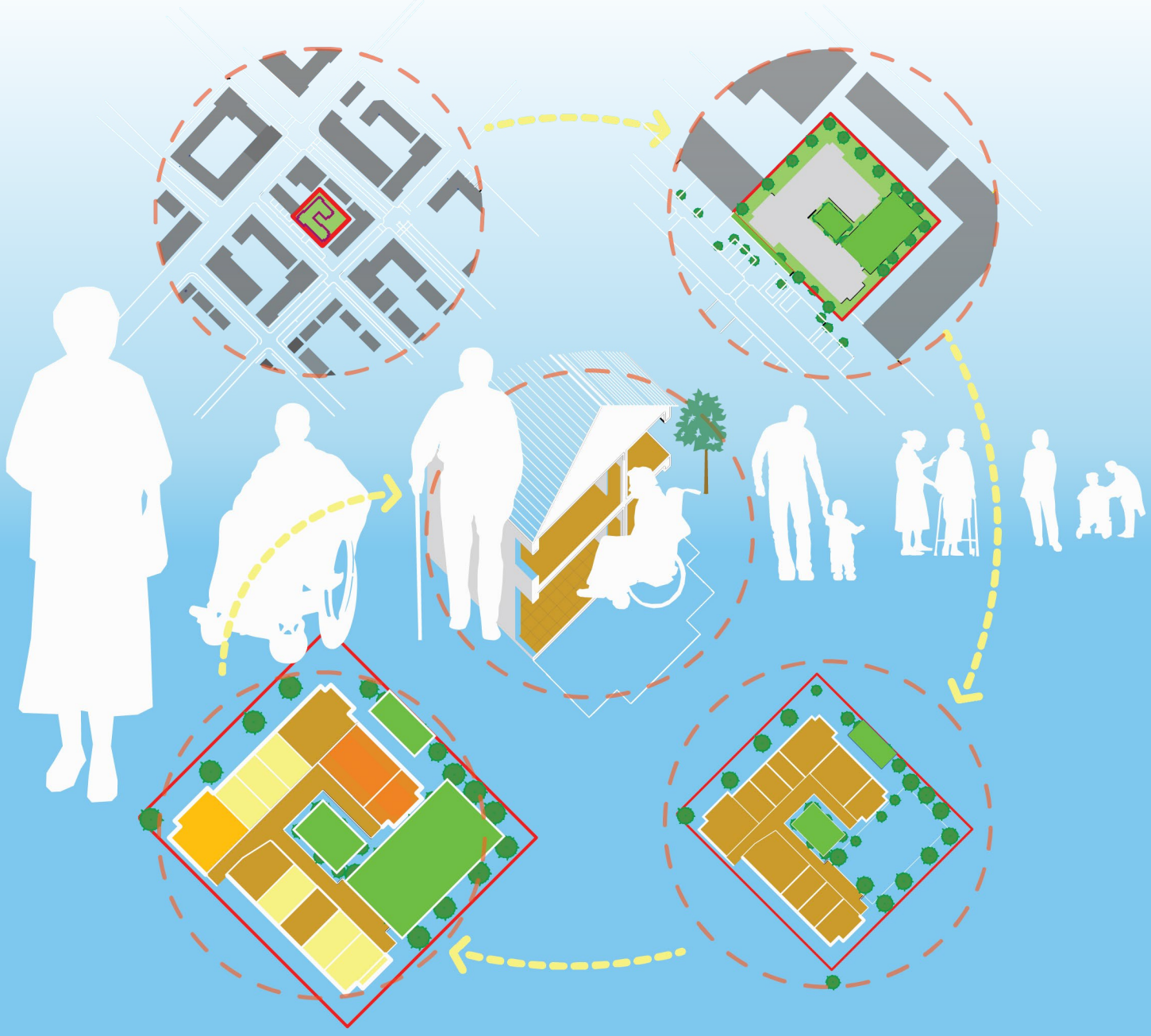
Universal Design for Improving Quality of Life and Enhancing COVID-19 Infection Control in Existing Residential Care Settings for Older People

Research Report



Centre for Excellence in Universal Design

Údarás Náisiúnta Míchumais
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Universal Design for Improving Quality of Life and Enhancing COVID-19 Infection Control in Existing Residential Care Settings for Older People

Research Report

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2022

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Sincere thanks to the Steering Committee for their continued support and excellent advice. The overall steering committee included:

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Executive Summary

Introduction: This project is funded by the **Centre for Excellence in Universal Design at the National Disability Authority** (CEUD-NDA) and was completed by **TrinityHaus, Trinity College Dublin** in collaboration with **Tallaght University Hospital** (TUH).

Recent research shows that Residential Long-Term Care (RLTC) settings have been disproportionately affected by COVID-19. COVID-19, like many other airborne infectious diseases, has serious implications for spatial practices and the design of the built environment (Megahed & Ghoneim, 2020; Oppel, 2020). In this regard and considering the toll that COVID-19 has taken on RLTC settings, it is important that the layout, design, and physical environment of these settings is carefully examined to determine the role and impact of the built environment on COVID-19 infections. The project was initiated and completed during the COVID-19 pandemic and focuses on existing residential long-term care settings (RLTC) for older people in Ireland. Specifically, this project examines how the built environment in these settings can be adapted and retrofitted to:

a) enhance the quality of life for residents,

b) improve the visitor experience for friends and family members (without compromising the quality of life for residents); and,

c) improve pandemic preparedness and resilience while still protecting the psychosocial health and well-being of residents.

This research paper is phase one of a two-phase project. The research was carried out to inform a set of evidence-based adaption and retrofit design guidelines, which are published separately:

1. **Research:** research was conducted to engage with key stakeholders, identify best practice, and examine Irish case studies, as described in this report.
2. **Guidelines:** this research report was then used to underpin a set of evidence-based adaptation and retro-fit design guidelines.

At a policy level, research in this area will support the Programme for Government "Our Shared Future" with its commitment to protecting those living in RLTC, while also supporting the work of the COVID-19 Nursing Homes Expert Panel who are tasked with providing learnings from the crisis and recommendations for the RLTC sector.

Adopting a Universal Design approach ensures that the research and guidelines are co-produced with key stakeholders, are people-centred, and address the diverse needs of residents, staff, and visitors regardless of their age, size, ability, or disability.

Building on previous research and guidelines: This research report builds on a range of age, dementia, and Universal Design projects and publications completed by TrinityHaus, TCD and members of the research team; including the Universal Design Guidelines for Dementia Friendly Dwellings and Dementia Friendly Hospitals from a Universal Design Approach.

Research Team: The core research team includes TrinityHaus, TCD (Tom Grey and Dimitra Xidous) and Tallaght University Hospital (Desmond O'Neill and Sean Kennelly).

Project partners and collaborators: The project involved diverse and representative partners including: HSE – Capital & Estates, Age Action, SAGE Advocacy, Age-Friendly Ireland, Nursing Homes Ireland, and TLC Nursing Homes (providing diverse perspectives across the public, private and voluntary sectors, in addition to key ageing advocates).

This report prioritises design for quality of life in RLTC and emphasises the importance of Universal Design, including dementia-friendly design. COVID-19 and infection control issues were carefully examined through a quality of life lens.

Key findings and recommendations

Key findings from this project address overall quality of life issues and infection control measures. The key findings incorporate relevant Universal Design considerations in addition to findings from the stakeholder engagement process.

The design of RLTC is impacted by many aspects of the physical environment across **all parts of a setting** and therefore, it is important to take a holistic and integrated approach **across all spatial scales**, from the location, access, and overall site layout, down to building layout, building components or specific applications of technology. In this regard, the following themes and spatial scales are used to set out a holistic and integrated approach:

1. Overarching design characteristics, features, or approaches
2. Site Location, inclusion, access, interaction with community, and healthy spaces
3. Site design providing a connected, welcoming, accessible, and pleasant setting with good contact with nature
4. Overall building layout, circulation, and key spaces (entering and moving about)
5. Key internal and external spaces
6. Building elements and components (finishes, furniture, fittings etc.)
7. Internal environment
8. Assistive technology, therapeutic technology, and ICT

Throughout this research a set of quality of life domains has been used to underpin the research and provide indicators for an environment where residents have the support and freedom to live full and meaningful lives.

In terms of COVID-19 and infection control, this research highlights how respiratory viruses are transmitted through contact, droplets, and airborne routes and that infection control strategies should take account of all transmission routes. However, there is now good evidence that COVID-19 related contact transmission is generally lower risk and that the principal modes of transmission involve respiratory droplets and airborne transmission.

Furthermore, research shows that risk of transmission is reduced outdoors due to air movement removing and diluting COVID-19 virus particles, and environmental conditions such as sunlight damaging the virus particles and decreasing transmission.

Taking into account quality of life and the principal modes of COVID-19 transmission, one of the main findings emerging from this research is the convergence between design for quality of life and design for good COVID-19 related infection control. From location down to technology, there are examples across all key spatial scales illustrating the impact of good planning and design to support the wellbeing of residents while also improving infection control and overall resilience.

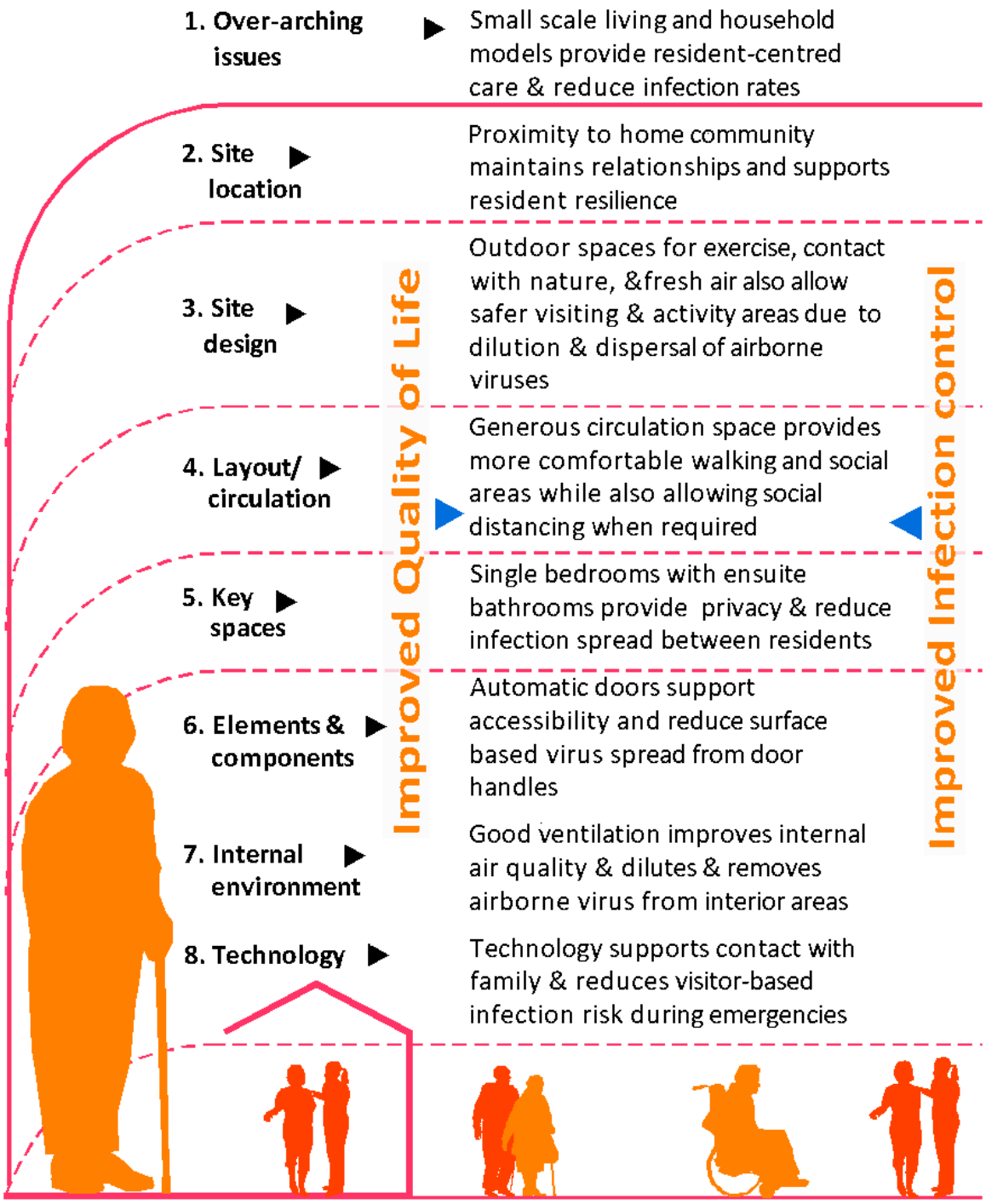


Figure 1

Key findings and recommendations associated with each of the eight themes and spatial scales described above are set out below.

1. Over-arching design characteristics, features, or approaches

Appropriate/reduced number of residents, and human scale of setting

Key findings

Smaller scale settings may be more comfortable in terms of scale and may reduce infection rates of COVID-19. Many stakeholders expressed concern regarding increasing setting sizes and its impact on quality of life and increased COVID-19 infection control risk.

Key recommendations to inform design guidelines

Smaller scale settings, or settings carefully broken down into smaller distinct units may provide less institutional and more home-like environments. This may also support Universal Design by providing more accessible, legible, and manageable settings. For existing settings this may involve breaking up or subdividing the overall setting into smaller units or 'households'. Depending on the layout or build structure, this may or may not involve structural changes, the construction of new walls or installation of new doors.

Resident-centred whole-facility care model

Key findings

Smaller scale, home-like, or household models have been linked to better resident satisfaction and improved quality of life. Home-like models such as the 'Green House' model may also be less prone to infectious outbreaks.

Key recommendations to inform design guidelines

Smaller scale household models (typically less than 12 residents) have been shown to improve quality of life and reduce infection risk. This may also support Universal Design by providing smaller, more legible, and manageable settings (see previous recommendation for potential retrofit measures required).

Mixed-use models, co-location, or shared facility models

Key findings

Co-location of settings with supported housing or similar was noted by stakeholders as being advantageous as it provides a continuum of care in the same location. Similarly, stakeholders noted that co-location with primary care was beneficial in terms of healthcare access. Settings that are more integrated with other facilities or allow outside users to access facilities can be beneficial for resident's quality of life, i.e., integration with childcare and day-care facilities.

Key recommendations to inform design guidelines

Mixed-use models, co-location or shared facility models may have benefits for quality of life, but this very much depends on the context. They may also have benefits in terms of Universal Design due to the possibility of greater integration, flexibility, and adaptability. However, while there is no research showing a correlation between these models and infection spread, the risks related to mixing and community interaction have to be carefully considered. This is an area where further studies are required in order to provide more research to underpin decisions around RLTC planning and design in the context of mixed-use models, co-location and shared facility models.

For existing settings that are being reconfigured or where new services are being considered, mixed-use models or shared facility models can be considered in terms of adapting the setting or adding new services or spaces.

2. Site Location, inclusion, access, interaction with community, and healthy spaces

Proximity to previous home, family, and friends to allow easy inward and outward visiting

Key findings

Many settings are located in areas which sever the connections between residents and their community, making visiting both into the setting and out, more difficult. Locating RLTC settings within residents' home communities may help with retaining continuity and connected-ness with a place or community.

Key recommendations to inform design guidelines

Settings that are located centrally within a community will benefit from proximity and access to the community, local amenities, services, local parks, green spaces, public transport and walking and cycling infrastructure.

Connection and engagement with the community is also dependent on the management and operation of the setting, Resident autonomy should be respected at all times, and any community engagement should be appropriate to the resident and a matter of resident choice.

While redesign or retrofit projects, which are the focus of these guidelines, cannot change the location of existing settings, careful consideration should be given to location to ensure that the setting is maximising its relationship with the community in terms of social interaction and inclusion in community life. Knowledge about the location and adjacent local community will also inform design and operational decisions around infection control and community interaction during a pandemic.

Pleasant, comfortable, accessible, and supportive adjacent public realm

Key Findings

A rapid review found that a pleasant, safe, and accessible public realm, with good walking/cycling routes and public transport access is essential in an age-friendly community and is critical for a dementia-inclusive community. Good internal environment considerations, i.e., air quality, noise levels, natural light etc., are linked to improved mental health. Older people are more vulnerable to short-term and long-term air pollution. Emerging research has linked poor air quality with a higher incidence of COVID-19.

Key recommendations to inform design guidelines

Providing a pleasant, safe, and accessible public realm with good walking and cycling routes, and easy access to public transport for residents, staff, and visitors (often older people) improves the quality of life for those in RLTC settings. This may be feasible or appropriate for urban settings, but many of these public realm issues should also be considered in villages, towns, and suburbs. While these issues are outside the scope of most retrofit projects, setting owners or managers should be aware of these issues and should liaise with the local authority to highlight these issues if required, and to request local improvements. In some circumstances, where a setting is located within a larger development, the setting may have greater influence over the design, management, and maintenance of the local public realm. This influence should be used to improve the safety, accessibility, and attractiveness of the public spaces adjacent to the setting.

Air quality at a neighbourhood scale is a quality of life, infection control, and resilience issue. RLTC settings should be located within neighbourhoods or locations with good air quality. Local authorities or developers can help to improve local air quality by reducing vehicle traffic (i.e., low vehicle environments through greater active travel via walking and cycling infrastructure and public transport) to minimise vehicle related pollution, and control local harmful emissions.

3. Site design providing a connected, welcoming, accessible, and pleasant setting with good contact with nature

Community Interface: a welcoming and open/permeable boundary with community, and positive physical interface to encourage and promote community interaction

Key findings

Higher quality of life is associated with buildings that facilitate engagement with a variety of activities both inside and outside. It is also important to maintain resident privacy and sense of security by creating some kind of "defensible space" as a buffer between the setting and the public realm, i.e., planting strip.

Key recommendations to inform design guidelines

Providing a positive community interface with a welcoming and visually open/permeable boundary with the community can help create a greater sense of ease and encourage community interaction.

While the boundary should be welcoming, it should also maintain privacy to protect residential amenity, as this supports the sense of security experienced by people in the setting.

Seeing out and feeling like part of the community: Visual access from the setting to the community

Key findings

A site layout that allows residents to 'watch the world go by' from their bedroom/day rooms/balcony etc. can provide interest and stimulation for residents and help them connect with the community. Balconies, porches, and verandas that allow for casual interaction with the community provide a visual stimulus through purposeful design, critical for physical and mental health. Stakeholders stressed the importance of a visual connection to the community to reduce isolation, and provide a sense of familiarity, sense of place and belonging.

Key recommendations to inform design guidelines

Good visual connection to the community can provide a sense of familiarity, sense of place and belonging. It can also help with spatial orientation as people can use familiar external landmarks to orientate themselves within a setting.

While residents in RLTC may need to quarantine or shelter in place during a pandemic, visual access from the setting and from resident bedrooms to the community, the outside world, and nature can help alleviate loneliness and isolation.

Pleasant, homelike, and accessible site design

Key Findings

A homely and accessible site design helps to provide a 'homelike' environment that promotes activities of daily living and encourages residents to undertake everyday tasks for as long as possible. Additionally, site layout is important in terms of infection control.

Key recommendations to inform design guidelines

Create a memorable and distinctive layout that creates a strong sense of place.

Create a pleasant, homelike, and accessible site design that encourages residents to go out and about on the grounds (walking, sitting, reading etc.), while also providing a restful and welcoming environment for staff and visitors.

Employ a Universal Design approach, including dementia-friendly design measures to ensure the site can be accessed, understood, and used by all residents, visitors, and staff.

To facilitate enhanced infection control when required, consider how permanent and temporary site measures can be used to create site zoning to separate activities with high infection risk (e.g., removal of materials associated with infection cases) and other activities (e.g., resident movement, visitor access, etc). It may be more appropriate that site flexibility can temporarily facilitate these measures only when required.

Creating good environmental site conditions: A healthful and relaxing setting in terms of air quality, acoustics, views and contact with nature

Key Findings

Environment issues such as air quality, crowding, noise, indoor air quality, and light are important for health and are also critical for the site design of a RLTC setting. Site design determines how the setting supports contact with nature through the overall site layout and circulation.

There is good evidence to show that outdoor spaces are considerably safer in terms of COVID-19 infection risk.

Key recommendations to inform design guidelines

The site design should create good environmental site conditions that provide a healthful, calm, and relaxing setting in terms of air quality, acoustics, views and contact with nature.

Due to the low infection risk association with the outdoors, as well as the positive impact of access to nature on quality of life; creation of outdoor spaces for activity, exercise, and social interaction becomes a critical part of site design in RLTC settings (For more information see Outdoor Space in Section 5 of the Executive Summary).

Site design also needs to take into account local and onsite air quality, not just to provide high quality outdoor areas, but also to protect against the damaging effects of poor air quality and pollution. A building layout that locates key indoor habitable spaces away from areas of poor air quality, the appropriate placement of key outdoor areas, and the use of site micro-climates to create air flow and ventilation, are all ways to maximise air quality on the site.

Air quality can also be improved by limiting onsite vehicle emissions, controlling harmful onsite emissions, and by planting trees or other appropriate vegetation in strategic locations.

4. Overall building layout and circulation (Entering and moving about)

Overall layout of the setting providing a human scale and supporting accessibility

Key Findings

Fewer beds and lower social density (i.e., more area of floor space provided per resident) is connected to improved quality of life and better care and social interaction outcomes. A smaller setting with a simple and legible layout will improve wayfinding and orientation by reducing dependence on cognitive mapping, providing good visual access, and clearly communicating the overall structure of the space. A smaller setting with shorter and clearly legible circulation will provide easy access between key spaces such as living rooms, kitchens, bedrooms, and bathrooms. Stakeholders noted that larger settings may take the form of multi-storey buildings and argued that residents living on upper floors may have restricted access to outdoor space or restricted mobility in terms of moving between floors. They also noted that ground floor bedrooms allow for window visits during periods of COVID-19 restrictions.

Key recommendations to inform design guidelines

The benefit of smaller scale settings, or settings carefully broken down into smaller distinct units has been outlined previously. Therefore, the overall layout of a setting should be considered in this context, and the layout should be designed to provide these smaller units.

Provide a coherent, legible, and logical building layout that provides orientation for users and is easy to understand and navigate.

For multi-storey settings, residents on all floors should have access to usable and meaningful outdoor space. Furthermore, access to upper floors for visitors should be facilitated through spacious and well-ventilated circulation routes, ideally without having to travel through key parts of the main building.

Building circulation supporting accessibility - Spacious, legible, and accessible circulation areas (corridors, stairs lifts)

Key Findings

Predetermined routes for resident transfers within the setting and more spacious circulation routes are important for infection control.
Stakeholders were concerned that larger settings presented more challenges for COVID-19 infection control due to higher resident population, greater traffic, larger common areas with a higher number of occupants, and challenges around accessing multiple floors using lifts.

Key recommendations to inform design guidelines

Provide calm, spacious, uncluttered circulation routes articulated by visual clues including identifiable spaces, features, connections to external spaces and views, artwork, planting, lighting, fittings, and furniture. This should be supported by clear wayfinding using signage, colour coding, images, or other visual cues to help create a more easily navigated setting.

Where possible, a circular or looped circulation route, that passes through or runs adjacent to the day room, may be appropriate as this provides continuous walking routes that return a person to their starting point. This arrangement also avoids dead-ends and any associated disorientation or anxiety.

Provide spacious dedicated circulation systems for separation between clean, semi-clean, and contaminated zones where possible.

Carefully consider the location and number of lifts and staircases as part of the overall layout and zoning to provide additional circulation capacity, and possibly separate routes for visitors or service personnel.

Signage systems focusing on infection control should be included in the design for the setting (for more information see Orientation and Wayfinding Features in Section 6 of the Executive Summary).

Provide increased ventilation for lifts by leaving elevator doors open for longer periods, increasing of the lift's mechanical ventilation capacity, reversing the flow direction of the ventilator, and creating a unidirectional downflow of fresh (e.g., HEPA filtered) air from the ceiling towards the floor of the elevator cabin.

Layout provides a centrally located, high quality outdoor space or garden

Key Findings

Quality outdoor spaces provide both direct access to nature, but also space to exercise, get fresh air and exposure to the sun. Where outdoor space is readily accessible and safe, it makes it easier for residents to go outdoors independently.

Key recommendations to inform design guidelines

The layout of the building should incorporate a centrally located outdoor space or garden that is easily accessible via the main circulation route, or key common areas, such as the living room or dayroom.

Despite being outside, it is still important to consider good ventilation in all outdoor areas, especially in relation to any covered outdoor seating areas or similar outdoor structures.

5. Key Internal and external spaces

Overall design issues

Key Findings

The design and quality of all key spaces is important for overall quality of life. Good ventilation is key to reducing the transmission of COVID-19 indoors.

Key recommendations to inform design guidelines

For household models, provide a central, shared, spacious but domestic scale communal area composed of a living area, an open kitchen, and a dining area.

Good ventilation is critical for reducing the transmission of COVID-19 in indoor spaces; therefore, all living, kitchen, and dining areas should be well ventilated.

Visiting Areas

Key Findings

Some stakeholders expressed concern that some central living spaces were too small and did not allow for private visiting. Using outdoor spaces, particularly covered ones, can provide valuable visiting spaces, but weather or resident frailty does not always allow for this.

Key recommendations to inform design guidelines

Provide more numerous and varied visitor spaces within settings to handle different kinds and numbers of visitors at different levels of privacy. This may involve converting existing rooms, subdividing common areas, or building on new visitor spaces.

All visitor areas should be spacious enough for social distancing and well ventilated.

Provide a range of open and sheltered outdoor visiting areas in gardens or courtyards, or on balconies or roof terraces. Within these spaces provide a variety of open areas and seating and covered areas such as verandas or garden shelters (see outdoor space below).

Bedrooms

Key Findings

Research indicates that private bedrooms with ensuite bathrooms are preferred by residents and families. They are also linked to quality of life, improved infection control, and allow for the isolation of confirmed or suspected cases of COVID-19. Private rooms also allow for visitation in resident bedrooms.

Key recommendations to inform design guidelines

Provide spacious single bedrooms with private bathrooms for all residents where possible. Ideally, bedrooms should have a small sitting area and kitchenette that would allow more autonomy, independence, and enable the hosting of visitors.

Bedrooms should be provided with large windows with good views to the outside, including from the bed, and ideally a small private outdoor space in the form of a terrace or balcony.

Good ventilation is critical to reducing the transmission of COVID-19 in indoor spaces, therefore all bedrooms and bathrooms should be well ventilated.

Outdoor space: Garden, courtyard, or other key outdoor space

Key Findings

High-quality outdoor space should ideally be centrally located, easily seen, and accessed from the main central communal areas. These spaces should be safe, accessible, and easy to understand and use. Stakeholders emphasised the importance of outdoor space in terms of overall quality of life and visiting during COVID-19.

Outdoor spaces provide significantly safer environments in terms of airborne COVID-19 transmission, and are vital for contact with nature, physical activity, and natural ventilation.

Key recommendations to inform design guidelines

Provide centrally located, high quality outdoor spaces or gardens directly linked to key internal spaces to support quality of life and infection control.

Provide safe, comfortable, and accessible outdoor areas where a resident can be brought to meet with family, while maintaining physical distance from others who might also be using the space.

Provide sheltered external spaces with heaters for the colder months.

Well-designed balconies and terraces can provide many of the same benefits as a ground level garden including access to fresh air, daylight, views, and contact with nature. These spaces become even more important if a patient is located on an upper floor or is unable to travel to or access a ground level garden due to illness, frailty, delirium, or infection control.

Despite being outside, it is still important to consider good ventilation in all outdoor areas, especially in relation to any covered outdoor seating areas or similar outdoor structures.

6. Building elements and components (finishes, furniture, fittings)

Finishes, materials, and fittings

Key Findings

Finishes and fittings which consider infection control, can be institutional.

Key recommendations to inform design guidelines

Finishes, materials, and fittings should strike a balance between being homely and being accessible, whilst taking infection control into consideration.

New research that emphasises the role of airborne transmission means that surface transmission is now deemed lower risk for COVID-19. Therefore, there is less focus on finishes, materials, and fittings as part of the COVID-19 infection control strategy.

Orientation and wayfinding features

Key Findings

Good wayfinding signage between key spaces, with multiple cues (e.g., sight, sound etc.) has positive effects on residents. A balance must be struck between signage and creating a home-like environment.

Key recommendations to inform design guidelines

A signage system focusing on infection control should be included in the design for the setting. This may include signage indicating a one-way circulation system; signage indicating distinct zones (i.e., Infection risk zones, zones for visitors and residents); signage to point out sanitation stations and promote good hygiene. Depending on circumstances, signage may be temporary (i.e., during a pandemic emergency), or permanent (i.e., signage related to hand sanitation stations).

7. Internal environment

Comfortable and balanced room temperatures (not too hot, not too cold)

Key Findings

Comfortable temperatures have been associated with good quality of life among RLTC setting residents. High temperatures in resident bedrooms are associated with a lower quality of life. The spread of pathogens and viruses could be facilitated in cold and dry conditions.

Key recommendations to inform design guidelines

The virus (SARS-CoV-2) that causes COVID-19, survives longer in cold and excessively dry environments. These conditions may be problematic in terms of encouraging the spread of COVID-19; therefore, it is advisable to have warm indoor temperatures (e.g., 18-21 degrees Celsius, depending on room and occupant preference/health), and an indoor relative humidity at approximately 50%. (See also below for findings and recommendations around ventilation).

Healthful and comfortable ventilation via natural and mechanical ventilation (including appropriate internal relative humidity)

Key Findings

Ventilation and air quality are critical to the wellbeing of older people in nursing homes. Openable windows can be helpful in providing natural ventilation and fresh air, particularly in regard to COVID-19 infection control. It can be difficult to balance ventilation and air quality with resident comfort in settings with older people.

Key recommendations to inform design guidelines

Increase natural ventilation to dilute the virus in the air and help extract it outside.

Perform purge ventilation at regular intervals to air out the rooms by opening windows and doors to replace any stale air in the room with fresh air. Ensure windows are capable of being easily operated and fully opened when required (while considering safety and security).

Monitor poor ventilation and low humidity with CO2 (carbon dioxide monitors) to keep CO2 below 600ppm (parts per million).

Use portable air filters in the bedrooms of residents with COVID-19, (portable high-efficiency particulate air (HEPA) filters) to help remove aerosols from the air. Many domestic type filters are equipped with H13 HEPA filters capable of filtering 99.97% of particles with a clean air delivery rate of 467 m3 per hour on the highest fan speed setting.

High levels of natural light and a well-balanced acoustic environment

Key Findings

Higher levels of natural light in nursing homes have been shown to have positive impacts on residents, such as, improved sleep, improved function, and reduced depression. Additionally, increasing illumination to typical day time levels has been shown to regulate circadian rhythms and improve sleep patterns for people with dementia.

Interviewees expressed concern about the lack of natural light in many settings and stressed the importance of maintaining good levels of natural light for people with dementia.

Excessive noise levels have been associated with negative impacts such as, lower levels of social interaction, increased wandering, and aggressive and disruptive behaviour with increased agitation. However, moderate sound levels appear to be associated with more engaged behaviours, suggesting that an excessively quiet environment may not be comfortable.

Stakeholders noted the poor noise insulation within settings, and this being particularly difficult with resident's heavy reliance on call bell systems. Interviewees stated that settings often have populations with significant numbers of people with hearing impairments and stressed the importance of sound levels. They also noted that poor noise insulation presented a privacy concern, as individuals often need to raise their voice to communicate with residents with hearing impairments.

Key recommendations to inform design guidelines

Create spaces that reflect a peaceful environment away from sources of external noise, and closer to sources of pleasant sounds such as bird life in a garden. This is of particular importance for a bedroom where sleep disturbance may already be an issue.

Careful use of technology such as a silent staff call system to reduce noise within a setting.

8. Assistive technology, therapeutic technology, and ICT

Assistive technology to support independence, health, comfort, and safety

Key Findings

Adjustable ambient lighting represents a therapeutic technology that can alleviate an austere and overtly clinical setting by changing the lighting colour temperature to create either a calming, restful, or stimulating lighting environment as required. Stakeholders felt assistive technology should be more prevalent in RLTC settings.

Key recommendations to inform design guidelines

Ensure building structure and materials facilitate Wi-Fi technologies, to allow for contact with families and friends via. ICT, and access to telehealth such as remote consultations with GP, etc.

While Wi-Fi may be suitable for many technologies, the provision of CAT 6 ethernet cables will ensure a stronger and more reliable connection, which may be vital during important health assessments.

For resident bedrooms consider the following technologies: infrared fall detection devices; pull-cord emergency call unit; movement sensors or bed pressure mats that turn lights on automatically at night if a person needs to use the bathroom or move about.

Consider how the use of automatic sensor taps, automatic opening doors, and other 'no touch' features can help with infection control and accessibility.

Careful use of technology such as silent staff call systems to reduce noise within settings.

Ensure technology is accessible and usable by all residents including those with physical, sensory, or cognitive disabilities.

Where possible, encourage residents to use their own technologies (such as smartphones and tablets) that they are familiar with.

Therapeutic technology

Key Findings

A number of studies have shown multi-sensory stimulation to be an appropriate and effective therapy for people with dementia. However, stakeholders noted that, especially during COVID-19, spaces like sensory rooms are often repurposed due to lack of space. Technology, such as augmented reality (AR) and virtual reality (VR) could be of benefit to residents, for immersive connection with loved ones to visiting spaces that are otherwise inaccessible.

Key recommendations to inform design guidelines

Ensure building structure and materials facilitate Wi-Fi technologies.

Provide headphones to allow residents the choice to listen to music or the radio.

Consider augmented reality (AR) and virtual reality (VR) technologies for therapeutic activities or entertainment, where appropriate and desired by the resident; supported by staff training/competency.

This report document acknowledges the wide diversity of care needs across individuals in RLTC settings. While a proportion of residents will be able to get out of bed, move around the setting, and leave the premises on their own or with little or no assistance, there are many residents who will have higher care needs, and who will require a significant degree of assistance from staff, family members, and assistive technologies.

A Universal Design approach recognises these diverse care needs and helps to provide inclusive settings that support a diversity of users with varying physical, sensory and cognitive capabilities, needs and preferences. A Universal Design approach also recognises that settings must cater to a wide spectrum of people including residents, staff, visiting health and social care professionals, family members, friends, and othervisitors.

Conclusion and next steps

The report has endeavoured to prioritise design for quality of life in RLTC and to emphasise the importance of Universal Design. The report argues for alternative and holistic approaches that balance infection control and quality of life at multiple spatial scales in existing and proposed settings. The report demonstrates the convergence on many fronts between these issues and shows that certain design models and approaches that improve quality of life, will also benefit infection control, support greater resilience, and in turn improve overall pandemic preparedness.

The report also identifies many gaps in the research literature regarding both design for quality of life and infection control. While there is significant material regarding ventilation and HVAC, and a limited number of studies regarding internal layout, materials etc., there is a dearth of research examining the macro issues (i.e., location and access), meso issues (local neighbourhood), and site design issues (where we found only one significant study in this area).

Next steps

This Key Research Findings report has been developed to underpin a set of high- level evidence-based Universal Design guidelines for adaptation and retrofit of existing RLTC settings in Ireland.

Guidelines: This report will be used to select the high priority key design considerations and infection control issues as part of the high-level Universal Design guidance. (See Figure 1 for a graphic of the key spatial framework for the guidelines)

Future research: The research report identifies further research, stakeholder engagement, and collaboration opportunities to examine macro issues (i.e., location and access); meso issues (local neighbourhood), and site design issues in relation to RLTC design for quality of life, Universal Design, infection control and overall resilience; and micro level issues on the quality of life of both providers and users of these services.

1. Project Introduction

1.1. Introduction

This project was funded by the **Centre for Excellence in Universal Design at the National Disability Authority** (CEUD-NDA) and was completed by **TrinityHaus, Trinity College Dublin** in collaboration with **Tallaght University Hospital** (TUH).

The project focuses on existing public, private and voluntary residential long-term care settings for older people in Ireland and examines how the built environment in these settings can be adapted and retrofitted to:

a) enhance the quality of life for residents,

b) improve the visitor experience for friends and family members (without compromising the quality of life for residents); and,

c) improve COVID-19 infection control, pandemic preparedness and resilience while still protecting the psychosocial health and well-being of residents.

1.2. Background

COVID-19 has highlighted that Residential Long-Term Care (RLTC) is vulnerable to infectious diseases. Recent research shows that RLTC settings have been disproportionately affected by COVID-19 (Kennelly et al., 2021), with serious impacts on residents, staff, and family members.

COVID-19, like many other airborne infectious diseases, has serious implications for spatial practices and the design of the built environment (Megahed and Ghoneim, 2020, Oppel, 2020). In this regard and considering the toll that COVID-19 has taken on RLTC settings, it is important that the layout, design, and physical environment of these settings is carefully examined to determine the role and impact of the built environment on COVID-19 infections.

Already, research has identified how certain built-environment issues can make settings more prone to infection, including: the number and density of residents, the numbers of staff and visitors accessing a single building, staff movement between multiple residents' rooms, and singular high traffic communal areas such as dining rooms or living spaces (Barnett and Grabowski, 2020, Dosa et al., 2020).

Furthermore, space related measures put in place to protect residents against infection can have serious negative impacts on their psychosocial health and well-being. These include quarantine, constrained social interaction, restricted visits from family and friends, the cancellation of shared activities, and the wearing of personal protective equipment (PPE) by staff (World Health Organization, 2020b, World Health Organization, 2020a). These interventions are particularly difficult for people with cognitive impairment or a person that walks with purpose, formerly termed 'wandering' (Fallon et al., 2020).

In this regard, understanding how the existing layout and design of settings influenced COVID-19 infection is a crucial part of combating the illness in long term care.

Furthermore, it is important to consider the adaptations to the layout and operation of space, or the modifications or retrofit of building elements and systems that were carried out within settings to control infection. It is vital that we learn from this pandemic and identify how the design, layout, management, and modification of the built environment **can support quality of life for residents and improve pandemic resilience.** This knowledge will help inform adaptation and retrofit of the 581 public, private, and voluntary RLTC settings in Ireland to protect the people who live and work in RLTC settings from the current pandemic situation and the possibility of future waves of COVID-19.

At a policy level, research in this area will support the Programme for Government "Our Shared Future" with its commitment to protecting those living in RLTC, while also supporting the work of the COVID-19 Nursing Homes Expert Panel who are tasked with providing learnings from the crisis and recommendations for the RLTC sector.

1.3. Project Scope

The project has been carried out in two phases:

1) Research was conducted to engage with key stakeholders, identify best practice, and examine Irish case studies
2) The research was used to underpin a set of evidence-based adaptation and retro-fit design guidelines.

This document is the research report associated with phase 1 as outlined above.

Adopting a Universal Design approach ensures that the research and resulting guidelines are co-created with key stakeholders, are people-centred, and address the diverse needs of residents, staff, and visitors regardless of their age, size, ability, or disability.

This research examines the key spatial scales, from site layout to individual internal spaces, space management (i.e., function, use, and circulation), and the elements and systems (i.e., materials and finishes); fit-out; internal environment; and technology, of existing settings.

1.4. Methodology

The research utilised a mixed methods approach composed of the following:

- 'Rapid Review' of best practice: in line with established Rapid Review methodologies.
- High level case studies - 3 site-based Irish case studies: To investigate and categorise successful RLTC approaches and measures in relation to Quality of Life and COVID-19 infection control. The selection of the Irish case studies and the data collection was guided by Tallaght University Hospital geriatricians and consisted of 3 case studies located in the Tallaght University Hospital catchment area.
- Stakeholder Questionnaires: 3 questionnaires were shared with the residents, family/visitors, and staff of the 3 Irish case studies, gathering information on the lived experience of RLTC, quality of life, COVID-19 infection control and the built environment.
- Stakeholder Interviews: Approximately 18 interviews were conducted with various key stakeholders, service providers and advocates in the area of RLTC (full list of interviewee organisations listed in Appendix C).

1.5. Building on previous research and guidelines

This research and the resulting guidelines build on a range of age, dementia, and Universal Design projects and publications completed by the team named in this project. This includes the Universal Design Guidelines for Dementia Friendly Dwellings (Grey et al., 2015), Dementia Friendly Hospitals from a Universal Design Approach (Grey et al., 2018), stakeholder based publications (Xidous et al., 2019), and systematic reviews (Grey et al., 2019).

1.6. Project partners

The project involves diverse and representative partners including:

- **Lead/funding organisation:** CEUD/NDA
- **Research team** - TrinityHaus, TCD (Tom Grey – Co-Principal Investigator and Dimitra Xidous), and Tallaght University Hospital (TUH) (Desmond O'Neill - Co-Principal Investigator and Sean Kennelly).
- **Project steering committee**: HSE – Capital & Estates, Age Action, SAGE, Age-Friendly Ireland, Nursing Homes Ireland, and TLC Nursing Homes (these partners provide diverse perspectives across the public, private and voluntary sectors, in addition to key ageing advocates).

1.7. Key project Deliverables

The key project deliverables include:

a) Key Research Findings Report (this document)

b) Guidelines document

2. Rapid Review: Universal Design, quality of life, and infection control issues.

2.1. Rapid Review Introduction

A Rapid Review[1] methodology containing a scope and key questions was developed in conjunction with the project steering committee. The scope outlined the key site and building areas to be examined and these included:

- Site Entry and Site Layout: including footpaths, external spaces, car parking
- Entering and moving about inside: e.g., main entrance, corridors stairs, lifts, etc.
- Key Internal & External Spaces: e.g., bedrooms, living rooms, staff areas, gardens, etc.
- Elements and Systems: e.g., fixtures and fittings, internal environment (heating, ventilation, etc.), and technology (e.g., Automatic, or hands-free systems, Assistive technology and ICT, Health, and safety technology).

The main research question was as follows:

How can the built environment in existing RLTC settings be retrofitted or adapted to help create a balanced approach between residential quality of life, infection control, and overall pandemic resilience?

Based on the key spaces and the main question outlined above, five sub-questions were presented including:

1. What are the key quality of life issues in RLTC in Ireland?
2. What are the key built environment features and building operation issues (e.g., access to setting and key spaces, access to outdoors, management of setting, building maintenance etc.) that underpin quality of life for older people in existing RLTC settings in Ireland?
3. What are the main Universal Design issues in terms of accessibility, understanding, and usability for all users within RLTC settings?
4. What are the main built environment and building operation issues related to COVID-19 and infection control in existing settings?
5. What are the main convergences and divergences between Quality of Life and Universal Design features, and COVID-19 building related infection control measures?

[1] Rapid reviews represent a knowledge generation strategy. They synthesize findings and assess the validity of research evidence using "abbreviated" systematic review methods, modifying these methods to generate evidence in a short time. Rapid Reviews to Strengthen Health Policy & Systems: A Practical Guide TRICCO, A. C., LANGLOIS, E. & STRAUS, S. 2018. Rapid reviews to strengthen health policy and systems: a practical guide. 2017. *World Health Organisation: Geneva*.

2.2. Key outputs

The aim of this review was to examine peer reviewed and grey literature to identify national and international best practice regarding Universal Design and key built environment issues in RLTC settings. From this review, key successful built environment features and building-related operational measures were identified. The results of this rapid review provide an evidence base to underpin key adaptation and retrofit guidelines from a Universal Design approach.

2.3. Structure of the review.

Section 2.4 establishes overall Quality of Life issues that should be supported in RLTC settings, **Section 2.5** sets out the main Universal Design issues relating to RLTC and identifies the key infection control considerations. **Section 2.6** describes the key policy context of residential care settings for older people in Ireland, while **Section 2.7** provides an overview of COVID-19 Nursing Homes Expert Panel Examination of Measures to 2021. **Section 2.8** outlines Covid-19 and overall infection control issues. Finally, **Section 2.9** presents key built environment considerations related to COVID-19 and infection control in existing settings**.** Section 2.9 does not provide detailed findings as these are covered in Chapter 4 as part of the overall key research findings.

2.4. Overall Quality of life issues including well-being, and thriving

The best RLTC settings support the wellbeing of residents, regardless of age, health, or illness. Such settings provide accommodation in which residents are "thriving not surviving" (Tremethick, as cited in Bergland & Kirkevold, p. 682, 2006).

Bergland and Kirkevold (2006) observe that thriving can act as a function of the individual's interaction with their surrounding environment. In other words, a nice and pleasant RLTC setting that meets the expectations of individual residents, can contribute to the wellbeing and thriving of residents.

The Quality of Life domains set out in this report, are underpinned by the important concepts of 'wellbeing', and 'thriving'. A brief explanation of these key concepts is provided below.

Well-being is generally understood to be the presence of positive emotions and moods, with the absence of negative emotions. It is contingent on a person's mental, social, and physical status, and is affected by everyday life experiences, activities, and environmental influences (Reed, 2008).

Thriving has been described as a contemporary and health-promoting multidimensional concept (e.g., physical, psychological, and social) that can be used to explain place-related well-being (Baxter et al., 2021)

Focussing on **quality of life**, **wellbeing**, and **thriving** helps to provide RLTC environments where residents have the support and freedom to live full and meaningful lives. Drawing on the literature (Kane, 2001, Bowling, 2005, Walker, 2005) four sectors are presented below that overlap to form an overall picture of what may be considered the key issues around quality of life, wellbeing, and thriving for residents in RLTC. These four sectors are further defined by a set of 15 specific domains (See Figure 2 below).

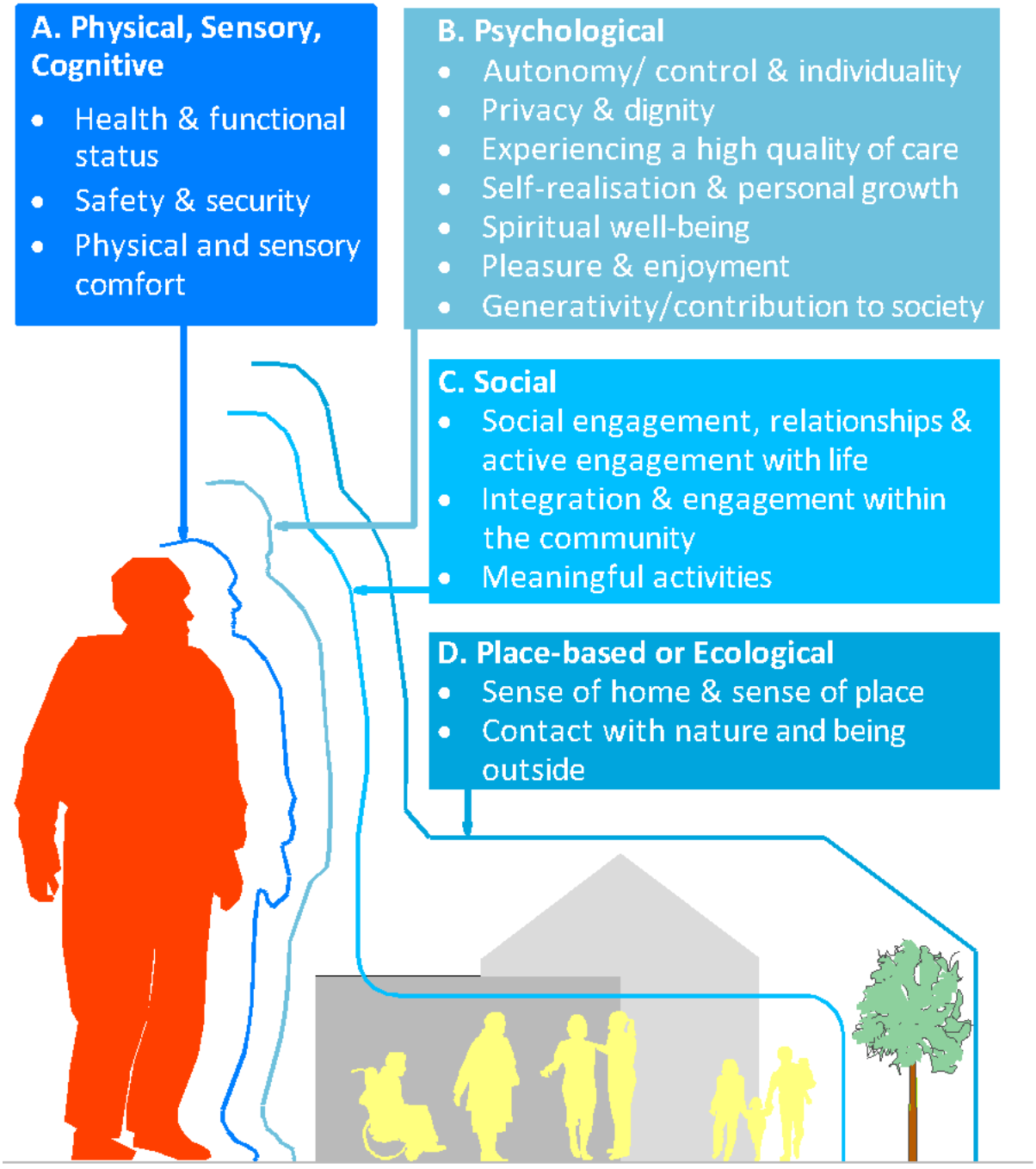


Figure 2 Quality of Life Domains

A. Physical, Sensory, Cognitive

1. **Health & functional status** (including sensory/cognitive issues such as orientation & navigation)
2. **Safety & security** (e.g., avoiding injuries, harm or ill-health, and real and perceived security).
3. **Physical and sensory comfort** (environmental comfort including heating, air quality, lighting, and noise).

B. Psychological

4. **Autonomy/control & individuality** (e.g., freedom to make decisions, freedom to express yourself and personalise your space)
5. **Privacy & dignity** (e.g., having your own private space and time. Feeling valued and respected)
6. **Experiencing a high quality of care** (a strong sense of a caring environment or experiencing an atmosphere of care)
7. **Self-realisation & personal growth** (this depends on a person's capabilities but could range from learning new skills and growing as a person, to experiencing new things)
8. **Spiritual well-being** (traditional spiritual activities such as going to mass or music, and less traditional activities such as being in nature)
9. **Pleasure & enjoyment** (having fun, entertainment, enjoying food, spending time with animals, or having aesthetic experiences)
10. **Generativity or contribution to society** (volunteering, childminding, taking care of animals, growing vegetables for dinner)

C. Social

11. **Social engagement, relationships & active engagement with life** (being with family, friends, other residents, and staff)
12. **Integration & engagement within the community** (going out and about, shopping, to the library, pub, sporting occasions)
13. **Meaningful activities** (cleaning, washing clothes, doing chores, gardening, going for a walk)

D. Place-based or Ecological

14. **Sense of home & sense of place** (where a person feels at home and has a sense of belonging)
15. **Contact with nature** (experiencing nature both inside and outside. Also spending **time being outside** getting fresh air, sunlight, and generally being out and about.)

2.5. Universal Design and residential long-term care

2.5.1. Universal Design for diversity and inclusion

> "Universal Design is the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability" (http://universaldesign.ie/what-is-universal-design/)

A Universal Design approach recognises that RLTC settings cater to a wide spectrum of people including residents, staff, visiting health and social care professionals, family members, friends, and various visitors. In this regard, an inclusive setting must support a diversity of users with varying physical, sensory and cognitive capabilities, needs and preferences.

2.5.2. Designing for dementia through Universal Design

Cahill et al. highlight that almost two-thirds of RLTC residents may be living with dementia (2015), therefore adopting dementia-inclusive practices is important for these settings. Building on the work of Lawton (1977), Marshall (1998), Judd et al. (1998), Cohen & Weisman (1991), Calkins et al. (2001), Fleming & Bennett (2014) and many others, CEUD developed the **Universal Design Guidelines: Dementia Friendly Dwellings for People with Dementia, their Families and Carers** (Grey et al., 2015). While this document focuses on private dwellings as opposed to RLTC, it drew heavily from long-term care research and contains much useful guidance for RLTC settings.

2.5.3. Universal Design Guidelines for improving quality of life and enhancing COVID-19 infection control in existing residential care settings for older people

These guidelines recognise that people will experience dementia differently, and that no two people with dementia will have the same symptoms and experiences. However, in the context of design and the physical environment, and in the interest of providing designers with a broad understanding of dementia, the following symptoms are highlighted:

- Impaired rational thinking, judgement, and problem-solving.
- Difficulty with memory (initially short-term but progressing over time to long-term memory difficulties).
- Problems learning new things.
- Increasing dependence on the senses (i.e., with impaired cognitive abilities a person may rely more on their sense of smell, touch, hearing, or sight).
- Fear, anxiety, and increased sensitivity to the built and psycho-social environment

Furthermore, considering the age profile of many people with dementia, other age-related health problems such as cardiovascular disease, Parkinson's disease and diabetes may be an issue. They are also more likely to experience other age-related difficulties such as:

- Mobility difficulties
- Visual difficulties
- Hearing difficulties

These symptoms, characteristics, and capabilities are then used in the guidelines document to frame a range of key design issues including to:

- Encourage a participatory design approach where people with dementia, their family and carers can take part in the design process.
- Use familiar design with the use of recognisable features consistent with user expectations.
- Support personalisation of the environment to enhance continuity of self.
- Provide an environment that is easy to interpret and calm, paying close attention to the reduction of acoustic and visual disturbances.
- Provide good visual access to key areas of the dwelling or to important objects to remind and prompt the occupant when required.
- Provide unobtrusive safety measures and appropriate technology such as Assistive Technology (AT), Ambient Assisted Living (AAL), Telecare or Telehealth to provide a safe and secure environment.
- Create distinct spaces for different domestic activities so that the meaning and function of these spaces is legible and more memorable.
- Provide safe and accessible outdoor spaces which are perceptible from the interior to encourage occupant use of these spaces.

These issues must be carefully managed to ensure a balanced design approach for Universal Design dementia friendly settings. Considering these issues within the framework of Universal Design will ensure that building design meets the specific needs of people with dementia while also supporting other occupants, family members, or carers.

2.5.4. COVID-19 in Residential Long-term Care Settings

Recent research shows that RLTC settings have been disproportionately affected by COVID-19 with one Irish study showing how 75% of settings that were included in the study had COVID-19 outbreaks; in these settings 43.9% of residents and 23.8% of staff were infected, and the case-fatality rate in residents was 26.7% (Kennelly et al., 2021). This study also highlighted that these findings were largely consistent with international findings, thus revealing the toll taken by COVID-19 in RLTC.

COVID-19 has heavily impacted people living with dementia (see Section 2.8.3 COVID-19: primary and secondary impacts). According to Olson and Albensi, COVID-19 generated a high death rate among persons with dementia due to many factors including their poor overall lung health and frailty, and chronic co-morbidities (Olson and Albensi, 2021). However, she argues that this toll was compounded by the design of many existing facilities:

> "Old, institutionalized buildings with inadequate infection control design, inadequate ventilation that could spread germs throughout a building, dense populations, shared bedrooms and bathrooms, large communal gathering rooms, lack of access to the outdoors, and narrow hallways and crowded nursing stations placed PWD (persons with dementia) at a high risk of contracting COVID-19 and spreading it throughout the facility."

Olson represents the view of many experts in RLTC, for instance, Siegelaar et al. (2020), warns about future reoccurrence of COVID-19 or other epidemic or pandemics and calls for a fundamental change in the design of environments for people with dementia:

> "We need creative minds and interdisciplinary cooperation, including architecture, elderly care medicine, facility management, interior design, nursing and real estate, to rethink current building designs to prevent both infection and solitude."

2.5.5. Universal Design across key spatial scales

A Universal Design approach also considers the built environment across all key spatial scales as highlighted by Booklet 9 'Planning and Policy', of the 'Building for Everyone' series (CEUD, 2014b). This document argues for the inclusion of Universal Design at every level of planning.

> "Universal Design is not just about access to individual buildings; it is about how easily people can get around and to where they want to go. Key factors in creating an accessible environment are the location of services and of good transport links. Safe routes between key places that are designed to be easy to use by all individuals are another essential feature" (p. 27).

'Building for Everyone' introduces the idea of a 'Travel Chain Analysis' to ensure that a person's journey from one destination to another is fully considered to eliminate barriers along the way that may hinder a person from reaching their destination in a safe and comfortable manner.

This holistic approach to spatial scales is picked up again in CEUD's '**Universal Design Guidelines for Homes in Ireland'** where they introduce the following four principles:

1) Integrated into the neighbourhood

2) Easy to approach, enter and move about in

3) Easy to understand, use and manage

4) Flexible, cost-effective, safe, and adaptable over time.

While these principles apply to private dwellings as opposed to residential settings, they are highly relevant for RLTC, where there is a growing acknowledgement that these settings should be first and foremost a 'home' rather than an institution. Reflecting the needs of RLTC, these principles can be adapted as follows:

- **Integrated into the neighbourhood –** highlights the relationship with the community and ensures the setting is close to local services and public transport and is well integrated into the community.
- **Easy to approach, enter and move about in** – provides accessible and comfortable routes when approaching the setting from the community, when entering and moving around on the site, and when entering and exiting the building including internal circulation within the setting (i.e., doors, corridors, stairs, lifts, and other circulation routes and issues).

- **Easy to understand, use and manage –** covers a wide spectrum of considerations across various scales; from the wider issues around circulation and wayfinding, to more specific issues such as the use of furniture and fittings, to signage and technology.
- **Flexible, cost effective, safe, and adaptable over time –** ensures a setting is flexible and adaptable in use on a daily basis. However, it also means that a setting should be economically sustainable and that the building should be flexible and adaptable to cater for changing health, social, and environmental circumstances, if required.

2.6. Residential care settings for older people in Ireland: Key policy context

2.6.1. National Quality Standards for Residential Care Settings for Older People in Ireland'

The Health Information and Quality Authority (HIQA) is responsible for inspecting residential centres for older people to ensure conformance with the 'National Quality Standards for Residential Care Settings for Older People in Ireland' (HIQA, 2016). These HIQA standards comprise eight themes and 35 standards that cover issues ranging from health and quality of life, to staffing, and governance and management. Across a number of these themes there are standards related to the built environment and how design can support quality of life.

See https://www.hiqa.ie/reports-and-publications/standard/national-standards-residential-care-settings-older-people-ireland

2.6.2. The Health Act 2007 (Care and Welfare of Residents in Designated Centres for Older People)

Health Act, 2007 (Care and Welfare of Residents in Designated Centres for Older People) (Amendment) Regulations 2016 specific certain design requirements for residential settings for older people. For instance, from January 2022, the regulations require bedrooms to have a minimum floor area of 7.4m2 per resident (including bed, chair, and personal storage space). The regulations state that if rooms are shared, they should not have more than 4 residents, other than in high-dependency rooms which will not have more than 6 residents, in that room. The regulations also provide requirements for sitting and recreational space.

See https://www.irishstatutebook.ie/eli/2016/si/293/made/en/print

2.6.3. Health Information and Quality Authority: Guidance on Dementia Care for Designated Centres

The 2017 HIQA 'Guidance on Dementia Care for Designated Centres for Older People' highlights the importance of the physical environment for people with dementia. In terms of dementia specific units, this guidance promotes "small size, in terms of the numbers of people accommodated", a "familiar building style, that is, domestic and home like" and "single rooms - big enough for a reasonable amount of personal belongings".

See https://www.hiqa.ie/sites/default/files/2017-01/Dementia_Care-Guidance.pdf

2.6.4. Health Services Executive (HSE) 'Design Brief: 10 Bed Dementia Specific Household - Residential Care Centre'

The 2016 Health Services Executive (HSE) 'Design Brief: 10 Bed Dementia Specific Household - Residential Care Centre' provides design criteria for dementia specific units as part of an RLTC setting. The brief states that the "10 bed dementia specific household core areas with single bedroom en-suites will have their own sitting/ sunroom area, dining room and kitchenette at the centre or 'heart' of the home."

The brief is based on the 'Teaghlach', or 'household' model as described in Appendix 3 (p. 109 – 121) of this brief, which contains a document called 'Person Centred Care in Residential Services for Older People. Appendix 3 sets out a vision for a small scale and resident centred living model where overall settings are divided into individual households that can cater to all residents, not only people living with dementia.

(Please note that the link below provides access to documents from 2016 and that the HSE should be consulted for current information).

See https://www.lenus.ie/hse/bitstream/10147/621465/1/Dementia+Specific+Household+Brief+Final+April+2016comp.pdf

The Housing Options for our Ageing Population provides a policy framework to support Ireland's ageing population in a way that will increase the accommodation options available and give meaningful choice in how and where people choose to live as they age. It identifies a programme of 40 strategic actions to further progress housing options for older people including Action 4.12, which focuses on the issuing of planning guidelines for the development of residential care homes and primary care centres to ensure that they are appropriately designed and located in areas with access to transport and amenities.

See https://www.gov.ie/en/publication/ea33c1-housing-options-for-our-ageing-population-policy-statement/

2.7. 'COVID-19 Nursing Homes Expert Panel Examination of Measures to 2021'

2.7.1. Introduction

Following a recommendation from the National Public Health Emergency Team (NPHET) in 2020, an Expert Panel on Nursing Homes was established to examine the complex issues surrounding the management of COVID-19 in nursing homes. This resulting 'COVID-19 Nursing Homes Expert Panel Examination of Measures to 2021' set out a variety of recommendations ranging from Nursing Home Procedures, and Communication Across the Healthcare System, to Oversight and Guidance, and End of Life Care (COVID-19 Nursing Homes Expert Panel, 2020).

2.7.2. Recommendations related to built environment issues

The role of the built environment in relation to COVID-19 infection spread and control was identified within the panel's report, and it was noted that several stakeholders argued for a move away from large facilities to households with lower numbers of residents. These stakeholders pointed to progress in other services, such as specialist services for people with intellectual disabilities and people with enduring mental health issues, where people have been moved out of congregated settings and into community integrated settings. The panel state that:

> "Smaller household models of residential care permit changes in infrastructure from the traditional institutional model to an environment that more resembles a family home (accommodating – 12 people). Construction of facilities like this are national policy and this model has become the norm in some European countries for 10 or many years".

In this context, several built environment related recommendations were included such as: internal circulation and spatial zoning (recomm.2.10); isolation and cohorting (i.e., grouping people together who are affected by similar medical conditions) facilities (recomm.3.5); social distancing facilities (recomm.3.7); infrastructural adaptations for visitors (recomm.12.2); ICT for patient/family communication (recomm.13.3). See the COVID-19 Nursing Homes Expert Panel Examination of Measures to 2021' or more information on recommendations.

In terms of overall models, recommendation 15.8 states that:

> "Incentives, including financial, must be explored to help provide a wider range of service and ownership models for both care in the home and in smaller congregated units/settings. This would acknowledge and reflect most people's preferred wishes."

2.8. Covid-19 and overall infection control issues

2.8.1. Covid-19 transmission routes

According to the US Centre for Disease Control (CDC, 2020) respiratory viruses are mainly transmitted through contact, droplets, and airborne routes. Infection control strategies must take account of all transmission routes, however, there is growing evidence that contact transmission of COVID-19 is generally lower risk (CDC, 2021) and that the principal modes of transmission involve respiratory droplets and airborne transmission. In fact, some experts argue that airborne transmission may be dominant. For instance, according to a recent Lancet article by Greenhalgh et al. (2021)

> "There is consistent, strong evidence that SARS-CoV-2 spreads by airborne transmission. Although other routes can contribute, we believe that the **airborne route is likely to be dominant.** The public health community should act accordingly and without further delay."

Further detail about the three main transmission routes is outlined by the CDC (2020:

- **Droplet transmission**: infection through exposure to virus-containing respiratory droplets (i.e., larger, and smaller droplets and particles) exhaled by an infectious person. Transmission is most likely to occur when someone is close to the infectious person, approximately within 2 metres - this is now considered high risk.
- **Airborne transmission**: infection through exposure to tiny airborne liquid particles known as 'aerosols' that contain the virus. These aerosols can remain suspended in the air over long distances (usually more than 2 metres) and over a longer time (typically hours), therefore, airborne transmission is now also considered high risk (see Greenhalgh et al. 2021 above).
- **Contact transmission**: infection through direct contact with an infectious person (e.g., transmission through a handshake) or with a contaminated object or surface (also referred to as 'fomite' transmission) – this is now considered lower risk.

The CDC points out that these modes of transmission are not mutually exclusive, and that infection can happen through a combination of the above routes.

However, given the principal modes of transmission are through respiratory droplets and airborne transmission, the WHO has issued a Roadmap to improve and ensure good indoor ventilation in the context of COVID-19 (WHO, 2021) stating that:

> "Understanding and controlling building ventilation can improve the quality of the air we breathe and reduce the risk of indoor health concerns including prevent the virus (sic) that causes COVID-19 from spreading indoors."

2.8.2. Covid-19 and infection control in long term settings: HSE recommendations (Jan 2021) related to the built environment

The HSE Health Protection Surveillance Centre (HPSC) outlines the following three key elements to prevent and control the risk of infection of COVID-19 in RLTC:

1. "Take all practical measures to reduce or prevent any introduction of virus into the residential care facility. If the virus is not introduced by a person with infection, then it cannot spread."
2. "Even when all practical precautions are taken, the virus can still be introduced at any time, so, you need to have all practical measures in place to reduce the risk of spread of the virus if that happens."
3. "Have processes in place to minimise the risk of harm to residents and staff if both other elements fail and the infection has been introduced and spreads."

In terms of prevention and control measures related to the operation and use of the built environment, the guidance document "COVID-19 - Interim Public Health, Infection Prevention & Control Guidelines on the Prevention and Management of COVID-19 Cases and Outbreaks in Residential Care Facilities (V6.4 19.04.2021)" (Health Protection Surveillance Centre, 2021) includes a range of recommendations including:

- **Section 4 General measures to prevent a COVID-19 outbreak during the pandemic:** includes sections on Planning; Social activity; Physical distancing measures & Pods; Group Activities; Staff occupational health & workforce planning**;** Visitors, Pastoral Support, and other Essential/Important Service Providers; and Resident transfers.
- **Section 5.3 'Management of a possible or confirmed case of COVID-19':** Guidance on single rooms with transmission-based precautions and appropriate use of PPE; movement of these residents within settings including going outside, and communication with family via phone or video calls and where possible window visits.
- **Section 5.4 'Cohorting residents with possible or confirmed COVID-19:** Placement of residents with COVID-19 in designated zones; cohorting residents in single rooms close together, or in multi-occupancy areas within the building or section of a ward/unit; minimising unnecessary movement of staff in cohort areas; improving ventilation in the cohort area in so far as practical, consistent with comfort and safety.
- **Section 5.5 Management of close contacts of a possible or confirmed case of COVID-19:** Residents who are close contacts of a confirmed case accommodated in a single room with their own bathing and toilet facilities; cohorting in small groups (two to four); movement of these residents within settings including going outside; and the creation of a 'safe zone' to allow residents to walk around in a safe space (particularly important for a person with dementia).
- **Section 5.6 Infection prevention and control measures:** Provision of 'Hand hygiene' facilities, bedside waste bags for immobile residents for disposal of tissues; defined clean and contaminated zones for the donning and doffing of PPE; staff

refreshment areas provided; corridors between units as designated clean zones; and placement of clinical stations in clean zones.

- **Section 5.7 Duration of transmission-based precautions: contains guidance around**: Care Equipment; Management of waste; safe management of linen (laundry); Environmental hygiene; terminal cleaning (when a resident with COVID-19 permanently leaves a room).
- **Section 5.8 Support services for staff and residents:** Reinforces the idea that good communication is essential for residents, family, and staff members.

  Appendix H Admissions, transfers, and discharges to and from residential care facilities: Outlines the need for areas where new residents can safely restrict their movement; the prioritisation of single rooms for new transfers and admissions from community or other healthcare facilities; and the zoning of longer-term nursing home and short-term respite or convalescence residents in different areas.

  This appendix also states that space for the 14-day period of restricted movement needs to be managed carefully with residents, families, and others. Existing residents should not be required to move from their room/accommodation in order to facilitate the creation of new areas to facilitate transfers.

2.8.3. COVID-19: primary and secondary impacts

According to UNICEF (2021), Covid-19 has both primary and secondary impacts stating that:

> "Primary impacts of an outbreak are defined as the direct and immediate consequences of the epidemic on human health. Secondary impacts are defined as those caused by the epidemic indirectly, either through the effect of fear on the population or as a consequence of the measures taken to contain and control it."

In terms of secondary impacts, the infection prevention and control measures outlined in Section 2.8.2 above, involve restricted visitor access, resident quarantine, constrained social interaction, and the limitation of shared activities. According to a study by McCarron et al. (2021), these secondary impacts negatively affect mental health and well-being, with those in residential care more likely to report missing family as a source of stress. The study also highlights how the "prolonged restrictions had a major impact on the mental health and wellbeing of older adults with an intellectual disability, with increased levels of anxiety and loneliness."

Section 2.5.2 has already outlined some of the main issues that affect people with dementia in RLTC. Secondary impacts such as isolation, stress due to lack of family contact or a breakdown in routine have serious consequences for a person with dementia. Furthermore, for nursing home residents with a cognitive impairment or a person that walks with purpose, formerly termed "wandering", infection control measures that involve isolation or restricted movement have been very difficult and present additional complications (Fallon et al., 2020).

2.9. Key built environment considerations related to COVID-19 and infection control in existing settings

The previous sections briefly describe key quality of life issues, outline the role of Universal Design in RLTC (including designing for dementia), and set out overall infection control issues (including primary and secondary impacts). This section briefly outlines some of the main findings emerging from the rapid review.

Due to the scope of the rapid review, our search was limited to COVID-19, RLTC settings, and had a 2020 date restriction. For some topics where there are currently no available studies specific to RLTC, for instance in COVID-19 infection control and passenger lifts, we have selected studies from related healthcare environments, such as acute hospitals, to fill this gap.

As mentioned in Section 2.3, this current section does not include detailed findings, but instead provides a snapshot of the issues that emerged from the rapid review as a way of introducing the themes and topics that underpin Chapter 4 and the overall key research findings.

The main themes and topics that emerged included:

- **Overarching design characteristics, features, or approaches:** the possible challenges associated with larger settings in terms of infection control and the potential benefits of smaller clustered settings both in terms of infection control and quality of life.
- **Site Location:** Some research linking increased infection risk to areas with higher population density, while other research found that over-crowding is the main factor, rather than population density.
- **Site design:** Very limited research around site design with one Chinese study describing COVID-19 design guidelines issued by the State Council of China that provide guidance around site layout, loading zones, parking, adequate and safe provision of outdoor amenity and activity areas.
- **Overall building layout and circulation (Entering and moving about):** Research regarding single and multiple access points, and the role of smaller settings that result in less thorough traffic.
- **Overall layout:** Research recommending the division of the setting into separate operating areas, controlled movement between areas to reduce infection spread, and the creation of dedicated 'clean' environmental zones (e.g., residential rooms), semi-clean (e.g., facility clinic), and contaminated.
- **Circulation:** Recommendations regarding predetermined routes for patient/resident transfers within the setting, and more spacious circulation areas.
- **Vertical circulation: lifts:** No research found on RLTC settings, instead one study related to hospital settings recommending improved ventilation.

- **Key Internal and external spaces** Research ranging from the benefit of single rooms and private bathrooms, the use of screens in communal areas to the provision of adequate outdoor space for social interaction and visitors.
- **Overall Building elements and components** (finishes, furniture, fittings etc.): Very little research that examined fittings, furniture or finishes in relation to COVID-19 in RLTC. Notably one study that showed how copper surfaces had no protective effect in preventing the transmission of COVID-19.
- **Internal environment:** With a diminished importance of contact transmission and a greater focus on airborne risks, ventilation has become a vital issue and there are a number of studies promoting an increase in indoor air ventilation rates, the use of high-efficiency filtration for recirculated air (MERV 13 or greater), and the management of air flow direction and speed to prevent spread of aerosols. Humidity and air temperature are also emerging as important considerations.
- **Technology:** Information and communications technology (ICT) has been promoted as a way to mitigate at least some of the negative impacts of isolation and quarantine. Other research points to the potential for augmented reality (AR) and virtual reality (VR) to provide immersive experiences. The expansion of telehealth and telemedicine services to nursing homes is also mentioned as a way to reach isolated residents and improve care in the longer term.

  These issues and other topics that emerged from the rapid review regarding the built environment and to a lesser extent, technology, are discussed in greater detail in Chapter 4.

3. Stakeholder Engagement

3.1. Introduction

The design and implementation of the stakeholder engagement strategy undertaken during this project places the needs and preferences of older people living in long term residential care at the centre of engagement. Through its various elements, listed and outlined below, this strategy also captures key aspects of how RLTC settings can provide better support for family members, visitors, and staff. In addition, the strategy adopts a Universal Design approach such that the research outputs are co-created with key stakeholders, are people-centred, and address the diverse needs of all users regardless of their age, size, ability, or disability.

The engagement strategy is composed of:

1) A mapping exercise to identify key stakeholders
2) A series of engagement activities including input into rapid review, case study questionnaires, semi-structured expert interviews, case study analysis, and a stakeholder workshop
3) A series of dissemination and project communication activities (including steering committee meetings) to share progress on and gather feedback on research findings/outputs.

The remaining sections in this chapter will provide outline information on the outcomes of the stakeholder engagement strategy elements. Specifically, this part of the report will report on key findings and feedback from:

- Steering Committee
- Case Studies (Questionnaires – Residents, Family, and Staff)
- Semi-structured interviews with selected experts
- Stakeholder workshop

3.2. Steering committee feedback

Over the course of the project, there were 3 steering committee meetings. During the first meeting, members were provided with an overview of the research project, in the context of the overall research programme (Resident Long-term Care: Built Environment, Quality of Life and Infection Control from a Universal Design Approach). In the following two meetings, the research team sought guidance in relation to quality-of-life domains, the rapid review, the selection of case studies, and the convergence/divergence between quality of life and infection control. Key issues and themes that emerged from these meetings included:

- **Quality of life in general**: Concern among the steering committee that the predominant nursing home models in Ireland can undermine the quality of life of many older people in these settings.
- **Quality of life and COVID-19**: The steering committee felt that COVID-19 has undermined quality of life, and while we need to carefully consider infection control, it cannot take precedence over quality of life.
- **Quality-of-life issues developed in project**: Broad support for the quality-of-life issues that were circulated to the committee and the positive feedback and suggestions were used to create the suite previously described in Figure 2.
- **Increased comorbidities and frailty, reduced life expectancy/length of stay**: Compared to previous decades, many people are entering nursing homes at a more advanced age and therefore may be experiencing greater levels of comorbidities, frailty, and cognitive impairment, also reducing the average length of stay/time to death to less than two years. This has an impact on the design of the setting, the kinds of activity possible, and the level of engagement with the wider community.
- **Personal movement, autonomy, and dignity:** Concern that infection control has limited personal movement, and undermined dignity and autonomy. Furthermore, concerns that many settings are designed with security/control in mind rather than quality-of-life.
- **Importance and challenges around ventilation**: Good ventilation is often a problem in many buildings, but COVID-19 has highlighted the importance of ventilation in terms of removing or diluting virus laden air from internal and external spaces. However, ventilation and the balancing of air quality and comfort can be difficult in settings with older people, due to their common avoidance of drafts/cold air and their possible frailty.
- **Benefits of technology:** Information and communications technology (ICT) to support communication and engagement, telehealth, and other forms of technology have been essential during COVID-19 and need to be carefully considered in the research.

3.3. Case study-settings: Resident, Staff, and Family engagement

3.3.1. Introduction

As part of the stakeholder engagement process, three nursing homes were identified as case studies to engage directly with residents, family members and staff, and to get an insight into the physical environment and operation of a small sample of nursing homes in Ireland. These settings include TLC City West, City West, Dublin; Millbrook Manor Nursing Home, Saggart, Dublin; and Sally Park Nursing Home, Firhouse, Dublin. These settings were chosen for the following reasons:

1. Members of the research team from Tallaght University Hospital were familiar with them and could facilitate engagement.
2. They represented a mix of small, medium, and large settings; new-build and existing or repurposed buildings; and represented rural and suburban settings.

3.3.2. Settings outline

These settings are largely based on a conventional or traditional model of care rather than any specific model such as a 'household[2]' model or similar. Unlike a 'household model', which breaks the setting into smaller clusters, each gathered around a dedicated living area, traditional or conventional models tend to have less differentiation between areas and usually provide one or two larger living areas for all residents.

Some key information about these settings is presented below.

[2] The 'household' approach groups residents into smaller clusters (typically less than 12 people) of single bedrooms gathered around dedicated common areas. These households often have an independent 'front door' direct access to a garden and are designed to create a homelike setting.

TLC City West

HIQA Centre ID: 692

Address: Cooldown Commons, Fortunestown Lane, City West, D24.

Maximum occupancy: 139

01: TLC City West

Key Information

- Location: Suburban
- Size: Large (139 resident spaces)
- Height/stories: 4
- Ownership: Private (part of larger chain)
- Type: New build based on conventional model
- Co-located: No

Millbrook Manor Nursing Home

HIQA Centre ID: 763

Address: Slade Road, Coolmine, Saggart, D24.

Maximum occupancy: 63

02: Millbrook Manor

Key Information

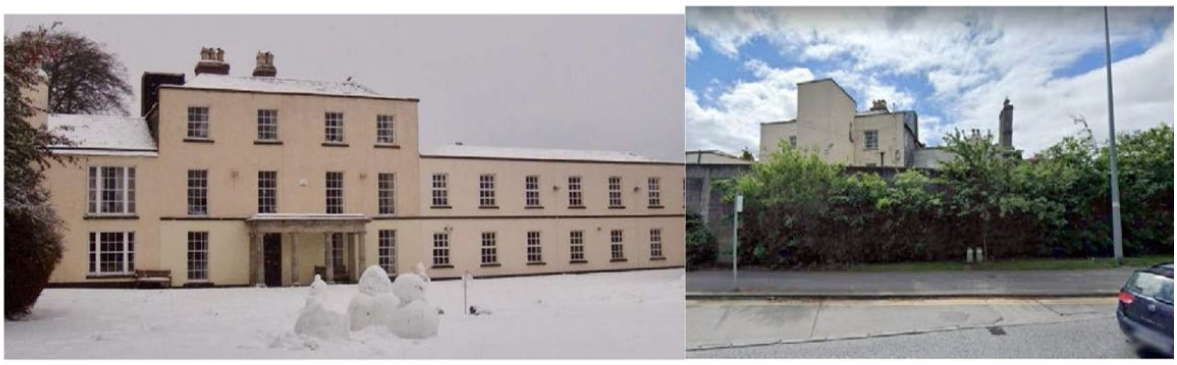
- Location: Rural
- Size: Medium (63 resident spaces)
- Height/stories: 2
- Ownership: Private
- Type: New build, based on traditional model
- Co-located: no

Sally Park Nursing Home

HIQA Centre ID: 5565

Address: Sally Park Close, Firhouse, D24.

Maximum occupancy: 43



03: *Sally Park*

Key Information

- Location: Suburban
- Size: Small to medium (43 resident spaces)
- Height/Stories: 3
- Ownership: Private
- Type: Existing country house with new build extensions based on traditional model
- Co-located: No

3.3.3. Questionnaires and key findings

The key findings from the questionnaires gather and reflect responses from all three case studies.

Quality of Life: Regarding Quality of Life, residents, family/visitors, and staff all stressed the importance of daily/weekly activities and events on resident's quality of life. Mentioned activities included: visits from families, physiotherapy, live music, bingo, and quizzes. Respondents noted that a lot of activities, especially live music, ceased due to COVID-19 restrictions. Additionally, staff and family/visitors noted that restrictions on family visits and residents being isolated in their rooms or during mealtimes negatively impact resident's quality-of-life during the pandemic. Family/visitors and staff reported that a high quality of care, access to outdoor spaces and private visiting rooms were aspects of the setting that positively impacted resident's quality of life.

Universal Design: accessibility, ease of understanding and usability for all users. Both Family/Visitors and Staff overwhelmingly agreed that "It is easy for [all] to move around and access all parts of the setting". Residents, Family/Visitors and Staff all strongly agreed that "things like the building layout, lighting or signage make the setting easy to understand and navigate" and "It is easy to find and use the things I need in the setting".

Impacts of COVID-19 and Infection Control in General: The questionnaire also examined how COVID-19 and the subsequent infection control measures impacted on residents, family/visitors, and staff. More than half of residents surveyed began their residencies during COVID-19 and were not able to report on their experience of the setting prior to COVID-19. Residents felt that their bedrooms, communal spaces such as dayrooms, and window visits with family had a positive impact on their experience of COVID-19.
Family/Visitors stressed the positive impact of access to green space and family visits on their loved one's experience of COVID-19.

I. Location (Including access to and from the setting)

All respondents felt that the setting locations made it easy to visit, as well as for residents to visit their friends, family, and local community.

2. Site Design (entry, layout, footpaths, external spaces, car parking)

Respondents felt that the settings were generally easy to move around and access different areas. Family/Visitors of one setting noted that their setting had plenty of parking and that the only external walking path ran past the bedroom windows, impacting the privacy of residents in these rooms.

3. Entering and Moving about inside: Circulation areas, including main entrance etc.

All respondents agreed that entering and moving about inside the setting was not difficult, for the most part, with the main door being easy to find and operate, there being a welcoming reception area and clear directions and signs for the various rooms/parts of the setting (Sallypark and Millbrook Manor). Regarding circulation strategies in Millbrook Manor in relation to COVID-19, respondents noted that residents having their own rooms had a positive impact, and that the layout of the nursing home allowed for a one-way system if necessary.

4. Key Internal and External spaces

During COVID-19, both the dayrooms and dining rooms of the settings had limited capacity to allow for social distancing. In Millbrook Manor: "Distancing from another person was difficult to accept" for residents, as some of them missed out on interaction with others and daily/weekly activities: "staff implemented rotation systems to combat this". The dayroom was also used as a secondary dining space, as an alternative to residents dining alone in their rooms. Regarding outdoor space, respondents noted a lack of an outdoor covered space, which would allow residents to get fresh air on days when the weather isn't good. In Millbrook manor, during warmer months, the outdoor space had views of green fields and was used more. Respondents from Sallypark commented on the importance of the "nice view of green space from the reception area, living rooms and bedrooms at front of building" and a view of a "floral courtyard with furniture" from bedrooms at the rear.

5. Elements and Systems: finishes, fixtures and fittings, internal environment, technology

Both residents and family/visitors reported having difficulty using certain fittings/fixtures within the setting, such as residents having difficulty with soap dispensers and family/visitors noting that on the main floors all doors are double doors which are difficult for wheelchairs users and have no electric opening.

Regarding the internal environment (heating, ventilation, light, sound, etc.) family/visitors reported that sound between resident rooms is often an issue, especially at evening times. On the topic of technology, family/visitors reported that their loved one's reliance on their bell/communication device with staff and spotty mobile network coverage led to frustration. During COVID restrictions, activity coordinators organised a tablet for video calls with families, which was helpful when visiting wasn't possible.

Discussion and conclusion

In conclusion, preliminary findings from the first group of case studies note the impact COVID-19 related infection control measures have had on the quality of life of residents. Isolation from family, and from other residents due to social distancing, as well as confusion or difficulty with PPE have unduly affected members of this vulnerable group. However, high quality of care and a commitment to maintaining as much normalcy for residents as possible, have been important aspects of nursing home responses to residents' needs.

3.4. Expert Interviews

As part of the stakeholder engagement process, the research team conducted 18 interviews with key experts in various fields related to residential long-term care for older people. The interviews were conducted online through the video conferencing platform, Zoom. A semi-structured interview template was created to guide interviews and shared with participants in advance of the meetings (appendix B). Where necessary due to scheduling conflicts, a handful of interviewees also opted to fill in the interview template, instead of participating in the online interview. The interviews were transcribed by a research team member for later analysis. Transcribed interviews were then compiled into short concise statements or codes. These codes were combined to generate themes and grouped according to the spatial framework (Fig. 1). All interviews were anonymous, however the represented organisations included were:

- Centre for Excellence in Universal Design at the National Disability Authority
- Health Services Executive – Capital and Estates
- Irish Association of Directors of Nursing and Midwifery (IADNAM)
- Sage Advocacy
- Nursing Homes Ireland
- TLC Nursing Homes
- Age Friendly Ireland
- Age Action Ireland
- Tallaght University Hospital
- All Ireland Gerontological Nurses Association (AIGNA)
- HIQA (4 representatives)
- Care Champions
- Infection Control and Ventilation advocate
- Department of Health

Experts were identified mainly through participating stakeholders and steering committee members. Many essential organisations in the area were represented on the steering committee and were asked to participate, as well as suggest other possible interviewees based on their knowledge of the research area. Additionally, members of the research team contacted representatives from relevant organisations that had been in communication with the research team in advance of the interview commencement, for other aspects of the project.

Findings from the interviews are integrated into Chapter 4, and inform the overall recommendations presented therein.

3.5. Stakeholder Workshop

An online (Zoom) stakeholder workshop was held on June 2, 2021, to share research findings to date, including an overview of the three case studies, and preliminary results from the questionnaires. In addition, the stakeholder workshop provided an opportunity to develop and deliver a practical exercise to capture participants' lived experience of home.

Participants at the workshop included: Steering Committee members (CEUD, AFI, HSE), research team members (TCD and TUH), as well as staff and residents from two of the case studies (Millbrook Manor and TLC).

The practical exercise involved the writing of individual memory texts, based on a photograph or object that held significance for participants in relation to the question – 'what does home mean to us?'. During the session the participants presented and spoke about a variety of images or objects including old and current family photos, photos of their house or garden, photos or personal belongings that conjured memories of home, or images of objects such as teacups or tea bags that represented the everyday important rituals of home.

Some of the main themes that emerged included:

- Connections to people, family, friends, and the different things that happened there - birthdays, the Christmases, especially when you were young.
- The importance of personal and familiar objects to create a sense of home through memory, meaning, and ritual.
- The role of smell such as home cooking, or the scent from a garden, or fruit.
- The importance of music, especially when it connects you to memories or loved ones.
- Home as a place for activities such as learning to knit or to play music.
- Playing with friends
- The importance of being outside and having access to gardens, especially those that were carefully planted, tended to, and loved by members of the family.
- Home being a place that nurtures and protects us but also provides us with the right level of support we need at different stages of our lives to experience life and meet a lot of different people. Home allows you the space and time to connect with other people, and also to start to know yourself through relationships.

While this was only one short workshop with a limited number of participants, it starts to show us how the meaning of home aligned with many of the quality-of-life issues set out in Figure 2 for instance: Safety & security, self-realisation & personal growth; pleasure & enjoyment; social engagement and relationships; meaningful activities; sense of home & sense of place; and contact with nature. The research findings in Chapter 4 draw on the outputs from the memory exercise to ensure that the lived experience and voices and perspectives of users are reflected in a meaningful way.

4. Built environment supporting quality of life and infection control: Key findings

This chapter brings together the broad set of overall Quality of Life issues developed in Section 2.4 and the infection control measures identified in Section 2.8 and 2.9. It selects relevant Universal Design considerations as discussed in Section 2.5, in particular any relevant aspects from the Universal Design Guidelines for Homes in Ireland (Universal Design Homes). It also incorporates the main findings from the stakeholder engagement in Chapter 3.

As previously discussed, the design of RLTC is impacted by many aspects of the physical environment across **all parts of a setting** and therefore it is important to take a holistic and integrated approach **across all spatial scales**, from the location, access, and overall site and building layout, down to building components or specific applications of technology. In this regard, the following themes are discussed in this chapter:

- Overarching design characteristics, features, or approaches
- Site Location, inclusion, access, interaction with community, and health
- Site design providing a connected, welcoming, accessible, and pleasant setting with good contact with nature
- Overall building layout and circulation (Entering and moving about and key internal spaces)
- Building elements and components (finishes, furniture, fittings etc.)
- Internal environment
- Assistive technology, therapeutic technology, and ICT

All these issues apply to the **overall setting** (if it is planned, operated, and perceived as one building) or to a **specific unit or standalone part of a setting** (if the overall setting is divided up into a number of distinct sections or buildings as the unit in question is designed to be operated and perceived as an independent entity).

In order to develop a balanced approach to Quality of Life and infection control, the following themes in this chapter examine firstly, the main quality of life issues at each spatial scale, and then identify any priority infection control issue at each one of these scales. Furthermore, each section or subsection is provided with 'Key recommendations to inform design guidelines'. These offer concise, high-level and priority recommendations to underpin the follow-on Universal Design guidelines.

4.1. Quality of life

Based on the Quality-of-Life domains set out in Figure 2., the research identified a range of distinct **physical environment design issues** including built environment features, characteristics, interventions, or approaches that may impact or improve Quality of Life outcomes.

1. These design issues are based on the premise that RLTC settings are first and foremost a person's home, the place where they live, and that these settings should therefore adhere to many general residential design requirements such as appropriate location, a supportive local public realm, good community integration and interface, and other overall site and building design requirements. Where these general requirements are at odds with Quality of Life for RLTC, this will be highlighted.
2. These design issues are taken from a range of sources, predominantly related to RLTC settings. However, due to the evolution of design thinking and the overlap between design for RLTC, private dwellings, and general healthcare settings, some of the research and sources come from these sectors.
3. These sources are drawn from a mixture of peer-reviewed research articles, best practice design guidance, or material from established older person representative organisations.
4. In addition, some of the material underpinning these design issues relate to people with dementia, however, given that almost two-thirds of RLTC residents may be living with dementia (Cahill et al., 2015), a dementia-inclusive design from a Universal Design approach is highly relevant.
5. Given the diversity of occupants within RLTC, from residents with varying health status and abilities, to a diversity of staff, and visitors, the physical environment of RLTC settings requires a Universal Design approach to ensure it caters to people of all ages, sizes, abilities, and disabilities. In this context, many of the design issues draw on Universal Design (which includes design for all, inclusive design, and other similar design approaches)

4.2. Infection control

Based on Section 2.9 'Key built environment considerations related to COVID-19 and infection control in existing settings', high priority infection control issues are highlighted at each spatial scale, as set out below. These infection control issues are informed by stakeholder feedback where relevant.

4.3. Key Spatial Scales: Bringing together Quality of Life and Infection Control

Below are the identified key Quality of Life (Section 2.4) issues and Infection Control considerations (Section 2.8 and 2.9), and the key recommendations to inform design guidelines for each spatial scale.

4.3.1. Overarching design characteristics, features, or approaches

a) **Appropriate/reduced number of residents, and human scale of setting** (in broad terms)

Key design considerations for quality of life

Rapid review findings: Smaller scale settings may be less institutional, more home-like in size, and are easier to relate to and more comfortable in terms of scale (Fleming and Bennett, 2017, Fleming and Bennett, 2014, Judd et al., 1998, Cohen and Weisman, 1991). See below for a further discussion of size and scale in terms of a whole facility care model.

Universal Design issues: The Universal Design Homes principles 'Easy to approach, enter and move about in' and 'Easy to understand, use and manage' may be easier to achieve in smaller settings, or at least in settings that are broken down into smaller more legible and accessible units.

Stakeholder feedback: Many of the interviewees were concerned that new settings are increasing in size and capacity and as a result may be more institutional and clinical. Conversely, they felt that smaller settings had a better opportunity for community integration and achieving a more home-like setting.

From the questionnaires, some family members felt that in larger settings staff have less connection with residents, others stated that smaller homes have less activities. One family member thought that a setting with approximately 60 residents was the ideal size for staff to get to know residents.

Interviewees also pointed out that larger settings may also result in multi-storey buildings where direct access to outdoor space or independent mobility (beyond any one floor) may be difficult to achieve for residents living on upper floors.

High priority infection control issues

Rapid Review Findings: Research by Abrams et al. looking at the Characteristics of U.S. Nursing Homes with COVID-19 Cases, found that larger size settings (>150 beds) were more prone to COVID-19 infection (Abrams et al., 2020). In terms of crowding Brown et al. (2021) used the 'nursing home crowding index' defined as the "mean number of occupants per room and bathroom across an entire home" to conduct a study looking at the relationship between COVID-19 related mortality and crowding within nursing homes in Ontario, Canada. In terms of this index, a single-occupancy room with a private bathroom has a value of 1; a single-occupancy room with a shared bathroom is 1.5; a double-occupancy room (with shared bathroom) is 2; and a quadruple-occupancy room is 4. Settings with values of 2 or greater were defined as a high crowding index, while homes less than 2 are defined as low crowding. The research shows that COVID-19 mortality in homes with low crowding was less than half than that of homes with high crowding. See b) below for a further discussion of size and scale in terms of a whole facility care model.

Stakeholder feedback: Some interviewees were concerned that larger settings presented more challenges not just around quality of life, but also in terms of infection control due to a higher resident population, greater traffic, larger common areas with a higher number of occupants, and challenges around accessing multiple floors using lifts.

Concern was also expressed that larger settings, particularly those that are made up of multi-storey buildings present a greater risk for increased isolation for residents during COVID-19. For instance, for residents on upper floors, window visits or socialising in gardens or other outdoor areas is very difficult to achieve. Similarly, room visits by family members to residents on upper floors was deemed more difficult in multi-storey buildings as visitors typically had to enter the main building and use stairs or lifts.

Key recommendations to inform design guidelines – Human-scale of Setting

Smaller scale settings, or settings carefully broken down into smaller distinct units may provide less institutional and more home-like environments. This may also support Universal Design by providing more accessible, legible, and manageable settings. For existing settings this may involve breaking up or subdividing the overall setting into smaller units or 'households'. Depending on the layout or build structure, this may or may not involve structural changes or the construction of new walls or installation of new doors.

b) **Resident-centred whole-facility care model**

Key design considerations for quality of life

Rapid review findings: The 'Green House' and other small nursing home (NH) models are considered 'non-traditional' due to their size (10 to 12 beds), home-like features, and 'universal caregivers'. In the 'Green House' model nursing assistants are assigned to the one small setting and have extra duties such as personal care, meal preparation and service, housekeeping, laundry, and other activities. This allows the staff and residents to get to know each other well and also reduces the movement of staff in and out of the setting.

Smaller scale, home-like, or household models have been linked to better resident satisfaction and improved quality of life (Cohen et al., 2016, Verbeek et al., 2009). A study by Afendulis et al. (2016) compared 15 nursing homes that adopted the Green House model to 223 traditional nursing homes. The results showed improvement in rehospitalisations and certain nursing home quality measures, including decline in bedfast and catheterized residents, and low risk residents with pressure ulcers.

Universal Design issues: See 4.3.1 (a) above for outline of UD Homes principles 'Easy to approach, enter and move about in' and 'Easy to understand, use and manage' which align with smaller scale, home-like, or household models. Dementia-friendly considerations such as familiar design or personalisation of the environment to enhance continuity of self, also suggests that home-like household models will also support universal design.

Stakeholder feedback: In line with feedback relating to overall size, many interviewees argued that smaller, home-like, household models benefit quality of life.

04: Willow and Meadow View, St Joseph's Centre, Clonsilla, Dublin 15: Household model providing homely dining and kitchen area for residents

High Priority infection control issues

Literature: Non-traditional models that employ small scale units and household models have attracted much interest regarding their potential benefit in limiting COVID-19 infections. In the US, Zimmerman et al. (2021) completed research that looked at rates of COVID-19 infections and mortality in 219 Green House/small scale settings and compared this to 177 traditional nursing homes with less than 50 beds, and 215 traditional nursing homes with 50 or more beds. The research found that rates for all outcomes were significantly lower in the Green House/small scale settings. For instance, the median rate of COVID-19 cases per 1000 resident days[3] was zero (0) in Green House/small scale settings, zero (0) in nursing homes with less than 50 beds, and 0.06 in nursing homes with 50 or more beds. For COVID-19 mortality, the median rate per 100 positive residents was zero

[3] Zimmerman et al (2021) calculated COVID-19 cases per 1000 resident days. For each nursing home, COVID-19 case counts during the study period were summed over the reporting periods (usually weeks), and case rates were then calculated by dividing total case counts by days of exposure (ie, resident days ¼ sum over reporting periods of occupied beds times the number of days in the reporting period) and multiplying by 1000.

(0) in Green House/small scale settings, 10 in nursing homes with less than 50 beds, and 12.5 where there were 50 beds or more.

Beyond the size or the number of beds in settings, Zimmerman et al. (2021) acknowledge that more research is required to identify specific features in Green House/small scale settings that contribute to these findings. However, they point to the potential benefits due to private bedrooms and bathrooms, limited ancillary staff, and fewer people living, working, and visiting the unit.

This is echoed by Terry Fulmer, president of The John A. Hartford Foundation in the United States, who argues that "we need small", and points to the Green House model with "universal care workers" as a good way forward. She contrasts this to the more traditional settings with "long corridors", double rooms and shared bathrooms, which she considers to be "a nightmare for infection control" (Abbasi, 2021).

The issue of single rooms and infection control has also been highlighted by the United States based 'Coronavirus Commission for Safety and Quality in Nursing Homes', which highlights that the "ability to physically separate residents is greatly enhanced when rooms are occupied by only a single resident". In this regard, a key recommendation from the commission is to "encourage nursing homes to shift residents to single occupancy rooms for facilities that can accommodate this approach without detrimental reduction in census" (MITRE Corporation, 2020).

Brown et al. (2021) when examining the role of crowding in nursing homes in Ontario, Canada (as referred to Section 4.3.1) used simulations to estimate the incidence of COVID-19 infections in various scenarios where bedroom crowding was lowered. These simulations found that 31% of infections and 31% of deaths may have been prevented if all Ontario nursing residents had single rooms. However, the authors acknowledge that 30,000 additional private rooms would have been required to achieve this reduced infection and death rate.

Olson and Albensi (2021) discuss 'Dementia-Friendly Design' and its impact on COVID-19 Death Rates in Long-Term Care Facilities globally, and contend that small scale "cluster" design could have aided in isolation of COVID-19 residents in single bedrooms, reduced stress, agitation, and aggression, improved sleep quality, reduced the risk of falls, reduced restraint and medication usage, improved the ability of the caregiver/staff to supervise residents, and kept family members involved directly with their care, without requiring extensive PPE or hospitalization.

Finally, issues related to small scale models and COVID-19 infection control were discussed at an 'International Virtual Townhall' in September 2020. Evidence was presented that linked larger settings, crowding, and shared rooms to COVID-19 outbreaks. Reporting on the proceedings from this event, Heckman et al. (2021) states that:

> "Data suggest that the Green House model leads to better resident outcomes and lower hospitalization costs, which may partially offset increased costs associated with the homes themselves. The fact that smaller homes not only support better resident outcomes but are more resilient against infectious outbreaks should prompt policy makers to reimagine LTC infrastructure in a post pandemic world."

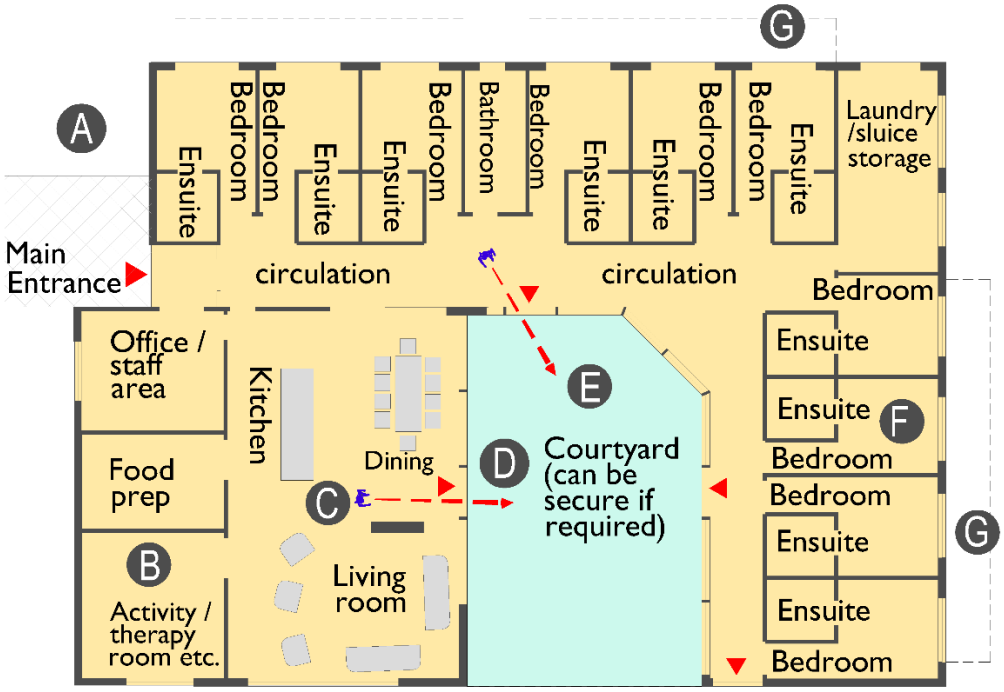


Figure 3: Generic and hypothetical ground floor plan of a household model

A. The household has a small number of residents (10). This reduces traffic from residents or visitors. The household also has a small number of fixed staff who do not move between units, this reduces traffic and potential cross contamination.

B. Activity room can be used as small visitor area

C. Visual and physical access to the outside from the central social area.

D. Potential for multiple exterior doors facilitate separate entrance/exit areas (i.e., one-way systems) or dedicated staff or visitor access points.

E. Easy access to outdoor areas and fresh air provides safer space for social interaction and exercise.

F. Single room with a private ensuite provides privacy and dignity, reduces risk of infection spread and makes isolation and socially distanced visits easier.

G. Depending on the context or floor level, a terrace or balconies can be considered.

Key recommendations to inform design guidelines – Care Model

Smaller scale household models (typically, less than 12 residents) have been shown to improve quality of life and reduce infection risk. This may also support Universal Design by providing smaller, more legible, and manageable settings (see previous recommendation for potential retrofit measures required).

c) **Mixed-use models, co-location, or shared facility models** (e.g., co-location with healthcare facilities, housing, education, childcare, or community facility)

Key design considerations for quality of life

Rapid review findings: While many RLTC settings are standalone facilities, there are examples of settings that are more integrated with other types of facilities or allow other users to access and share their facilities. For example, in the UK there are settings that integrate RLTC with childcare, or various settings in a number of European countries (e.g. France, Switzerland) where RLTC is part of a mixed-use model that may contain intergenerational housing, healthcare, community facilities, or retail (Feddersen and Lüdtke, 2017). Greater integration of older people in society and intergenerational engagement are the objectives for many of these models. For others, such as the integration of 'Day care Guests' with RLTC as seen in some German settings (Hämel and Röhnsch, 2020), it is about a more integrative care approach, but this also has the potential for generating more social interaction for both the residents and the community dwelling day care guests.

Finally, there are initiatives exploring the potential for supported housing and in some cases, RLTC, to act as community hubs and provide integrated social and healthcare facilities for the wider community (Evans et al., 2017). It is argued that these models may help provide badly needed community services, while at the same time reduce social isolation in RLTC settings.

Universal Design issues: Mixed-use, co-location, or shared facilities may help RLTC settings align with the first Universal Design Homes principle 'Integrated into the neighbourhood'. Integrating a setting with supported housing may provide flexibility for residents to temporarily move to a higher care facility as required or access services within the RLTC setting thus aligning with the fourth Universal Design Homes principle 'Flexible, cost effective, safe and adaptable over time'.

Stakeholder feedback: Some interviewees spoke about the advantages of co-location with primary care in terms of healthcare access. Others mentioned the advantages of co-location with supported housing or similar as this provided a continuum of care in the same location and the possibility of sharing facilities.

High Priority infection control issues

Rapid Review Findings: No research found regarding impact of mixed-use models, co-location, or shared facility models on infection control. However, it may be logical to assume that greater mixing and community interaction may bring infection risks.

Stakeholder feedback: One questionnaire respondent who worked in a setting beside a doctor's surgery reported that surgery patients kept mistaking the RLTC setting for the doctor's surgery and erroneously approaching the front door of the setting for appointments. The respondent deemed this a safety issue.

Key recommendations to inform design guidelines – Co-Location and Shared Facilities

Mixed-use models, co-location or shared facility models may have benefits for quality of life, but this very much depends on the context. They may also have benefits in terms of Universal Design due to the possibility of greater integration, flexibility, and adaptability. However, while there is no research showing a correlation between these models and infection spread, the risks related to mixing and community interaction have to be carefully considered. This is an area where further studies are required, in order to provide more research to underpin decisions around RLTC planning and design in the context of mixed-use models, co-location and shared facility models.

For existing settings that are being reconfigured or where new services are being considered, mixed-use models or shared facility models can be considered in terms of adapting the setting or adding new services or spaces.

4.3.2. Site Location, inclusion, and interaction with the community

05: Pleasant and accessible urban environment to allow residents to be in and a part of the community.

a) **Proximity to previous home, family, and friends to allow easy inward and outward visiting**

Key design considerations for quality of life

Rapid review findings: Many ageing advocates argue that RLTC settings are in locations that sever connections between residents and their community, make inward and outward visiting harder, and make it difficult to integrate the setting with the community.
"The current practice of building nursing homes on green field sites outside villages and towns cuts residents off from community life and social interaction, and isolates those residing in them, thereby lessening their quality of life." (Alone, 2018).

Anderson et al. (2020) note that a RLTC setting located within a residents' home community may help with a continuity of self through continuity and connected-ness with place or community (Reed et al., 1998). Moreover, according to Christie (2020), a 'sense of connectedness' supports resilience in older people, particularly those living with dementia. This highlights the importance of location and connection to family, not only in terms of social interaction, but also in terms of a resident's resilience and their ability to adapt to adversity.

Universal Design issues: If the previous home is located within a community of a certain population density, such as a village, town, or city neighbourhood, then this issue is relevant to the first Universal Design Home principle 'Integrated into the neighbourhood'. However, where the previous home is in a more isolated or rural location then close proximity to the previous home may not be feasible.

Stakeholder feedback: Many Interviewees believed that people would rather remain in their homes, or the community they have lived in all their lives, but that this does not often happen.

High Priority infection control issues

No research found linking infection control to proximity to previous home, family, and friends.

b) Community embeddedness and proximity and access to local amenities, services, local parks, green spaces

Key design considerations for quality of life

Rapid review findings: Andersen et al. (2021) argue that the social exclusion experienced by some RLTC residents can be mitigated by improved spatial integration of RLTC settings with the community:

> "In this context, nursing home residents should have the possibility to be part of the social life of the cities, communities or neighbourhoods in which they live. Whether or not the nursing home is situated in the same area that the resident has lived in for years, remaining or becoming part of a neighbourhood and local community when moving to a nursing home is of great importance for individuals' quality of life." (p. 397 - 398).

In a similar manner, O'Shea and Walsh (Rowles and Bernard, 2013, O'Shea, 2013) argue that RLTC should be at the centre of communal activity and welcome people from outside, while Barney (1974) goes further and states that direct community involvement and responsibility in the RLTC is important for improving standards.

The integration of RLTC with the community requires access and engagement with local amenities and public spaces. Frameworks such as WHO Age-Friendly Cities (WHO, 2012), or the UN Sustainable Development Goals argue for the provision of "universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities" (UN General Assembly, 2015).

Finally, according to the UK's 'Housing our Ageing Population Panel for Innovation' (HAPPI) (Porteus, 2012) housing for older people should be located in areas that constitute a 'Lifetime Neighbourhood' (Bevan and Croucher, 2011) in terms of access to transport, retail and other amenities and facilities that older people need.

Universal Design issues: The first Universal Design Home principle 'Integrated into the neighbourhood' - highlights the relationship with community and ensures the setting is close to local services and public transport and is well integrated into the community

Stakeholder feedback: Many interviewees argued that the location of many RLTC settings did not take account of community engagement and that the locations were often isolated and peripheral to the community. Furthermore, they stated the advantages of proximity to urban centres in terms of visiting, walking, cycling, and access to amenities, shops, services, and public transport. Accessibility is not just an issue for residents and visitors, and as one interviewee pointed out, inaccessible settings make it harder to find staff.

However, they also stated that sites located in communities are more expensive and harder to find.

In terms of creating connections between the setting and the community, some interviewees commented that community services should be utilised over bringing services

into the setting, wherever possible. Conversely, internal services such as a setting café, need to be attractive enough to bring local people into the setting.

One interviewee cautioned that proximity or a central location within a community does not guarantee connectivity and that residents can still be isolated within a community. In addition to location, connection and engagement with the community depends on how the setting is managed and operated. Finally, in this regard, resident autonomy must be respected, and any community engagement must be appropriate to the resident and a matter of the resident's choice.

Finally, it was argued by one interviewee, that integration into the community, particularly when it is not their local community, is not a high priority for the high dependency populations in nursing homes.

High Priority infection control issues

Rapid Review Findings: A study by Abrams et al. links urban location to higher COVID-19 infection in RLTC (2020), while Chow found more outbreaks in settings in densely populated areas (Chow, 2020). However, these findings should be tempered by research that has examined if high-density districts are more vulnerable to COVID-19 and found that over-crowding is the main factor, rather than population density (Khavarian-Garmsir et al., 2021). For instance, Khavarian-Garmsir et al., argue that over-crowding can also happen in areas of low population density.

Stakeholder feedback: Surprisingly, the issue of infection control and community integration was not raised by stakeholders.

Key recommendations to inform design guidelines – Community Proximity and Access

Settings that are located centrally within a community will benefit from proximity and access to the community, local amenities, services, local parks, green spaces, public transport and walking and cycling infrastructure.

Connection and engagement with the community also depends on how the setting is managed and operated. At all times resident autonomy should be respected, and any community engagement should be appropriate to the resident and a matter of resident choice.

While redesign or retrofit projects, which are the focus of these guidelines, cannot change the location of existing settings, careful consideration should be given to location to ensure that the setting is maximising its relationship with the community in terms of social interaction and inclusion in community life. Knowledge about the location and adjacent local community will also inform design and operational decisions around infection control and community interaction during a pandemic.

c) Pleasant, comfortable, accessible, safe, and supportive adjacent public realm

Key design considerations for quality of life

Rapid review findings: Providing a pleasant, safe and accessible public realm with good walking and cycling routes, and easy access to public transport for staff and visitors (often older people) is essential for an age-friendly community (WHO, 2007) and also critical for a dementia-inclusive community (Burton and Mitchell, 2006). While a supportive public realm is important for residents in terms of going out and about in the locality, it is also vital for visitors (many of whom will be older people), and possibly older people visiting for day services.

Finally, the quality of the built environment including air quality, crowding, noise, indoor air quality, and light have been linked to mental health (Evans, 2003)). Therefore, providing a healthy local public realm is an important consideration for RLTC. Air quality, for instance, is a growing concern with research showing that older people are more vulnerable to both short-term and long-term air pollution. (Simoni et al., 2015).

Universal Design issues: The second Universal Design Homes principle: 'Easy to approach, enter and move about in' is significant for the public realm and demands accessible and comfortable routes when approaching the setting from the community.

Stakeholder feedback: In line with 'community embeddedness and proximity' as discussed previously, interviewees argued that good access to a setting, by public transport, walking, cycling etc. is essential for all users including staff.

One interviewee commented on the risks of a setting being located adjacent to a busy road.

High Priority infection control issues

Rapid Review Findings: Research shows that older people are more vulnerable to both short-term and long-term air pollution (Simoni et al., 2015). Emerging research is also linking poor air quality to higher rates of COVID-19, (Zhu et al., 2020) making air quality at a neighbourhood scale both a quality of life and resilience issue.

Key recommendations to inform design guidelines – Public Realm

Providing a pleasant, safe, and accessible public realm with good walking and cycling routes, and easy access to public transport for residents, staff, and visitors (often older people) improves the quality of life for those in RLTC settings. This may be feasible or appropriate for urban settings, but many of these public realm issues should also be considered in villages, towns, and suburbs. While these issues are outside the scope of most retrofit projects, setting owners or managers should be aware of these issues and should liaise with the local authority to highlight these issues if required, and to request local improvements. In some circumstances, where a setting is located within a larger development, the setting may have greater influence over the design, management and maintenance of the local public realm and should use this influence to improve the safety, accessibility, and attractiveness of the public spaces adjacent to the setting.

Air quality at a neighbourhood scale is a quality of life, infection control, and resilience issue. RLTC settings should be located within neighbourhoods or locations with good air quality. Local authorities or developers can help to improve local air quality by reducing vehicle traffic (i.e., low vehicle environments through greater active travel via walking and cycling infrastructure and public transport) to minimise vehicle related pollution, and control local harmful emissions.

4.3.3. Site design providing a connected, welcoming, accessible, and pleasant setting with good contact with nature

06: Entrance to Farnogue Residential Healthcare Centre, Co. Wexford.

a) **Community Interface: a welcoming and open/permeable boundary with community, and positive physical interface to encourage and promote community interaction**

Key design considerations for quality of life

Rapid review findings: The 2009 'Urban Design Manual: A best practice guide' promotes visual connections between a development and the wider community (DEHLG, 2009b). The manual argues that views into the site can help create connections, reduce a sense of separateness or social division.

Fleming and Bennett (2014) observe that higher quality of life is associated with buildings that facilitate engagement with a variety of activities both inside and outside. Elsewhere, Fleming (2011) explores the value of amenities that encourage links to the community.

In line with these findings, it could be argued that greater visibility of the setting within the community, and more open, welcoming, and visually permeable boundaries may help foster connections and relationships with the community.

While the boundary should be welcoming, it must also maintain privacy to protect residential amenity, to support the sense of security experienced by people in their homes. Where ground floor dwellings adjoin the public street, it is important that some kind of "defensible space" is created as a buffer between the building and the public realm (e.g., a planting strip). In these scenarios, the design of ground floor windows need to be carefully

considered to ensure privacy (Department of Housing Local Government and Heritage, 2009).

Stakeholder feedback: Some interviewees were concerned that many settings have a culture of being very closed down, especially during pandemic.

High Priority infection control issues

Rapid Review Findings: No research found linking infection control to the Community Interface.

Key recommendations to inform design guidelines – Community Interface

Providing a positive community interface with a welcoming and visually open/permeable boundary with the community can help create a greater sense of ease and encourage community interaction.

While the boundary should be welcoming, it should also maintain privacy to protect residential amenity, as this supports the sense of security experienced by people in the setting.

b) **Seeing out and feeling like part of the community: Visual access from the setting to the community**

Key design considerations for quality of life

Rapid review findings: The Urban Design Manual (DEHLG, 2009b), as mentioned earlier, promotes visual connections across site boundaries, and argues that "Creating views out of the site will also help to give the new development a strong sense of local identity and place". In a similar vein, HAPPI (PORTEUS, 2009) recommends that housing for older people should engage positively with the street, offer connections to the wider context, encourage interaction, and avoid an 'institutional feel'.

A site layout and boundaries that allow residents to 'watch the world go by' from their bedroom, sitting rooms, balconies, verandas, or from a garden can provide interest and stimulation for residents and help them connect with the community. Rowles (2000) talks about 'Peggy's window' and one of his research subjects, Peggy a 68-year old-women who due to health issues had become withdrawn and isolated in her home. However, her life was transformed with the installation of a large picture window that gave her a view of activity on the street and enabled engagement with the community.

In RLTC settings, this casual interaction with the community is often provided by way of balconies, porches, and verandas. Granger (2020) refers to these as transitional spaces and argues that they provide visual stimulus through purposeful design, critical for physical and mental health: "Even in old age, there is joy, companionship, and spontaneity which, I would add, is facilitated by the material context - the places and porches - that allow the elderly to touch the world beyond."

According to Torrington and Tregenza these views of the community and everyday activities taking place outside are particularly important and attractive to those who are confined indoors (Torrington and Tregenza, 2007).

Universal Design issues: Torrington and Tregenza (2007) outline the spatial orientation benefits of an external view as people can use familiar external landmarks to orientate themselves within a setting.

Stakeholder feedback: Some interviewees spoke about the importance of a visual connection to the community to reduce isolation and provide a sense of familiarity, sense of place and belonging.

High Priority infection control issues

Rapid Review Findings: While residents in RLTC may need to quarantine or shelter in place during a pandemic, visual access from the setting or from resident bedrooms to the community, the outside world, and nature can help alleviate loneliness and isolation.

Key recommendations to inform design guidelines – Visual Connection with Community

Good visual connection to the community can provide a sense of familiarity, sense of place and belonging. It can also help with spatial orientation as people can use familiar external landmarks to orientate themselves within a setting.

While residents in RLTC may need to quarantine or shelter in place during a pandemic, visual access from the setting or from resident bedrooms to the community, the outside word, and nature can help alleviate loneliness and isolation.

c) Pleasant, homelike, and accessible site design

Key design considerations for quality of life

Rapid review findings: The Sustainable Residential Developments in Urban Areas (Department of Housing Local Government and Heritage, 2009) advocates site layouts that create a sense of identity and place and that create "a logical hierarchy of places within the scheme working from streets to semi-private and private areas". It recommends a clear definition of private, communal, and public spaces, maximising natural surveillance of open spaces from windows and avoiding blank building facades to any public spaces. In the case of an RLTC setting these recommendations could apply equally to public spaces outside the site and semi-public spaces within.

The Urban Design Manual (DEHLG, 2009b) suggests that the site layout should capitalise on any opportunities presented by existing buildings, landform and ecological features to create a memorable and distinctive layout that creates a strong sense of place.

The site layout and design determine many key aspects of a RLTC setting such as onsite pedestrian, cycling and vehicle movement, and parking. Universal Design guidance such as 'Building for Everyone' (CEUD, 2014a) and the Universal Design Guidelines for Homes for Ireland (CEUD, 2015) provide detailed guidance to make site design accessible, easy to understand, and easy to use for a wide range of users.

A pleasant, homelike, and accessible site design encourages residents to go out and about on the grounds (walking, sitting, reading etc.) and provides an accessible and welcoming environment for staff and visitors.

A homely and accessible site design will help provide a 'homelike' environment that promotes activities of daily living and encourages residents to undertake everyday tasks for as long as possible (Verbeek et al., 2009).

Universal Design issues: For RLTC settings, where a high percentage of residents may have a cognitive impairment, specific design issues covered by the 'Universal Design Guidelines: Dementia Friendly Dwellings for People with Dementia, their Families and Carers' (Grey et al., 2015) will be relevant. These guidelines outline how people living with dementia may have orientation difficulties in the external environment and may also experience age-related physical and sensory impairments. To create a more supportive environment, the site design should:

- Increase spatial legibility by providing a coherent and legible spatial structure composed of well-connected short onsite routes with good visual access to key landmarks and spaces. Greater enclosure formed by clearly visible buildings and spaces with obvious functions and entrances will also aid legibility.
- Consider how the site design can engender a sense of familiarity by the provision of human-scale spaces. This does not preclude innovative design but instead challenges the designer to employ recognisable spaces, features and functions which are consistent with users' expectations.
- Provide calm spaces on the site that avoid excessive acoustic disturbance through design that reduces traffic volume and speed and orientates noise generating activities away from residents and key amenity spaces.
- People with dementia, in common with many older people, will often need higher levels of lighting to compensate for vision difficulties, which may be related to both older age and dementia. The design of artificial light should seek to create even illumination, reduce the effects of glare, and enhance task visibility.
- Good signage will help with orientation and wayfinding around the site for both residents and visitors.
- Good visual access to key paths and main entrance doors will help with orientation and prompt people about their destination.
- Entrance gates to a communal space should be easily seen and identified from within the site when leaving, or from the street or road when entering.
- For settings with a campus layout or with multiple units, the buildings should be of a consistent quality, but they should not all look the same. Design features such as varying

door colours, distinct boundary treatments or porch canopy details, or individualised planting, can be used to identify individual units. Design features which reinforce familiarity, personalisation and good visual access should be used to maximum effect to help orientate a person living with dementia and enable them to navigate around the site.

High Priority infection control issues

Rapid Review Findings: COVID-19 RLTC guidelines developed in China emphasise the importance of site layout in terms of infection control. Wang et al., (2021) highlight the following from these guidelines:

- To prevent COVID-19 from entering the facility, a loading zone or area for material handover outside the facility was suggested in the guidelines, along with a dedicated parking lot inside the facility for visiting vehicles.
- Location of the contaminated zones should be downwind on the facility's site and relatively separated from other buildings or spaces
- Dedicated areas for staff members' facility stay during facility lockdown should be considered in planning. Multipurpose interior or exterior spaces outdoors, such as sites for portable temporary housing, may be used to provide environmental flexibility.
- Outdoor environments for physical activities (e.g., walking routes) should be provided on facility sites to promote residents' active living. With good natural ventilation, the outdoor environments may be developed into safe common areas with low risk of infection.
- The rules of social distancing should be followed, and more research is needed to promote residents' active living during the difficult time of facility lockdown.

Key recommendations to inform design guidelines – Site Design

Create a memorable and distinctive layout that creates a strong sense of place.

Create a pleasant, homelike, and accessible site design that encourages residents to go out and about on the grounds (walking, sitting, reading etc.), while also providing a restful and welcoming environment for staff and visitors.

Employ a Universal Design approach, including dementia-friendly design measures to ensure the site can be accessed, understood, and used by all residents, visitors, and staff.

To facilitate enhanced infection control when required, consider how permanent and temporary site measures can be used to create site zoning to separate activities with high infection risk (e.g., removal of materials associated with infection cases) and other activities (e.g., resident movement, visitor access, etc.). It may be more appropriate that site flexibility can temporarily facilitate these measures only when required.

d) Creating good environmental site conditions: A healthful and relaxing setting in terms of air quality, acoustics, views and contact with nature

Key design considerations for quality of life

Rapid review findings: Some relevant findings from the literature include:

- Environmental issues such as air quality, crowding, noise, indoor air quality, and light are important for health and these issues are also critical for the site design of a RLTC setting.
- Site design determines how the setting supports contact with nature through the overall site layout and circulation (e.g., onsite routes and landscaping, provision of planting and natural features, views to nature within and outside the site etc.), and through the creation of dedicated outdoor spaces (e.g., terraces/patios, courtyards, gardens etc.). The interaction between the site layout and the building configuration also determines the physical and visual access between the interior and the exterior of the setting. These factors influence the quality of interaction between the residents and nature as they move around the site, spending time in gardens and outdoor spaces, or view and experience nature from within the building.
- In recent years the role of nature and access to outdoor spaces in RLTC settings has received greater attention (Bengtsson and Carlsson, 2006), elsewhere, the role of biophilic design, which promotes the supports the innate connection between humans and nature (Kellert and Wilson, 1995), is being promoted as a critical part of aged care design (Miller and Burton, 2020).

Universal Design issues: Unnecessary or large amounts of stimulation for residents such as noise levels, busy access routes, can be distressing for people with dementia (Fleming and Bennett 2017). Stimulation should be controlled and balanced (Marshall, 2001) as it may alter the perception or experience of people living with dementia (Grey et al., 2018).

High Priority infection control issues

Onsite air quality, pollution, and the creation of safe outdoor spaces: As discussed numerous times throughout this report, there is good evidence to show that outdoor spaces are considerably safer in terms of infection risk. Early research from Chinese hospitals treating COVID-19 found outdoor hospital spaces had undetectable or very low concentrations of the virus. (Liu et al., 2020). More recently, Bulfone et al. (2020), having completed a systematic review looking at outdoor transmission of SARS-CoV-2 and other respiratory viruses found five studies showing a low proportion of reported global SARS-CoV-2 infections occurring outdoors (<10%). They conclude that:

> "While it has been acknowledged that spending time outside has general health benefits, our review posits that there are also benefits in reducing transmission of SARS-CoV-2 by reducing exposure time (substituting time indoors with time outdoors). These results suggest that moving activities to outdoor settings may reduce infections and ultimately save lives". (Bulfone et al., 2020)

While more research is required in this area, reviews of previous pandemics argue for the benefits of spending time outdoors (Hobday and Cason, 2009). As a result, the creation of outdoor spaces for activity, exercise, and social interaction becomes a critical part of site design in RLTC settings.

Furthermore, as mentioned earlier, emerging research links poor air quality to higher rates of COVID-19, (Zhu et al., 2020) making air quality at site layout level both a quality of life and a resilience issue.

Key recommendations to inform design guidelines – Environmental Conditions

The site design should create good environmental site conditions that provide a healthful, calm, and relaxing setting in terms of air quality, acoustics, views and contact with nature.

Due to the low infection risk association with the outdoors, as well as the positive impact of access to nature on quality of life; creation of outdoor spaces for activity, exercise, and social interaction becomes a critical part of site design in RLTC settings (for more information see Outdoor Space in 4.3.5 (f)).

Site design also needs to take into account local and onsite air quality, not just to provide high quality outdoor areas, but also to protect against the damaging effects of poor air quality and pollution. In a building layout that locates key indoor habitable spaces away from areas of poor air quality, the appropriate placement of key outdoor areas, and the use of site micro-climates to create air flow and ventilation, are all ways to maximise air quality on the site.

Air quality can also be improved by limiting onsite vehicle emissions, controlling harmful onsite emissions, and by planting trees or other appropriate vegetation in strategic locations.

4.3.4. Overall building layout and circulation (entering and moving about)

a) Overall layout of the setting providing a human scale and supporting accessibility

Key design considerations for quality of life

Rapid review findings: Fleming and Bennett (2017) discuss the importance of a 'human scale' in any setting for people with dementia. In this regard they present evidence relating to three key factors:

- Number of places (beds): fewer places/beds in a setting is linked to improved quality of life.
- Physical/spatial size: larger spaces have been connected to greater levels of disturbance, while more compact spaces have been shown to provide more comfort and to aid resident supervision and care. This involves a move away from a high number of beds, long corridors, more circulation space towards smaller, more compact units.
- Social density: lower social density (i.e., more floor area or space provided per resident) connected to better care and social interaction outcomes.

Universal Design issues: The Universal Design Homes principles 'Easy to approach, enter and move about in' and 'Easy to understand, use and manage' is an important consideration in terms of layout. In terms of size, this may be easier to achieve in smaller settings, or at least in settings that are broken down into smaller, more legible, and accessible units.

Passini et al., (1998) point to the importance of a 'spatial organisation' that minimises memory and inference-based decisions. A smaller setting with a simple and legible layout will improve wayfinding and orientation by reducing dependence on cognitive mapping, providing good visual access, and clearly communicating the overall structure of the space.

In terms of resident mobility and access, the overall floor area and number of floors determines if travel distances, and circulation routes are accessible and comfortable for residents, visitors, and staff. A smaller setting with shorter and clearly legible circulation will provide easy access between key spaces such as living rooms, kitchens, bedrooms, and bathrooms (Grey T et al., 2018).

Stakeholder feedback: As discussed in 4.3.1, Interviewees pointed out that larger settings may take the form of multi-storey buildings. In terms of layout, they argued that residents living on upper floors may have restricted direct access to outdoor space or experience restricted independent mobility in terms of moving from one floor to another or accessing the ground floor.

Many of the questionnaire respondents and interviewees referred to the fact that ground floor bedrooms allowed window visits and that multi-storey settings made window visits very difficult.

High Priority infection control issues

Scopetti et al. (2020) advocate for the division of the setting into separate operating areas, with controlled movement between areas to reduce infection spread. In this regard, Siegelaar et al. (2020), endorse adjustable retrofitting and flexible compartmentalisation within settings to enable isolation of individuals and small groups.

Wang (2021) refers to dedicated environmental zones including clean (e.g., residential rooms), semi-clean (e.g., facility clinic), and contaminated (resident areas) zones that should be considered at the level of site planning. Each zone should have independent air-conditioning systems, dedicated circulation systems (e.g., entries and exits), and routes for waste collection. Physical separations, such as partitions, between these zones would be necessary in the time of pandemic, and the spaces to store these partitions materials for engineering separation should be included in planning.

Key recommendations to inform design guidelines – Overall Layout and Scale

The benefit of smaller scale settings, or settings carefully broken down into smaller distinct units has been outlined previously. Therefore, the overall layout of the setting should be considered in this context, and the layout should be designed to provide these smaller units.

Provide a coherent, legible, and logical building layout that provides orientation for users and is easy to understand and navigate.

For multi-storey settings, residents on all floors should have access to usable and meaningful outdoor space. Furthermore, access to upper floors for visitors should be facilitated through spacious and well-ventilated circulation routes, ideally without having to travel through key parts of the main building.

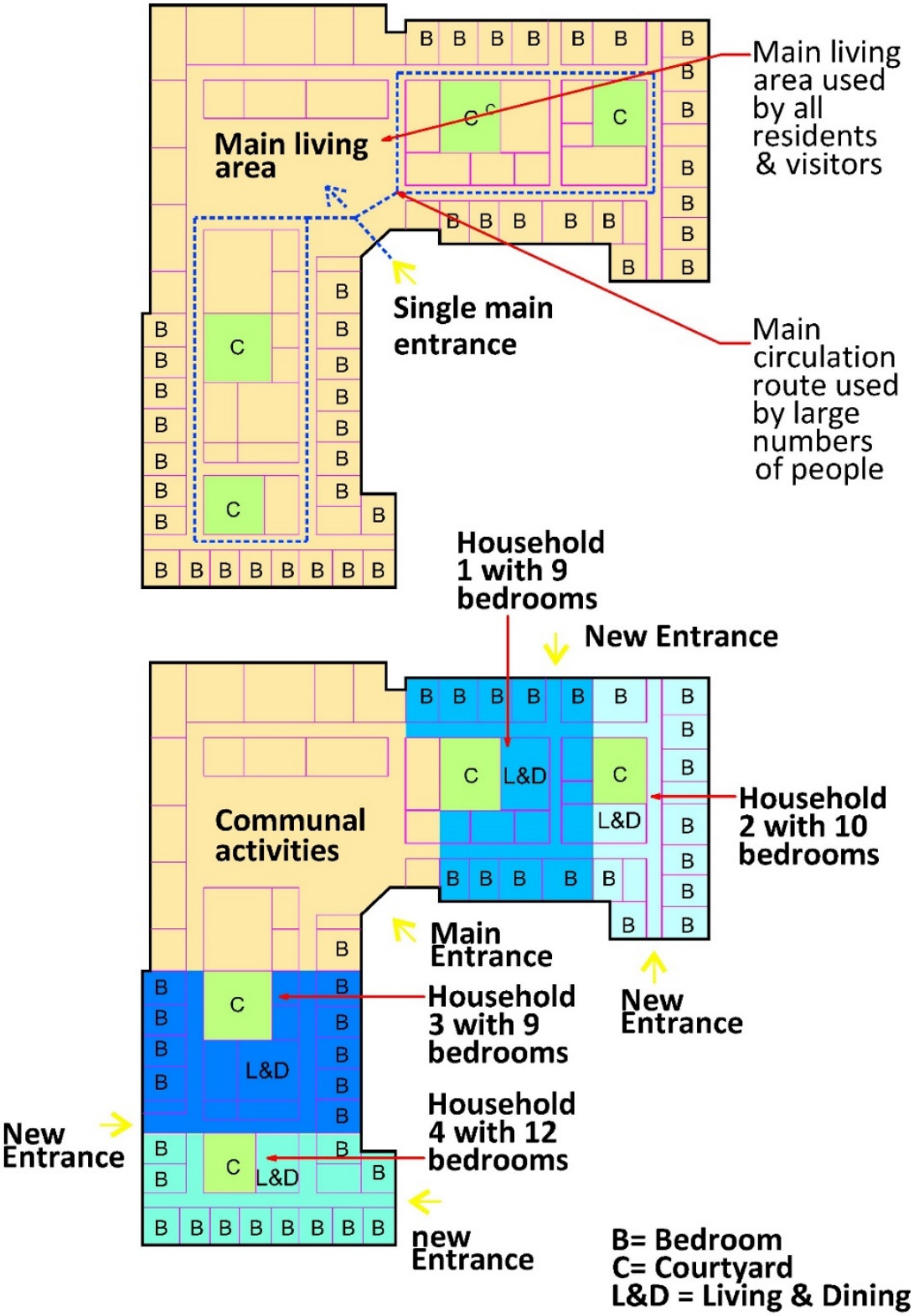


Figure 4 - Reconfiguring a large traditional layout into four household units.
Top plan: typical layout/traditional model
Bottom plan: how a typical layout/traditional model might be reconfigured.

b) Building circulation supporting accessibility - Spacious, legible, and accessible circulation areas (corridors, stairs lifts)

Key design considerations for quality of life

Universal Design issues: Again, the Universal Design Homes principles 'Easy to approach, enter and move about in' and 'Easy to understand, use and manage' are important considerations in terms of circulation areas. In line with the accessibility, perception and experience of the overall setting as discussed in (a) above, spacious, legible, and accessible circulation areas are important for quality of life in RLTC settings.

Stakeholder feedback: As stated in 4.3.1 (a), some interviewees were concerned that larger settings presented more challenges for infection control due to a higher resident population, greater traffic, larger common areas with higher number of occupants, and challenges around accessing multiple floors using lifts. While these are related to overall size, they are also clearly circulation challenges in terms of the amount of people using hallways, stairs, and lifts at any one time.

Interviewees suggested that continuous or 'circular' circulation routes can help with 'wandering'.

Some interviewees mentioned the need for a balanced approach to infection control and argued that while white walls and light floors may be good for infection control, they can make it difficult to navigate, particularly for people with dementia.

High Priority infection control issues

Rapid Review Findings: As outlined by the WHO (2021), building good ventilation is critical to reducing the transmission of COVID-19 in indoor spaces, therefore all circulation areas should be well ventilated.

Predetermined routes for patient/resident transfers within the setting (Scopetti et al., 2020) and more spacious circulation areas / corridors are important for infection control. (Siegelaar et al., 2020).

According to Wang (2021) dedicated circulation systems for separation between clean, semi-clean, and contaminated zones should also be considered. The location and number of lifts and staircases also needs to be appropriately planned. Finally, a signage system focusing on infection control should be included in design for the setting.

While the research found no studies related to passenger lifts in RLTC settings, there is one hospital-based study from Van-Rijn et al. (2020) that examines ways to reduce aerosol transmission of COVID-19 in hospital elevators. While acknowledging that more research is required, these authors recommend the following:

- Leaving elevator doors open for a longer period
- Increasing the elevator's mechanical ventilation capacity. Current standards for the air change rate by mechanical ventilation in hospital elevators may vary between 6 and 20

air changes per hour. If we assume that aerosol particles will be continuously mixed with supply air, without considering particle deposition, re suspension, and stagnant flows, an air change rate of 10 times per hour implies a 100-fold reduction in aerosol particles in about 28 minutes. From the experiments, a 100-fold reduction in 24-30 minutes (cf. ACH = 10) with closed doors was found, 12-18 minutes during operation, and 3-5 minutes with open doors. The ventilation inside all studied elevators in idle position automatically shut off after 1-2 minutes; this can easily be prolonged by reprogramming the ventilation control software

- Reversing the flow direction of the ventilator, and creating a unidirectional downflow of fresh (e.g., HEPA filtered) air from the ceiling towards the floor of the elevator cabin, is a measure that is standard in most operating rooms to create and maintain an airborne microbial free environment.

Key recommendations to inform design guidelines – Circulation Routes

Provide calm, spacious, uncluttered circulation routes articulated by visual clues including identifiable spaces, features, connections to external spaces and views, artwork, planting, lighting, fittings, and furniture. This will be supported by clear wayfinding using signage, colour coding, images, or other visual cues to help create a more easily navigated setting.

Where possible, a circular or looped circulation route, that passes through or runs adjacent to the day room, may be appropriate as this provides continuous walking routes that return a person to their starting point. This arrangement also avoids dead-ends and any associated disorientation or anxiety.

Provide spacious dedicated circulation systems for separation between clean, semi-clean, and contaminated zones where possible.

Carefully consider the location and number of lifts and staircases as part of the overall layout and zoning to provide additional circulation capacity, and possibly separate routes for visitors or service personnel.

Signage systems focusing on infection control should be included in the design for the setting (for more information see Orientation and Wayfinding Features in 4.3.6 (b))

Provide increased ventilation for lifts by leaving elevator doors open for a longer period, increasing the lift's mechanical ventilation capacity, reversing the flow direction of the ventilator, and creating a unidirectional downflow of fresh (e.g., HEPA filtered) air from the ceiling towards the floor of the elevator cabin.

c) Layout providing good internal visibility, high levels of natural light and views to outside (including access to nature from within a building)

Key design considerations for quality of life

Rapid review findings: Good visibility, high levels of natural light and views to outside (including access to nature from within a building) are an important quality of life issue for residents in RLTC (Fleming & Bennett, 2017).

Contact with nature and biophilic design was discussed earlier in Chapter 4, and this is also important in the context of the overall building layout. For instance, the integration of landscape and outdoor space with the overall layout not only determines how residents interact with nature and the outdoors, but also helps to break down and soften the negative appearance of large institutional buildings (Grey et al., 2018).

Furthermore, if residents are not able to access the outdoors directly from a particular space, then openable windows and views to the outside will support some level of contact with nature. Providing obstacle free, clear glazing to outdoor areas will maximise natural light and views to nature, while opened windows will admit fresh air and provide sounds from outside such as birdsong and other outdoor or natural sounds.

Bearing in mind that most, if not all of the biophilic design elements described by Kellert et al. (e.g., natural colours, views, plants, animals, natural shapes and patterns etc.) can be experienced within a building (Kellert et al., 2011) the overall layout of the building and how it supports biophilic experiences from within a building is important for resident quality of life. Particularly, for people with dementia or people whose mobility or ability to go outside is reduced, external views and interaction with natural elements may be one of the few ways through which they can experience the outdoors and have contact with nature (Gibson et al., 2007).

Universal Design issues: Good visibility and visual access within the building can be achieved by optimising natural light and making sure important features (e.g., handrails), spaces (e.g., toilets), and people (e.g., staff) are clearly visible along circulation routes and within key spaces (Grey et al., 2018).

Stakeholder feedback: Family members emphasised the importance of having a good view of nature, especially from bedrooms. This was reiterated by many interviewees who stressed the importance of contact with nature and access to outdoor space.

High Priority infection control issues

Rapid Review Findings: Design qualities such as good internal visibility, high levels of natural light and views to outside (including access to nature from within a building) support quality of life in RLTC settings (Fleming and Bennett, 2017). Moreover, it can be argued that they help to create a more humane environment during lockdown or quarantine.

For residents living on the ground floor, well designed windows (e.g., with low windowsills) allowed window visits.

d) Layout provides a centrally located, high quality outdoor space or garden

Key design considerations

Rapid review findings: While outdoor spaces provide direct access to nature as outlined above), they also provide space to exercise, get fresh air (Bengtsson and Carlsson, 2006), and exposure to the sun which provides a natural boost for vitamin D (McCartney and Byrne, 2020).

This access to outdoor space and gardens is crucial to the health and wellbeing of people with dementia in terms of socialising (Rappe and Topo, 2007), as therapy (Gibson et al., 2007), as a restorative space (Moore, 2007), and as a break from the "dominant ambiance" of the internal setting (Cohen and Weisman, 1991).

If the outdoor space is readily accessible and safe, it makes it easier for residents to go outdoors independently, to enjoy nature, socialise, or carry out gardening. All of these activities have been shown to be therapeutic for people with dementia and are therefore an important part of dementia friendly design. Specifically:

> "There is a need for therapeutic gardens to be incorporated as a 'standard' complementary element in special care units for people with dementia. Such an inclusion directly impacts the quality of life for residents, staff and family members" (Hernandez, 2007).

Stakeholder feedback: Many stakeholders emphasised the importance of good quality and easily accessible outdoor space, not just in terms of COVID-19, but for overall quality of life.

High Priority infection control issues

As discussed in 4.3.3 (d), there is good evidence to show that outdoor spaces are considerably safer in terms of infection risk (Bulfone et al., 2020). As a result, the creation of safe and accessible outdoor space for activity, exercise, and social interaction is critical for infection control in RLTC settings.

Note: See 4.3.5 (f), or further discussion of outdoor space.

Key recommendations to inform design guidelines – Contact with Nature and Natural Light

The layout of the building should incorporate a centrally located, outdoor space or garden that is easily accessed via the main circulation route, or key common area, such as a living room or dayroom.

Despite being outside, it is still important to consider good ventilation in all outdoor areas, especially in relation to any covered outdoor seating areas or similar outdoor structures.

4.3.5. Key internal and external spaces

a) Overall design issues

Key design considerations for quality of life

Rapid review findings: A typical RLTC setting will include a range of key spaces such as bedroom, ensuite bathrooms, sitting rooms or central living spaces, dining areas, kitchens, shared toilets along circulation routes or adjacent to common areas, and specialised spaces such as therapy and treatment rooms. The design and quality of these spaces is important for overall quality of life.

Universal Design issues: In line with Universal Design (CEUD, 2015), these spaces should be designed so they can be accessed, understood, and used by all residents, visitors, and staff. In terms of dementia-inclusive design from a Universal Design approach (Grey et al., 2015), these spaces should be designed with the following key issues in mind:

- Participatory Design: will identify the kind of living spaces, internally and externally, that will meet the needs of the residents. This may be important, for instance, in deciding on an open plan or a more traditional internal layout.
- Familiar Design: will provide a recognisable layout for the person with dementia to ensure they can operate successfully.
- Personalisation: allowing space for people with dementia to add their own touches will help create a more recognisable and familiar environment.
- Easy to Interpret and Calm: this can be achieved in living spaces through good spatial planning, careful light and acoustic design, and the use of easily operated and understood fixtures and fittings.
- Good Visual Access: being able to see key internal and external spaces, or important objects will help remind and prompt an occupant to carry out certain tasks, engage in a particular activity, or venture outside to enjoy the garden. This will also facilitate supervision which may help alleviate anxiety on the part of the person with dementia.
- Unobtrusive Safety Measures and Assisted Living Technologies: the safety measures and technology that can be used to support a person's orientation and navigation when they are out in the community, as well as within the setting itself.
- Distinct Spaces: separate rooms dedicated primarily to certain activities, such as dining or watching TV, will help reinforce the function of the space and provide further orientation cues. However, while open plan space may increase visual access, there is some debate as to whether the lack of defined or enclosed space may cause disorientation.
- Safe and Accessible Outdoor Spaces: will allow people with dementia to spend more time outdoors, helping to regulate the body clock, promote exercise, and provide multisensory experiences.

High Priority infection control issues

As discussed earlier, good ventilation is critical to reducing the transmission of COVID-19 in indoor spaces, therefore all indoor areas should be well ventilated (WHO, 2021)

See 4.3.4 (d) above for COVID-19 issues related to outdoor space.

b) Household models

Key design considerations for quality of life

Rapid review findings: As outlined previously, household models that create smaller, compact settings can be more supportive for residents, moreover, the provision of homelike environments and greater levels of privacy are linked to improved quality of life in RLTC (McKinley and Adler, 2006). Aspects contributing to thriving in RLTC challenge the traditional passive perspective of residents and instead emphasise more active aspects within a setting including positive relationships with other residents, such as visiting each other's rooms, and participation in meaningful activities (Bergland and Kirkevold, 2006). In this regard, creating more homelike spaces that balance social interaction with privacy are crucial for successful RLTC design.

Furthermore, as discussed in 4.3.4, the layout of the building and the design of key internal spaces should consider contact with nature and biophilic design through views to outside, the use of natural materials, images of nature and other biophilic design elements as described by Kellert et al., (2011).

Note: See Figure 3 for a Generic and hypothetical ground floor plan of a household model.

High Priority infection control issues

See previous infection control issues related to household models.

In addition to the above key design issues, there are a number of main spaces that require specific design considerations as set out below.

c) Central living, kitchen, and dining area

Key design considerations for quality of life

Rapid Review Findings: The success of the Green House model demonstrates the value of a central, shared, domestic-scale communal area composed of a living area, an open kitchen and dining area, collectively called a 'hearth'. Meals are prepared in the open kitchen by caregivers and shared at the common kitchen table. This shared area is typically connected to a protected outdoor space, where in the more successful settings the doors are left unlocked, and the outdoor space is used for activities and socialising (Cohen et al., 2016).

Stakeholder feedback: Many stakeholders lamented the fact that COVID-19 restricted access to common areas for many residents and reduced social interaction, especially those

on upper floors who were "marooned" in their bedroom. Space was further limited in some settings where some communal spaces were repurposed for clinical use during COVID-19.

One staff member admitted that it was difficult to achieve social distance in dining rooms as residents prefer to eat together. Where dining rooms were insufficiently sized, residents had to eat in their rooms during certain periods.

Other staff believed that dining room space should not be co-located with sitting rooms.

Many stakeholders argued that well-ventilated common rooms were helpful during COVID-19.

High Priority infection control issues

Rapid Review Findings: Restricted access to common areas or shared living areas can be isolating for residents and a balance must be struck between social engagement, communal activities, and infection control. This issue pre-dates COVID-19 with Stone arguing that "Maximizing quality of life for the resident while minimizing transmission of infections is a known challenge facing NH staff" (Stone et al., 2015). While more research is required in this area, it is useful to consider the advice set out by the AIA (2020) to change layouts in shared spaces to facilitate social distancing or provide outdoor seating and exterior social areas for occupants and visitors (see below).

While some settings may need to zone or group patients, it is still important to ensure there is safe walking space, especially for residents with a cognitive impairment who may 'walk with purpose' (BGS, 2020).

For dining rooms Wang (2021), suggests separations such as retractable screens to reduce the risk of droplets and provide the flexibility of space use.

In line with recent WHO guidelines, good ventilation is critical to reducing the transmission of COVID-19 in indoor spaces and therefore all living, kitchen, and dining areas areas should be well ventilated (WHO, 2021)

Key recommendations to inform design guidelines – Overall Design, Household Models and Kitchen, Living and Dining Areas

For household models, provide a central, shared, spacious but domestic scale, communal area composed of a living area, an open kitchen, and a dining area.

Good ventilation is critical for reducing the transmission of COVID-19 in indoor spaces; therefore, all living, kitchen, and dining areas should be well ventilated.

d) Visiting areas

Key design considerations for quality of life

Stakeholder feedback: Some family members expressed concerns about certain central living areas being too small and there being a need for more spaces where people can gather in privacy.

One of the most challenging aspects of COVID-19 in settings has been the restriction of visitors. This is compounded by settings that only have a single, centralised living area to host visitors. During a pandemic the use and sharing of these spaces among multiple visitors and residents is often not feasible. Furthermore, residents and family members often lament the lack of privacy in these areas and the noisy nature of such shared spaces. In response to COVID-19 some settings converted offices, storage areas, or other spaces to dedicated visiting rooms for small groups or single visits.

Where residents have their own room, visits can take place there, but in some situations and in relation to certain visitors, this may feel like an invasion of a person's privacy. For instance, you wouldn't visit a friend or a neighbour in their bedroom.

Using outdoor spaces, particularly covered outdoor spaces such as verandas or garden shelters can also provide valuable visiting space, but the weather or the frailty of a resident may not always permit this.

Key recommendations to inform design guidelines – Visiting Areas

Provide more numerous and varied visitor spaces within settings to handle different kinds and numbers of visitors at different levels of privacy. This may involve converting existing rooms, subdividing common areas, or building on new visitor spaces.

All visitor areas should be spacious enough for social distancing and well ventilated.

Provide a range of open and sheltered outdoor visiting areas in gardens or courtyards, or on balconies or roof terraces. Within these spaces provide a variety of open areas and seating and covered areas such as verandas or garden shelters (see outdoor space below).

e) Bedrooms

Key design considerations for quality of life

Rapid Review Findings: Research indicates that private bedrooms and ensuite bathrooms are preferred by residents and families (Zimmerman et al., 2002). Furthermore, many Green House model settings provide greater freedom for residents in terms of bringing their own furniture, or rearranging furniture with the room. This supports 'personalisation', as discussed above, and the importance of personal possessions that remind people of their past, old chair, or dresser from their home (van Hoof et al., 2016). To enable this personalisation, Marshall (1998) and others argue that bedrooms must be large enough to facilitate these personal belongings.

A study by Burton & Sheehan (2010) states how residents noted the layout of their bedroom, and the position of the bed ("some liked the bed in the middle for easy access, others preferred it at the side to prevent them from falling out"). Participants remarked that the important features in their bedroom included: nice views of the outdoors, good layouts, and less commonly, home-like features, cosiness, practicality, comfort, and privacy.

Stakeholder feedback: Family members stated that private, single rooms are preferable, but also warned against the danger of residents being isolated in their room. They also recommended a ground floor bedroom with outward facing windows to allow window visiting. Bedrooms with direct access to outdoor spaces made visiting a lot easier. Interviewees also expressed concern about resident isolation in single rooms. Some referred to the minimum floor areas contained in HIQA's (Health Information and Quality Authority) 2016 National Standards for Residential Care Settings for Older People in Ireland. They argued that the current 12.5m2 minimum area for new-build single bedrooms (excluding en-suite facilities) as set out in his standard is insufficient for a person who is essentially 'moving their life' to this new setting.

One interviewee referred to S.I. No. 293/2016 - Health Act 2007 (Care and Welfare of Residents in Designated Centres for Older People) (Amendment) Regulations 2016 (which also apply to existing settings where there are already shared rooms). From January 2022, for shared rooms, these regulations require a minimum floor area of 7.4m2 per resident (including bed, chair, and personal storage space), and these rooms should not have more than 4 residents, other than high-dependency rooms, which will not have more than 6 residents in that room. This was raised as an important issue for all nursing homes, particularly those who are planning to retrofit or adapt their setting.

Finally, some interviewees stated that bedrooms should have a small sitting area and kitchenette that would allow more independence and the hosting of visitors.

Given the diversity of care needs, the progressively high levels of care required in many settings, and the aspiration to support individual residents as their care needs evolve, a key stakeholder advised that bedrooms should be provided with ceiling mounted hoists to assist in the movement of residents from their bed and assist in transfer to the bathroom. Furthermore, to provide flexibility in terms of medical care, consideration should be given to the installation of an integrated gas supply system in the headwall of each bedroom to provide connections for various gases such as oxygen, if required.

High Priority infection control issues

Private rooms with ensuite bathrooms are linked to quality of life in nursing homes (Bergland and Kirkevold, 2006), improved infection control, and can be used to isolate confirmed or suspected cases of COVID-19 and to facilitate visitors. The quality of these rooms is important and therefore size, good natural light and ideally access to a private outdoor space or balcony would improve the experience for the resident, visitor, and staff.

In addition to the above, Wang (2021) highlights the following:

- Rooms should be relatively larger than typical residential rooms in order to provide spaces for care services inside the rooms. Moreover, spaces for disinfection inside and outside these rooms and related equipment should be provided.
- Access to telemedicine facilitates care within the room, especially for immediate responses to urgent patient safety issues is critical. Internet, television, radio, and reading materials are necessary in order to keep the resident intellectually active and socially supported through tele-interaction with families and friends.
- Quality of views from the window should ensure residents have visual access to nature and the world outside, reducing stress and promoting active living.

The advantages of single rooms with private bathrooms was demonstrated in a Canadian study by Brown et al. (2021) who found that shared bedrooms and bathrooms in nursing homes are associated with larger and deadlier COVID-19 outbreaks.

07: Residential setting where a bedroom has direct level access to a small outdoor space and also to the overall garden

Key recommendations to inform design guidelines - Bedrooms

Provide spacious single bedrooms with private bathrooms for all residents where possible.

Ideally, bedrooms should have a small sitting area and kitchenette that would allow more autonomy, independence, and the hosting of visitors.

Bedrooms should be provided with large windows with good views to the outside, including from the bed, and ideally a small private outdoor space in the form of a terrace or balcony.

Good ventilation is critical to reducing the transmission of COVID-19 in indoor spaces, therefore all bedrooms and bathrooms should be well ventilated.

f) Outdoor space: Garden, courtyard, or other key outdoor space

Key design considerations for quality of life

Rapid Review Findings: In recent years the role of nature and access to outdoor spaces in RLTC settings has received greater attention (Bengtsson and Carlsson, 2006), elsewhere, the role of biophilic design, which supports the innate connection between humans and nature (Kellert and Wilson, 1995), is being promoted as a critical part of aged care design (Miller and Burton, 2020).

Access to outdoor space and gardens is crucial to the health and wellbeing of people with dementia in terms of socialising (Rappe and Topo, 2007), as therapy (Gibson et al., 2007), as a restorative space (Moore, 2007), and as a break from the "dominant ambiance" of the internal setting (Cohen and Weisman, 1991).

Universal Design issues: As outlined by Grey et al. (Grey T et al., 2018, Grey et al., 2015), high-quality outdoor space should ideally be centrally located, easily seen, and accessed from the main central communal areas. These spaces should be safe, accessible, easy to understand, and easy to use. They should provide clearly legible pathways, seating, covered areas, multi-sensory planting, and objects and areas of interest.

Stakeholder feedback: As discussed previously, stakeholders emphasised the importance of outdoor space in terms of overall quality of life and in terms of COVID-19 and socially distanced visiting. Some family members emphasised the need for better outdoor exercise spaces and walking paths.

Many pointed out that due to frailty of the population, there should be more sheltered external spaces with heaters for the colder months. Also, access to outdoor space should be possible no matter what floor a resident lives on.

High Priority infection control issues

As outlined earlier, outdoor spaces provide significantly safer environments in terms of COVID-19 transmission and are therefore vital for contact with nature, outdoor amenities, and visiting. As discussed previously, Wang (2021) advocates for outdoor spaces for physical activities (e.g., walking routes) to promote resident wellbeing. He argues that with good natural ventilation, the outdoor environments may be developed into safe common areas with lower risk of infection.

Ickert et al. (2020) highlight the role of outdoor visits but that these visits require a safe, comfortable physical location where a resident can be brought to meet with family, while maintaining physical distance from others outdoors. From their study, several of the settings had purchased outdoor tents to help facilitate outdoor visits while keeping residents from sun or rain exposure. However, they point out that staff must remain nearby during outdoor visits in the event that residents have difficulty and need to end the visit early or require other assistance from staff. They also warned that following outdoor visits, staff must clean resident wheelchairs and hands before assisting them into the setting. If blankets were provided to residents, they must be laundered between uses, and outdoor seating areas must be cleaned between visits.

08: Residential setting with well-designed outdoor space that provides a combination of large and small social areas, and covered seating area with direct access to the main day room. (This photograph was taken prior to COVID-19)

Key recommendations to inform design guidelines – Outdoor Space

Provide centrally located, high quality outdoor spaces or gardens directly linked to key internal spaces to support quality of life and infection control.

Provide safe, comfortable, and accessible outdoor areas where a resident can be brought to meet with family, while maintaining physical distance from others who might also be using the space.

Provide sheltered external spaces with heaters for the colder months.

Well-designed balconies and terraces can provide many of the same benefits as a ground level garden including access to fresh air, daylight, and views, and contact with nature and the outdoors. These spaces become even more important if a patient is located on an upper floor or is unable to travel to or access a ground level garden due to illness, frailty, delirium, or infection control.

Despite being outside, it is still important to consider good ventilation in all outdoor areas, especially in relation to any covered outdoor seating areas or similar outdoor structures.

4.3.6. Building elements and components (finishes, furniture, fittings etc.)

a) Finishes, materials, and fittings

Key design considerations for quality of life

Universal Design issues: In line with the Universal Design Homes principles, fittings should be easy to understand, use and manage. This covers a wide spectrum of considerations in relation to furniture and fittings, signage, and technology.

Materials and finishes are also critical, for instance, bold floor patterns and dark lines can confuse people with dementia, (Passini et al., 1998) while Zamora (2008) found texture and colour can be associated with falls on pathways. Finishes and materials can also provide important orientation and way-finding cues to reduce the risk of getting lost and disoriented (Fleming & Bennett, 2017).

Stakeholder feedback: Interviews stated that infection control and safe fittings can be institutional, but that ideally fittings should make it seem like someone's home. Overall, the setting design should be homely, with wallpaper, dressers with ornaments, and similar.

High Priority infection control issues

This review did not identify many studies that examined fittings, furniture or finishes in relation to COVID-19 in RLTC. This may be attributable to the growing evidence that contact transmission is generally lower risk (CDC, 2021). It is worth mentioning one study by Coutureau et al. (2021) that showed how copper surfaces (i.e., finishes to door handles, handrails, and grab bars) had no protective effect in preventing the transmission of COVID-19. This led the authors of this research report to question the degree of virus spread through surface contamination, which in turn puts the value of surface decontamination in question in the context of COVID-19.

In relation to surfaces, and finishes, Allen and Marr (2020) state that frequent cleaning and disinfection of surfaces may also help reduce secondary airborne transmission. They highlight the role of technological controls such as ultraviolet C or UV-C (short-wavelength ultraviolet) germicidal irradiation, which has been shown to be highly effective in deactivating COVID-19 virus replication (Biasin et al., 2021). UV-C germicidal irradiation uses ultraviolet light/energy to kill organisms (i.e., virus, bacteria, and fungi), and often takes the form of ultraviolet light sources. UV-C fixtures can kill airborne pathogens and be installed in such a way that prevents direct UV exposure to people.

They also refer to the cleaning of surfaces using vacuums with high-efficiency particulate air (HEPA) filters (see Section 4.3.7 (b) for more detail on HEPA filters).

Key recommendations to inform design guidelines – Finishes, Materials and Fittings

Finishes, materials, and fittings should strike a balance between being homely, being accessible, and taking infection control into consideration.

New research that emphasises the role of airborne transmission means that surface transmission is now deemed lower risk for COVID-19. Therefore, there is less focus on finishes, materials, and fittings as part of the COVID-19 infection control strategy.

b) Orientation and wayfinding features

Key design considerations for quality of life

Universal Design issues: Marshall (2001) argues that good wayfinding signage between key spaces and multiple cues (e.g., sight, smell, sound) have positive effects on residents. However, a balance must be struck e.g., large arrows on the floor along with the large format signage using words like 'toilet' (Namazi and Johnson, 1991) may conflict with the creation of a homelike environment.

High Priority infection control issues

Wang (2021) recommends that a signage system focusing on infection control should be included in design for the setting.

Key recommendations to inform design guidelines – Orientation and Wayfinding

A signage system focusing on infection control should be included in the design of the setting. This may include signage indicating a one-way circulation system; signage indicating distinct zones (i.e., infection risk zones, zones for visitors and residents); signage to point out sanitation stations and promote good hygiene. Depending on circumstances, signage may be temporary (i.e., during a pandemic emergency), or permanent (i.e., signage related to hand sanitation stations).

4.3.7. Internal environment

a) Comfortable and balanced room temperatures (not too hot, not too cold):

Key design considerations for quality of life

Comfortable temperatures have been shown to be associated with quality of life among residents. Specifically, high temperature in the resident's bedroom was associated with lower quality of life (Garre-Olmo, López-Pousa et al. 2012 as cited in Fleming & Bennett 2017).

Stakeholder feedback: Family members believed that residents should be able to modulate room temperature according to their own preferences, but many residents are unable to open windows without assistance. In terms of temperature, some family members thought that it was too cold with the window open during window visits.

Some interviewees stated that there were health issues associated with dry, over-heated environments, and that nursing homes tend to be too warm. These conditions can exacerbate health issues with dehydrated people in dry over-heated environments where the virus can linger.

High Priority infection control issues

A large amount of data and studies have found that the spread of pathogens and viruses could be facilitated in cold and dry conditions. The indoor relative humidity between 50 and 60% is suggested to reduce the risk of spreading airborne-infectious diseases.

Key recommendations to inform design guidelines – Temperature and Humidity

The virus (SARS-CoV-2) that causes COVID-19, survives longer in cold and excessively dry conditions. These conditions may be problematic in terms of encouraging the spread of COVID-19; therefore, it is advisable to have warm indoor temperatures (e.g., 18-21 degrees Celsius, depending on the room and the occupant's preference/health), and an indoor relative humidity at approximately 50%. (See also below for findings and recommendations around ventilation).

b) Healthful and comfortable ventilation via natural and mechanical ventilation (including appropriate internal relative humidity)

Key design considerations for quality of life

Rapid Review Findings: Ventilation and air quality are critical to the wellbeing of older people in nursing homes (Mendes et al., 2015). Openable windows should be used to provide natural ventilation and fresh air can improve well-being. The overall building and the design of the windows should be carefully considered where high noise level, pollution or dust levels may be a potential problem (Department of Health (UK), 2015).

Universal Design issues: Various design standards, such as ISO 21542 Building construction – Accessibility and usability of the built environment (ISO, 2021), or the recently published EN 17210 - Accessibility and usability of the built environment - Functional requirements, consider immunological system functions as a key component of human abilities. For instance, EN 17210 recommends design considerations that facilitate accessibility for persons with immunological system impairments and limitations, for example the use of materials, finishes and plants that do not cause allergic reactions, or the avoidance of dust-collecting surfaces and furnishings in public areas (CEN-CENELEC, 2021).

In this context, EN 17210 recommends ventilation systems that filter out respiratory allergens in order to better support persons with immunological system impairments and limitations.

Stakeholder feedback: Family members reported that rooms with many openable windows were very useful during COVID-19.

Interviewees also stated the importance of good ventilation and believed that air quality may sometimes be poor in RLTC settings. However, many thought that achieving good natural ventilation can be tricky due to the fact that many older people don't want windows open because they dislike draughts or that windows are often kept closed for energy efficiency. There was a concern that there is very little policy or regulation of ventilation in care settings.

An interview with an architect with expertise in the area of building ventilation has set out the following prevention strategy for Covid-19 Risks in Nursing Homes:

- Purge ventilation at intervals to disperse the virus with regular 'airing out' of rooms. Purge ventilation is the introduction of intermittent, rapid ventilation into a habitable room, usually via an openable window or external door, to maintain or restore a pleasant living environment.
- Improve background ventilation to dilute the virus and keep air moving (windows slightly open, doors open for cross ventilation etc.). Wall vents must not be blocked, and hit/miss vents kept open.
- Increase humidity with humidifiers and/or bowls of water for evaporation.
- Monitor poor ventilation and low humidity with CO2 (carbon dioxide monitors) to keep CO2 below 600ppm. CO2 build up is a proxy for inadequate ventilation.
- Use air purification fans to 'clean' the air. Proprietary units are available.

The steering committee also noted that good ventilation is often a problem in many buildings, but COVID-19 has highlighted the importance of ventilation in terms of removing or diluting virus laden air from internal and external spaces. However, they also recognised that ventilation and the balancing of air quality and comfort can be difficult in settings with older people.

High Priority infection control issues

Rapid Review Findings: Allen and Marr (2020), point to emerging evidence indicating that COVID-19 can be transmitted via inhalation of aerosols. To combat this, they recommend:

- increasing outdoor air ventilation rates above current minimums
- using high-efficiency filtration for recirculated air (MERV 13 or greater)
- verifying that sensitive areas, such as bathrooms and rooms where infected patients are cared for in hospitals and senior homes, are negatively pressurized relative to adjacent areas
- managing air flow direction and speed to prevent spread of aerosols across occupants

Wang (2021) identifies the following important ventilation issues:

- Natural ventilation helps reduce the concentration of virus in the air and has been strongly suggested in the guidelines for infection control. Associated with functional declines, older adults spend a lot of hours inside their rooms, and thus, natural ventilation in their rooms is of great significance to reduce the risk of infection. The availability of indoor natural ventilation is generally influenced by factors associated with site planning and building design, such as site location, building location, building orientation, window location and size.
- Air-conditioning systems need to be integrated with zoning and provide an orderly design of air flows by zone to ensure negative air pressures in contaminated zones. Due to the high concentration of airborne virus emitted from contaminated zones, it is recommended to have relatively high ceilings in these zones and set the return vent near the ceilings and as far away as possible from the supply vent.
- Window air conditioners may be considered to ensure dedicated air-conditioning.
- For single rooms, where it is not possible to achieve sufficient natural ventilation through windows, mechanical ventilation for outdoor air exchange should be applied and necessary equipment at the room level and spaces for installation were recommended.

Key recommendations to inform design guidelines – Ventilation and Air Quality

Increase natural ventilation to dilute the virus in the air and help extract it outside.

Perform purge ventilation at regular intervals to air out the rooms by opening windows and doors to replace any stale air in the room with fresh air. Ensure windows are capable of being easily operated and fully opened when required (while considering safety and security).

Monitor poor ventilation and low humidity with CO2 (carbon dioxide monitors) to keep CO2 below 600ppm (parts per million).

Use portable air filters in the bedrooms of residents with COVID-19, (portable high-efficiency particulate air (HEPA) filters) to help remove aerosols from the air. Many domestic type filters are equipped with H13 HEPA filters capable of filtering 99.97% of particles at a clean air delivery rate of 467 m3 per hour on the highest fan speed setting.

See - https://www.hse.gov.uk/coronavirus/equipment-and-machinery/air-conditioning-and-ventilation/improve-mechanical-ventilation.htm

c) High levels of natural light (to support circadian rhythms) while balancing excessive glare or overheating

Key design considerations for quality of life

High levels of natural light in nursing homes have been shown to improve sleep during the night and reduce daytime sleeping (Alessi, Martin et al., 2005 as cited in Fleming & Bennett 2017). Higher overall light levels are associated with improved function (Brush et al., 2002). Increasing illumination to typical day time levels has been shown to regulate circadian rhythms and improve sleep patterns for people with dementia (Satlin et al., 1992, Mishima et al., 1994). There is some evidence suggesting that sunlight in patient rooms can reduce depression (Fleming & Bennett, 2017). Reduce glare from light fittings, direct view above bed and sitting area by carefully placing light fittings and concealing light sources (Department of Health (UK), 2015).

Stakeholder feedback: Interviewees expressed concern about the lack of natural light in many settings and stated how maintaining good levels of ambient light is very important for people with dementia.

High Priority infection control issues

No specific findings from literature regarding natural light and infection control.

d) A well-balanced acoustic environment that supports hearing, eliminates excessive noise, and provides a relaxing environment especially at night

Key design considerations for quality of life

High noise levels in living rooms have been associated with low levels of social interaction (Garre-Olmo, López-Pousa et al., 2012 as cited in Fleming & Bennett, 2017). High levels of noise are associated with increased wandering and aggressive and disruptive behaviour (Cohen-Mansfield and Werner, 1995) and agitation (Joose, 2012 as cited in Fleming & Bennett, 2017). However, on the other hand, moderate levels of sound appear to be associated with more engaged behaviours (Cohen-Mansfield et al., 2015), giving rise to the idea that an excessively quiet environment may not be comfortable (Fleming & Bennett, 2017).

Universal Design issues: Good acoustics are a key element when designing for people with hearing impairments and people with dementia. The basic principle for creating good acoustic environments is to increase sound - help a person hear important things; and at the same time reduce noise. It is not only about blocking things out, but also about ensuring that a person can hear pleasant and stimulating sounds.

Stakeholder feedback: Some family members complained about poor noise insulation within settings. Others mentioned that the call bell can be very heavily relied on, and this causes noise issues.

Interviewees stated that settings would have populations with significant numbers of people with hearing impairment and therefore acoustics are important.
Finally, some felt that a lack of noise insulation undermined privacy due to people having to raise their voice to communicate with people with hearing impairments.

High Priority infection control issues

Research shows that raised voices can accelerate aerosol dispersal so acoustic environments that do not necessitate loud voices for communication may be beneficial.

Key recommendations to inform design guidelines – Natural Light and Acoustic Environment

Create spaces that reflect a peaceful environment away from sources of external noise and closer to sources of pleasant sounds such as bird life in a garden. This is of particular importance for a bedroom where sleep disturbance may already be an issue.

Careful use of technology such as a silent staff call system to reduce noise within a setting.

4.3.8. Technology: Hygiene, Assistive, Therapeutic Technology, and ICT

a) Hygiene technology

High priority infection control issues

Section 4.3.8 (a) outlined the role of ultraviolet C or UV-C (short-wavelength ultraviolet) germicidal irradiation to deactivate the COVID-19 virus (Biasin et al., 2021). UV-C equipment can be fitted within air conditioning units or as freestanding units at ceiling level or the upper part of a room (Upper Room-Ultraviolet Germicidal Irradiation or UVGI) to kill airborne pathogens.

Automated room disinfection systems may also be effective as a COVID-19 related infection measure when used to decontaminate surfaces. Studies by Franke et al. (2021) have shown the effectiveness of automated room disinfection systems using ozone and an integrated nebulizer (for controlled increase of room humidity) against surrogates for SARS-CoV-2, therefore pointing to potential solutions for COVID-19 related disinfection.

However, as pointed out at the start of Section 4.3.8 (a), there is growing evidence that contact transmission is generally lower risk, and therefore automated room surface disinfection systems, and automatic door handle sanitisers, may not be priority issues in the context of COVID-19.

High priority infection control issues

No research found in rapid review related to infection control in this area.

b) Assistive technology to support independence, health, comfort, and safety

Key design considerations for quality of life

Adjustable ambient lighting represents a therapeutic technology that can alleviate an austere and overtly clinical setting by changing the lighting colour temperature to create either a calming, restful, or stimulating lighting environment, as required (Grey et al., 2018).

Universal Design issues: Assistive technology is often used in terms of accessibility and safety in care settings. For instance, the main application of technology for people with dementia relates to safety, including assistive technology; ambient assisted living, and telecare or telehealth (Grey et al., 2015). The use of monitoring equipment (Andrews, 2013), and technology for the prevention and monitoring of falls (Cameron Ian et al., 2012) is also important.

While the benefit of automatic sensor taps, automatic opening doors, and other 'no touch' features may be marginal in terms of COVID-19 infection control, these features have benefits in terms of accessibility for a wide range of setting users.

Stakeholder feedback: Interviewees believed that assistive technology should become more prevalent in RLTC settings.

High Priority infection control issues

No research found in rapid review related to infection control in this area.

c) Healthcare related ICT for contact/appointments with external health and social care professionals

Key design considerations for quality of life

Healthcare technology is always evolving, and new innovations such as robotic telepresence (Becevic et al., 2015) where remote controlled mobile robotic devices allow doctors to interact with other staff or patients from a distance. While this may be beneficial and effective in terms of delivering medical care, it is worth considering how such technology will be perceived by a person with dementia (Grey et al., 2018).

Stakeholder feedback: Interviewees believed that telemedicine has been more prevalent due to COVID-19 but warned that it cannot replace person-to-person interaction.

High Priority infection control issues

Technology can help residents access healthcare that may not be otherwise available during isolation or quarantine. Davidson and Szanton (2020), welcome advances made in the context of COVID-19 around the expansion of telehealth and telemedicine services to nursing homes, which may provide opportunities to improve care in the longer term.

Grindle (2021) points to the use of technology, in particular platforms supporting the audio and video assessment of patients that reduce the risk to the patient or the wider nursing community by reducing foot fall into the setting. Referring to her own experience, she describes a video consulting platform called 'Attend Anywhere' that has provided positive outcomes for patients, while also providing cost efficacy.

d) ICT to communicate with families and friends:

Key design considerations for quality of life

Technology can assist in social networking that enables residents to communicate with friends and family who are not able to visit on a regular basis (Department of Health (UK), 2015).

Stakeholder feedback: Some family members note that phone coverage could be very poor in some settings, but that video calls during restrictions were very important. Many interviewees stated that Broadband/Wi-Fi throughout facilities is very important. They also noted the importance of tablets for video calls.

High Priority infection control issues

The secondary impacts of COVID-19 included isolation, loneliness, stress, and lack of engagement with family and friends. In this regard, information, and communications technology (ICT) has been promoted as a way to mitigate at least some of these impacts.

There was no mention in literature reviewed about infection transmission from shared devices, further reviews on this issue may be required.

Due to the potential high levels of disability, frailty, or cognitive decline in many RLTC settings, technology must be designed so it can be accessed, understood, and used to the greatest extent possible by all RLTC residents. In this regard, Ickert et al. (2020) propose that technology should:

- Enable residents to independently make connections. For example, a wall-mounted tablet screen where residents could simply press an image of their family member to make a video call.
- Be appropriately modified for their unique needs. For example, large screens with easy-to-use visuals, loud-speakers or audio that connects directly to hearing aids.
- Provide robust technological infrastructure to support ongoing virtual connections. In older buildings, this may include things like wall-mounted Wi-Fi extenders.

Key recommendations to inform design guidelines – Technology and ICT

Ensure building structure and materials facilitate Wi-Fi technologies, to allow for contact with family and friends via. ICT, and access to telehealth such as remote consultations with GP, etc.

While Wi-Fi may be suitable for many technologies, the provision of CAT 6 ethernet cables will ensure a stronger and more reliable connection, which may be vital during important health assessments.

For resident bedrooms consider the following technologies: infrared fall detection devices; pull-cord emergency call unit; movement sensors or bed pressure mats that turn lights on automatically at night if a person needs to use the bathroom or move about.

Consider how the use of automatic sensor taps, automatic opening doors, and other ‘no touch’ features can help with infection control and accessibility.

Careful use of technology such as silent staff call systems to reduce noise within settings.

Ensure technology is accessible and usable by all residents including those with physical, sensory, or cognitive disabilities.

Where possible, encourage residents to use their own technologies (such as smart phones and tablets) that they are familiar with.

e) Therapeutic technology such as sensory rooms etc.

Key design considerations for quality of life

The 'Snoezelen', room (Baker et al., 1997) concept provides an example of how technology can provide therapeutic spaces in RLTC. A number of studies have shown multi-sensory stimulation to be an appropriate and effective therapy for people with dementia (Baker et al., 2001; Maseda et al., 2014 as cited in Grey et al., 2018).

Stakeholder feedback: Interviewees stated that sensory rooms and sensory technology can be very useful, especially for people with dementia. However, spaces like sensory rooms are often repurposed due to lack of space.

High Priority infection control issues

Eghtesadi (2020) argues that technology, such as augmented reality (AR), could prove beneficial to RLTC residents during isolation. While a virtual reality (VR) headset could provide the patient with immersive experiences, ranging from connecting with loved ones in a common simulated space to visiting environments not otherwise accessible (e.g., a music concert or a nature expedition that could include interaction with virtual animals). According to Eghtesadi, the provision of these technology-dependent amenities and social contacts for older patients isolated in RLTC facilities, could potentially decrease their sense of loneliness, and increase their self-perceived health, similarly to the benefits seen with physically going outdoors.

Key recommendations to inform design guidelines – Therapeutic Technology

Ensure building structure and materials facilitate Wi-Fi technologies
Provide headphones to allow residents the choice to listen to music or the radio.

Consider augmented reality (AR) and virtual reality (VR) technologies for therapeutic activities or entertainment, where appropriate and desired by the resident; supported by staff training/competency.

4.4. Conclusion

This chapter has detailed how the design of settings and the balance between quality of life and infection control is impacted by many aspects of the physical environment across all spatial scales, from the location, access, and overall site layout, down to building layout, building components or specific applications of technology. Having completed this analysis, one of the main findings that emerges from this research is the convergence between design for quality of life and design for good COVID-19 related infection control. From location down to technology, there are examples across all key spatial scales that illustrate how good planning and design can not only support the wellbeing of residents but also improve infection control and overall resilience.

5. Conclusion and next steps

5.1. Conclusion

This report builds on previous work by Anderson et al. (2020) to argue for alternative and holistic approaches that balance infection control and quality of life at multiple spatial scales in existing settings. It emphasises the importance of Universal Design, while also acknowledging the role of dementia-inclusive design.

Throughout the research, the set of quality of life domains described in Section 2. 4 have been used to underpin the research and provide indicators for an environment where residents have the support and freedom to live full and meaningful lives.

In terms of COVID-19 and infection control, the research highlights how respiratory viruses are transmitted through contact, droplets, and airborne routes and that infection control strategies should take account of all transmission routes. However, there is now good evidence that COVID-19 related contact transmission is generally lower risk and that the principal modes of transmission involve respiratory droplets and airborne transmission.

Furthermore, research shows that risk of transmission is reduced outdoors due to air movement removing and diluting COVID-19 virus particles, and environmental conditions such as sunlight damaging the virus particles and decreasing transmission.

Taking on board the quality of life domains mentioned above and the principal modes of COVID-19 transmission and related infection control measures, this report highlights the role of the built environment and the convergence between design for improved quality of life, and design for good infection control across the key themes and spatial scales. Some of the priority issues are set out below

- **Overarching design characteristics, features, or approaches:** The value of small-scale living models composed of small self-contained household units (typically less than 12 residents) for both quality of life and infection control. For these models, the size of the overall setting is not always important, it is the smaller and more homelike nature of the household and the provision of household specific staff that are the primary concerns. For existing settings, adopting this model may involve breaking up or subdividing the overall setting into smaller units or households.

  These small-scale household models are promoted in many Irish policies and guidelines (see Section 2.6) and are recommended for dementia related settings, along with domestic and home-like buildings with single rooms that are big enough for personal belongings. The 'COVID-19 Nursing Homes Expert Panel Examination of Measures to 2021' also identified the role of smaller household models in providing more diverse and resilient settings into the future.

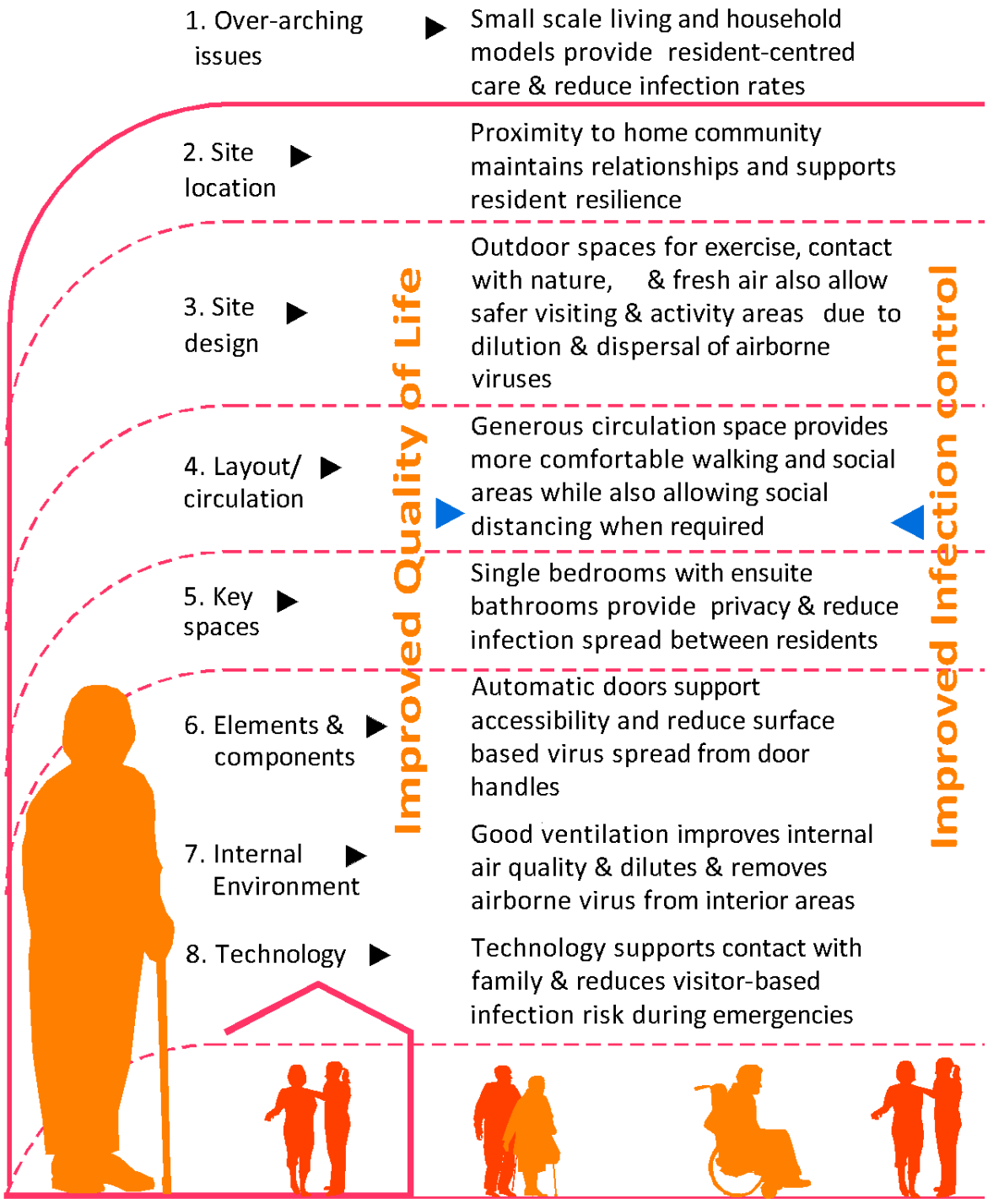
- **Site Location:** Proximity to a person's home community and the embedding of RLTC settings into the local community has been a concern for many ageing advocates and

stakeholders. Furthermore, the maintenance of connections and relationships was highlighted as important for both quality of life and resilience in older people.

Finally, The Housing Options for our Ageing Population (See section 2.6) which provides a policy framework to support Ireland's ageing population, includes Action 4.12, which focuses on the issuing of planning guidelines for the development of RLTC settings to ensure that they are appropriately designed and located in areas with access to transport and amenities.

- **Site design:** The design of RLTC sites should provide safe, high quality outdoor spaces and help to create a positive interface with the local community**.**
- **Overall layout:** Beyond the sub-division of settings into smaller 'households', circulation strategies and space use should be used to reduce occupant density in a space and to create comfortable walking areas that can support social distancing when required.
- **Key spaces:** The provision of single rooms appears to provide the best outcomes in terms of resident quality of life and COVID-19 infection control. Beyond bedrooms, the provision of easily accessed, centrally located, high quality outdoor space has emerged as an important component of resilience and quality of life. Access to outdoor space, in the form of balconies or roof gardens, for bedrooms on upper levels is critical for quality of life, particularly during a pandemic when a resident might be isolating.
- **Elements and systems:** Due to the declining importance of COVID-19's surface transmission, the use of infection resistant surfaces or surface decontamination systems may not be a priority in RLTC settings. However, devices such as automated doors may reduce disease transmission via door handles, but possibly more importantly, enhance accessibility within the setting.
- **Internal environment:** Ventilation has emerged as a major concern due to the airborne nature of the virus, therefore optimising ventilation to admit fresh air, providing air filtration and cleaning, and improving and monitoring air quality are key, both for quality of life and infection control.
- **Technology:** Using technology to enhance residents' communication with their family, to avail of telemedicine such as video consultations, or engage with therapeutic activities from listening to music to using augmented reality or virtual reality devices.

These measures support infection control and greatly improve quality of life by supporting: a more homelike and human-scale setting; maintaining connections and relationships, providing privacy and dignity; enabling greater access to the outdoors and nature, improving air quality, and providing greater inclusion through appropriate technology.



The report also identifies many gaps in the research literature regarding both design for quality of life and infection control. While there is significant material regarding ventilation and HVAC, and a limited number of studies regarding internal layout, materials etc., there is a dearth of research examining the macro issues (i.e., location and access), meso issues (local neighbourhood), and site design issues (where we found only one significant study in this area) and micro issues.

5.2. Next steps

This Key Research Findings report has been developed to identify major current issues related to the built environment and its role in creating a balance between quality of life and COVID-19 infection control in existing RLTC settings. Furthermore, the report has been used to underpin a set of high-level evidence-based Universal Design guidelines for adaptation and retro-fit design of existing RLTC settings in Ireland (see below).

5.2.1. Guidelines

This report has been used to select the high priority key design considerations and infection control issues as part of a new high-level guidance document titled: **Universal Design Guidelines for improving quality of life and enhancing COVID-19 infection control in existing residential care settings for older people.** These new guidelines can be found at: https://universaldesign.ie/built-environment/residential-long-term-care-settings-for-older-people-/

5.2.2. Future research

Due to the scope of this project this document only reports on key issues in relation to existing settings. Additional research, stakeholder engagement, and collaboration are required to further examine RLTC design for quality of life, Universal Design, infection control and overall resilience in both new-build and existing settings as follows:

- macro issues: more in-depth research regarding setting location and access.
- meso issues: investigate the impact of local neighbourhood and site design issues.
- micro issues: more detailed examination at a building level including further research into ventilation and overall air quality issues.

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Appendix A - Stakeholder Groups and related activities

Stakeholder Group (Organisation)	Individual (s)	Stakeholder Engagement Activity
Nursing Homes Ireland	Tadgh Daly (CEO)* *Represented by Deirdre Shanagher	Steering Committee Semi-structured interview Stakeholder Workshop Rapid Review
O'Connell Mahon Architects	Sean Mahon Victoria Mannion	Steering Committee Semi-structured interview Stakeholder Workshop Rapid Review
HSE – Capital and Estates	Derek Dockrell	Steering Committee Semi-structured interview Stakeholder Workshop Rapid Review
Age Action	Patrick Connolly* *Represented by Celine Clarke	Steering Committee Semi-structured interview Stakeholder Workshop Rapid Review
Sage Advocacy	Mervyn Taylor	Steering Committee Semi-structured interview Stakeholder Workshop Rapid Review
Age-Friendly Ireland	Catherine McGuigan Eimear Coveney	Steering Committee Semi-structured interview Stakeholder Workshop Rapid Review
AIGNA	Catherine Buckley	Steering Committee Semi-structured interview Stakeholder Workshop
IADNAM	Deirdre Lang	Steering Committee Semi-structured interview Stakeholder Workshop
	Mary Flanagan	Steering Committee Stakeholder Workshop
TLC – City West	Elaine Keane	Steering Committee Semi-Structured Interview Stakeholder Workshop Rapid Review
Tallaght University Hospital	Sean Kennelly	Steering Committee Semi-Structured Interview Stakeholder Workshop Rapid Review
TLC	Staff (3-5) (Person in charge and resident-facing staff, e.g., activities coordinator, physio, OT, nurse)	Questionnaires
	Residents (3-5)	Questionnaires
	Family Members (3-5)	Questionnaires
	Other	On-site building analysis

Sallypark	Staff Members (3-5) Person in charge and resident-facing staff, e.g., activities coordinator, physio, OT, nurse)	Questionnaires
	Residents (3-5)	Questionnaires
	Family Members (3-5)	Questionnaires
	Other	On-site building analysis
Millbrook	Staff Members (3-5) Person in charge and resident-facing staff, e.g., activities coordinator, physio, OT, nurse)	Questionnaires
	Residents (3-5)	Questionnaires
	Family Members (3-5)	Questionnaires
	Other	On-site building analysis

Appendix B: Semi-structured interview template

Semi-Structured Questions - 7 questions; 1 hr interview conducted online.

Part A: Reflecting on the COVID-19 pandemic, and its particular impact on LTC facilities in Ireland

1. Reflecting on the quality-of-life issues (as previously circulated), do you think that a) this list is comprehensive enough for RLTC? and b) that these quality-of-life issues are all relevant to the built environment in one way or another?

2. How would you rate the typical built environment of RLTC settings in Ireland? How well do you think the design and layout of these settings support the quality of life of older people in residential care in Ireland, in terms of:
    a. Location and Integration with the Community
    b. Available Facilities within the Setting (i.e., types of services and spaces provided within the settings)
    c. Overall Design of the Built Environment
3. Bearing in mind the key spatial scales that comprise RLTC settings (refer to flyer), how well has the built environment served residents, their families, and staff in these settings during COVID-19?

4. What are the key built-environment related infection control issues for RLTC settings in terms of reducing the following:
    a. primary infection impacts (i.e. reducing infection risk and transmission)
    b. whether the built environment infection control issues exacerbate secondary impacts, such as loneliness, isolation, reduced movement and physical activity, etc.

Part B: The role of design in improving QoL and addressing infection control measures in LTC facilities

5. In the context of existing RLTC settings, what are the key built environment elements and adaptation/retrofit issues that need to be considered in relation to achieving a balance between quality of life and infection control? Are there any good adaptation/retrofit examples in Ireland or internationally that come to mind?

6. Regarding new-build RLTC settings, what are the key built environment elements that need to be considered in relation to achieving a balance between quality of life and infection control? Are there any good examples of new-build settings in Ireland or internationally that you would like to mention?

Part C: The Way Forward – Key policy and practice Issues that need to be considered

7. How can the current and future policy landscape in this area help support good RLTC design in Ireland that balances quality of life with infection control?

Appendix C: Semi-structured interviewees

Interviewed Organisations:

- Centre for Excellence in Universal Design at the National Disability Authority
- Capital and Estates, Health Services Executive
- Irish Association of Directors of Nursing and Midwifery (IADNAM)
- Sage Advocacy
- Nursing Homes Ireland
- TLC Nursing Homes
- Age Friendly Ireland
- Age Action Ireland
- Tallaght University Hospital
- All Ireland Gerontological Nurses Association (AIGNA)
- HIQA
- Care Champions
- Infection Control and Ventilation advocate
- Department of Health

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National Disability Authority

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