



# What Personal Protective Equipment for Highly Infectious Diseases in Highly Isolation Units

The European perspective

## EUNID Agreement on PPE in HIUs

In order to reach an agreement on PPE for highly infectious diseases (HIDs), managed in highly infectious diseases (HIUs), it was prepared a proposal considering what mentioned in:

- EUNID PPE questionnaire
- National guidelines indicated by EUNID partners (when available)
- Guidelines of international organizations (WHO, E-CDC, BICHAT, US-CDC, PHAC, ENVID)
- Data from the literature



## The EUNID Questionnaire

European national experts on Infection Control joining in the EUNID project developed and answered a questionnaire in order to know the preparedness and response to HIDs in Europe.

The aims of this questionnaire were to evaluate what the current situation and numbers of HIUs for the management of HIDs, and what personal protective equipments (PPE), and the sequence they were removed, were thought to be necessary for the management of patients with HIDs.



## The EUNID Questionnaire on PPE

The aim of the questionnaire on PPE was to evaluate which equipments were considered suitable for looking after patients with HIDs.

In particular:

- Precautionary measures used (contact, droplet, airborne)
- gloves (single, double)
- respirators (FP1, FFP2, FFP3, HEPA, PAPR)
- surgical masks
- head protection (full face shield, eye protection, hood with face shield, hair covering)
- Body protection (gowns, shirts, aprons, tyvek suits)
- shoe covering, and "others"



## Countries which participated at the EUNID meeting

During the EUNID meeting, hold in London on 5-6 April 2006, the partners of the project discussed the proposal, achieving an agreement .

At the meeting representatives from 14 countries were present:

- Austria
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Ireland
- Italy
- Luxembourg
- Netherlands
- Spain
- Sweden
- UK



## Why to use PPE in Healthcare Setting

To improve safety in health care personnel



## PPE definition

“any device or appliance designed to be worn or held by an individual for protection against one or more health and safety hazards”  
(89/686/EEC)

devices that “provides a physical barrier between micro-organisms and the wearer. It offers protection by helping to prevent micro-organisms from: contaminating hands, eyes, clothing, hair and shoes; and being transmitted to other patients and staff” (WHO)

“specialized clothing or equipment worn by an employee for protection against infectious materials” (OSHA)



## European Legislation on Safety in Healthcare Setting

### Measures to encourage improvements in the safety and health of workers at work (Council Directive 89/391/EEC)

General obligations on employers (*article 6*):

- to adopt technical progress
- to give priority to collective protective measures over individual protective measures

### Protection of workers from risks related to exposure to biological agents at work (Directive 2000/54/EC)

Determination and assessment of risks (*article 3*)

Reduction of risks (*article 6*): (...) “the risk of exposure must be reduced to as low a level as necessary in order to protect adequately the health and safety of the workers. In particular the following measures are to be applied :  
(b) design of work processes and engineering control measures so as to avoid or minimise the release of biological agents into the place of work;  
(c) collective protection measures and/or, where exposure cannot be avoided by other means, individual protection measures”



## What PPE should be worn?

- The proper selection of control measures is based on a hierarchy of elimination and minimization by engineering controls, followed last by personal protective equipment when exposures cannot be eliminated
- Once it is decided that personal protective equipment is needed, the process of selecting an appropriate PPE requires an understanding of the work activities associated with potential exposure:
  - type of exposure
  - foreseeable conditions of use



## European Legislation on PPE in Healthcare Setting

**Approximation of the laws of the Member States relating to personal protective equipment (and following amendments) (Council Directive 89/686/EEC)**

### **Annex II. Basic Health and Safety Requirements**

#### **3.10. Protection against dangerous substances and infective agents**

##### *3.10.1. Respiratory protection*

to supply the user with breathable air when the user is exposed to a polluted atmosphere the breathable air supplied to the user must be obtained by appropriate means

The constituent materials must ensure appropriate user respiration and respiratory hygiene

The leak-tightness of the facepiece and the pressure drop on inspiration and, in the case of the filtering devices, purification capacity must keep contaminant penetration low enough not to be prejudicial to the health or hygiene of the user

##### *3.10.2. Protection against cutaneous and ocular contact*

to prevent the surface contact of all or part of the body with infective agents PPE must be capable of preventing the penetration or diffusion of such agents through the protective integument



## European Legislation on PPE in Healthcare Setting

### Council Directive 89/686/EEC

#### **Annex II. Basic Health and Safety Requirements**

##### 3.10. Protection against dangerous substances and infective agents

the constituent materials and other components of PPE must be so chosen, or designed and incorporated as to ensure complete protection and hygiene for the period of wear concerned under the foreseeable conditions of use

the PPE must bear the manufacturer's identification mark and details of the specific characteristics of that type of equipment which, in conjunction with the instructions for use, will enable a trained and qualified user to employ the PPE correctly

the manufacturer's notes must also in the case of filtering devices, indicate the deadline for the storage of filters as new and kept in their original packaging



## European Legislation on PPE in Healthcare Setting

### Council Directive 89/686/EEC

#### **Annex II. Basic Health and Safety Requirements**

##### *General requirements applicable to all PPE*

- Ergonomics
- Levels and classes of protection
- Highest level of protection possible
- Classes of protection appropriate to different levels of risk
- Innocuousness of PPE
- Absence of risks and other 'inherent' nuisance factors
- Suitable constituent materials
- Satisfactory surface condition of all PPE parts in contact with the user
- Maximum permissible user impediment
- Adaptation of PPE to user morphology
- Lightness and design strength
- Compatibility of different classes or types of PPE designed for simultaneous use



## European Legislation on PPE in Healthcare Setting

### *... in particular*

#### *Highest level of protection possible*

The optimum level of protection to be taken into account in the design is that beyond which the constraints imposed by the wearing of the PPE would prevent its effective use during the period of exposure to the risk or normal performance of the activity.

#### *Absence of risks and other 'inherent' nuisance factors*

PPE must be so designed and manufactured as to preclude risks and other nuisance factors under foreseeable conditions of use.



## European Legislation on PPE in Healthcare Setting

### **Council Directive 89/686/EEC**

#### **Annex II. Basic Health and Safety Requirements**

##### *Information supplied by the manufacturer*

- name and address of the manufacturer
- his authorized representative in the Community
- storage, use, cleaning, maintenance, servicing and disinfection
- performance as recorded during technical tests to check the levels or classes of protection provided by the PPE
- suitable PPE accessories and the characteristics of appropriate spare parts;
- the classes of protection appropriate to different levels of risk and the corresponding limits of use
- the obsolescence deadline or period of obsolescence of PPE or certain of its components
- the type of packaging suitable for transport
- the significance of any markings



## Type of PPE used in Healthcare Setting

### Body protection

|   |              |
|---|--------------|
| Gloves                                  | EN 374-2003  |
| Protective Clothing (gown, apron, suit) | EN14126:2003 |

### Face protection

|                  |        |
|------------------|--------|
| Full face mask   | EN 136 |
| Half mask        | EN 140 |
| Goggles, eyewear | EN 166 |

### Respiratory protection

#### **Respirators**

|   |             |
|---|-------------|
| Disposable face piece                                 | EN 149:2001 |
| Powered hoods/helmets [TH1 (FFP2), TH2 (FFP3) or TH3] | EN 12941    |
| PAPR  | EN 147      |

#### **Filters**

|                                 |                   |
|---------------------------------|-------------------|
| Filters (P1, P2, P3) efficiency | EN 143            |
| Respiratory resistance          | EN 141 and EN 371 |



## Routes of Transmission

- **Contact**

it occurs when there is a skin-to-skin contact or contact with a contaminated intermediate object and physical transfer of micro-organisms to a susceptible host

- **Droplet**

it occurs when there is adequate contact between the mucous membranes of the nose and mouth or conjunctivae of a susceptible host and large particle droplets (> 5 µm)

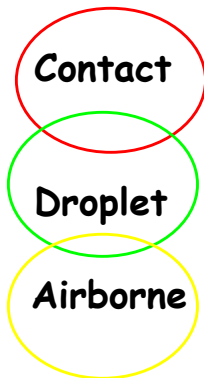
- **Airborne**

it occurs when droplet nuclei (evaporated droplets) <5µm in size are disseminated in the air, and can remain suspended in the air for some time





## Relationships between 'droplet' infection and 'airborne' infection



Respiratory secretions and largest droplets in which pathogens can survive

Small-medium size droplets can be propelled 2 or more meters (6 to 10 feet) from the source



## Isolation Precautions

- **Standard precautions**

applies to all patients receiving care in hospitals, regardless of their diagnosis or presumed infection status, when there may be contact with blood, body fluids, secretions, excretions and known and unknown contaminated equipment or surfaces

- **Additional precautions**

- Contact
- Droplets
- Airborne

They are designed to reduce the transmission of diseases spread by the contact, droplet, and airborne route, respectively





## Respiratory Hygiene/Cough Etiquette

droplet precautions for all patients with respiratory illness

### Universal Respiratory Etiquette Strategy for Healthcare Facilities

- Provide surgical masks to all patients with symptoms of a respiratory illness. Provide instructions on the proper use and disposal of masks.
- For patients who cannot wear a surgical mask, provide tissues and instructions on when to use them (i.e., when coughing, sneezing, or controlling nasal secretions), how and where to dispose of them, and the importance of hand hygiene after handling this material.
- Provide hand hygiene materials in waiting room areas, and encourage patients with respiratory symptoms to perform hand hygiene.
- Designate an area in waiting rooms where patients with respiratory symptoms can be segregated (ideally by at least 3 feet) from other patients who do not have respiratory symptoms.
- Place patients with respiratory symptoms in a private room or cubicle as soon as possible for further evaluation.
- Implement use of surgical or procedure masks by healthcare personnel during the evaluation of patients with respiratory symptoms.
- Consider the installation of plexiglass barriers at the point of triage or registration to protect healthcare personnel from contact with respiratory droplets.
- If no barriers are present, instruct registration and triage staff to remain at least 3 feet from unmasked patients and to consider wearing surgical masks during respiratory infection season.
- Continue to use droplet precautions to manage patients with respiratory symptoms until it is determined that the cause of symptoms is not an infectious agent that requires precautions beyond standard precautions.

## Who should wear PPE?

Personal protective equipment for **highly isolation unit (HIU)** staff should be used by:

- health care workers who provide direct care to patients;
- support staff including medical aides, cleaners, and laundry staff;
- laboratory staff;
- family members who provide care to or visit patients;



Modified from *Practical guidelines for infection control in health care facilities*, WHO 2004

## How to use PPE in Healthcare Setting

It is important to use PPE

- **correctly** (chose the proper device)
- and
- **effectively** (control their fit)



## When should PPE be worn?

**In HIU, PPE must be worn  
before entering the patients room**



## Where should PPE be worn and removed?

- PPE should be worn outside the patient room
- Remove PPE either in the anteroom or if there is no anteroom make sure that neither the environment outside the isolation room/area nor other persons can get contaminated



## EUNiD Agreement on PPE in HIUs

For each pathology,

PPE were grouped in three categories:

- **Body protection** (gloves, gown, plastic apron, tyvek suit, shoe covering, surgical boots, head covering)
- **Face protection** (full face shield, eye protection)
- **Respiratory protection** (FFP2, FFP3, filters, PAPR)

A proposal was offered for discussion, distinguishing:

- **Standard conditions**
- **High risk conditions**



## EUNID Agreement on PPE in HIUs

### High risk conditions

- cough-inducing or aerosol producing procedures, such as:
  - bronchoscopy
  - sputum induction
  - somministration of aerosolized medications
  - airway suctioning
  - intubation
  - mechanical ventilation
- procedures with risk of splashing or conditions with heavy contamination by body fluids (e.g. diarrhoea, vomiting, bleeding)



## EUNID Agreement on PPE in HIUs

For each PPE a proposal was shown for discussion with a rating strength of recommendation:

- R** “recommended”
- Ch** “to be **C**onsidered” but conferring “**H**igher protection”
- Cl** “to be **C**onsidered” but conferring “**L**ower protection”
- D** “discouraged”



## Isolation Precautions According to EUNID PPE agreement

|                     | Contact              | Droplets | Airborne                                    |
|---------------------|----------------------|----------|---|
| Smallpox            | X                    | X        | X   |
| VHFs                | X                    | X        | X   |
| Pneumonic<br>Plague | X                    | X        | <b>Only in high<br/>risk<br/>procedures</b> |
| MDR-TBC             | Standard precautions |          | X   |
| SARS<br>Avian Flu   | X                    | X        | X   |



## General Statements

- The incremental benefit of respirators for preventing transmission of airborne infectious agents has not been assessed
- Although there is **limited information** on the efficacy of respirators or masks in preventing transmission, particulate respirators have been shown to have greater filtration efficiency and better facial fit qualities than surgical masks
- For highly infectious diseases a precautionary principle should be applied
- Including triage areas and admission units in all healthcare settings (other than HIUs)
- In order to encourage adherence to PPE, the partners agreed to favour homogeneity in infection control protocols for HIU against the risk to over protection



## MDR Tuberculosis

| Body protection  | single gloves               | double gloves | Imperm . gown | plastic apron | full body tyvek suit | shoe covering | surgical boots | hair covering |
|------------------|-----------------------------|---------------|---------------|---------------|----------------------|---------------|----------------|---------------|
| <b>standard</b>  | <b>Standard precautions</b> |               |               |               |                      |               |                |               |
| <b>high risk</b> |                             |               |               |               |                      |               |                |               |

| Face protection  | Full face shield            | Goggles | eyeglasses with lateral shield | Hood with face shield | Safety glasses |
|------------------|-----------------------------|---------|--------------------------------|-----------------------|----------------|
| <b>Standard</b>  | <b>Standard precautions</b> |         |                                |                       |                |
| <b>High risk</b> |                             |         |                                |                       |                |

| Respiratory protection | Surgical mask | FFP1 | FFP2 | FFP3     | PAPR/Mask with HEPA filter |
|------------------------|---------------|------|------|----------|----------------------------|
| <b>Standard</b>        | D             | D    | Cl   | <b>R</b> | Ch                         |
| <b>High risk</b>       | D             | D    | D    | Cl       | <b>R</b>                   |



## Smallpox

| Body protection  | single gloves | double gloves | Imperm . gown | plastic apron | Full body tyvek suit | shoe covering | surgical boots | hair covering |
|------------------|---------------|---------------|---------------|---------------|----------------------|---------------|----------------|---------------|
| <b>standard</b>  | <b>R</b>      | Ch            | <b>R</b>      | Ch            | Ch                   | <b>R</b>      | Ch             | <b>R</b>      |
| <b>high risk</b> | <b>R</b>      | Ch            | <b>R</b>      | Ch            | Ch                   | <b>R</b>      | Ch             | <b>R</b>      |

| Face protection  | Full face shield | Goggles  | eyeglasses with lateral shield | Hood with face shield | Safety glasses |
|------------------|------------------|----------|--------------------------------|-----------------------|----------------|
| <b>Standard</b>  | Ch               | <b>R</b> | Cl                             | Ch                    | D              |
| <b>High risk</b> | <b>R</b>         | Cl       | D                              | Ch                    | D              |

| Respiratory protection | Surgical mask | FFP2 | FFP3     | PAPR/Mask with HEPA filter |
|------------------------|---------------|------|----------|----------------------------|
| <b>Standard</b>        | D             | Cl   | <b>R</b> | Ch                         |
| <b>High risk</b>       | D             | D    | Cl       | <b>R</b>                   |



## Viral Haemorrhagic fevers

| Body protection  | single gloves | double gloves | Imperm . gown | plastic apron | Full body tyvek suit | shoe covering | surgic al boots | hair covering |
|------------------|---------------|---------------|---------------|---------------|----------------------|---------------|-----------------|---------------|
| <b>standard</b>  | Cl            | <b>R</b>      | Cl            | Cl            | <b>R</b>             | <b>R</b>      | Ch              | Cl            |
| <b>high risk</b> | D             | <b>R</b>      | D             | D             | <b>R</b>             | <b>R</b>      | Ch              | D             |

| Face protection  | Full face shield/m ask | Goggles | eyeglasses with lateral shield | Hood with face shield | Safety glasses |
|------------------|------------------------|---------|--------------------------------|-----------------------|----------------|
| <b>Standard</b>  | <b>R</b>               | Cl      | D                              | Ch                    | D              |
| <b>High risk</b> | <b>R</b>               | D       | D                              | Ch                    | D              |

| Respiratory protection | Surgical mask | FFP2 | FFP3     | Mask/PAPR with HEPA filter |
|------------------------|---------------|------|----------|----------------------------|
| <b>Standard</b>        | D             | Cl   | <b>R</b> | Ch                         |
| <b>High risk</b>       | D             | D    | Cl       | <b>R</b>                   |



## SARS

| Body protection  | single gloves | double gloves | Imperm . gown | plastic apron | Full body tyvek suit | shoe covering | surgic al boots | hair covering |
|------------------|---------------|---------------|---------------|---------------|----------------------|---------------|-----------------|---------------|
| <b>standard</b>  | <b>R</b>      | Ch            | <b>R</b>      | Ch            | Ch                   | <b>R</b>      | Ch              | <b>R</b>      |
| <b>high risk</b> | <b>R</b>      | Ch            | <b>R</b>      | Ch            | Ch                   | <b>R</b>      | Ch              | <b>R</b>      |

| Face protection  | Full face shield | Goggles  | eyeglasses with lateral shield | Hood with face shield | Safety glasses |
|------------------|------------------|----------|--------------------------------|-----------------------|----------------|
| <b>Standard</b>  | Ch               | <b>R</b> | Cl                             | Ch                    | D              |
| <b>High risk</b> | <b>R</b>         | Cl       | D                              | Ch                    | D              |

| Respiratory protection | Surgical mask | FFP2 | FFP3     | Mask /PAPR with HEPA filter |
|------------------------|---------------|------|----------|-----------------------------|
| <b>Standard</b>        | Cl            | Cl   | <b>R</b> | Ch                          |
| <b>High risk</b>       | D             | Cl   | Cl       | <b>R</b>                    |





## Pandemic Flu (Phase 3 to 5)

| Body protection  | single gloves | double gloves | Imperm. gown | plastic apron | Full body tyvek suit | shoe covering | surgical boots | hair covering |
|------------------|---------------|---------------|--------------|---------------|----------------------|---------------|----------------|---------------|
| <b>standard</b>  | R             | Ch            | R            | Ch            | Ch                   | Ch            | Ch             | Ch            |
| <b>high risk</b> | R             | Ch            | R            | Ch            | Ch                   | Ch            | Ch             | R             |

| Face protection  | Full face shield | Goggles | eyeglasses with lateral shield | Hood with face shield | Safety glasses |
|------------------|------------------|---------|--------------------------------|-----------------------|----------------|
| <b>Standard</b>  | Ch               | R       | Cl                             | Ch                    | D              |
| <b>High risk</b> | R                | Cl      | D                              | Ch                    | D              |

| Respiratory protection | Surgical mask | FFP2 | FFP3 | Mask with HEPA filter | PAPR |
|------------------------|---------------|------|------|-----------------------|------|
| <b>Standard</b>        | D             | Cl   | R    | Ch                    | Ch   |
| <b>High risk</b>       | D             | D    | D    | R                     | R    |



## Pneumonic Plague

| Body protection  | single gloves | double gloves | Imperm. gown | plastic apron | Full body tyvek suit | shoe covering | surgical boots | hair covering |
|------------------|---------------|---------------|--------------|---------------|----------------------|---------------|----------------|---------------|
| <b>standard</b>  | R             | Ch            | R            | Ch            | Ch (D)               | Ch            | Ch             | R             |
| <b>high risk</b> | R             | Ch            | R            | Ch            | Ch                   | Ch            | Ch             | R             |

| Face protection  | Full face shield | Goggles | eyeglasses with lateral shield | Hood with face shield | Safety glasses |
|------------------|------------------|---------|--------------------------------|-----------------------|----------------|
| <b>Standard</b>  | Ch               | R       | Cl                             | Ch (D)                | D              |
| <b>High risk</b> | Ch               | R       | Cl                             | Ch (D)                | D              |

| Respiratory protection | Surgical mask | FFP2 | FFP3 | MaskPAPR with HEPA filter |
|------------------------|---------------|------|------|---------------------------|
| <b>Standard</b>        | R             | Ch   | Ch   | Ch                        |
| <b>High risk</b>       | Cl            | R    | R    | Ch                        |



## Removal of PPE

### Agreement for the removal of PPE in HIU:

- a detailed and pre-defined sequence to remove PPE after their use has to be known by HCWs, who should be trained in removing PPE.
- the sequence depends on the PPE chosen, which ultimately depends on the HID managed
- the HCW should be extremely careful in removing protection from the mucous membranes of the face with decontaminated hands, in order to prevent self-contamination with contaminated PPE or hands
- PPE should be removed in the anteroom, if present

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