Covid-19 In Long-Term Care: The Built Environment Impact on Infection Control

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Abstract

Purpose: The purpose of this article is to review available literature for evidence-based impact of the Built Environment upon the prevention and management of COVID-19 with a view to emphasizing lessons learned for future infection control of pandemics.
Background: This is urgently needed given the devastation brought upon Long-Term Care residents world-wide. Long-term care (LTC) facilities face a battle to protect their residents. Previous studies of Infection Control design issues have focused generally on Fomites: that is, contaminated objects and surfaces. As COVID-19 has been shown to be largely spread through the air this article will broaden the focus to include Engineering Controls that effect this type of transmission.
Method: A literature search was conducted using Keywords such as Long-Term Care Facilities, Built Environment, COVID-19, Infection Control, Nursing Homes.
Results: Results were sorted using an Engineering Controls Pyramid developed by the Author to stratify approaches to LTC infrastructure. Basically, six elements were supported: Ventilation, Spatial Separation, Physical Barriers, Hand Hygiene stations, Resident Room Zones, and Private Rooms.
Implications: Conclusions were that the Built Environment has a major impact on Infection Control that can be deleterious or beneficial. Substantial changes need to be made to protect the very vulnerable LTC population from future pandemics and infectious diseases.

The COVID-19 Pandemic has stimulated extensive and ongoing research into how best to protect nursing home residents from infectious diseases. Many factors are being studied. This article will focus specifically on the impact of the Built Environment in preventing and managing infectious diseases such as COVID. The Occupation Safety and Health Administration (OSHA) has provided Infection control specialists with a pyramid depiction of the three lines of defense against work hazards as shown in figure 1. (Nilfisk, 2017)

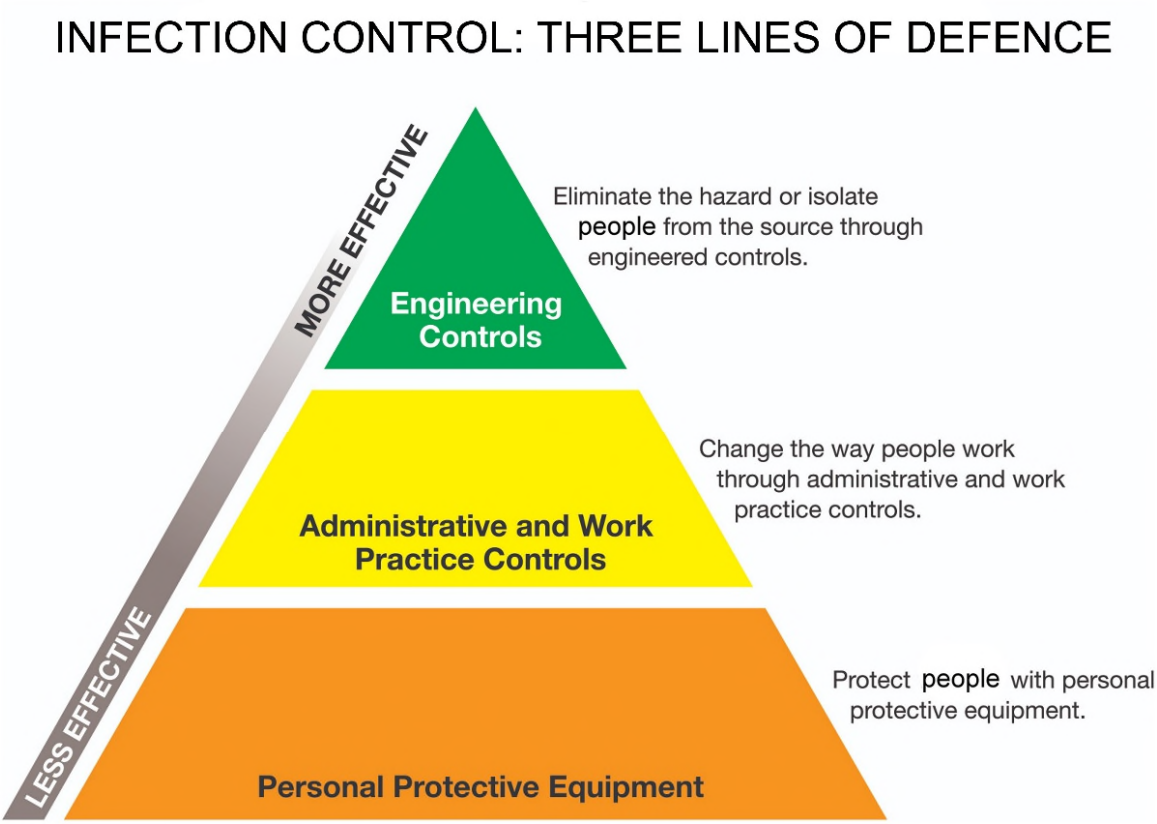

Figure 1: OSHA Three Lines of Defense" (reference Nilfisk, 2017)

This is useful in understanding how the Built Environment fits into an overall defense against infectious diseases. The first and most effective line of defense is Engineering Controls which are placed at the apex. OSHA defines engineering controls as physical changes to the workplace that eliminate or reduce the hazard in question. The second line is Administrative and Work Practice Controls such as processes and procedures performed by staffing**.** At the bottom of the pyramid is personal protective equipment (PPE), which includes protective wear like glasses, gloves, masks, and respirators. Engineering Controls are most effective because they are built into the facility infrastructure and do not rely primarily on individuals to implement them correctly.

This author has developed a hierarchy of controls depicted in the Engineering Controls Pyramid (Figure 2: Benbow, 2020) which is a useful frame to sort and organize evidence-based research for this discussion. At this point the actual ranking of the six elements of the pyramid is based on the authors experience, judgement, literature review and a survey of LTC homes (Benbow, 2020, in press). This selection and arrangement of factors is preliminary and more targeted research is needed to support the choice and prioritizing of elements. Understanding the impact of the built environment will help us develop tactics and strategies for immediate and future action. These research findings will be of assistance to Government

funding and guideline development, LTC facility owners, Boards, developers, architects, engineers, designers and development consultants.

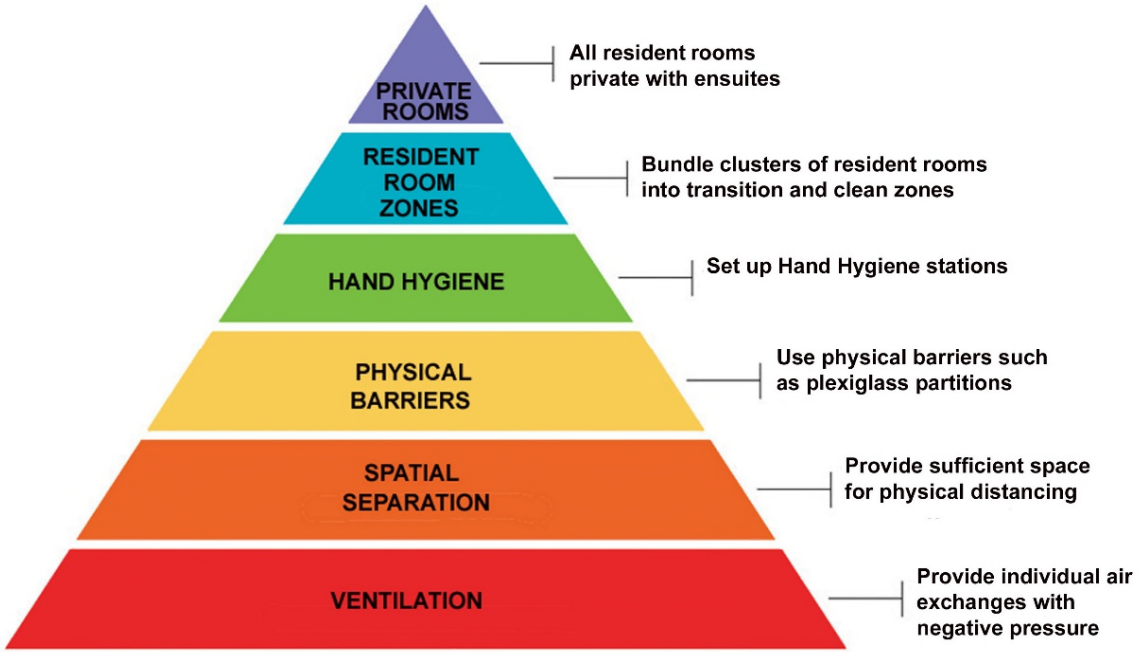

Figure 2: Engineering Controls Pyramid for Infection Prevention in Long-term care (Benbow, 2020)

Method

Several Literature Review articles were analyzed for specific Built Environment references. Some studies were found related to room occupancy, individual tenancy, congregate living, crowding and facility density as well as some environmental concerns related to ventilation and sanitation (Dykgraaf, Konetzka). A British comprehensive report reviewing scientific evidence of long-term care experiences during the Pandemic noted that most studies were descriptive and observational without randomized controlled trials. Most research focused on responses such as staffing, testing, cohorting and isolation. The report noted evidence gaps: the authors found few studies that examined the environment or building impacts (Byrd et al., 2021).

A further literature search was conducted using Keywords such as Long-Term Care Facilities, Nursing Home Characteristics, Built Environment, COVID-19, Infection Control, Nursing Homes, Cohorting, Shared Accommodation, Non-pharmacological measures, Engineering Controls. In addition, the six elements of the Engineering Controls Pyramid were targeted. General Research data bases were searched included PubMed, Google Scholar, Elsevier's Novel Coronavirus Information Center, Academia, Research Gate and other on-line COVID-

19 journal article collections. Articles were selected based on research that included specifically targeting factors of the Built Environment that impacted COVID-19. Research articles were then sorted and organized into the six elements of the Engineering Controls Pyramid.

A number of recent studies were found that looked at how LTC facilities coped with COVID-19 within their physical environment. As research is expanding rapidly with multiple new relevant publications appearing weekly, these selections are not intended to be exhaustive but rather representative of elements of the Built Environment that need to be further explored and researched.
Overall, general agreement is emerging that certain elements of the built environment are a major factor in the high incidence of COVID-19 in LTC. For analysis and organization these studies have been sorted into the six elements of the Engineering Controls Pyramid with the most frequently addressed elements at the apex.

Ventilation

As the Pandemic progressed, the first element, Ventilation, at the base of the Engineering Controls Pyramid, was found to be a critical infrastructure foundation. Ventilation is the process of providing outdoor air to a space. It controls how quickly stale room air is removed and replaced. The main principle is to replace contaminated air with clean air. During an epidemic such as COVID-19 air should not be recirculated as far as is practically possible. Enhanced ventilation can be a key element in limiting the spread of COVID-19 (Morawska et al., 2020).

The American Society of Heating, Refrigeration, and Air Conditioning Engineers acknowledges the potential airborne hazard indoors. Personalized ventilation systems are recommended to provide local exhaust source control and/or supply 100% outdoor, highly filtered, or UV-disinfected air. Negative Pressure is advocated for resident rooms containing contagious residents as this minimizes leakage from the room to other parts of the facility. The number of Air Exchanges an hour impacts airborne-contaminant dilution and removal. Older facilities often have only 2 air exchanges an hour which means it takes 138 minutes to remove 99% of potential infectious aerosol particles. Four exchanges per hour for resident rooms in LTC facilities shortens this to 69 minutes. Six exchanges reduce this to 46 minutes which is the recommendation for highly infectious diseases in acute care patient rooms Duration is an important factor in a human host acquiring airborne viruses so these figures are important in determining staff susceptibility to infection when they enter a contagious person’s room to provide care services or cleaning (ASHRAE, 2020).

A Dutch nursing home attributed their outbreak to aerosol transmission due to inadequate ventilation. They found that 81% of residents and 50% of staff from 1 of 7 wards were diagnosed with COVID-19; whereas all tests of the 106 staff and 95 residents in the 6 other wards were negative. The virus was detected in dust present on the mesh of the living room air conditioners and in filters from ventilation cabinets in the Outbreak ward. The other wards were ventilated with outside air (de Man et al., 2021).

For existing facilities, Lynch and Goring have provided practical steps to improve air flow and negative pressure in LTC resident rooms. Detailed information is given on installing supplemental exhaust ventilation through bathroom or kitchenette exhaust fans with the aid of an HVAC contractor (Lynch and Goring, 2020).

A more sophisticated negative pressure 13 bed isolation unit was created in a skilled nursing facility in Pennsylvania to control COVID-19. Modifications were made to HVAC with additional vents, blowers, anteroom and HEPA filters. No facility-acquired transmission of COVID-19 was subsequently identified between residents in the isolation space (Miller et al., 2021).

Where it is difficult to enhance ventilation, portable HEPA filters can be utilized to clean the air. The effectiveness of these filters and temporary plastic anterooms to mitigate the spread of COVID-19 was evaluated in a hospital setting in the US. This study concluded that the optimal location for the portable air purifier was near the resident's bed, and when combined with a temporary anteroom could prevent 99% of the aerosols from migrating into the adjacent corridor. The plastic barrier alone could prevent up to 80% of the particles from spreading to adjacent spaces (Mousavi et al., 2020). Ideal ventilation is separate outside air intake with exhaust direct to outdoors for each room.

Spatial Separation: Especially for Group Activities

The second element of the Engineering Controls Pyramid, Spatial Separation and Physical Distancing is necessary because the virus loves crowds, especially indoors where COVID-19 droplets can so easily spread by coughs, sneezes, singing, talking and just breathing. This has meant reducing close contact between residents by curtailing group activities, large group dining, and when necessary, isolating residents temporarily in their rooms or Households. Side effects of these limitations on social contacts are well documented such as loneliness, boredom and depression. Efforts need to be made to mitigate the impact of Spatial Separation.

An early study found that dining rooms and activity rooms were among the most crowded areas in long-term care settings. In the dining room residents were more evenly spaced as a result of furniture placement, while in the activity room residents were more likely to be crowded together. To reduce crowding where adding space is not feasible, the authors suggest altering time of day and uses of the space: for example, with two sittings for dining and smaller groups in activity areas. Infection is noted as a potentially negative consequence of crowding (Algase et al., 2011).

Many facilities applied these concepts during the pandemic with dining and group programs adjusted to allow sufficient spatial separation between participating residents. In China it was recommended that group meals should be suspended where possible, and residents should take their meals in their rooms. Alternatively, small-group meals could be arranged with appropriate social distancing applied in dining rooms (Wang, 2021).

If group activities take place, the number of residents should be limited to the smallest feasible groups, and residents spaced as far from one another as possible, in the space

available, maintaining a minimum distance of 1 meter between them, with 2 meters preferably. Group activities should wherever possible be restricted to a single unit (Household) and floor (Chu et al., 2020). To enable Spatial Separation, common areas such as lounges and multi-purpose activity rooms need to be enlarged. One suggestion is for two or three Households or Zones to share enlarged adjacent Activity space on rotation with disinfection cleaning between uses.

An easily accessible well sized Outdoor area can help alleviate crowding and extend living space. Infection is much less likely outdoors due in part to bright sunlight with ultraviolet light, and the movement of air diluting and dispersing droplets and aerosols (Wang, 2021). Ample opportunity for outdoor access with adequate Spatial Separation is highly recommended for Long-Term Care residents.

Physical Barriers: Actual Separations

The third element of the Engineering Controls Pyramid, Physical Barriers, proved useful for setting up barricades between humans and the COVID-19 virus. There are interesting innovations for LTC Visitors cropping up around the world. In the South East of England a group of care facilities placed “Summer Homes” in their gardens for visits. The small one room buildings are divided in two so that residents enter into one side while visitors are shown into the other side through a separate entrance. There is a full clear screen dividing the space and separating the parties. A Dutch version used a similar design for temporary buildings initially used as small flex-hotels set up for concerts. Canadian facilities have used modified shipping containers to create two distinct spaces separated by a plexiglass screen (Benbow, 2020).

Physical barriers could also be used in dining areas, e.g., a plexiglass screen across the middle of dining tables which could be reduced from 4 residents per table to just two during outbreaks. Engineering separations such as retractable screens could be utilized. Caution is now recommended in terms of partial plexiglass separations in rooms in that ventilation needs to be considered so as not to create dead air areas where aerosols can accumulate (Parker-Pope, 2021).
Engineering Control adaptations are recommended to minimize the risks of cross-contamination involving COVID-19. Soiled and clean laundry should be transported separately in double plastic bags, dealt with in distinct areas of the laundry room, and routed with separate entrance and exit. Routes for servicing, waste collection and deliveries should be separated from residential use as much as possible (Munanga, 2020).

Hand Hygiene Stations

A British literature review of existing evidence regarding the fourth element of the Engineering Controls Pyramid, Hand Hygiene (HH), concluded that access to HH facilities is a critical factor in reducing infection rates and containing pandemic spreads such as COVID-19 in care homes (Koshkouel, et al., 2020).

A German study found that nursing staff's compliance with HH procedures was dependent upon the equipment's immediate availability in the work area, and role modeling. Staff reported that they were impeded in following HH protocols when hand rub facilities were not available in their work areas, corridors, common rooms and residents' room (Hammerschmidt & Manser, 2019).

A recent American exploratory study identified the importance of visibility in addition to the availability of HH stations to improve their use. The study found a higher average frequency of HH activity in the Unit that had superior visibility of HH stations. The frequency of HH did not just depend on the ratio of HH stations to beds, but was definitely impacted by visibility. This study reinforced the importance of the strategic placement of the HH Stations to maximize visibility and accessibility (Cai et al., 2021).
A study of COVID-19 Infection Prevention and Control Adherence in Georgia found that facilities with low prevalence of the disease had significantly higher compliance with HH protocols. HH stations were more likely to be available at nursing stations, medical carts, in hallways (every 2-3 rooms minimum), immediately outside COVID or observation units, and in resident rooms. Not having a bathroom and sink within resident rooms created obstacles for adequate HH (Telford et al., 2021). Hand Hygiene stations need to be visible and readily available.

Resident Room Zones: Small, Separate, Self-Contained Units

The fifth element of the Engineering Controls Pyramid "Resident Room Zones" has received attention, particularly in studies related to establishing Quarantine and Isolation cohorts.
A 2020 Taiwanese study recommends 'enhanced traffic control bundling' *(*eTCB) for the protection of Long-Term Care facility residents and staff in outbreaks such as the current Pandemic of COVID-19. Taiwan developed eTCB protocols based on lessons learned from SARS 2003. It is based on grouping residents by establishing Quarantine, transition and Clean Zones or Cohorts in LTC Facilities (Yen, et al., 2020).
An analysis of the guidelines used in China supports this approach. "Environments in a senior-living facility should be categorized into contaminated, semi-clean, and clean zones for infection-control purposes…These zones should be physically separated by engineering controls. A dedicated air-conditioning system should be set up for each zone" (Wang, 2021).

The Household Model, small self-contained units of residents in private rooms, is ideal for a zoning approach. Household Models allow COVID-19 outbreaks to be managed in Zones without affecting adjacent or collocated units (Anderson et al.). Studies have shown that Small House Nursing Homes have fewer COVID-19 cases and deaths. All rates were significantly lower for the Household Model homes in a US study comparing 219 Green House/Small House Nursing Homes with 392 traditional nursing homes that were geographically proximate. Both the median incidence rate and median mortality rate were 0 per 100 COVID positive residents for the Household model facilities (Zimmerman et al., 2021).
The US Department of Veterans Affairs has followed a Small House model since 2011 with 13 of its 134 nursing homes now following the Household model. Christina Noel, a V.A. spokeswoman, reported in 2020 that in the Household model homes only a single veteran has

tested positive for COVID-19 (Margolies, 2020). When you design with zones you can isolate the virus and quarantine residents appropriately.

Private Rooms: Reduce and Eliminate Shared Accommodation

The Canadian experience has been particularly informative for the sixth element at the apex of the Engineering Controls Pyramid, Private Rooms. A study of all LTC homes in Ontario, explained that the odds of a COVID-19 outbreak were associated with older design standards that have ward-style or shared accommodation and centralized common spaces in which all residents interact. Recommended are newer design standards intended to promote infection prevention and control with larger and more private rooms as well as smaller resident groupings or units that are less crowded and have self-contained common areas. This should be a focus of infection control efforts and future policy (Stall et al., 2020).

A retrospective study looking at crowding as a factor in 618 nursing homes in Ontario from March 29 to May 20, 2020, found that LTC residents in shared rooms were more likely to contract COVID-19. Rooms were classified as "low" or "high" based on number of residents. Rooms with 2 - 4 residents were considered "high". Incidence of COVID-19 infection in "high" crowded homes was 9.7% vs. 4.5% in "low" crowding homes, while mortality was 2.7% vs. 1.3% respectively. Homes with a median "high" crowding index had double the risk of infection and dying. A conversion of all 4-bed rooms to 2-bed rooms would have prevented 19.1% of cases and 18.1% of deaths. It is estimated that converting all shared occupancy rooms to single occupancy rooms would have saved 1641 infections (31.4%) and 437 deaths (30.1%) during the study time period. (Brown et al., 2021)

An in-depth longitudinal spatial analysis of an Ontario LTC home found that the high degree of interconnectedness within the home and multi-bedded rooms explained the COVID-19 high attack rate. 51.6 percent of residents resided in 3 or 4 bed rooms. More than 50% of residents had a definite C0VID-19 exposure from a roommate prior to developing the disease themselves. The outbreak resulted in 85.8% of residents with confirmed COVID-19 and 21.6% mortality. (Kain et al., 2021)

In her review of COVID-19 outbreaks in care homes in British Columbia, the Seniors Advocate found that the likelihood of having a larger outbreak was 24% greater in sites with shared rooms than those with only private rooms. She recommends eliminating shared rooms (BC Seniors Advocate, 2021).
A study comparing the two Canadian Provinces, British Columbia and Ontario, found that in Ontario 63% of residents were in shared rooms while only 24% shared accommodation in BC. Rates of COVID-19 infection in LTC facilities as of Sept. 10, 2020 were 7.6% in Ontario vs. 1.7% in BC. Mortality was 2.3% vs. 0.6% respectively. (Liu et al., 2020)

An Australian cross-sectional study confirmed the Canadian experience. It looked at underlying factors contributing to nursing homes' risk of COVIC-19. The study found that factors enhancing transmission are related to individuals' behaviours and the built environment: transmission through communal facilities, shared living spaces and bathrooms and difficulty physically distancing. Large outbreaks and high mortality were more likely in

homes with shared rooms (Ibrahim et al., 2021). The virus flourishes in a crowd, especially indoors. Three is generally considered a crowd. In resident rooms, two is a crowd.

Discussion

Pertinent research during the COVID-19 pandemic has explored the impact of Engineering Control elements of the Built Environment. Focusing on these infrastructure factors is a first step in redesigning and upgrading Long-Term Care facilities to mitigate risks to residents of infectious diseases and prepare facilities for the next pandemic. To be clear, the Built Environment is just one aspect of infection control in LTC facilities, and hence improved design of infection control elements of the Built Environment is just one piece of the overall approach to protecting Nursing Home residents.

Research has shown that ventilation is critical in limiting aerosol spread. In existing facilities it needs to be assessed by appropriate Engineers in order to ascertain effectiveness. If centralized HVAC systems are used then filtration needs to be adequate, up to current code and properly maintained. Upgrading existing systems to increase air exchanges is possible with enhanced exhaust through washrooms, and opening windows. In addition, portable air purifiers can be added to dining, lounge and activity areas. In new facilities resident and staff utilized rooms need to be individually ventilated with direct outside air, and exhaust air not recirculated. Systems need to be flexible so that the number of air exchanges per hour can be adjusted to suit the risk. Guidelines and examples are available.

Crowding has been found to be a factor in COVID-19 distribution in LTC facilities. Spatial Separation, particularly for group Activities needs to be reviewed and modified to ensure adequate area for social distancing. In existing facilities group activities need to be downsized to suit social distancing. In new facilities amenity areas should to be increased to suit the number of anticipated users, particularly dining, activity and lounge spaces. Consideration could be given to sharing Activity Rooms between Households. A particular problem uncovered in facility surveys is the need for increased physical space to allow suitable social distancing in staff break rooms (Benbow, 2022). Outdoor areas need to be directly accessible with suitable seating and space.

Physical Barriers can be utilized to support separation of residents from potential contact with contagious diseases. Innovations in visitor rooms have proven successful in mitigating visitor to resident contagion. Safe visitor rooms need to be included in new construction and renovations and should be flexible so that appropriate separation is possible when needed. Physical separation should be designed for routing soiled laundry, waste disposal, deliveries and other staff related services to reduce contact with residents. Temporary barriers can be designed to separate residents in rooms such as dining, though caution is recommended to consider impact on aerosol spread.

Hand Hygiene stations are a critical element in reducing infection rates. They should be planned for in renovation and new construction of Long-term care facilities. Research has shown that they need to be easily accessible and visible, particularly at entrances to residents'

rooms and amenities. Portable stations can be made available in existing facilities and permanent ones designed into new LTC Homes.

Facilities designed with zoning in mind facilitate cohorting for isolating and quarantining infected residents from those not symptomatic, exposed or testing positive. The Household Model of small self-contained units has proven effective during the Pandemic in cohorting. Research has found that large groupings of residents have higher infection rates. In existing facilities zoning can be utilized by floor or temporarily screening areas into subdivisions and repurposing rooms. In new facilities zoning should be designed and built following the Household model.

Most significantly, crowding in resident rooms is a serious breach in infection control. Shared accommodation has a much higher risk factor for contracting infectious disease. Private rooms with their own ensuite should be the norm. In one study 50% of those infected were exposed to the virus by a roommate. There is little that can be done to effectively separate residents in shared accommodation so it needs to be phased out. In existing facilities infected residents need to be quickly separated from room mates and moved to private accommodation or cohorted to quarantine areas. New facilities should be designed with all private rooms.

Limitations

It is early days in terms of research on the impact of the LTC facility infrastructure upon COVID-19. More time and more rigorous studies are needed to better understand the shortcomings and potential of the Built Environment. It is difficult to design randomized double-blind studies in the midst of a life and death Pandemic. Most relevant studies regarding the Built Environment and COVID-19 so far have had to be retrospective and observational. These have been useful for lessons learned and practical implications but need to be followed up and further verified and fine-tuned. The Built Environment elements most supported by good research so far are Ventilation as recommended by professional organizations such as ASHRAE; and the anathema of Shared Accommodation as found by several retrospective Canadian studies (Brown et al., 2021, Kain et al., 2021, and Liu et al., 2020); and Zoning as in the Household Model (Yen et al, 2020, Zimmerman et al, 2021). The importance of Hand Hygiene Stations is well supported by observation and descriptive studies. As data improves with more rigorous research all of the elements of the Engineering Controls Pyramid can be substantiated and updated in terms of priorities. More rigorous research will better inform recommended design guidelines for updating existing facilities and building new ones.

Conclusion

An international virtual townhall concluded that the LTC built environment was a major determinant of COVID-19 outbreak occurrence and severity. It recommended investing in smaller, more home-like LTC units to reduce the risk of infections. The extent of outbreaks, the report indicated, was related to older building standards, crowding, shared rooms and washrooms (Heckman et al., 2021). Although COVID-19 is thought to be predominantly air-born and effected in particular by Ventilation and proximity, many of these Built Environment

elements apply to infections spread by other forms of transmission such as fomite contact: for example, with crowding, physical contact and poor hand sanitation.

Not to be overlooked is the tremendous impact that an Outbreak imposes on the Quality of Life of LTC facility residents. We do not want to build in infrastructure that diminishes the homelike environment and activities that seniors crave. Isolation, boredom and lack of contact with families and friends is devastating and exacerbates loneliness and depression. Infection Control Specialists designing Engineering Controls need to take this into account and balance infection control with Quality of Life. Isolation practices in particular need to be mitigated by design decisions such as enlarged resident rooms and cohorting in small groups such as Households where small group activities can continue with appropriate social distancing. Such a model offers more psychosocial benefits, more direct staff support, more appropriately distanced socialization and family visits and overall quality of life benefits (Power and Carson, 2021).

The Engineering Controls Pyramid is a hierarchy of Controls that stratifies approaches to improve infection prevention, protection and management through physical design. Engineering and Architectural elements are a first line of defence. More rigorous research of these elements is needed and will help to quantify and qualify these factors. It is imperative that Long-Term Care facility infrastructure improvements be included as part of the three lines of defense needed in post COVID-19 efforts to address Infection Control in LTC facilities.

Implications for Practice:

Knowing the impact of the Built Environment in terms of the six Engineering Control elements is a first step in redesigning and upgrading Long-Term Care facilities. This is a first line of defense to mitigate risks to residents of infectious diseases and prepare facilities for the next pandemic.

- Ventilation: Ventilation needs to be assessed by every LTC facility, weaknesses determined and addressed. If centralized HVAC systems are used then filtration needs to be upgraded and maintained. Wherever possible rooms need to be individually ventilated with direct outside air, and exhaust air not recirculated. Systems need to be flexible so that the number of air exchanges per hour can be adjusted to suit the risk.

- Spatial Separation: Group Activities need to be reviewed and scheduled so as to ensure sufficient space for physical distancing for anticipated numbers of users. Amenity areas need to be increased, particularly dining, activity and lounge spaces to allow for this. And outdoor use needs to be facilitated with direct access, and adequate space.

- Physical Barriers: Physical Barriers need to be devised to support separation of residents from potential contact with infectious vectors. Visitor rooms need to be designed as part of new construction and renovations so that they are flexible enough to provide appropriate separation when needed. Routes for laundry, waste disposal, deliveries and other staff related services need to be separate where possible from

resident use. Temporary barriers need to be designed and available where needed to decrease resident contact in rooms such as dining.

- Hand Hygiene Stations: Hand Hygiene stations should be included in design for both renovating and new construction of Long-term care facilities. They need to be plentiful and visible, particularly at access points to resident's individual rooms and group amenities.

- Zoning: Facilities need to be designed with zoning in mind so that infectious residents and staff can be isolated, guaranteed and separated from the uninfected. The Household Model has proven effective in facilitating such cohorting. Large centralized groupings of resident living areas need to be broken up and subdivided into small homelike self-sufficient units.

- Private Resident Rooms: And most significantly, crowding in resident rooms needs to end: shared accommodation must be reduced and replaced with all private rooms for residents. And washrooms must not be shared. Lives are at stake. 4, 3, and 2 bed wards should be shut down. Private rooms ought to be the standard, and not the premium.

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