Introduction to Antimicrobial Stewardship

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Lesson Outline

- Appropriate and Inappropriate Antibiotic Use
  - Frequency of inappropriate use of antibiotics
  - Consequences of inappropriate antibiotic Use
- Reasons for Inappropriate Antibiotic Use
- Improving Antibiotic Use: Antibiotic Stewardship
  - The clinician's role
  - Systems approaches
  - The big picture

APPROPRIATE AND INAPPROPRIATE ANTIBIOTIC USE

Antibiotics: An Important Resource

- Likelihood of being prescribed an antibiotic if you are:
  - A patient admitted to a hospital for any reason: ***1 in 2***
  - A yearlong resident in a nursing home: ***2 in 3***
  - A child presenting to the pediatrician's office with an ear infection: ***3 in 4***
  - An adult presenting to the primary care physician's office with a sinus infection*:* ***4 in 5***

Appropriate Antibiotic Use

- Antibiotics are appropriate when use is:
  - for patients with ***bacterial infections*** (as opposed to viral infections, or in uninfected patients)
  - of the ***correct spectrum of activity*** for the known or likely infecting pathogens
  - at a ***safe and effective dose*** for the patient
  - for the ***correct duration*** for that infection

APPROPRIATE OR INAPPROPRIATE? YOU DECIDE

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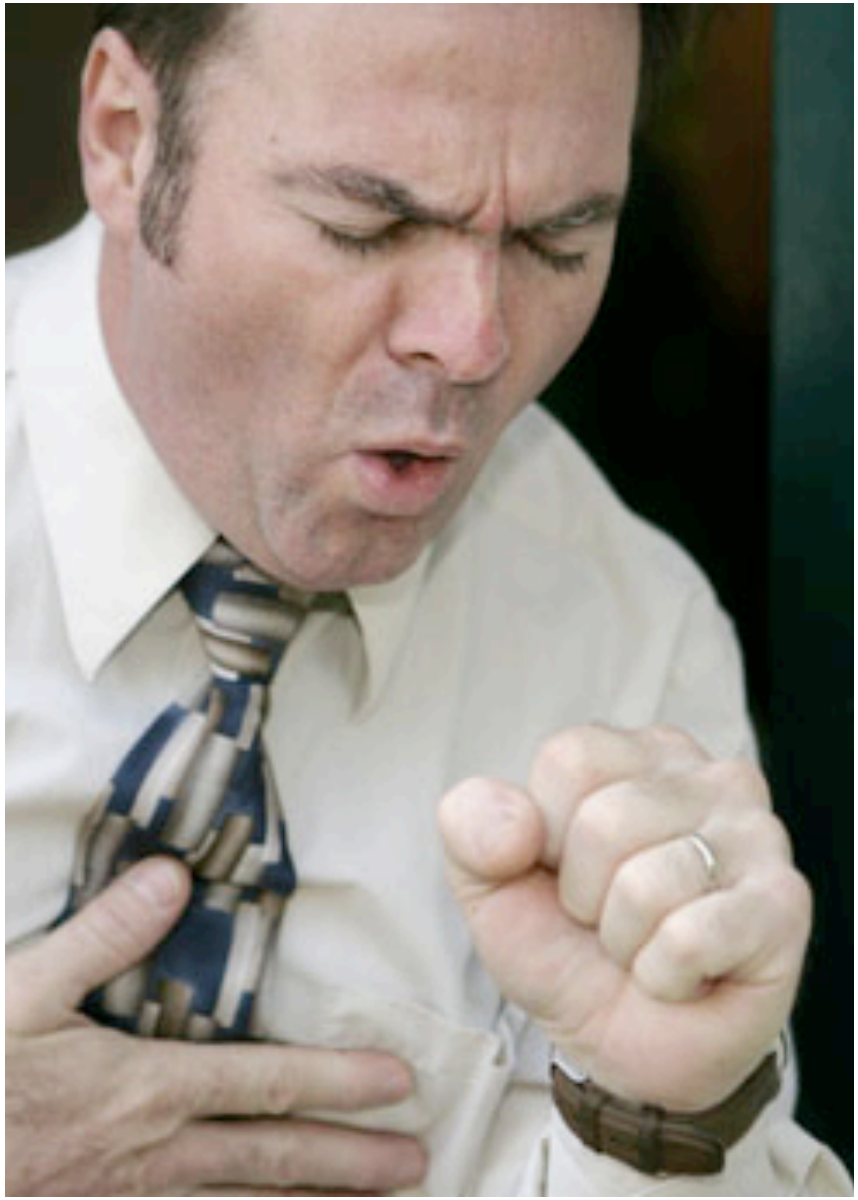

- RM is a 45 year old male who presents to clinic with nasal congestion and a cough. He denies fever, shortness of breath, or a sore throat. He has a big business meeting coming up and wants some antibiotics so he'll be in better shape for his meeting. He says if he doesn't get an antibiotic prescription today he'll just use some of his wife's old prescription.

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- PQ is a 89 year old male nursing home resident who developed a fever and a cough. Blood and urine cultures and a rapid influenza test were performed. The influenza test was positive for influenza A and PQ was started on oseltamivir. Two days later the blood cultures were negative but the urine culture grew *Staphylococcus epidermidis* and PQ was started on vancomycin.

- JW is a 72 year old female who is hospitalized for a stroke and develops pneumonia. JW's team starts her on vancomycin and piperacillin/ tazobactam. Two days later respiratory cultures grow *E. coli* susceptible to all typically used antibiotics. The team keeps JW on the vancomycin and piperacillin/tazobactam because "it's working."

FREQUENCY OF INAPPROPRIATE USE OF ANTIBIOTICS

Frequency of Inappropriate Use of Antibiotics

Study	Setting	% of Antibiotic Regimens Meeting Criteria for Appropriate Use
Ingram 2012	Adult inpatients, all antibiotics	53%
Bolon 2005	Pediatric inpatients, broad-spectrum antibiotics	28%
Gonzales 2001	Adult outpatients, respiratory tract infection	45%
Watson 1999	Pediatric outpatients, bronchitis	18%

CONSEQUENCES OF INAPPROPRIATE ANTIBIOTIC USE

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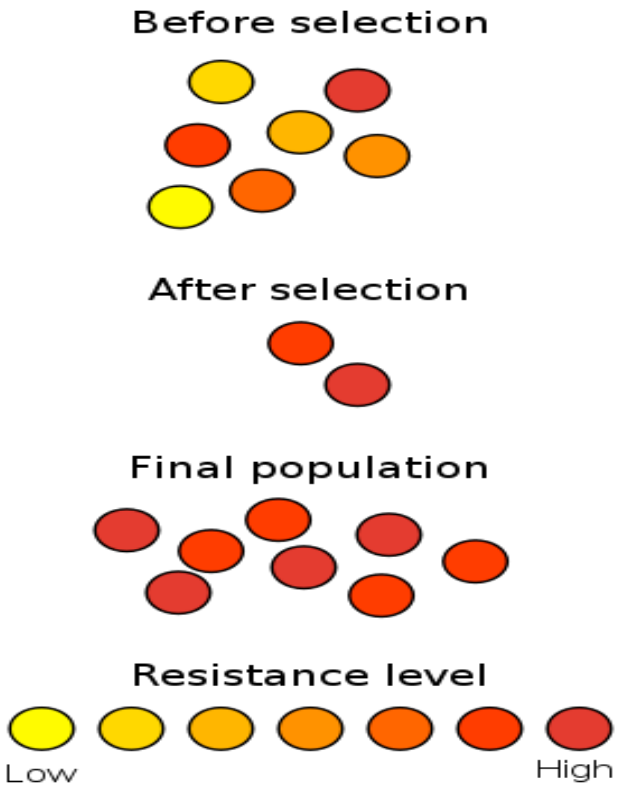
Consequences of Inappropriate Antibiotic Use

Adverse Drug Events

Unnecessary Healthcare Costs

Selection for Antibiotic Resistance



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Adverse Drug Events

- Allergic Reactions
  - 1-10% of the population has a ***penicillin allergy***; 1% of these are potentially fatal
- Antibiotic Toxicity
  - Antibiotics are the ***2nd most frequent category*** of drugs causing ED visits due to ***drug toxicity***
- *Clostridium difficile* Superinfection
  - Almost always associated with antibiotic use, ***14,000 deaths/year*** result from *C. difficile* disease

Robinson JL, et al. *Clin Infect Dis* 2002;35:26-31
Budnitz DS, et al. *JAMA* 2006;;196:1858-1866
CDC Epidemiologic Surveillance

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Unnecessary Healthcare Costs

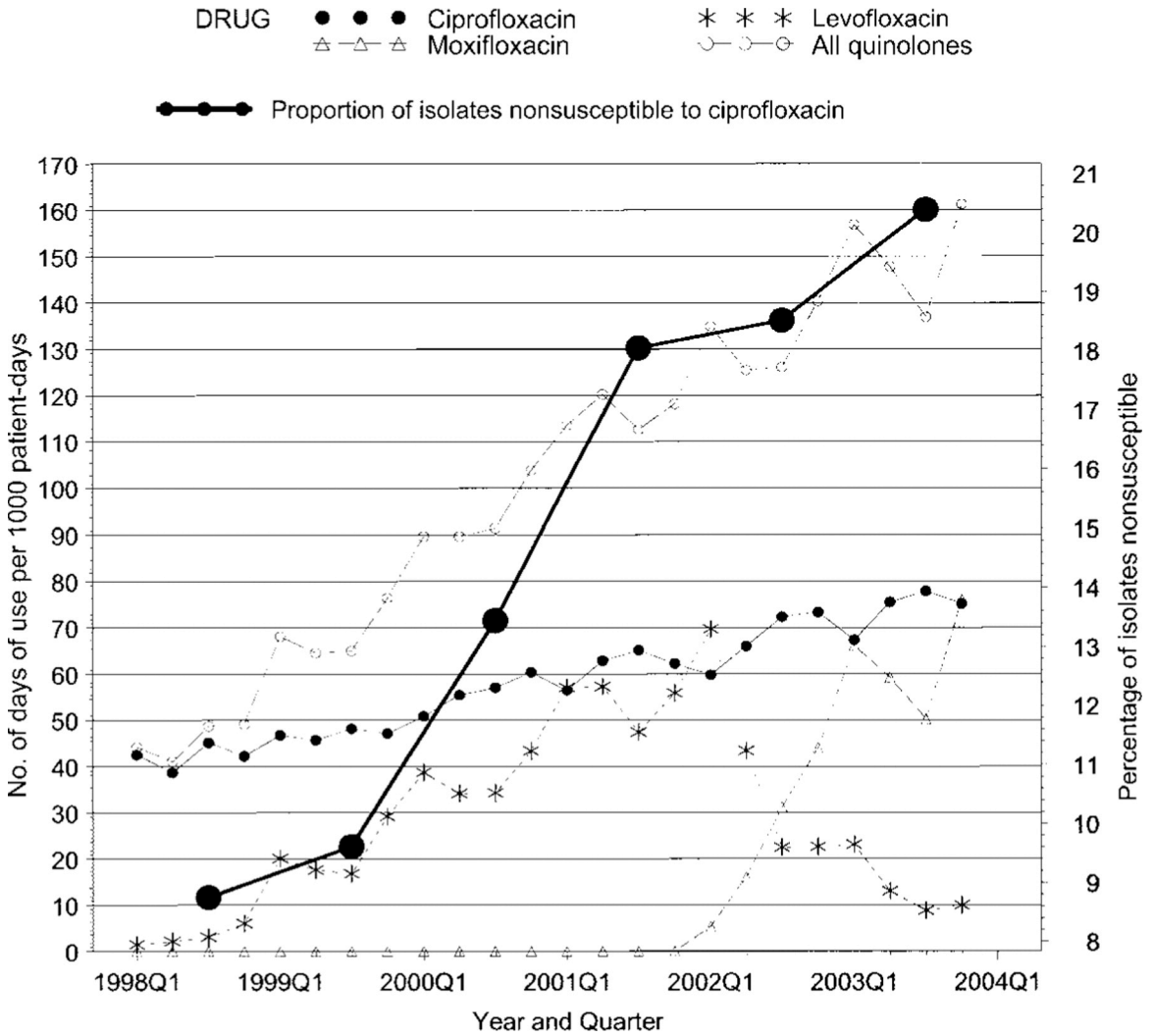
- ***Direct cost*** of excessive antibiotic use in ambulatory care estimated at ~$1 billion
- ***Indirect costs*** of inappropriate antibiotic use due to antibiotic resistance leading to:
  - Use of ***more costly alternative antibiotics***
  - Greater patient ***severity of illness***
  - Prolonged hospital ***length of stay***

Estimated at almost $50 billion for 2012

Gonzales R, et al. *Clin Infect Dis* 2001;33:757-762 Adjusted for inflation
Roberts R, et al. *Clin Infect Dis* 2008;49:1175-1184

Selection for Antibiotic-Resistant Organisms

- Increased use of antibiotics is associated with an ***increase in the prevalence of antibiotic-resistant organisms***



Ray GT, et al. *Clin Infect Dis* 2005;41:441-449

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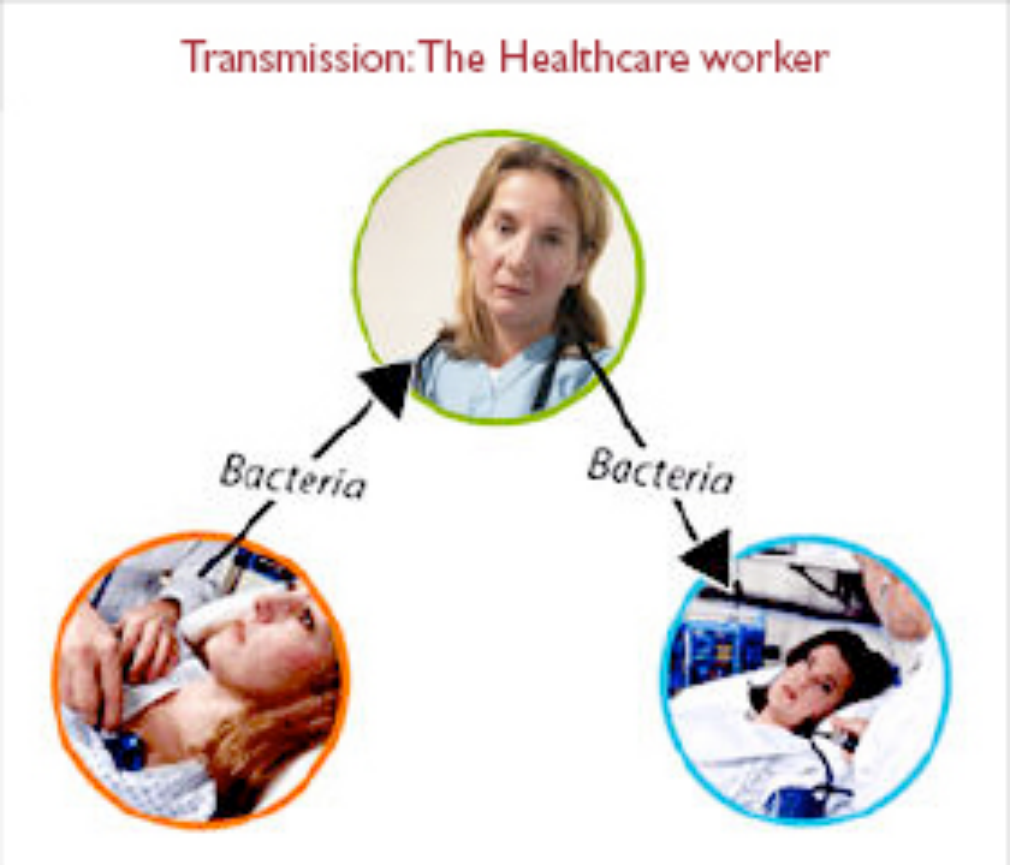
Selection for Antibiotic-Resistant Organisms

- Antibiotic-resistant organisms can spread to ***patients who have never received antibiotics***, through transmission by healthcare personnel or the environment



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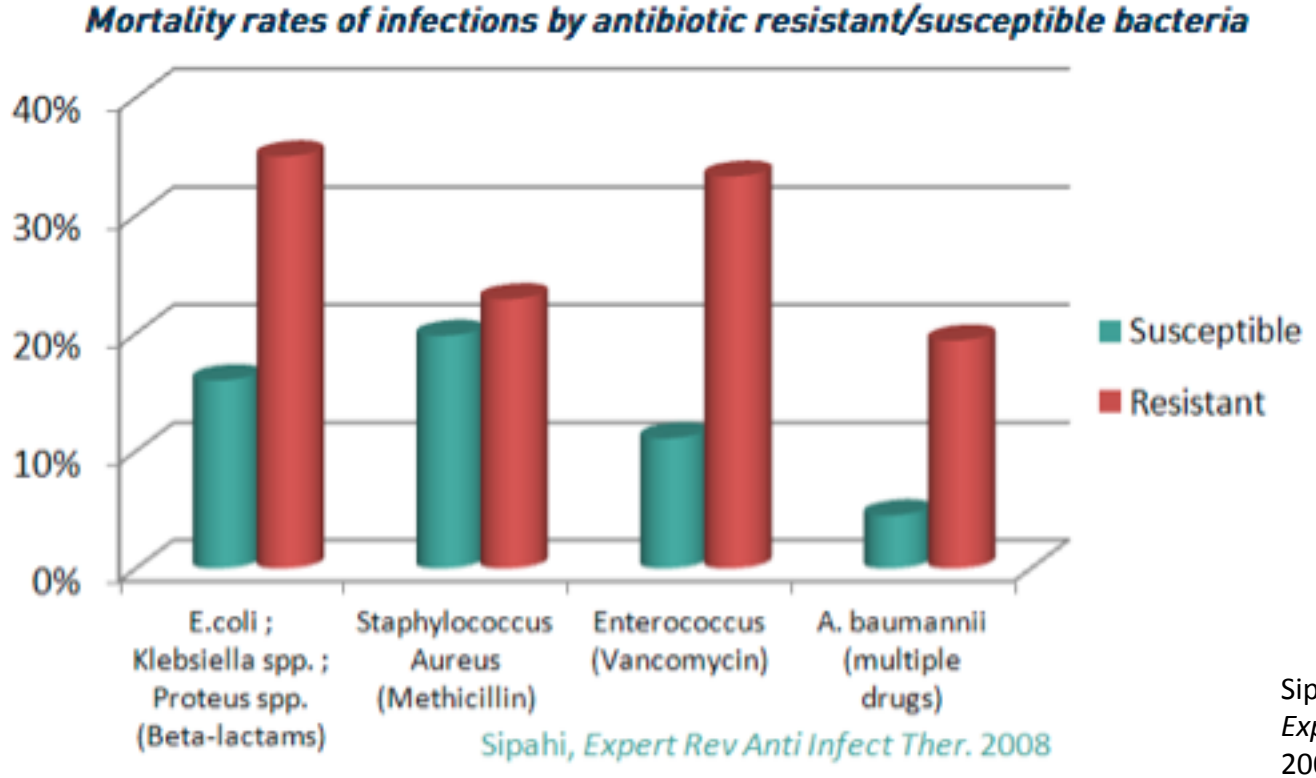
Selection for Antibiotic-Resistant Organisms

- Infection with antibiotic-resistant bacteria is associated with an ***increased risk of death, delayed time until cure,*** and ***increased healthcare costs***



Sipahi OR.
Exp Rev Anti-infect Ther
2008;6:523-539

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REASONS FOR INAPPROPRIATE ANTIBIOTIC USE

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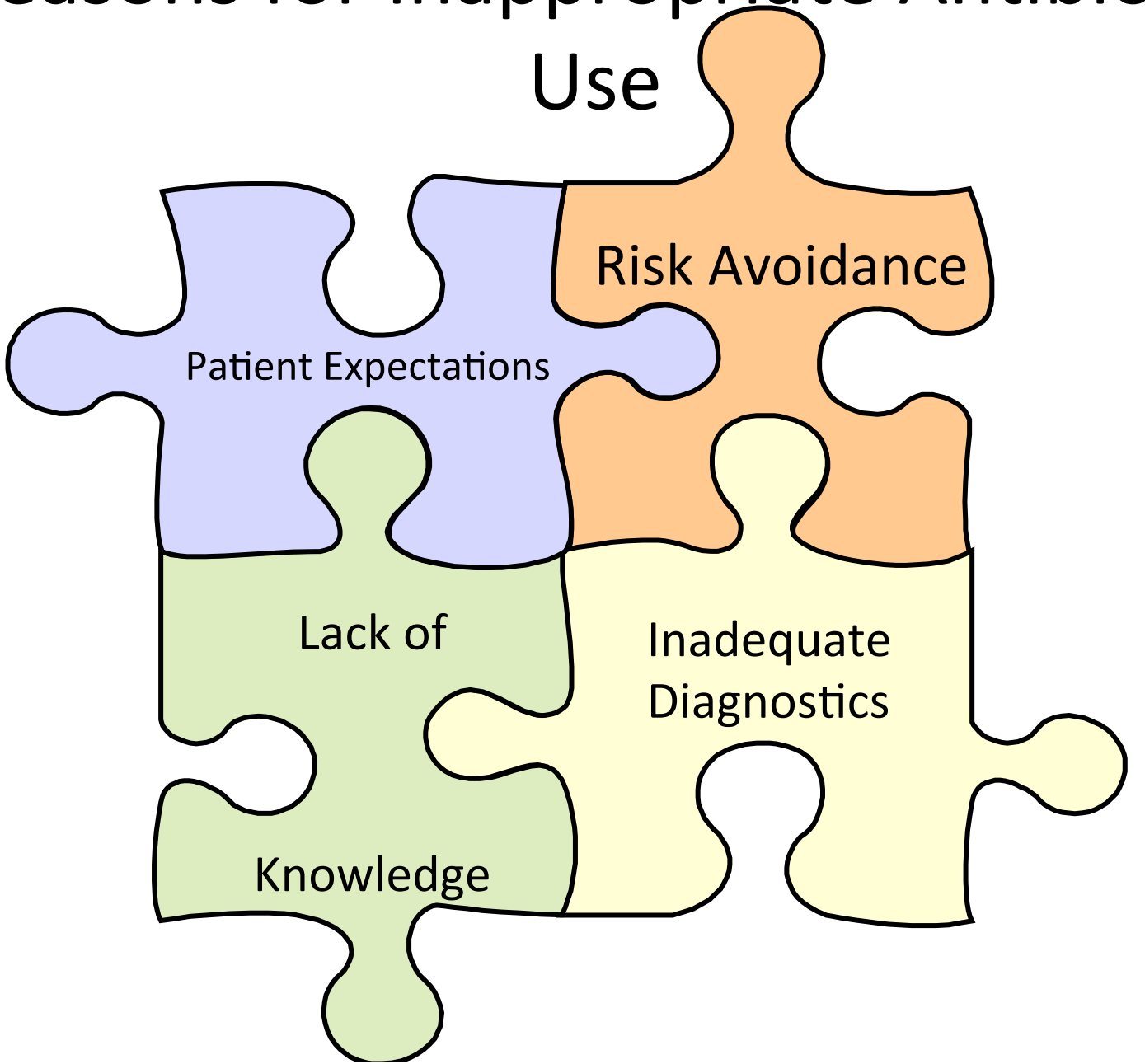
Reasons for Inappropriate Antibiotic Use



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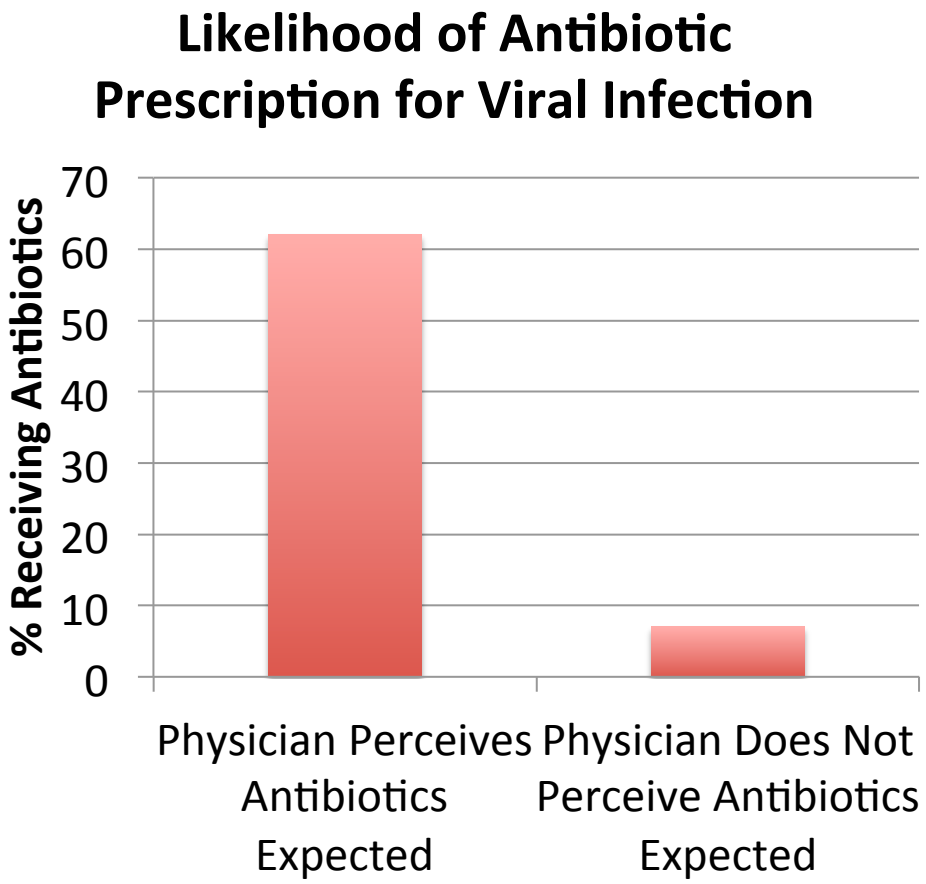
Patient Expectations

- Many patients and parents ***expect an antibiotic prescription*** when visiting a doctor
- Patient expectations have ***strong influence*** on physician prescribing habits



Mangione-Smith R, et al. *Pediatrics* 1999;103:711-718

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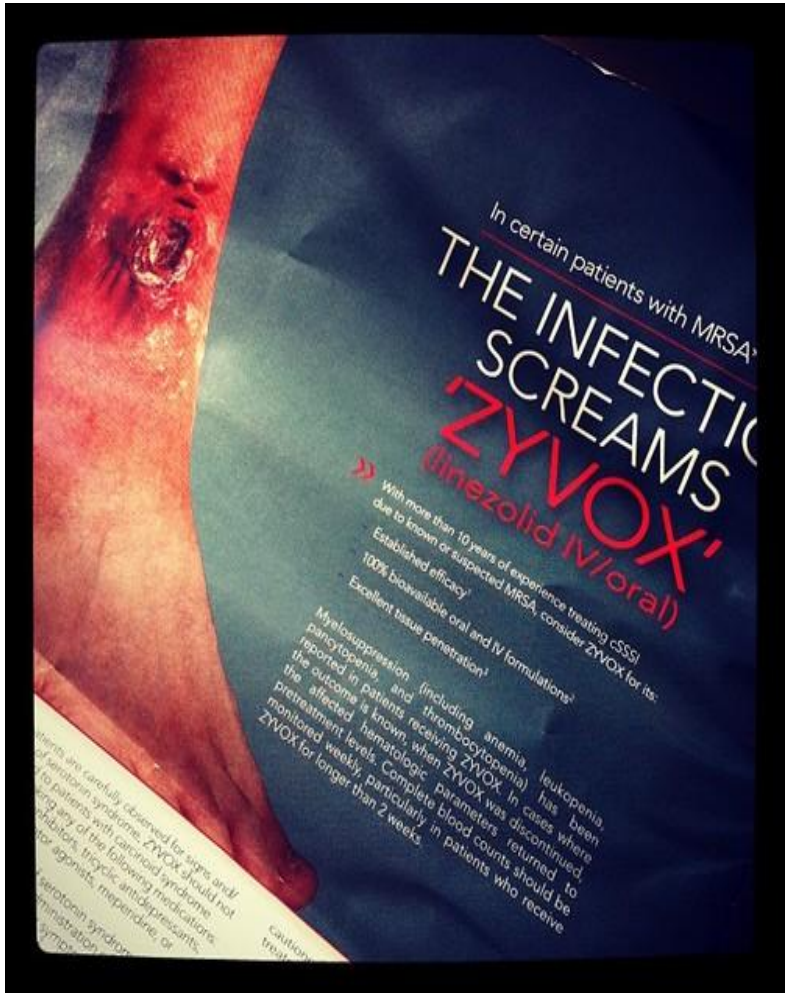
Lack of Knowledge

- ***Lack of time and training*** on antibiotic use in health professions education
- Potentially ***biased advertisements*** and continuing education from manufacturers of antibiotics



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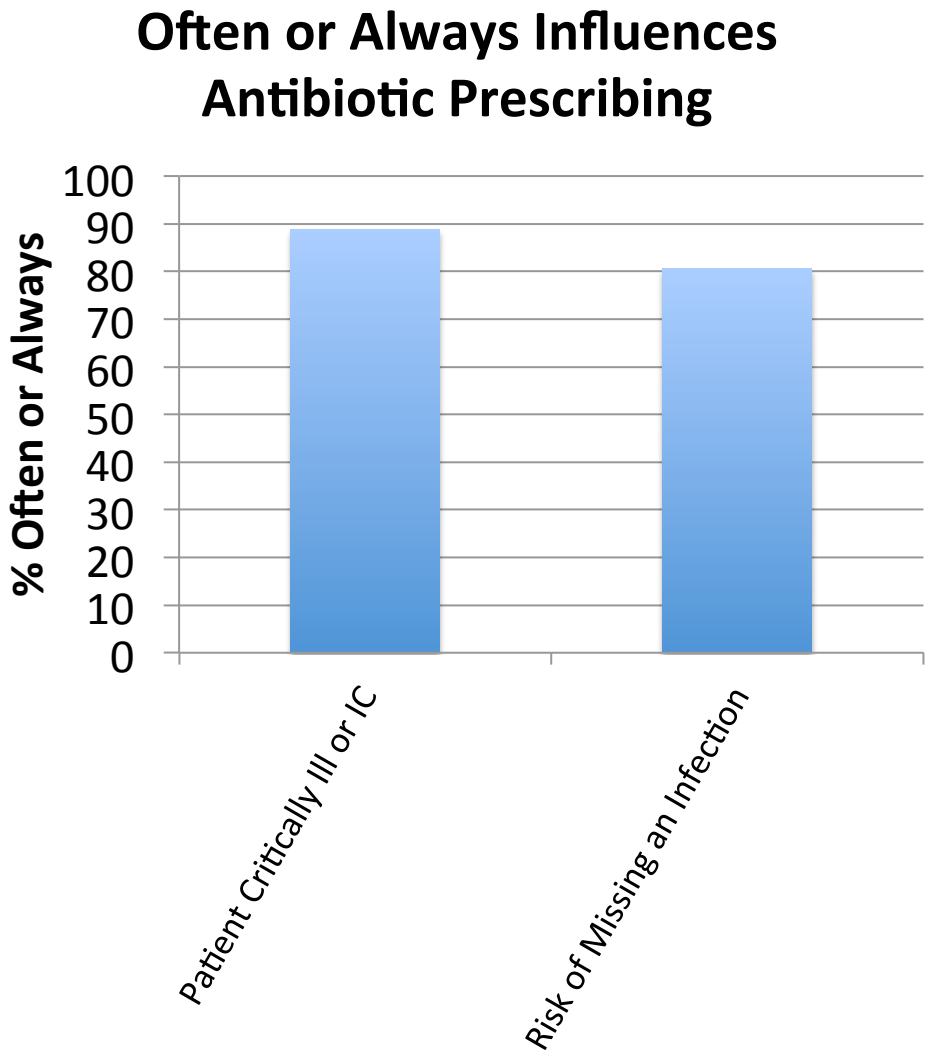
Risk Avoidance

- Factors that most physicians felt often or always influenced antibiotic use were the ***risk of missing an infection*** and whether a patient is critically ill or immuno-compromised (IC).



Abbo L, et al. *Infect Control Hosp Epidemiol* 2011;32:714-718

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Inadequate Diagnostics

- Standard microbiology tests often ***fail to isolate the infecting pathogen***, leading to continuation of broad-spectrum antibiotics

Syndrome	% of cases with definitive microbiologic diagnosis using standard methods
Endocarditis	80%
Severe Sepsis	70%
Secondary Peritonitis	63%
Ventilator-associated pneumonia	22-71%
Community-acquired pneumonia	27%
Skin/soft tissue infection	20-50%
Otitis media, sinusitis	Cultures rarely performed

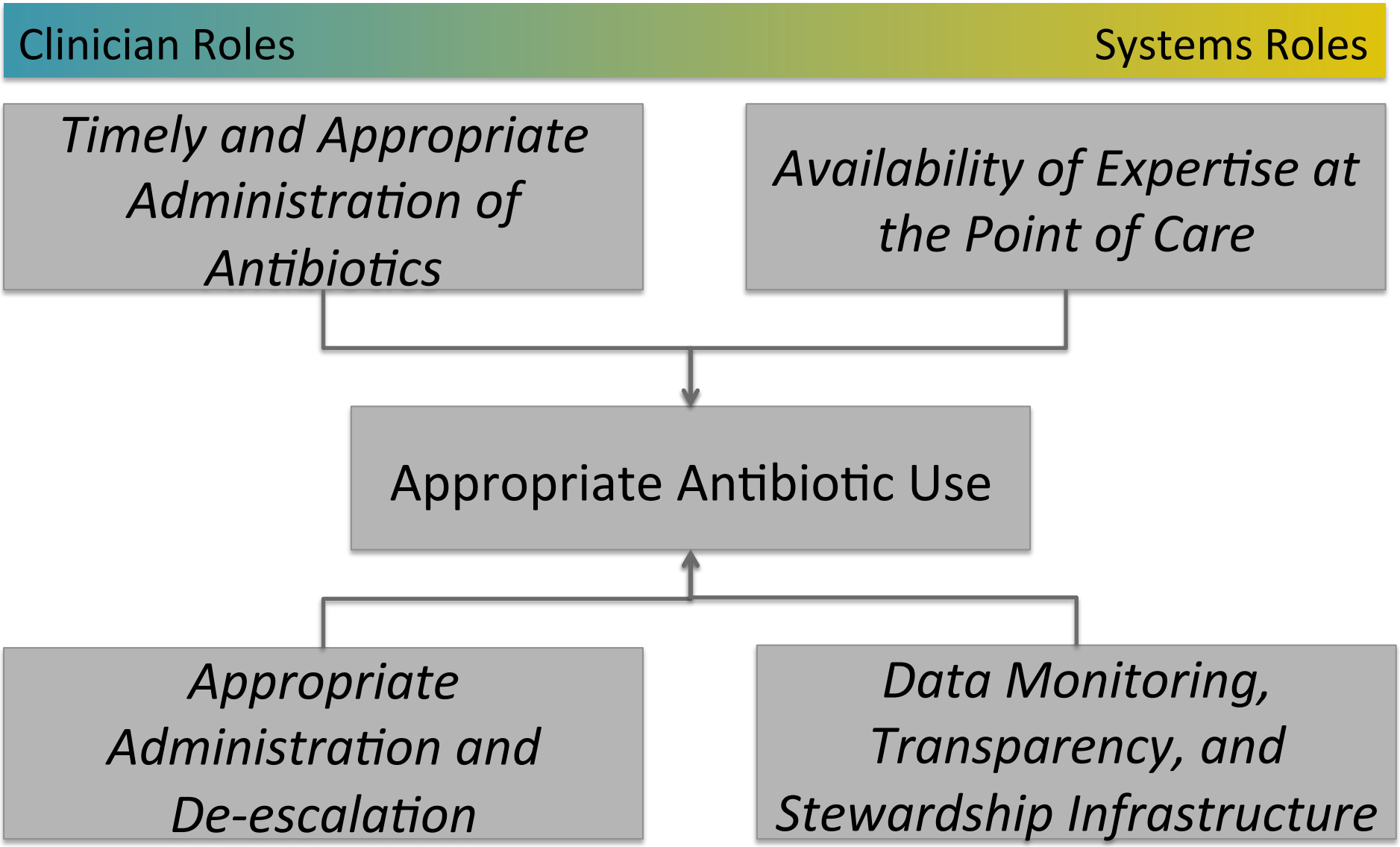
Medicine 2003;82:263-273 *NEJM* 2005;353:1332-1341
Ann Surg 2003;237:235-245 *AJRCCM* 2002;165:867-903
Diagn Micro ID 2009;63:52-61 *Clin Infect Dis* 2005;41:1373-1406

IMPROVING ANTIBIOTIC USE: ANTIBIOTIC STEWARDSHIP

Improving Antibiotic Use: Antibiotic Stewardship

- ***Antibiotic stewardship*** is a term used to describe efforts to improve antibiotic use
- Antibiotic stewardship is a responsibility of:
  - ***individual clinicians*** in their patient care activities;
  - ***healthcare organizations*** in their oversight of antibiotic use in their organization;
  - ***governmental organizations*** in the laws, policies, and agendas they pursue;
  - the ***pharmaceutical industry*** in their development and marketing of new therapies and diagnostics

Antibiotic Stewardship Schema



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USING ANTIBIOTICS WISELY: THE CLINICIAN'S ROLE

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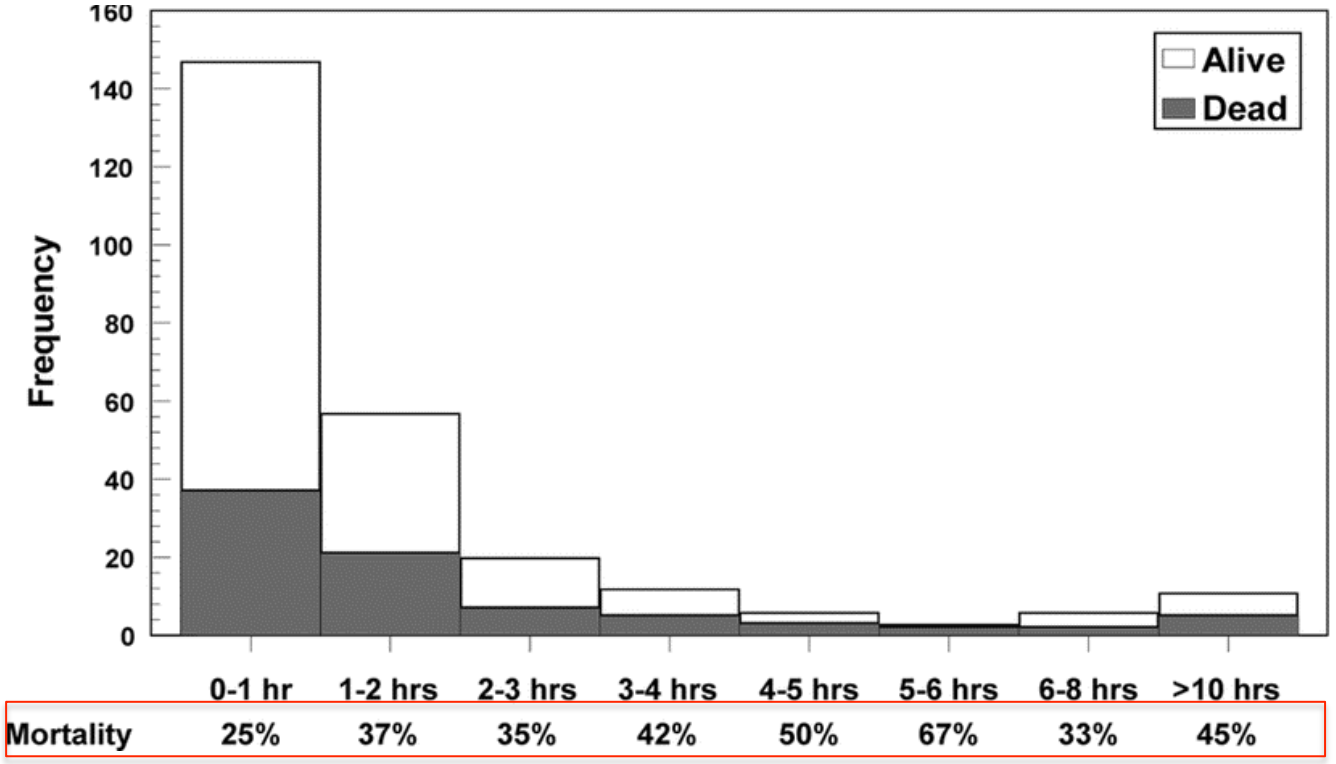
Appropriate Antibiotic Use:

Timely and Appropriate Initiation of Antibiotics

- ***Promptly identify*** patients who require antibiotics
- ***Obtain cultures prior to*** starting antibiotics
- Do not give antibiotics with ***overlapping activity or combinations not supported***
- Determine and verify ***antibiotic allergies***
- Consider local ***antibiotic susceptibility***
- ***Start treatment promptly***
- Specify ***expected duration of therapy*** based on evidence and guidelines

Starting Antibiotics: Start it Early And Get it Right

- For patients with serious infections, each hour of delay until administration of appropriate antibiotics ***increases risk of death***



Gaeski, DF et al. *Crit Care Med* 2010;38: 1045-1053

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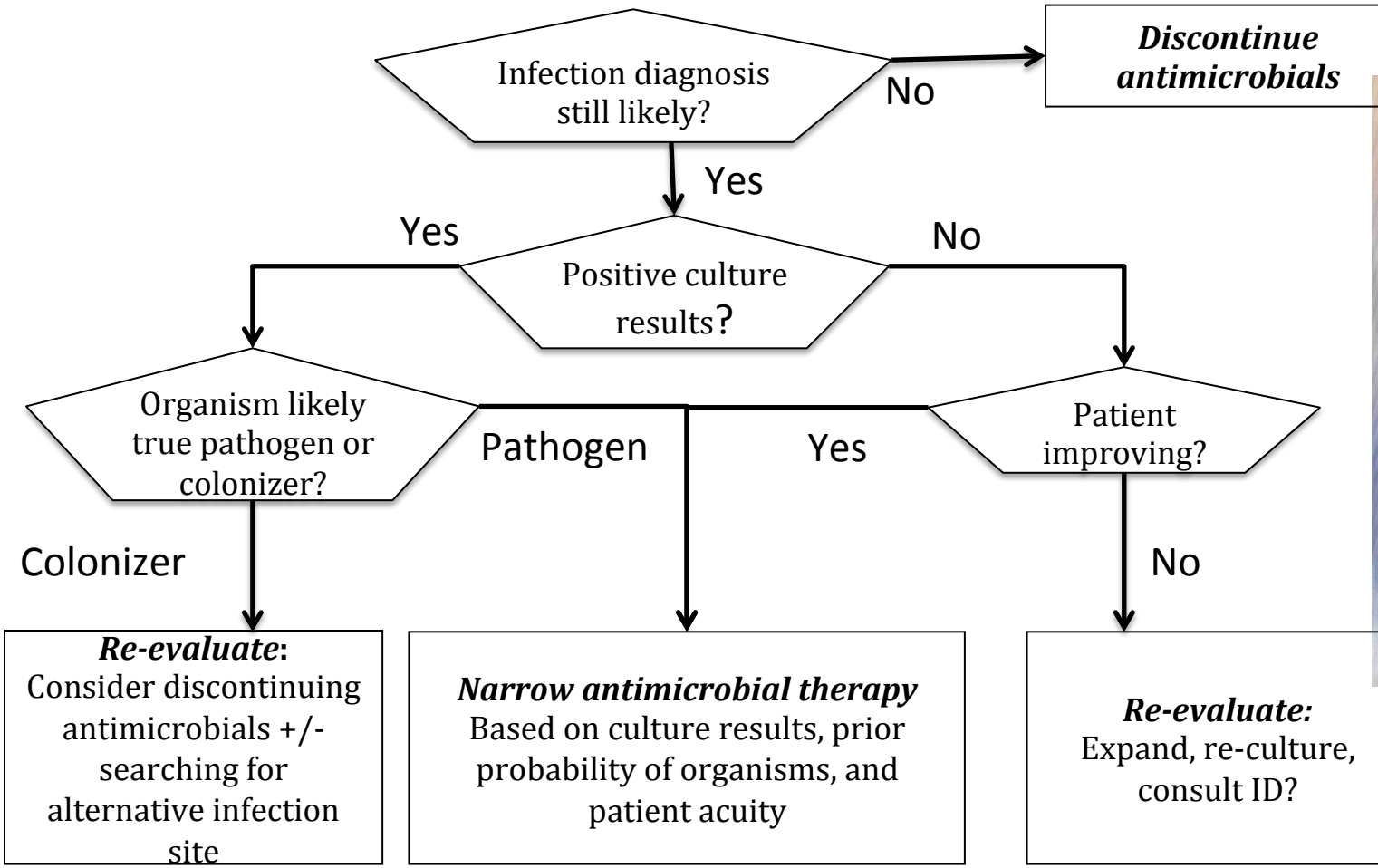
Appropriate Antibiotic Use:
Appropriate Administration and De-escalation

- Make antibiotics receiving and start dates ***available at the point of care***
- Give antibiotics at the ***right dose and interval***
- ***Stop or de-escalate promptly*** based on culture and sensitivity results
- Reconcile and ***adjust antibiotics at all transitions*** and changes in patient condition
- ***Monitor for toxicity*** reliably and adjust agent and dose promptly

48-72 Hours:
Take an "Antibiotic Timeout"



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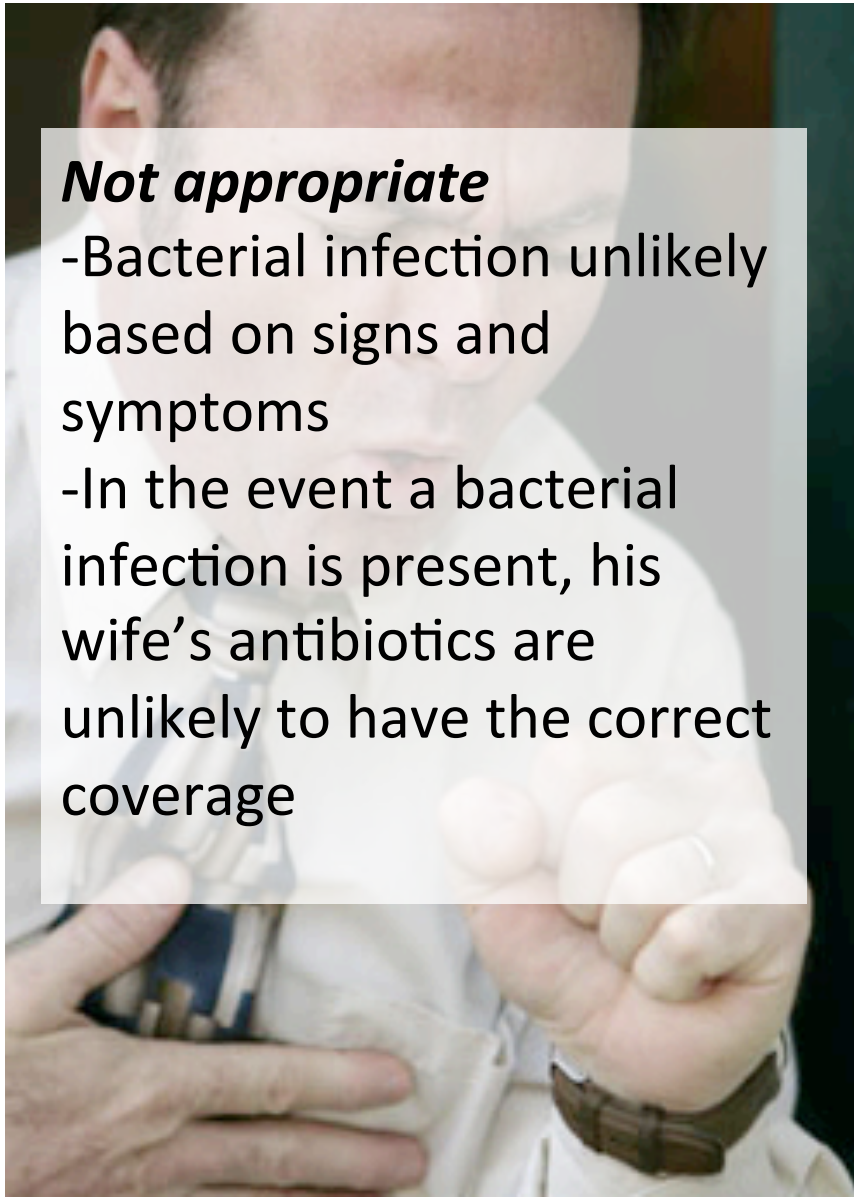

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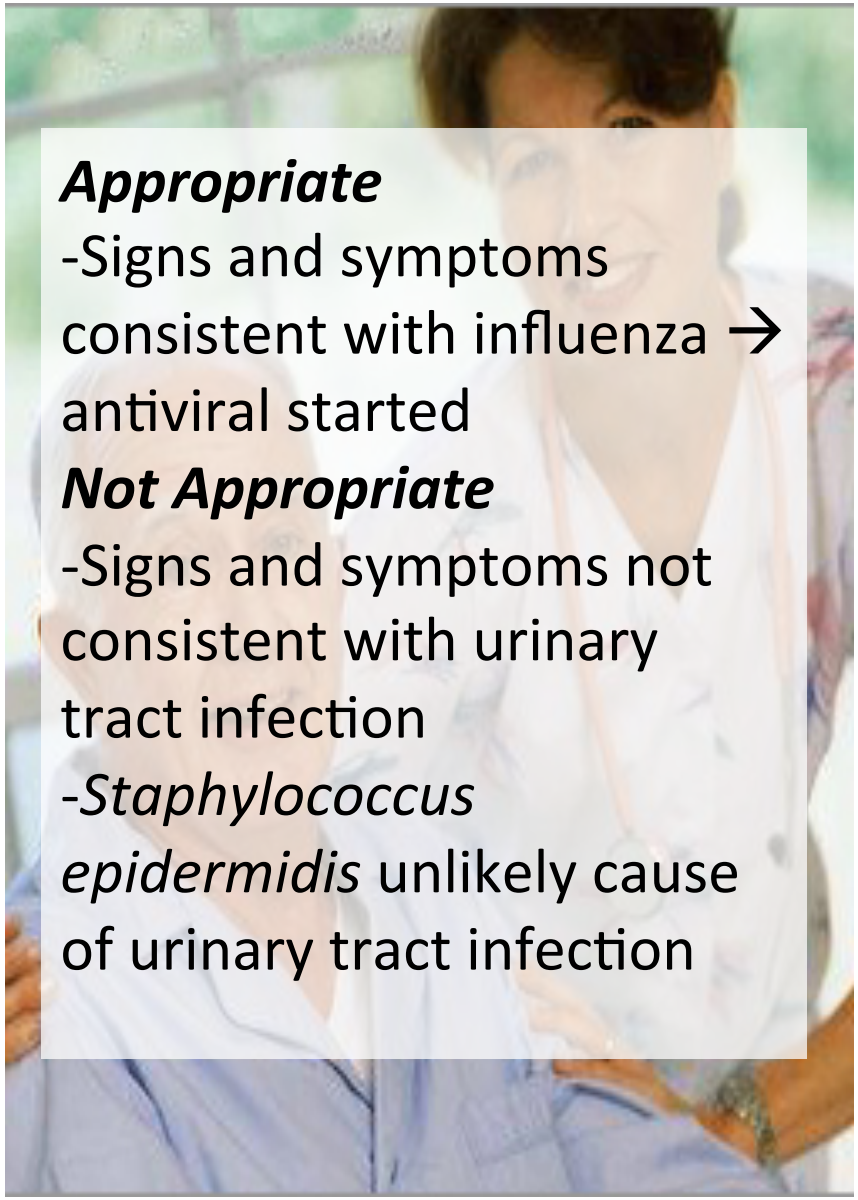

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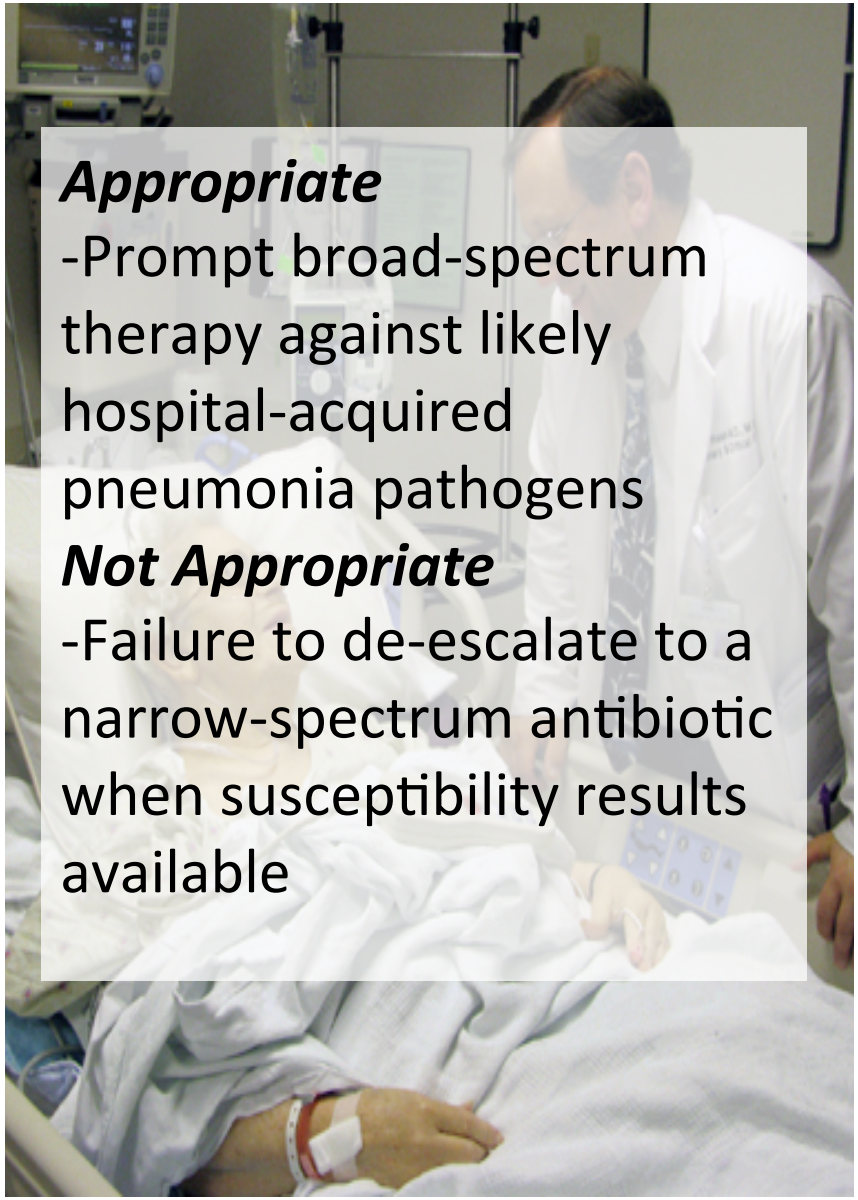

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USING ANTIBIOTICS WISELY: A SYSTEMS APPROACH

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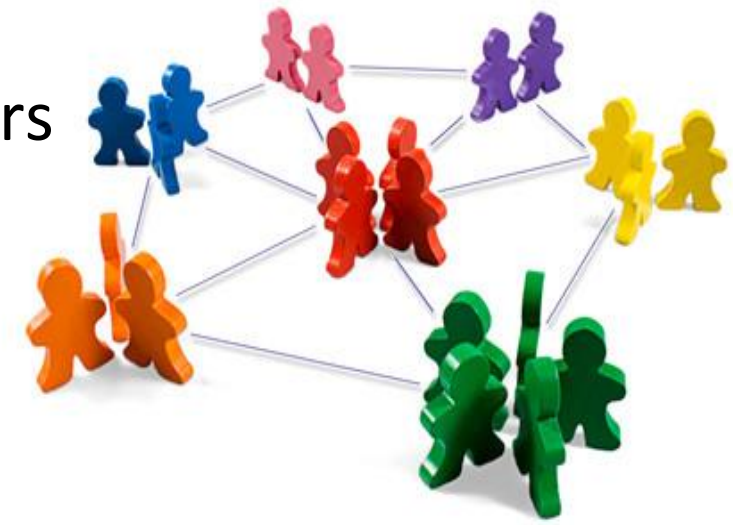
Antibiotic Stewardship Programs: The Role of Healthcare Organizations

- An ***antimicrobial stewardship program*** consists of ***coordinated interventions*** designed to improve and measure the ***appropriate use of antimicrobial agents*** by promoting selection of the optimal antibiotic drug regimen including dosing, duration of therapy and route of administration throughout the course of their use.

Antimicrobial Stewardship Programs: Team Members

- Core Members
  - Physician
  - Pharmacist
- Supporting Members
  - Clinical Microbiologist
  - Infection Control Practitioners
  - Hospital Administration



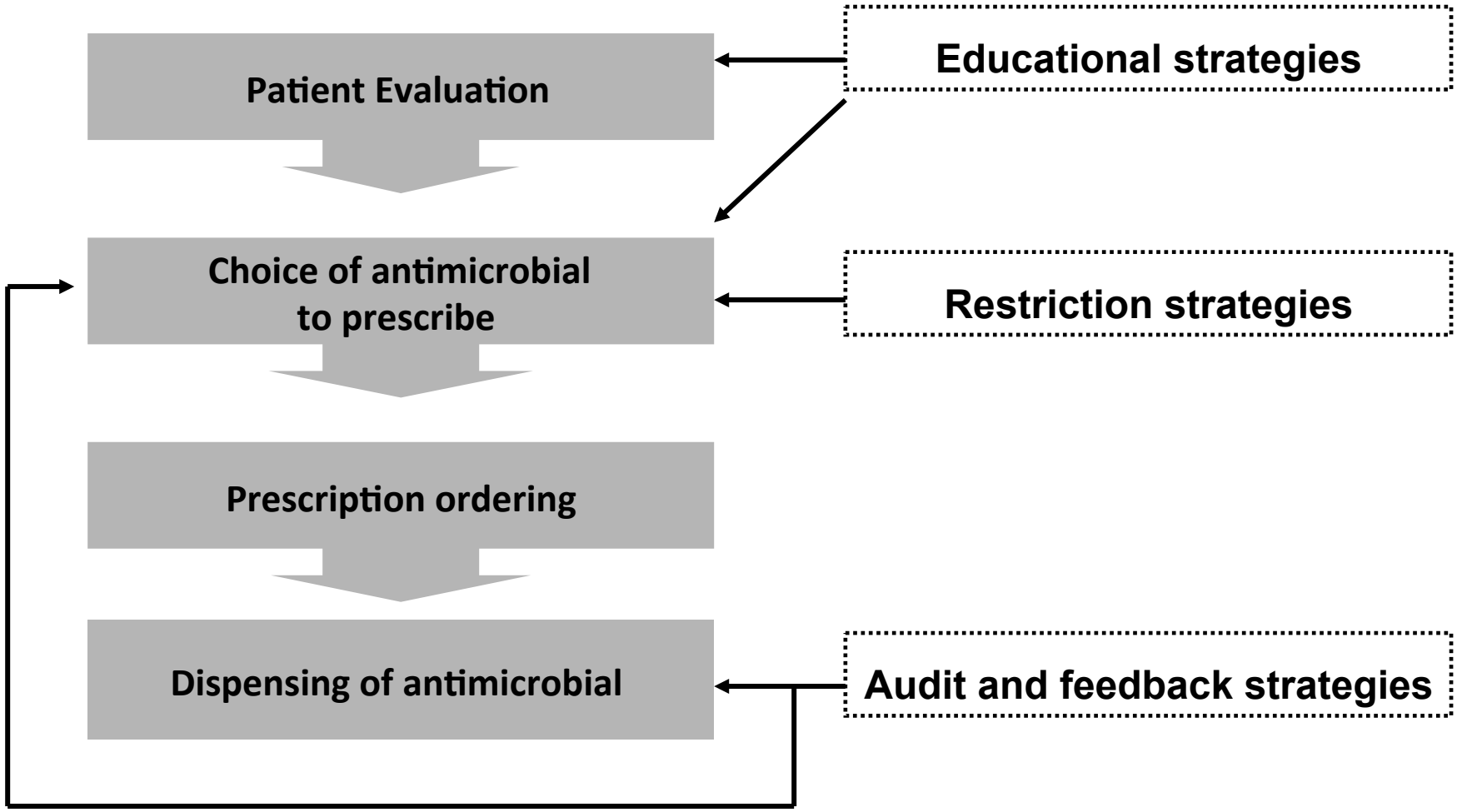
Antimicrobial Stewardship Programs: Role of the Physician

- Develop ***evidence-based guidelines*** for appropriate antibiotic use
- Develop ***antibiotic formulary*** and antibiotic use criteria
- ***Engage other physicians*** in supporting appropriate antibiotic use
- Analyze data on ***antibiotic use and outcomes***

Antimicrobial Stewardship Programs: Role of the Pharmacist

- ***Monitor antibiotic use*** to find opportunities for improvement
- Enforce the ***antibiotic formulary and antibiotic use restrictions***
- Advise prescribers on ***optimal antibiotic selection and dosing***
- Assist in ***guideline development***
- Collect and analyze ***data on antibiotic use and outcomes***

Antimicrobial Stewardship Programs: Strategies



Antimicrobial Stewardship Strategies: Education

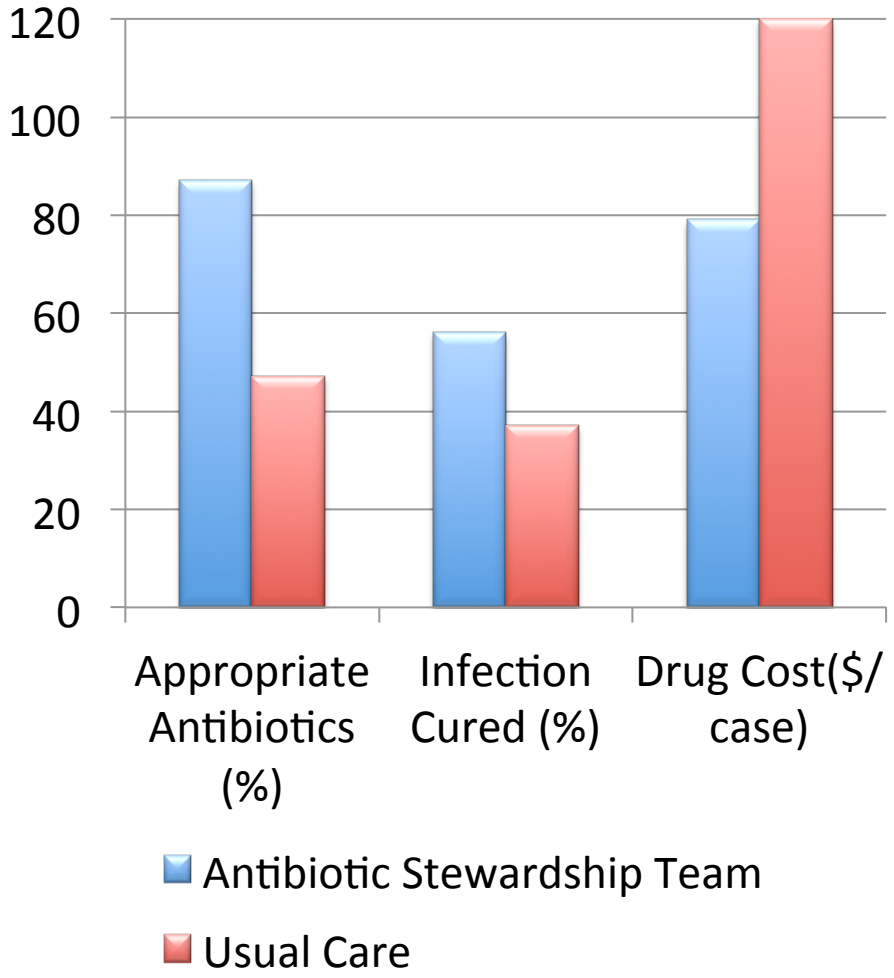
- Enhance the ***knowledge and skills of clinicians*** in appropriate antibiotic use through:
  - Classroom teaching
  - Grand rounds
  - One-on-one consultation
  - Provision of guidelines and protocols

Medical Students Who Feel Their Education in Antibiotic Use Has Been Good/Very Good	All
Perceptions	n = 300
Find reliable sources of information to treat infections	63%
Basic mechanisms of antimicrobial resistance	61%
Handle patients demanding unnecessary antibiotics[b]	54%
When to start antimicrobial therapy	54%
Select the best antimicrobial for a specific infection	39%
Spectrum of therapy for different antibiotics	34%
Interpret antibiograms[c]	34%
Transition intravenous to oral antibiotics[d]	32%
Streamline antibiotic therapy[e]	31%

Abbo LM, et al. *Clin Infect Dis* 2013

Antimicrobial Stewardship Strategies: Restriction

- ***Limit antibiotic formulary*** to most effective agents
- Require ***prior consultation*** with an ID clinician before use of targeted agents



Gross R, et al. *Clin Infect Dis* 2001;33:289-295

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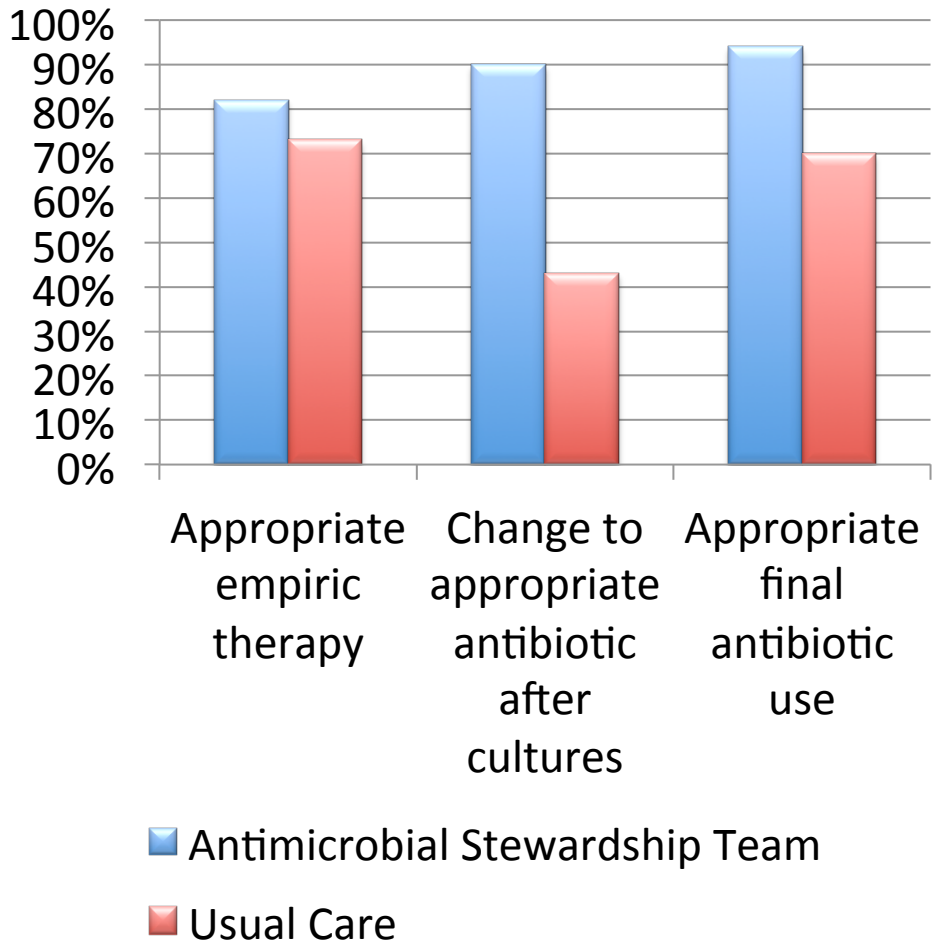
Antimicrobial Stewardship Strategies: Audit and Feedback

- ***Monitor usage*** of antibiotics in a healthcare system
- ***Contact prescribers*** to provide recommendations for optimal use including:
  - Appropriate spectrum
  - De-escalation
  - Dosing
  - Intravenous to oral switch



Camins BC, et al. *Infect Control Hosp Epidemioll* 2009;30:931-938

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USING ANTIBIOTICS WISELY: THE BIG PICTURE

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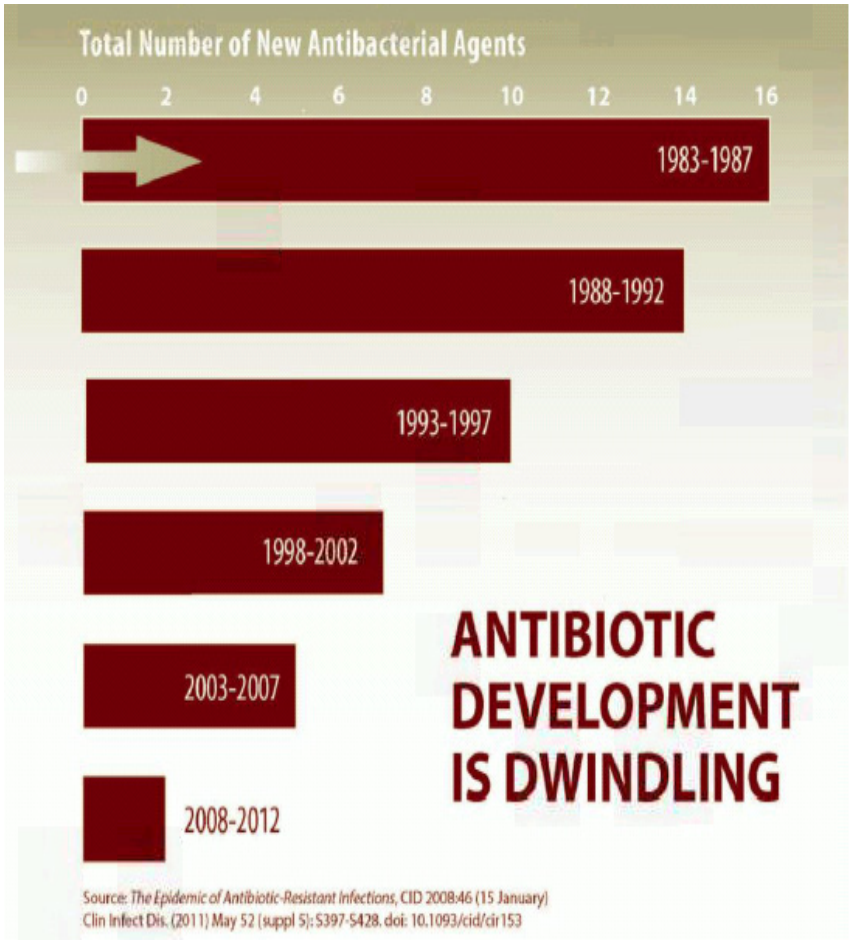
Antibiotic Stewardship: Governmental Agencies

- ***Educate public*** on antibiotic resistance and appropriate antibiotic use
- ***Enact regulations*** requiring clinicians and healthcare systems to improve antibiotic use
- ***Incentivize pharmaceutical industry*** to develop new antibiotics

www.cdc.gov/getsmart

Antibiotic Stewardship: Pharmaceutical Industry

- ***Re-invest*** in antibiotic drug development
- ***Promote appropriate use*** of antibiotics
- Develop ***new diagnostics*** to support appropriate antibiotic use



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Where to Learn More

- Infectious Diseases Society of America
  http://www.idsociety.org/stewardship_policy/
- Alliance for the Prudent Use of Antibiotics
  http://www.tufts.edu/med/apua/
- Centers for Disease Control and Prevention
  http://www.cdc.gov/getsmart/healthcare/inpatient-stewardship.html
- Wake Forest School of Medicine Stewardship Education
  http://www.wakehealth.edu/School/CAUSE/Get-Smart-About-Antibiotics.htm

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