Melioidosis in the United States: What Clinicians Need to Know Following Newly Discovered Endemicity

Clinician Outreach and Communication Activity (COCA) Call

Thursday, October 13, 2022

Free Continuing Education

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- Instructions on how to earn continuing education will be provided at the end of the call.

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- In compliance with continuing education requirements, all planners and presenters must disclose all financial relationships, in any amount, with ineligible companies over the previous 24 months as well as any use of unlabeled product(s) or products under investigational use.

- CDC, our planners, and presenters wish to disclose they have no financial relationship(s) with ineligible companies whose primary business is producing, marketing, selling, re-selling, or distributing healthcare products used by or on patients.

- Presentations will not include any discussion of the unlabeled use of a product or a product under investigational use, except Dr. Caroline Schrodt and Julia Petras' discussion of melioidosis as a rare disease in the United States with no FDA-approved drugs specifically for treating melioidosis; given this, the antimicrobials recommended for treatment are considered off-label.

- CDC did not accept financial or in-kind support from ineligible companies for this continuing education activity.

Objectives

At the conclusion of today's session, the participant will be able to accomplish the following:

1. Outline the evolving epidemiological risk factors and clinical characteristics of melioidosis, and when to consider melioidosis as a potential diagnosis.
2. Discuss best practices for preventing, diagnosing, and treating melioidosis, including how to address diagnostic challenges.
3. Describe what CDC is doing to learn more about melioidosis in the United States and how clinicians and public health officials can help.

To Ask a Question

- Using the Zoom Webinar System
  - Click on the “Q&A” button
  - Type your question in the “Q&A” box
  - Submit your question

- If you are a patient, please refer your question to your healthcare provider.

- If you are a member of the media, please direct your questions to CDC Media Relations at 404-639-3286 or email media@cdc.gov

Today's Presenters

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Epidemic Intelligence Service Officer
Bacterial Special Pathogens Branch
Division of High-Consequence Pathogens & Pathology
National Center for Emerging and Zoonotic Infectious Diseases
Centers for Disease Control and Prevention

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National Center for Emerging and Zoonotic Infectious Diseases
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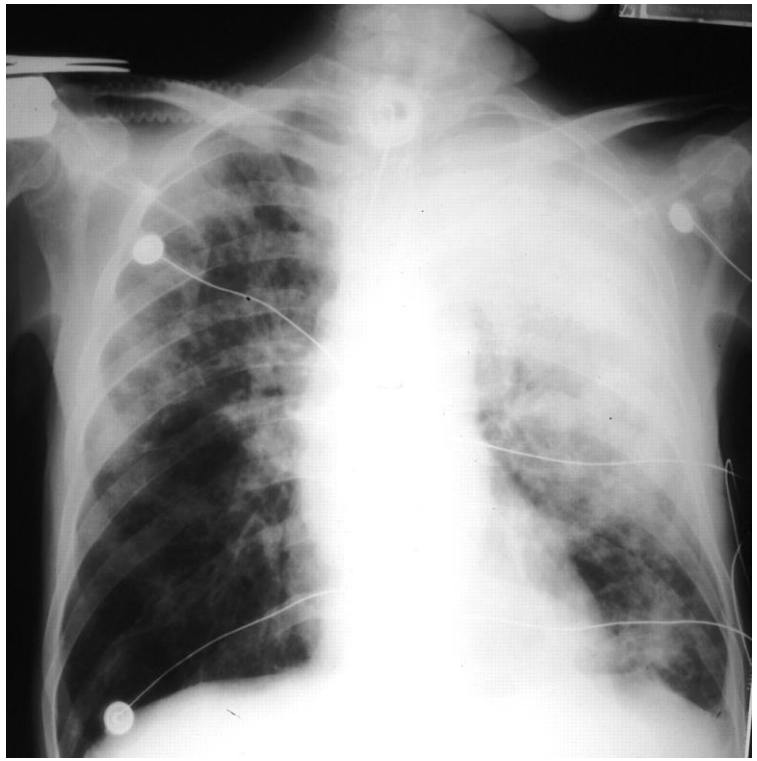


Clinician Outreach and Communication Activity (COCA) Call—October 13, 2022

July 27, 2022: CDC Health Advisory 00470

- Melioidosis Locally Endemic in Areas of the Mississippi Gulf Coast after *Burkholderia pseudomallei* Isolated in Soil and Water and Linked to Two Cases – Mississippi, 2020 and 2022

Link to HAN: https://emergency.cdc.gov/han/2022/han00470.asp

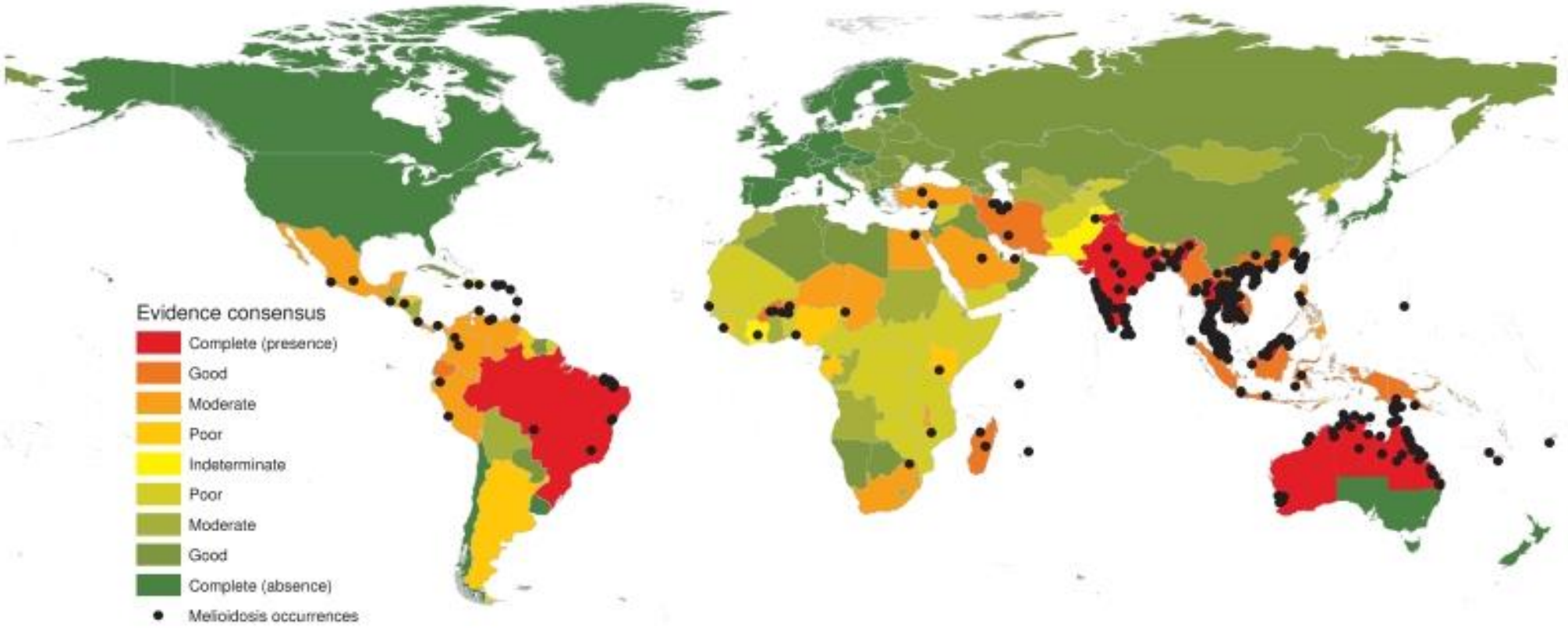
Overview

1. Epidemiology and Background
2. Clinical Presentation
3. Diagnostic Considerations
4. Treatment
5. Prevention & Key Messages
6. What is CDC doing to learn more about melioidosis in the U.S.?

Epidemiology & Background

Julia Petras, MSPH, BSN, RN
Epidemic Intelligence Service (EIS) Officer

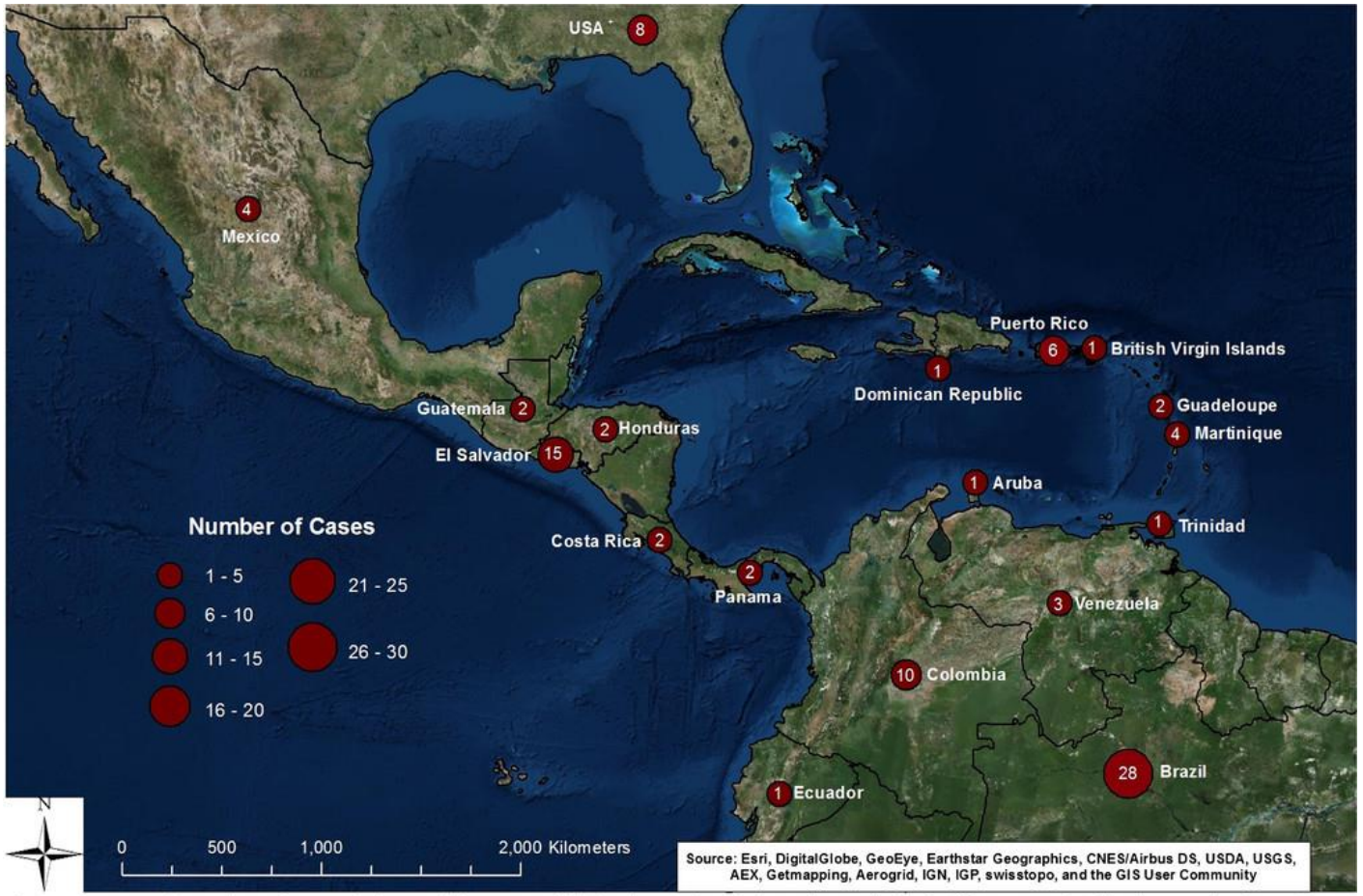
Melioidosis is caused by the environmental gram-negative bacterium *Burkholderia pseudomallei* found in tropical and sub-tropical regions



Global evidence consensus and geographic locations of melioidosis occurrence data from 1910 to 2014

Source: Limmathurotsakul, D., et al., *Predicted global distribution of Burkholderia pseudomallei and burden of melioidosis.* Nature Microbiology, 2016. **1**(1): p. 15008.

Melioidosis is an emerging disease in the Americas



Two cases are not shown above. One case had a travel history to multiple locations such as Aruba and several other Caribbean countries. The other case had a travel history to Trinidad and Tobago.

* Seven cases were in mainland USA and one was in Hawaii.

Distribution of melioidosis cases in the Americas

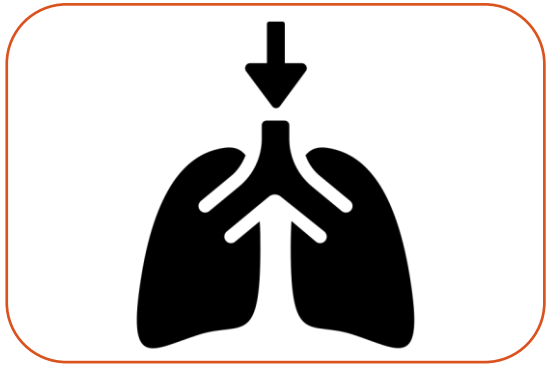
Source: Benoit, T.J., et al., *A Review of Melioidosis Cases in the Americas. The American Journal of Tropical Medicine and Hygiene, 2015.* ***93(6): p. 1134-1139.***

Modes of transmission and incubation period

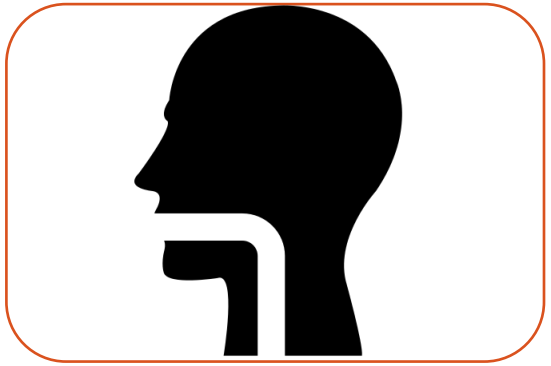
- **Routes of transmission**: Direct contact with *B. pseudomallei*-contaminated soil or water via:

Percutaneous inoculation

Inhalation



Ingestion



- **Incubation period: 1-21 days** post exposure (median 4 days)
  - In ~5% of cases, infection can be activated months to years after exposure (latent reactivated infection)

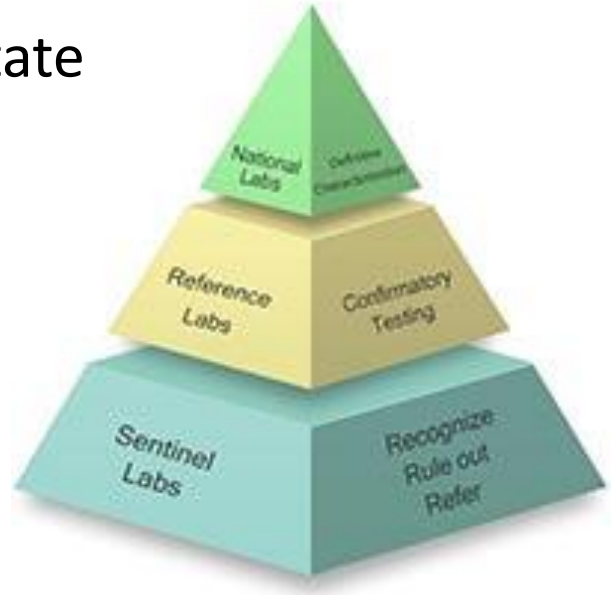
B. pseudomallei is a Tier 1 Select Agent

- *Bacillus cereus* Biovar *anthracis*
- *Bacillus anthracis*
- Botulinum neurotoxins
- Botulinum neurotoxin producing species of *Clostridium*
- *Burkholderia mallei*
- ***Burkholderia pseudomallei***
- Ebola virus
- Foot-and-mouth disease virus
- *Francisella tularensis*
- Marburg virus
- Rinderpest virus
- Variola major virus (Smallpox virus)
- Variola minor virus (Alastrim)
- *Yersinia pestis*

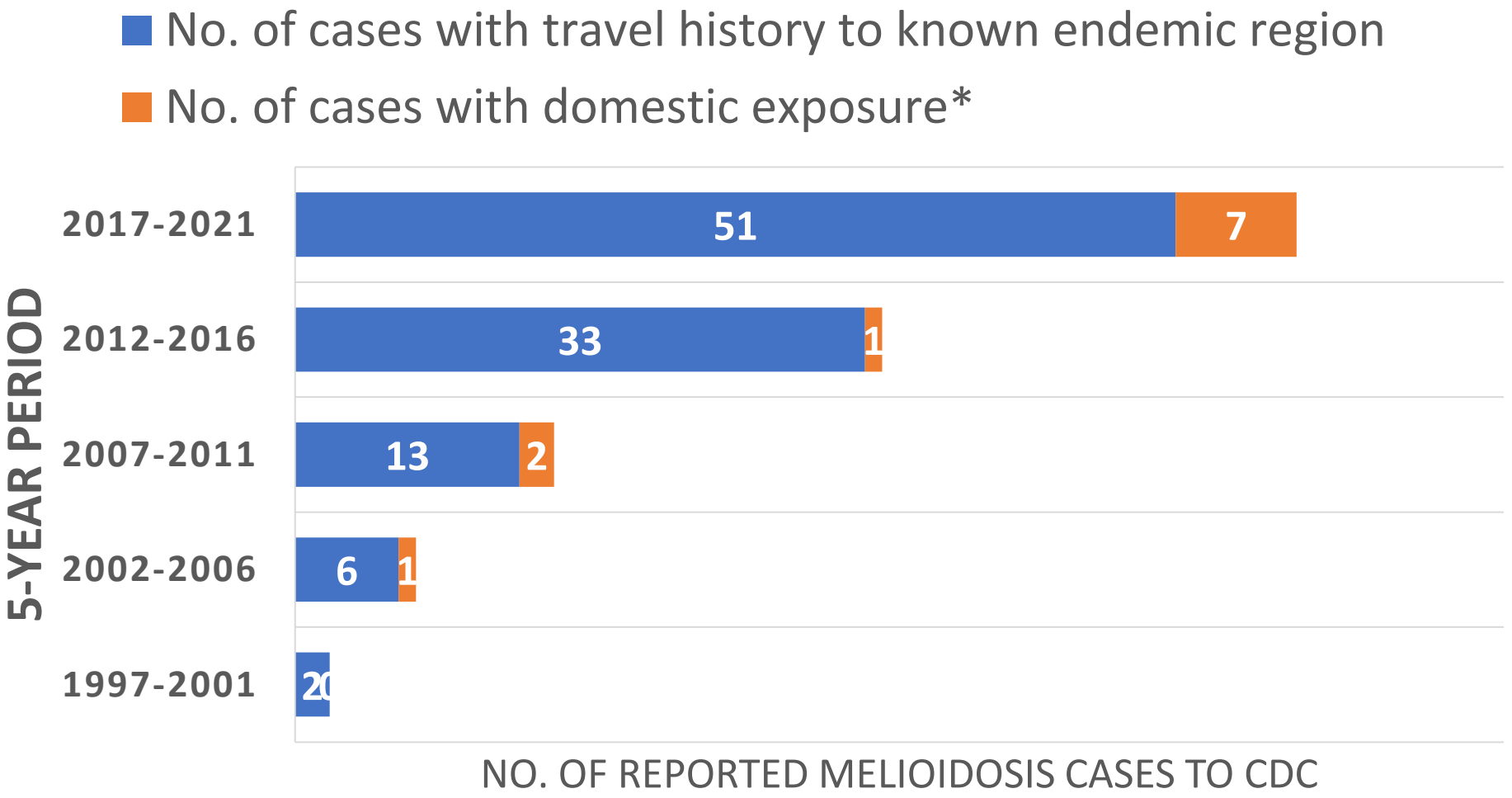
List of Tier 1 Select Agents
Source: https://www.selectagents.gov/sat/list.htm

National surveillance and reporting

- Laboratory Response Network (LRN)
  - *B. pseudomallei* is a Tier 1 select agent and falls under Select Agent Regulations for reporting
  - Sentinel labs can forward cultures to the closest LRN in their state (e.g., reference lab) where *B. pseudomallei* can be confirmed
- CDC's Bacterial Special Pathogens Branch
  - Zoonoses Select Agent Laboratory (ZSAL)
    - Serology, PCR, and culture for *B. pseudomallei*
    - Antimicrobial susceptibility testing for *B. pseudomallei*
    - Whole genome sequencing for *B. pseudomallei*
  - Epi Team – collaborates with ZSAL & collects epi data from state health departments (HD) and assists with case/outbreak investigations



Evolving melioidosis epidemiology in the U.S.



*likely or confirmed domestic exposure based on genomic and epidemiologic data

Domestically acquired melioidosis

Atascosa County, TX

Domestically acquired melioidosis

Atascosa County, TX

MD Home Aquarium Case

Domestically acquired melioidosis

2018 | 2019 | 2020 | 2021 | 2022

Atascosa County, TX

MD Home Aquarium Case

Imported aromatherapy spray associated multistate outbreak

Domestically acquired melioidosis

2018	2019	2020	2021	2022
Atascosa County, TX	MD Home Aquarium Case	MS Case #1 of 2	Imported aromatherapy spray associated multistate outbreak	MS Case #2 of 2

July 27, 2022: CDC Health Advisory 00470

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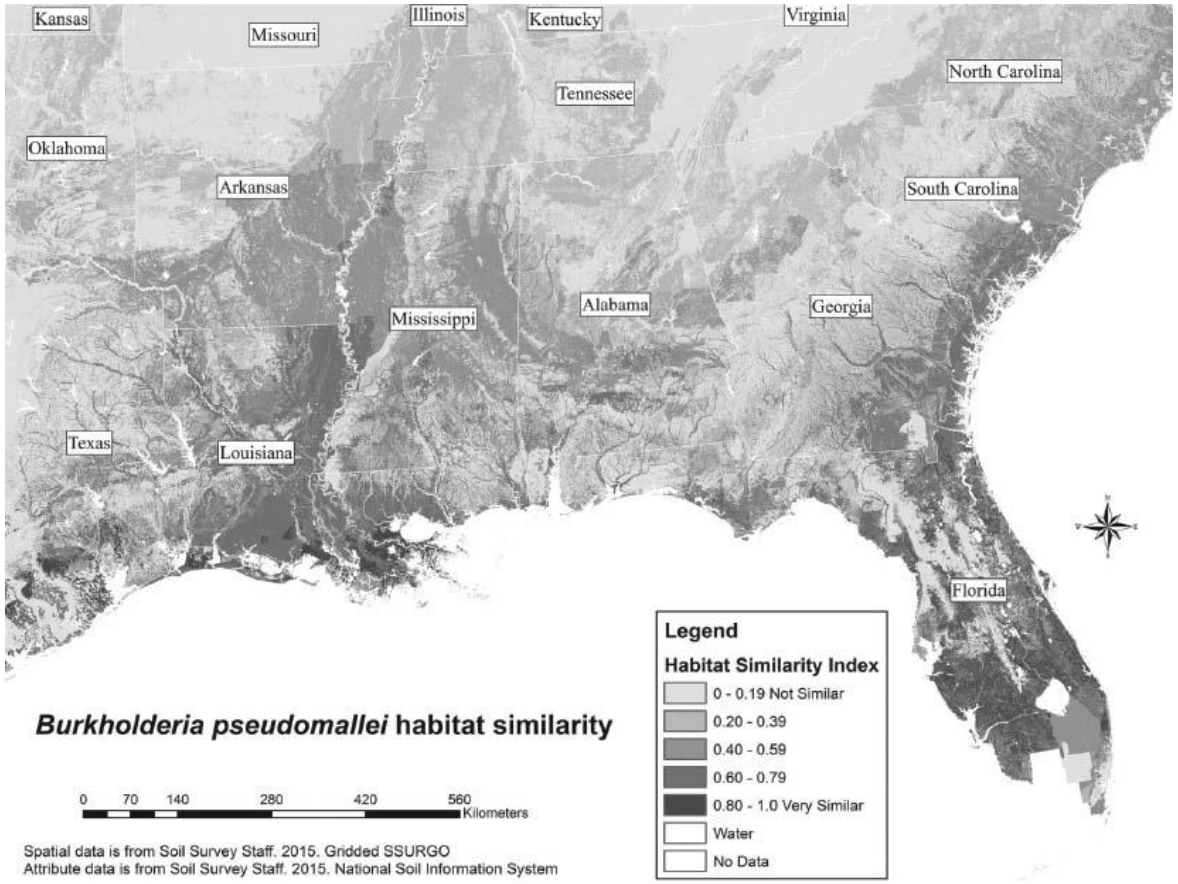
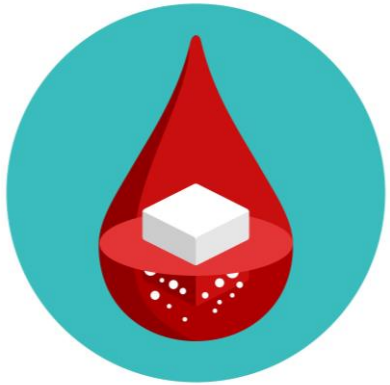
B. pseudomallei is likely more widespread in the southern U.S. according to environmental modeling studies



Source: Portacci, K., Rooney, A. P., & Dobos, R. (2017). Assessing the potential for *Burkholderia pseudomallei* in the southeastern United States, *Journal of the American Veterinary Medical Association*, *250*(2), 153-159.

Risk Factors – clinical

- **Diabetes - #1**
- Excessive alcohol use
- Chronic lung disease
- Chronic renal disease
- Malignancy
- Immunosuppressive therapy or condition (not related to HIV)
- Rheumatic heart disease or congestive cardiac failure
- Chronic liver disease
- Thalassemia



Risk Factors – exposures

- Travel to endemic area (past 30 days)
- Occupational/recreational
  - Gardening
  - Outdoor maintenance/yard work
- Severe weather events
  - Heavy rainfall
  - Aerosolized soil dust
  - Flood water exposure
- Injury or accident with soil or water exposure
  - Outdoor falls, motor vehicle accidents, crush injuries
- Unchlorinated/untreated drinking water

Clinical Presentation

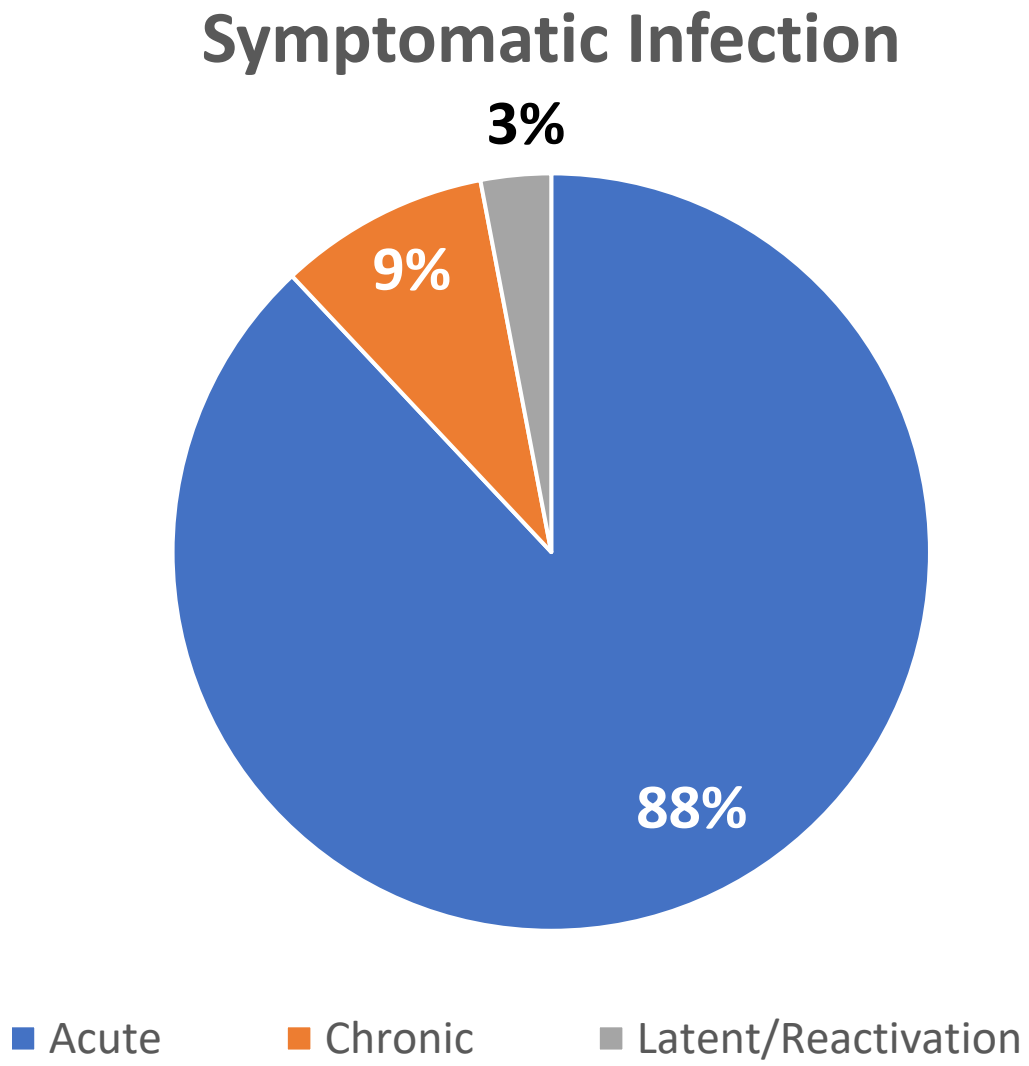
Caroline A. Schrodt, MD, MSPH
Lieutenant Commander, U.S. Public Health Service

Clinical Presentation

- Wide range of clinical presentations
- Known as the great mimicker
- Often confused with tuberculosis
- **Temporality**: Can be acute, chronic, or reactivated
- **Infection site**: Can be localized or disseminated

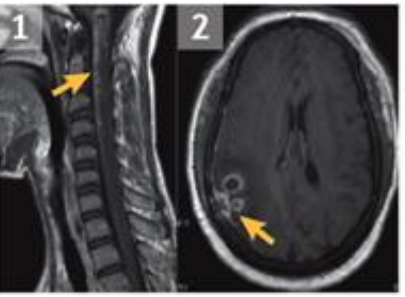
Clinical Presentation

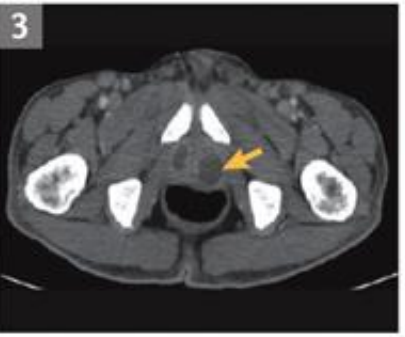
- Most people exposed never develop clinically apparent disease
- **Symptomatic**:
  - Acute, 88%
    - Recent infection
    - Incubation Period 1-21 days (median 4 days)
  - Chronic, 9%
    - Recent infection
    - Sick > 2 months
  - Latent/Reactivation, 3%
    - Reactivation from latent past infection

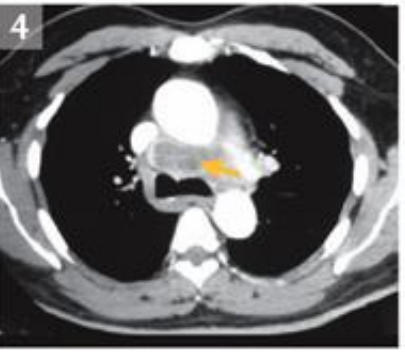


Clinical Manifestations of Melioidosis

Adapted from Figure 4: Wiersinga, W. J. *et al.* (2018) Melioidosis *Nat. Rev. Dis. Primers* doi:10.1038/nrdp.2017.107





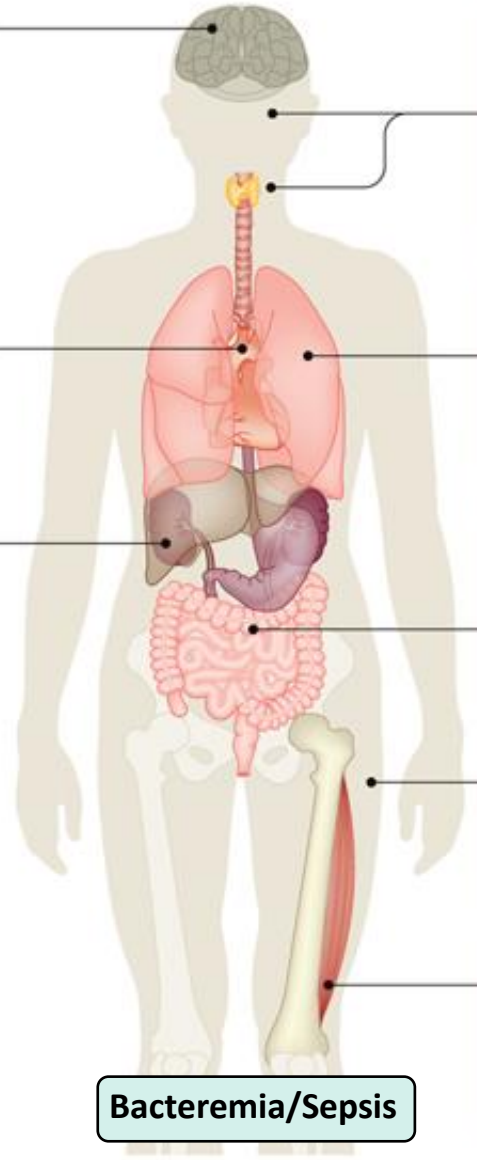


Central nervous system
- Encephalomyelitis
- Brain abscess

Cardiovascular system
- Bacteraemia
- Pericarditis
- Mycotic aneurysm

Urinary tract system
- Acute pyelonephritis
- Kidney abscess
- Prostatic abscess (20% of males in Austrailia)

Other
- Mastitis
- Mediastinal mass
- Corneal ulcer
- Epididymo-orchitis
- Scrotal abscess



Head and neck
- Parotid abscess (30% of children in Thailand)
- Neck abscess
- Lymphadenitis

Respiratory system
- Pneumonia
- Pulmonary abscess
- Pleuritis

Gastrointestinal system
- Liver abscess
- Splenic abscess
- Para-intestinal mass

Skin and soft tissue
- Skin ulcer
- Soft tissue abscess

Musculoskeletal system
- Septic arthritis
- Myositis
- Osteomyelitis

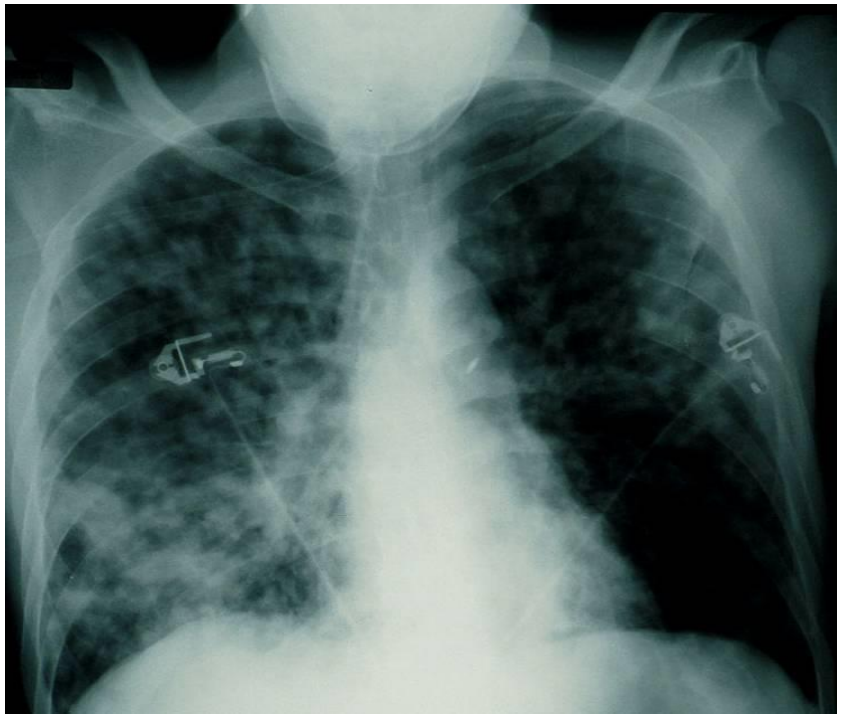
*** Image:** Clinical images 1–4, 6–8 courtesy of Bart J. Currie, Menzies School of Health, Australia. Clinical image 5 is reproduced with permission from Rothe, C. *et al*. *Clinical Cases in Tropical Medicine* (Saunders Ltd., 2014), Elsevier

Signs and Symptoms

- Fever
- Fatigue/Lethargy
- Headache
- Chest pain
- Abdominal pain
- Myalgias
- Weight loss
- Anorexia
- Cough
- Shortness of breath
- Hypoxia
- Respiratory distress
- Dysuria
- Hematuria
- Arthralgias
- Skin ulceration
- Abscesses
  - Cutaneous or internal
  - Single or numerous
- Pain/Swelling
- Erythema
- Altered mental status
- Seizures

The Darwin Prospective Melioidosis Study: a 30-year prospective, observational investigation

- Royal Darwin Hospital (Australia) 1989-2019
- 1148 patients with culture-confirmed melioidosis
- 133 (12%) died
- Median age 50 (IQR 38-60)
- 48 (4%) children < 15 years old
- 576 (50%) older than 50 years old
- 721 (63%) male
- 600 (52%) Indigenous Australians
- All but 186 (16%) had clinical risk factors
  - 513 (45%) had diabetes
  - 455 (40%) alcohol abuse
- 80% of infections occurred during the wet season



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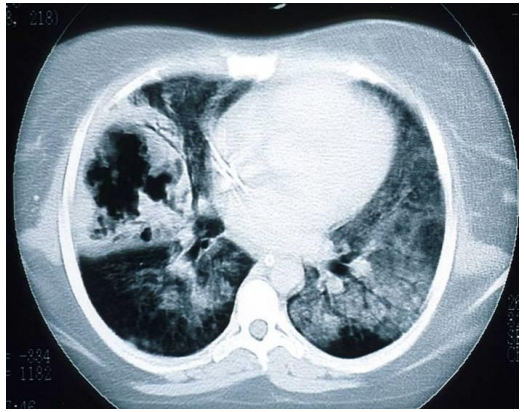
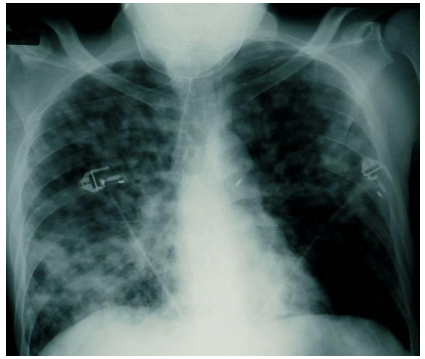
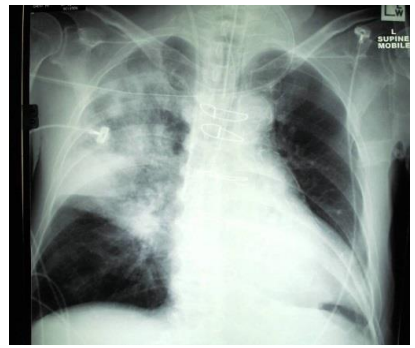
Pneumonia

- The most common primary diagnosis
- 52% (595) presented with pneumonia as primary diagnosis
- Secondary pneumonia developed among 19% of patients with non-pulmonary primary presentations



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Skin Infection

- 13% (149) presented with primary skin melioidosis
- Those with primary skin melioidosis were more likely than those without primary skin melioidosis to have chronic presentations (≥2 months)
- Children more likely than adults to present with skin infection







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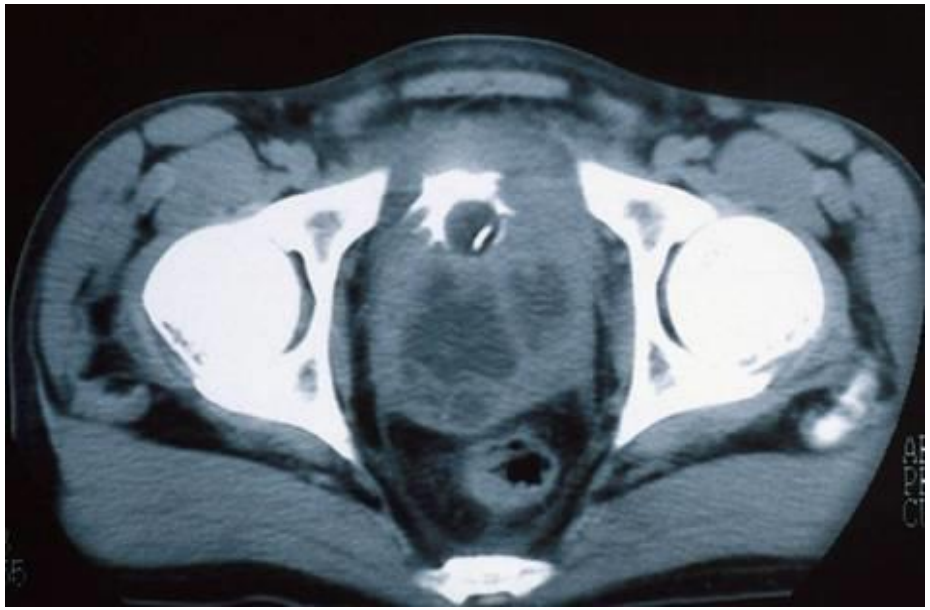
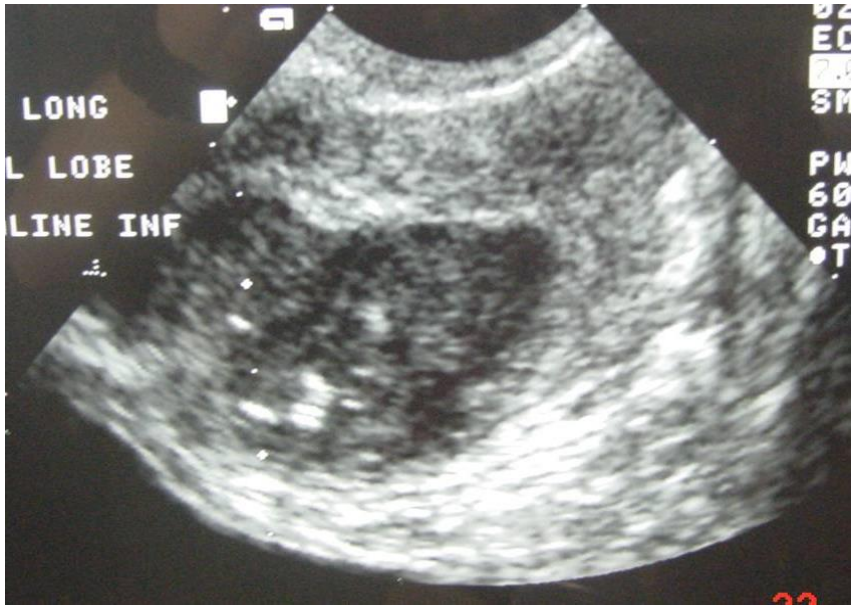
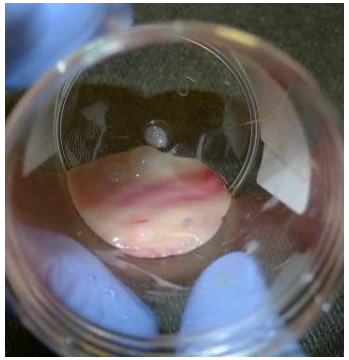
Genitourinary Infection

- 12% (140) presented with genitourinary infection
- Of these 74% (103) were male with prostatic abscesses







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Bacteremia with no evident focus

was present in **11%** (130) of patients

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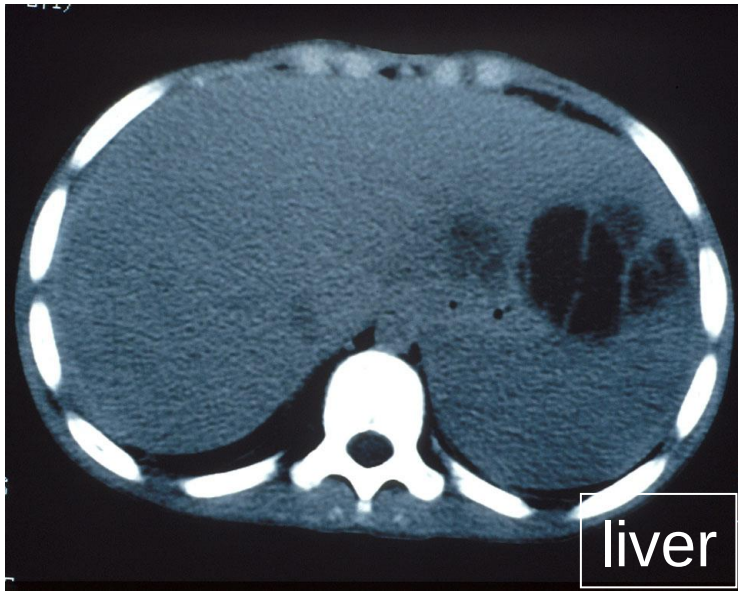
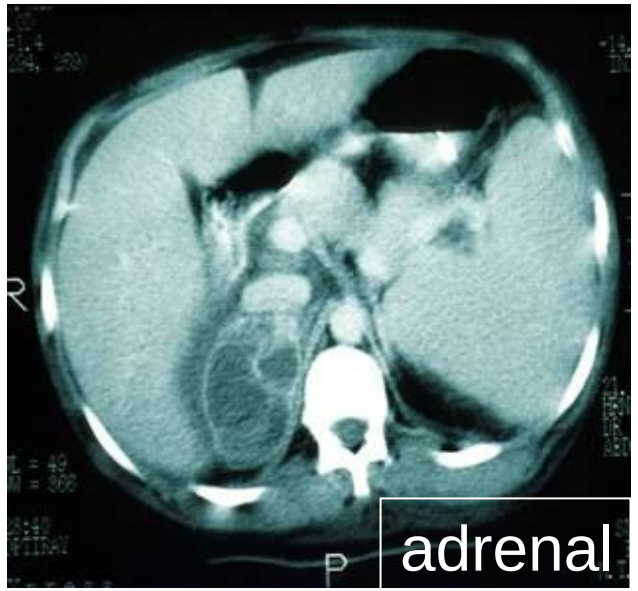
Soft tissue abscess was present in **4%** (46) of patients.





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Neurological disease was present in **2%** (19) of patients

- 11 meningoencephalitis
- 4 cerebral abscesses
- 2 myelitis
- 1 meningitis
- 1 epidural abscess

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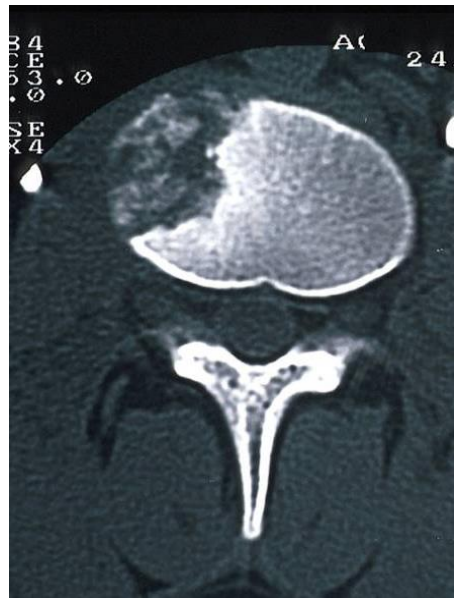
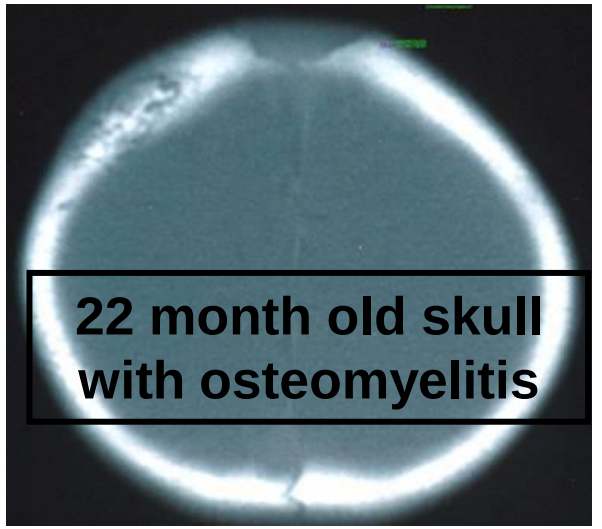
Osteomyelitis was present in 1% (15) of patients.

Septic Arthritis was present in 3% (29) of patients.





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Self-knowledge Check

Which of the following is the most common primary presentation of melioidosis?

A. Cutaneous lesions

B. Abscesses

C. Genitourinary

D. Pneumonia

E. All of the Above

ANSWER: Self-knowledge Check

Which of the following is the most common primary presentation of melioidosis?

A. Cutaneous lesions

B. Abscesses

C. Genitourinary

D. Pneumonia

E. All of the Above

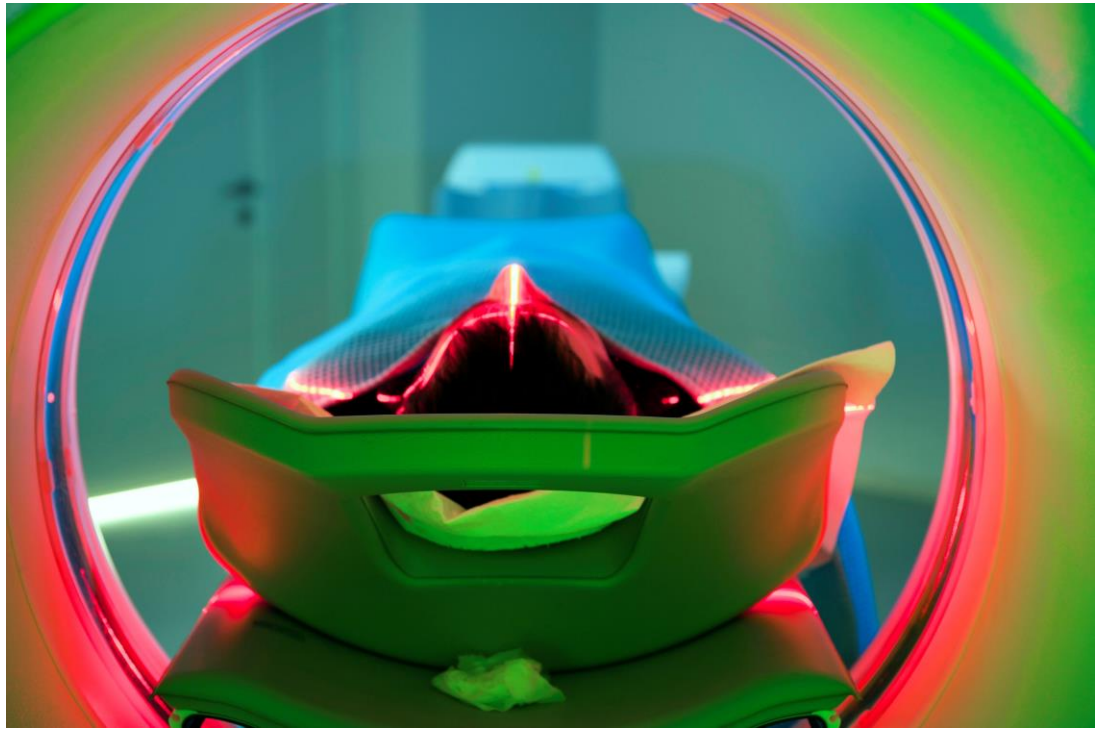
Explanation: Over half of patients with melioidosis present with primary pneumonia. Melioidosis is often mistaken for pulmonary tuberculosis.

Diagnostic Considerations

Julia Petras, MSPH, BSN, RN
Epidemic Intelligence Service (EIS) Officer

Imaging

- Imaging (e.g., CT, US, MRI) should be guided by clinical presentation
- Anyone suspected to have melioidosis:
  - Chest x-ray for all
  - Abdominal imaging for all
    - CT scan abdomen & pelvis to evaluate for abdominal/prostate involvement
    - Abdominal ultrasound in pregnant women and children



- Central Nervous System involvement?
  - MRI preferred over CT

Specimen Collection

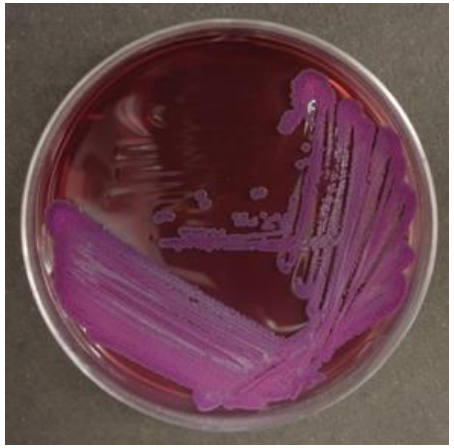
- Anyone suspected to have melioidosis should have blood, sputum, and urine cultures collected
- Additionally, collect specimens from **all** relevant sites of infection, such as:
  - Purulent exudate/pus (skin or internal abscesses)
  - Skin ulcerations
  - Synovial fluid
  - Peritoneal fluid
  - Pericardial fluid
  - Cerebrospinal fluid
  - Throat
  - Rectal
- Consider paired sera taken 2 weeks apart

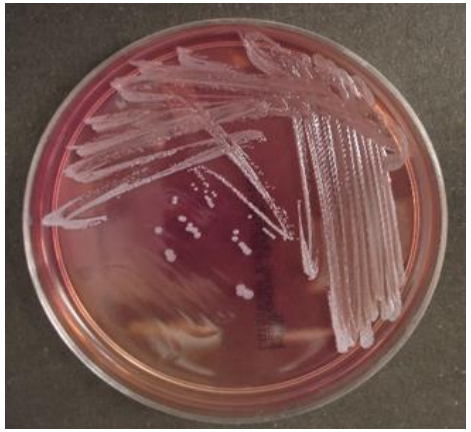
Diagnostics for *B. pseudomallei*

- **Culture** of *B. pseudomallei* from **any specimen** is the gold-standard for diagnosis of melioidosis.
- Diagnosis can be **challenging** as initial cultures may be negative.
- **Serial cultures** should be considered in patients with a strong indication for *B. pseudomallei* infection, as it is common to find subsequent samples positive despite initial negative results.
- Growth of *B. pseudomallei* in blood culture bottles can be detected within 48 hours of incubation

Diagnostics for *B. pseudomallei*

- *B. pseudomallei* can grow on most routine laboratory media and can be isolated from sterile sites using standard techniques.
- Specimens from non-sterile sites can benefit from the use of selective media (e.g. Ashdown's agar) which can promote the growth of *B. pseudomallei* while reducing the growth of other organisms.
- Selective media is considered highly cost effective. It has been reported that 29 patients in one year in SE Asia would not have been diagnosed without the use of selective media.
- Ashdown's agar is the most used selective media but is not commercially available. *Pseudomonas cepacia* (PC) agar is a good alternative and commercially available.





Additional Diagnostic Challenges

- Laboratory automated identification algorithms (e.g., MALDI-TOF, 16s, VITEK-2) may misidentify *B. pseudomallei* as another bacterium.
- Common misidentification for *B. pseudomallei* include:
  - *Burkholderia* spp. (specifically *B. cepacia* and *B. thailandensis*)
  - *Chromobacterium violaceum*
  - *Ochrobactrum anthropi*
  - And sometimes *Pseudomonas* spp., *Acinetobacter* spp., and *Aeromonas* spp.
- If suspicion is high for melioidosis, contact your local/state public health department to facilitate forwarding isolates presumptively identified as the above species for advanced diagnostics (e.g., Laboratory Response Network)

Presumptive Diagnostics for *B. pseudomallei*

- **Serology**
  - Indirect Hemagglutination Assay (IHA) is the most commonly used assay.
  - Available only at CDC
  - Cannot distinguish between past exposure, latent infection, or active disease
  - Only presumptive
  - Paired specimens taken two weeks apart may be useful for diagnosis
- **PCR**
  - Poor success with clinical specimens
  - Useful with clinical isolates
  - Only presumptive

Self-knowledge Check

Which of the following is *B. pseudomallei* commonly misidentified as on automated systems?

A. *B. cepacia*

B. B. thailandensis

C. *E. coli*

D. Both A and B

ANSWER: Self-knowledge Check

Which of the following is *B. pseudomallei* commonly misidentified as on automated systems?

A. *B. cepacia*

B. B. thailandensis

C. *E. coli*

D. Both A and B

Treatment

Caroline A. Schrodt, MD, MSPH
Lieutenant Commander, U.S. Public Health Service

Treatment

- Many antibiotic treatment regimens are not sufficient
- Intrinsically resistant to penicillin, ampicillin, first- and second-generation cephalosporins, gentamycin, tobramycin, streptomycin
- Susceptible to beta-lactams, carbapenems, trimethoprim-sulfamethoxazole (TMP-SMX), and doxycycline*
- *Resistance during therapy has emerged with all antibiotics
- Consultation with infectious disease specialists is strongly recommended

Sullivan, R.P. et al. *2020 Review and revision of the 2015 Darwin melioidosis treatment guideline; paradigm drift not shift*. PLoS Negl Trop Dis 14,9 e0008659. 28 Sep. 2020, doi:10.1371/journal.pntd.0008659

Lipsitz, R., et al. *Workshop on treatment of and postexposure prophylaxis for Burkholderia pseudomallei and B. mallei infection*, 2010. Emerg Infectious Dis 18,12 (2012): e2. doi:10.3201/eid1812.120638

Treatment (continued)

- High rate of treatment failure/relapse without long-term antibiotic therapy
- Long-term antibiotic therapy consists of 2 phases:
  - Acute phase
  - Eradication phase

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Lipsitz, R., et al. *Workshop on treatment of and postexposure prophylaxis for Burkholderia pseudomallei and B. mallei infection*, 2010. Emerg Infectious Dis 18,12 (2012): e2. doi:10.3201/eid1812.120638

The acute phase always involves intravenous (IV) antibiotics

- At least 2 weeks of IV antibiotics, even for mild cases
- Up to 8 weeks of IV antibiotics may be required
- Ceftazidime preferred
- Use Meropenem or Imipenem for critically ill patients requiring intensive care

- Higher doses required if involvement of the central nervous system

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Lipsitz, R., et al. *Workshop on treatment of and postexposure prophylaxis for Burkholderia pseudomallei and B. mallei infection*, 2010. Emerg Infectious Dis 18,12 (2012): e2. doi:10.3201/eid1812.120638

The acute phase sometimes involves oral antibiotics

- Patients with non-pulmonary focal sites of infection should receive:
  - Concurrent oral trimethoprim-sulfamethoxazole (TMP-SMX)

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Transition from **Acute** to **Eradication** phase

- In patients for whom concurrent oral antibiotic therapy is not indicated during the entire acute phase:
  - The oral eradication phase should start during the final week of the acute phase
  - Eradication therapy starts the day after the last intravenous therapy

Sullivan, R.P. et al. *2020 Review and revision of the 2015 Darwin melioidosis treatment guideline; paradigm drift not shift*. PLoS Negl Trop Dis 14,9 e0008659. 28 Sep. 2020, doi:10.1371/journal.pntd.0008659

Lipsitz, R., et al. *Workshop on treatment of and postexposure prophylaxis for Burkholderia pseudomallei and B. mallei infection*, 2010. Emerg Infectious Dis 18,12 (2012): e2. doi:10.3201/eid1812.120638

The eradication phase involves prolonged oral antibiotics

- At least 3 months of oral antibiotics for all cases
- Up to 6 months* of oral antibiotics may be required
- *Longer courses and sometimes lifelong antibiotics may be required
- Duration < 3 months associated with higher rate of relapse

- Trimethoprim-sulfamethoxazole (TMP/SMX) preferred
- Amoxicillin/clavulanic acid alternative

Sullivan, R.P. et al. *2020 Review and revision of the 2015 Darwin melioidosis treatment guideline; paradigm drift not shift*. PLoS Negl Trop Dis 14,9 e0008659. 28 Sep. 2020, doi:10.1371/journal.pntd.0008659

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Additional Treatment Modalities

- Abscess drainage, particularly for prostatic abscesses

- Post-Exposure Prophylaxis, 21 days
  - Trimethoprim-sulfamethoxazole (TMP/SMX) preferred
  - Amoxicillin/clavulanic acid alternative

Lipsitz, R., et al. *Workshop on treatment of and postexposure prophylaxis for Burkholderia pseudomallei and B. mallei infection*, 2010. Emerg Infectious Dis 18,12 (2012): e2. doi:10.3201/eid1812.120638

Self-knowledge Check

Which of the following should be taken into consideration during treatment of melioidosis?

A. Severity of illness

B. Organ systems involved

C. Resistance to antibiotics

D. Duration of treatment

E. All of the Above

ANSWER: Self-knowledge Check

Which of the following should be taken into consideration during treatment of melioidosis?

A. Severity of illness

B. Organ systems involved

C. Resistance to antibiotics

D. Duration of treatment

E. All the Above

Explanation: Severity of illness, involvement of certain organ systems, resistance to antibiotics, and duration of treatment all are important considerations during treatment of melioidosis.

Prevention & Key Messaging

Julia Petras, MSPH, BSN, RN
Epidemic Intelligence Service (EIS) Officer

Key Messages for patients at-risk* for melioidosis

* patients with risk factors who travel to or live in a known (Gulf Coast MS, Puerto Rico, USVI) or potential melioidosis-endemic area (other Gulf Coast States)

1. Protect skin contact with soil or muddy water

   - Protect open wounds, cuts, or burns from coming into contact with soil or water by using waterproof bandages. If open wounds, cuts, or burns come into contact with soil, wash them thoroughly
   - Wear footwear and use gloves when gardening or working outdoors (e.g., doing yard work, agricultural work)

2. Avoid walking through flood water and working with soil during or following severe weather events/heavy rain

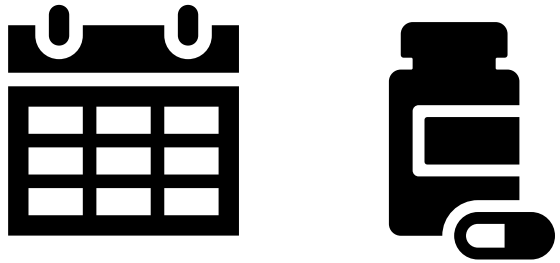
   - Wear waterproof boots during and after flooding or storms if working or playing outside which can prevent infection through the feet and lower legs

3. Drink safe water

   - Do not drink water directly from shallow wells, lakes, rivers, ponds, and streams

Key messages for patients diagnosed with melioidosis

- **Melioidosis is treatable with antibiotics but can come back if the full course is not completed in entirely.**
  - Complete full course of oral antibiotics to prevent reoccurring/relapse infection



What is CDC doing to learn more about melioidosis in the U.S.?

Julia Petras, MSPH, BSN, RN
Epidemic Intelligence Service (EIS) Officer

Domestic Melioidosis Surveillance

- Laboratory Response Network (LRN)
- CDC's Nationally Notifiable Diseases Surveillance System
  - Recently added to Nationally Notifiable Disease list
  - Jurisdictions should report to CDC w/in 24 hours of a case
  - Reporting requirement differs by jurisdiction
- CDC's Bacterial Special Pathogens Branch
  - Epi Team
  - Zoonoses Select Agent Laboratory (ZSAL)

Research Questions & Study Needs

- How widespread is *B. pseudomallei* in the continental U.S.?
  - Environmental sampling survey in Gulf Coast states
  - Serosurvey in Gulf Coast region to estimate seroprevalence (compare to non-endemic region)
  - Retrospective chart review of hospitalized patients in Gulf Coast MS between 2020 and 2022 to look for potentially missed cases
- What are the risk factors for domestically acquired melioidosis in the U.S.?
  - Active surveillance study in Gulf Coast states
  - Routine national surveillance data analysis

Summary: 5 take-away points

- Consider melioidosis in patients with a compatible illness who reside in or have traveled to the Gulf Coast region of the southern United States or areas where *B. pseudomallei* has historically been endemic.
- Given risk of melioidosis associated with exposure to imported products, consider melioidosis in patients with compatible illness, even if they do not have a history of travel to melioidosis-endemic areas.
- Report melioidosis cases to your local/state health departments. Contact your state health department if you have any questions or suspect a patient may be infected with *B. pseudomallei.* They can facilitate forwarding cultures to the closest reference lab for confirmation of *B. pseudomallei.*
- Keep trying to culture if high suspicion.
- Call CDC when in doubt.

Additional Resources

Resources

- Local endemicity in U.S.: HAN 00470
  - https://emergency.cdc.gov/han/2022/han00470.asp
- CDC Melioidosis Webpage- general information
  - https://www.cdc.gov/melioidosis/index.html
- Imported aromatherapy spray associated melioidosis outbreak
  - https://www.nejm.org/doi/full/10.1056/NEJMoa2116130
  - https://emergency.cdc.gov/han/2021/han00456.asp
  - https://emergency.cdc.gov/han/2021/han00455.asp
  - https://www.cpsc.gov/Recalls/2022/Walmart-Recalls-Better-Homes-and-Gardens-Essential-Oil-Infused-Aromatherapy-Room-Spray-with-Gemstones-Due-to-Rare-and-Dangerous-Bacteria-Bacteria-Identified-in-this-Outbreak-Linked-to-Two-Deaths
- Largest and most current clinical and epidemiological data for melioidosis based on patients in hyperendemic Northern Territory, Australia
  - https://www.sciencedirect.com/science/article/pii/S147330992100220?via%3Dihub

Resources

- For technical clinical questions related to melioidosis, contact CDC's Bacterial Special Pathogens Branch:
  - Email: bspb@cdc.gov
  - Phone: 404-639-1711
  - Urgent inquiries: CDC 24/7 Emergency Operations Center at 770-488-7100
- Diagnostic testing for melioidosis at ZSAL:
  - https://www.cdc.gov/ncezid/dhcpp/bacterial_special/zoonoses_lab.html
- CSTE melioidosis case definition for public health surveillance
  - https://cdn.ymaws.com/www.cste.org/resource/resmgr/ps/ps2022/22-ID-08_Melioidosis.pdf

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- Mississippi State Department of Health
  - Dr. Paul Byers
  - Jennifer Hanson
  - Carla Boutwell
  - Gail Answorth
- Menzies School of Health Research
  - Dr. Bart Currie

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

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Joining the Q&A Session

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