THE PRESENT AND FUTURE OF ANTIMICROBIAL STEWARDSHIP

Zach Willis, MD, MPH

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Outline

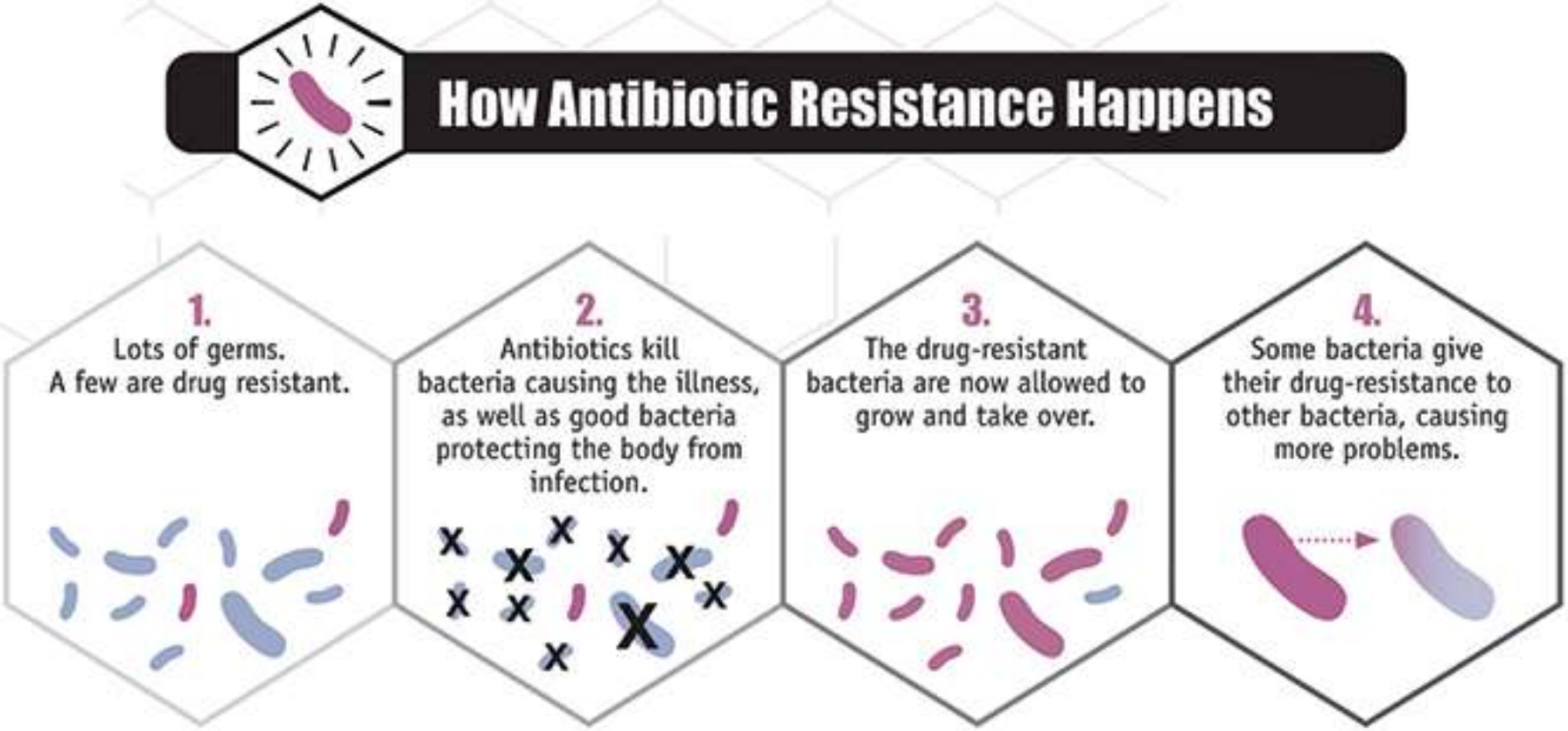
- The Why of antimicrobial stewardship
- Identifying antimicrobial prescribing that is not subject to stewardship
- Opportunities to enhance current AS
- New directions for AS
- Your role in preventing Antimicrobial Resistance

Why is Antimicrobial Resistance Bad?

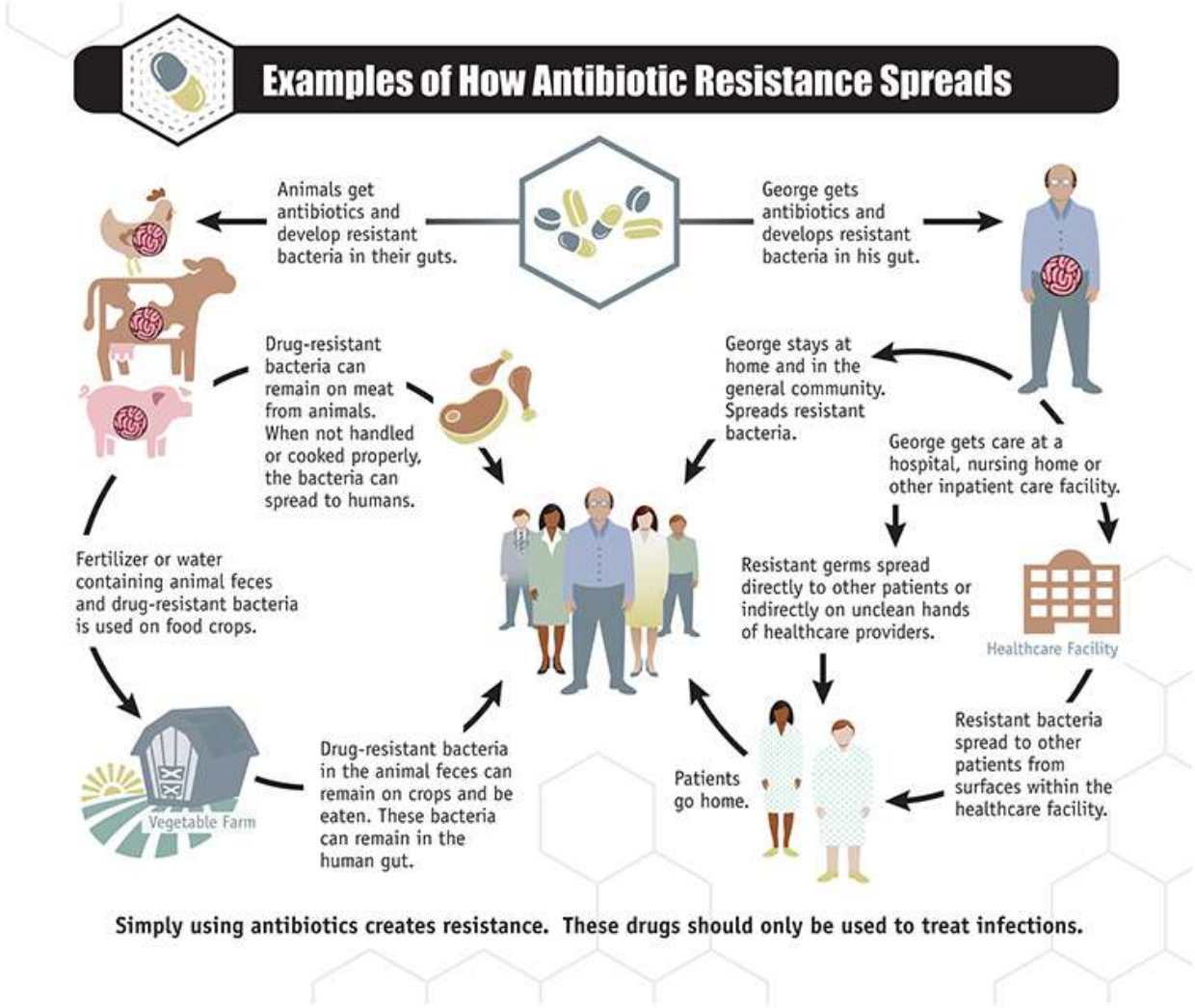
- 1.3 million direct deaths per year worldwide
- 2.8 million AMR infections in US wordwide
  - 35,000 deaths
- $4.6 billion dollars in healthcare spending in US

Impact of Antimicrobial Resistance

- Empiric therapy may be inadequate. Delays in providing effective antibiotic therapy increase risk of mortality.
- Drugs used for antibiotic-resistant infections are:
  - Usually more toxic (vancomycin vs. cefazolin)
  - Usually more expensive
  - Often less effective (e.g., vancomycin vs. cefazolin)
  - Often not available PO → increased LOS, increased central-line use
  - Often broader spectrum → future AMR, higher risk of C-diff
- Threat of resistance → increased use of more toxic, less effective, more expensive, IV-only drugs in patients *without* resistant organisms



CDC, *Antibiotic Resistance Threats in the United States*, 2013.
https://stacks.cdc.gov/view/cdc/20705



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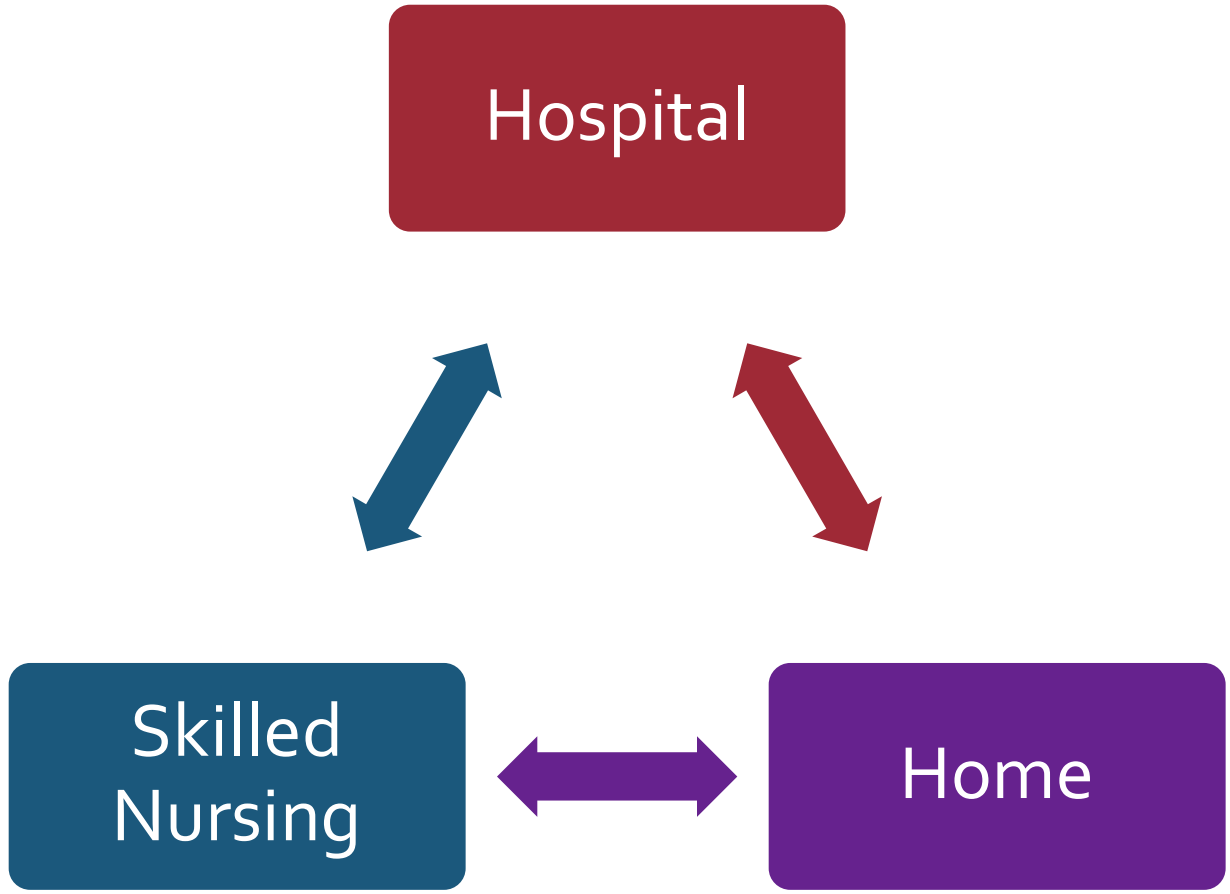
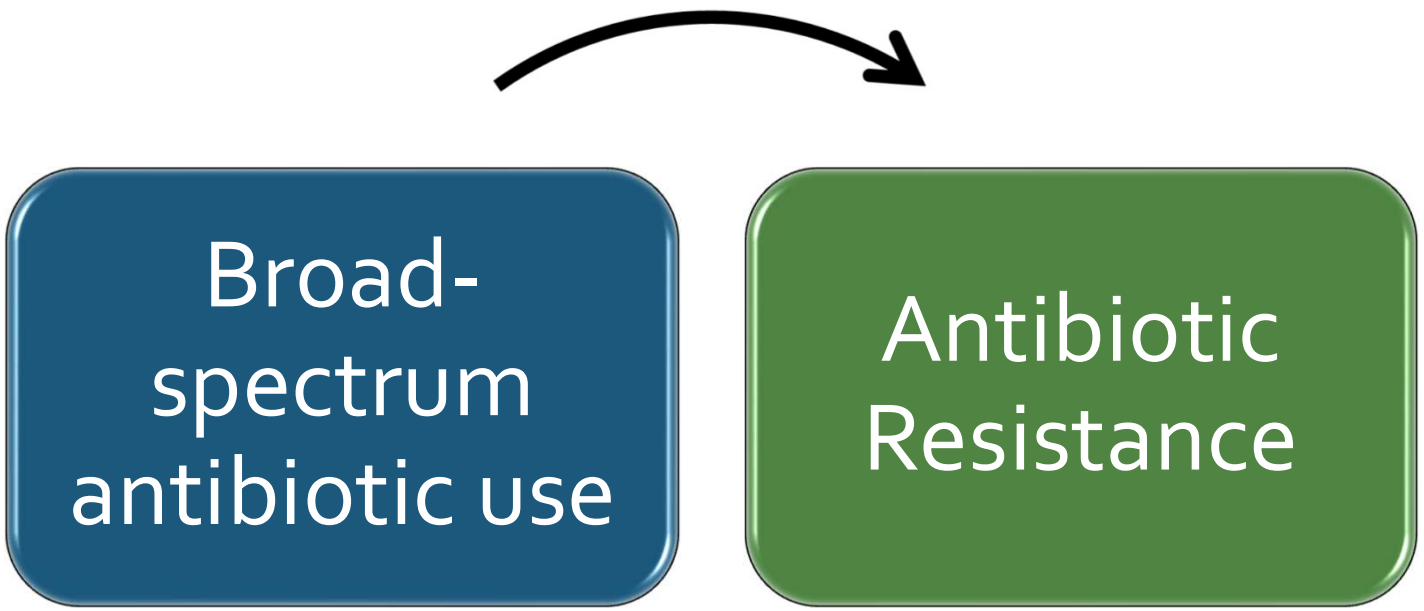
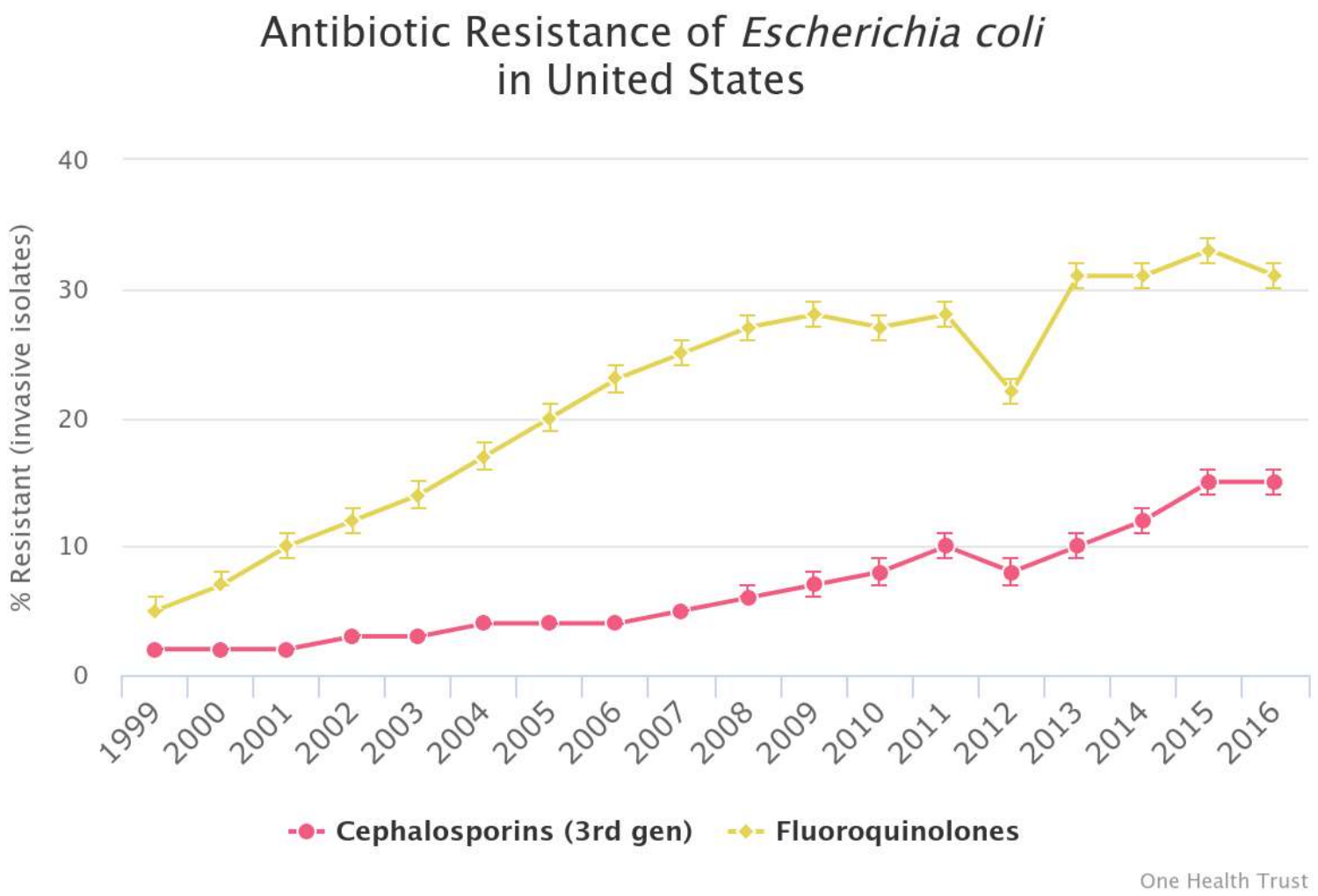
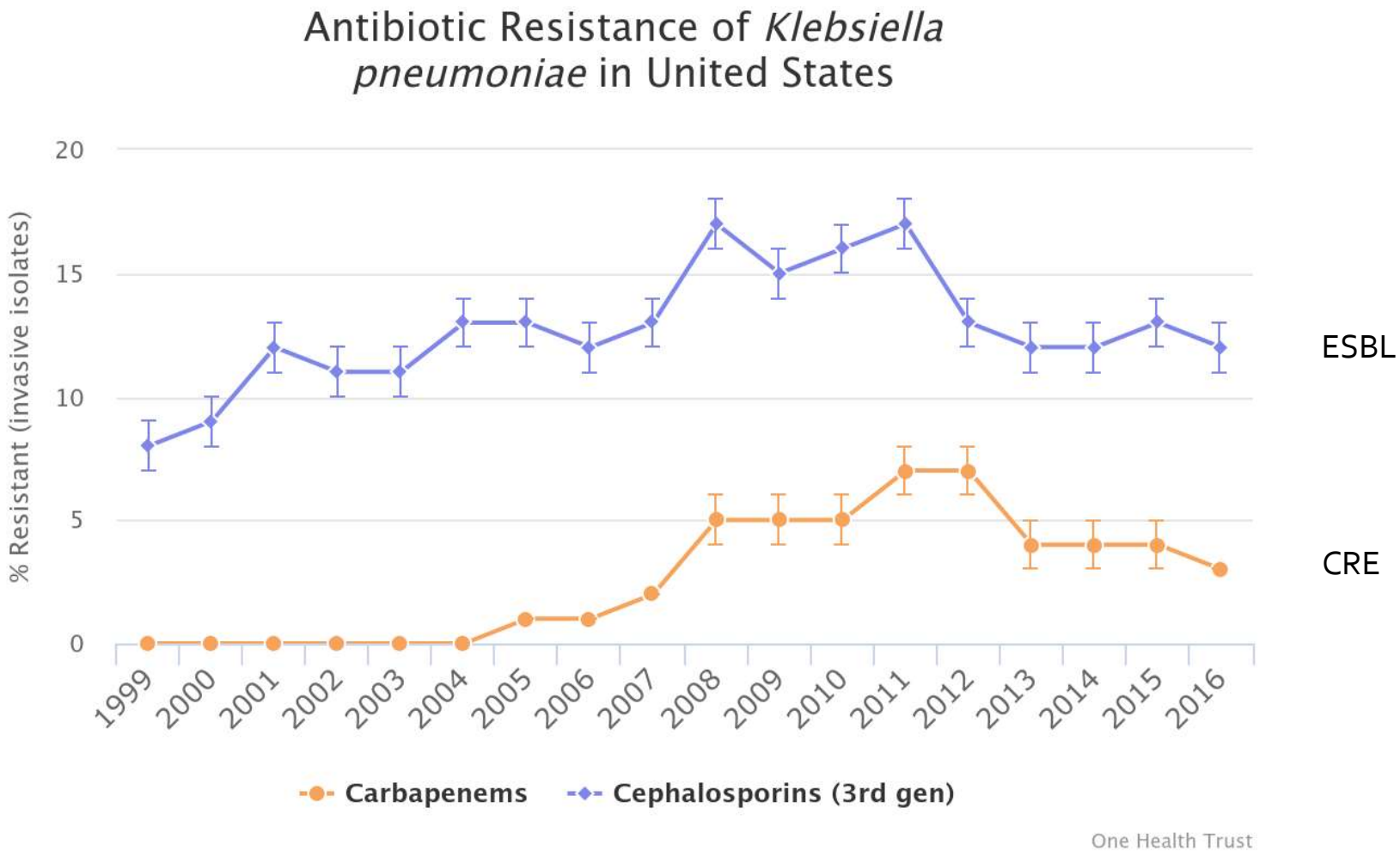

Hospital
Skilled Nursing
Home


Broad-spectrum antibiotic use
Antibiotic Resistance



ResistanceMap. https://resistancemap.onehealthtrust.org/



ESBL

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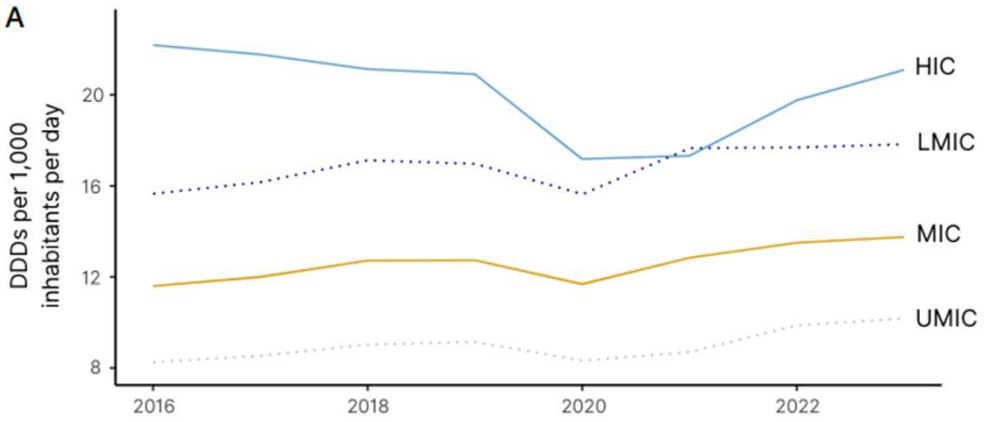
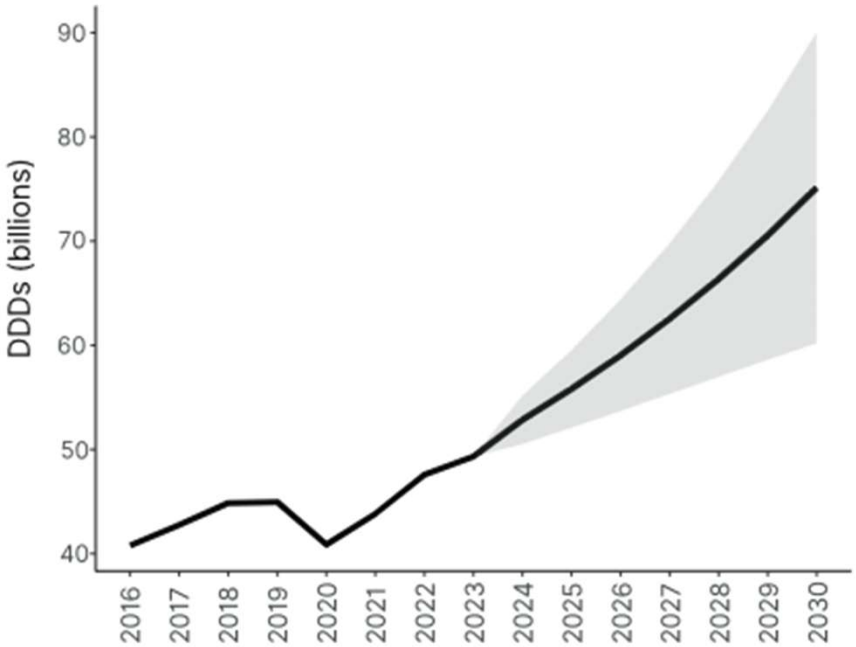
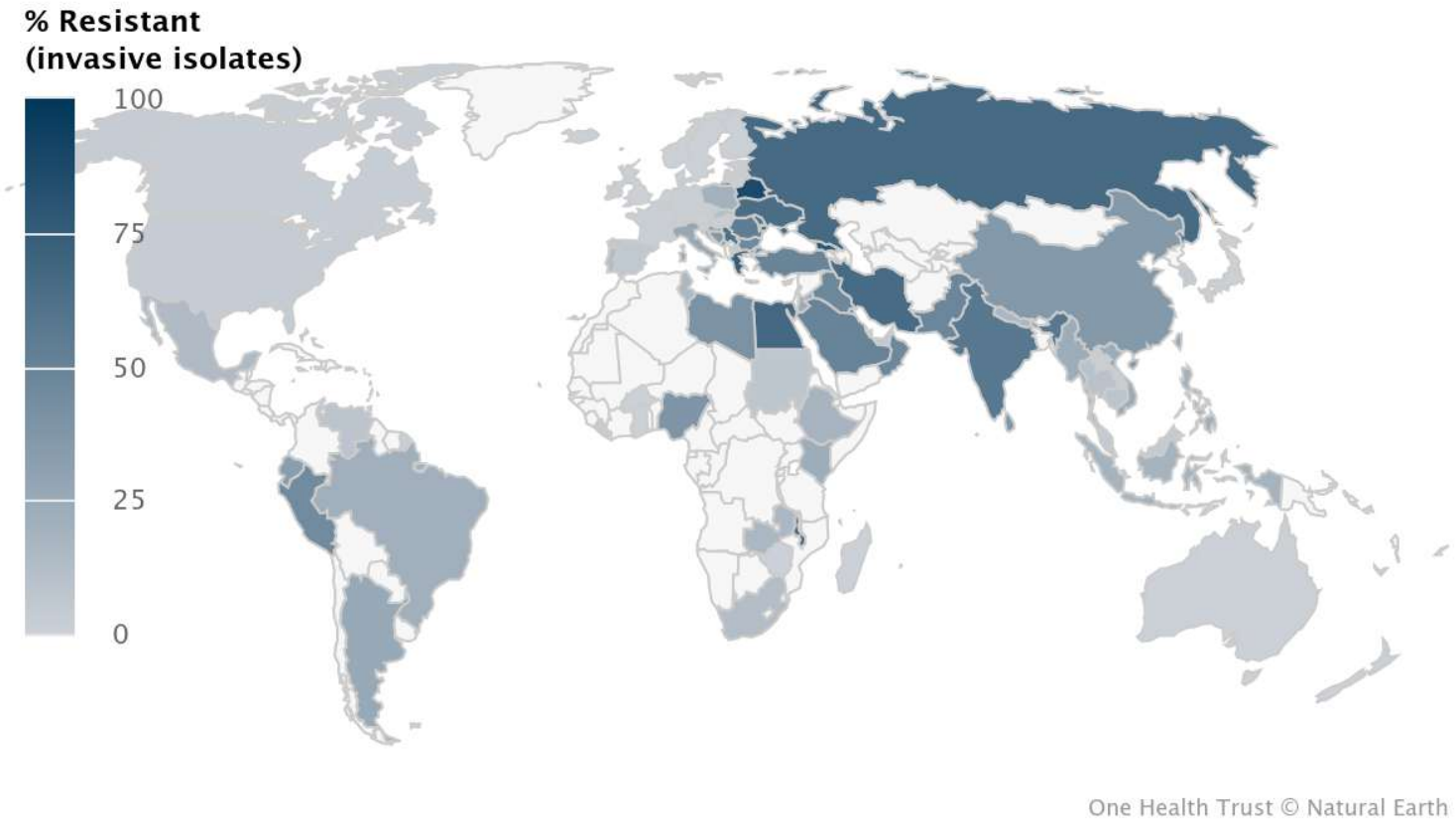
ResistanceMap. https://resistancemap.onehealthtrust.org/

Global trends in antibiotic consumption during 2016–2023 and future projections through 2030

Eili Y. Klein[a,b], Isabella Impalli[a], Suprena Poleon[a], Philippe Denoel[c], Mariateresa Cipriano[d], Thomas P. Van Boeckel[a,e,f], Simone Pecetta[d], David E. Bloom[g], and Arindam Nandi[a,h,1]







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Does Antimicrobial Stewardship Work?

- Unequivocally, AS can lead to:
  - Reduced costs
  - Improved patient outcomes
  - C-diff reduction
- Can AS reverse antimicrobial resistance trends? **Yes,** but there are many contingencies:
  - Current evidence is primarily in hospitals
  - Prevention of healthcare-associated infections is paramount
    - Hand-washing, bundles, isolation precautions, outbreak investigation
  - ASPs currently prevent only a small fraction of antibiotic exposure

Effect of antibiotic stewardship on the incidence of infection and colonisation with antibiotic-resistant bacteria and *Clostridium difficile* infection: a systematic review and meta-analysis

David Baur*, Beryl Primrose Gladstone*, Francesco Burkert, Elena Carrara, Federico Foschi, Stefanie Döbele, Evelina Tacconelli

- ASP effects:
  - 51% reduction in infection and colonization with MDR Gram-negative bacteria
  - 37% reduction in infection and colonization with MRSA
  - 32% reduction in incidence of C-diff

- More effective when combined with infection control, especially hand hygiene
- No effect on incidence of VRE, quinolone resistance, aminoglycoside resistance

Lancet Infect Dis, 2017

STEWARDSHIP BLIND SPOTS

Current Regulatory Framework

Setting	Federal	Joint Commission	Rankings
Hospitals	Robust CMS requirement (2019)	Robust requirement (2017)	-Leapfrog Group -US News -CMS
LTC/SNF	CMS requires Infection Prevention and Control which includes Antibiotic Stewardship component (2017)	Accreditation is not mandatory	CMS Nursing Home Compare includes infection-related metrics
Ambulatory	No requirements	Required (2020), but few clinics seek accreditation. (At UNC, only hospital-attached clinics)	None

Interpretation

- Hospitals:
  - Fairly robust requirements (can be a bit box-checky)
  - Joint Commission increasingly requiring truly meaningful AS activities
  - Still variable implementation

- Long-Term Care:
  - CMS requirement, but AS component much less robust than hospitals
  - Generally inadequate funding/expertise for serious AS in most settings

- Ambulatory:
  - Almost no oversight
  - 80-90% of antibiotic prescribing

Where Else are Antibiotics Used?

- Outpatient areas:
  - Emergency Departments
  - Urgent Cares
  - Telehealth
  - Primary care
  - Subspecialty care
  - Dentistry
- Animals
  - Pets
  - **Livestock**
- Nonprescription use
  - Leftovers
  - Over-the-counter (mostly in developing countries)

FUTURE OF ANTIMICROBIAL STEWARDSHIP

Expanded Regulatory Requirements?

- Further expansion of antibiotic stewardship requirements:
  - More robust in long-term care
  - Extension of oversight to outpatient prescribers
    - Inclusion of specialists, dentists, etc.
- Greater focus on Urgent Care and Emergency Department settings
- More teeth in antimicrobial stewardship requirements?

What Would Outpatient Stewardship Requirements Look Like?

Joint Commission Standard:

Identify an antimicrobial stewardship leader

Establish an annual antimicrobial stewardship goal

Implement evidence-based practice guidelines related to the AS goal

Provide clinical staff with educational resources related to the AS goal

Collect, analyze, and report data related to the AS goal

Joint Commission, "Antimicrobial Stewardship in Ambulatory Health Care," June 20, 2019

EMR Support

- EMR Support demonstrated last decade:
  - Free-text justification for antibiotic prescriptions
  - Pop-up alerts when antibiotic order linked to viral diagnosis code
  - Condition-specific order panels
    - First-line antibiotic orders pre-selected

- Future role of EMR support:
  - Diagnostic algorithms (sinusitis vs URI, pneumonia vs bronchitis)
  - Guideline-appropriate antibiotic suggestions, incorporating patient data (drug allergies, recent antibiotic exposure or hospitalization, history of C-diff, etc)

Professional Practice

- Further recognition of importance of responsible antibiotic prescribing across healthcare spectrum
- Practice societies continue to develop antibiotic prescribing guidelines for common conditions
- Train future healthcare providers to be responsible antibiotic prescribers
- State-led efforts to improve antibiotic prescribing

Private Payors

- Pay-for-performance measures on AS-related HEDIS measures:

Appropriate testing for pharyngitis (CWP)

- Not treating streptococcal pharyngitis without diagnostic testing

Appropriate Treatment for Upper Respiratory Infection (URI)

- Percentage of patients with a URI diagnosis who do *not* receive antibiotics

Avoidance of Antibiotic Treatment for Acute Bronchitis/Bronchiolitis (AAB)

- Percentage of patients with bronchitis who receive antibiotics

Antibiotic Utilization for Respiratory Conditions (AXR)

- Percentage of patients with any respiratory diagnosis who receive antibiotics

Hospitals

- Increasing reporting of Antimicrobial Utilization (AU) and Antimicrobial Resistance (AR) to CDC
  - Benchmarking to identify antibiotic overuse
  - Surveillance for resistance problems
  - Could there be penalties for antibiotic overuse?

- Technology – AI?
  - Live identification of de-escalation opportunities
  - Identifying patients at high risk of antimicrobial-resistant infections
  - Monitor more patients with less cost

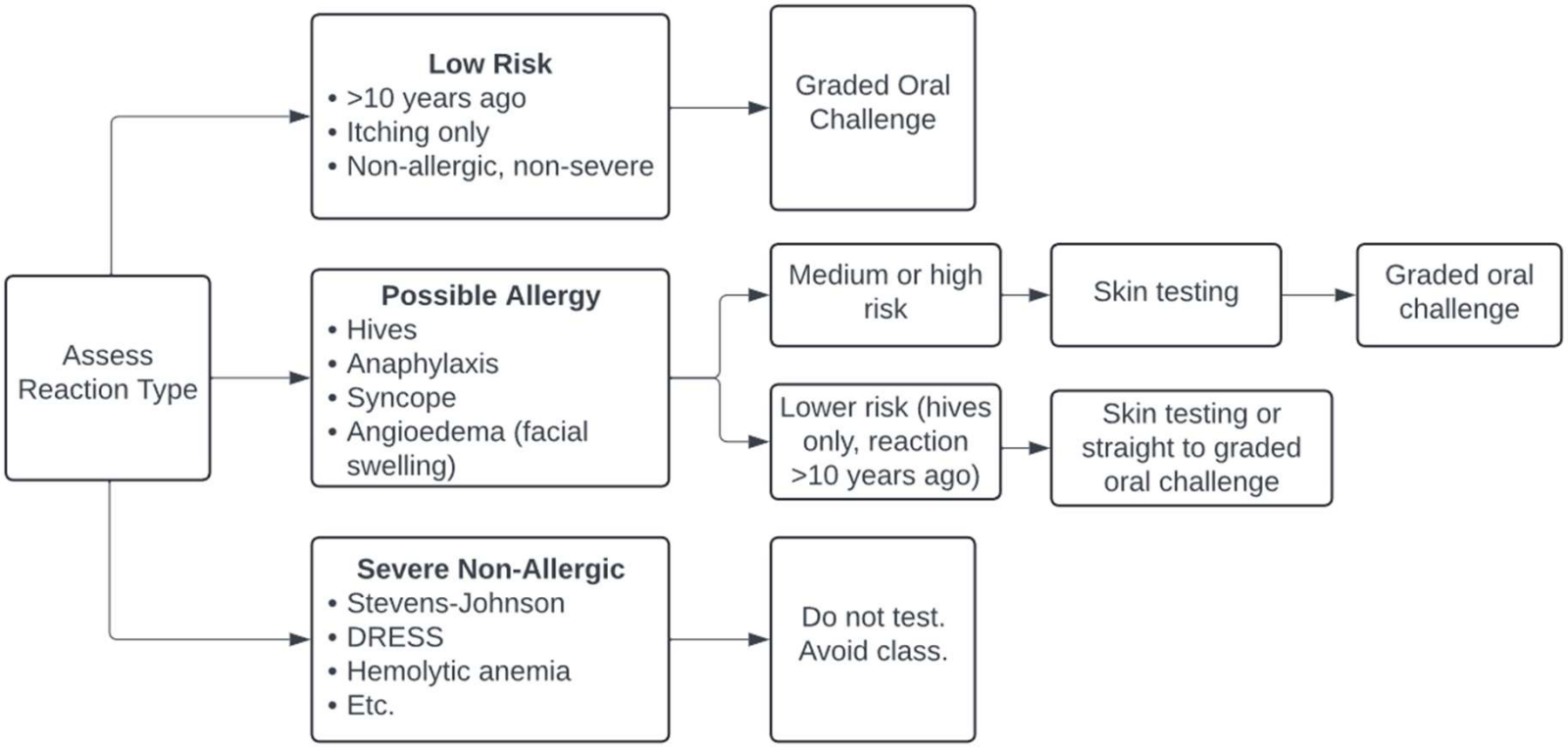
Penicillin Allergies

- 10% of all patients report a penicillin allergy
- Only 10% of allergy reporters are *actually* allergic
- Penicillin allergy is associated with increased risk of surgical-site infection, MRSA infection, C-diff, and possibly death
- Alternative antibiotics are often:
  - Broader-spectrum: vancomycin, carbapenems
  - Less effective: vancomycin, clindamycin, oral cephalosporins
  - More likely to cause C-diff: carbapenems, broad cephalosporins, fluoroquinolones

Penicillin Allergy Misconceptions

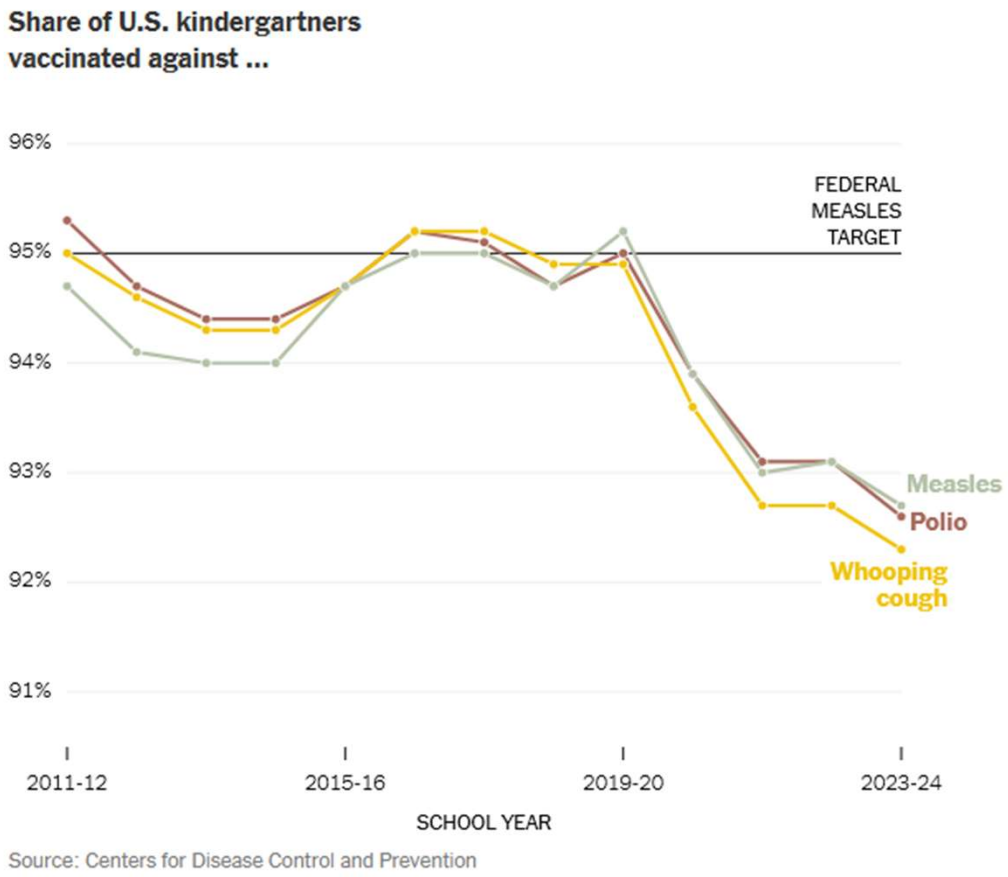
Penicillin allergy is not important	• Increased risk of bad outcomes in the hospital!
Penicillin allergy is pretty common	• Actually about 1% of the population
Penicillin allergy runs in families	• Not true!
Penicillin allergy is lifelong	• About 10% of people with penicillin allergy lose their allergy every year!

Example Penicillin Allergy Algorithm



Vaccine Coverage

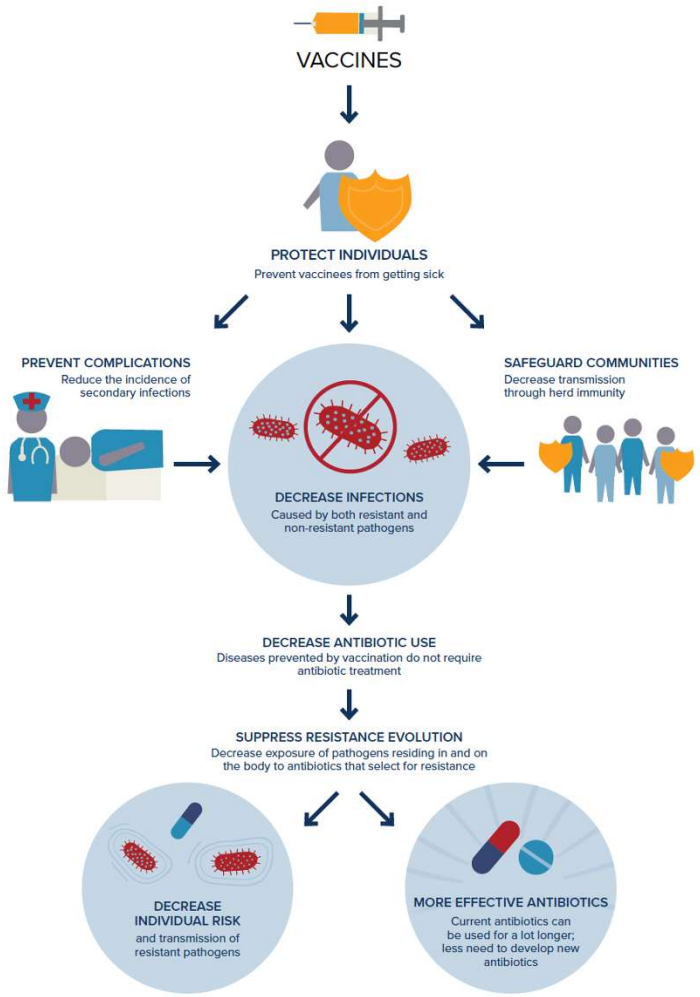
- Since COVID, vaccine coverage has declined significantly
- Measles and pertussis are resurgent



New York Times, 1/12/2025, accessed 6/24/25

Vaccines and AMR

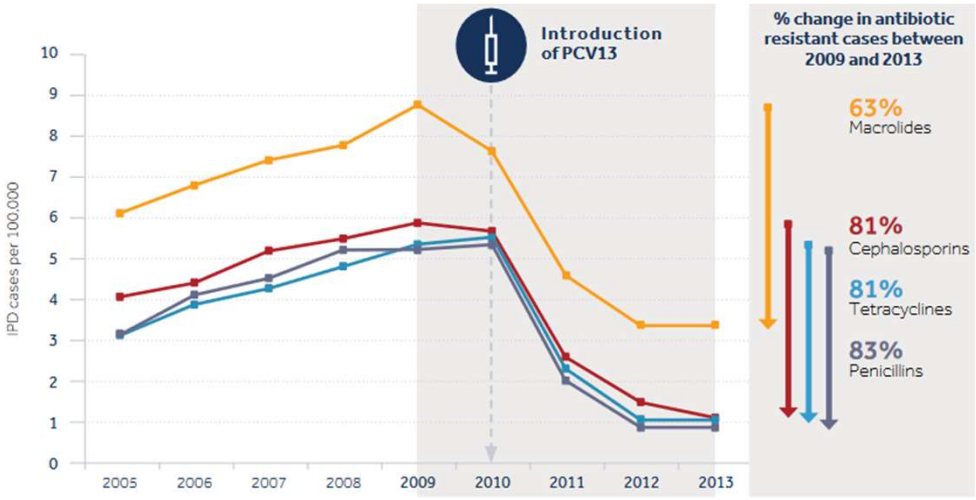
- Most antibiotic stewardship focuses on proper treatment of sick people
- Vaccines prevent people from getting sick!



WHO, 2021

Bacterial Vaccines and AMR

- Direct prevention of bacterial infections that require antibiotics
  - Pneumococcus, Hib, meningococcus, pertussis, diphtheria, typhoid
- Less fear of bacterial complications
- Targeting key bacterial drivers of antibiotic resistance
  - Pneumococcus
  - Typhoid

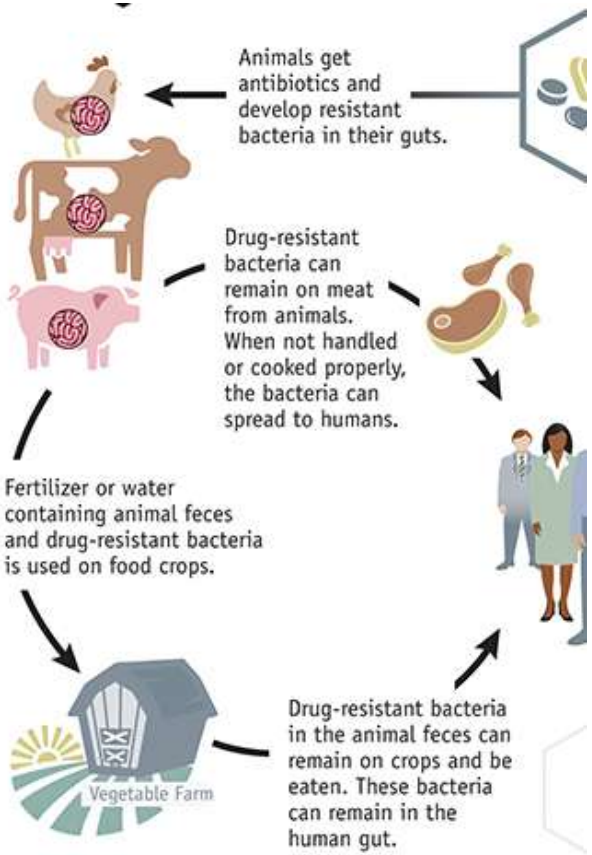


WHO. Leveraging Vaccines to Reduce Antibiotic Use and Prevent Antimicrobial Resistance, 2020

Viral Vaccines and AMR

- Prevention of viral infections with bacterial complications
  - Influenza, measles, varicella
  - Increasing flu vaccine coverage by 10 percentage points → 6.5% decrease in antibiotic prescribing (Klein et al., *OFID*, 2020)

- Prevention of viral infections that may lead to unnecessary antibiotics
  - Less acute illness → fewer antibiotic prescriptions
  - Influenza, COVID-19, RSV, etc.



Antibiotics in Animals

- Antibiotics are used commonly in agriculture:
  - Growth promotion: low doses in feed
  - Mass dosing and prophylaxis for infections
    - Facilitates denser production
- Continuous selection pressure on microbiota

AS in Developing Countries

- Antibiotic utilization increases with economic development
- Biggest problems in developing countries:
  - Public health and hygiene
  - Access to healthcare facilities, clinicians, diagnostic testing, medicines
- Without adequate healthcare infrastructure:
  - Bacterial infections common (diarrhea, pneumonia, bacteremia)
  - Profligate use of antibiotics when available
    - May be off-target, improperly dosed, or counterfeit
    - Over-the-counter in many countries
- Needs:
  - Public health and hygiene, health infrastructure
  - Policies to limit OTC antibiotic prescribing and obtain antibiotic use data

Antibiotics for Livestock

	2017	2018	2019	2020
Human medicine	**3.46M**	**3.32M**	**3.30M**	**2.67M**
All animals	**5.56M**	**6.04M**	**6.19M**	**6.00M**
Cattle	*2.33M*	*2.52M*	*2.53M*	*2.45M*
Pigs	*2.02M*	*2.27M*	*2.58M*	*2.45M*
Turkeys	*0.67M*	*0.67M*	*0.64M*	*0.69M*
Chickens	*0.27M*	*0.22M*	*0.19M*	*0.14M*
Medicine + animals, combined	**9.02M**	**9.36M**	**9.49M**	**8.67M**
Share used in livestock production	61.6%	64.5%	65.3%	69.2%

National Resources Defense Council, 2023, https://www.nrdc.org/bio/david-wallinga-md/antibiotic-use-remains-far-too-intensive-us-livestock, accessed 6/23/25

Reducing Antibiotic Use in Livestock

- US Government:
  - All medically important antibiotics now require veterinary prescription
  - Removal of growth promotion claims from antibiotic labels
  - USDA research on disease prevention without antibiotics

- Restaurants and meat producers
  - Various commitments to using antibiotic-free meat

Why are some US food producers using antibiotics in meat again?

Several companies have abandoned commitments to serve antibiotic-free meat, citing supply and animal welfare concerns.

Al-Jazeera, 4/3/2024

Despite rising deaths from bacterial infection, meat industry under little pressure to wean itself off antibiotics

Reuters, 3/12/2024

What Can You Do Today to Prevent Antimicrobial Resistance?

- Avoid prescribing antibiotics outside of in-person visits whenever possible
- Use appropriate diagnostic criteria for common infections
- Use the most targeted antibiotic and the shortest effective duration
  - Use NCDHHS Adult and Pediatric Antibiotic Prescribing Guidelines!
- Continue to promote vaccination
- Educate patients:
  - Viral vs bacterial infections, symptomatic care, return-to-care
  - Penicillin allergies
- Buy antibiotic-free meat if possible

What Can You Do Next to Prevent Antimicrobial Resistance?

- Measure antibiotic prescribing!
  - Look for problematic conditions or antibiotic choices
  - HEDIS measures?
- Reduce antibiotic overuse
  - Education plus prescriber feedback
  - EMR support for guideline-concordant antibiotic prescribing
- Set improvement targets and follow through

The Future of Preventing Antimicrobial Resistance

- Everyone has a stake
- All healthcare and veterinary personnel have a role
- Continuing policy updates are needed at the state, national, and international levels
- AMR prevention is fully aligned with improving the quality and safety of healthcare worldwide