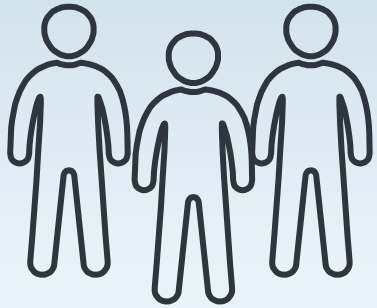
# Antibiotic Resistance

By Seoyoung Lee and Oh Jeongwoo

# How does antibiotic resistance affect humans?



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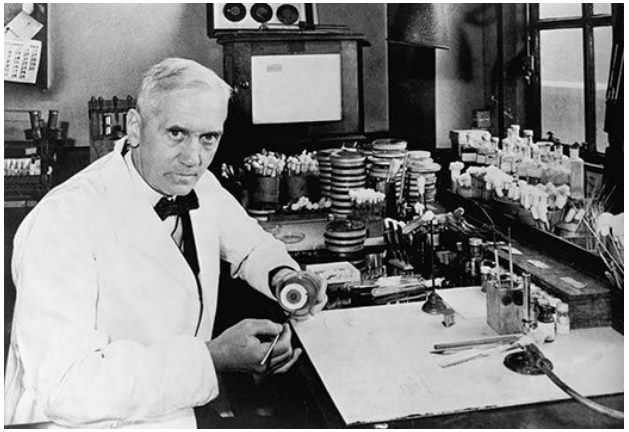
# Antibiotic



Medicine used to treat bacterial infections.

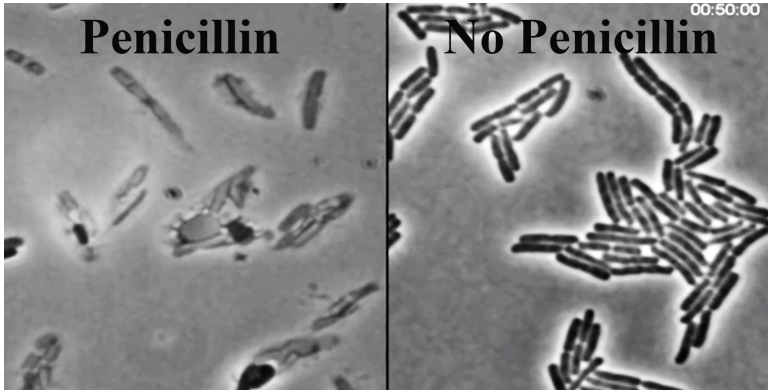
- Kills or prevents the activity of bacteria.

History

- Alexander Fleming found penicillin in 1928 August (Scientific revolution!)

Before Antibiotics:

- Higher risk of death during surgery
- Higher risk of death by pneumonia
- … And more



# Bacteria vs Virus

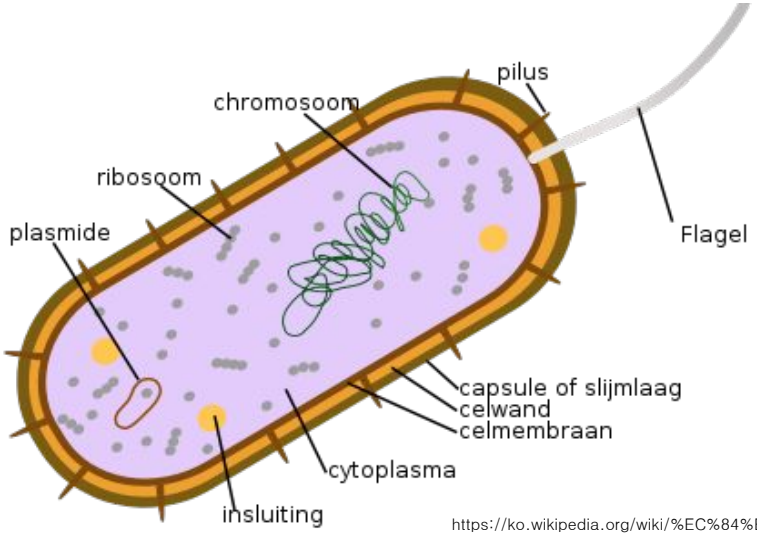
1. Size


1 to 5 micrometer

30 to 300 nanometer

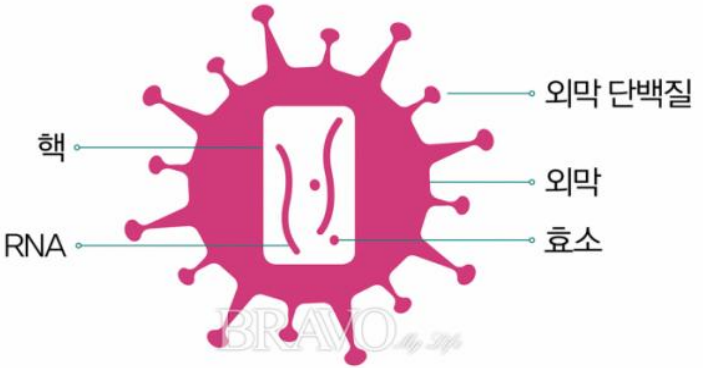
# Bacteria vs Virus

2. Structure




https://ko.wikipedia.org/wiki/%EC%84%B8%EA%B7%A0

Bacteria is a single celled organism
and has many organelles



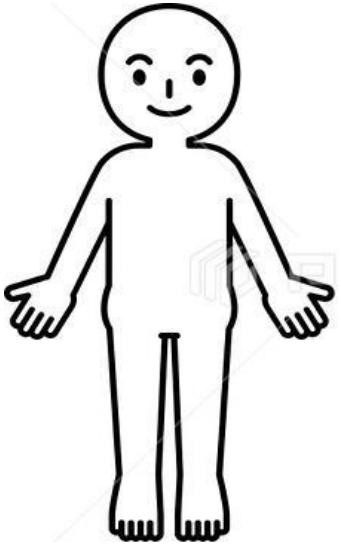

Virus only has nucleic acid and capsid

# Bacteria vs Virus

3. Survive

https://canadablog.tistory.com/139

Bacteria can survive anywhere with its food
It can make energy by itself



Virus can’t survive without its host
It can’t make energy by itself

# Bacteria vs Virus

4. Remove

Bacteria

Antibiotics

Virus

Vaccine

Antiviral Drugs

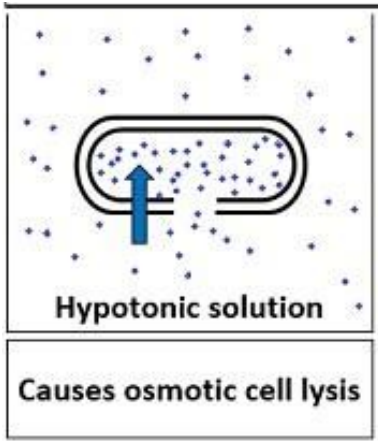
# Antibiotic Mechanism

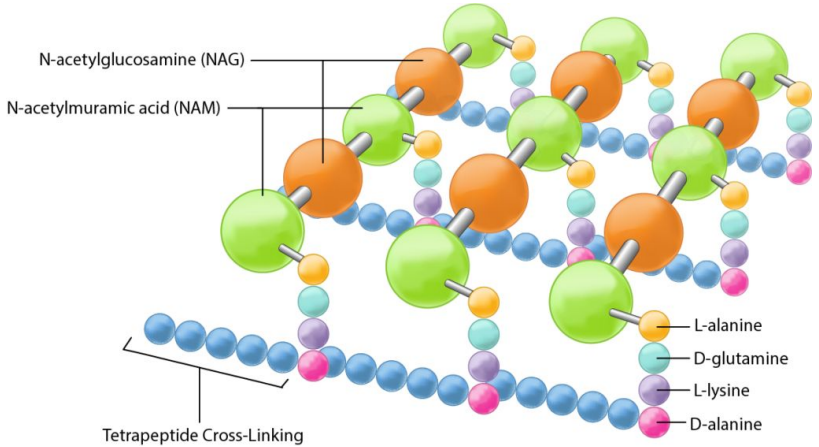
- Understanding bacteria
  - **Peptidoglycan cell wall** allows bacteria to withstand high osmosis pressure from hypotension (low concentration of surrounding)
- Types of antibiotics:
  - Penicillin (Methicillin, ampicillin)
  - Cephalosporin
  - Carbapenems
  - Tetracycline
  - Aminoglycosides

Inhibits cell wall production

Inhibits protein synthesis

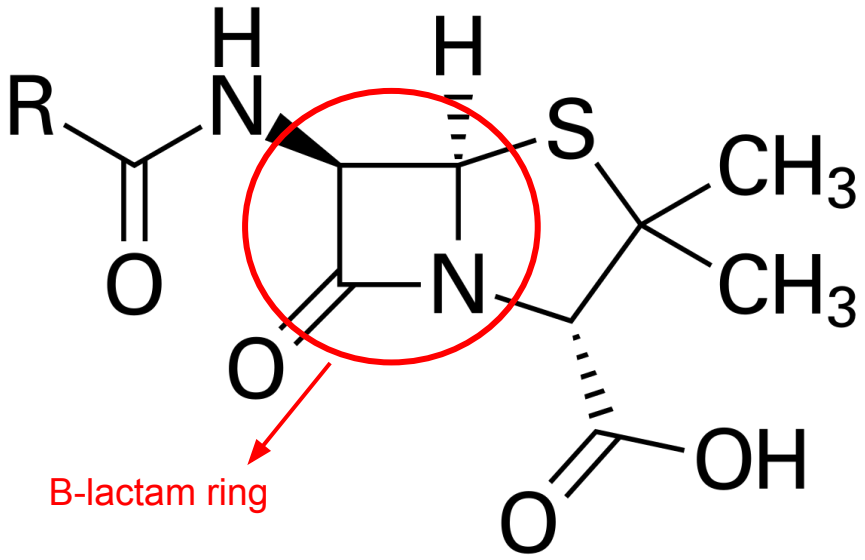
Inhibits DNA/RNA synthesis



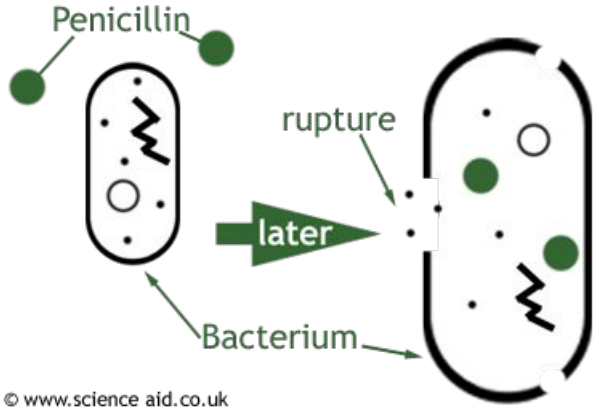




Bacteria cell wall structure

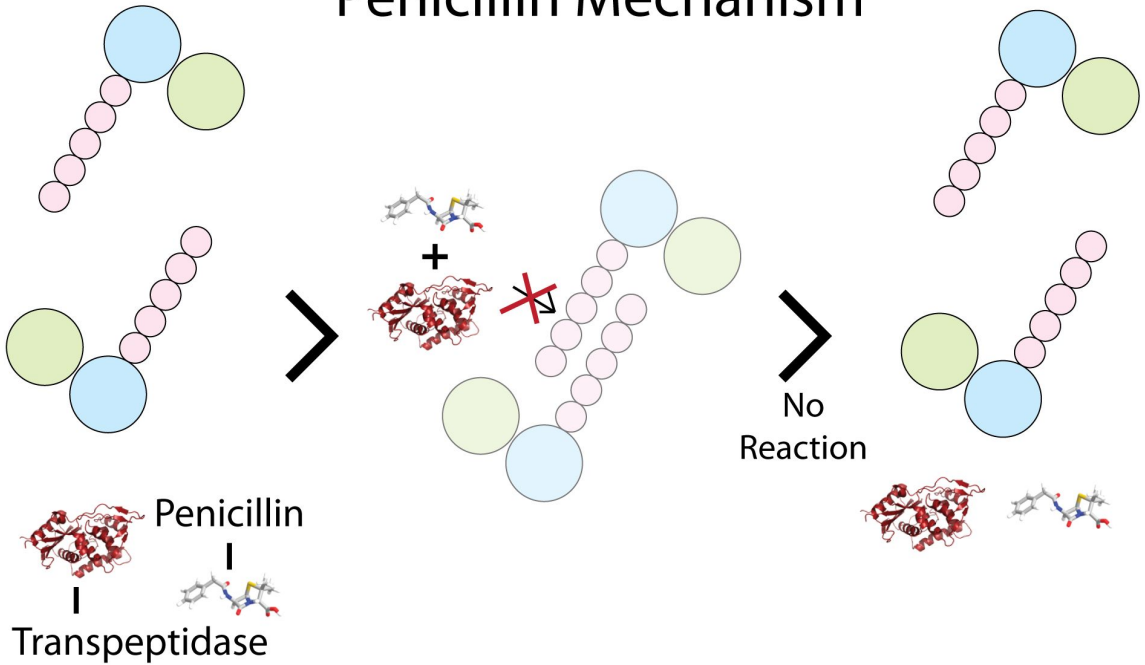
# Penicillin




- Penicillins competitively inhibit DD-transpeptidase
- Transpeptidase enzyme catalyses the cross-linking of peptidoglycan in bacteria cell wall.
- Bacteria cell wall weakens → influx of water into cell → Cell lysis



# Penicillin Mechanism




- Competitive inhibition - penicillins competitively inhibit transpeptidase
- Peptidoglycan = polysaccharide made of N-acetylglucosamine (NAG) and N-acetylmuramic acid (NAM) alternating in long chains
    - Tetrapeptide cross linking

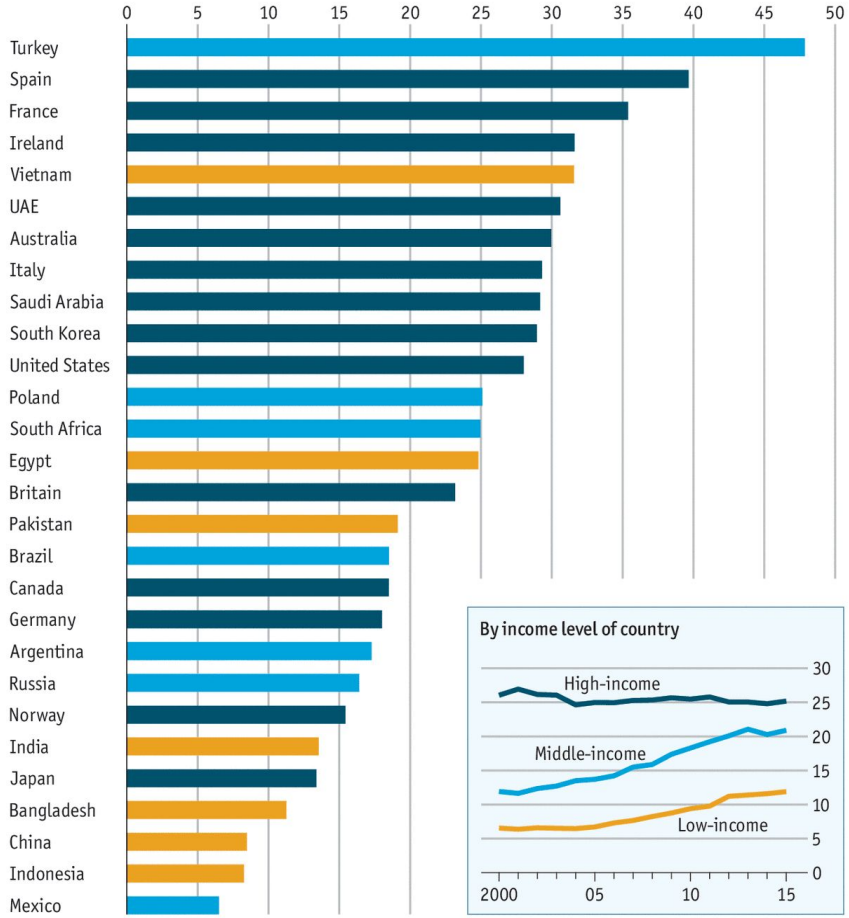
# Antibiotic Misuse

1. Daily dosage

Many people in the world are getting a lot of amount of antibiotics

The dosage is larger in countries with higher incomes

Doses in middle income and low-income countries have steadily increased over time




Source: "Global increase and geographic convergence in antibiotic consumption between 2000 and 2015", by Eili Klein et al., Proceedings of the National Academy of Sciences, March 2016

Economist.com

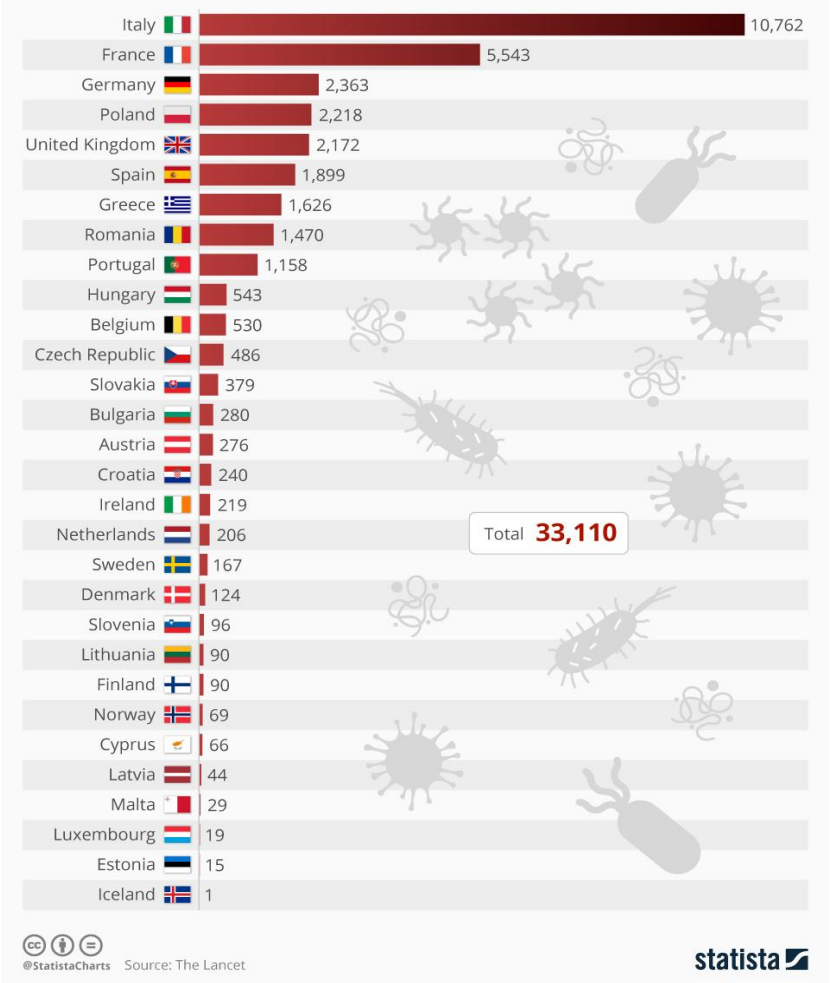
# Antibiotic Misuse

2. Europe

33100 people die from infection due to antibiotic resistance

75% of total infection: healthcare-associated infections

Other reasons: taking large amount of antibiotics



# Antibiotic Misuse

2. Europe


https://www.gov.uk/government/publications/health-matters-antimicrobial-resistance/health-matters-antimicrobial-resistance

# Antibiotic Misuse

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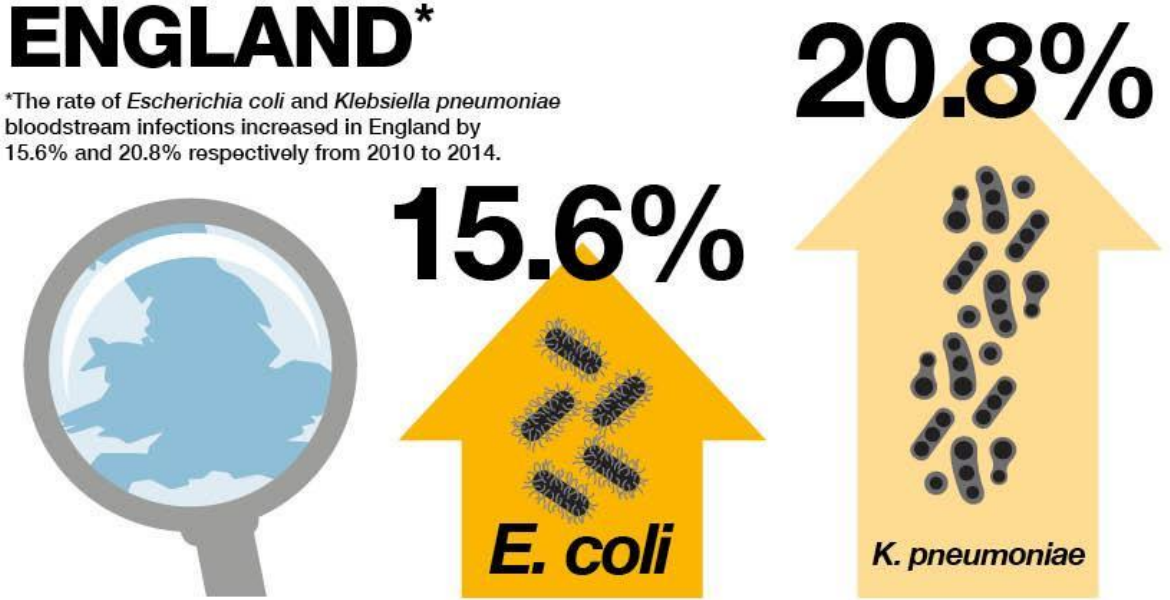



https://www.gov.uk/government/publications/health-matters-antimicrobial-resistance/health-matters-antimicrobial-resistance

# Antibiotic Misuse

3. Middle East Asia


https://www.k-health.com/news/articleView.html?idxno=45632

After being injured in a war,

they get infection to antibiotic resistance virus

because they can’t get proper treatment

# Antibiotic Misuse

3. South East Asia

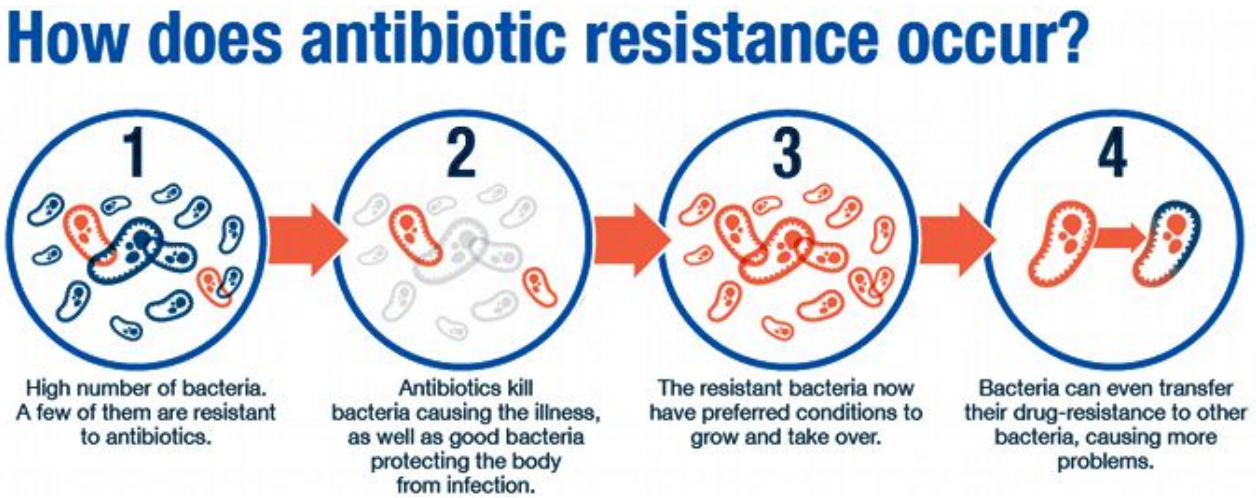

https://www.studentdoctor.net/2018/08/15/how-to-write-a-prescription/

About 50% of the total patient is antibiotic abuse patient

Antibiotics are widely used in food and can be used without doctor's prescriptions

# Consequence & effects

- **Antibiotic resistance** ⇒ Bacterias become resistant to antibiotics
  - Natural Selection
  - Genetic information shared between bacterias by **plasmid** (#4 in diagram)




*How does antibiotic resistance occur? World Health Organization, 2020*

# Superbug

- Super Bug - has bacteria resistance to several antibiotics, or the strongest one
- Serious danger to public health
- High risk germs
  - Acinetobacter - resistant to carbapenems
  - Vancomycin resistant *enterococci* (VRE)


- New antibiotics are developed (in mixture) against these super bacterias

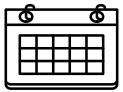
# Solutions

1. General Public

1. Use antibiotics only when prescribed by a doctor

2. Do not ask for antibiotics if your doctor says you don't need them

3. Always follow the instructions of the medical practitioner when using antibiotics



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