

In the name of God



HCW IMMUNIZATION: BACKGROUND

- HCWs are at risk of exposure to and possible transmission of communicable diseases
 - some vaccine preventable
- establishing and maintaining immunity is an essential component of Occupational Health and Infection Prevention and Control programs
- applies to all health care facilities
 - offices, clinics, acute care, LTC, labs, first responders
- applies to all health care personnel
 - employees, physicians, students, contract workers, volunteers



HCW IMMUNIZATION: BACKGROUND

- immunization protects HCWs, their families, colleagues and patients
- cost containment through prevention of infection
 - furloughing susceptibles after exposure
 - costs of prophylaxis
 - costs of treatment
 - absenteeism during acute illness
 - disability following illness
 - outbreak investigation and control



DISEASE CATEGORIES FOR HCW IMMUNIZATION

- active immunization strongly recommended - specific risk for HCWs
 - i.e., hepatitis B, influenza, measles, mumps, rubella, varicella
- active ± passive immunization may be indicated in certain circumstances
 - e.g., hepatitis A, meningococcal disease, TB, pertussis
- immunization recommended for all adults
 - i.e., tetanus, diphtheria



EVEN SUPER HEROS CAN SUCCUMB TO INFECTIOUS DISEASES....



INFECTIOUS DISEASES IN HEALTHCARE

ACCORDING TO THE CDC, THE FOLLOWING MAY BE TRANSMITTED AND/OR ACQUIRED IN HEALTHCARE SETTINGS

- Acinetobacter
- Bloodborne Pathogens
- Burkholderia cepacia
- Chickenpox (Varicella)
- Clostridium Difficile
- Clostridium Sordellii
- Creutzfeldt-Jakob Disease (CJD)
- Ebola (Viral Hemorrhagic Fever)
- Gastrointestinal (GI) Infections
- Hepatitis A
- Hepatitis B
- Hepatitis C
- HIV/AIDS
- Influenza
- **Covid 19**
- MRSA - Methicillin-resistant Staphylococcus Aureus
- Mumps
- Norovirus
- Parvovirus
- Poliovirus
- Pneumonia
- Rubella
- SARS
- S. pneumoniae (Drug resistant)
- Tuberculosis
- Varicella (Chickenpox)
- Viral Hemorrhagic Fever (Ebola)
- VISA - Vancomycin Intermediate Staphylococcus aureus
- VRE - Vancomycin-resistant enterococci



BLOOD BORNE PATHOGEN TRANSMISSION TO HEALTHCARE WORKERS

- In addition to Hepatitis B and C, and HIV from 1996 – 2005 there were “published case reports of 60 pathogens: 26 viruses, 18 bacterial/rickettsia, 13 parasites, and 3 yeast” known to occupationally infect HCW’s. (*Tarantola, AJIC, 2006*)



OCCUPATIONAL DEATHS FROM INFECTIOUS DISEASES: HEPATITIS B

- 1983 – 10,000 HCW's exposed
 - 5%-10% (500-1000) develop chronic infection
 - 15%-25% (75-200) die/year
- Risk of Hep B has diminished >90% due to Hep B Vaccine
- >30% HCW's decline vaccine resulting 400 HCW's/year becoming infected



OCCUPATIONAL DEATHS FROM INFECTIOUS DISEASES: HEPATITIS C

- CDC estimates that Hepatitis C is prevalent in 1.8% of US population, same for HCW's
- 1-3% of percutaneous exposures result in Hep C infection to HCW
- 3-8 HCW's annually die from Hepatitis C (estimate based on needlestick rate)



OCCUPATIONAL DEATHS FROM INFECTIOUS DISEASES: HIV

- 138 HCW's acquired AID's from a percutaneous exposure
- CDC methods do not collect death information



Infection	Exposure-Associated Attack Rate	Group of Health Care Workers Most Affected	Intervention†	Comment
HIV infection	0.1% to 0.4% per needlestick (4, 5)	Nurses, laboratory workers (6)	Zidovudine, lamivudine, indinivir (7)	Recent studies suggest that zidovudine may reduce risk, but additional trials are needed (7)
Hepatitis B	Rate per needlestick depends on E antigen status: 2% (e−) to 20% to 40% (e+) (8–10)	Nurses, laboratory workers, surgeons, dentists, dialysis workers (8)	Vaccination, hepatitis B immune globulin	In the United States, 125 to 190 deaths among health care workers occur each year (8)
Hepatitis C	1.2% to 10% per needlestick (11–15)	Oral surgeons (16, 17)	Immune globulin not effective (18)	No increased seroprevalence of hepatitis C virus among health care workers compared with volunteers (19)
Cytomegalovirus infection	Very low (20, 21)	None	NA	Pediatric health care workers at little or no risk (20, 21)
Ebola virus infection	High (22–25)	Nurses	Guidelines (26)	Health care workers account for many deaths during outbreaks (24, 25)
B virus infection	High (27)	Animal handlers (27)	Guidelines (28), acyclovir (27, 29)	Duration of acyclovir therapy unknown (27)
Creutzfeldt–Jakob disease	NA	None	Guidelines (30)	Epidemiologic studies show no increased risk for health care workers (31, 32)

* Numbers in parentheses are reference numbers. HIV = human immunodeficiency virus; NA = not applicable.

† All patients with indicated infection should be placed into universal precautions isolation. For more detailed information, consult reference 33.

Group of Health Care Workers	Documented Case of Occupational Acquisition	Possible Case of Occupational Acquisition
	<i>n</i>	
Dental workers, including dentists	0	7
Embalmers or morgue technicians	0	3
Emergency medical technicians or paramedics	0	9
Health aides or attendants	1	12
Housekeepers or maintenance workers	1	7
Laboratory technicians, clinical	15	15
Laboratory technicians, nonclinical	3	0
Nurses	19	24
Physicians, nonsurgical	6	10
Physicians, surgical	0	4
Respiratory therapists	1	2
Technicians, dialysis	1	2
Technicians, surgical	2	1
Other technicians or therapists	0	4
Other health care occupations	0	2
Total	49	102

* Adapted from reference 6. HIV = human immunodeficiency virus.

WHAT DO WE KNOW ABOUT STAFFING AND HCW INJURIES?

- High workloads associated with 50-200% increase in needlestick injuries/near misses, (Clark, 2002)
- Adverse work schedule and health care system changes associated with neck, shoulder, back MSD (Lipscomb, 2004).



EXTREME WORK SCHEDULES, INJURIES AND PATIENT CARE (JAMA, SEPT. 06)

- 84% of interns worked > than ACGME limits; 67% worked > 30 consecutive hrs.
- Odds of exposure to sharps or contaminated body fluids increase 61% when interns worked > 20 consecutive hrs. compared with interns working < 12 hrs.
- “24 hrs of continuous wakefulness causes impairment of cognitive performance comparable to that induced by a blood alcohol concentration of 100 mg/dl (legal intoxication in most states).”



Blood borne Pathogen Risks

- 2-40% risk of developing Hepatitis B
- 3-10% risk of developing Hepatitis C
 - 560-1,120/year
 - 85% become chronic carriers
- 0.3% risk of transmission of HIV
- >1000 workers will contract Hepatitis B, Hepatitis C, or HIV/year



WHAT DO WE KNOW?

- 300,000 + needlesticks continue to occur/year.
- Needlesticks and BB infections are extremely costly.
- Safety syringe have reduced incidence (> 50%)



AIRBORNE INFECTIONS

- TB, SARS, influenza, Covid
- Seasonal flu - <40% immunization among HCW
- Pandemic flu preparedness
- Aerosol vs droplet transmission
- Respiratory protection
 - Type, fit testing, stockpiles



WHAT DO WE KNOW?

- Short staffing leads to sick staff.
- Sick staff lead to sicker patients.
- Current levels of staff immunization inadequate.
- Current levels of available respiratory protection (N95s) inadequate for pandemic flu.

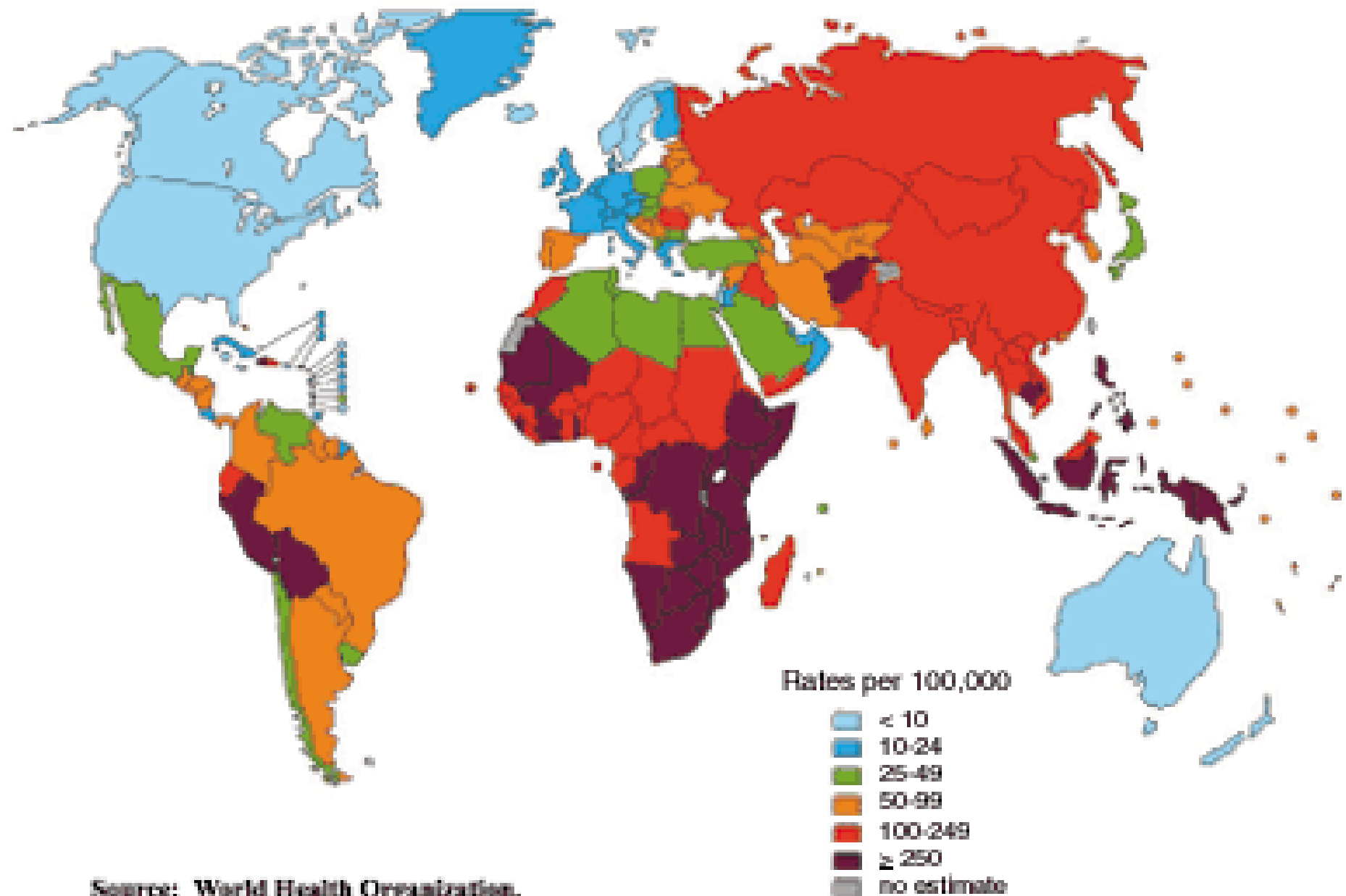


A scanning electron micrograph showing numerous yellow, rod-shaped Mycobacterium tuberculosis bacteria against a dark blue background. The bacteria are clustered in several groups, with some appearing as individual rods and others as small aggregates. The background has a textured appearance with small, dark, circular indentations.

Infectious diseases
are a major threat
to the well-being of
health care workers

More than 3% of TB infections in
2004 occurred in health care workers

Estimated Rates of New Cases of Tuberculosis, 1997

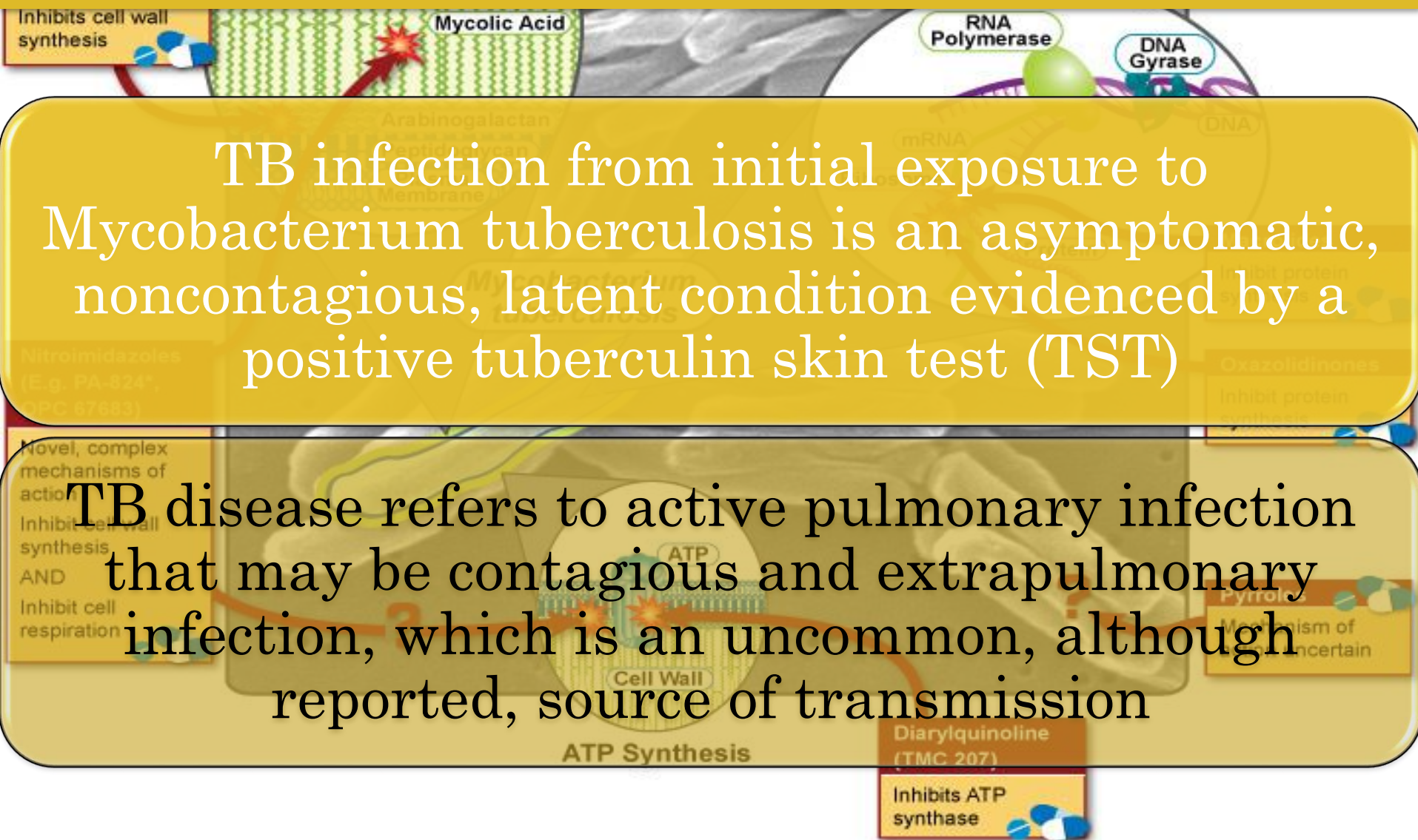


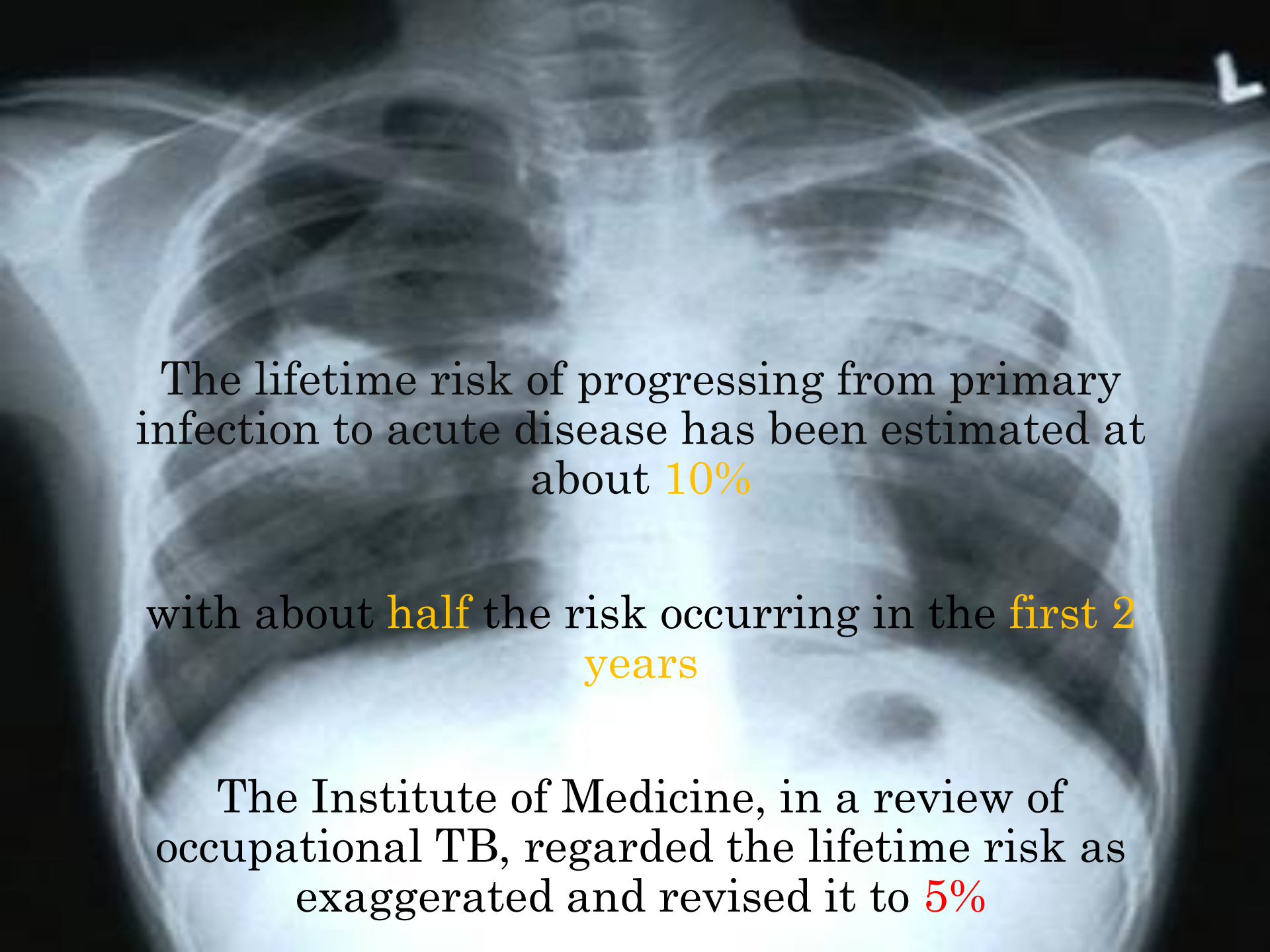
Source: World Health Organization.

Extent of the Problem

potentially affects all
workers in patient
care and allied fields
has major societal
implications

TUBERCULOSIS INFECTION VERSUS DISEASE





The lifetime risk of progressing from primary infection to acute disease has been estimated at about 10%

with about half the risk occurring in the first 2 years

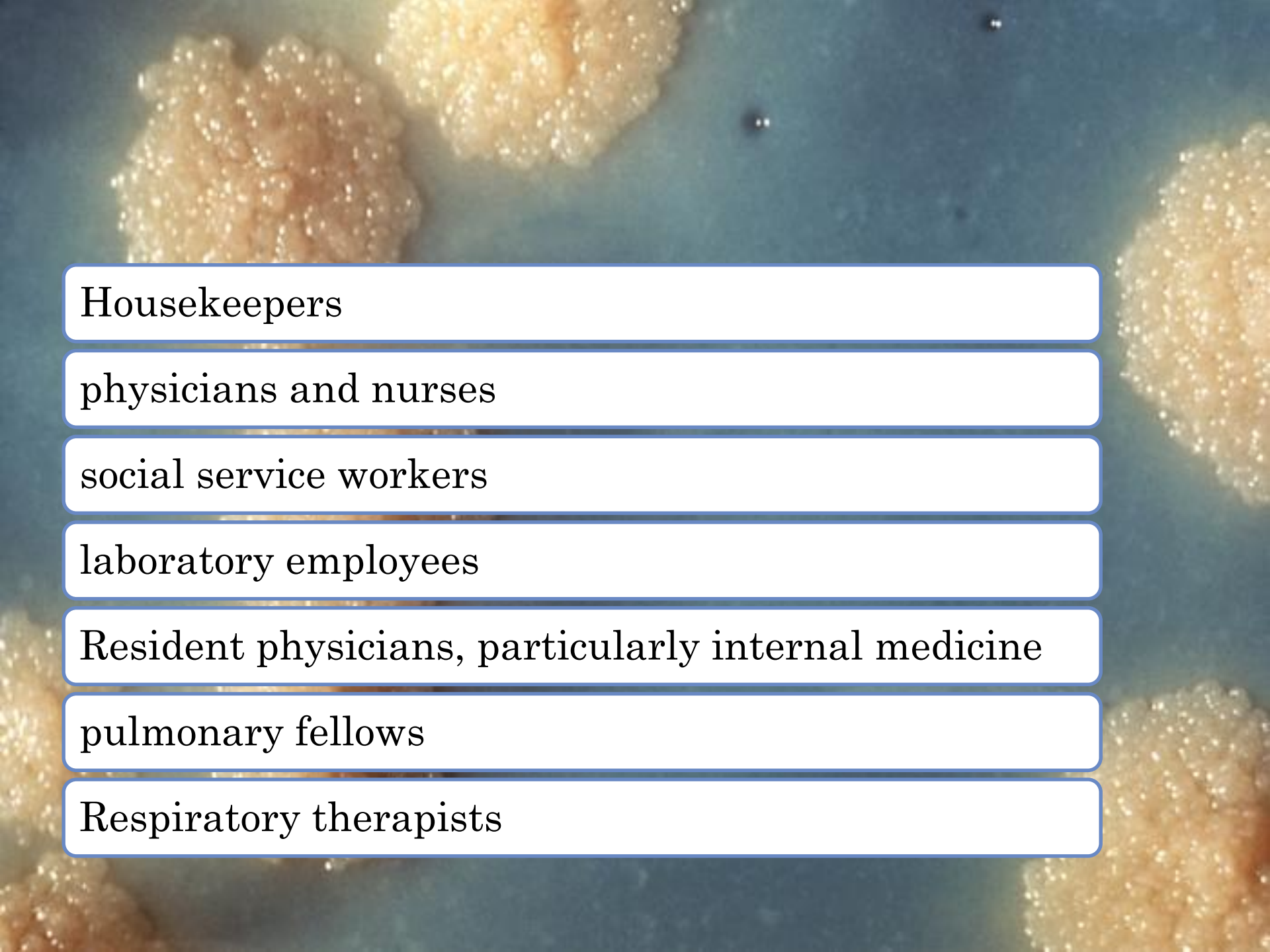
The Institute of Medicine, in a review of occupational TB, regarded the lifetime risk as exaggerated and revised it to 5%

Vulnerable Groups

Health care personnel who spend time with TB-infected patients are at a high risk for acquiring TB

One study of a nosocomial MDR-TB outbreak in an urban hospital demonstrated that simply working in the areas where treatment of TB patients took place was a sufficient risk factor, even without involvement in their care





Housekeepers

physicians and nurses

social service workers

laboratory employees

Resident physicians, particularly internal medicine

pulmonary fellows

Respiratory therapists

Tuberculosis



Lungs

Residents are notoriously noncompliant with infection control regulations, especially with use of respiratory protective devices and routine tuberculin testing

EMERGENCY DEPARTMENTS

Conditions unique to EDs pose special risks to their personnel

newly arrived immigrants, the homeless, the poor, substance abusers, and those with HIV/AIDS

Even patients in whom the diagnosis is promptly suspected or assigned empirically may spend hours awaiting isolation and initiation of treatment

Many EDs lack sufficient facilities to practice optimal infection control standards, such as isolation in negative-pressure rooms with frequent air exchange

Before engineering controls were adopted at the University of Pennsylvania Medical Center, the tuberculin conversion rate among ED staff members was 5.9 times that of other hospital employees



PATHOLOGY

autopsy suite

medical students, pathologists, and technicians

the greatest risk of TB infection is incurred during postmortem examination of a patient in whom a diagnosis of TB was overlooked during life



MICROBIOLOGY LABORATORY

TB is the sixth most common occupational infection afflicting laboratory workers

Autopsy and clinical laboratory staff are estimated to be 100 to 200 times more likely than the general public to develop active TB

LAMP-1

Cathepsin B/L

V-H⁺ATPaseProcessed
cathepsin D

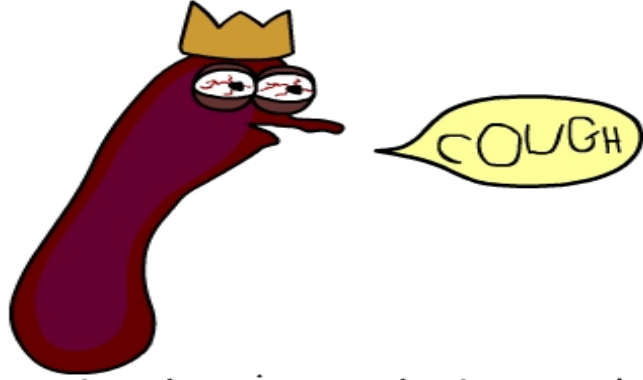
INFECTIOUSNESS

Disease factors that may influence the contagiousness of TB:

strain and drug resistance pattern

but definitive studies to establish the associations have not been done





mycobacterium tuberculosis

Patient factors

respiratory tract disease

pulmonary cavitation as seen on chest radiographs

smear positivity

frequency of cough, failure to cover mouth and nose during cough

HIV/AIDS (?)





health care system:

delay in **identification** and **treatment** of TB patients

The problem is that many cases, particularly in **HIV-infected patients** who may have **nonspecific presentations**, are not diagnosed for some time after hospital admission



How is TB spread?



Considering the possibility of TB as the diagnosis in **any coughing patient** and in any HIV-infected person with a nonspecific febrile or wasting illness



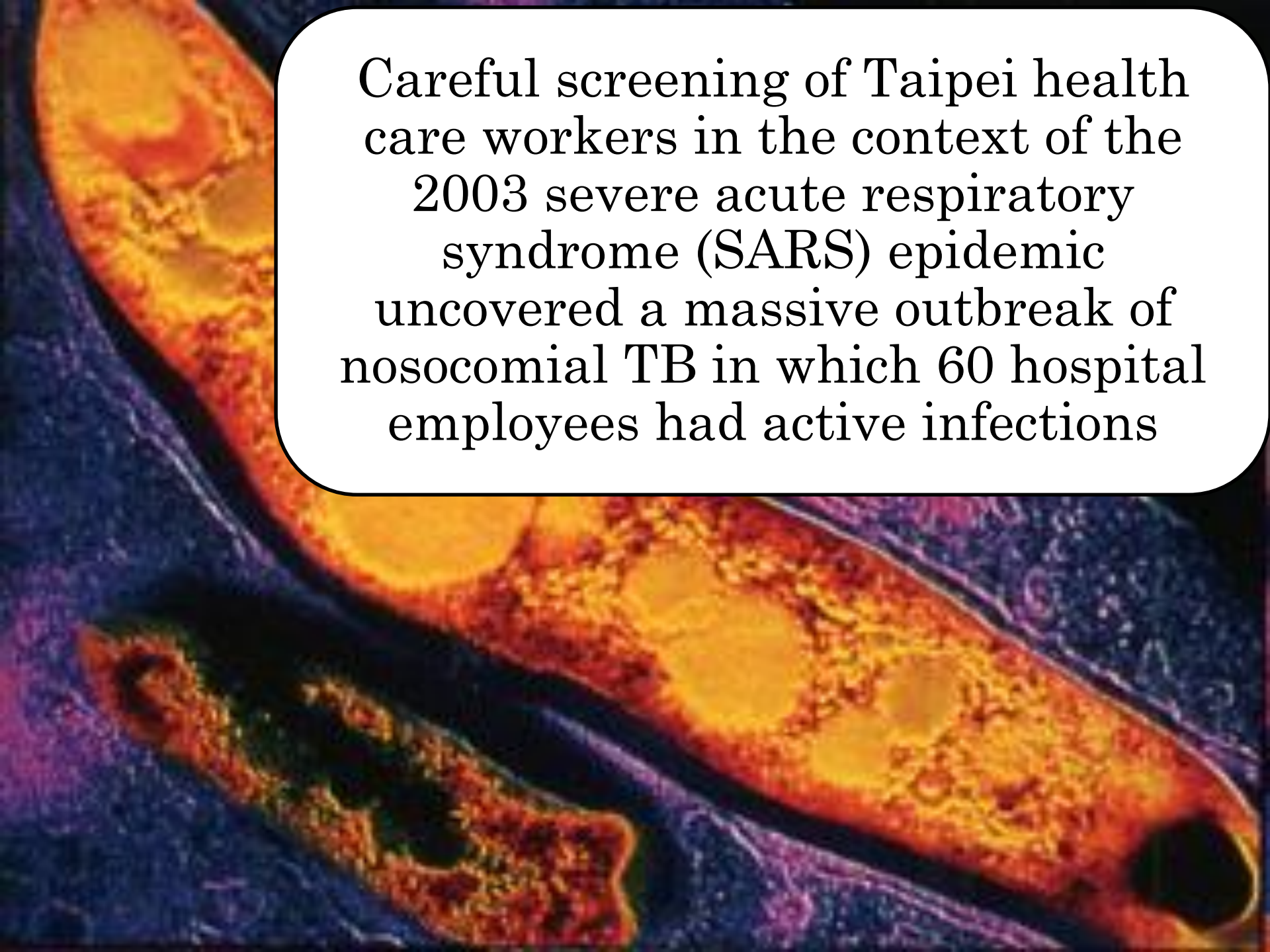
Suspecting TB and proceeding to make a diagnosis may not be sufficient; many hospitals routinely isolate all patients on whom acid-fast bacillus (AFB) smears are being sent

In Maryland, 45% of TB patients remained undiagnosed 30 days after first seeing a physician, including 25% with positive AFB smears

Other failings of health care systems:

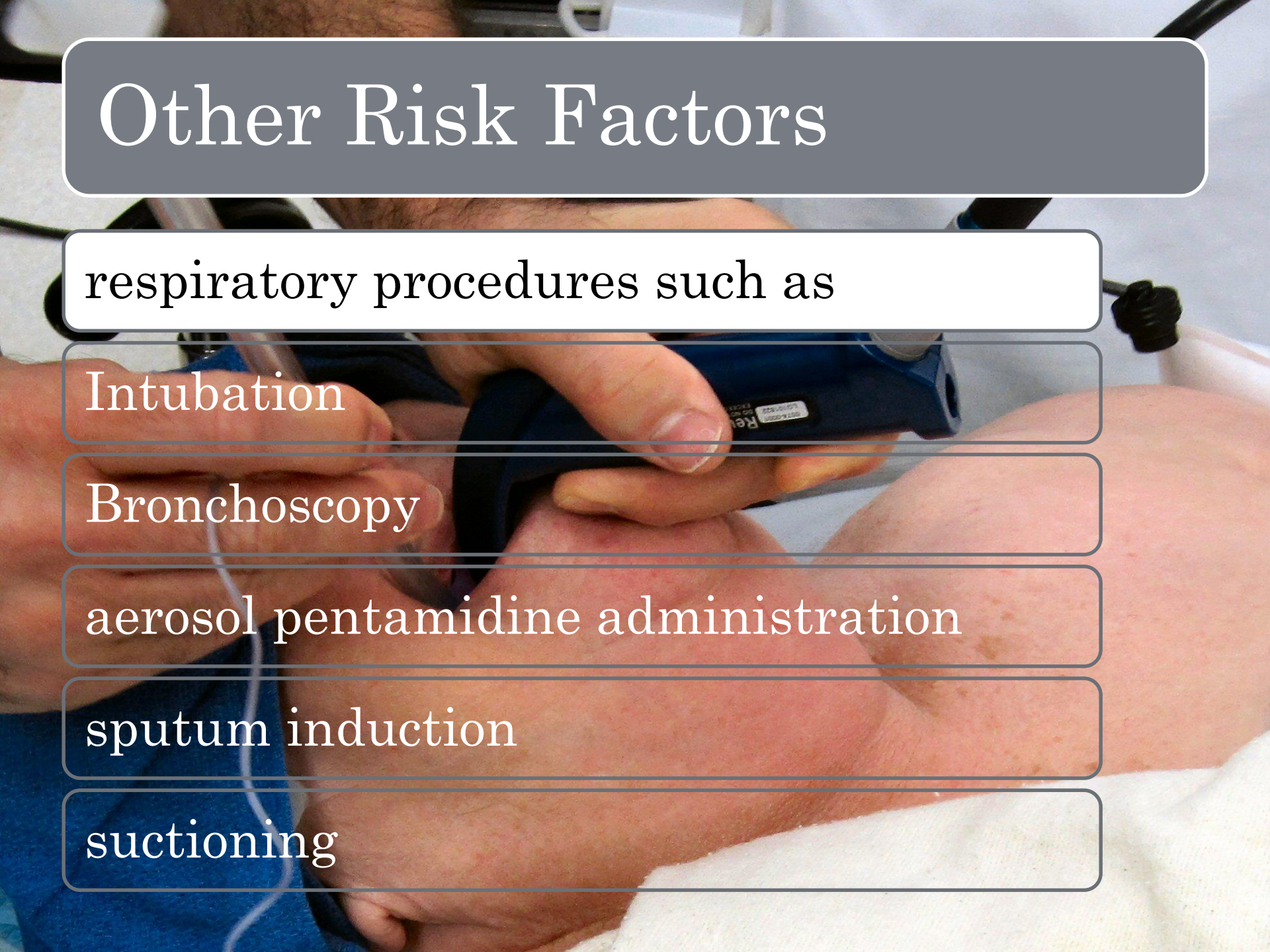
Delays in laboratory reporting of
susceptibility results

inadequate communication of
laboratory or other clinical findings to
health care workers

A detailed electron micrograph of a cell, likely a liver cell, showing a large nucleus with a prominent nucleolus, surrounded by rough endoplasmic reticulum and other organelles. The image is in color, with the nucleus appearing in shades of yellow and orange, and the surrounding cytoplasm in blue and purple.

Careful screening of Taipei health care workers in the context of the 2003 severe acute respiratory syndrome (SARS) epidemic uncovered a massive outbreak of nosocomial TB in which 60 hospital employees had active infections

Other Risk Factors

A background image showing a medical procedure. A person's arm is visible, and a hand is holding a blue medical device, possibly a nebulizer or a suction tip, near the arm. The device has some text on it, including "Rel" and "1000000".

respiratory procedures such as

Intubation

Bronchoscopy

aerosol pentamidine administration

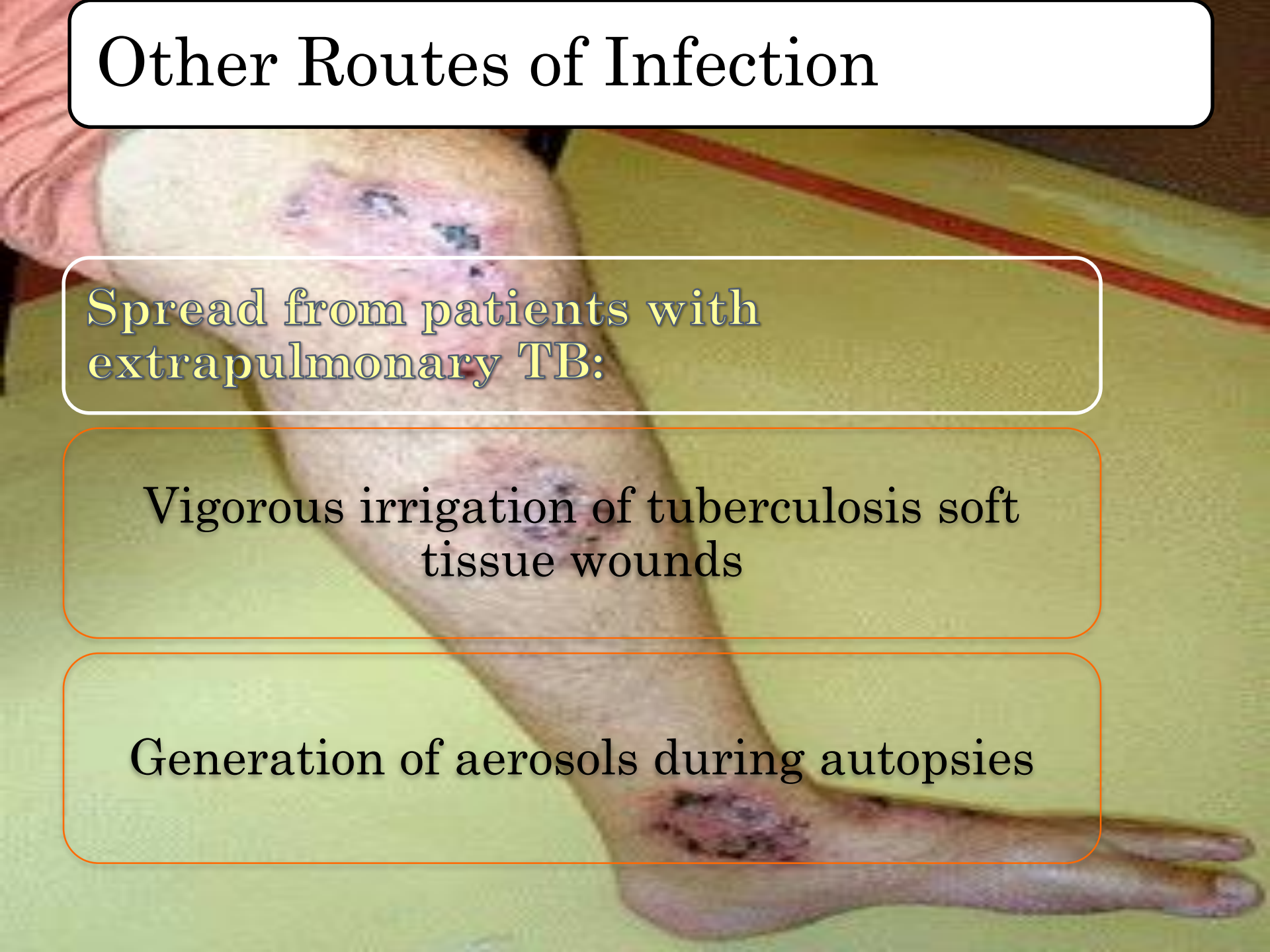
sputum induction

suctioning

An intubated patient in San Diego with smear-negative TB, which was unlikely to be transmitted otherwise, spread infection to 10 of 13 health care workers present at bronchoscopy



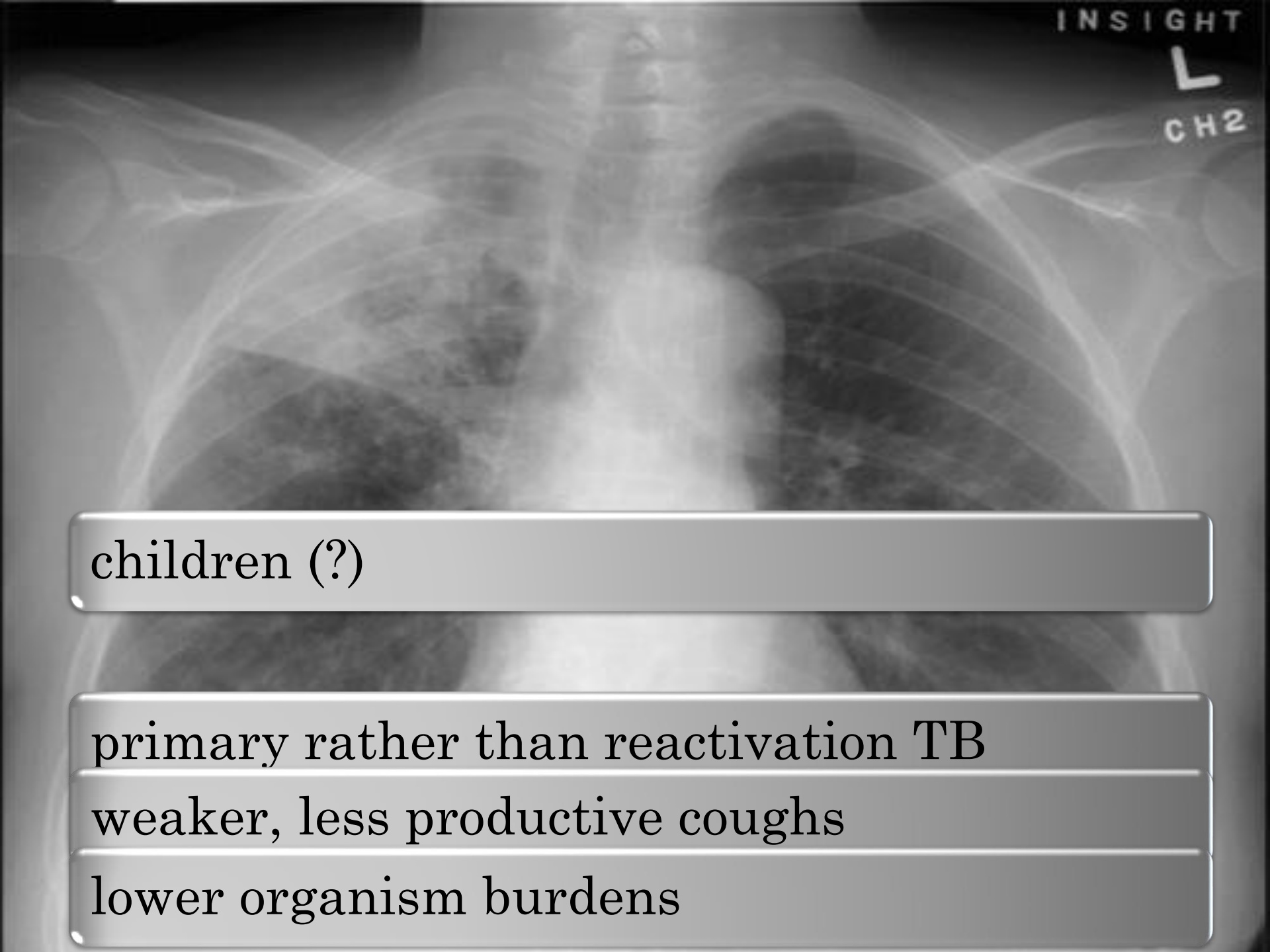
Other Routes of Infection



Spread from patients with
extrapulmonary TB:

Vigorous irrigation of tuberculosis soft
tissue wounds

Generation of aerosols during autopsies



children (?)

primary rather than reactivation TB

weaker, less productive coughs

lower organism burdens

The Tuberculin Test

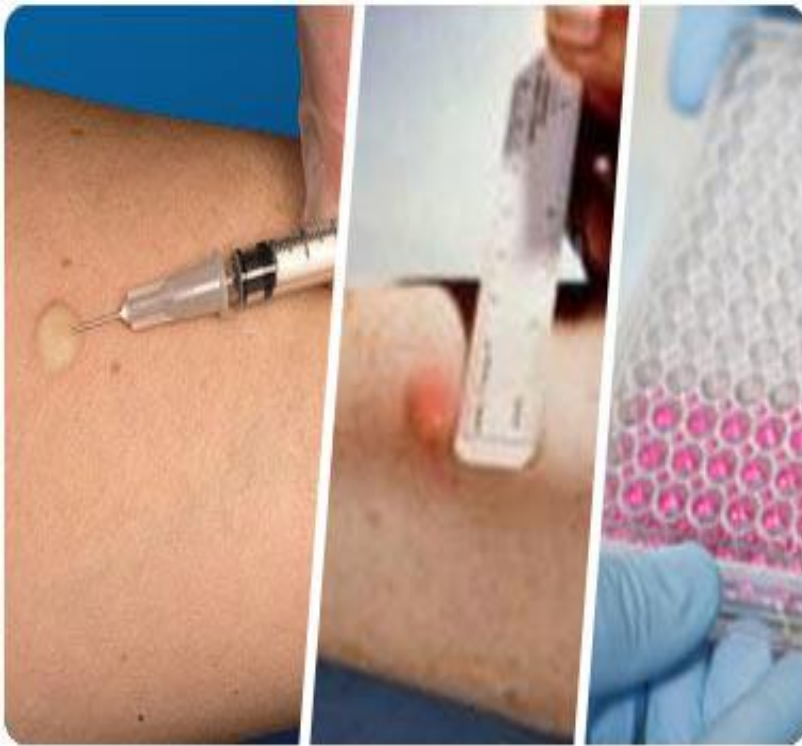


Tuberculin was developed by Koch in 1890 and modified to a simple protein precipitate by Siebert in 1932

The test is imperfect at best, and its results can be misleading

It has a poor sensitivity and specificity

Error in administration and reading of the test can give false-positive or false-negative results



It cannot differentiate infection with susceptible strains of TB from MDR-TB

Booster effects, or augmented immunologic recall due to repeated testing, can confound the interpretation of the test

Despite the limits of the TST, it remains an essential screening tool

All workers in hospitals, long-term care facilities, prisons, homeless shelters, and other high-risk health care settings should undergo pre-employment two-step tuberculin testing

The results of the second test are the baseline against which subsequent tests are compared



The CDC guidelines recommend two-step testing of new employees, followed by one-step testing at regular intervals





TUBERCULOSIS

yearly in hospitals with moderate to high TB caseloads but good infection control

Serial testing may not be necessary in hospitals with low TB caseloads and no evidence of nosocomial transmission because the chance of a false-positive test might exceed that of a true conversion





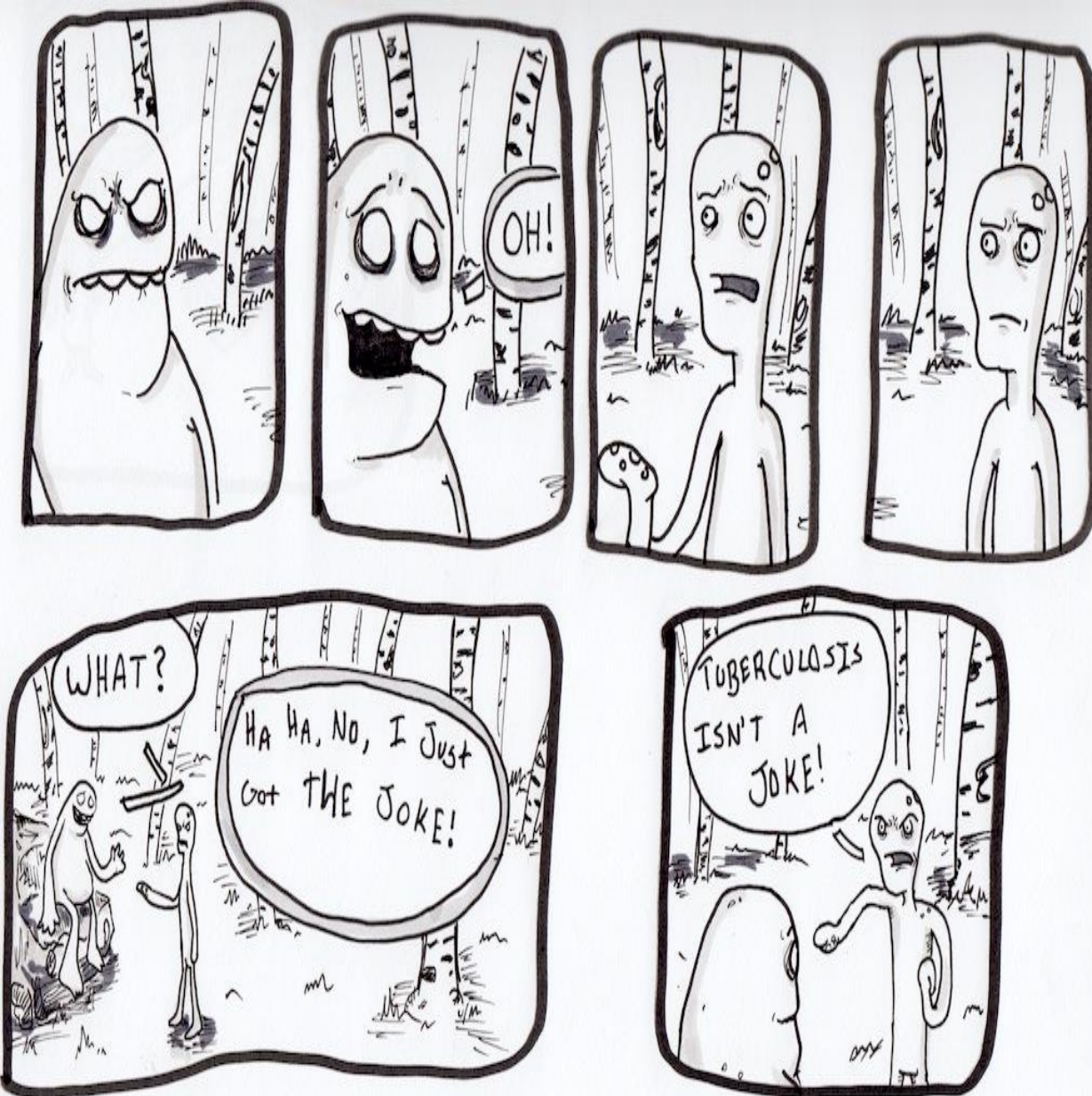
**AN IMPORTANT CONSEQUENCE
OF BCG VACCINATION IS THAT
ROUTINE TUBERCULIN TESTING
BECOMES DECIDEDLY LESS
SPECIFIC BECAUSE BCG
INFECTION, LIKE M.
TUBERCULOSIS, RESULTS IN A
POSITIVE TST**

The duration of TST positivity after BCG vaccination is controversial and probably depends in part on the vaccine preparation used

official recommendation is to disregard it in interpreting and treating a positive TST



COMPLIANCE WITH TUBERCULIN TESTING



Noncompliance is more frequent in attending and resident physicians

Health care worker compliance with tuberculin testing varies widely from 40% to 71%

Evaluation and Treatment of a New Positive Purified Protein Derivative

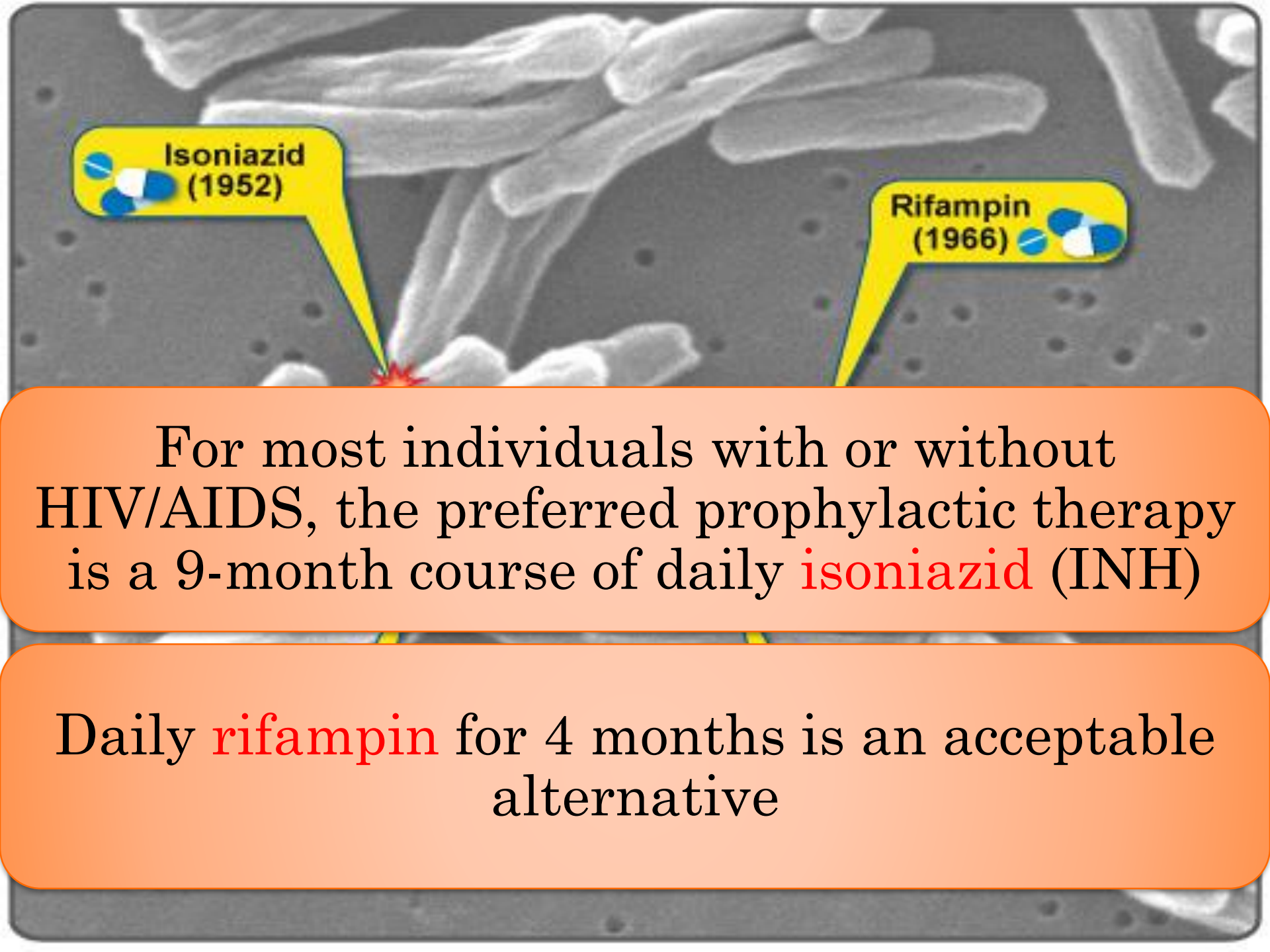
PPD converters should not work until they undergo medical evaluation, including symptom assessment and a chest radiograph



If a newly tuberculin-positive employee is asymptomatic and has an unremarkable chest film, radiographs should not be repeated unless symptoms develop

All new converters should receive treatment for latent TB infection





Isoniazid
(1952)

Rifampin
(1966)

For most individuals with or without HIV/AIDS, the preferred prophylactic therapy is a 9-month course of daily **isoniazid** (INH)

Daily **rifampin** for 4 months is an acceptable alternative

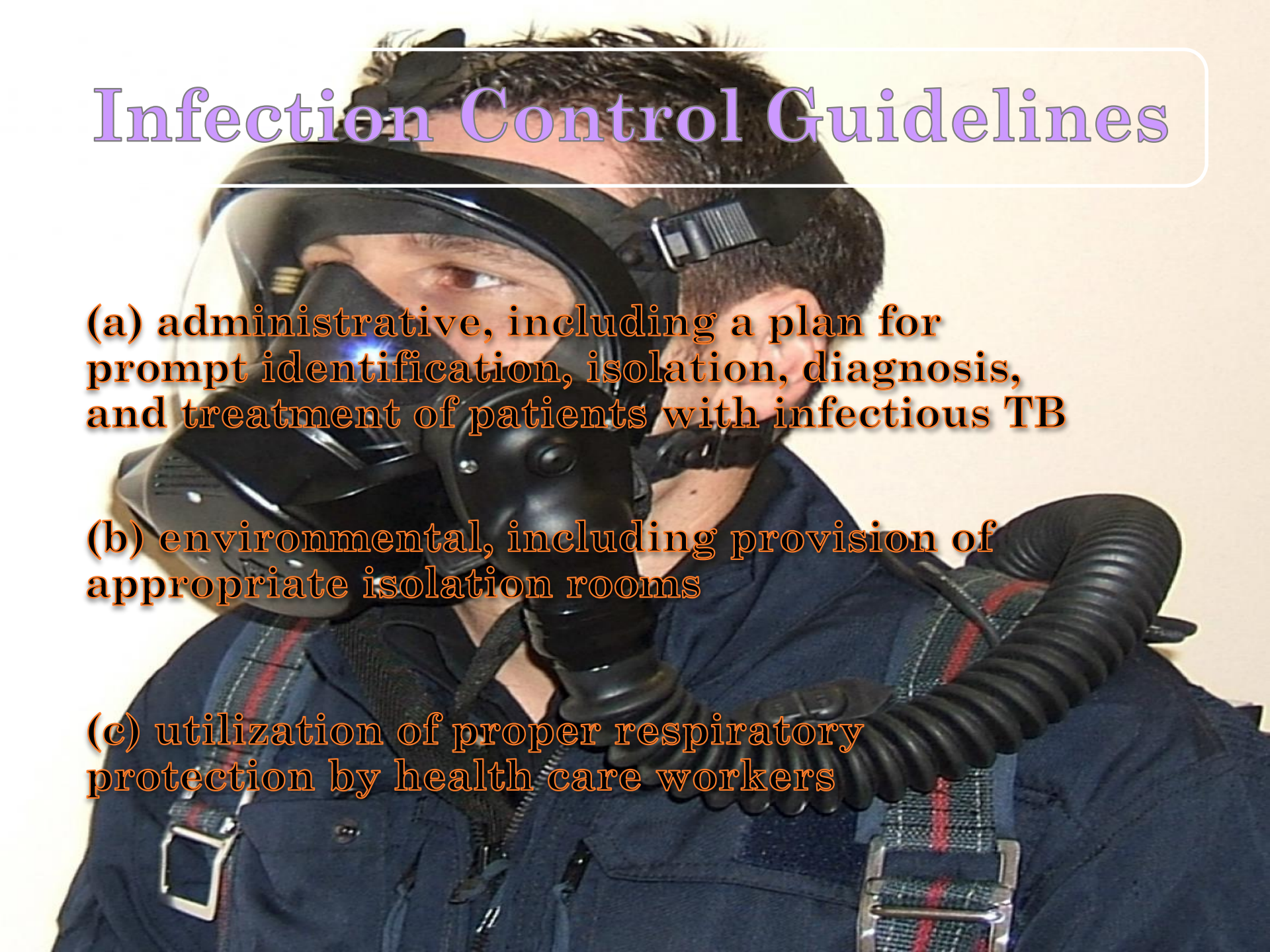
Health care workers who have completed a course of INH for latent TB infection should not be considered at risk for acquisition of TB from subsequent exposures

such a worker need not undergo chest radiograph or consideration of a repeat INH course after exposure, including exposure to a source case with MDR-TB

for an immunocompromised health care worker, this approach may not be optimal



Infection Control Guidelines

A close-up photograph of a person wearing a full-face respirator mask and a dark blue protective suit. The respirator has a large clear lens and a black filter canister attached to the side. The person is looking slightly to the left. The background is a plain, light-colored wall.

(a) administrative, including a plan for prompt identification, isolation, diagnosis, and treatment of patients with infectious TB

(b) environmental, including provision of appropriate isolation rooms

(c) utilization of proper respiratory protection by health care workers

ADMINISTRATIVE CONTROLS

EARLY IDENTIFICATION OF ACTIVE TB CASES

Cough

Afternoon Fever



Weight loss

Blood stained sputum

Night sweats

Environmental Controls

isolation rooms:

Ventilation standards include negative-pressure ventilation, with 6 to 12 air exchanges per hour, and high-efficiency particle air (HEPA) filtration or outdoor exhaust of room air

Additional options:

vertical displacement ventilation, with air introduced at the floor level and exhausted at the ceiling

ultraviolet germicidal air disinfection

PERSONAL RESPIRATORY EQUIPMENT



THE N95 DISPOSABLE PARTICULATE RESPIRATOR IS THE MOST COMMONLY USED PERSONAL RESPIRATORY EQUIPMENT

THESE RESPIRATORS ARE APPROPRIATE FOR MOST INTERACTIONS WITH INFECTIOUS PATIENTS

HEPA MASKS ARE ANOTHER OPTION

ANOTHER OPTION, IS THE POWERED AIR-PURIFYING RESPIRATOR (PAPR), WHICH DRAWS IN CONTAMINATED AIR THROUGH A FILTER AND PUMPS THE NEWLY PURIFIED AIR INTO A MASK OR HOOD

Bronchoscopists

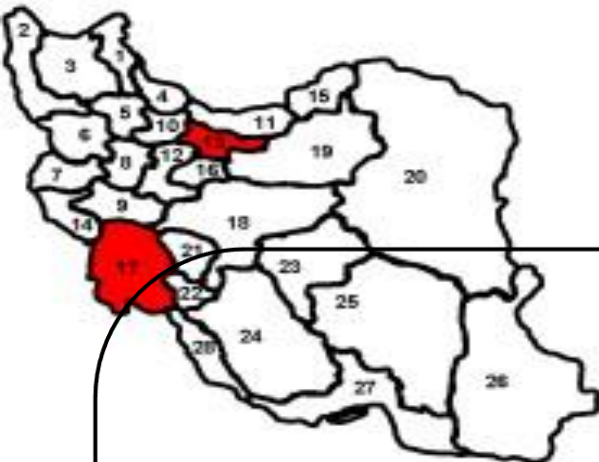
autopsy technicians

those with beards and other reasons
for poor respirator fit

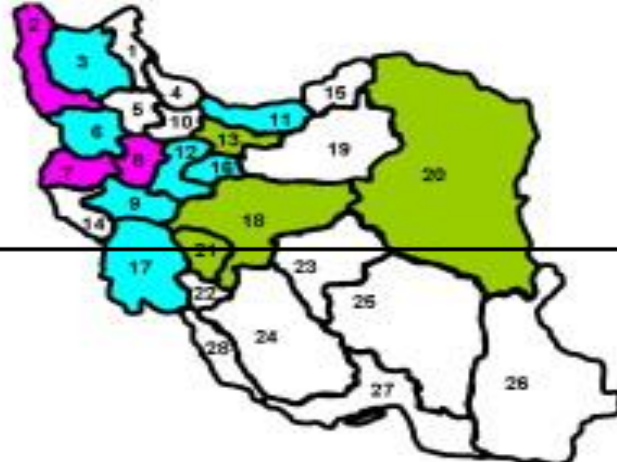
Powered

Air-purifying Respirator

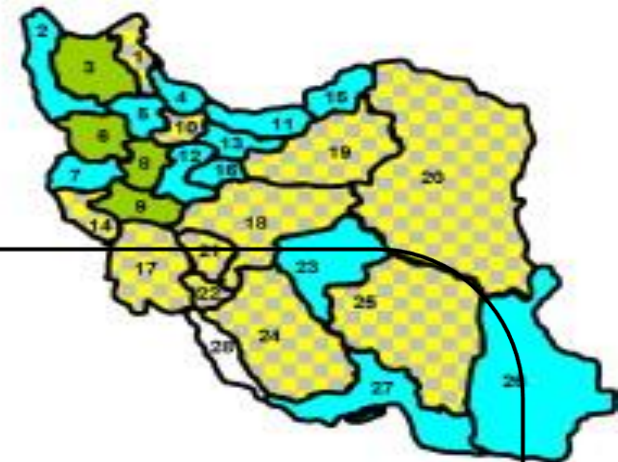




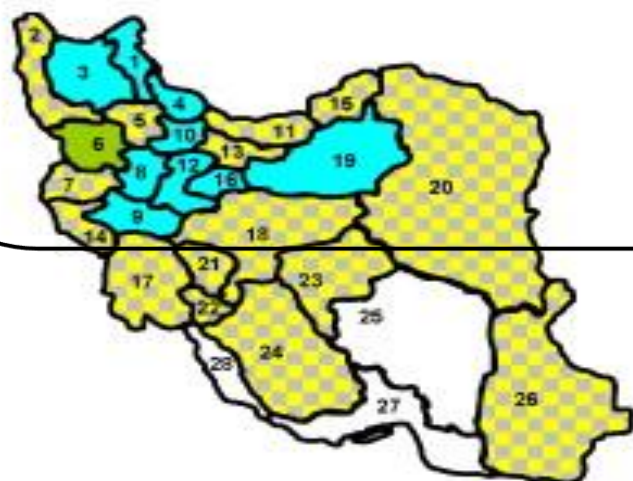
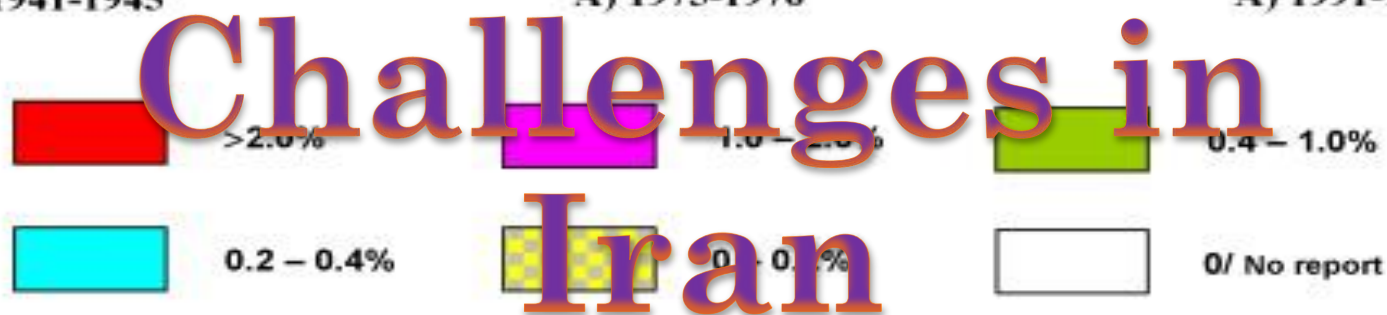
A) 1941-1945



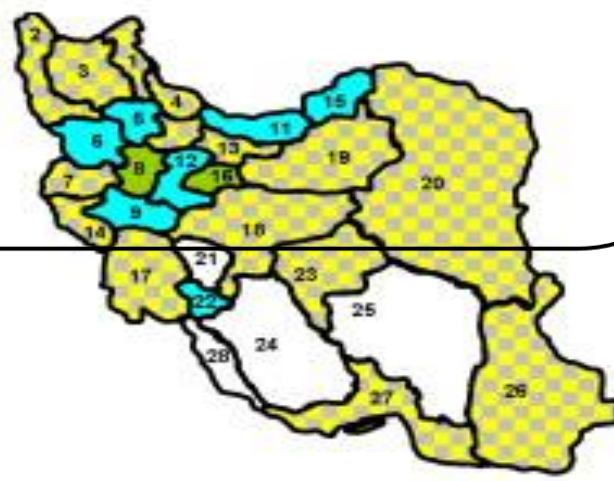
A) 1975-1976



A) 1991-1995



A) 1996-2000



A) 2001-2005

Administrative Controls

Engineering Controls

BCG vaccination

Lack of a Nationwide Guideline



HEALTH AND SAFETY PROGRAMS: A FRAMEWORK FOR PREVENTION

- Management commitment and employee involvement
- Worksite analysis
- Hazard control
- Training
- Evaluation



H & S PROGRAM ELEMENTS

- All necessary, none sufficient
- Critical for any and all hazards
- Success dependent on genuine team work
- Can't be successful without management commitment
- Direct care and support staff expertise are essential



HAZARD CONTROL: HIERARCHY OF CONTROLS

- Substitution – with a less hazardous chemical or device such as antimicrobials that don't cause asthma
- Engineering Controls - modify or control the hazard at the source, such as ventilation hoods?
- Administrative Controls – reduce the amount of exposure to hazard via policies and procedures
- Personal Protective Equipment - gloves, respirators, protective clothing



HEALTH, SAFETY AND ENVIRONMENT (HSE)
VISION, MISSION, CHARTER, SERVICES EXPECTED AND PERFORMANCE OUTCOMES

VISION

Protect the health and safety of Johns Hopkins Institutions' visitors, faculty, employees and students by insuring an environment free of hazards and providing appropriate medical care to injured employees.

MISSION

The Joint Committee on Health, Safety and Environment (JCHSE) and its operating unit, the Department of Health, Safety and Environment (HSE), is responsible for monitoring and insuring compliance with all federal and state safety and environmental regulations for both the Johns Hopkins University (JHU) and Johns Hopkins Medicine (JHM) two separate, though, related corporations. The Executive Director of Health, Safety and Environment serves as Chairman of the Joint Committee.

Health, Safety and Environment is responsible for monitoring environmental conditions and correcting hazards as they are identified, as well as for assessing and placing individuals in environments they are capable of working without harm to themselves or others. HSE is responsible for paying all workers' compensation claims for all entities of the Johns Hopkins Health System and the Johns Hopkins University, Maryland Campuses with the exception of Children's Hospital in Florida.

GOVERNING COMMITTEE

Under Joint Commission Environment of Care requirements, the Joint Committee for Health, Safety and Environment is the designated safety committee of the Johns Hopkins Hospital governing all Environment of Care activities. The Committee is made up of members of the University and Hospital Administration, as well as the faculty and staff of both Institutions. The members of the Committee are as follows:

Edward J. Bernacki, MD, MPH, Chair
Clyde Bennett, Co-Chair
Dani Buchanan
James Bukowski
Perry Cooper
Stephen Dahl, Ph.D.
Patricia Day
George Economas
John Grinnalds
Marla Hallacy
Gary Hayward, Ph.D.
John Highsmith



