Fundamentals of TB

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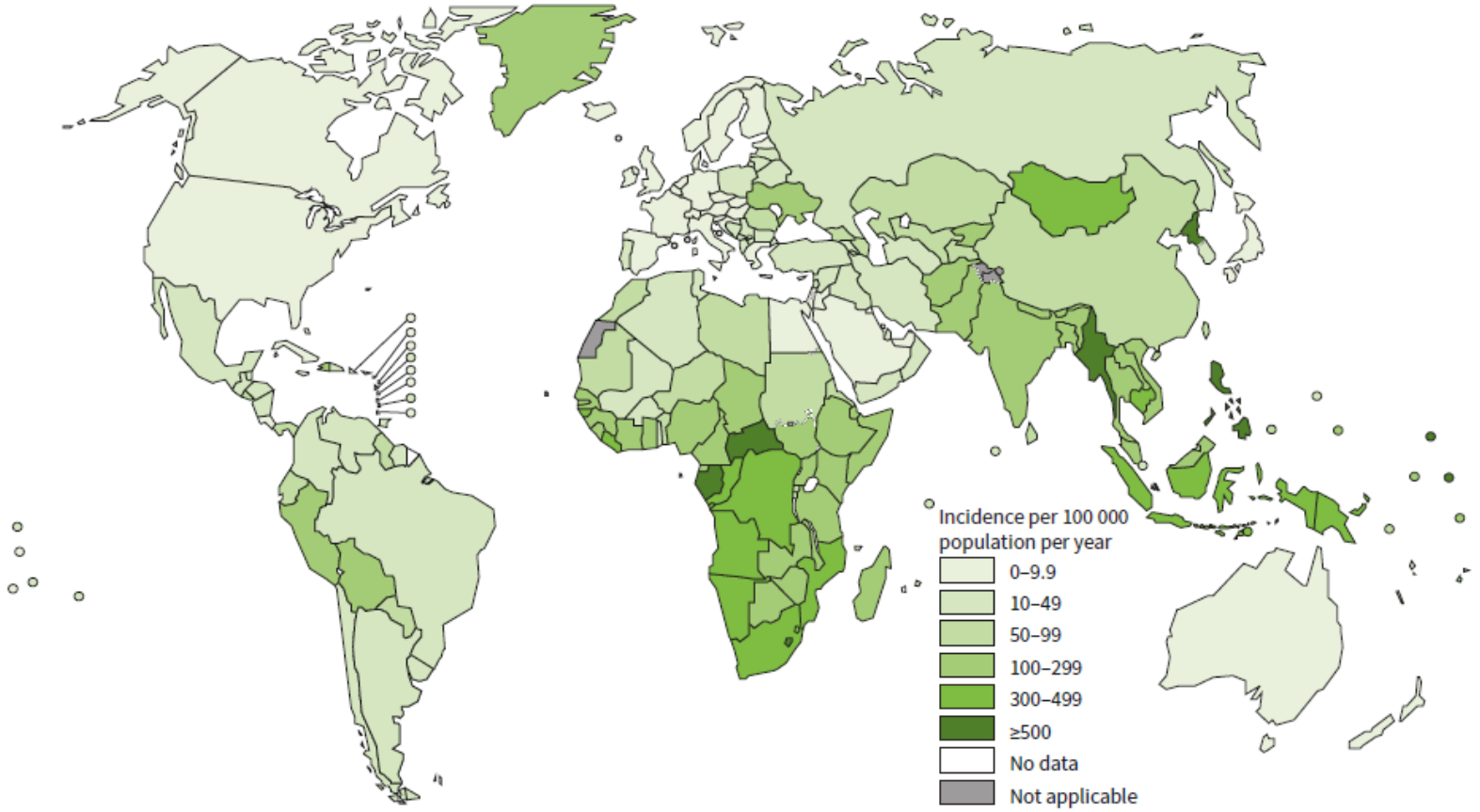
Epidemiology

Global Epidemiology of TB

FIG. 5

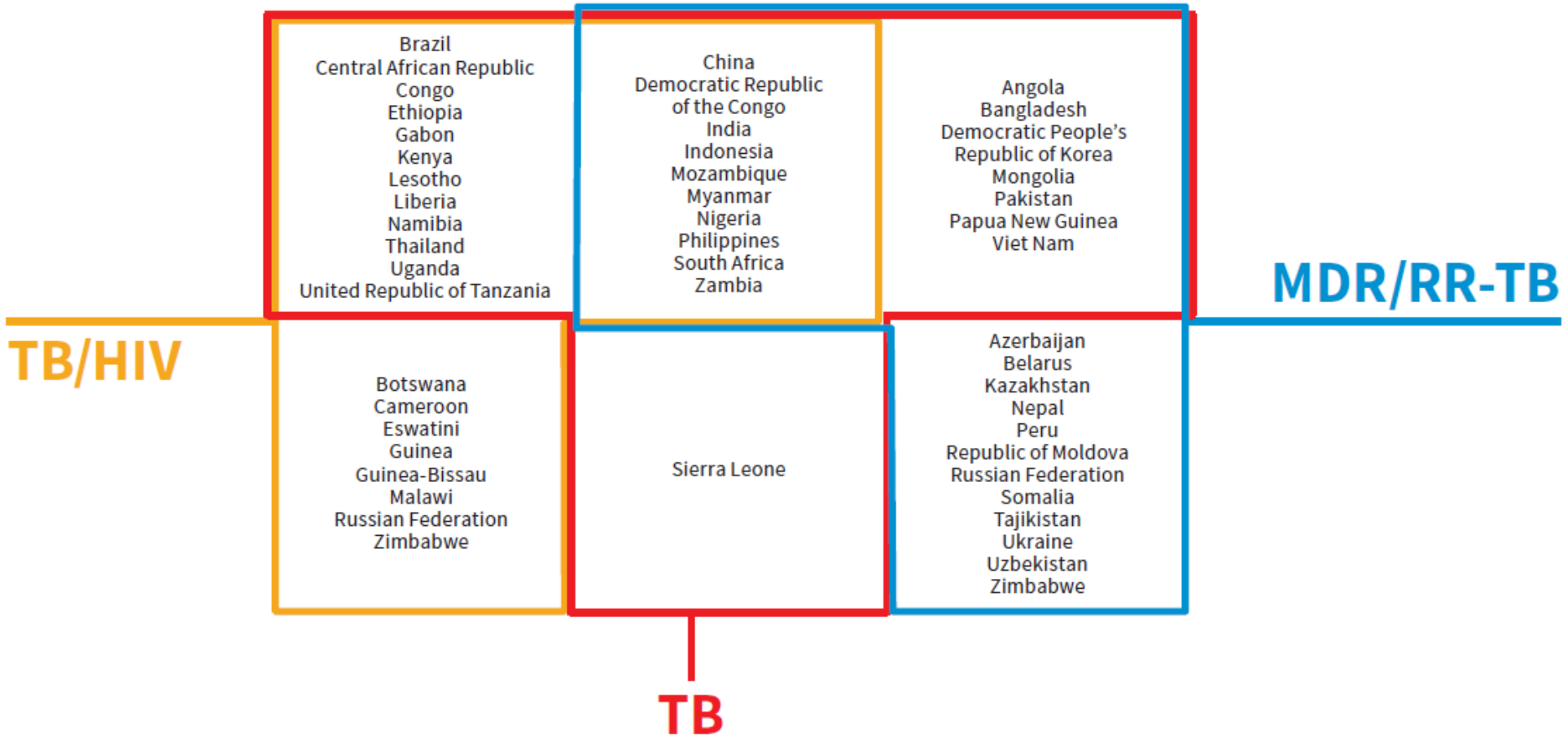
Estimated TB incidence rates, 2023



Global Tuberculosis Report 2024

FIG. A3.1

The three global lists of high-burden countries for TB, HIV-associated TB and MDR/RR-TB being used by WHO in the period 2021–2025, and their areas of overlap

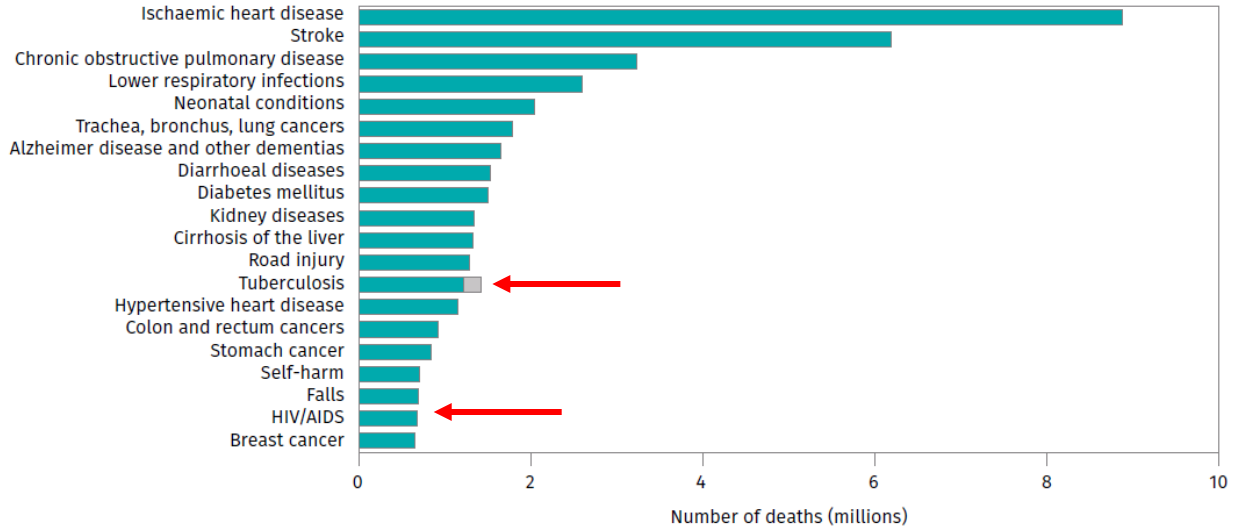


TB: Greatest Infectious Killer Worldwide -2019

FIG. 7

Top causes of death worldwide in 2019[a,b]

Deaths from TB among HIV-positive people are shown in grey.



[a] This is the latest year for which estimates for all causes are currently available. See WHO estimates, available at https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death

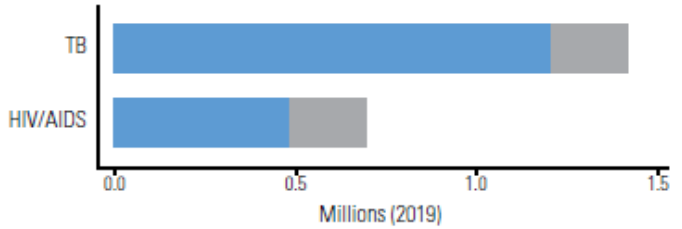
[b] Deaths from TB among HIV-positive people are officially classified as deaths caused by HIV/AIDS in the International Classification of Diseases.

Global Tuberculosis Report 2021

FIG. 4.15

Estimated number of deaths worldwide from TB and HIV/AIDS in 2019[a,b]

Deaths from TB among HIV-positive people are shown in grey.



[a] For HIV/AIDS, the latest estimates of the number of deaths in 2019 that have been published by UNAIDS are available at http://www.unaids.org/en/ (accessed 16 August 2020). For TB, the estimates for 2019 are those published in this report.

[b] Deaths from TB among HIV-positive people are officially classified as deaths caused by HIV/AIDS in the International Classification of Diseases.

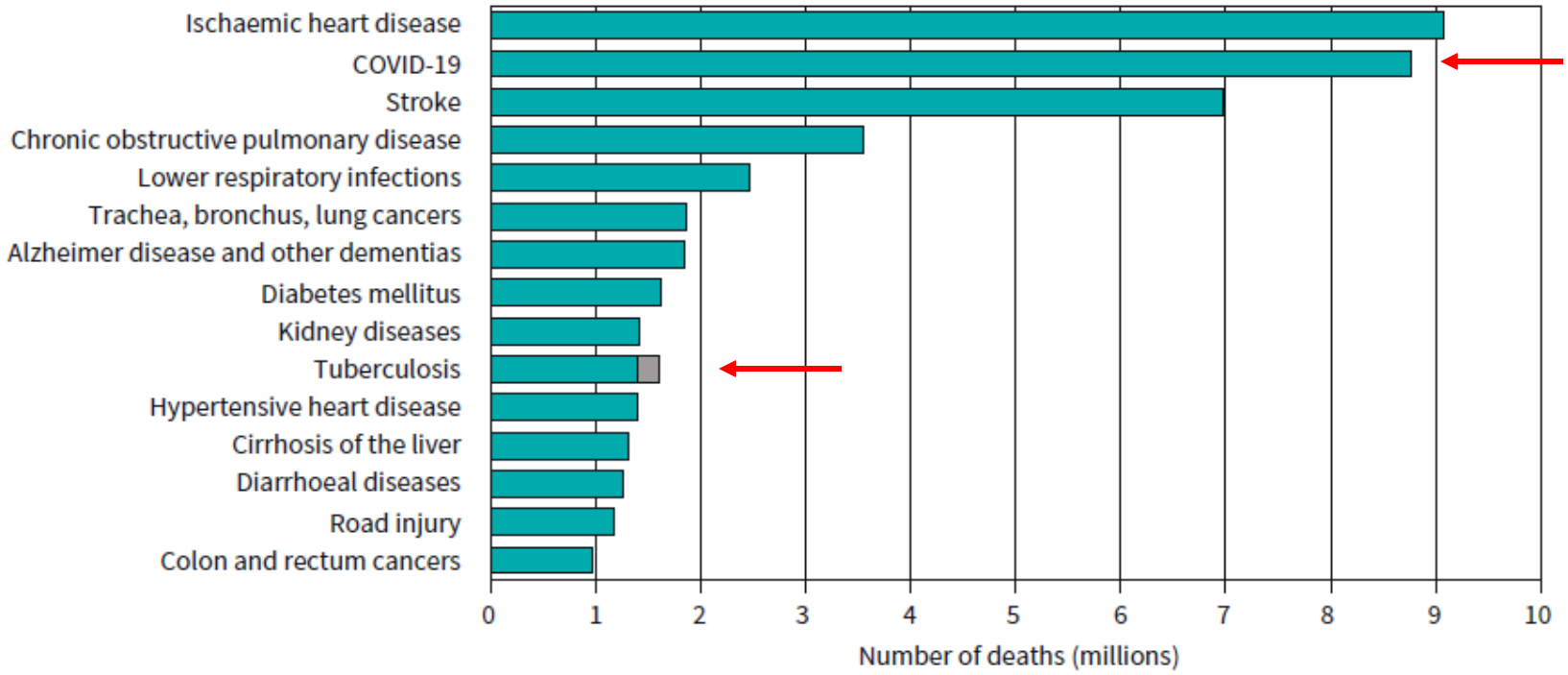
Global Tuberculosis Report 2020

Covid Surpasses TB as the #1 Infectious Killer

FIG. 12

Top 15 causes of death worldwide in 2021[a,b]

Deaths from TB among people with HIV are shown in grey.



[a] This is the latest year for which estimates for all causes are currently available. See WHO estimates, available at https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death.

[b] Deaths from TB among people with HIV are officially classified as deaths caused by HIV/AIDS in the International Classification of Diseases.

In 2022, TB remained the second leading cause of death from an infectious disease, after COVID-19

Estimated number of TB deaths among HIV-negative people*	**1.13 million** (95% UI: 1.02–1.26)
Officially reported number of deaths from COVID-19	**1.24 million**
Estimated number of deaths from HIV/AIDS	**0.63 million** (95% UI: 0.58–0.67)

*Deaths from TB among people with HIV officially classified as deaths from HIV/AIDS

Sources: Coronavirus (COVID-19) dashboard. Geneva: World Health Organization; 2022 (https://covid19.who.int/)
AIDS info. Geneva: UNAIDS; 2023. (https://aidsinfo.unaids.org/).

World Health Organization

TB Returns to the Top Spot

World Health Organization

Health Topics | Countries | Newsroom | Emergencies

Home / News / Tuberculosis resurges as top infectious disease killer

Tuberculosis resurges as top infectious disease killer

29 October 2024 | News release | Washington D.C., USA | Reading time: 4 min (950 words)

Reuters

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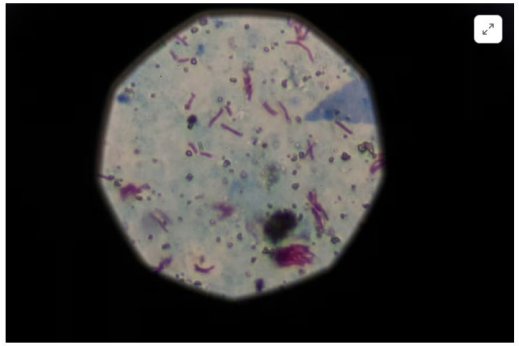
Tuberculosis returns as top infectious disease killer, WHO says

By Reuters

October 29, 2024 5:22 PM CDT · Updated 5 months ago



[1/2] A sample that tested positive for tuberculosis is seen from a microscope in Buenos Aires, Argentina, March 29, 2019. Cases of the "white death" illness, closely linked to poverty, malnutrition and poor housing, have been on the rise since the turn of the decade as Latin America's third largest... Purchase Licensing Rights Read more

Oct 29 (Reuters) - Tuberculosis replaced COVID-19 to become the top cause for infectious disease-related

PAHO Pan American Health Organization | World Health Organization Americas Region

TOPICS

Home / News / Tuberculosis resurges as top infectious disease killer

Tuberculosis resurges as top infectious disease killer

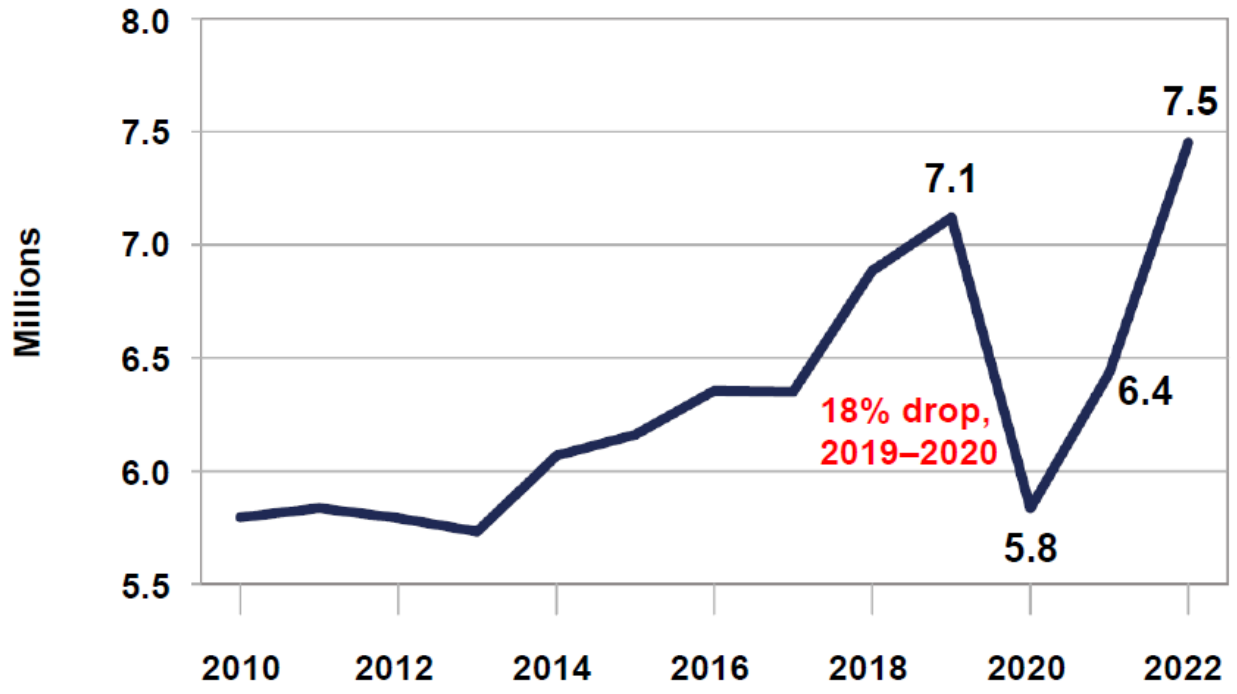
1 Nov 2024

New global report shows that while cases continue to rise in the Americas, improvements in diagnosis and treatment are helping to reduce deaths

1 November 2024 – The World Health Organization (WHO) published a new report on

Global recovery in reported number of people newly diagnosed with TB

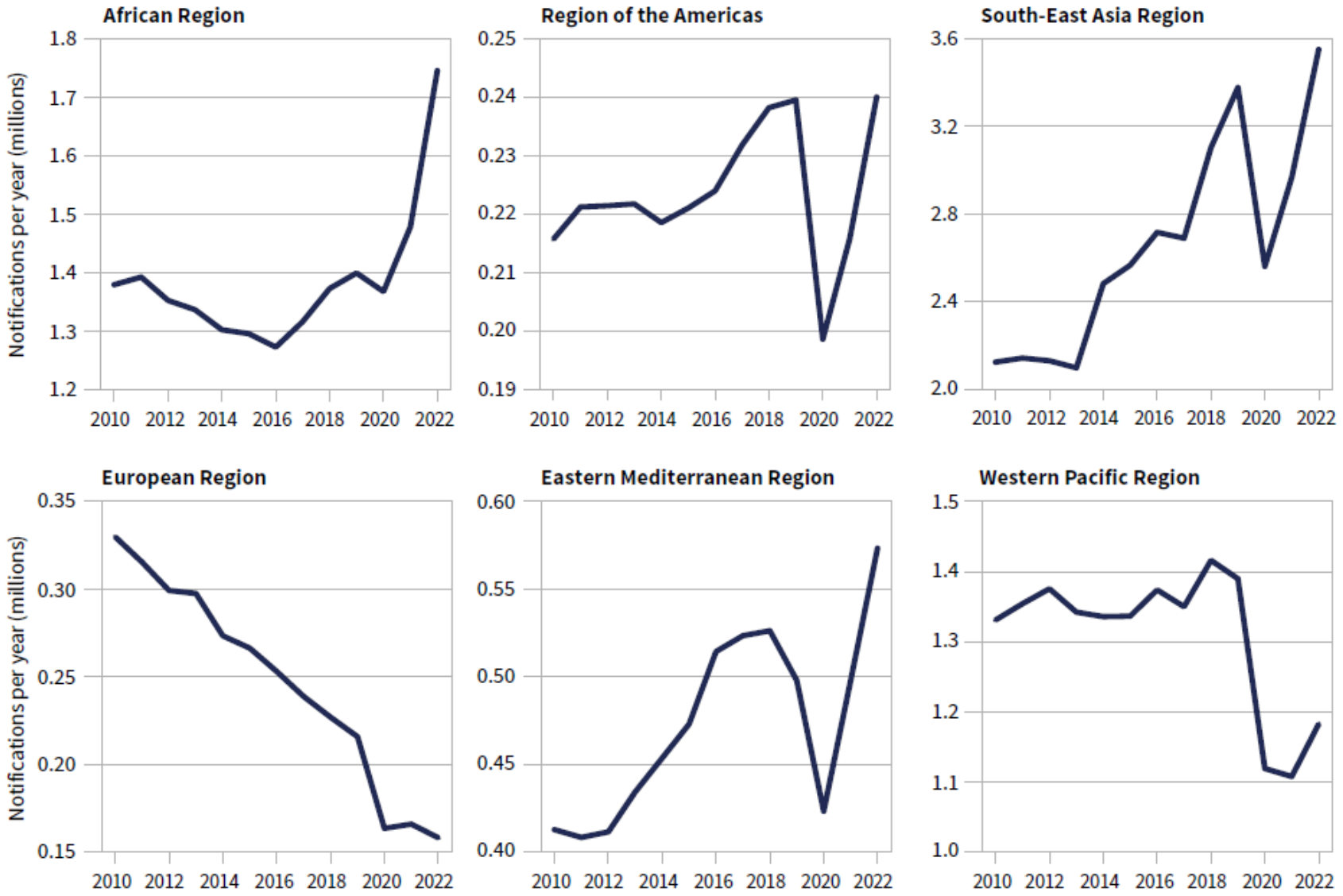
7.5 million in 2022: highest number since WHO started global TB monitoring in mid-1990s



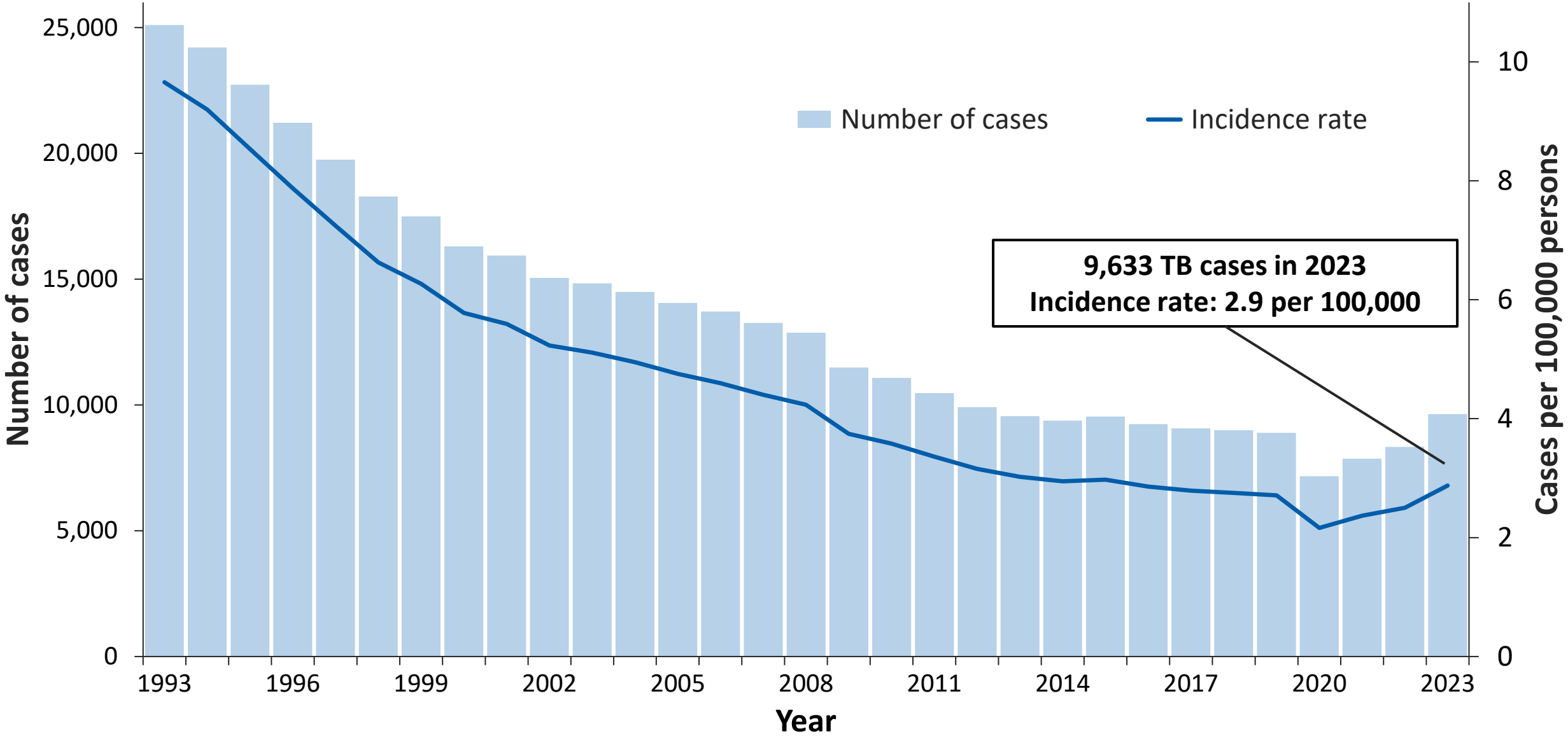
World Health Organization

FIG. 2

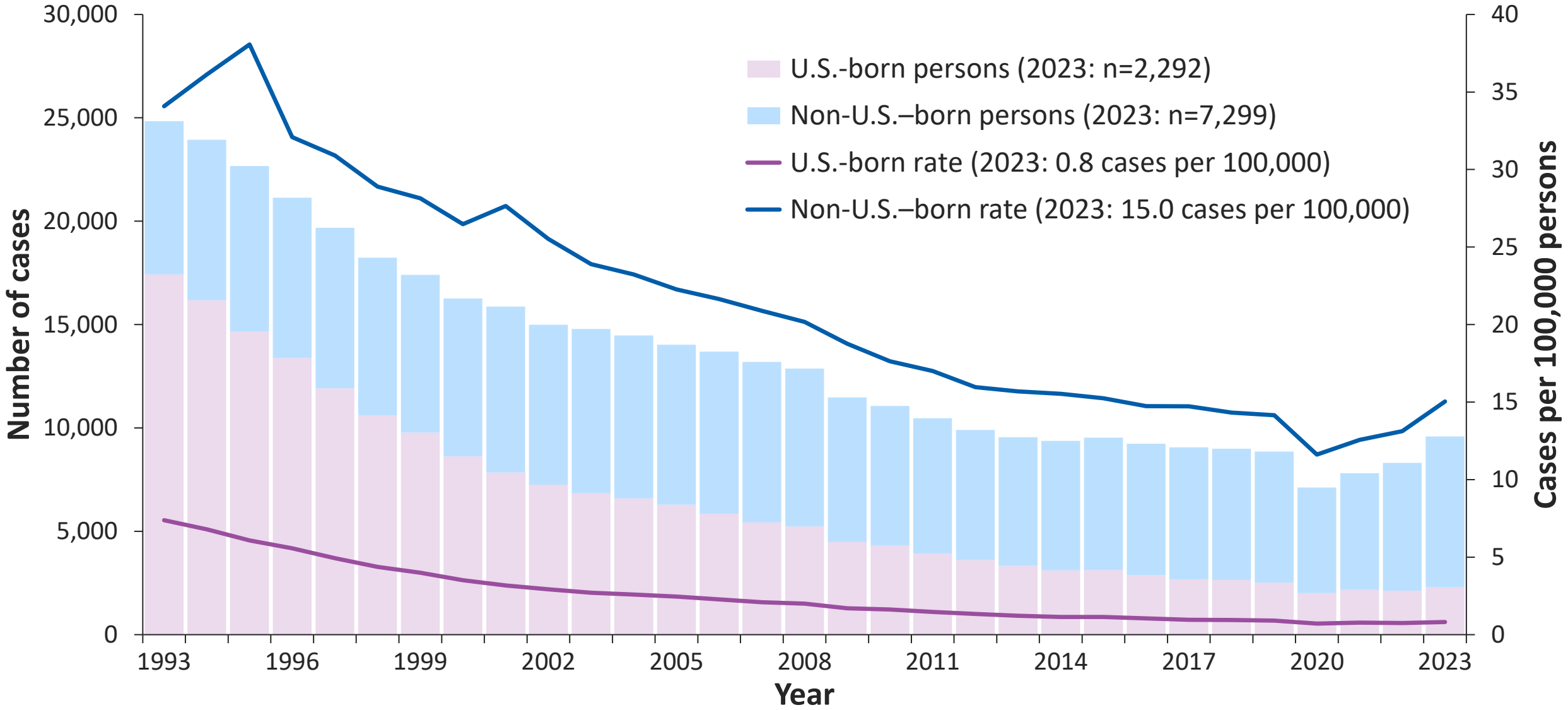
Trends in case notifications of people newly diagnosed with TB by WHO region, 2010–2022



TB Cases and Incidence Rates, United States, 1993–2023

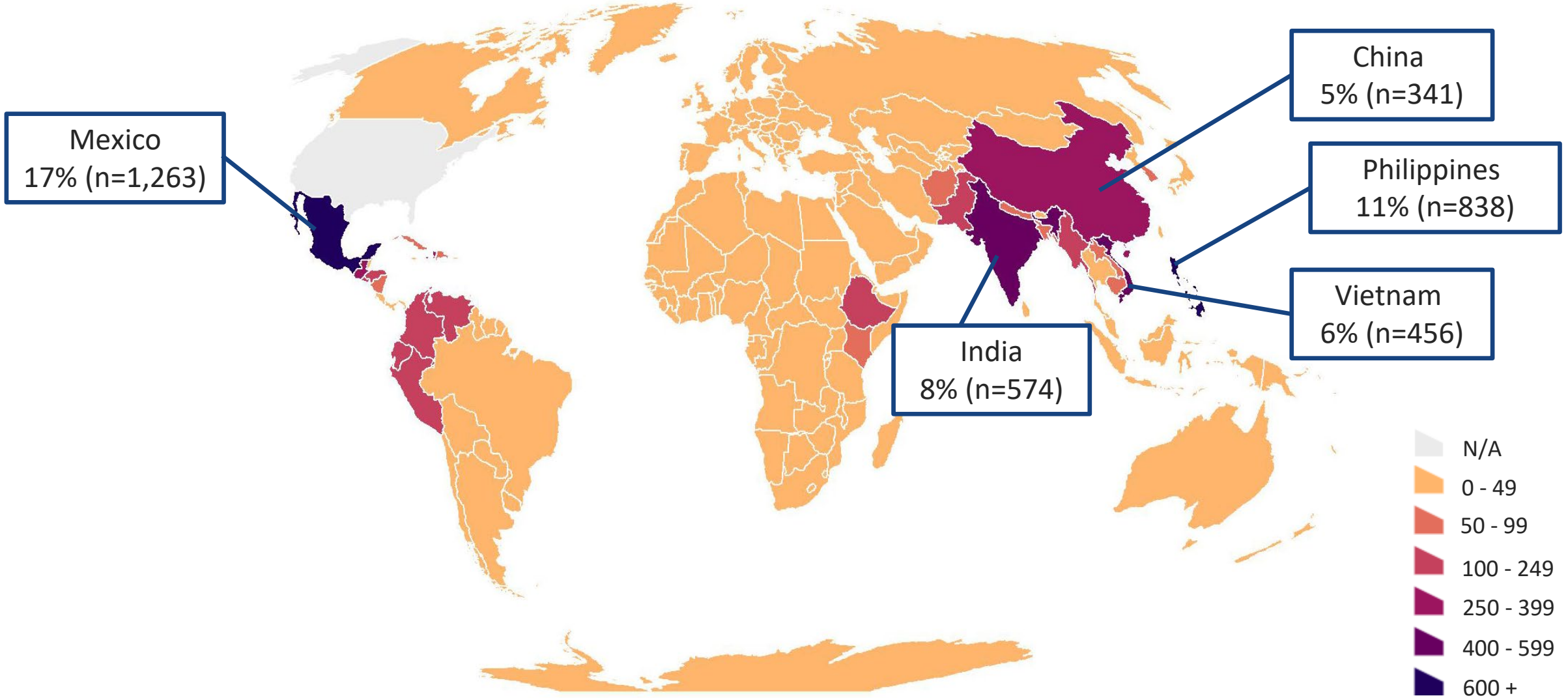


TB Cases and Incidence Rates by Origin of Birth,* United States, 1993–2023



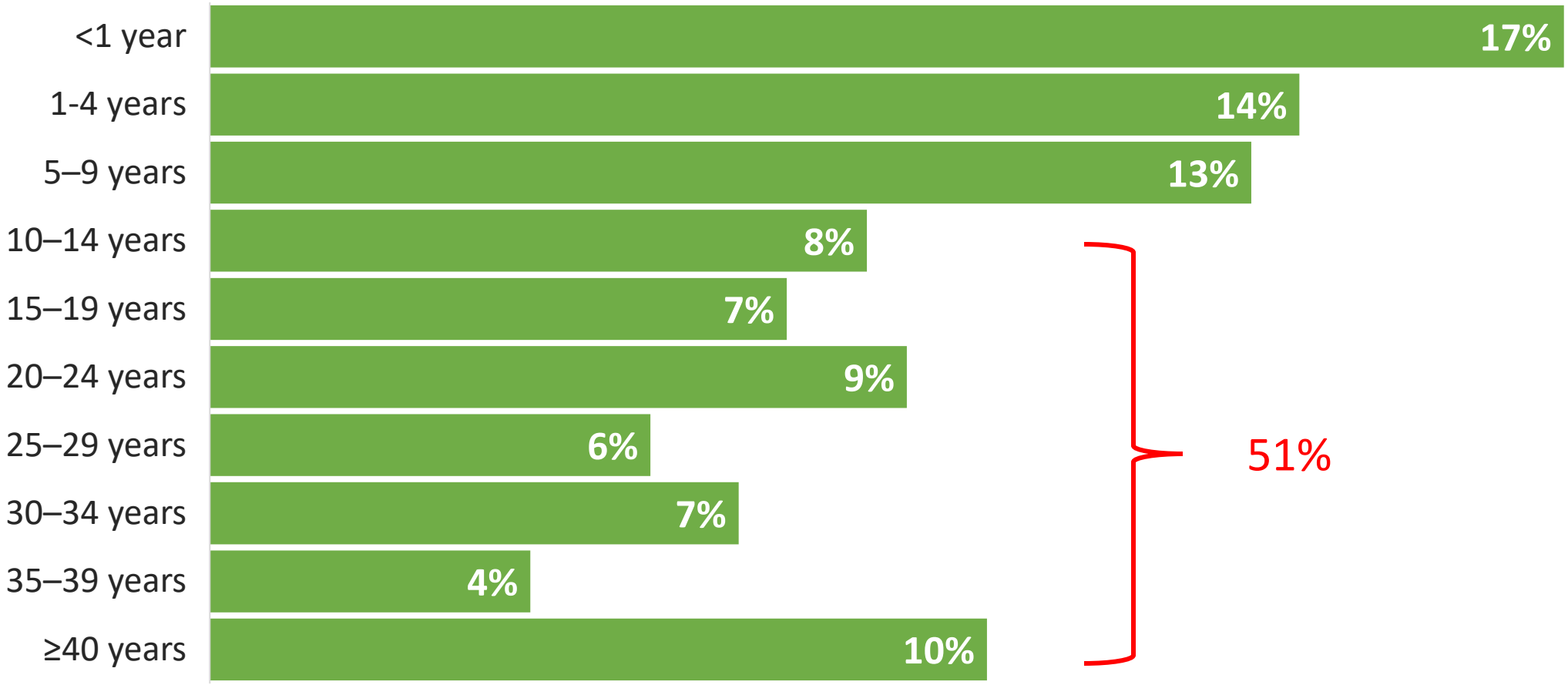
*Persons born in the United States, certain U.S. territories, or elsewhere to at least one U.S. citizen parent are categorized as U.S.-born. All other persons are categorized as non-U.S.–born.

TB Cases by Countries of Birth Among Non-U.S.–Born* Persons, United States, 2023 (N=7,299)



*Persons born in the United States, certain U.S. territories, or elsewhere to at least one U.S. citizen parent are categorized as U.S.-born. All other persons are categorized as non-U.S.–born.

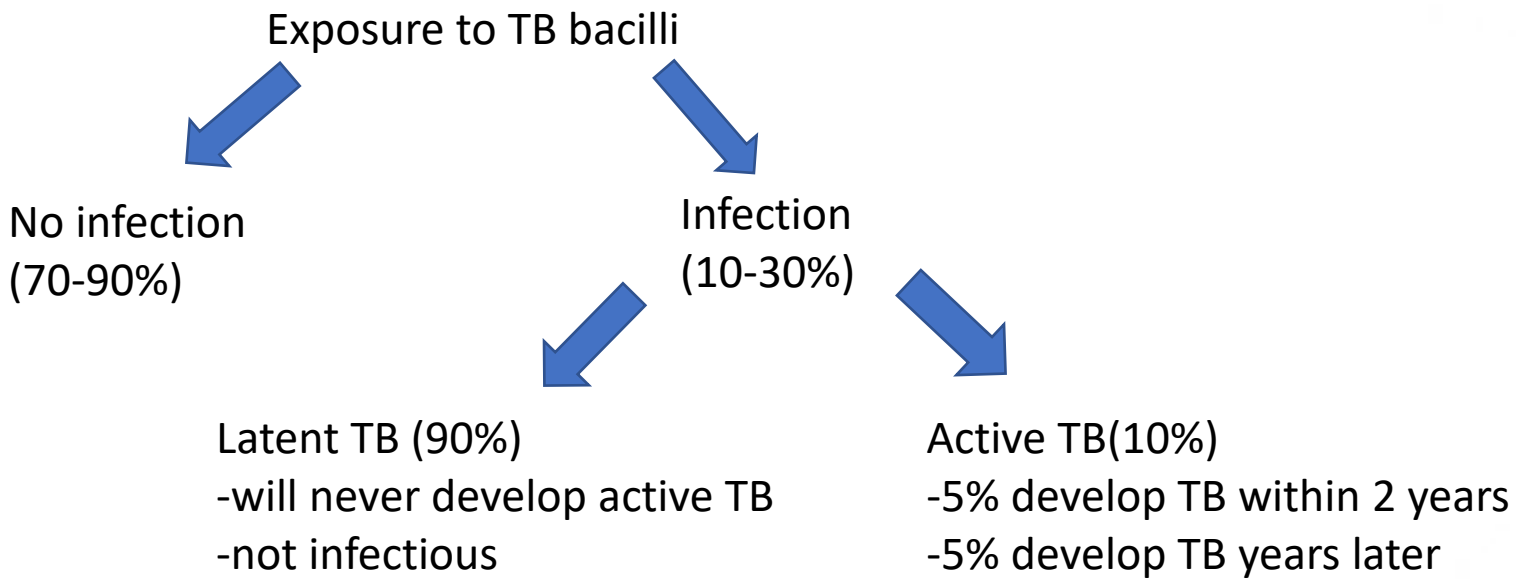
Percentage of TB Cases Among Non-U.S.–Born* Persons by Years Since Initial Arrival in the United States at Diagnosis,† 2022 (N=6,148)



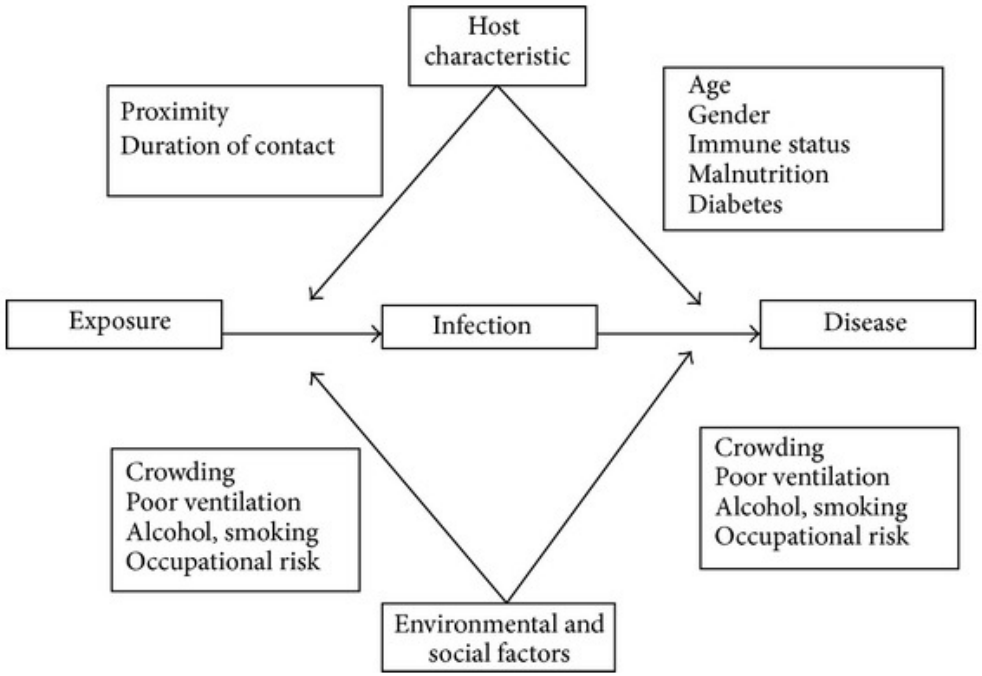
*Persons born in the United States, certain U.S. territories, or elsewhere to at least one U.S. citizen parent are categorized as U.S.-born. All other persons are categorized as non-U.S.–born.
†The number of years since initial arrival in the United States at diagnosis was unknown or missing for 7% of non-U.S.–born persons. These persons were included in the denominator when percentages were calculated.

Who is more likely to be exposed to or infected with *Mycobacterium tuberculosis*?

Pathogenesis of Tuberculosis



Risk Factors for Tuberculosis



Who is more likely to be **exposed** to *M. tuberculosis*?

- Persons from countries with a high incidence of TB disease
- Residents and employees of high risk congregate settings (e.g. correctional facilities, long term care facilities)
- Healthcare workers
- Contacts to persons with infectious TB disease
- Persons who spend time in shelters
- Persons who use illicit drugs

Table 1. Prevalence of Latent Tuberculosis Infection among U.S. Residents, as Assessed by Tuberculin Skin Testing.*

Group and Study	Expected Prevalence (95% CI)
	%
Foreign-born persons	
Bennett et al.[4]	18.7 (13.5–25.2)
Close contacts of persons with infectious tuberculosis†	
Marks et al.[8]	37.1 (35.7–38.5)
Homeless persons	
Kong et al.[9]	12.8 (12.2–13.5)
Moss et al.[10]	32.4 (30.5–34.4)
Injection-drug users	
Riley et al.[11]	16.1 (12.5–22.4)
Grimes et al.[12]	27.7 (19.3–37.5)
Brassard et al.[13]	22.4 (17.7–28.5)
Salomon et al.[14]	14.0 (11.4–17.1)
Prisoners	
Lobato et al.[15]	17.0 (16.8–17.1)
U.S.-born, no other risk	
Bennett et al.[4]	1.8 (1.4–2.1)

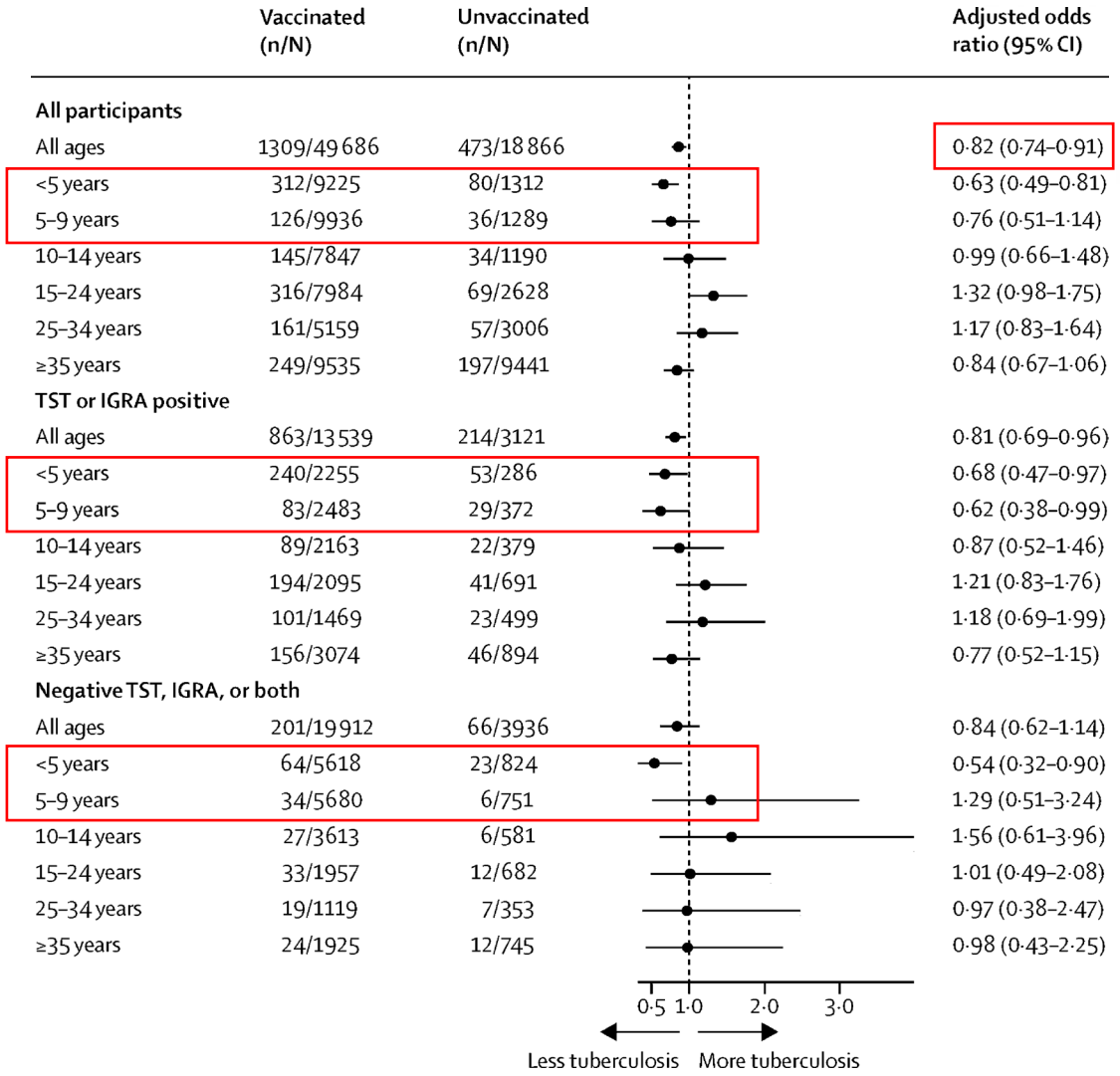
* See the Supplementary Appendix for the definition of a positive test result. CI denotes confidence interval.
† This group was not strictly defined but is generally considered to consist of members of the household of an infected person.

Latent Tuberculosis Infection in the United States, Horsburgh R., NEJM, 4/14/2011

BCG

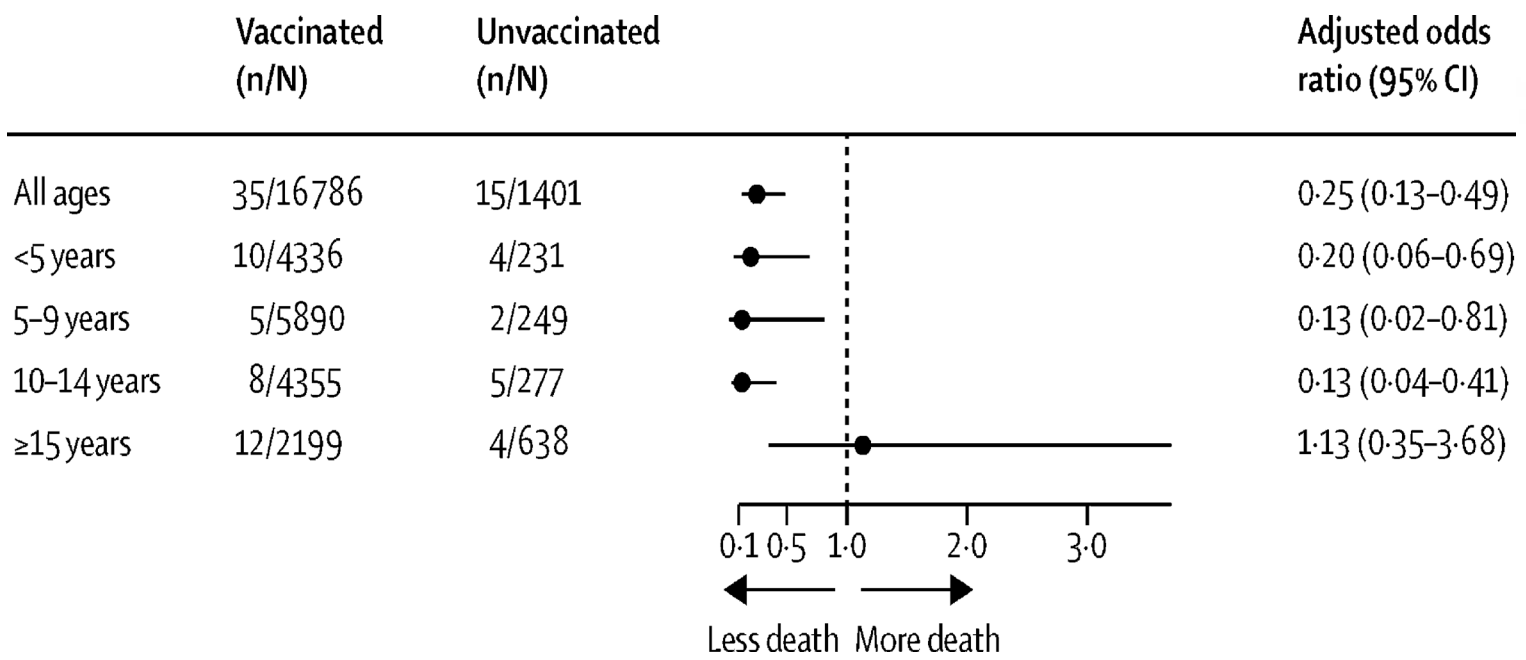
What does it do? Who does it protect?

Figure 2 BCG vaccination at birth and the risk of all tuberculosis, stratified by infection status and age



The Lancet Global Health
Volume 10 Issue 9: e1307-e1316
(September 2022)

Figure 3 BCG vaccination at birth and the risk of death, stratified by age



The Lancet Global Health
Volume 10 Issue 9: e1307-e1316 (September 2022)

Contacts to persons with infectious TB disease

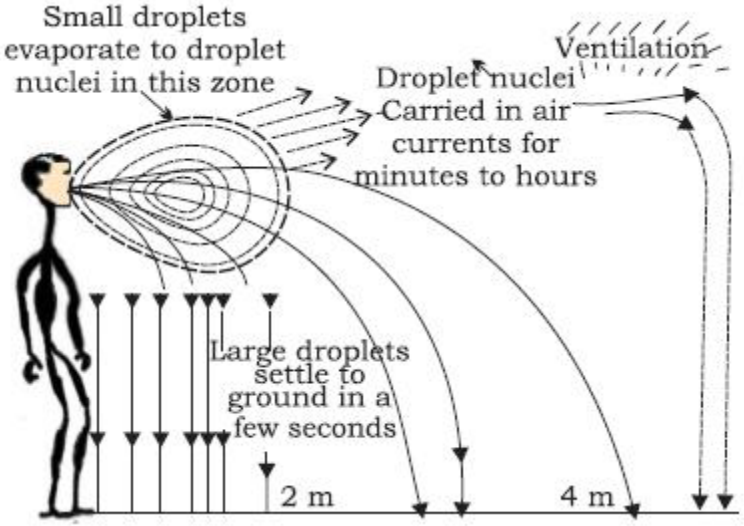
- Factors include:
  - Infectiousness of TB patient
  - Susceptibility of contact
  - Duration of contact
    - No safe exposure time has been established
  - Proximity of contact
    - Difficult to determine

- Working with the health department is imperative

Contact Investigation for Tuberculosis: a systematic review and meta-analysis; Fox G, Eur Respir J. 2013

What are environmental factors which increase likelihood of TB transmission?

- Poorly ventilated settings
- Crowding

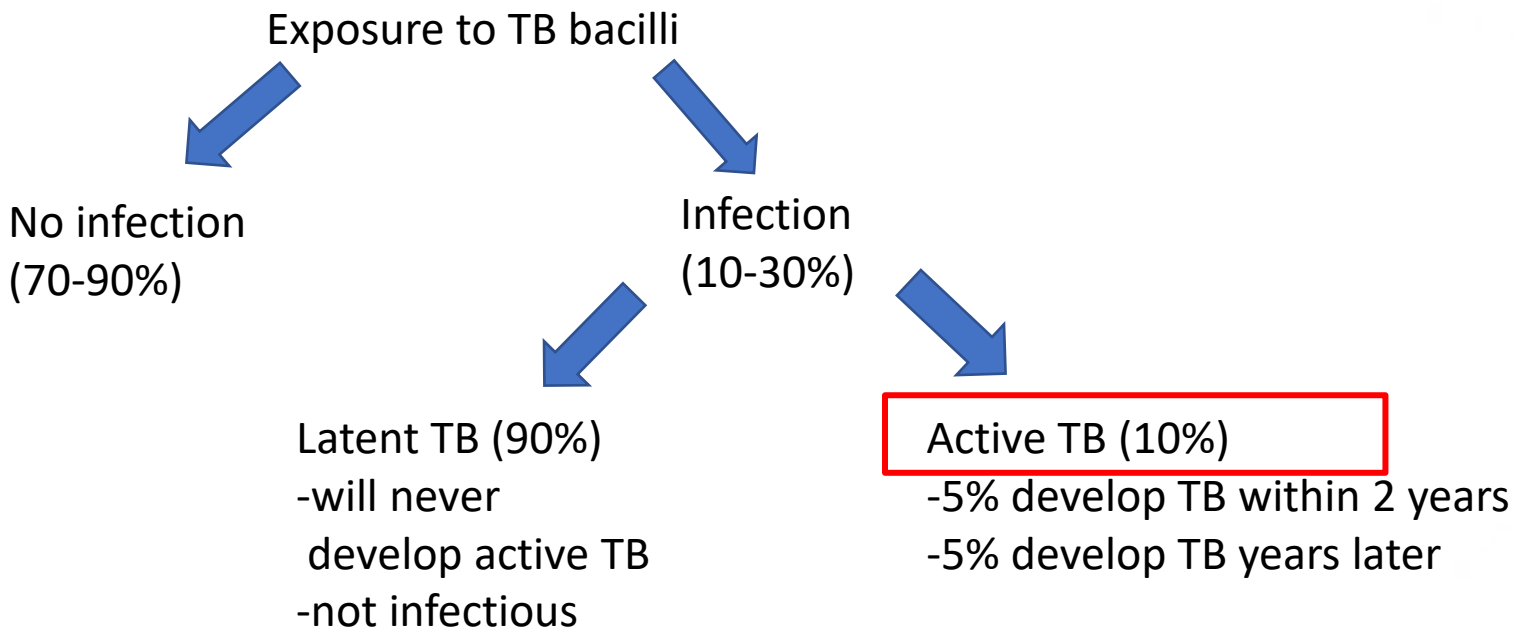


Healthcare workers

- Misconception: ‘TB immune’ or ‘TB proof’
- A certain numbness regarding risks
  - ‘‘Why are you wearing that (N95) mask? I have worked here for many years and have never gotten TB.’’
- Stigma
- Career implications

Who is likely to progress to TB disease after infection with *M. tuberculosis?*

Pathogenesis of Tuberculosis



Effect of HIV on Progression from Latent to Active TB

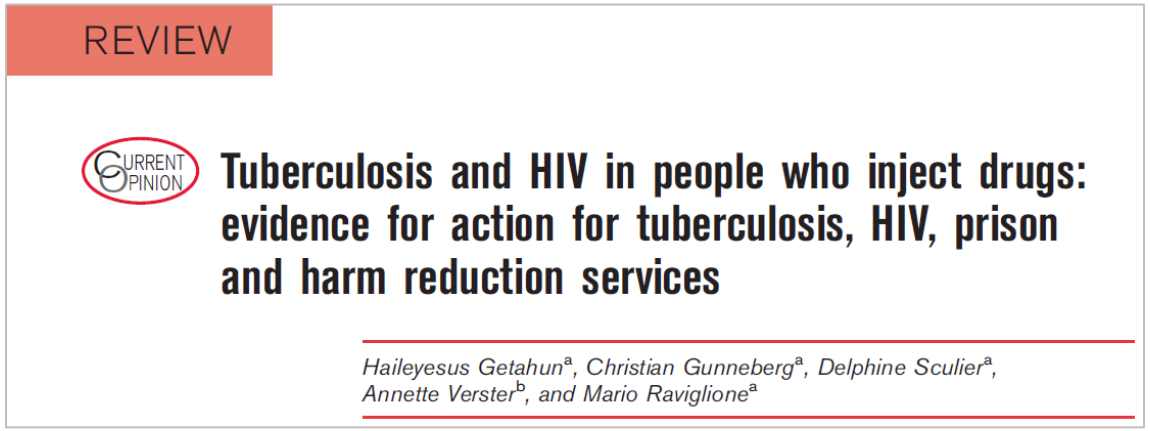
Tuberculosis in the Homeless; A Prospective Study
Moss, A.; J Respir Crit Care Med Vol 162. pp 460–464, 2000

INCIDENCE OF REPORTABLE TUBERCULOSIS IN THE SAN FRANCISCO GENERAL HOSPITAL HOMELESS COHORT BY HIV AND TUBERCULIN SKIN TEST (TST) STATUS AT BASELINE

	n	Person-years	Cases	Rate per Person-Year	95% Confidence Interval
TST+, HIV+	40	134	6	4.46	(1.76–9.10)
TST+, HIV−	695	2,524	12	0.48	(0.25–0.80)
TST−, HIV+	155	559	3	0.56	(0.14–1.46)
TST−, HIV−	1,382	4,422	3	0.07	(0.02–0.18)
TST unknown, HIV+	49	185	1	0.54	(0.02–2.14)
TST unknown, HIV−	443	1,418	0	0	(0.0–0.21)
Total	2,764	9,221	25	0.27	(0.18–0.39)

HIV infected had about a 10 times higher risk of reactivation than those HIV uninfected

IVDU and TB


REVIEW

CURRENT OPINION

Tuberculosis and HIV in people who inject drugs: evidence for action for tuberculosis, HIV, prison and harm reduction services

Haileyesus Getahun[a], Christian Gunneberg[a], Delphine Sculier[a], Annette Verster[b], and Mario Raviglione[a]

- People who live with HIV and inject drugs have a **2–6-fold increased risk of developing TB** compared with non-injectors, and commonly have comorbidities with hepatitis B (HBV) and C viral (HCV) infection.
- They are also at increased risk of criminalization and incarceration.
- The risk of TB disease in prisons is on average 23 times higher than the level in the general population.

Volume 7 • Number 4 • July 2012

Tuberculosis Outbreak Investigations in the United States, 2002–2008

Kiren Mitruka, John E. Oeltmann, Kashef Ijaz, and Maryam B. Haddad

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 17, No. 3, March 2011

Table 2. Tuberculosis risk factors for patients in CDC–investigated TB outbreaks, United States, 2002–2008*

Risk factor†	No. (%) patients
Total	398 (100)
Medical	
HIV co-infection	46 (12)‡
Diabetes	23 (6)
Immunosuppression (not HIV associated)	14 (4)
History of TB	16 (4)
Incomplete treatment	7 (44)
Social	
Any substance abuse	233 (58)
Alcohol abuse	204 (51)
Nonintravenous drug use	117 (29)
Intravenous drug use	19 (5)
Incarceration history§	126 (32)
Homelessness	78 (20)

Table 3. Predominant characteristics of CDC–investigated TB outbreaks, United States, 2002–2008*

Characteristic	No. (%) outbreaks†
Total	27 (100)
US born	24 (89)
Male sex	22 (81)
Substance abuse (alcohol/drugs)	18 (67)
Acid-fast bacilli smear positive	17 (63)
Non-Hispanic black	16 (59)
Incarceration history	8 (30)
Cavitary disease on chest radiograph	7 (26)
Non-Hispanic white	4 (15)
Homelessness	4 (15)
Hispanic	3 (11)
HIV co-infection	1 (4)

*TB, tuberculosis; CDC, Centers for Disease Control and Prevention.
†Outbreak had ≥50% of patients with the select characteristic.

Alcohol and TB Disease

Table 2 Differences in disease characteristics between North Carolina tuberculosis cases report
out excess alcohol use

Characteristic	Excess alcohol use		
	Yes	No/unknown	
Site of disease			
Pulmonary (±extrapulmonary)	1227 (92.5%)	3266 (77.2%)	
Extrapulmonary only	99 (7.5%)	964 (22.8%)	
Chest radiographic findings			
Cavitary	452 (36.8%)	920 (28.2%)	1.31 (1.19–1.43)
Non-cavitary	775 (63.2%)	2346 (71.8%)	
Sputum smear			
Positive	809 (65.9%)	1495 (45.8%)	1.44 (1.36–1.52)
Negative	418 (34.1%)	1771 (54.2%)	
Sputum culture			
Positive	1038 (84.6%)	2270 (69.5%)	1.22 (1.18–1.26)
Negative	189 (15.4%)	996 (30.5%)	

Chest radiographic, sputum smear, and sputum culture data are for cases with pulmonary involvement only.

INT J TUBERC LUNG DIS 16(7):886–890
©2012 The Union
http://dx.doi.org/10.5588/ijtld.11.0624
E-published ahead of print 8 May 2012

Tuberculosis and alcohol misuse in Scotland: a population-based study using enhanced surveillance data

B. de la Haye,*† S. H. Wild,* J. Stevenson,*‡ F. Johnston,§ O. Blatchford,§ I. F. Laurenson†

*Centre for Population Health Sciences, University of Edinburgh, Edinburgh, †Scottish Mycobacteria Reference Laboratory, Royal Infirmary of Edinburgh, Edinburgh, ‡Public Health Department, Lothian Health Board, Edinburgh, §Health Protection Scotland, Glasgow, UK

Pulmonary Disease
92.3% vs 61.1%

Smear positive
74% vs 57.6%

IV drug use
4.2% vs 0.8%

Fiske et al Journal of Infection (2009) 58, 395-401

TABLE 3—Adjusted[a] Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for Tuberculosis among Patients Discharged from Civilian Hospitals in California during 1991, by Race/Ethnicity

Variable	Whites		Hispanics		Blacks	
	Adjusted OR	95% CI	Adjusted OR	95% CI	Adjusted OR	95% CI
Sex (male vs female)	1.51	1.42, 1.61	1.02	0.96, 1.10	1.87	1.68, 2.08
Age, y						
<25 (reference)						
25–54	4.98	4.35, 5.70	2.87	2.66, 3.10	5.92	5.02, 6.98
>54	12.71	11.02, 14.65	9.98	8.93, 11.15	4.90	4.00, 6.01
Foreign born[b]	1.18	1.15, 1.21	1.14	1.11, 1.19	0.94	0.90, 0.99
Poor education[b]	1.40	1.31, 1.50	0.96	0.88, 1.05	2.33	2.02, 2.68
Median income[c]	0.99	0.98, 0.99	1.00	0.99, 1.01	0.97	0.95, 0.99
Health insurance						
Other (reference)[d]						
Medicare	2.22	2.04, 2.42	1.78	1.54, 2.06	2.58	2.17, 3.07
Medicaid	5.87	5.33, 6.46	3.71	3.39, 4.05	5.21	4.50, 6.02
None	2.10	1.88, 2.36	2.51	2.29, 2.76	5.39	4.61, 6.29
Diabetes mellitus	1.31	1.19, 1.45	2.95	2.61, 3.33	0.93	0.78, 1.09
Type II, uncomplicated	0.99	0.87, 1.15	1.67	1.39, 2.01	0.63	0.49, 0.82
Type I, uncomplicated	1.49	1.17, 1.88	2.22	1.66, 3.00	0.80	0.56, 1.13
Poor control/complicated	1.93	1.64, 2.28	5.73	4.78, 6.87	1.52	1.18, 1.95
HIV-related conditions	54.26	47.66, 61.77	237.81	160.81, 351.56	79.37	52.64, 119.67
Chronic renal insufficiency	4.11	3.30, 5.11	10.92	7.50, 15.89	2.23	1.61, 3.09
Alcohol-related conditions	10.19	8.87, 11.70	24.49	18.95, 31.64	9.29	6.92, 12.47
Drug use	4.63	3.26, 6.58	9.51	6.36, 14.20	9.26	6.26, 13.70

[a]Race stratified models containing all the variables listed in the table. The odds ratios for all variables, except drug use, were statistically different across race/ethnicity ($P < .01$ for each two-way interaction term).
[b]Risk associated with a 10% increase in the prevalence of foreign-born people or the proportion not completing high school in the zip code area where patients resided.
[c]Risk associated with a $1000 decrease in the mean income per capita in the zip code area where patients resided.
[d]Health insurance other than Medicare or Medicaid.

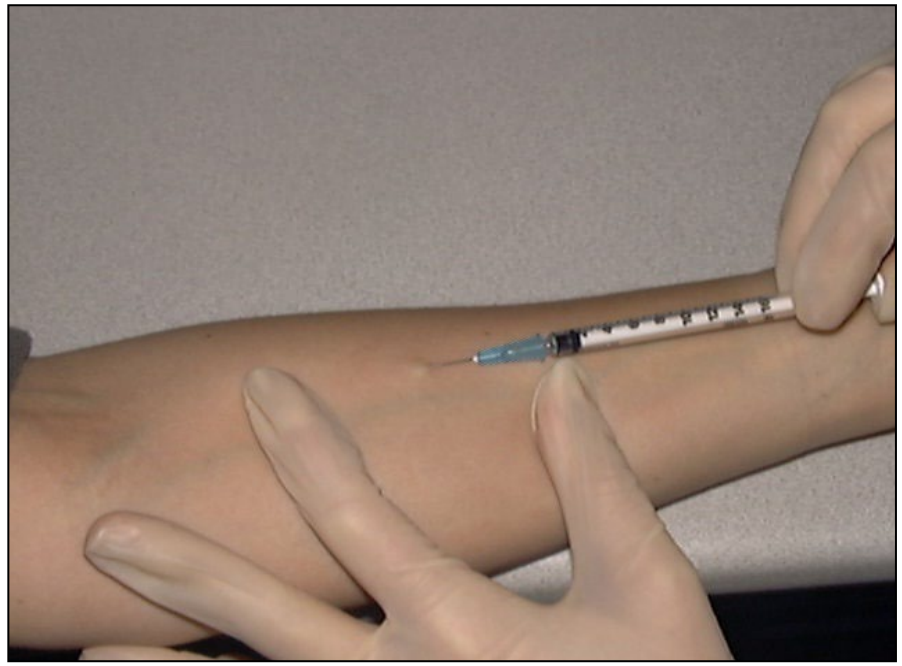
The role of diabetes mellitus in the higher prevalence of tuberculosis among Hispanics; Pablos M.A.; Am J Public Health 1997; 87:574-9

TB Infection Diagnosis Recommendations

Available Tools

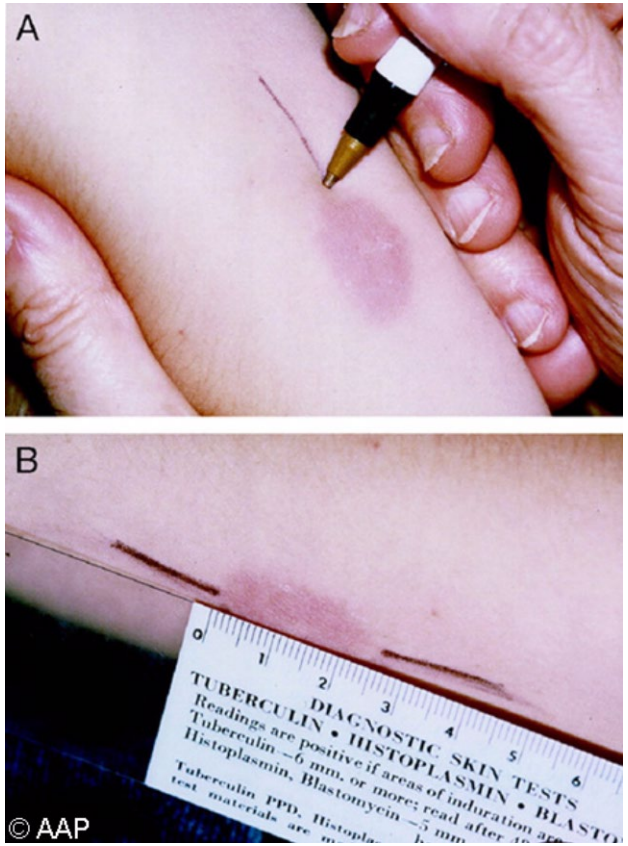
The Tuberculin Skin Test (TST)

- 0.1 ml of 5 TU PPD tuberculin injected intradermally
- Induration in millimeters read 48-72 hours after injection



Reading the TB Skin Test

Measure induration,
not erythema!!!



TB Skin Test (TST)

- Pros:
  - Inexpensive
  - Simple to perform
    (if you know what you are doing)

- Cons:
  - Must return in 48-72 hrs
  - Interpretation is somewhat subjective
  - False Negatives:
    - Elderly
    - Immunosuppressed
  - False Positives:
    - Low risk populations
    - Non-tuberculous mycobacteria
    - BCG vaccination

Classifying the Tuberculin Reaction

- Requires that you know something about the patient

- 5 mm is classified as positive in High-Risk Individuals
  - HIV/Immune suppressed
  - Recent contact with a person with infectious TB
  - Persons with evidence of old disease

- 10 mm is positive in Persons in High-Risk Settings
  - Immigrants from countries with high rates of TB (> 20/100K) (Mexico 28/100K)
  - Residents/Employees of congregate settings

- 15 mm is positive…..period

Antigens for Newer Generation IGRAs

- Negative control or nil (e.g., saline, heparin)
- Positive control or mitogen:
  - non-specific immune response stimulator (e.g., phytohemagglutinin)
- *M. tuberculosis*-specific antigens
  - Unlike PPD used in TST, do not cross-react with BCG or NTM (some exceptions)
  - ESAT-6, CFP-10 (actually simulated using overlapping peptides)

QuantiFERON®-TB Gold Plus

Mitogen – Positive Control
Low response may indicate inability to generate IFN-γ

Nil – Negative Control
Adjusts for background IFN-γ

TB1 – Primarily detects CD4 T cell response

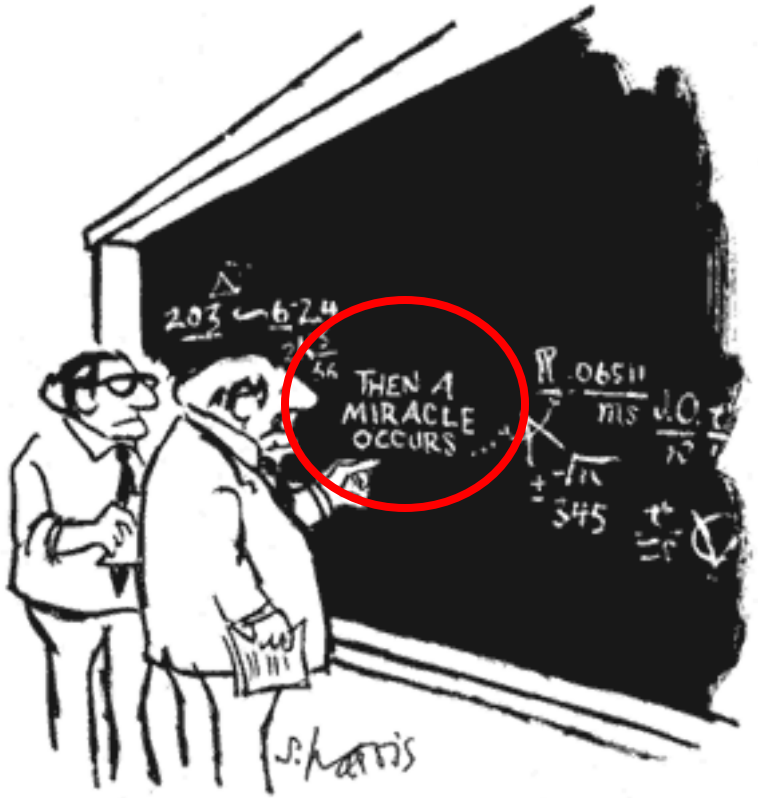
TB2 – Optimized for detection of CD4 and CD8 T cell responses

- Essentially 2 tests in one blood draw
- TB1 and TB2 should be close in value

Interpretation Criteria for the QFT-GIT Test

Nil (IU/mL)	TB Antigen minus Nil (IU/mL)	QFT-GIT (IU/mL)	Mitogen	Interpretation
≤ 8.0	≤ 0.35 or < 25% of Nil value	Negative	≥ 5.0	*M. tuberculosis* infection unlikely
≤ 8.0	≥ 0.35 and ≥ 25% of Nil value	Positive	ANY	*M. tuberculosis* infection likely
≥ 8.0	ANY	Indeterminate	ANY	Indeterminate
≤ 8.0	≤ 0.35 and or < 25% of Nil value	Indeterminate	< 5.0	Indeterminate

QFT calculation…..



"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."

QuantiFERON-TB Gold

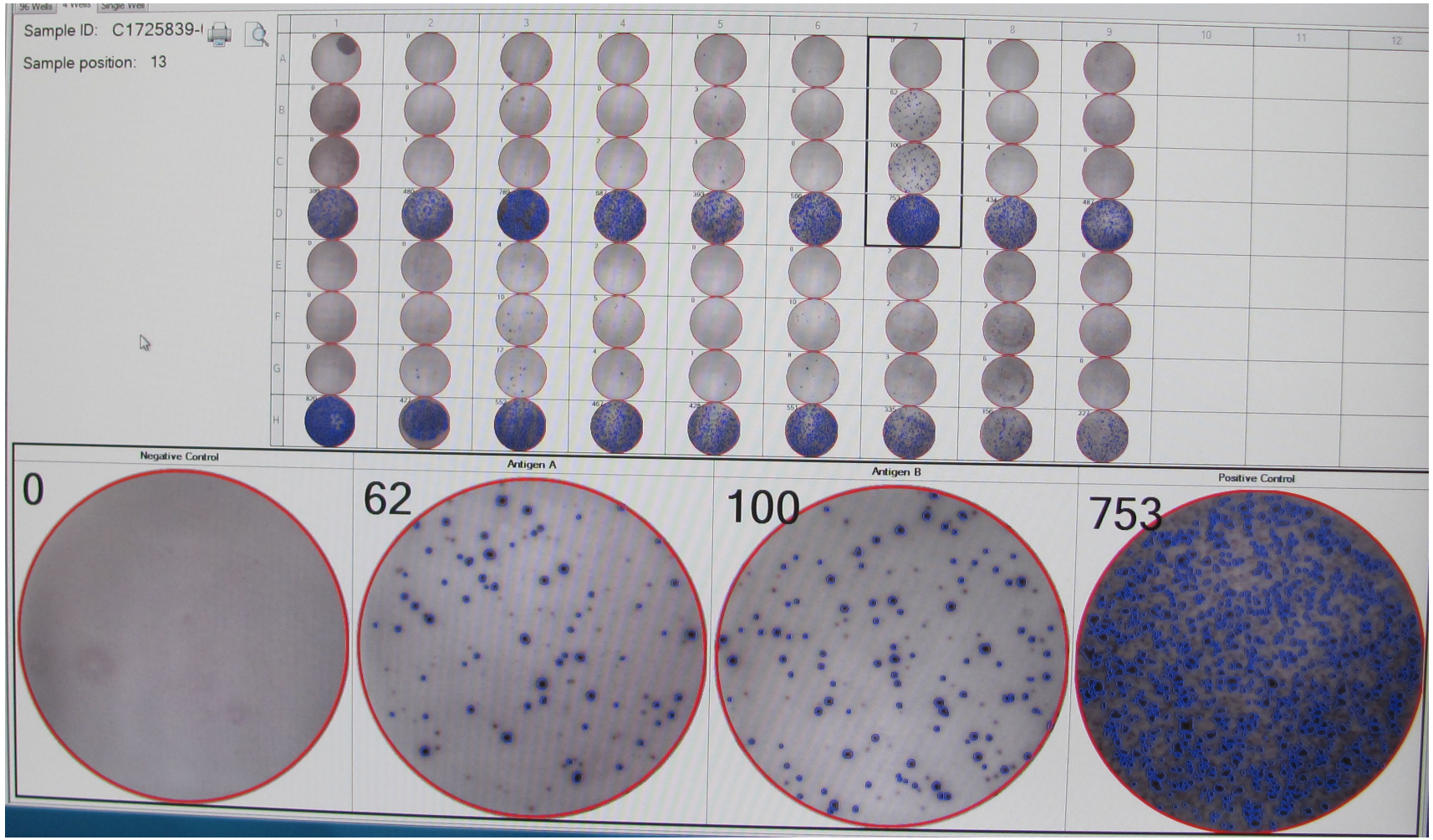
TABLE 2. TEST SENSITIVITY AND SPECIFICITY FOR CFP-10 AND ESAT-6 AT VARIOUS CUTOFFS IN WHOLE-BLOOD IFN-γ ASSAY

Cutoff, IFN-γ	CFP-10		ESAT-6		CFP-10 and/or ESAT-6	
(*IU/ml*)	Specificity (%)	Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)	Sensitivity (%)
0.05	92.5	81.4	94.8	94.9	89.4	97.5
0.10	94.4	77.1	96.2	90.7	92.0	95.8
0.15	95.8	72.9	97.6	88.1	93.9	93.2
0.20	96.7	71.2	99.1	86.4	96.2	91.5
0.25	97.2	67.8	99.1	84.7	96.7	91.5
0.30	97.7	66.9	99.1	83.1	97.2	89.8
0.35	**98.6**	**65.3**	**99.5**	**81.4**	**98.1**	**89.0**
0.40	98.6	61.9	99.5	79.7	98.1	88.1
0.45	98.6	60.2	100.0	78.8	98.6	86.4
0.50	99.1	60.2	100.0	75.4	99.1	83.9

Sensitivity was determined on the basis of data from 118 patients with culture-positive tuberculosis, and specificity was determined on the basis of data from 213 low-risk subjects. The chosen cutoff (0.35) is in boldface.

Mori et al 2004 Am J Respir Crit Care Med ,170: 59–64

T-Spot.*TB*


Sample ID: C1725839-I
Sample position: 13
Negative Control
0
Antigen A
62
Antigen B
100
Positive Control
753

Interpretation Criteria for the T-Spot.TB

Result	Nil*	TB Response##	Mitogen++	Interpretation+
Positive	≤ 10 spots	≥ 8 spots	Any	*M.tuberculosis* infection likely
Borderline	≤ 10 spots	5, 6, or 7 spots	Any	Uncertain likelihood of *M. tuberculosis* infection
Negative	≤ 10spots	≤ 4 spots		M Tb infection unlikely
Indeterminate	> 10 ≤ 10	Any < 5 spots	Any < 20 spots	Uncertain likelihood of *M. tuberculosis* infection

Indeterminate and Borderline Results

- Indeterminate
  - Negative control result is too high
    - High background production of IFN-γ
  - Positive control result is too low
    - Immunocompromised patients may not respond to mitogen
  - Something went wrong with performing the test

- Borderline (T-Spot only)
  - Falls within borderline zone close to negative/positive cut point

Repeat the test

Which is the better test?

- For use in testing, the QFT-Gold Plus and T-spot can be considered equivalent.

- The goal is to get an answer!

More important questions

- Who are you testing?
- What does your lab say?
- Where are you testing/how often do you test?

Who are you testing?

- BCG vaccinated populations
- Those unlikely to return for a reading
- Children
  - 4 tubes of blood from little people that don't like needles……
- Persons living with HIV/persons with low WBCs (such as with chemotherapy)
  - May not have that many cells to start with, concentrating them may help

What does your lab say?

- Where will the tubes go once the blood is drawn?
- How can we make our clinic hours and lab hours work together?
- Is my lab giving me what I need or do I need to consider other options?

Where are you testing and how often?

- Hospitals and low volume clinics may have more issues with QFT
- Get to know your rep and have them come out for training if need be

TB Testing Take Homes

- TST expertise is fading fast
  - When can I still use it?
    - If you trust the person placing/reading it knows what they are doing
    - No history of BCG
    - To add sensitivity
    - Repeatedly indeterminate or borderline IGRAs
- IGRAs are becoming the preferred screening tests for TB
  - Single visit
  - Objective result (positive or negative…..ish)
- TB screening tests are tools that add to the answer
  - They are not the answer themselves
  - They do not distinguish between TB infection (LTBI) and TB disease

Evaluate for Tuberculosis Disease

Evaluate to Exclude Active TB Disease

- If there are signs or symptoms to suggest TB disease
- If the TST or IGRA is Positive

OR

- Child < 5 or immunocompromised person with recent exposure **even if TST/IGRA negative**
    - History
    - Physical examination
    - Chest X-Ray

Is There Evidence of Disease?

- Symptoms*
  - Fever
  - Chills
  - Night Sweats
  - Weight Loss
  - Cough (dry/productive)
  - Hemoptysis
  - Fatigue

    * **only one may be present**

Is Patient at Risk of Progression to Disease?

- Medical History:
  - HIV
  - Silicosis
  - Chronic Kidney Disease
  - Diabetes
  - Immunosuppression
  - Drug/alcohol/tobacco
  - TB exposure

Physical Exam

- General assessment – does person look well?
- Lung exam
- Check for lymph nodes
- Palpate liver
- Look for anything that will complicate therapy!
- *In children* look at growth curve/weight/activity

Radiologic Exam

- CXR must be done **before treatment of TB Infection**
  - Must be read as normal

    Or

  - IF abnormal:
    - Not consistent with Active TB
    - Stable abnormality confirmed over a 3 month period

Management of Positive TST or IGRA When CXR is Abnormal and the Patient Has ANY Signs or Symptoms of TB

- The patient should be suspected of having TB disease
- Collect 3 sputa for smear and culture
- Consider referring out for TB care or starting standard 4 drug (RIPE) treatment
- If positive smear and/or Gene Xpert
  - Report to the health authority and start 4 drug (RIPE) treatment
- Never (ever!) start a treatment for TB infection in a patient with possible active TB

Pediatric Considerations for TB Screening

- Young immune systems, like young bodies, are growing
- By the time you have 5 candles on your birthday cake, your immune system behaves more like an adult's
- There is grey area in children < 6 months of age (any test….every test), treat any positive and some negatives
- We overtreat and we are not sorry

TB Testing in Pregnant Persons

- Test in every instance you would test if they were not pregnant
  - HIV
  - Contact to an active case
  - Immigrant from a high-risk country
- The immune system may not react as expected
- Yes, you can/should get a CXR

Yes! You can X-ray a pregnant patient!

The American College of Obstetricians and Gynecologists
WOMEN'S HEALTH CARE PHYSICIANS

ACOG COMMITTEE OPINION

Number 723 • October 2017 *(Replaces Committee Opinion Number 656, February 2016)*

Committee on Obstetric Practice

This document is endorsed by the American College of Radiology and the American Institute of Ultrasound in Medicine. This Committee Opinion was developed by the American College of Obstetricians and Gynecologists' Committee on Obstetric Practice. Member contributors included Joshua Copel, MD; Yasser El-Sayed, MD; R. Phillips Heine, MD; and Kurt R. Wharton, MD. This document reflects emerging clinical and scientific advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed.

Table 2. Effects of Gestational Age and Radiation Dose on Radiation-Induced Teratogenesis ⇦

Gestational Period	Effects	Estimated Threshold Dose*
Before implantation (0–2 weeks after fertilization)	Death of embryo or no consequence (all or none)	50–100 mGy
Organogenesis (2–8 weeks after fertilization)	Congenital anomalies (skeleton, eyes, genitals)	200 mGy
	Growth restriction	200–250 mGy
Fetal period	**Effects**	**Estimated Threshold Dose***
8–15 weeks	Severe intellectual disability (high risk)†	60–310 mGy
	Intellectual deficit	25 IQ-point loss per 1,000 mGy
	Microcephaly	200 mGy
16–25 weeks	Severe intellectual disability (low risk)	250–280 mGy*

*Data based on results of animal studies, epidemiologic studies of survivors of the atomic bombings in Japan, and studies of groups exposed to radiation for medical reasons (eg, radiation therapy for carcinoma of the uterus).

†Because this is a period of rapid neuronal development and migration.

Modified from Patel SJ, Reede DL, Katz DS, Subramaniam R, Amorosa JK. Imaging the pregnant patient for nonobstetric conditions: algorithms and radiation dose considerations. Radiographics 2007;27:1705–22.

Table 3. Fetal Radiation Doses Associated With Common Radiologic Examinations ⇦

Type of Examination	Fetal Dose* (mGy)
Very low-dose examinations (<0.1 mGy)	
Cervical spine radiography (anteroposterior and lateral views)	<0.001
Head or neck CT	0.001–0.01
Radiography of any extremity	<0.001
Mammography (two views)	0.001–0.01
Chest radiography (two views)	0.0005–0.01
Low- to moderate-dose examinations (0.1–10 mGy)	
Radiography	
Abdominal radiography	0.1–3.0
Lumbar spine radiography	1.0–10
Intravenous pyelography	5–10
Double-contrast barium enema	1.0–20
CT	
Chest CT or CT pulmonary angiography	0.01–0.66
Limited CT pelvimetry (single axial section through the femoral heads)	<1
Nuclear medicine	
Low-dose perfusion scintigraphy	0.1–0.5
Technetium-99m bone scintigraphy	4–5
Pulmonary digital subtraction angiography	0.5
Higher-dose examinations (10–50 mGy)	
Abdominal CT	1.3–35
Pelvic CT	10–50
^{18}F PET/CT whole-body scintigraphy	10–50

Questions?