Long term care and the coronavirus pandemic: a new role for environmental design in a changing context

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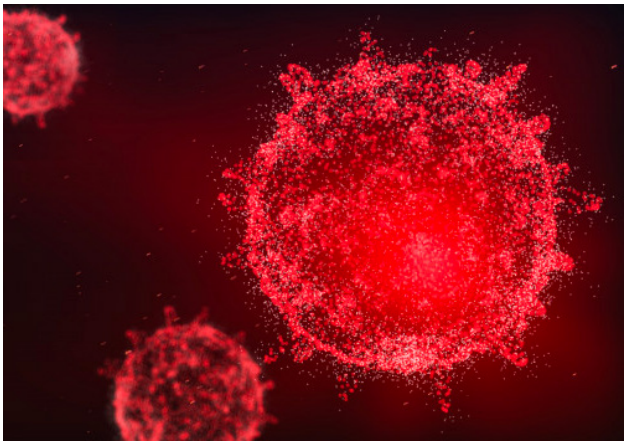
Introduction

It took more than three decades of championing the principles of environmental design for dementia and developing the research evidence base on how the physical environment can support the independence and wellbeing of people with dementia to reach a point where cognitively supportive design should be the default requirement for new and existing long term residential care facilities. It has taken a fraction of that time for an emerging coronavirus to displace concern with residents' lived experience in favour of strict transmission and infection control measures, forcing a return to more institutionalised and medicalised environments and care practices.

We urgently need to consider the impact of COVID-19 on the aspirations of environmental design for long term care and to re-evaluate its future role in this changed context.

As the coronavirus pandemic has developed globally, recommended infection control precautions (ICPs) based on the best evidence available have been swiftly implemented by long term care providers anxious to protect those that they care for. These ICPs are designed to minimise transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus which causes COVID-19. In some cases, this is achieved by restricting residents' opportunities for physical activity and social interaction (e.g. remaining



in and receiving meals/care only in their bedroom, no outside visitor policies). Evidence is starting to emerge that these measures have had ongoing detrimental effects on the overall health and wellbeing of residents.

> Restrictions imposed to minimise the risk of harm to residents resulting from COVID-19 are suspected to have accelerated physical and cognitive declines and/or indirectly contributed to the deaths of some residents.

In this chapter, we argue that environmental designers, care providers and care managers all urgently need to respond to the changing context of long term care precipitated by COVID-19, and that the challenge in future will be to design settings which can be dynamically adapted to respond to novel infectious agents and aid infection control whilst also providing the levels of stimulus, activity and interaction necessary to allow residents to live well.

In the remainder of this chapter we briefly set out and consider the aims of pre-COVID guiding principles for environmental design of long-term residential environments which, we would argue, must remain a core part of future long term care design solutions. We then consider pre-COVID infection risk and control in long term care, drawing attention to infectious agents which have historically presented risks to residents' health and to the measures which have routinely been deployed to manage them. Following on from that, we explain why COVID-19 potentially presents additional challenges for infection control and why supporting infection control must also be a core element in future environmental designs. Finally, we summarise the direct and indirect impacts of COVID-19 on long term care residents, drawing on evidence of the latter to support our contention that in future the role of environmental design will be to take into account and balance competing needs for infection control and maximising residents 'effective capacities' to live well.

PRE-COVID ENVIRONMENTAL DESIGN CONSIDERATIONS

The primary aim of environmental design prior to the coronavirus pandemic was the creation or reconfiguration of long-term care facilities to provide settings which support and enable residents to live their best possible lives. It has long been suggested that environmental design can improve the quality of life for residents with dementia and there is increasing support in the academic literature for a variety of different environmental design interventions which deliver beneficial outcomes for residents, even if significant gaps remain in the evidence base (1, 2).

In 1998 Mary Marshall set out a series of key design principles for residential environments which would support and enable people living with dementia. Her principles are expressed in terms of outcomes, both for people living with dementia and for care staff working in residential environments, but actioned via evidence-based environmental design [3]. Drawing on a 1987 statement of principles [4], Fleming, Forbes and Bennett [5] set out ten design principles for such settings, broadly consistent with Marshall's in terms of impact, but described in terms of environmental characteristics. Table 1 sets out both sets of environmental design principles.

Principles set out by Marshall [3]	Principles set out by Fleming et al. [5]
Design of care environments should:	Care environments for people living with dementia should:
• Compensate for disability	• Be safe and secure
• Maximise independence	• Be small
• Enhance self-esteem and confidence	• Be simple and provide good 'visual access'
• Demonstrate care for staff	• Reduce unwanted stimulation
• Be orientating and understandable	• Highlight helpful stimuli
• Reinforce personal identity	• Provide for planned wandering
• Welcome relatives and the local community	• Be familiar
• Allow for the control of stimuli	• Provide a variety of spaces with opportunities for both privacy and community
	• Provide links to the community
	• Be domestic and homelike

The principles set out by Marshall and Fleming et al. have proven hugely influential in environmental design and each formed the basis of tools for auditing or assessing care environments. However, more recently Barrett, Sharma [1] have made the case for a dementia 'holistic evidence and design' (HEAD) model. The HEAD model takes its lead from Marshall's earlier concern with compensating for the reduced capabilities of the person living with dementia, incorporating three top-down design principles: manageable cognitive load; clear sequencing; and appropriate level of stimulation.

These principles, when applied to personal spaces and to shared spaces / wayfinding respectively, link to a series of evidence-based practical design parameters which speak to Fleming et al.'s ten principles. Barrett et al. argue that the 'effective capacity' of a person to live well with dementia at any point in time is the product of that individual's current capacity plus gains derived from enabling physical and technical environments, supportive caring and social environments, and pharmacological treatments.

This approach to thinking about maximising effective capacity helps to highlight the need to consider how the social and environmental measures taken to reduce transmission of COVID-19 and control infection impact negatively on other broad matters of health and wellbeing for residents with dementia

and the frontline staff who care for them and how they impact on care based models in which social activity and interaction are critical components, e.g. 'Eden Alternative' and 'Gentle Care'.

CONTROLLING INFECTIONS IN LONG TERM CARE

Long term care residents have always been vulnerable to a range of bacterial, viral, fungal, and other infectious agents with risks of infection often exacerbated by age, functional impairment, multimorbidities and use of indwelling devices. Urinary tract, respiratory and skin and soft tissue infections are common in long term care [7]. Facilities may also experience outbreaks of communicable diseases including influenza [8] and gastroenteritis caused by norovirus [9]. A review of reports by Utsumi, Makimoto [10] identified 37 infectious agents associated with 206 outbreaks. Many infections can present serious risks to health but respiratory infections in particular can have high hospitalisation and fatality rates for long term care residents, for which reason long term care providers routinely employ a range of measures to reduce the risks of infection.

The risks of transmission of infectious agents are minimised through the implementation of a combination of standard infection control precautions (SICPs) and transmission-based precautions (TBPs). SICPs are the basic infection prevention and control measures necessary to reduce the risk of transmission of infectious agents from both recognised and unrecognised sources such as bodily fluids or secretions, equipment and other items in the care environment [11]. Examples of SICPs include: good hand hygiene; covering the mouth and nose whilst coughing, sneezing or blowing the nose; using personal protective equipment (PPE), such as aprons, face masks and gloves; regular cleaning / decontamination of the care environment and equipment within it; segregating people known or suspected to be infected, e.g. in negative pressure isolation facilities or single rooms; and restricting or suspending visits to those in care. TBPs are additional more targeted precautions which are applied when a person is known or suspected to be infected by a specific infectious agent and SICPs alone are insufficient to prevent cross transmission [11]. TBPs are categorised by identified transmission types: contact, droplet, or airborne, and a combination of these types of precautions should be implemented based on the route(s) of transmission of the specific infectious agent.

WHAT IS DIFFERENT ABOUT COVID-19?

Characteristics of the SARS-CoV-2 virus and, following infection, of COVID-19 mean that it presents a greater risk to long term care facilities and residents than more familiar infections.

Petersen, Koopmans [12] compare transmissibility, hospitalisation, and mortality rates for SARS-CoV-2 with other epidemic coronaviruses and with 1918 and 2009 pandemic influenza viruses. They find that SARS-CoV-2 has the highest average transmissibility, longest incubation period and shortest interval between

symptom onset and maximum infectivity of the viruses compared, making outbreaks difficult to contain. The high proportion of people who experience only mild symptoms makes COVID-19 outbreaks more difficult to detect. Petersen et al. note that a 'key difference between SARS-CoV-2 and pandemic influenza is the age distribution of patients who are severely ill'. SARS-CoV-2 infections are experienced as severe mainly by older people, whereas influenza is experienced by people across all age groups. Whilst similarly small proportions of individuals with 2009 pandemic influenza and SARS-CoV-2 infections require hospitalisation, Petersen et al. estimate that more than five times as many people with COVID-19 than with influenza in 2009 require intensive care (1 in 16,000 compared to 1 in 104,000).

There are significant issues around the collection and reporting of data available for comparative analyses, but evidence suggests that COVID-19 represents a more significant threat to life than infections such as influenza, particularly for older people. Based on weekly counted deaths in the USA from COVID-19 in April 2020 compared to mean counted deaths from influenza for the same week (normally the peak week for counted deaths from influenza) from 2013–2020, Faust and del Rio [13] estimate that on average there were more than 20 times as many deaths from COVID-19 in the weeks examined than from influenza in those weeks in other years. WHO [14] suggest that COVID-19 infection fatality ratios (IFR), estimates of the proportion of deaths among all infected individuals, are hard to accurately determine due to issues including attributing and/or reporting deaths from COVID-19. However, Faust and del Rio [13] estimate a case fatality rate (the proportion of deaths in confirmed cases of COVID-19) of 0.5% based on age-adjusted data from the Diamond Princess cruise ship outbreak which, they suggest, would still be five times greater than the case fatality rate normally suggested for adult seasonal influenza.

In addition, airborne transmission may play a greater part in the spread of SARS-CoV-2 than in the transmission of other infectious agents such as influenza. This may be a characteristic of the virus that long term care environments are not currently well equipped to deal with as most other viral disease risks in care settings can be controlled through contact and droplet TBPs. Transmission was initially thought to be primarily via respiratory droplets expelled when a person infected by SARS-CoV-2 coughs or by contact with surfaces where infected respiratory droplets came to rest, and recommended infection prevention and control measures are primarily based on a combination of SICPs and TBPs for droplet and surface transmission, e.g. maintaining minimum physical distances between individuals, regularly disinfecting surfaces, and maintaining good hand hygiene. Airborne transmission, in which pathogens in smaller 'microdroplets' can remain in the air for long periods and be transmitted over greater distances, was thought to be confined to settings and procedures which generate aerosols (WHO 2020). However, the potential for airborne transmission has been a concern within the research community since the start of the COVID-19 pandemic. Research prior to the pandemic found that respiratory droplets could evaporate to form smaller 'droplet nuclei', and that indoor humidity and air turbulence influence droplet nuclei size and dispersion [15]. In a commentary published on 6 July 2020 and signed by 239 other scientists, Morawska and Milton [16] set out the research evidence for the potential for airborne spread of COVID-19 and advocated the use of preventive measures to mitigate this.

Lack of scientific agreement over the risks posed by infected aerosol-like particles, a resulting lack guidance on possible precautions, and/or inability to address these risks throughout the care setting, but especially in 'high traffic', less well ventilated areas, could potentially have contributed to the rapid spread of COVID-19 in some settings.

THE IMPACT OF COVID-19 IN LONG-TERM CARE

A grim picture has emerged of the direct impact of COVID-19 in long term care.

Disproportionate numbers of deaths due to COVID-19 have been recorded in long term care facilities in many countries around the world, although there is significant international variation. Comas-Herrera, Zalakaín [17] report that, as of 26 June 2020, some countries (Hong Kong, Jordan and Malta) had reported no COVID-19 infections or deaths in care homes whereas in others (Canada, Slovenia) more than 80% of the country's COVID-19 deaths were care home residents. Based on data from 26 countries excluding those who reported no deaths, Comas-Herrera et al. found that on average 47% of people who died from COVID-19 in those countries were care home residents. They also found that, for 18 countries for which these data were available, the proportion of all care home residents who have died and whose deaths are known to be linked to COVID-19 ranges from 0.04% (New Zealand) to 6.1% (Spain), with these proportions strongly correlated with the severity of the coronavirus pandemic nationally as expressed in COVID-19 deaths per million population.

The indirect impact of COVID-19 in long term care is less clear. Evidence appears to be emerging that responses to COVID-19 which were designed to minimise disease transmission and control infection, such as prohibiting visitors to care facilities in all but life and death situations and encouraging residents to remain in their rooms, may have accelerated the physical and cognitive declines and/or indirectly contributed to the deaths of some residents. In the UK, figures from the Office for National Statistics [18] suggest that in England and Wales for a three-month period from 15 March 2020, only two-thirds of the nearly 30,000 'excess deaths' over the same period in 2019 could be directly attributed to COVID-19. It has been suggested that COVID-19 may be indirectly responsible for many of the remaining excess deaths, including via adverse consequences resulting from 'the impact of changes to normal routines for vulnerable care home residents following lockdown' [19].

Such adverse consequences include but are not limited to: cognitive decline due to lack of stimulation or meaningful programming; physical deconditioning due to lack of ability to exercise; loneliness.

Whilst research is not yet available to substantiate the extent of resident decline following measures taken to improve infection control in long term care during the pandemic, there is significant anecdotal evidence. For example, in oral evidence given on 12 August 2020 to the All-Party Parliamentary Group on Coronavirus, an informal cross-party group of UK Members of Parliament and the House of Lords convened to learn lessons from the UK's handling of the coronavirus pandemic, Helen Wildbore, Director of the Relatives and Residents Association, commenting on the effects of visitor restrictions and isolation within care homes said (at p7):

'We hear daily from our helpline callers about how their relatives in care are deteriorating, not just their mental health but also the knock on impact on the physical health of older people losing weight, losing speech, losing their memory, no longer being able to recognise their family members and there's one relative put it to us that they're losing the will to live,…' [20]

A NEW ROLE FOR ENVIRONMENTAL DESIGN

In this chapter we have set out why COVID-19 presents new challenges to long term care providers who already routinely safeguard residents against infectious agents. A range of explanations have been offered for levels of COVID-19 transmission to and within long term care settings, for example focusing on issues of low-paid staff, poor training around infection control, the availability or adequacy of personal protective equipment (PPE) for staff, and/or the risks of disease transmission posed by those visiting residents in professional (e.g. physicians, nurses) or personal capacities and research is underway in many countries to examine these and other potential causes of disease transmission.

Beyond the obvious impact of sharing rooms with multiple other residents, little has been said about how environmental design may have directly or indirectly influenced the impact of COVID-19 in long term care to date or how it might contribute to reducing negative impacts in future.

This research gap urgently needs to be addressed. We need to learn all possible lessons and better understand how environmental design can contribute positively to improved infection control.

We have also suggested that whilst reducing the risk of COVID-19 outbreaks, infection control measures which isolate residents of long term care from external visitors and restrict opportunities for meaningful activities and/or social interaction within facilities may have serious negative outcomes for some residents.

The principles of environmental design for dementia set out in the 1980s and 90s remain revolutionary and relevant. They have been greatly instrumental in shaping the physical, technical, caring and social environments of long-term care in ways which contribute positively to resident wellbeing and quality of life and to staff job satisfaction. These principles should not and *must not* be abandoned or made totally subservient to the needs of infection control as long terms care providers seek to establish a 'new normal'

Since the start of the pandemic, in order to protect the most vulnerable residents, long term care providers have been forced to make sometimes deep moral and ethical decisions to implement measures which have costs to all residents in terms of loss of opportunities for activity and interaction and to balance such decisions against the negative health and well-being outcomes which flow from such measures. Much research effort is currently focused on the development of an effective vaccine against COVID-19, but we cannot know if or when such a vaccine will be found and what its efficacy might prove to be for different age groups / health contexts. In its absence, long term care providers will be faced repeatedly with having to weigh the risks of COVID-19 infection and transmission to staff and residents against the risks to those same groups of losing, even temporarily, access to activities or practices which support and enable residents to have the best possible lived experience of care.

The new role of environmental design needs to be maximising the benefits to all by supporting providers in maintaining a balance between these competing risks. Architects, designers, academics, long term care providers, residents and their supporters in the wider community need to come together and take up the challenge of developing evidence-based modifications and designing long term care facilities which:

- reduce the risk of COVID-19 disease transmission and/or improve infection control for residents, staff and visitors – where possible without excessive negative impact on other areas of resident wellbeing
- incorporate dementia design principles to support and enable long-term care residents to maintain existing capabilities and enjoy their best possible lived experience of care; and
- are capable of being adapted to rapidly changing levels of threat from coronavirus and/or other future emerging infectious agents in ways which, in every configuration, maintain the opportunities for stimulation through activity and social interaction that are critical to residents' wellbeing and quality of life

To succeed we will need to work together, recognising different expertise and valuing every contribution. We must rise to this challenge: until we do every day that passes more lives will be lost and more loved ones will become lost to us. The stakes could not be higher.

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