Infection Prevention and Control considerations in the initial care of COVID-19 patients

Joao Toledo
Advisor, clinical management of infectious diseases
PHE/IHM – PAHO HQ
Virtual, April 15, 2021
Infection Prevention and Control and COVID-19

Figure 1. Epidemic phases and response interventions

Epidemic phases
- Introduction or emergence
- Localized transmission
- Amplification
- Reduced transmission

Response interventions
- Anticipation
- Early detection
- Containment


https://www.who.int/emergencies/diseases/managing-epidemics/en/
## Infection Prevention and Control and COVID-19

### Standard Precautions

<table>
<thead>
<tr>
<th>Step</th>
<th>Precaution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Limit human-to-human transmission</td>
</tr>
<tr>
<td></td>
<td>- Hand hygiene (water and soap or alcohol-based solutions)</td>
</tr>
<tr>
<td></td>
<td>- Use of personal protective equipment (PPE) according to risk</td>
</tr>
<tr>
<td></td>
<td>- Respiratory hygiene (or cough etiquette)</td>
</tr>
<tr>
<td></td>
<td>- Safe injection practices</td>
</tr>
<tr>
<td></td>
<td>- Sterilization / disinfection of medical devices</td>
</tr>
<tr>
<td></td>
<td>- Environmental cleaning</td>
</tr>
<tr>
<td>2</td>
<td>Reduce secondary infections</td>
</tr>
<tr>
<td>3</td>
<td>Prevent transmission through amplification and super-spreading events</td>
</tr>
</tbody>
</table>

**PAHO. Prevention and Control of Healthcare associated infections – Basic Recommendations” - PAHO, 2017 (adapted)**
Three aspects in the initial management of COVID-19 – what health workers should know

**Screen**
- Use of screening questionnaires based on the current case definition

**Isolate**
- Set up triage station with trained support staff at the entrance to the health facility
- Prioritize the care of symptomatic patients and create a separate waiting area

**Educate**
- Train health workers to have a high degree of clinical suspicion
- Display signs with information on COVID-19 in public areas

https://www.paho.org/en
Spatial separation and physical barriers

https://www.paho.org/en

Source – Google images

PAHO

- Each clinical question presents a group of recommendations / good practices that provide guidance for the management of critical patients with COVID-19
- GRADE system

https://iris.paho.org/handle/10665.2/52614 – to be updated
Question 7 –

What is the triage strategy that should be used for critical patients with COVID-19?

*Updated question

<table>
<thead>
<tr>
<th>No</th>
<th>RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>It is recommended that institutional protocols for triage of patients with suspected diagnosis or COVID-19 be implemented to classify adequately patients requiring management in an intensive care unit.</td>
</tr>
</tbody>
</table>

The duration and severity of symptoms, diagnostic imaging findings (radiography, CT scan or lung ultrasound, according to their availability), origin of pulmonary infiltrates, oxygenation needs, vital organ dysfunction, sepsis and septic shock should be evaluated to identify critical patients infected with COVID-19.

The Pan American Health Organization (PAHO) has a patient management algorithm with suspected COVID-19 infection at the first level of care and in remote areas of the Region of the Americas (https://iris.paho.org/handle/10665.2/52501).

**Point of good practice**

https://iris.paho.org/handle/10665.2/52614 – to be updated
Initial care of COVID-19: triage / isolate / refer

Initial care of COVID-19: triage / isolate / refer

**Question 3 –**

What is the effectiveness and safety of interventions to prevent infection of health professionals who care for patients with COVID-19?

*Updated question*

<table>
<thead>
<tr>
<th>N.o</th>
<th>RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>For health workers in contact with COVID-19 patients performing aerosol-generating procedures* in the intensive care unit (ICU) or in a unit where these procedures are performed without adequate ventilation or independent negative pressure system, it is recommended to wear respiratory masks (respiratory masks N-95, FFP2 or equivalent), instead of surgical masks, in addition to other personal protective equipment (gloves, gown and eye protection such as protective masks or safety goggles).</td>
</tr>
</tbody>
</table>

* Procedures that generate aerosols and are performed in the ICU include endotracheal intubation, bronchoscopy, open aspiration, nebulized treatment, manual pre-endotracheal intubation ventilation, physical patient pronation, fan patient disconnection, non-invasive ventilation with positive pressure, tracheostomy and cardiopulmonary resuscitation.

**Point of good practice**

https://iris.paho.org/handle/10665.2/52614 – to be updated
Airborne Transmission – What to consider?

Question – Is the detection of a pathogens in room air sufficient to suggest transmission through the air?

Answer – No

Transmission of SARS-CoV-2: implications for infection prevention precautions
Scientific Brief . 9 July 2020

• The proportion of exhaled droplet nuclei or of respiratory droplets that evaporate to generate aerosols, and the infectious dose of viable SARS-CoV-2 required to cause infection in another person are not known, but it has been studied for other respiratory viruses.

• Studies in health care settings where symptomatic COVID-19 patients were cared for, but where aerosol generating procedures were not performed:
  • Reported the presence of SARS-CoV-2 RNA in air samples;
  • Other similar investigations in both health care and non-health care settings; found no presence of SARS-CoV-2 RNA;
  • No studies have found viable virus in air samples.

• Within samples where SARS-CoV-2 RNA was found, the quantity of RNA detected was in extremely low numbers in large volumes of air and one study that found SARS-CoV-2 RNA in air samples reported inability to identify viable virus.

Aerosol-generating procedures (AGP)

Number of healthcare providers exposed should be limited

The quality of ventilation has been pointed as a major factor in determining the risk of exposure.

Question 3 –

What is the effectiveness and safety of interventions to prevent infection of health professionals who care for patients with COVID-19?

*Updated question

<table>
<thead>
<tr>
<th>N.o</th>
<th>RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>For health workers who provide care to patients with COVID-19 without mechanical ventilation in ICU, it is suggested to wear surgical masks instead of respiratory masks, in addition to other personal protective equipment.</td>
</tr>
</tbody>
</table>

**Conditional Recommendation. Evidence quality: low**

| 4   | For health workers performing procedures that do not generate aerosols in patients with COVID-19 and mechanical ventilation (closed circuit), the use of surgical masks instead of respiratory masks, in addition to other personal protective equipment, is suggested. |

**Conditional Recommendation. Evidence quality: low**

https://iris.paho.org/handle/10665.2/52614 – to be updated
Personal protective equipment according to the level of care

### HOW TO PUT ON PERSONAL PROTECTIVE EQUIPMENT (PPE)

**Step 1:** Put on a gown

**Step 2:** Put on surgical mask or respirator (N95/FPP2)

**Step 3:** Put on eye (goggles) or facial protection (facial shield)

**Step 4:** Put on gloves (over cuff)

**Step 5:** Put on hand hygiene

### HOW TO TAKE OFF PPE

- Avoid contamination of self, others and environment
- Remove the most heavily contaminated items first

### Level of Care

<table>
<thead>
<tr>
<th>Level of Care</th>
<th>Hand hygiene</th>
<th>Gown</th>
<th>Surgical mask</th>
<th>Respirator (N95/FPP2) or Face shield</th>
<th>Goggles</th>
<th>Gloves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triage</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Collection of specimens for laboratory diagnosis</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Suspected or confirmed case of COVID-19 requiring healthcare facility admission and NO aerosol-generating procedure</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Suspected or confirmed case of COVID-19 requiring healthcare facility admission and WITH aerosol-generating procedure</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

General principles of the use of personal protective equipment (PPE)

Hand hygiene should always be performed despite PPE use.

Remove and replace if necessary, any damaged or broken pieces of re-usable PPE as soon as you become aware that they are not in full working condition.

Remove all PPE as soon as possible after completing the care and avoid contaminating the environment outside the isolation room; any other patient or worker; and yourself.

Discard all items of PPE carefully and perform hand hygiene immediately afterwards.

Source: https://apps.who.int/iris/handle/10665/69793
Question 3 –
What is the effectiveness and safety of interventions to prevent infection of health professionals who care for patients with COVID-19?

*Updated question

<table>
<thead>
<tr>
<th>N.o</th>
<th>RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It is recommended that aerosol-generating procedures in patients with COVID-19 in the ICU be performed in designated areas for this purpose and have the best available measures to limit contamination of other patients or health workers. If there is no availability of a room with negative pressure it is suggested to designate an area with natural ventilation in all patient care areas.</td>
</tr>
</tbody>
</table>

**Point of good practice**
For natural ventilation, the following average minimum ventilation rates per hour are recommended:

- 160 L/s/patient (average ventilation rate per hour) for air transmission prevention rooms (with a minimum of 80 L/s/patient).

- When patients are treated in the corridors in emergency or other situations, the ventilation rates should be the same as those required for air transmission prevention rooms.

- Where natural ventilation is not sufficient to meet recommended ventilation requirements, other ventilation systems, such as hybrid (mixed) natural ventilation, shall be used and mechanical ventilation shall not be used if sufficient.

**Point of good practice**

https://iris.paho.org/handle/10665.2/52614 – to be updated
Hierarchy of controls in infection prevention and control

MOST EFFECTIVE
- Elimination
  - RISK elimination
- Substitution
  - RISK substitution
- Engineering controls
  - Isolation of individuals at RISK / Ventilation of the environment
- Administrative controls
  - Re-think the way of working
- Use of PPE
  - Use of PPE according to RISK evaluation

Adapted from NIOSH, 2020
Ventilation and COVID-19

- Any modifications to health-care ventilation need to be made carefully, taking into consideration the cost, design, maintenance and potential impact on the airflow in other parts of the health-care facility.

- Poorly designed or maintained ventilation systems can increase the risk of health-care-associated infections transmitted by airborne pathogens due to incorrect airflow and poor maintenance of the system.

Source: https://apps.who.int/iris/bitstream/handle/10665/339857/9789240021280-eng.pdf?sequence=1&isAllowed=y.
Advantages and disadvantages of different types of ventilation systems

<table>
<thead>
<tr>
<th></th>
<th>Mechanical ventilation</th>
<th>Natural ventilation</th>
<th>Hybrid ventilation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantages</strong></td>
<td>Suitable for all climates</td>
<td>Suitable for warm/mild or moderate climates</td>
<td>Suitable for all climates and weather</td>
</tr>
<tr>
<td>More controlled environment</td>
<td>More controlled environment</td>
<td>Lower capital, operational and maintenance costs</td>
<td>Energy-saving</td>
</tr>
<tr>
<td>Smaller range of control of environment by occupants</td>
<td>Smaller range of control of environment by occupants</td>
<td>Capable of achieving very high ventilation rate</td>
<td>More flexible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Large range of control of environment by occupants</td>
<td></td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>Expensive to install and maintain</td>
<td>Easily affected by outdoor climate and/or occupant’s behaviour</td>
<td>May be expensive</td>
</tr>
<tr>
<td></td>
<td>Reported failure delivering the required ventilation rate</td>
<td>More difficult to predict, analyse and design</td>
<td>May be more difficult to design</td>
</tr>
<tr>
<td></td>
<td>Potential for noise from equipment</td>
<td>Reduces comfort level of occupants when too hot, humid or cold</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inability to establish negative pressure in isolation areas but may be provided by proper design.</td>
<td></td>
</tr>
</tbody>
</table>
Application of Natural ventilation - TB ward

https://www.who.int/water_sanitation_health/publications/natural_ventilation.pdf
Ventilation and COVID-19

• **When AGPs are not performed,** adequate ventilation is considered to be 60 liters/second per patient (L/s/patient) for naturally-ventilated areas or 6 air changes per hour (ACH) (equivalent to 40 L/s/patient for a 4x2x3 m³ room) for mechanically-ventilated areas.

• **For areas where AGPs are performed,** the ventilation rate should be 12 ACH (e.g. equivalent to 160L/s/patient), ideally 12 ACH for new constructions, with a recommended negative pressure differential of ≥2.5Pa (0.01-inch water gauge) to ensure that air flows from the corridor into the patient room.

---

Table B.1. Air changes/hour (ACH) and time required for airborne-contaminant removal by efficiency *

<table>
<thead>
<tr>
<th>ACH § ¶</th>
<th>Time (mins.) required for removal 99% efficiency</th>
<th>Time (mins.) required for removal 99.9% efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>138</td>
<td>207</td>
</tr>
<tr>
<td>4</td>
<td>69</td>
<td>104</td>
</tr>
<tr>
<td>6⁺</td>
<td>46</td>
<td>69</td>
</tr>
<tr>
<td>8</td>
<td>35</td>
<td>52</td>
</tr>
<tr>
<td>10⁺</td>
<td>28</td>
<td>41</td>
</tr>
<tr>
<td>12⁺</td>
<td>23</td>
<td>35</td>
</tr>
<tr>
<td>15⁺</td>
<td>18</td>
<td>28</td>
</tr>
<tr>
<td>20</td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td>50</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

* This table is revised from Table S3-1 in reference 4 and has been adapted from the formula for the rate of purging airborne contaminants presented in reference 1435.  
  + Denotes frequently cited ACH for patient-care areas.

https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html#tableb1
IPC and COVID-19: summary

- Standard, contact and droplet precautions should be used to care for the patient with COVID-19.
- Airborne precaution should be in place when AGP is performed.
- SARS-COV-2 is susceptible to the disinfectants usually used in hospital settings, therefore no changes in types of detergents, or cleaning/disinfectant products is necessary.
- Due to the transmission mechanism of the disease, the areas near the patient are those with the highest risk of being contaminated and must be cleaned more frequently.
- Ventilation rates of 12ACH or 160L/s/patient for AGP areas and 6AHC or 60L/s/patient must be observed.
- Minimum 1 meter and beds and chairs should be guaranteed.
- Use of physical barriers, is recommended when possible.
Thank you