

Introduction to Communicable Disease Surveillance and Investigation in North Carolina

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Unit 9: Drug Resistant Infections

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Learning Objectives

1. Identify principles of drug resistance
2. Distinguish vancomycin-intermediate *Staph aureus* (VISA) from vancomycin-resistant *Staph aureus* (VRSA)
 - Identify VRSA as a public health emergency
3. Locate resources for selected other high-profile drug-resistant infections
 - Methicillin-resistant *Staphylococcus aureus* (MRSA)
 - Carbapenem-resistant Enterobacteriaceae (CRE)

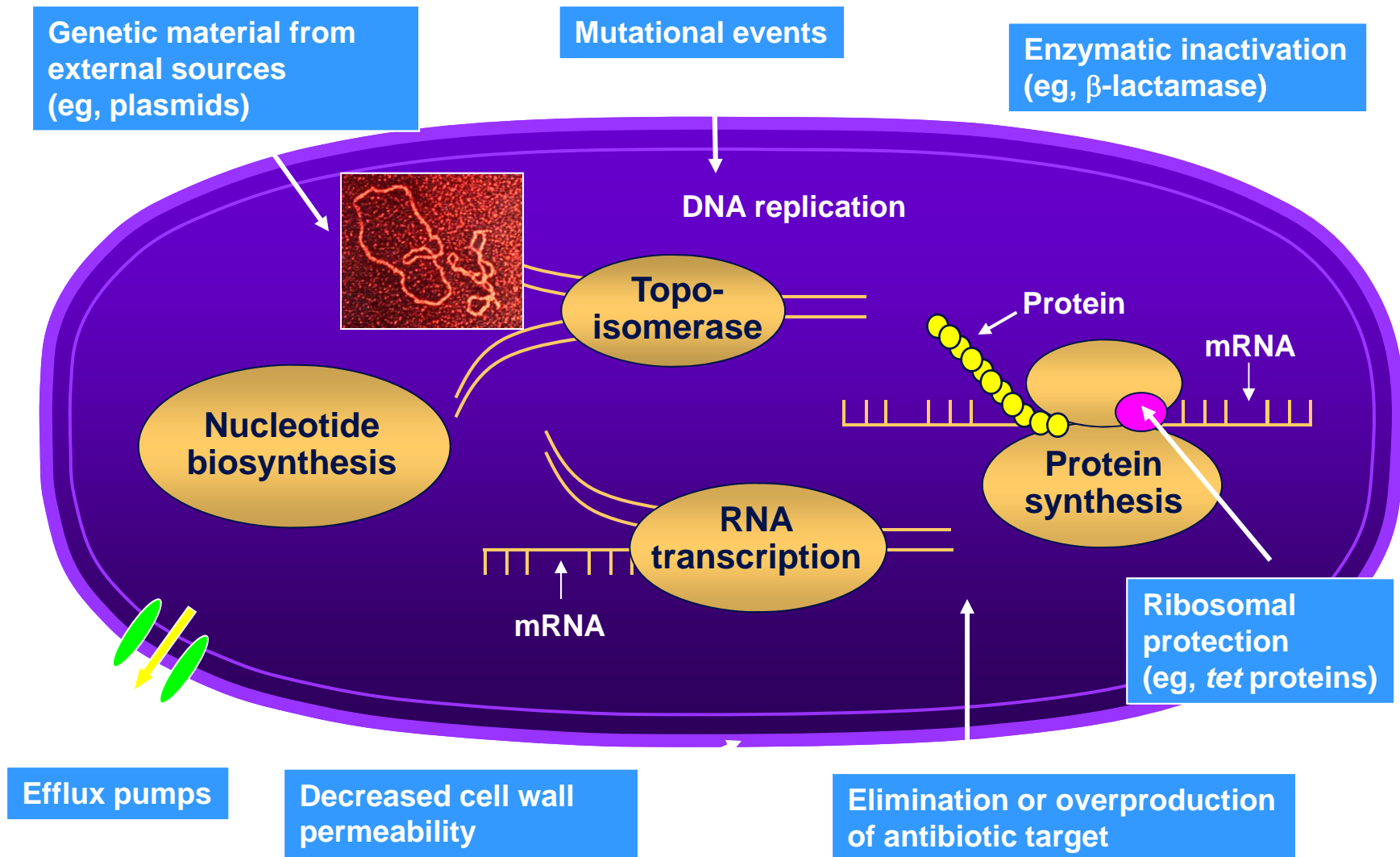
Impact of Antibiotic Resistance

Estimated minimum number of illnesses and deaths caused annually by antibiotic resistance*:

At least  **2,049,442** illnesses,
 **23,000** deaths

**bacteria and fungus included in this report*

Mechanisms of Resistance to Antibiotics



Slide by Dr. David Weber, adapted from: Chopra I. *Curr Opin Pharmacol.* 2001;1:464-469.



How Antibiotic Resistance Happens

1.

Lots of germs.
A few are drug resistant.



2.

Antibiotics kill
bacteria causing the illness,
as well as good bacteria
protecting the body from
infection.



3.

The drug-resistant
bacteria are now allowed to
grow and take over.

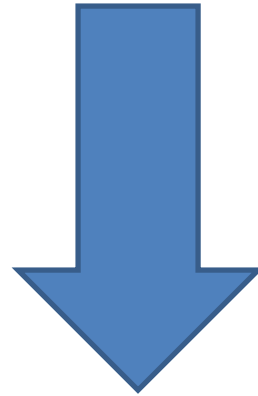


4.

Some bacteria give
their drug-resistance to
other bacteria, causing
more problems.



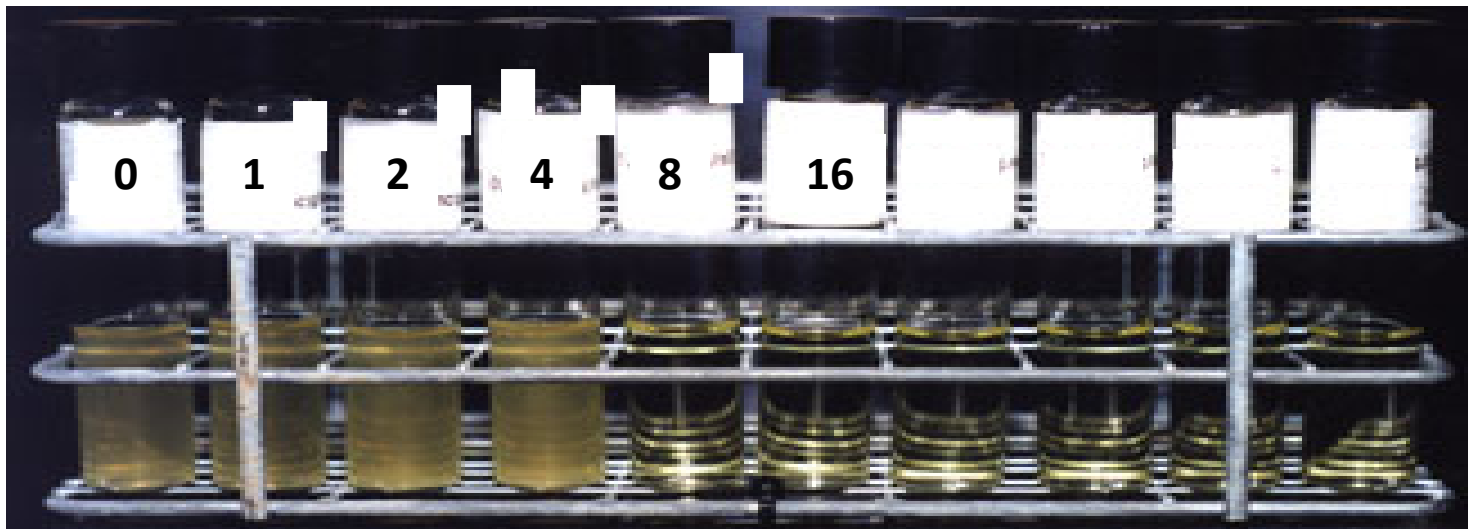
Antibiotic use



Antibiotic resistance

Vancomycin Intermediate and Vancomycin Resistant *Staph aureus*

- Classified based on minimum inhibitory concentration (MIC) required to suppress bacterial growth



- MIC 4–8 = Intermediate (VISA)
- MIC ≥ 16 = Resistant (VRSA)

VISA versus VRSA

- VISA:
 - Exposure to vancomycin
 - Thickened cell wall
 - Reversible
 - Uncommon
- VRSA:
 - Resistance genes
 - Highly resistant
 - Rapid spread
 - Rare

VISA/VRSA: Control and Reporting

- VRSA is a PUBLIC HEALTH EMERGENCY!!!
- Confirm laboratory results
- Send isolate to SLPH
- Investigation and Control Guidelines in “Local Health Department Investigation Steps” section of CD manual

MRSA and CRE

- Cases not individually reportable
- Investigate and report outbreaks of public health significance

Methicillin-Resistant *Staphylococcus aureus* (MRSA)

- Leading identifiable cause of skin and soft tissue infections
- CDC: 94,000 invasive infections per year
 - 85% healthcare
 - 15% community
- ~19,000 deaths per year

MRSA Infections

- MRSA penetrates natural barriers
 - Minor cuts or scrapes
 - Breathing surfaces inflamed from colds or flu
- Skin & soft tissue infection (SSTI) most common
- Less frequently infection of bloodstream, bones, joints, lungs, heart or other organs

MRSA Skin Lesions



MRSA Transmission: Proven Routes

- Skin-to-skin contact
 - Draining lesions highly infectious
- Shared personal items
 - Razors, towels, sports equipment, etc



MRSA Transmission: Unproven Routes

- Coughing and sneezing
- Contact with non-personal items such as pencils, paper, or books
- Being in a room with an infected person



MRSA Outbreaks

1. Enhance surveillance
2. Refer for testing and treatment
3. Provide wound care education
4. Promote basic hygiene
5. Exclude patients from certain activities if draining lesions that can't be covered
6. Achieve and maintain a clean environment

MRSA Resources

NC Division of Public Health

<http://epi.publichealth.nc.gov/cd/diseases/mrsa.html>

Centers for Disease Control and Prevention

www.cdc.gov/MRSA

Carbapenem-Resistant Enterobacteriaceae (CRE)

Enterobacteriaceae:

- Family of bacteria that normally live in water, soil, and the human gut
- Common cause of healthcare and community infections (*E. coli*, *K. pneumoniae*)

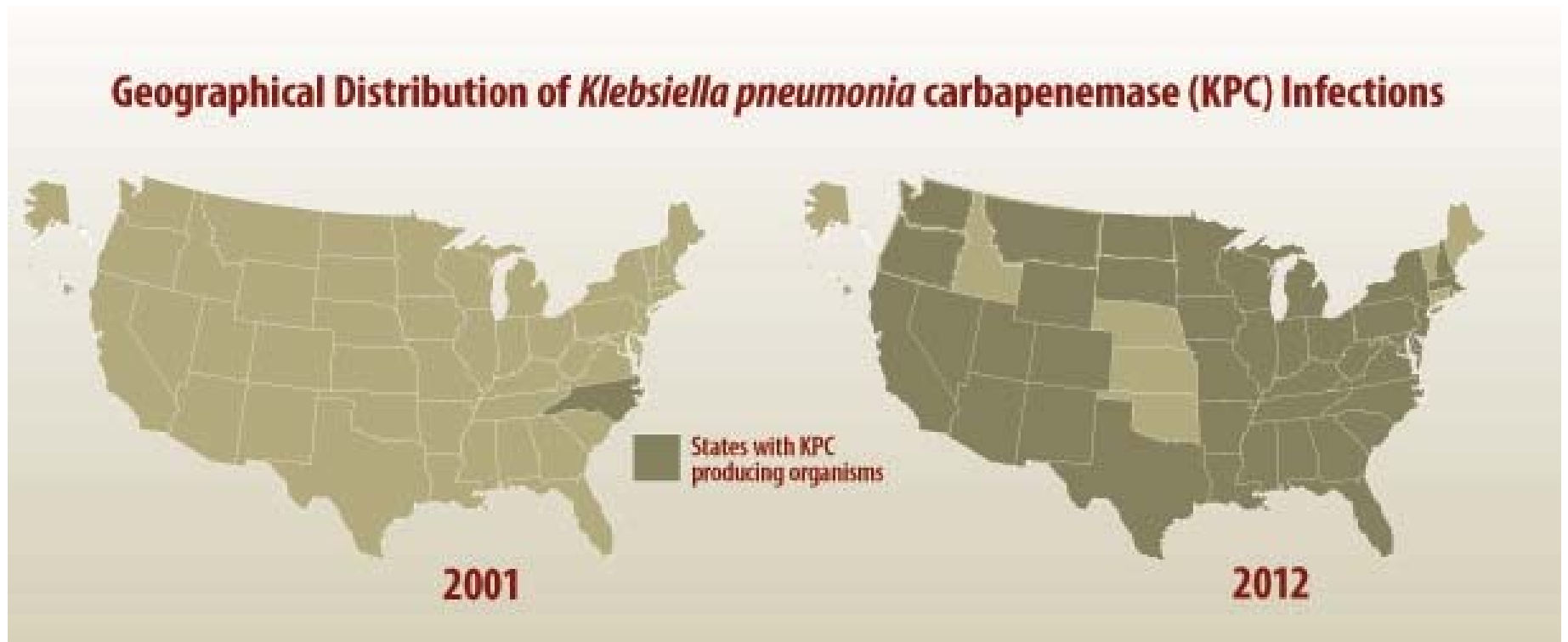
Carbapenems:

- Class of broad-spectrum antibiotics considered the “last resort” for treatment of serious gram-negative infections

Carbapenemases

- Enzymes that break down carbapenems
- Confer resistance to other β -lactams including penicillins and cephalosporins
 - Difficult or impossible to treat
- Genes carried on plasmids
 - Easily transferred to nonresistant bacteria

Carbapenemase-Producing Enterobacteriaceae in the US



<http://www.cdc.gov/getsmart/campaign-materials/week/images/kpc-states.png>

CRE: Surveillance and Control

- Identified in >50% of North Carolina hospitals (2012)
- Periodic surveys of acute and long-term care facilities
- Resources for prevention and control available on CDB and CDC websites:

<http://epi.publichealth.nc.gov/cd/diseases/cre.html>

<http://www.cdc.gov/hai/organisms/cre/>

Other Drug-Resistant Infections

- Drug-resistant *Clostridium difficile*
- Drug resistant *Neisseria gonorrhoea*
- Vancomycin-resistant enterococcus (VRE)
- Multidrug-resistant tuberculosis (MDR TB) and extensively drug-resistant tuberculosis (XDR TB)
- Drug-resistant *Streptococcus pneumoniae* (DRSP)
- Etc.

Conclusions

- Drug resistant infections are a growing threat
- Vancomycin resistant *Staph aureus* is rare
 - Reports of VRSA require urgent investigation
- MRSA, CRE and others not individually reportable, may require public health intervention