

Emerging Infections 2019

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What's New In Medicine

September 2019

Disclosures

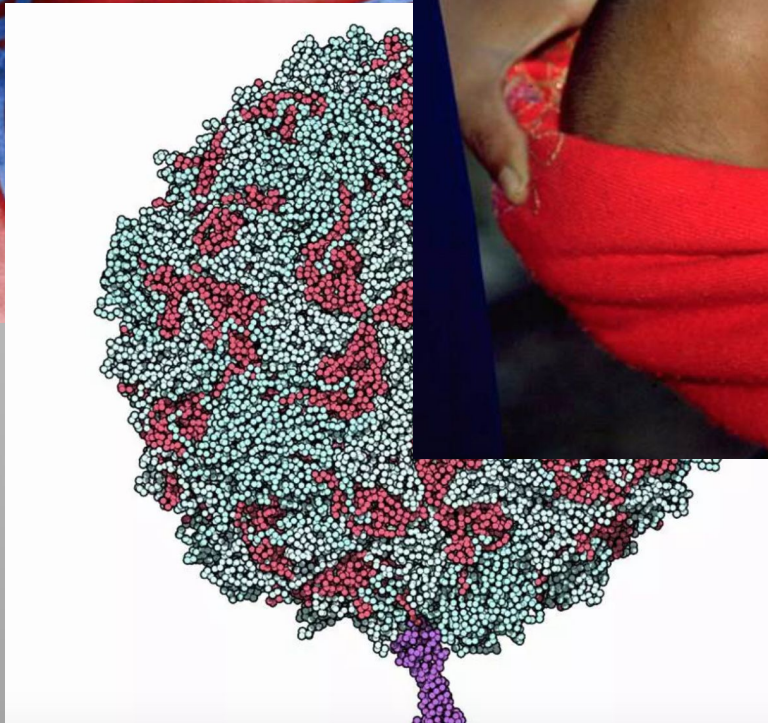
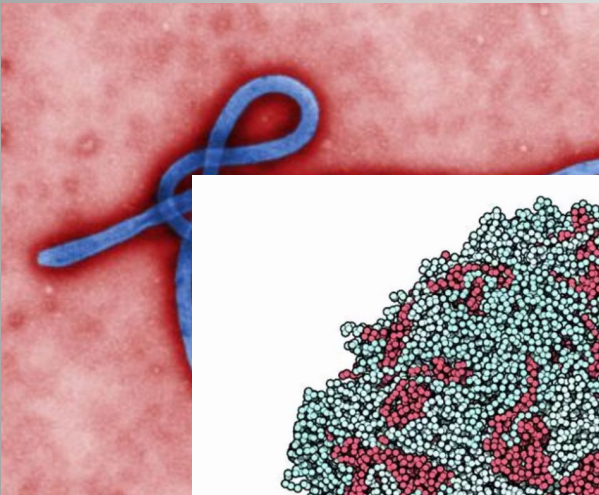
No relevant financial relationships with commercial interests to disclose

Objectives

- Discuss epidemiology, presentation, diagnosis and management of emerging infectious diseases in 2019
- Discuss pathogens with potential to give rise to future epidemics



PHOTO: JIMMY SUZUKI / IMAGES GETTY IMAGES / IMAGES



Environmental changes	Example diseases	Pathway of effect
Dams, canals, irrigation	Schistosomiasis	▲ Snail host habitat, human contact
	Malaria	▲ Breeding sites for mosquitoes
	Helminthiasis	▲ Larval contact due to moist soil
	River blindness	▼ Blackfly breeding, ▼ disease
Agricultural intensification	Malaria	Crop insecticides and ▲ vector resistance
	Venezuelan haemorrhagic fever	▲ rodent abundance, contact
Urbanization, urban crowding	Cholera	▼ sanitation, hygiene; ▲ water contamination
	Dengue	Water-collecting trash, ▲ <i>Aedes aegypti</i> mosquito breeding sites
	Cutaneous leishmaniasis	▲ proximity, sandfly vectors
Deforestation and new habitation	Malaria	▲ Breeding sites and vectors, immigration of susceptible people
	Oropouche	▲ contact, breeding of vectors
	Visceral leishmaniasis	▲ contact with sandfly vectors
Reforestation	Lyme disease	▲ tick hosts, outdoor exposure
Ocean warming	Red tide	▲ Toxic algal blooms
Elevated precipitation	Rift valley fever	▲ Pools for mosquito breeding
	Hantavirus pulmonary syndrome	▲ Rodent food, habitat, abundance

Ebola

- Ebola virus disease (EVD)
 - First recognized in 1976 in Sudan and DRC
- Transmitted from wild animals but spreads through human-to-human transmission
- EVD case fatality is ~ 50%

Ebola

The New York Times

GLOBAL HEALTH

A Cure for Ebola? Two New Treatments Prove Highly Effective in Congo

The therapies saved roughly 90 percent of the patients who were newly infected, a turning point in the decades-long fight against the virus.

HEALTH NEWS AUGUST 25, 2019 / 6:24 AM / 2 DAYS AGO



REUTERS

Congo has given over 200,000 people Merck Ebola vaccine: government

MERS-CoV

2 458

• Middle East Respiratory Syndrome
Coronavirus

Since September 2012, WHO has been notified of 2458 laboratory-confirmed cases of infection with MERS-CoV.

- First reported in 2012 in Saudi Arabia

- Source ? Camels

848

- Symptoms – ranging from cold to severe respiratory distress

848 MERS-CoV associated deaths have occurred since September 2012.

- ~35% of patients with MERS have died
- Human-to-human transmission

27

Since September 2012, 27 countries have reported cases of MERS-CoV

MERS

- Only 2 cases reported in the US in 2014
 - Indiana and Florida
 - Both healthcare workers who came to US from Saudi Arabia
- Consider dx in patients coming from Middle East with respiratory symptoms

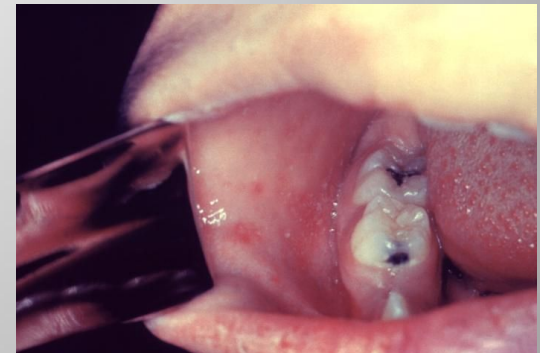


Case

23 year old man who presents with maculopapular rash which began on his face and spread down his body. He states he had fever and mild cough prior to onset of rash. He visited family in Vancouver, Washington a few days ago and returned to Spokane area where he resides. No travel outside US.

Measles: Clinical Presentation

- High fever, cough, conjunctivitis, coryza (3 Cs)
- +/- Koplik spots
- Rash
 - Top to bottom
 - 4 days after symptoms start
- Potential serious complications
 - Encephalitis (1/1000)
 - Pneumonia (1/20)
 - Subacute sclerosing panencephalitis (SSPE) (1/1000)
 - Death (1-2/1000)

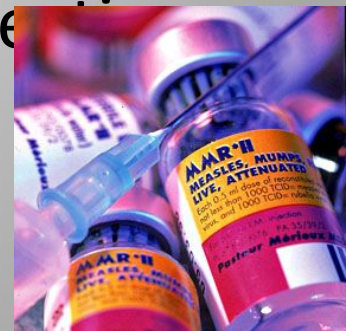


Measles: Transmission

- Incubation period 7-21 days
- Contagious 4 days before to 4 days after the rash appears
- 9/10 susceptible people with close contact develop measles
- Spread by direct or airborne contact with infectious droplets
- Measles virus can remain infectious on surfaces and in the air for up to 2 hours after an infected person leaves an area

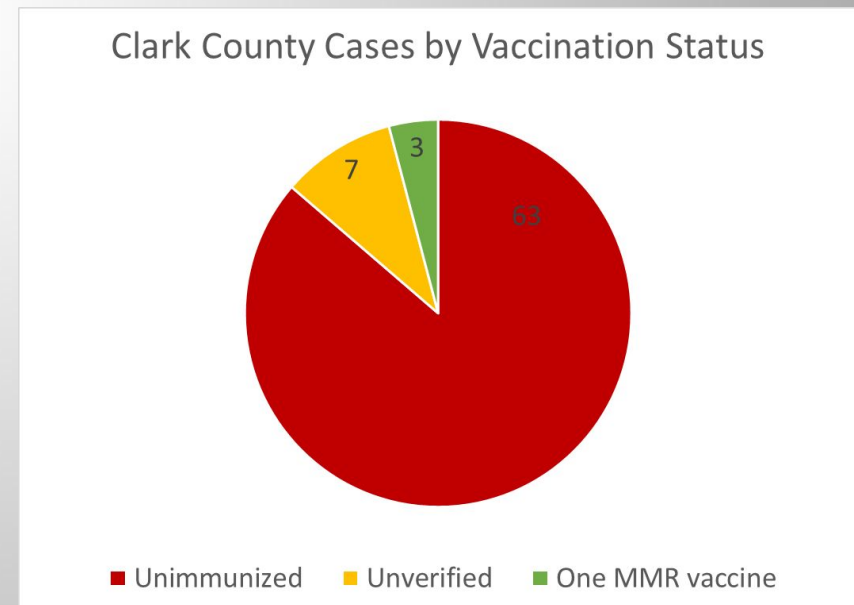
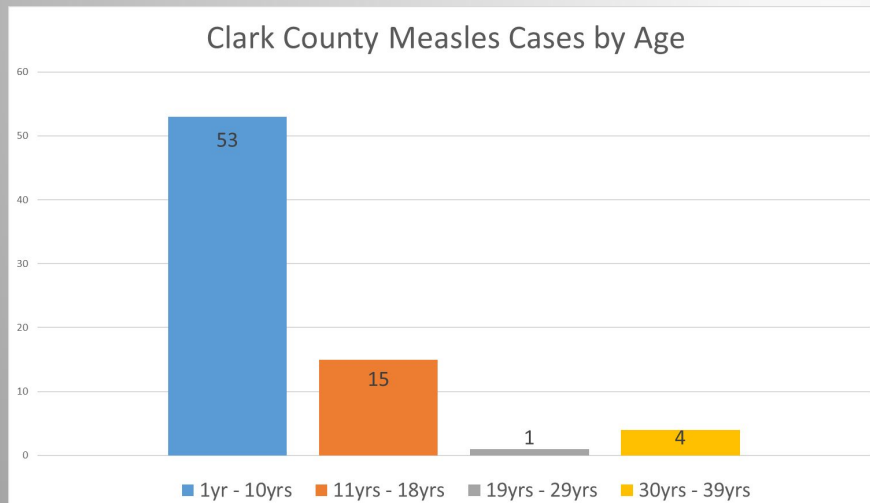
Measles: Immunization & Efficacy

- Licensed in 1963
 - Inactivated vaccination from 1963-1967 □ live attenuated
 - Revaccinate those who received inactivated (killed) vaccine
- Usually administered as MMR or MMRV
- One dose of MMR: approximately 93% effective
- Two doses of MMR: approximately 97% effective
- Two doses recommended since 1989

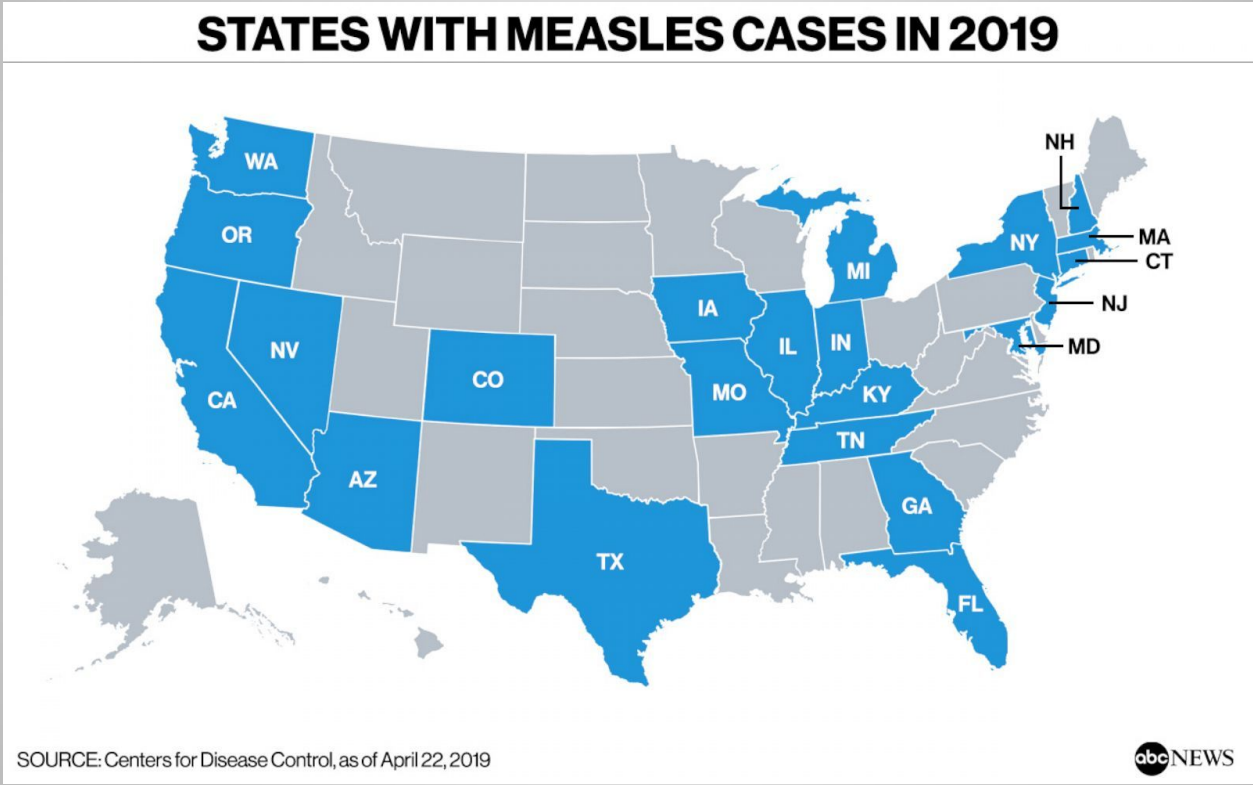


2019 Measles Outbreak: Epidemiology, Washington

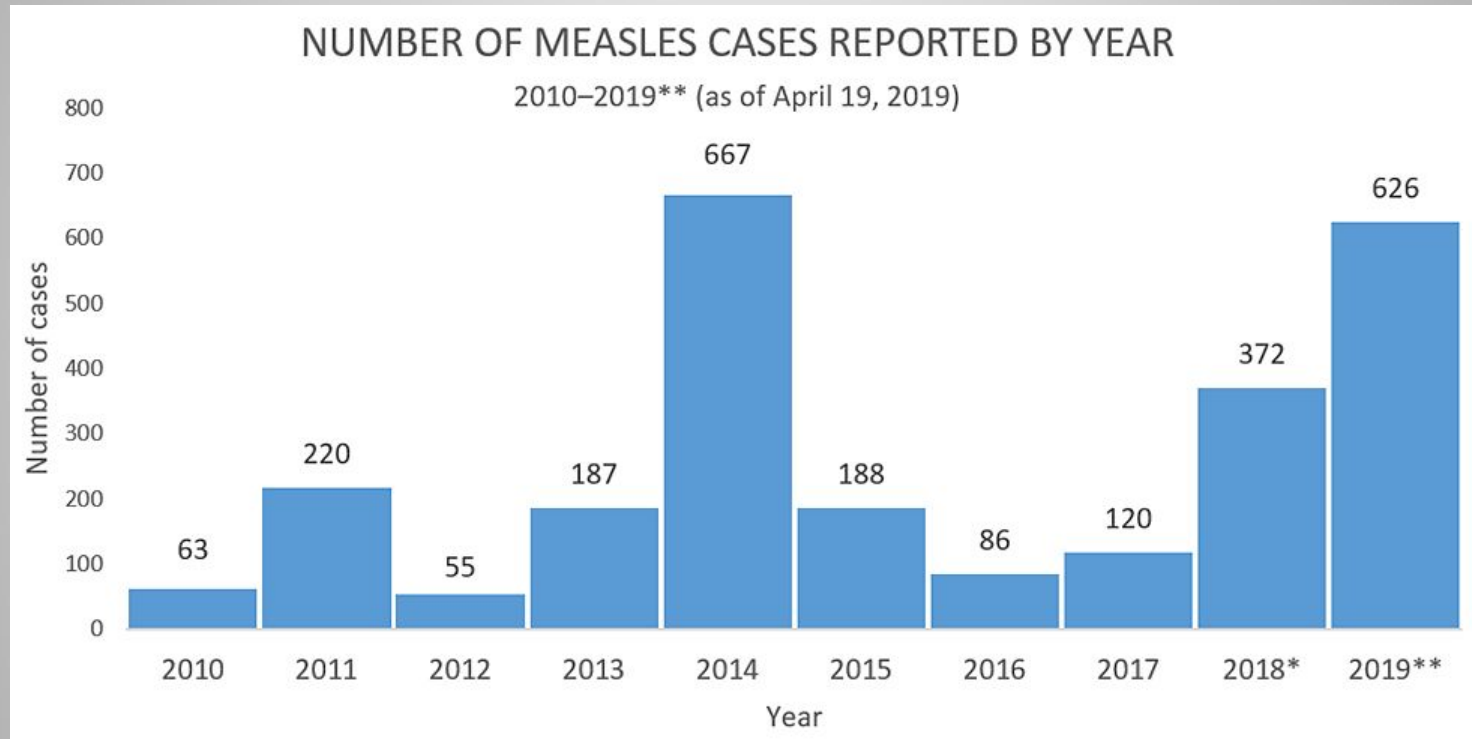
- 73 cases in Clark County, WA
- 1 case in King County



2019 Measles Outbreak: Epidemiology



2019 Measles Outbreak: Epidemiology



2019 Measles Outbreak: Transmission

- 9 in 10 exposed will contract
- Direct contact with droplets
- Airborne spread – up to 2hrs

>90% vaccination
to stop spread

Most infectious:

- 4 days BEFORE
- 4 days after symptoms start

2019 Measles Outbreak

- People at high risk
 - Infants and children <5yrs
 - Adults over 20ys
 - Pregnant women
 - Immunocompromised
- Complications
 - 1 in 4: hospitalization
 - 1 in 1000: acute encephalitis
 - 1-2 in 1000: death from respiratory and neuro complications
 - Sub-acute sclerosing panencephalitis (SSPE)
 - Fatal neurodegeneration
 - 7-10 years after infection

Question

Which of the following is most appropriate if measles is suspected?

A. Place in airborne precautions

B. Place in contact precautions

C. Place in both respiratory and contact precautions

2019 Measles Outbreak: Suspected Case

- Mask and isolate the patient
 - Airborne AND Contact precautions
 - Gown
 - Gloves
 - N95
 - Negative pressure room if available
 - If not available do NOT use the room for 2hrs after the patient leaves
- Call the local health dept to arrange testing **WHILE THE PATIENT IS THERE**
- Collect specimens
 - Nasopharyngeal swab (PCR)
 - Clean urine (PCR)
 - Serum (IgM and IgG)

2019 Measles Outbreak: Vaccine Facts

- MMR or MMRV – live virus vaccine
- Give at 12mos
 - If given younger, revaccinate at 12mos



Effectiveness

- 93% effective after 1 dose
- 97% effective after 2 doses
- Immunity is lifelong

Contraindications to vaccination

- Known pregnancy
- CD4 <200 cells/ μ L
- Known severe immunodeficiency

2019 Measles Outbreak: Quick Facts

Do I need to have my titer checked?

- Not if you were vaccinated

Evidence of presumptive immunity

- Written documentation of adequate vaccination
 - 1+ doses of vaccine at ≥ 12 mos
 - Pre-school age
 - Adults not at high risk
 - 2 doses
 - School age children
 - College students
 - Healthcare personnel
 - International travelers
- Lab evidence of immunity
- Lab confirmation of measles disease
- Birth prior to 1957

Measles: Lessons Learned From Outbreak

- Know the signs/symptoms of measles
- Isolate early if suspicion for infection
- Communicate with public health about suspected case



Case

35 year old man who is living homeless presents with abdominal pain and jaundice. He injects heroin daily. He notes that others have been ill in the tent community where he stays.

Hepatitis A

- RNA virus
- Fecal-oral transmission
- Vaccine is highly effective, >95% protection
- No chronic phase of illness – acute only
- Can lead to fulminant hepatitis

Hepatitis A – clinical manifestations

- Symptoms start usually 4 weeks after exposure (range 2-7 weeks)
- Symptoms include:
 - Fever
 - Fatigue
 - Nausea/Vomiting
 - Diarrhea
 - Clay-colored stools
 - Jaundice

Hepatitis A: On the Rise!

- > 15,000 cases of acute hepatitis A reported to CDC between 2016-2018
- Nearly 300% increase compared to 2013-2015
- Majority of cases seen in people living homeless and PWID

Hepatitis A

According to the CDC, which state has experience >500% increase in the number of hepatitis A cases?

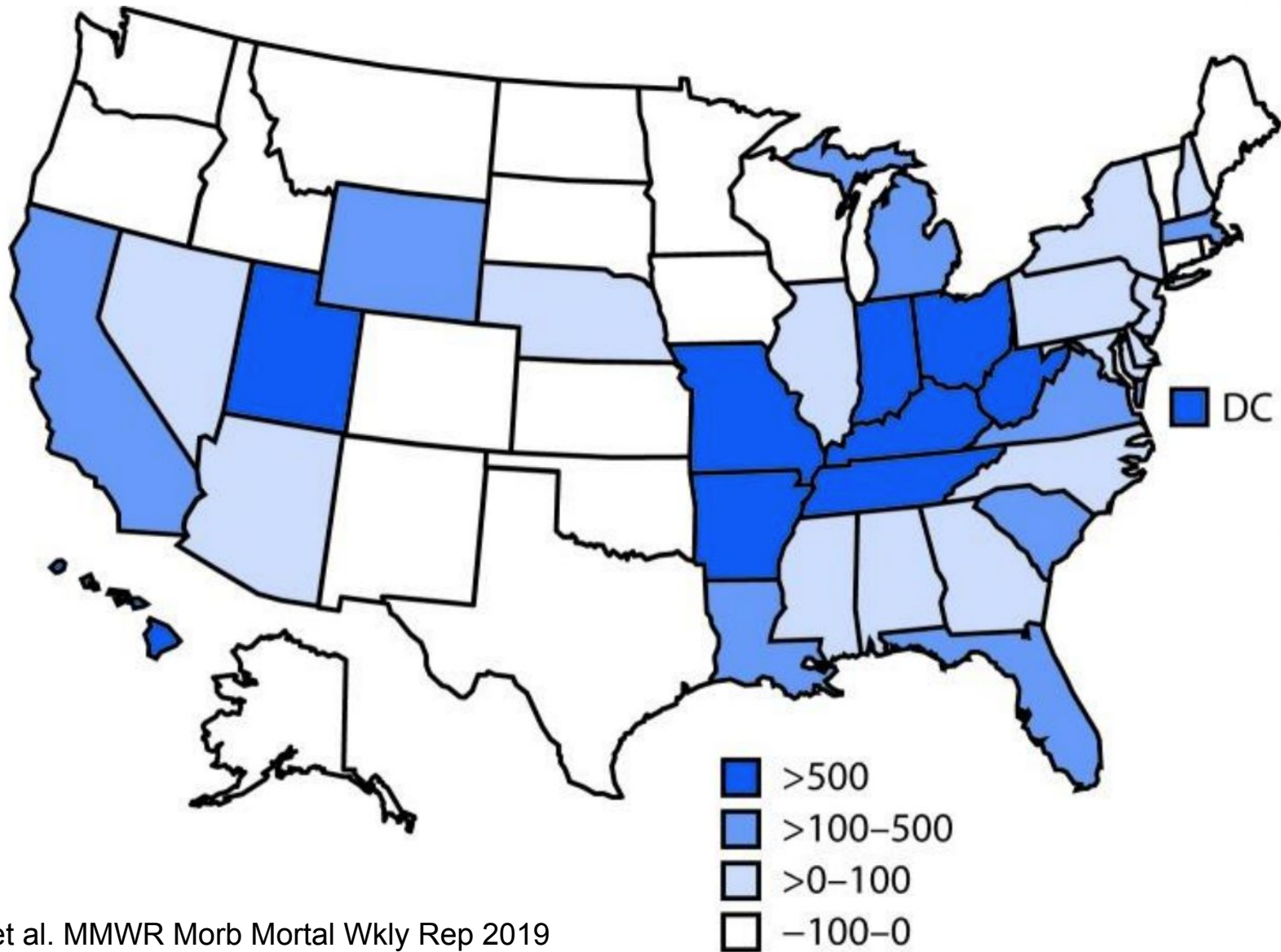
1. Washington

2. Texas

3. Kentucky

4. Georgia

Hepatitis A



California Outbreak

Jurisdiction	Cases	Hospitalizations	Deaths
San Diego	576	395	20
Santa Cruz	76	33	1
Los Angeles	12	8	0
Other	24	13	0
Total	688	449	21

What about Washington State?

From

Hepatitis A outbreak among homeless, drug users hits 4 Wash. counties

by KOMO New Staff | Tuesday, July 30th 2019

AA

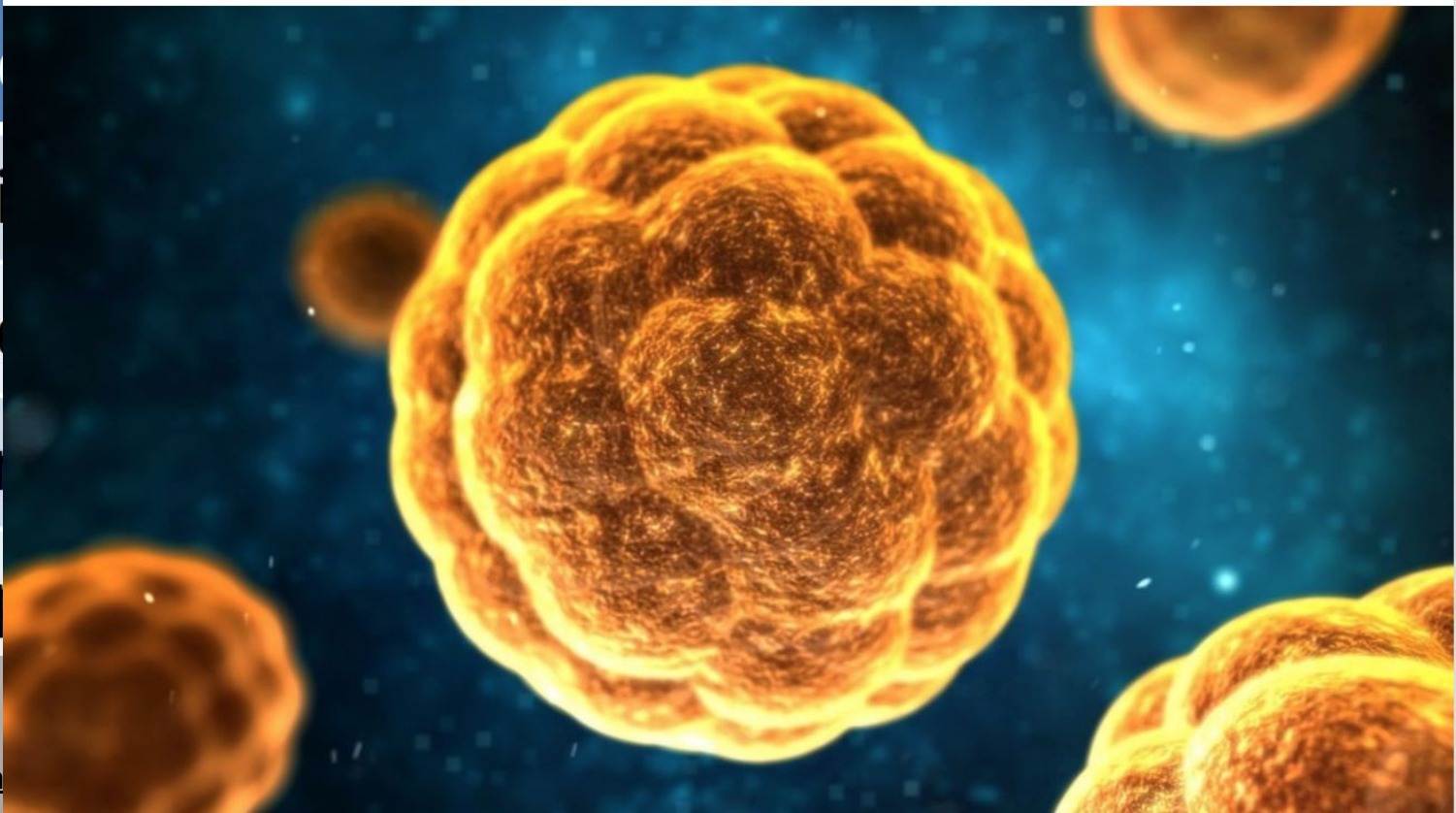
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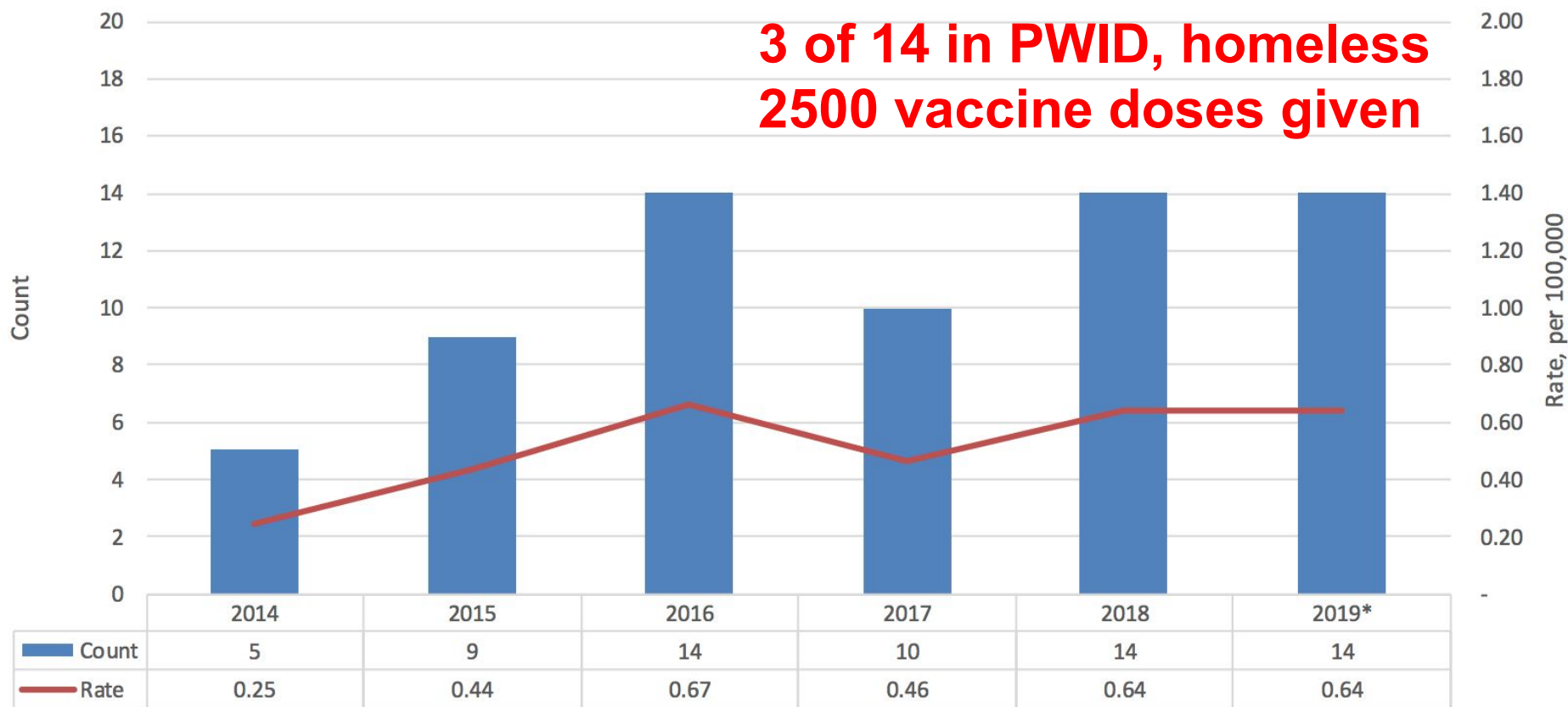
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Hepatitis A: King County Experience

Confirmed hepatitis A cases among King County residents, 2014-2019



*2019 as of July 31st, 2019, rates use 2018 population data

Hepatitis A: What can we do?

VACCINATE!!!

Hepatitis A: Who to Vaccinate

- Experiencing homelessness
- Involved in or exposed to a hepatitis A outbreak
- Traveling or working in countries in which hepatitis A is common
- Working in research with hepatitis A
- In sexual relationship with an infected person
- Have chronic liver disease
- Use illicit drugs
- Men who have sex with men
- Have clotting disorder (ie hemophilia)

CLEANING TO KILL HEPATITIS A

- **ATTENTION: A person living homeless in King County was recently hospitalized with hepatitis A (hep A)**
- **Hep A is very contagious**
- **Special cleaning and disinfecting is important to prevent hep A from spreading**

DISINFECT SURFACES THAT PEOPLE TOUCH A LOT



All bathroom surfaces



All kitchen surfaces



Anything else people touch a lot

USE BLEACH + WATER TO KILL HEPATITIS A



Most cleaning products don't kill hep A



Bleach kills hep A. Always mix bleach with water

To check if a different product kills hep A, read the label. The product label should say "effective against hepatitis A" or "effective against feline calicivirus." Follow instruction on the label.

HOW TO USE BLEACH TO DISINFECT FOR HEPATITIS A



1. Protect yourself from the bleach: Wear gloves and a mask



2. Get air flowing: Open windows or use a fan



3. Clean surfaces: Use soapy water



4. Disinfect surfaces:

If using 8.25% bleach: mix 1 cup bleach with 1 gallon water.
If using 5.25% bleach: mix 1.5 cups bleach with 1 gallon water.



5. Let it sit: Apply bleach mix, leave for 1-2 minutes



6. Rinse with water. Dry with paper towel or air dry

Don't save your bleach + water mix. It stops working after 24 hours.

Question: Post-Exposure

A 50 year old man living homeless is notified by public health that 2 people living in his tent community were diagnosed with hepatitis A in the last week. He does not know if he has been vaccinated but he is not in routine medical care. He denies any symptoms. Which of the following is most appropriate:

- A. He does not need vaccine as he is asymptomatic
- B. He should receive Hep A vaccine as soon as possible
- C. He should receive combination Hep A and Hep B vaccine as he is likely non-immune to both

Hepatitis A Post-Exposure Prophylaxis

- No PEP needed if healthy and previously vaccinated
- PEP should be given immediately (within 14 days of exposure)
- No data available for combination HepA/HepB vaccine for PEP in HAV outbreak setting (contains only half the Hep A antigen compared to HAV vaccine – so not recommended after exposure)
- If non-immune, should complete 2-dose vaccine series (2nd dose at least 6 months after 1st dose)
- Immune globulin + vaccine (at separate sites) for immunocompromised and those with chronic liver disease
- For infants < 12 months, immune globulin only ASAP (within 2 weeks)

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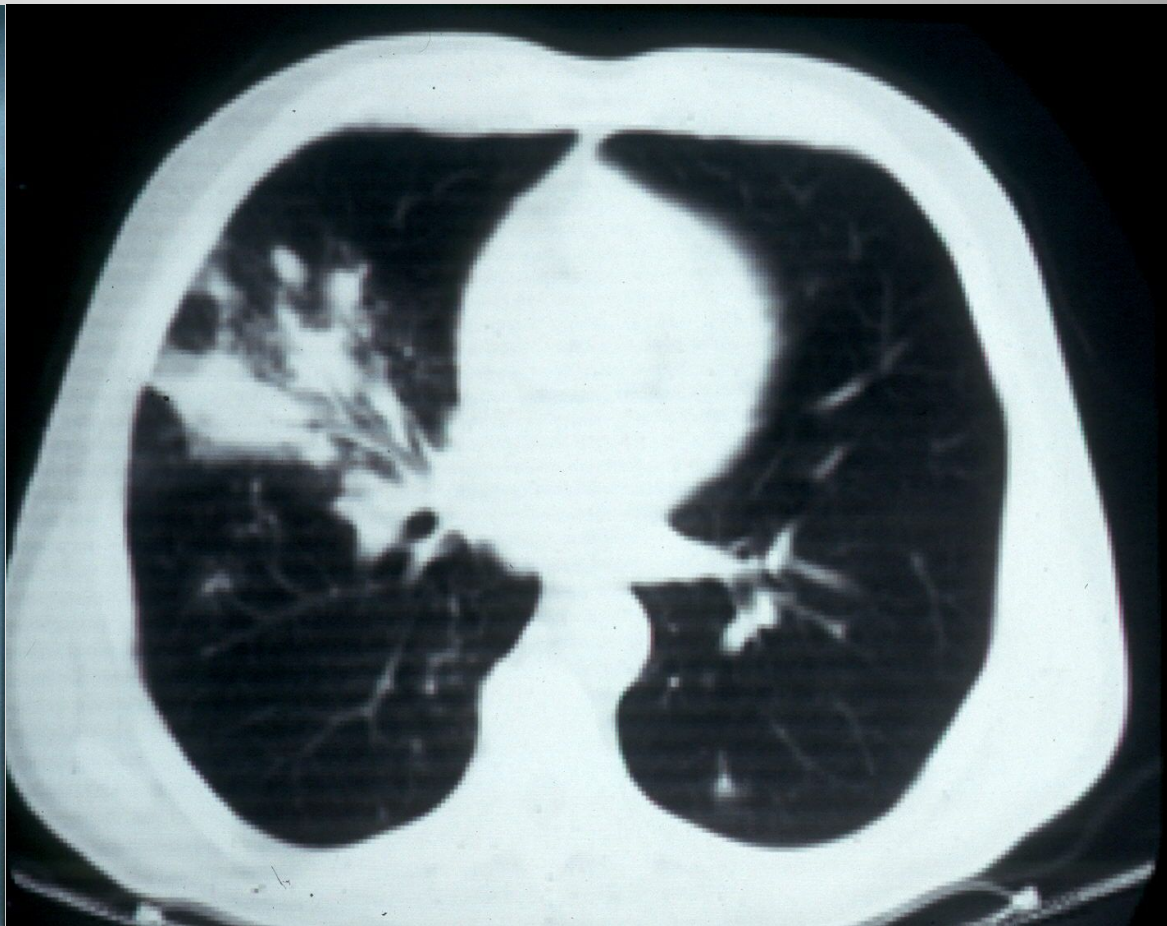
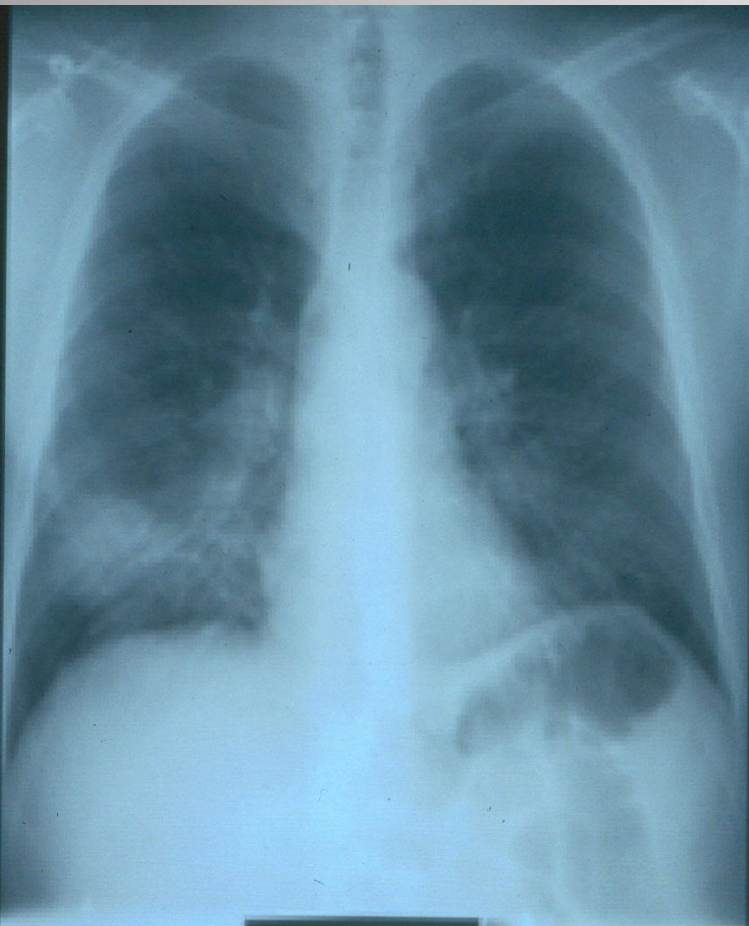
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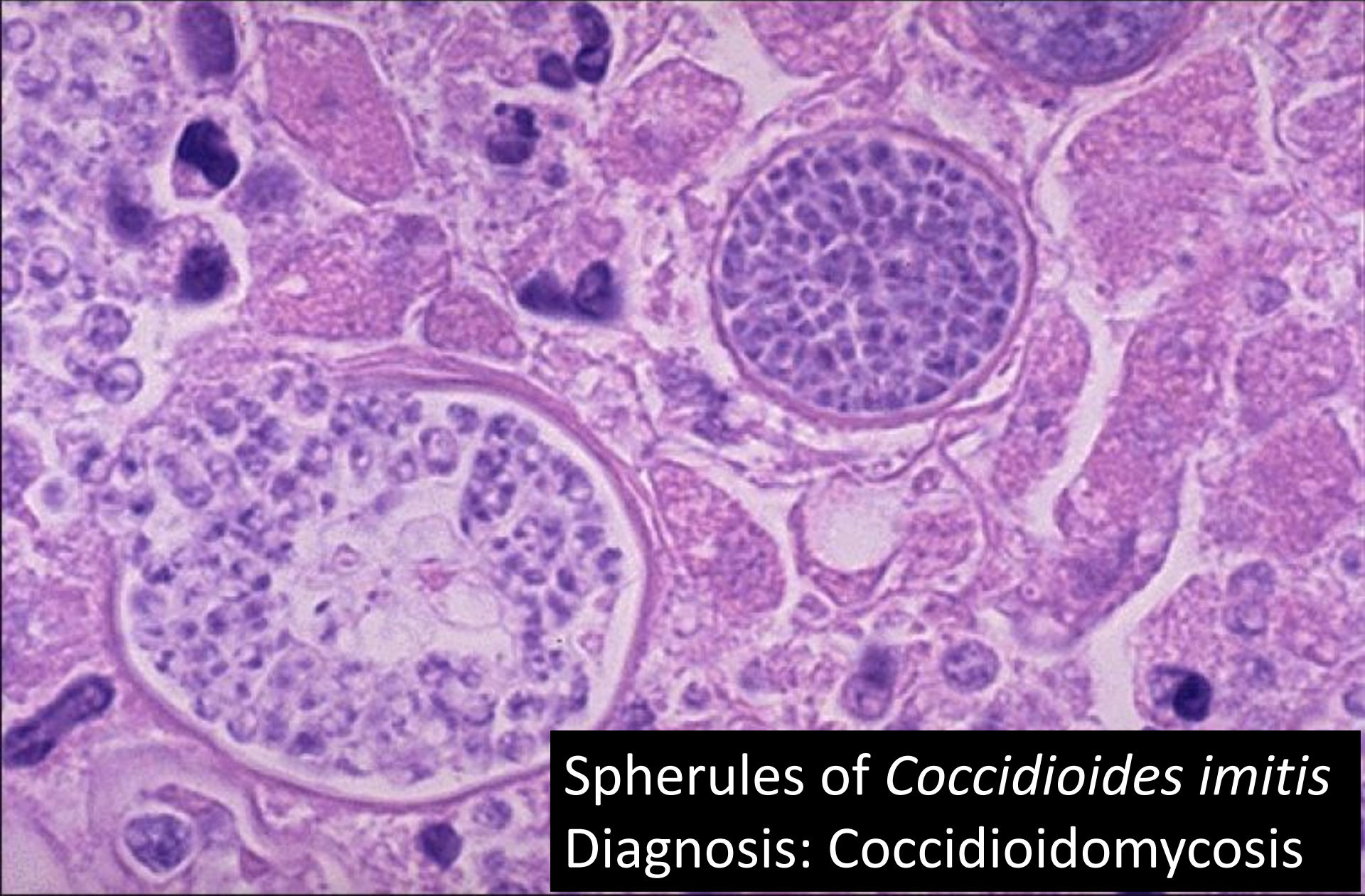
Case

- 58 y/o man who lives in Kennewick, WA presents with acute fever, cough, pleuritic chest pain, WBC 23,000.
- He has advanced liver disease and is employed as a construction worker in outdoor excavation
- CXR and chest CT show RML nodule and effusion. No response to Unasyn + Levo.
- Concern for pneumococcal pneumonia. Thoracentesis and BAL are performed....

Case

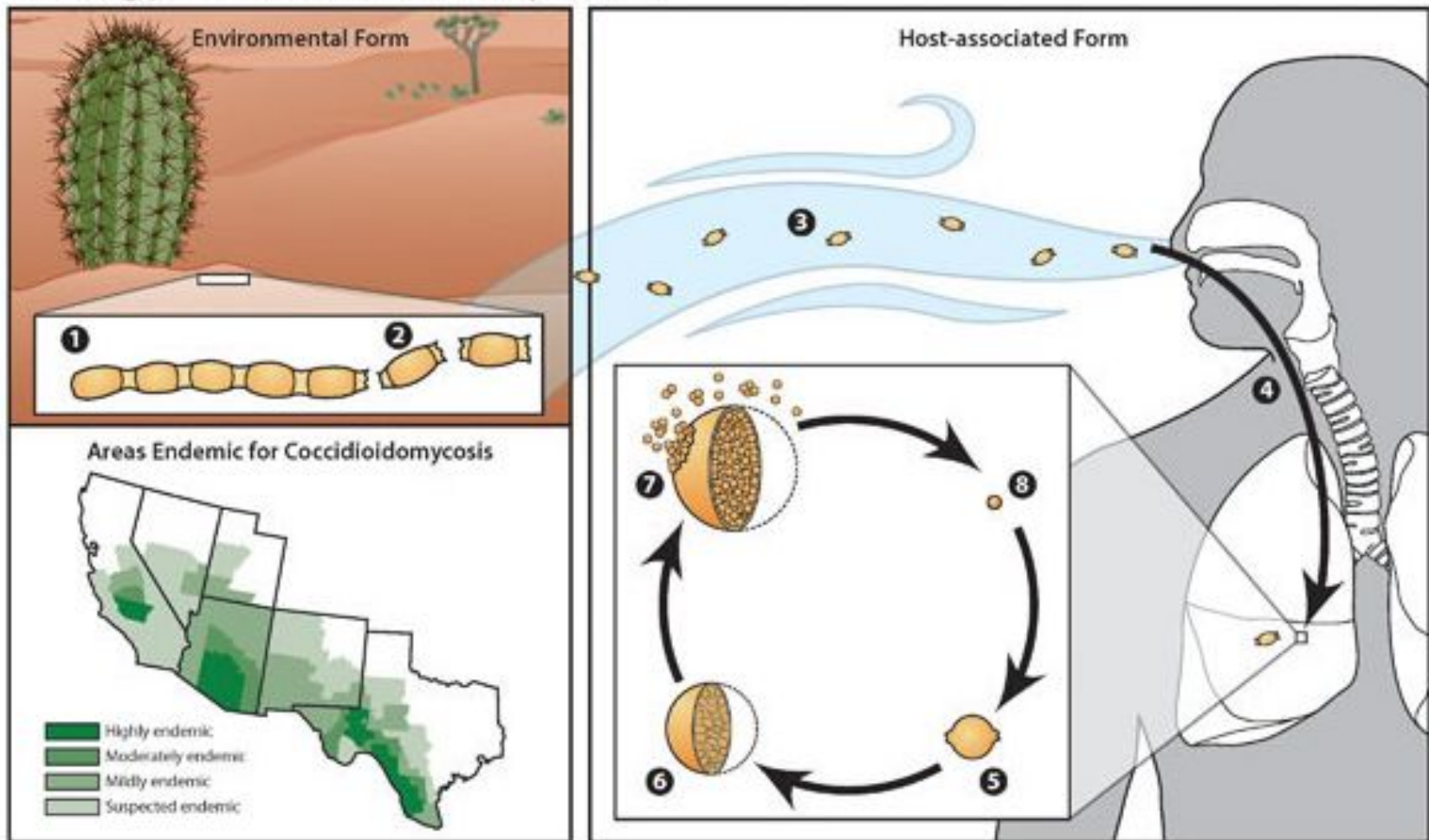


From lungs ...



Spherules of *Coccidioides immitis*
Diagnosis: Coccidioidomycosis

Biology of Coccidioidomycosis



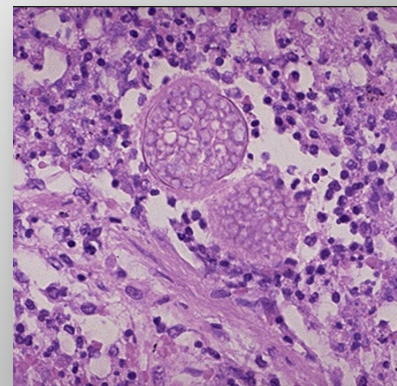
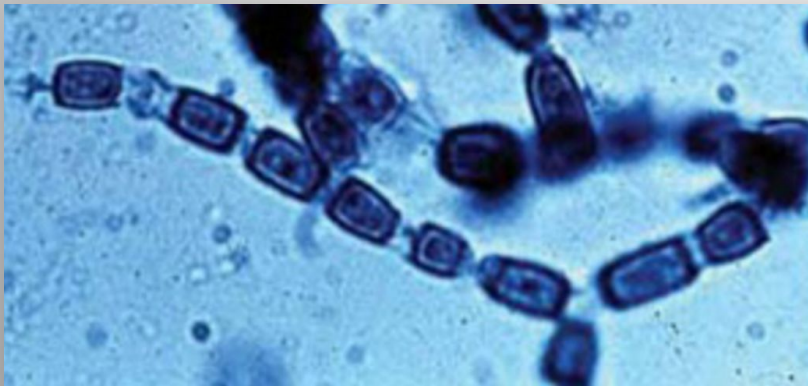
In the environment, *Coccidioides* *ssp.* exists as a mold (1) with septate hyphae. The hyphae fragment into arthroconidia (2), which measure only 2-4 μm in diameter and are easily aerosolized when disturbed (3). Arthroconidia are inhaled by a susceptible host (4) and settle into the lungs. The new environment signals a morphologic change, and the arthroconidia become spherules (5). Spherules divide internally until they are filled with endospores (6). When a spherule ruptures (7) the endospores are released and disseminate within surrounding tissue. Endospores are then able to develop into new spherules (6) and repeat the cycle.



Emerging PNW Infection: *Coccidioidomycosis*

Coccidioides immitis

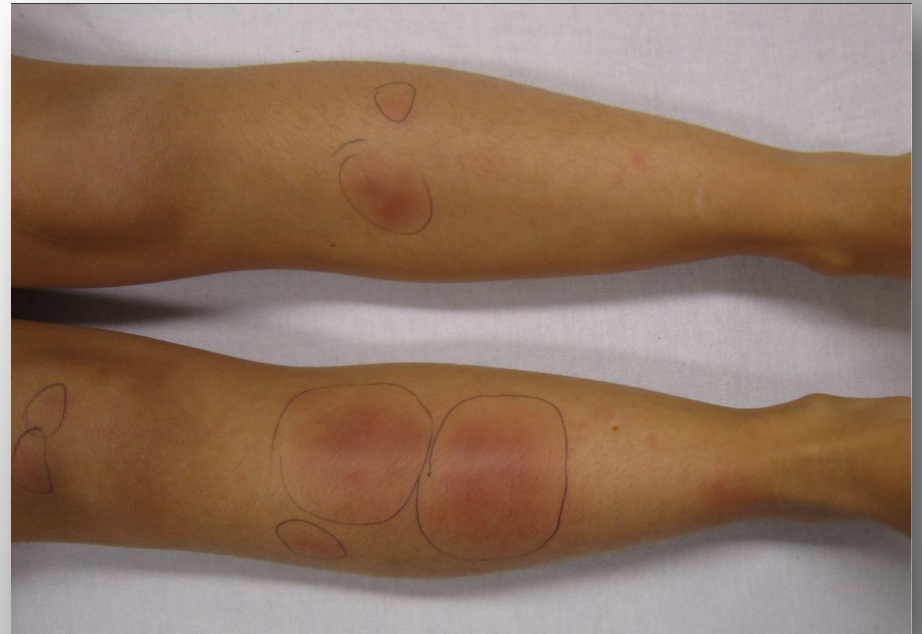
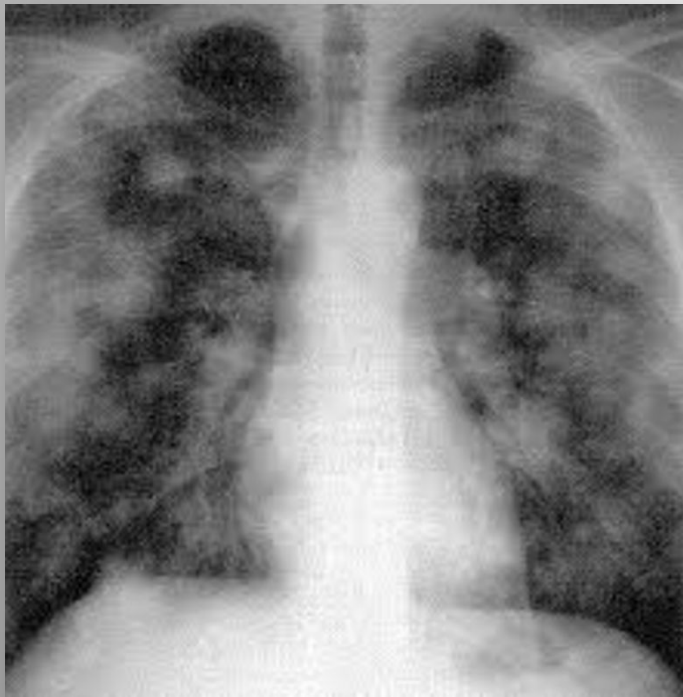
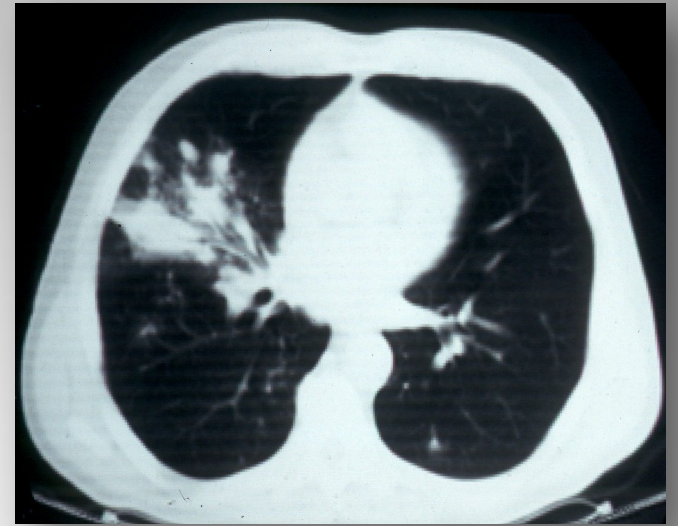
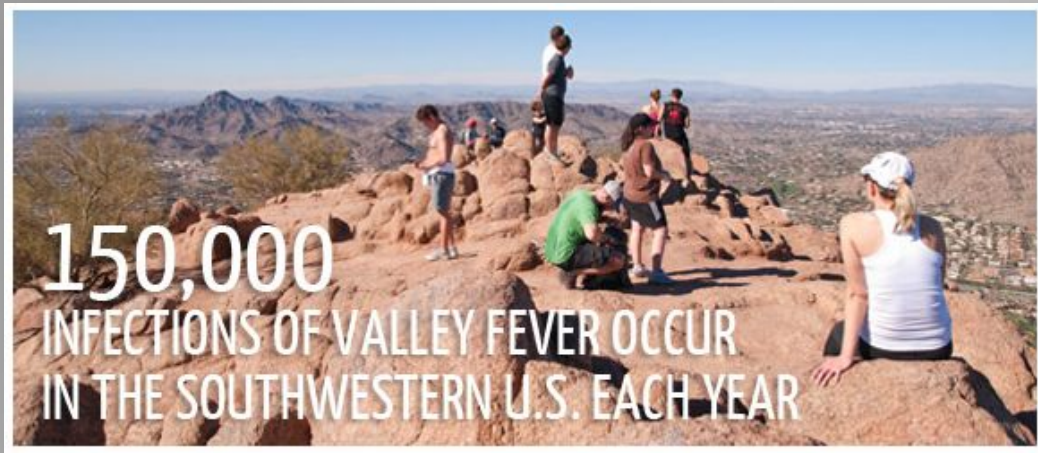
- Free-living dimorphic **fungus**
- Endemic to US Desert **Southwest**
- Usually **inhaled**
- Direct wound inoculation less common
- Body tries contain infection by making **granulomas**



Emerging PNW Infection: *Coccidioidomycosis*

Coccidioides immitis

- Most common presentation:
 - ✓ Community-Acquired Pneumonia
 - Very similar to Pneumococcus
 - Acute, often self-limited
 - Sometimes called “Valley fever”
 - ✓ Immune response may trigger erythema nodosum, arthralgias (“Desert Rheumatism”)



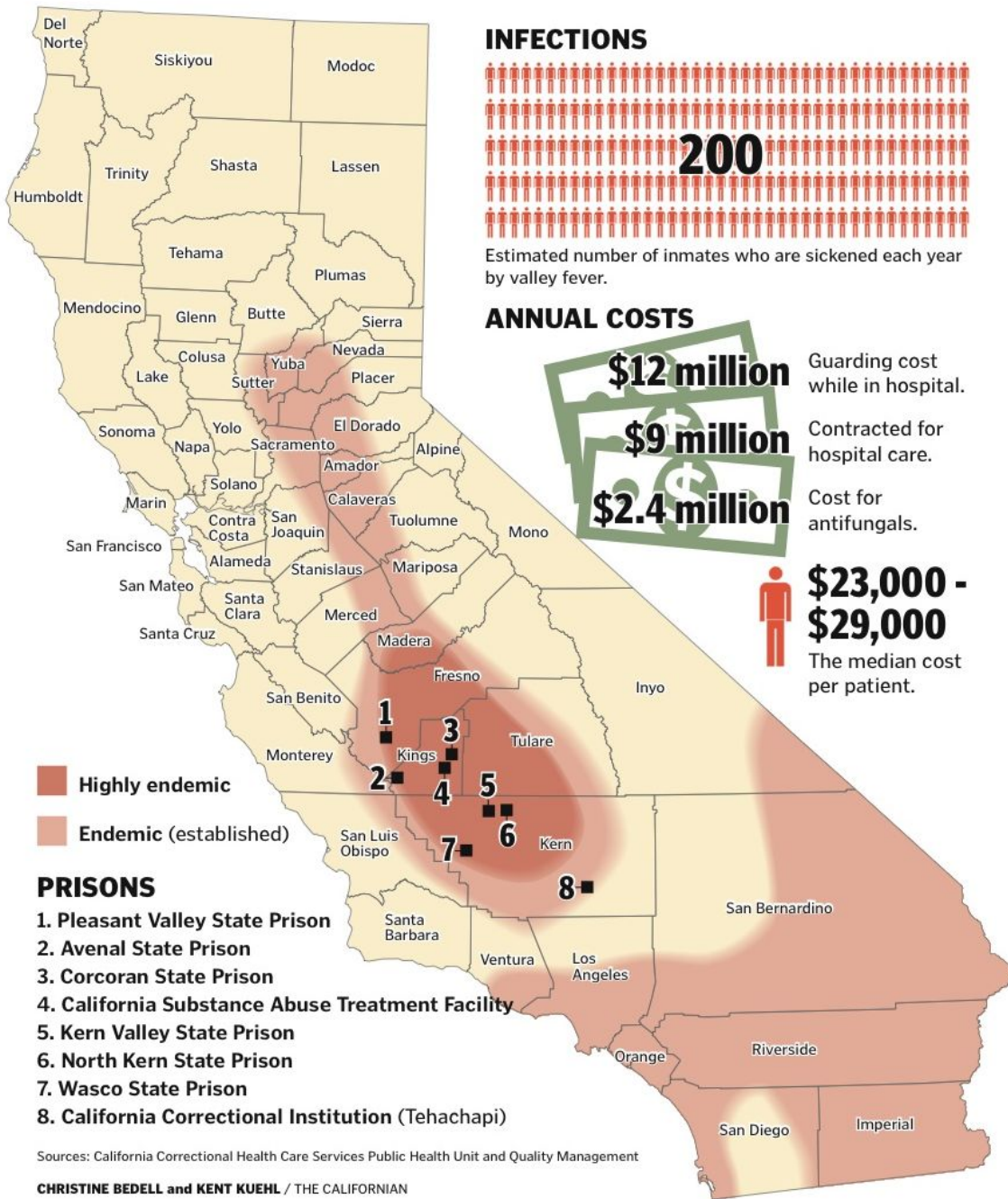
Emerging PNW Infection: *Coccidioidomycosis*

Coccidioides immitis

- Less common presentation: Dissemination
- Skin... Abdomen... GU tract... Bones... CNS...
- Risk factors:
 - ✓ non-Caucasian
 - ✓ Pregnant
 - ✓ Immunocompromised



Valley fever: The effect and costs on the prison system



INFECTIONS



Estimated number of inmates who are sickened each year by valley fever.

ANNUAL COSTS



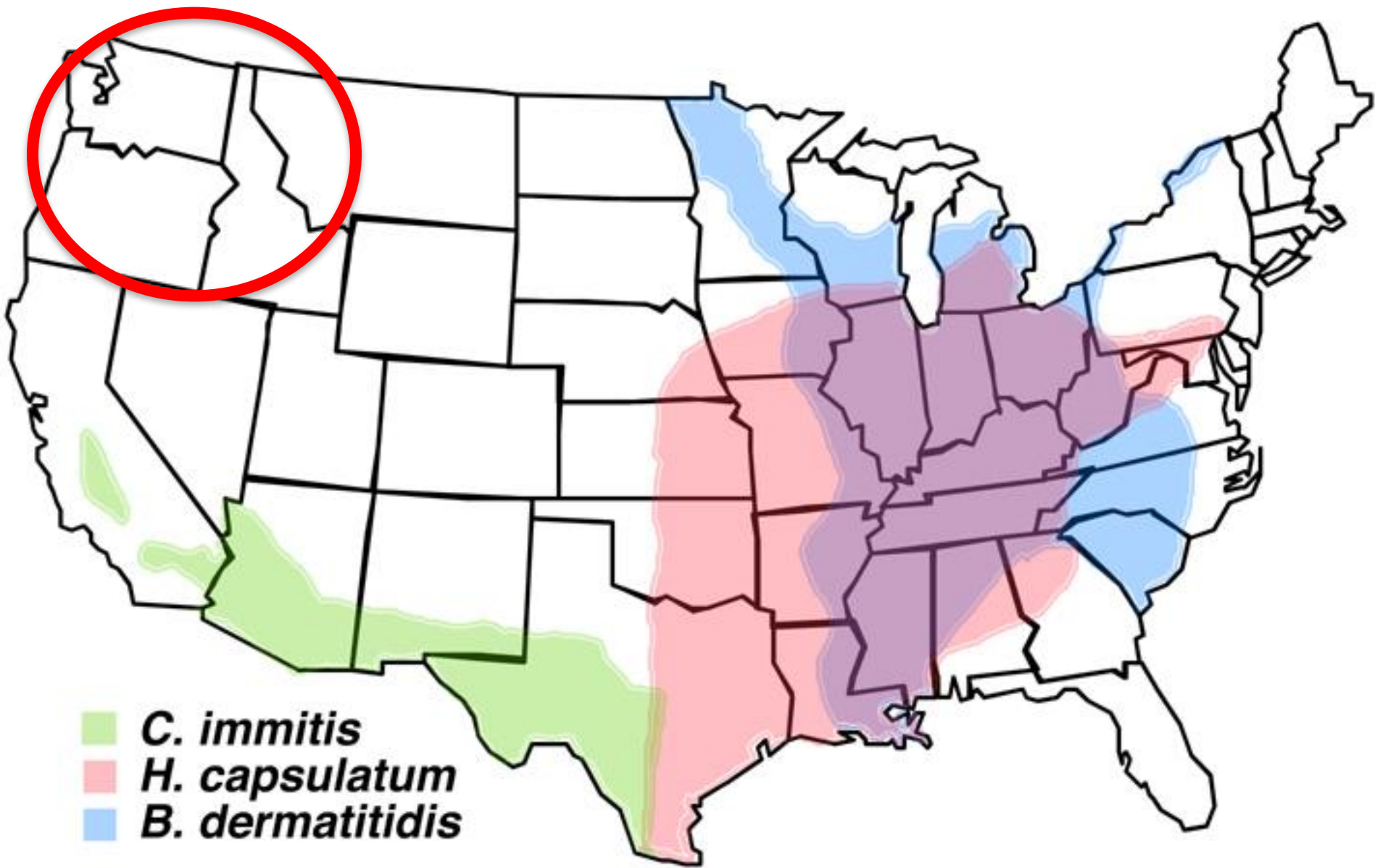
\$23,000 - \$29,000
The median cost per patient.

- Highly endemic**
- Endemic (established)**

PRISONS

- 1. Pleasant Valley State Prison**
- 2. Avenal State Prison**
- 3. Corcoran State Prison**
- 4. California Substance Abuse Treatment Facility**
- 5. Kern Valley State Prison**
- 6. North Kern State Prison**
- 7. Wasco State Prison**
- 8. California Correctional Institution (Tehachapi)**

Sources: California Correctional Health Care Services Public Health Unit and Quality Management



Outbreak of Coccidioidomycosis in Washington State Residents Returning from Mexico

Lisa Cairns,^{1,3} David Blythe,^{1,2} Annie Kao,⁴
Demosthenes Pappagianis,⁵ Leo Kaufman,⁴
John Kobayashi,¹ and Rana Hajjeh⁴

From the ¹Section of Communicable Disease Epidemiology, Washington State Department of Health, and ²University of Washington School of Public Health and Community Medicine Preventive Medicine Residency, Seattle, Washington; ³Epidemic Intelligence Service, Division of Applied Public Health Training, Epidemiology Program Office, and ⁴Division of Bacterial and Mycotic Diseases, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia; and ⁵Department of Medical Microbiology and Immunology, School of Medicine, University of California at Davis, Davis, California

In July 1996 the Washington State Department of Health (Seattle) was notified of a cluster of a flulike, rash-associated illness in a 126-member church group, many of whom were adolescents. The group had recently returned from Tecate, Mexico, where members had assisted with construction projects at an orphanage. After 1 member was diagnosed with coccidioidomycosis, we initiated a study to identify further cases. We identified 21 serologically confirmed cases of coccidioidomycosis (minimum attack rate, 17%). Twenty cases (95%) occurred in adolescents, and 13 patients (62%) had rash. Sixteen symptomatic patients saw 19 health care providers; 1 health care provider correctly diagnosed coccidioidomycosis. *Coccidioides immitis* was isolated from soil samples from Tecate by use of the intraperitoneal mouse inoculation method. Trip organizers were unaware of the potential for *C. immitis* infection. Travelers visiting regions where *C. immitis* is endemic should be made aware of the risk of acquiring coccidioidomycosis, and health care providers should be familiar with coccidioidomycosis and its diagnosis.

Coccidioidomycosis Acquired in Washington State

Nicola Marsden-Haug,¹ Marcia Goldoft,¹ Cindy Ralston,² Ajit P. Limaye,⁴ Jimmy Chua,³ Heather Hill,² Larry Jecha,² George R. Thompson III,⁵ and Tom Chiller⁶

¹Office of Communicable Disease Epidemiology, Washington State Department of Health, Shoreline, ²Communicable Disease Program, Benton-Franklin Health District, and ³Infectious Diseases Department, Kennewick General Hospital, Kennewick, and ⁴Division of Allergy and Infectious Diseases, University of Washington, Seattle, Washington; ⁵Coccidioidomycosis Serology Laboratory, University of California, Davis; and ⁶Mycotic Diseases Branch, Centers for Disease Control and Prevention, Atlanta, Georgia

Clinical, laboratory, and epidemiologic evidence suggest that 3 individuals with acute coccidioidomycosis were exposed in Washington State, significantly beyond previously identified endemic areas. Given the patients' lack of recent travel, coccidioidomycosis was not suspected, leading to delays in diagnosis and appropriate therapy. Clinicians should be aware of this possibility and consider the diagnosis.

Keywords. *Coccidioides*; coccidioidomycosis; endemic fungi; Washington

using DNA probe of fungal cultures [5] and enzyme immunoassay. The University of California, Davis (UCD) Coccidioidomycosis Serology Laboratory and the Centers for Disease Control and Prevention Mycotic Diseases Branch performed confirmatory testing by immunodiffusion to detect early immunoglobulin M (IgM) tube precipitin (IDTP) and complement fixation (CF) immunoglobulin G (IgG) antibodies (IDCF), with quantitative IgG titers. UCD identified 1 isolate as *C. immitis* by polymerase chain reaction amplification and sequencing of the serine proteinase gene [6].

CASE REPORTS

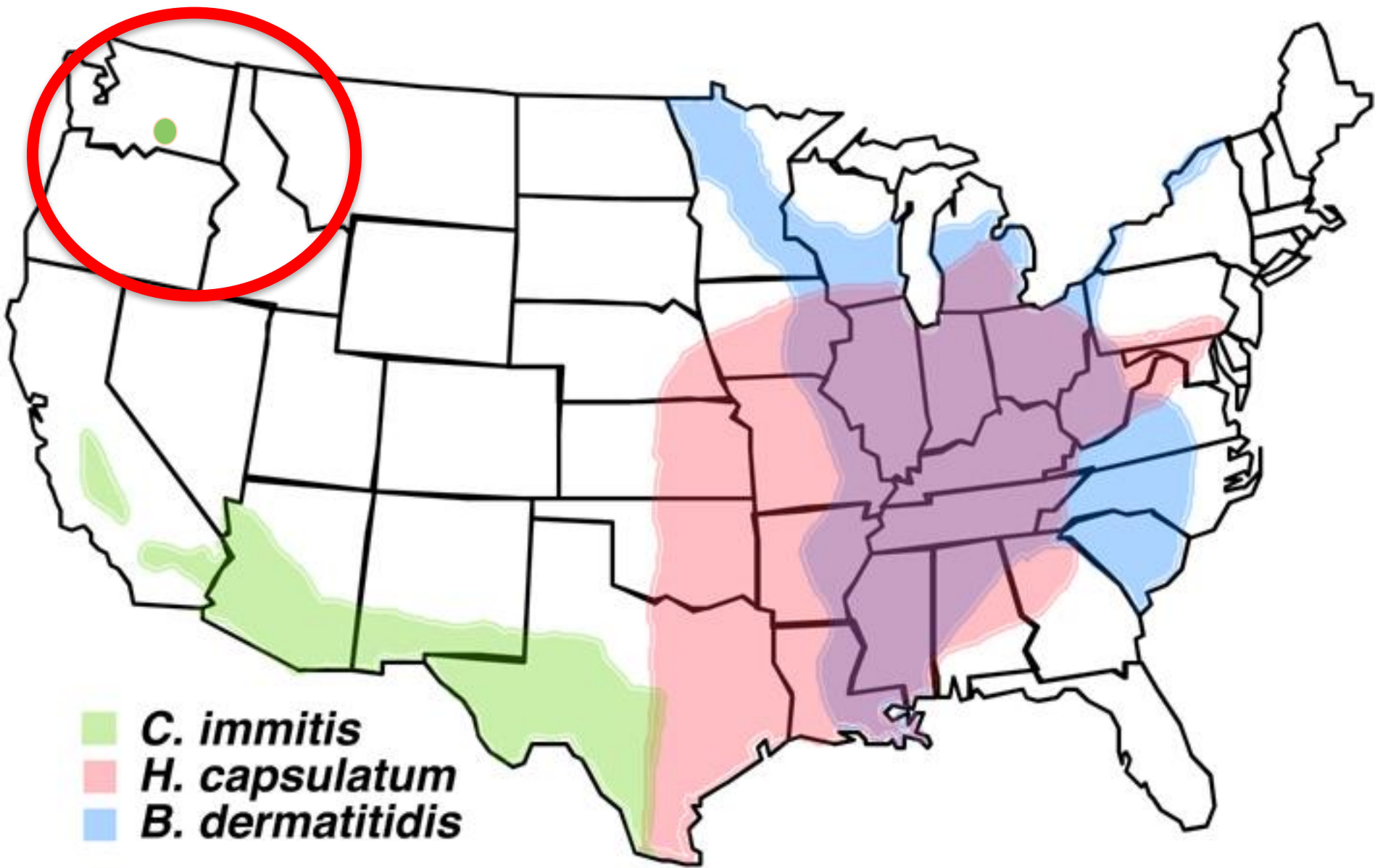
Case 1

A 12-year-old boy developed chest pain on 1 June 2010. Out-patient chest radiography (CXR) 2 days later was clear. Three days later, CXR to evaluate worsening chest pain, fever, and difficulty breathing revealed right lower lobe parenchymal infiltrate and pleural effusion. The patient was admitted, prescribed vancomycin and ceftriaxone for pneumonia and azithromycin for erythema multiforme, then discharged 6 days later on oral amoxicillin/clavulanate.

Emerging PNW Infection: *Coccidioidomycosis*

Coccidioides immitis in Washington State

- 3 cases reported by Chua et al *Clin Infect Dis* 2013, MMWR 2014. Absent any convincing travel history... *significant delays* in establishing diagnosis
- Consider coccidio in pneumonia, FUO, wound infections that fails to respond to usual treatment in Eastern WA.



Emerging PNW Infection: *Coccidioidomycosis*

Coccidioides immitis

- Diagnosis

✓ Your Clinical Suspicion!

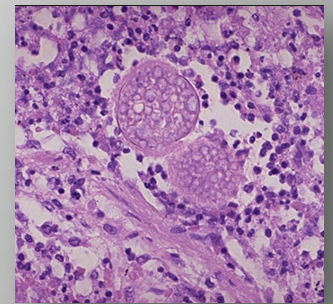
✓ Acute, Mild

Serology may help

✓ Severe (disseminated, lung damage)

BAL for culture

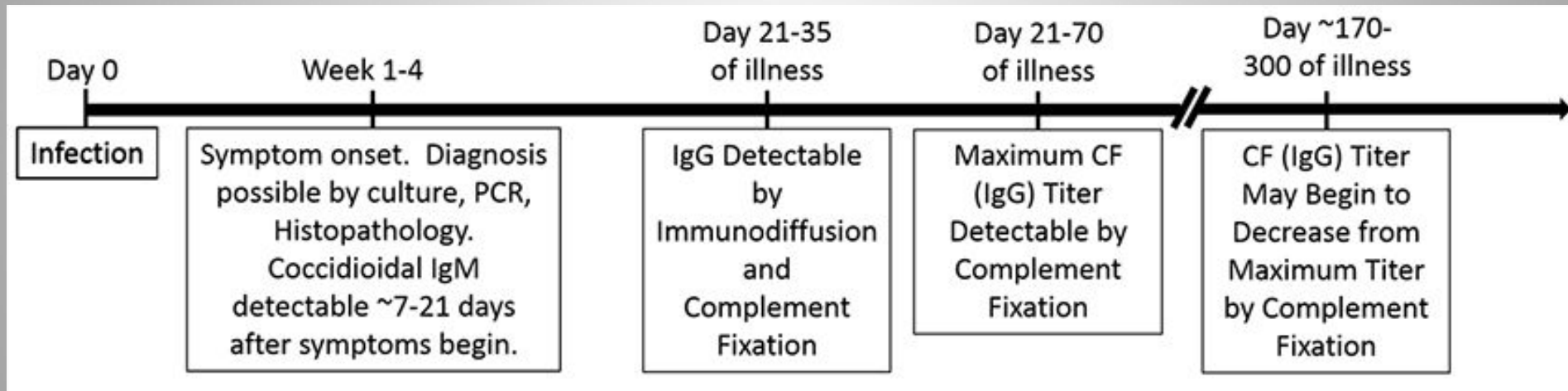
Tissue for culture and pathology



Emerging PNW Infection: *Coccidioidomycosis*

Coccidoides immitis

• Serologic Timeline



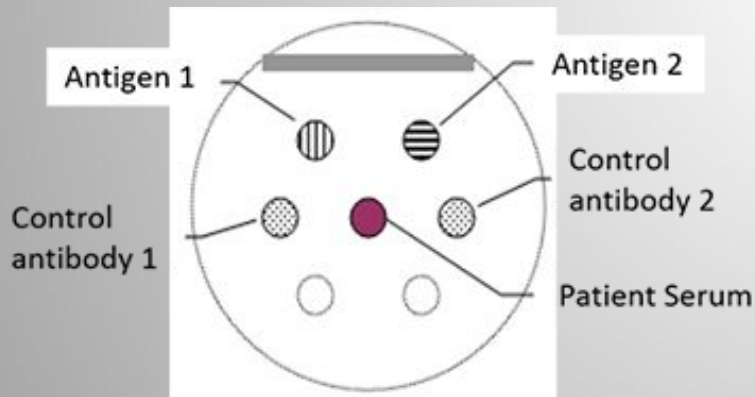
Emerging PNW Infection: *Coccidioidomycosis*

Coccidioides immitis

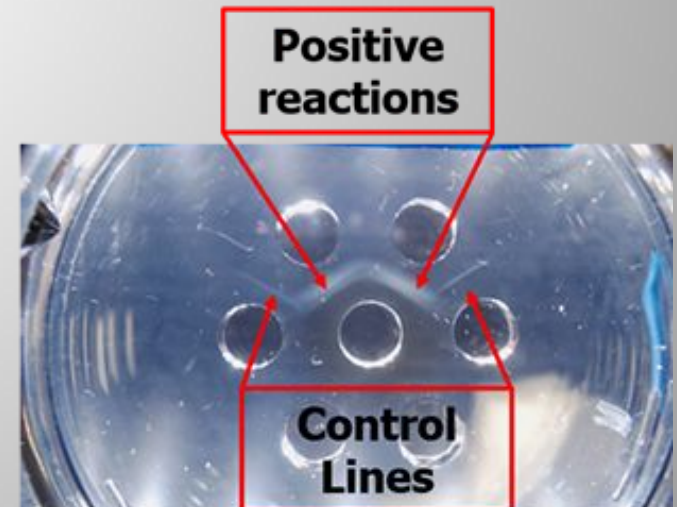
- Serology Options

✓ Acute: IgM Immunodiffusion

□ NPV **problematic**... helpful if positive, but push for tissue if negative!



**24
Hours**



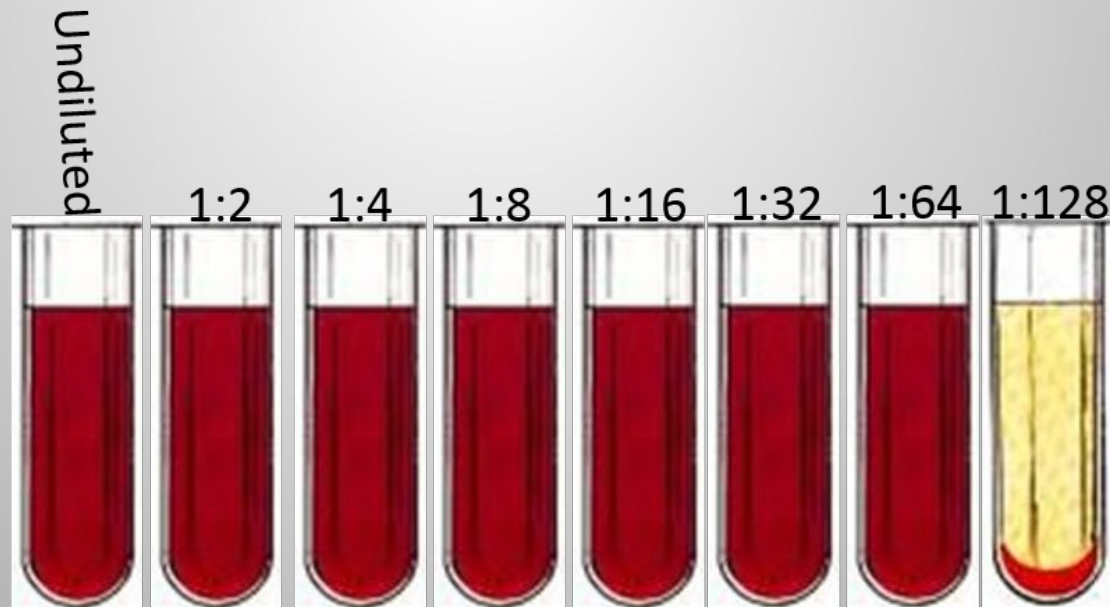
Emerging PNW Infection: *Coccidioidomycosis*

Coccidoides immitis

- Serology Options

- ✓ Chronic: IgG Complement Fixation

- Can be used to monitor **response** to therapy



Emerging PNW Infection: *Coccidioidomycosis*

Coccidoides immitis

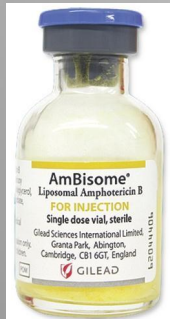
- Treatment



Valley Fever, “normal host:” No antifungals necessary,
follow closely



of complications, or severe infection: Fluconazole
mg PO daily x 3-6 months



“severe” infection: Consider **Ambisome**, and step down to
Fluconazole **suppression**

Summary: *Coccidioidomycosis*

- Environmental fungal infection
- Masquerades as CAP but can disseminate if immunosuppressed
- In Eastern Washington!
- Diagnose with serology if mild disease ... but pursue tissue diagnosis if patient ill
- Treat with fluconazole if mild, ampho if severe

"Unbeatable" superbug fungus sickens hundreds across the U.S., CDC says

TIME

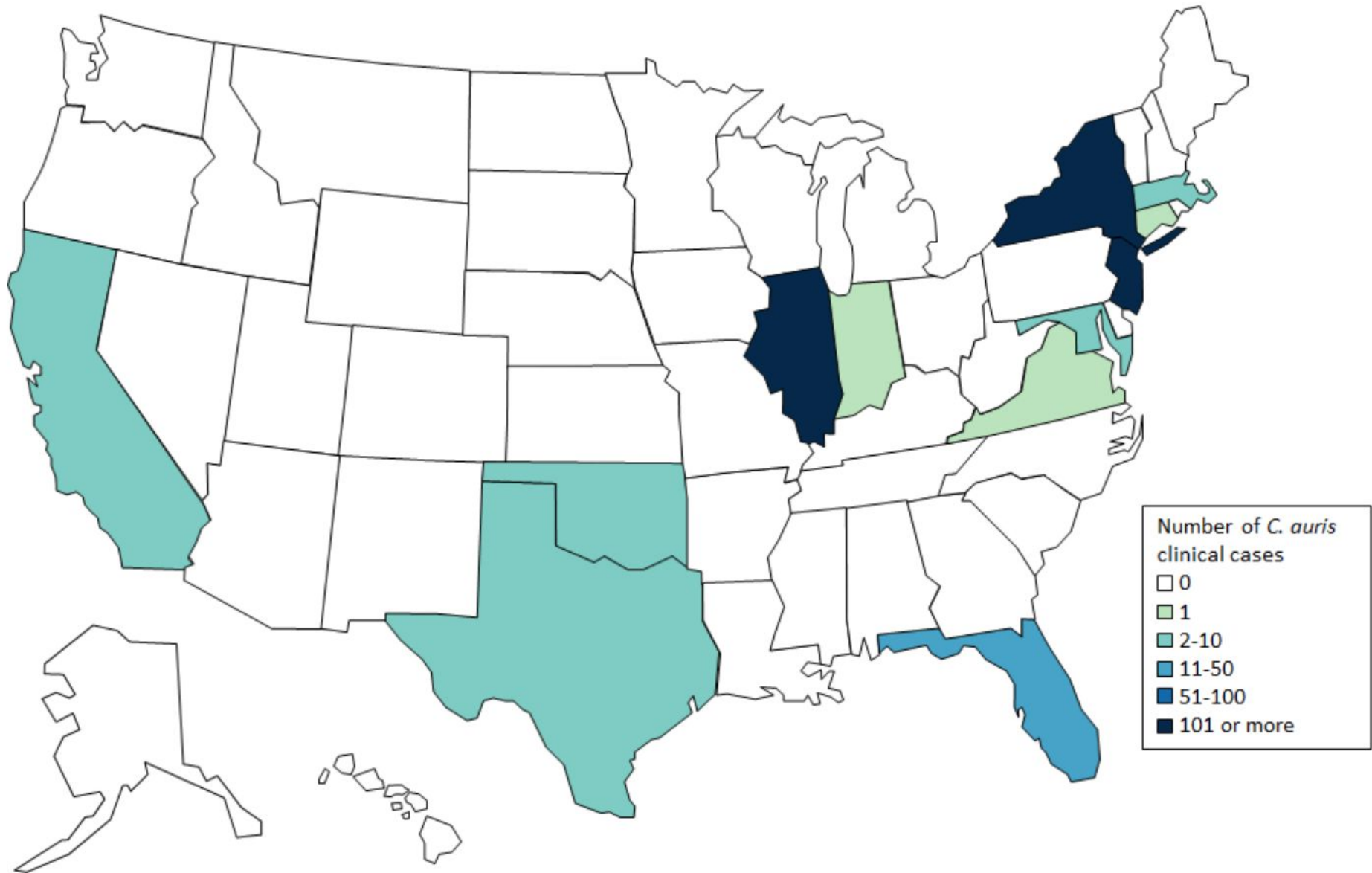
Deadly Fungal Infection Emerged Because of Global Warming, Study Says

BY **SANYA MANSOOR** JULY 24, 2019

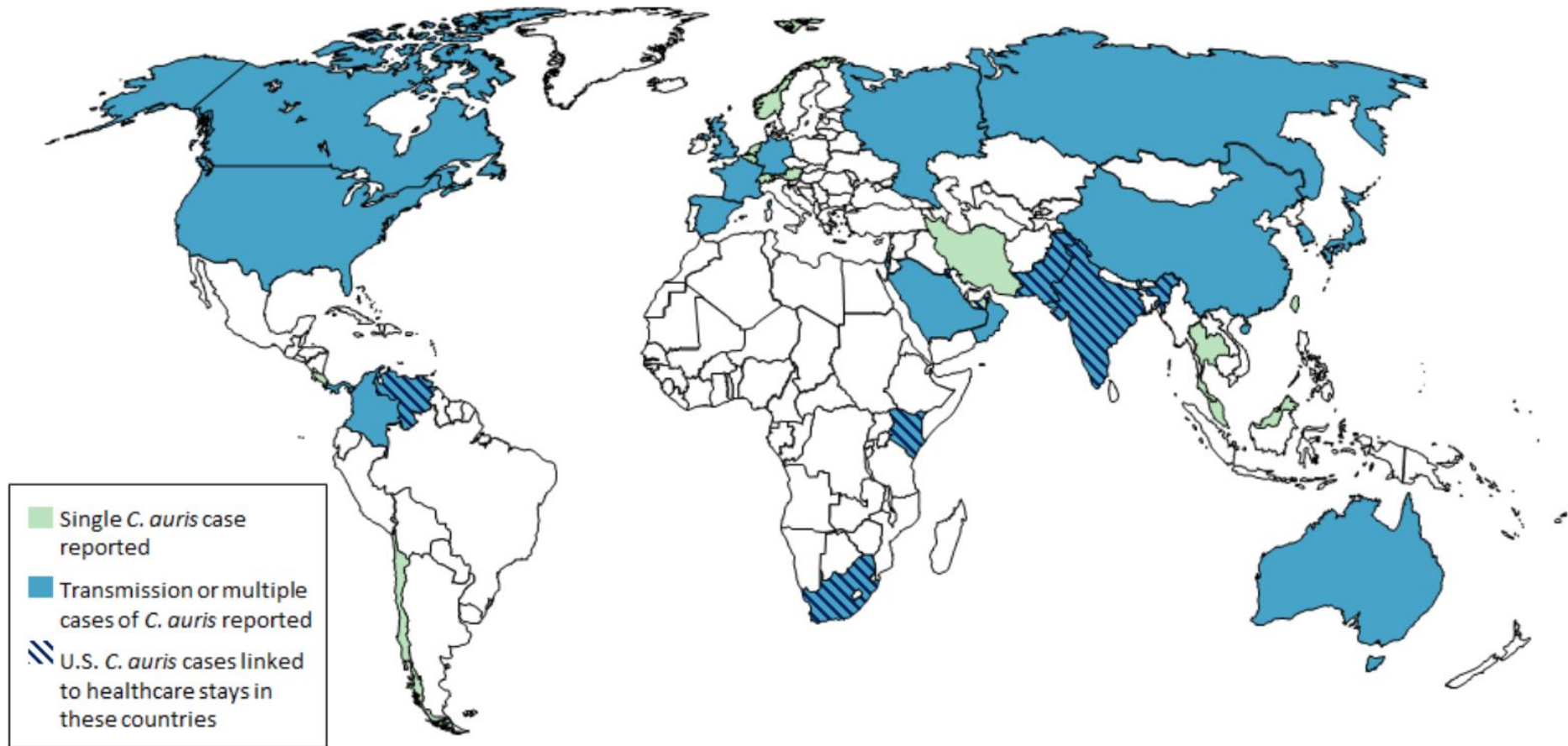
***Candida auris*: A drug-resistant yeast that spreads in healthcare facilities**

A CDC message to infection preventionists

U.S. Map: Clinical cases of *Candida auris* reported by U.S. states, as of June 30, 2019



Countries from which *Candida auris* cases have been reported, as of July 31, 2019



Take Home Points

- Be mindful of current outbreaks both domestically and globally
- Vaccinate for what we can – measles, hepatitis A
- With global warming and ease of travel, we will likely see more and more “tropical” infections in the PNW

THANK YOU
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