

Tuberculosis: Infection Control, Infectiousness, & Isolation

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Accreditation Statement



Accreditation Statement

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For disclosure information regarding Mayo Clinic School of Continuous Professional Development accreditation review committee member(s) and staff, please go [here](#) to the course accreditation page.

Available Credit

- 14.00 ANCC
- 14.00 Attendance
- 14.00 IPCE

Disclosures

- None

Good afternoon. I'm reaching out to this group as you have been identified as possibly being exposed to a tuberculosis

Tuberculosis Global Burden

- 25% of world's population infected
- 10.7 million disease

2.38 deaths per minute

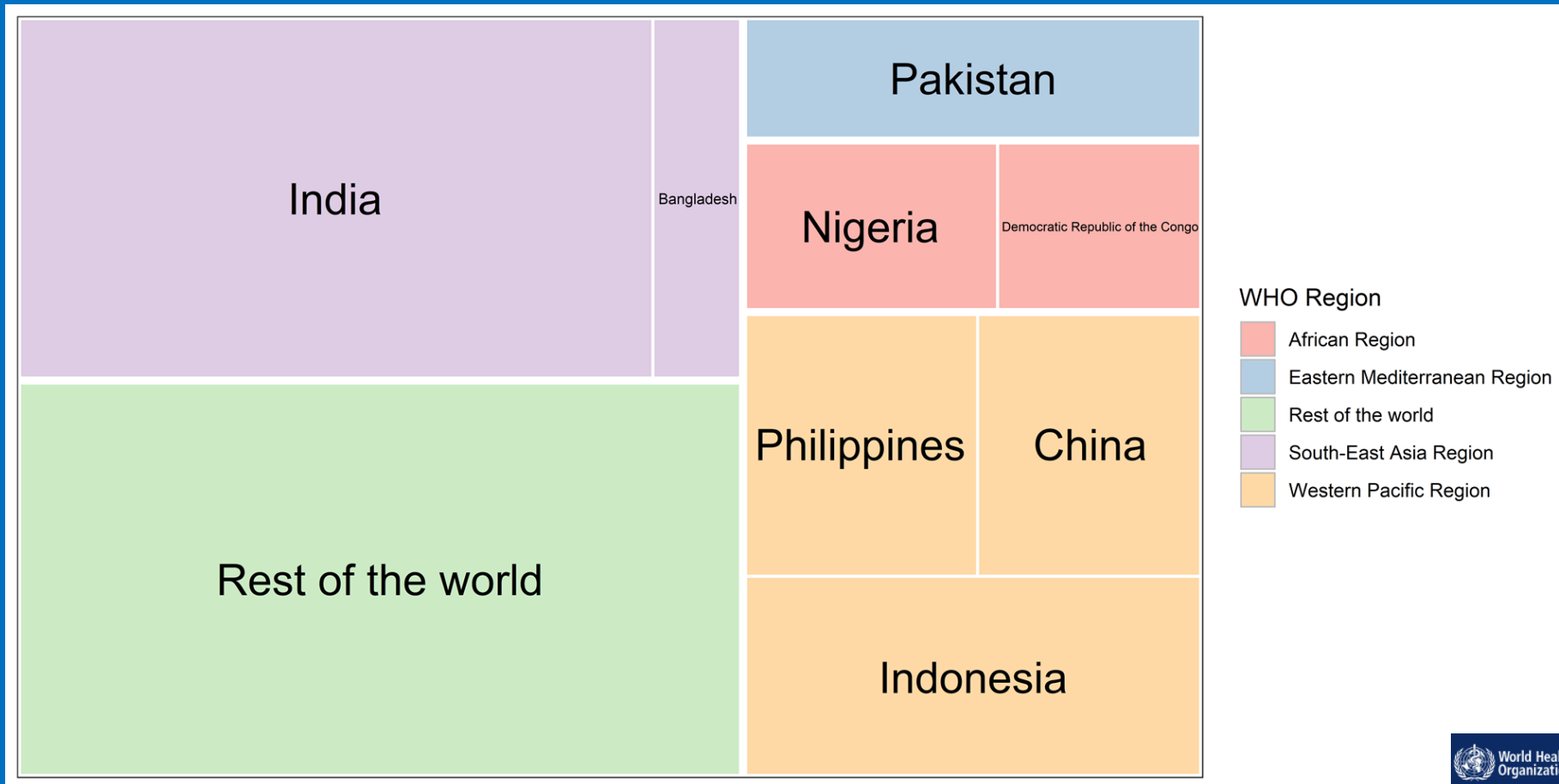
3420 deaths per day

- **AIDS**
 - Highest risk factor for progression

Tuberculosis incidence rates per 100,000 population

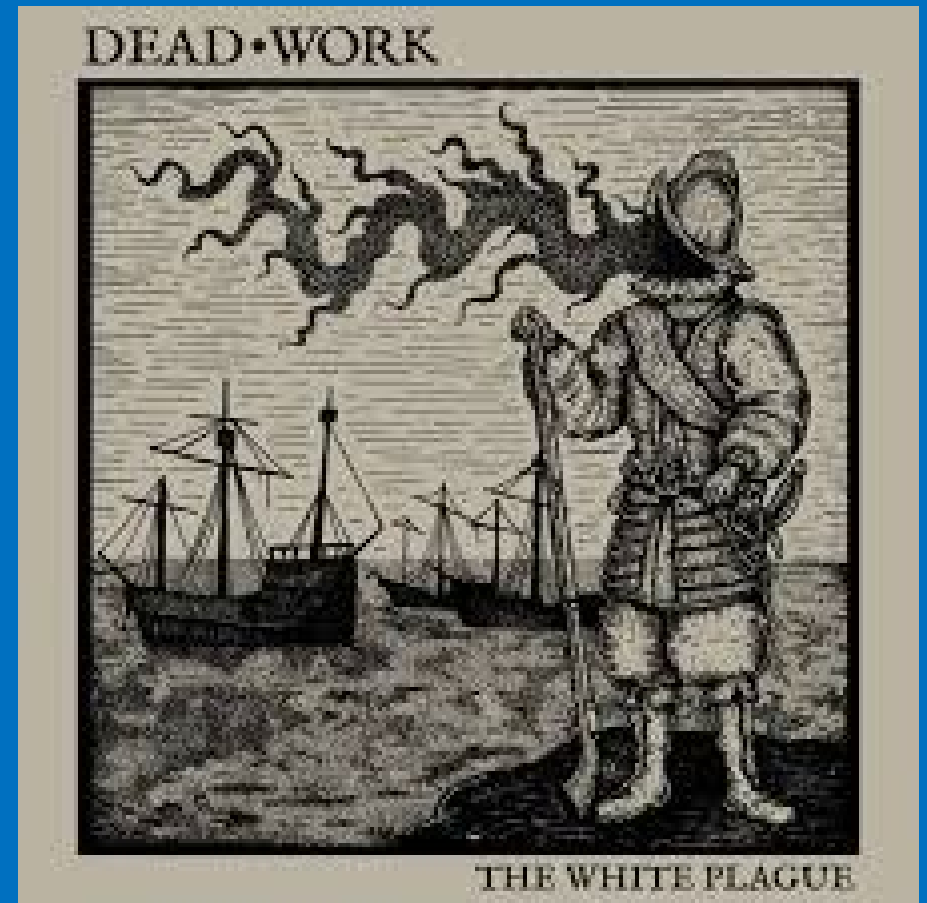


Tuberculosis Global Burden



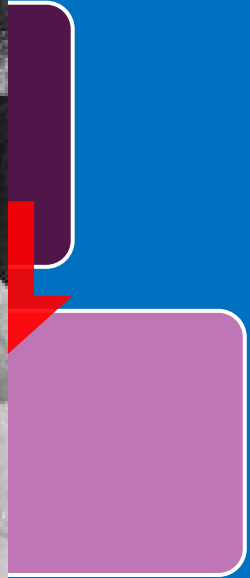
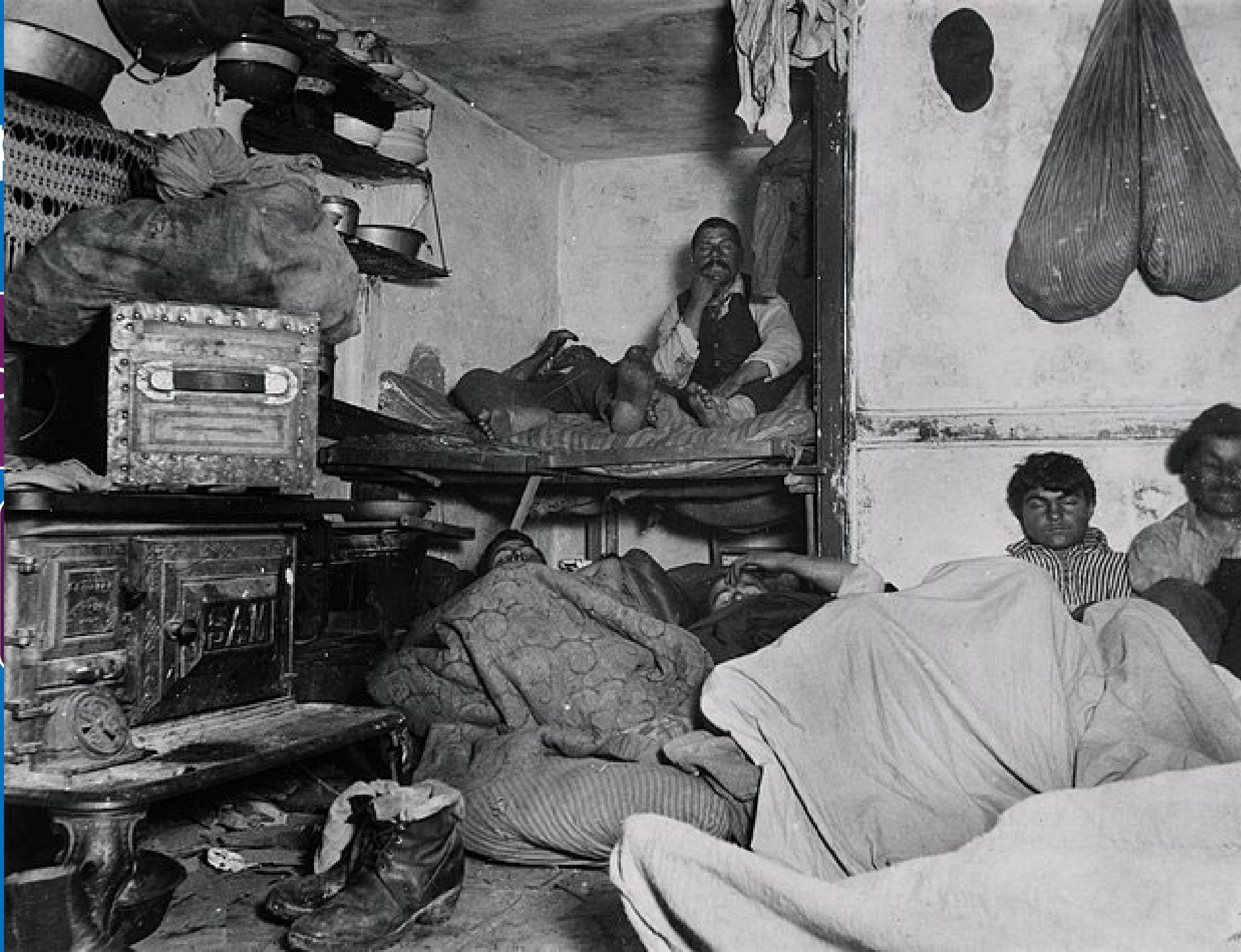
***Yet the captain of all these
men of death that came
against him to take him
away was Captain
Consumption, for he it was
that brought him down to
the grave.***

The Life and Death of Mr. Badman
John Bunyan (1680)



Cap

Evid



Tuberculosis transmission

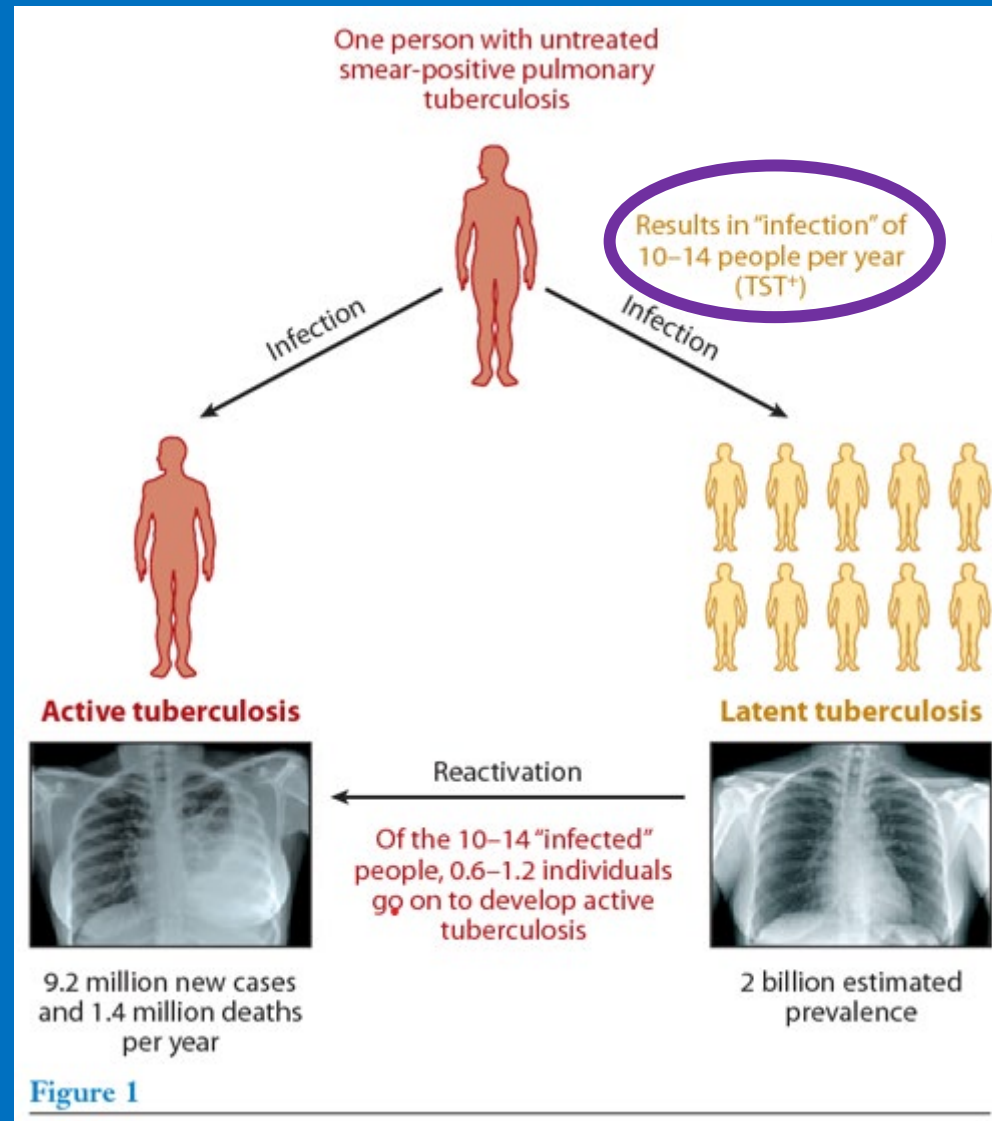
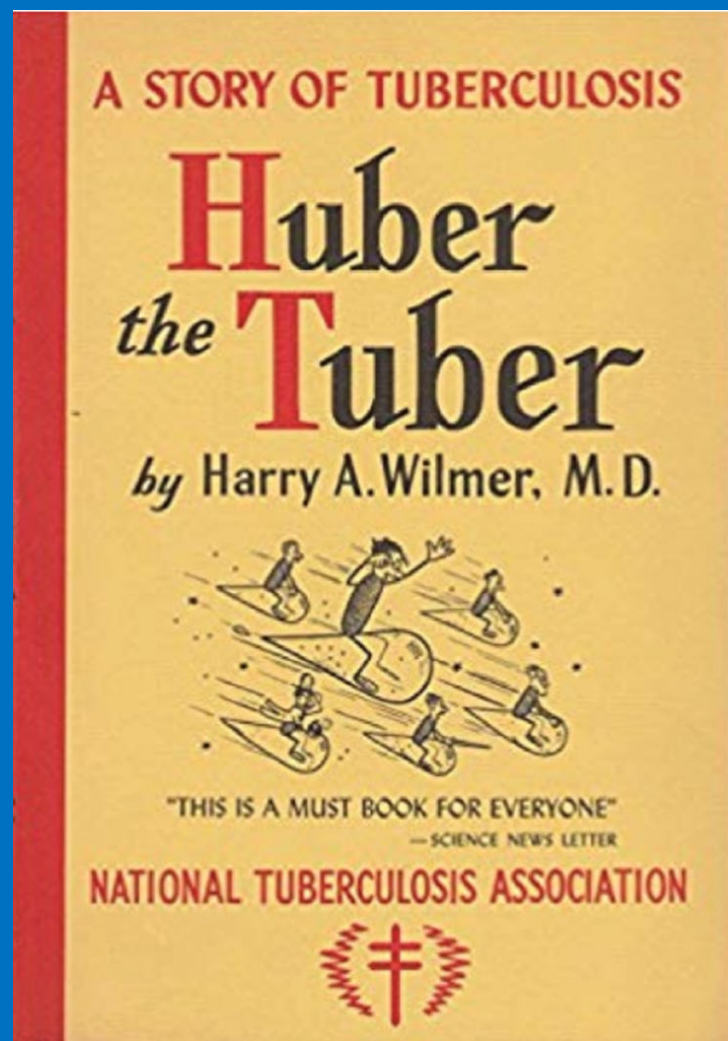


Figure 1

Tuberculosis transmission



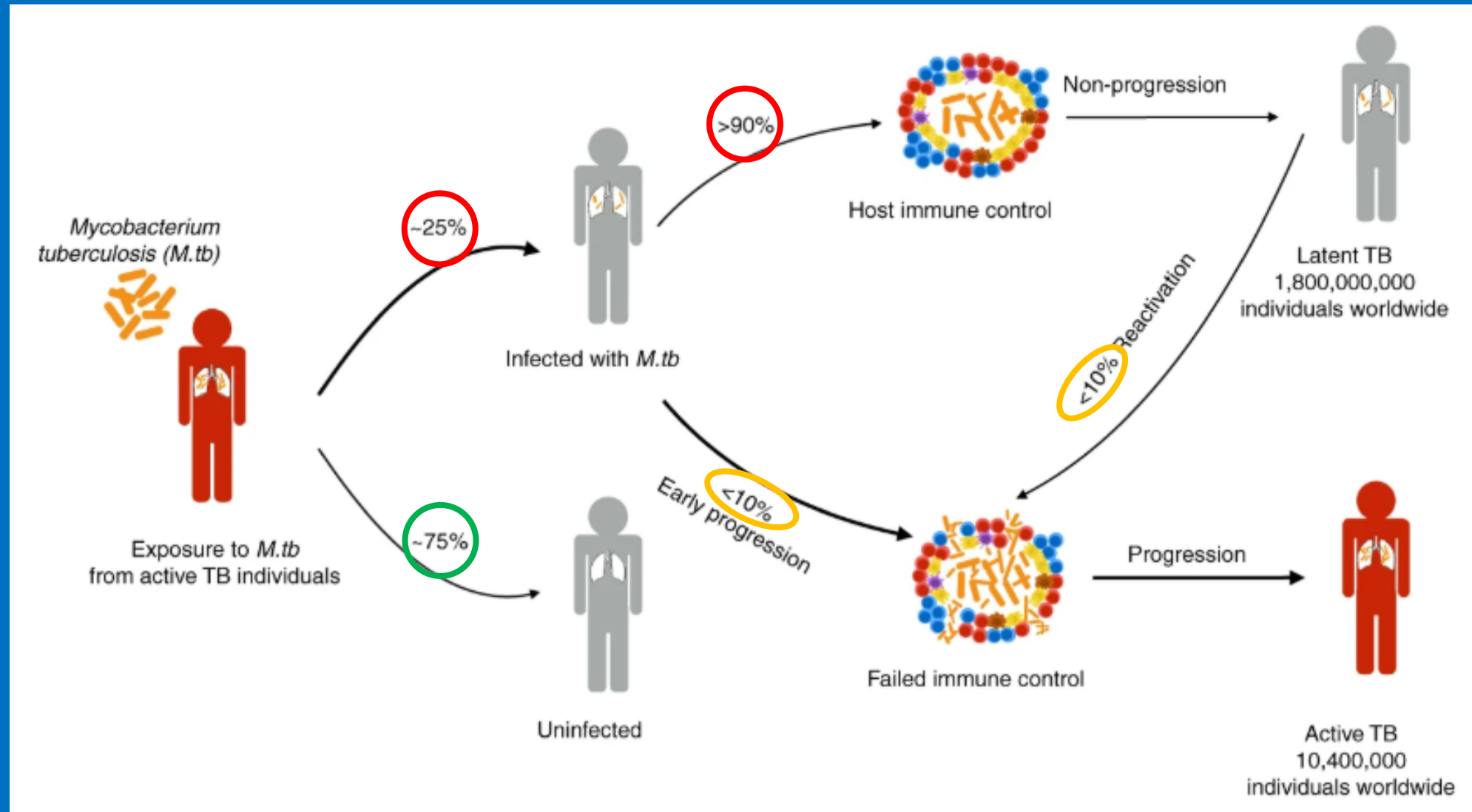
How long is long enough?

8 hours per week*

Close contact time

Generally, days to weeks

Tuberculosis transmission



TB Control Measures Historical

- Mandatory notification of all TB cases
- Free sputum examinations
- Individual nursing follow-up
 - Isolation of patients if necessary
- Awareness of the communicability of TB
 - Public education
- Strengthened political
 - Gain financial and administrative support for TB programs



Dr. Hermann Biggs
1859-1923

TB Control Measures Historical

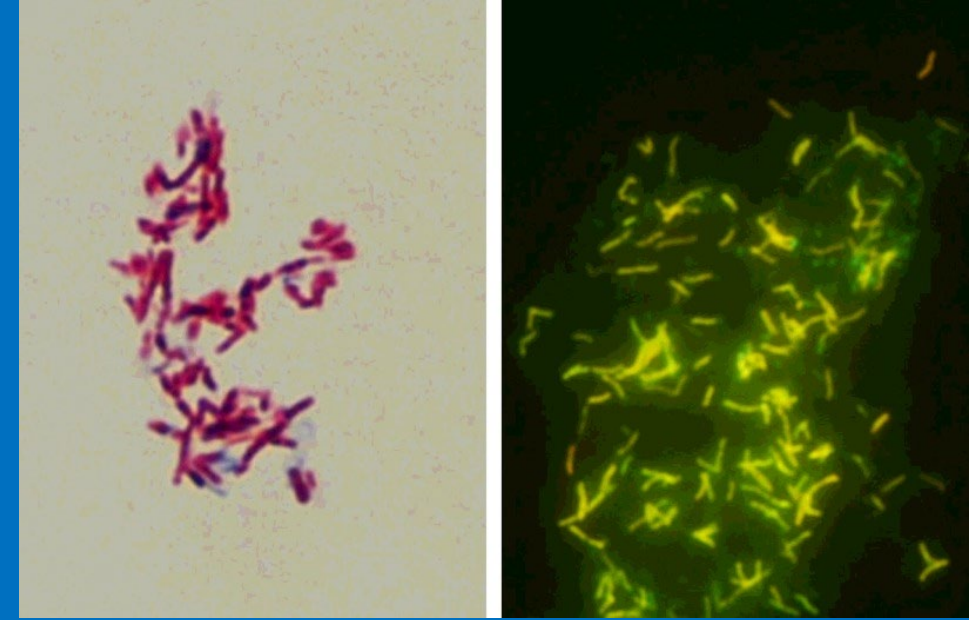
- The New York Academy of Medicine (1897)
 - "mistaken, untimely, irrational, and unwise"
 - "aggressive tyrannies of the Health Board"
 - "offensively dictatorial"
 - "had only to declare a disease infectious in order to take charge of it"

TB Disease Isolation



AFB Smears

- Measure of infectiousness
 - Used to guide isolation
- Acid fast staining
 - Ziehl-Neelsen (1882-83)
 - **Kinyoun** (1915)
 - Aurmaine-O (1937)
 - **Auramine-Rhodamine Fluorochrome** (1962)



J Clin Tuberc Other Mycobact Dis. 2016;4:33-43.

AFB Smears

- 3 sputa specimens
 - Ideally 1 early AM specimen
 - Sensitivity 12% greater than random sputum
 - Induced sputa

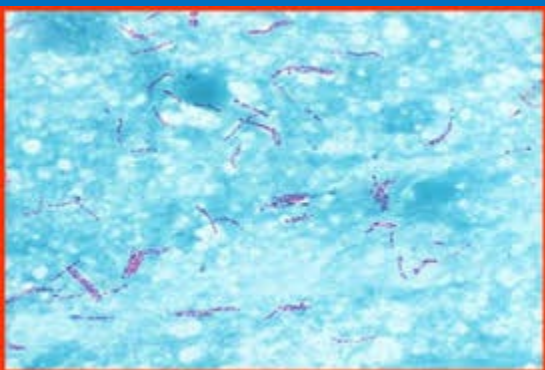
Table 2

Select studies of sensitivity gained by serial AFB smears.

Study	# positive smears	% of total positives detected by:		
		1st smear	2nd smear	3rd smear
Ipuge et al. [25]	11,650	83.4	12.2	4.4
Nelson et al. [26]	53	77.4	15.1	7.5
Walker et al. [27]	166	77.1	15.0	7.9
Mathew et al. [28]	19	89.4	5.3	5.3
Wilmer et al. [29]	64	89.1	7.8	3.1
Khogali et al. [30]	60	93	5	2
Rehman et al. [31]	1164	77.0	16.3	6.7
Hassan et al. [32]	719	96.4	3.6	0

AFB Smear Grading KUMC

# Positive Organisms Seen		
Fluorochrome 400x	Kinyoun 1000x	Report
0	0	Negative
1-2 per 50 fields	1-2 per 300 fields	Report #
3-18 per 50 fields	1-9 per 100 fields	1+
4-36 per 10 fields	1-9 per 10 fields	2+
4-36 per field	1-9 per field	3+
>36 per field	>9 per field	4+



TB Disease Isolation

14 days

**Where did this
recommendation
come from?**

TB Disease Isolation

TRANSMISSION OF TUBERCLE BACILLI: THE EFFECTS OF CHEMOTHERAPY*

Tubercle 57 (1976), 275–299

* This article has already been published in **French** in *Revue Francaise des Maladies Respiratoires* 1976, 4, 241–272. It is published here in English by permission of the Editor of this journal.

6. Conclusion and practical consequences

(2) *The best form of isolation is achieved by regular chemotherapy.*

(a) with an effective combination of drugs, hospital treatment and isolation are usually no longer justified for more than two weeks *on account of possible transmission*. They may be justified for other reasons which need not be discussed here ;

TB Disease Isolation

- Community setting

- Received
- AFB
- Adherer
- Evidenc
- Contact
- Espe

* These criteria for absence of infectivity with treatment should be considered general guidelines. Decisions about infectivity of a person on treatment for TB should depend on the extent of illness and the specific nature and circumstances of the contact between the patient and exposed persons.

LTBI

MMWR

November 4, 2005

Vol. 54 / RR-12

Recommendations and Reports

1

Controlling Tuberculosis in the United States

Recommendations from the American Thoracic Society, CDC,
and the Infectious Diseases Society of America

TB Disease Isolation

- Congregate settings
 - Received standard ATT for 2–3 weeks
 - Adherence to treatment
 - Evidence of clinical improvement
 - Contacts identified
 - 3 consecutive AFB sputum smears negative
 - Collected 8–24 hours apart
 - At least one being an early morning specimen

MMWR

November 4, 2005

Vol. 54 / RR-12

Recommendations and Reports

1

Controlling Tuberculosis in the United States
Recommendations from the American Thoracic Society, CDC,
and the Infectious Diseases Society of America

TB Disease Isolation

- Decisions about infectiousness should always be individualized:
 - 1) extent of illness
 - 2) presence of cavitory pulmonary disease
 - 3) degree of positivity of sputum AFB smears
 - 4) frequency and strength of cough
 - 5) likelihood of infection with multidrug-resistant organisms
 - 6) nature and circumstances of the contact(s)

MMWR

November 4, 2005

Vol. 54 / RR-12

Recommendations and Reports

1

Controlling Tuberculosis in the United States

**Recommendations from the American Thoracic Society, CDC,
and the Infectious Diseases Society of America**



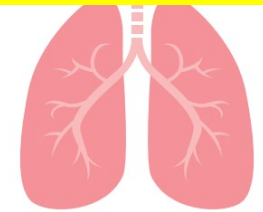
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TB Disease Isolation

- Community setting
 - No detailed guidance regarding duration of isolation

So... deferred to 2005 guidance



**Core Curriculum
on Tuberculosis:**
What the Clinician
Should Know

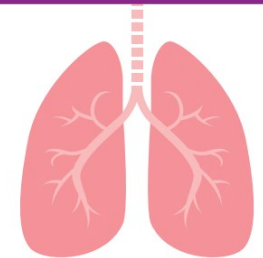


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TB Disease Isolation

- Congregate settings
 - 3 consecutive AFB sputum smears negative
 - Collected 8–24 hours apart
 - At least one being an early morning specimen
 - Symptoms have improved clinically
 - Received adequate ATT for ≥ 2 weeks



**Core Curriculum
on Tuberculosis:**
What the Clinician
Should Know

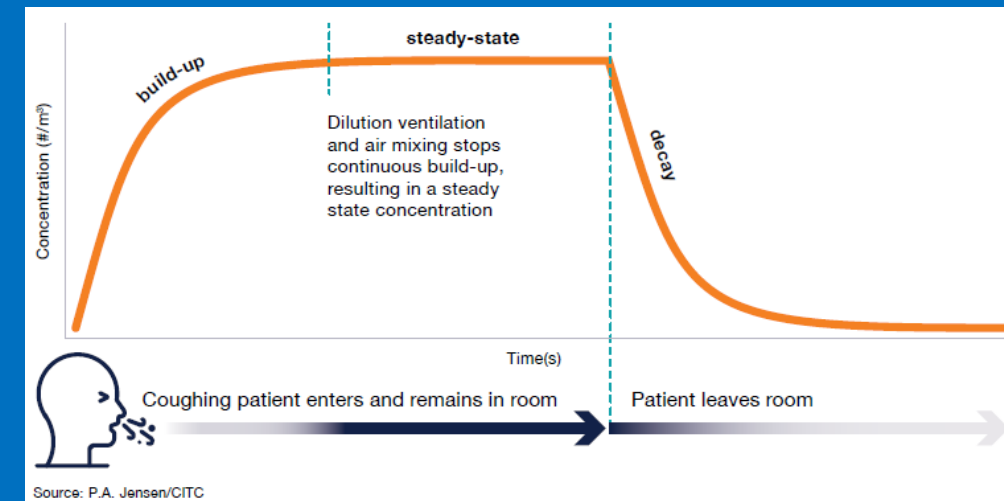


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TB Transmission Mitigation

- Space
 - **BIGGER** is better
 - Outside is BEST
- Ventilation
 - >12 air exchanges per hour
- Air circulation
 - Recirculation
 - HEPA (high efficiency particulate air) filters
 - UVGI (ultraviolet germicidal irradiation)
- Airborne-infection isolation (All) rooms
 - Negative pressure rooms
- PPE
 - N95
 - Half-mask elastomeric respirators
 - PAPR (powered air-purifying respirators)



Source: P.A. Jensen/CITC

TB Isolation Discontinuation for Rule Outs

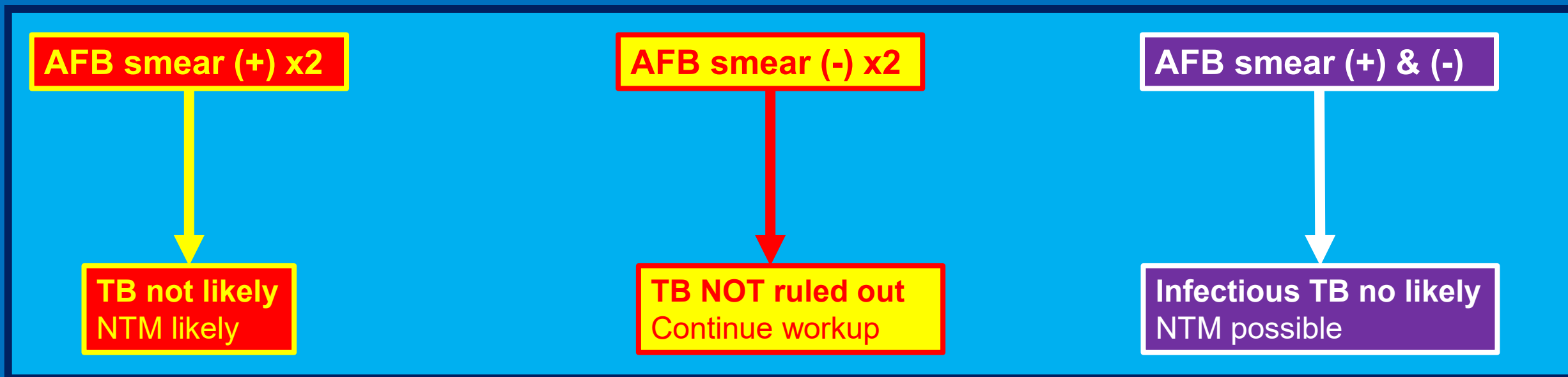
- 3 consecutive AFB sputum smears negative
 - Collected 8–24 hours apart
 - At least one being an early morning specimen

or

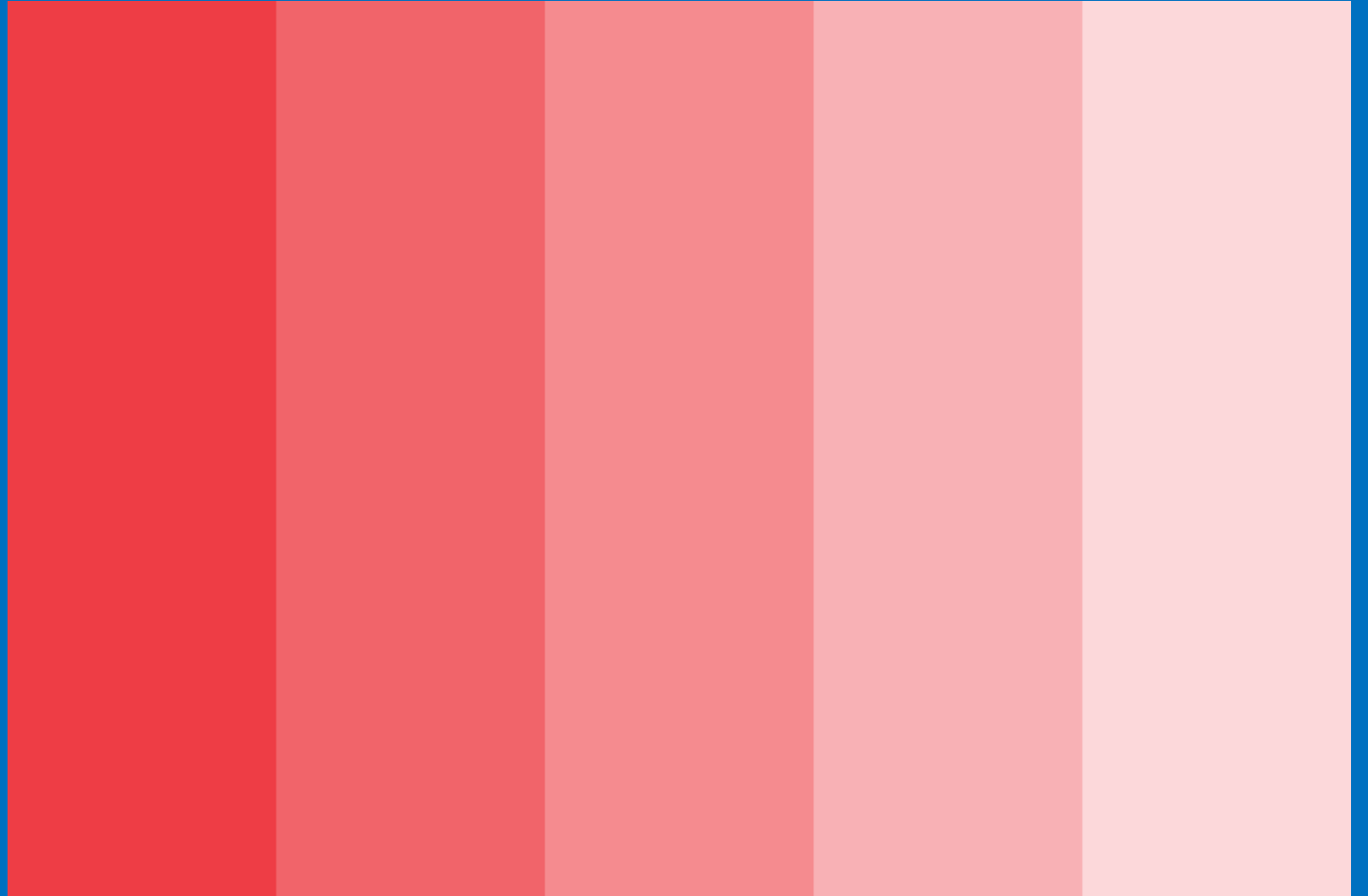
- 2 consecutive AFB sputum GeneXpert MTB/RIF negative
 - 2 AFB sputum smears **POSITIVE** → TB not likely
 - 2 AFB sputum smears **Negative** → TB not ruled out
 - 2 AFB sputum smears **discordant** → Infectious TB not likely

TB Isolation Discontinuation for Rule Outs

- 2 consecutive AFB sputum GeneXpert MTB/RIF negative



Tuberculosis Color Palette



TB Disease Isolation

Clinical Infectious Diseases

GUIDELINES



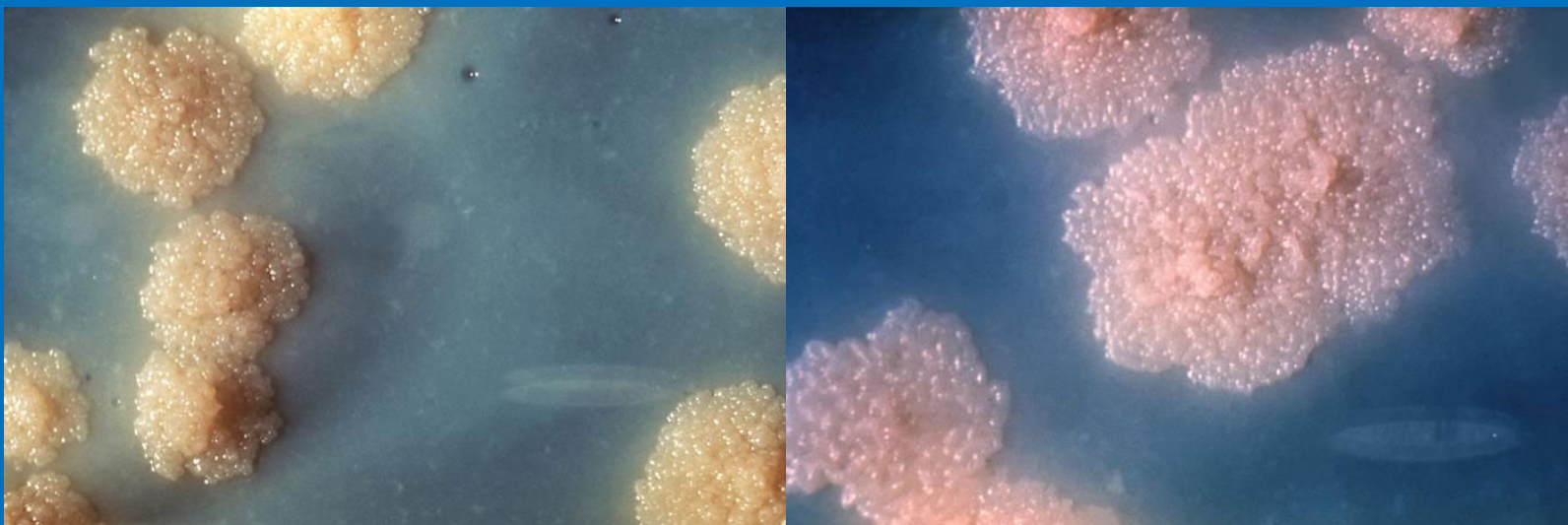
OXFORD

National Tuberculosis Coalition of America (NTCA) Guidelines for Respiratory Isolation and Restrictions to Reduce Transmission of Pulmonary Tuberculosis in Community Settings

Maunank Shah,^{1,*} Zoe Dansky,¹ Ruvandhi Nathavitharana,² Heidi Behm,³ Shaka Brown,⁴ Lana Dov,⁵ Diana Fortune,⁶ Nicole Linda Gadon,⁴ Katelynne Gardner Toren,⁷ Susannah Graves,⁸ Connie A. Haley,⁹ Olivia Kates,^{1,10} Nadya Sabuwala,¹¹ Donna Wegener,¹² Kathryn Yoo,¹³ and Joseph Burzynski¹⁴; on Behalf of the National TB Coalition of America

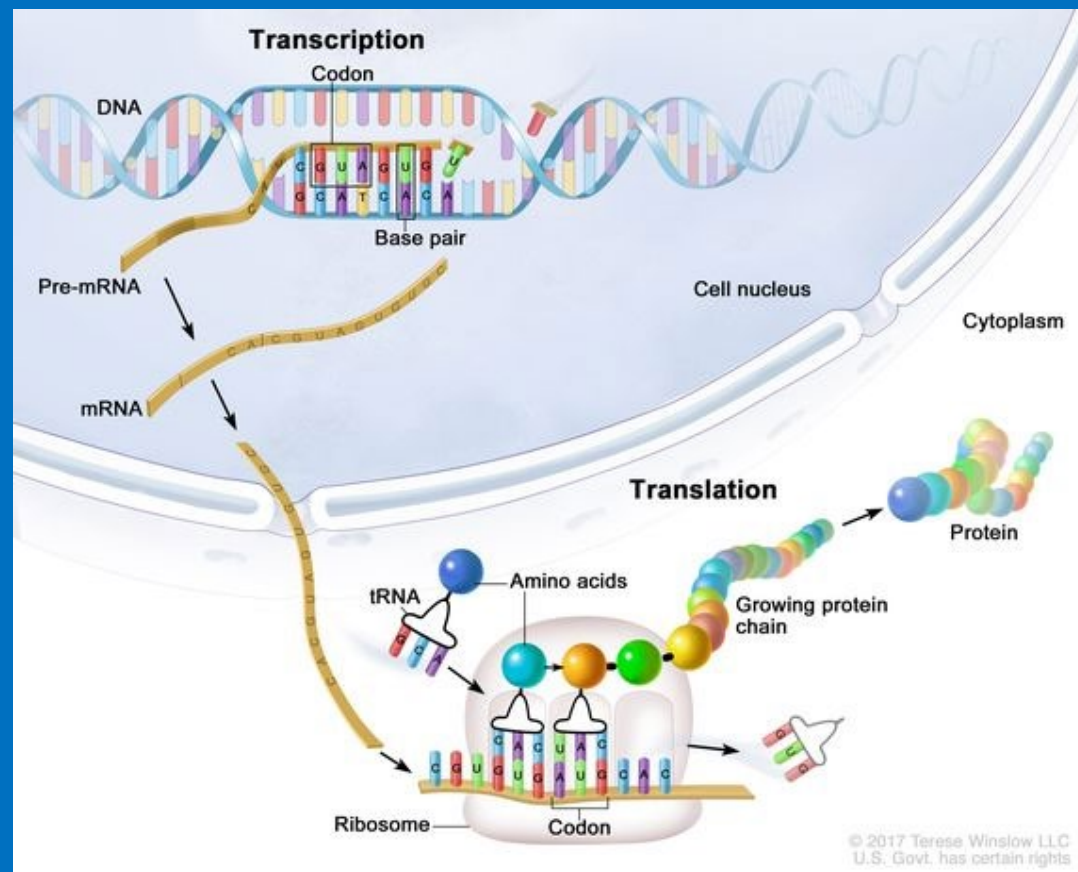
ATT & TB Infectiousness

- Majority of data are <72 hours v/ > 2 weeks ATT
- High proportion with cough become culture negative within days
- Sputum AFB smear & culture conversion often occurs >2 weeks



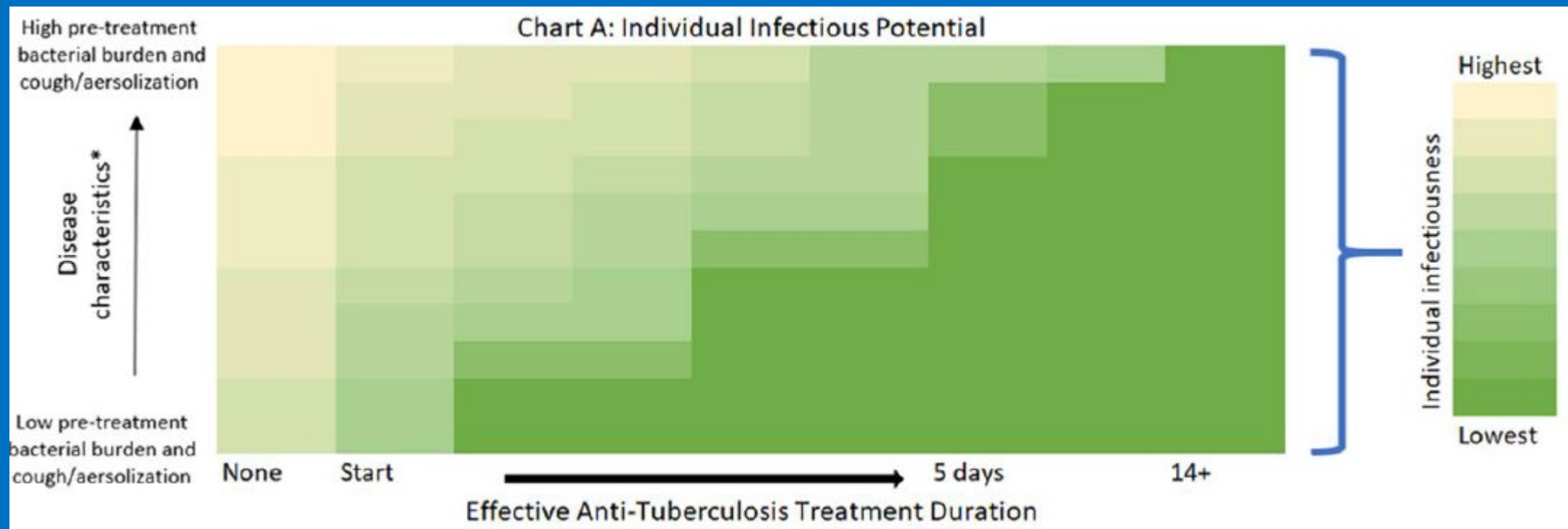
ATT & TB Infectiousness

- Reduces infectivity in 48–72 hours
 - Quantitative bacteriologic studies
 - 90% decline within 48 hours
 - TB exhibits transcriptomic changes
 - Impacts pathogenicity and virulence
 - Drug-sensitive and drug-resistant TB



www.cancer.gov/publications/dictionaries/genetics-dictionary/def/transcription

TB Disease Isolation

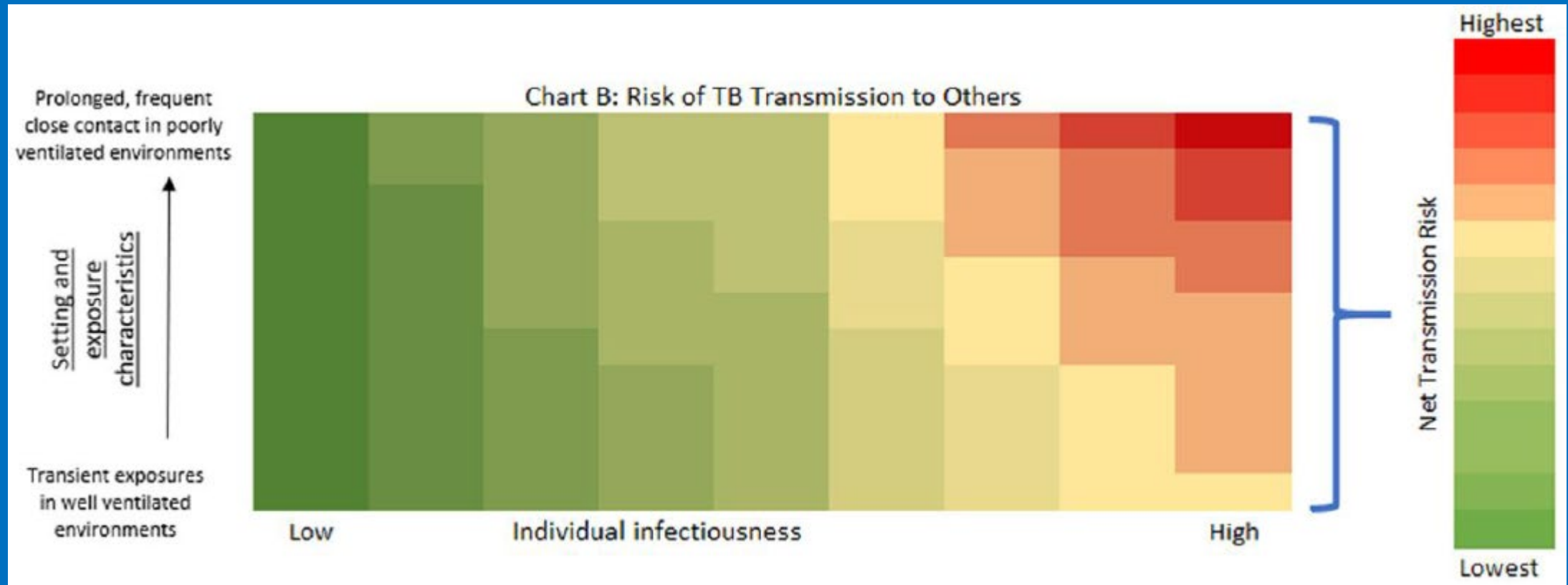


ATT & TB Infectiousness

- Decreases transmissibility earlier than it inhibits AFB culture
- Unlikely infectious irrespective of sputum AFB smear status
- Sputum while on ATT do not predict post-treatment infectiousness

Routine sputum for assessment of infectiousness discouraged

TB Disease Isolation



TB Disease Isolation

- **NO** specific duration universally predicts when noninfectious
- Longer durations of isolation
 - Increasing potential for harms
 - Diminishing returns in preventing community transmission
- 5 days ATT expected to reduce infectivity to low levels in most

TB Disease Isolation

Table 3. Integrated Schematic and Decision Aid to Support Community-Based Respiratory Isolation and Restriction Recommendations for Individuals With Pulmonary Tuberculosis

Recommendation 3: Determining Infectiousness			Recommendation 4: Determining RIR	Recommendation 5: Level of RIR	Notes
ATT status	Pretreatment respiratory bacterial burden ^a	Assessment of individual infectiousness ^{a,b}	Is RIR indicated? ^c	What level of RIR to choose? (Rec 2; Table 2)	Specific recommendations should balance community and patient risks and benefits (Rec 1)
Pretreatment	High	Highest (Rec 3.1)	Yes (Rec 4.3)	Extensive	Support should be provided to mitigate harm to PWTB (Rec 5.3)
	Low	Moderate (Rec 3.1)	Yes (Rec 4.3)	Extensive or moderate (Rec 5.1)	
Treatment ≤5 d	High	Moderate (Rec 3.2)	Yes (Rec 4.3)	Moderate (Rec 5.1)	Individual exceptions to continue RIR may be considered (Rec 5.2) ^d
	Low	Moderate/low (Rec 3.2)	Yes (Rec 4.3)	Moderate (Rec 5.1)	
Treatment >5 d	High	Low (Rec 3.3) ^b	Not indicated in most situations (Rec 4.2) ^d	None	
	Low	Lowest (Rec 3.3)		None	

TB Disease Isolation Children <10 y.o.

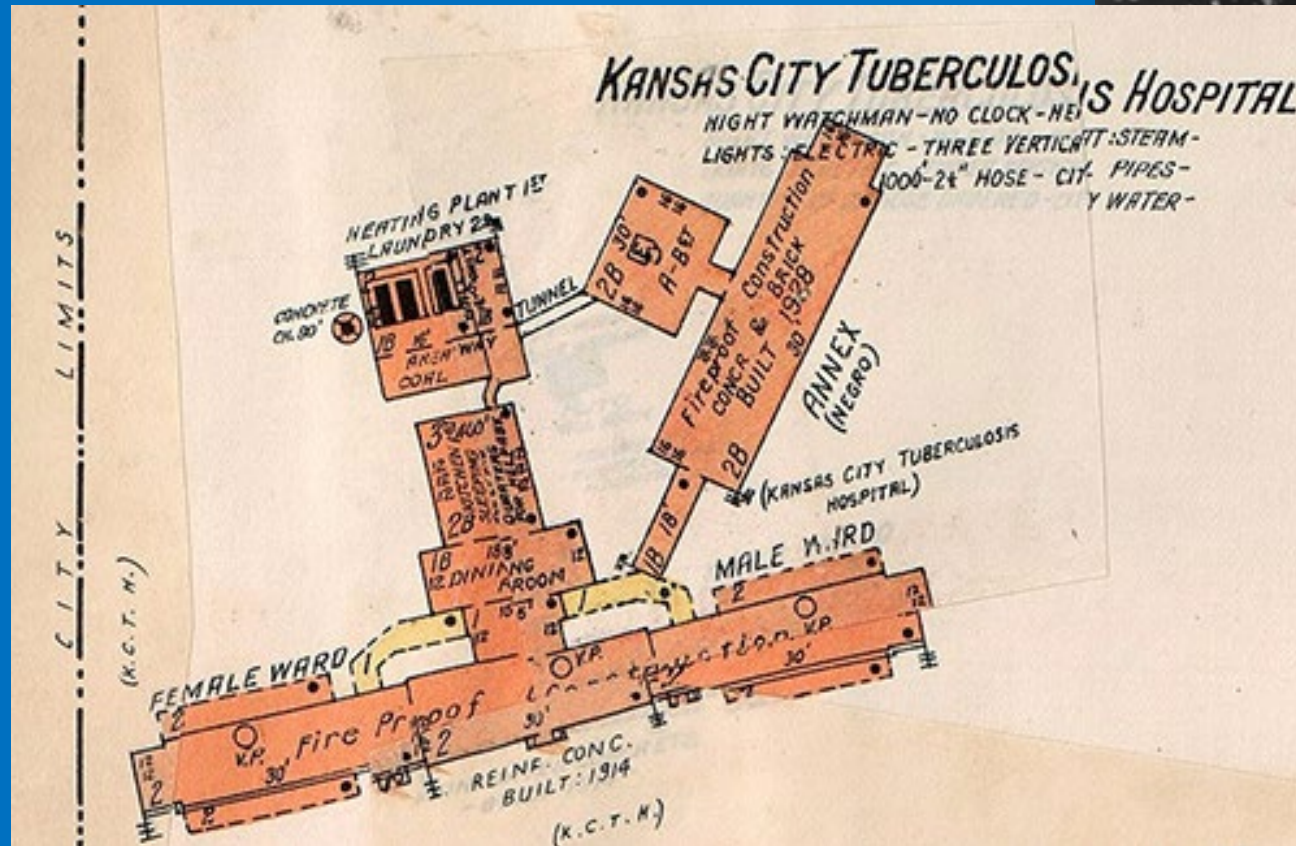
- Considered noninfectious in most instances & are **NOT** isolated
 - Lack the ability to generate sufficient infectious aerosols
 - Lower concentration of organism in respiratory secretions
- Children with adult-type TB considered infectious & are isolated
 - Cavitation
 - Higher respiratory bacterial burden
 - More significant pulmonary or laryngeal involvement

TB Disease Isolation >5 days

- Known or suspected MDR or XDR TB with ongoing evaluation
- Prolonged infectiousness
 - High pretreatment bacillar burden
 - AFB smear grade
 - NAAT cycle thresholds?
 - Cavitory lesions
 - ATT adherence
 - ATT tolerability
 - ATT absorption
- Slow or inadequate clinical response
- High transmission risk settings – prolonged, frequent, close contact
 - Poorly ventilated areas
 - Indoor environments
 - Children <5 y.o.
 - Immunosuppressed
- Clinical judgment



Kansas City Tuberculosis Hospital



Kansas City Tuberculosis Hospital (1917-1945)

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- Clin Infect Dis. Published online April 18, 2024. doi:10.1093/cid/ciae199.

Updated Respiratory Isolation Restrictions

Wisconsin Tuberculosis Program Recommendations

Recommendations

Recommendation 3.2—PWTB on less than five days of effective treatment should be considered relatively more infectious than those on longer durations of effective therapy.

Recommendation 3.3—PWTB on effective treatment for at least 5 days should be considered noninfectious or with a low likelihood of infectiousness, regardless of sputum bacteriologic status during treatment.

The Wisconsin Tuberculosis Program recommends use of the NTCA Guidelines for Respiratory Isolation and Restrictions to Reduce Transmission of Pulmonary Tuberculosis in Community Settings, 2024 to guide decisions about respiratory isolation and restrictions for people with TB in the state of Wisconsin.

Updated Recommendations

Isolation

- All individuals should remain in extensive restrictions at least until adequate therapy is started.
- All people newly diagnosed with respiratory tract TB should remain in midlevel/moderate restrictions at a minimum until they have been on therapy for at least five days via DOT and clinically improved.

Updated Recommendations

Isolation

- If a TB NAAT positive respiratory sample is available, molecular testing for the detection of drug resistance for rifampin (for example, **GeneXpert**) should be performed and results known before release from isolation.
- Most **outdoor activities** in uncrowded areas away from vulnerable individuals **are permissible** for patients under midlevel/moderate restrictions.

Updated Recommendations

Isolation

- People under midlevel/moderate restriction isolation should be **highly encouraged to wear a surgical mask** for essential indoor activity outside their home or residence

Essential Definition

Essential activity is defined as activities critical for the health of the individual, such as picking up food and/or medication.



Limitations

This updated guidance is for **community and non-congregate settings only** and does not address:

- Drug resistance
- Other vulnerable populations (infants and children under 5 years of age, people living with HIV, and others)



Implementation

Updates to Respiratory Isolation Restrictions for Tuberculosis

Recommendations from the Wisconsin Tuberculosis Program

Claire Leback, MPH, RN
Andrea Liptack, MSN, RN
Mary Raschka BSN, RN

Wisconsin Tuberculosis Program
Bureau of Communicable Disease

Division of Public Health

STATE OF WISCONSIN
Department of Health Services
Division of Public Health



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PO Box 2659
Madison WI 53701-2659

Telephone: 608-267-9003
Fax: 608-261-4976
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Date: September 30, 2024

BCD 2024-03

To: Wisconsin Local Health Departments and Tribal Health Agencies

From: Ryan Westergaard, MD, PhD, MPH
Chief Medical Officer and State Epidemiologist for Communicable Diseases

Elizabeth Ann Misch, MD
DHS Tuberculosis Medical Consultant

Wisconsin Tuberculosis Program Statement on the *National Tuberculosis Coalition of America (NTCA) Guidelines for Respiratory Isolation and Restrictions to Reduce Transmission of Pulmonary Tuberculosis in Community Settings (2024)*

PLEASE DISTRIBUTE WIDELY

Background

Tuberculosis is caused by the bacteria, *Mycobacterium tuberculosis*. It is spread from person to person through the air when someone with active infectious tuberculosis (TB) coughs, sings, or speaks. Isolation is the practice of separating individuals with infectious TB from others to prevent the spread of infection. In Wisconsin, most patients with infectious TB reside at home or in another community setting during the required isolation period. Recently, the National Tuberculosis Coalition of America (NTCA) recognized a national need to provide guidelines backed by current evidence for safe isolation of TB patients within the community.

Summary of Wisconsin TB Program Endorsements

The Wisconsin Tuberculosis (TB) Program endorses the use of the [NTCA Guidelines for Respiratory Isolation and Restrictions to Reduce Transmission of Pulmonary Tuberculosis in Community Settings, 2024](#) to guide decisions about respiratory isolation and restrictions (RIR) for people with TB (PWTB) in the state of Wisconsin. The revised guidelines describe RIR as a spectrum comprised of 3 levels: [No restrictions](#), [moderate/midlevel restrictions](#), and [extensive restrictions](#) (see Table 1). The TB Program offers the following comments regarding implementation of RIR:

- All people with confirmed active infectious TB should remain in extensive restrictions *at least* until adequate therapy¹ is started.

How Long is Isolation in Wisconsin?

Average length of isolation was calculated:

“Before”

PWTB diagnosed in 2023
and 2024 until
10/01/2024

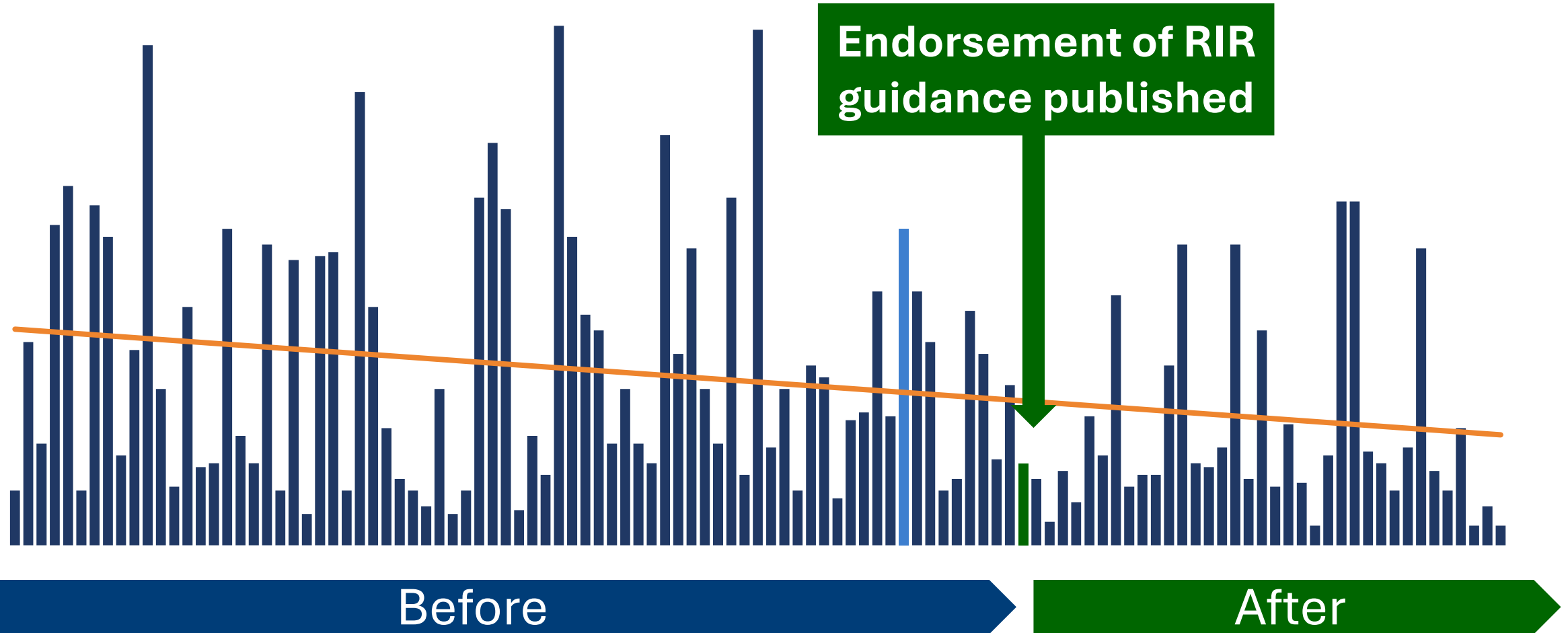
“After”

PWTB diagnosed after
10/01/24

Average Length of Isolation Decreased After Endorsement of NTCA RIR Guidelines



Number of Days People Spent in Isolation Decreased



Obstacles for Implementation

- **Hesitancy** to apply new guidance to patients with **higher burden of disease**.
- Patients may live in community but work or visit high risk settings, resulting in a **“hybrid” release**.
- **Unclear applicability** to different types of TB with resistance to first-line medications.
- Confirmed extrapulmonary TB and suspected pulmonary TB may not meet criteria for release as easily.

Wisconsin Administrative Code DHS 145.11

- **Discharge from isolation or confinement.** The local health officer or the department shall authorize the release of a person from isolation or confinement if all the following conditions are met:
- **(1)** An adequate course of chemotherapy has been administered for a minimum of two weeks and there is clinical evidence of improvement, such as a decrease in symptom severity, radiographic findings indicating improvement, or other medical determination of improvement.

Wisconsin Administrative Code DHS 145.11 continued

- **(2)** Sputum or bronchial secretions are free of acid-fast bacilli.
- **(3)** Specific arrangements have been made for post-isolation or post-confinement care.
- **(4)** The person is considered by the local health officer or the department not to be a threat to the health of the general public and is likely to comply with the remainder of the treatment regimen.



Questions?

TB Program Contact Information

Phone: 608-261-6319

Fax: 608-266-0049

Email:

DHSWITBProgram@dhs.wisconsin.gov

WTBP Website:

www.dhs.wi.gov/tb/index.htm



Oklahoma Isolation Criteria

Amy Hill

O K L A H O M A S T A T E D E P A R T M E N T O F H E A L T H

Oklahoma Isolation

- Our physician will write orders to override the standing orders (old) when she uses the (new) recommendations