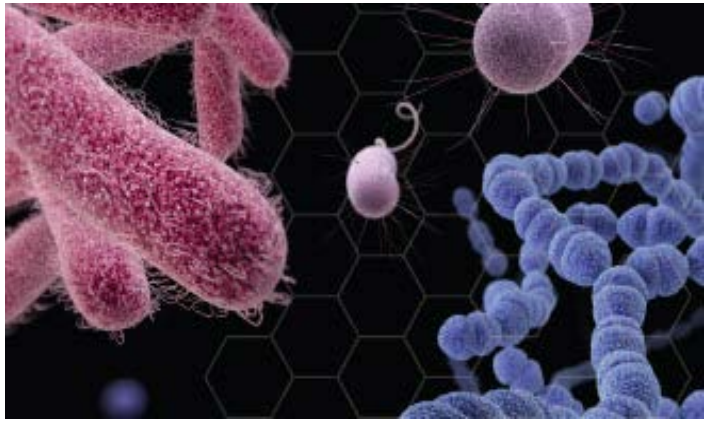
Antimicrobial Resistance: An Emerging Public Health Threat



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Public Safety Committee
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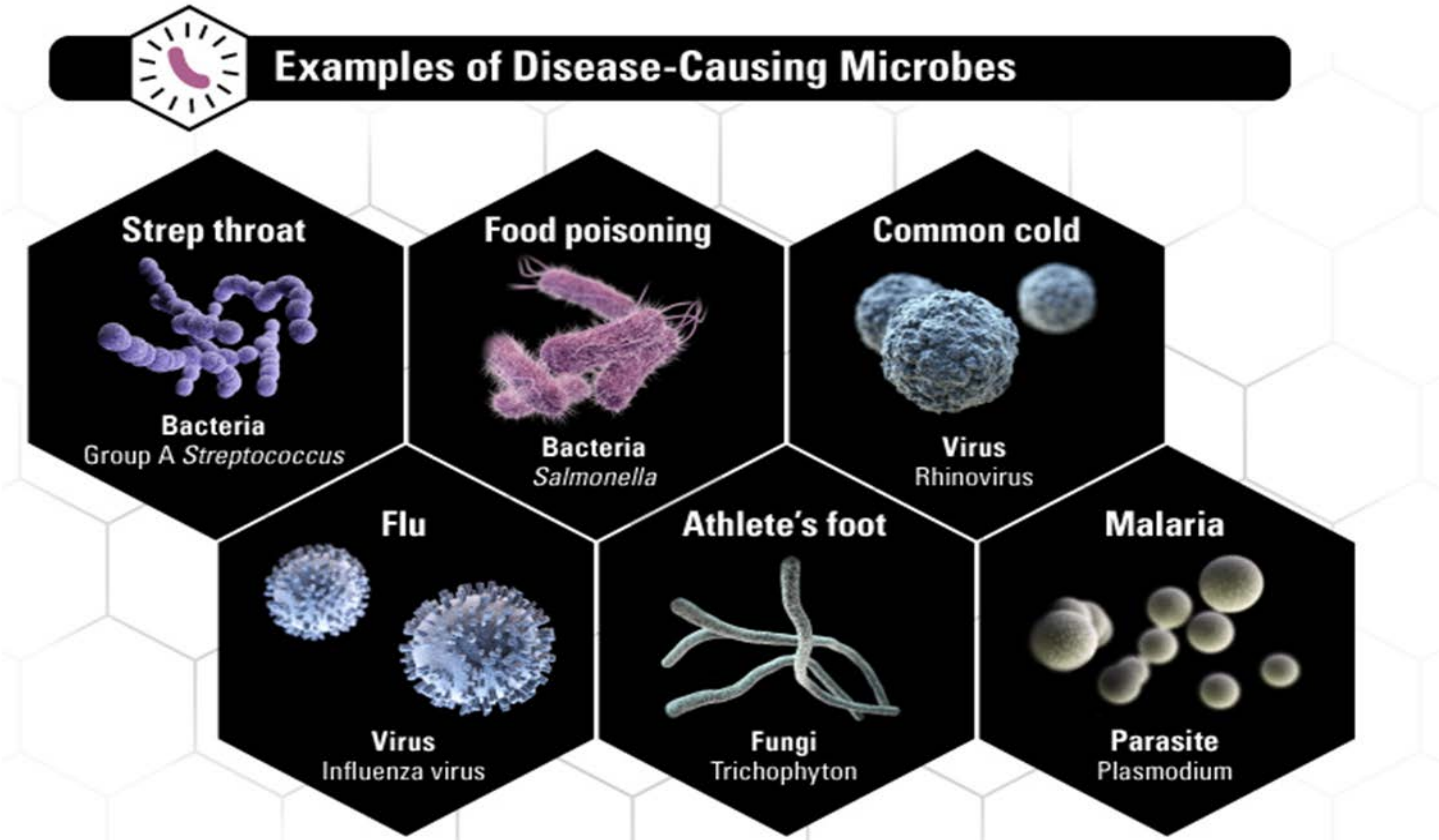
An antibiotic is a type of drug that kills or stops the growth of bacteria. Examples include penicillin and ciproflaxin

An antimicrobial is a type of drug that kills or stops the growth of microbes, such as bacteria, viruses, fungi, and parasites.

Antibiotic / Antimicrobial resistance is the ability of microbes to resist the effects of drugs – that is, the germs are not killed, and their growth is not stopped



Source: CDC

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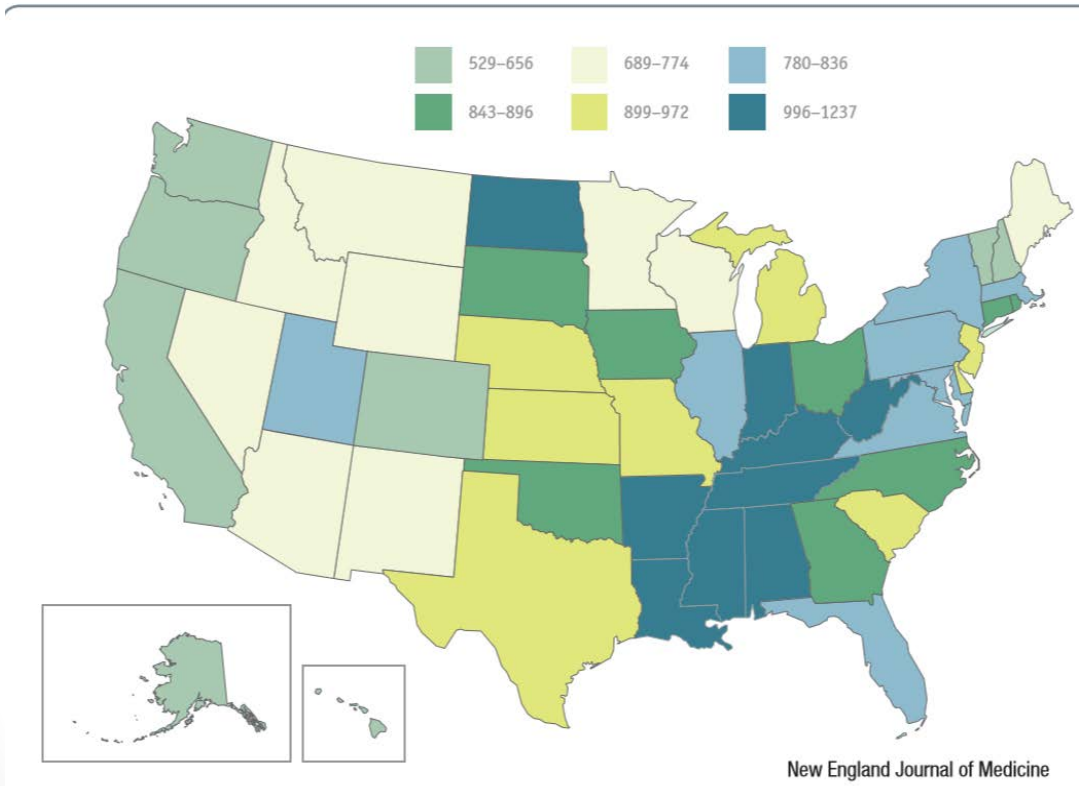
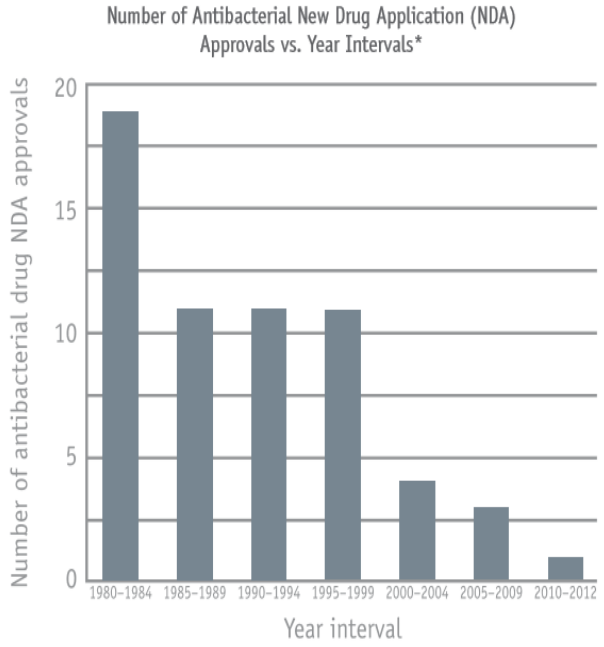
Lots of antibiotic use but …. fewer new antibiotics!

Antibiotic Prescriptions per 1000 Persons of All Ages According to State, 2010



New England Journal of Medicine

The number of new antibiotics developed and approved has steadily decreased in the past three decades, leaving fewer options to treat resistant bacteria.



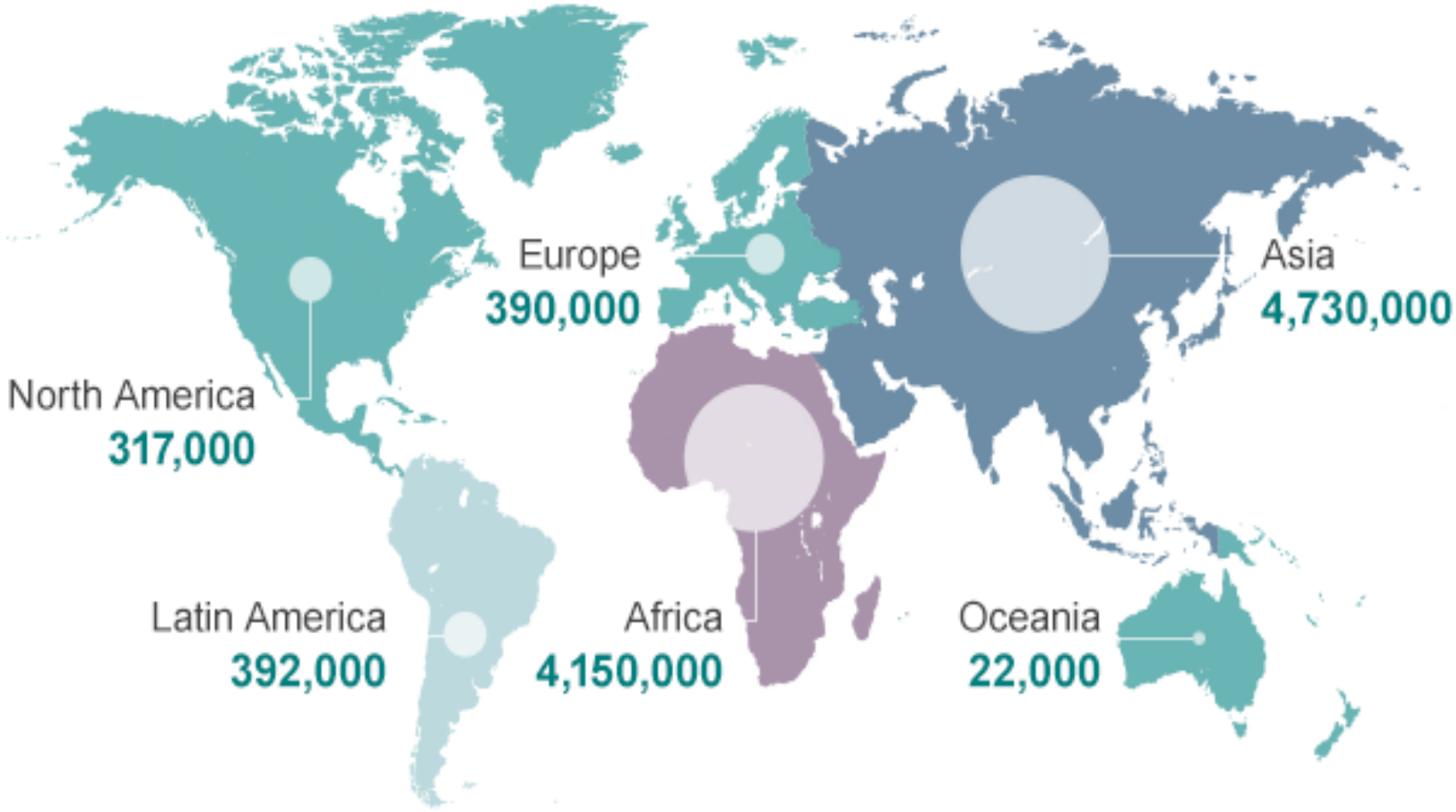
*Intervals from 1980–2009 are 5-year intervals; 2010–2012 is a 3-year interval. Drugs are limited to systemic agents.
Data courtesy of FDA' s Center for Drug Evaluation and Research (CDER).

Antibiotic Resistance: An Emerging Public Health Threat

- Some resistant infections cause severe illness. People with these infections:
  - May require increased recovery time,
  - Tend to incur increased medical expenses
  - May die from the infection.

Source: CDC Antibiotic Resistance Threats in the United States 2013

Deaths attributable to antimicrobial resistance every year by 2050



Source: Review on Antimicrobial Resistance 2014

Trends in Antibiotic Resistance

- Antibiotics are among the most commonly prescribed drugs used in human medicine. **However, up to 50% of the time antibiotics are not optimally prescribed**

- The germs that contaminate food can become resistant because of the improper use of antibiotics in people and in food animals.

- A major factor in the growth of antibiotic resistance is spread of the resistant strains of bacteria from person to person or from the non-human sources in the environment

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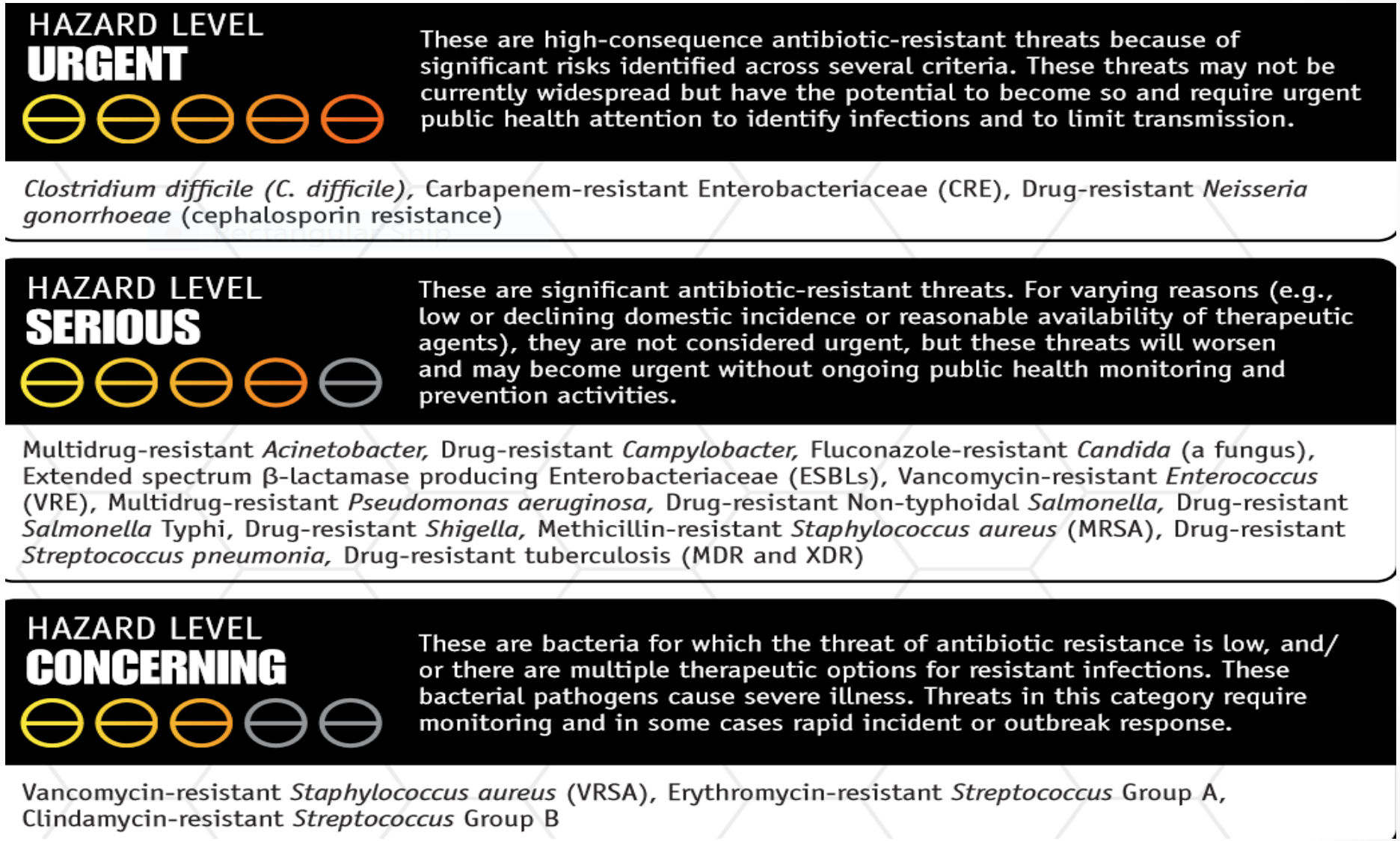
Antibiotic Resistance and Animals

- All animals carry bacteria in their intestines. Giving antibiotics will kill many bacteria, but resistant bacteria can survive and multiply.
- When food animals are slaughtered and processed, these resistant bacteria can contaminate the meat or other animal products.
- These bacteria can also get into the environment when an animal poops and may spread to produce that is irrigated with contaminated water.



Source: CDC *Antibiotic Resistance Threats in the United States 2013*

Public Health Strategies

- Preventing Infections Prevents the Spread of Resistance
- Tracking Infections through Surveillance
- Improving Stewardship and Prescribing Practices
- Developing New Drugs and Diagnostics

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What can the general public do?

- Regularly washing hands, practicing good food hygiene, avoiding close contact with sick people and keeping vaccinations up to date
- Only using antibiotics when prescribed by a certified health professional
- Always taking the full prescription
- Never using left-over antibiotics
- Never sharing antibiotics with others

*Detection of multi-drug resistant Escherichia coli in the urban waterways of Milwaukee, WI**

- Comparative study of antibiotic resistance in E. coli in urban waterways vs. human sewage and human clinical specimens
- 259 isolates analyzed. All were multi-drug resistant
- Urban waterway isolates were found to be more antibiotic resistant than human isolates (isolate incidence was higher, resistance to higher number of antibiotics and larger presence of genetic determinants in isolates)
- **Conclusion: Milwaukee urban waterway may have higher incidence of antibiotic resistant organisms as well a gene pool selecting for antibiotic resistance as opposed to human and clinical specimens**

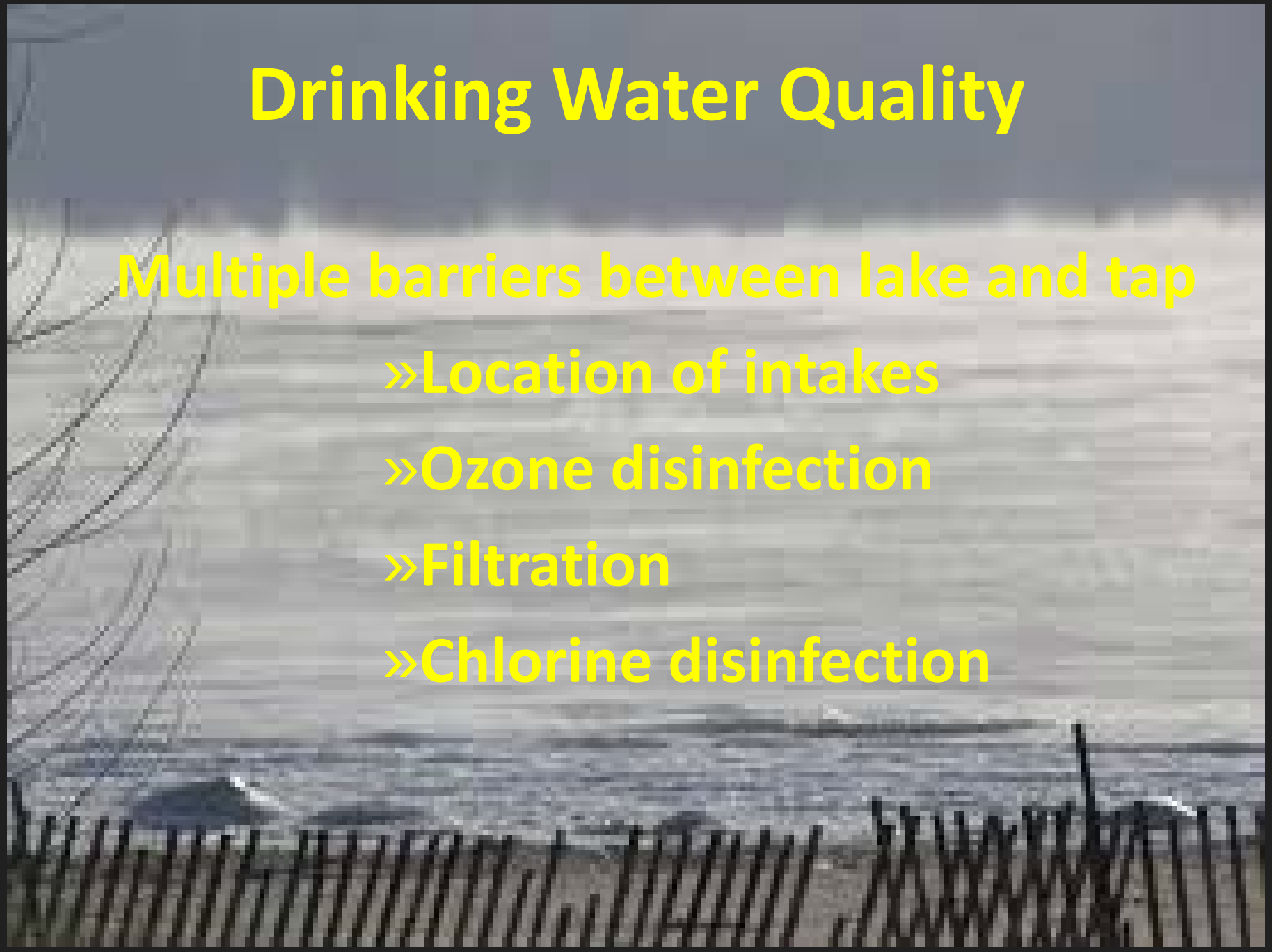
*Kapell, D. Anthony, DeNeis, Hristova, R. Krassimira, et al, Frontiers in Microbiology, 6:336, April 2015

Public Health Implications of Study?

- **Scientific surveys of natural environments for antibiotic resistant microorganisms represents emerging science** (i.e. no comprehensive inventory or regulations)
- **Study does not identify origin of antibiotic resistant microorganisms** (likely both human and animal contributions)
- **No indication of imminent public health risk identified** (i.e. evidence of gene transference from indigenous microorganisms to human pathogens)

Other considerations …

- E. coli is found in the intestines of many species of wild and domestic animals and humans.
- 150-200 serotypes of E. coli – most do not cause human illness
- E. coli has been recognized as a contributor to antibiotic resistance gene transference in natural environments in other studies.
- Collaboration with Zilber School of Public Health on seasonal beach monitoring reveals presence of antibacterial agents in water (positive selective pressure for antibiotic resistance?)



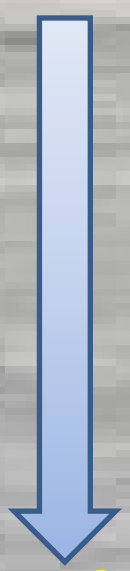
Drinking Water Quality

Multiple barriers between lake and tap

- »Location of intakes
- »Ozone disinfection
- »Filtration
- »Chlorine disinfection

Disinfection Effectiveness

Easiest to kill



Bacteria

Viruses

Giardia

Cryptosporidium

Hardest to kill

(MWW kills them ALL)