Antimicrobial Stewardship (AMS) in the Acute Care Setting
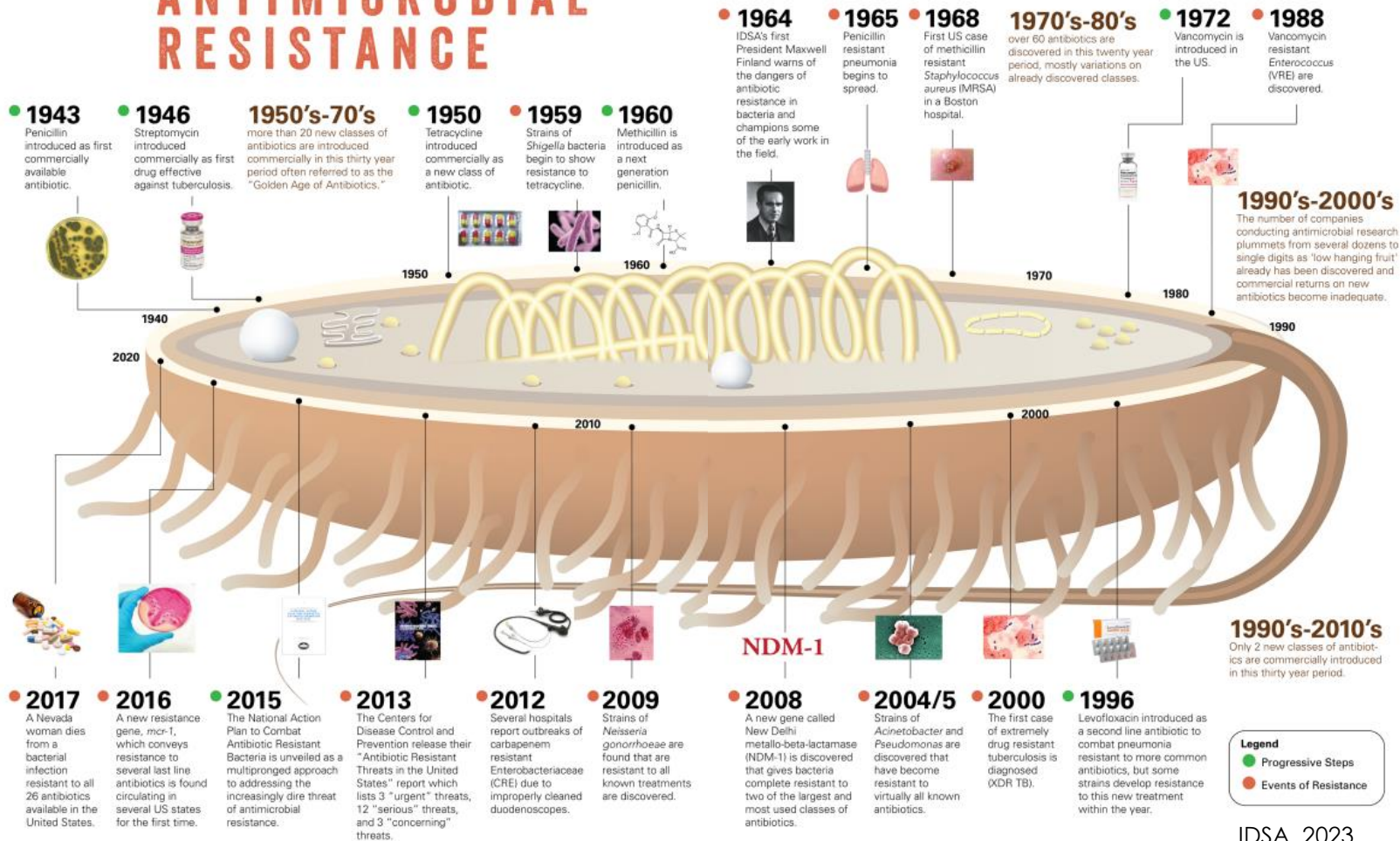
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Conflicts of interest statement

- I am not an employee of, or affiliated with, the Indiana Department of Health

- The views expressed are my own and may not reflect the view(s) of the Indiana Department of Health

- I have no additional conflicts to report

Objectives

- ▶ List the CDC core elements for hospital stewardship
- ▶ Describe the priority actions for each core element
- ▶ Identify the four moments of antibiotic decision making
- ▶ Support the impact of antimicrobial stewardship efforts and standardization within your organization

The Development of ANTIMICROBIAL RESISTANCE

1943 Penicillin introduced as first commercially available antibiotic.

1946 Streptomycin introduced commercially as first drug effective against tuberculosis.

1950's-70's more than 20 new classes of antibiotics are introduced commercially in this thirty year period often referred to as the "Golden Age of Antibiotics."

1950 Tetracycline introduced commercially as a new class of antibiotic.

1959 Strains of *Shigella* bacteria begin to show resistance to tetracycline.

1960 Methicillin is introduced as a next generation penicillin.

1964 IDSA's first President Maxwell Finland warns of the dangers of antibiotic resistance in bacteria and champions some of the early work in the field.

1965 Penicillin resistant pneumonia begins to spread.

1968 First US case of methicillin resistant *Staphylococcus aureus* (MRSA) in a Boston hospital.

1970's-80's over 60 antibiotics are discovered in this twenty year period, mostly variations on already discovered classes.

1972 Vancomycin is introduced in the US.

1988 Vancomycin resistant *Enterococcus* (VRE) are discovered.

1990's-2000's The number of companies conducting antimicrobial research plummets from several dozens to single digits as 'low hanging fruit' already has been discovered and commercial returns on new antibiotics become inadequate.

1990's-2010's Only 2 new classes of antibiotics are commercially introduced in this thirty year period.

NDM-1

2017 A Nevada woman dies from a bacterial infection resistant to all 26 antibiotics available in the United States.

2016 A new resistance gene, *mcr-1*, which conveys resistance to several last line antibiotics is found circulating in several US states for the first time.

2015 The National Action Plan to Combat Antibiotic Resistant Bacteria is unveiled as a multipronged approach to addressing the increasingly dire threat of antimicrobial resistance.

2013 The Centers for Disease Control and Prevention release their "Antibiotic Resistant Threats in the United States" report which lists 3 "urgent" threats, 12 "serious" threats, and 3 "concerning" threats.

2012 Several hospitals report outbreaks of carbapenem resistant Enterobacteriaceae (CRE) due to improperly cleaned duodenoscopes.

2009 Strains of *Neisseria gonorrhoeae* are found that are resistant to all known treatments are discovered.

2008 A new gene called New Delhi metallo-beta-lactamase (NDM-1) is discovered that gives bacteria complete resistant to two of the largest and most used classes of antibiotics.

2004/5 Strains of *Acinetobacter* and *Pseudomonas* are discovered that have become resistant to virtually all known antibiotics.

2000 The first case of extremely drug resistant tuberculosis is diagnosed (XDR TB).

1996 Levofloxacin introduced as a second line antibiotic to combat pneumonia resistant to more common antibiotics, but some strains develop resistance to this new treatment within the year.

Timeline years: 1940, 1950, 1960, 1970, 1980, 1990, 2000, 2010, 2020

Legend
- ● Progressive Steps
- ● Events of Resistance

IDSA. 2023.

Each year in the U.S., at least **2.8 million people** become infected with an antimicrobial-resistant infection and more than **35,000 people** die.

Learn more at cdc.gov/antibiotic-use.

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

CDC

Faces of ANTIMICROBIAL RESISTANCE

IDSA
Infectious Diseases Society of America

CDC core elements of antibiotic stewardship

HEALTH DEPARTMENT

HOSPITAL

OUTPATIENT

NURSING HOME

RESOURCE-LIMITED SETTINGS

Hospital stewardship core elements

Hospital leadership commitment

Accountability

Pharmacy expertise

Action

Tracking

Reporting

Education

Leadership commitment

Dedicate necessary human, financial, and information technology resources
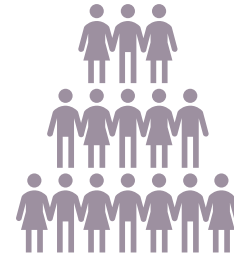
Priority: responsibilities tied to contracts, job descriptions, or performance reviews

Staffing/dedicated resources

Senior executive leader appointed to serve as the "champion"

Accountability

▶ Leader or co-leaders are appointed

▶ Priority: program is co-led by a physician and a pharmacist

    ▶ Responsible for program management and outcomes

Pharmacy expertise

- ▶ Pharmacist appointed to help lead stewardship efforts surrounding improved antibiotic use
  - ▶ Specialized training in infectious diseases
  - ▶ Completed a stewardship certificate program
  - ▶ Additional training in antibiotic stewardship

Action

► Implement interventions
  ► Audit and feedback
  ► Preauthorization or restriction criteria
  ► Pharmacy-driven protocols
    ► IV to PO
    ► Dose optimization/renal dosing
    ► Therapeutic drug monitoring policies (vancomycin, aminoglycosides)

Tracking

- Monitor antibiotic prescribing, impact of interventions and outcomes
  - *C. difficile* infections and other hospital-acquired infections
  - Multidrug resistant organisms
- Data submission to NHSN Antimicrobial Use and Resistance
  - Starting in 2024, required by CMS Hospital Inpatient Quality Reporting (IQR) and Promoting Interoperability (PI) program

Reporting

► Regular distribution of information on antibiotic use and resistance to hospital leadership, prescribers, pharmacists, nurses, and staff

  ► Antibiotic use reports should be provided annually, at minimum

  ► Monitor adherence to facility-specific treatment recommendations for at least one common clinical condition (pneumonia, urinary tract infections, sepsis, etc.)

Education

- Prescribers, pharmacists, nurses, and patients
  - Adverse effects from antibiotics
  - Antibiotic resistance
  - Optimal prescribing
    - Right diagnosis
    - Right drug
    - Right dose
    - Right de-escalation
    - Right duration

#BeAntibioticsAware

Percentage of hospitals meeting All 7 Core Elements
79% - 83% 84% - 87% 88% - 91% 92% - 95% 96% - 98% 99%+

CDC. 2022.
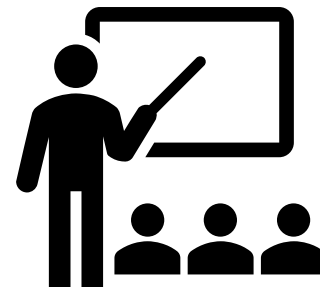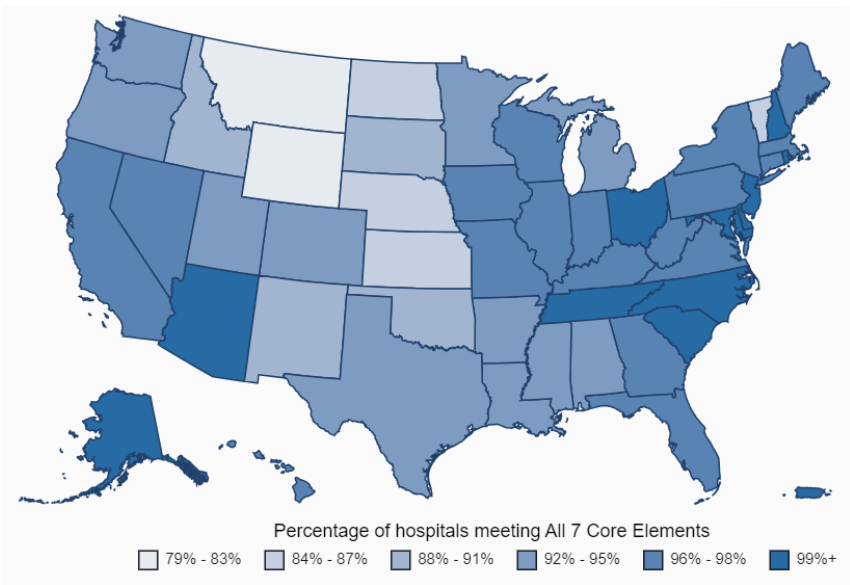
Core measure implementation

Many stewardship programs meet the minimal requirements outlined by the CDC core elements.
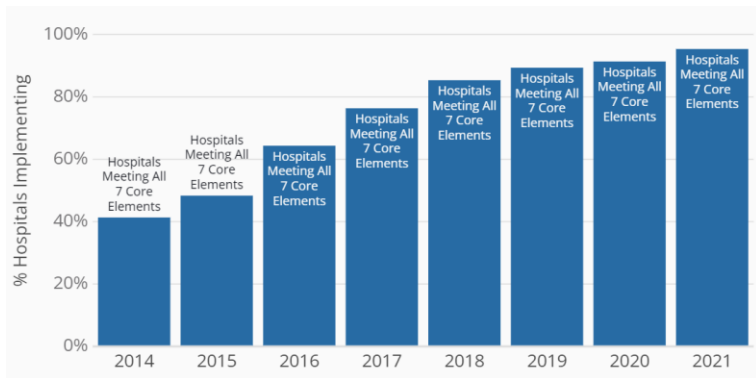
Priority Elements Implementation

CDC. 2022.
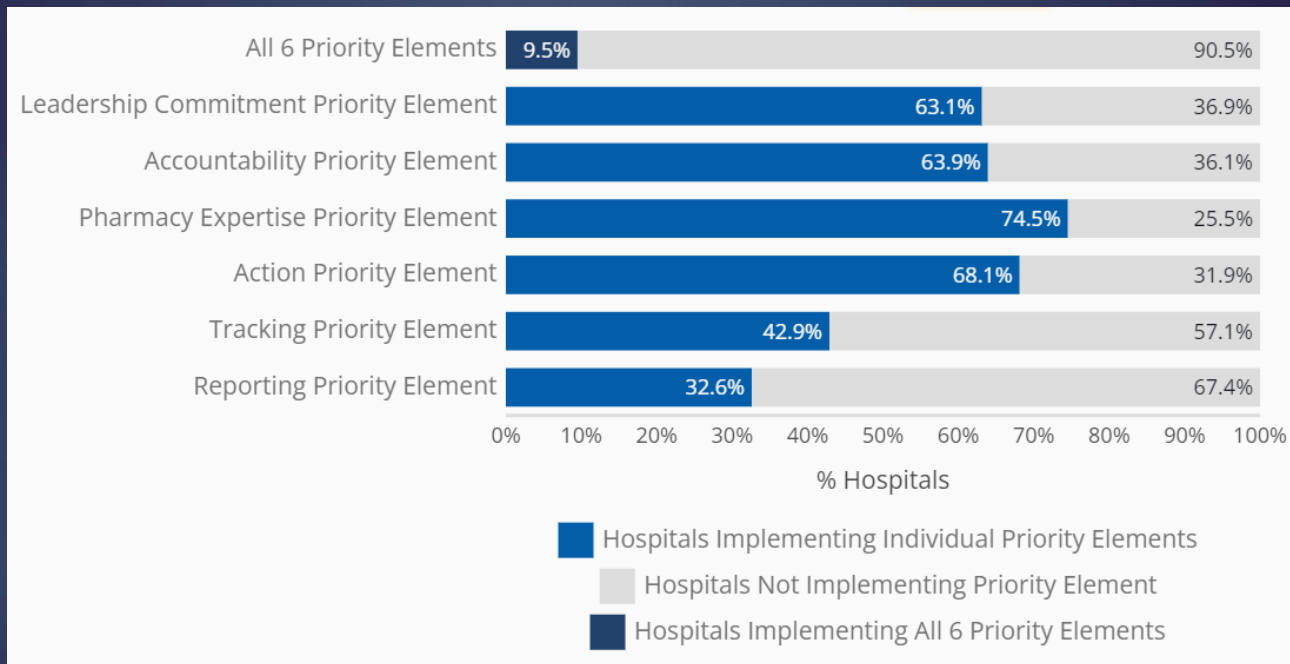
So, let's get to work!

…But insufficient resources or competing demands preclude optimal operations

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

CDC sounds the alarm

Antimicrobial resistance (AR) = public threat

2017

COVID-19 pandemic

2022

2013

Decreased deaths from AR

(overall 18%; hospital 30%)

2019

Increase in AR; HAIs, and deaths increase by 15%

CDC. 2022.

Antimicrobial stewardship matrix
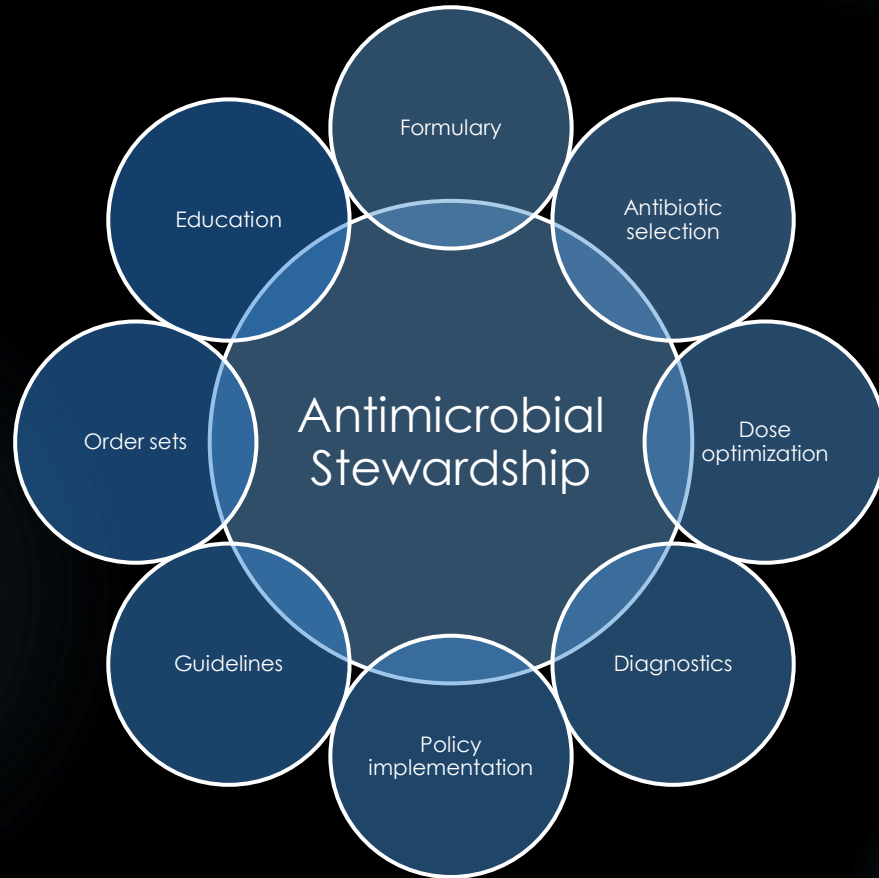
Initial work for downstream wins

- Interdisciplinary approach
- Microbiology – cascade reporting, suppression rules, panel selection, nudge comments, reflex rules, antibiogram
- Set quantitative and qualitative thresholds for culture results
- Rapid diagnostics response
- Antimicrobial indications with expected duration
- Quality review – who, when, what -> standardize the process

Who has the time?

Dedicated personnel

Priority review

Tiered approach

Scoring systems

Predictive modeling

Prioritize your efforts

- Impactful
- Feasible
- Actionable
- Measurable

Tier	Priority	Actionability	Impact
A	Must do	Majority	High
B	Should do	Frequently	Moderate to high
C	Nice to do	Sometimes	Low to high
D	Delegate	Routinely	Low to high
E	Eliminate	Infrequently	Low

Heil EL, et al. *Open Forum Infect Dis*. 2023.

Prioritization – quantitative scoring

Table S1. The Antimicrobial Stewardship Initiative Prioritization Tool

Initiative	Initiative Type?			Impact				Feasibility	Actionability	Measurability	Priority	
	PAF	PRA	Other	Gap between Current Clinician Practices and Best Practices?	Impact of Suboptimal Practices on Individual Patient Care?[a]	How Common are the Infectious Syndromes Affected by this Initiative?	Address a Regulatory Priority (e.g. CMS, Joint Commission, local administration)?	Feasibility of Building Functional Targeted Alert(s) for the Initiative?	Likely Actionability of Targeted Alert(s)?	Measurability of Initiative Outcomes?	Risk Score[b]	Priority Rank
				1 = Small 2 = Moderate 3 = Large	1 = Low 2 = Moderate 3 = High	1 = Less Common (CDI, IE, Osteomyelitis) 2 = Moderately Common (BSI, IAI) 3 = Very Common (PNA, UTI, SSTI)	1 = No 2 = Yes	1 = Difficult 2 = Moderate 3 = Easy	1 = Low (≤33% of alerts) 2 = Moderate (34-66% of alerts) 3 = High (≥67% of alerts)	1 = Difficult 2 = Moderate 3 = Easy	Total	1 = Highest Rank
	☐	☐	☐									
	☐	☐	☐									
	☐	☐	☐									
	☐	☐	☐									

BSI = bloodstream infection; CDC = Centers for Disease Control and Prevention; CDI = *Clostridioides difficile* infection; CMS = Centers for Medicare and Medicaid Services; IAI = intraabdominal infection; IE = infective endocarditis; PAF = prospective audit and feedback; PNA = pneumonia; PRA = preauthorization; SSTI = skin and soft tissue infection; UTI = urinary tract infection

[a] Scale: 1 = Low (no increased length of stay, readmission, morbidity, and/or mortality), 2 = Moderate (mild-moderate increased length of stay, readmission, morbidity and/or mortality), 3 = High (markedly increased length of stay, readmission, morbidity and/or mortality)

[b] Risk Score Analysis: Low Priority ≤ 8, Moderate Priority 9-14, High Priority ≥ 15 points

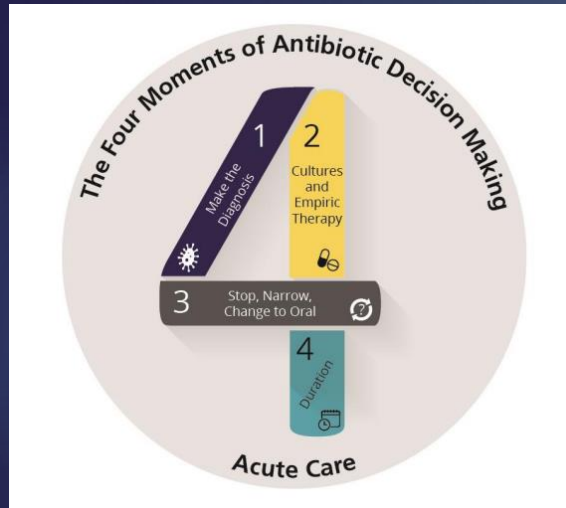# Prioritization – predictive modeling

▶ AKA "machine learning"

▶ Can help identify areas of opportunity from ongoing prospective feedback and audits

Goodman KE, et al. Open Forum Infect Dis. 2022.
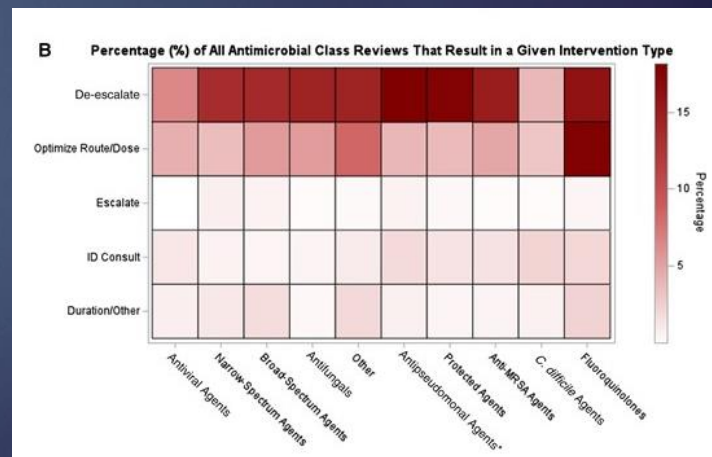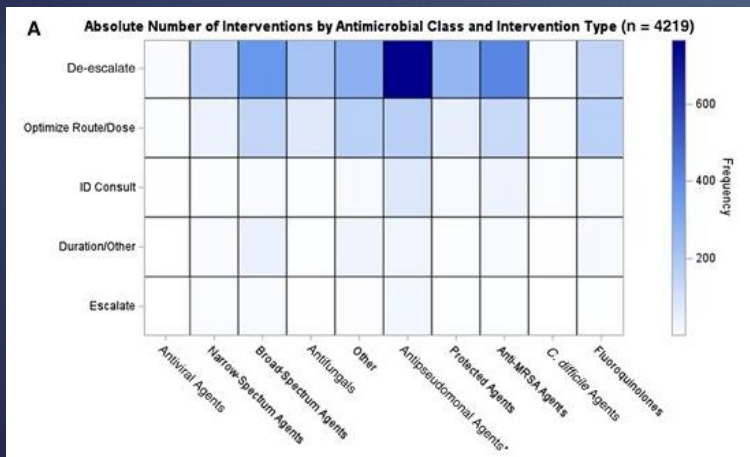
AHRQ Safety Program for Improving Antibiotic Use:
Acute Care Cohort Final Report

Moment 1 occurs at the time initiation of antibiotic therapy is considered:
Ask, "Does my patient have an infection that requires antibiotics?"

Moment 2 occurs when the decision is made to start antibiotics:
Ask 2 questions, "Have I ordered appropriate cultures before starting antibiotics? What empiric therapy should I initiate?"

Moment 3 occurs every day of antibiotic therapy:
Ask 3 questions, "Can I stop antibiotics? Can I narrow therapy? Can I change from IV to oral therapy?"

Moment 4 occurs when the infectious process is clear and the patient responds to therapy:
Ask, "What duration of antibiotic therapy is needed for my patient's diagnosis?"

AHRQ. 2019.

AMS transitions of care

Emergency department

- Diagnostics
  - Urinalysis to urine cx
  - Blood culture necessity
- Medication and allergy reconciliation
- Empiric antibiotic dosing
- Sepsis order sets
- Culture callback
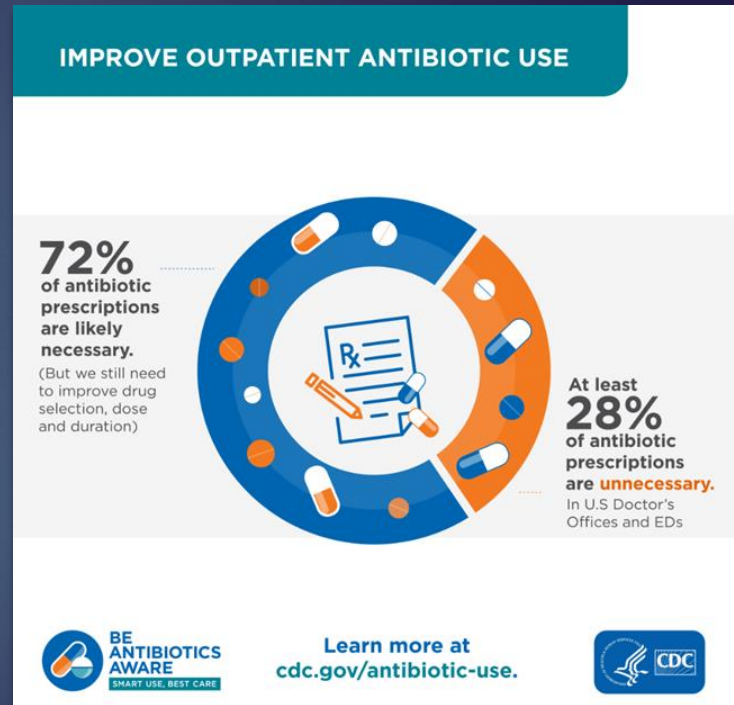
AMS transitions of care

Medical floors/intensive care units

- Further determine source/source control
- Antimicrobial time-out
- Rapid diagnostic results
  - De-escalation or therapy optimization
- Dose optimization
  - Renal adjustment
  - Pharmacokinetic/pharmacodynamic
- Route optimization

AMS transitions of care

✓ <u>Readiness for discharge</u>

IV to PO   Dose Optimization

Monitoring

Medication reconciliation   Affordability/availability

Necessity

Outpatient parenteral antimicrobial therapy

Antimicrobial Stewardship (AMS) in the Acute Care Setting

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