Ventilation and Cooling Sources: 
Control and Maintenance 
In Manitoba Long Term Care (LTC) Settings

The transmission of pathogenic organisms can usually be categorized as contact, droplet or airborne. The appropriate use of Infection Prevention & Control (IP&C) protocols, including disinfection of surfaces, proper hand hygiene, physical separation (distancing or physical barriers), and personal protective equipment (PPE) limit and manage contact and droplet transmission. Air exchange (including the introduction of fresh air, filtering of air and exhausting of air) is used in addition to PPE to limit and manage airborne transmission.

Ventilation systems in health care can decrease the risk of airborne transmission of organisms inside buildings. The Canadian Standards Association (CSA) indicate, “Indoor air quality is an important health and wellness consideration, and is especially critical to the health of patients, visitors, staff, and occupants of health care facilities (HCFs). Inadequate indoor air quality can complicate patient care and recovery and negatively affect health and wellness. The proper design, installation, commissioning, operation, and maintenance of HVAC systems can decrease the risk of airborne transmission of organisms inside buildings and therefore the risk of healthcare acquired infections. Optimization of indoor air quality protects the health and safety of patients, staff, and visitors and supports positive clinical outcomes” (Z317.2, 2019, clause 0).

By contrast, improper air movement can push droplets beyond the normal 6 foot/2 metre zone.

In Manitoba, CSA standard Z317.2 is to be implemented in all new construction and renovation (via references in the Manitoba Building Code). While the standard does not require retroactive changes to facilities, nor mandate operational practices, it does serve as the reference standard.

The Public Health Agency Canada (PHAC) has also issued a guidance document on ventilation and filtration specifically related to COVID-19 in LTC settings (the term Personal Care Homes or PCHs is replaced with LTC in this document for national consistency). Other jurisdictions have reference material regarding the use of portable fans and air conditioning units in LTC settings during COVID-19, including Public Health Ontario and Alberta Health Services.

Manitoba health care facilities have raised questions related to ventilation and cooling. This document is intended to provide provincial guidance and to address frequently asked questions.

**WHAT IS “GOOD VENTILATION”?**

The ventilation system should decrease the risk of airborne transmission of organisms inside buildings and therefore the risk of healthcare acquired infections.

The ventilation should not complicate patient care and recovery or negatively affect health and wellness.
There are various elements to consider for good ventilation:

- Temperature, humidity, airflow rates, airflow patterns and air exchange rates can be measured and have target or desired rates (quantitative criteria)

- Odour control, temperature fluctuation and regulation, drafts from supply air ducts, control for individuals and systems which are maintainable must also be considered (qualitative criteria).

In long term/personal care home settings, the current CSA standards calls for a total of 4 air changes per hour (ACH) in patient rooms, with 2 of those being fresh (non-recirculated). Pressurization between the resident rooms and hallways should be equal/neutral, with temperature goals ranging between 22-24 C and humidity of 30-60% RH. These conditions are our target state.

For Manitoba LTC settings, the Personal Care Home Regulation (30/2005), section 33, Temperature, requires a minimum temperature of 22 C to be achieved. There is no reference to ventilation or cooling requirements.

ACHs alone do not indicate good or poor ventilation and systems must be viewed in their entire capacity. While a system may provide lower ACHs, it does not mean they are not providing good ventilation just as systems that provide high ACHs may not provide good ventilation. For example: some facilities may always operate rooms at 24 C or warmer in all seasons. Some ventilation systems may provide hallway only ventilation, which is drawn through the resident rooms via an exhaust fan.

While summer temperature control is often is the measure by which ventilation systems are judged for capacity and performance, system performance cannot be evaluated only on extreme weather conditions. Building systems are designed for certain “design conditions”, (these vary across the province; in Winnipeg are normally -30 C to + 29 C). While systems are designed with consideration for days beyond these conditions, with climate changes being experienced and more humid conditions across the summers, even new systems may not fully meet all criteria beyond design day conditions.

Whether building systems meet or do not meet the quantitative criteria is not the sole indication of good ventilation. Qualitative evaluation (particularly odour control and freshness of air) and the ability of cooling systems to recover to resident safe temperatures on the of hours of design day conditions, are primary drivers.

There are three areas where facilities must focus with respect to their ventilation systems. These include:

1. **Maintenance**: Proper maintenance of existing equipment and systems must be undertaken. In some cases, remedial maintenance work may be necessary to bring existing equipment and systems back to their original performance. Maintenance activity is critical for new and existing systems. Prior to any investment or request for funding, documentation of proper maintenance activity is necessary. See **Appendix A: Maintenance of HVAC Systems**.
II. Temporary Impairments: Where there are temporary HVAC system impairments (failure of equipment), temporary solutions will necessitate different actions depending upon the weather conditions at the time of year and the length of time until the HVAC systems can be repaired. In these temporary situations it is important to discuss the length of time and the degree to which the system is impaired. The facility, staff, IP&C and Facility Management are critical to these discussions.

III. Interim Solutions: Where HVAC systems have limitations only during extreme weather conditions, interim measures will likely be undertaken but must not become the permanent solution. Where system limitations (for temperature control or odour control) exist, any interim measures must be reviewed following a risk assessment between the facility and clinical staff. Long term solutions to address failing equipment or system inadequacies will usually be funded through the Safety & Security funding process. This risk-based prioritization process is conducted annually in the year prior to when the capital funding is required. Sites must provide information and demonstrate that they are maintaining their systems and that for system inadequacies all alternate methods of addressing have been explored.

Only after a thorough and documented evaluation of the HVAC system, reviewed by site and Regional Health Authority leadership, determines there are no other approaches to mitigate the health risks associated with heat stress risk from a lack of cooling, should additional local ventilation or cooling approaches be considered while awaiting funding of an engineered HVAC system upgrade. The scope of long term solutions must be factored in to determining the temporary or interim solutions.

This evaluation and risk assessment must consider the experienced frequency, length and actual temperature of internal conditions and the extent of the impact (number of residents or areas affected), the specific ventilation (odour) control challenges, etc. The evaluation and risk assessment shall be documented and must include input of facility management/maintenance, clinical leadership and IP&C.

**CAN OPERABLE WINDOWS, SUPPLEMENTARY COOLING, AIR MOVEMENT AND PORTABLE FILTRATION BE USED?**

Opening of windows, use of fans and portable air conditioners in the non-resident care area of the facility (laundry, food preparation, etc.) are not covered by this guideline.

Where support rooms (clean or dirty supply, team rooms, offices, etc.) are a part of the resident care area the requirements of this guideline will apply.

When it is determined that in resident care areas the opening of windows, supplementary cooling, air movement (portable fans) or portable filtration systems are required in temporary or interim situations, the following requirements must be followed:
Facilities in declared outbreak or any room where Additional Precautions (Droplet & Contact, Enhanced, etc.) are in place SHALL NOT use open windows, portable fans or window/portable air conditioners. Care must be taken to ensure that in situations where additional precautions are in place for one resident room that any adjacent rooms are also restricted from using operable windows/fans/air conditioners.

In general, the following information must be considered in all situations:

Windows:

Open windows introduce fluctuating air flow patterns which can carry droplets and move aerosols from one care space to another. As such, windows in care areas should not be opened. Ventilation systems are designed to move air from clean to dirty points in the healthcare space, and not to mix air from one patient/resident care space to another.

Opening windows changes internal airflow patterns resulting in uncontrolled air movements and moving contaminated air from patient rooms into other patient rooms and common areas (such as hallways and dining areas). Windows also allow unfiltered air into the care space.

Fans:

Portable fans are currently used in some sites to assist in patient comfort or to regulate a patient’s body temperature. Other sites have chosen to disallow the use of fans in patient care areas.

Consider the following: Fans have the potential to disperse dust and airborne-transmitted microorganisms, create airborne Clostridioides difficile spores, and alter airflow patterns.

Fans, portable or window air conditioners in general SHOULD NOT be used. Where a risk assessment is completed and fan use is permitted, the fans must draw air from the hallway into the patient space. Fans should be directed to move air into the upper area of the room, but not at the ceiling, and should avoid being directed at areas and surfaces where the fan use may dislodge debris.

When fans are used in resident care areas, they shall be turned off during any resident care treatment and during any interaction with a healthcare provider (including dressing changes, wound care, oral care, foot care, bathing, etc.).

Large industrial hallway fans shall not be used as the airflow that they create is significant.

For specific recommendations and instructions on fan use in acute care refer to: Portable_Fans_Restrictions.pdf (wrha.mb.ca).
Window, Portable or Split Air Conditioners:

The amount/degree of additional cooling necessary is to be factored into the operational risk. For example, there is a different operational risk if the existing cooling system cannot provide adequate cooling when outside temperatures exceed 28°C than in a situation where the system cannot provide adequate cooling when outside temperatures exceed 24°C.

The area where interim cooling is needed will also influence the assessment of the operational risk. For example, if the dining room is the only area where temperatures cannot be maintained in extreme conditions, this represents a risk that could be operationally managed differently than a situation where all patient/resident room temperatures exceed comfort levels.

**When portable window/portable air conditioners are used in resident care areas, they shall be turned off during any resident care treatment**

Portable Air Filtration Systems:

Portable filter systems (also known as portable HEPA filters) are often considered to control airborne contaminants including pathogens. While HEPA filters have their place in controlling airborne contaminants in certain settings, **DO NOT** consider widespread deployment of HEPA filters before evaluation of the HVAC system. Before making any assessments or adjustments to HVAC systems, consult regional/SDO Facility Management or a professional engineer.

Portable HEPA filters may be considered as an interim solution to situations where AGMP control is necessary. HEPA filters are appropriate for use for the temporary control of airborne contaminants during construction, renovation and maintenance. HEPA filters must be maintained according to manufacturers’ recommendations, with particular attention to keeping the physical body of the unit and the pre-filters clean and ensuring the total use/run time of the HEPA filters are within the manufacturers’ specifications. If a portable HEPA unit is used for airborne contaminant control during construction, renovation and maintenance, before it is used in a patient space for contaminant control, the physical unit must be cleaned and disinfected, and the prefilter changed.

Any portable HEPA filters for airborne contaminant control for AGMPs, should achieve 12 ACH within the enclosed space. This ACH rate provides an 99% air clearance time of 23 minutes while also lowering the viral load during this time within the space, similar to that of an airborne infection isolation room (AIIR), though not providing all of the benefits. If the selected or available portable HEPA filter cannot achieve 12 ACH within the enclosed space, a discussion with IP&C and Facility Management is required to determine air clearance time. The ACH can be determined by using the rated HEPA filter fan capacity (usually expressed in cubic feet per minute – CFM) multiplied by 60 (mins/hour) and dividing by the room size (L X W X H in cubic feet) = ACH.
Portable Humidifiers/Dehumidifiers:

Relative humidity (RH) of room air is important for human comfort, to ensure droplets don’t desiccate quickly, and to assist in moistening skin and mucous membranes, which improves viral resistance.

Current research supports a 40-60% RH as the ideal range. In the cold Manitoba climate, winter humidity levels of 30% may be hard to reach without causing moisture problems with the building envelope, particularly with windows. Nonetheless most buildings should have humidity introduction for the extremely dry winter season.

**Portable humidifiers SHOULD NOT be used in healthcare settings.** Most portable humidifiers hold standing room temperature water and require that surface materials become wetted to humidify fan forced air. Some “ultrasonic” humidifiers or atomizing systems can aerosolize water contaminates and have the challenge of standing room temperature water. The mould and pathogen growth risks of standing room temperature water and moistened materials prohibit the use of these systems. Only when portable humidifiers are prescribed by a physician can they be considered for use. If there is a prescription, distilled or reverse osmosis water must be used in the device (refer to the manufacturers recommendation as to the suitable water type as some water types may damage the humidifier components). Reference: [https://www.publichealthontario.ca/-/media/documents/e/2017/eb-humidifier-hc.pdf?la=en](https://www.publichealthontario.ca/-/media/documents/e/2017/eb-humidifier-hc.pdf?la=en)

The use of kettles or other hot water generation to introduce moisture into the air are also **prohibited**.

Only appropriate AHU unit mounted humidification systems which meet the requirements of the CSA Z317.2 standards shall be used. Strict adherence to the operation and maintenance requirements of these systems is essential.

**Portable dehumidifiers SHALL NOT be used in resident areas** as they add heat into the space, disrupt airflows and generate standing water.
Glossary of Terminology used:

AHU – air handling unit – meaning the interior, exterior ground level or roof mounted unit which is meant to condition (heat/cool), filter and move air through a facility.

Exhaust fan – a fan which removes air from the facility and discharges it to the outside directly. Dirty areas such as washrooms and soiled utility rooms should be exhausted.

Finned radiator – where fins are used to reject heat from an electric, steam or hot water system to provide heat into a space.

Finless radiator - where heat is rejected from a smooth surface generated from either electrical or hot water heating sources.

HVAC – heating ventilation and air conditioning – is the entire system which includes air handling units, ductwork, distribution points, heating radiators, and control systems.

Packaged Terminal Air Conditioner (PTAC) – also known as a hotel style unit. Are similar to a window air conditioner but also have a heating source in lieu of having a separate room heating source.

Portable air conditioner – a unit which is designed to provide spot cooling of air by drawing in air from inside the space, cooling it, and rejecting the heat to the outside via a flexible duct. These units are usually floor mounted. These units will also condense moisture and have a condensate pan or tray to catch that water. These units are usually limited to around 1.5 tons/18,000 BTU of cooling on a normal power circuit.

Portable Air Filtration – a unit which has a fan and a high-quality filter system used to provide localized areas within a building filtration to lower airborne contaminants. Primarily these units are fitted with High Efficiency Particle Absorbing (HEPA) filters. They may also have other filtering or pathogen inactivation technologies such as UV or plasma generators. These units are available as large console and smaller tabletop devices.

Return fan system (also known as a mixed air system) – which uses some portion of air drawn from non-dirty occupied areas, mixes in a portion of fresh outdoor air, before passing it again through the air handling unit where it is conditioned, filtered and then returned to the occupied space. Return air systems must not return air from dirty locations.

Portable Humidifier – a small appliance which introduces moisture into the air by evaporating, vapourizing (e.g., steam, mist) or aerosolizing (ultrasonic) water and injecting into the airstream.
Split air conditioner – a unit which is designed to provide cooling air into a space by only cooling the air from inside the space. The heat is rejected outside at a separate condenser unit which is mounted outside and connected to the inside of building evaporator unit via refrigerant piping and electrical wiring. These units will also condense moisture which will either be drained to the outside via a tube or will require that the tube be connected to a local drain. These units require special installation and power but can provide cooling of 2 tons to well over 20 tons, with many options.

Window air conditioner – a unit which is designed to pass through the building envelope (window or wall) whose primary purpose is to provide cooling air into the space, usually by mixing in some outside air mixed with entrained room air. These units will also condense moisture and will usually be built such that the condensed moisture drains to the outside via a path built into the unit. These units are usually limited to around 1.5 tons/18,000 BTU of cooling on a normal power circuit.
Appendix A: Maintenance of HVAC Systems and Equipment

Maintenance of existing HVAC systems is critical. Work must be carried out by individuals who understand the nature of the work they are performing and are qualified to perform the tasks. Baseline maintenance of the various components includes:

AHU: regular changing of filters (monthly checks or with continuous monitoring of filter differential pressure a quarterly visual check), annual cleaning of heating/cooling coils, maintaining fan and motor belts and bearings, and maintenance and calibration of controls.

Refer to Air Filtration requirements which should be followed: http://home.wrha.mb.ca/facilitymgmt/files/guidelines/3005.pdf.

Exhaust fans: maintaining fan and motor belts and bearings and ensuring the fan outlet is not blocked (year-round including ice buildup).

Ductwork including supply and return grills: kept clean (grills should never be visibly soiled). Ductwork, particularly exhaust ducts, should be inspected quarterly and cleaned when observed with any dirt. The exhaust duct may require cleaning every 3-5 years. Note: supply ductwork should never become dirty if proper AHU filtration has been maintained.

All in room heating/cooling units are to be kept clean.

Electric, steam and hot water finned radiators should have the safety covers removed and cleaned/vacuumed/brushed of any entrapped lint at least annually (frequency should increase depending on how much lint build up is seen during an annual inspection).

Where window air conditioners are temporarily in place (see Window, Portable or Split Air Conditioners below, filters over the evaporator must be cleaned regularly. This may be monthly during the cooling season. At least annually, clean the finned coils with a brush and coil cleaner to remove any dirt, to prevent the growth of mould. Cover these units with an insulated cover during the winter months.

Maintain packaged terminal air conditioning (PTAC) units the same as window air conditioners, with the added element of an annual inspection of the heating source. Some PTACs have electric heating elements, while others use a refrigerant heat pump systems.

The moisture pans of portable air conditioners must be emptied at least daily (more frequently during high moisture periods). Additionally, the drain pan must then be cleaned with soap and water to prevent mould growth. The units must have the filters over the evaporator cleaned regularly, usually every month during cooling season. Annually, clean the finned coils with a brush and coil cleaner to remove any dirt (which will grow mould given the presence of condensed moisture). These units must have the heat rejection ducts disconnected in the off season, and the opening to the exterior covered with an insulated cover, for the winter months.
Portable fans: Fan blades must be cleaned with soap and water whenever the blades are visibly soiled. Fan blades and the entire fan shroud and stand must be cleaned and disinfected when the fan is relocated to another patient/resident care space. Should the motor assembly show visible soiling, return the fan to facility management/maintenance for appropriate cleaning and check.