



Science vs. Society: Microbial Resistance and Vaccine Trust

Kerry L. LaPlante, PharmD., FCCP, FIDSA, FIDP
Dean, College of Pharmacy, University of Rhode Island, Kingston, RI

RHODE
ISLAND

Why This Conversation Matters

- Human behavior, trust, and storytelling shape outcomes
- Scientific advances alone are not enough
- Infectious disease is both biological and social



DISCLOSURE

- The views expressed in this lecture are my own and do not reflect the official positions of the **University of Rhode Island**, the **U.S. Department of Veterans Affairs**, the **Rhode Island Department of Health**, or the **Warren Alpert School of Medicine at Brown University**.

Learning Objectives: Treatment and Prevention

- 1. Trace the evolution of antimicrobials and the rise of antimicrobial resistance** as a critical threat to effective infectious disease treatment.
- 2. Explain how vaccination underpins infectious disease prevention,** reducing disease burden, antimicrobial use, and the spread of resistance.
- 3. Examine the interdependence of science, clinical practice, and public trust** in advancing effective prevention and treatment of infectious diseases.

MICROBES THAT ADAPT

Microbial evolution is inevitable

Antibiotic and antimicrobial overuse accelerates resistance

Framework (Start with “Why”....)

- Antibiotics are a shared resource...and now a scarce resource
- Antibiotics are essential to patient safety
- Highest rates of antibiotics in older adults



- Antibiotics do not treat viral illness like COVID, Influenza, Common cold...
- Antimicrobial resistance is occurring faster than we can make new antibiotics to treat infections

GOAL: Increase the number of antibiotic stewardship champions

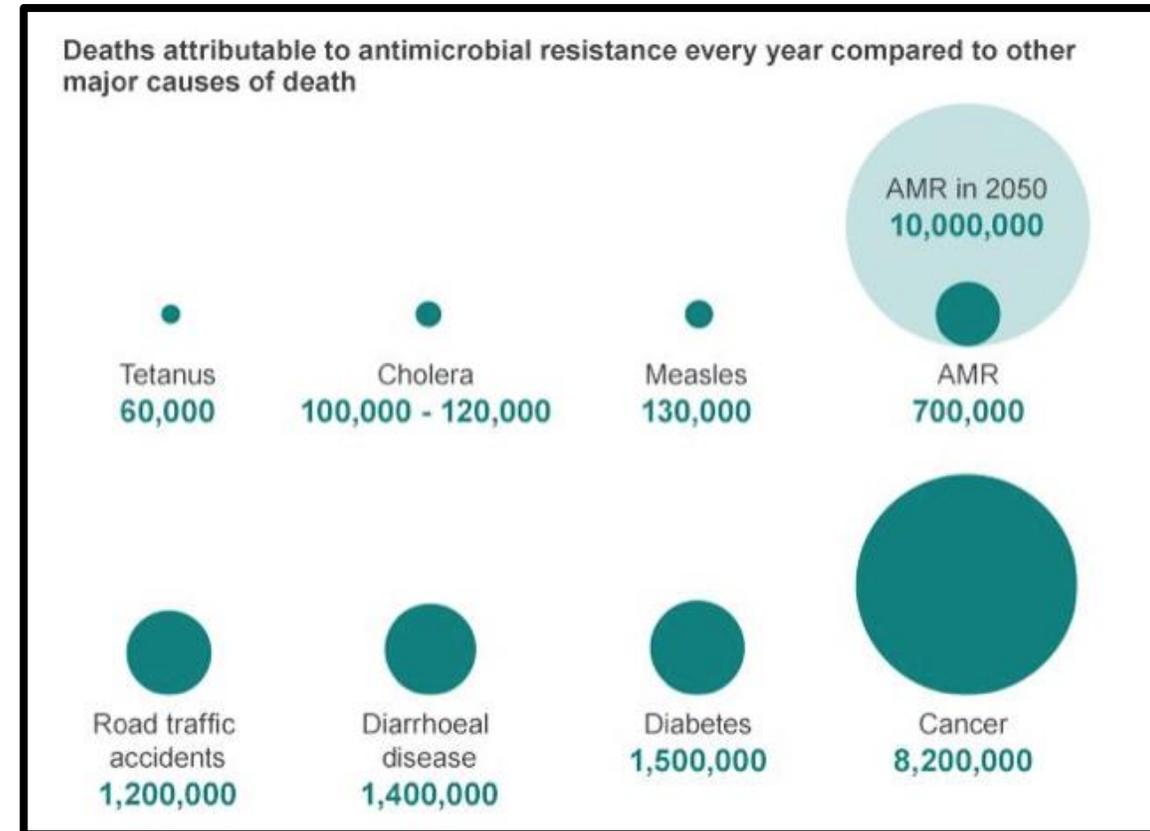
WHY: AMR kills more than Cancer by 2050

“Drug resistant infections will kill an extra 10 million people a year worldwide - more than currently die from cancer by 2050”

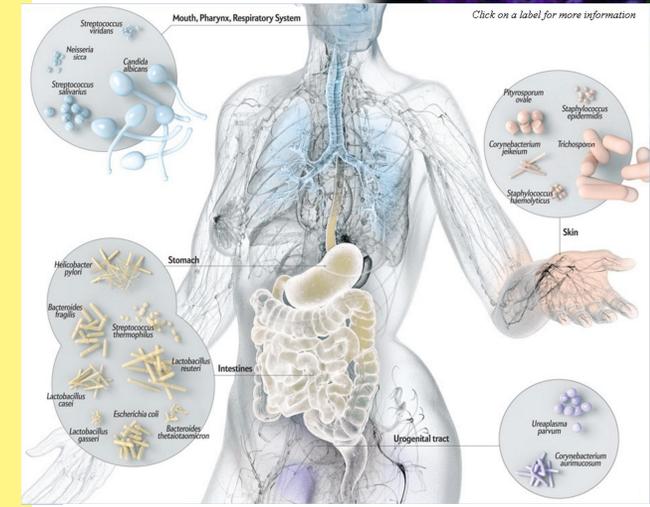
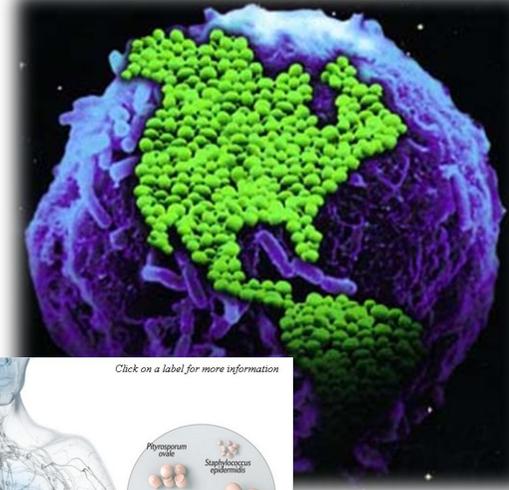
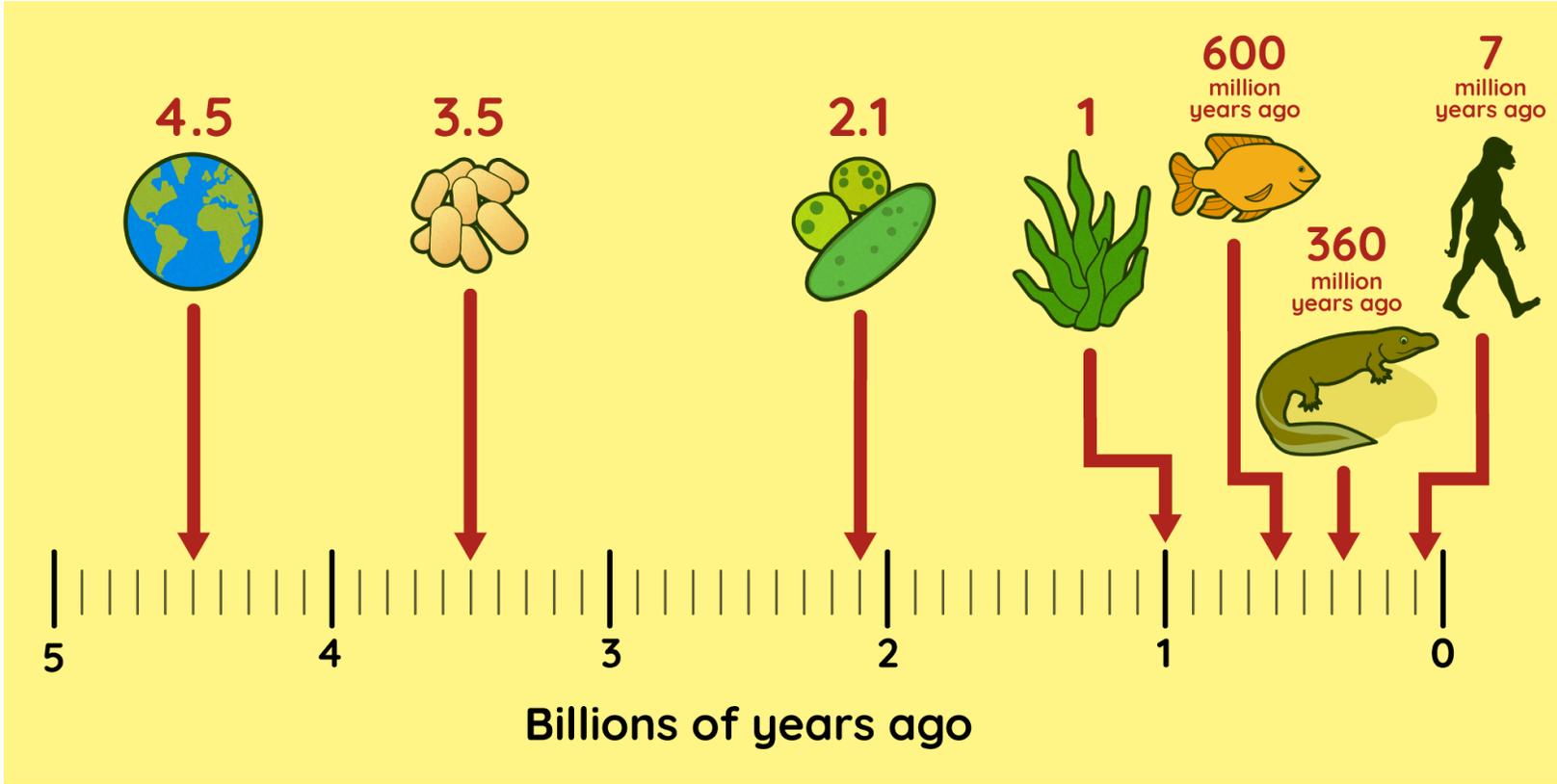
- *Jim O'Neil, Wellcome Trust and the UK Department of Health*



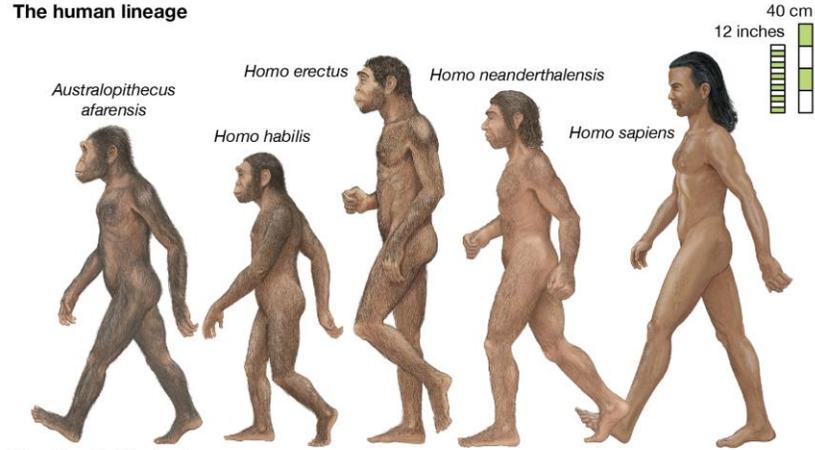
A petri dish containing antibiotic-resistant strains . PHOTO: KIRSTY WIGGLESWORTH/AP



Bacteria evolved 3.5 BILLION years ago...



The human lineage



Homo sapiens, a culture-bearing upright-walking species that lives on the ground and very likely first evolved in Africa about **315,000 years ago**

“Mold Juice” –The Discovery of Penicillin



St. Mary's Hospital in London in 1928. A 47 year old Alexander Flemming observed that a plate culture of *Staphylococcus* had been contaminated by a blue-green mold (*Penicillium notatum*) and that colonies of bacteria adjacent to the mold were being dissolved.



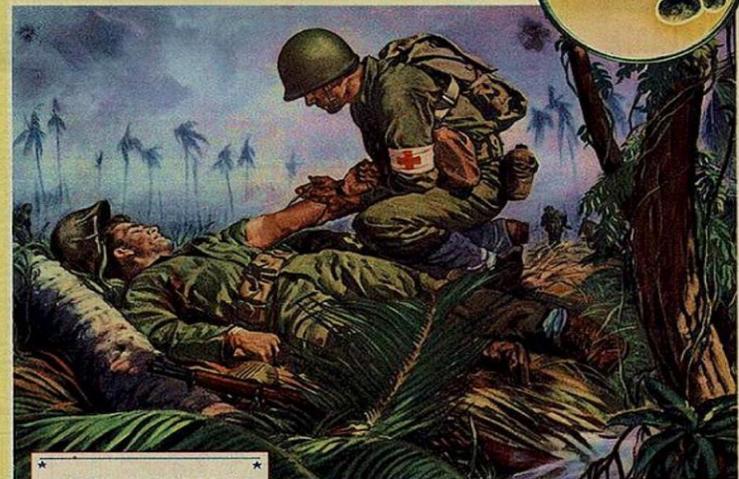
*Bacterial inhibition originally noticed by a French medical student, Ernest Duchesne, in 1896

~ Nobel Prize in Physiology or Medicine in 1945 ~

One of the most important medical events of medical history discovery and use of penicillin



Thanks to **PENICILLIN**
...He Will Come Home!



FROM ORDINARY MOLD—
the Greatest Healing Agent of this War!

On the gray, green and yellow mold above, called *Penicillium notatum* in the laboratory, grows the miraculous substance first discovered by Professor Alexander Fleming in 1928. Named penicillin by its discoverer, it is the most potent weapon ever developed against many of the deadliest infections known to man. Because research on molds was already a part of Schenley's *Streptococcus*, Schenley Laboratories were well able to meet the problem of large scale production of penicillin, when the great need for it arose.

When the thunderous battles of this war have subsided to pages of silent print in a history book, the greatest news event of World War II may well be the discovery and development — not of some vicious secret weapon that *destroys* — but of a weapon that *saves* lives. That weapon, of course, is penicillin.

Every day, penicillin is performing some unbelievable act of healing on some far battlefield. Thousands of men will return home who otherwise would not have had a chance. Better still, more and more of this precious drug is now available for civilian use... to save the lives of patients of every age.

A year ago, production of penicillin was difficult, costly. Today, due to specially-devised methods of mass-production, in use by Schenley Laboratories, Inc. and the 20 other firms designated by the government to make penicillin, it is available in ever-increasing quantity, at progressively lower cost.

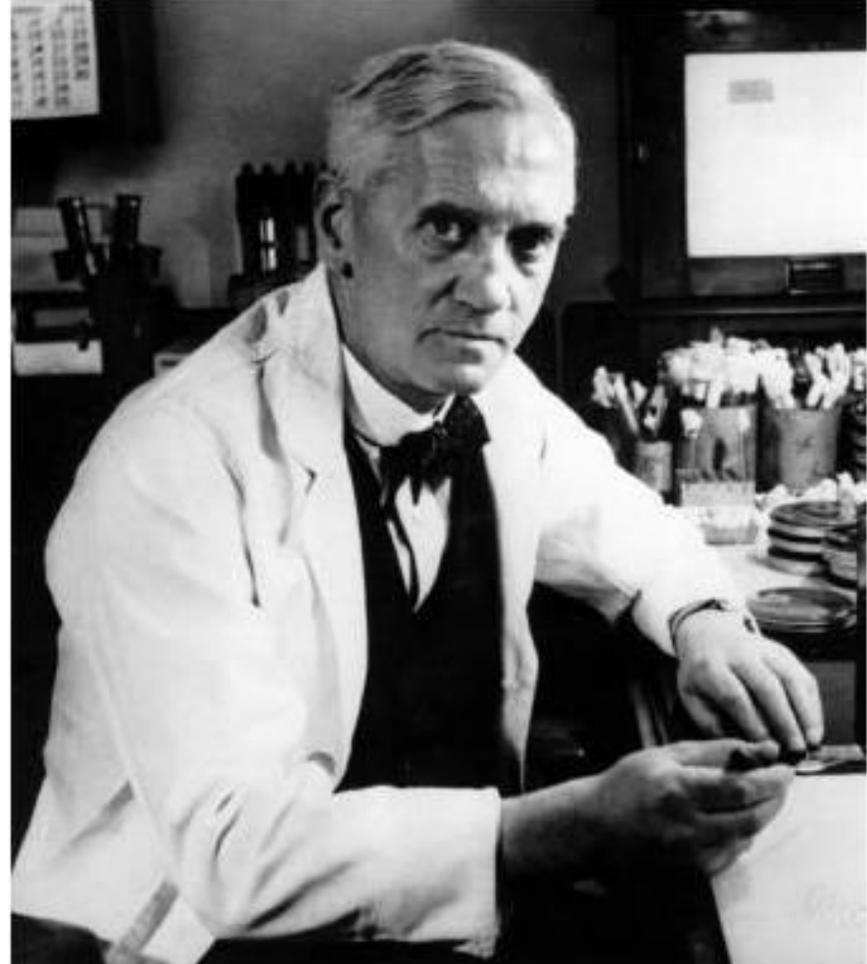
Listen to "THE DOCTOR FIGHTS" starring RAYMOND HASKET, Tuesday evenings, 8-9 P.M. See your paper for time and station.

SCHENLEY LABORATORIES, INC.
Lancaster, Indiana
Producers of **PENICILLIN-Schenley**

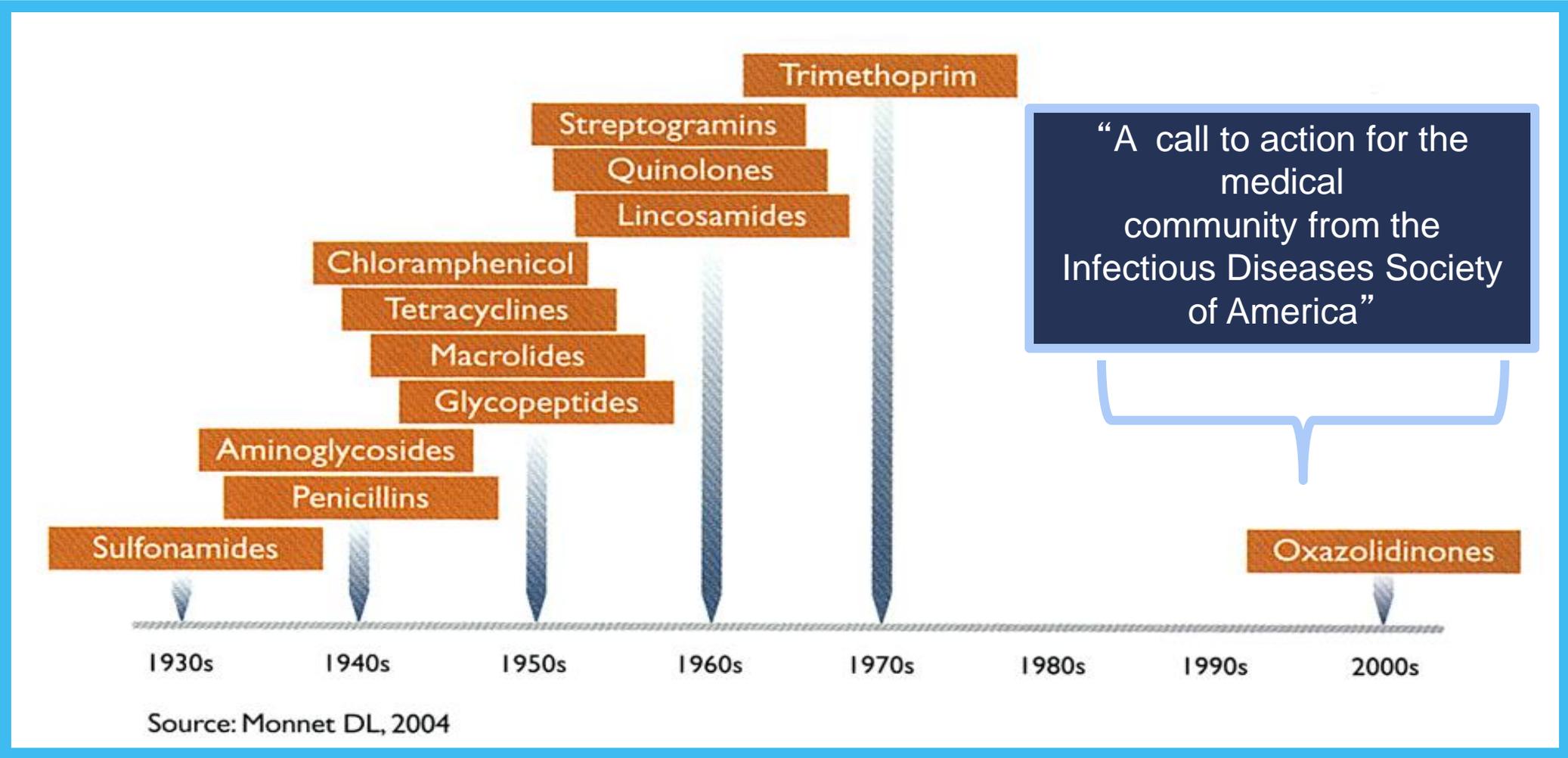


Sir Alexander Fleming on June 26, 1945

“The microbes are educated to resist penicillin and a host of penicillin-fast organisms is bred out....In such cases the thoughtless person playing with penicillin is **morally responsible for the death of the man** who finally succumbs to infection with the penicillin-resistant organism. I hope this evil can be averted.”



Steady decline in the number of new antibacterials

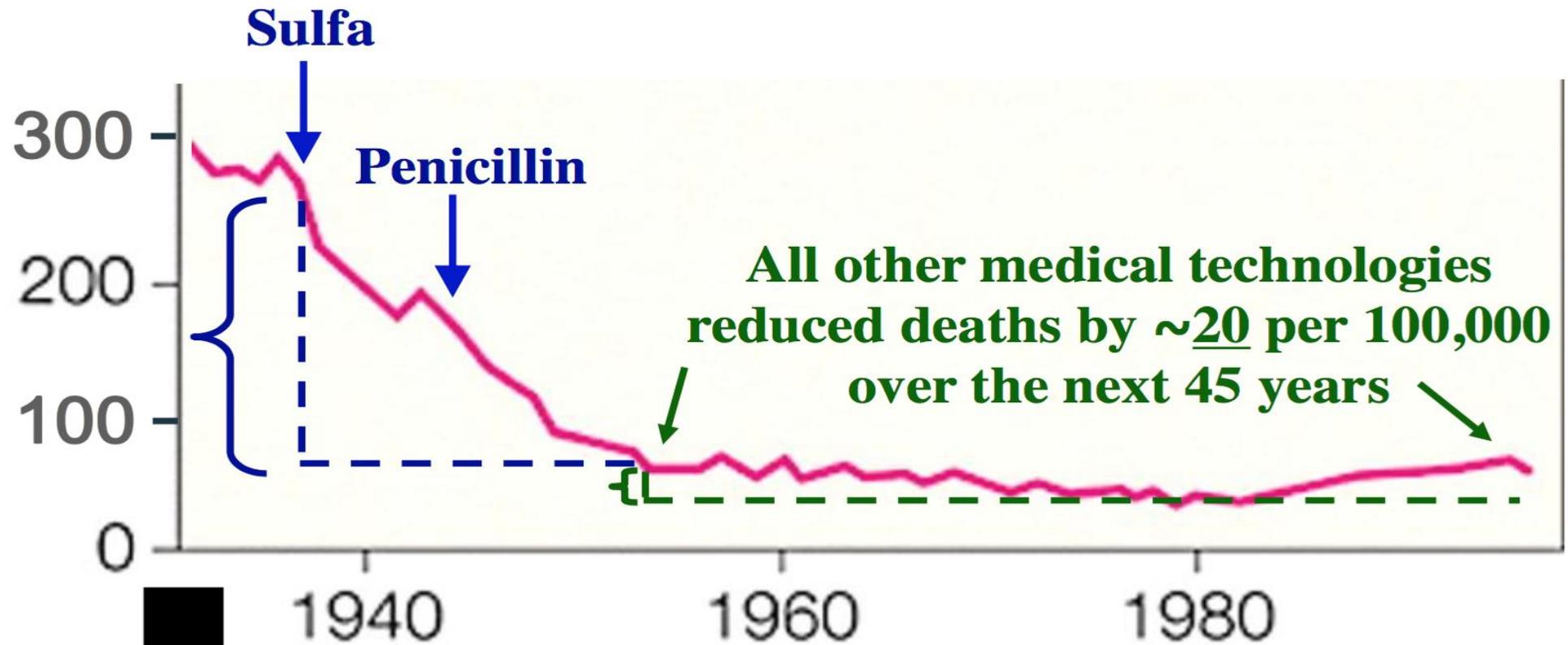


Spellberg et al., The epidemic of antibiotic-resistant infections: Clin Infect Dis 2008, 46:155-164

Antibiotics' Effectiveness

Antibiotics caused US deaths to decline by ~220 per 100,000 in 15 years

US Infection Death Rate per 100,000 population



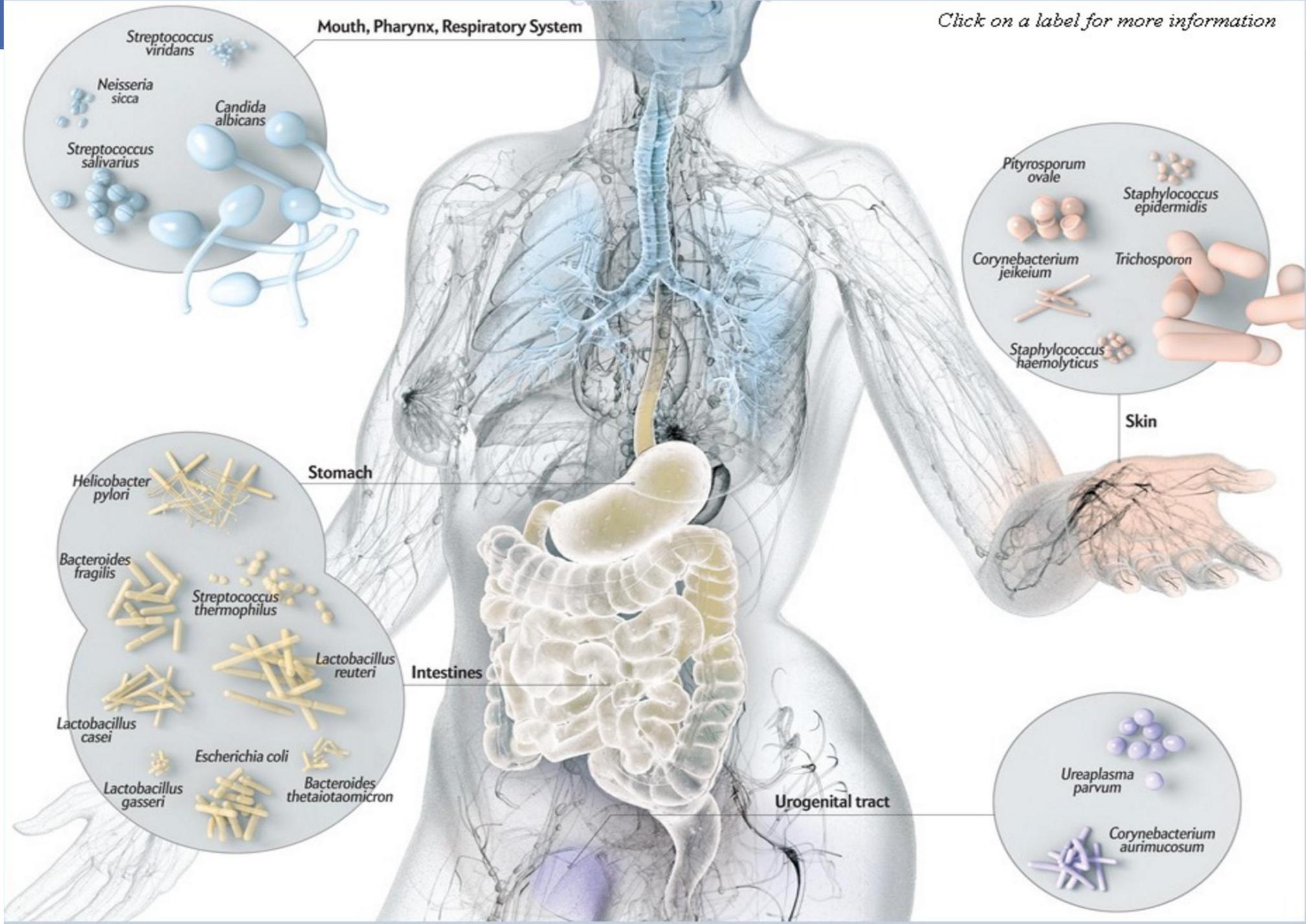
Armstrong, G. L. et al. JAMA 1999;281:61-66.

The Power of Antibiotics

Disease	Death Pre-Antibiotics	Death With Antibiotics	Change in Death
Community Pneumonia ¹	~35%	~10%	-25%
Hospital Pneumonia ²	~60%	~30%	-30%
Heart Valve Infection ³	~100%	~25%	-75%
Brain Infection ⁴	>80%	<20%	-60%
Skin Infection ⁵	11%	<0.5%	-10%
<i>By comparison...treatment of myocardial infarction with aspirin or streptokinase⁶</i>			-3%

¹IDSA Position Paper '08 Clin Infect Dis 47(S3):S249-65; ²IDSA/ACCP/ATS/SCCM Position Paper '10 Clin Infect Dis In Press; ³Kerr AJ. Subacute Bacterial Endocarditis. Springfield IL: Charles C. Thomas, 1955 & Lancet 1935 226:383-4; ⁴Lancet '38 231:733-4 & Waring et al. '48 Am J Med 5:402-18; ⁵Spellberg et al. '09 Clin Infect Dis 49:383-91 & Madsen '73 Infection 1:76081
⁶Lancet 2:349-60

Click on a label for more information



NEW RESEARCH: Who is in charge - microbes or people?

Developing research:

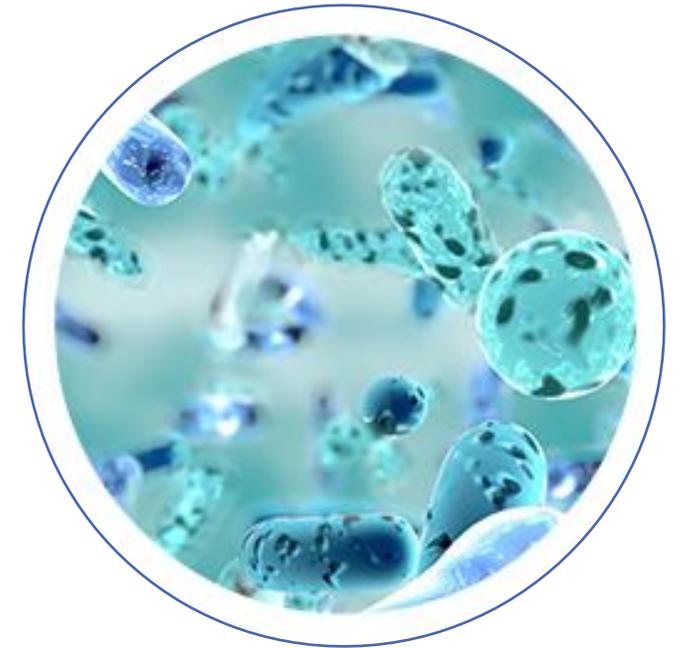
- We all host our own unique microcommunity
- Although the womb is sterile, we start acquiring our microscopic guests the minute we are born internal injection of microbes (seeding digestive track from maternal stool in vaginal birth) and externally (skin to skin contact)
- Microbes outnumber your body cells by 10 to 1, maybe 1:1?
 - Bacteria are much smaller than human cells → total weight ~ 2 to 6 lbs (200lb adult)

Hygiene Hypothesis lack of early childhood exposure to infectious agents, symbiotic microorganisms (such as the gut flora or probiotics), and parasites increases susceptibility to allergic diseases by suppressing the natural development of the immune system

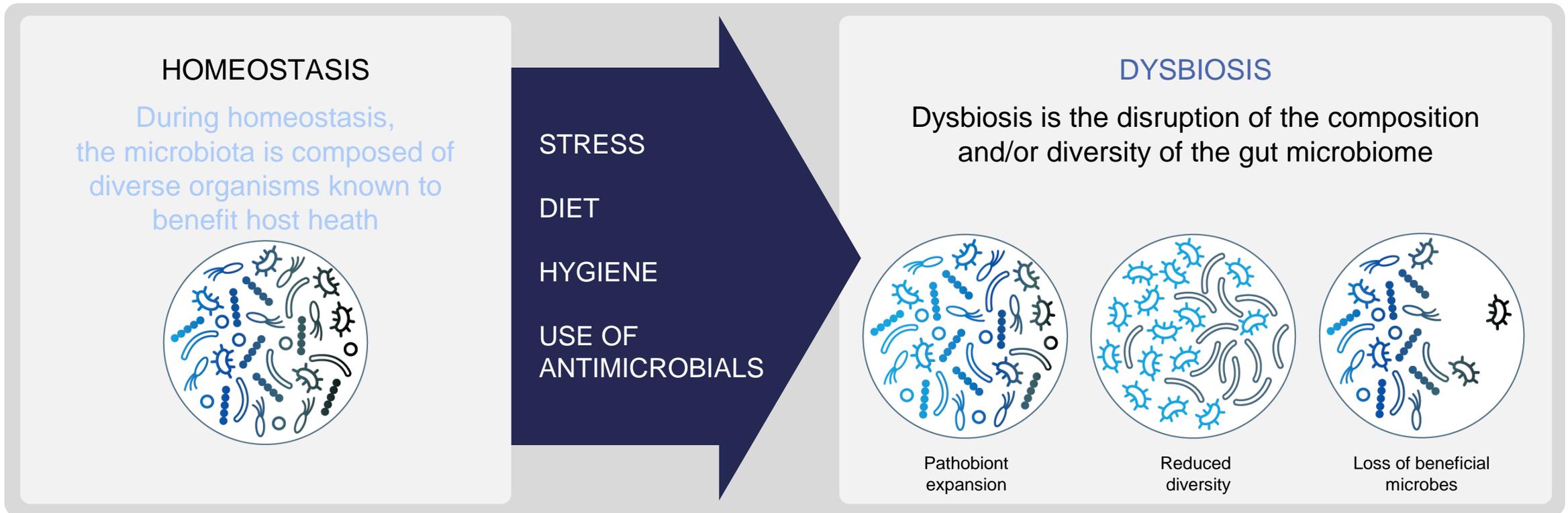
The Gut Microbiome Is Composed of Highly Diverse Microorganisms Living in the Human Intestinal Tract

- Considered a distinct and essential organ within the human body, the gut microbiome contains 100 trillion microorganisms and consists of an estimated 500-1000 different species
- Common bacterial phyla in the gut:
 - Bacteroidetes
 - Firmicutes
 - Proteobacteria
 - Actinobacteria
 - Fusobacteria
 - Verrucomicrobia
- Also composed of yeast, viruses, archaea, and fungi

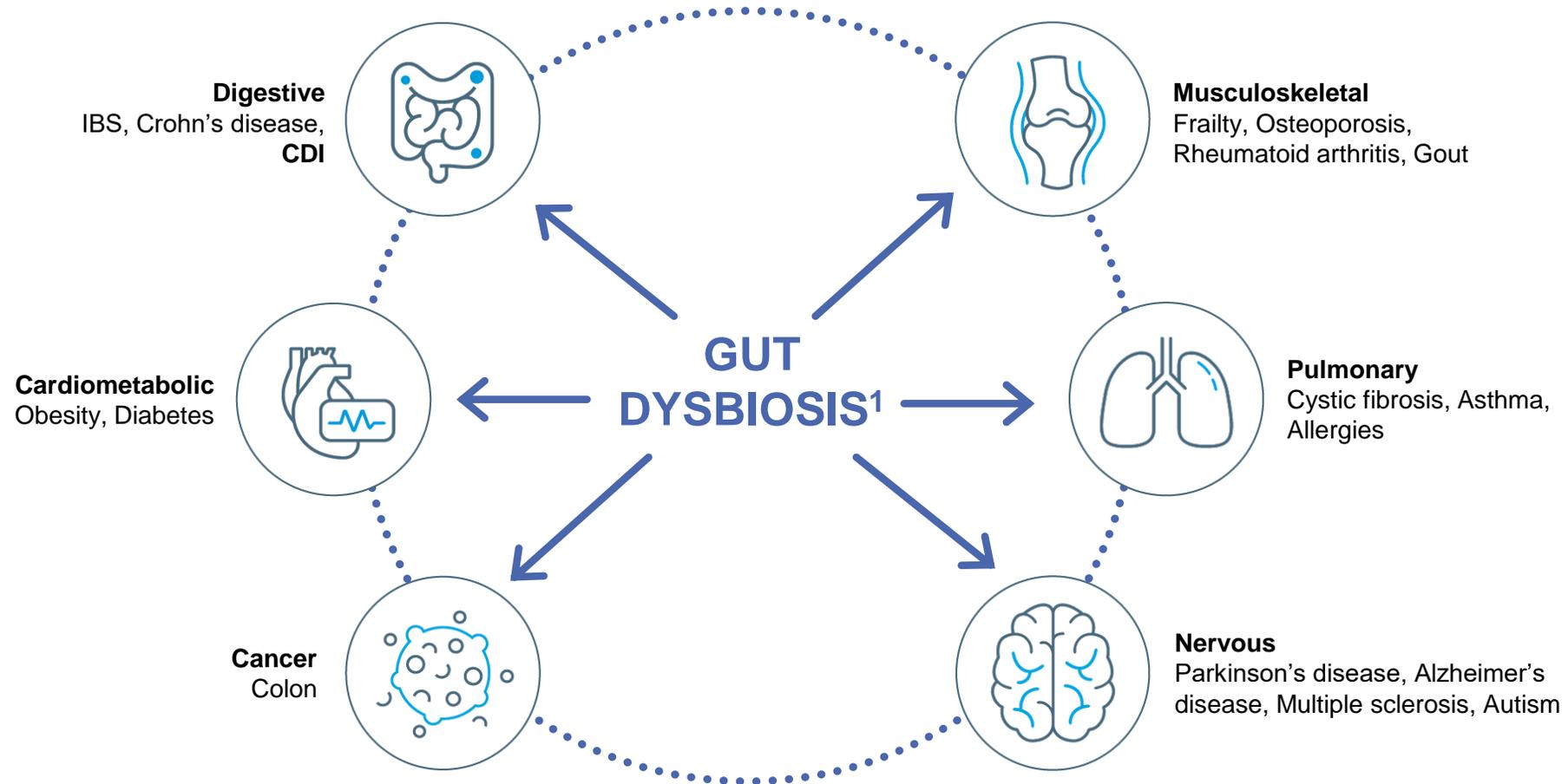
Comprise ~90% of microbiota



Dysbiosis Is Most Often Caused by Environmental Factors, Including Antibiotics



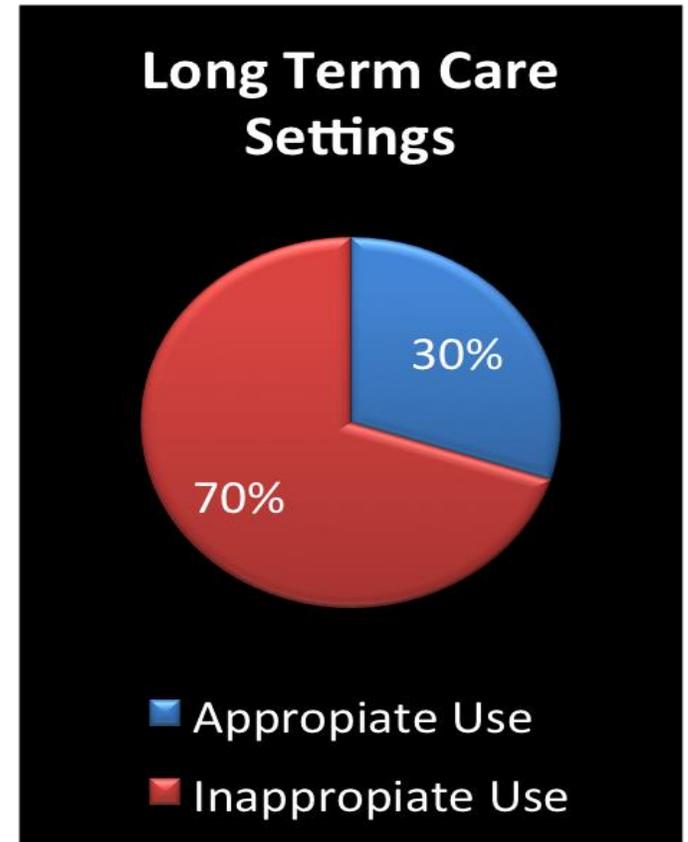
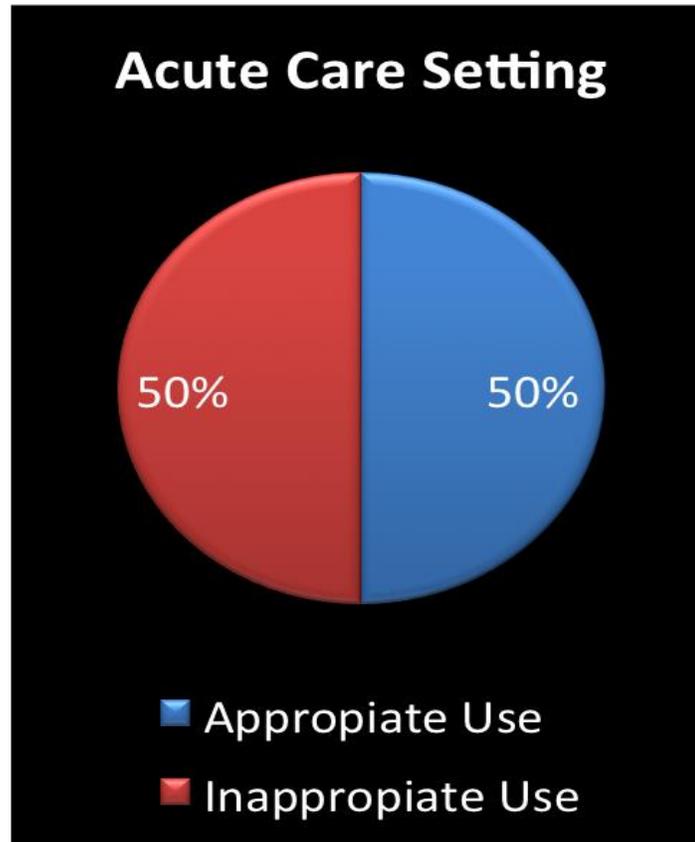
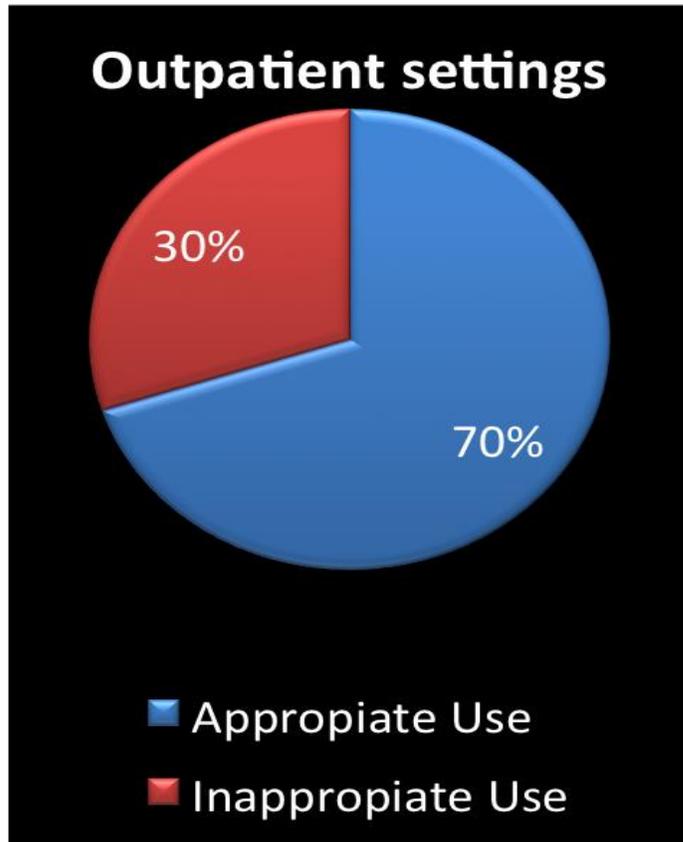
Dysbiosis of the Gut Microbiota Is Associated With a Variety of Diseases



IBS = irritable bowel syndrome.

1. Buford TW. *Microbiome*. 2017;5(1):80. 2. Hufnagl K, et al. *Semin Immunopathol*. 2020;42(1):75-93.

Antimicrobial “Misuse”

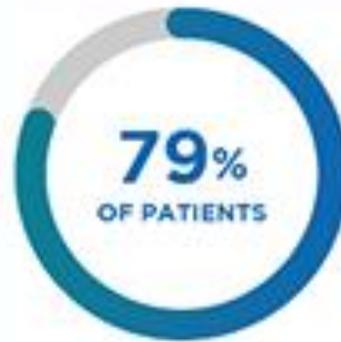


NEW CDC DATA

MORE THAN HALF OF ANTIBIOTIC PRESCRIBING FOR SELECTED EVENTS IN HOSPITALS WAS NOT CONSISTENT WITH RECOMMENDED PRESCRIBING PRACTICES



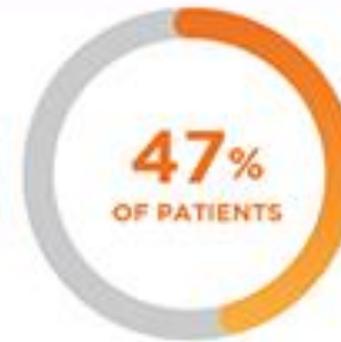
ANTIBIOTIC PRESCRIBING WAS NOT SUPPORTED IN:



with community-acquired pneumonia



with urinary tract infections



prescribed fluoroquinolone treatment



prescribed intravenous vancomycin antibiotic

HOSPITAL PRESCRIBERS & PHARMACISTS CAN IMPROVE PRESCRIBING:



Optimize antibiotic selection



Re-assess antibiotic treatment when the results of diagnostic testing are available



Use the shortest effective duration of therapy

FIND RESOURCES ON HOW TO IMPROVE HOSPITAL ANTIBIOTIC USE AND HELP FIGHT ANTIBIOTIC RESISTANCE:

<http://bit.ly/HospAbx>

ANTIBIOTICS

DON'T

WORK

ON COVID-19

www.cdc.gov/DrugResistance



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

What Can We Do?

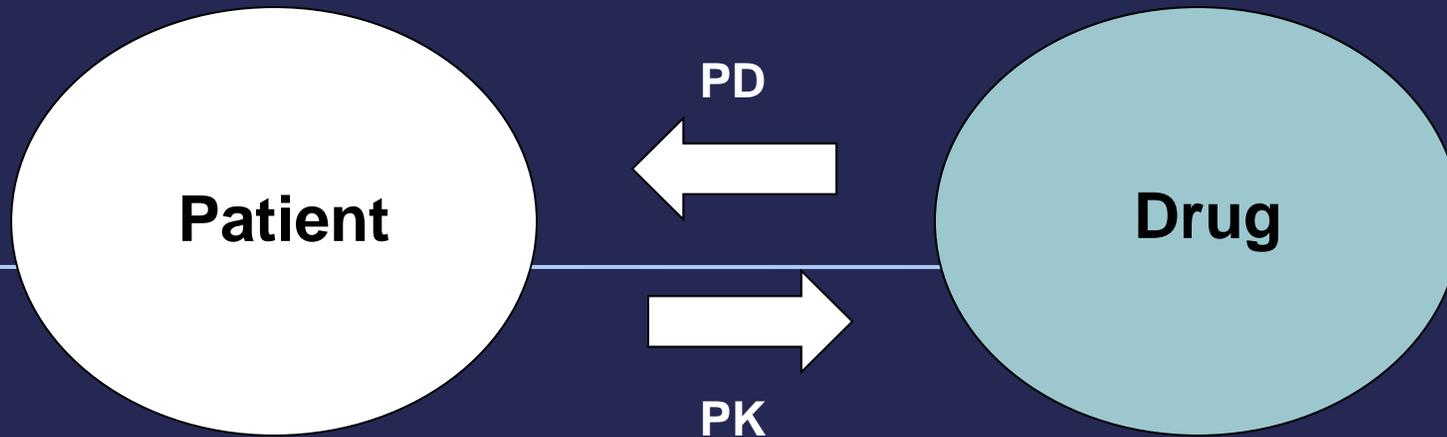
Must preserve the limited effective antibiotics that are currently available

Antibiotics Are a Shared Resource

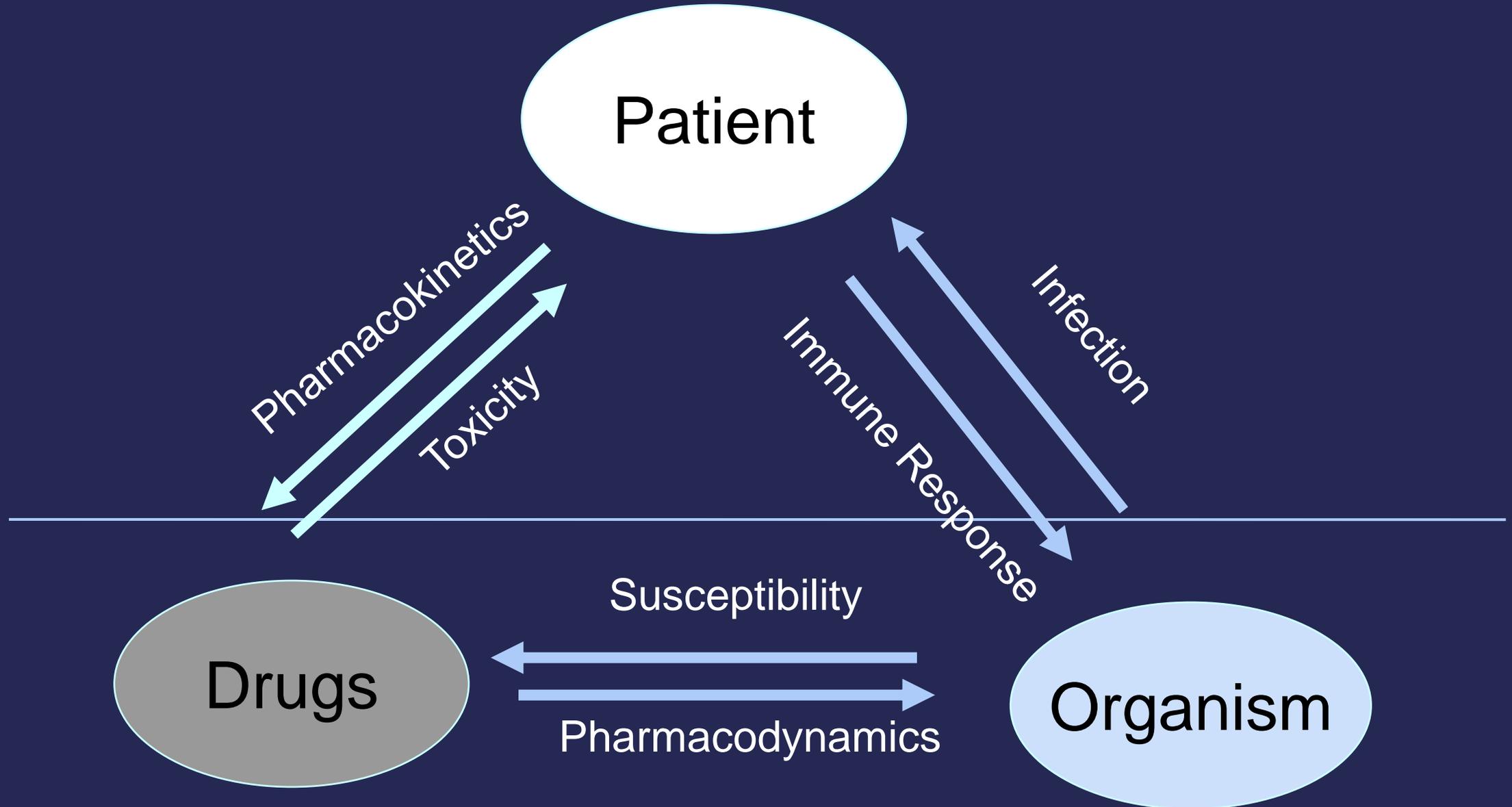
- How we use antibiotics in one patient today directly how effective the drug will be in another patient tomorrow
 - Resistant bacteria have the potential to spread to others, promoting resistant infections

ANTIMICROBIAL RESISTANCE IN PRACTICE

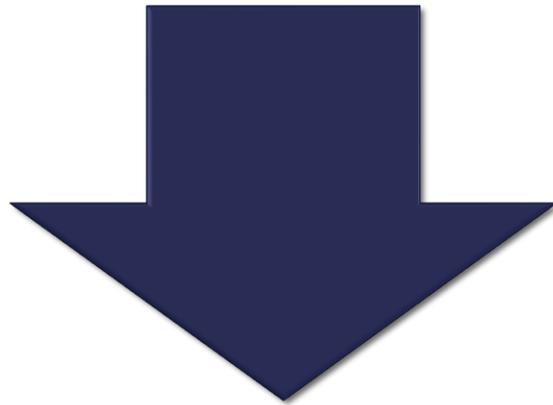
PHARMACOLOGY



ANTIMICROBIAL PHARMACODYNAMICS



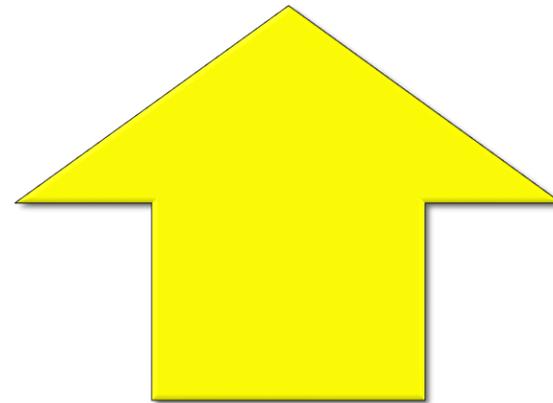
Goal of Antimicrobial Therapy



Effectively
eradicate
pathogen



Minimizing
toxicities



STEP 1: IDENTIFY THE PATHOGEN

What bacteria is causing the infection?

Bacteria Cell Wall Anatomy

Lipopolysaccharide
(orange)

Peptidoglycan
layer (yellow)

Phospholipid
(brown)

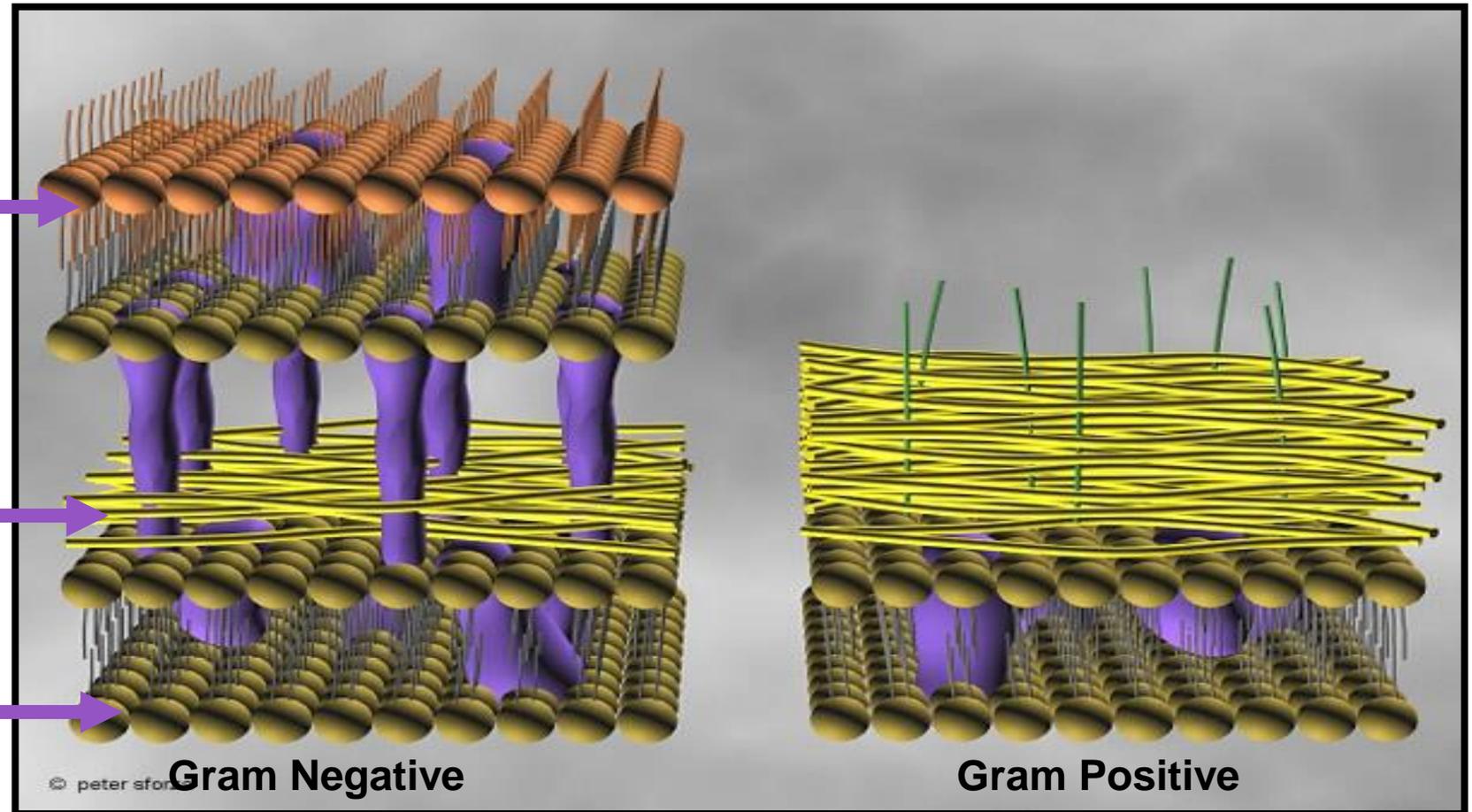


Table of Bacterial Causes of Infection

✓ = Common Cause - = Not a Common cause ? = Uncommon Cause **OR** only under specific circumstances (see notes)

Clinical Scenarios	Gram-positive Bacteria										Gram-negative Bacteria											
	Staphylococcus aureus (MSSA)	Staphylococcus aureus (MRSA)	Coagulase Negative Staphylococcus	Beta-haemolytic Streptococcus (A, B, C, G)	Enterococcus faecalis	Enterococcus faecium	Streptococcus pneumoniae	Listeria monocytogenes	Anaerobes			Neisseria meningitidis	Neisseria gonorrhoeae	Haemophilus influenzae	Escherichia coli	ESBL-positive Escherichia coli	Enterobacteriaceae	Pseudomonas aeruginosa	Moraxella catarrhalis	Non-Culturable		
									Clostridium perfringens	Clostridium difficile	Bacteroides fragilis									Legionella pneumophila	Mycoplasma pneumoniae	Chlamydia spp.
Respiratory Infections																						
Community Acquired Pneumonia (CAP)	✓ ¹	-	-	-	-	-	✓	-	-	-	-	-	-	✓	-	-	-	-	-	✓	✓	✓
Hospital Acquired Pneumonia (HAP)	✓	✓	-	-	-	-	✓	-	-	-	-	-	✓	? ²	? ²	✓	✓	-	-	-	-	-
Ventilator Associated Pneumonia (VAP)	✓	✓	-	-	-	-	✓	-	-	-	-	-	✓	✓	✓	✓	✓	-	-	-	-	-
Aspiration Pneumonia	✓	-	-	-	-	-	✓	-	-	-	-	-	✓	✓	✓	✓	-	-	-	-	-	-
Exacerbation of COPD	✓	-	-	-	-	-	✓	-	-	-	-	-	✓	-	-	-	-	-	✓	-	-	-
Acute Bronchitis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Head and Neck Infections																						
Otitis Media	-	-	-	-	-	-	✓	-	-	-	-	-	-	✓	-	-	-	-	-	-	-	-
Otitis Externa	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orbital Cellulitis	✓	-	-	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sinusitis	✓	-	-	✓	-	-	✓	-	-	-	-	-	✓	-	-	-	-	-	-	-	-	-
Urogenital Infections																						
Urinary Tract Infection (UTI)	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	✓	✓	? ³	-	-	-	-	-
Prostatitis	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	✓	✓	? ³	-	-	-	-	-
STDs	-	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-	-	-	✓
Skin, Soft Tissue, Bone and Joint Infections																						
Cellulitis	✓	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cellulitis in Diabetes & Vascular Insufficiency	✓	✓	-	✓	-	-	-	-	✓	-	-	-	✓	-	✓	✓	-	-	-	-	-	-
Bites	✓	-	-	✓	-	-	-	-	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-
Burns, Skin Grafts, Post-Operative	✓	✓	-	✓	-	-	-	-	✓	-	-	-	✓	-	✓	✓	-	-	-	-	-	-
Intravenous Device Associated Infection	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	? ⁴	? ⁴	-	-	-	-	-	-
Osteomyelitis	✓	✓	-	✓	-	-	-	-	-	-	-	-	? ⁵	-	? ⁵	-	-	-	-	-	-	-
Septic Arthritis	✓	✓	-	✓	-	-	-	-	-	-	-	-	? ⁵	-	? ⁵	-	-	-	-	-	-	-

Table of Bacterial Causes of Infection Cont.

✓ = Common Cause - = Not a Common cause ? = Uncommon Cause **OR** only under specific circumstances (see notes)

Clinical Scenarios	Gram-positive Bacteria											Gram-negative Bacteria										
	Staphylococcus aureus (MSSA)	Staphylococcus aureus (MRSA)	Coagulase Negative Staphylococcus	Beta-haemolytic Streptococcus A, B, C, G)	Enterococcus faecalis	Enterococcus faecium	Streptococcus pneumoniae	Listeria monocytogenes	Anaerobes			Neisseria meningitidis	Neisseria gonorrhoeae	Haemophilus influenzae	Escherichia coli	ESBL-positive Escherichia coli	Enterobacteriaceae	Pseudomonas aeruginosa	Moraxella catarrhalis	Non-Culturable		
									Clostridium perfringens	Clostridium difficile	Bacteroides fragilis									Legionella pneumophila	Mycoplasma pneumoniae	Chlamydia spp.
Gastrointestinal Infections																						
Peritonitis	-	-	-	-	✓	✓	-	-	✓	-	✓	-	-	-	✓	?6	✓	?6	-	-	-	-
Cholecystitis & Cholangitis	-	-	-	-	✓	✓	-	-	✓	-	✓	-	-	-	✓	?6	✓	?6	-	-	-	-
Necrotising Pancreatitis	-	-	-	-	✓	✓	-	-	✓	-	✓	-	-	-	✓	?6	✓	?6	-	-	-	-
Other Infections																						
Infective Endocarditis	✓	-	✓	-	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Emergencies																						
Sepsis	✓	✓	-	✓	-	-	✓	✓	-	-	-	✓	-	-	✓	-	✓	✓	-	-	-	-
Neonatal Sepsis	-	-	-	✓7	-	-	-	-	-	-	-	-	-	-	✓	-	?8	-	-	-	-	-
Neutropaenic Sepsis	✓	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	✓	✓	-	-	-	-	-
Meningitis	-	-	-	-	-	-	✓	-	-	-	-	✓	-	✓	-	-	-	-	-	-	-	-
Neonatal Meningitis	-	-	-	✓7	-	-	-	✓	-	-	-	-	-	✓	-	?8	-	-	-	-	-	-
Epiglottitis	-	-	-	✓	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-	-
Epidural Abscess	✓	-	-	-	-	-	-	-	-	-	-	-	-	✓	-	✓	-	-	-	-	-	-
Necrotising Fasciitis	-	-	-	✓	-	-	-	-	✓	-	-	-	-	-	-	✓	-	-	-	-	-	-
Toxic Shock Syndrome	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. *Staphylococcus aureus* is an uncommon cause of CAP except after Influenza or out-of-hospital cardiac arrest
2. *Escherichia coli* occasionally causes HAP in particularly debilitated patients
3. *Pseudomonas aeruginosa* can cause UTIs and prostatitis in patients with anatomically abnormal urinary tracts or catheters
4. Enterobacteriaceae and *Pseudomonas aeruginosa* can cause central venous catheter infections, particularly in the immunodeficient
5. *Escherichia coli* and Enterobacteriaceae can cause osteomyelitis and septic arthritis in the elderly, particularly following haematogenous seeding from UTIs
6. ESBL-positive *Escherichia coli* and *Pseudomonas aeruginosa* are more common in intra-abdominal infections following surgery
7. Group B Beta-haemolytic *Streptococcus* is the most common cause of neonatal sepsis and meningitis
8. Enterobacteriaceae such as *Klebsiella* spp., *Salmonella* spp. and *Serratia marcescens* are unusual but severe causes of neonatal sepsis and meningitis

STEP 2: COLONIZATION OR INFECTION?

Understanding the difference between normal host microbiota and typical pathogens will help to determine whether a patient is truly infected or merely colonized.

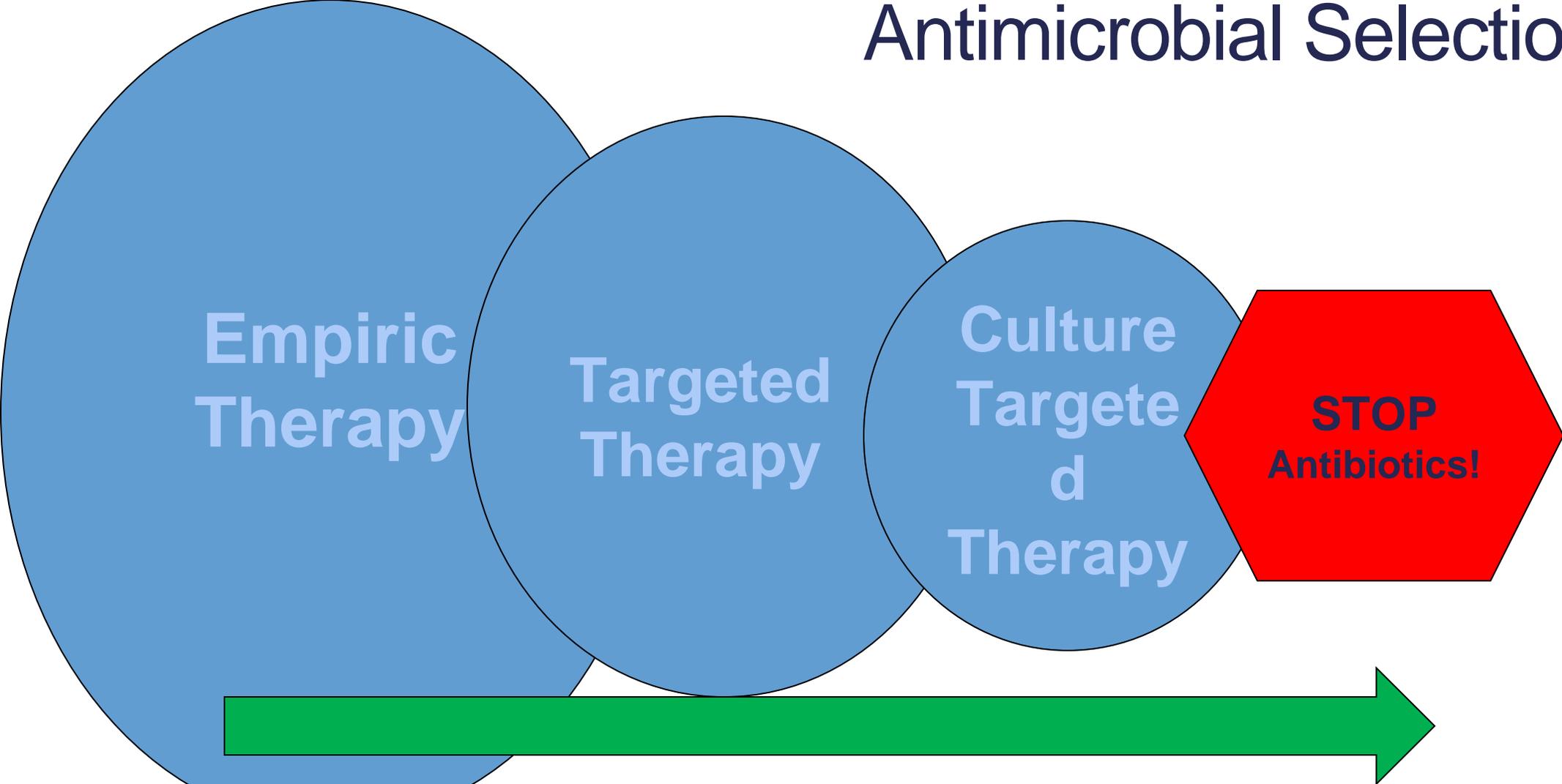
COLONIZATION VS. INFECTION

- **Colonization:** presence of organism without clinical or sub-clinical disease
 - Organisms occur naturally in our tissue, they provide benefits by taking up space, compete for essential nutrients and suppress growth of potentially pathogenic bacteria and fungi.
- **Contamination:** presence of organisms on a body surface without invasion or response (i.e., dx of UTI with dirty catheter, without a clean catch)
- **Infectious:** able to transmit infections to others
- **Carrier:** person who is infected with an organism but shows no evidence of disease

STEP 3: TREAT THE INFECTION

Is it resistant to empiric antibiotics?

Antimicrobial Selection



ED Department

- ✓ Patient Risk Factors
- ✓ Local Antibigram
- ✓ Take cultures
- ✓ Deescalate therapy
- ✓ Escalate Therapy
- ✓ STOP Antibiotics

U.S. Antimicrobial Resistance Threats

20% increases in antimicrobial resistance (AR) burden



Vancomycin-resistant Enterococcus (VRE)



Candida auris (*C. auris*)



Methicillin-resistant *Staphylococcus aureus* (MRSA)



Extended-spectrum beta-lactamase (ESBL)-producing Enterobacterales



Carbapenem-resistant Enterobacterales (CRE)



Multidrug-resistant (MDR) *Pseudomonas aeruginosa*



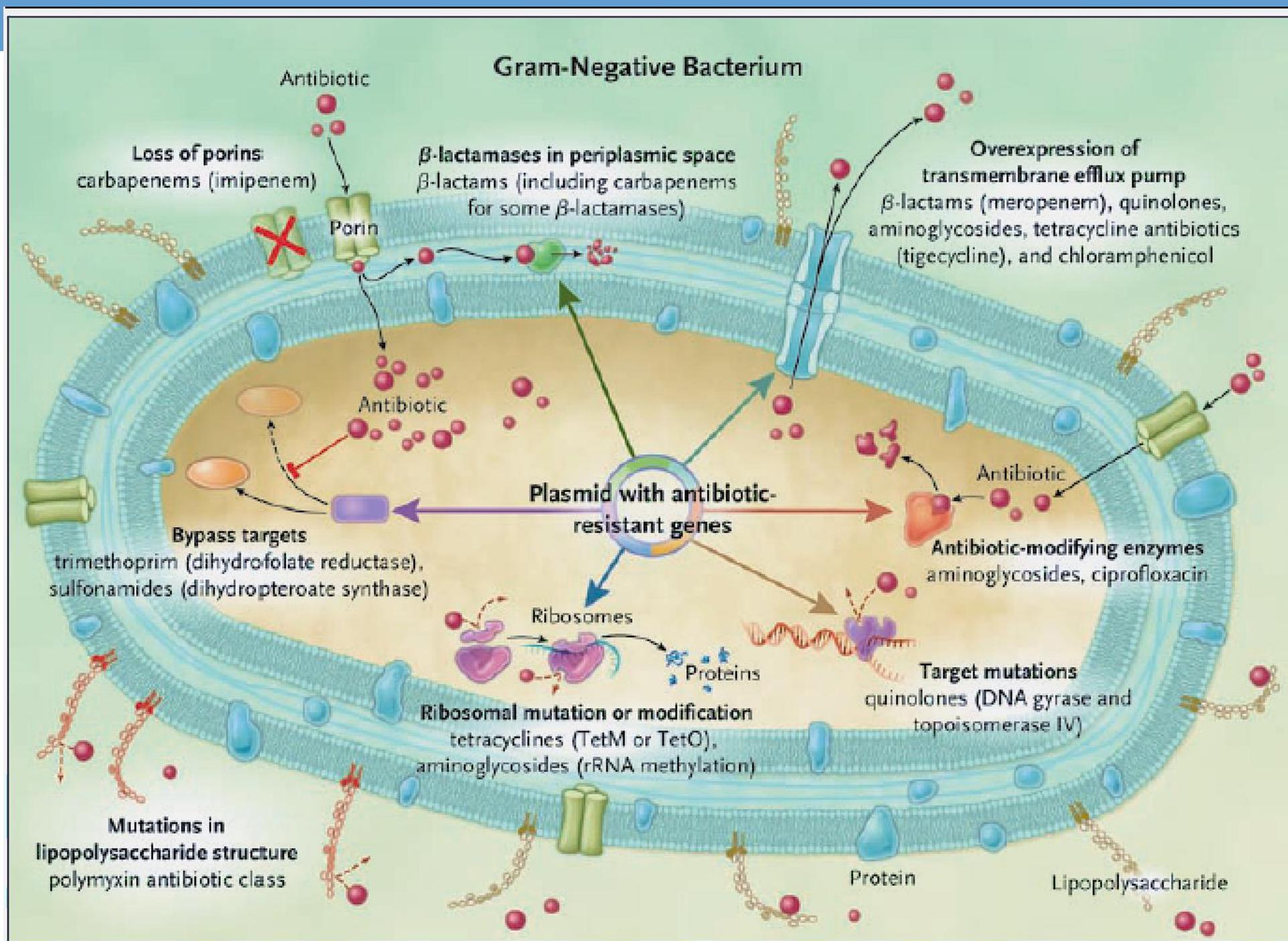
Carbapenem-resistant *Acinetobacter*

STEP 3: EDUCATE YOUR PATIENT

Science, Clinicians and Society

SCIENCE

Mechanisms of Antibiotic Resistance in Gram-Negative Bacteria



SOCIETY: “The Resistant Body”

“My body is resistant to antibiotics”

- The public have an **incomplete** understanding of antibiotic resistance
- Interpret resistance as one’s body ‘**getting used to**’ antibiotics with increasing exposure, and the antibiotics therefore ceasing to work: “If you take them too much then you get to the point where it doesn’t work anymore, because *the body gets used* to it (why patients don’t finish the full course of antibiotics)”

“If you take antibiotics too much and when you don't really need them, then the body gets used to them and then later when you do actually need them they don't work or they're less effective, kind of like what happens with addiction”

Viruses or Bacteria What's got you sick?



**BE
ANTIBIOTICS
AWARE**
SMART USE, BEST CARE

Common Respiratory Infections	Common Cause			Are Antibiotics Needed?*
	Virus	Virus or Bacteria	Bacteria	
Common cold/runny nose	✓			No
Sore throat (except strep)	✓			No
COVID-19	✓			No
Flu	✓			No
Bronchitis/chest cold (in otherwise healthy children and adults)		✓		No**
Middle ear infection		✓		Maybe
Sinus infection		✓		Maybe
Strep throat			✓	Yes
Whooping cough			✓	Yes

*Antiviral drugs are available for some viral infections, such as COVID-19 or flu.

**Studies show that in otherwise healthy children and adults, antibiotics for bronchitis won't help patients feel better.



Name: _____

Date: ____/____/____



Diagnosis:

- Cold
- Cough
- Flu
- Middle ear fluid (Otitis Media with Effusion, OME)
- Viral sore throat
- Other: _____

You have been diagnosed with an illness caused by a virus. Antibiotics do not cure viral infections. If given when not needed, antibiotics can be harmful. The treatments prescribed below will help you feel better while your body's own defenses are fighting the virus.

General instructions:

- Drink extra water and juice.
- Use a cool mist vaporizer or saline nasal spray to relieve congestion.
- For sore throats, use ice chips or sore throat spray; lozenges for older children and adults.

Specific medicines:

- Fever or aches:
- Ear pain:
- _____
- _____

Use medicines according to the package instructions or as directed by your healthcare provider. Stop the medication when the symptoms get better.

Follow up:

- If not improved in ____ days, if new symptoms occur, or if you have other concerns, please call or return to the office for a recheck.
- Other: _____



Signed: _____

For More Information call 1-800-CDC-INFO
or visit www.cdc.gov/getsmart

“It takes five minutes
to write a prescription,
15 minutes not to!”



VACCINES: A PUBLIC HEALTH SUCCESS

Vaccines reduce morbidity and mortality

Herd immunity protects vulnerable populations

Success can reduce perceived risk over time

Barriers in Progress on Prevention of ID: Trust and Access



SCIENTISTS, CLINICIANS and SOCIETY

1. **Misinformation and Politicization:**

- Science competes with misinformation; spreads faster and with emotion than evidence-based findings (ie social media).
- Scientific issues (e.g., vaccines, climate change, public health guidance) become politicized, people often evaluate science through ideological lenses rather than evidence, eroding trust.

2. **Communication Gaps and Uncertainty:**

- Scientific processes are iterative, but the public often expects certainty (black and white)
- When recommendations change (as they should when evidence evolves), it is misinterpreted as incompetence or dishonesty.
- Technical language and limited engagement with public concerns further widen the gap.

3. **Perceived Conflicts of Interest and Institutional Distrust:**

- Public trust declines when science is seen as influenced by industry funding, government agendas, or elite institutions disconnected from everyday concerns. Broader mistrust in institutions media, government, academia spills over into skepticism toward science itself.



Original Investigation | Public Health

Trust in Physicians and Hospitals During the COVID-19 Pandemic in a 50-State Survey of US Adults

Roy H. Perlis, MD, MSc; Katherine Ognyanova, PhD; Ata Uslu, MS; Kristin Lunz Trujillo, PhD; Mauricio Santillana, PhD; James N. Druckman, PhD;
Matthew A. Baum, PhD; David Lazer, PhD

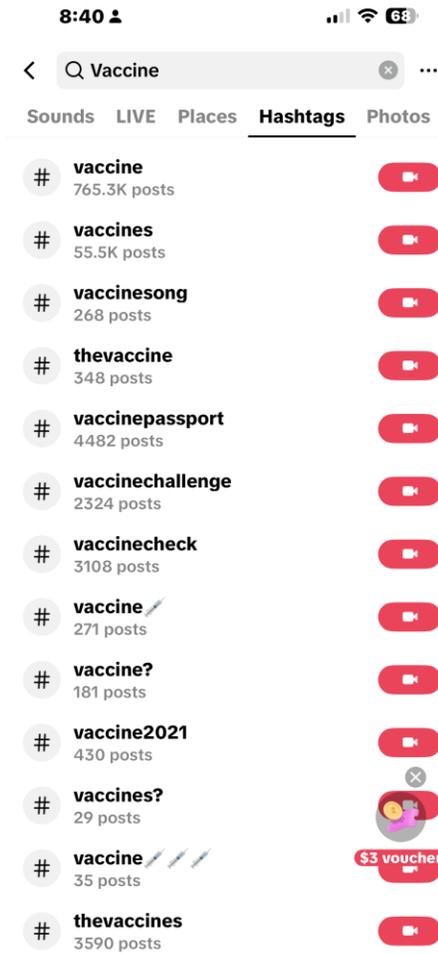
In every sociodemographic group in this survey study among 443 455 unique respondents aged 18 years or older residing in the US, **trust in physicians and hospitals decreased substantially over the course of the pandemic, from 71.5% in April 2020 to 40.1% in January 2024.**

Individuals with **lower levels of trust were less likely to have been vaccinated** or received boosters for COVID-19.....

As lower levels of trust were associated with lesser likelihood of pursuing vaccination, restoring trust may represent a public health imperative

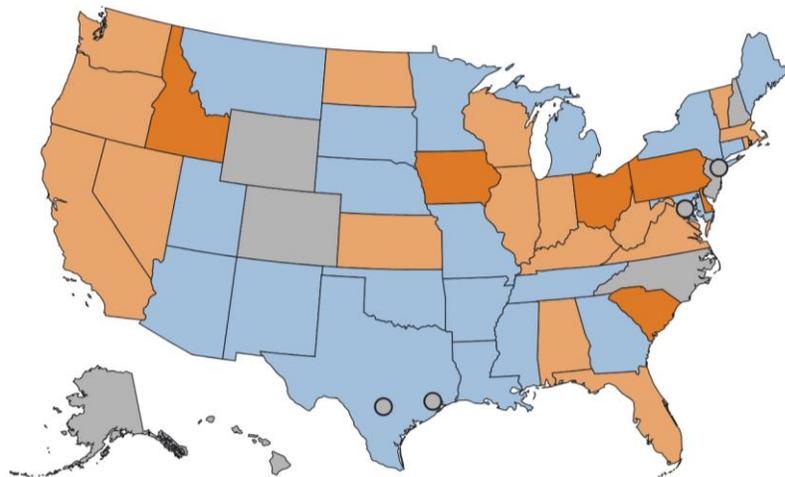
TRUST Process: Science and Society

- Search “Vaccine”
- PubMed; filter 5 years; 180,200
- Instagram; 1.7M Posts
- PubMed; 763.5K

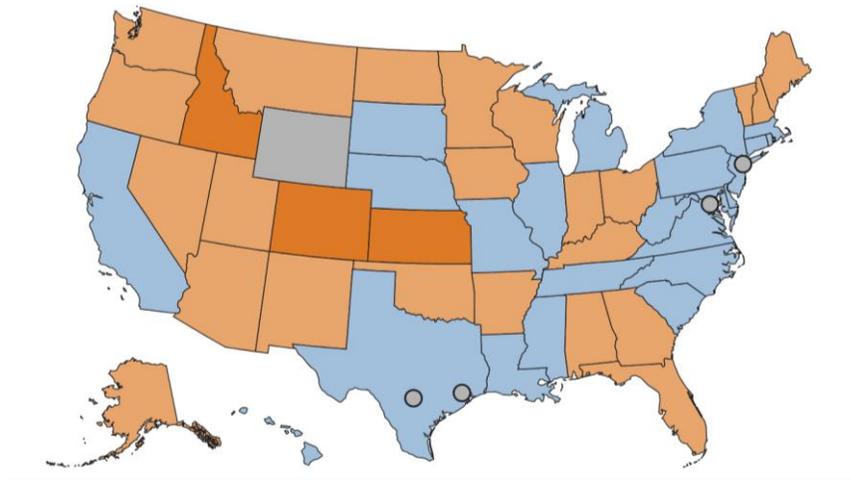


Estimated Percent Vaccinated Decreasing in U.S Population

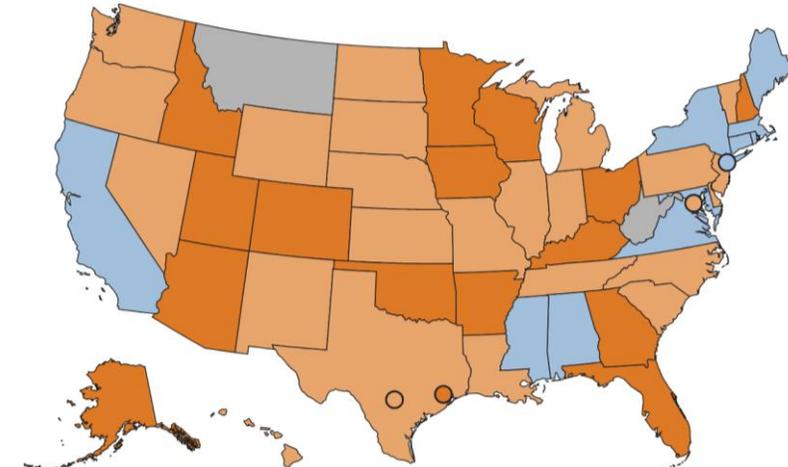
2009-2010



2017-2018 (pre-COVID19)



2024-2025



Less than 90%

90-94.9%

95%+

Not available

Society 's Conversations: Vaccines

Decreased Trust / Loss of Faith from the Public – Why?

“Over regulation of vaccines” and the belief that “it is not a shared conversation with your physician”, it has “become black and white / blanket recommendation, and not individualized medicine

“if you want to discuss, and delay or decline some vaccines you are not allowed to be part of the practice (patient dismissal)” and this decreases child's access, wanted “individual based shared decision-making”

Truth: Disease cause risk and Vaccines can cause risk - advocacy groups want an informed and shared decision making



Individual Health vs Population Health



Individual Health

- Focuses on diagnosis and treatment of disease in individual patients.
- Emphasizes personalized care, shared decision-making, and therapeutic interventions based on individual needs (support, safety, precision medicine falls in here)



Population Health

- Focuses on prevention and health outcomes across communities and populations.
- Emphasizes public health measures (e.g., vaccination, surveillance) to reduce disease burden and health disparities.

VACCINES

Recent CDC Recommendation for Childhood Vaccinations

Childhood Vaccination Policy Review (Dec 5, 2025)

- **Presidential Mandate:** The President directed HHS and CDC to assess U.S. childhood vaccine recommendations against best practices and evidence from peer nations.
- The review included consultations with public health officials from Japan, Germany, and Denmark, as well as CDC and FDA experts on vaccine safety and efficacy.



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

Centers for Disease Control and Prevention (CDC)
Atlanta GA 30329-4027

Decision Memo

DATE: January 5, 2026

TO: Jim O'Neill, Acting Director, Centers for Disease Control and Prevention (CDC)

FROM: Jay Bhattacharya, MD, PhD, Director, National Institutes of Health
Mehmet Oz, MD, MBA, Administrator, Centers for Medicare and Medicaid Services
Marty Makary, MD, MPH, Commissioner of Food and Drugs

SUBJECT: DECISION REQUESTED – Adopting Revised Childhood and Adolescent Immunization Schedule

PURPOSE

This memorandum proposes a revised childhood and adolescent immunization schedule for your review and approval.

RECOMMENDATION AND ACTION REQUESTED

After considering the data and recommendations contained in TAB 1, "Assessment of the U.S. Childhood and Adolescent Immunization Schedule Compared to Other Countries," and your discussions with relevant health officials, you should approve the revised immunization schedule.

BACKGROUND AND SUMMARY OF RECOMMENDED ACTION

On December 5, 2025, the President directed the Department of Health and Human Services (HHS) and the Centers for Disease Prevention and Control (CDC) to review best practices from peer, developed nations regarding core childhood vaccination recommendations and the scientific evidence underlying those practices. The President further instructed that, "if [HHS and CDC] determine that those best practices are superior to current domestic recommendations, update the United States core childhood vaccine schedule to align with such scientific evidence and best practices from peer, developed countries while preserving access to vaccines currently available to Americans."

[Press Room](#)[HHS Live](#)

Fact Sheet: CDC Childhood Immunization Recommendations

Scientific Review

- In 2024, the U.S. recommended more childhood vaccine doses than any other peer nation, and more than twice as many as some European nations.
- A 2024 comparison between the U.S. and peer nations, found that countries without vaccine mandates had as high immunization rates as the U.S. and other countries with vaccine mandates.
- Trust in U.S. public health declined from 72% to 40% between 2020 and 2024, coinciding with public health failure during the pandemic, including COVID-19 vaccine mandates. Though the COVID-19 vaccine was recommended for all children on the CDC schedule, the uptake rate was less than 10% by 2023. The uptake rate of other childhood vaccines declined during the same time period.
- Large placebo-controlled randomized trials on individual vaccines, combinations of vaccines, and vaccine schedules, as well as observational studies, are needed to better inform patients, parents, and providers and help restore trust in public health.

Peer Countries n = 20

- US, from the Highest number of childhood vaccinations to the lowest.
- Denmark recommends fewer (10 diseases in total).
- Greece and Ireland (16 diseases)
- Australia, Canada, Denmark, Ireland, Spain, and the United Kingdom (15 diseases)
- Japan recommends childhood immunization against 14 different diseases.

Universal Vaccine Recommendations Funded by the Government	Age at 1st Vaccine (months)	Rotavirus	Diphtheria	Tetanus	Pertussis	Polio	Hib	Tuberculosis	Japanese Encephalitis	Hepatitis A	Hepatitis B	Pneumococcal	Measles	Mumps	Rubella	Varicella	HPV	Meningococcal	Influenza	Covid-19	# Vaccine Doses	# Diseases	# Mandated
Australia	0	2	6	6	6	4	4	..	..	..	4	3	2	2	2	1	1	2	5-6	..	50-51	15	13
Austria	2	2-3	5	5	5	5	3	..	..	..	4	3	2	2	2	..	2	1	17-18	..	58-60	14	0
Belgium	2	..	6	6	6	5	4	..	..	..	4	3	2	2	2	..	2	1	..	..	43	12	1
Canada	2	2-3	6	6	6	5	4	..	..	..	2-3	3-4	2	2	2	2	1	2	18-19	..	64-68	15	0
Denmark	3	..	4	4	4	4	3	..	..	..	..	3	2	2	2	..	2	..	..	..	30	10	0
Finland	2	3	5	5	5	4	3	..	..	..	..	3	2	2	2	2	2	..	6-7	..	44-45	13	0
France	2	2-3	5	5	5	5	3	..	..	..	3	3	2	2	2	..	2	6	..	..	45-46	13	11
Germany	1.5	2-3	5	5	5	4	3	..	..	..	3	3	2	2	2	2	2	4	..	..	44-45	14	1
Greece	2	2-3	6	6	6	4-5	4	..	..	2	3	3	2	2	2	2	2	5	5-6	..	56-58	16	0
Ireland	2	2	6	6	6	5	4	..	..	..	4	3	2	2	2	1	1	5	16	..	65	15	0
Italy	3	2	5	5	5	5	3	..	..	..	3	3	2	2	2	2	2	6	..	..	47	14	10
Japan	2	2-3	5	5	4	4	4	1	4	..	3	4	2	..	2	2	2-3	..	..	..	44-46	14	0
Netherlands	1.5	2	6	6	5	5	4	..	..	..	4	3	2	2	2	..	2	2	..	..	45	13	0
New Zealand	1.5	2	5	5	5	4	4	..	..	..	3	3	2	2	2	1	2	3	..	..	43	14	0
Norway	1.5	2	5	5	5	5	3	..	..	..	3	3	2	2	2	..	2	..	..	..	39	12	0
Portugal	0	..	6	6	5	5	4	..	..	..	3	3	2	2	2	..	2	4	..	..	44	12	0
Spain	2	2-3	5	5	4	4	3	..	..	..	3	3	2	2	2	2	1	6	4-5	..	48-50	15	0
Sweden	1.5	2-3	5	5	5	4	3	..	..	..	3	3	2	2	2	..	2	..	..	..	38-39	12	0
Switzerland	2	2	5	5	5	4	3	..	..	..	3	3	2	2	2	2	2	6	..	..	46	14	0
United Kingdom	2	2	6	6	5	6	4	..	..	..	4	2	2	2	2	2	1	4	14	..	62	15	0
# Recommended		17	20	20	20	20	20	1	1	1	18	20	20	19	20	12	20	15	8	0			
# Mandated		1	3	3	3	4	3	0	0	0	3	2	4	3	3	2	0	2	0	0			
USA 2024	0	2-3	6	6	6	4	3-4	..	..	2	3	4	2	2	2	2	2	2	18-19	18-19	84-88	17	12
USA Suggested	2	A	6	6	6	4	3-4	..	..	A	A	4	2	2	2	2	1	A	A	A	38-39	11	0

A table from HHS's assessment of the US vaccine schedule in comparison to other wealthy nations. The table shows the number of doses for each type of vaccine recommended. The "# Mandated" row uses the example of New York state. The "18-19" number in the bottom right reflects the number of shots a child could receive if they take a yearly COVID-19 and flu shot. Some vaccines are duplicated, such as the measles, mumps, rubella combined vaccine (MMR). "A" reflects the new CDC guidance that these shots be only for high-risk patients or at the bequest of caregivers. The US has no childhood federal vaccine mandate – these vary by state.

Schedule 2026

- **All:** Vaccines against diphtheria, tetanus, and pertussis (DTaP or Tdap); measles, mumps, and rubella (MMR); polio; varicella (chickenpox); Haemophilus influenzae type b (Hib); pneumococcal; and human papillomavirus (HPV) are recommended for **all children**.
- **High-risk:** Respiratory syncytial virus (RSV); hepatitis A; hepatitis B; meningococcal (bacterial meningitis); and dengue vaccines are recommended for high-risk populations.
- **Shared clinical decision-making:** The CDC advises parents to consult their health care provider to determine whether their child needs vaccines for rotavirus, COVID, flu, hepatitis A, hepatitis B, and meningococcal disease.

The CDC will now routinely recommend vaccines for **11 diseases instead of 17**, with several vaccines shifted to high-risk groups or “shared clinical decision-making.”

This moves the U.S. away from population-level prevention toward individualized risk. This is a fundamental, high-stakes shift in how we protect kids.

New HHS Childhood Immunization Schedule

(released January 5, 2026)

Recommended for All Children

- Diphtheria
- Tetanus
- Acellular pertussis (whooping cough)
- Haemophilus influenzae type b (Hib)
- Pneumococcal conjugate
- Polio
- Measles
- Mumps
- Rubella
- Human papillomavirus (HPV)
- Varicella (chickenpox)

Recommended for Certain High-Risk Groups or Populations

- RSV*
- Hepatitis A
- Hepatitis B
- Meningococcal

*Note: any children whose mother did not have the vaccine should get one dose

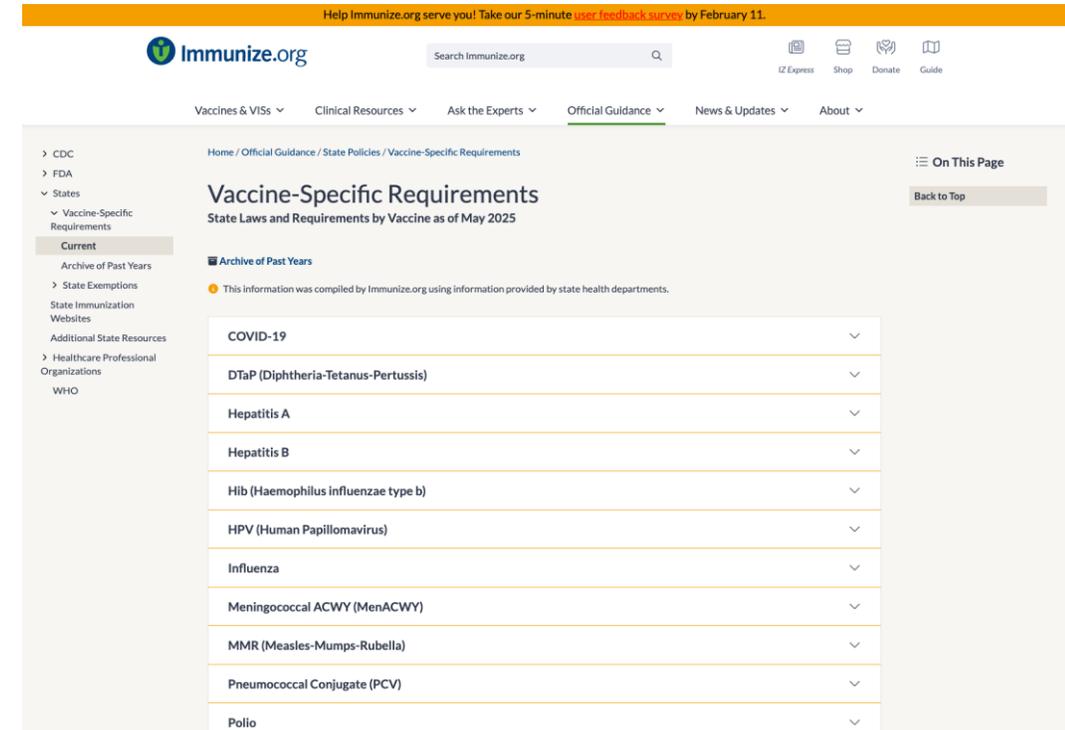
Recommended Based on Shared Clinical Decision-Making

- Rotavirus
- COVID-19
- Influenza
- Hepatitis A
- Hepatitis B
- Meningococcal

Vaccine	Previous recommendation	Revised recommendation
Measles, mumps, & rubella	Routinely recommended (2 doses)	Routinely recommended (2 doses)
Polio	Routinely recommended (4 doses)	Routinely recommended (4 doses)
Chicken pox (varicella)	Routinely recommended (2 doses)	Routinely recommended (2 doses)
Diphtheria, tetanus, & pertussis (DtAP)	Routinely recommended (5 doses)	Routinely recommended (5 doses)
Tetanus, diphtheria, & pertussis (Tdap)	Routinely recommended (1 dose, booster)	Routinely recommended (1 dose, booster)
Hib	Routinely recommended (3-4 doses)	Routinely recommended (3-4 doses)
Pneumococcal conjugate vaccine (PCV)	Routinely recommended (3 doses + booster)	Routinely recommended (3 doses + booster)
Human papillomavirus (HPV)	Routinely recommended (2-3 doses)	Routinely recommended (only 1 dose)
Respiratory syncytial virus (RSV)	Routinely recommended (1 dose)	High-risk groups only
Hepatitis A	Routinely recommended (2 doses)	High-risk groups only
Hepatitis B	Routinely recommended (2-4 doses)	Delay by 2 months (unless high-risk)
Meningococcal ACWY	Routinely recommended (1 dose + booster)	High-risk groups only
Dengue	High-risk groups only	High-risk groups only
Influenza	Routinely recommended (annual)	Shared decision-making (annual)
Covid	Shared decision-making (annual)	Shared decision-making (annual)
Rotavirus	Routinely recommended (2-3 doses)	Shared decision-making

Mandated States: States Govern Themselves

- **Meaning:** A state that has enacted laws requiring individuals (most commonly students, daycare and healthcare workers) to receive certain vaccinations as a condition for school entry or employment
- **Therefore:** A Federal Change (i.e., CDC Recommendation) does not mean State Change
- All 50 states mandate specific vaccinations for children to attend school, generally including DTaP, Polio, MMR, and Varicella.
- While all states allow medical exemptions, requirements for **non-medical (religious or philosophical)** exemptions vary significantly, with some states allowing them and others only permitting medical exemptions.



The screenshot shows the Immunize.org website. At the top, there is a yellow banner with the text "Help Immunize.org serve you! Take our 5-minute user feedback survey by February 11." Below this is the Immunize.org logo and a search bar. The navigation menu includes "Vaccines & VISs", "Clinical Resources", "Ask the Experts", "Official Guidance", "News & Updates", and "About". The main content area is titled "Vaccine-Specific Requirements" and "State Laws and Requirements by Vaccine as of May 2025". A sidebar on the left lists various categories like "CDC", "FDA", "States", "Vaccine-Specific Requirements", "Current", "Archive of Past Years", "State Exemptions", "State Immunization Websites", "Additional State Resources", "Healthcare Professional Organizations", and "WHO". The main content area has a section for "Archive of Past Years" with a note: "This information was compiled by Immunize.org using information provided by state health departments." Below this is a table of vaccine types with dropdown arrows next to each:

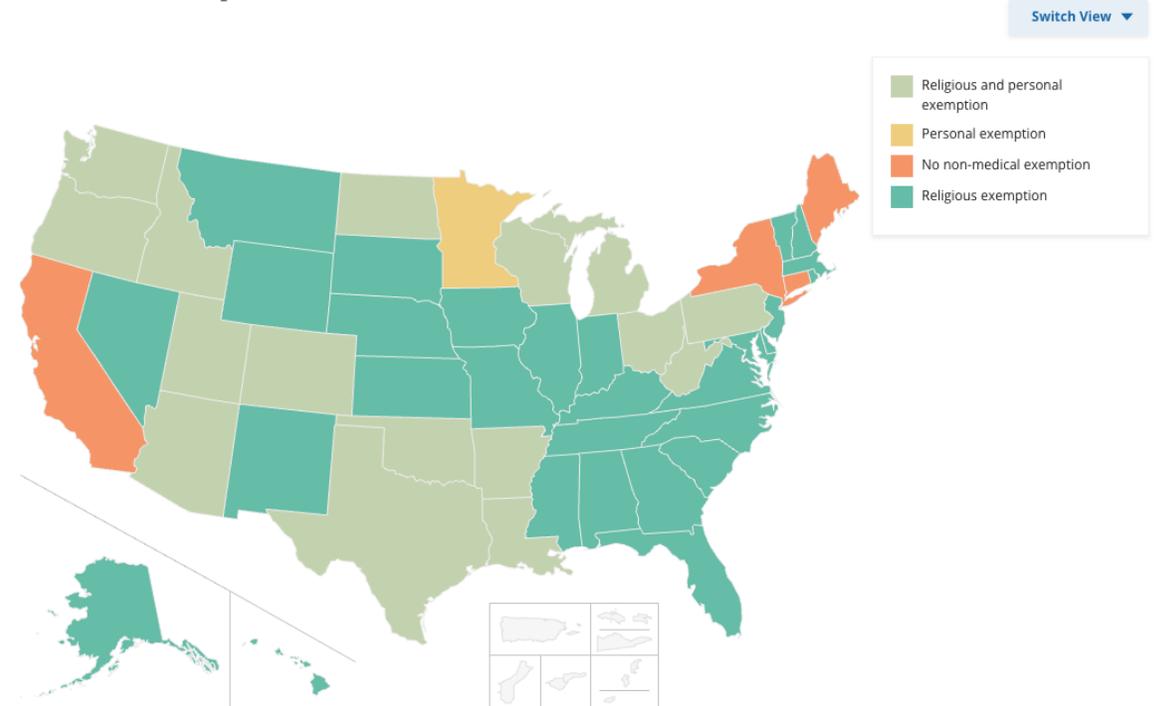
COVID-19	▼
DTaP (Diphtheria-Tetanus-Pertussis)	▼
Hepatitis A	▼
Hepatitis B	▼
Hib (Haemophilus influenzae type b)	▼
HPV (Human Papillomavirus)	▼
Influenza	▼
Meningococcal ACWY (MenACWY)	▼
MMR (Measles-Mumps-Rubella)	▼
Pneumococcal Conjugate (PCV)	▼
Polio	▼

Non-Medical Exemption



- Twenty-nine states and Washington D.C. allow exemptions for individuals with religious objections to immunizations.
- Sixteen states allow exemptions for either religious or personal reasons.
- Four States including Connecticut, Maine, Mississippi, New York, and West Virginia do not allow non-medical (religious or philosophical) exemptions for school-required vaccinations, only allowing medical exemptions.

Non-Medical Exemption Policies for School Immunizations



CDC recommendation no longer align with these states; but the stricter rule applies!

U.S. childhood vaccination schedule changes

All vaccines are still available at no cost

PREVIOUS SCHEDULE

Chickenpox
Diphtheria
Hib
HPV (2 doses)
Measles
Mumps
Pneumococcal
Polio
Rubella
Tetanus
Whooping cough
RSV
Hepatitis A
Hepatitis B
Meningococcal ACWY
COVID-19
Flu
Rotavirus
Dengue
Meningococcal B

UPDATES SINCE OCT. 2025

Chickenpox
Diphtheria
Hib
HPV (1 dose)
Measles
Mumps
Pneumococcal
Polio
Rubella
Tetanus
Whooping cough
Dengue
RSV
Hepatitis A
Hepatitis B
Meningococcal ACWY
Meningococcal B
COVID-19
Flu
Rotavirus

Recommended for all babies whose mothers did not receive the maternal RSV vaccine

- Recommended for all kids
- Recommended for high-risk
- Recommended for high-risk, shared clinical decision-making for others
- Shared clinical decision-making

Can my child still receive all of the vaccines from the old schedule?

Yes, and the American Academy of Pediatrics advises that they do.

Will insurance cover all vaccines?

Yes. All of the vaccines are still available at no cost to families.

What does "shared clinical decision-making" mean?

A **conversation** with a health care provider about the risks and benefits of a vaccine.

CDC Updated Recommendations

Pros Changes

Arguments from Federal Officials & Supporters

- **Trust:** Shared decision-making empowers parents, and empowerment builds trust
- **International Alignment:** Proponents, including Health and Human Services (HHS), argue the changes align the U.S. with peer nations like Denmark, which routinely recommend fewer vaccines but maintain high public health standards.
- **Individualized Care:** By moving vaccines like the flu and COVID-19 to "shared clinical decision-making," the CDC emphasizes individualized, risk-informed discussions between parents and doctors rather than a one-size-fits-all approach.
- **Safety & Simplicity:** The CDC suggests a more focused schedule may improve adherence to the most critical shots while reducing the total number of doses children receive.

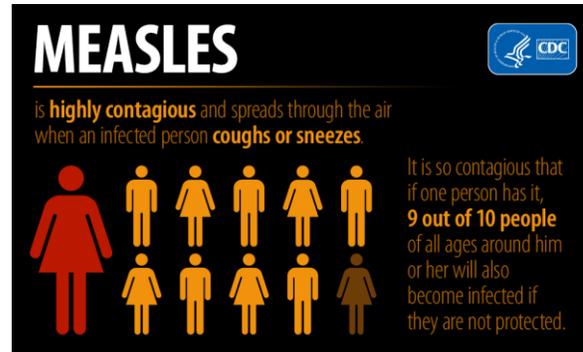
Against Changes

American Academy of Pediatrics (AAP), American Medical Association (AMA) and American Academy of Family Physicians (AAFP)

- **Not an evidence-based decision:** Not an evidence-based immunization policy process; but peer review of other countries
- **Apples and Oranges:** Many high-income countries have universal coverage and paid family leave that make it easier to get care and stay safe when kids get sick,"
- **US Childhood Health Status Is Suboptimal:** Denmark and Japan's healthier population, more robust healthcare systems, surveillance, testing, and social support mean there is less reliance on vaccines.
- **Uninsured and Limited Access:** We have fragmented insurance, we've got millions uninsured, we don't have a national health registry and we've got enormous gaps in the continuity of care, we use broader vaccine recommendations because our system can't reliably identify and follow up with every person at risk

MEASLES OUTBREAK

Current Measles outbreak in U.S



- Highly contagious
- After two doses, the vaccine is 97% effective against measles, and its protection is considered lifelong.
- Driven by low vaccination coverage 95% coverage needed for herd immunity
- Schools in outbreak zones have **low MMR vaccination rates** (e.g., some <20%)

	2026 To date	2025 Full year
Total Cases	416	2255
Age		
Under 5 years	102 (25%)	577 (26%)
5-19 years	252 (61%)	993 (44%)
20+ years	42 (10%)	670 (30%)
Age unknown	20 (5%)	15 (1%)
Vaccination Status		
Unvaccinated or Unknown	94%	93%
One MMR dose	3%	3%
Two MMR doses	3%	4%

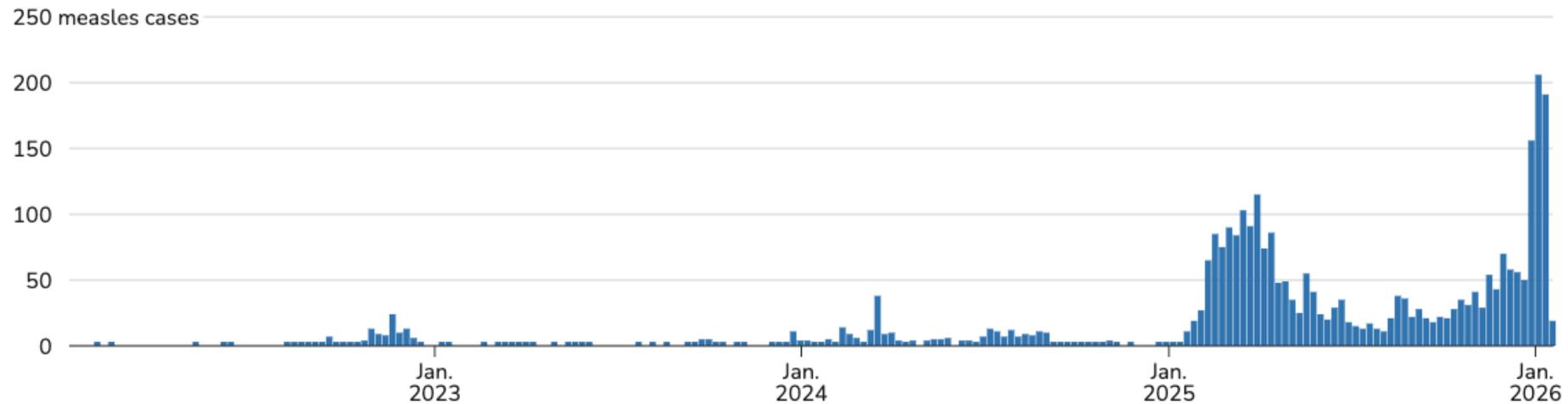
Measles Cases and Outbreaks



EXPLORE THIS TOPIC ▾

Weekly measles cases by rash onset date

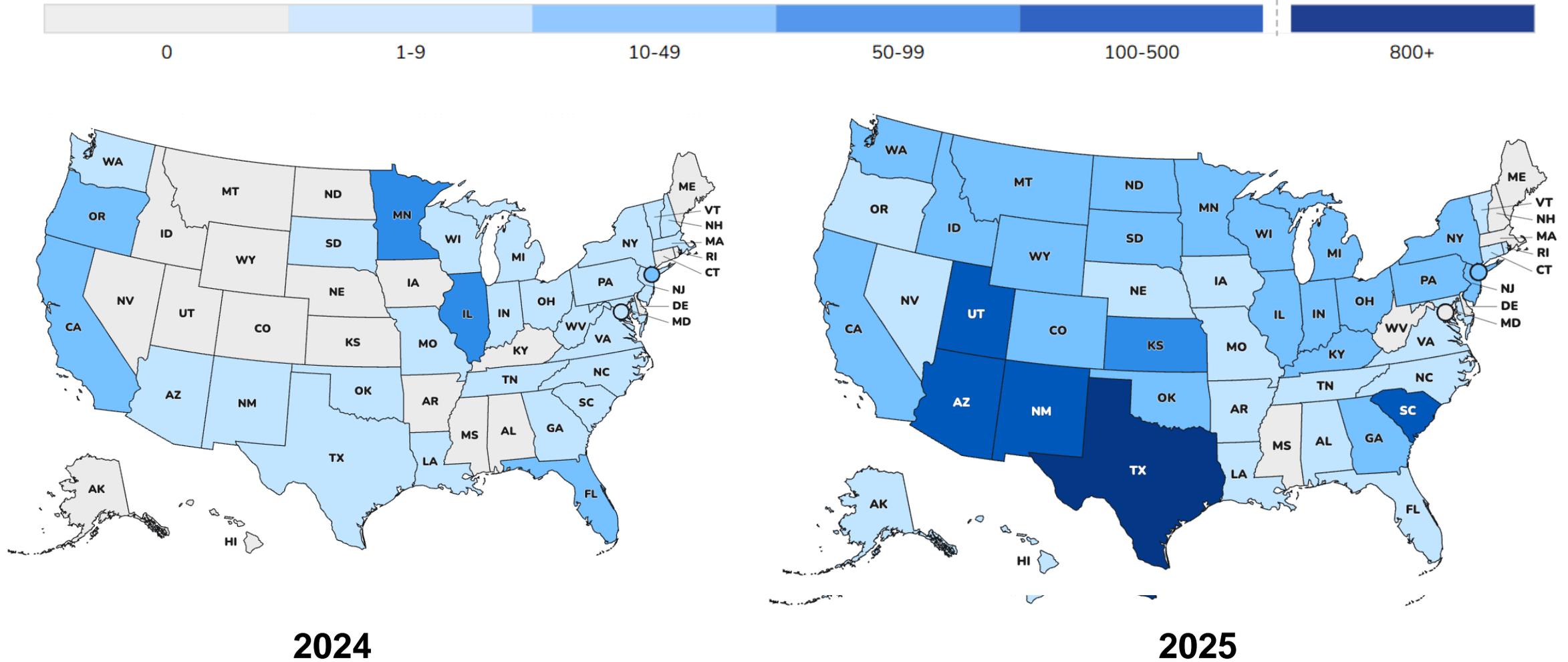
2023–2026* (as of January 22, 2026)



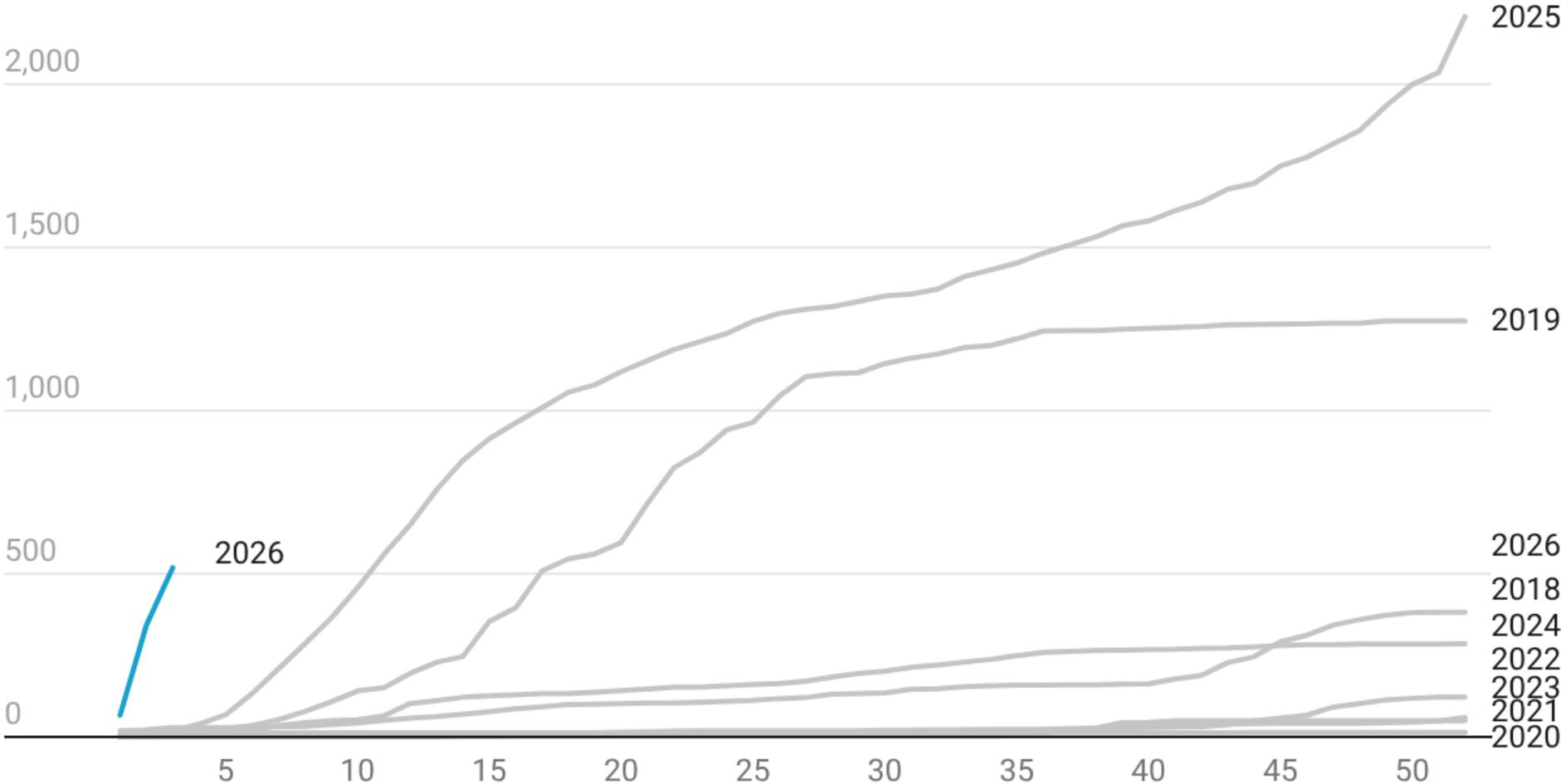
Data Table +

Source: <https://www.cdc.gov/measles/data-research/index.html>; Accessed Jan 28th 2026

Map of measles cases in U.S. (2024 vs. 2025)



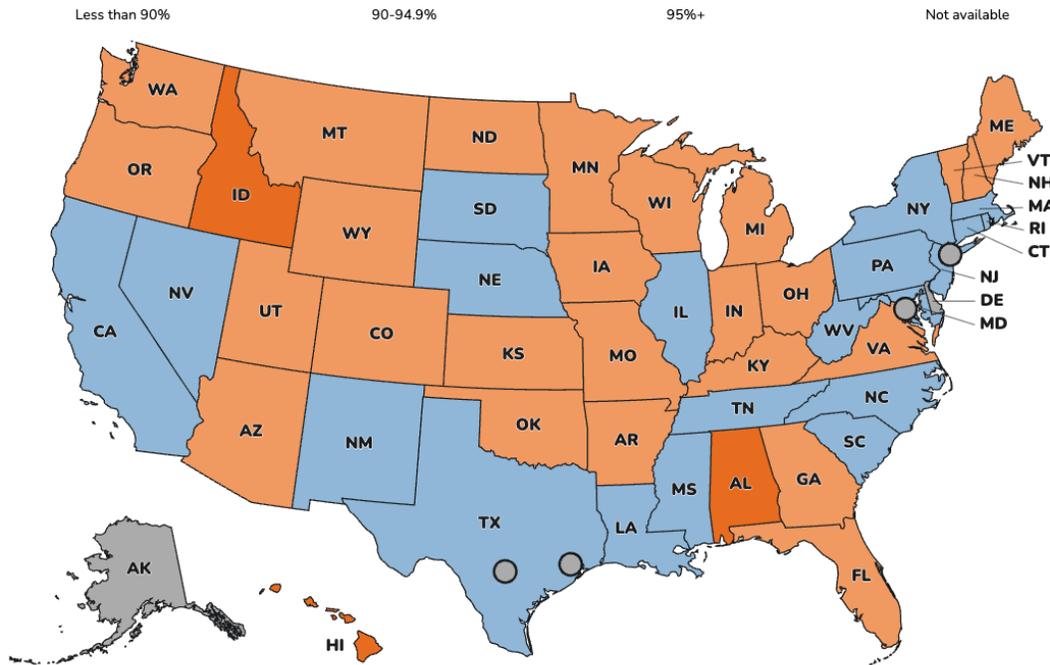
Cumulative measles cases reported in the United States by year



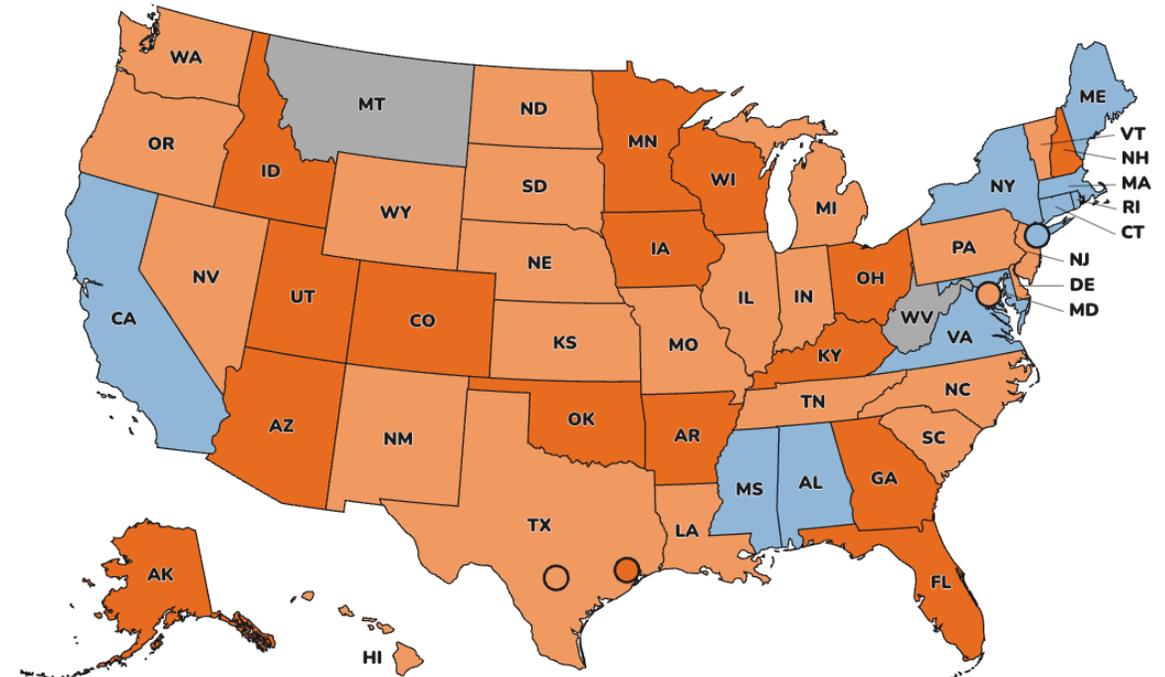
Source: Johns Hopkins University

Map of measles Percent Vaccinated in U.S. (Past Five Years)

Percent Vaccinated



2020



2025

Measles cases reported in the United States

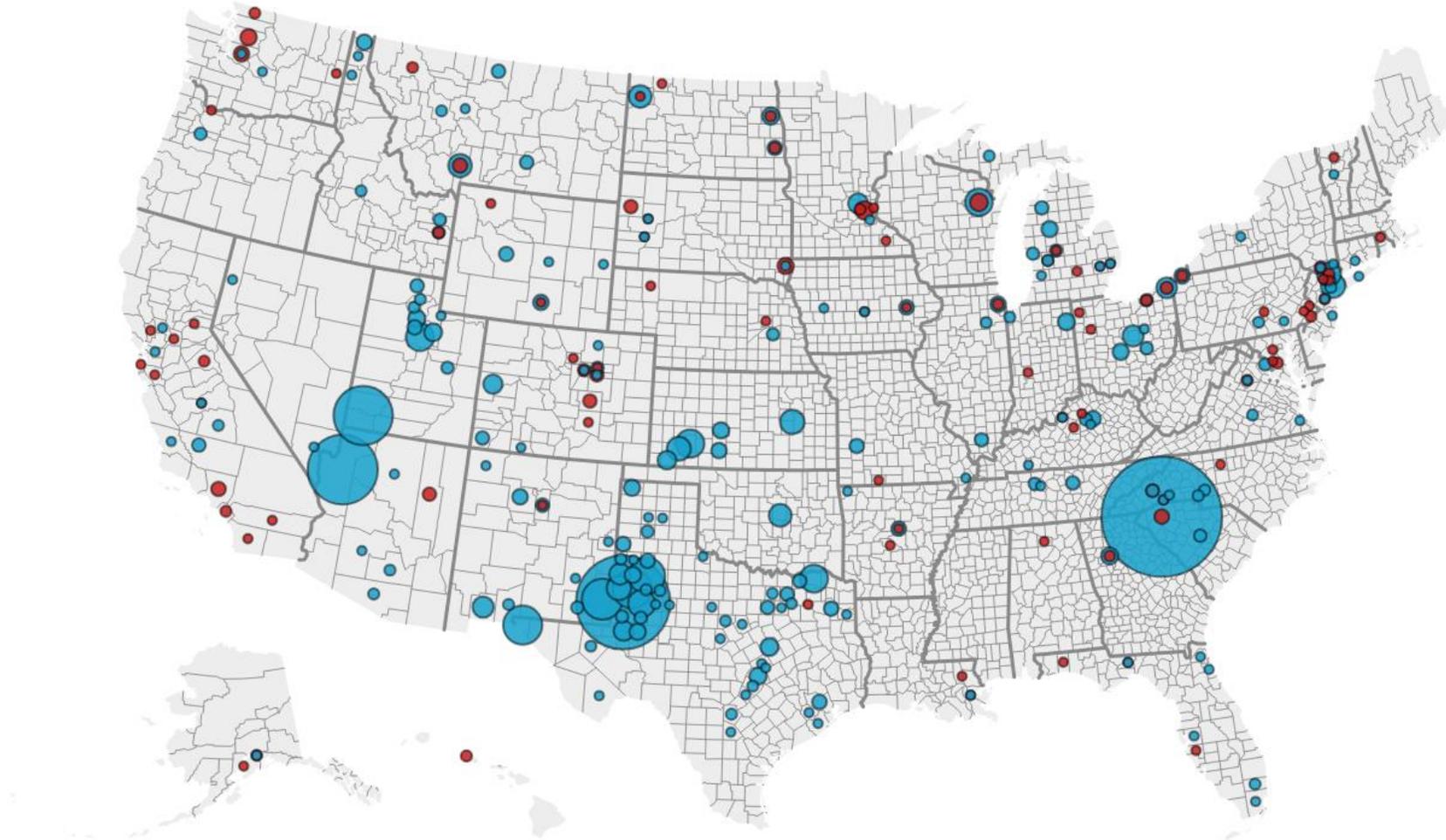
■ Imported ■ Local

count ○ 70 ○ 300 ○ 700

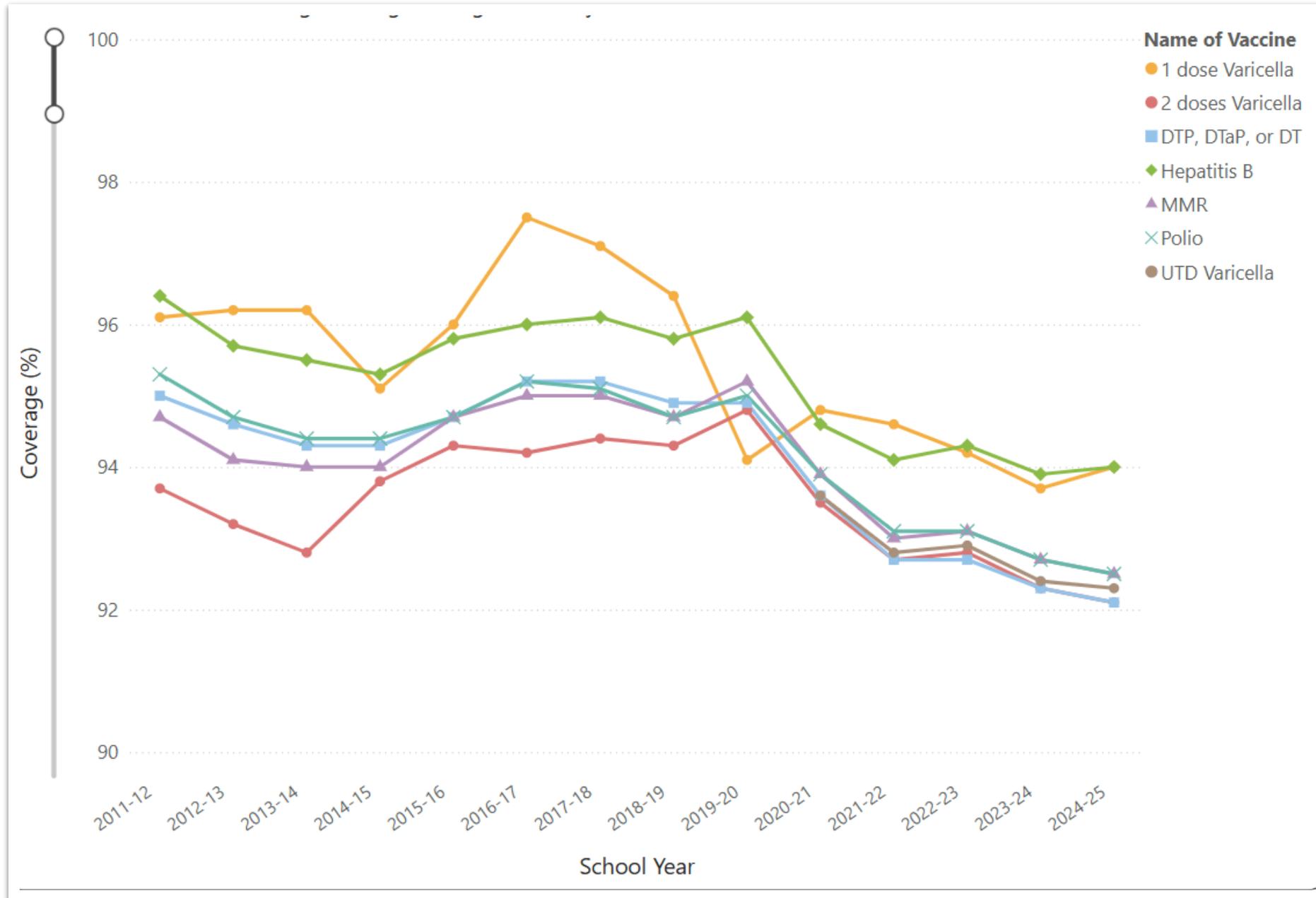
U.S. MEASLES CASES

January 1, 2025 - Jan 23, 2026

2724



National Vaccination Coverage Amongst Kindergarteners by School Year



Source:
<https://www.cdc.gov/schoolvaxview/data/index.html>

SCIENCE VS SOCIETY

Trust

SCIENTISTS, CLINICIANS and SOCIETY

1. Misinformation and Politicization:

- Science competes with misinformation; spreads faster and with emotion than evidence-based findings (ie social media).
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- Scientific processes are iterative, but the public often expects certainty (black and white)
- When recommendations change (as they should when evidence evolves), it is misinterpreted as incompetence or dishonesty.
- Technical language and limited engagement with public concerns further widen the gap.

3. Perceived Conflicts of Interest and Institutional Distrust:

- Public trust declines when science is seen as influenced by industry funding, government agendas, or elite institutions disconnected from everyday concerns. Broader mistrust in institutions media, government, academia spills over into skepticism toward science itself.