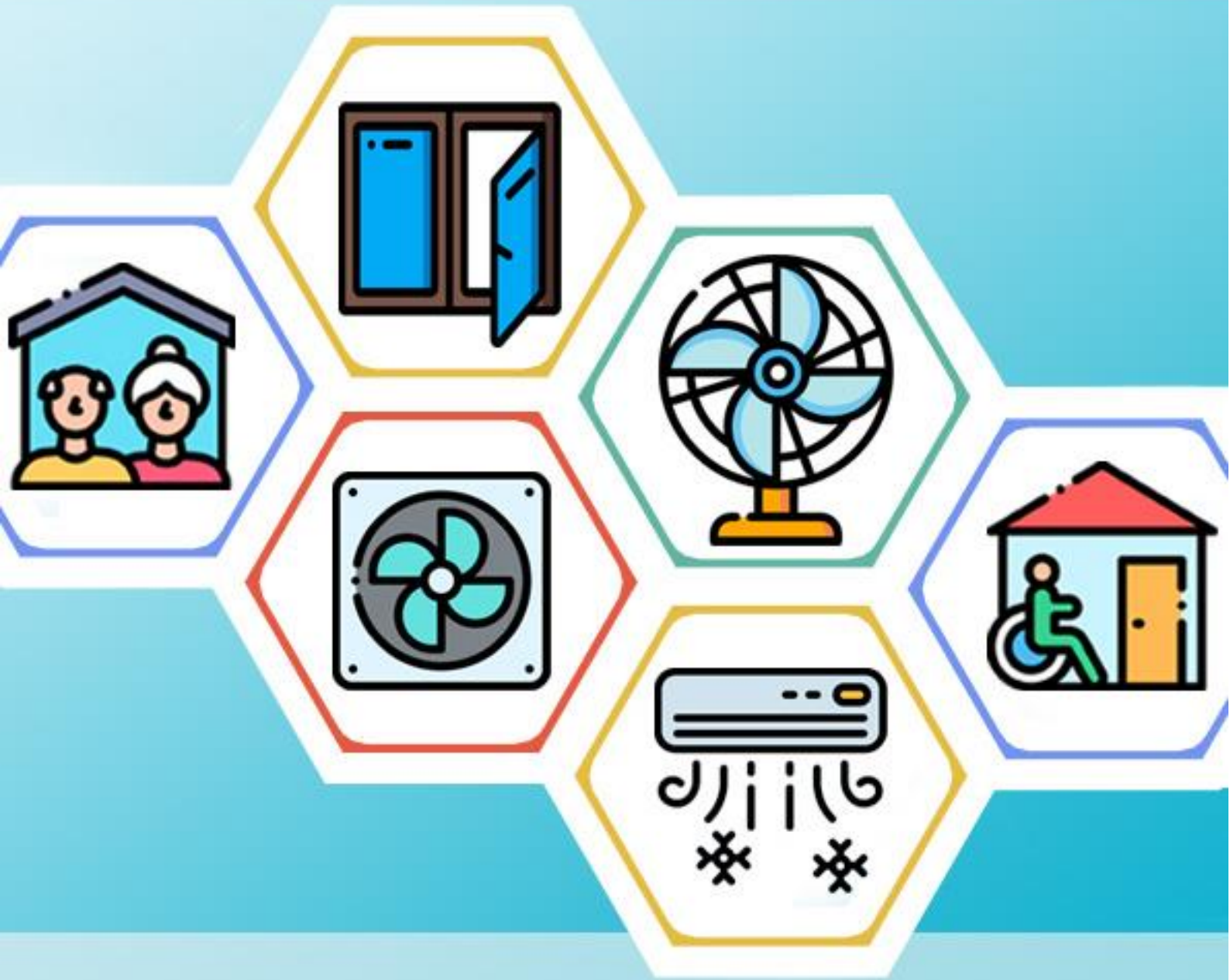
A Supplement on Ventilation

Guidelines on Prevention of Communicable Diseases in Residential Care Homes for the Elderly &
Guidelines on Prevention of Communicable Diseases in Residential Care Homes for Persons with Disabilities



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Protecting Hong Kong's health

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CONTENT

Foreword

The purpose of this supplement is to provide practical information and develop good practices for Residential Care Homes for the Elderly (RCHE) and Residential Care Homes for Persons with Disabilities (RCHD) to improve ventilation in their premises so as to reduce the spread of airborne and droplet-borne infections. This supplement should be read in conjunction with the "Guidelines on Prevention of Communicable Diseases in Residential Care Homes for the Elderly" and “Guidelines on Prevention of Communicable Diseases in Residential Care Homes for Persons with Disabilities”.

1. Airborne and Droplet Transmitted Communicable Diseases

1.1 Certain infectious diseases are transmitted when susceptible persons are exposed to pathogens contained in droplets. When an infected person talks, sneezes, coughs or vomits, microbe-laden droplets are expelled. These droplets can travel a short distance (1 metre) and infect people within this distance. Examples of diseases which spread in this manner are influenza, rubella, SARS and COVID-19.

1.2 The spread of airborne infectious diseases via droplet nuclei is another important mode of disease transmission. Droplet nuclei are the residuals of droplets where pathogens attached to them remain suspended for a longer time in the air and are transported over longer distances. Meanwhile, it can also be generated through aerosolized oral and nasal secretions from infected persons. Examples of infectious diseases transmitted this way include tuberculosis, chickenpox and measles. Short-range airborne transmission of COVID-19 can occur in poorly ventilated enclosed environments.

1.3 There are three important factors causing the spread of airborne / droplet-borne communicable diseases. They are (1) pathogen, (2) mode of transmission and (3) susceptible host. We can control the spread of communicable diseases by targeting these factors.

Factors of transmission	Examples of control measures
Pathogen	Early detection, isolation and treatment of infected persons
	Cleaning and disinfection
Mode of Transmission	Proper use of face mask and personal protective equipment
	Personal hygienic practices (e.g. hand washing)
	Maintenance of good indoor ventilation
Susceptible host	Building up personal immunity
	Receiving immunization

1.4 This supplement focuses on maintaining good ventilation in an indoor environment. Please note that the effective prevention of communicable diseases requires measures targeted at all the above factors to be implemented simultaneously.

2. Ventilation

2.1 Function

Ventilation is defined as the process of changing air in an enclosed space to maintain good indoor air quality of the following basic components:

- Supply of fresh air to meet the respiratory needs of the occupants;
- Control of indoor temperature and humidity;
- Dilution of any airborne contaminants such as carbon dioxide, dusts, toxic gases and pathogenic microorganisms; and
- Control of air movement such that the transfer of airborne contaminants from less clean to cleaner areas is minimised.

2.2 Methods

Methods to achieve good ventilation may come under two categories: (I) natural and (II) mechanical.

(I) Natural ventilation is the free movement of air into and out of the premises through doors, windows or any openings. The rate of air exchange in this type of ventilation is inherently unstable as it is governed by geographical, meteorological and many other factors. Wind driven cross-ventilation (air pressure) and stack ventilation (heat) are the principal mechanisms for natural ventilation, which employ the difference in air densities to provide air movement across space.

(II) Fan-assisted movement of air is the basic component of mechanical ventilation. Properly designed and operated mechanical ventilation provides reliable air exchange. Exhaust fan, fresh air supply fan, energy recovery ventilation unit combined with air conditioners (AC), and central air conditioning system (or Mechanical Ventilation and Air Conditioning, MVAC, in short) are common mechanical ventilation systems found in Hong Kong.

3. Advice for Good Ventilation

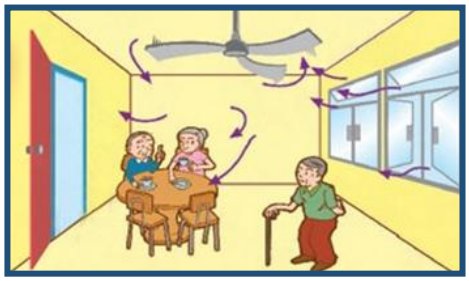
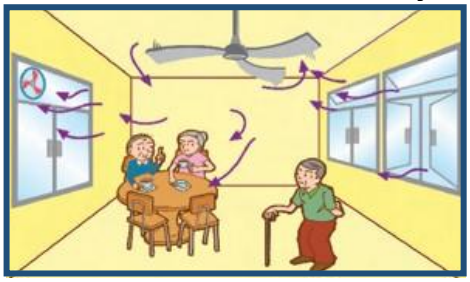
3.1 Three key points for achieving good ventilation

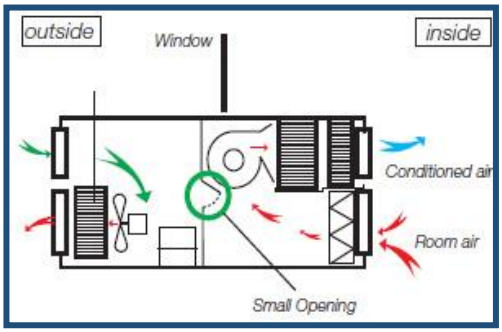
- For Residential Care Homes (RCHs) adopting mechanical ventilation, rate of fresh air replacement to attain a minimum of 10L/s/person (i.e. 0.6m^3/min/person) is advised;
- Pathway of air movement should be from clean to less clean areas, then to dirty or potentially contaminated areas; the direction of air inflow and outflow through locations / rooms should be clearly indicated on a plan; air inlets and outlets should be 7.5 metres apart to minimize the recirculation of exhausted air back into the premises; and
- Even distribution of fresh air within the space is suggested for effective dilution of contaminants.

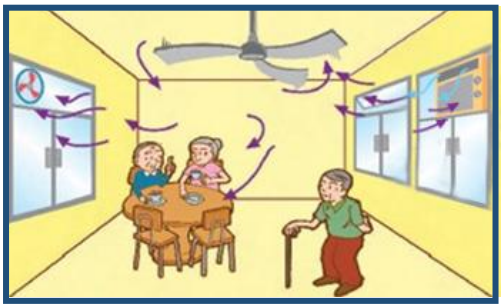
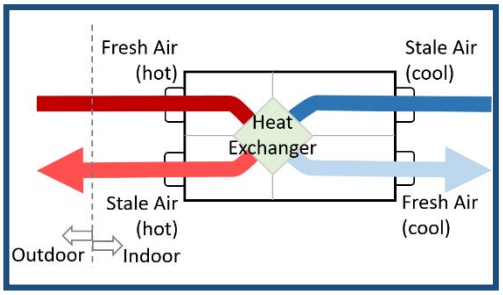
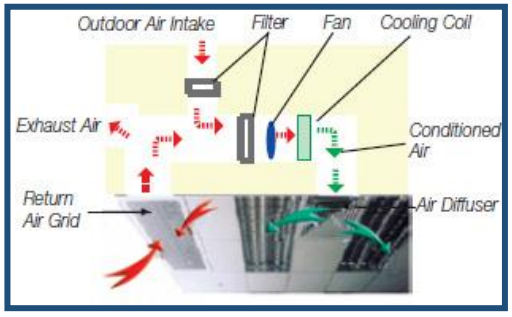
3.2 Other considerations for ventilation

- Indoor temperature (20-25.5°C optimal range) and humidity (40-70% optimal range);
- Weather condition;
- The quality of outdoor air - no pollution source is nearby the fresh air inlet, e.g.
  - exhaust of other ventilation systems;
  - debris or refuse collection areas;
  - enclosed alleys or poorly-ventilated light wells (including air inlet through gaps of window or doors from these areas);
  - roads and construction sites (dust, or vehicle exhaust);
  - water cooling towers (in respect of Legionnaires' disease); and
  - vent pipes of drainages;
- Water traps at floor drains or sink drains must be filled with water;
- Caution of activities of tenants, e.g.
  - nebulizer use, or other aerosol generating procedures; and
- Other environmental factors, e.g.
  - mosquitoes (avoidable by equipping mosquito screens on windows and doors).

3.3 Practices for General Habitable Rooms

Type of Ventilation	Practices
Natural  *Fig1. Natural ventilation—cross ventilation*	Open windows, louvers and doors (premises relying entirely on natural ventilation should have openings of area more than 6.25% of the usable floor area to obtain adequate ventilation). (More information can be found in the Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers APP-130 Lighting and Ventilation Requirements – Performance-based Approach, Buildings Department, December 2016.) • Obtain cross ventilation by opening windows or louvers located on different sides; and • Switch on circulating fans to enhance air movement within the premises (but avoid blowing air directly from one person or group of people to another).
Mechanical - Exhaust only  *Fig2. Use of exhaust fan to provide adequate and stable ventilation*	A propeller fan is installed over an external wall, where indoor air is actively extracted out and fresh air is pulled from the outside via openings. • Switch on exhaust fans if occupied by people as well as shortly before use of the venue; • Open some windows or louvers for sufficient replacement of air by cross-ventilation (to prevent short circuit of airflow, open windows or louvers located on different sides and/or located far from the exhaust fan); • Exhaust fans should not be located close to air-conditioners; • Switch on circulating fans to enhance air movement within the premises (but avoid blowing air directly from one person or group of people to another); • Remove any obstruction to the ventilation inlets or outlets; and • Clean the exhaust fans regularly.

Type of Ventilation	Practices
Mechanical - Fresh Air Supply and Exhaust	Unlike mechanical exhaust system, both fresh air supply and stale air exhaust are achieved by mechanical means. Both fresh air supply fans and exhaust fans are installed. This system can deliver fresh air evenly in various locations in the premises via properly installed distribution ducts for better control of air movement pathways. • Use in conjunction with the exhaust fans installed in toilets, laundries or other areas; • Switch on fresh air supply fans and exhaust fans at the same time; • Switch on circulating fans to enhance air movement within the premises (but avoid blowing air directly from one person or group of people to another); • Remove any obstruction to the ventilation inlets or outlets; and • Clean the fans and the air filters regularly.
Mechanical - Ventilation plus Air Conditioning  *Fig3a. Window or split-type AC — not a good ventilator*	It is an integration of ventilation into the air-conditioning, such as window-type air conditioners or split-type air conditioners to control the indoor temperature and humidity as well as to provide fresh air. • Both window-type and split-type air conditioners are not effective ventilation systems, as they are designed to condition temperature and humidity of recirculated air primarily. Most window-type air conditioners are equipped with vent valve (Fig 3a), which is recommend to be opened at any times. (Note: The vent valve can provide minimal amount of fresh air only, which cannot meet the fresh air requirement in the premises);

Type of Ventilation	Practices
 *Fig3b. Use of exhaust fan to enhance ventilation when using air conditioner*  *Fig3c. Schematic diagram of a energy recovery ventilation unit*	• Must be complemented by ventilation to provide adequate fresh air. The common ventilation includes: (1) switch on exhaust fans with some opened windows / louvers to pull outside air into the premises (Fig 3b) and/or (2) switch on the energy recovery ventilation unit to provide adequate fresh air with energy saving feature (Fig 3c); • Switch on circulating fans to enhance air movement within the premises (but avoid blowing air directly from one person or group of people to another); • Remove any obstruction to the ventilation inlets or outlets; and • Clean air filters and AC louvers regularly, check condenser trays to ensure proper drainage.
Mechanical - Central Air Conditioning System / MVAC  *Fig4. Schematic diagram of a MVAC*	It is a centralized system used to off-set generated heat, control humidity, and deliver fresh air into a building or large space area. • Ensure that each room has sufficient fresh air supply from the system; • Remove any obstruction to the ventilation inlets and outlets; • Switch on circulating fans to enhance air movement within premises (but avoid blowing air directly from one person or group of people to another); • Clean and/or replace air filters and the system regularly; and • Proper inspection, cleaning, testing and maintenance schedules for the system should be drawn up and followed.

3.4 Additional advice for toilets

- Must be installed with exhaust fans or have a separate ventilation system;
- Ensure air movement from a clean-air location towards toilet, then outwards to outdoor non-sensitive area (e.g. away from other ventilation inlets) (Fig 5);
- It is not recommended to operate a circulating fan within a toilet, in order to prevent the spread of pathogens due to air mixing induced by the circulating fan;
- If windows are closed while in use or there are no windows in the toilet, toilet doors should be installed with vent louvers to avoid drawing in air from dried floor drains / pipes; and
- Inspect drainage pipes regularly. If drains and pipes leak or are blocked, or foul odour comes out from drain outlets, arrange immediate repair by a qualified technician.

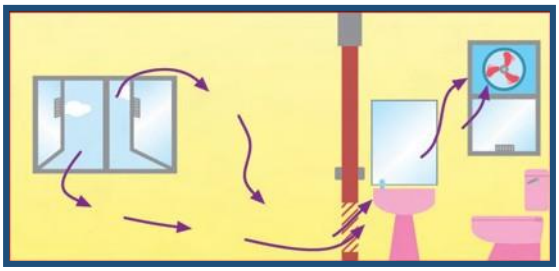


Fig5. Air flow pattern — from clean to less clean area

3.5 Other advice

- Air purifying devices with filter and disinfection functions, e.g. high-efficiency particulate air (HEPA) filter and/or ultra-violet-C (UV-C) air sanitiser in appropriate locations may improve the air cleanliness of indoor environment. These devices cannot provide fresh air and are not a replacement of proper ventilation design;
- Use only air-purifying devices that comply with appropriate safety standards and follow manufacturer recommendations of operation with proper maintenance;
- Ensure adequate spacing between beds where possible;
- Overcrowding or insufficient ventilation may be reflected by high level of indoor carbon dioxide (>0.1%). If so, appropriate measures must be taken, such as
  - increase ventilation rates; and
  - limit the number of occupants;
- Adhere to operating procedures and safety precautions stated in user manuals when using ventilation systems or related appliances (exhaust fans, fresh air supply fans, air conditioners, circulating fans, heaters, air cleaners, etc.);
- Prohibit smoking in the premises; and
- Assign a suitable person of relevant trade to carry out inspection together with the management of the premises to review the ventilation in the premises at least yearly, with proper record keeping; and hire professionals on ventilation to inspect and to advise, where necessary.