OCCUPATIONAL HEALTH

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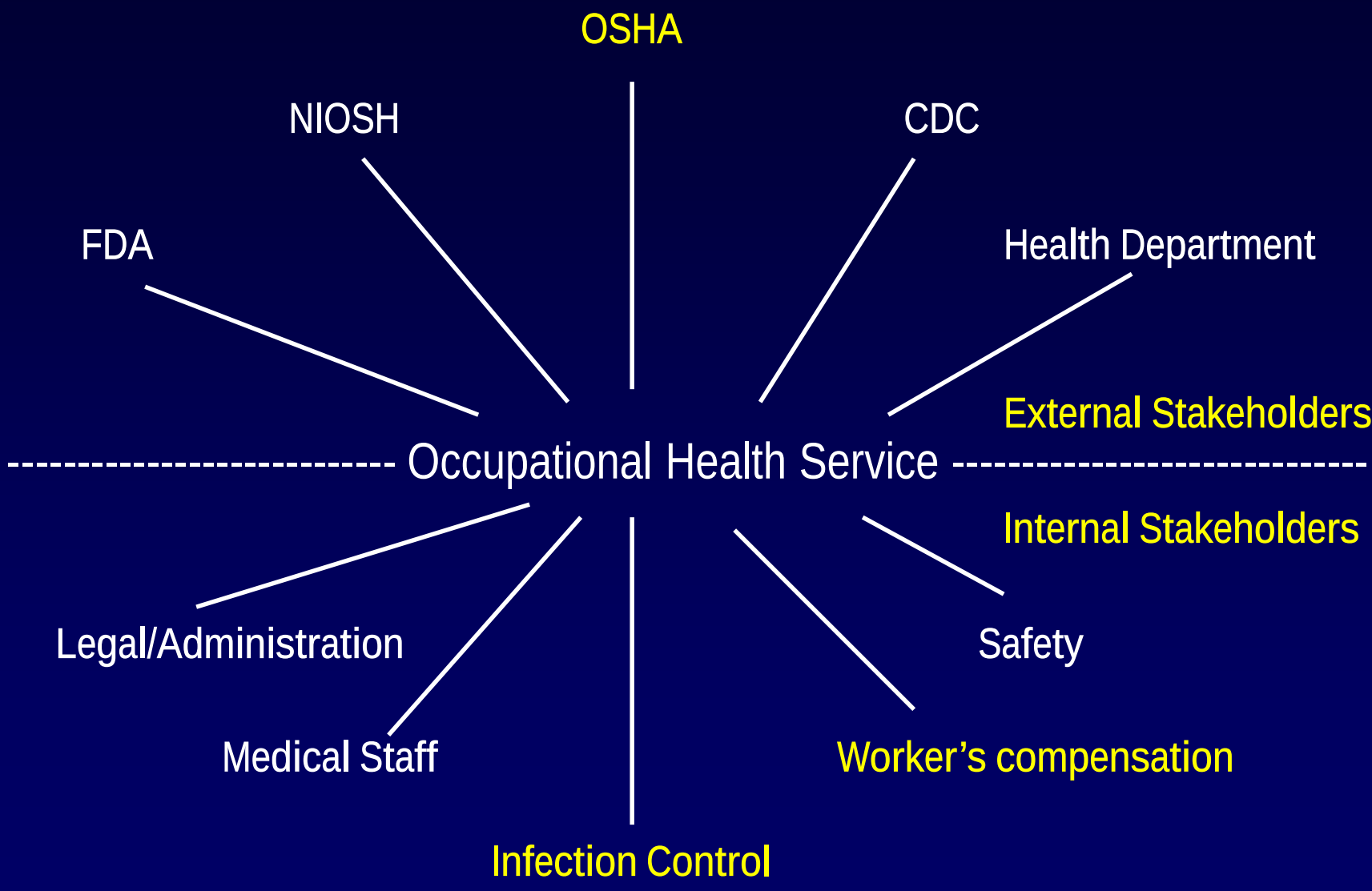
LECTURE TOPICS

- Activities of an occupational health department
- OSHA regulations: Bloodborne pathogens, TB
- Review of immunizations for HCP
- Review of key communicable diseases
- Review of management of bloodborne exposures
- Review of management of HCP for tuberculosis


OSHA
NIOSH
CDC
FDA
Health Department
External Stakeholders
Occupational Health Service
Internal Stakeholders
Legal/Administration
Safety
Medical Staff
Worker's compensation
Infection Control

OCCUPATIONAL HEALTH ACTIVITIES

- Pre-employment screening
  - Immunization review
  - Employment physical (selected; DOT, FAA, police)
  - Drugs/alcohol screening
  - Latex allergy screen (history; if positive, blood test)
  - Screen for active TB (symptoms; if positive CxR, sputums?)
  - Screen for latent TB (TST or IGRA blood test)
  - Fit test clearance (questionnaire, medical exam?); N95 fit testing
  - Hearing evaluation/audiogram (if indicated by noise exposure)
  - Counseling: pregnant women, immunocompromised

OCCUPATIONAL HEALTH ACTIVITIES

- Annual screening
  - Immunization review
  - Screen for active TB (symptoms; if positive CxR, sputums?)
  - Screen for latent TB (TST or IGRA blood test)
- Evaluation of injured personnel
  - First aid
  - Long-term care
  - Communication with Worker's Compensation
- Return to work evaluation (non-occupational diseases and/or injuries)

OCCUPATIONAL HEALTH ACTIVITIES

- Evaluation of HCP with a potentially communicable disease
  - Need for exposure evaluation
  - Need for work restriction
  - Therapy if indicated
- Infectious disease exposures
  - Determination of exposure & risk of disease transmission
  - Evaluate for post-exposure prophylaxis
  - Consider need for work restrictions
  - Communicate with infection control if patients exposed

OSHA: BLOODBORNE PATHOGEN RULE

- Employers must establish an Exposure Control Plan (reviewed yearly)
- Employers must utilize a hierarchy of methods to prevent exposure to blood or potentially contaminated body fluids
  - Engineering controls (e.g., needleless devices)
  - Work practice controls (e.g., single handed recapping)
- Mandates use of universal precautions (all body fluids assumed contaminated except sweat)
- Requires offering hepatitis B vaccine to persons with the potential for exposure
  - Persons may refuse by signing a declination form
- PEP must be immediately available as per CDC guidelines
- Yearly training required

Federal Register December 6, 1991;56:64003–64182

TUBERCULOUS: OSHA & CDC GUIDANCE

- Rule proposed by OSHA 997; withdrawn 2003 [compliance required with 29 CFR 1910.134 – Respiratory Protection; 29 CFR – General Duty Clause Section 5(a)(1)]
- CDC recommendations
  - Prompt detection of infectious patients
  - Airborne precautions (private room, ≥12 air exchanges per hour, direct out exhausted air)
  - Treatment of people with suspected or confirmed TB disease
- Hierarchy of control measures
  - Administrative measures: TB risk assessment of the setting, TB control plan, timely lab testing, training and educating HCP, screen exposed HCP
  - Environmental control: Airborne isolation, proper hoods in labs
  - Use of respiratory protective equipment (per OSHA - N95 respirator, medical clearance, yearly fit testing)

CDC: http://www.cdc.gov/tb/topic/infectioncontrol/default.htm
OHSA: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL_REGISTER&p_id=18050
OHSA: https://www.osha.gov/SLTC/etools/hospital/hazards/tb/tb.html

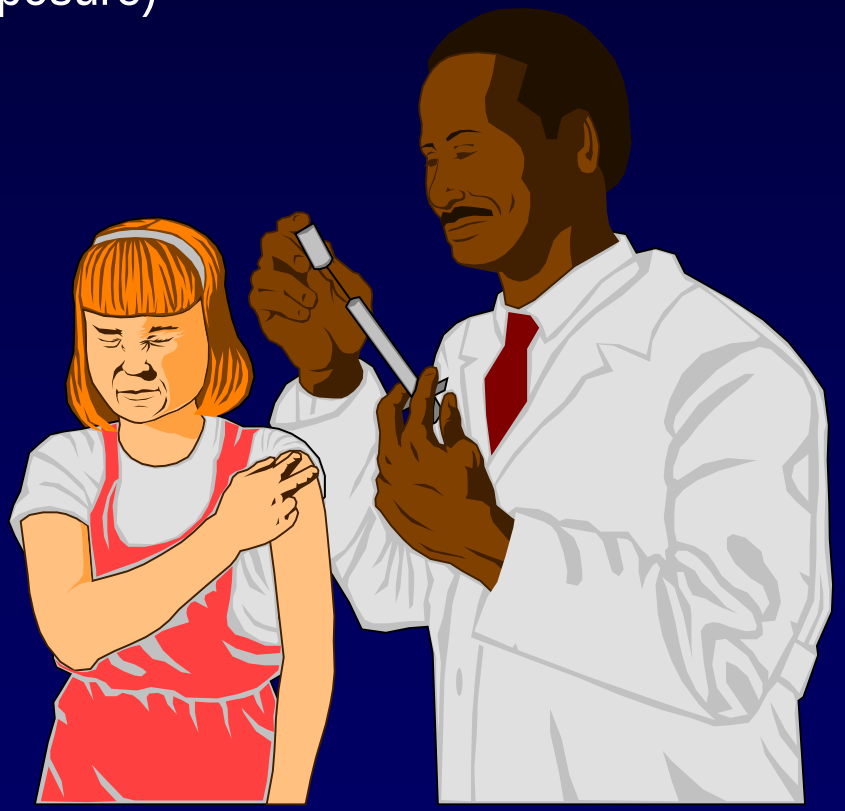
VACCINE PREVENTABLE DISEASES

- Anthrax (PEP)
- Cervical, vulvar, vaginal cancer (HPV)
- Diphtheria (outbreak)
- Genital warts (HPV)
- Hepatitis A (PEP, outbreak)
- Hepatitis B (PEP)
- Hepatitis D
- *H. influenza* type b
- Human papillomavirus
- Influenza A and B
- Japanese encephalitis
- Liver cancer (hepatitis B)
- Lyme disease
- Measles (PEP, outbreak)
- Meningococcal (outbreak)
- Monkeypox
- Mumps (outbreak)
- Pertussis (outbreak)
- Pneumococcal disease
- Poliomyelitis (outbreak)
- Rabies (PEP)
- Rectal cancer (HPV)
- Rotavirus
- Rubella (outbreak)
- Smallpox (PEP, outbreak)
- Tetanus (PEP)
- Tuberculosis
- Typhoid fever
- Varicella (PEP)
- Yellow fever
- Zoster (Shingles)

PEP = post-exposure prophylaxis

RECOMMENDED VACCINES FOR HCP: CDC, ACIP, HICPAC

- Hepatitis B (OHSA required, blood exposure)
- Influenza*
- Measles (MMR preferred)*
- Mumps (MMR preferred)*
- Rubella (MMR preferred)*
- Varicella (V)*
- Tetanus (Tdap)*
- Diphtheria (Tdap)*
- Pertussis (Tdap)*
- Meningococcus A,C,Y,W135^
- Meningococcus B^



* Required at UNC; ^ microbiologists

PROOF OF IMMUNITY FOR HCP

Vaccine	Birth before 1957	MD Dx	+ Serology	Self Report	Documented Vaccination
Mumps	✓[1]	Yes[3]	✓	No	✓
Measles	✓ [1]	Yes[3]	✓	No	✓
Rubella	✓ [1,2]	No	✓	No	✓
Varicella	No	Yes	✓	No	✓
Hepatitis B	No		≥10 MIU/mL[4]	No	✓
Pertussis	No	No	No	No	✓
Influenza	No	No	No	No	✓

[1]Consider immunization of HCP born before 1957, recommend during an outbreak;
[2]All HCP of childbearing potential should be immunized; [3]requires lab confirmation;
[4]Obtain 1-2 months post last vaccine dose

Weber DJ, Schaffner W. ICHE 2011;32:912-4

KEY FACTS WITH REGARD TO VACCINES FOR HCP

- HCP should be immune to certain vaccine preventable disease; immunization is only one means to demonstrate immunity
- For a multiple dose vaccine series (e.g., hepatitis B), is HCP is late in obtaining a scheduled dose, the series never needs to be restarted (just put them back on the recommended dose schedule)
- A post-vaccine titer is only recommended for hepatitis B (i.e., $\geq$10 mIU/mL)
- A intermediate serology should be interpreted that the HCP is NOT immune
- For mumps, measles and rubella, written proof of a complete vaccine series is presumptive evidence of immunity even if the titer is not positive
- HCP should wear a mask in the patient's room for all patients on droplet or airborne precautions even if presumed immune (e.g., measles, varicella)

PREGNANT HCP

- Diseases of concern in pregnancy
  - Fetal infection or adverse fetal events may occur: CMV, HIV, HSV, parvovirus B19, varicella, rubella, syphilis, tuberculosis, toxoplasmosis
- Immunizations
  - Recommended: influenza each year, Tdap each pregnancy (by LMD)
  - If indicated: All inactivated vaccines such as hepatitis A, hepatitis B, etc
  - If indicated: Any immunoglobulin preparation such as HBIG, VariZIG, RIG
  - Contra-indicated: Any live attenuated vaccine such as LAIV, MMR, varicella
- No restrictions on care for any patient provided HCP wears proper PPE and practices standard precautions

BORDETELLA PERTUSSIS

- Incubation period: 9-10 days (range, 6-20 days)
- Communicable period: Onset of sx, up to 6 weeks (most infectious 0-3 weeks)
- Transmission: Droplet
- Pre-exposure prophylaxis: Tdap x 1 (after age 11)
- Post-exposure prophylaxis: Antibiotics (azithromycin x 5 days orally)
- Diagnosis: Nasopharyngeal swab for pertussis PCR
- Treatment: Azithromycin x 5 days orally
- Work restrictions (after unprotected exposure):
  - Asymptomatic (on antibiotic PEP): Furlough x 5 days
  - Asymptomatic (refuses PEP): Furlough x 21 days after last exposure
  - Symptomatic: Furlough x 5 days after onset of appropriate antibiotics

HERPES SIMPLEX VIRUS

- Pathogens: HSV 1 (generally oral), HSV 2 (generally genital)
- Incubation period: 2-12 days (longer for neonatal infections)
- Communicable period: Highest with lesion but can occur during asymptomatic period
- Transmission (isolation): Contact (Mucucutaneous, disseminated or primary, severe = contact until lesions dry and crusted; mucocutaneous, recurrent {skin}, oral, genital = standard; neonatal = contact until lesions dried and crusted)
- Pre-exposure prophylaxis: None
- Post-exposure prophylaxis: None
- Treatment: Antiviral (acyclovir, valacyclovir)
- Diagnosis: Swab of lesion for PCR
- Work restrictions:
  - Hands (herpetic whitlow): Restrict from patient contact and contact with the patient's environment until lesions heal
  - Orofacial: Evaluate for need to restrict from care of high-risk patients
  - Genital: No restrictions

INFLUENZA

- Incubation period: 2 days (range, 1-4 days)
- Communicable period: 1-2 days prior to sx, generally up to 5 days in adults; longer in children (7-10 days) and those immunocompromised (>7-10 days)
- Transmission (isolation): Droplet, contact – direct & indirect ()
- Pre-exposure prophylaxis: Influenza vaccine
- Post-exposure prophylaxis: Antiviral (neuraminidase inhibitor)
- Diagnosis: Nasopharyngeal swab for molecular test
- Work restrictions:
  - URI sx (fever plus cough or sore throat): Until afebrile off antipyretics for >24 hours
  - Consider restricting from work in protected environment (i.e., BMTU) for 7 days

MEASLES

- Incubation period: ~14 days (range, 7-21 days)
- Communicable period: From 4 days before rash onset to 4 days after rash appearance.
- Transmission (isolation): Airborne (Airborne, 4 days after onset of rash & illness duration)
- Pre-exposure prophylaxis: MMR x 2
- Post-exposure prophylaxis: Ig and/or MMR
- Diagnosis: Serological test - IgG paired acute and convalescent specimens; RT-PCR on nasopharyngeal secretions, throat, blood or urine
- Work restrictions:
  - Active disease (measles): Furlough from work until ≥4 days following rash onset
  - Post-exposure (non-immune): HCP without evidence of immunity should be offered the 1st dose of MMR vaccine and be excluded from work from day 5-21 following exposure (even if they accept vaccine or Ig)
  - Post-exposure (HCP s/p 1 dose MMR): HCP without evidence of immunity should be offered the 2nd dose of MMR vaccine and may stay at work

MUMPS

- Incubation period: 16-18 days (range, 12-25 days)
- Communicable period: 7 days before onset of parotitis to 5 days after onset of parotitis
- Transmission (isolation): Droplet (droplet for 5 days after onset of parotitis)
- Pre-exposure prophylaxis: MMR x 2
- Post-exposure prophylaxis: None
- Diagnosis:
- Work restrictions:
  - Active: Furlough until 5 days after onset of parotitis through 26th day after last exposure or until 5 days after onset of parotitis

RUBELLA

- Incubation period: 14-17 days (range, 14-21 days)
- Communicable period: 1 week before onset of rash to 7 days after onset of rash; infants with congenital rubella syndrome may be infectious for 1 year
- Transmission (isolation): Droplet (droplet until 7 days after onset of rash)
- Pre-exposure prophylaxis: MMR x 1
- Post-exposure prophylaxis: None
- Diagnosis:
- Work restrictions:
  - Active infection: Furlough until 5 days after rash starts
  - Post-exposure (susceptible): Furlough from 7th day after 1st exposure through 21st day after last exposure

NEISSERIA MENINGITIDIS

- Incubation period: 3-4 days (range, 2-10 days)
- Communicable period: Until 24 hours after start of effective therapy
- Transmission (isolation): Droplet (droplet until 24 hours after start of effective therapy)
- Pre-exposure prophylaxis (only for lab workers who spin CSF): Meningococcal vaccine A,C,W,Y (booster every 5 years) and meningococcal vaccine B
- Post-exposure prophylaxis: Antibiotics (ciprofloxaxcin)
- Diagnosis: Culture of CSF and/or blood
- Work restrictions:
  - Active infection (meningitis or sepsis): Until 24 hours after start of effective therapy
  - Post-exposure (asymptomatic): None (if on appropriate PEP)\

HEPATITIS A

- Incubation period: 28-30 days (range, 15-50 days)
- Communicable period: 1-2 weeks prior to onset of symptoms and until 7 days after onset of jaundice
- Transmission (isolation): Ingestion, fecal-oral (Contact, diapered or incontinent patients; infants & children <3 yrs of age for duration of hospitalization, 3-14 yrs for 2 weeks after onset sx, >14 yrs for 1 week after onset of sx)
- Pre-exposure prophylaxis: Hepatitis A vaccine (not routinely recommended for HCP)
- Post-exposure prophylaxis: Hepatitis A vaccine (Ig may also be indicated)
- Diagnosis:
- Work restrictions:
  - Active infection: Restrict from patient contact, contact with patient's environment, and food handling until 7 days after onset of jaundice

HEPATITIS B

- Incubation period: 60-90 days (range, 45-180 days)
- Communicable period: While HBsAg positive (higher risk if HBeAg positive)
- Transmission (isolation): Bloodborne (standard)
- Pre-exposure prophylaxis: Hepatitis B vaccine
  - Use standard 3 dose series (0, 1, 6) or new 2 doseadjuvanted vaccine (0, 1)
  - Post-immunization obtain anti-HBs at 1-2 mo ; if <10 mIU/mL), repeat series and obtain anti-HBs; if <10 mIU/mL consider non-responder & obtain HBsAg (if + refer)
- Post-exposure prophylaxis: See table
- Diagnosis: HBsAg
- Work restrictions:
  - If HCP does invasive activities (surgery, dental, Ob/Gyn) consult expert panel

TABLE 1. Typical interpretation of test results for hepatitis B virus infection

HBsAg	Total anti-HBc	IgM anti-HBc	Anti-HBs	HBV DNA	Interpretation
-	-	-	-	-	Never infected
+	-	-	-	+ or -	Early acute infection; transient (up to 18 days) after vaccination
+	+	+	-	+	Acute infection
-	+	+	+ or -	+ or -	Acute resolving infection
-	+	-	+	-	Recovered from past infection and immune
+	+	-	-	+	Chronic infection
-	+	-	-	+ or -	False-positive (i.e., susceptible); past infection; "low-level" chronic infection; or passive transfer of anti-HBc to infant born to HBsAg-positive mother
-	-	-	+	-	Immune if anti-HBs concentration is ≥10 mIU/mL after vaccine series completion; passive transfer after hepatitis B immune globulin administration

Abbreviations: - = negative; + = positive; anti-HBc = antibody to hepatitis B core antigen; anti-HBs = antibody to hepatitis B surface antigen; HBsAg = hepatitis B surface antigen; HBV DNA = hepatitis B virus deoxyribonucleic acid; IgM = immunoglobulin class M.

HEPATITIS C

- Incubation period: 6-9 weeks (range, 2 weeks to 6 months) – may persons may asymptomatically develop infection
- Communicable period: As long as HCV RNA positive
- Transmission (isolation): Bloodborne (standard)
- Pre-exposure prophylaxis: None
- Post-exposure prophylaxis: None
- Diagnosis: Anti-HCV; if positive, reflex to HCV RNA
- Work restrictions:
  - None recommended at present time by CDC
  - May be useful to set up expert panel as with HBV and HIV positive HCP

VARICELLA

- Incubation period: 14-16 days (range, 8-21 days)
- Communicable period: 1-2 days before symptoms develop until lesions dried and crusted
- Transmission (isolation): Airborne & contact (airborne and contact until all lesions dried and crusted)
- Pre-exposure prophylaxis: 2 doses of varicella vaccine
- Post-exposure prophylaxis: VariZIG (for HCP at high risk of varicella complications)
- Diagnosis: PCR of lesions
- Work restrictions:
  - Active infection: Furlough until all lesions dried and crusted
  - Post-exposure (susceptible): From 8th day after 1st exposure through 21st day (28th day if VariZIG given) after last exposure

ZOSTER

- Incubation period: Reactivation
- Communicable period: Until lesions dried and crusted
- Transmission (isolation): Airborne & contact (disseminated, localized in immunocompromised patient = airborne & contact for duration of illness; Localized in patient with intact immune system with lesions that can be contained/covered = standard for duration of illness {until wounds stop draining})
- Pre-exposure prophylaxis: Zoster vaccine (not specifically indicated for HCP)
- Post-exposure prophylaxis (susceptible): Antiviral (acyclovir or valacyclovir)
- Diagnosis: Swab of lesions for PCR
- Work restrictions:
  - Active infection (localized, healthy HCP): Cover lesions; restrict from care of high-risk Pts*
  - Active infection (generalized or localized in immunocompromised HCP): Furlough*
  - Post-exposure (susceptible HCP): Same as varicella

* Duration = until all lesions dried and crusted

TUBERCULOSIS

- Incubation period: 8-10 weeks (but persons with LTBI may reactivate in future)
- Communicable period: Pulmonary TB until 2 weeks of therapy and negative sputum smears
- Transmission (isolation): Airborne (airborne for pulmonary TB)
- Pre-exposure prophylaxis: BCG vaccine (not used in US) – poor efficacy
- Post-exposure prophylaxis
  - Obtain PPD or IGRA at soon as exposure realized; if negative follow-up test in 8-10 wks
  - If already PPD or IGRA positive follow symptoms; obtain CxR if symptoms develop
- Diagnosis: Sputum for smear and culture (CxR and TST/IGRA useful but not conclusive)
- Work restrictions:
  - Active pulmonary infection: Furlough until response to therapy (>2 wks) and negative sputum smears
  - LTBI: No restrictions

Symptoms of Pulmonary and Extrapulmonary TB Disease

Symptoms of Pulmonary TB Disease (TB disease usually causes one or more of the symptoms)	**Symptoms of Possible Extrapulmonary TB Disease** (Depends on the part of the body that is affected by the disease)
• Cough (especially if lasting for 3 weeks or longer) with or without sputum production • Coughing up blood (hemoptysis) • Chest pain • Loss of appetite • Unexplained weight loss • Night sweats • Fever • Fatigue	• TB of the kidney may cause blood in the urine • TB meningitis may cause headache or confusion • TB of the spine may cause back pain • TB of the larynx can cause hoarseness • Loss of appetite • Unexplained weight loss • Night sweats • Fever • Fatigue

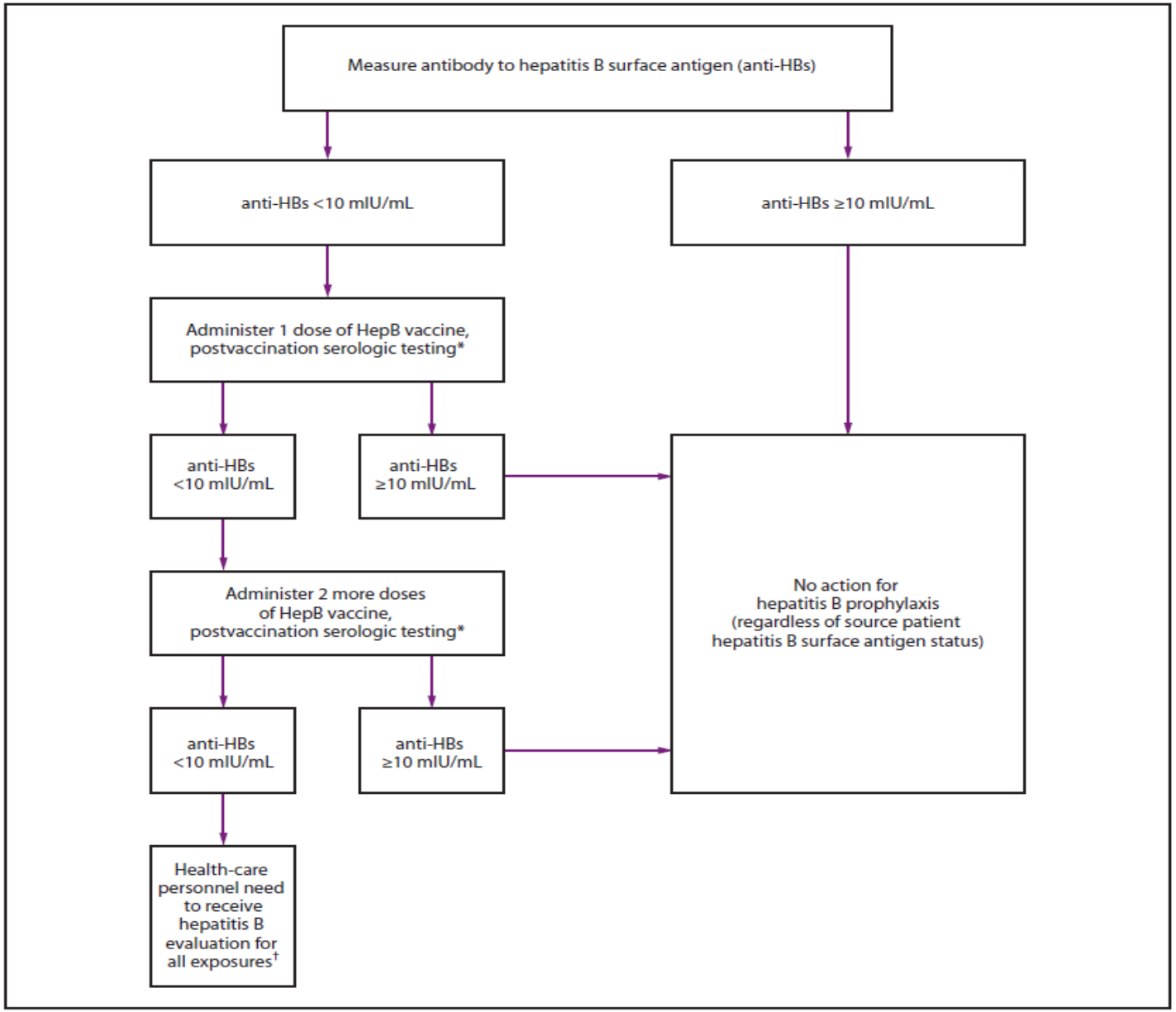
DEFINITION OF EXPOSURE TO A BLOODBORNE PATHOGEN

- Percutaneous exposure to contaminated body fluid
- Mucous membrane exposure to contaminated body fluid
- Non-intact skin expose to contaminated body fluid
- Contaminated fluids: blood, CSF, vaginal secretions, semen, synovial, pleural, peritoneal, pericardial, amniotic
- Body fluids considered contaminated only if visibly bloody: Sputum, saliva, tears, vomitus, stool, urine

NEEDLESTICK INJURIES: MANAGEMENT

- Test source for hepatitis B (HBsAg), hepatitis C (RNA), HIV (ideally 4th generation test)
- Provide hepatitis B prophylaxis, if indicated
- Provide follow-up for hepatitis C, if indicated
- If source HIV+ or source unknown, exposure confirmed, offer HCP HIV prophylaxis per CDC protocol
- Maintain confidentiality: Separate records, labs & pharmacy requisitions sent with code number

FIGURE 6. Pre-exposure evaluation for health-care personnel previously vaccinated with complete, ≥3-dose HepB vaccine series who have not had postvaccination serologic testing*



Source: Adapted from CDC. A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States: recommendations of the Advisory Committee on Immunization Practices (ACIP). Part II: immunization of adults. MMWR 2006;55(No. RR-16).

* Should be performed 1–2 months after the last dose of vaccine using a quantitative method that allows detection of the protective concentration of anti-HBs (≥10 mIU/mL) (e.g., enzyme-linked immunosorbent assay [ELISA]).

† A nonresponder is defined as a person with anti-HBs <10 mIU/mL after ≥6 doses of HepB vaccine. Persons who do not have a protective concentration of anti-HBs after revaccination should be tested for HBsAg. If positive, the person should receive appropriate management or vaccination.

CDC GUIDELINES FOR HBV PEP, 2018

TABLE 5. Postexposure management of health care personnel after occupational percutaneous or mucosal exposure to blood or body fluids, by health care personnel HepB vaccination and response status

	Postexposure testing		Postexposure prophylaxis		
HCP status	**Source patient (HBsAg)**	**HCP testing (anti-HBs)**	**HBIG**	**Vaccination**	**Postvaccination serologic testing**
Documented responder after complete series			No action needed		
Documented nonresponder after two complete series	Positive/unknown	—*	HBIG x2 separated by 1 month	—	N/A
	Negative		No action needed		
Response unknown after complete series	Positive/unknown	<10 mIU/mL	HBIG x1	Initiate revaccination	Yes
	Negative	<10 mIU/mL	None	Initiate revaccination	Yes
	Any result	≥10 mIU/mL	No action needed		
Unvaccinated/incompletely vaccinated or vaccine refusers	Positive/unknown	—	HBIG x1	Complete vaccination	Yes
	Negative	—	None	Complete vaccination	Yes

Abbreviations: anti HBs = antibody to hepatitis B surface antigen; HBIG = hepatitis B immune globulin; HBsAg = hepatitis B surface antigen; HCP = health care personnel; N/A = not applicable.

* Not indicated.

US PHS HIV POSTEXPOSURE GUIDELINES: NEW RECOMMENDATIONS

- PEP is recommended when occupational exposures to HIV occur
- HIV status of exposure source patient should be determined, if possible, to guide need for HIV PEP
- PEP medication regimens should be started as soon as possible after exposure to HIV, and should be continued for a 4-week duration
- PEP medication regimen should contain 3 (or more) antiretroviral drugs for all occupational exposures to HIV
- Close follow-up for exposed person should be provided; follow-up should begin within 72 ours of an HIV exposure
- Expert consultation recommended for any occupational exposure to HIV
- If newer 4th generation combination HIV p24 Ag HIV test is used for follow-up of exposed HCP, HIV testing may be concluded 4 months after exposure; in a newer test is not available, follow for 6 months

Kuhnar DT, et al. ICHE 2013;34:875-892

US PHS HIV POSTEXPOSURE GUIDELINES: GUIDELINE EMPHASIS

- Primary prevention of occupational exposures
- Prompt management of occupational exposures
- Selection of PEP regimens that have the fewest side-effects and are best tolerated by prophylaxis recipients
- Anticipating and preemptively treating side effects commonly associated with taking anti-retroviral drugs
- Attention to potential interactions involving both drugs that could be included in HIV PEP regimens, as well as other medications that PEP recipients could be taking
- Consultation with experts on PEP management strategies
- HIV testing of source patients (without delay in PEP initiation) using methods that product rapid results
- Counseling and follow-up of exposed HCP

US PHS HIV POSTEXPOSURE GUIDELINES: DEFINITIONS

- HCP = all paid and unpaid persons working in healthcare settings who have the potential for exposure to infectious materials, contaminated medical supplies and equipment, or contaminated environmental surfaces (e.g., ED, dental, lab, autopsy personal; MDs, RNs, technicians, pharmacists, students, trainees, etc.)
- Exposure that place HCP at risk = Percutaneous injury, contact of mucous membranes or nonintact skin with blood, tissue, or other potentially infected material (OPIM)
- Potentially infectious material = blood, visibly bloody body fluids, semen, vaginal secretions. Also CSF, synovial fluid, pleural fluid, peritoneal fluid, amniotic fluid, pericardial fluid.
- No known risk (unless visibly bloody) = feces, nasal secretions, saliva, sputum, sweat, tears, urine, and vomitus
- Human bites result in 2-way exposure

US PHS HIV POSTEXPOSURE GUIDELINES: RISK OF HIV

- Type of exposure
  - Percutaneous ~0.3%
  - Mucous membrane = ~0.09%
- For percutanous exposure, factors increasing risk of HIV acquisition
  - A device visibly contaminated with patient's blood
  - A procedure that involved a need being placed directly in a vein or artery
  - Deep injury
  - Blood from a person with late stage disease
  - Hollow bore (as opposed to solid bore) needle
- Despite lower risk, PEP should still be offered even if the source patient has an undetectable viral load

Box 1: Situations for Which Expert Consultation for Human Immunodeficiency Virus (HIV) Postexposure Prophylaxis (PEP) Is Recommended

Delayed (ie, later than 72 hours) exposure report
- Interval after which benefits from PEP are undefined

Unknown source (eg, needle in sharps disposal container or laundry)
- Use of PEP to be decided on a case-by-case basis
- Consider severity of exposure and epidemiologic likelihood of HIV exposure
- Do not test needles or other sharp instruments for HIV

Known or suspected pregnancy in the exposed person
- Provision of PEP should not be delayed while awaiting expert consultation

Breast-feeding in the exposed person
- Provision of PEP should not be delayed while awaiting expert consultation

Known or suspected resistance of the source virus to antiretroviral agents
- If source person's virus is known or suspected to be resistant to 1 or more of the drugs considered for PEP, selection of drugs to which the source person's virus is unlikely to be resistant is recommended
- Do not delay initiation of PEP while awaiting any results of resistance testing of the source person's virus

Toxicity of the initial PEP regimen
- Symptoms (eg, gastrointestinal symptoms and others) are often manageable without changing PEP regimen by prescribing antimotility or antiemetic agents
- Counseling and support for management of side effects is very important, as symptoms are often exacerbated by anxiety

Serious medical illness in the exposed person
- Significant underlying illness (eg, renal disease) or an exposed provider already taking multiple medications may increase the risk of drug toxicity and drug-drug interactions

Expert consultation can be made with local experts or by calling the National Clinicians' Post-Exposure Prophylaxis Hotline (PEPline) at 888-448-4911.

Preferred HIV PEP Regimen

Raltegravir (Isentress; RAL) 400 mg PO twice daily

Plus

Truvada, 1 PO once daily

(Tenofovir DF [Viread; TDF] 300 mg + emtricitabine [Emtriva; FTC] 200 mg)

Alternative Regimens

(May combine 1 drug or drug pair from the left column with 1 pair of nucleoside/nucleotide reverse-transcriptase inhibitors from the right column; prescribers unfamiliar with these agents/regimens should consult physicians familiar with the agents and their toxicities)[a,b]

Raltegravir (Isentress; RAL)	Tenofovir DF (Viread; TDF) + emtricitabine (Emtriva; FTC); available as Truvada
Darunavir (Prezista; DRV) + ritonavir (Norvir; RTV)	Tenofovir DF (Viread; TDF) + lamivudine (Epivir; 3TC)
Etravirine (Intelence; ETR)	Zidovudine (Retrovir; ZDV; AZT) + lamivudine (Epivir; 3TC); available as Combivir
Rilpivirine (Edurant; RPV)	Zidovudine (Retrovir; ZDV; AZT) + emtricitabine (Emtriva; FTC)
Atazanavir (Reyataz; ATV) + ritonavir (Norvir; RTV)	
Lopinavir/ritonavir (Kaletra; LPV/RTV)	

The following alternative is a complete fixed-dose combination regimen, and no additional antiretrovirals are needed: Stribild (elvitegravir, cobicistat, tenofovir DF, emtricitabine)

Alternative Antiretroviral Agents for Use as PEP Only with Expert Consultation[b]

Abacavir (Ziagen; ABC)
Efavirenz (Sustiva; EFV)
Enfuvirtide (Fuzeon; T20)
Fosamprenavir (Lexiva; FOSAPV)
Maraviroc (Selzentry; MVC)
Saquinavir (Invirase; SQV)
Stavudine (Zerit; d4T)

Antiretroviral Agents Generally Not Recommended for Use as PEP

Didanosine (Videx EC; ddI)
Nelfinavir (Viracept; NFV)
Tipranavir (Aptivus; TPV)

Antiretroviral Agents Contraindicated as PEP

Nevirapine (Viramune; NVP)

Box 2: Follow-Up of Healthcare Personnel (HCP) Exposed to Known or Suspected Human Immunodeficiency Virus (HIV)–Positive Sources

Counseling (at the time of exposure and at follow-up appointments). Exposed HCP should be advised to use precautions (eg, use of barrier contraception and avoidance of blood or tissue donations, pregnancy, and, if possible, breast-feeding) to prevent secondary transmission, especially during the first 6–12 weeks after exposure.

For exposures for which postexposure prophylaxis (PEP) is prescribed, HCP should be informed regarding the following:

- Possible drug toxicities (eg, rash and hypersensitivity reactions that could imitate acute HIV seroconversion and the need for monitoring)
- Possible drug interactions
- The need for adherence to PEP regimens

Early reevaluation after exposure. Regardless of whether a healthcare provider is taking PEP, reevaluation of exposed HCP within 72 hours after exposure is strongly recommended, as additional information about the exposure or source person may be available.

Follow-up testing and appointments. Follow-up testing at a minimum should include the following:

- HIV testing at baseline and at 6 weeks, 12 weeks, and 6 months after exposure; alternatively, if the clinician is certain that a fourth-generation combination HIV p24 antigen–HIV antibody test is being utilized, then HIV testing could be performed at baseline, 6 weeks after exposure, and 4 months after exposure
- Complete blood counts and renal and hepatic function tests (at baseline and 2 weeks after exposure; further testing may be indicated if abnormalities are detected)

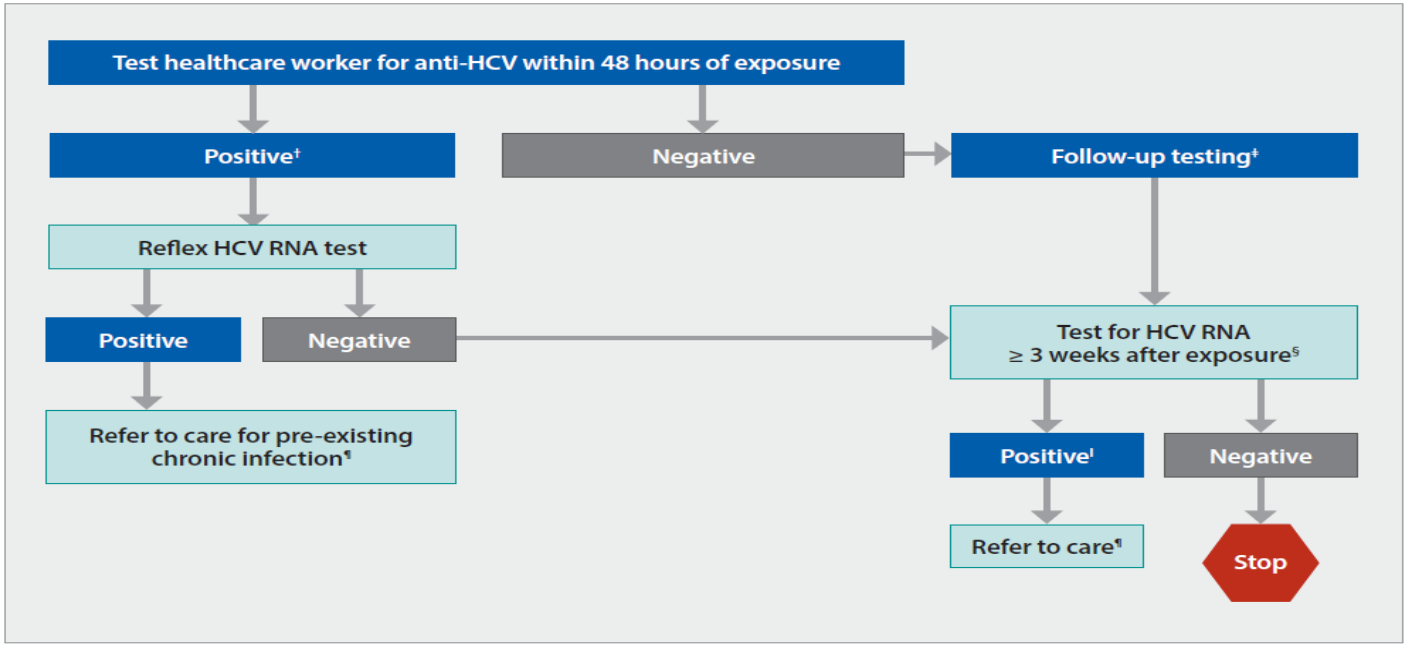
HIV testing results should preferably be given to the exposed healthcare provider at face-to-face appointments.

Information for Healthcare Personnel Potentially Exposed to Hepatitis C Virus (HCV)

Recommended Testing and Follow-up

Exposure to viral hepatitis has long been recognized as an occupational risk for healthcare personnel, with recommendations previously established for the management of occupational exposures to hepatitis C virus (HCV). This notice, which is based on current laboratory guidance[1], updates the 2001 HCV testing algorithm for healthcare personnel[2]. Postexposure prophylaxis (PEP) of hepatitis C is not recommended, as outlined in the 2001 MMWR on management of healthcare personnel who have occupational exposure to blood and other body fluids[2].

Test the source for HCV RNA*. If the source is HCV RNA positive, or if HCV infection status unknown, follow the algorithm below. After a needlestick or sharps exposure to HCV-positive blood, the risk of HCV infection is approximately 1.8%[2]. If the healthcare worker does become infected, follow AASLD/IDSA guidelines (www.hcvguidelines.org) for management and treatment of hepatitis C.



*If it is not possible to test source for HCV RNA, then test for antibodies to HCV (anti-HCV) and screen HCW exposed to anti-HCV positive source. Note that persons with acute infection may test HCV RNA positive but anti-HCV negative.

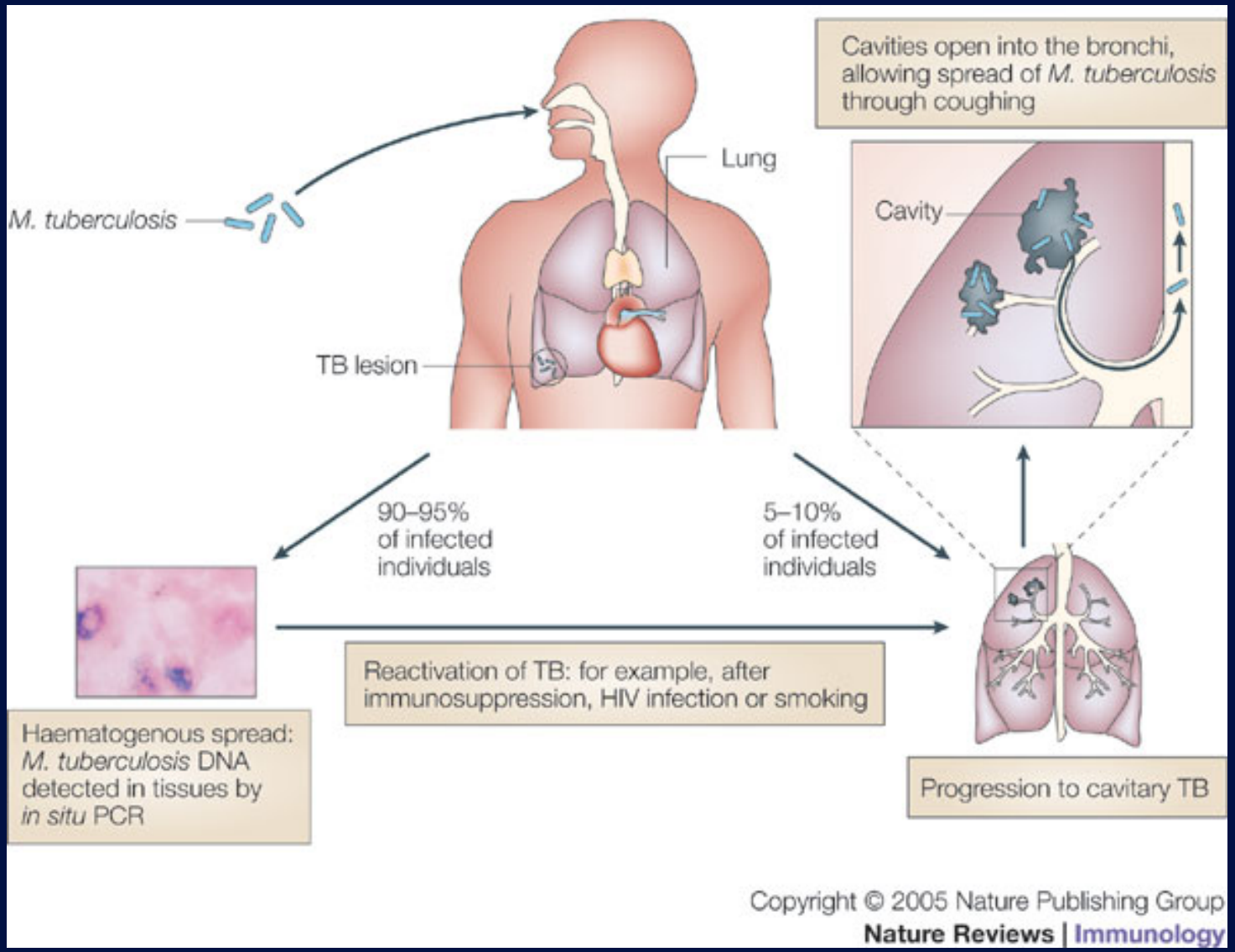
†In a nationally representative population sample with low (1%) HCV infection prevalence, 22% of anti-HCV positive results were determined to be false-positive. An additional 10% had indeterminate results in a confirmatory assay; most were likely to be false-positive. Among the subset of persons testing anti-HCV screening reactive and subsequently HCV RNA negative, 50% of the anti-HCV tests were false-positive.[3]

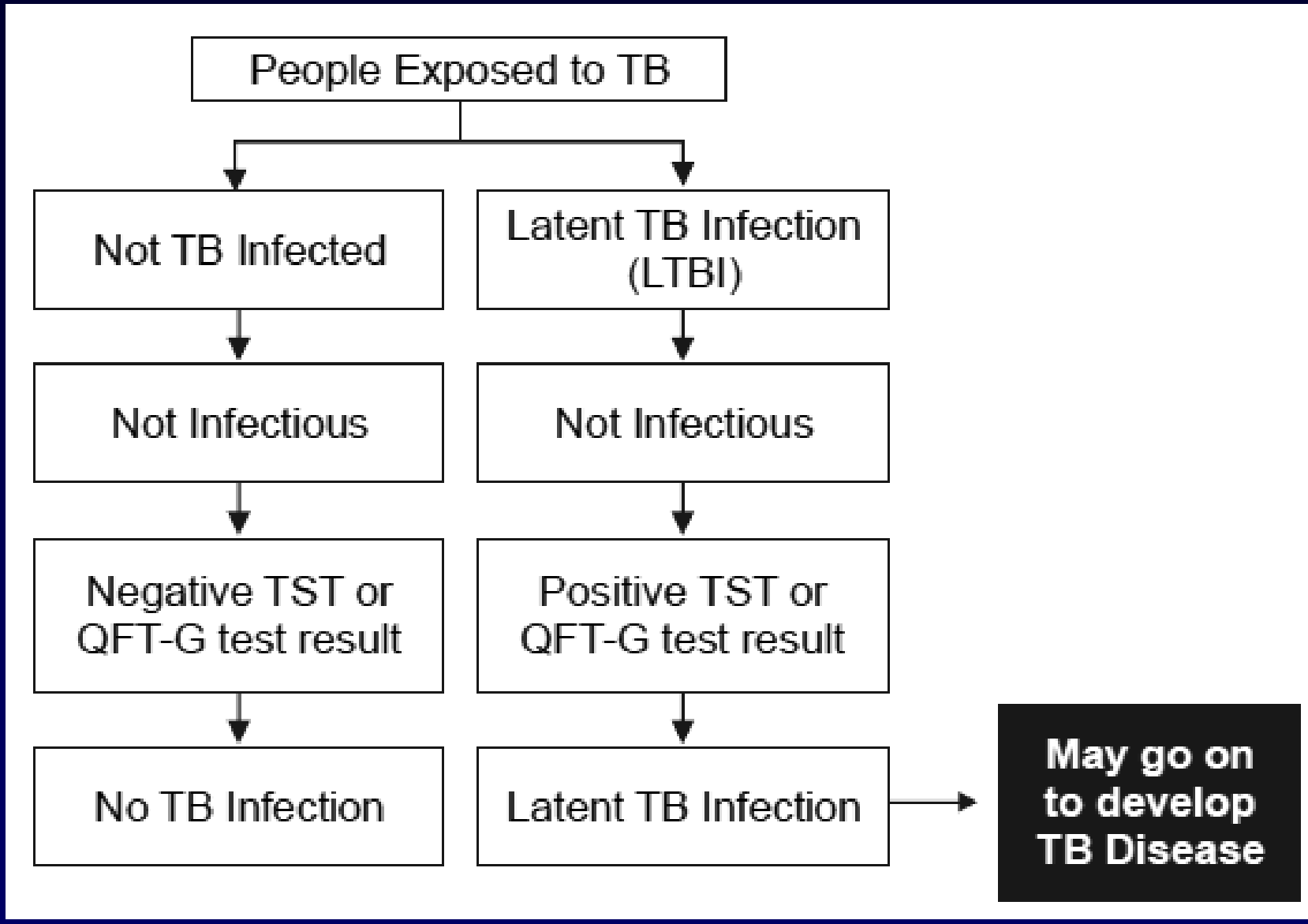
‡Anti-HCV testing at >= 6 months with reflex to HCV RNA test, if positive, could also be done.

METHODS TO DECREASE BLOODBORNE EXPOSURES

- Wear gloves for all procedures and if contact with any body fluid (except sweat) is anticipated
- Wear mask, eye protection, protective gown if there is a possibility of more extensive body fluid exposure
- Double gloving for procedures which might damage a glove
- Shielded or self-blunting needles for vacuum-tube phlebotomy sets
- Plastic vacuum/specimen tubes resistant to breakage
- Retracting, sheathing, or blunted butterfly-type needles
- Blunt cannula blood transfer devices
- Automatically retracting fingerstick and heelstick lancets
- Unbreakable plastic capillary tubes for hematocrit determination
- Hemoglobin reader that does not use capillary tubes or require centrifugation of the sample

TUBERCULOSIS: PATHOGENESIS



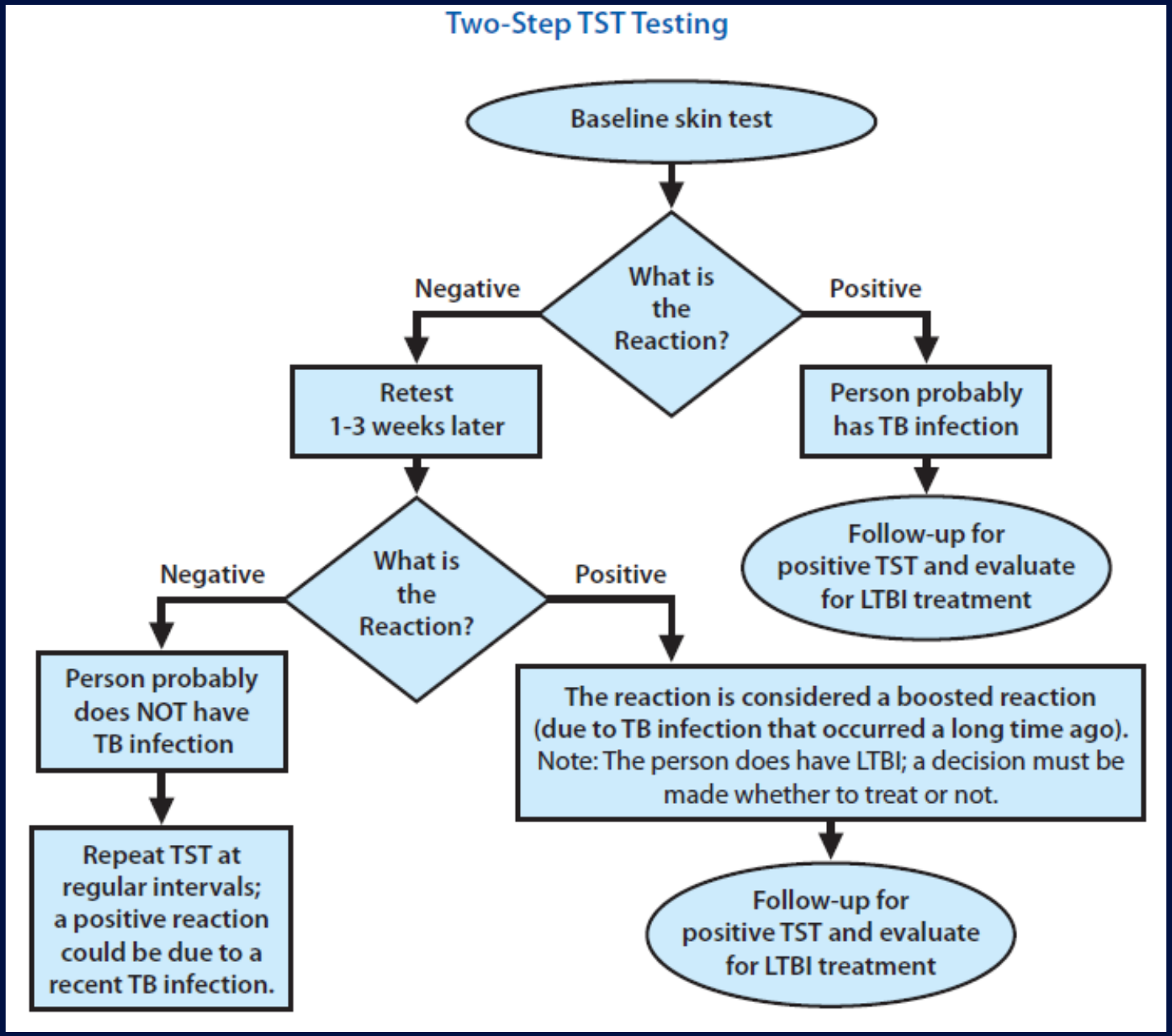

People Exposed to TB
Not TB Infected
Latent TB Infection (LTBI)
Not Infectious
Not Infectious
Negative TST or QFT-G test result
Positive TST or QFT-G test result
No TB Infection
Latent TB Infection
May go on to develop TB Disease

LTBI vs. TB Disease

Person with LTBI (Infected)	Person with TB Disease (Infectious)
Has a small amount of TB bacteria in his/her body that are alive, but inactive	Has a large amount of active TB bacteria in his/her body
Cannot spread TB bacteria to others	May spread TB bacteria to others
Does not feel sick, but may become sick if the bacteria become active in his/her body	May feel sick and may have symptoms such as a cough, fever, and/or weight loss
Usually has a TB skin test or TB blood test reaction indicating TB infection	Usually has a TB skin test or TB blood test reaction indicating TB infection
Radiograph is typically normal	Radiograph may be abnormal
Sputum smears and cultures are negative	Sputum smears and cultures may be positive
Should consider treatment for LTBI to prevent TB disease	Needs treatment for TB disease
Does not require respiratory isolation	May require respiratory isolation
Not a TB case	A TB case

TESTING FOR LATENT TUBERCULOUS INFECTION

- Test methods
  - Mantoux tuberculin skin test (TST)
  - IGRA
- IGRA can be used in place of TST
- These tests do NOT exclude LTBI or TB disease
- Decisions about medical management should include other data and not just rely on TST/IGRA results
- Cannot switch back and forth between TST and IGRA
- 2-Step testing: Recommended for person who have not had TST within previous 12 months or a previous 2 step test


Two-Step TST Testing
Baseline skin test
What is the Reaction?
Negative
Positive
Retest 1-3 weeks later
Person probably has TB infection
Follow-up for positive TST and evaluate for LTBI treatment
What is the Reaction?
Negative
Positive
Person probably does NOT have TB infection
Repeat TST at regular intervals; a positive reaction could be due to a recent TB infection.
The reaction is considered a boosted reaction (due to TB infection that occurred a long time ago). Note: The person does have LTBI; a decision must be made whether to treat or not.
Follow-up for positive TST and evaluate for LTBI treatment

Groups with Increased Likelihood of Infection with Mtb	Benefit of Therapy	LTBI Testing Strategy	
Household contact or recent exposure of an active case	Yes	Likely to be Infected Low to Intermediate Risk of Progression (TST ≥ 10mM)	Likely to be Infected High Risk of Progression (TST ≥ 5mM)
Mycobacteriology laboratory personnel	Not demonstrated		
Immigrants from high burden countries (>20 / 100,000)	Not demonstrated		
Residents and employees of high risk congregate settings	Yes		
None	Not demonstrated	Unlikely to be Infected (TST > 15mM)	

Risk of Infection

Risk of Developing Tuberculosis if Infected

Low	Intermediate (RR 1.3 -3)	High (RR 3-10)
No risk factors	Clinical predisposition Diabetes Chronic renal failure Intravenous drug use	Children age less than 5 HIV infection Immunosuppressive therapy Abnormal CXR consistent with prior TB Silicosis

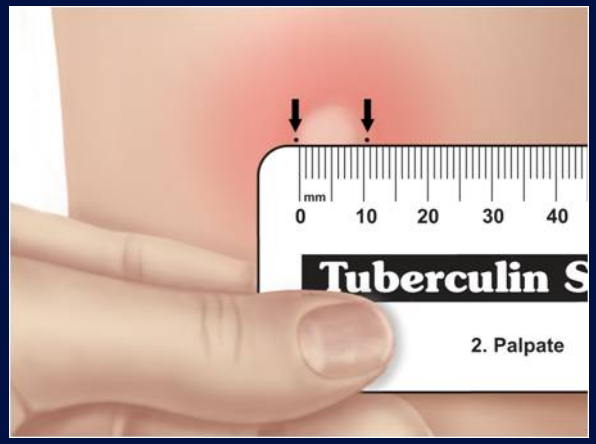
Benefit of Therapy

Not demonstrated — Yes

Group	Testing Strategy	Considerations
Likely to be Infected **High** Risk of Progression (TST ≥ 5mM)	**Adults** **Acceptable**: IGRA OR TST Consider dual testing where a positive result from either result would be considered **positive** **Children ≤ 5 years of age** **Preferred**: TST **Acceptable**: IGRA OR TST Consider dual testing where a positive result from either would be considered **positive**[1]	Prevalence of BCG vaccination Expertise of staff and/or laboratory Test availability Patient perceptions Staff perceptions Programmatic concerns
Likely to be Infected **Low** to **Intermediate** Risk of Progression (TST ≥ 10mM)	**Preferred**: IGRA where available **Acceptable**: IGRA or TST	
Unlikely to be Infected (TST > 15mM)	**Testing for LTBI is not recommended** **If necessary:** **Preferred:** IGRA where available. **Acceptable**: Either IGRA OR TST **For serial testing**: **Acceptable**: Either IGRA OR TST Consider repeat or dual testing where a negative result from either would be considered **negative**[2]	

1. Performing a second diagnostic test when the initial test is negative is a strategy to increase sensitivity. This may reduce specificity, but the panel decided that this is an acceptable tradeoff in situations in which the consequences of missing LTBI (i.e., not treating individuals who may benefit from therapy) exceed the consequences of inappropriate therapy (i.e., hepatotoxicity).
2. Performing a confirmatory test following an initial positive result is based upon both the evidence that false-positive results are common among individuals who are unlikely to be infected with Mtb and the committee's presumption that performing a second test on those whose initial test was positive will help identify initial false-positive results.

READING THE PPD



- Read 48-72 hours after injection
- Palpate (feel) injection site to find raised area
- Measure diameter of induration across forearm; only measure induration, not erythema
- Record size of induration in mm

INTERPRETING THE TST REACTION

- ≥5 mm is classified as positive:
  - HIV-infected persons
  - Recent contacts of infectious TB
  - Persosn with fibrotic changes on CxR consistent with prior TB
  - Patients with organ transplants and other immunocompromised persons
- ≥10 mm is classified as positive:
  - HCP
  - Recent arrivals from high-prevalence countries (< 5-years)
  - Inject drug users
  - Residents and personnel (HCP) of high-risk congregate settings
  - Persons with conditions that increase the risk for progression to active TB
  - Children <4 years of age
- ≥15 mm is classified as positive:
  - Persons with no known risk factors for TB

False-Positive and False-Negative Reactions to the TST

Type of Reaction	Possible Cause	People at Risk
False-positive	Nontuberculous mycobacteria (NTM)	People infected with NTM
	BCG vaccination	People vaccinated with BCG
	Administering of incorrect antigen	Any person being tested
	Incorrect interpretation of TST result	Any person being tested
False-negative	Anergy	HIV-infected people, other people with weakened immune systems, severe TB disease, and some viral illness (e.g., measles, mumps, and chicken pox) or bacterial infection (e.g., typhoid, etc.)
	Recent TB infection	People infected with *M. tuberculosis* within the past 8 weeks
	Concurrent viral infection	People injected with a live-virus vaccination
	Concurrent bacterial infection	People with typhoid fever, brucellosis, typhus, leprosy, pertussis
	Concurrent fungal infection	People with fungal infection
	Chronic renal failure	People with renal failure
	Low protein states	People with severe protein depletion or afibrinogenemia
	Diseases affecting lymphoid organs	People with Hodgkin's disease, lymphoma, chronic leukemia, sarcoidosis
	Immunosuppressive drugs	People taking medical steroids, TNF-alpha blockers or comparable drugs
	Very young or elderly persons	Newborns or elderly patients with immature or waning immunity
	Stress	People who have had surgery, burns, mental illness, graft-versus-host reactions
	Incorrect storage or handling of antigen, administering the TST, or results that are **not** measured or interpreted properly	Any person being tested

Recommendations for the Use of IGRAs

Category	Recommended	Not Recommended
Groups for use	• Preferred for groups that historically have poor rates of return for TST reading • Preferred for persons who have received BCG (as a vaccine or for cancer therapy)	• Children younger than 5 years of age unless it is used in conjunction with TST • Persons at low risk of infection • Persons at low risk of disease due to *M. tuberculosis* (except those who are likely to be at increased risk in the future)
In place of TST	• Recent contacts of persons with TB disease with special considerations for follow-up testing » If IGRAs are used in contact investigations, negative results obtained prior to 8 weeks typically should be confirmed by repeating the test 8 to 10 weeks after the end of exposure » Use of the same test for repeat testing will minimize misclassification errors that occur due to test discordance • Periodic screening that addresses occupational exposure to TB disease (e.g., surveillance programs for health workers)	
Testing with both TST and IGRA	Results from both tests may be useful when the initial test is **negative** • When the following risks are high » Risk of infection » Risk of progression from infection to disease » Risk of a poor outcome • When there is clinical suspicion for active TB and confirmation of *M. tuberculosis* infection is desired	Routine testing with both TST and IGRA

THANK YOU!