Emergency Response Infection Control Tools for Public Health Workers

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Purpose: Identify and assess available IC education for public health workers, promulgate existing guidance, and develop education tools for public health workers in their use of personal protective equipment.

Challenge: Addressing what do ph workers need to know or be able to do to protect themselves and others from infection during emergency response. This includes the provision of expert consultation and direction on infection prevention and control practices.

Member Contributions are color-coded:
Ruth
John K.
John H.
Dave
Roz

THE PLANNING PROCESS

- What is the emergency response situation?
  - Infectious Disease
  - Natural disaster with infectious disease secondary component
- What is the scope of the problem, i.e. what is the public health response role?
- What is the infectious disease hazard?
- What are the control strategies?
  - Engineering (e.g. isolation)
  - Personal Protection (PPE, work practices)
  - Other (immunization, quarantine, social distancing, etc)
- What is feasible given the resources available?

CORE KNOWLEDGE

Ruth (last updated: 4 02 06)
(e.g. modes of disease transmission, basic principles of infection control, pathogens of primary concern, acknowledge surveillance but exclude)

Basic Principles of Infection Control

Chain of transmission
- Causative agent
- Reservoir
- Portal of exit
- Mode of transmission
- Portal of entry
- Susceptible host

Standard precautions
Transmission-based precautions

Modes of Disease Transmission

Airborne
Droplet
Contact
Combined Modes

Pathogens of Primary Concern

Existing
  o Seasonal influenza

Emerging/Re-emerging
  o Avian Influenza H5N1
  o SARS

Bioterrorism
  o Category A agents

Role of surveillance

Healthcare facilities
Local
State

PPE CAPABILITIES AND LIMITATIONS

Hierarchy of Safety and Health Controls

Controlling exposures to occupational hazards is the fundamental method of protecting workers. There are four potential levels of cumulative protections; those at the top of the list are potentially more protective and effective than those at the bottom.
1. Training and Administrative Controls (e.g. policies to rapidly identify and isolate the source, and for triage, immunization/prophylaxis, decontamination, education and training programs, cough hygiene, etc)

2. Engineering Controls (e.g. air dilution and mixing, dedicated exhaust, negative pressure, UV air cleansing, portable isolation chambers, portable HEPA room filtration)

3. Work Practice Controls (e.g. engineered sharps protection, decontamination of workspaces, policies to limit eating, applying lipstick, and contact lenses where transmission can occur)

4. Personal Protective Equipment appropriate to the anticipated exposure (skin, mucous membrane, respiratory and total protection)
   - PPE becomes more important in uncontrolled environments where Training, Administrative, Engineering and Work Practice controls are not available

Principles of PPE Use
(Adapted from WHO. Avian Influenza: Prevention and Control of Influenza due to Avian Influenza Virus A (H5N1)
http://w3.whosea/en/Section10/Section1027/Section1091_4149.htm)

- PPE reduces but does not completely eliminate the possibility of infection
- PPE is only effective if selected and used correctly and at all times when exposure may occur
- All potential routes of exposure must be considered when selecting PPE
- When patients are in isolation, any contact between contaminated (used) PPE and surfaces/clothing/people outside the isolation area must be avoided
- Used PPE must be placed in prescribed receptacles and disposed of or sterilized/decontaminated per policy
- The use of PPE does not replace basic hygiene measures such as hand-washing; washing is still essential to prevent transmission
- Protection from exposure that is afforded by respirators cannot be assured without a high-functioning Respiratory Protection Program

More to be added
General Selection Considerations

- **Hazard type:** Communicable disease agent, concentration
- **Route(s) of exposure:** Respiratory, Skin, Mucous Membrane, Gastrointestinal, Mixed
- **Effectiveness of protection:** does the PPE choice reduce exposure to a level corresponding to the acceptable risk criteria?
- **Duration of exposure:** For prolonged exposure, PPE that afford comfort is preferable, e.g. PAPR instead of an N-95 respirator for reduced effort of breathing
- **Personal characteristics of wearer** (e.g. beard, unusual facial characteristics, medical conditions, claustrophobia)
- **Reusable or disposable**
- **Disposal, cleaning, maintenance and storage**
- **Complexity and frequency of education/training/retraining**
- **Ease of proper donning and doffing**
- **Storage and distribution**

Protection and PPE Types

1. **Respiratory**

   - **Respirators**
     - N-95
     - N-99-100
     - PAPR with hood or loose facepiece
     - Elastomeric Half mask and Full face piece air purifying respirators
     - with particulate filter efficiencies from N-95 to P-100

2. **Oronasal mucosa and conjunctiva**

   - **Goggles**
   - **Safety Glasses**
   - **Masks**
   - **Face Shields**
   - **Full-face respirators**
     - Design of these respirators provide optimal eye protection
3. Skin (and clothing)
   - Gloves
   - Gowns
   - Aprons
   - Shoe and hair covers

4. Total Protection
   - Protective suit with respirator, gloves and shoe covers

PPE Capabilities and Limitations Chart 1.1

<table>
<thead>
<tr>
<th>Exposure Type</th>
<th>Capabilities</th>
<th>Advantages</th>
<th>Limitations/Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicable Disease: Avian influenza, VHF, Tuberculosis, Smallpox, SARS, aerosolized Anthrax powder, Chickenpox, Hantavirus, Monkeypox</td>
<td>Prevents inhalation of infectious and other particles to ___ microns by filtering air through HEPA filter</td>
<td>Persons with beards, facial hair and unusual facial dimensions can be protected</td>
<td>Limited battery life</td>
</tr>
<tr>
<td>Respiratory for the Airborne Route</td>
<td>Provides positive air pressure to wearer</td>
<td>No added work of breathing</td>
<td>Must have fully charged battery to work properly</td>
</tr>
<tr>
<td>Powered Air Purifying Respirator (PAPR)</td>
<td>Used to protect against exposure to communicable diseases transmitted via the airborne route,</td>
<td>More protective than N-95, suitable for high risk medical procedures, e.g. intubation, bronchoscopy, sputum induction, airway suctioning, positive pressure ventilation via facemask, medication by nebulizer, etcetera</td>
<td>Batteries require electricity for recharging</td>
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<tr>
<td></td>
<td>Can be worn comfortably for longer periods than N-95</td>
<td></td>
<td>Vision and hearing are somewhat limited</td>
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<td></td>
<td>Eyeglasses can compromise face seal with tight-fitting PAPR. Special prescription inserts are necessary. Loose fitting PAPR or hoods do not require special inserts.</td>
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<td>Hoods and other apparatus must be properly cleaned, inspected, stored</td>
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<td>Wearer may be able to over–breathe the capacity of the respirator to supply filtered air under certain conditions</td>
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<td>Parts must be replaced when torn, worn or malfunctioning</td>
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<td></td>
<td></td>
<td></td>
<td>Hood/headpiece cannot be shared between users</td>
</tr>
<tr>
<td>Exposure Type</td>
<td>Capabilities</td>
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<td>Limitations/Disadvantages</td>
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<tr>
<td>Exposure Route</td>
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<td>PPE Type</td>
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<td></td>
<td>Some headpieces/hoods may contain latex</td>
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<td></td>
<td>Mechanical parts of the device can fail unexpectedly</td>
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<td>Claustrophobic persons may object</td>
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<td></td>
<td></td>
<td></td>
<td>Initially more expensive than N-95</td>
</tr>
</tbody>
</table>

| Communicable Disease: Avian influenza, Tuberculosis, Smallpox, Chickenpox, Monkeypox |
| Respiratory for the Airborne Route |
| N-95 Respirator |

NOTE: The above examples for N-95 and PAPR used for communicable disease would be repeated for other types of PPE, exposure types and routes.

Reference List 1.1  PPE Resources


DJJS. CDC. Updated Interim Infection Control and Exposure Management Guidance in the Health-Care and Community Setting for Patients with Possible Monkeypox Virus Infection
World Health Organization. Avian Influenza, including Influenza A (H5N1), in Humans: WHO Interim Infection Control Guideline for Health Care Facilities. 9 February 2006  (note: Chapter 19; Prioritizing the use of PPE when supplies are limited)


World Health Organization. Avian Influenza: Prevention and Control of Influenza due to Avian Influenza Virus A (H5N1) http://w3.whosea/en/Section10/Section1027/Section1091_4149.htm


NIOSH. Interim Recommendations for the Selection and Use of Protective Clothing and Respirators Against Biological Agents. October 24, 2001


Campbell DK, Coffey CC, Lenhart SW. Respiratory Protection as a Function of Respirator Fitting Characteristics and Fit-Test Accuracy. AIHAJ 2001 January/February;62:36-40

NIOSH. Understanding Respiratory Protection Against SARS. http://www.cdc.gov/niosh/npptl/topics/respirators/factsheets/respsars.html
**PLEASE NOTE THAT TOPIC AREA Infection Control in Resource Deficient Environments is being developed.**

**Isolation and Quarantine experiences (e.g. SARS)**

**What is quarantine and how does it differ from isolation?**

- **Isolation:**
  Restriction and response to infected people who are sick

- **Quarantine:**
  Restriction of people who are exposed, but not sick

**History**

**Laws**

**Limitations of quarantine**

- Large borders for US
- Rapid transportation
- Few public health personnel
- Economic and social pressures to avoid quarantine
- Many diseases are infectious when symptoms are non-specific or mild
Types of quarantine

• **Involuntary:**
  Legally possible but very rarely done

• **Voluntary:**
  All basic needs of quarantined people must be provided. Many people are needed to provide this.

Steps to consider before quarantine is done:

• For the pathogen of concern, is quarantine a biologically plausible intervention? (transmission can occur from person to person, infectious mainly in the time when the disease can be diagnosed)
• Incubation period long enough to allow a response
• Infectious period short enough (naturally or through treatment) so that quarantine can be stopped after some limited period).

Reference List 2.1 Quarantine and Isolation References

CDC Division of Global Migration and Quarantine Home Page
http://www.cdc.gov/ncidod/dq/index.htm

Contact information for quarantine stations:

Online training materials:

CDC, Emergency Preparedness and Response:

Clinician Outreach and Communication Activity (COCA)
http://www.bt.cdc.gov/coca/
Select: Conference Call Information Summaries, & Slide Sets
Feb 7, 2006 lecture: Danitza Tomanovic, MPH Quarantine Public Health Officer CDC, NCID, Division of Global Migration and Quarantine, Miami Quarantine Station

CDC SARS website
http://www.cdc.gov/ncidod/sars/
See:
Public Health Guidance for Community-Level Preparedness and Response
Slide Sets to Accompany SARS Public Health Guidance Document
http://www.cdc.gov/ncidod/sars/sarsplanslides.htm

See also SARS home page, community containment, legal authorities, etc. as indexed on the upper right side.

Course: “Smallpox: Disease, Prevention, and Intervention
http://www.bt.cdc.gov/agent/smallpox/training/overview/
See module 5 – isolation and quarantine.

Monkeypox - veterinarians
http://www.cdc.gov/ncidod/monkeypox/vet.htm
INFECTION DISEASE RISK COMMUNICATION (acknowledge but exclude)  

ISSUES OF INFECTION CONTROL IN RESOURCE-LIMITED ENVIRONMENT (WHO materials)

Supply and equipment shortages  Roz, Dave, Ruth

Physical Plant limitations  Dave, Ruth

  • Ventilation

General patient care areas

Infectious isolation areas
  o Standards for engineered Airborne Infectious Isolation Rooms (AIIR)
Strategies for converting non-AIIIR to infectious isolation use as Airborne Infectious Isolation Units (AIIU)

- Expedient enclosures for special purposes and extreme surge demand

**Protective environment areas**

- **Sanitation**
  - Hand washing, bathing, and toilet facilities
  - Hospital waste disposal processes
  - Cleaning, disinfection, and sterilization
  - Laundry

- **Safe Drinking Water**
  - Water sources
    - Piped
    - Packaged
    - Stored
  - Testing for microbial contamination
  - Disinfection strategies

- **Physical Security**
  - Access control
  - Secure storage
  - Internal traffic flow control

- **Utilities**
  - Power requirements
  - Water supply
  - Natural gas
  - Specialty gases
  - Communications
    - Phones
    - Internet access

**Personnel Limitations**

- Potential for personnel shortages during widespread outbreaks
- Strategies for preparation to maximize work attendance
  - Family preparedness planning
  - Work quarantine arrangements
- Alternate personnel resources

**Altered Standards of Care**

- Defining altered standards of care
  - Doing the greatest good for the greatest number of people

- Staffing

- Supplies and equipment

- Space
• Ethics