Personal Protective Equipment

And Just-in-Time Training

EMORY UNIVERSITY SCHOOL OF MEDICINE

Serious Communicable Diseases Program

Project ECHO

Explore recommended PPE ensembles for pathogens of concern

Describe the steps for safe PPE usage

Discuss methods and requirements for training

Portal of Exit – how a pathogen leaves a host

Some respiratory pathogens are viable in urine and stool[1]

Some viruses can accumulate in areas thought to have immune privilege[2]

Modes of Transmission

Portal of Entry – how a pathogen enters a potential host

How many copies make an infectious dose

Not all entry points allow transmission to occur[4]

Susceptibility of potential host

Contact

Enhanced Contact

Droplet

Airborne

Gloves and Pearls

- Be aware of what you have touched
- Work clean to dirty then CHANGE gloves
- Consider double gloving if starting with dirty task
- Everything within reach of the patient should be considered dirty
- Never lose sight of the cuff of your glove
- **Safe glove removal is a skill**

- All gowns are not created equal
- Staff may not be aware of type or protection level[5]
- Whether launderable or disposable, gowns should all be SINGLE use
- **Safe removal is a skill**

Coveralls

Pro

Body area coverage
Single level of protection[6]
Lower risk of breach
Many can be wiped during use
Staff confidence in protection

Con

Time to don/doff
Difficult to don
Difficult to doff
Doffing may require assistance, seating, space
Not amenable to work flow

Safe removal of coveralls is a skill

Evidence on the need for eye protection continues to mount

Studies to distinguish ocular exposure from mouth and nose exposure have demonstrated transmission of influenza from eye exposure alone in animal subjects[7]

The surface of the eye, the fluid of the eye, and access to the upper respiratory tract are all potential means of infection.

Adequate eye protection has not been available or adopted in many healthcare facilities

PPE Selection for Special Pathogens

Viral Hemorrhagic Fevers = Enhanced Contact + Droplet + Airborne

Enhanced contact = total body coverage impervious to body fluids
Respiratory protection by N95 or better
Eye Protection
Double gloves

Rationale = High viral loads in many body fluids. Patients frequently or suddenly WET. Very small infectious dose that can cause infection by many entry points, including un-intact skin, mucous membranes.

AAMI Level 4 Gown or Coverall F1670/1671

N95 or higher or PAPR - Powered Air Purifying Respirator

Surgical hood or impervious head covering

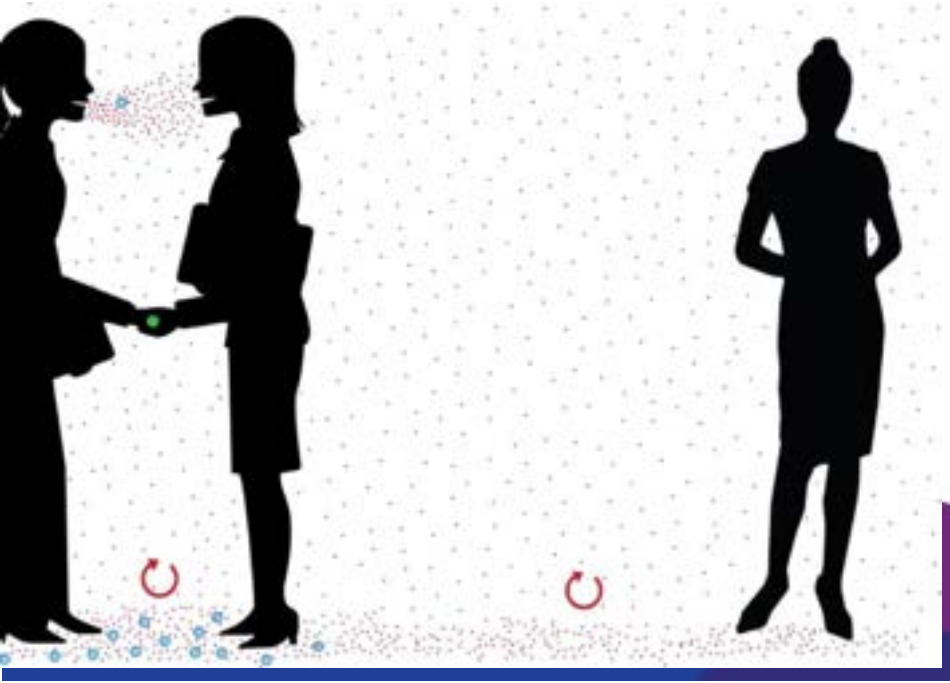
Face shield or Goggles

PPE Selection for Special Pathogens

Novel or High Consequence Respiratory = Contact, Droplet, Airborne

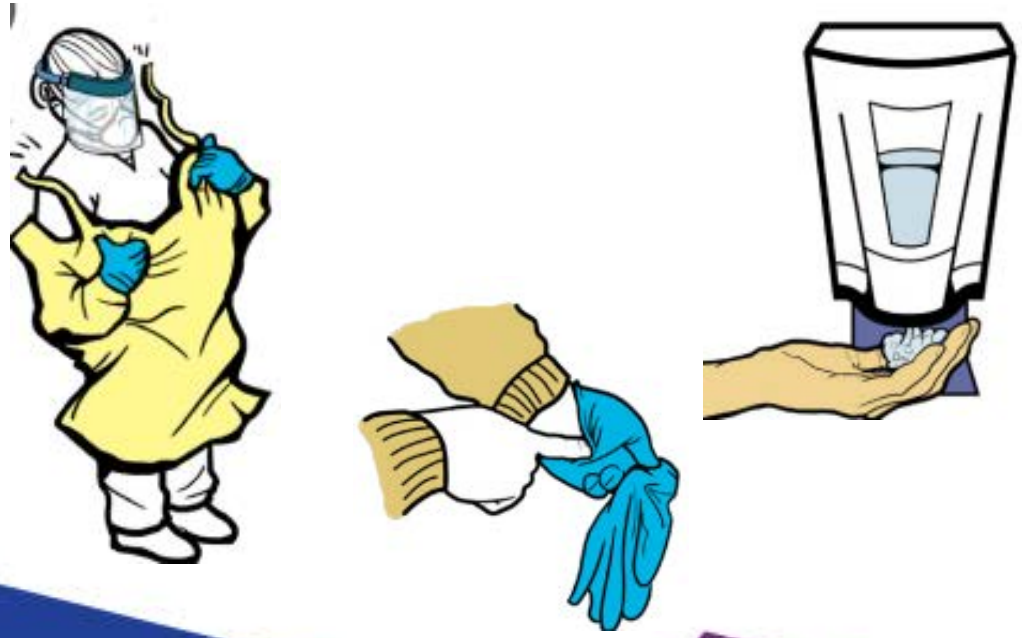
Contact = Isolation gown
Respiratory protection by N95 or better
Eye Protection
Gloves

Rationale = Mode of transmission, infectious dose, viral load information may not be known. Aerosols are not limited to traditional AGPs, no data to support 6' safe distance, known similar pathogens have ocular transmission, fomite risk unknown and may depend on staff behavior.[8]



Considerations for PPE Selection:

1. Physical infrastructure
2. Order of donning and doffing
3. Physicality demands
4. Risk encountered while performing tasks
5. Risk of doffing



Safe Behavior in PPE:

Awareness: limits of protection, altered proprioception, inherent risks, HANDS
Mitigation: hygiene opportunities, breach, additional barriers
Skill: meticulous doffing in the correct sequence in a safe space

Image credit: Emory SOM

Training

A Word to the Whys

WHY is PPE necessary

- ✓ Invisibility of danger – contamination, aerosolization, re-aerosolization
- ✓ It CAN be that bad
- ✓ Unconscious behaviors – what we touch, frequency of face contact
- ✓ Spread to other patients – high cost for all
- ✓ Transport to our homes, families – COVID, RSV, MRSA

In 2019, U.S. hospitals recorded 221,400 work-related injuries and illnesses, a rate of 5.5 work-related injuries and illnesses for every 100 full-time employees. This is almost twice the rate for private industry as a whole.[9]

Training

A Word to the Whys

The purpose of the piece

The importance of risk reduction

Ability to **anticipate**, **recognize**, **mitigate**

- ✓ What did I just touch?
- ✓ What might this patient do?
- ✓ What might I find in or under there?
- ✓ What do I need to do while I am in here?
- ✓ What do I have?
- ✓ What do I need?

Training

The importance of HANDS ON

Can donning and doffing be done alone?

If assistance may be required for doffing, what does the assistant wear?

Does it fit?

Can everyone physically perform donning and doffing?

Supply chain
Vendors
Pre-existing contracts
Other systems or products in use

What are equivalent pieces?
What substitutions are OK?
What modifications can be made?

HCW are creative! Guidelines are important to maintain safety

The best ideas on paper don’t always work in practice.

The aperture on these surgical hoods obscures their vision and occludes their respirators.

What modifications would you consider safe and allowable, if any?

Other known fit issues:

- Length of surgical gowns may allow the material to sweep the ground, especially when bending or crouching.
- Redundant fabric folds can trap contamination.

What fits on one may not fit on all

Leg cover extends to just above the knee or all the way to the groin.
Fit variations may effect the ability to doff safely.

Consider the variety of shapes and sizes of staff along with their strength and flexibility.

Doffing areas may need to contain grab bars or chairs in addition to trash cans and hand sanitizer.

Hands on training should include more than donning and doffing

Can you do your job in the PPE ensemble that has been chosen?

If your ensemble calls for two pairs of gloves, can you perform your usual tasks in them?

Consider practicing with two pair next time you start an IV, perform a venipuncture, touch monitors, or even peel apart a band-aid wrapper.

Just in Time

- ✓ Include a brief explanation of the WHYs
- ✓ Consider and discuss PPE behaviors
- ✓ Consider a communication plan that allows for a Time Out for safety concerns
- ✓ If time allows for demonstration and return demonstration, it should be included
- ✓ If there is not time for a demonstration, then donning, in-room behavior, and doffing should be performed under the supervision of a trained staff member, empowered to intervene if necessary for staff or patient safety, and appropriately protected to assist if needed.

Just in Time

Refresher for previously trained staff

- Short video clips
- PPE paper dolls
- Text quizzes
- Mnemonic devices for sequence of items

Competency check for previously trained staff prior to drill or real event

Immediate-need education for untrained staff who can not be replaced with trained staff or whose tasks can not be accomplished using safer, remote means.

(need to intubate? OK. Want to get a closer look at that rash or think you have to be in the room to take a history? Nope)

1. McKinney, K. R., Gong, Y. Y., & Lewis, T. G. (2006). Environmental transmission of SARS at Amoy Gardens. *Journal of environmental health*, *68*(9), 26.

2. Shantha, J. G., Crozier, I., Varkey, J. B., Kraft, C. S., Lyon, G. M., Mehta, A. K., ... & Yeh, S. (2016). Long-term management of panuveitis and iris heterochromia in an Ebola survivor. *Ophthalmology*, *123*(12), 2626-2628.

3. Musso, D., Stramer, S. L., & Busch, M. P. (2016). Zika virus: a new challenge for blood transfusion. *The Lancet*, *387*(10032), 1993-1994.

4. Randall, K., Ewing, E. T., Marr, L. C., Jimenez, J. L., & Bourouiba, L. (2021). How did we get here: What are droplets and aerosols and how far do they go? A historical perspective on the transmission of respiratory infectious diseases. *Interface focus*, *11*(6), 20210049.

5. https://wwwn.cdc.gov/PPEInfo/Standards/Info/ANSI/AAMIPB70Class3

6.https://wwwn.cdc.gov/PPEInfo/Standards/Info/ASTMF1670/F1670M17a#:~:text=ASTM%20F1670%20and%20ISO%2016603,buffer%20solution%2C%20and%20stabilizing%20agents.

7. Belser, J. A., Gustin, K. M., Katz, J. M., Maines, T. R., & Tumpey, T. M. (2014). Influenza virus infectivity and virulence following ocular-only aerosol inoculation of ferrets. *Journal of Virology*, *88*(17), 9647-9654.

8. Tang, Julian W., William P. Bahnfleth, Philomena M. Bluyssen, Giorgio Buonanno, Jose L. Jimenez, Jarek Kurnitski, Yuguo Li et al. "Dismantling myths on the airborne transmission of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2)." *Journal of Hospital Infection* 110 (2021): 89-96.

9. https://www.osha.gov/hospitals#:~:text=In%202019%2C%20U.S.%20hospitals%20recorded,private%20industry%20as%20a%20whole