# A mixed-methods scoping review of long-term care facility design and associated outcomes

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## Abstract

As people live to late older adulthood, their reliance on disability supports and services increases. While these supports and services can often be provided at home, many people spend a period of their lives in residential long-term care, and the quality of long-term care environments is of great significance to those who make this transition and to those who support it. The objective of this study was to survey the range of design innovations in residential long-term care and to consider outcomes for residents, family caregivers, employees, and healthcare organizations. To achieve this, we conducted a systematic scoping review and analyzed results using a convergent segregated mixed methods approach. We summarized 65 articles on the topic of long-term care home building design by classifying structural design features and associated outcomes. We identified one non-innovative design type (the traditional *Institutional Model)*, and three innovative design types (*Small-scale Homelike Models, Large-scale Homelike Models*, *Special Small-scale Approaches*). Among innovative design types, a wide range of positive outcomes were identified for residents, families, and staff. These outcomes were achieved without necessarily increasing costs and included outcomes of central significance for long-term care, including improved quality of life, improved family satisfaction, and improved staff engagement in work. Based on these results, environmental design is a critical contributor to long-term care quality.

**A systematic review of long-term care facility design and associated outcomes**

People increasingly live longer today, and often with one or more chronic health conditions, such as osteoarthritis, cardiovascular disease, frailty, and dementia.[1] For those who live long enough, these conditions will eventually contribute to a decrease in functional ability and a corresponding increase in disability support needs.[2-3] For instance, in North America, over 70% of adults who survive to age 65 will ultimately need long-term supports and services, including home care or care provided in a residential setting.[4] The design of healthcare services, and how these services intersect with place, matters.

Most people would like to live in their own home as long as possible, and relatively simple innovations could extend 'aging in place'. Incorporating more universal design into new builds (main-floor bedrooms, wider doorways, smooth thresholds, low-sill windows, lever-style faucets and door handles) helps people remain at home longer.[5] In-home support can further extend aging in place.[6] For instance, in the USA, the *Continuing Care Retirement Community without Walls,* funded by long-term care insurance, brings a broader array of homecare services to people who need them.[7] Similarly, in Canada's *nursing homes without walls* initiative, long-term care homes provide outreach services within the local community to help people age in place.[8] In the Netherlands, "apartments for life" provide different levels of care within a single apartment block.[9] These solutions, and others like them, support peoples' participation in their own homes, families, and communities as they grow older with disabilities.

For many people, innovations in community care will help them remain at home. Yet, for others, this shift in services is unlikely to fully replace the need for long-term care. Using Canada as a case in point, although only 6.8% of adults over age 65 rely on long-term care at any given moment, 30% of Canadians over the age of 85 are living in residential long-term care settings.[10]

Most long-term care stays are short, occurring near the end of life.[4] Thus, it may be best to think of innovations in community care as *deferring* the need for residential long-term care by improving community-based support. Seen this way, both community care and long-term care benefit from investments that recognize the full continuum of disability support needs, prioritizing participation in home and community as some of the key objectives of disability support.

Unfortunately, Canadian long-term care homes currently have a relatively poor reputation in this regard. The clustering together of people with disabilities, an extension of the workhouse model of congregate living that existed past the Second World War, can lead to a sense that they have been shut away or "warehoused"; even jailed.[11-13] The sense is exacerbated by the institutional feeling of some long-term care homes,[11,14] and by the prioritization of safety and efficiency over homelikeness or support to participate in everyday aspects of home, family, and community life.[11,15-17] Yet, just as there have been innovations to support aging in place, there have also been innovations in long-term care. The objective of this study was to survey the range of design innovations in long-term care design, to consider how these interact with the model of care, and to examine outcomes for residents, family caregivers, employees, and healthcare organizations.

## Methods

Using a reputable scoping review methodology,[18] we developed a four-part search strategy to identify whole-building or whole-unit structural design approaches in long-term care. First, we completed a search of English-language academic literature. Then, we reviewed grey literature. Third, we completed a hand-search of *Health Environments Research and Design*, to

ensure no relevant articles had been missed. Finally, the reference lists of all other articles that met the inclusion criteria were hand-searched to potentially identify additional literature.

For the academic literature search, medical subject headings (MeSh) and keywords were used to search MEDLINE, CINAHL, Scopus, Web of Science, and ProQuest Dissertations and Theses Global databases (see Appendix A1). Relevant keywords included: “building design”, “layout”, “built environment”, “long-term care”, and “nursing home”. The timeframe was unrestricted. Before commencing the search, the strategy was piloted and refined to limit the scope of results to those most relevant to research question.[18] The search was completed in July 2022. A subsequent grey literature search was conducted in August 2022 using a keyword search in Google (see Appendix A2). For each group of search terms entered, the first 10 pages of search results were examined.

After removing duplicate references, three reviewers screened articles for inclusion in the review using the following criteria: (1) written in English; (2) focused on the context of long-term residential care (LTC) facilities; (3) described building design at the ‘macro’ level (i.e., whole unit or whole building); (4) included any focus on evaluating the building design (i.e., both qualitative and quantitative). Articles were excluded if they did not meet the inclusion criteria, including if they focused on: (1) LTC-analogous settings such as assisted living facilities; (2) ‘micro’ level design features such as lighting or interior decoration; (3) the design or renovation of a portion of a building (e.g., a dining room); (4) staffing models; (5) description rather than evaluation (e.g., commentary articles, conference abstracts, protocol papers, design manuals, proposed designs, and articles focused on measurement properties). To select articles, first, two reviewers screened all available article titles and abstracts and eliminated those that did not meet the selection criteria. Next, the same two reviewers examined the full text of all

remaining articles to eliminate those that did not meet the selection criteria. At each step, any discrepancies were resolved by a third reviewer.

This mixed methods review used a convergent segregated approach, in which qualitative and quantitative data were analyzed separately and juxtaposed in the results.[19] The measured outcomes associated with the structural models were also analyzed by compiling them into comprehensive tables including article details (i.e., title, author, and year; country of origin); research design (i.e., quantitative, qualitative, mixed methods, or thesis/dissertation); aim; methods; design; features (i.e., the number of residents per unit and the layout of the building); quantitative outcomes; qualitative outcomes; theorized factors (i.e., how the structural model might produce the observed outcomes); and additional findings. Three reviewers were involved in data extraction. One reviewer edited the tables for clarity and consistency.

## Results

Overall, 4082 articles were screened for eligibility and 145 met criteria for full-text review. Of these, two could not be retrieved, and 49 were included. Additionally, 12 articles were identified through Google searches and 12 more through reference list scanning. Of these, 16 of these were eligible for inclusion. Therefore, a total of 65 reports were reviewed (see Figure 1).

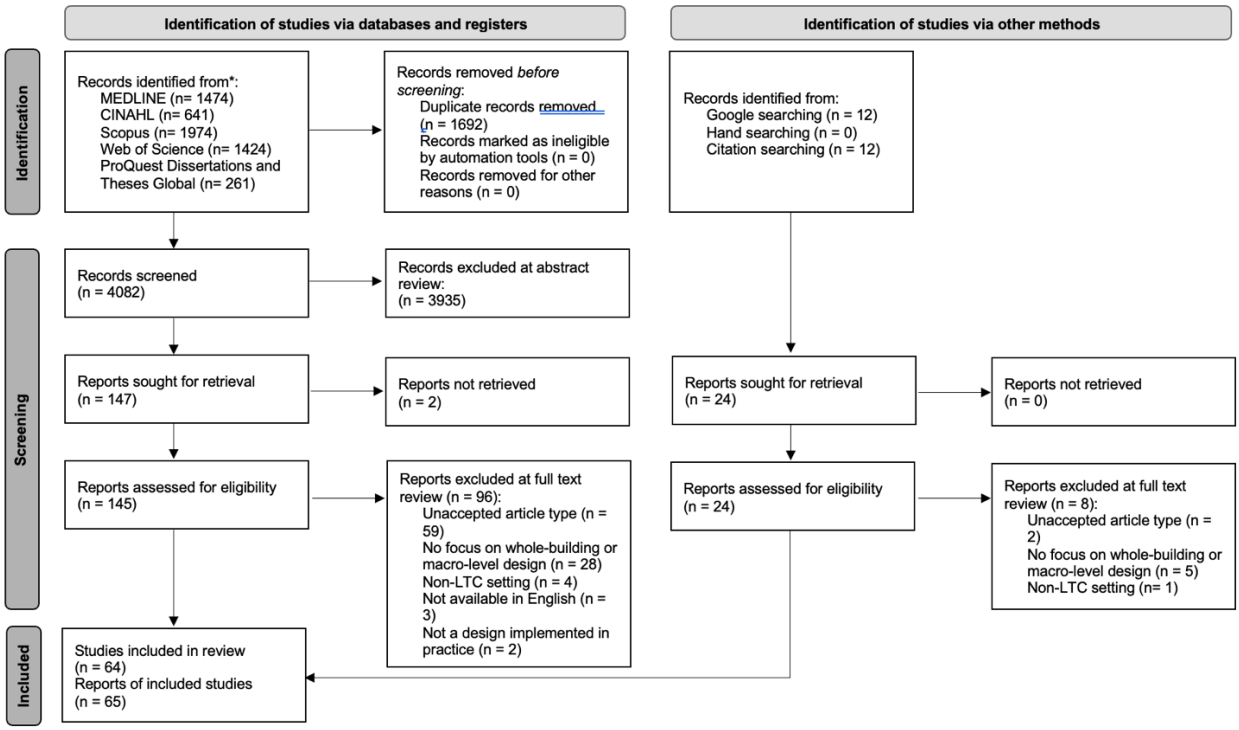


*Figure 1. Prisma flow diagram*[92]

## Long-term care home designs

Four long-term care residence design types were identified by considering the number of residents who lived together and the lifestyle and/or care approach supported by the building design. *Small-scale Homelike Models* were defined as residences for approximately five to 15 residents, whereas *Large-scale Homelike Models* were defined as housing approximately 15 to 25 residents in each household; these models having in common a homelike approach to the physical environment and the care provided. *Special Small-scale Approaches* were buildings or units designed to accommodate approximately five to 15 residents, yet emphasizing an environment or approach distinct from small-scale homelike models. Finally, *Institutional Models* were large-scale, generally housing over 20 residents per ward using a traditional healthcare facility design within an institutional environment. The history, features, and variations of these models are further described below.

***Small-scale Homelike Models***

Small-scale homelike models debuted in the early 1980s, in Scandinavia and Japan, under names such as *Collective Living* or *Group Home*. Altogether, while 18 different small-scale homelike models were identified in this review (see Table 1), a preponderance of the reviewed articles focused on the *Green House (GH) model*. The GH model features include a shared kitchen, dining and living area, as well as private bedrooms and bathrooms.[20-29] Each house accommodates seven to 12 residents,[30-31] either as a standalone building or as part of a larger complex.[32] Many include dedicated outdoor space for each house. Space for special services, such as a beauty salon, is allocated within the larger building complex.[23,28,32-33] GH home design supports a humanistic model of care that includes family-style meals and consistent staff assignments.[20,24,34-35]

| **Table 1. Small-scale (~5-15) Homelike Models** |
|---|
| Small House Model |
| Green House Model |
| Small Household Model |
| Small Scale Living Facilities |
| Small Segregated Living Units |
| Woodside Place Model |
| Cottage Model |
| Normalized Small Scale Homes |
| CADE Unit |
| Small Scale Homelike SCU |
| Special Care Facility |
| Domus Philosophy |
| Butterfly Care Model |
| Residential Groups |
| Small Scale Housing Arrangement |
| Group Living |
| Group Home |
| Collective Living Unit |

There were significant similarities between the GH model and other small-scale homelike models. For example, small-scale homelike models typically accommodated five to 15 residents per household (most commonly about 8-12 residents). Private bedrooms were a common feature of the *Small Household Model*,[36] the *Woodside Place Model* (described as an early form of the GH model),[27,37] the *Cottage Model*,[38] *Small Scale Homelike Special Care Units*,[39-42] the *Small House Model*,[43] and *Group Living*.[44-46] Communal kitchen, dining, and living areas were also emphasized.[38,47-49] Additionally, small-scale homelike models were described as scalable, and could be built as standalone homes, a multiplex of home-like units within a single facility, or a series of interconnected buildings.[39,45,50] The *Cottage Model*, for example, consists of separate self-contained cottages, connected by walkways to a larger community building in which group activities take place.[38] The main differences among the identified small-scale homelike models were in building layout and allocation of space for additional services.

***Special Small-Scale Approaches***

*Special small-scale approaches* also emphasized small-scale units, but their environmental features and the lifestyle and/or care model were distinct from other small-scale homelike models. For example, the *Dementia Village* incorporates several small-scale homes into a faux village where residents can access outdoor space and internal businesses, such as cafes or supermarkets.[51] *Green Care Farms* provide 24-hour care for six to 15 residents in a homelike setting, but are uniquely situated on farms, allowing meaningful participation in daily agricultural activities.[51-53] The farms can include animals, stables, and vegetable gardens, providing space for both indoor and outdoor activities to suit varying abilities and interests.[53] The scalability of these models has not been evaluated.

### *Large-scale Homelike Models*

Within the large-scale homelike model type are the *Large Homelike Special Care Unit* (SCU) and the *Household Model*. The Homelike SCU accommodates approximately 20 residents within a larger long-term care facility.[54] Key features are a dining room, a recreation area, and individual bedrooms for each resident.[54] Similarly, the Household Model emulates some design features of a small-scale homelike model, but there may be up to 25 residents per household, often in units within a larger facility.[55-57] Typically, large-scale homelike models are retrofits of institutional-style building designs. While the structure is not significantly changed, there is an attempt to modify the environment and culture of care within the unit to be more homelike.[57-58] For example, the design of common areas, including a kitchen, living room, and dining room is emphasized.[57,59] Households may have their own entrances separating them from other units in the facility. Attention may also be given to the kinds of amenities available within the larger facility, such as a café, a designated sacred space, or a swimming pool.[59]

## Outcomes Associated with Long-Term Care Building Design

Of the 65 reviewed articles, 39 were experimental studies that quantified the outcomes obtained within innovative models and compared them with institutional long-term care homes (below, ‘experimental research on outcomes'). Occasionally, mediators and moderators were examined alongside experimental results, but more often than not, these were hypothesized rather than studied. Several (23) qualitative studies (or studies with a qualitative component) further enhanced the evidence base by revealing which outcomes might be expected, and why (below, ‘qualitative description of outcomes’).

### *Small-scale Homelike Models*

**Experimental research on resident outcomes.** Nine studies examined quality of life (QOL) in small-scale homelike settings, with seven finding that results were superior to institutional settings[48-49,60-64] and two finding no significant difference.[41,65] One article hypothesized that improvement in QOL is associated with the potential for higher-quality relationships in a closer environment,[64] and another hypothesized that small homelike environments promote residents' autonomy.[48] A third author found that functional or cognitive ability moderated results; specifically, those with the highest function displayed less improvement.[61]

Residents in small-scale settings also experienced higher levels of stimulation and activity engagement than those in institutional settings,[49,61,66] with only one article finding no difference.[63] One article hypothesized that a habit of encouraging participation in the household develops in small-scale settings, where this is more feasible than in institutional settings.[49]

Quality of care was assessed in five studies. Specific measures included care hours per resident per day, number of hospital admissions, reliance on restraints and catheters, and satisfaction with quality of care. Four studies documented superior quality of care, [30,38,62] while one found no change.[53] Lower rates of restraint use[67] were not universally documented[45] and one author theorized that organizational culture contributes to realizing this outcome.[67] Improved communication among a smaller number of care workers was thought to be a factor in reduced hospital readmissions.[30]

Of the eight studies assessing functional ability or functional decline, typically using activities of daily living (ADL) function trajectories, four found a slower rate of functional decline[45,62,64,66] and one observed improvement in functional ability.[38] The three remaining

studies found no significant change in these outcomes.[61,68-69] Cognitive function was assessed by four studies, with three reporting no change[39,66,68] and one finding an improvement in this outcome.[61] Additionally, one study found blood pressure to be comparatively lower in small-scale settings, attributing this to reduced stress in a smaller, calmer, and more homelike environment.[38]

For residents living with dementia, one article reported an improvement in neuropsychiatric symptoms associated with small-scale settings.[41] However, most articles found no change.[42,65,67] There were mixed results concerning the outcome of agitated or aggressive behaviour. Three articles found an increase,[45,67-68] whereas two found no change.[63,65] One article found an increase only in vocalizations and attributed this to a lack of environmental stimulation in the setting under observation.[67]

There was some evidence of improved social engagement in small-scale homelike settings[26,67]; however, two articles found no significant difference.[62,66] One author posited that small-scale settings offer better access to meaningful stimuli due to the homelike setting (e.g., resident involvement in food preparation), therefore increasing the opportunity for social interaction.[67] Considering emotional well-being, three articles found an increase,[62-63,66] two found a decrease,[26,68] and one found no change.[39] One article attributed their observation of increased depressive symptoms to superior assessment due to closer resident-employee relationships, but did not rule out other possible explanations.[26]

**Table 2a. Small-scale (~5-15) Homelike Models – Resident Outcomes [*]**

| Resident Outcomes | | Model Type | Context [†] |
|---|---|---|---|
| ***COVID-19 infection control*** | ↑: Zimmerman et al. (2021)[29] | Green House Model | Improvement in all outcomes |

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| ***Social engagement*** | —: Kane et al. (2007)[62] | Green House Model | A lower rate of decrease in social engagement |
| | ↑: Yoon et al. (2015)[26] | Green House Model | |
| | —: Reimer et al. (2004)[66] | Special Care Facility | Measure of social withdrawal |
| | ↑: Verbeek et al. (2014)[67] | Small Scale Living Facility | At baseline and 6 months |
| ***Quality of life*** | ↑: Kane et al. (2007)[62] | Green House Model | |
| | ↑: Duan et al. (2022)[48] | Small House Model | Including the domains of environment, autonomy, and caregiving |
| | ↑: Funaki et al. (2005)[49] | Small Scale Housing Arrangement | Including the domain of "vivid communication with surroundings"; no change in domain of "control of behavioural disturbances" |
| | ↑: Nakanishi et al. (2012)[64] | Small Scale Housing Arrangement | |
| | —: Kok et al. (2018)[41] | Small Scaled Homelike Special Care Unit | |
| | ↑: de Rooij et al. (2012a)[60] | Small Scale Living Facility | Including the domains of "having something to do", positive affect and social relations |

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| | ↑: Hemming et al. (1981)[61] | Small Scale Living Facility | The least improvement was observed for residents with the highest functional ability levels |
| | ↑: Lee et al. (2021)[63] | Small Scale Living Facility | |
| | —: Verbeek et al. (2010b)[65] | Small Scale Living Facility | |
| ***Global satisfaction*** | ↑: Kane et al. (2007)[62] | Green House Model | |
| | —: Kok et al. (2018)[41] | Small Scaled Homelike Special Care Unit | |
| ***Emotional well-being*** | ↑: Kane et al. (2007)[62] | Green House Model | |
| | ↓: Yoon et al. (2015)[26] | Green House Model | A higher rate of increase in depressive symptoms |
| | ↓: Yoon (2013)[68] | Green House Model | Measures of baseline negative mood and change in negative mood |
| | ↑: Reimer et al. (2004)[66] | Special Care Facility | Less negative affect |
| | —: Kok et al. (2016)[39] | Small Scaled Homelike Special Care Unit | |
| | ↑: Lee et al. (2021)[63] | Small Scale Living Facility | Less time spent in negative emotional states |

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| ***Functional decline*** | ↓: Kane et al. (2007)[62] | Green House Model | Less decline in late-loss ADL functioning |
| | —: Yoon et al. (2016)[69] | Green House Model | |
| | —: Yoon (2013)[68] | Green House Model | |
| | ↓: Reimer et al. (2004)[66] | Special Care Facility | Measure of ADL functioning trajectory |
| | ↓: Wimo et al. (1995a)[45] | Small Scale Housing Arrangement | Measures of dress and motor function |
| | ↓: Nakanishi et al. (2012)[64] | Small Scale Housing Arrangement | Measure of physical dependence trajectory |
| ***Functional ability*** | ↑: Thistleton et al. (2012)[38] | Cottage Model | Measure of ADL function |
| | —: Yoon et al. (2016)[69] | Green House Model | Measure of ADL function |
| | —: Hemming et al. (1981;1986)[61,94] | Small Scale Living Facility | Measure of independence; increased most for resident with lower functional ability |
| ***Quality of care*** | ↑: Thistleton et al. (2012)[38] | Cottage Model | |
| | ↑: Afendulis et al. (2016)[30] | Green House Model | Measures of number of bedfast residents, pressure ulcers, and catheter use |
| | ↑: Kane et al. (2007)[62] | Green House Model | Specifically, satisfaction |

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| | | | with quality of care |
| | —: de Boer et al. (2017b)[53] | Small Scale Living Facility, Green Care Farm | Including clinical outcomes and hours per resident per day |
| | ↑: Lee et al. (2021)[63] | Small Scale Living Facility | Measure of diversity of occupation |
| | ↑: de Rooij et al. (2012a)[60] | Small Scale Living Facility | Including the domains of "having something to do", positive affect and social relations |
| | ↑: Hemming et al. (1981)[61] | Small Scale Living Facility | The least improvement was observed for residents with the highest functional ability levels |
| ***Stimulation*** | ↑: Reimer et al. (2004)[66] | Special Care Facility | Measure of sustained interest in environment |
| | ↑: Lee et al. (2021)[63] | Small Scale Living Facility | Higher levels of stimulation and less withdrawn behaviour |
| ***Cognitive function*** | —: Yoon (2013)[68] | Green House Model | |
| | —: Reimer et al. (2004)[66] | Special Care Facility | Measures of concentration, memory, and orientation |
| | ↑: Hemming et al. (1981;1986)[61,94] | Small Scale Living Facility | Measure of language |

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| | | | ability; improvement was not maintained at 5-year follow-up |
| | —: Kok et al. (2016)[39] | Small Scaled Homelike Special Care Unit | |
| ***Physical health indicators*** | ↑: Thistleton et al. (2012)[38] | Cottage Model | Reduction of blood pressure |
| ***Neuropsychiatric symptoms*** | ↓ : Kok et al. (2018)[41] | Small Scaled Homelike Special Care Unit | Measure of anxious behaviour; no change in other symptoms |
| | —: Kok et al. (2020)[42] | Small Scaled Homelike Special Care Unit | |
| | —: Verbeek et al. (2010b)[65] | Small Scale Living Facility | |
| | —: Verbeek et al. (2014)[67] | Small Scale Living Facility | Including symptoms of depression |
| ***Restraint use*** | —: Wimo et al. (1995a)[45] | Small Scale Housing Arrangement | Specifically psycho-pharmacological drug use |
| | ↓: Verbeek et al. (2014)[67] | Small Scale Living Facility | Includes physical and psychotropic restraints |
| ***Activity engagement levels*** | ↑: Hemming et al. (1981;1986)[61,94] | Small Scale Living Facility | Measure of domestic activities |

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|---|---|---|---|
| | ↑: Funaki et al. (2005)[49] | Small Scale Housing Arrangement | Measure of housekeeping activity involvement |
| | —: Lee et al. (2021)[63] | Small Scale Living Facility | Measure of potential positive engagement |
| **Agitation/Agression** | ↑: Yoon (2013)[68] | Green House Model | Measure of aggressive behaviour |
| | ↑: Wimo et al. (1995a)[45] | Small Scale Housing Arrangement | Including aggressive behaviour toward employees |
| | —: Lee et al. (2021)[63] | Small Scale Living Facility | |
| | —: Verbeek et al. (2010b)[65] | Small Scale Living Facility | |
| | ↑: Verbeek et al. (2014)[67] | Small Scale Living Facility | Measures of physically non-aggressive and aberrant motor behaviours, but no change in physically aggressive behaviours |
| ***Rest-activity rhythms*** | —: Kok et al. (2017)[40] | Small Scaled Homelike Special Care Unit | |

[*] A summary of the quantitative outcomes which utilize comparison to a baseline or control. An up arrow represents an increase in an outcome compared to baseline (i.e., prior to a move to this model) or control (i.e., compared to a similar group living in an institutional setting). A down arrow represents a decrease or lower level, and a dash represents no significant change.
[†] Additional context can be found in the data extraction table (Appendix B)

**Qualitative description of residents' experiences.** Residents in small-scale homelike facilities reported feeling more at home, and valued the privacy provided by individual bedrooms, seeing this as a positive change.[22,32] They also had a greater sense of freedom, even though some reported still lacking the freedom to participate in preferred activities –such as cooking or walking without a walker.[22,33] The majority of those who moved from an institutional setting to a small-scale homelike setting reported an improvement in their living situation.[22,33]

When residents left the facility to participate in activities within the broader community, they reported sense of "leaving home" that is not commonly described in institutional settings.[70] Residents generally enjoyed the variety of activities offered in these homes or within the broader community and felt as though they were meaningfully engaged.[22,23] However, some reported barriers to activity participation, especially if the activities were hosted outside their living units, or when employees were unavailable to assist with transportation.[22,70]

Despite improvements in the quality of interactions between employees and residents,[70] findings related to social interaction and loneliness were mixed. Two studies reported limited opportunities for residents to socialize within and between living units, a lack of meaningful relationships, or loneliness, suggesting that a relationally oriented climate cannot be taken for granted in small-scale homelike models.[32-33] However, residents in another study reported increased socialization with other residents and family visitors, and valued the contribution communal dining made to a sense of community.[22] In addition, for those who moved from one setting to another, there was a period of adjustment to new relationship networks.[22] One report stated that residents valued time in their personal rooms more than time in common areas, suggesting that privacy might be just as important an outcome to evaluate as social interaction.[32]

**Summary.** A high level of consensus existed for many objectively assessed outcomes of small-scale homelike models. Overall, care quality, rate of functional decline, social stimulation, emotional wellbeing, and quality of life were typically superior in small-scale homelike settings. These results compare well to previous reviews that documented improved care quality in small-scale homelike models.[23,47, 71-72] These superior outcomes have been attributed to improved staff consistency and teamwork, closer assessment, and improved relationships. On the other hand, cognitive and functional status were unlikely to improve. In addition, mental health symptoms, including those associated with agitation, were not necessarily alleviated.

**Experimental research on family outcomes.** Family member global satisfaction, as well as satisfaction with care specifically, was consistently superior in small-scale settings, compared with traditional care settings.[31,48,65] Additionally, caregiver burden was lower.[65,73] Two articles reported no difference in family engagement,[65,73] while a third reported a decrease.[31] Small-scale environments may promote interaction between family caregivers and employees, contributing to decreased burden as family caregivers come to rely more on employees.[73]

**Table 2b. Small-scale (~5-15) Homelike Models - Other Outcomes [*]**

| Family Outcomes | | Model Type | Context [†] |
|---|---|---|---|
| ***Global satisfaction*** | ↑: Lum et al. (2008)[31] | Green House Model | Including physical environment, privacy, and autonomy |
| | ↑: Duan et al. (2022)[48] | Small House Model | Includes the domains of care, environment, and food |

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|---|---|---|---|
| ***Family assistance/engagement*** | ↓: Lum et al. (2008)[31] | Green House Model | Lower family assistance score, including help with laundry |
| | —: Verbeek et al. (2010b)[65] | Small Scale Living Facility | Measures of involvement, frequency and length of visits, and number of activities performed together |
| | —: Andren & Elmstahl (2002)[73] | Small Scale Housing Arrangement | Substantial time was spent regardless of home type |
| ***Satisfaction with care*** | ↑: Verbeek et al. (2010b)[65] | Small Scale Living Facility | Specifically, satisfaction with nursing employees |
| | ↑: Lum et al. (2008)[31] | Green House Model | Measure of satisfaction with healthcare |
| ***Caregiver burden*** | ↓: Verbeek et al. (2010b)[65] | Small Scale Living Facility | |
| | ↓: Andren & Elmstahl (2002)[73] | Small Scale Housing Arrangement | |
| Employee Outcomes | | | |
| ***Job satisfaction*** | ↑: Adams et al. (2017)[75] | Small Scale Living Facility | |

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|---|---|---|---|
| | —: Verbeek et al. (2010b)[65] | Small Scale Living Facility | |
| ***Job motivation*** | ↑: Adams et al. (2017)[75] | Small Scale Living Facility | |
| | —: Verbeek et al. (2010b)[65] | Small Scale Living Facility | |
| ***Job autonomy*** | ↑: Adams et al. (2017)[75] | Small Scale Living Facility | |
| | ↑: Zwakhalen et al. (2018)[76] | Small Scale Living Facility | Measure of self-perceived autonomy |
| ***Job demands*** | ↓: Adams et al. (2017)[75] | Small Scale Living Facility | |
| | ↓: Zwakhalen et al. (2018)[76] | Small Scale Living Facility | Includes psychological demands, workload, and physical demands |
| ***Desire to work in home type*** | ↑: Adams et al. (2017)[75] | Small Scale Living Facility | Those working in traditional settings more often wanted to switch to small-scale settings |
| | ↑: Verbeek et al. (2012)[74] | Small Scale Living Facility | A small minority of employees wanted to |

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|---|---|---|---|
| | | | switch home types |
| ***Resident relationship quality*** | ↑: Thistleton et al. (2012)[38] | Cottage Model | Measure of relationship quality |
| ***Engagement with residents*** | ↑: Sharkey et al. (2011)[25] | Green House Model | Measure of hours per resident per day |
| | ↑: Hemming et al. (1981)[61] | Small Scale Living Facility | Measures of frequency and quality of interactions |
| ***Perceived respect*** | ↑: Thistleton et al. (2012)[38] | Cottage Model | Specifically respect from the institution |
| ***Burnout symptoms*** | —: Zwakhalen et al. (2018)[76] | Small Scale Living Facility | |
| | ↑: de Rooij et al. (2012b)[77] | Small Scale Living Facility | Measure of emotional strain, but not depersonalization or personal accomplishment |
| | ↓: Kuremyr et al. (1994)[78] | Small Scale Housing Arrangement | Measure of risk of burnout |
| ***Mental health issues*** | | | |
| | —: de Rooij et al. (2012b)[77] | Small Scale Living Facility | |
| ***Social support*** | ↑: Zwakhalen et al. (2018)[76] | Small Scale | Includes social support |

| | | | |
|---|---|---|---|
| | | Living Facility | from co-workers, but not from supervisors |
| Organizational Outcomes | | | |
| ***Operating costs*** | —: Thistleton et al. (2012)[38]<br>↓: Wimo et al. (1995a)[45] | Cottage Model Small Scale Housing Arrangement | |

[*] A summary of the quantitative outcomes which utilize comparison to a baseline or control. An up arrow represents an increase in an outcome compared to baseline (i.e., prior to a move to this model) or control (i.e., compared to a similar group living in an institutional setting). A down arrow represents a decrease or lower level, and a dash represents no significant change.
[†] Additional context can be found in the data extraction table (Appendix B)

**Qualitative description of family experience.** Family caregivers reported being satisfied with the environment of small-scale homelike facilities.[31-32,38] Two studies reported that families visited more often.[22,38] Similarly, families reported feeling more comfortable and involved.[74] Regarding the social environment, families reported having good relationships with the care staff and appreciation for the attention they provided to residents, describing them as open, friendly and involved.[31,74]

Nevertheless, one report following experiences of a move to a small-scale homelike setting illustrated some trade-offs.[22] Although families perceived more freedom and better quality of life for residents, there were fewer encounters with nursing and professional staff.[22] With fewer staff around and a greater emphasis on resident autonomy, families worried about the

level of support for residents with frailty and dementia, a finding that also surfaced in an additional report.[22,74] In addition, given a new emphasis on household activities over formal programming, some reports documented family caregiver concerns about too few activities and services.[22,38,74] Accessibility of recreational activities was an additional concern, especially when mobility support or outdoor travel was needed to attend these activities.[22,38,74] Similarly, one study reported that some family members were not satisfied with the social environment and perceived more isolation among residents in small-scale settings.[38]

**Experimental research on employee outcomes.** Employees were more interested in working in small-scale facilities than institutional facilities.[74-75] One study found improved job satisfaction and job motivation after making this change,[75] while another found no change.[65] Within small-scale facilities, employees perceived higher job autonomy, and lower job demands.[75-76] This finding was hypothesized to be associated with improved team relationships within smaller, more consistent teams.[76] Indeed, perceived social support from co-workers was higher in small-scale homelike facilities.[76]

The overall level of employee mental health symptoms did not change with a move to a small-scale setting.[77] Similarly, there was no consistency in effects on employee burnout.[76-78] However, small-scale settings consistently promoted employee engagement with residents and improved resident-employee relationships.[25,38,61] Due to the small size of these facilities, employees seemed to be better able to engage with residents while completing other tasks such as housekeeping or charting.[25]

**Qualitative description of employee outcomes.** Employees seem to work more efficiently in teams in small-scale settings, but it can take a few months to shift to a new model and optimize teamwork.[22,36,38] Some aspects of communication are hindered; for example, there

is no place for employees to speak privately with each other, and there may be fewer opportunities for interactions between employees and managers.[36] Nevertheless, employees find they have more time to interact with residents, and believe this contributes to better quality care.[38,70,79] They feel more involved in the daily life of residents, and have an increased understanding of individual needs, allowing them to better recognize and support both emotional and physical needs.[20,74,79] Employees feel more alone at night in this setting.[22,36,74] Some report lower levels of stress overall,[38,79] while others report higher levels of stress, particularly while transitioning to a new model of care.[22,78]

**Experimental research on organizational outcomes.** At the organizational level, operating cost was examined in two studies with a focus on small-scale homelike settings. One study found no difference in operating cost compared to institutional settings,[38] whereas another study measured a decrease in costs.[45]

**Qualitative description of organizational outcomes.** Managers perceived small-scale homelike settings to have a superior climate of resident-centred care.[24] They believed the availability of common spaces for smaller groups of residents supported a sense of community and facilitated communication.[32] Using multi-home facilities to replace standalone homes was also perceived as useful for achieving economies of scale, such as with administrative support and interdisciplinary staffing.[37]

### *Special Small-scale Approaches*

**Experimental research on resident outcomes.** The *Green Care Farm* was the only model within the special small-scale approaches model type for which experimental research was identified. Among residents, social engagement, activity involvement and outdoor access were found to be higher than in control facilities, a result attributed to increased freedom and

autonomy given the prioritization of access to the outdoors.[52] No significant differences in quality of care were found; however, quality of life was significantly improved.[53] Staffing levels were higher in the Green Care Farm model, but in statistical modeling, this did not account for the observed differences in quality of life.[53]

**Qualitative description of resident and family outcomes.** One study. found that family caregivers in Green Care Farms had more positive experiences with the physical environment and culture of person-centred care than in traditional long-term care settings.[80] Families also perceived there to be many meaningful activities available for residents.[80]

**Table 3. Special Small-Scale (~5-15) Approaches [*]**

| Resident Outcomes | | Model Type | Context [†] |
|---|---|---|---|
| ***Activity levels*** | ↑: de Boer et al. (2017a)[52] | Green Care Farm | Measure of physical activity levels, and domestic activity participation |
| ***Social engagement*** | ↑: de Boer et al. (2017a)[52] | Green Care Farm | Measure of social interactions |
| ***Outdoor access*** | ↑: de Boer et al. (2017a)[52] | Green Care Farm | Measure of frequency of outdoor activities |
| ***Quality of life*** | ↑: de Boer et al. (2017b)[53] | Green Care Farm | Includes domains of positive affect, "having something to do", and social relations |

| | | | |
|---|---|---|---|
| ***Quality of care*** | —: de Boer et al. (2017b)[53] | Green Care Farm | Including clinical indicators |

[*] A summary of the quantitative outcomes which utilize comparison to a baseline or control. An up arrow represents an increase in an outcome compared to baseline (i.e., prior to a move to this model) or control (i.e., compared to a similar group living in an institutional setting). A down arrow represents a decrease or lower level, and a dash represents no significant change.
[†] Additional context can be found in the data extraction table (Appendix B)

### *Large-scale Homelike Models*

One experimental study of the Large Homelike SCU model was identified,[57] and there were two such studies of the Household Model.[48,81]

**Experimental research on resident outcomes.** Higher levels of social engagement and independence were reported after the renovation of a traditional SCU into a large homelike SCU, and this was attributed to a more homelike environment, opportunities for increased resident autonomy, and higher-quality social interactions.[57] A shift to the household model was associated with improved neuropsychiatric symptoms, cognitive function, and quality of care, potentially due to improved opportunities for autonomy and participation.[81] Quality of life was also superior, compared to a traditional long-term care facility.[48] Two studies assessed falls, with one reporting a lower rate in the large homelike SCU model[57] and the other reporting an increase in falls in the household model, attributed to greater risk tolerance to encourage ambulation.[81]

**Qualitative description of resident experience.** Both employees and residents' relatives perceived a better overall QOL for residents in large-scale homelike facilities, including improved sleep and improved affect, including happiness, contentment and relaxation.[54,57] Residents were perceived to be more engaged in activities, and freer to decide what level of

participation they desired, and what level of risk they were willing to take.[54,81] This extended to dining choices and sleeping times.[59] Some positive results were attributed to the safety of a contained, open concept living space.[54] Additionally, a greater sense of home and freedom to choose seemed to be facilitated by access to private space (i.e., a private bedroom), a home-like living environment, and a larger complex and grounds.[59] An increase in social engagement was also reported.[57,59] While the model can increase a sense of distance between residents from different units, new relationships within the unit often flourish.[57,59]

**Experimental research on family outcomes.** Family members were more satisfied with the overall home in Household Model facilities compared to the control homes.[48,81] Additionally, family engagement was higher.[57]

**Qualitative description of family experience.** Families were more comfortable bringing children to visit Household Model settings than traditional long-term care homes.[54,57] Children could interact with residents in a more natural way in common areas, rather than residents' private rooms.[57] Family members generally felt more welcomed, engaged, and supported, and felt that it was easier to communicate with and work with employees.[54,57] In addition, families began relying on each other for support, forming a sense of community.[57] The observed engagement of families within the Household Model contributed to resident well-being.[54]

**Experimental research on employee outcomes.** Employee engagement with residents in Household Model facilities was higher than in traditional settings.[57] Employees felt a greater sense of empowerment.[48]

**Qualitative description of employee experience.** Employees reported satisfaction with the environment, as it provided them with the equipment and layout necessary to better care for residents.[54,82] For example, dedicated space for medication management in each self-contained

unit allow for the personalization of medication delivery within the large-scale homelike environment.[82] Relationships between employees and residents were strengthened by the environment of large-scale homelike settings, as employees had better knowledge of residents' individual needs, and sensed greater mutual trust, translating to more person-centred care.[57,59,81] However, employees also reported some challenges, including an increased workload; for example, meals are cooked by employees within each household rather than in a centralized kitchen.[81] In addition, due to a staffing model in large-scale homelike settings which often involves employees in multi-role work (e.g., both housekeeping and assistance with ADLs), they reported a need for stronger leadership to establish responsibilities.[81] Nevertheless, employees preferred the large-scale homelike model to a traditional model.[55,82]

**Experimental research on organizational outcomes.** In one study, operating costs, were somewhat higher in due to the creation of a new 'homemaker' role to facilitate implementation of the model.[57] This outcome was not assessed in other studies.

**Table 4. Large-scale (~15-25) Homelike Models [*]**

| Resident Outcomes | | Model Type | Context [†] |
|---|---|---|---|
| ***Social engagement*** | ↑: Morgan-Brown (2013)[57] | Household Model | |
| ***Quality of life*** | | | |
| | ↑: Duan et al. (2022)[48] | Household Model | Including the domains of environment, autonomy and caregiving |

| | | | |
|---|---|---|---|
| ***Quality of care*** | ↑: Proffitt (2017)[81] | Household Model | |
| ***Cognitive function*** | ↑: Proffitt (2017)[81] | Household Model | A decrease in cognitive impairment |
| ***Neuropsychiatric symptoms*** | | | |
| | ↓: Proffitt (2017)[81] | Household Model | Including behavioural symptoms of anxiety and depression |
| ***Safety*** | ↑: Morgan-Brown (2013)[57] | Household Model | A decrease in falls and recordable incidents |
| | ↓: Proffitt (2017)[81] | Household Model | Measure of fall rate |
| ***Independence*** | ↑: Morgan-Brown (2013)[57] | Household Model | Measure of independent interactivity with the environment and with others |
| Family Outcomes | | | |
| ***Global satisfaction*** | ↑: Duan et al. (2022)[48] | Household Model | Includes the domains |

| | | | |
|---|---|---|---|
| | | | of care, environment, and food |
| | ↑: Proffitt (2017)[81] | Household Model | |
| **Family assistance/ engagement** | ↑: Morgan-Brown (2013)[57] | Household Model | |
| Employee Outcomes | | | |
| ***Empowerment*** | ↑: Duan et al. (2022)[48] | Household Model | Within a measure of culture change |
| ***Engagement with residents*** | ↑: Morgan-Brown (2013)[57] | Household Model | More time spent interacting with residents when in communal areas |
| Organizational Outcomes | | | |
| ***Operating costs*** | ↑: Morgan-Brown (2013)[57] | Household Model | Measure of staffing costs |

[*] A summary of the quantitative outcomes which utilize comparison to a baseline or control. An up arrow represents an increase in an outcome compared to baseline (i.e., prior to a move to this model) or control (i.e., compared to a similar group living in an institutional setting). A down arrow represents a decrease or lower level, and a dash represents no significant change.

[†] Additional context can be found in the data extraction table (Appendix B)

**Qualitative description of organizational experience.** The culture of care in large-scale homelike facilities was described as person-focused, meaning that residents were more often put at the center of decisions surrounding their own individualized care.[59] The environment was reported to be similar to the environment of a family home in that residents have private bedrooms, and the unit incorporates an open-plan kitchen and dining area with homelike furnishings.[54]

## Discussion

This systematic scoping review of long-term care home designs identified four main design types: small-scale homelike models (5-15 residents per unit), large-scale homelike models (up to 25 residents), special small-scale approaches such as green care farms (5-15 residents), and institutional models (>20 residents). Objective comparisons between model types were readily identified. While most compared small-scale homelike models and institutional models, studies of special small-scale approaches and large-scale homelike models were also available. Favourable outcomes were observed for residents living in all types of homelike settings, as compared with institutional settings, although the evidence for supporting small-scale homelike settings is strongest, given the current volume of evidence across design types.

Favourable outcomes observed for residents living in homelike long-term care settings included a sense of home and improved quality of life – logical extensions of a homelike shift in design. Small-scale homelike settings were also associated with lower restraint use and a greater opportunity to participate in everyday life, addressing significant ethical and legal (i.e., human rights) issues concerning the quality of support for people with disabilities in healthcare settings.[83] In addition, several clinically relevant outcomes were superior in this setting (e.g.,

decreased rate of functional decline; care quality), with some leading to cost savings elsewhere in the healthcare system (e.g., fewer admissions to hospital). Family caregivers, key partners in disability support,[84] were more satisfied with care, potentially because of the opportunity for more continuous relationships with the care staff.[31,74] Moreover, consistent with findings from other reviews of small-scale homelike settings,[21,85] employees felt more motivated to maintain their employment in this setting, addressing a critical problem in LTC, where low employee retention is currently considered one of the barriers to achieving high-quality care.[86-87] Small-scale homelike environmental design is contributing value beyond expectation, as it is difficult to name another intervention that achieves superior results across so many areas without either inflating costs or requiring a fundamentally different staffing model.

Infection control has not been studied comprehensively across design types, but this outcome should be included in future studies of long-term care design, since encouraging a smaller per-unit staff and resident population size has the potential to contain virus spread.[29,72] Homelike settings may also provide an excellent context for supporting family caregiver involvement in outbreak planning and care, potentially mitigating human rights concerns raised during the COVID-19 pandemic.[88] The post-pandemic period is an ideal time for pilot and feasibility research on the novel practice of cohorting residents and families with similar values (e.g., those who accept the possibility of acquiring illness from other household members and those who would prefer that all possible measures be taken to avoid this).

While the mechanisms by which smaller or homelike models improve outcomes are beginning to be explored, they remain largely hypothetical. Proximity and familiarity seem to be important. When a small group of people interacts within a specific setting (proximity), they naturally get to know each other (familiarity). Within small-scale homelike settings, one outcome

is that both staff and residents report stronger relationships with each other and with their peers than are reported in other settings.[28] Proximity and familiarity also seem to lead to superior assessment and health outcomes, since staff are more likely to notice differences in residents' health behaviour for both reasons.[79] Furthermore, since supervision occurs more naturally in close settings, staff seem more comfortable encouraging independence, rather than discouraging it to manage risk.[36] To advance the study of long-term care design, it is important to continue to propose, measure, and analyze mediator variables. For instance, in discussing the findings documented in this report, our research team identified 'a sense of responsibility to others' as a potentially important mediator variable that has not yet been named. This construct has previously been recognized as important to healthcare quality improvement[89] and associated research paradigms are currently developing in other fields.[90]

Although a private residence is the smallest example of the small house model, the concept of 'homes within buildings' can theoretically be scaled to any size. Scalability is a distinct advantage, since the benefits associated with small homelike environmental design can be introduced not only within new buildings but also expansions that accommodate relevant considerations such as entrances, exits, accessible outdoor spaces, and access to amenities within the larger facility.[43] Retrofitting homes to achieve smaller cohort sizes and more homelike designs also seems to achieve some of the positive results associated with small-scale homelike designs. This flexibility reduces the barriers to achieving the outcomes associated with this design.

Of course, no intervention addresses every problem. While small-scale homelike models delivered superior care quality, social stimulation, emotional wellbeing, and quality of life, and slower functional decline, they did not improve cognitive or functional status. These outcomes

can be much more challenging to influence, considering that most people who rely on long-term care have progressive cognitive disabilities (i.e., dementias).[91] In addition, small-scale homelike models were not as likely to improve mental health, suggesting that more specific interventions are needed to address this important outcome. And, while family satisfaction was higher, this did not necessarily lead to increased family engagement. Furthermore, although staff and family caregivers clearly preferred homelike designs, both noted the reduced visibility of professional staff and managers as a potential concern. Lastly, one size cannot be expected to fit all. Long-term care homes support people living with a diverse array of disability support needs, and it is important to consider the design adaptations that best support each kind of need, and to specify the target outcomes for each population. To support evaluation, future studies of LTC design would best include detailed description of the population served, the building layout, and the staffing model.

## Conclusion

This systematic review of the outcomes of homelike environmental design (including attention to cohort size) in long-term care identified a wide range of positive outcomes for residents, families, and staff. These included several outcomes previously identified as cornerstones of quality in long-term care, including quality of life, family satisfaction, and staff engagement. These outcomes were achieved without necessarily increasing costs. Nevertheless, there were some trade-offs, such as lower professional and manager visibility. In addition, some outcomes, such as mental health, were not as readily influenced by long-term care home design. Overall, very few interventions in long-term care have been associated with such a wide range of positive outcomes for residents, families, staff, and organizations. Environmental design is a critical consideration for the future improvement of long-term care services.

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**Appendix A1 – Academic Literature Search Strategy**

*Table 1*. Database search strategies

| Database | Search Strategy |
|---|---|
| Generic search | "building design" OR "facility design" OR "built environment" OR "physical environment" OR "environmental design" OR "architectural (design OR model)" OR architecture OR "design model" OR layout OR "spatial (configuration OR layout)" OR renovation OR "green house" OR greenhouse OR "small house" OR "small-scale (living OR environment)" OR "small unit" OR "cottage model" OR "village model" OR "dementia village" OR "clustered domestic model" OR "household model" OR "models of care" AND "long-term care" OR "nursing (home OR facility OR facilities)" OR "skilled nursing (home OR facility OR facilities)" OR "residential aged care" OR "residential care" OR "aged care (home OR facility OR facilities)" OR "senior living (home OR facility OR facilities)" OR "eldercare" OR "continuing care home" OR "personal care (home OR facility OR facilities)" OR "care (home OR facility OR facilities)" OR "veterans home" OR "special care (facility OR facilities)" OR "dementia care (facility OR facilities)" OR "memory care (facility OR facilities)" |
| Medline | 1. "facility design".mp. or "Facility Design and Construction"/<br>2. "building design".mp.<br>3. "built environment".mp. or Built Environment/<br>4. "physical environment".mp.<br>5. *Environment Design/ or "environmental design".mp. or *Health Facility Environment/<br>6. "architectural design".mp.<br>7. "architectural model".mp.<br>8. architecture.mp. or *Architecture/<br>9. "design model".mp.<br>10. layout.mp.<br>11. "spatial configuration".mp.<br>12. "spatial layout".mp.<br>13. renovation.mp.<br>14. "green house".mp.<br>15. greenhouse.mp.<br>16. "small house".mp.<br>17. "small-scale living".mp.<br>18. "small-scale environment".mp.<br>19. "small units".mp.<br>20. "cottage model".mp.<br>21. "village model".mp.<br>22. "dementia village".mp.<br>23. "clustered domestic model".mp. |

| | |
|---|---|
| | 24. "household model".mp.<br>25. ("longterm care" or "long-term care").mp. or *Long-Term Care/<br>26. ("nursing" adj1 (home* or facility or facilities)).mp.<br>27. *Nursing Homes/<br>28. Homes for the Aged/ or "residential aged care".mp.<br>29. *Residential Facilities/ or "residential care".mp.<br>30. ("aged care" adj1 (home* or facility or facilities)).mp.<br>31. ("skilled nursing" adj1 (home* or facility or facilities)).mp.<br>32. ("senior living" adj1 (home* or facility or facilities)).mp.<br>33. eldercare.mp.<br>34. ("continuing care home*" or "care home*").mp.<br>35. ("personal care" adj1 (home* or facility or facilities)).mp.<br>36. "veteran* home?".mp.<br>37. ("special care" adj1 (facility or facilities)).mp.<br>38. ("dementia care" adj1 (facility or facilities)).mp.<br>39. ("memory care" adj1 (home* or facility or facilities)).mp.<br>40. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24<br>41. 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39<br>42. 40 and 41 |
| CINAHL | S42. S25 AND S41<br>S41. S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40<br>S40. """veterans home*"""<br>S39. """memory care facility"" OR ""memory care facilities"""<br>S38. """dementia care facility"" OR ""dementia care facilities"""<br>S37. """special care facility"" OR ""special care facilities"""<br>S36. """care home*"" OR ""care facility"" OR ""care facilities"""<br>S35. (MM "Long Term Care") OR """long term care"" OR ""longterm care"""<br>S34. """personal care home*"" OR ""personal care facility"" OR ""personal care facilities"""<br>S33. """continuing care home*"""<br>S32. "eldercare"<br>S31. """senior living home*"" OR ""senior living facility"" OR ""senior living facilities"""<br>S30. """aged care home*"" OR ""aged care facility"" OR ""aged care facilities"""<br>S29. (MM "Residential Care") OR """residential care"""<br>S28. """residential aged care"""<br>S27. (MM "Skilled Nursing Facilities") OR """skilled nursing home*"" OR ""skilled nursing facility"" OR ""skilled nursing facilities""" |

| | |
|---|---|
| | S26. """nursing home*"" OR ""nursing facility"" OR ""nursing facilities""" OR (MM "Nursing Homes")<br>S25. S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24<br>S24. """household model"""<br>S23. """clustered domestic model"""<br>S22. """dementia village"""<br>S21. """village model"""<br>S20. """cottage model"""<br>S19. """small unit*"""<br>S18. """small scale living"" OR ""small scale environment"""<br>S17. """small scale living"" OR ""small scale environment"""<br>S16. """small house"""<br>S15. "greenhouse"<br>S14. """green house"""<br>S13. "renovation"<br>S12. """spatial configuration"" OR ""spatial layout"""<br>S11. """spatial configuration"" OR ""spatial layout"""<br>S10. "layout"<br>S9. """design model"""<br>S8. (MM "Architecture") OR "architecture"<br>S7. """architectural design"" OR ""architectural model"""<br>S6. """architectural design"" OR ""architectural model"""<br>S5. (MM "Nursing Home Design and Construction") OR """environmental design"""<br>S4. """physical environment"""<br>S3. (MM "Built Environment") OR """built environment"""<br>S2. (MM "Facility Design and Construction") OR """facility design"""<br>S1. """building design""" |
| ProQuest Dissertations and Theses Global | noft(("building design" OR "facility design" OR "built environment" OR "physical environment" OR "environmental design" OR ("architectural design" OR "architectural model") OR "architecture" OR "design model" OR "layout" OR ("spatial configuration" OR "spatial layout") OR "renovation" OR "green house" OR "greenhouse" OR "small house" OR ("small scale living" OR "small scale environment") OR ("small unit" OR "small united" OR "small units") OR "cottage model" OR "village model" OR "dementia village" OR "clustered domestic model" OR "household model") AND ("long term care" OR (("nursing home" OR "nursing homes") OR "nursing facility" OR "nursing facilities") OR ("skilled nursing home*" OR "skilled nursing facility" OR "skilled nursing facilities") OR "residential aged care" OR "residential care" OR ("aged care home*" OR "aged care facility" OR "aged care facilities") OR ("senior living home*" OR "senior living facility" OR "senior living |

| | |
|---|---|
| | facilities") OR "eldercare" OR "continuing care home*" OR ("personal care home*" OR "personal care facility" OR "personal care facilities") OR (("care home" OR "care homes") OR "care facility" OR "care facilities") OR ("veterans home" OR "veterans homes") OR ("special care facility" OR "special care facilities") OR ("dementia care facility" OR "dementia care facilities") OR ("memory care facility" OR "memory care facilities"))) |
| Web of Science | Can be produced upon request |
| Scopus | Can be produced upon request |

## Appendix A2 – Grey Literature Search Strategy

*Table 2.* Grey literature search strategy

| Resource | Search strategy |
|---|---|
| Google | 1. (“long-term care” OR “nursing home”) AND “building design”<br>2. (“long-term care” OR “nursing home”) AND “built environment”<br>3. (“long-term care” OR “nursing home”) AND “layout”<br>4. (“long-term care” OR “nursing home”) AND “models of care”<br>5. (“long-term care” OR “nursing home”) AND “small house model” |

## Appendix B – Data Extracton Table

Available upon request.