Supplemental Material

Table S1. Characteristics of the included studies.

Author, year	Setting	Study design	Publication type	Participants and sample size	Residential status	Research orientations	Wayfinding relevance	Design elements examined	Lighting relevance	Light elements	Environmental experience relevance	Environmental experience outcomes	Key findings
Wu et al, 2022	Hospitals	Experimental study	Primary investigation	Older adults without severe cognitive or visual impairment; *n* = 101	Not reported; recruited from communities	F	P	SG	No		No		Developed a wayfinding signage design framework, which improved older adults' comprehension of hospital signage.
Tseng et al., 2020	Nursing home	Experimental study	Primary investigation	Older adults with cognitive impairment; *n* = 9	Not clearly reported; older participants recruited from care institutions	F	P	LM; DN	No		No		A wayfinding system combining landmarks with text, images, and voice reduced navigation errors in care facilities.
Tseng and Fang, 2022	Nursing facilities	Experimental study	Primary investigation	Older adults with mild-to-moderate dementia and no visual impairment; *n* = 30	Residents of nursing facilities	F	P	LM; DN	No		No		DECMGSS combined landmark guidance and monitoring, reducing caregivers' anxiety, perceived workload, and care time.
Leung et al, 2019	Nursing home	Survey and interviews	Primary investigation	Older adults with mild-to-moderate dementia; visual status not reported; *n* = 114	Residents of care-and-attention homes	E	S	SG; CO	Yes QL	Lighting conditions	Yes	Satisfaction; sense of belonging	Signage, contrast, tactile cues, and lighting supported orientation. The authors recommended pictorial signs and personalised rooms to aid recognition and belonging.
Xu. et al., 2025	Real-world and virtual environments	Review	Systematic review and meta-analysis	Healthy older	Not reported	F	B	SG	No		No		Environmental cues may support older adults' wayfinding, but findings from virtual settings need real-world validation.

Author, year	Setting	Study design	Publication type	Participants	Residential status	Research orientations	Wayfinding relevance	Design elements examined	Lighting relevance	Light elements	Environmental experience relevance	Environmental experience outcomes	Key findings
Innes et al., 2011	Nursing home	Qualitative focus group study	Primary investigation	Older adults with dementia; visual status not reported; $n = 40$	Nursing home residents	E	P	SG; CO; LM	Yes QL	Lighting conditions	Yes	Sense of belonging; user experience	Colour coding, personal signs, and memory boxes aided room finding, while familiar belongings supported a sense of home.
Davis and Weisbeck, 2016	Review of residential care, virtual, video and outdoor studies.	Review	Review	Older adults with and without dementia	Not reported	F	P	CO; LM; DN	No		No		Colourful, familiar, and personally meaningful cues at decision points and room doors support wayfinding in people with Alzheimer's disease. No direct testing of evidence.
Ghamari et al, 2025	Review of care, hospital and community settings.	Review	Review	Older adults with dementia; visual status not reported	Not reported	E	S	SG; CO; LM	Yes QL	Lighting conditions color temperature	No		Landmarks, colour and lighting are validated as effective wayfinding strategies. Bright blue-enriched daytime lighting and warm night lighting play a vital role in boosting well-being by creating a homely and comfort atmosphere A homelike atmosphere may improve their comfort and psychological well-being. Design recommendations were not tested with residents.
Olson & Albensi, 2021	Review of design in long-term care, homes and communities	Review	Review	Older adults with dementia; visual status not reported	Home, community, and long-term care settings	E	S	SG; CO; LM	Yes QT	Illuminance color temperature	No		Individuals with dementia prefer colours in the order blue > red > green, and colour brightness affects recognition; paints with a reflectance value above 65% improve visual clarity. Wayfinding effects of the proposed design features were not tested.

Author, year	Setting	Study design	Publication type	Participants	Residential status	Research orientations	Wayfinding relevance	Design elements examined	Lighting relevance	Light elements	Environmental experience relevance	Environmental experience outcomes	Key findings
Engelen et al., 2022	Review of aged care, home and other indoor settings.	Review	Narrative review	Older adults with varied cognitive and visual abilities	Home and residential settings across cited studies	E	S	SG; CO; SL	Yes QT	Illuminance color temperature	No		The review discussed distinctive layouts and signage as wayfinding supports; lighting findings concerned cognition, mood, and sleep. Lighting effects on wayfinding were not directly tested.
Shum et al., 2025	Hospital	Non-randomized before-and-after study	Quality-improvement project	Older adults with dementia; visual status not reported; *n* = 79	Short-stay hospital inpatients	F	P	SG; CO	No		No		Door decals reduced approaches to staff-only doors and exits but did not significantly improve room finding. Findings came from one short-stay dementia unit.
Man et al, 2025	Real and virtual environment	Review	Systematic review and meta-analysis	Older adults; cognitive and visual status not systematically reported	Not reported across	F	P	DN	No		Yes	Satisfaction; user experience	A meta-analysis found better navigation performance with AR than conventional tools; the benefit increased with mean age. Only 13 studies provided usable data
Deng et al., 2025	Medical facility	Experimental study	Primary investigation	Older adults；normal corrected visual acuity; *n* = 100	Not reported	F	P	SG	No		No		Older adults understood hospital symbols less well; familiarity and accurate depiction of meaning predicted comprehension. Symbols were tested without the text and colour of complete signs.
Leung et al., 2020	Care and attention homes	Questionnaire survey	Primary investigation	Older adults with mild-to-moderate dementia; visual status not reported; *n* = 65	Care-and-attention home residents	F	S	SG; CO	No		Yes	Satisfaction	Signage satisfaction was associated with less short-term and spatial memory loss; satisfaction with its location was associated with less time confusion; navigation was not tested.

Author, year	Setting	Study design	Publication type	Participants	Residential status	Research orientations	Wayfinding relevance	Design elements examined	Lighting relevance	Light Elements	Environmental experience relevance	Environmental experience outcomes	Key findings
Deng et al, 2024	Hospitals	Questionnaire survey	Primary investigation	Older adults：cognitive and visual status not reported; *n* = 762	Not reported	F	P	SG; CO	No		Yes	Satisfaction	Older hospital users reported difficulty with sign graphics and colours; the authors recommended clearer text, familiar symbols, and more salient colours. Questionnaire responses did not measure navigation performance.
Anthony, 2025	Urban walking and public transport	Review	Systematic literature review	Older adults with visual and cognitive impairment	Not reported	E	S	DN	No		Yes	User experience	Smart voice assistants deliver personalized, real-time, step-by-step auditory navigation. The proposed guidance was not tested with users.
Mazzei et al, 2014	Hospital units	Observational case study	Primary investigation	Older adults with dementia; visual status not reported; *n* = 6	Inpatients in an acute geriatric psychiatry unit	E	S	SL	No		No		Door checking declined after relocation to a purpose-built unit; colour coding and personal photos were proposed as wayfinding aids. A small observational study could not isolate the effects of individual features.
Davis and Sikorskii, 2020	Virtual senior residence	VR wayfinding eye-tracking study (secondary analysis)	Primary investigation	Older adults with early Alzheimer's disease or MCI; adequate corrected vision and no colour blindness; *n* = 15	Community-dwelling	F	S	CO; LM	No		No		Participants with Alzheimer's disease attended less to salient cues and more to repetitive building features than controls. Men relied more on salient visual cues for navigation than women. Small sample size.
Bosch and Gharaveis, 2017	Airport	Review	Review	Older adults with visual or cognitive decline	Not reported	E	P	SG; CO; LM	Yes QT	Illuminance color temperature	Yes	Satisfaction; user experience organizational image	Legible signage, distinctive cues, and clear layouts were identified as potential supports for older travellers' wayfinding. Enhancing seniors' independent travel benefits operators' image and profits. The review did not test these strategies in airports.

Author, year	Setting	Study design	Publication type	Participants	Residential status	Research orientations	Wayfinding relevance	Design elements examined	Lighting relevance	Light elements	Environmental experience relevance	Environmental experience outcomes	Key findings
Wang et al, 2019	Shopping mall	Experimental study	Primary investigation	Older adults：normal or corrected vision; *n* = 20	Not reported	F	P	SG	No		No		Older adults performed worse than younger adults in map-guided mall navigation; no overall gender difference was found. Only 10 older adults were tested in one mall.
Boedeker et al., 2022	Testing venue not reported.	Experimental study	Primary investigation	Older adults with Alzheimer's dementia; corrected vision; *n* = 66	Not reported	F	B	CO	No		No		Dark symbols on light backgrounds yielded faster responses; participants with Alzheimer's disease distinguished black–white and red–yellow combinations more accurately than blue–green. The colour task did not test signs or navigation.
Leung et al, 2021	Nursing home	Questionnaire survey	Primary investigation	Older adults with dementia; *n* = 96	Nursing home residents	E	S	SG; CO	Yes QL	Lighting conditions	Yes	Satisfaction	Greater satisfaction with finishes and signage was associated with less disorientation among residents with dementia. Signage design can support older adults' autonomy, comfort, safety, health, and dignity. The questionnaire study cannot establish a causal effect.
Caffò et al., 2014	Nursing home	Review	Review	Older adults with dementia; visual status not reported	Not reported	F	S	LM; DN	No		No		Compensatory cues and restorative training may both support wayfinding in dementia. The eight reviewed studies were too varied for a definitive comparison.
Fleming & Purandare, 2010	Nursing home	Review	Review	Older adults with dementia; visual status not reported	Nursing home residents	E	S	SG; CO; LM; SL	Yes QL	Lighting conditions	No		The Marshall framework finds weak evidence for signage efficacy, recommending objects over colours for orientation due to dementia seniors' impaired colour discrimination. Effects of individual design features on navigation were not isolated.

Author, year	Setting	Study design	Publication type	Participants	Residential status	Research orientations	Wayfinding relevance	Design elements examined	Lighting relevance	Light elements	Environmental experience relevance	Environmental experience outcomes	Key findings
Chee, 2023	Nursing home	interview study	Primary investigation	Older adults, some with visual impairment; severe cognitive impairment excluded; *n* = 28	Nursing home residents	E	S	SG; CO; SL; DN	Yes QL	Lighting conditions	Yes	Satisfaction; user experience	Residents described long corridors, similar doors, and dim lighting as making orientation difficult. Interviews did not test the effects of design changes.
Qiu et al, 2024	University interior architecture	Experimental study	Primary investigation	Older adults; cognitive ability assessed, visual status not reported; *n* = 38	Not reported	F	P	LM; DN	No		No		Landmark-based AR navigation works effectively for seniors. Excessive routes raise cognitive load, and step-by-step guidance is strongly preferred. It was tested in one university building.
Wang et al., 2026	university campus	Experimental study	Primary investigation	Older adults without serious cognitive or obvious visual impairment; *n* = 40	Not reported	F	P	DN	Yes QL	Lighting conditions	No		Virtual avatar AR guidance leads in efficiency, time pressure and satisfaction among three modes. Centered text shortens first fixation; simpler 2D maps reduce seniors' fixations. Samples were small
Hock et al, 2026	Nursing home	Review	Realist synthesis	Older adults with dementia; visual status not reported	Nursing home residents	E	S	SG; CO; LM; SL	Yes QL	Lighting conditions	No		Compact, open layouts aid wayfinding; circular corridors support wandering but may induce fatigue. Symmetrical layouts need clear side differentiation, and open plans require defined spaces. Colour coding and contrast improve orientation. effects of individual strategies were not quantified.
Süzer & Olguntürk, 2018	Virtual hospital and comprehensive clinic	Experimental study	Primary investigation	Older adults without severe visual impairment or cognitive impairment; *n* = 90	Not reported	F	P	CO	No		No		Colour notably impacts seniors' navigation. Neutral environments impair visuospatial navigation more than warm or cold ones. Warm and cool settings did not differ significantly.

Author, year	Setting	Study design	Publication type	Participants	Residential status	Research orientations	Wayfinding relevance	Design elements examined	Lighting relevance	Light elements	Environmental experience relevance	Environmental experience outcomes	Key findings
Pouyan et al, 2024	VR simulations of Hospital's circulation patterns	Experimental study	Primary investigation	Older adults with normal or corrected vision; cognitive status not reported; *n* = 92	Not reported	F	P	SG; CO; LM; SL	Yes QL	Lighting conditions	No		Information-rich environments outperform plain baseline setups in navigation. Layouts need tailored strategies. Without these elements, older adults' wayfinding performance declined significantly. The simulation omitted crowds and restricted movement.
Chaudhury & Xu, 2022	Nursing home	Review	Scoping review	Older adults, including those with dementia; vision not reported.	Nursing home residents	E	S	SG; CO; SL	Yes QL	Lighting conditions	Yes	Satisfaction Image; user experience	The review linked complex floor plans to poorer resident wayfinding; lighting findings mainly concerned safety and mobility. Asian seniors generally view nursing homes negatively as institutional, low-privacy and under-supported. The effect of lighting on navigation was not isolated.
Davis et al., 2017	Virtual senior apartment	Experimental study	Primary investigation	Older adults; cognitive ability assessed, visual status not reported; *n* = 70	Not reported	F	P	SG; CO; LM; SL	No		No		Vibrant colours give cues perceptual salience; familiarity brings cognitive salience; placement at key decision points delivers contextual salience. The study did not isolate the effects of cue colour, familiarity, and placement.
Nagata et al., 2026	Residential and shopping streets in a Japanese city.	Experimental study	Primary investigation	Older adults with dementia; residents' visual status not reported; *n* = 40	Long-term care residents	F	P	LM; DN	No		Yes	User experience	Voice navigation achieves equivalent wayfinding performance to paper maps yet induces lower cognitive load and greater relaxation. Short outdoor routes were tested, and cognitive load was not measured.
Alam and Kim, 2023	Senior living communities	Survey and interviews	Primary investigation	Older adults with dementia; visual status not reported; *n* = 30	Not reported	F	P	SG; CO; LM	Yes QL	Lighting conditions	No		Caregivers valued visibility, landmarks, and natural light. They reported that personalised door cues helped orientation, while similar doors and complex floor patterns caused confusion. Residents' navigation was not directly observed.

Author, year	Setting	Study design	Publication type	Participants	Residential status	Research orientations	Wayfinding relevance	Design elements examined	Lighting relevance	Light elements	Environmental experience relevance	Environmental experience outcomes	Key findings
Caspi, 2014	Assisted living residence	Qualitative ethnographic study	Primary investigation	Older adults with dementia; vision not reported; *n* = 12	Assisted-living residents	F	P	CO; LM	No		No		Residents with dementia forgot or misread room numbers and struggled to locate their rooms, bathrooms, and shared spaces. Only six residents in one residence were studied
Chaudhury et al., 2018	Long-term care and dementia care settings	Review	Review	Older adults with dementia; vision not reported	Long-term care residents	E	S	CO; SL	Yes QL	Lighting conditions	No		Reviewed care-home studies reported conflicting layout findings; small studies found that personal photos and names helped residents find rooms. Much of the evidence came from small, cross-sectional studies.
Davis and Therrien, 2012	Virtual room	Experimental study	Primary investigation	Older adults with normal cognition and adequate corrected vision; *n* = 125	Community-dwelling	F	P	CO; LM	No		No		Colourful, familiar pictures were associated with significantly shorter search paths than the other three cue types. Colourful abstract pictures and black-and-white familiar pictures showed no similarly clear advantage. The simplified virtual arena excluded lighting and noise.
Delcampo-Carda et al., 2019	Review of studies in laboratories, homes, and institutions	Review	Review	Older adults with varied cognitive and visual abilities	Not reported	E	S	CO	Yes QL	Lighting conditions	No		Reviewed studies reported reduced blue–green discrimination and colour-contrast sensitivity with age. The authors propose contrasting door frames, walls, and zones to aid orientation, while noting that illumination changes colour visibility. Most cited studies tested vision rather than wayfinding.
Ferri-Molla et al., 2026	University buildings	Field usability study	Primary investigation	Older adults; cognition and vision not reported; *n* = 34	Not reported	F	P	LM; DN	No		No		Older adults rated route selection and voice clarity highly, and rated both the map and AR arrows as useful. Clearer voice instructions and easier route selection were associated with higher overall usability. Only 21 older adults took part in formal testing.
Leung et al., 2020	care-and-attention home	Observation and questionnaire study	Primary investigation	Older adults; vision not reported; *n* = 96	Care-and-attention home residents	E	S	SG; CO	Yes QL	Lighting conditions	Yes	Satisfaction	Lighting satisfaction was associated with more positive emotion and fewer sleep disturbances in the final model. Signage showed no independent significant association in that model. Lighting was rated rather than measured

Author, year	Setting	Study design	Publication type	Participants	Residential status	Research orientations	Wayfinding relevance	Design elements examined	Lighting relevance	Light elements	Environmental experience relevance	Environmental experience outcomes	Key findings
Marquardt & Schmieg, 2009	Nursing homes	Observational study	Primary investigation	Older adults with mild-to-severe dementia; vision not reported; *n* = 450	Nursing-home residents	F	P	SL	No		No		Straight corridors, full corridor visibility, and one communal kitchen per unit were associated with better orientation in residents with moderate or severe dementia. Staff-rated outcomes in an observational study cannot establish causality.
Netten, 1989	Nursing homes	Observational study	Primary investigation	Older adults with confusion; severe visual impairment excluded; *n* = 104	Nursing-home residents	F	P	SL	Yes QT	Lighting conditions	No		In group homes, higher rated light levels were associated with better room-finding ability, while longer routes were associated with poorer ability. Meaningful decision points appeared helpful in both layout types. Light was rated on a scale, not measured in lux.
O'Malley et al., 2017	Nursing homes	Review	Review	Older adults with dementia; vision not reported	Not reported	F	P	LM	No		No		Three landmark functions: cues near a destination help identify the goal; distant landmarks provide directional references for re-orientation; and cues at turns or junctions signal the next action. Much of the underlying evidence came from simplified virtual or single-session tasks.
Oliver et al., 2024	Virtual indoor environment	Experimental study	Primary investigation	Older adults with Alzheimer's disease; normal or corrected vision; *n* = 192	Not reported	E	P	LM	No		No		Compared with control pictures, personalized nostalgic pictures improved picture recognition and increased positive affect, self-esteem, self-continuity, social connectedness and meaning in life. Tested in VR, not a real nursing home.
Weisberg et al., 2024	Review of virtual, urban, and hospital settings.	Review	Conceptual publication	Older adults; visual status not reported.	Not reported	F	P	LM; DN	No		No		The review proposes matching navigation aids to difficulties with location, orientation, spatial mapping, or route travel. It notes that information-heavy maps may burden older adults' memory, while turn-by-turn guidance may support travel without improving spatial learning. The evidence spans varied tasks and settings rather than nursing-home wayfinding.

Author, year	Setting	Study design	Publication type	Participants	Residential status	Research orientations	Wayfinding relevance	Design elements examined	Lighting relevance	Light elements	Environmental experience relevance	Environmental experience outcomes	Key findings
Caffò et al., 2018	Virtual environment	Experimental study	Primary investigation	Older adults with or without cognitive impairment; severe vision loss excluded; *n* = 286	Not reported	F	P	LM; CO	No		No		Participants with probable dementia needed about twice as many attempts with a distant landmark as with a nearby one. Room geometry provided an additional cue, but its interaction with landmark position was not significant. Tested in VR, not a real nursing home.

Note: Research orientations: F = function-oriented; E = environmental-experience-oriented. Each source was classified by its primary focus. Sample sizes are reported for primary studies only. For reviews and conceptual publications, this field is left blank because they do not report a directly comparable participant sample size. Wayfinding relevance: P = primary focus; S = secondary focus; B = background context. Design elements examined: SG = signage; CO = colour; LM = landmarks; SL = spatial layout; DN = digital navigation. Multiple codes indicate that more than one element was examined. Lighting relevance: QL = qualitative discussion of lighting; QT = quantitative assessment of lighting. These codes describe the lighting evidence, not the overall study design.

Table S2. Transferability assessment of studies conducted outside nursing homes.

Author, year	Setting	Transferability rationale	Contextual limitations
Wu et al., 2022	Hospitals	Six of nine redesigned pictograms received higher estimated comprehension ratings; the findings may inform signs for comparable healthcare services in nursing homes	Ratings did not test actual recognition or navigation. Hospital-specific symbols and the exclusion of people with severe visual or cognitive impairment limit transferability.
Xu et al., 2025	16 virtual, one real-world, and one comparing real and virtual navigation.	Age differences in navigation and spatial learning may inform outcome selection for nursing-home wayfinding studies.	Many underlying studies used virtual environments or recall tasks, which may not reflect residents' routine wayfinding.
Davis and Weisbeck, 2016	Review of three residential room-finding studies, three virtual navigation studies, one video-route study and one outdoor route study.	Studies of personalised door cues and salient cues at decision points may inform room identification and route design in nursing homes.	The review provides no new resident data; room-finding and simulated routes do not establish effects on everyday navigation.
Ghamari et al., 2025	Architectural review drawing on care, hospital and community settings.	Its synthesis of junction landmarks and legible layouts may inform nursing-home route design.	Evidence comes from varied settings and secondary sources.
Olson & Albensi, 2021	Review of design in long-term care, homes and communities.	Cues at turns, continuous routes and colour contrast may inform orientation. Reported colour preferences and emotional responses may inform palette choices.	The recommendations draw on mixed settings; the review did not test their effects on residents' wayfinding.
Engelen et al., 2022	Review of aged care, home and other indoor settings.	Reviewed care-facility studies link repetitive layouts to disorientation, informing route differentiation in nursing homes.	This is secondary evidence from varied settings; the review did not test wayfinding itself.
Shum et al., 2025	Hospital	Dementia unit. Concealed staff and exit doors received fewer approaches, which may inform restricted-door design in nursing homes.	Patients stayed for shorter periods; decals did not significantly improve finding their own rooms.
Man et al., 2025	Review of AR navigation studies across varied tasks and settings.	AR showed gains in wayfinding and spatial knowledge over conventional aids, which inform digital guidance in nursing homes.	The studies combined different tasks, effects for nursing-home residents remain unverified.

Author, year	Setting	Transferability rationale	Contextual limitations
Deng et al., 2025	Hospital	Familiar symbols with clear meanings were easier for older adults to interpret; this may inform nursing-home pictograms.	Isolated symbol recognition does not establish wayfinding performance. Participants with known cognitive impairment were excluded.
Deng et al, 2024	Hospitals	Older respondents reported greater difficulty with signage text, symbols and colour as age increased, and tended to consult text first. These findings may inform readable, text-supported signage in nursing homes.	Self-reported hospital experiences do not establish navigation outcomes in nursing homes.
Anthony, 2025	Urban walking and public transport	Proposed personalised spoken directions and route confirmation may inform digital wayfinding in nursing homes.	These are design proposals; their effects on residents' indoor navigation were not tested.
Davis and Sikorskii, 2020	Virtual senior residence.	Participants with early AD or MCI looked less at distinctive cues during navigation. This may inform the placement and testing of landmarks in nursing homes.	A small eye-tracking subsample in VR; it shares participants with Davis et al. (2017).
Bosch and Gharaveis, 2017	Airports as the target setting; cited studies span nursing homes and other indoor environments.	The review links repetitive layouts with wayfinding difficulty in dementia, supporting distinct reference points in nursing homes.	This is secondary evidence; cited findings should not be counted as independent results.
Wang et al., 2019	Shopping mall	Older adults had more difficulty locating themselves, remembering routes and following indoor maps. This may inform map and turning-point information in nursing homes.	The sample was small, and participants with memory problems were excluded.
Boedeker et al., 2022	Testing venue not reported.	Dark targets on light backgrounds produced faster responses. Participants with Alzheimer's dementia also made fewer errors with black–white and red–yellow than blue–green combinations. These findings may inform sign contrast.	Participants distinguished shapes on a screen; the study did not test signs or routes.
Qiu et al., 2024	University interior architecture	Landmark-based AR guidance shortened initial routes and improved spatial pointing. It may inform digital guidance at nursing-home decision points.	Participants were highly educated older adults navigating an unfamiliar building; long-term resident use was not tested.

Author, year	Setting	Transferability rationale	Contextual limitations
Wang et al., 2026	University campus	Animated AR guidance reduced workload during walking; centrally placed text attracted attention sooner. These findings inform nursing-home digital interfaces.	The walking study used an outdoor university route with a small sample.
Süzer and Olguntürk, 2018	Virtual hospital and comprehensive clinic	Warm and cool colour schemes supported older adults' route finding better than a neutral scheme. This may inform colour differentiation between nursing-home areas.	The setting was virtual; participants with notable cognitive or visual difficulties were excluded. Warm and cool schemes did not differ significantly.
Pouyan et al., 2024	VR simulations of Hospital's circulation patterns	In the virtual hospital, routes with combined colour, lighting, signage and graphic cues generally supported better wayfinding than minimally differentiated routes. Corridor routes were comparatively easy to navigate. These findings may inform clear circulation and added cues at difficult points in nursing homes.	Participants navigated while seated in VR. Several design elements changed together, so their separate effects are unclear.
Davis et al., 2017	Virtual senior apartment	Large, memorable cues at decision points helped older adults, including those with early AD or MCI, find destinations faster and more often. This may inform landmark placement in nursing homes.	Wayfinding was tested in VR over two days, rather than during residents' daily use. The sample overlaps with Davis and Sikorskii (2020).
Nagata et al., 2026	Residential and shopping streets in a Japanese city.	Voice guidance showed no significant difference from paper maps in route completion or time, while participants reported greater relaxation. Their feedback may inform spoken directions and landmark prompts in nursing homes.	The routes were outdoors, and cognitive load was not directly measured.
Alam and Kim, 2023	Senior living communities	Visibility, landmark location, floor colour and patterns, and natural light were considered important for wayfinding. These findings may inform cue placement, flooring, and lighting design in nursing homes.	Residents' navigation was not tested, and lighting conditions were not physically measured.

Author, year	Setting	Transferability rationale	Contextual limitations
Caspi, 2014	Assisted living residence	Residents struggled to find rooms and shared spaces and sometimes forgot or misread room numbers. These difficulties may inform the design of room cues and destination signs in nursing homes.	It described existing corridor colours and door displays but did not test their effects.
Chaudhury et al., 2018	Long-term care and dementia care settings	Findings on room cues, corridor layouts, and floor colour coding address orientation needs shared across long-term care settings. Evidence from other care settings may inform nursing-home wayfinding design.	This is a narrative review of varied studies, including primary papers reported separately in S1. Findings should not be counted as independent confirmation.
Davis and Therrien, 2012	virtual room	Colourful, familiar pictures produced shorter search paths than abstract or black-and-white cues. This may inform the design of recognisable pictorial landmarks in nursing homes.	The simple virtual room did not test real routes, signs, or lighting.
Delcampo-Carda et al., 2019	Review of studies in laboratories, homes, and institutions	Older adults' blue–green discrimination and sensitivity to colour contrast decline with age, while illumination affects colour visibility. These findings may inform colour contrast at doorways and between zones in nursing homes.	The care-home colour schemes were illustrations, not tested designs
Ferri-Molla et al., 2026	University buildings	Clear voice instructions, easy route selection, maps and AR arrows support basic indoor wayfinding tasks that are not specific to university buildings. Older adults' positive ratings may therefore inform the design of digital guidance in nursing homes.	Safety and independence were self-reported; effects on residents' actual navigation were not tested.
Leung et al., 2020	Care-and-attention homes	Residents' evaluations of signage readability, contrast and lighting concern indoor design features also relevant to nursing homes. The association between lighting satisfaction and residents' emotion and sleep may inform nursing-home environmental design.	Lighting was rated, not physically measured; wayfinding was not tested, and the final model did not confirm an independent signage association.

Author, year	Setting	Transferability rationale	Contextual limitations
Oliver et al., 2024	Virtual indoor environment.	Personalized nostalgic pictures improved landmark recognition and positive experiences in older adults with Alzheimer's disease. This may inform the selection of personally meaningful landmarks in nursing homes.	Better picture recognition did not translate into a significant improvement in remembering which direction to take.
Weisberg et al., 2024	Review of virtual, urban, and hospital settings.	Its framework links specific navigation difficulties to maps, landmarks, and directional cues. This may help select wayfinding aids for nursing home residents.	The proposed applications were not tested with nursing home residents.
Caffò et al., 2017	Virtual environment	Landmark proximity and room geometry affected reorientation. These findings may inform landmark placement and spatial differentiation in nursing homes.	The geometry × landmark-position interaction was not significant.
Mazzei et al, 2014	Hospital units	Colour-free areas confuse zone recognition. Circular layouts cut wandering frequency, and personal photos help identify rooms. These features may inform route and exit design in nursing homes.	Only six hospital patients were observed. Several design features changed together, and room-finding was not tested; the effects of individual features cannot be established.

Supplementary Table S3. Benchmark studies and their retrieval by the search strategy.

Source review title	Benchmark study title	Retrieved by the search strategy (Yes/No)
Immersive technologies targeting spatial memory decline	The differential effect of normal and pathological aging on egocentric and allocentric spatial memory	Yes
	Evaluation of a cognition-sensitive spatial virtual reality game for Alzheimer's disease	Yes
	Applicability of an immersive virtual reality system to assess egocentric orientation of older adults	Yes
	Predicting real-world navigation performance from a virtual navigation task in older adults	Yes
	A comparison of the effects of older age on homing performance in real and virtual environments	Yes
	Two immersive virtual reality tasks for the assessment of spatial orientation in older adults with and without cognitive impairment	Yes
	Navmarkark: A landmark-based augmented reality (ar) wayfinding system for enhancing older adults' spatial learning	Yes
	At crossroads in a virtual city	Yes
	Spatial orientation assessment in the elderly: A comprehensive review of current tests	Yes
	Assessing the feasibility and efficacy of virtual reality navigational training for older adults	Yes

Source review title	Benchmark study title	Retrieved by the search strategy (Yes/No)
Immersive technologies targeting spatial memory decline	How to help older adults navigate through VR?	Yes
	Benefits of nostalgic landmarks for people living with Alzheimer's disease	No
	Bodily and visual-cognitive navigation aids to enhance spatial recall in mild cognitive impairment	No
Xr-based visual enhancing cues for human spatial navigation	Wayfinding in aging and Alzheimer's disease within a virtual senior residence: Study protocol	Yes
	Effectiveness of augmented reality technology in improving navigation performance	Yes
	Spatial navigation in older adults with mild cognitive impairment and dementia	Yes
	Differential brain activity in regions linked to visuospatial processing during landmark-based navigation	Yes
	Proficiency of allocentric and egocentric wayfinding	Yes
	Age differences in pedestrian navigational skills and performance	Yes
	Are visual cues helpful for virtual spatial navigation and spatial memory in patients with mild cognitive impairment or Alzheimer's disease?	No

Source review title	Benchmark study title	Retrieved by the search strategy (Yes/No)
A systematic review of the impact of environmental factors on older people's quality of life in residential care facilities	The role of the built environment on the quality of life for residents in long-term care facilities in asia	Yes
	Design for healthy ageing: The relationship between design, well-being, and quality of life	Yes
	Long-term care for people with dementia: Environmental design guidelines	Yes
	Effects of supporting facilities on memory loss among older people with dementia in care and attention homes	Yes
	A qualitative and quantitative investigation of effects of indoor built environment for people with dementia in care and attention homes	Yes
	Legibility of floor plans and wayfinding satisfaction of residents in care and attention homes in hong kong	No
	Environmental influences on indoor walking behaviours of assisted living residents	No
Association between the indoor visual environment and cognition in older adults: A systematic review	Integrated model for indoor built environment and cognitive functional ability of older residents with dementia in care and attention homes	Yes
	Dementia-friendly architecture: Environments that facilitate wayfinding in nursing homes	Yes

Source review title	Benchmark study title	Retrieved by the search strategy (Yes/No)
Association between the indoor visual environment and cognition in older adults: A systematic review	The aid of colour on visuospatial navigation of elderly people in a virtual polyclinic environment。	Yes
	Environments that facilitate wayfinding in nursing homes – dementia-friendly architecture	Yes
Virtual reality and serious videogame-based instruments for assessing spatial navigation in alzheimer's disease: A systematic review of psychometric properties	The potential of virtual reality for spatial navigation research across the adult lifespan	Yes
	Spatial orientation tasks show moderate to high accuracy for the diagnosis of mild cognitive impairment: A systematic literature review	Yes
	Reorientation deficits are associated with amnestic mild cognitive impairment	No
	Spatial reorientation decline in aging: The combination of geometry and landmarks	No

Supplementary Table S4. Overlap between secondary publications and primary studies included in the review.

Secondary publication	Primary study also included in the review	Overlapping finding
Age differences in pedestrian navigational skills and performance: A systemic review and meta-analysis	Gender and age differences in using indoor maps for wayfinding in real environments	The review used data from the same indoor-map wayfinding study to analyse age differences. The cited publication years differ, but the doi is identical.
Creating a supportive environment using cues for wayfinding in dementia	(1) Cue color and familiarity in place learning for older adults (2) Wayfinding difficulties among elders with dementia in an assisted living residence	The review repeats findings on colour and familiar cues from the experimental study and room-finding difficulties from the qualitative study.
Design for healthy ageing – the relationship between design, well-being, and quality of life: A review	(3) A qualitative and quantitative investigation of effects of indoor built environment for people with dementia in care and attention homes (4) Structural model for the relationships between indoor built environment and behaviors of residents with dementia in care and attention homes	The review repeats findings on pictorial signage and the associations of lighting with residents' emotional health and sleep.
Effectiveness of augmented reality technology in improving navigation performance: A systematic review and meta-analysis	Navmarkark: A landmark-based augmented reality (AR) wayfinding system for enhancing older adults' spatial learning	The review cites the navmarkar study's findings on shorter wayfinding times and more accurate cognitive maps with ar landmark guidance. This study was discussed narratively and was not included in the pooled meta-analysis.
Flying solo: A review of the literature on wayfinding for older adults experiencing visual or cognitive decline	(1) Cue color and familiarity in place learning for older adults (2) Exploring the influence of environment on the spatial behavior of older adults in a purpose-built acute care dementia unit (3) Dementia-friendly architecture: environments that facilitate wayfinding in nursing homes	The review repeats findings on colourful, familiar cues and increasing reliance on environmental support as dementia advances. It also presents room colour coding discussed by mazzei et al. As evidence of improved wayfinding, although the original study did not test that effect.

Secondary publication	Primary study also included in the review	Overlapping finding
Strategies to support safe wandering in care homes for older adults – what works, for whom, and in which circumstances? A realist synthesis	(1) Navigating the maze: caregivers perception on design elements to improve wayfinding for older adults with dementia in long-term care facilities (2) Care home design for people with dementia: what do people with dementia and their family carers value? (3) Dementia-friendly architecture: environments that facilitate wayfinding in nursing homes (4) Exploring the influence of environment on the spatial behavior of older adults in a purpose-built acute care dementia unit (5) A device designed to improve care and wayfinding assistance for elders with dementia	The realist synthesis draws on the included primary studies to discuss care-home layout, landmarks, signage, and technology-assisted movement. These discussions do not provide independent tests of those findings.
The influence of the physical environment on residents with dementia in long-term care settings: A review of the empirical literature	(1) Wayfinding difficulties among elders with dementia in an assisted living residence (2) Care home design for people with dementia: what do people with dementia and their family carers value? (3) Dementia-friendly architecture: environments that facilitate wayfinding in nursing homes	The review repeats findings on residents' wayfinding difficulties, the association between straight corridors and better orientation, and residents' and families' design preferences.
Decreasing spatial disorientation in care-home settings: How psychology can guide the development of dementia friendly design guidelines	Dementia-friendly architecture: environments that facilitate wayfinding in nursing homes	The review repeats the finding that straight routes without turns were associated with better orientation than routes with one change in direction among nursing-home residents with moderate or severe dementia.