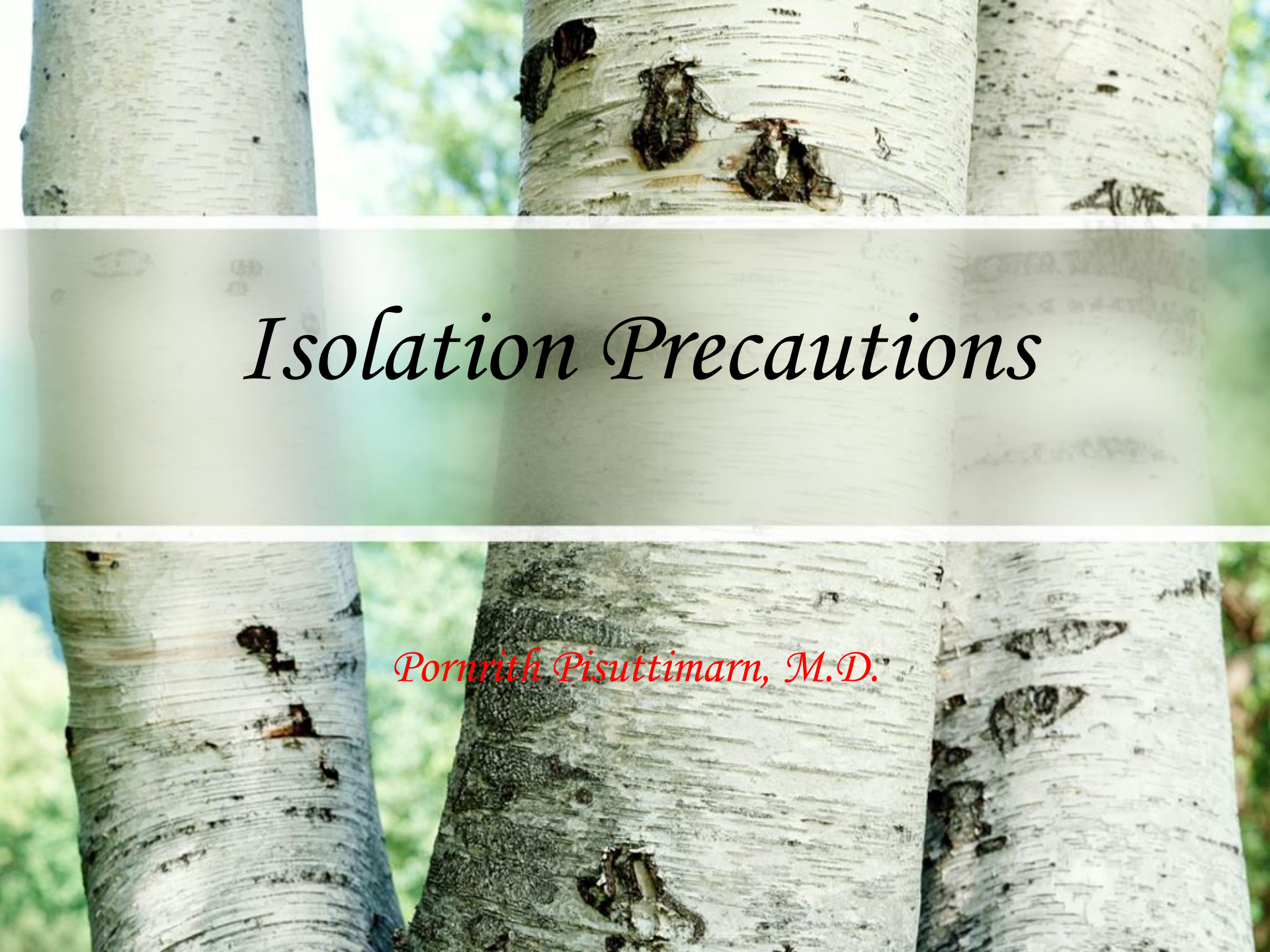


Isolation Precautions

Pornrith Pisuttimarn, M.D.

YEAR	DOCUMENT ISSUED
1970	Isolation Techniques for Use in Hospitals, 1st ed.
1975	Isolation Techniques for Use in Hospitals, 2nd ed.
1983	CDC Guideline for Isolation Precautions in Hospitals
1985-88	Universal Precautions
1987	Body Substance Isolation
1996	Guideline for Isolation Precautions in Hospitals

Change in Terminology

- Nosocomial infections was replaced by healthcare- associated infections (HAIs)
- Added respiratory hygiene/cough etiquette to Standard Precautions

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Rationale of Standard and Transmission Precautions

- Sources of infectious pathogens
- Susceptible persons
- Routes of transmission

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Sources of Infectious Pathogens

- Human reservoirs
- Environmental sources

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Human reservoirs

- Virus: HIV, HBV, HCV, Flu, VZV, HSV, HPV, etc.
- Bacteria: TB, meningococcus, gonococcus, STI, etc.
- Fungus: Dermatophytes
- Protozoa: Trichomonas, Giardia, Cryptosporidium, etc.

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Environmental sources

- Aspergillus
- Multi-drug resistant organisms (MDROs)

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Susceptible Persons

- Immune status
- Implantable medical devices

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Immunocompromised Hosts

- Phagocytic disorders
- Humoral immune defects
- Cell-mediated immune deficiencies

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Medical devices

- ICDs
- LVAD
- Indwelling catheters
- Prostheses
- etc.

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Routes of transmission

- Contact transmission: direct & indirect
- Droplet transmission
- Airborne transmission

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Contact transmission

- Direct Contact transmission:
  body fluids, skin & ectoparasites
- Indirect Contact transmission:
  healthcare worker hands, patient-care devices, toys & instruments

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Droplet transmission

- Particles greater than five microns in size
- Distance of not more than three feet
- Pathogens transmitted by this route include adenovirus, influenza virus, rhinovirus, SARS-associated coronavirus, *Bordetella pertussis*, group A streptococcus, *Mycoplasma pneumoniae*, *Neisseria meningitidis*, etc.

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Considerations

- Droplets from patients with smallpox and SARS could travel more than six feet away from their source

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Airborne transmission

- Particle size of five microns or less
- Transmission may occur at distances of more than three feet
- Pathogens transmitted by this route include TB, rubeola virus, VZV, etc.

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Reclassification of Aerosol Transmission

- Obligate: TB
- Preferential: measles, VZV
- Opportunistic: Flu, smallpox, SARS, noroviruses

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Environmental Transmission

- Aspergillus
- Legionella

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Other sources

- Vectorborne transmission

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Precautions to Prevent Infection Transmission

- Standard Precautions
- Transmission-Based Precautions:
  - Contact Precautions
  - Droplet Precautions
  - Airborne Precautions

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Standard Precautions

- All body fluids may carry communicable infectious pathogens
- Hand hygiene
- Personal protective equipment (PPE)
- New elements of standard precautions

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

New Elements of Standard Precautions

- Respiratory hygiene/cough etiquette
- Safe injection practices
- Infection control practices for special lumbar puncture procedues

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

http://www.youtube.com/watch?v=VQisWTZx02c

Hand hygiene

- Definitions
- Indications
- Recommended technique

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Definitions

- Hand hygiene
  - Performing handwashing, antiseptic handwash, alcohol-based handrub, surgical hand hygiene/antisepsis
- Handwashing
  - Washing hands with plain soap and water
- Antiseptic handwash
  - Washing hands with water and soap or other detergents containing an antiseptic agent
- Alcohol-based handrub
  - Rubbing hands with an alcohol-containing preparation
- Surgical hand hygiene/antisepsis
  - Handwashing or using an alcohol-based handrub before operations by surgical personnel

Guideline for Hand Hygiene in Health-care Settings. MMWR 2002; vol. 51, no. RR-16.

Indications for Hand Hygiene

- When hands are visibly dirty, contaminated, or soiled, wash with non-antimicrobial or antimicrobial soap and water.
- If hands are not visibly soiled, use an alcohol-based handrub for routinely decontaminating hands.

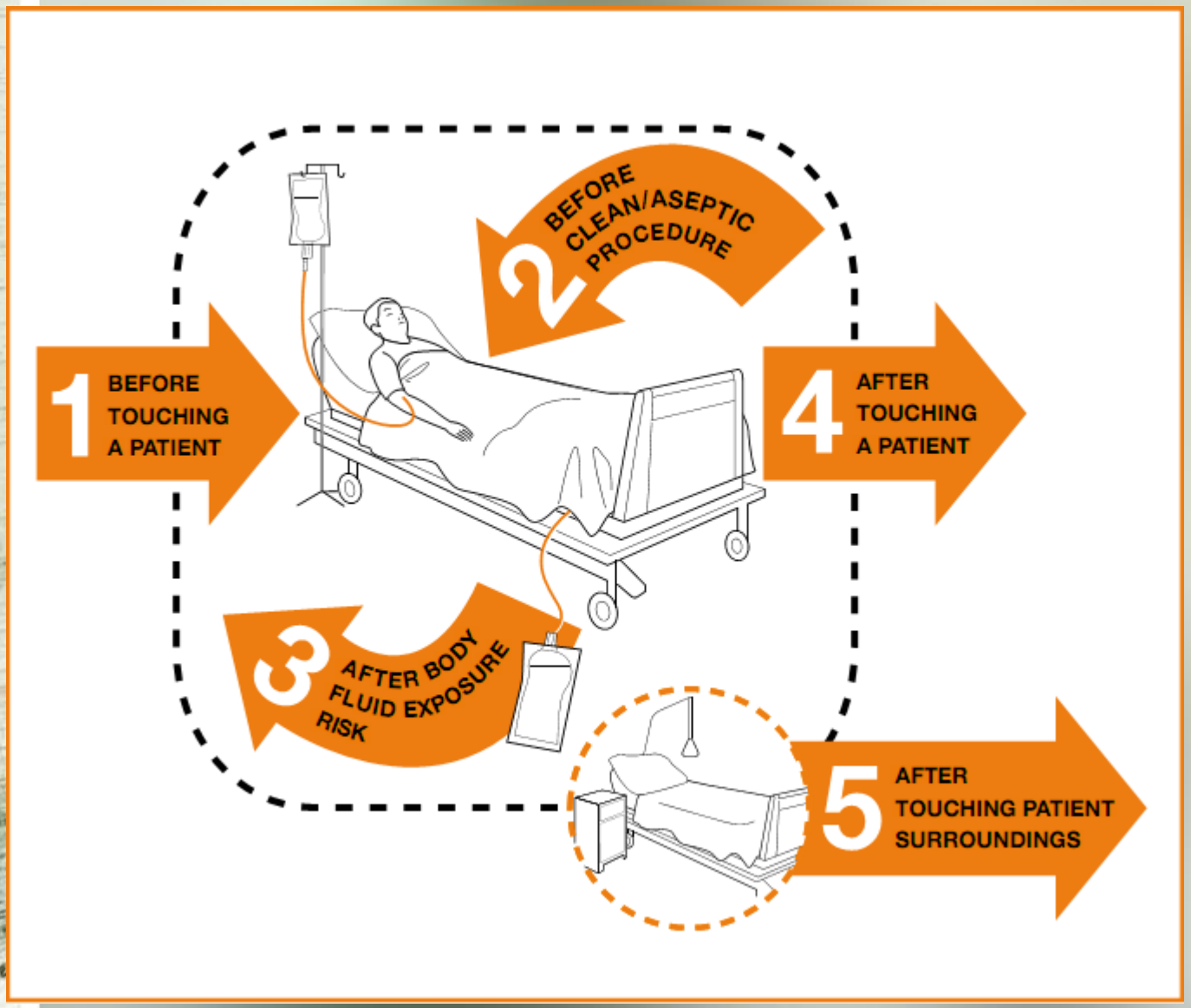
Guideline for Hand Hygiene in Health-care Settings. MMWR 2002; vol. 51, no. RR-16.

Specific Indications for Hand Hygiene

- Before:
  - Patient contact
  - Donning gloves when inserting a CVC
  - Inserting urinary catheters, peripheral vascular catheters, or other invasive devices that don't require surgery
- After:
  - Contact with a patient's skin
  - Contact with body fluids or excretions, non-intact skin, wound dressings
  - Removing gloves

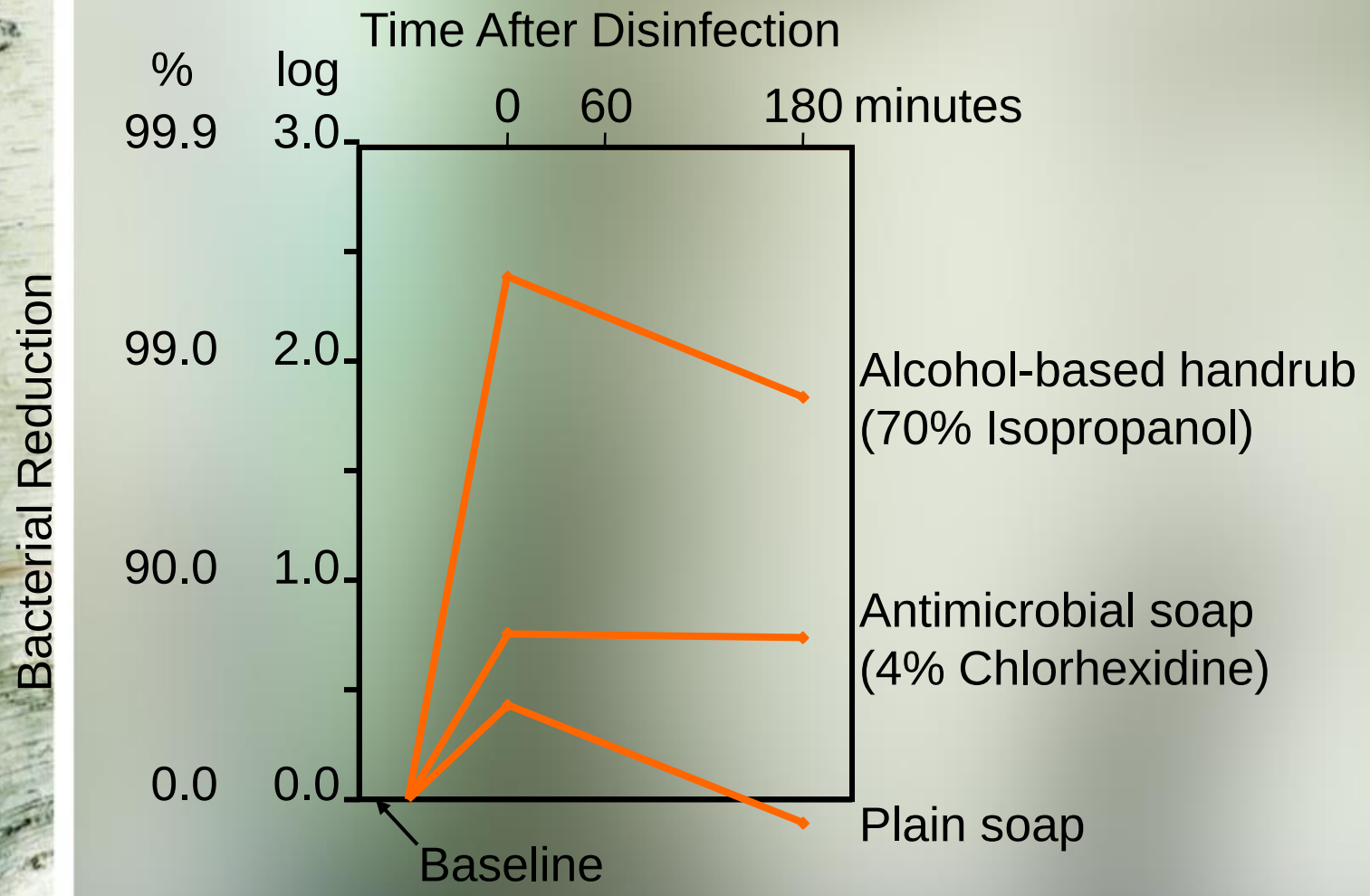
Guideline for Hand Hygiene in Health-care Settings. MMWR 2002; vol. 51, no. RR-16.

My five moments for hand hygiene



Sax H et al. 'My five moments for hand hygiene': a user-centred design approach to understand, train, monitor and report hand hygiene. Journal of Hospital Infection, 2007, 67:9–21.

Ability of Hand Hygiene Agents to Reduce Bacteria on Hands



Adapted from: Hosp Epidemiol Infect Control, 2nd Edition, 1999.

Recommended Hand Hygiene Technique

- Handrubs
  - Apply to palm of one hand, rub hands together covering all surfaces until dry
  - Volume: based on manufacturer
- Handwashing
  - Wet hands with water, apply soap, rub hands together for at least 15 seconds
  - Rinse and dry with disposable towel
  - Use towel to turn off faucet

Guideline for Hand Hygiene in Health-care Settings. MMWR 2002; vol. 51, no. RR-16.

Hand Hygiene Technique with Soap and Water

Duration of the entire procedure: 40-60 seconds

0

Wet hands with water;

1

Apply enough soap to cover all hand surfaces;

2

Rub hands palm to palm;

3

Right palm over left dorsum with interlaced fingers and vice versa;

4

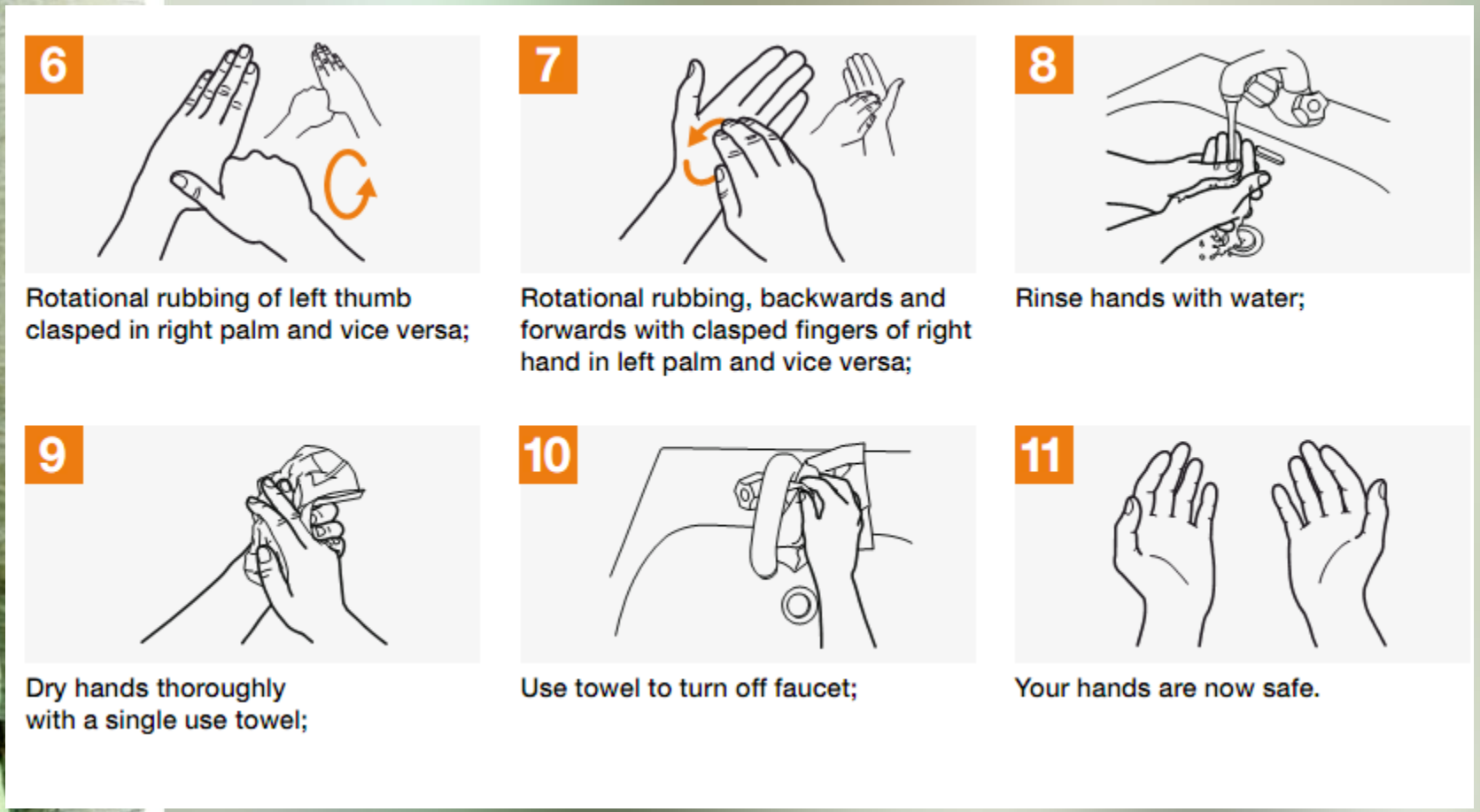
Palm to palm with fingers interlaced;

5

Backs of fingers to opposing palms with fingers interlocked;

whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf

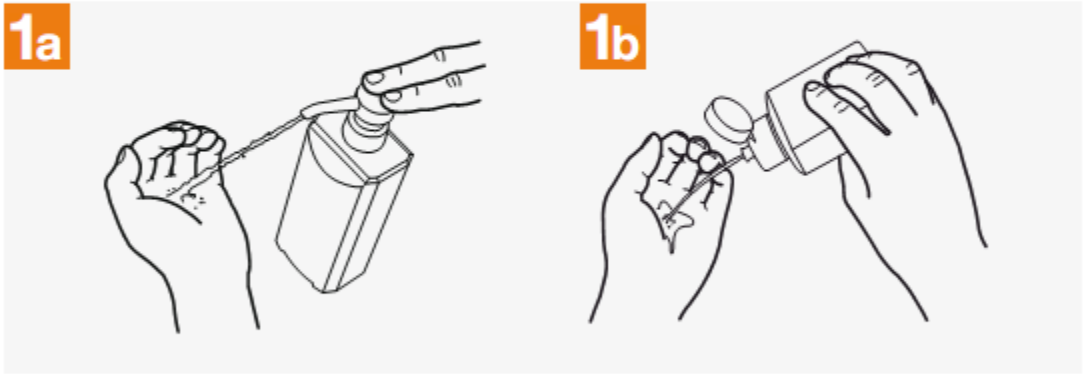
Hand Hygiene Technique with Soap and Water



whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf

Hand Hygiene Technique with Alcohol-Based Formulation

Duration of the entire procedure: 20-30 seconds



Apply a palmful of the product in a cupped hand, covering all surfaces;

Rub hands palm to palm;

whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf

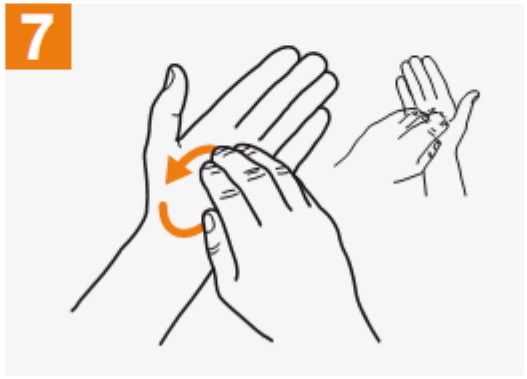
Hand Hygiene Technique with Alcohol-Based Formulation

Right palm over left dorsum with interlaced fingers and vice versa;

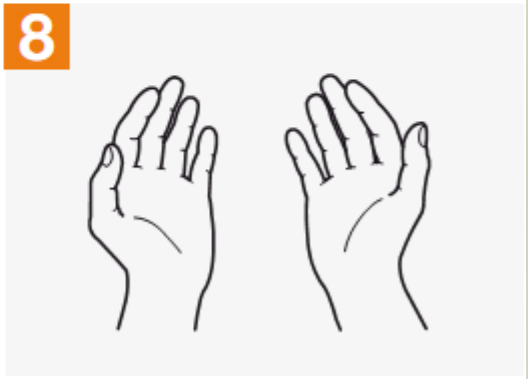
Palm to palm with fingers interlaced;

Backs of fingers to opposing palms with fingers interlocked;

Rotational rubbing of left thumb clasped in right palm and vice versa;



Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;



Once dry, your hands are safe.

whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf

Personal protective equipment

- Gloves
- Isolation gowns
- Face protection: masks, goggles, face shields
- Respiratory protection

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Gloves

- Purpose – patient care, environmental services, other
- Glove material – vinyl, latex, nitrile, other
- Sterile or nonsterile
- One or two pair
- Single use or reusable

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Do's and Don'ts of Glove Use

- Work from "clean to dirty"
- Limit opportunities for "touch contamination"- protect yourself, others, and the environment
  - Don't touch your face or adjust PPE with contaminated gloves
  - Don't touch environmental surfaces except as necessary during patient care

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Do's and Don'ts of Glove Use

- Change gloves
  - During use if torn and when heavily soiled (even during use on the same patient)
  - After use on each patient
- Discard in appropriate receptacle
  - Never wash or reuse disposable gloves

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Gowns or Aprons

- Purpose of use
- Material
  - Natural or man-made
  - Reusable or disposable
  - Resistance to fluid penetration
- Clean or sterile

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Face Protection

- Masks – protect nose and mouth
  - Should fully cover nose and mouth and prevent fluid penetration
- Goggles – protect eyes
  - Should fit snuggly over and around eyes
  - Personal glasses not a substitute for goggles
  - Antifog feature improves clarity

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Face Protection

- Face shields – protect face, nose, mouth, and eyes
  - Should cover forehead, extend below chin and wrap around side of face

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Respiratory Protection

- Purpose – protect from inhalation of infectious aerosols (e.g., Mycobacterium tuberculosis)
- PPE types for respiratory protection
  - Particulate respirators
  - Half- or full-face elastomeric respirators
  - Powered air purifying respirators (PAPR)

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Respiratory Protection Performance Criteria

- Types of Respiratory Protection
  - Nonpowered air-purifying respirators
  - Powered air-purifying respirators (PAPRs)
  - Supplied-air respirators

http://www.cdc.gov/nchstp/tb/pubs/mmwrhtml/ Maj_guide/infectioncontrol.htm

Nonpowered Air-Purifying Respirators

Resistance to Degradation	Filter Efficiencies		
	95 (95%)*	99 (99%)*	100 (99.97%)*
N (not resistant to oil)	N95	N99	N100
R (resistant to oil)	R95	R99	R100
P (oil proof)	P95	P99	P100

* The percentages in parentheses indicate the minimum allowable laboratory filter efficiency value when challenged with 0.3 µm particles

http://www.cdc.gov/nchstp/tb/pubs/mmwrhtml/ Maj_guide/infectioncontrol.htm

Sequence for Donning PPE

- Gown first
- Mask or respirator
- Goggles or face shield
- Gloves

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

How to Don a Gown

- Select appropriate type and size
- Opening is in the back
- Secure at neck and waist
- If gown is too small, use two gowns
  - Gown #1 ties in front
  - Gown #2 ties in back

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

How to Don a Mask

- Place over nose, mouth and chin
- Fit flexible nose piece over nose bridge
- Secure on head with ties or elastic
- Adjust to fit

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

How to Don a Particulate Respirator

- Select a fit tested respirator
- Place over nose, mouth and chin
- Fit flexible nose piece over nose bridge
- Secure on head with elastic
- Adjust to fit
- Perform a fit check –
  - Inhale – respirator should collapse
  - Exhale – check for leakage around face

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

How to Don Eye and Face Protection

- Position goggles over eyes and secure to the head using the ear pieces or headband
- Position face shield over face and secure on brow with headband
- Adjust to fit comfortably

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

How to Don Gloves

- Don gloves last
- Select correct type and size
- Insert hands into gloves
- Extend gloves over isolation gown cuffs

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

How to Safely Remove PPE

- Contaminated – outside front
  - Areas of PPE that have or are likely to have been in contact with body sites, materials, or environmental surfaces where the infectious organism may reside
- Clean – inside, outside back, ties on head and back
  - Areas of PPE that are not likely to have been in contact with the infectious organism

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

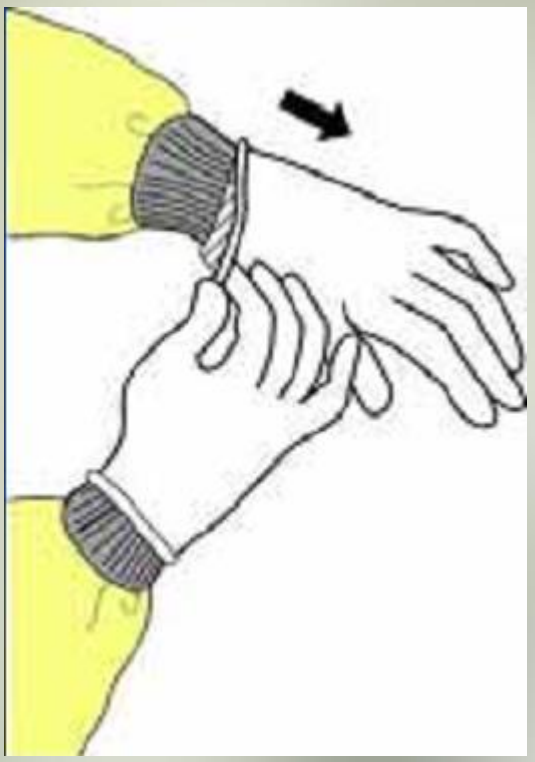
Sequence for Removing PPE

- Gloves
- Face shield or goggles
- Gown
- Mask or respirator

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

How to Remove Gloves

- Grasp outside edge near wrist
- Peel away from hand, turning glove inside-out
- Hold in opposite gloved hand



http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

How to Remove Gloves

- Slide ungloved finger under the wrist of the remaining glove
- Peel off from inside, creating a bag for both gloves
- Discard

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Remove Goggles or Face Shield

- Grasp ear or head pieces with ungloved hands
- Lift away from face
- Place in designated receptacle for reprocessing or disposal

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

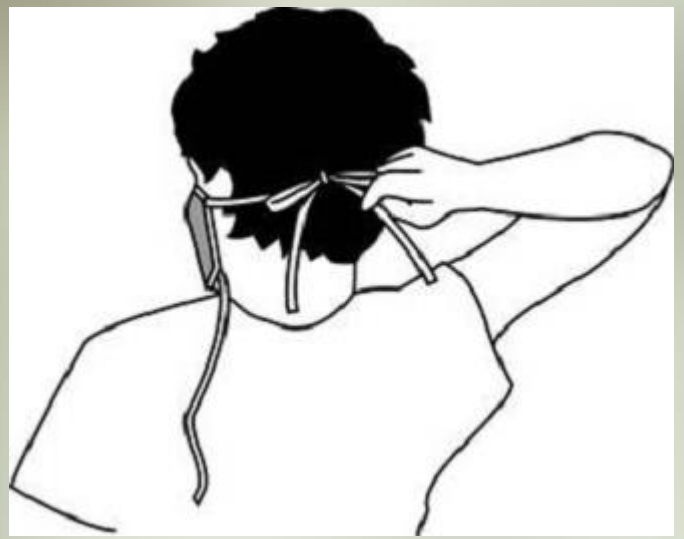
Removing Isolation Gown

- Unfasten ties
- Peel gown away from neck and shoulder
- Turn contaminated outside toward the inside
- Fold or roll into a bundle
- Discard

http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Removing a Mask

- Untie the bottom, then top, tie
- Remove from face
- Discard



http://www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Removing a Particulate Respirator

- Lift the bottom elastic over your head first
- Then lift off the top elastic
- Discard

www.cdc.gov/HAI/pdfs/ppe/PPEslides6-29-04.pdf

Respiratory Hygiene/Cough Etiquette

- Education of healthcare facility staff, patients, and visitors
- Posted signs, in languages appropriate to the population served, with instructions to patients and accompanying family members or friends
- Source control measures

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Respiratory Hygiene/Cough Etiquette

- Hand hygiene after contact with respiratory secretions
- Spatial separation

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Safe Injection Practices

- Use of a sterile, single-use, disposable needle and syringe for each injection given
- Prevention of contamination of injection equipment and medication

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Infection Control Practices for Special Lumbar Puncture Procedues

- Additional protection of a face mask for the individual placing a catheter or injecting material into the spinal or epidural space

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Contact Precautions

- Patients with wound drainage, fecal incontinence, or body discharges
- Single patient room was preferred
- Multi-patient rooms, ≥3 feet separation between beds was advised
- PPE

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Droplet Precautions

- Special air handling and ventilation were not required
- Single patient room was preferred
- Separation of ≥3 feet and drawing the curtain between patient beds was especially important

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Droplet Precautions

- Healthcare workers were s mask for close contact
- Respiratory hygiene/cough etiquette

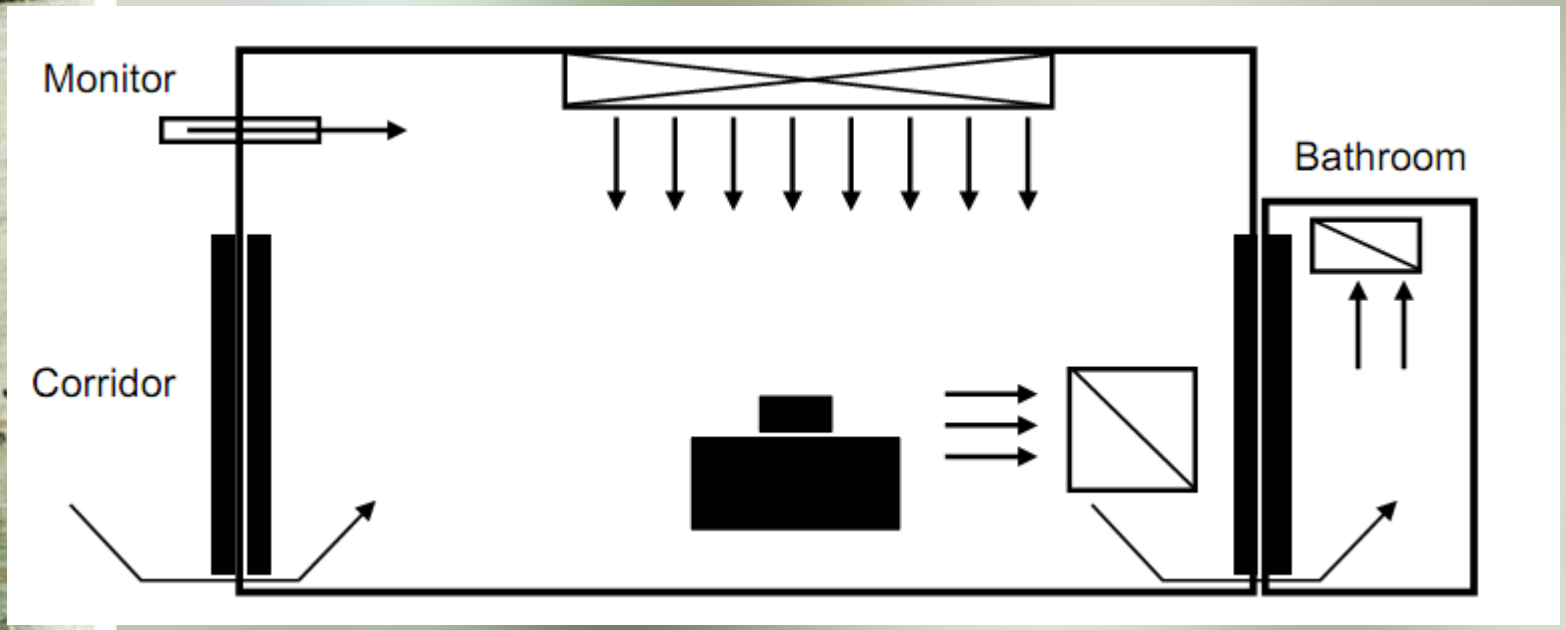
www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Airborne Precautions

- Airborne infection isolation room (AIIR)
- N95 or higher level respirators
- Non-immune healthcare workers should not care for patients with vaccine-preventable airborne diseases

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Negative-pressure room control for AII



www.cdc.gov/hicpac/pdf/guidelines/eic_in_HCF_03.pdf

Negative-pressure room engineering features

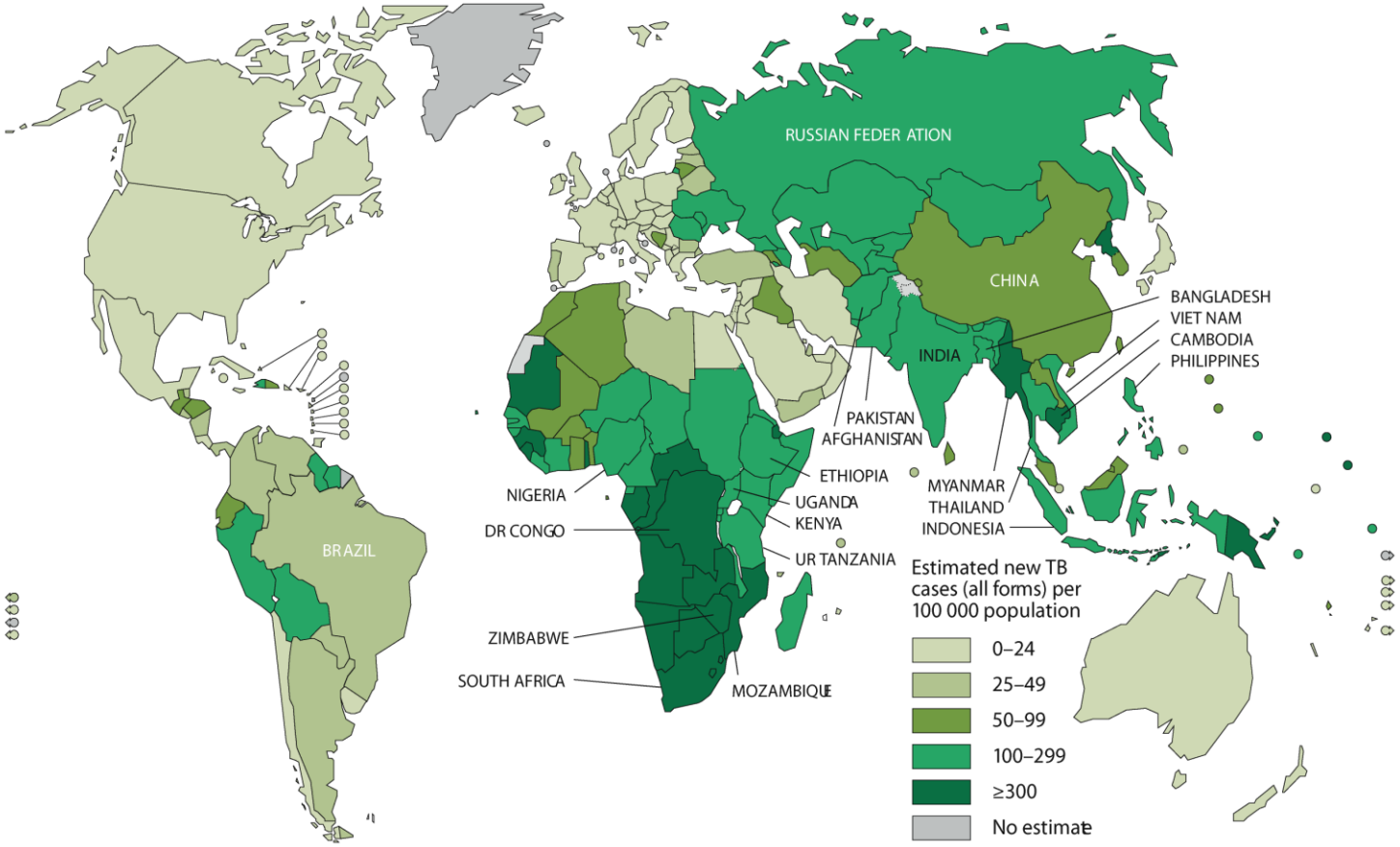
- Pressure differential of 2.5 Pa
- >12 air changes per hour
- Clean to dirty air flow
- Exhaust to outside or HEPA-filtered if recirculated
- Sealed room

*www.**cdc**.gov/hicpac/pdf/guidelines/eic_in_HCF_03.pdf*

IC: Interesting Issues

http://phil.cdc.gov/phil/details.asp

Estimated TB incidence rates, 2010



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Source: *Global Tuberculosis Control 2011*. WHO, 2011.

World Health Organization

http://gamapserver.who.int/mapLibrary/Files/Maps/Global_TB_incidence_2010.png

Type and duration of precautions recommended for TB

Tuberculosis	Type
Extrapulmonary, draining lesion	A,C
Extrapulmonary, no draining lesion, meningitis	S
Pulmonary or laryngeal disease, confirmed	**A**
Pulmonary or laryngeal disease, suspected	A

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

http://www.cdc.gov/vaccines/stats-surv/vasp/default.htm

Type and duration of precautions recommended for VZV

Infection	Type	Duration
Varicella Zoster	A,C	Until lesions dry and crusted

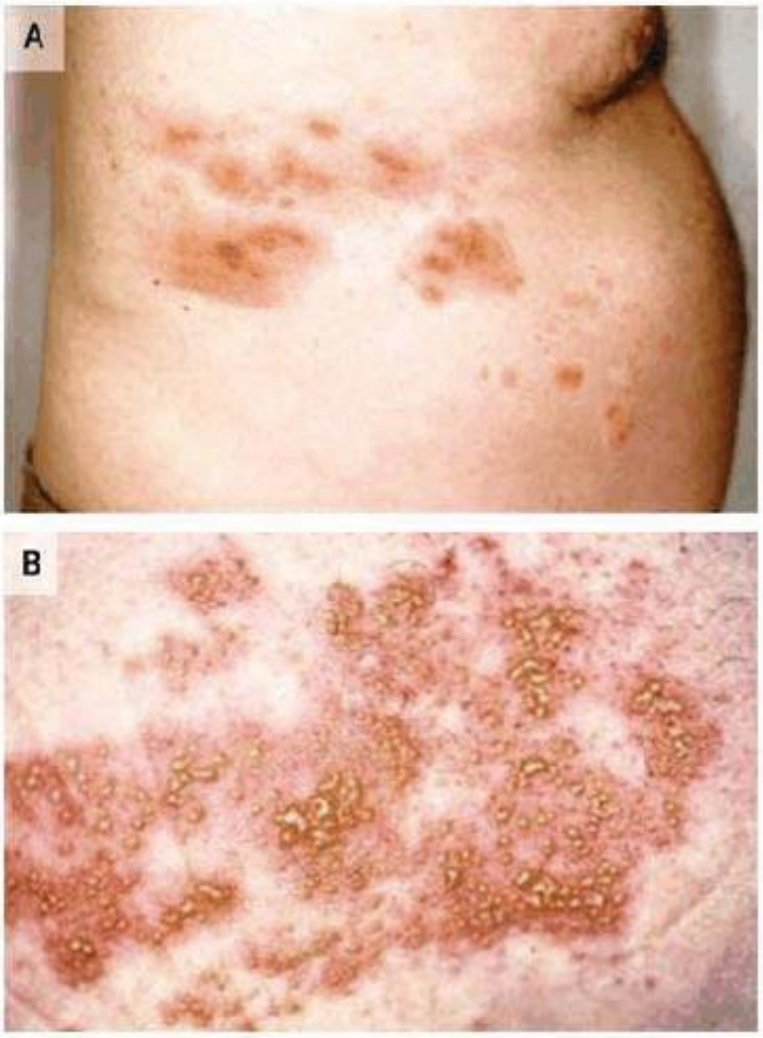
www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Post-exposure prophylaxis of VZV

- Zoster Vaccine
- Zoster immune globulin
- Antiviral Therapy
- IVIG

www.cdc.gov/mmwr/preview/.../rr57e0515a1.htm

FIGURE 1. Thoracic distribution of zoster (A), and zoster rash with coalescing clusters of clear vesicles (B)



http://www.cdc.gov/mmwr/preview/mmwrhtml/rr57e0515a1.htm

Type and duration of precautions recommended for HZ

Herpes zoster	Type
Disseminated disease, immunocompromised patient	A,C
Localized, intact immune system	S

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

http://phil.cdc.gov/phil/details.asp?pid=3187

Type and duration of precautions recommended for Measles

Infection	Type	Duration
Measles (rubeola)	A	4 days after onset of rash

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Post-exposure prophylaxis of Measles

- Live measles-containing vaccine (MCV), within 72 hours after initial exposure
- Measles immune globulin (IG), within 6 days of exposure

*wwwnc.**cdc**.gov/travel/yellowBookCh4-**Measles**.aspx*

http://phil.cdc.gov/phil/details.asp

Type and duration of precautions recommended for Rubella

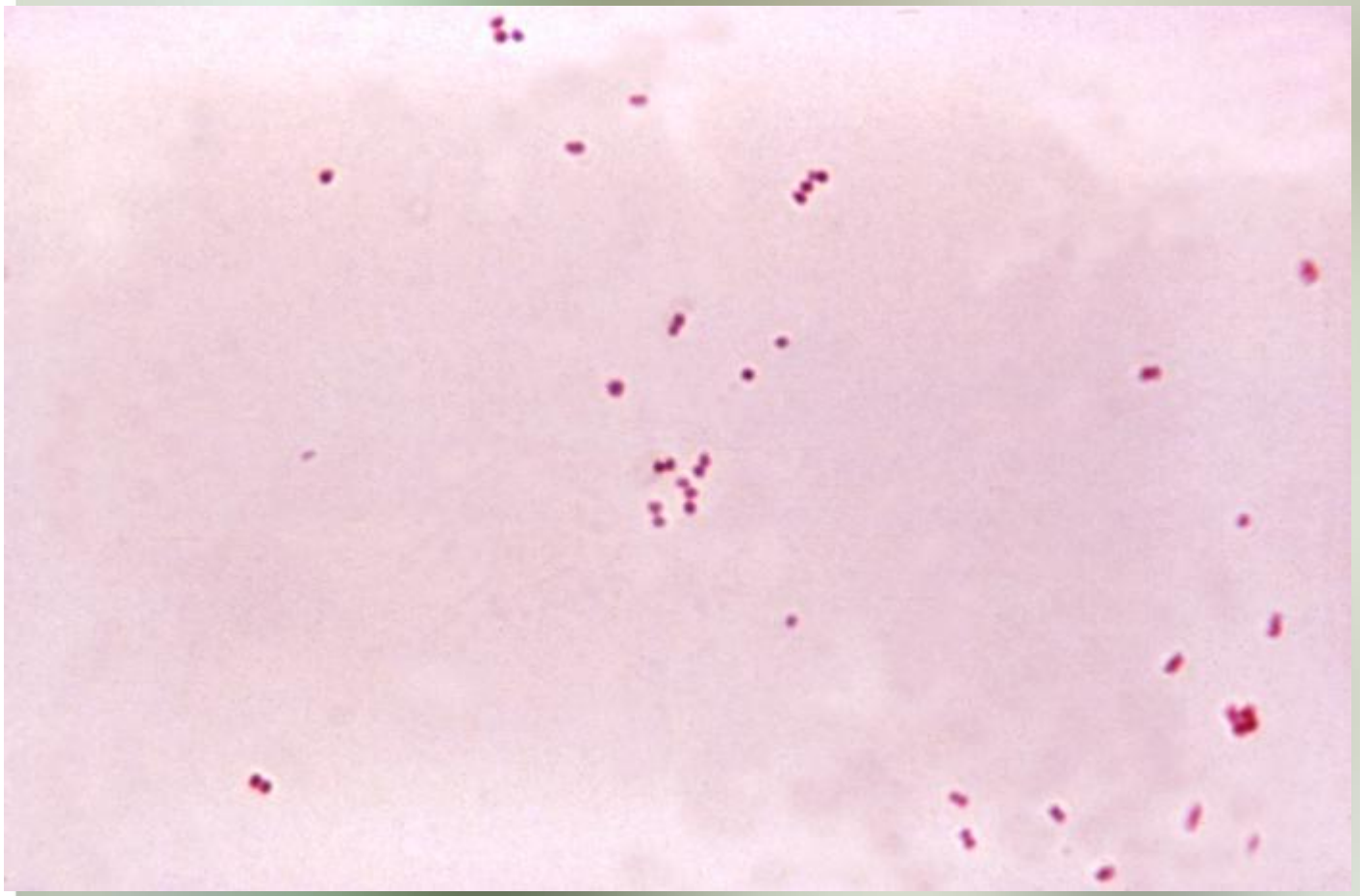
Infection	Type	Duration
Rubella (German measles)	D	7 days after onset of rash

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Post-exposure prophylaxis of Rubella

- Rubella vaccine, within 72 hours after initial exposure

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf



http://phil.cdc.gov/phil/details.asp?pid=6423

http://phil.cdc.gov/phil/details.asp?pid=1335

Type and duration of precautions recommended for Meningococcal disease

Infection	Type	Duration
Meningococcal disease	D	Until 24 hrs

www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Post-exposure prophylaxis of Meningococcal disease

- Antimicrobial chemoprophylaxis, within 24 hours after identification of the index case

www.cdc.gov/mmwr/preview/.../rr5407a1.htm

Detection of Infectious Influenza Virus in Cough Aerosols Generated in a Simulated Patient Examination Room

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http://cid.oxfordjournals.org/content/54/11/1569.full

Background. The potential for aerosol transmission of infectious influenza virus (ie, in healthcare facilities) is controversial. We constructed a simulated patient examination room that contained coughing and breathing manikins to determine whether coughed influenza was infectious and assessed the effectiveness of an N95 respirator and surgical mask in blocking transmission.

Methods. National Institute for Occupational Safety and Health aerosol samplers collected size-fractionated aerosols for 60 minutes at the mouth of the breathing manikin, beside the mouth, and at 3 other locations in the room. Total recovered virus was quantitated by quantitative polymerase chain reaction and infectivity was determined by the viral plaque assay and an enhanced infectivity assay.

Results. Infectious influenza was recovered in all aerosol fractions (5.0% in >4 μm aerodynamic diameter, 75.5% in 1–4 μm, and 19.5% in <1 μm; n = 5). Tightly sealing a mask to the face blocked entry of 94.5% of total virus and 94.8% of infectious virus (n = 3). A tightly sealed respirator blocked 99.8% of total virus and 99.6% of infectious virus (n = 3). A poorly fitted respirator blocked 64.5% of total virus and 66.5% of infectious virus (n = 3). A mask documented to be loosely fitting by a PortaCount fit tester, to simulate how masks are worn by healthcare workers, blocked entry of 68.5% of total virus and 56.6% of infectious virus (n = 2).

Conclusions. These results support a role for aerosol transmission and represent the first reported laboratory study of the efficacy of masks and respirators in blocking inhalation of influenza in aerosols. The results indicate that a poorly fitted respirator performs no better than a loosely fitting mask.

http://cid.oxfordjournals.org/content/54/11/1569.full

Thank you for your attention !