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Dementia: What living environments make a difference?

A Bruyère Rapid Review

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Executive summary

This rapid review examined what living environments make a difference in behavioural and psychosocial outcomes of people with dementia. Seven reviews met our inclusion criteria and their quality varied from low to high.

We found a relationship between various aspects of living environments and outcomes of people with dementia. We identified three categories of interventions involving the design, attributes and physical space of living environments for people with dementia.

The following design characteristics had an effect on outcomes of people with dementia. Special care units had a positive effect in behaviour, wellbeing, engagement and physical restraint use. In addition, there was improved wellbeing of caregivers of residents in special care units. Small-scale environments improved the behaviour, wellbeing and orientation of residents. Low social density reduced behavioural problems and psychotropic drug use in residents. Various aspects of building layout had different effects on outcomes. For example having a central nursing station improved resident engagement whereas long corridors worsened behaviour.

Environmental attributes such as lighting had conflicting effects on behaviour and wellbeing. Low noise levels improved behaviour, wellbeing, engagement and orientation. A comfortable room temperature improved behaviour and wellbeing. Camouflaging doors and door knobs improved behaviour and wellbeing. Unobtrusive safety features such as silent electronic door locks improved wellbeing. Floor patterns and dark lines or surfaces disoriented residents while the use of colours as cues improved orientation. Having specialized workers improved the wellbeing of residents.

Various interventions involving the physical space had a positive impact on the following outcomes: behaviour (non-institutional character, pleasant sensory stimulation, multi-sensory environment approach, and person-centred bathing protocols); wellbeing (non-institutional character and multi-sensory environment approach); engagement (non-institutional character and pleasant sensory stimulation); physical restraint use (pleasant sensory stimulation) and orientation (environmental cues).

All patient and clinician important outcomes were not assessed for each intervention in many studies. Assessing all important outcomes would contribute to the impact of the intervention on the overall quality of life of the residents and caregivers.

the impact of different interventions should be assessed with respect to the stage of dementia as people with dementia may respond differently at different stages of the disease.

Although advances have been made in the research of built environments for people with dementia, there is limited evidence on the effects on their caregivers. Improving the wellbeing of staff and family caregivers may enhance the care of people with dementia.

Design characteristics have been explored more than interventions involving attributes and the physical space. More interventions involving changes of the living environment should be explored as they may be easier to implement in already existing long-term care residential facilities.

Background

BCC Context

Bruyère Continuing Care (BCC) operates two long-term care sites: Élisabeth Bruyère Residence (EBH) and Saint-Louis Residence (SLR) with 71 and 198 beds respectively. Both locations offer specialised services for patients with dementia; the Saint-Louis Residence (SLR) has two units (50 beds) for patients with dementia. According to the most recent CIHI health indicator report 54% of the Saint Louis Residence population and 68.9% of Élisabeth Bruyère Residence population have dementia(1).

According to the Long Term Care Q1 2014-15 MDS Quality Indicator Report(2), 7.2% of residents in SLR and 12% in EBH presented with worsened behavioural symptoms (see Figure 1); 11.4% of residents in SLR and 11.1% in EBH had worsened depressive mood (see Figure 2).

Burden of Dementia

More people are living with dementia as the population ages; 6-15% of Canadians aged 65 years and older were living with dementia in 2011 and the number is expected to double by 2030(3). See Figure 3.

One in ten seniors (nearly 200,000 people over the age of 65) in Ontario are living with some form of dementia, including the most prevalent: Alzheimer's disease(5). See Figure 4.

Dementia is the leading cause of dependency and disability among older persons(4, 7). It is also the leading cause of institutionalization among seniors with over 70% of people with dementia living in long-term care(8).

Dementia care is mostly informal provided by family and friends of people with dementia, resulting in societal burdens. Informal dementia care is currently estimated at 19 million unpaid hours per week and will rise to 39 million unpaid hours per week over the next 20 years(9).

Dementia Care Strategies

Dementia progresses slowly from early, through mild, moderate, and severe stages. At the early stage, people with dementia may live at home and manage their care themselves but may require full assistance at the advanced stage where the patient may need to live in a long-term care home because of severe cognitive impairment, behavioral and psychosocial problems.

The national and provincial dementia care strategies are person-centered and focused on preventing, delaying and improving quality of life of people with dementia and also supporting their caregivers(5, 9). These are also reflected in the Champlain Local Health Integration Network's (LHIN) Integrated Model of Dementia Care(10).

To help people living with dementia and their caregivers, the Ontario government is committed to invest in long-term care homes for staff training and development opportunities that focus on improving the quality of care for residents, including those with dementia (5).

Different Types of Living Environments

The physical environment has been shown to influence the quality of life of people with dementia(11-16). With the person-centered care model, long-term care facilities are adapting their concepts to the special needs of people with dementia resulting in different types of long-term care facilities offering different care and services(17-19).

Since the 1980s, dementia special care units have increasingly been developed in long-term care setting institutions in North America. There is no standard definition of special care units (SCUs); however, they are specially designed residential care settings catering only for people with dementia or more specifically, Alzheimer's disease with a set of related interventions including features such as a unique staffing pattern, specially designed activity programming, family involvement, and specially designed physical environment that is segregated from other areas(15, 20, 21).

Various concepts of dementia special care units exist based on the size e.g. small-scale, homelike units called "small-scale living" in Netherlands /Belgium, "group living" in Sweden, "group homes" in Japan, "CADE units" in Australia, or "Cantou" in France. There also exist large segregated special care units or special care facility e.g. Hogewey dementia village in Hogeway, Netherlands. Some SCUs are within a nursing home or long-term care residence e.g. Saint-Louis Residence, Ottawa, Ontario; Georgian Bay Retirement Home, Penetanguishene, Ontario; The Lodge at Broadmead, Victoria, British Columbia, Canada. There are also long-term care villages e.g. Schlegel Village at University Gates, Waterloo, Ontario which has six separate specialized home areas called neighbourhoods including one active dementia home area for people with dementia.

With increasing dementia burden some traditional residential care units or nursing homes accept people with dementia although they do not have special care units.

Objective

This review aimed to identify evidence about the effects of living environments or changes to the living environment on quality of life, behavioural and psychosocial symptoms and caregiver quality of life for people with later stages of dementia.

Methodology

We defined the question by consulting with managers, clinicians and patients.

Eligibility and Selection Criteria

We included systematic reviews if they met the following eligibility criteria:

Population: people with dementia in long-term care and/or their care givers

Intervention: organizational or design characteristics, structures of care or environmental attributes and processes of care involving the physical spaces within the living environment including interventions to create a pleasant stimulating environment and environmental cues.

Comparison: usual care, other interventions or no treatment or control

Outcomes: reported findings on at least one of the following outcomes – wellbeing (including quality of life, depression and mood), behavioural symptoms, engagement, use of psychoactive medications and physical restraint, orientation (way-finding or safe wandering).

We excluded trials as well as reviews on prescribed therapies or interventions delivered at the personal level or outside the long-term care setting or interventions that did not measure the influence of the physical environment on people with dementia or their caregivers e.g. staff training.

Search Methods

An information specialist designed a sensitive search strategy in PubMed on April 1, 2015 to retrieve articles about characteristics of living environments in long term care settings for people with dementia (see Appendix 1 for the full search strategy). The search was not limited by study design, publication type, language or date. 733 items were retrieved and we also did a related article search for relevant articles. In addition we searched Trip Database, Health Evidence, Health Systems Evidence and the McMaster Aging Portal on April 17, 2015 to identify relevant systematic reviews.

We screened the search results and reference lists of eligible articles in duplicate. Disagreements were resolved by consensus.

Quality Assessment and Grading of Evidence

We assessed the quality of the included reviews using AMSTAR (see Appendix 2) and graded the quality of the evidence as platinum, gold, silver or bronze level as described in Appendix 3.

Evidence Review

Evidence Review from from patient/caregiver and clinician engagement. We discussed with the Medical director and Program director of the Regional Geriatric Program of Eastern Ontario (RGPEO). RGPEO works in partnership with healthcare professionals and other organisations (e.g. Alzheimer Society of Canada, Alzheimer Society of Ontario, Champlain Dementia Network, and BCC) to optimize the health and independence of seniors and prevent unnecessary and inappropriate institutionalization in the Champlain region. The following were identified as important outcomes for people with dementia: quality of life, behaviour, wandering, and engagement.

The Ontario government's Alzheimer Strategy of 2004 led to the creation of organizations including the Alzheimer Knowledge Exchange (AKE) in 2005, a resource center that supports moving forward innovations in practice. In 2008 a Design and Dementia Community of Practice (CoP) was formed through AKE, to improve the living environments of people with dementia and promote their wellbeing and autonomy. The CoP has developed evidenced-based dementia-friendly design recommendation tools on lighting, noise, doorways and wayfinding for long-term care homes and alternate care settings.

Discussion with a dementia patient caregiver revealed that nursing homes or long-term care residential facilities lacked accommodation for caregivers.

Systematic Review

Systematic review evidence of effects of different living environments on quality of life, depression and behavioural and psychosocial symptoms in people with dementia and their caregivers.

We identified 7 systematic reviews on different living environments for people with dementia in a long term care setting that met our inclusion criteria. There was a wide variation of the AMSTAR quality assessment scores of the reviews. One review scored 11/11(21), two scored 8/11(19, 22), one scored 5/11(23) and three scored 3/11(24), 2/11(25) and 1/11(15) respectively (see details in Appendix 2).

All the reviews assessed the effects of different types of living environments and two(19, 23) also assessed the effects of changes to existing living environments on people with dementia. Only two reviews presented evidence of effects on caregivers of people with dementia(15, 24). One review specified the stage of dementia – the included studies considered people with moderate to severe dementia in special care units(24).

There was an overlap of some included studies across the reviews; however, no study was included in all 7 reviews. Because of the diversity in study designs, types of interventions assessed and outcomes reported a quantitative analysis was only done in one review(21) which assessed the effects of SCUs compared to traditional nursing homes for people with dementia (see Table 1 on next page for the summary of findings).

Table 1: SCU vs traditional nursing home for dementia individuals with behavioural problems(21)

Outcome	# studies, # participants	Absolute risk difference*	Relative effects	Quality (GRADE)
Behaviour	2 studies, 933 participants (Nobili 2006, Leon 1999)	One study showed a reduction in behavioural problems of -4.3 units on NPI[1] scale (MD -4.3, 95% CI -7.22, -1.38). Another study showed no effect on the CMAI[2] scale (MD 0.74, 95% CI, -0.34 to 1.82)		
Quality of life (QOL) – measured in four different ways	1 study, 22 participants (Webber 1995)	20 more people out of 100 with higher formal activity participation in SCUs (RR 1.24, 95% CI 0.89 to 1.75); 53 fewer people out of 100 with higher informal activity participation in SCUs (RR 0.24, 95% CI 0.06 to 0.90); 3 more people out of 100 with higher QOL after exercise in SCU (RR 1.04, 95% CI 0.70 to 1.55); 20 more people out of 100 had higher individual QOL in SCUs (RR 1.67, 95% CI 0.55 to 5.02)		
Psychotropic drug use at 6 months	2 studies, 428 participants (Nobili 2006, Webber 1995)	One study showed a lower mean number of psychotropic drug use in SCUs of 0.2 at 6 months [MD 0.2, 95% CI 0.00 to 0.40]. Another study showed more people using psychotropic drug use in SCUs: 6 more people out of 100 using psychotropic drugs on a regular basis [RR 1.40, 95% CI 0.56 to 3.47] and 12 more people out of 100 using psychotropic drugs as needed [RR 2.52, 95% CI 0.44 to 14.57].		
Use of physical restraint at 6 months	2 studies, 354 participants (Nobili 2006, Webber 1995)	18 fewer people out of 100 with restraint use in SCUs	RR 0.71 (0.57 to 0.88)	
Mood/affect at 3 months only ([3]Cornell Scale of Depression)	1 study, 66 participants (Frisoni 1998)		MD -6.3 (-7.88 to -4.72)	

[1]NPI: Neuropsychiatric Inventory scale. Assesses the presence, frequency and severity of 12 neuropsychiatric behaviours in the previous month. Maximum score of 144. Higher score means higher level of agitation. See Appendix 4 for more details on scoring.

[2]CMAI: Cohen-Mansfield Agitation Inventory scale. Assesses agitated behaviours, 29 items using a 7-point scale. There is also a short form (14 items). Maximum score of 203 (70 for the short form). Higher score means higher level of agitation. See Appendix 4 for more details on scoring.

Organizational or Design Characteristics

Organizational or design characteristics included the overall model of care (e.g. special care units, small-scale homelike environments, nursing homes or residential care facilities), the building layout (e.g. size and shape of hallways, distribution of residential rooms and common spaces), and social density (number of people per room e.g. single, double or multi-occupancy bedrooms). The evidence from this category is summarized in Table 2.

Table 2: Summary of evidence of effects of organizational or design characteristics on health and psychosocial outcomes in people with dementia

Intervention	Wellbeing including quality of life, depression and mood	Behaviour	Social abilities/ Engagement	Medication use (psychotropic drugs)	Physical restraint use	Orientation/ way finding
Special care unit	P[1]	P	P	?	P	NR
Small-scale environments	P	?	P	P	NR	P
Low social density (number of people per surface area	NR	P	?	P	NR	O
Building layout – long corridors	NR	=	NR	NR	NR	NR
Building layout – central location of nursing station	NR	NR	P	NR	NR	NR
Building layout and orientation[2]	NR	NR	NR	NR	NR	P

[1] In addition, there was improved wellbeing of caregivers of residents in special care units.

[2]Building layout and orientation: specific interventions included – direct visual access, integration of reference points, implementation of several zones with a unique character, straight circulation, small number of doors and exit points, and spatial proximity of communal spaces.

Structures of Care or Environmental Attributes

Structures of care or environmental attributes included lighting interventions, noise, doorways and human resources (e.g. level of staffing, expertise of staff). See Table 3 for the summary of the evidence.

Table 3: Summary of evidence of effects of structures of care or environmental attributes on health and psychosocial outcomes in people with dementia

Intervention	Wellbeing including quality of life, depression and mood	Behaviour	Social abilities/ Engagement	Medication use (psychotropic drugs)	Physical restraint use	Orientation/ way finding	Comments
Light therapy	?	?	NR	NR	NR	NR	
Daylight control[1]	O	?	NR	NR	NR	NR	Light interventions were used to imitate or to control naturalistic forms of light.
Overall light level – brighter light[2]	?	?	NR	NR	NR	NR	Improved wellbeing in women but worse in men. Improved behaviour but led to more wandering
Noise level – reduced levels	P	P	P	NR	NR	P	
Comfortable room temperature	P	P	NR	NR	NR	NR	
Camouflaging doors and door knobs	P	P	NR	NR	NR	NR	
Unobtrusive safety features e.g. silent electronic door locks	P	NR	NR	NR	NR	NR	
Floor patterns and dark lines or surfaces	NR	NR	NR	NR	NR	=	
Use of colours as cues	NR	NR	NR	NR	NR	P	
Use of specialized workers	P	NR	NR	NR	NR	NR	

[1]Daylight control: Light interventions were used to imitate or to control naturalistic forms of light.

[2]Overall light level – brighter light: Light intervention used to increase the overall light level.

? = conflicting evidence from different studies

P = beneficial effects

O = no effect

= = negative effect

 = silver level of evidence

 = bronze level of evidence

NR = Not reported or not assessed

Processes of Care and Environmental Cues

Processes of care involving the physical spaces within the living environment included interventions to create a pleasant stimulating environment (e.g. non-institutional character or familiar homelike components and personalization, sensory stimulation or enhancement, person-centered bathing protocols) and environmental cues. See Table 4 for the summary of the evidence.

Table 4: Summary of evidence of effects of processes of care or interventions to create a pleasant stimulating environment on health and psychosocial outcomes in people with dementia

Intervention	Wellbeing including quality of life, depression and mood	Behaviour	Social abilities/ Engagement	Medication use (psychotropic drugs)	Physical restraint use	Orientation/ way finding
Non-institutional character [1]	P	P	P	NR	NR	NR
Pleasant sensory stimulation and minimizing distraction	NR	P	P	NR	P	NR
Snoezelen (multisensory environment approach)	P	P	NR	NR	NR	NR
Person-centered bathing protocols	NR	P	NR	NR	NR	NR
Environmental cues[2]	NR	NR	NR	NR	NR	P

[1]Non institutional environment e.g. Changing the seating arrangements and mealtime routines in dining rooms, unlocked door to a safe garden area) and personalization (e.g. decorating each room with wall decoration, ornaments, pictures, and towels)

Case Studies

Hogewey Village, the Netherlands

Hogewey dementia village has a town square, supermarket, hairdressing/barber salon, theatre, pub, café-restaurant and 23 houses reflecting 7 different lifestyle themes. The decor, design and direct environment of the dwellings are adapted to suit each separate lifestyle: Goois (upper class), homey, Christian, urban, artisan, Indonesian and cultural. The village is enclosed and has streets, squares, gardens and a park where the residents can safely roam free.

Small groups of 6-8 dementia residents with shared interests and backgrounds live in each house and are cared for by highly trained staff (a qualified nurse and two or more care assistants per house as well as doctors and social workers) and volunteers who also run the facilities as they would be in the wider community. Residents have their own bedrooms and share kitchens, bathrooms and living areas. They are encouraged to participate in therapeutic and sociocultural activities such as 'singing for the brain', reminiscence therapy, cooking and other household tasks, gardening, and even shopping in the village supermarket.

The village is government-funded and relatively affordable, with similar cost to more traditional nursing homes, €5,000 per month per resident.

Georgian Bay Retirement Home, Penetanguishene, Ontario

In August 2014, a smaller version of Hogewey village was created for dementia residents at the Georgian Bay Retirement home with the look and feel of the 1950s and '60s. It includes a grocery store, barber shop, coffee shop, and beach, with shared or single accommodations. Theme rooms include a vintage kitchen, a garage with a vintage 1947 Dodge and a nursery with dolls designed to feel like actual babies. All the doors in the theme rooms look like bookshelves, so residents won't recognize them and wander away.

The Lodge at Broadmead, Victoria, British Columbia

It is a 229-bed residential care facility with 8 lodges, including 4 secure lodges that reflect contemporary standards for dementia care. They are designed for residents with dementia at moderate to severe stages. Each lodge houses 14-45 residents and has its own dining room, specialized bathing room, and access to a courtyard garden or roof-top patio.

Two of the dementia lodges were renovated without moving the residents, from November 2004 – April 2005 to reflect the impact of the built environment on persons with dementia. Palm Lodge a 32-room unit was separated into two smaller self-contained units, Palm North and Palm South, one housing 14 and the other 16 residents. The renovations involved relocating three sets of dual egress smoke doors within the common corridor areas to delineate the two new living units; creating home-like kitchens and living and dining rooms; painting murals in the common areas to enhance the home-like residential atmosphere and to camouflage exit doors; adding non-institutional finishes and furnishings to the new lodges such as silent resident call system, electric fireplaces; reducing the noise factor e.g. by relocating the nursing station (or new team center) outside the residents' living area and using acoustically rated products and furnishing s that absorb sound; designing expansion areas to take advantage of natural light and views to the gardens in the courtyards. In addition, two existing resident rooms were converted to a new lounge to create additional common space in the Palm North lodge.

Their experience and recommendations are described in two articles(18, 26).

Synthesis

The 7 included systematic reviews considered different interventions and outcome measures. We identified three main categories of interventions and their effects on the following behavioral and psychosocial outcomes in people with dementia: wellbeing (quality of life, depression and mood), behaviour, engagement, psychotropic drug use, physical restraint use and orientation (way-finding or safe wandering).

1. Organizational or design characteristics

There was better engagement, and decrease in physical restraint use in SCU residents with dementia. One study also found a positive effect on the quality of life of caregivers of residents in SCUs. Some studies found a positive effect and others no effect on the wellbeing (quality of life, depression and mood) and behaviour of people with dementia. There was conflicting evidence on psychotropic drug use. Orientation was not assessed.

Small-scale homelike environments had a positive impact on psychotropic drug use and a conflicting effect on behaviour. Some studies found a positive effect and others no effect on wellbeing (quality of life, depression and mood), engagement and orientation in people with dementia.

Low social density (number of people per room) improved the quality of life of residents with dementia. There was reduced psychotropic drug use in units with a lower number of residents. Social density had no effect on orientation. There was conflicting evidence on engagement as low density led to improved engagement in three studies and fewer opportunities for social interaction and withdrawal in three other studies. Some studies showed that low social density had a beneficial impact on behaviour while others showed no effect.

For building layout different aspects had different effects on the residents. Long corridors had a negative impact on behaviour. A central nursing station and sightlines between relevant places improved engagement. A layout with direct visual access to relevant places, integration of reference points, implementation of several zones with a unique character, and straight circulation improved orientation.

2. Structures of care or environmental attributes

Environmental attributes involve the physical structures such as lighting, noise levels, temperature, the use of colour, contrasts and patterns and specialized workers.

Lighting had conflicting results on most outcomes. Bright lighting was associated with more wandering and negative behaviour (agitation, restlessness) but improved behaviour when used at the dining table with

Enhanced visual contrast of tableware. Mood and depressive symptoms improved in women but were worse in men after bright light intervention.

Reduced (low to moderate) noise levels improved behaviour, quality of life, engagement and orientation.

A comfortable room temperature was associated with less unwanted behaviour, and uncomfortable room temperature was associated with lower quality of life.

Camouflaging doors and door knobs improved wandering and disruptive behaviour as well as wellbeing.

Unobtrusive safety features e.g. silent electronic door locks improved wellbeing (less depression).

Floor patterns and dark lines or surfaces disoriented residents.

The use of specialized workers improved the quality of life of residents with dementia.

3. Processes of care and environmental cues

The interventions involve the physical spaces within the living environment such as non-institutional character, sensory stimulation or enhancement, person-centered bathing protocols) and environmental cues.

Non-institutional character (e.g. homelike environment, unlocked door to a safe garden) and personalization (e.g. personal decorations and furnishings in rooms) were associated with improved behaviour, quality of life and engagement with other residents and staff. Non-institutional character also reduced psychotropic drug use in residents with dementia.

Adequate or pleasant sensory stimulation or enhancement and minimizing distractions improved behaviour, engagement, and reduced physical restraint use. A multi-sensory environment approach (Snoezelen) also improved behaviour and wellbeing in mood.

The use of person-centred bathing protocols improved behaviour.

Environmental cues such as signposting, labels (name plates, room numbers), personal cues (such as portrait-type photographs of residents as young adults, personal memorabilia) and colour coding improved orientation of residents.

Patient Perspective

We consulted with one family caregiver about this topic. She felt that having spaces available for family meetings and visits was one of the most important design aspects from her experience caring for two family relatives with dementia.

Discussion of Evidence Review: Strengths and Limitations

The aim of this rapid review was to identify evidence about the effects of living environments or changes to the living environment on quality of life, behavioural and psychosocial symptoms and caregiver quality of life for people with later stages of dementia.

Seven reviews met our inclusion criteria and their quality varied from low to high. Some included studies had matched comparisons, and others had un-matched comparisons or no comparisons. Only two reviews presented evidence of effects on the quality of life of caregivers of people with dementia. Different aspects of the physical environment affect different outcomes in people with dementia.

We identified three categories of interventions involving the design, attributes and physical space of living environments for people with dementia. These categories of interventions have been used in various combinations in different living environments. For example interventions from all three categories were considered in the establishment of Hogewey village. Design characteristics and environmental attributes were considered in the renovation of Georgian Bay retirement home and the Lodge at Broadmead, Victoria.

Some interventions involved multiple features and categories (e.g. special care units) and it is unclear which specific design features have an impact or are most essential; also whether there is any interaction between the features. Single interventions could differ between studies (e.g. type of lighting). Others considered changes to the built environment (e.g. redesigning of an existing corridor). All the important outcomes were not assessed for each intervention and different measures and scales were used for the same outcomes. Wellbeing was defined differently in different reviews. It included depressive symptoms, mood and quality of life in one review and in another review it also included activities of daily living (ADL), physical and cognitive function, and staff wellbeing and job satisfaction. These components were assessed individually in other reviews. Nevertheless we found a relationship between various aspects of living environments and outcomes of people with dementia or their caregivers. There was no high quality evidence of the effects of living environments on people with dementia and their caregivers.

The stage of dementia was not always specified and people at different stages (mild, moderate or severe) would respond differently to interventions. However, we assumed that people with later stages of dementia would live in long term care facilities as they require more assistance.

Recommendations

The impact of different interventions was assessed for some outcomes only; behavioural symptoms were the most assessed. From the clinician and patient perspective, quality of life and wandering were the most important outcomes but these were not assessed in many studies. The assessment of all the important outcomes would contribute to the impact of the intervention on the overall quality of life of the residents and caregivers. A core outcome set for dementia is being developed as part of the COMET (Core Outcome Measures in Effectiveness Trials) Initiative, and this should be considered for future studies.

The impact of different interventions should be assessed with respect to the stage of dementia as people with dementia may respond differently at different stages of the disease.

Although advances have been made in the research of built environments for people with dementia, there is limited evidence on the effects on their caregivers. Improving the wellbeing of staff and family caregivers may enhance the care of people with dementia.

Design characteristics have been explored extensively (in 83 studies) however; interventions involving attributes and the physical space have not been explored as much (51 and 47 studies respectively). More interventions involving changes of the living environment should be explored as they may be easier to implement in already existing long-term care residential facilities.

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