Chicken & Fish

CID conference
Hunter Ratliff
09/05/2024

Ages, dates, and other less-relevant (and identifying) information may have been changed

Case #1

Case 1: HPI

A **58 y/o M** with PMH including central serous retinopathy, Afib, T2DM, HTN, HLD, OSA, CKD, hypothyroidism, hypogonadism p/w **multiple abscesses**

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- One month ago, had a large, heavy **chicken coup** fall across him
  - Fell on top of his right chest to left thigh
  - Unclear if puncture wound, but coop was covered in chicken wire
- A few days later, **developed SQ abscesses** at site of injury
  - Rx: **Keflex & doxy** but no improvement in symptoms
- Seen in surgery clinic where he was lethargic, mildly confused, and ill-appearing
  - Sent to ED and found to have sepsis

Case 1: Past medical history

A **58 y/o M** with PMH including central serous retinopathy, Afib, T2DM, HTN, HLD, OSA, CKD, hypothyroidism, hypogonadism p/w **multiple abscesses**

- **Central serous retinopathy**: Follows with Cleveland clinic, has been on high dose steroids, up to prednisone 60 mg / day, tapering recently
- **Hx of cellulitis**: Treated with IV antibiotics two years ago, unclear history
- Numerous **dental issues** in the past as well as **recurrent sinus infections**
- Hx of a few surgeries (multiple spine surgeries, TKR) w/ hardware

Case 1: Social History, Exposures, Risk Factors

Geographic & Occupational: The patient lives in West Virginia. He denies recent foreign or domestic travel. They are retired, used to sell pharma

Substance: They deny alcohol use and he does not use tobacco . They report no recreational drug use

Sexual History: Sexual activity with only women. Denied using any condoms or barriers. Denied ever testing positive for STIs

Environmental exposures: Denies freshwater exposure. Though he cannot recall if the coop caused a puncture wound, he thinks **if it did cause puncture injury there would have been soil exposure**

Animal Exposures: **Cats, dogs, chickens**

Tattoos & Piercing: They have previously gotten tattoos (professionally done)

Case 1: Initial exam

Hypotensive requiring low dose levophed

Gen: alert and oriented, NAD, vitals reviewed
Head/Neck: NCAT; trachea appears midline, no gross LAD
ENT: EOMI grossly, anicteric sclerae; MMM
Resp: normal respiratory effort, symmetric chest rise
CV: RRR; extremities perfused
GI: non-distended; no rebound or guarding
Extremities: **3+ BLE edema, + redness LLE**, no tenderness in the calves or thighs, no varicosities
Neurologic: gait is normal, DTR intact bilaterally. Alert and oriented x3. **Drowsy on exam**.

Case 1: Initial workup

WBC: 21 (90% NΦ)

ESR 27; **CRP** 8.6

Cr: 1.9

Lactate: 4

A1c: 9.7

CT C/A/P

- Multiple probable subcutaneous abscesses overlying (up to 5.7cm) the right anterolateral upper abdominal soft tissues, with overlying cellulitis.
- No extension into the peritoneum evident.

CT LLE

16.2 cm subcutaneous abscess in the soft tissues of the medial left mid to distal thigh with invasion of adjacent musculature

Case 1: Summary

A **58 y/o M** with PMH including central serous retinopathy (on **steroids**), Afib, T2DM, HTN, HLD, OSA, CKD p/w **multiple abscesses** one month after **chicken coop** fell on him.

- Rx: **Keflex & doxy** but no improvement in symptoms
- Unclear if puncture injury
- Recurrent sinusitis & dental issues

Exam
Hypotensive, BLE swelling, ?confused

Labs
WBC 21, lactate 4, A1c 9.7

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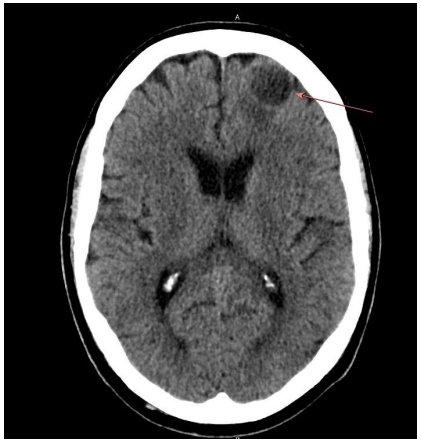
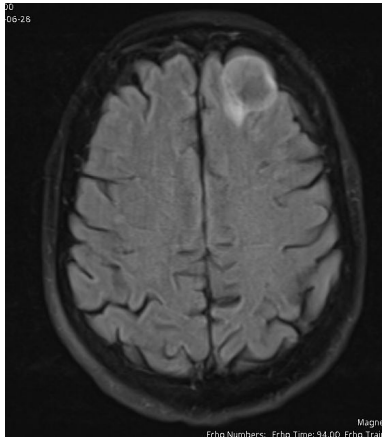


CT Head
2.3 cm rounded hypodense mass lesion within or adjacent to the **left anterior frontal lobe** possibly representing a cystic neoplasm or even abscess in the appropriate setting

MRI Brain
3 cm rim enhancing cerebral abscess within the left anterior frontal lobe with adjacent rim of edema.



Case 1: Hospital Course

- Taken from ED by surgery for emergent I&D of left leg & abdominal wall abscesses
- Operative cultures
  - Abdomen: Raoultella planticola
  - Leg: No growth at time of chart review
- Admitted to MICU for shock, transferred to Ruby for NSGY evaluation
- ID consulted (on my first day of fellowship)

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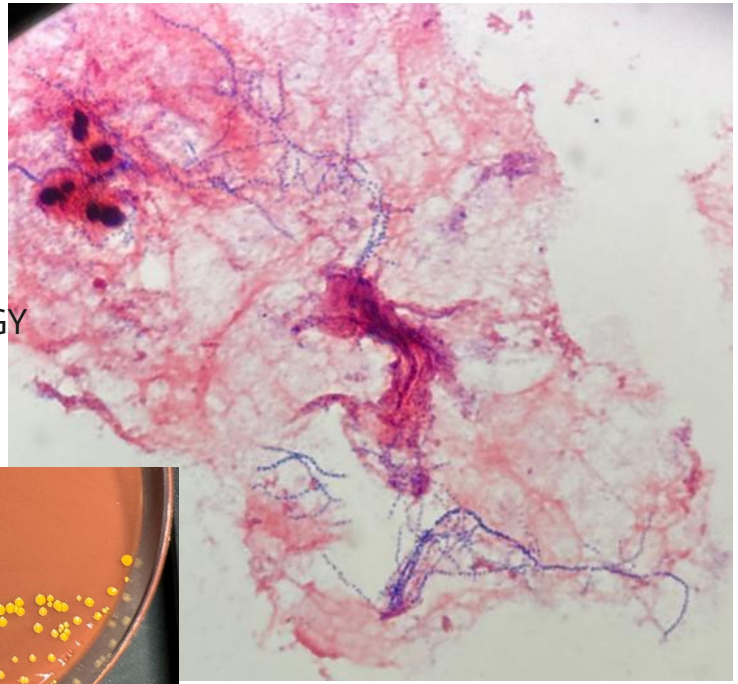
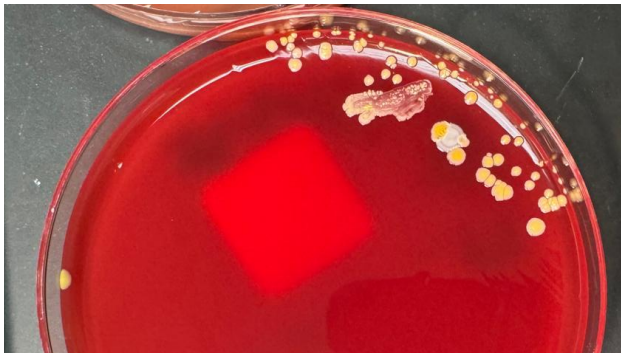
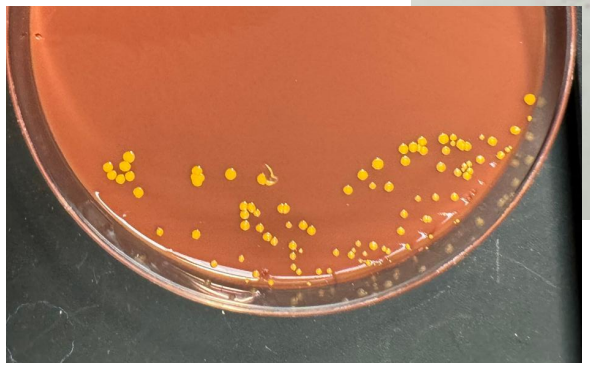
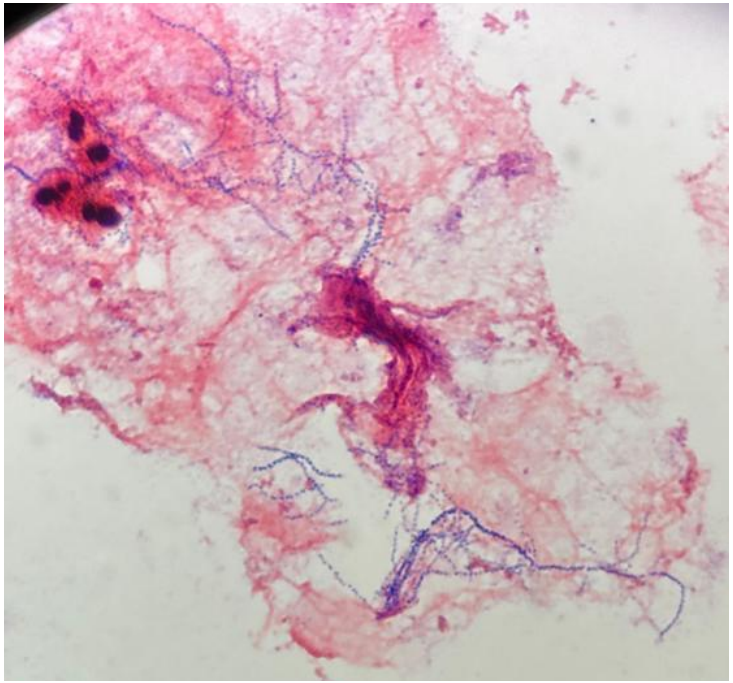






Case 1: Hospital Course

- Operative cultures
  - Abdomen: Raoultella planticola, S epi
  - Leg: **Nocardia farcinica**
  - Brain: Nocardia, S epi
- s/p multiple abdominal & leg washouts
- NSGY I&D of brain abscess



Case 1: Hospital Course

- Uncomplicated first admission
- Discharged on
  - Bactrim + Zyvox (CNS: Nocardia + MRSE)
  - Augmentin (SQ: Raoultella)

Antimicrobial course

- Bactrim / Imi / Linezolid (empiric)
- Discharge:
  - Bactrim + Zyvox (Nocardia + MRSE)
  - Augmentin (Raoultella)

Micro data

- Abdomen: Raoultella planticola, S epi
- Leg: **Nocardia farcinica**
- Brain: Nocardia, S epi

Case 1: Readmission

- Readmitted for unrelated reasons, but family wanted IV treatment
- Susceptibilities returned. Discharged on
  - CNS nocardia: Moxi + Bactrim
  - CNS MRSE: Vanco (DOT: 4 weeks) d/t TCP
- At discharge, had finished 2 weeks of Raoultella coverage for SQ infection

Antimicrobial courses

- Bactrim / Imi / Linezolid (empiric)
- Discharge #1:
  - Bactrim + Zyvox (Nocardia + MRSE)
  - Augmentin (Raoultella)
- Discharge #2:
  - CNS nocardia: Moxi + Bactrim
  - CNS MRSE: Vanco (DOT: 4 weeks)

Micro data

- Abdomen: Raoultella planticola, S epi
- Leg: **Nocardia farcinica**
- Brain: Nocardia, S epi

Nocardia susceptibilities

Tobramycin	32 Resist
Linezolid	4 Suscept
Bactrim	2/38 Suscept
Doxycycline	8 Resist
Ciprofloxacin	0.5 Suscept
Amoxicillin/Clavulanate	8/4 Suscept
Moxifloxacin	0.25 Suscept
Amikacin	1 Suscept
Imipenem	32 Resist
Ceftriaxone	>=128 Resist
Clarithromycin	>=32 Resist
Minocycline	4 Intermed

Case 1: Clinic #1

- During OPAT, developed AKI so vanco stopped a little early (but likely still had ~4 weeks)
- Having GI intolerance (maybe to Bactrim?)
- Kept on Moxi & Bactrim until 6 weeks

Antimicrobial courses

- Bactrim / Imi / Linezolid (empiric)
- Discharge #1:
  - Bactrim + Zyvox (Nocardia + MRSE)
  - s/p 2 weeks Augmentin (Raoultella)
- Discharge #2:
  - CNS nocardia: Moxi + Bactrim
  - s/p 4 weeks Vanco
- Clinic #1:
  - CNS nocardia: Moxi + Bactrim

Micro data

- Abdomen: Raoultella planticola, S epi
- Leg: **Nocardia farcinica**
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Ceftriaxone	>=128 Resist
Clarithromycin	>=32 Resist
Minocycline	4 Intermed

Case 1: Clinic #2

- During OPAT, developed AKI (again) so Bactrim stopped at 6 weeks. GI symptoms resolved
- Added Augmentin for SQ disease

Nocardia susceptibilities

Tobramycin	32 Resist
Linezolid	4 Suscept
Bactrim	2/38 Suscept
Doxycycline	8 Resist
Ciprofloxacin	0.5 Suscept
Amoxicillin/Clavulanate	8/4 Suscept
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Imipenem	32 Resist
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Minocycline	4 Intermed

Antimicrobial courses

- Bactrim / Imi / Linezolid (empiric)
- Discharge #1:
  - Bactrim + Zyvox (Nocardia + MRSE)
  - s/p 2 weeks Augmentin (Raoultella)
- Discharge #2:
  - CNS nocardia: Moxi + Bactrim
  - s/p 4 weeks Vanco
- Clinic #1:
  - CNS nocardia: Moxi + Bactrim
- OPAT: Had to stop bactrim 2/2 AKI
- Clinic #2:
  - c/w Moxi
  - Added Augmentin

Case 1 discussion

Links to articles discussed here

Nocardia

Objectives

- Review microbiology & risk factors
- Describe clinical syndromes
- Review treatment options

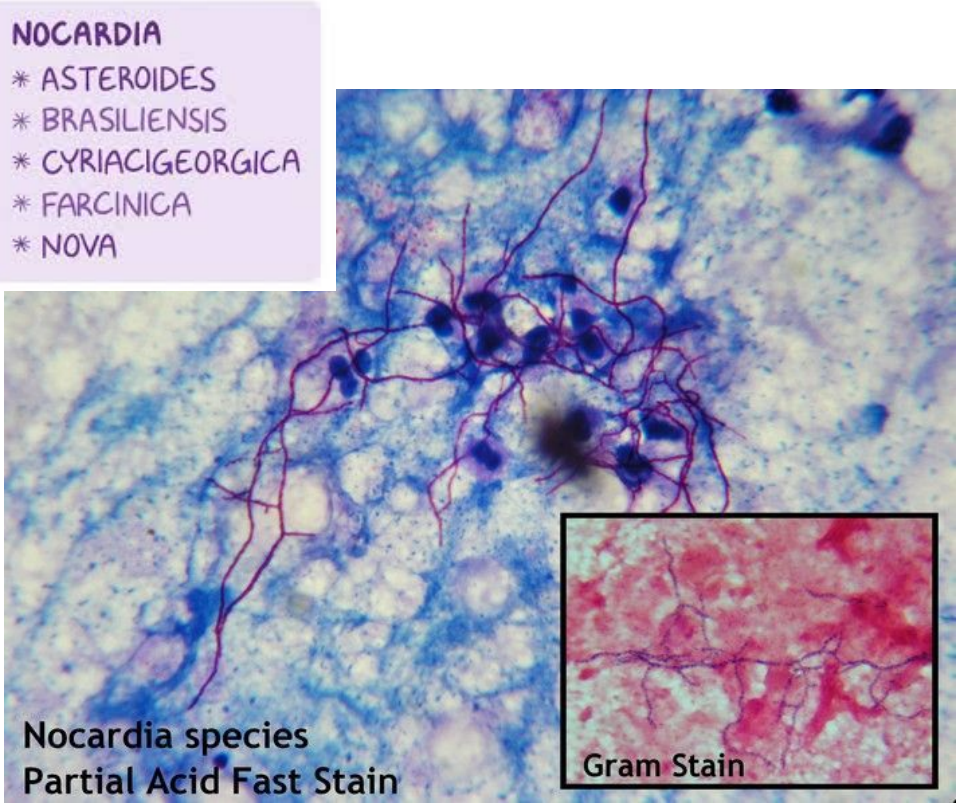
Articles

Nocardia: Microbiology

- Delicate **filamentous gram-positive branching rods**
- Weakly acid fast
- Aerobic growth

Numerous species

- Species can be helpful in predicting susceptibilities (Toyokawa 2021)



Nocardia: Antimicrobial susceptibilities

	N. farcinica	N. nova	N. brasiliensis	N. cyriacigeorgica	N. abscessus	N. otitidiscaviarum
Bactrim	**S**	**S**	**S**	**S**	**S**	**S**
Imipenem	S	S	R	S	S	R
Amikacin	**S**	**S**	**S**	**S**	**S**	**S**
Linezolid	**S**	**S**	**S**	**S**	**S**	**S**
Tobramycin	R	R	S	S	S	S
Augmentin	S	R	S	R	S	R
Ceftriaxone	R	S	R	S	S	R
Ciprofloxacin	R	R	R	R	R	R
Clarithromycin	R	S	R	R	R	R
Doxycycline	R	R	R	R	S	R
Minocycline	R	R	R	R	S	R
Erythromycin	R	S	R	R	R	R

Adapted from UpToDate

Nocardia: Risk factors

- Natural reservoir is **soil & decaying vegetation**
- Transmission via **inhalation** or **direct inoculation**
- **Immunosuppression** is major risk factor (though can occur in immunocompetent)
  - **Steroids** are most frequently reported risk factor
  - Solid organ transplant

Nocardia: Clinical Syndromes

- Subacute infection
- Main sites of infections
  - Lungs
  - Skin
  - CNS
- Hematogenous spread is common in disseminated disease

Nocardia: Clinical Syndromes

- Subacute infection
- Main sites of infections
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  - Skin
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Pulmonary disease

- Most **common site** of disease
- Variable presentation:
  - Pneumonia
  - Lung abscess
  - Cavitary lesion
  - Empyema
- **More likely to go to CNS** (vs skin)
- Can mimic flares of chronic lung disease (e.g. sarcoid patient who is on steroids)

Nocardia: Clinical Syndromes

- Subacute infection
- Main sites of infections
  - Lungs
  - **Skin**
  - CNS
- Hematogenous spread is common in disseminated disease

Skin / soft tissue

- Often in setting of trauma
- Primary skin infection is most common in immunocompetent

Types

1. **Localized**: Cellulitis or SQ abscess +/- drainage
2. **Lymphocutaneous**: Nodular lymphangitis "sporotrichoid nocardiosis"
   - If thinking sporotrichosis (e.g. thorn injury) consider nocardia
3. **Mycetoma**: chronic cutaneous infection that coalesces to large necrotic abscess with draining sinus tracts

Nocardia: Clinical Syndromes

- Subacute infection
- Main sites of infections
  - Lungs
  - Skin
  - **CNS**
- Hematogenous spread is common in disseminated disease

CNS disease

- Nocardia loves to go to the brain
- One or more abscesses
- May or **may not be symptomatic**
- If someone has nocardia, **you should scan their head**!

Nocardia: Initial treatment

- Bactrim is the mainstay treatment
  - Resistance can occur, so send for susceptibilities
- Initial therapy often **Bactrim** + **something else**
  - Often imipenem or amikacin
  - If CNS, **some use all three**

- Disseminated disease (including CNS) induction therapy:
  - At least six weeks of double coverage
  - Frequently IV

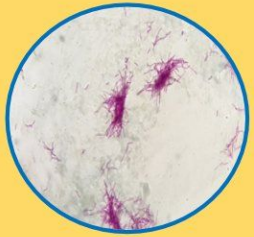
Nocardia: Long term treatment

- Always guided by susceptibilities and clinical response
  - **High risk of relapse** / treatment failure
- **PO stepdown**: After 3-6 weeks and clinical response:
  - **Non-CNS**: After **3 weeks**, consider PO monotherapy
  - **CNS &/or immunocompromised**: After **6 weeks**, consider switch to PO combo therapy
- Duration of therapy
  - Not well defined
  - **Isolated cutaneous**: 3-6 months (immunocompetent), 6-12 months (immunocompromised)
  - **CNS or immunocompromised**: At least one year
- Secondary prophylaxis:
  - May be some role for Bactrim PPx (1 DS daily) if immunosuppressed and no expected recovery (e.g. BMT, SOT)

NOCARDIA Spp

Pathogen

Filamentous gram-positive branching rod



Grows in acid fast staining and anaerobic conditions.

Different from Actinomyces.

Risks Factors

- ❑ Glucocorticoid therapy
- ❑ Malignancy
- ❑ Organ Transplant recipient
- ❑ HIV
- ❑ Immunotherapy

Treatment

Allergy to sulfonamides = Desensitization

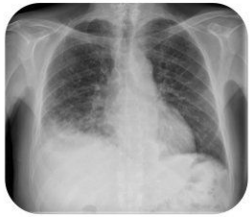
Clinical Presentation

Systemic (≥2 sites involved) 32%

Pulmonary

Primary site of Infection. 39%

- Fever
- Night sweats
- Fatigue
- Anorexia
- Weight loss
- Dyspnea
- Cough
- Hemoptysis
- Pleuritic chest pain



Immunocompetent: TMP (5 -10 mg/kg) –SMX. PO, BID

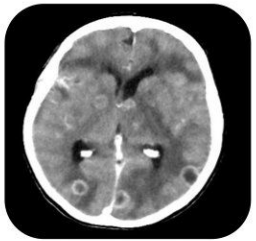
Immunocompromised: TMP (10 -15 mg/kg) –SMX,PO BID

CNS

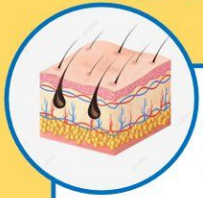
CNS infection alone: 9%. Up to 20% with Lung involvement

Brain abscess most common flinging. Meningitis is rare

- Fever
- Headache
- Meningismus +/-
- Seizures
- Focal neurologic deficits



TMP(15mg/Kg)-SMX IV + imipenem 500 mg IV + amikacin (7.5 mg/kg IV)

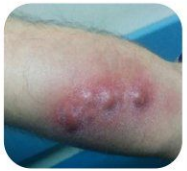


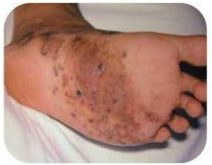
Cutaneous

Cutaneous infection alone : 8%. direct inoculation from trauma.

Primary cutaneous
Ulcerations, pyoderma, cellulitis, nodules, and subcutaneous abscesses

Lymphocutaneous
Similar syndrome caused by *Sporothrix schenckii*.





Mycetoma
chronic cutaneous infection

TMP (5 -10 mg/kg) –SMX. PO, BID (3-6mo)

Mycetoma MP(10 mg/kg) –SMX. PO, BID W/wo Dapsone 100mg (6-12 mo)

Diagnosis

Tissue : Gram stain, modified acid-fast staining. Culture (5 to 21 days for growth). PCR.

@TheIDTrivia

Case #2

Case 2: HPI

A **25 y/o M** with PMH of bipolar (on Lamictal) is referred to ID clinic for a **positive PPD**

- Feels well, ROS entirely negative
- No known exposure to TB
- Prior TB testing (both TST & IGRA) have all been negative

Case 2: Social History, Exposures, Risk Factors

Geographic: He has **never traveled abroad** (all of his military work was stateside). During his time in the military, was **stationed in Louisiana** for most of the time, but also a few months in North Carolina. When he left the military two years ago, he moved from Louisiana to WV and hasn't traveled out of WV since

Occupational / Hobbies: Joined Army six years ago. Primarily **worked in healthcare** (his base's clinic) doing mostly **administrative work**. Would provide **limited patient care** when needed (e.g. triage) and only off-base work was during EMT training. While in Louisiana, he went out to the **bayous to fish**. Still enjoys **fishing in WV**, but not as good crayfishing up here. Now working in athletics department here, which prompted TB testing.

Case 2: Social History, Exposures, Risk Factors

Infectious PMH: **No history of BCG vaccine**. No known household contacts with TB or who are immunocompromised. Aside from what was mentioned in occupational section, no other worrisome possible exposures to TB (incarceration exposure, homeless shelters)

Animal Exposures: Has pets (**cats and fish**). Otherwise denies farm animal exposures, bird/reptile exposures, or other animal exposure.

Substance: They only drink socially and he does not use tobacco. They report no recreational drug use

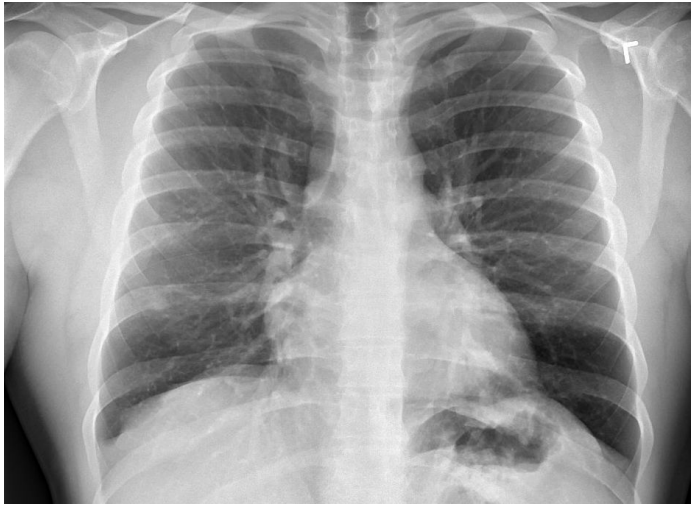
Sexual History: They are are sexually active with only their female partner (of many years). The patient reports consistent condom use. No history of STIs

Tattoos & Piercing: They have previously gotten tattoos (professionally done) and no piercings .

Case 2: TB testing history

- Initial TST when he joined the military was **negative**
- While in the military, had TB testing (both TST and IGRA) **every six months** that were **all negative**
  - Was not told that any of his clinic patients were positive for TB
- He had testing at the end of his time in the service which was **negative**
- Had two step PPD for pre-employment screen

Date	PPD induration
-3mo	0mm
-3mo + 9 days	12mm
1 week ago	15mm



Case 2: Summary

A **25 y/o M** with PMH of bipolar (on Lamictal) is referred to ID clinic for a **positive PPD**

- Pre-military: TST **negative**
- q6mo: **all negative**
- End of service: **negative**

Date	PPD induration
-3mo	0mm
-3mo + 9 days	12mm
1 week ago	15mm

Case 2: Conclusion

A **25 y/o M** with PMH of bipolar (on Lamictal) is referred to ID clinic for a **positive PPD**

- Pre-military: TST **negative**
- q6mo: **all negative**
- End of service: **negative**

Date	PPD induration
-3mo	0mm
-3mo + 9 days	12mm
1 week ago	15mm

HIV screen negative

QuantGold negative

Treated PPD as false positive

- Possibly from NTM exposure given fishing history & time in Louisiana

Case 2 discussion

Links to articles discussed here

NTM infections & Mtb testing

NTM = nontuberculous mycobacterial
Mtb = Mycobacterium tuberculosis

Objectives

Articles

- Review the classification of mycobacteria
- Review features of NTM
  - Transmission & exposures
  - Clinical syndromes
- Describe geographic distribution of NTM infections in US
- Discuss LTBI screening guidelines
  - Focus on distinguishing NTM from Mtb

Types of mycobacteria

Mycobacterium tuberculosis complex

- *M. tuberculosis*
- *M. bovis*
- *M. africanum*
- *M. microti*
- *M. canetti*

M. leprae

Rapidly growing NTM

Slow growing NTM

Types of mycobacteria

Mycobacterium tuberculosis complex

M. leprae

Rapidly growing NTM

- *M. fortuitum complex*
  - *M. fortuitum*
  - *M. peregrinum*
  - *M. porcinum*
- *M. chelonae*
- *M. abscessus complex*
- *M. smegmatis*
- *M. mucogenicum*

Slowly growing NTM

Photochromogens

- *M. kansasii*
- *M. marinum*

Scotochromogens

- *M. gordonae*
- *M. scrofulaceum*

Nonchromogens

- *M. avium complex*
  - *M. avium*
  - *M. intracellulare*
  - *M. chimaera*
- *M. terrae complex*
- *M. ulcerans*
- *M. xenopi*
- *M. simiae*
- *M. malmoense*
- *M. szulgai*
- *M. asiaticum*
- *M. haemophilum*

NON-TUBERCULOUS MYCOBACTERIA (NTM)

Ubiquitous environmental organisms

Higher rates of isolation and clinical disease in SE US

NTMS often classified as rapidly growing (RGM) and slowly growing mycobacteria

RGM = usually grow within 7 days*

*specifically means growth on solid media after subculture -- growth in liquid media influenced by quantity of inoculum!

Runyon classification can help with phenotypic identification

- Photochromogens: slow growing; yellow-orange pigment only with light exposure
- Scotochromogens: pigment +/- light exposure
- Nonchromogens: produce no pigment (all RGMS!)

Transmission via:

- Inhalation of infected aerosols from environment (shower head, hot tub)
- Ingestion of organism (presumed route for disseminated MAC)
- Direct inoculation in skin breaks or trauma
- No human-human or animal-human transmission (not communicable)

Inoculate clinical specimens in both:

Solid media
Middlebrook 7H11 media
Lowenstein-Jensen media

Liquid media
MGIT broth

Clinical syndromes typically classified into 4 categories

		Caused mostly by:
1	Pulmonary infection	MAC M.abscessus M.kansasii
2	Lymphadenitis	MAC M.scrofulaceum
3	Skin, soft tissue, bone disease	M.fortuitum M.chelonae M.marinum M.abscessus M.ulcerans
4	Disseminated infection (ICH)	M.avium, M.kansasii M.abscessus M.chelonae

Where does NTM live?

Habitat	Reference
Natural waters	Falkinham *et al.* 1980; von Reyn *et al.* 1993
Drinking water distribution systems	Covert *et al.* 1999; Falkinham *et al.* 2001
Biofilms in drinking water distribution systems	Falkinham *et al.* 2001; Torvinen *et al.* 2004
Building, hospital, and household plumbing	Du Moulin *et al.* 1988; Wallace *et al.* 1998; Nishiuchi *et al.* 2007; Falkinham *et al.* 2008
Hot tubs and spas	Embil *et al.* 1997; Kahana *et al.* 1997; Mangione *et al.* 2001; Marras *et al.* 2005
Natural and household/building aerosols	Falkinham *et al.* 2008
Boreal forest soils and peats	Iivanainen *et al.* 1997, 1999
Acidic, brown-water swamps	Kirschner *et al.* 1992
Potting soils	De Groote *et al.* 2006
Metal removal fluid systems	Bernstein *et al.* 1995; Shelton *et al.* 1999; Moore *et al.* 2000

Table 2: Habitats of environmental opportunistic mycobacteria
Falkinham 2009

Mycobacterium avium complex

Exposures:

- Soil
- Water (aerosolized from showerheads; hot tubs, natural surface water)
- Animals
- Higher rates near gulf coast

Disease:

- Lung disease
- Disseminated in immunocompromised

Slow growers

- ***M. avium complex***
- ***M. kansasii***
- *M. marinum*
- *M. ulcerans*
- *M. xenopi*
- *M. simiae*
- *M. malmoense*

Rapid growers

- ***M. abscessus complex***
- *M. fortuitum complex*
- *M. chelonae*
- *M. abscessus* subspecies *massiliense*
- *M. abscessus* subspecies *bolletii*

Mycobacterium kansasii

Exposures:

- Also high predisposition for south coast & central plains
- Not found in soil or natural water supply
- Has been found in city water supply

Disease:

- Can cause lung disease like MTB
- Similar to MAC, mostly occurs in those with existing lung disease or immunocompromised

Slow growers

- ***M. avium complex***
- ***M. kansasii***
- *M. marinum*
- *M. ulcerans*
- *M. xenopi*
- *M. simiae*
- *M. malmoense*

Rapid growers

- ***M. abscessus complex***
- *M. fortuitum complex*
- *M. chelonae*
- *M. abscessus* subspecies *massiliense*
- *M. abscessus* subspecies *bolletii*

Mycobacterium abscessus complex

Exposures:

- Similar environmental exposures (soil, water, animals)
- Hospital tap water
- Breast implant outbreak

Disease:

- Lung disease (even in immunocompetent)
- SSTI
- Disseminated in immunocompromised

Slow growers

- ***M. avium complex***
- ***M. kansasii***
- *M. marinum*
- *M. ulcerans*
- *M. xenopi*
- *M. simiae*
- *M. malmoense*

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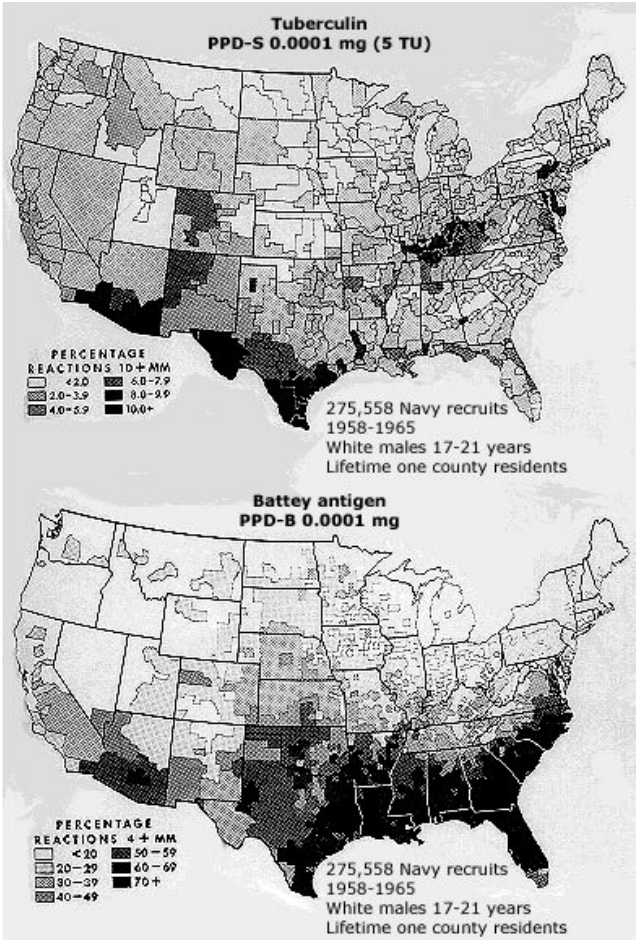
NTM Geography

Very old study of 275,000 Navy recruits (1969)

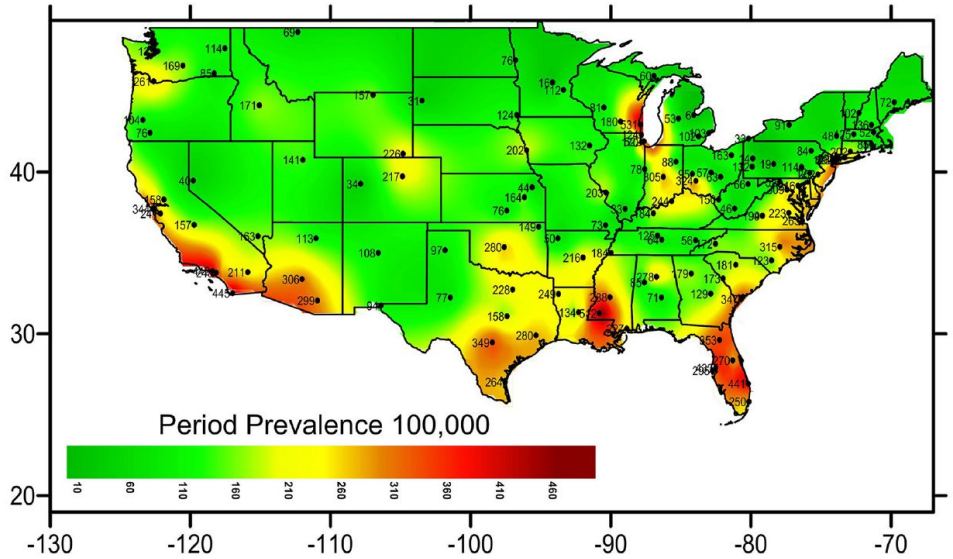
- I can't access the article but sounds like they all lived their entire lives in one county
- Over 70% of those in southeastern or gulf coast states had been exposed or infected with MAC

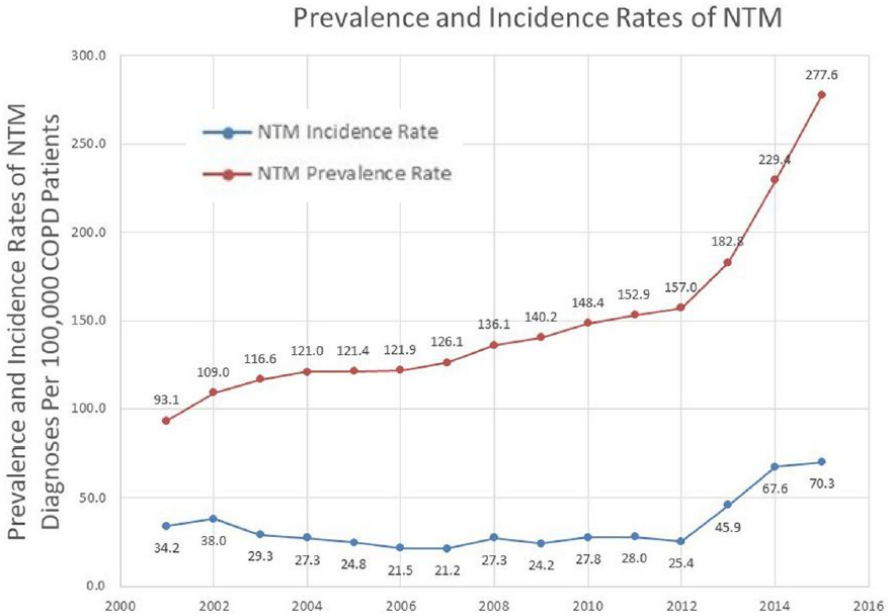


Geographic variation in the frequency of reactors to PPD-S (top) and to PPD-B 9 (bottom).
Edwards, et al, Am Rev Respir Dis 1969; 99(Suppl):1.

NTM Geography

- VA administrative data (2001 - 2015)
  - Only looked at COPD patients
  - Rising incidence in 2012

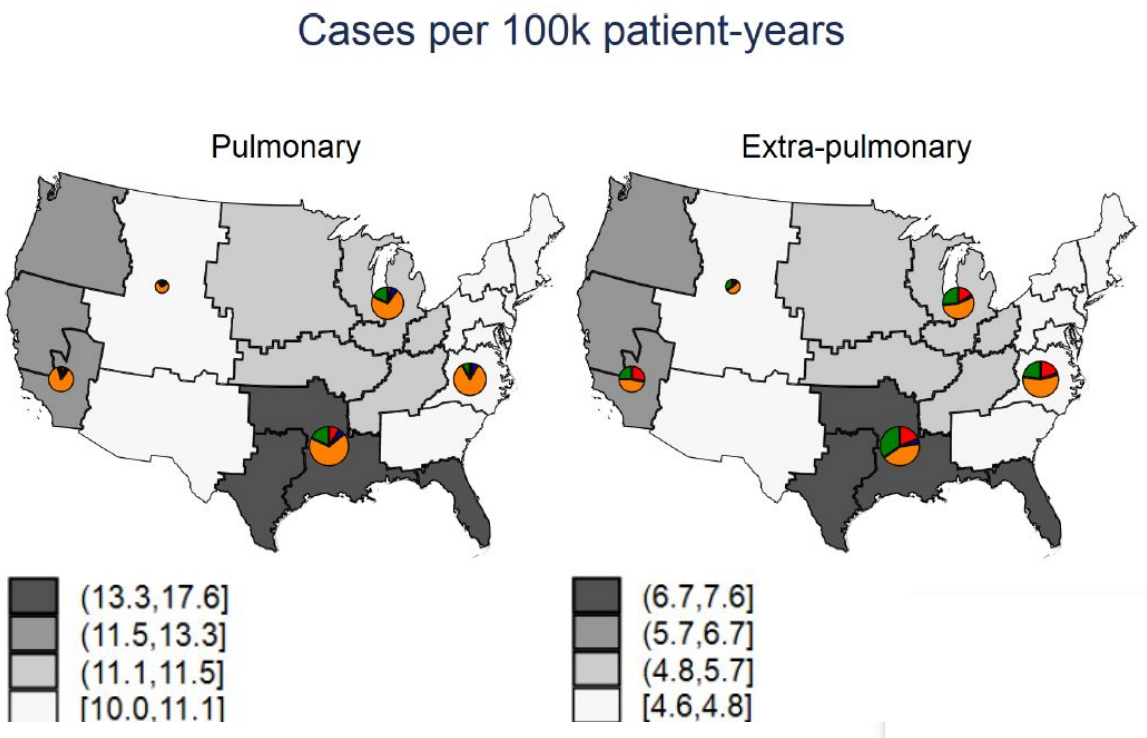




Left: Period prevalence of NTM infections (figure 1)
Above: Prevalence & incidence (figure 2)
Pyarali et al (2018)

NTM Geography

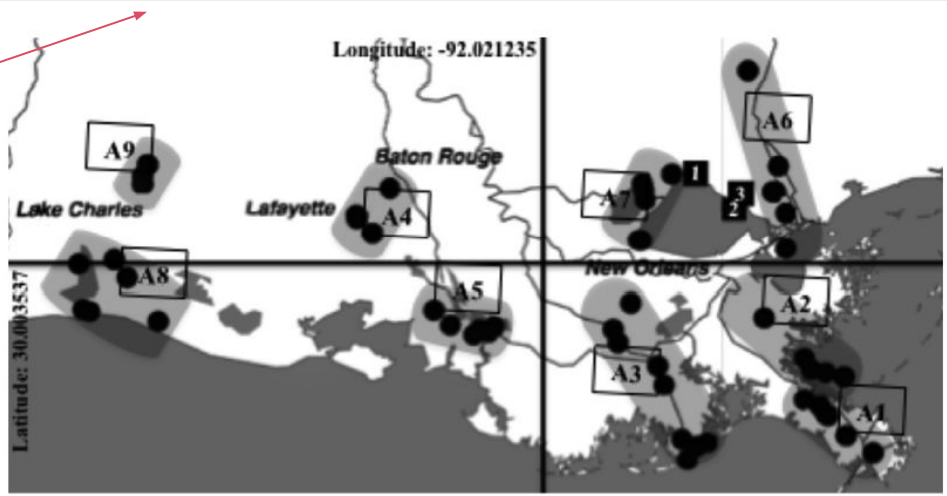
- Also VA patients (2009 - 2012)
  - Not restricted to COPD patients
- Identified cases by ICD code and natural language processing of micro data



Incident rates of NTM infections in VA patients (2009-2012)
Jones et al (2018), Figure 1

NTM Geography

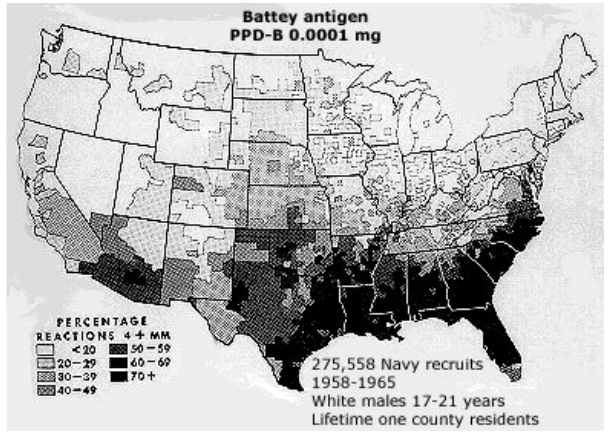
- Environmental study out of LSU & Tulane (summer of 2011)
- PCR for M. ulcerans
  - So far no human cases in US from M ulcerans
- Samples collected from 9 sites
  - High rates (47%) found in water samples
  - Similar rates for fresh / brackish / salt water



Location	No. of *M. ulcerans*-positive samples/total no. of samples (%)		
	Aquatic vegetation	Water	Combined
Area 1	1/6	2/6	3/12 (25)
Area 2	1/8	4/6	5/14 (36)
Area 3	1/6	4/6	5/12 (42)
Area 4	1/9	3/9	4/18 (22)
Area 5	1/7	3/6	4/13 (31)
Area 6	3/6	1/6	4/12 (33)
Area 7	0/6	3/6	3/12 (25)
Area 8	0/5	4/6	4/11 (36)
Area 9	1/6	3/6	4/12 (33)
Total	9/59 (15)	27/57 (47)	36/116 (31)

Top: Sampling sites in Louisiana study of M. ulcerans (Figure 1)
Bottom: Sample PCR positivity for M. ulcerans, by type & source (Table 3)
Hennigan (2013)

But back to the Cajun food



Mycobacterium marinum

- Infection is less common
- Found in water (fresh & salt): marine environment, swimming pools, and fish tanks
- **Fish tank granuloma**: Sink infection from contaminated fish tank, often when preexisting skin injury

Slow growers

- ***M. avium complex***
- ***M. kansasii***
- *M. marinum*
- *M. ulcerans*
- *M. xenopi*
- *M. simiae*
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Rapid growers

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- *M. chelonae*
- *M. abscessus* subspecies *massiliense*
- *M. abscessus* subspecies *bolletii*

Mycobacterium marinum

- Infection is less common
- Found in water (fresh & salt): marine environment, swimming pools, and fish tanks
- **Fish tank granuloma**: Sink infection from contaminated fish tank, often when preexisting skin injury
- Can cause **false positive TST test**
- Case series of patients (n=7) who had SSTI infection with M marinum (Lewis 2003)
    - 100% had PPD ≥ 10mm
    - 29% had PPD ≥ 15mm
    - Four patients had negative PPD documented before infection

Slow growers

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Mycobacterium marinum

- Infection is less common
- Found in water (fresh & salt): marine environment, swimming pools, and fish tanks
- **Fish tank granuloma**: Sink infection from contaminated fish tank, often when preexisting skin injury
- Can cause **false positive TST test** (Lewis 2003)
- Case series of NTM SSTI (n=78) from **UTMB**, which is on the gulf coast (Philips 2019)
    - M. abscessus (47%)
    - M. fortuitum (26%)
    - M. marinum (21%)

Slow growers

- ***M. avium complex***
- ***M. kansasii***
- *M. marinum*
- *M. ulcerans*
- *M. xenopi*
- *M. simiae*
- *M. malmoense*

Rapid growers

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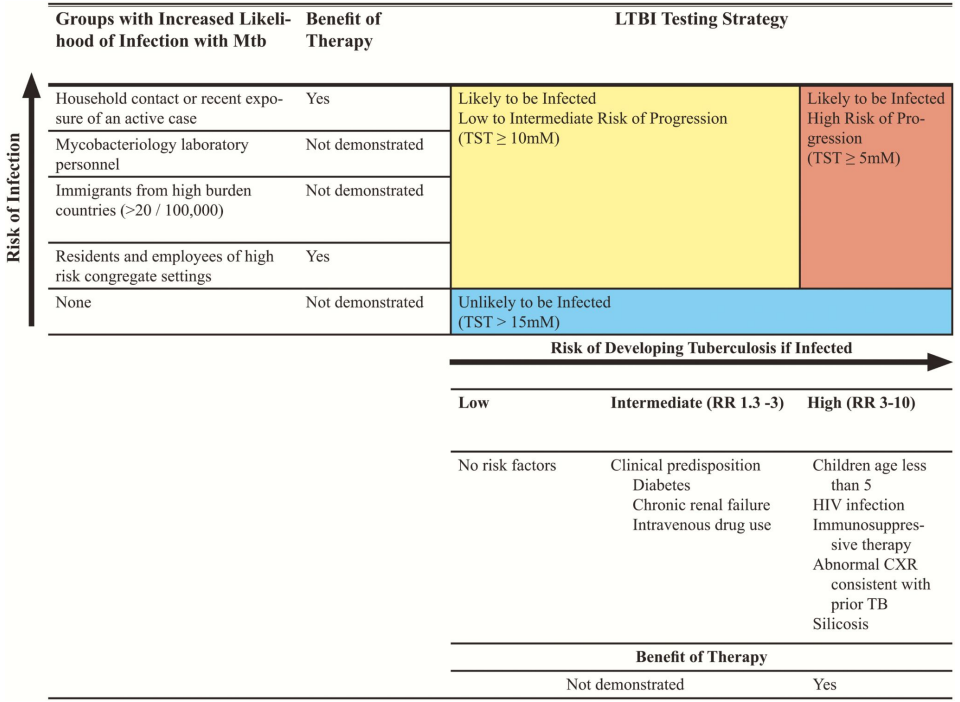
IDSA: LTBI screening

- Persons at low risk for Mtb infection and disease progression NOT be tested for Mtb infection



LTBI = latent tuberculosis infection
Mtb = Mycobacterium tuberculosis

Paradigm for evaluation of those with LTBI based on risk of infection, risk of progression to tuberculosis, and benefit of therapy. (figure 1, 2017 IDSA guidelines)

IDSA: LTBI screening

- Persons at low risk for Mtb infection and disease progression NOT be teste for Mtb infection
- If you *have* to test them
  - Favor IGRA over TST (if >5 y.o.)
- If **initial test is positive**, suggest a second diagnostic test

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]	

Summary of recommendations for testing for LTBI (figure 2, 2017 IDSA guidelines)

LTBI = latent tuberculosis infection
Mtb = Mycobacterium tuberculosis
IGRA = interferon-γ release assay
TST = tuberculin skin test

JAMA study with CDC (April 2024)

- Prospective diagnostic trial of 22,000 subjects at high risk for TB infections
- Compared TST & the two IGRA

Table 3. Incremental Value Gained by Second Test: Change in PPV

Test A[a]	Test B	Incremental change estimate in PPV (95% CI)[b]
TST^+	QFT^-GIT^+	1.64 (1.40-1.93)
TST^+	QFT^-GIT^-	0.36 (0.18-0.75)
TST^+	$TSPOT^+$	1.94 (1.65-2.27)
TST^+	$TSPOT^-$	0.29 (0.13-0.65)
QFT^-GIT^+	TST^+	1.10 (0.98-1.24)
QFT^-GIT^+	TST^-	0.54 (0.19-1.59)
QFT^-GIT^+	$TSPOT^+$	1.24 (1.09-1.41)
QFT^-GIT^+	$TSPOT^-$	0.39 (0.13-1.12)
$TSPOT^+$	TST^+	1.10 (1.02-1.18)
$TSPOT^+$	TST^-	0.31 (0.05-2.13)
$TSPOT^+$	QFT^-GIT^+	1.08 (1.00-1.17)
$TSPOT^+$	QFT^-GIT^-	0.34 (0.05-2.33)

Results of the second test are highlighted in **red** if it was **positive** and **green** if it was **negative**
(Table 3, Ayers 2024)

Learning points & take aways

Learning points & take aways

Sources

- Nocardia is a G(+) branching rod, often **found in soil**, that can cause infections in **immunocompromised hosts**
- Common sites of infection are **skin** and **lungs**, with a high predisposition to go to the **CNS**
- **Bactrim** is a key back bone in **multidrug therapy**, which should be **tailored to susceptibilities**
- Despite **prolonged treatment** (up to one year), **high rates of recurrence**

- Nontuberculous mycobacterial (NTM) is everywhere, including **water and soil**
- Epidemiological studies show higher rates in the **south/gulf coast**
- Some NTM (e.g. *M. ulcerans* & ***M. marinum***) have unique associations (e.g. **fish tanks**)
- NTM can cause **false positive PPDs** (*M. marinum*)
- If positive PPD (and low pretest probability), **repeat IGRA** may be of some utility