STAY SAFE MN

Heating, Ventilation, and Air Conditioning (HVAC) and Fan Considerations for Long-term Care during COVID-19

Long-term care facility ventilation systems can work with or against infection prevention efforts in long-term care facilities. This document provides guidance to long-term care facilities on the proper control of air flow and ventilation (for example, increasing air dilution, filtration, and directional air flows) to prevent transmission of COVID-19 (and other respiratory viruses) among residents and staff.

Initial considerations

Consider an analysis of heating, ventilation, and air conditioning (HVAC) structure and options at the facility with a multi-disciplinary team – containing at least the following positions:

- Mechanical and electrical engineers
- Infection prevention
- Environmental services director
- Administrator
- Director of nursing (or nurse)

Sometimes, simple changes to HVAC systems can be quite effective in reducing COVID-19 transmission risk. If changes need to be made when certain things happen (for example, a COVID-19 case is diagnosed in the facility), make sure these are written into the facility emergency preparedness plan and/or infection prevention plans. This guidance provides optional adjustments and practices for facilities to consider to prevent infection and respond to COVID-19 cases. These recommendations are highly dependent on the needs and capabilities of each facility, so a facility's multi-disciplinary team should conduct a thorough analysis to determine which of the below means can and should be implemented in the facility.

Easiest tactics to consider

- Close doors from rooms or units that contain resident(s) with confirmed COVID-19 or symptoms consistent with COVID-19.
- Rooms should have "negative pressure" when possible, meaning outside air (e.g., from the hallway) flows into the room and not the other way around. Bathroom doors should be left open to achieve this result, as bathrooms typically have return air vents and exhaust fans. A 'tissue paper test' is a simple way to make sure the return vent and/or exhaust fan is 'drawing' air, but an engineer can conduct a more definitive assessment of airflow and ability to generate negative pressure.
- Consider opening operable windows (when weather and safety/security will allow). However, depending on wind direction, wind strength, and HVAC system structure, open windows could result in air being pushed into hallways. Accordingly, consultation with a system engineer is recommended. The use of fans can help ensure airflow in the intended direction.
    - Double-hung windows – if a room has more than one window, consider opening the upper sash on one and lower the other to facilitate airflow through the room. If there is one double-hung window, consider partially opening both the lower and upper sashes.
    - Single-hung windows can still generate fresh air flow and movement in the room which can be helpful in diluting any viral particles.
- Consider a box fan mounted in the window to draw air outside. Any window fans/units must be properly secured and safe for the room's occupants.
- Review the HVAC system with your mechanical engineer and contractor partners.
    - Understand what zone control potential exists in the building(s) and any ability to selectively change ventilation to certain areas.
    - Understand where the system supply and exhausts are, and whether exhausts and returns from bathrooms and other locations can recirculate in the facility, potentially spreading infection. Also, ensure that exhaust is at least 10 feed from any building air intakes.
    - Verify that systems are operating as designed. Verify airflows in rooms meet original design intent. If your staff does not have the capability to perform their own measurements, this may require the services of a qualified testing and balance contractor.
    - Evaluate whether the system needs updating to at least meet current minimum code standards.
- Hot weather and portable fan use.
- Air conditioning should be adjusted whenever possible to avoid the need for fans.
- Fans may be difficult to decontaminate if used in rooms with COVID-19 positive patients.
- Unless properly used, fans may blow air directly from one resident to another increasing, rather than decreasing infection risk.

- Box fans should be discouraged in the rooms of COVID-19 infected patients, unless used to draw and exhaust air to the outside through a window.
- Small personal fans directed at the patient's head disrupt the airflow less and may be appropriate if the heat is intolerable. Facilities can also consider other heat control measures, including closing blinds to reduce heat from direct sunlight, cool cloths to the resident's forehead, etc.

Intermediate tactics to consider

- Consider increasing air changes and air removal methods in rooms assigned to infected residents.
- Consider increasing exhaust in individual resident bathrooms.
  - Evaluate if localized rebalancing can increase exhaust airflow. This would also be conducive to creating negative pressurization.
  - Generally, exhaust outlets are near toilets. If a toilet is closed off from the rest of the bathroom, open any doors to the toilet room and the bathroom to increase airflow.
  - Investigate whether bathroom fan exhausts discharge outdoors in areas or at heights that could cause an unexpected exposure concern (e.g., to patios, sidewalks, etc.). If there is concern, consider installing a MERV 14 or HEPA (MERV 17) filter in the exhaust path. (Review this possibility with the multi-disciplinary team.)
- Consider using portable air cleaners. These units can increase overall room air recirculation, and can capture aerosolized microorganisms that may contain COVID 19 to reduce airborne concentrations. Choosing an appropriate size unit for the space is important to improve effectiveness.
- Refer to CDC for more information on air change rates and relative timeframes related to effective removal of airborne pathogens at Appendix B. Airborne Contaminant Removal (www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html#b1).
- Consider using temporary, portable exhaust fans to create negative pressure in selected resident rooms or other areas. Ensure proper clearances (distance from the exhaust to at-risk areas) so contaminated air does not go to sidewalks, patios or any public area. If clearances are not sufficient, incorporate a HEPA filter (or use a HEPA fan) in temporary exhaust systems.
- Create negative pressure areas for infection isolation. Producing negative pressure up to established health care standard threshold of -0.01" w.c. (water column) is best, but any reasonable amount of CFM (cubic feet per minute) difference between exhaust/return and supply will contribute to pressure effect in the right direction.
- Consider equipment damper and control adjustments to provide 100% outside air (OA) supply if possible, rather than the usual mixture of fresh and re-circulated air settings. Demand control mechanisms may be able to be deactivated to allow for continuous airflow rather than variable based on temperature or other conditions. HVAC equipment can often accommodate operating

in 100% OA mode when the outdoor temperature is between 45°F and 75°F and maintain relatively comfortable conditions.

- Evaluate the possibility of using air filters with a minimum efficiency reporting value (MERV) of 13 or better on return air to filter out viral particles. To minimize any potential drop-off of equipment performance or damage to equipment, consult with an engineer, qualified HVAC contractor, or the manufacturer to determine the highest MERV-rated filters that have comparable initial air pressure drops.
- Try to maintain humidity levels in the facility, ideally 30-40% relative humidity (RH) minimum (if wall and window construction are suitable) and 50%-60% RH maximum. Note that during winter, these levels may be too high and could contribute to mold.

Other options

Consider air treatment technologies such as ultraviolet (UVC/UVGI) lights (e.g., wall-mounted), and monitor other evolving technologies such as bi-polar ionization (BPI or NPBI). Consult with engineers and refer to ASHRAE position papers as these products continue to expand in the marketplace. At this time, air treatment technologies for central HVAC systems remain expensive and there is little data to support their use when not built into initial construction (e.g., hospital systems).

Construction/remodeling considerations

For future new construction and major renovations, facilities could consider the following design concepts with the current, and possible future pandemics in mind:

- Ability to designate wing(s) or unit(s) to be surge isolation infection units with ASHRAE 170 recommended concepts integrated for HVAC, ventilation, and pressurization.
- Surge isolation units that have their own Air Handling Unit (AHU) and dedicated exhaust fans; and consider extra capacity provisions for extended operations with 100% outside air.
- Consider HVAC designs that can utilize HEPA air filters, either permanently or “ready-to-deploy” during emergency situations and/or incorporate technologies such as UV light.
- Consider back-up generator capacity sufficient to power the HVAC system.

Related considerations

Revisit your facility’s emergency management plan to determine whether an emergency generator serves the critical HVAC systems. If not, consider adding an exterior generator docking station to allow connection of a temporary/portable generator to support the HVAC system should a failure occur.

Conclusion

The configuration of HVAC systems can contribute to infection prevention in long term care facilities or can contribute to disease spread. Understanding the HVAC system in the facility, what its capabilities are, how it functions, and what other techniques may be used to control and direct airflow is an important factor in preventing infection, including COVID-19 infection. However, it is only one consideration – proper ventilation does not substitute for source control (i.e., face coverings), hand hygiene, social distancing, PPE use, and surface cleaning and disinfection.

There is not a "one size fits all" solution to HVAC system operations to improve resident and caregiver safety during these uncertain times. The solutions at hand depend on the type of HVAC system, the use of the building, and the physical space limitations of the building and HVAC system. Establishing the multi-disciplinary team is the best way to identify potential problems and solutions and ensure that the HVAC system is used as an ally in the fight against COVID-19.

Other resources

Minnesota Department of Health: Engineering Services (www.health.state.mn.us/facilities/regulation/engineering/index.html)
COVID-19 resources including ASHE links, information about temporary negative pressure ventilation strategies, and frequently asked questions.

New Hampshire Department of Human Services: Long Term Care Facility Guidance on Fans and Air Conditioning During an Outbreak of COVID-19 (www.dhhs.nh.gov/dphs/cdcs/covid19/documents/ltcf-covid-air-cond-guidance.pdf)

Centers for Disease Control and Prevention: Appendix B. Air, Guidelines for Environmental Infection Control in Health-Care Facilities (2003) (www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html)

American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE). Standard 170 – 2017, Ventilation of Health Care Facilities (www.ashrae.org/technical-resources/standards-and-guidelines/standards-addenda/ansi-ashrae-ashe-standard-170-2017-ventilation-of-health-care-facilities)

American Society of Health Care Engineering, COVID-19 Resources for Health Care Facilities (www.ashe.org/COVID19resources)

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Minnesota Department of Health | health.mn.gov | 651-201-5000
625 Robert Street North PO Box 64975, St. Paul, MN 55164-0975

Contact health.communications@state.mn.us to request an alternate format.

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