EMERGING INFECTIOUS DISEASES

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OBJECTIVES

1

The participant will be able to discuss currently emerging infectious diseases.

2

The participant will be able to counsel patients regarding prevention measures.

3

The participant will decrease unnecessary antibiotic use.

OUTLINE

- Climate Change and Emerging Pathogens
- Monkeypox
- Polio
- MDRO's
- Antimicrobial Stewardship

TYPES OF EMERGING PATHOGENS

Novel Pathogens with potential for pandemics

Re-emergence of vaccine-preventable infections

Increased resistance in existing pathogens

nature climate change

ANALYSIS

https://doi.org/10.1038/s41558-022-01426-1

Check for updates

Over half of known human pathogenic diseases can be aggravated by climate change

Camilo Mora[1]✉, Tristan McKenzie[2,3], Isabella M. Gaw[4], Jacqueline M. Dean[1], Hannah von Hammerstein[1], Tabatha A. Knudson[1], Renee O. Setter[1], Charlotte Z. Smith[5], Kira M. Webster[1], Jonathan A. Patz[6] and Erik C. Franklin[1,7]

It is relatively well accepted that climate change can affect human pathogenic diseases; however, the full extent of this risk remains poorly quantified. Here we carried out a systematic search for empirical examples about the impacts of ten climatic hazards sensitive to greenhouse gas (GHG) emissions on each known human pathogenic disease. We found that 58% (that is, 218 out of 375) of infectious diseases confronted by humanity worldwide have been at some point aggravated by climatic hazards; 16% were at times diminished. Empirical cases revealed 1,006 unique pathways in which climatic hazards, via different transmission types, led to pathogenic diseases. The human pathogenic diseases and transmission pathways aggravated by climatic hazards are too numerous for comprehensive societal adaptations, highlighting the urgent need to work at the source of the problem: reducing GHG emissions.

https://www.nature.com/articles/s41558-022-01426-1

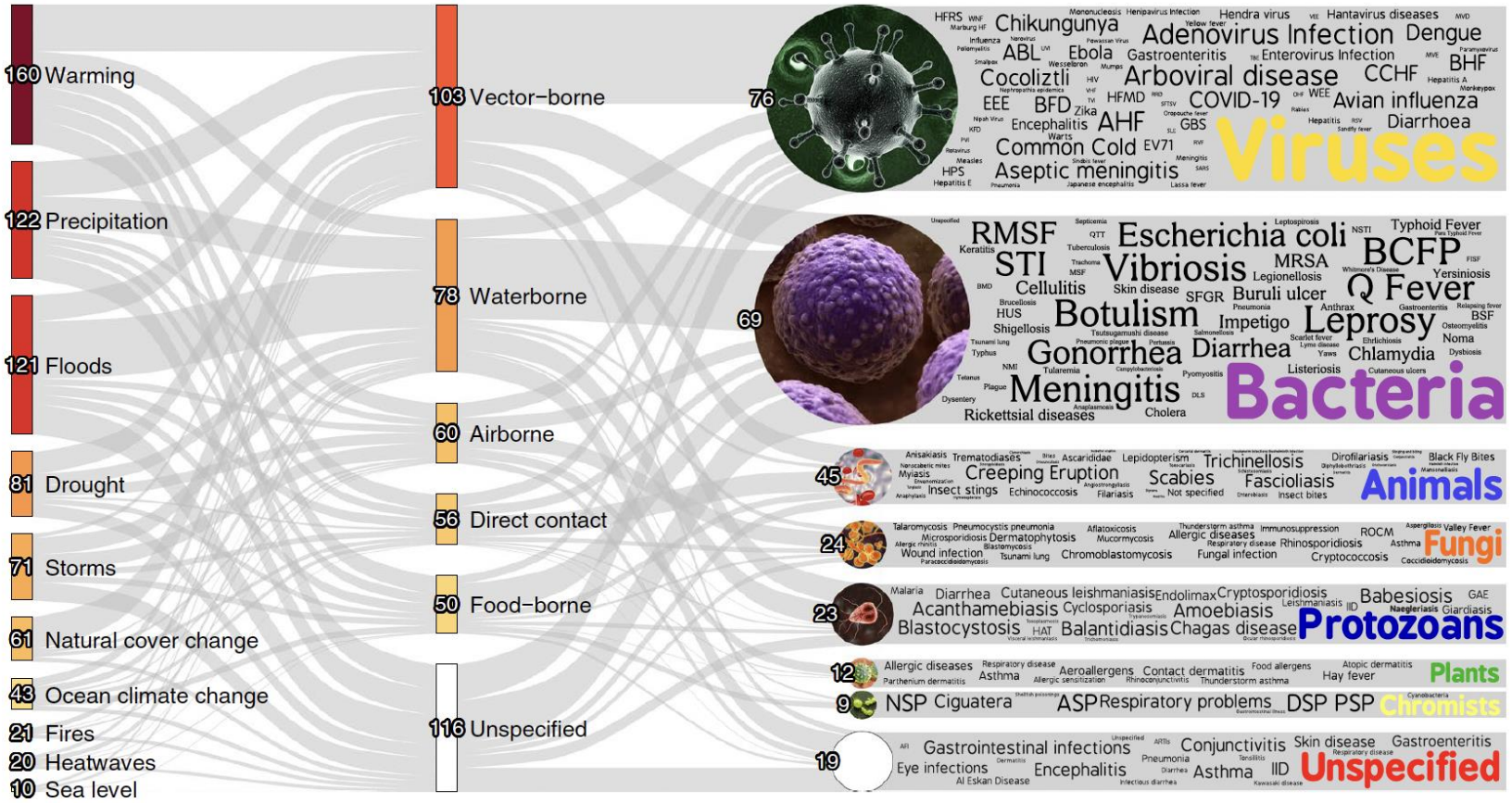

Fig. 3 | Pathogenic diseases aggravated by climatic hazards. Here we display the pathways in which climatic hazards, via specific transmission types, result in the aggravation of specific pathogenic diseases. The thickness of the lines is proportional to the number of unique pathogenic diseases. The colour gradient indicates the proportional quantity of diseases, with darker colours representing larger quantities and lighter colours representing fewer. Numbers at each node are indicative of the number of unique pathogenic diseases (caveats in Supplementary Information 1). An interactive display of the pathways and the underlying data are available at https://camilo-mora.github.io/Diseases/. Several disease names were abbreviated to optimize the use of space in the figure; their extended names are provided in Supplem https://camilo-mora.github.io/Diseases/ uds, WordArt.com; bacteria, Wikimedia Commons (www.scientificanimations.com); other images, istockphoto.

https://www.nature.com/articles/s41558-022-01426-1

Article

Climate change increases cross-species viral transmission risk

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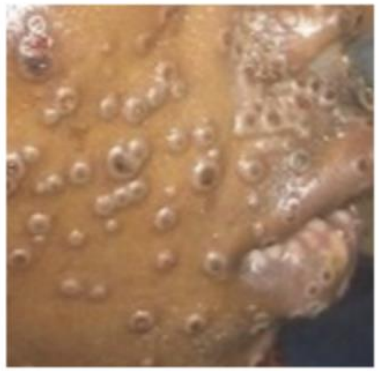
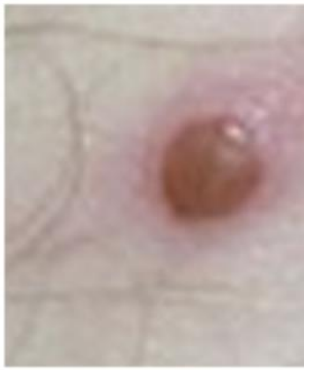
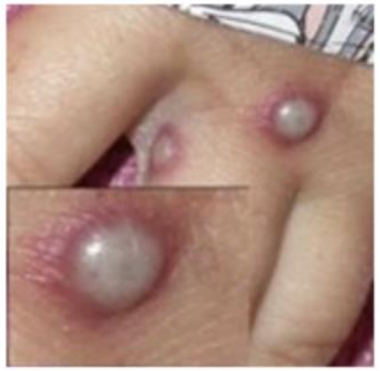
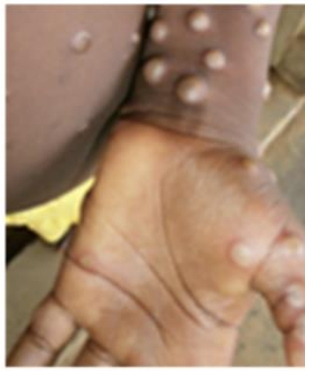
Check for updates

Colin J. Carlson[1,2,7]✉, Gregory F. Albery[1,3,7]✉, Cory Merow[4], Christopher H. Trisos[5], Casey M. Zipfel[1], Evan A. Eskew[3,6], Kevin J. Olival[3], Noam Ross[3] & Shweta Bansal[1]

At least 10,000 virus species have the ability to infect humans but, at present, the vast majority are circulating silently in wild mammals[1,2]. However, changes in climate and land use will lead to opportunities for viral sharing among previously geographically isolated species of wildlife[3,4]. In some cases, this will facilitate zoonotic spillover—a mechanistic link between global environmental change and disease emergence. Here we simulate potential hotspots of future viral sharing, using a phylogeographical model of the mammal–virus network, and projections of geographical range shifts for 3,139 mammal species under climate-change and land-use scenarios for the year 2070. We predict that species will aggregate in new combinations at high elevations, in biodiversity hotspots, and in areas of high human population density in Asia and Africa, causing the cross-species transmission of their associated viruses an estimated 4,000 times. Owing to their unique dispersal ability, bats account for the majority of novel viral sharing and are likely to share viruses along evolutionary pathways that will facilitate future emergence in humans. Notably, we find that this ecological transition may already be underway, and holding warming under 2 °C within the twenty-first century will not reduce future viral sharing. Our findings highlight an urgent need to pair viral surveillance and discovery efforts with biodiversity surveys tracking the range shifts of species, especially in tropical regions that contain the most zoonoses and are experiencing rapid warming.

https://www.nature.com/articles/s41586-022-04788-w

MONKEYPOX

WHAT IS MONKEYPOX?

- Used to be a rare disease caused by infection with monkeypox virus.
- Prior to current outbreak, occurred throughout Central and West Africa, often near tropical rain forests
- People usually become infected with monkeypox virus through contact with skin lesions or bodily fluids of infected animals or humans (alive or dead), including respiratory droplets, or through contact with materials contaminated with the virus.
- This is similar to smallpox, but milder less severe
- Case fatality rate ranges from 1-11%

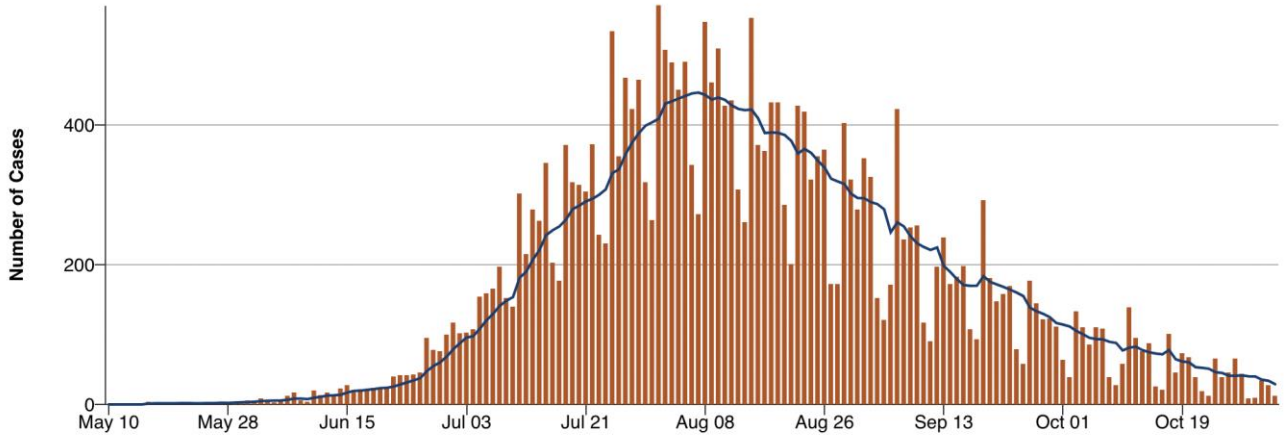
U.S. Monkeypox Case Trends Reported to CDC

Data as Reported to CDC as of 02 Nov 2022 2:00 PM EDT

Español | Print

Trends of monkeypox cases reported to CDC since May 17, 2022, the start of the response to the current outbreak in the United States. Data include cases with reporting date.*

Daily Monkeypox Cases Reported* and 7 Day Daily Average



SIGNS/SYMPTOMS

- Lesions are firm or rubbery, well-circumscribed, deep-seated, and often develop umbilication (resembles a dot on the top of the lesion)
- During the current global outbreak:
  - Lesions often occur in the genital and anorectal areas or in the mouth
  - Rash is not always disseminated across many sites on the body
  - Rash may be confined to only a few lesions or only a single lesion
  - Rash does not always appear on palms and soles
- Rectal symptoms (e.g., purulent or bloody stools, rectal pain, or rectal bleeding) have been frequently reported in the current outbreak
- Lesions are often described as painful until the healing phase when they become itchy (crusts)
- Fever and other prodromal symptoms (e.g., chills, lymphadenopathy, malaise, myalgias, or headache) can occur before rash but may occur after rash or not be present at all
- Respiratory symptoms (e.g. sore throat, nasal congestion, or cough) can occur

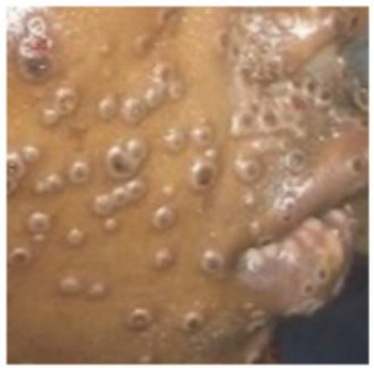
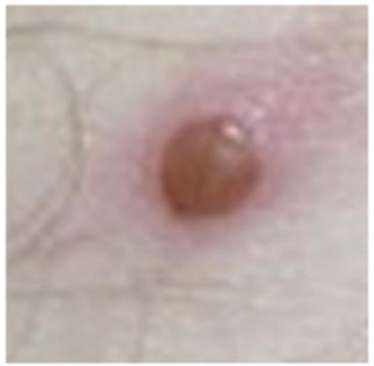
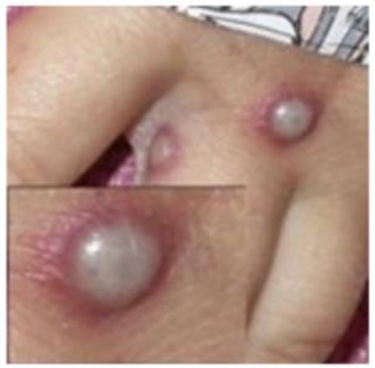
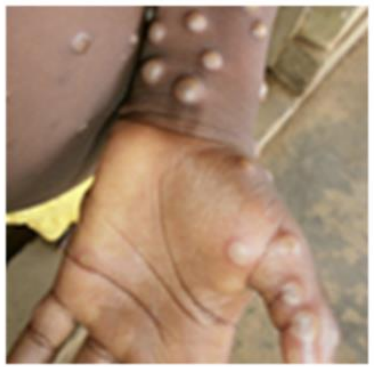
Enanthem Through the Scab Stage

Stage	Stage Duration	Characteristics
Enanthem		• Sometimes, lesions first form on the tongue and in the mouth.
Macules	1–2 days	• Macular lesions appear.
Papules	1–2 days	• Lesions typically progress from macular (flat) to papular (raised).
Vesicles	1–2 days	• Lesions then typically become vesicular (raised and filled with clear fluid).
Pustules	5–7 days	• Lesions then typically become pustular (filled with opaque fluid) – sharply raised, usually round, and firm to the touch (deep seated). • Finally, lesions typically develop a depression in the center (umbilication). • The pustules will remain for approximately 5 to 7 days before beginning to crust.
Scabs	7–14 days	• By the end of the second week, pustules have crusted and scabbed over. • Scabs will remain for about a week before beginning to fall off.

*This is a typical timeline, but timeline can vary.

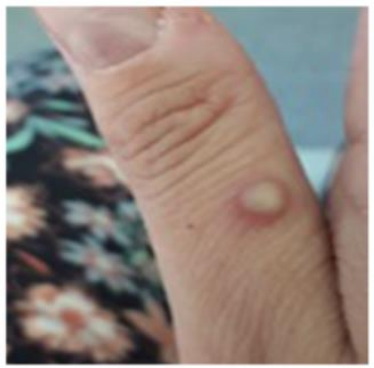
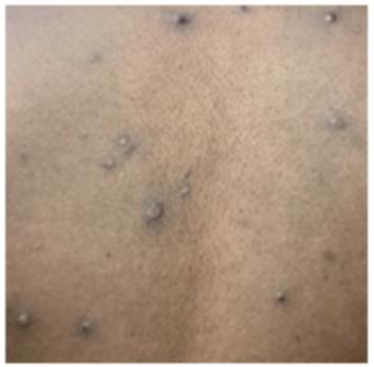
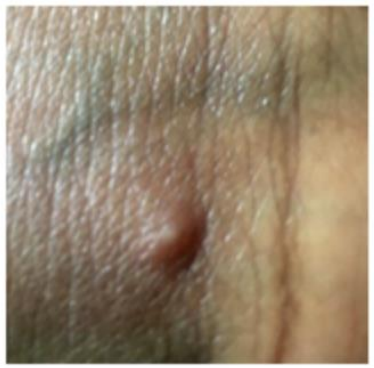
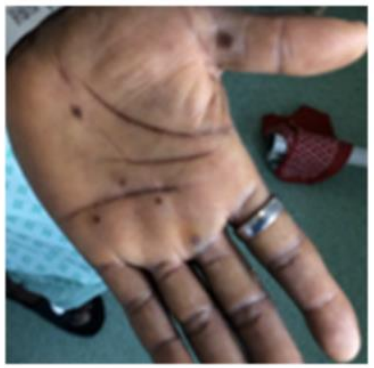
https://www.cdc.gov/poxvirus/monkeypox/clinicians/clinical-recognition.html

Key Characteristics of Monkeypox Rash

More Monkeypox Rash Photos

Photo Credit: NHS England High Consequence Infectious Diseases Network

https://www.cdc.gov/poxvirus/monkeypox/clinicians/clinical-recognition.html

DIFFERENTIAL DIAGNOSIS

- VZV
- Syphilis
- Erythema Multiforme
- Allergic dermatitis
- Drug rash
- Generalized vaccinia
- Sepsis
- Herpes
- Measles

EPIDEMIOLOGICAL CRITERIA

Reports having contact with a person or people with a similar appearing rash or who received a diagnosis of confirmed or probable monkeypox **OR**

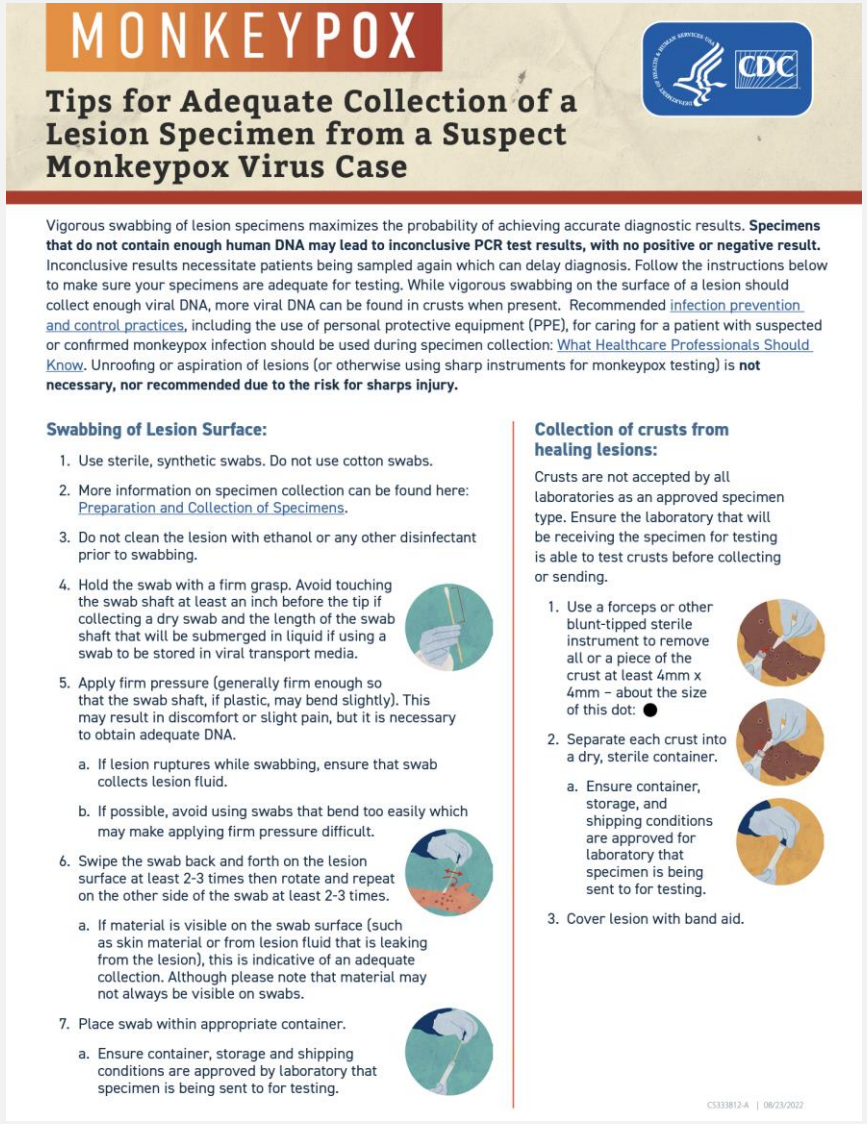
Had close or intimate in-person contact with individuals in a social network experiencing monkeypox activity, this includes men who have sex with men (MSM) who meet partners through an online website, digital application ("app"), or social event (e.g., a bar or party) **OR**

Traveled outside the US to a country with confirmed cases of monkeypox or where *Monkeypox virus* is endemic **OR**

Had contact with a dead or live wild animal or exotic pet that is an African endemic species or used a product derived from such animals (e.g., game meat, creams, lotions, powders, etc.)

SPECIMEN COLLECTION

- Unroofing or aspiration of lesions (or otherwise using sharp instruments for monkeypox testing) is not necessary, nor recommended, due to the risk for sharps injury.
- All Recommended PPE should be worn when collecting a specimen from a person with suspected or confirmed monkeypox.
- Only sterile, synthetic swabs (including but not limited to polyester, nylon, or Dacron) with plastic, wood, or thin aluminum (wire) shafts should be used to collect suspected or confirmed monkeypox specimens for diagnostic testing. Do not use cotton swabs.
- Skin lesion material, including swabs of lesion surface, exudate, or lesion crusts are the recommended specimen types for laboratory testing of monkeypox virus specimens. Procedures and materials used for collecting specimens may vary depending on the phase of the rash (e.g., swabs from lesion surface or crust from healing lesion). Collect two swabs from each lesion, preferably from different locations on the body or from lesions that differ in appearance (e.g., a pair of swabs for each lesion with a total of 2-3 lesions). Vigorously swab each lesion, avoiding contamination of gloved hands, to ensure adequate viral DNA is collected.



MONKEYPOX

Tips for Adequate Collection of a Lesion Specimen from a Suspect Monkeypox Virus Case

Vigorous swabbing of lesion specimens maximizes the probability of achieving accurate diagnostic results. **Specimens that do not contain enough human DNA may lead to inconclusive PCR test results, with no positive or negative result.** Inconclusive results necessitate patients being sampled again which can delay diagnosis. Follow the instructions below to make sure your specimens are adequate for testing. While vigorous swabbing on the surface of a lesion should collect enough viral DNA, more viral DNA can be found in crusts when present. Recommended infection prevention and control practices, including the use of personal protective equipment (PPE), for caring for a patient with suspected or confirmed monkeypox infection should be used during specimen collection: What Healthcare Professionals Should Know. Unroofing or aspiration of lesions (or otherwise using sharp instruments for monkeypox testing) is **not necessary, nor recommended due to the risk for sharps injury.**

Swabbing of Lesion Surface:

1. Use sterile, synthetic swabs. Do not use cotton swabs.
2. More information on specimen collection can be found here: Preparation and Collection of Specimens.
3. Do not clean the lesion with ethanol or any other disinfectant prior to swabbing.
4. Hold the swab with a firm grasp. Avoid touching the swab shaft at least an inch before the tip if collecting a dry swab and the length of the swab shaft that will be submerged in liquid if using a swab to be stored in viral transport media.
5. Apply firm pressure (generally firm enough so that the swab shaft, if plastic, may bend slightly). This may result in discomfort or slight pain, but it is necessary to obtain adequate DNA.
   a. If lesion ruptures while swabbing, ensure that swab collects lesion fluid.
   b. If possible, avoid using swabs that bend too easily which may make applying firm pressure difficult.
6. Swipe the swab back and forth on the lesion surface at least 2-3 times then rotate and repeat on the other side of the swab at least 2-3 times.
   a. If material is visible on the swab surface (such as skin material or from lesion fluid that is leaking from the lesion), this is indicative of an adequate collection. Although please note that material may not always be visible on swabs.
7. Place swab within appropriate container.
   a. Ensure container, storage and shipping conditions are approved by laboratory that specimen is being sent to for testing.

Collection of crusts from healing lesions:

Crusts are not accepted by all laboratories as an approved specimen type. Ensure the laboratory that will be receiving the specimen for testing is able to test crusts before collecting or sending.

1. Use a forceps or other blunt-tipped sterile instrument to remove all or a piece of the crust at least 4mm x 4mm – about the size of this dot: ●
2. Separate each crust into a dry, sterile container.
   a. Ensure container, storage, and shipping conditions are approved for laboratory that specimen is being sent to for testing.
3. Cover lesion with band aid.

CS333812-A | 08/23/2022

KEY POINTS

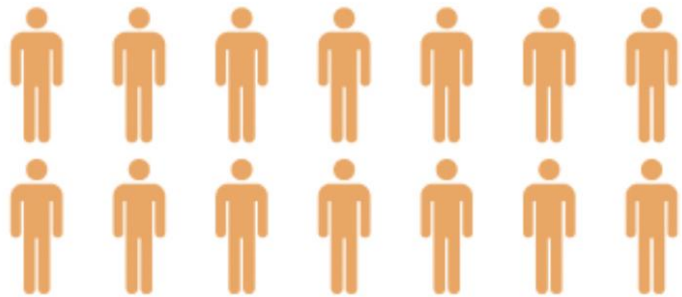
- The cases of monkeypox described in the current outbreak have some atypical features. The rash may start in the genital and perianal areas, the rash may not always disseminate to other parts of the body and typical prodromal symptoms may be mild or absent. These features of the newest monkeypox cases can easily be confused with sexually transmitted infections (STI).
- It is important to comprehensively evaluate patients presenting with genital or perianal ulcers for STIs. However, co-infections with monkeypox and STIs have been reported and the presence of an STI does not rule out monkeypox.
- Patients with a new characteristic rash or who meet one or more of the epidemiogical criteria and in which there is a high suspicion should be tested for monkeypox.

People eligible for monkeypox vaccination should get vaccinated as soon as possible

Study of males ages 18–49 years eligible for vaccination*

For every **1** infection among people receiving one dose†

there were **14** infections among people receiving no doses



It's important to get both doses for best protection

* During July 31, 2022—September 3, 2022

† Received first dose of vaccine 14 days or more earlier

bit.ly/mm7140e3

SEPTEMBER 30, 2022

MMWR

WHO SHOULD BE VACCINATED

- People can be vaccinated after known or suspected exposure to someone with monkeypox. Vaccination should also be offered to people with the highest potential for exposure to monkeypox.
  - People who are aware that a recent sex partner within the last 14 days was diagnosed with monkeypox.
  - Gay, bisexual, or other men who have sex with men, as well as transgender people or nonbinary people who have had any of the following within the past 14 days:
    - Sex with multiple partners (or group sex)
    - Sex at a commercial sex venue
    - Sex associated with an event, venue, or defined geographic area where monkeypox transmission is occurring.
- Monkeypox pre-exposure prophylaxis (PrEP) should be offered to people with the highest risk for being exposed to monkeypox such as:
  - Those who work in a high risk occupation (research or clinical laboratorians working with monkeypox, orthopoxvirus or health care personnel response teams designated by public health or antiterror authorities)
  - Gay, bisexual, and other men who have sex with men, as well as transgender or nonbinary people who in the past 6 months have had
    - A new diagnosis of one or more nationally reportable sexually transmitted diseases (i.e., acute HIV, chancroid, chlamydia, gonorrhea, or syphilis)
    - More than one sex partner
  - People who have had any of the following in the past 6 months:
    - Sex at a commercial sex venue
    - Sex in association with a large public event in a geographic area where monkeypox transmission is occurring
  - Sexual partners of people with the above risks
  - People who anticipate experiencing the above risks

JYNNEOS

- JYNNEOS™ is administered as a live virus that is non-replicating.
- JYNNEOS is the only FDA-licensed vaccine in the US to prevent monkeypox disease in individuals 18 years of age and older (Also licensed to prevent smallpox disease)
- Non-replicating viral vectored vaccine using Modified Vaccinia Ankara (MVA-BN) originally developed as alternative to ACAM2000 (live replicating vaccinia virus-based smallpox vaccine)
- It is administered as two subcutaneous or intradermal injections four weeks apart. There is no visible "take" and as a result, no risk for spread to other parts of the body or other people.
- The frequencies of solicited local and systemic adverse reactions among adults with HIV-infection and adults with atopic dermatitis were generally similar to those observed in healthy adults.

TECOVIRIMAT (TPOXX)

- Tecovirimat (TPOXX or ST-246) is an antiviral medication developed for smallpox and is available from the Strategic National Stockpile
- Oral capsule and IV formulations approved by FDA for the treatment of human smallpox disease in adults and pediatric patients
- Efficacy based on studies of non-human primates infected with monkeypox and rabbits infected with rabbitpox

Summary of Recent Changes

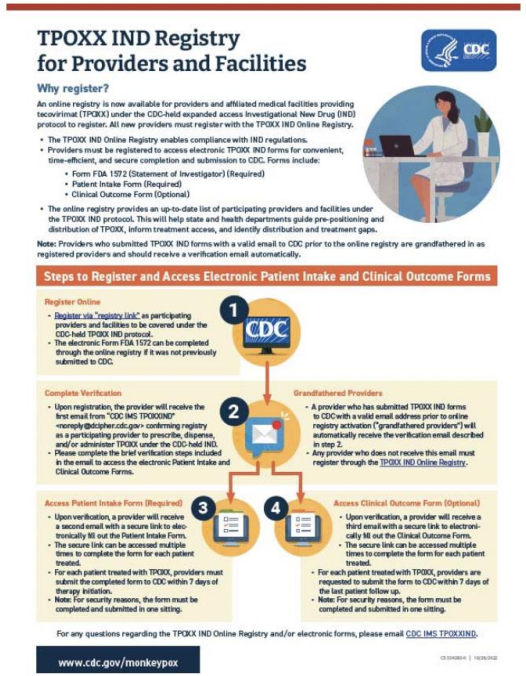
Updates as of October 28, 2022

Tecovirimat (TPOXX) IND Online Registry

NEW: Tecovirimat (TPOXX) IND Online Registry for Providers and Facilities and Transition to Electronic Patient Intake and Clinical Outcome Forms

- New providers and affiliated facilities can now register online as participating providers/sites under the CDC-held EA-IND for tecovirimat.

Access the Tecovirimat (TPOXX) IND Registry here



- New providers and affiliated medical facilities providing tecovirimat under the EA-IND protocol must register with the tecovirimat IND online registry starting October 28, 2022.
- Through the registry, providers can submit
  - Form FDA 1572
  - Patient Intake Form
  - Clinical Outcome Form
- The tecovirimat IND Online Registry allows for convenient, time-efficient, and secure completion and return of EA-IND forms to CDC. View this Fact Sheet for an overview of the tecovirimat IND online registry process.
- Providers who have returned required IND forms prior to the online registry transition are grandfathered in as participating providers under the EA-IND. Any providers with valid email addresses on record should have received emails providing them access to the electronic Patient Intake and Clinical Outcome forms on October 25, 2022.
- Any questions about the registry and transition to electronic tecovirimat IND Patient Intake and Clinical Outcome forms can be directed to CDC IMS TPOXXIND (eocevent477@cdc.gov).

TREATMENT INDICATIONS

Severe disease — consider severe disease when a patient has conditions such as hemorrhagic disease; a large number of lesions such that they are confluent; necrotic lesions; severe lymphadenopathy that can be necrotizing or obstructing (such as in airways); involvement of multiple organ systems and associated comorbidities (for example, pulmonary involvement with nodular lesions; sepsis; encephalitis; myocarditis; ocular or periorbital infections); or other conditions requiring hospitalization

Involvement of anatomic areas which might result in serious sequelae that include scarring or strictures — these include lesions directly involving the pharynx causing dysphagia, inability to control secretions, or need for parenteral feeding; penile foreskin, vulva, vagina, urethra, or anorectum with the potential for causing strictures or requiring catheterization; anorectal lesions interfering with bowel movements (for example, severe pain); and severe infections (including secondary bacterial skin infections), especially those that require surgical intervention such as debridement.

ADDITIONAL TREATMENT CONSIDERATIONS

- People currently experiencing severe immunocompromise due to conditions such as advanced or poorly controlled human immunodeficiency virus (HIV), leukemia, lymphoma, generalized malignancy, solid organ transplantation, therapy with alkylating agents, antimetabolites, radiation, tumor necrosis factor inhibitors, high-dose corticosteroids, being a recipient of a hematopoietic stem cell transplant <24 months post-transplant or ≥24 months but with graft-versus-host disease or disease relapse, or having autoimmune disease with immunodeficiency as a clinical component[1]
- Pediatric populations, particularly patients younger than 8 years of age
- Pregnant or breastfeeding people
- People with a condition affecting skin integrity — conditions such as atopic dermatitis, eczema, burns, impetigo, varicella zoster virus infection, herpes simplex virus infection, severe acne, severe diaper dermatitis with extensive areas of denuded skin, psoriasis, or Darier disease (keratosis follicularis)

Monkeypox

CARING FOR THE SKIN

The monkeypox virus causes lesions to form on the body. While these can be locate anywhere, many individuals during the current outbreak have experienced lesions in anogenital region, though involvement of other areas including the face, extremities mucosal areas such as the mouth have also occurred.[1-3]

While the number of lesions can vary widely, a recent CDC report indicated that the majority of cases in the current outbreak develop less than 50 lesions.[4,5] No matter t number, monkeypox lesions can lead to both atrophic and hypertrophic scarring.[6,7]

For individuals who have developed lesions from a monkeypox infection, care should be taken tc lesions heal properly with minimal scarring. Though data on lesion healing in monkeypox infectio limited, information on wound healing in general, as well as care for similar skin lesions form othe can aid in understanding how to best care for monkeypox lesions and prevent scarring:

Wash skin with a mild soap and water.[8]

To avoid potential transmission, ask patients not to share towels, bath linens, or clothing with others.

Monkeypox lesions are considered infectious until have healed

(scabs have fallen off and a fresh layer of intact skin has formed Therefore, the CDC recommends that all rashes should be cove extent possible (for example, by wearing long sleeves and long Monkeypox isolation and infection control at home guidelines f CDC can be found here.

Keep affected sites and individual lesions covered.

In general, all lesions of monkeypox are considered infectious (capable of transmitting infection) through contact, and it is advisable to keep affected sites and individual lesions covered.

Antiseptics or anti-bacterial agents

are only required if there is concern for bacterial infection.[8-15]

If the lesion becomes infected,

patients should contact their physician or other healthcare provider immediately.

After lesions have healed,

if there is concern for scarring, silicone-based gels or sheeting may also be used.[10,16]

Sun protection

(broad spectrum SPF 30 or higher) should also be emphasized for several months after lesion resolution to avoid hyper or hypopigmentation of lesions or scars.[10]

No scratching.

Individuals with monkeypox lesions should be instructed not to scratch or unroof lesions or scabs, which may lead to secondary infection. Dermatologists should suggest keeping fingernails short to avoid unintentional scratching.[9,17]

To help soothe skin, baths may be taken.

Alternatively, sitz baths and warm or cool compresses may help in soothing lesions in the anogenital region.[17-19]

Certain patients may qualify for monkeypox-specific therapeutics;

consultation with appropriate specialists as necessary may be indicated to identify the most up-to-date options.

For more information about monkeypox, visit the CDC site for monkeypox at: **www.cdc.gov/monkeypox**

AAD American Academy of Dermatology Association

INFECTION CONTROL IN HEALTHCARE SETTINGS

Gown, Gloves, Eye protection (i.e., goggles or a face shield that covers the front and sides of the face)

NIOSH-approved particulate respirator equipped with N95 filters or higher

Avoid Aerosolizing procedures

Airborne isolation not needed

Isolation Precautions should be maintained until all lesions have crusted, those crusts have separated, and a fresh layer of healthy skin has formed underneath.

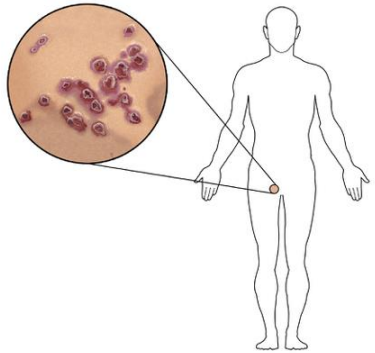
Think COVID minus HEPA filter; no fans

MONKEYPOX

What To Do If You Suspect Monkeypox

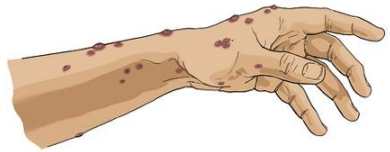
Early detection can help stop the spread of monkeypox.
Know what to look for and what to do if you suspect monkeypox.

Signs and Symptoms



- A new, maculo-papular rash that develops into vesicles and then pustules. Lesions may be deep-seated, firm, well-circumscribed and umbilicated. The rash may:
  - Appear anywhere on the body, including palms, soles and anogenital region
  - Be localized to a specific body site or diffuse
  - Be the only symptom people experience
  - Be painful, painless, or itchy
- Fever, headache, malaise, chills, and lymphadenopathy may occur.
- Patients may present with anorectal pain, rectal bleeding, or tenesmus in association with visible perianal skin lesions and proctitis.

Ask the patient: Within the last 21 days, have you



- Traveled to a country with recent monkeypox cases, one that's experienced prior outbreaks?
- Had close or intimate contact with someone with a similar rash or confirmed monkeypox infection?
- Had close or intimate contact with someone in a social network experiencing monkeypox infection?
  - Most U.S. cases have been among gay, bisexual, and other men who have sex with men; many of whom had anonymous sex with someone they met on dating apps or sex with multiple partners at commercial sex venues or events where anonymous sex is common.

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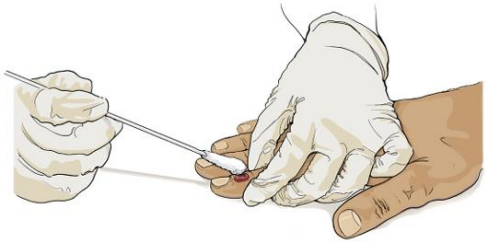
Call your health department as soon as you suspect monkeypox



- Your state or local public health agency will:
  - Provide guidance for specimen collection and arrange for testing
  - Provide guidance for isolation
  - Discuss treatment options, if needed
- Tell your hospital epidemiologist or infection preventionist about the patient.

Protect your patient, yourself, and others

- Have the patient wear a mask and place them in a single-person room. Follow CDC's infection prevention and control guidelines for healthcare facilities, including using appropriate PPE around the patient.

Share resources with your patient

Let patients know:

- What to do if they are sick, including how to manage symptoms and rash relief
- How to identify close contacts and tips on what to say
- How to prevent spreading monkeypox to others

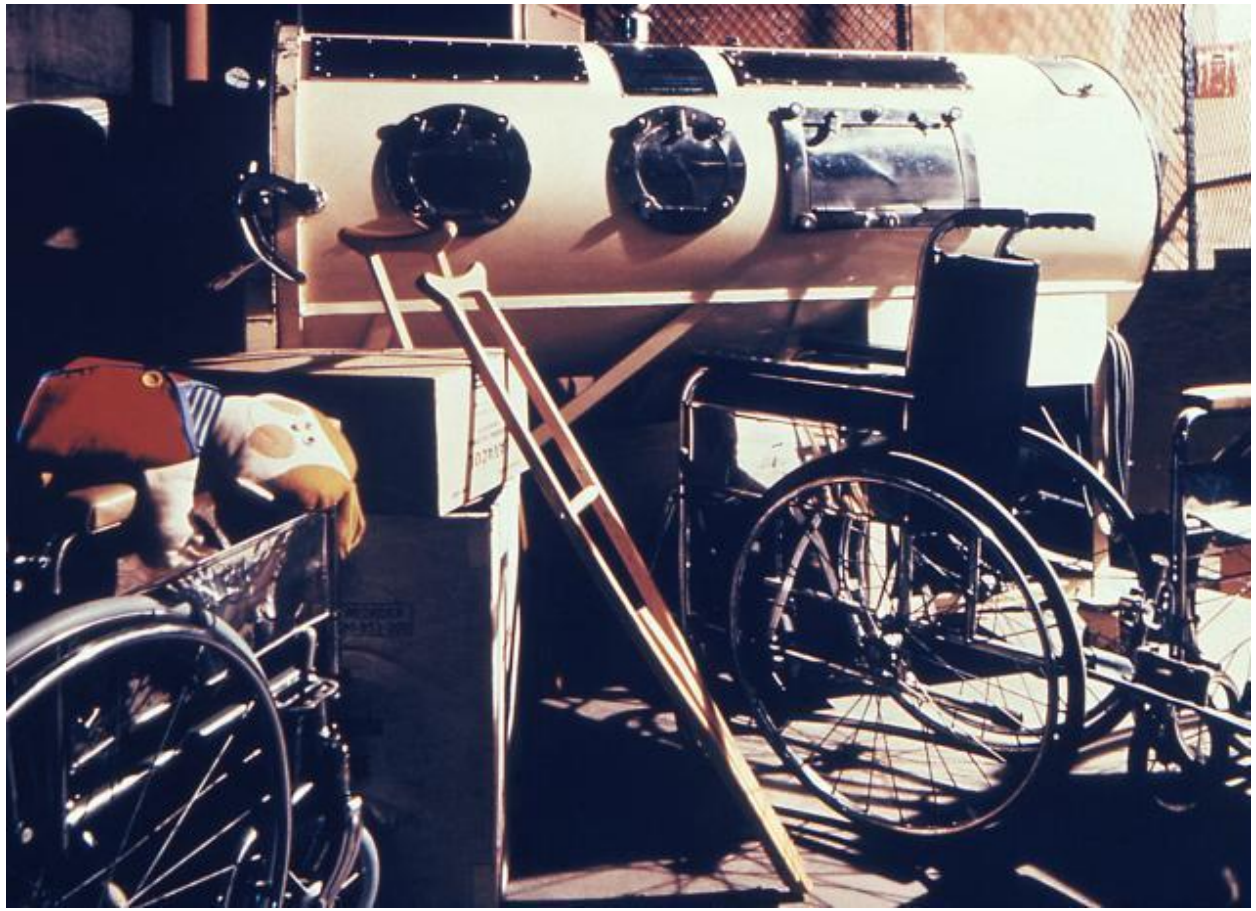
  People with monkeypox are advised to stay at home (isolate) if they have monkeypox symptoms, including until the monkeypox rash has healed and a new layer of skin has formed.
- How to disinfect their home, including what type of disinfectant to use and how to clean hard and soft surfaces
- If treatment may be right for them

www.cdc.gov/monkeypox

CS 332623-A | 08/18/2022

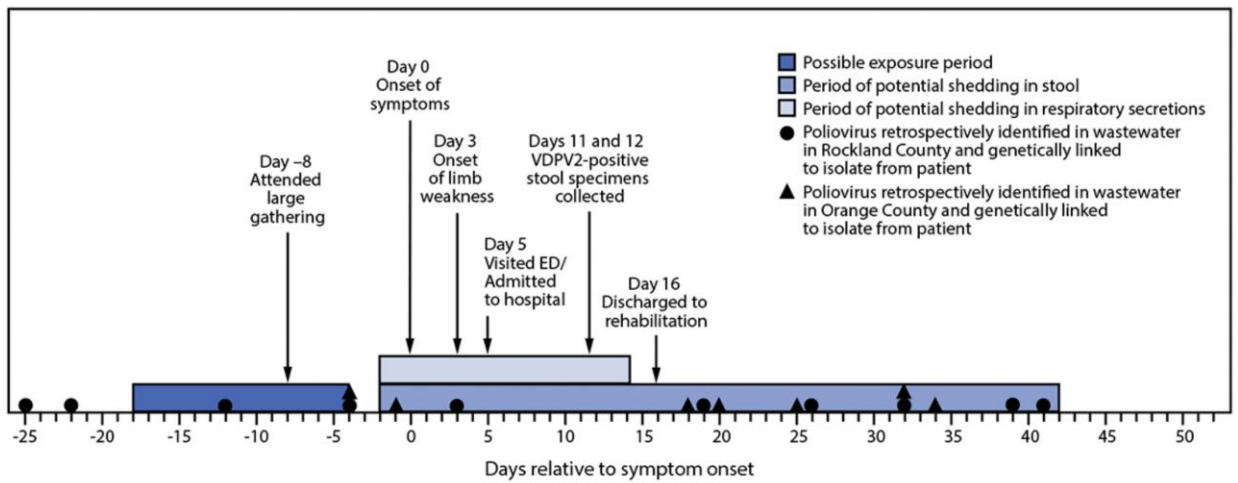
HOME ISOLATION

- Bathroom usage:
  - If possible, use a separate bathroom if there are others who live in the same household.
  - If there is not a separate bathroom in the home, the patient should clean and disinfect surfaces using an EPA-registered household cleaning product after using a shared space if the lesions are exposed
- Consider disposable glove use while cleaning if lesions are present on the hands.
- Limit exposure to others:
- Avoid contact with unaffected individuals until lesions have resolved, the scabs have fallen off, and a fresh layer of intact skin has formed.
- Isolate in a room or area separate from other household members and pets when possible.
- Limit use of spaces, items, and food that are shared with other household members.
- Do not share dishes and other eating utensils. It is not necessary for the infected person to use separate utensils if properly washed. Wash soiled dishes and eating utensils in a dishwasher or by hand with warm water and soap.
- Limit contamination within household:
  - Avoid direct contact with upholstered furniture and porous materials that cannot be laundered by placing coversheets, waterproof mattress covers, blankets, or tarps over these surfaces. Additional precautions such as steam cleaning can be considered if there is concern about contamination.



POLIO

FIGURE. Timeline of patient activities, potential poliovirus exposures, shedding, and poliovirus-positive wastewater* samples† genetically linked to a patient with a case of type 2 vaccine-derived poliovirus — New York, May–August 2022



MMWR Morb Mortal Wkly Rep 2022;71:1065-1068.

ROCKLAND COUNTY

- On July 21, 2022, the New York State Department of Health (NYSDOH) and the Rockland County Department of Health (RCDOH) alerted the public to a case of paralytic polio in an unvaccinated young adult in Rockland County.
- The case was identified by NYSDOH's Wadsworth Center Laboratory and confirmed by the Centers for Disease Control and Prevention (CDC) through testing.
- The individual experienced severe symptoms, including paralysis, and was hospitalized. New Yorkers should know that paralysis from polio is typically permanent, resulting in life-long disability.

WASTEWATER SURVEILLANCE

- NYSDOH launched wastewater surveillance
- Testing and sequence analysis from the Centers for Disease Control and Prevention (CDC) has detected poliovirus repeatedly in samples collected from Rockland County, Orange County, Sullivan County and in samples collected from New York City and Nassau County.
- All samples reported are samples of concern, meaning they are types of poliovirus that can cause paralysis in humans.
- 82 of these samples have been genetically-linked to the case in Rockland County.

POLIO VACCINATION

- High rates of poliovirus vaccination coverage resulted in the elimination of paralytic polio caused by wild-type poliovirus in the United States in 1979.
- Only IPV has been used in the United States since 2000; 3 doses of IPV confer 99%–100% protection from paralytic poliomyelitis. It does not prevent infection or excretion, limited mucosal immunity, protects against paralysis
- Some countries still use OPV; advantages to this approach include low cost, ease of use, and high efficacy in stopping outbreaks.
- In rare cases, the live attenuated virus in OPV can regain neurovirulence, circulate in underimmunized populations, and cause paralytic disease.

WHY IS THIS HAPPENING?

- 2 types of polio vaccines currently available: IPV and OPV
- IPV is inactivated poliovirus; not all countries are using IPV; US uses only IPV
- OPV is easier to administer; OPV contains an attenuated strain of virus
- In about 1 in 2.5 million cases, transmission of the vaccine strain can occur to a susceptible individual
- With adequate vaccine coverage, these events are incredibly rare; when vaccine coverage falls, there are opportunities for outbreaks

INFECTION AND TRANSMISSION

- Poliovirus is an enterovirus and is highly contagious
- There are three poliovirus serotypes (PV1, PV2, and PV3) with minimal heterotypic immunity between them. That is, immunity to one serotype does not produce significant immunity to the other serotypes.
- Poliovirus infects only humans. Infection is more common in infants and young children.
- The virus enters through the mouth and multiplies in the oropharynx and gastrointestinal tract.
- The virus is usually present in nasopharyngeal secretions for 1 to 2 weeks and can be shed in stools for several weeks after infection, even in individuals with minor symptoms or no illness.

SYMPTOMS

- 70% of people will have no symptoms
- 25% will have a mild flu-like illness
- Fewer than 1% of people will have weakness or paralysis in their arms, legs, or both. The paralysis can lead to permanent disability and death.
- Incubation period for nonparalytic symptoms is 3 to 6 days. The onset of paralysis usually occurs 7 to 21 days after infection.
- Adults who had paralytic poliomyelitis during childhood may develop noninfectious post-polio syndrome (PPS) 15 to 40 years later. PPS is characterized by slow and irreversible exacerbation of weakness often in those muscle groups involved during the original infection. Muscle and joint pain also are common manifestations. The prevalence and incidence of PPS is unclear. Studies estimate that 25–40% of polio survivors suffer from PPS.

Polio Vaccination Recommendations for Specific Groups

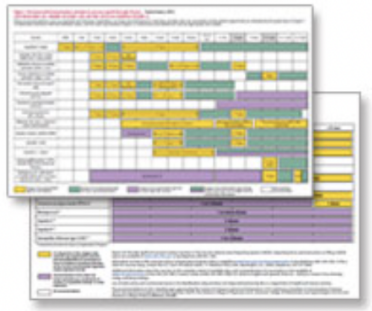
Most adults (i.e., persons aged >18 years) residing in the United States are presumed to be immune to poliovirus from previous routine childhood immunization and have only a small risk of exposure to poliovirus in the United States.

However, adults who are unvaccinated, incompletely vaccinated, or are at higher risk for exposure to poliovirus should receive polio vaccination. Higher risk situations include:

- Travelers who have recently traveled or are going to areas or countries where polio is epidemic or endemic (For additional information, see Polio: For Travelers).
- Laboratory and healthcare workers who handle specimens that might contain polioviruses.
- Healthcare workers who are treating patients who could have polio or have close contact with a person who could be infected with poliovirus.
- People who are in contact with or caring for a person who could be infected with polio or has been exposed to polio.
- Unvaccinated adults whose children will be receiving oral poliovirus vaccine (for example, international adoptees or refugees).

Recommendations for poliovirus vaccination for adults will depend on previous records of polio vaccination and the time available before protection is required.

Immunization Schedules



View current schedules for children, teens, and adults.

Contraindication to IPV:

People who have had anaphylactic reactions after a previous dose of inactivated polio vaccine (IPV) or after taking streptomycin, polymyxin B, or neomycin should **not** receive IPV. IPV contains trace amounts of streptomycin, polymyxin B, and neomycin, and people who are sensitive to these antibiotics can also have hypersensitivity reactions to IPV.

No serious adverse events related to use of enhanced-potency IPV have been documented.

CASE

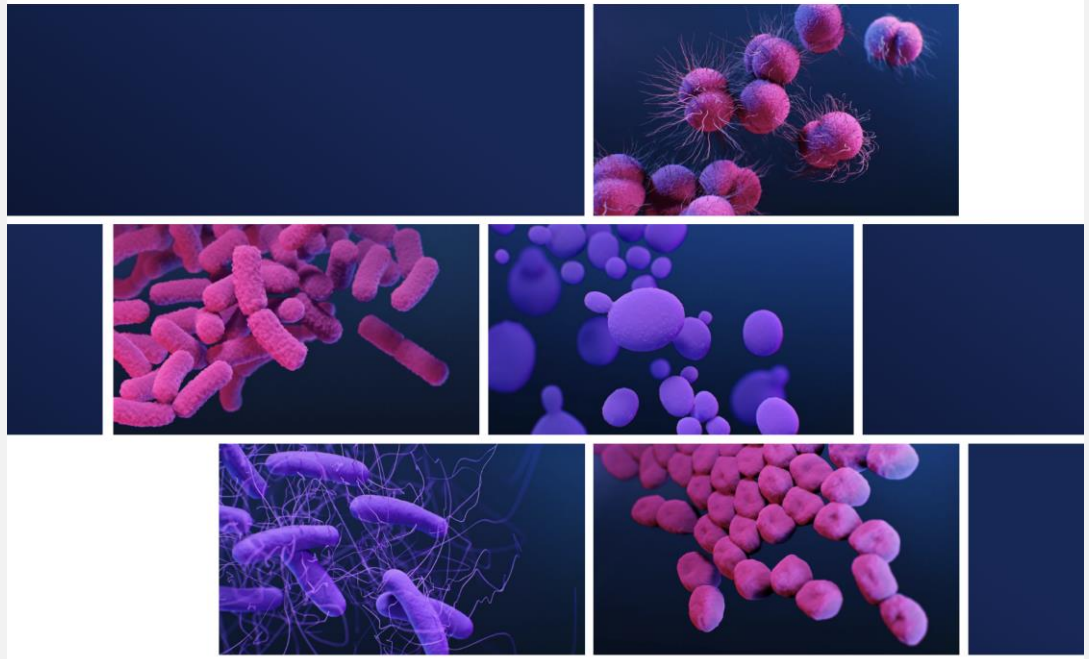
Patient with ESRD on HD presents with a diabetic foot ulcer. He undergoes debridement and bone biopsy. Culture results show: the following. What would you do?

Susceptibility

	Klebsiella Pneumoniae					Proteus Mirabilis				Staphylococcus Aureus	
	E TEST METHOD		KIRBY BAUER METHOD	MIC METHOD		E TEST METHOD		MIC METHOD		MIC METHOD	
Amikacin				<=2	Susceptible						
AMP/SULBACTAM				>=32/16	Resistant			>=32/16	Resistant		
Ampicillin				>=32	Resistant			>=32	Resistant		
Cefazolin				>=64	Resistant			>=64	Resistant		RESISTANT(DEDUCED)
Cefepime				>=64	Resistant			4	Resistant		
CEFTAZIDIME/AVIBACTAM	>256	Resistant				0.125	Susceptible				
CEFTOLOZANE/TAZOBACTAM	>256	Resistant				1.0	Susceptible [1]				
Ceftriaxone				>=64	Resistant			>=64	Resistant		
Ciprofloxacin				>=4	Resistant			>=4	Resistant		
Clindamycin										>=4	Resistant
Doxycycline										>=16	Resistant
Ertapenem			Resistant								
ESBL Test									POSITIVE [2]		
Gentamicin				<=1	Susceptible			8	Intermediate		
IMIPENEM				>=16	Resistant						
Levofloxacin				>=8	Resistant			>=8	Resistant		
Meropenem				>=16	Resistant						
MULTIDRUG RESISTANCE/MDRO					POSITIVE [3]						
Oxacillin										>=4	Resistant
PIPERACIL/TAZOBACTAM				>=128	Resistant			<=4	Susceptible		
Tobramycin				8	Intermediate			8	Intermediate		
TRIMETH/SULFAMETHOXAZOLE				>=16/304	Resistant			>=16/304	Resistant	<=0.5/9.5	Susceptible
Vancomycin										1	Susceptible

ANTIBIOTIC RESISTANCE THREATS IN THE UNITED STATES

2019



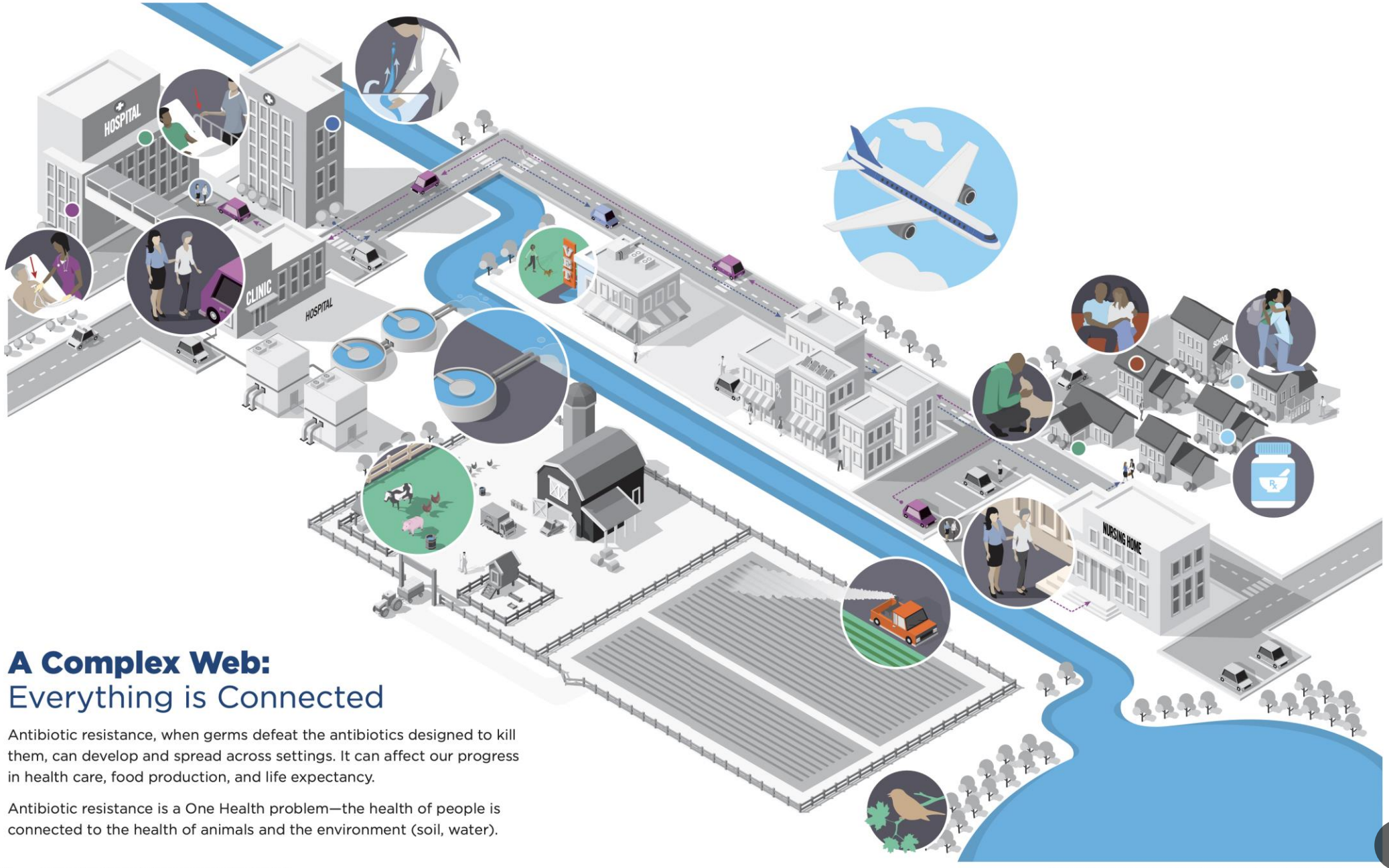
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Revised Dec. 2019

Detect Resistant Threats

Prevent & Contain Resistant Germs

Improve Antibiotic Use



A Complex Web:
Everything is Connected

Antibiotic resistance, when germs defeat the antibiotics designed to kill them, can develop and spread across settings. It can affect our progress in health care, food production, and life expectancy.

Antibiotic resistance is a One Health problem—the health of people is connected to the health of animals and the environment (soil, water).

MULTIDRUG-RESISTANT *PSEUDOMONAS AERUGINOSA*

THREAT LEVEL **SERIOUS**

32,600 Estimated cases in hospitalized patients in 2017

2,700 Estimated deaths in 2017

$767M Estimated attributable healthcare costs in 2017

Pseudomonas aeruginosa (P. aeruginosa) **causes many types of healthcare-associated infections, including pneumonia, bloodstream infections, urinary tract infections, and surgical site infections.**

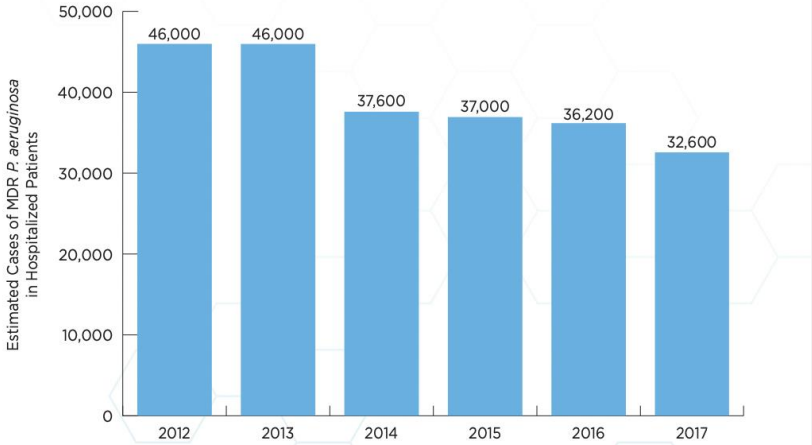
WHAT YOU NEED TO KNOW

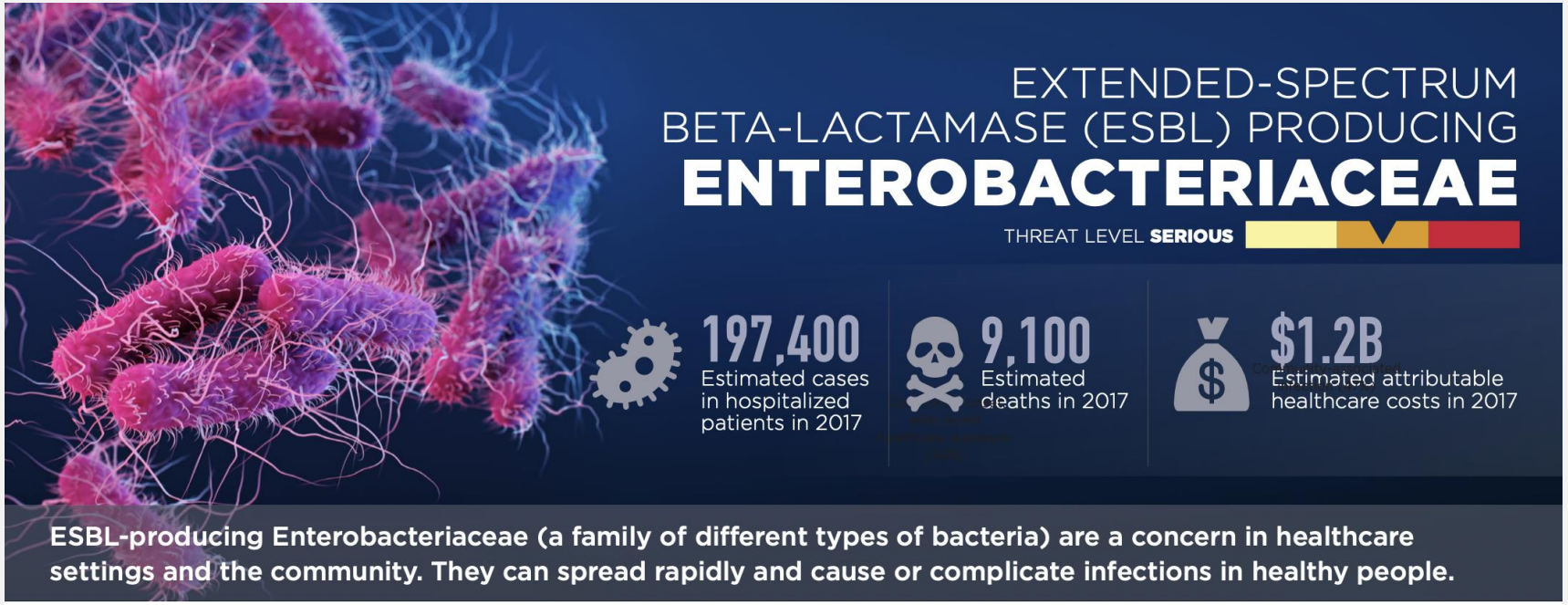
- *P. aeruginosa* infections usually occur in people in the hospital or with weakened immune systems. It is particularly dangerous for patients with chronic lung diseases.
- Some types of multidrug-resistant (MDR) *P. aeruginosa* are resistant to nearly all antibiotics, including carbapenems.
- Two to 3% of carbapenem-resistant *P. aeruginosa* carry a mobile genetic element that makes a carbapenemase enzyme. This enzyme makes carbapenem antibiotics ineffective. Mobile genetic elements are easily shared between bacteria, rapidly spreading resistance that destroys these important drugs.

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

CASES OVER TIME

Continued infection control and appropriate antibiotic use are important to maintain decreases in MDR *P. aeruginosa* infections.





EXTENDED-SPECTRUM BETA-LACTAMASE (ESBL) PRODUCING ENTEROBACTERIACEAE

THREAT LEVEL **SERIOUS**

197,400 Estimated cases in hospitalized patients in 2017

9,100 Estimated deaths in 2017

$1.2B Estimated attributable healthcare costs in 2017

ESBL-producing Enterobacteriaceae (a family of different types of bacteria) are a concern in healthcare settings and the community. They can spread rapidly and cause or complicate infections in healthy people.

WHAT YOU NEED TO KNOW

- ESBLs are enzymes that break down commonly used antibiotics, such as penicillins and cephalosporins, making them ineffective.
- ESBL-producing Enterobacteriaceae often cause infections in otherwise healthy people. About one-quarter of patients with these infections had no known underlying health conditions.
- Antibiotic options to treat ESBL-producing Enterobacteriaceae infections are limited. Healthcare providers often have to use intravenous (IV) carbapenem antibiotics to treat infections that used to be treated with oral antibiotics.

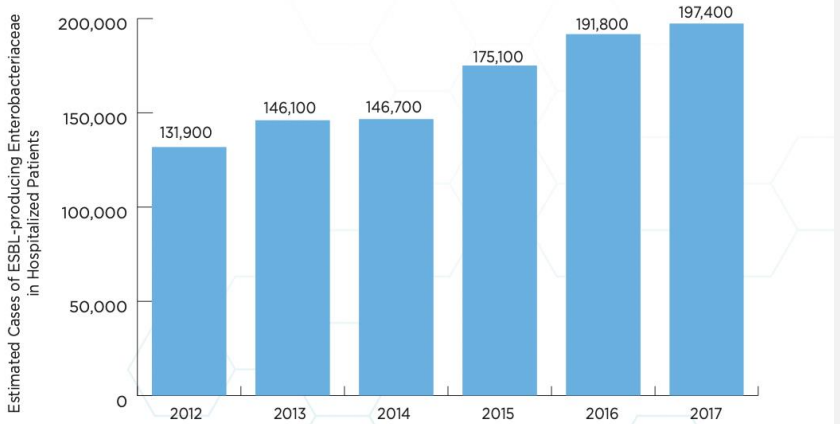
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

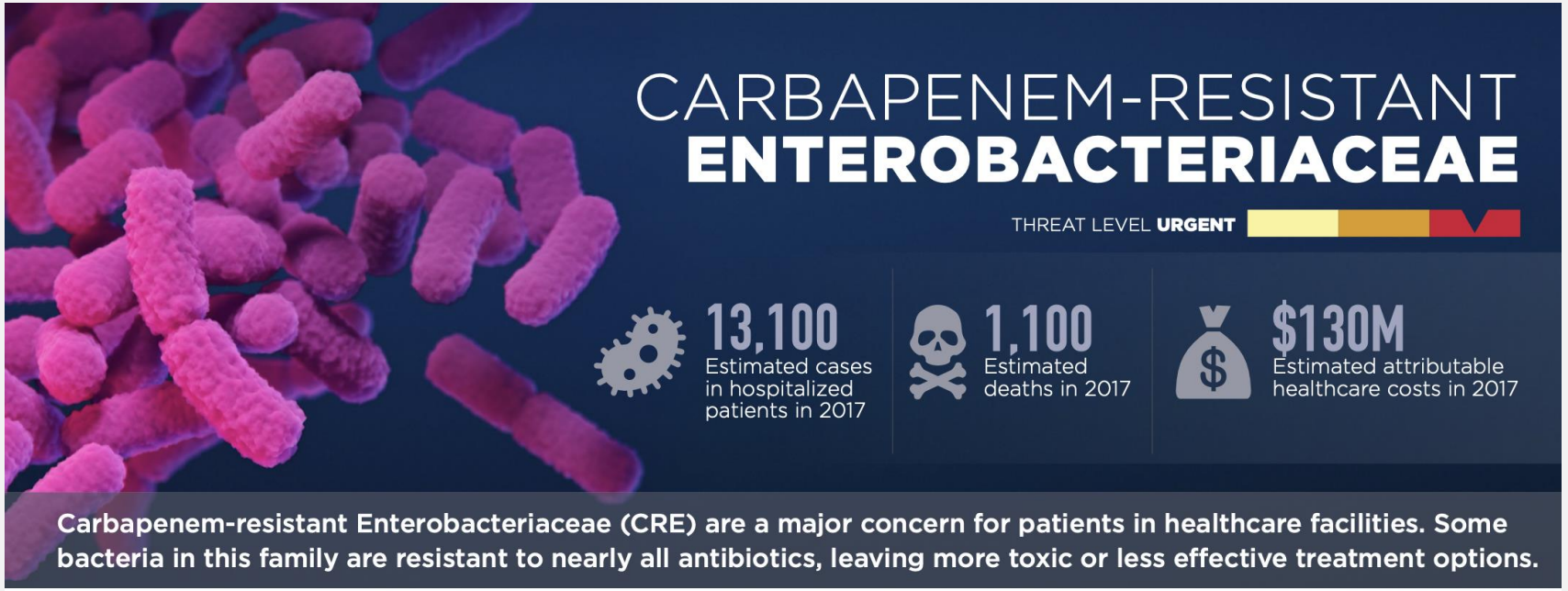
CASES OVER TIME

Long-term care facility-onset infection (14%)

Hospital-onset infection (5%)

CDC and partners are working to assess and address why cases of ESBL-producing Enterobacteriaceae have increased since 2012.





CARBAPENEM-RESISTANT ENTEROBACTERIACEAE

THREAT LEVEL **URGENT**

13,100 Estimated cases in hospitalized patients in 2017

1,100 Estimated deaths in 2017

$130M Estimated attributable healthcare costs in 2017

Carbapenem-resistant Enterobacteriaceae (CRE) are a major concern for patients in healthcare facilities. Some bacteria in this family are resistant to nearly all antibiotics, leaving more toxic or less effective treatment options.

WHAT YOU NEED TO KNOW

- Patients who require devices (e.g., catheters) and patients taking long courses of some antibiotics are most at risk for CRE infections.
- CRE can carry mobile genetic elements that are easily shared between bacteria. Approximately 30% of CRE carry a mobile genetic element that can make an enzyme, which makes carbapenem antibiotics ineffective and rapidly spreads resistance that destroys these important drugs.
- Preventing CRE infections and containing the spread of carbapenem resistance is important to protect people.

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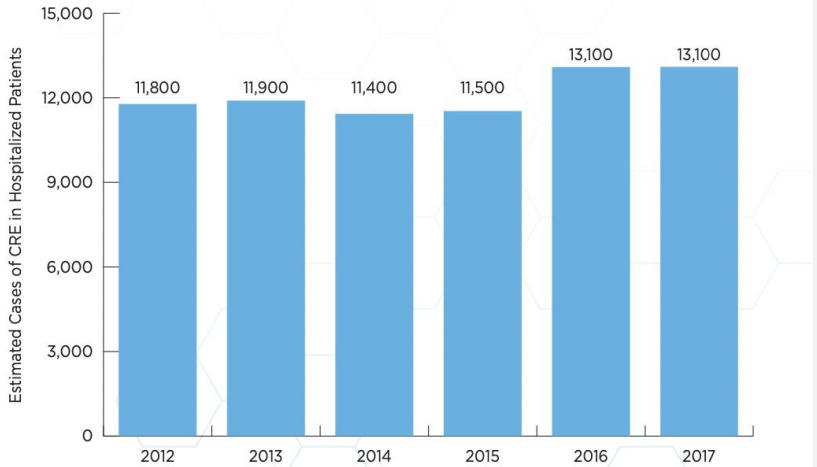
Centers for Disease Control and Prevention

CASES OVER TIME

Containment strategies have prevented further spread of some types of CRE in the United States, but continued action is needed.



CARBAPENEM-RESISTANT *ACINETOBACTER*

THREAT LEVEL **URGENT**

8,500 Estimated cases in hospitalized patients in 2017

700 Estimated deaths in 2017

$281M Estimated attributable healthcare costs in 2017

Acinetobacter **bacteria can survive a long time on surfaces. Nearly all carbapenem-resistant *Acinetobacter* infections happen in patients who recently received care in a healthcare facility.**

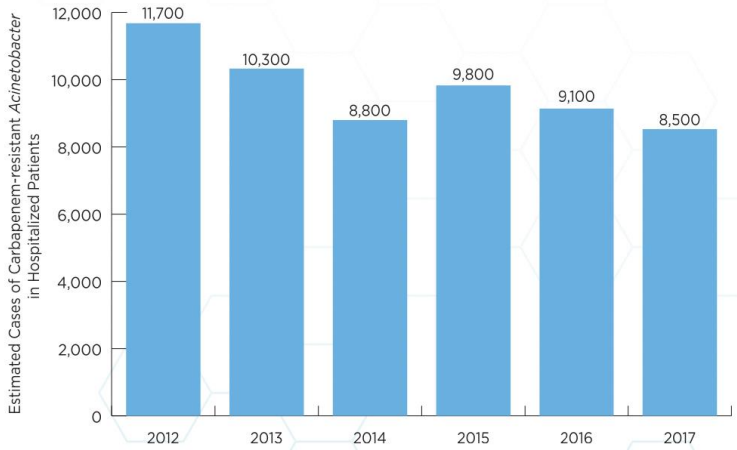
WHAT YOU NEED TO KNOW

- Carbapenem-resistant *Acinetobacter* cause pneumonia and wound, bloodstream, and urinary tract infections. These infections tend to occur in patients in intensive care units.
- Carbapenem-resistant *Acinetobacter* can carry mobile genetic elements that are easily shared between bacteria. Some can make a carbapenemase enzyme, which makes carbapenem antibiotics ineffective and rapidly spreads resistance that destroys these important drugs.
- Some *Acinetobacter* are resistant to nearly all antibiotics and few new drugs are in development.

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

CASES OVER TIME

Continued infection control and appropriate antibiotic use are important to maintain decreases in carbapenem-resistant *Acinetobacter* infections.



CLOSTRIDIOIDES DIFFICILE

THREAT LEVEL **URGENT**

223,900 Estimated cases in hospitalized patients in 2017

12,800 Estimated deaths in 2017

$1B Estimated attributable healthcare costs in 2017

Clostridioides difficile (C. difficile) **bacteria can cause life-threatening diarrhea. Infections occur most often in people who have taken antibiotics for other conditions. It is the most common healthcare-associated infection.**

WHAT YOU NEED TO KNOW

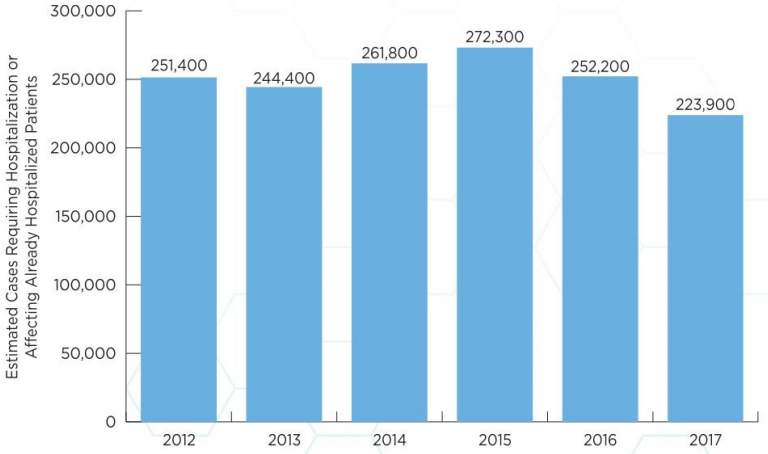
- While healthcare-associated *C. difficile* cases are decreasing, community-associated cases are not.
- Strategies to reduce *C. difficile* infections include improving antibiotic use, infection control, and healthcare facility cleaning and disinfection.
- *C. difficile* infections are more common and tend to be more severe in older patients.

Previously *Clostridium difficile.* Also called *C. diff.* Cost includes hospital-onset cases only.

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

CASES OVER TIME

Continued appropriate infection control, antibiotic use, and diagnostic testing are important to maintain decreases in *C. difficile* cases.



Climate change: fires, floods, and infectious diseases

Against a backdrop of devastating wildfires and floods across the world and the hottest July on record, on Aug 9, the Intergovernmental Panel on Climate Change (IPCC) published Working Group I's contribution to its Sixth Assessment Report, Climate Change 2021. This document focuses on the physical science basis of climate change and is the starkest yet to be released by IPCC, stating the unequivocal contribution of humans to the warming of the planet.

As per the report, rising global temperatures have driven "widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere". The breadth of the implications on human and natural systems will be explored in the 2022 Working Group II's contribution to the report. However, after almost 2 years of global focus on the COVID-19 pandemic, this first volume comes as a severe reminder that other major global crises are ongoing and require immediate action.

Among the wide-ranging effects of climate change on health, infectious diseases are not spared. Climatic conditions are becoming increasingly suitable for the transmission of multiple infectious diseases, by directly affecting biological features of pathogens (eg, growth, survival, and virulence) and their vectors, and by indirectly favouring transmission through the modification of ecosystems and changes in human behaviour.

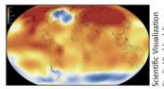
Rising temperatures and increased precipitation can promote an array of infectious diseases, from vector-borne diseases (eg, malaria, dengue, and leishmaniasis), to enteric infections and diarrhoea (eg, cholera, vibriosis, and rotavirus infection), and to parasitic diseases such as schistosomiasis. Climate-related suitability for dengue transmission in 2018 had globally increased since 1950 by an estimated 8·9%, when considering *Aedes aegypti*, and by 15·0%, when considering *Aedes albopictus*. This increase is partly due to the broadened geographical reach of these vectors—eg, several *Aedes* spp, absent from Europe before 1990, have become established in several European countries. Other vectors, such as *Ixodes ricinus* ticks, carriers of *Borrelia burgdorferi* (causing Lyme disease) and tick-borne encephalitis virus, have also gradually spread to wider regions in Europe. In the past 10 years, Europe has seen a return of malaria, with sustained local transmission of *Plasmodium vivax* infections in Greece in 2012, increased incidence of pathogenic *Vibrio* spp infections in the Baltic region, recurring summer outbreaks of West Nile virus in southern and eastern Europe, cases of local transmission of chikungunya in France and Italy, and a report of local transmission of Zika virus in France in 2019.

The multitude and complexity of factors that influence transmission patterns prevent accurate predictions of the effects of climate change on infectious diseases. But the devastating global consequences of the COVID-19 pandemic on health, health systems, and economies should caution governments, policy makers, and the general public to not underestimate the threat of climate-related changes to infectious disease geographical distribution and burden.

The upcoming 26th UN Climate Change Conference of the Parties (COP26) represents a unique opportunity for participating nations to reinforce the commitments made in the 2015 Paris Agreement "to limit global warming to well below 2°C" and "to achieve a climate neutral world by mid-century". The IPCC 2021 report offers some space for cautious optimism, by including a very low greenhouse gas emission scenario that predicts a temperature rise of 1·0–1·8°C by 2100 (*vs* 1850–1900), but achieving this scenario will require immediate and major policy changes.

When thinking specifically of infectious diseases, curbing greenhouse gas emissions is only one crucial issue. The COVID-19 pandemic has stimulated numerous pandemic preparedness initiatives, primarily focused on the potential emergence of novel pathogens. Such initiatives might do well to broaden their scope to include surveillance of existing infectious diseases and their changing transmission trends in response to evolving climatic conditions. Much research has been done on the impact of climate on health, but little research has been dedicated to mitigation or adaptation measures. The global research community, policy makers, and funders must come together to identify and implement such measures—including strengthening health systems and preparedness—with the primary goal of protecting vulnerable populations, on whom any effects of climate-related changes in infectious disease transmission will be exacerbated by compounding factors such as pre-existing health conditions and low socioeconomic status.

■ *The Lancet Microbe*



Scientific Visualization Studio/Goddard Space Flight Center

For **IPCC's Sixth Assessment Report** see https://www.ipcc.ch/report/ar6/wg1/#outreach

For more on **effects of climate change on health** see **Review** *Lancet* 2021; **387:** 129–70

For more on **infectious diseases and climate change** see https://www.ipcc.ch/report/ar5/wg2/

For more on **increased geographical reach of vectors** see **Review** *Lancet Infect Dis* 2015; **15:** 721–30

For more on **transmission of West Nile virus, chikungunya, and Zika virus in Europe** see *Lancet Reg Health Eur* 2021; **1:** 100017

For **COP26** see https://ukcop26.org/

For more on **research on climate and health** see **Articles** *Lancet Planet Health* 2021; **5:** e514–25

Fungus Amungus

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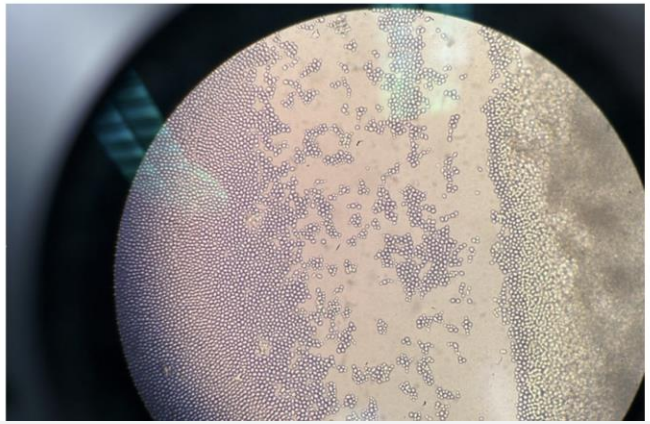


https://www.wnycstudios.org/podcasts/radiolab/articles/fungus-amungus

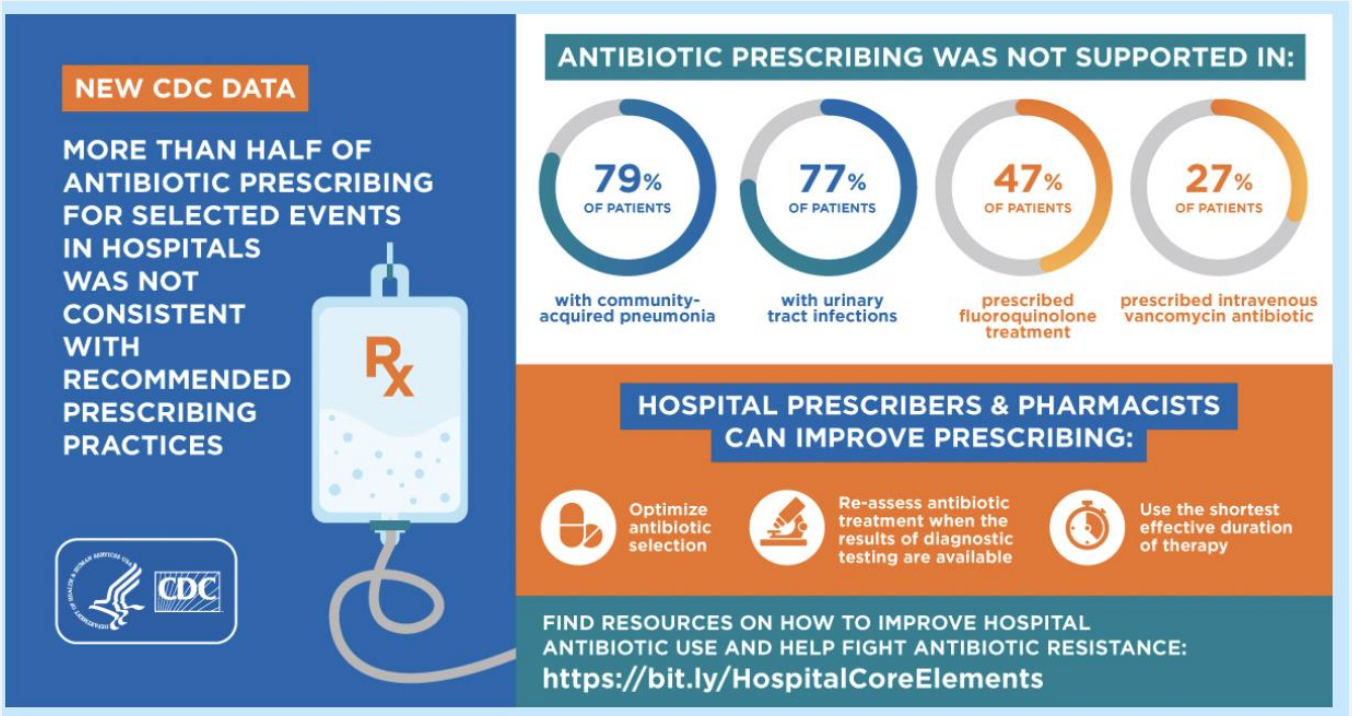
CANDIDA AURIS

- **It causes serious infections**. *C. auris* can cause bloodstream and other types of invasive infections, particularly in patients in hospitals and nursing homes with underlying comorbidities. More than 1 in 3 patients die within a month of being diagnosed with an invasive *C. auris* infection.
- **It is often multidrug-resistant**. Antifungal medications commonly used to treat other *Candida* infections often don't work for *C. auris*. Some *C. auris* isolates are resistant to all three major classes of antifungal medications.
- **It is becoming more common**. Although *C. auris* was just discovered in 2009, the number of cases has grown quickly. Since 2009, it has been reported in dozens of countries, including the United States.
- **It is difficult to identify**. *C. auris* can be misidentified as other types of fungus unless specialized laboratory methods are used. Correctly identifying *C. auris* is critical for starting measures to stop its spread and prevent outbreaks.
- **It can spread and cause outbreaks in healthcare facilities**. Just like other multidrug-resistant organisms such as carbapenem-resistant Enterobacteriaceae (CRE) and methicillin-resistant Staphylococcus aureus (MRSA), *C. auris* can be transmitted in healthcare settings and cause outbreaks. It can colonize patients for many months, persist in the environment, and withstand some commonly used healthcare facility disinfectants.

RISK FACTORS FOR C.AURIS AND MDRO

- Patients who have received healthcare in post-acute care facilities especially those with ventilator units.
- Patients recently hospitalized outside the United States, especially in countries with known *C. auris* cases and patients infected or colonized with carbapenemase-producing bacteria.
- People who have recently spent time in nursing homes and have indwelling catheters, PEG's or trachs are at increased risk for colonization and infection. Risk factors for *Candida auris* infections are generally similar to risk factors for other types of *Candida* infections and include recent surgery, diabetes, broad-spectrum antibiotic and antifungal use.
- Infections have been found in patients of all ages, from preterm infants to the elderly

WHAT CAN YOU DO TO DECREASE MDRO'S?



JAMA Network Open

Original Investigation | Infectious Diseases

Assessment of the Appropriateness of Antimicrobial Use in US Hospitals

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Abstract

IMPORTANCE Hospital antimicrobial consumption data are widely available; however, large-scale assessments of the quality of antimicrobial use in US hospitals are limited.

OBJECTIVE To evaluate the appropriateness of antimicrobial use for hospitalized patients treated for community-acquired pneumonia (CAP) or urinary tract infection (UTI) present at admission or for patients who had received fluoroquinolone or intravenous vancomycin treatment.

DESIGN, SETTING, AND PARTICIPANTS This cross-sectional study included data from a prevalence survey of hospitalized patients in 10 Emerging Infections Program sites. Random samples of inpatients on hospital survey dates from May 1 to September 30, 2015, were identified. Medical record data were collected for eligible patients with 1 or more of 4 treatment events (CAP, UTI, fluoroquinolone treatment, or vancomycin treatment), which were selected on the basis of common infection types reported and antimicrobials given to patients in the prevalence survey. Data were analyzed from August 1, 2017, to May 31, 2020.

EXPOSURE Antimicrobial treatment for CAP or UTI or with fluoroquinolones or vancomycin.

MAIN OUTCOMES AND MEASURES The percentage of antimicrobial use that was supported by medical record data (including infection signs and symptoms, microbiology test results, and antimicrobial treatment duration) or for which some aspect of use was unsupported. Unsupported antimicrobial use was defined as (1) use of antimicrobials to which the pathogen was not susceptible, use in the absence of documented infection signs or symptoms, or use without supporting microbiologic data; (2) use of antimicrobials that deviated from recommended guidelines; or (3) use that exceeded the recommended duration.

RESULTS Of 12 299 patients, 1566 patients (12.7%) in 192 hospitals were included; the median age was 67 years (interquartile range, 53-79 years), and 864 (55.2%) were female. A total of 219 patients (14.0%) were included in the CAP analysis, 452 (28.9%) in the UTI analysis, 550 (35.1%) in the fluoroquinolone analysis, and 403 (25.7%) in the vancomycin analysis; 58 patients (3.7%) were included in both fluoroquinolone and vancomycin analyses. Overall, treatment was unsupported for 876 of 1566 patients (55.9%; 95% CI, 53.5%-58.4%): 110 of 403 (27.3%) who received vancomycin, 256 of 550 (46.5%) who received fluoroquinolones, 347 of 452 (76.8%) with a diagnosis of UTI, and 174 of 219 (79.5%) with a diagnosis of CAP. Among patients with unsupported treatment, common reasons included excessive duration (103 of 174 patients with CAP [59.2%]) and lack of documented infection signs or symptoms (174 of 347 patients with UTI [50.1%]).

(continued)

Key Points

Question What percentage of hospital antimicrobial use in the US deviates from recommended practices, such as treatment selection or duration, on the basis of medical record documentation?

Findings In this cross-sectional study of 1566 patients at 192 hospitals, antimicrobial use deviated from recommended practices for 55.9% of patients who received antimicrobials for community-acquired pneumonia or urinary tract infection present at admission or who received fluoroquinolone or intravenous vancomycin treatment.

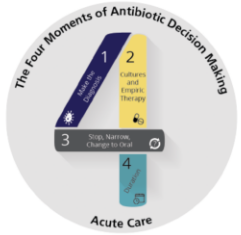
Meaning The findings suggest that standardized assessments of hospital antimicrobial prescribing quality can be used to estimate the appropriateness of antimicrobial use in large groups of hospitals.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

ACUTE CARE HOSPITAL TOOLKIT

Four Moments of Antibiotic Decision Making



The Four Moments of Antibiotic Decision Making are the critical time periods of antibiotic decision making. Clinicians are encouraged to use the Four Moments framework for all patients receiving antibiotics and whenever the need for antibiotics is being considered.

Four Moments Questions

- **Moment 1: Does my patient have an infection that requires antibiotics?** +
- **Moment 2: Have I ordered appropriate cultures before starting antibiotics? What empiric therapy should I initiate?** +
- **Moment 3: A day or more has passed. Can I stop antibiotics? Can I narrow therapy or change from IV to oral therapy? These questions should be asked every day that a patient is on antibiotics.** +
- **Moment 4: What duration of antibiotic therapy is needed for my patient's diagnosis?** +

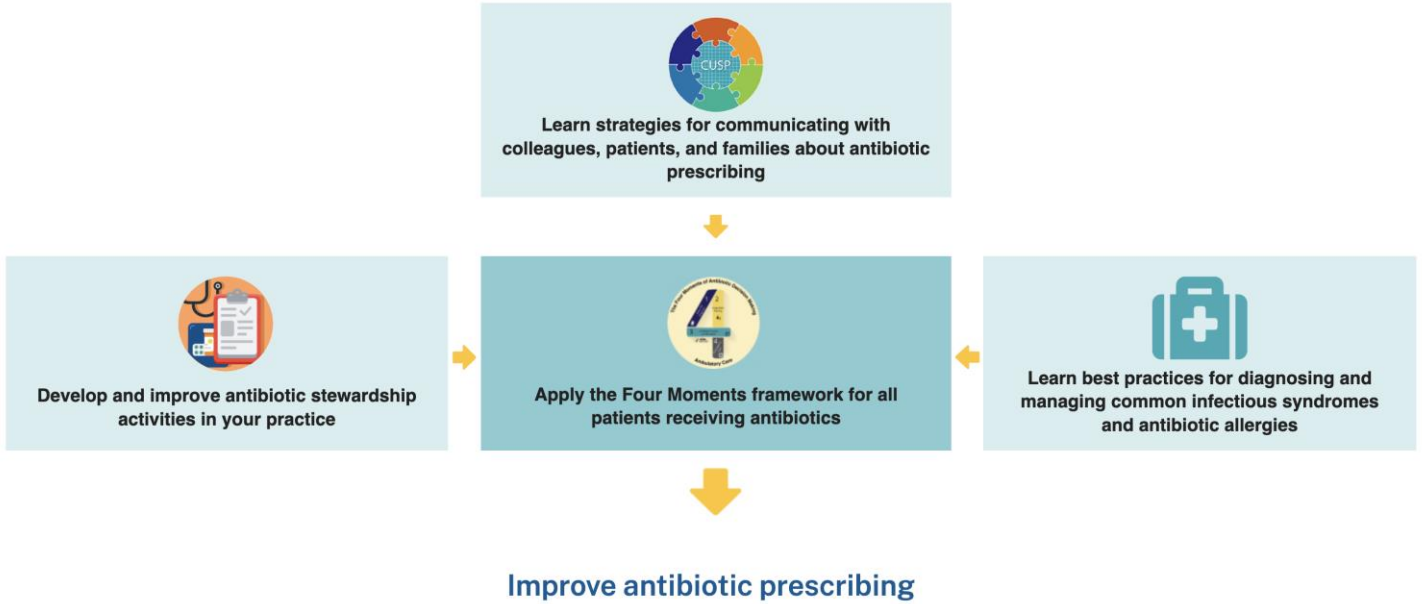
https://www.ahrq.gov/antibiotic-use/acute-care/four-moments/index.html

Toolkit To Improve Antibiotic Use in Ambulatory Care

Welcome to the Toolkit To Improve Antibiotic Use in Ambulatory Care. The Ambulatory Care Toolkit explains the Four Moments of Antibiotic Decision Making and has tools to support their implementation and improve prescribing in three areas: developing and improving antibiotic stewardship activities in your practice, learning strategies for communicating about antibiotic prescribing, and disseminating best practices for common infectious diseases.

The components of the Toolkit can be accessed by clicking on the four boxes below. They include an explanation of the Four Moments of Antibiotic Decision Making and how to apply them in practice. They also include presentations and tools to support implementation of the Four Moments and improve antibiotic prescribing, focusing on three critical areas:

1. Developing and improving antibiotic stewardship activities in your practice.
2. Learning strategies for communicating with patients, their families, and colleagues about antibiotic prescribing.
3. Learning best practices for diagnosing and managing common infectious syndromes and antibiotic allergies.



https://www.ahrq.gov/antibiotic-use/ambulatory-care/index.html

Infectious process	Specific agents/circumstances	Recommended duration of antibiotic therapy*
Community-acquired pneumonia	**n/a**	5 days[1-3]
Hospital-acquired or healthcare-associated pneumonia	**n/a**	7 days[4,5]
Ventilator-associated pneumonia	**n/a**	7 days[4,5]
Cystitis	Nitrofurantoin or cephalosporin	5 days[6-8]
	Trimethoprim/sulfamethoxazole (TMP/SMX)	3 days[6-9]
Pyelonephritis	Fluoroquinolone	5–7 days[6,10-12]
	TMP/SMX or oral cephalosporin	10-14 days[6,11] (shorter course if early response)
Complicated urinary tract infection (UTI), including catheter-associated UTI (CAUTI)	Lower tract CAUTI in women ≤ 65 years if catheter is removed	3 days[13,14]
	Prompt resolution of symptoms	7 days[14]
	Delayed response, obstruction or other urologic abnormality	10–14 days[14]
Skin and soft-tissue infection	Clinical response by day 3	5–7 days[15]
Diverticulitis	Acute, uncomplicated	0–4 days[16,17]
	Complicated or initial severe illness with source control	4 days after source control[18]
	Complicated with small abscess, not drained*	5–10 days based on clinical response[15,19]
Biliary tract infection	Acute cholangitis and source control	3 days after source control[20,21]
	Acute cholangitis and source control with concomitant bacteremia	7 days[22]
	Uncomplicated acute cholecystitis, medical management*	5–10 days based on clinical response[15,19]
	Uncomplicated acute cholecystitis, surgical management	No antibiotics after surgery[23]
	Complicated acute cholecystitis (e.g., perforation, fistula), surgical management for source control	4 days after surgery[18]
Intra-abdominal infection with source control	**n/a**	4 days[18]
Gram-negative bloodstream infection with source control	**n/a**	7 days[24]

*For all durations, recommendations are for patients without significant immunocompromise or complex presentations; relevant multi-specialty consultation, including infectious diseases, should be considered for cases falling outside of the scope of these recommendations.

Antibiotic Time Out Tool

Date: _____ Patient Name or Identifier: _____

Directions: This form should be completed by frontline clinicians on a daily basis for patients receiving antibiotics.

Note: A table of commonly recommended durations of therapy can be found on the back of the document.

Antibiotic 1: _____ Treatment day #: _____
Antibiotic 2: _____ Treatment day #: _____
Antibiotic 3: _____ Treatment day #: _____

Check the patient's indication(s) for continuing antibiotics below:

- ☐ Prophylaxis
- ☐ Central nervous system infection
- ☐ Head and neck infection
- ☐ Endovascular infection/endocarditis
- ☐ Community-acquired pneumonia
- ☐ Hospital-acquired pneumonia
- ☐ Ventilator-associated pneumonia
- ☐ *Clostridioides difficile* infection
- ☐ Biliary tract infection
- ☐ Diverticulitis
- ☐ Intra-abdominal infection
- ☐ Urinary tract infection (UTI)
- ☐ Osteoarticular infection
- ☐ Skin/soft tissue infection
- ☐ Sepsis, unknown source
- ☐ Bacteremia
- ☐ Other:

Is the patient receiving antibiotics for any of the following conditions even though antibiotics are NOT typically recommended?

- ☐ Positive urine culture without symptoms of a UTI (Exceptions: pregnancy or impending urologic surgery where mucosal bleeding is expected)
- ☐ *Enterococcus* in sputum
- ☐ Coagulase-negative staphylococci in a single blood culture
- ☐ *Candida* in sputum or urine
- ☐ Surgical prophylaxis beyond 24 hours
- ☐ Noninfectious etiology of symptoms

Answer Yes or No questions below based on patient's clinical status and culture results.

Can any of the antibiotics be discontinued?	☐ Yes	☐ No
Can existing therapy be changed to a more narrow spectrum regimen?	☐ Yes	☐ No
Should additional agents or broader-spectrum agents be added?	☐ Yes	☐ No
Are there any IV agents that can be changed to the PO route?	☐ Yes	☐ No
Are the antibiotics selected consistent with local guidelines?	☐ Yes	☐ No

What is the planned duration of antibiotic therapy?

Antibiotic 1: _____ Planned duration: _____ Consistent with recommended duration? ☐Yes ☐No
Antibiotic 2: _____ Planned duration: _____ Consistent with recommended duration? ☐Yes ☐No
Antibiotic 3: _____ Planned duration: _____ Consistent with recommended duration? ☐Yes ☐No

COMMON SCENARIOS WHEN BROAD-SPECTRUM ANTIBIOTICS ARE OVERUSED

ANTIBIOTIC OVERUSE

- Do you need MRSA coverage for SSTI, CAP, HAP?
- Do you need anaerobic coverage?
- Do you need coverage for resistant gram negatives?

CELLULITIS

- As a general rule, if no pus is present, it is less likely that MRSA is the cause of cellulitis
- For most cellulitis, a narrow-spectrum β-lactam antibiotic is the drug of choice

Best Practice Advice 4:

In patients with nonpurulent cellulitis, clinicians should use a 5- to 6-day course of antibiotics active against streptococci, particularly for patients able to self-monitor and who have close follow-up with primary care.

Lee RA, et al. Appropriate use of short-course antibiotics in common infections: best practice advice from the American College of physicians. Annals of internal medicine. 2021 Jun;174(6):822-7.

PNEUMONIA

- MRSA nasal swab should be used to help guide therapy
- A negative result has excellent negative predictive value for MRSA as cause of pneumonia, especially for CABP/HAP
- Use this to streamline antibiotics and eliminate unnecessary MRSA coverage

Dangerfield B, et al. Antimicrob Agents Chemother. 2014;58(2):859-64.
Diane M Parente et al.*Clinical Infectious Diseases*, Volume 67, Issue 1, 1 July 2018: 1-7.

ANAEROBIC COVERAGE FOR COMMUNITY-ACQUIRED PNEUMONIA

Question 10: In the Inpatient Setting, Should Patients with Suspected Aspiration Pneumonia Receive Additional Anaerobic Coverage beyond Standard Empiric Treatment for CAP?

Recommendation

We suggest not routinely adding anaerobic coverage for suspected aspiration pneumonia unless lung abscess or empyema is suspected (conditional recommendation, very low quality of evidence).

Metlay JP, et al. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019 Oct 1;200(7):e45-e67.

IS IT A UTI OR IS IT ASYMPTOMATIC BACTERIURIA?

- Asymptomatic bacteriuria should be treated in pregnant women for 3-7 days, and prior to a urologic procedure where mucosal bleeding is anticipated
- Prolonged treatment is not recommended
- Bacteriuria which is found in the absence of signs and symptoms of UTI should also be considered asymptomatic bacteriuria, and should not be treated

INAPPROPRIATE REASONS FOR URINE CULTURE

Odorous, cloudy, or discolored urine in the absence of other localizing signs/symptoms

Reflex urine cultures based on urinalysis results, such as pyuria, in the absence of other indications (Absence of pyuria suggests diagnosis other than CAUTI)

Urine culture to document response to therapy unless symptoms fail to resolve

As "5th Vital Sign"

INDICATIONS FOR URINE CULTURES

- Presence of symptoms suggestive of a urinary tract infection (UTI). For example;
  - Flank pain or costovertebral angle tenderness,
  - acute hematuria,
  - new pelvic discomfort
- New onset or worsening sepsis without evidence of another source on history, physical examination, or laboratory testing
- Fever or altered mental status without evidence of another source on history, physical examination, or laboratory testing
- In spinal cord injury patients: increased spasticity, autonomic dysreflexia, sense of unease

IMAGING AND ANTIBIOTICS FOR SACRAL PRESSURE ULCERS

- Both CT and MRI are overly sensitive for sacral osteomyelitis
- **Address goals of care first**
- Consider nutritional status
- Consider the likely risk vs. benefit of a long course of IV antibiotics

Clinical Infectious Diseases

INVITED ARTICLE

CLINICAL PRACTICE: Ellie J.C. Goldstein, Section Editor

Osteomyelitis Complicating Sacral Pressure Ulcers: Whether or Not to Treat With Antibiotic Therapy

Darren Wong,[1] Paul Holtom,[1,2] and Brad Spellberg[1,2]

[1]Division of Infectious Diseases, Keck School of Medicine, University of Southern California (USC), and [2]Los Angeles County + USC Medical Center, California

The treatment of osteomyelitis in patients with stage IV sacral pressure ulcers is controversial. We conducted a systematic literature review and did not find evidence of benefit of antibacterial therapy in this setting without concomitant surgical debridement and wound coverage. Furthermore, many patients with chronically exposed bone do not have evidence of osteomyelitis when biopsied, and magnetic resonance imaging may not accurately distinguish osteomyelitis from bone remodeling. The goal of therapy should be local wound care and assessment for the potential of wound closure. If the wound can be closed and osteomyelitis is present on bone biopsy, appropriate antibiotic therapy is reasonable. We find no data to support antibiotic durations of >6 weeks in this setting, and some authors recommend 2 weeks of therapy if the osteomyelitis is limited to cortical bone. If the wound will not be closed, we find no clear evidence supporting a role for antibiotic therapy.

Keywords. osteomyelitis; sacral pressure ulcer; antibiotic; debridement; wound flap.

A 79-year-old man with a history of spinal cord injury was referred for further evaluation of a sacral pressure ulcer. The ulcer developed several years earlier from local trauma related to a motorized wheelchair. Over the subsequent months, the ulcer progressed and tunneled to the level of the sacrum.

The patient was referred for infectious disease consultation due to an increase in wound discharge over the preceding month. Outpatient magnetic resonance imaging (MRI) indicated an increased size of the ulcer over the right ischial tuberosity with increased granulation tissue, reactive myositis, and mild marrow edema. The MRI did not reveal a drainable fluid collection or abscess.

The patient had normal vital signs. He appeared comfortable and had a deep penetrating ischial ulcer of approximately 6 cm × 3 cm, without significant purulence or erythema of the surrounding soft tissue. White blood cell count, creatinine, and a liver panel were unremarkable.

this setting is challenging, and if present, whether it can be successfully treated without covering the wound is unclear. We hypothesized that eradication of osteomyelitis in the setting of exposed bone cannot be achieved without debridement and soft tissue coverage of the wound, and thus antibiotics to attempt to treat osteomyelitis are not indicated in this setting. We conducted a systematic review of the literature to determine if data are available to support or refute this hypothesis.

We searched for the keywords "pelvic osteomyelitis" or "decubitus AND osteomyelitis" or "sacral osteomyelitis" from 1975 to the present using PubMed, Google Scholar, and Web of Science search engines. We reviewed abstracts from all identified, peer-reviewed, published articles to determine if they included information on clinical outcomes or diagnostic accuracy, in which case we reviewed the full manuscripts. We also reviewed references from identified articles to identify other relevant studies.

VERIFY ALLERGIES

Clinical Review & Education

JAMA | Review

Evaluation and Management of Penicillin Allergy
A Review

Erica S. Shenoy, MD, PhD; Eric Macy, MD, MS; Theresa Rowe, DO, MS; Kimberly G. Blumenthal, MD, MSc

IMPORTANCE β-Lactam antibiotics are among the safest and most effective antibiotics. Many patients report allergies to these drugs that limit their use, resulting in the use of broad-spectrum antibiotics that increase the risk for antimicrobial resistance and adverse events.

OBSERVATIONS Approximately 10% of the US population has reported allergies to the β-lactam agent penicillin, with higher rates reported by older and hospitalized patients. Although many patients report that they are allergic to penicillin, clinically significant IgE-mediated or T lymphocyte–mediated penicillin hypersensitivity is uncommon (<5%). Currently, the rate of IgE-mediated penicillin allergies is decreasing, potentially due to a decreased use of parenteral penicillins, and because severe anaphylactic reactions to oral amoxicillin are rare. IgE-mediated penicillin allergy wanes over time, with 80% of patients becoming tolerant after a decade. Cross-reactivity between penicillin and cephalosporin drugs occurs in about 2% of cases, less than the 8% reported previously. Some patients have a medical history that suggests they are at a low risk for developing an allergic reaction to penicillin. Low-risk histories include patients having isolated nonallergic symptoms, such as gastrointestinal symptoms, or patients solely with a family history of a penicillin allergy, symptoms of pruritus without rash, or remote (>10 years) unknown reactions without features suggestive of an IgE-mediated reaction. A moderate-risk history includes urticaria or other pruritic rashes and reactions with features of IgE-mediated reactions. A high-risk history includes patients who have had anaphylaxis, positive penicillin skin testing, recurrent penicillin reactions, or hypersensitivities to multiple β-lactam antibiotics. The goals of antimicrobial stewardship are undermined when reported allergy to penicillin leads to the use of broad-spectrum antibiotics that increase the risk for antimicrobial resistance, including increased risk of methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant *Enterococcus*. Broad-spectrum antimicrobial agents also increase the risk of developing *Clostridium difficile* (also known as *Clostridioides difficile*) infection. Direct amoxicillin challenge is appropriate for patients with low-risk allergy histories. Moderate-risk patients can be evaluated with penicillin skin testing, which carries a negative predictive value that exceeds 95% and approaches 100% when combined with amoxicillin challenge. Clinicians performing penicillin allergy evaluation need to identify what methods are supported by their available resources.

CONCLUSIONS AND RELEVANCE Many patients report they are allergic to penicillin but few have clinically significant reactions. Evaluation of penicillin allergy before deciding not to use penicillin or other β-lactam antibiotics is an important tool for antimicrobial stewardship.

Author Audio Interview

JAMA Patient Page page 216

Video and Supplemental content

CME Quiz at jamanetwork.com/learning


QUESTIONS?