that dementia-friendly home design is not a niche add-on but integrated into mainstream housing and ageing policy.

Strengths and Limitations of the Review

A strength of this review is its comprehensive mapping across multiple types of innovations (physical, technological, and conceptual) within a clear PCC framework, supported by interdisciplinary synthesis and an explicit focus on home rather than institutional settings. These strengths highlight the value of examining diverse forms of innovation within clearly defined population, concept, and context boundaries, consistent with prior scoping reviews in this field ([O'Malley & Croucher, 2005](#)).

However, the review has limitations. Some included documents were guidelines or conceptual papers without detailed methodological information. Limitations also include heterogeneity of evidence, limited long-term experimental data, and

sparse economic evaluation (Newton et al., 2023). Data extraction was constrained by the quality and accessibility of the studies while also focusing on English language articles. As a scoping review, findings map evidence rather than quantify effect sizes.

Implications for Practice, Policy, and Research

This scoping review demonstrates that dementia-friendly home design is most effective when approached as a longitudinal, staged process rather than a one-off retrofit (Soilemezi et al., 2019; van Hoof et al., 2010). The evidence indicates that dementia-friendly homes function best when design anticipates change and enables incremental adaptation as needs evolve (Newton et al., 2023). Housing and care pathways that delay assessment until crises occur increase the risk of preventable falls, rushed modifications, and loss of familiarity (Allen et al., 2019; O'Malley & Croucher, 2005). These overarching implications are elaborated below across practice and service delivery, design and housing provision, technology implementation, policy development, and future research priorities.

Implications for practice and service delivery

For practitioners such as occupational therapists, nurses, and case managers, there is a clear need to incorporate systematic home environment assessment into routine dementia care, use evidence-based guidelines and checklists to recommend modifications and aids, and advocate for early and proactive environmental interventions (Allen et al., 2019). Nurse- and OT-led interventions demonstrate measurable benefits, yet many households continue to adapt reactively without guidance (Yeni & Yilmaz, 2022). Systems should therefore improve access to early professional input while also providing clear, practical information that supports informed self-initiated adaptations.

Across study types, the strongest empirical support relates to bathrooms and toilets, stairs and thresholds, circulation routes, lighting, and clutter

management ([van Hoof et al., 2010](#)). Practice guidelines and funding schemes should prioritise these zones as a minimum viable dementia-friendly home package, recognising their consistent association with improved safety and usability. At the same time, while falls prevention is critical, the evidence shows that autonomy, meaningful activity, and identity are central outcomes for people living with dementia ([Park et al., 2023](#)). Practice standards should therefore require that home modification plans articulate dual objectives—risk reduction and support for participation—rather than safety alone.

Implications for design and housing provision

For designers and housing providers, applying dementia-friendly and universal design principles in new housing developments and retrofits is essential ([Quirke et al., 2023](#)). The evidence highlights the importance of considering cognitive accessibility alongside physical accessibility, including visual access, simplified layouts, cues, and task-supportive environments ([Davis & Weisbeck, 2016](#)). Cognitive accessibility should be treated as core design, not an add-on, and explicitly integrated alongside physical modifications.

Preserving familiarity and “home-ness” also emerges as a critical design consideration. Incremental, domestic-looking changes are more acceptable and may reduce disorientation ([Allen et al., 2019](#)). Policies and specifications should discourage institutional aesthetics in private homes and support phased, familiarity-preserving adaptations, including continuity of materials, layouts, and cues. Engaging with people living with dementia and carers early in design processes is therefore essential ([Zhang et al., 2025](#)).

Design-led evidence further highlights gaps between general accessibility standards and dementia-specific needs. Planning and housing policy should move toward dementia-inclusive, future-proofed housing, embedding adaptable features such as lighting readiness, adaptable bathrooms, and clear circulation into mainstream housing to reduce later disruption and cost ([Balocating-Dunn, 2025](#); [Moore et al., 2017](#)).

Technology and implementation considerations

Simple, low-cost and low-tech adaptations are widely adopted and effective (Evans et al., 2019). Assistive technologies can add value, but benefits are conditional on usability, alignment with routines, and caregiver support (Henderson et al., 2020; Nauha et al., 2018). Reviews of digital and smart-home interventions highlight that technology adoption is uneven, with many systems remaining pilot-based and rarely evaluated for long-term, real-world effectiveness (Schneider et al., 2024). Policy and practice should therefore promote a stepwise approach, beginning with low-tech environmental changes and introducing technology selectively where fit, training, and support are assured. Ethical, privacy, and autonomy considerations remain central, particularly in relation to smart-home sensing and monitoring, and must be addressed alongside implementation (Cornelius et al., 2025; Tiersen et al., 2021).

Implications for policy

For policymakers, key implications include developing and funding programs that integrate home modifications and technology into dementia care pathways, addressing tenancy and regulatory barriers to reasonable modifications, and supporting research on cost-effectiveness and equity impacts of home design interventions (O'Malley & Croucher, 2005; Soilemezi et al., 2019). Studies consistently report that fragmented housing–health systems and restrictive tenure arrangements limit access to timely and appropriate environmental interventions, particularly for renters and people with lower incomes (Aitken et al., 2023; Allen, 2018).

Policy frameworks should promote early post-diagnosis home assessment and anticipatory planning, rather than crisis-driven responses. Qualitative evidence shows that delayed or reactive adaptations are often triggered by adverse events such as falls, resulting in rushed changes that can undermine familiarity and wellbeing (Allen et al., 2019).

Implications for research

Future research should conduct robust, larger-scale evaluations of multi-component environmental interventions, including long-term outcomes and cost-effectiveness, as current evidence is dominated by small-scale studies and short follow-up periods ([Newton et al., 2023](#); [van Hoof et al., 2010](#)). There is also a need to explore dementia-friendly home design in diverse cultural and socio-economic contexts, including social housing and rental markets, which remain under-represented in the literature.

Research should further prioritise the development and validation of standardised, dementia-relevant outcome measures that capture safety, participation, autonomy, and wellbeing, rather than focusing solely on falls or physical risk ([Park et al., 2023](#); [Soilemezi et al., 2019](#)). Finally, future studies should investigate ethical, privacy, and autonomy issues related to smart-home monitoring and expand co-design research involving people living with dementia as active partners in shaping their home environments ([Tiersen et al., 2021](#); [Zhang et al., 2025](#)).

Design Recommendations

Building on the implications for practice, policy, and research, this section synthesises the review findings into a set of evidence-informed design recommendations intended to guide real-world application in domestic settings. These recommendations are framed to support designers, practitioners, housing providers, and policymakers in translating the scoping review evidence into practical, scalable, and context-sensitive design decisions.

The design recommendations table (Table 4) translates the synthesised evidence into a set of actionable, design-focused principles for supporting ageing in place with dementia, drawing on convergent findings across empirical studies, reviews, and design guidance (e.g., [Soilemezi et al., 2019](#); [van Hoof et al., 2010](#)). Across studies, dementia-friendly home design is consistently characterised as a phased, longitudinal process rather than a one-time retrofit,

with strong evidence supporting early, incremental adaptation. Empirical findings converge on bathrooms, stairs, circulation routes, lighting, and clutter as priority targets, while outcomes should be evaluated using dual criteria of safety and autonomy rather than falls risk alone. The table further highlights the importance of preserving familiarity, embedding cognitive accessibility into core design decisions, and prioritising low-cost, low-tech modifications as a first-line strategy. Assistive technologies show conditional benefit and should be implemented selectively, with appropriate tailoring and support.

Table 4. Design Recommendations to Support Ageing in Place for People Living with Dementia in Domestic Settings

Design domain	Evidence-based recommendation	Supported by studies
Adaptation strategy	Treat dementia-friendly home design as a phased, longitudinal process, not a one-time retrofit	3, 4, 10, 12, 15, 21
Primary targets	Prioritise bathrooms, stairs, circulation routes, lighting, and clutter	1, 9, 10, 11, 14, 17, 20
Safety + autonomy	Evaluate success using both falls risk and participation/autonomy outcomes	13, 14, 16, 18, 21
Familiarity preservation	Implement incremental, domestic-looking changes to avoid institutional feel	9, 12, 15, 18, 21
Cognitive accessibility	Integrate visual access, simplified layouts, cues, and routines as core design features	9, 10, 14, 15, 18
Cost & feasibility	Start with low-cost, low-tech modifications before complex solutions	1, 6, 11, 14, 16
Assistive technology	Use AT only when tailored, supported, and aligned with daily routines	2, 6, 7, 16
Professional input	Provide early post-diagnosis home assessment to avoid crisis-driven changes	11, 17, 20
Housing policy & design	Embed dementia-inclusive and adaptable features into mainstream housing standards	3, 5, 9, 18

Collectively, the evidence supports a “minimum viable dementia-friendly home package” combining lighting, bathroom safety, circulation clarity, and familiarity-preserving cues, alongside early professional assessment and policy frameworks that embed dementia-inclusive, adaptable features into mainstream housing.

Conclusion

This scoping review highlights that supporting ageing in place for people living with dementia requires a person-centred, staged, and adaptable approach to home design. The review demonstrates that design innovations—particularly low-cost home modifications and activity-focused adaptations—can meaningfully support people living with dementia to age in place. Evidence consistently supports the value of early, proactive assessment, prioritisation of high-impact zones, and the use of low-cost, familiarity-preserving adaptations as a foundation for safety, autonomy, and wellbeing. Evidence is strongest for physical home modifications, while assistive and smart-home technologies show promise but remain under-evaluated, with benefits contingent on careful integration, usability, and ethical implementation. Key evidence-informed design recommendations, including a minimum viable dementia-friendly home package and principles for staged, adaptable modification, are summarised in Table 4.

To realise the full potential of dementia-friendly home design, coordinated action is required across practice, design, housing, and policy, alongside strengthened evidence on effectiveness, equity, and implementation. Technical solutions must be accompanied by systemic, ethical, and equity-focused implementation strategies, and person-centred, adaptable, context-sensitive, and co-designed approaches should be embedded within housing, health, and ageing policy. Embedding dementia-inclusive principles into mainstream housing and care systems, and explicitly incorporating environmental design and home modifications as core components of community-based dementia care, offers a critical opportunity to support people living with dementia to remain safely, meaningfully, and with dignity at home for longer.

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