Basics of Airborne Infection Control

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2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings

Infection prevention and control of epidemic- and pandemic-prone acute respiratory diseases in health care

WHO Interim Guidelines

June 2007

World Health Organization
What is Infection Control?
Prevention of Transmission

<table>
<thead>
<tr>
<th>Patient to:</th>
<th>Worker</th>
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<tbody>
<tr>
<td></td>
<td>Patient</td>
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<tr>
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<tr>
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What is Airborne Infection Control?

- It’s part of the overall Infection Control Program!
So, let’s talk about general Infection Control first!

• Standard Precautions *(formerly Universal Precautions)*
• Transmission-based Precautions
  – Contact
  – Droplet
  – Airborne

Standard Precautions

• Basic infection control precautions in health care
• Applied routinely in all health-care settings
• If these basic precautions are not in place, additional specific precautions may not be effective.
Selected Elements of Standard Precautions

- Hand hygiene
- Use of personal protective equipment (PPE) to avoid direct contact with patient's blood, body fluids, secretions and non-intact skin
- Prevention of needle stick/sharp injury
- Cleaning and disinfection of the environment and equipment

Main Elements of Standard Precautions

- Waste management
- Immunization
Summary

• Minimize and prevent exposure to infection by:
  – Using Standard Precautions with every patient
  – Disposing of clinic waste properly
• Work together to make the workplace safer.
• Teach patients and their families how to reduce risk of exposure in the home.

 Transmission-Based Precautions

• Transmission-Based Precautions are designed for patients documented or suspected to be infected with highly transmissible or epidemiologically important pathogens, transmitted by air, droplet or contact, for which additional precautions are needed.

*Transmission-Based Precautions must be used in addition to Standard Precautions!*
Types of Transmission-Based Precautions

- **Contact**—Gown and gloves for contact with patient or environment
- **Droplet**—Surgical masks and eye protection *within 1 meter (3 feet)*
- **Airborne**—Particulate respirator - required during endotracheal intubation, suctioning, and aerosolized nebulizer treatments *(Containment also required)*

**Table 1. Infection control precautions for HCWs and caregivers providing care for patients with ARDs according to a sample of pathogens**

<table>
<thead>
<tr>
<th>Precaution</th>
<th>No pathogen identified</th>
<th>Novel organism causing ARD*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand hygiene†</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Gown*</td>
<td>Risk assessment*</td>
<td>Risk assessment*</td>
</tr>
<tr>
<td>Gloves</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Surgical masks and eye protection</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Medical masks on HCWs and caregivers</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Airborne respiratory equipment (no masks)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Airborne respiratory equipment (masks)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Medical masks on patient, when outside isolation area*</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Standard plus Drape for exposed patient</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Standard plus Drape for exposed caregiver</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Transmission-Based Precautions

For Avian or Pandemic Influenza

- Contact
- Droplet
- Airborne

Use in combination ???
### Table 1. Infection control precautions for HCWs and caregivers providing care for patients with ARDs according to a sample of pathogens

<table>
<thead>
<tr>
<th>Precaution</th>
<th>TB</th>
<th>TB &amp; Influenza</th>
<th>HIV &amp; Bact ARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand hygiene*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Gloves</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Gown*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Eye protection</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Medical mask on HCWs and caregivers*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Particular separation on HCWs and caregivers*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Medical mask on patient when outside isolation area*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Single room*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Antimicrobial procurement*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Summary of infection control precautions for routine patient care, excluding non-invasive procedures*</td>
<td>Standard plus Disposable Precautions</td>
<td>Standard plus Disposable Precautions</td>
<td>Standard plus Disposable Precautions</td>
</tr>
</tbody>
</table>

**What about the patient???

**What about the visitor???
“Your mission, should you decide to accept it . . . ”

Actually, our mission and the mission of this course is to focus on airborne infection control

However, don’t forget about general infection control!!!
### Droplets vs. Droplet Nuclei
(Droplet vs Airborne Precautions)

<table>
<thead>
<tr>
<th>$d_{ae}$ (μm)</th>
<th>Terminal Settling Velocity time to fall 1m (m/s)</th>
<th>Time to “Touchdown” (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.50E-05</td>
<td>7.9 h</td>
</tr>
<tr>
<td>5</td>
<td>7.80E-04</td>
<td>21 m</td>
</tr>
<tr>
<td>10</td>
<td>2.90E-03</td>
<td>5.7 m</td>
</tr>
<tr>
<td>50</td>
<td>7.50E-02</td>
<td>13 s</td>
</tr>
<tr>
<td>100</td>
<td>1.70E-01</td>
<td>5.9 s</td>
</tr>
</tbody>
</table>

### Respiratory Aerosols

- **Droplets**
  - $> 5$ μm
  - $> 30$ μm
  - $> 100$ μm

- **Droplet nuclei**
  - $\leq 5$ μm
  - 1-10 μm
What is Airborne Infection Control?
How can we decrease transmission?

Hierarchy of Infection Control

Managerial and Administrative
Environmental
Personal Protective Equipment
Worker
Patient
Facility
Hierarchy of Infection Control

Managerial and Administrative
Environmental
Personal Protective Equipment
Facility
Patient
Worker

Hierarchy of Infection Control

Managerial and Administrative
Environmental
Personal Protective Equipment
Facility
Patient
Worker
VCT
Hierarchy of Infection Control

Managerial and Administrative
Personal Protective Equipment
Environmental

Worker
Patient
Facility

Education
Hierarchy of Infection Control

Managerial and Administrative
Environmental
Personal Protective Equipment
Facility
Worker
Patient
Front Field
Positive Pressure
Hierarchy of Infection Control

Managerial and Administrative

Environmental

Personal Protective Equipment

Facility

Worker

Patient

Negative Pressure
Hierarchy of Infection Control

Managerial and Administrative
Environmental
Personal Protective Equipment
Facility
Worker
Patient
Door
Hierarchy of Infection Control

Managerial and Administrative
Environmental
Personal Protective Equipment
Facility
Worker
Patient

Maintenance and Operation
Hierarchy of Infection Control
Hierarchy of Infection Control

Managerial and Administrative
Environmental
Personal Protective Equipment
Facility
Worker
Patient

Respiratory Protection Program
Surgical Masks
Respirator
Hierarchy of Infection Control

Managerial and Administrative
Environmental
Personal Protective Equipment

Worker
Patient
Facility

Education
Hierarchy of Infection Control

Managerial and Administrative
Environmental
Personal Protective Equipment
Facility
Patient
Worker

Hierarchy of Infection Control

Managerial and Administrative
Environmental
Personal Protective Equipment
Education
Facility
Patient
Worker
Precaução Respiratória por Aerossol
A disseminação aérea ocorre por via respiratória, através de aerossol disperso pelo ar.

- Quarto privativo - manter a porta fechada e a janela aberta.
- Máscara: filtro especial (vestir antes de entrar no quarto).
- Transporte: o paciente deve usar máscara cirúrgica.

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