A Supplement on Ventilation

Guidelines on Prevention of Communicable Diseases in Residential Care Homes for Elderly &
Guidelines on Prevention of Communicable Diseases in Child Care Centres / Kindergartens / Schools
Airborne and Droplet Transmitted Communicable Diseases

Ventilation
- Function
- Methods

Advice for Good Ventilation
- Two key points to achieve good ventilation
- Other considerations for ventilation
- Practices for general habitable rooms
- Additional practices for lavatory and area for cohorting patients
- Other advices

Further Information
The purpose of this supplement is to provide practical information for Residential Care Homes for the Elderly, Child Care Centres, Kindergartens and Schools to improve ventilation in their institutions in reducing 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 elderly" and "Guidelines on prevention of communicable diseases in child care centres / kindergartens / schools".
1. Airborne and Droplet Transmitted Communicable Diseases

1.1 Certain infectious diseases are transmitted when susceptible persons are exposed to pathogens contained in droplets or droplet nuclei (e.g., through aerosolized oral and nasal secretions from infectious patients). When an infectious person talks, sneezes, coughs or vomits, microbe-laden droplets are expelled. These droplets can travel a short distance (1 meter) and infect people within this distance. Examples of diseases spread in this manner are influenza, rubella and SARS.

1.2 The spread of airborne infectious diseases via droplet nuclei is another important form 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 transported over longer distances. Examples of infectious diseases transmitted this way include tuberculosis, chickenpox and measles.

1.3 There are four important factors causing the spread of airborne / droplet-borne communicable diseases outbreak. They are (1) source (infectious persons), (2) pathogen dose, (3) transmission pathway and (4) host (susceptible persons). We can control the spread of communicable diseases by targeting at these factors.

<table>
<thead>
<tr>
<th>Factors of transmission</th>
<th>Examples of control measures</th>
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<tbody>
<tr>
<td>Source of infection</td>
<td>• Early detection, isolation and treatment of patients</td>
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<tr>
<td></td>
<td>• Proper use of face mask</td>
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<tr>
<td>Pathogen</td>
<td>• Disinfection</td>
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<tr>
<td>Transmission pathway</td>
<td>• Proper personal hygienic practices (hand washing)</td>
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<td></td>
<td>• Maintenance of good indoor ventilation</td>
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<tr>
<td>Host</td>
<td>• Building up personal immunity</td>
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<tr>
<td></td>
<td>• Receiving immunization</td>
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<tr>
<td></td>
<td>• Proper use of face mask and personal protective equipment</td>
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1.4 This supplement focuses on maintaining good ventilation in an indoor environment. Please note that efficient prevention of communicable diseases requires measures targeted at all the above factors to be implemented together.
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; and
- Removal of any airborne contaminants such as carbon dioxide, dusts, toxic gases and pathogenic microorganisms.

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 principle 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. Proper designed and operated mechanical ventilation provides reliable air exchange. Exhaust fan, fresh air supply fan, air conditioner and central air conditioning system (or Mechanical Ventilation and Air Conditioning, MVAC) are the most common mechanical ventilation systems found in Hong Kong.
3. Advice for Good Ventilation

3.1 Two key points for achieving good ventilation:

- Sufficient fresh air replacement (normally >0.43 m³/min/person, American Society of Heating, Refrigerating and Air-conditioning Engineers - ASHRAE Standard 62-2004, Ventilation for acceptable indoor air quality);
- Air movement - from clean to less clean area to dirty area or potentially contaminated area (where an infectious person located)

3.2 Other considerations for ventilation:

- Indoor temperature (20-25.5°C) and humidity (40-70%);
- Weather condition;
- The quality of outdoor air - no pollution source is nearby the fresh air inlet, e.g.,
  - Exhaust of other ventilation system;
  - Debris or refuse collection area;
  - Road and construction site (dust, vehicle exhaust or noise problems); and
  - Water cooling tower (in respect of Legionnaires' disease);
- 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

<table>
<thead>
<tr>
<th>Type of Ventilation</th>
<th>Practices</th>
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</thead>
<tbody>
<tr>
<td>Natural</td>
<td>• Open windows, louvers and doors (premises relying entirely on natural ventilation should have openings more than 6.25% of the usable floor to obtain adequate ventilation. This is based on design criteria stipulated in Practice Notes for Authorized Persons and Registered Engineers, PNAP 278 - Lighting and ventilation requirements: performance -based approach, Buildings Department, December 2003);</td>
</tr>
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Natural ventilation—cross ventilation
### Type of Ventilation

<table>
<thead>
<tr>
<th>Practices</th>
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<tr>
<td>Obtain cross ventilation by opening windows or louvers located not on the same walls;</td>
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<tr>
<td>Switch on circulating fan to enhance air movement within premises; and</td>
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<tr>
<td>Install exhaust fans.</td>
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### Mechanical Exhaust Fan

A propeller fan is installed over an external wall, where indoor air actively extracted out.

- Switch on exhaust fan at any time;
- Open some windows or louvers for sufficient replacement of air (to obtain the better result by opening windows or louvers located not on the same wall and/or having long distances to the exhaust fan in order to prevent short circuit of air flow);
- Switch on circulating fan to enhance air movement within premises;
- Remove any obstruction to the ventilation inlet or outlet; and
- Clean the exhaust fan regularly.

### Mechanical Fresh Air Supply Fan

Similar to the exhaust fan, the fan, however, is reversed to deliver the fresh air in.

- Less effective than exhaust fan in controlling airflow;
- Switch on the supply fan at any time;
- Open some windows or louvers for sufficient venting (to obtain the better result by opening windows or louvers located not on the same wall and/or having long distances to the fresh air supply fan in order to prevent short circuit of air flow);
- Switch on circulating fan to enhance air movement within premises;
- Remove any obstruction to the ventilation inlet or outlet; and
- Clean the fan and the air filter regularly.
Advice for Good Ventilation

**Type of Ventilation**

**Mechanical Air Conditioner**

It is a compact mechanical system (including fans, evaporator, compressor, condenser and air filter) to control the indoor temperature and humidity.

- Both window-type and split-type air conditioner are not effective ventilation systems, as they are designed to condition indoor air (Fig 3a).
- Must be complemented by exhaust fan with some opened windows or louvers in order to provide adequate fresh air, even if some air conditioners have vent valves within their systems (only a small opening) (Fig 3b);
- Switch on circulating fan to enhance air movement within the premises;
- Remove any obstruction to the ventilation inlet or outlet; and
- Clean the air filter and AC louver regularly;

**Mechanical Central Air Conditioning System / MVAC**

It is a system used to off-set generated heat, control humidity, and deliver fresh air into a building or large space area.

- Ensure each room has sufficient fresh air supply from the system;
- Remove any obstruction to the ventilation inlet and outlet;
- Switch on circulating fan to enhance air movement within premises;
- 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.

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Window or split-type AC — not a good ventilator

Use of exhaust fan to enhance ventilation when using air conditioner

Schematic diagram of a MVAC
3.4 Additional advice for lavatory / area used for cohorting patients

- Must be installed with exhaust fans or have a separate ventilation system;
- Ensure air movement from a clean-air location towards lavatory or area for cohorting patients, then outwards to outdoor non-sensitive area (e.g. away from other ventilation inlet) (Fig 5); and
- It is not recommended to operate circulating fan within this area under normal functional situation, in order to prevent the spread of pathogens due to air mixing induced by the circulating fan.

![Air flow pattern — from clean to less clean area](Fig 5)

3.5 Other advice

- 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 by additional exhaust fan coupled with natural ventilation;
  - 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 fan, air conditioners, circulating fans, heaters, air cleaners, etc); and
- Prohibition of smoking in the premises.
4. **Further Information**

4.1 If you have any questions about this supplement, please contact the Centre for Health Protection, Department of Health.

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**Acknowledgement**

We thank the Education and Manpower Bureau, the Social Welfare Department, the Electrical and Mechanical Services Department, and the Environmental Protection Department for their advice on the preparation of this supplement.