

## **OTWARTE SEMINARIA IETU**

# **THE ROLE OF WASTEWATER TREATMENT PLANTS IN THE CONTROL OF ANTIBIOTIC RESISTANCE DISSEMINATION**

**Ph.D. Ivone Vaz-Moreira** – Portuguese Catholic University, Faculty of Biotechnology, Centre for Biotechnology and Fine Chemistry, Porto, Portugal

**Katowice, 11 października 2018**



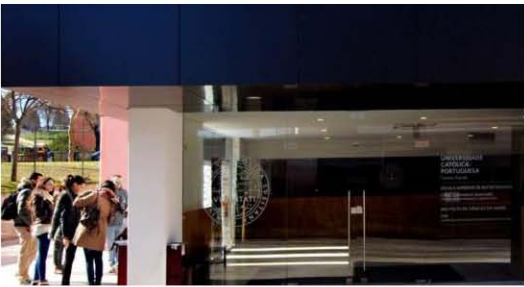
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OF BIOTECHNOLOGY

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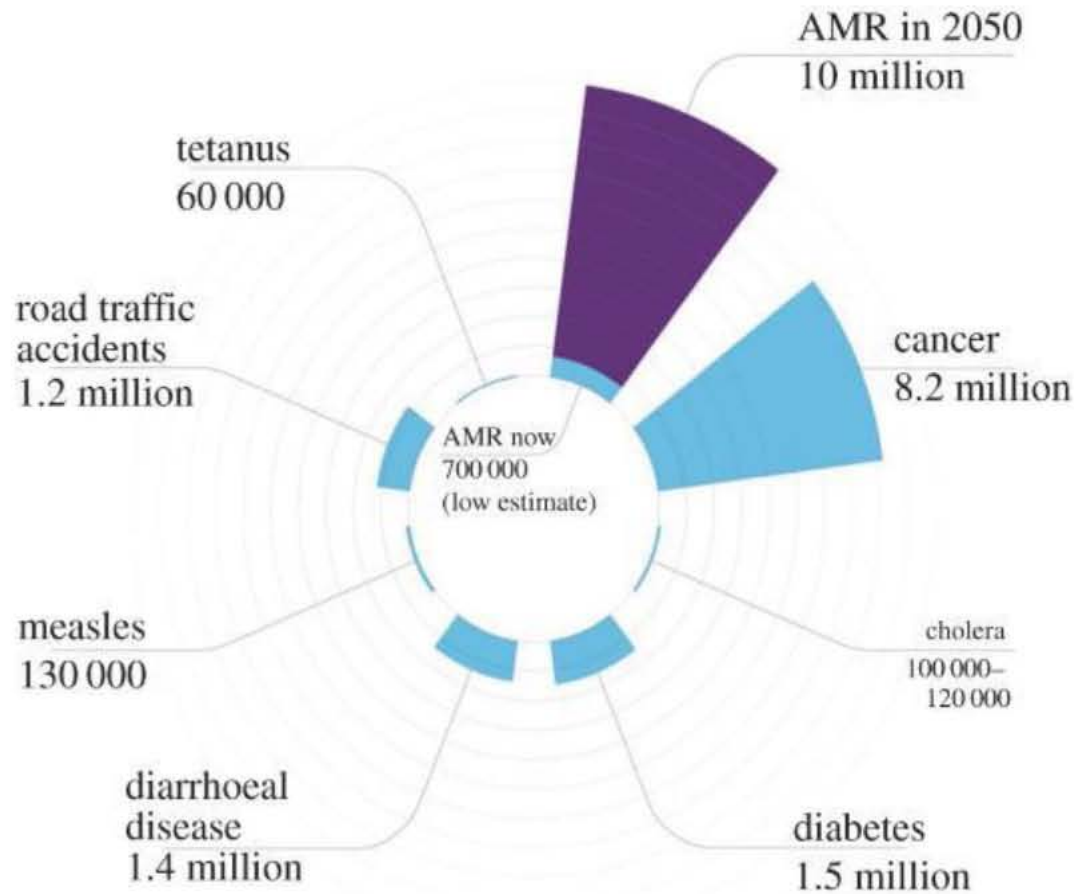
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# The role of Wastewater Treatment Plants in the control of Antibiotic Resistance dissemination

Ivone Vaz-Moreira

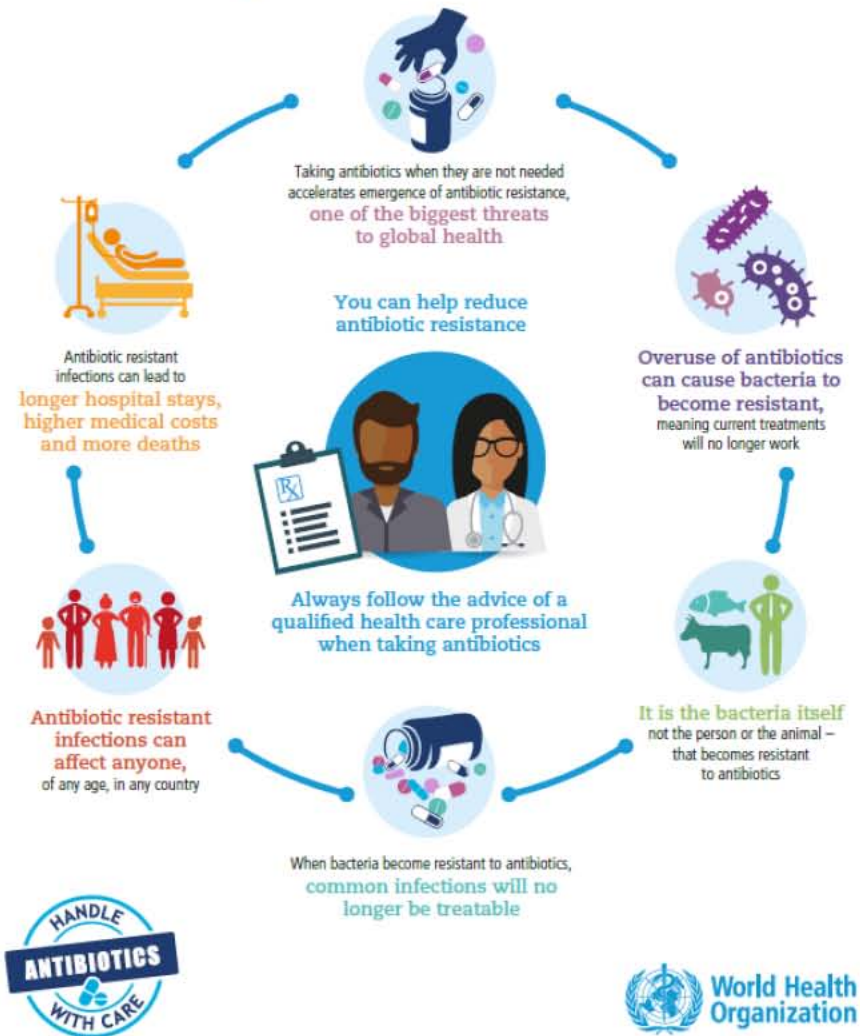


# Antimicrobial resistance – a global health problem



O'Neill. *Review on antimicrobial resistance*, December 2014. <http://amr-review.org/>

# Misusing and overusing **ANTIBIOTICS** puts us all at risk



WHO, Infographics 2017

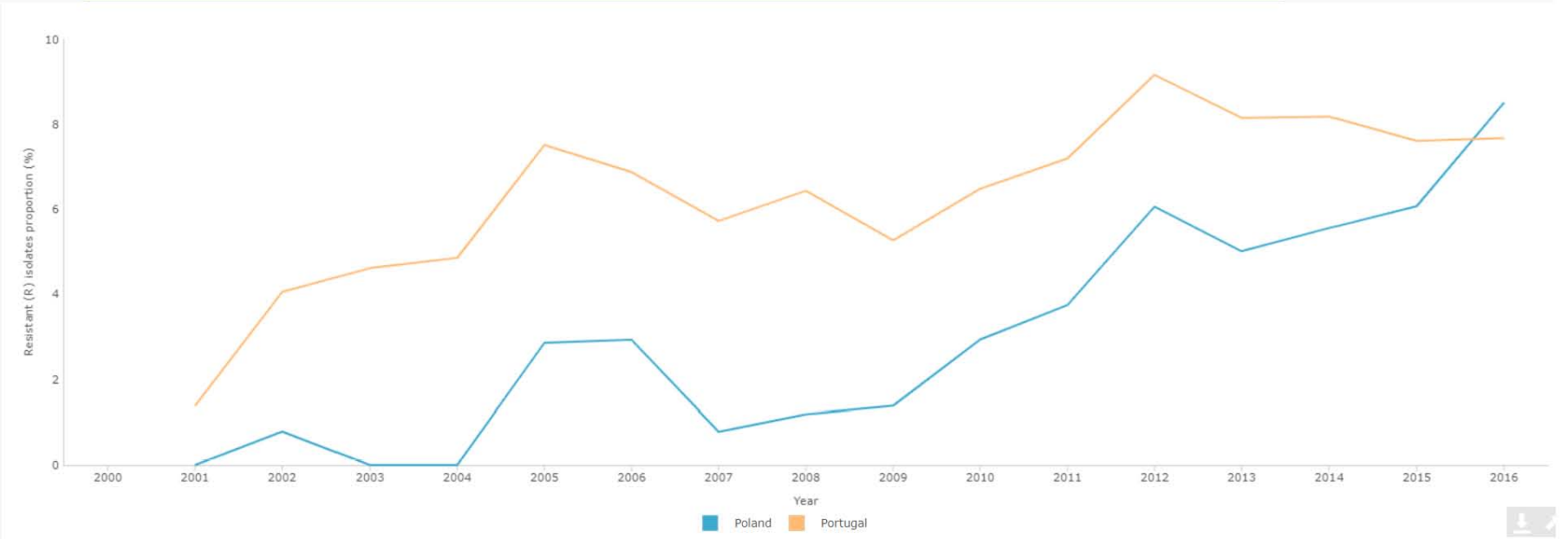


# Superbugs occurrence



## Surveillance Atlas of Infectious Diseases

← → Antimicrobial resistance ▼ Escherichia coli ▼ Combined resistance (third-generation cephalosporin, fluoroquinolones and aminoglycoside) ▼  
Resistant (R) isolates proportion ▼ 2016 ▼



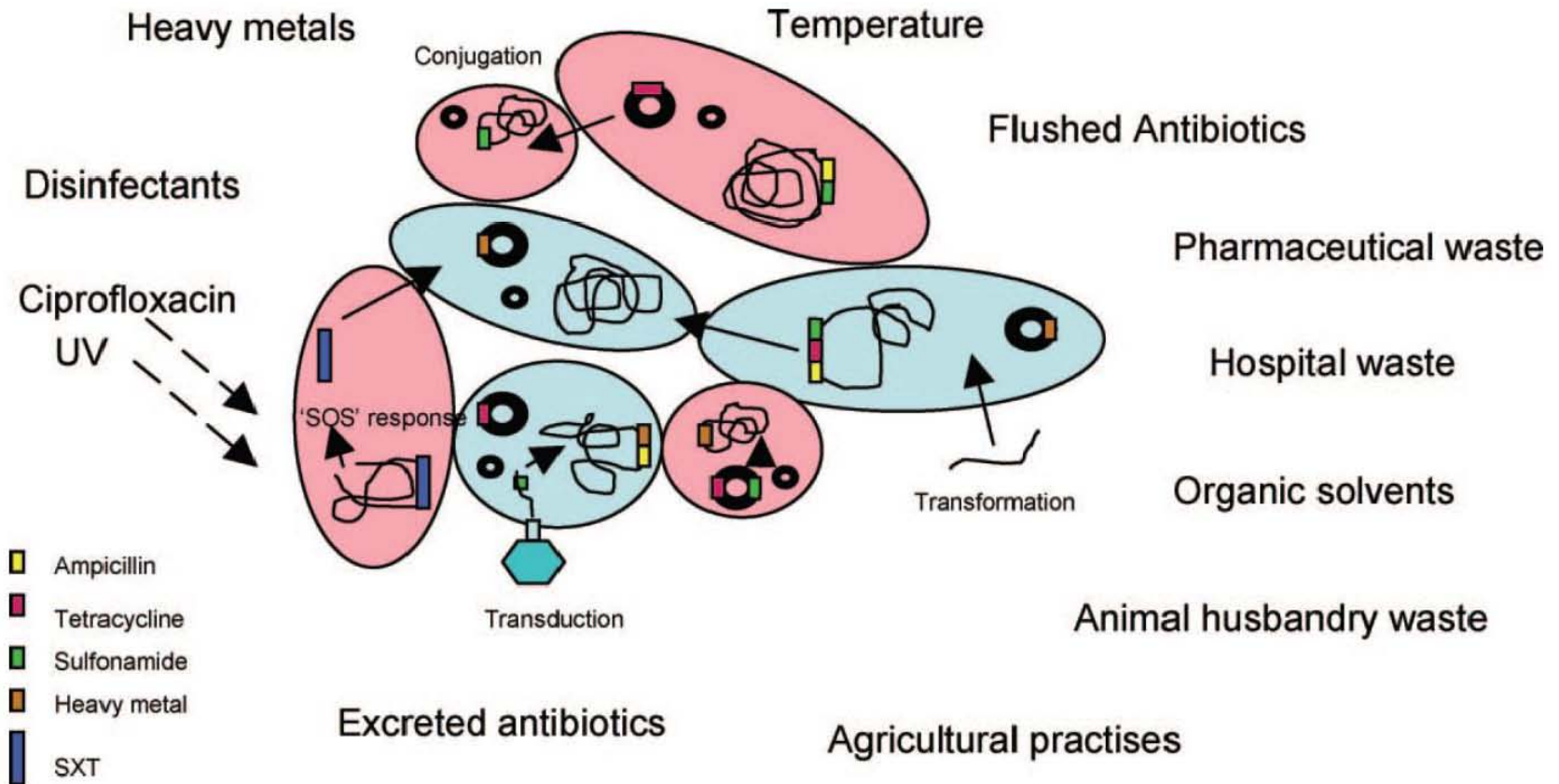
Source: <https://atlas.ecdc.europa.eu/>



# Emerging contaminants

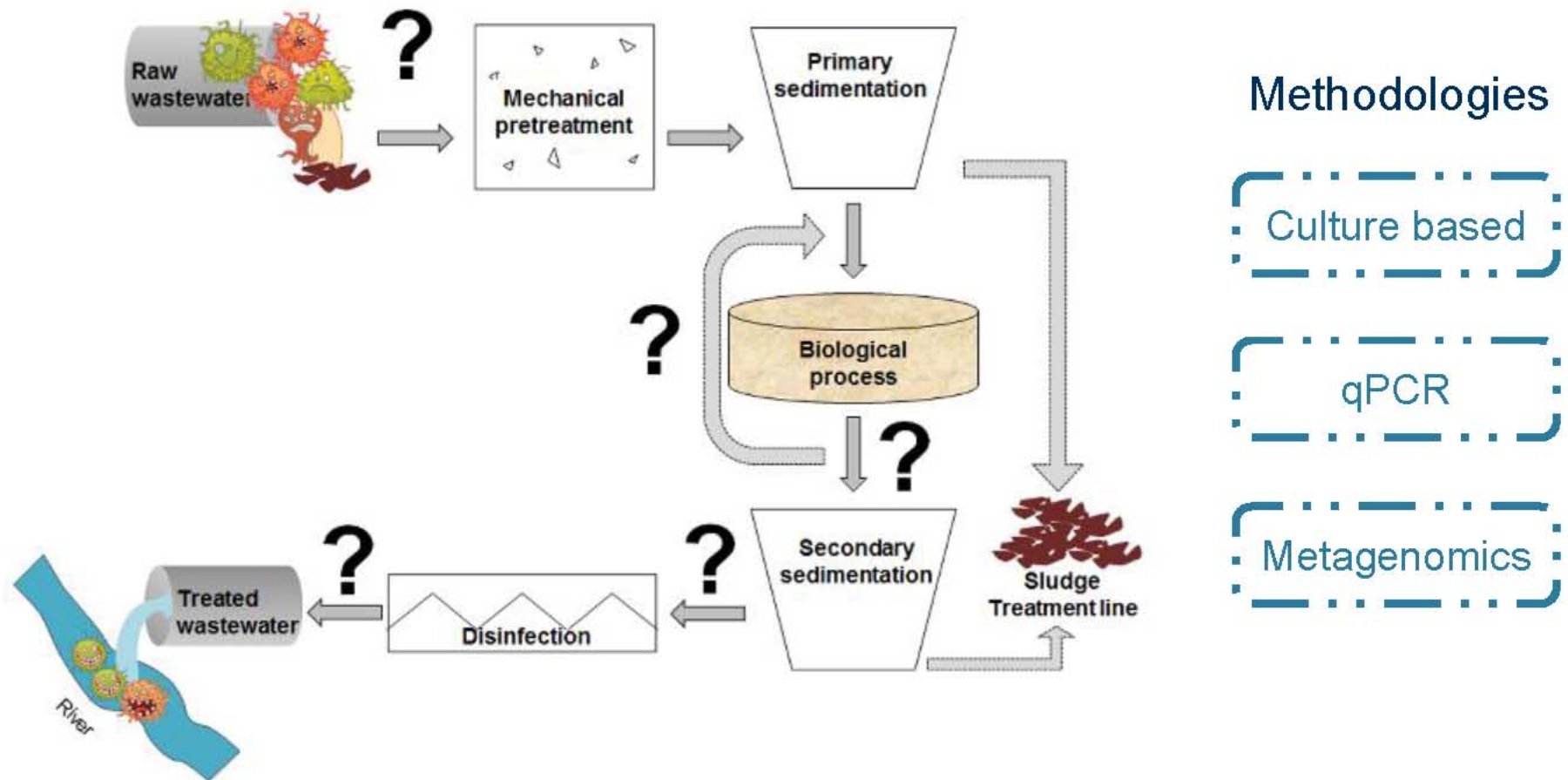


# Possible selectors of AR in WWTP



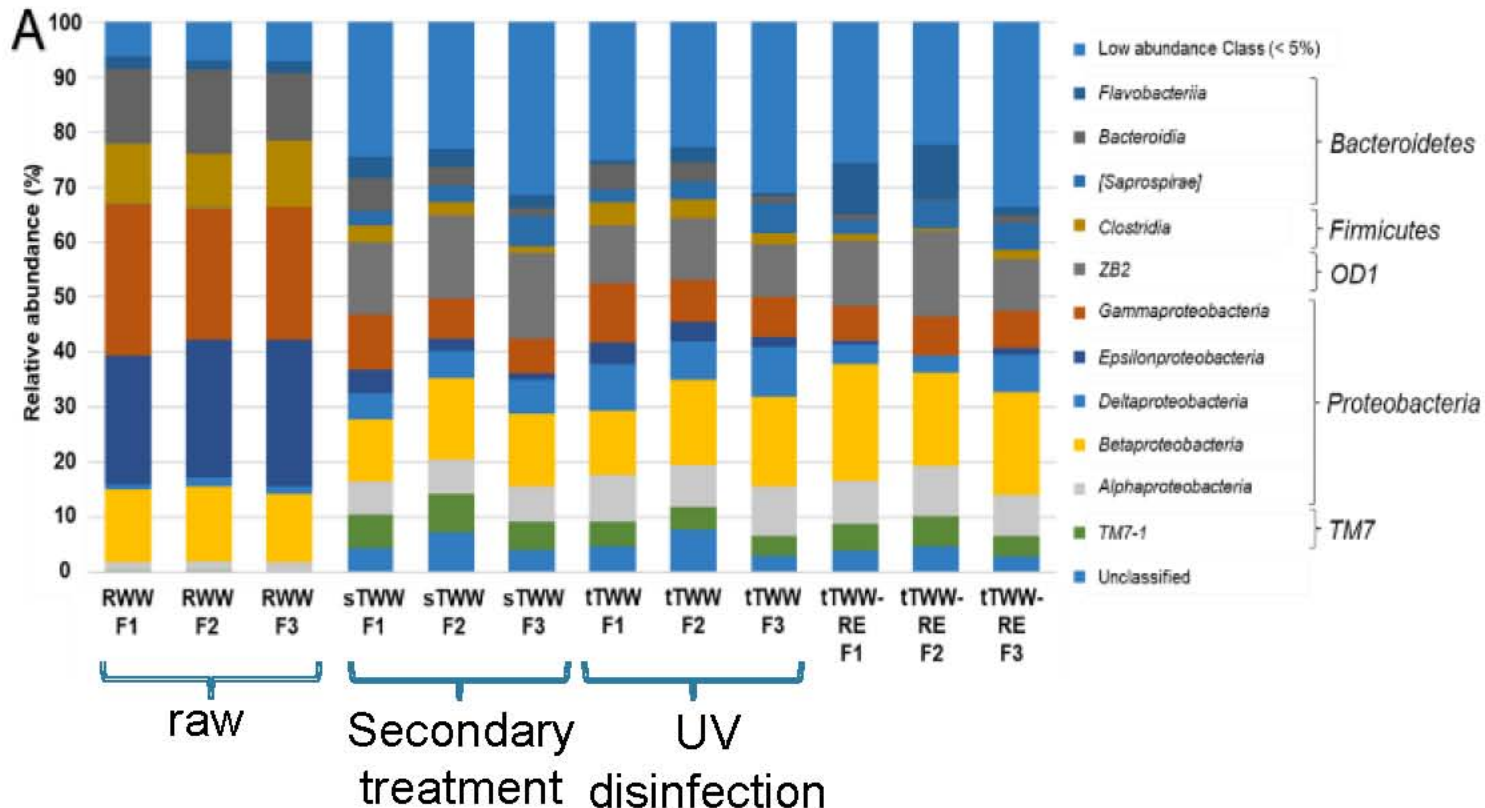
Jury et al. (2011) *Critical Reviews in Environmental Science and Technology*, 41(3), 243-270.

# The importance of the sampling and methodologies to correctly answer the question



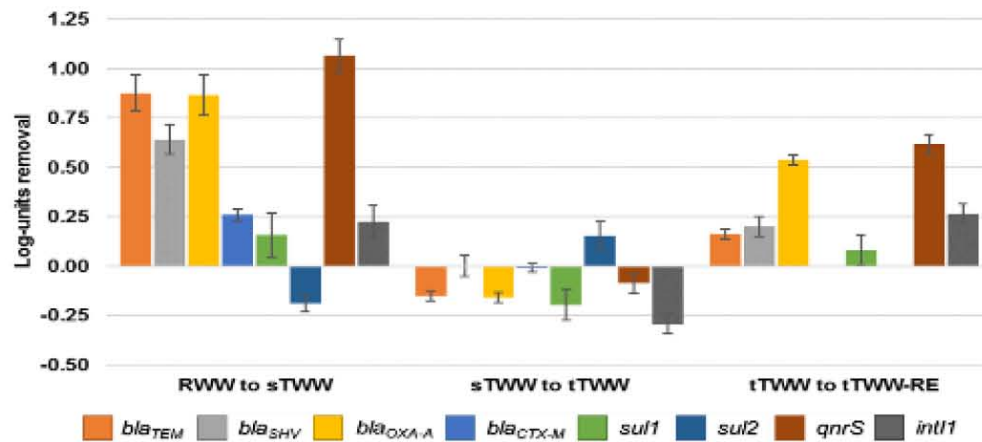
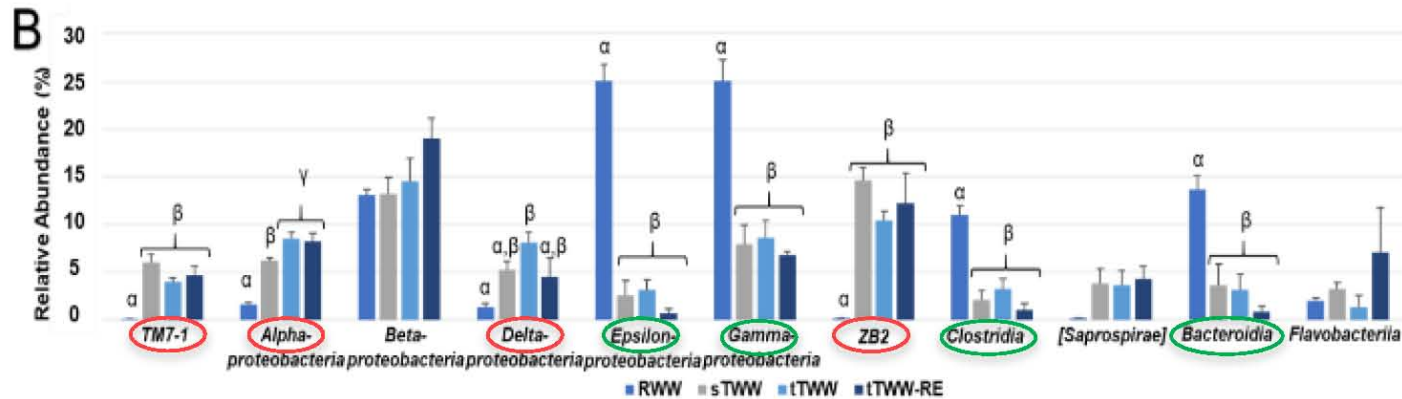
Manaia et al. (2018). *Environment International* 115, 312-324.

# Effect of the wastewater treatment in the bacterial communities



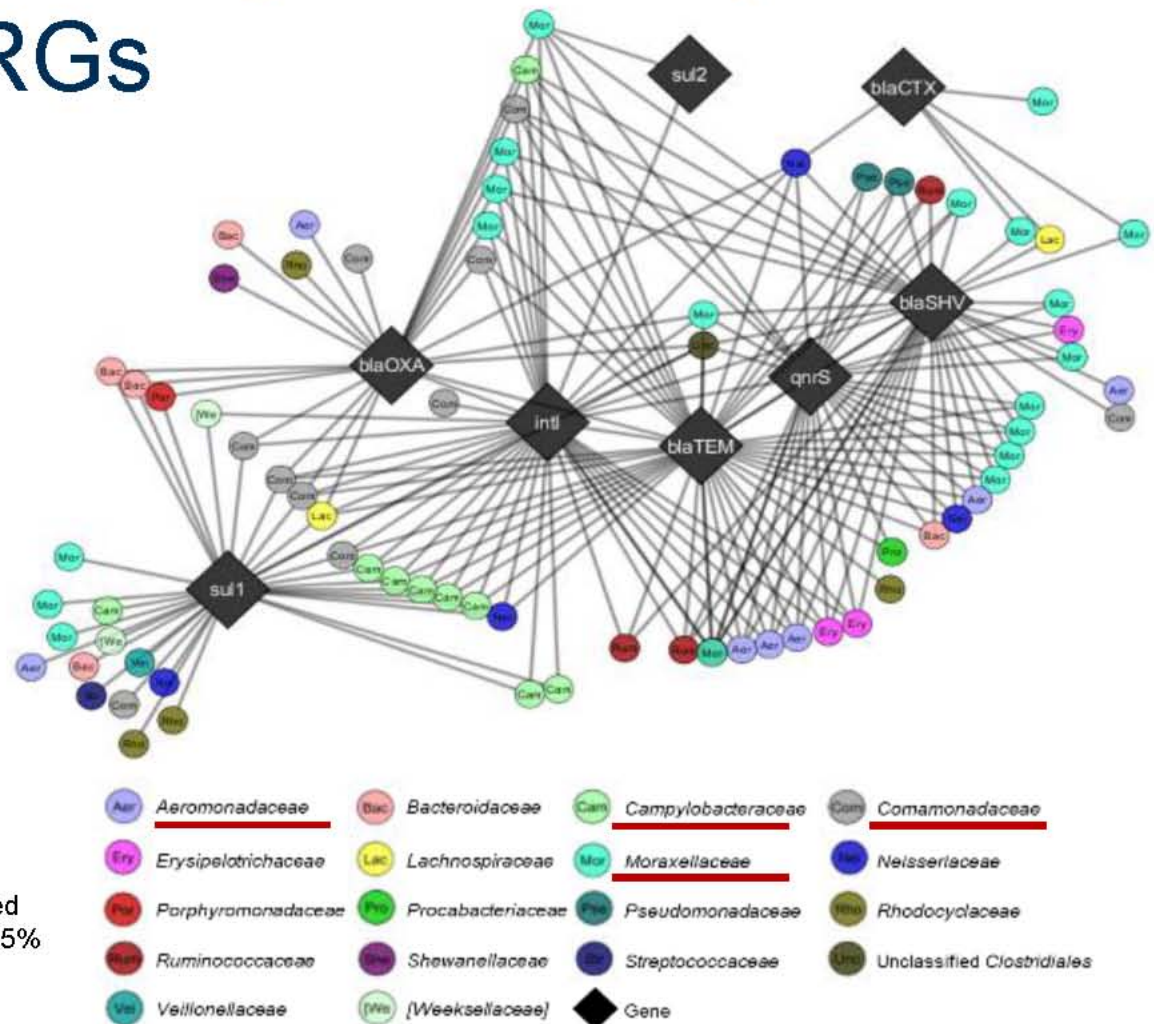
Narciso-da-Rocha et al. (2018) *Environment International*, 118, 179-188.

# Not all bacteria and ARGs are equally removed



Narciso-da-Rocha et al. (2018) *Environment International*, 118, 179-188.

# Which bacteria may be the major carriers of ARGs

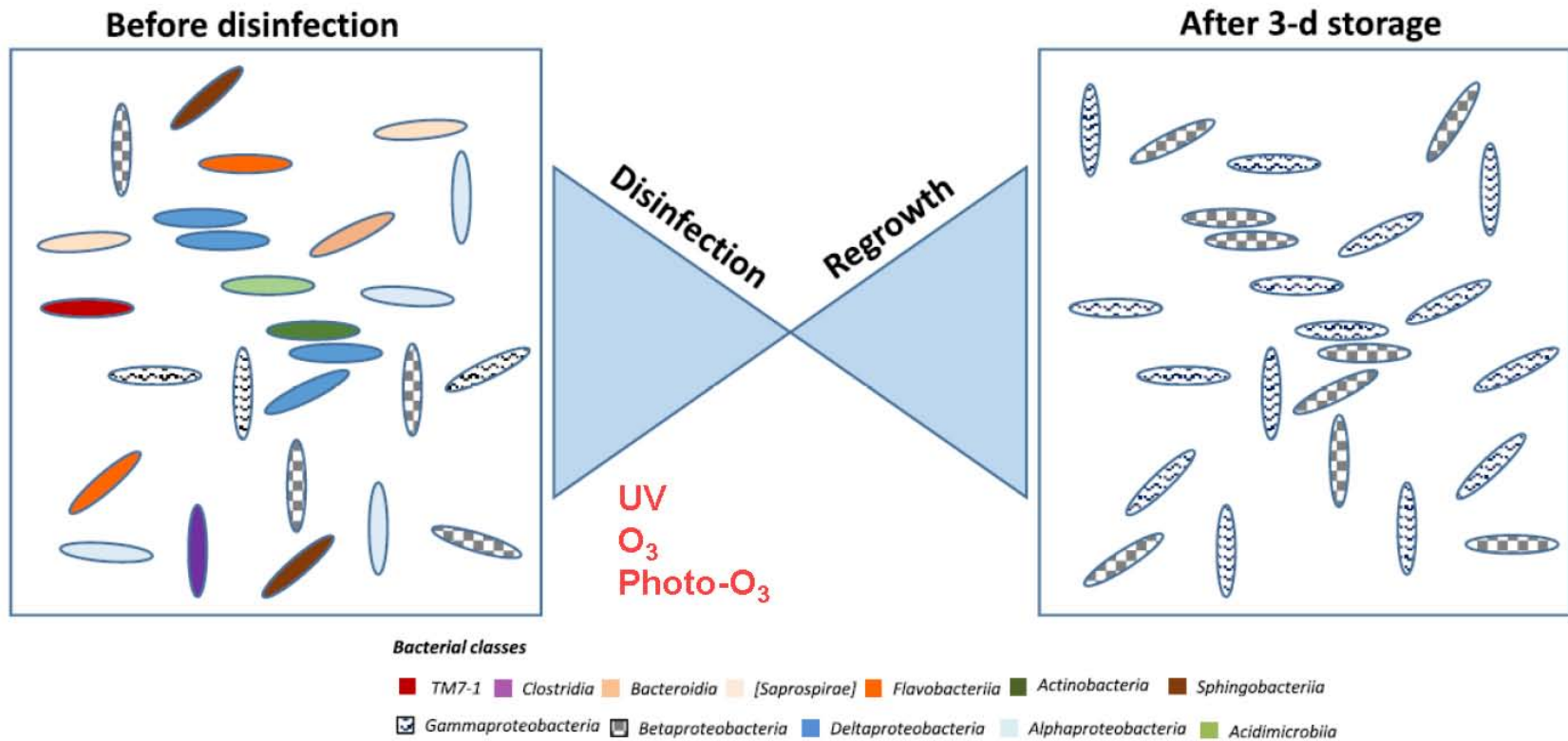


Minor bacterial populations (abundance < 5%) may also have an important role

Abundance of the OTUs observed to be correlated with the ARGs: 5.7% in RWW, 1.3% in sTWW, 1.5% in tTWW and 0.6% in tTWW-RE

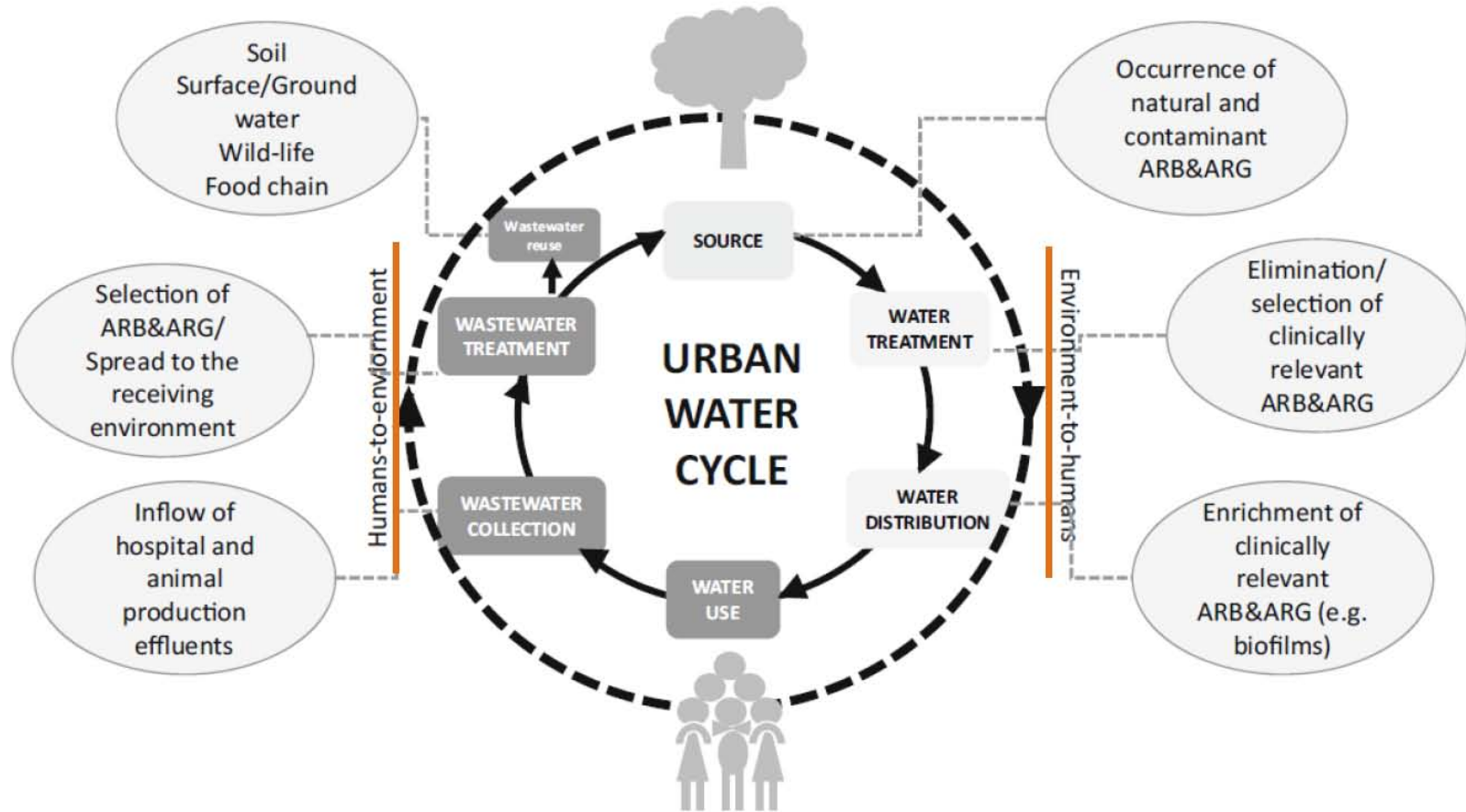
Narciso-da-Rocha et al. (2018) *Environment international*, 118, 179-188.

# Water disinfection selects *Proteobacteria*



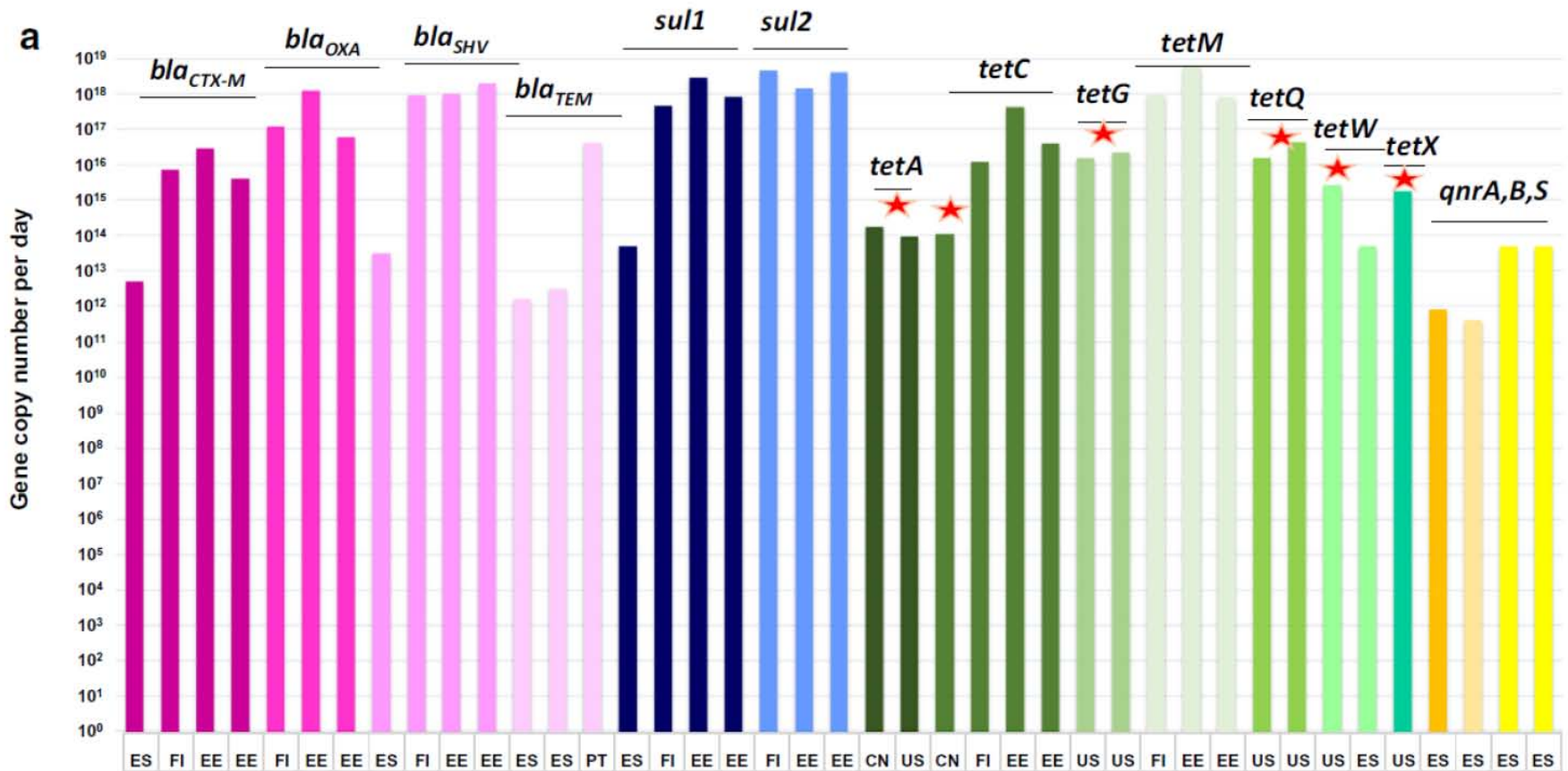
Becerra-Castro et al. (2016) *Science of the Total Environment*, 573, 313-323.

# The spread to the Environment and Humans



Manaia et al. (2016). *Applied Microbiology and Biotechnology*, 100(4), 1543-1557.

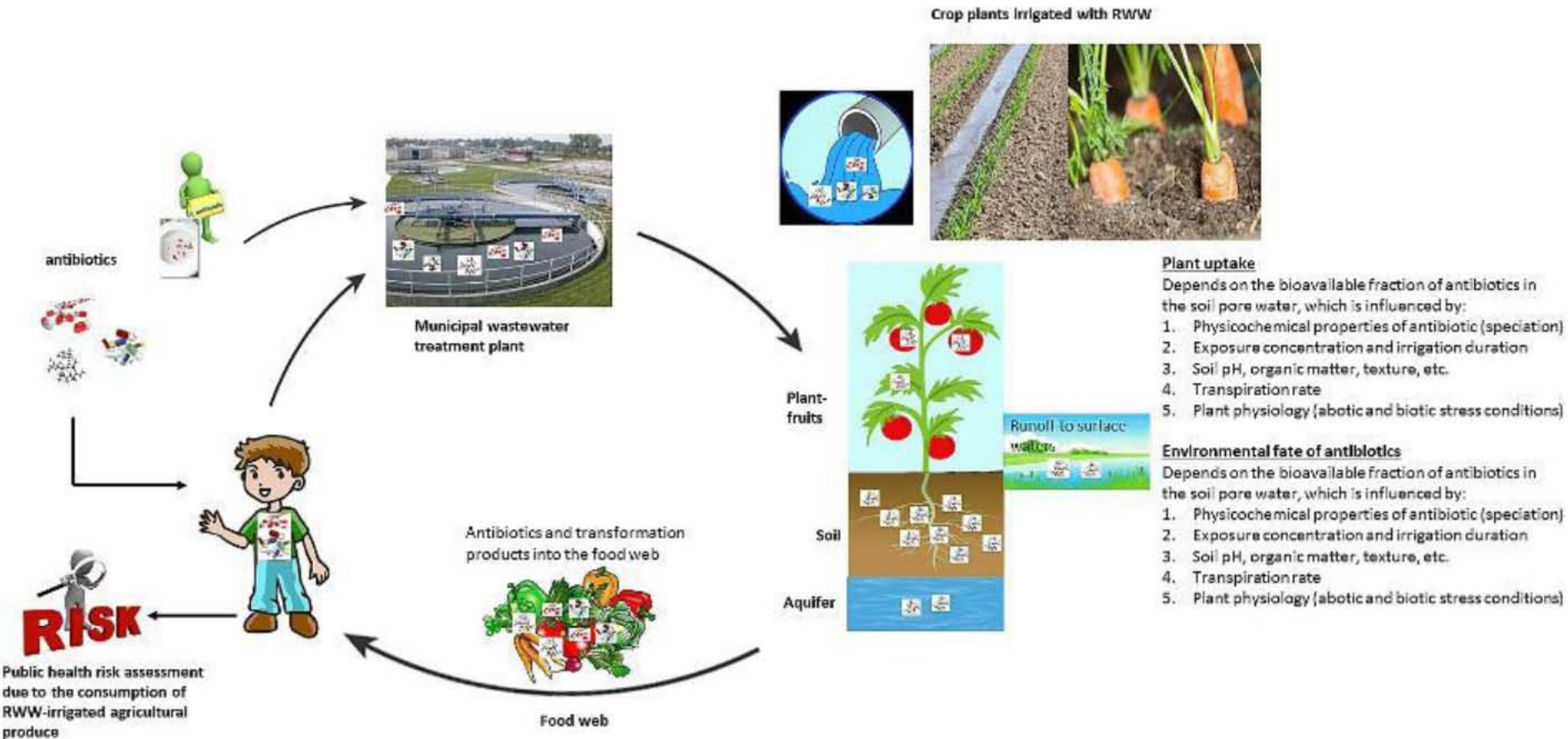
# Amount of ARGs released by WWTPs



★ UV disinfection

Manaia et al. (2016). *Applied Microbiology and Biotechnology*, 100(4), 1543-1557.

# Treated wastewater use in irrigation



Christou et al. (2017) *Water research*, 123, 448-467.

# Non-detection $\neq$ Absence of risk

Soil spiked with antibiotic resistant bacteria (ARB) harboring known antibiotic resistance genes (ARG)

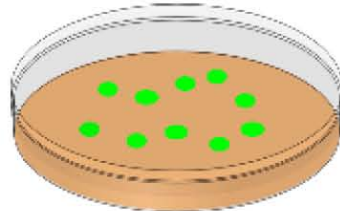


**Limit of quantification (LOQ)?**

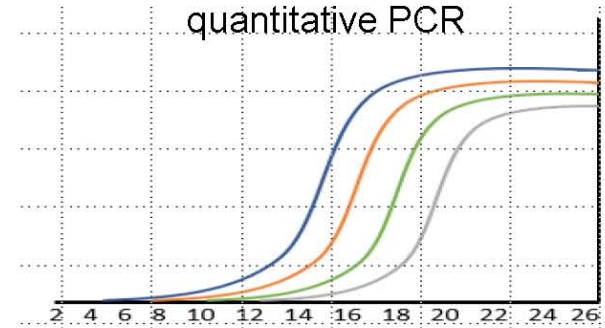
**>3 log-units ARG copy number/g soil dry weight**



Enumeration of culturable ARB

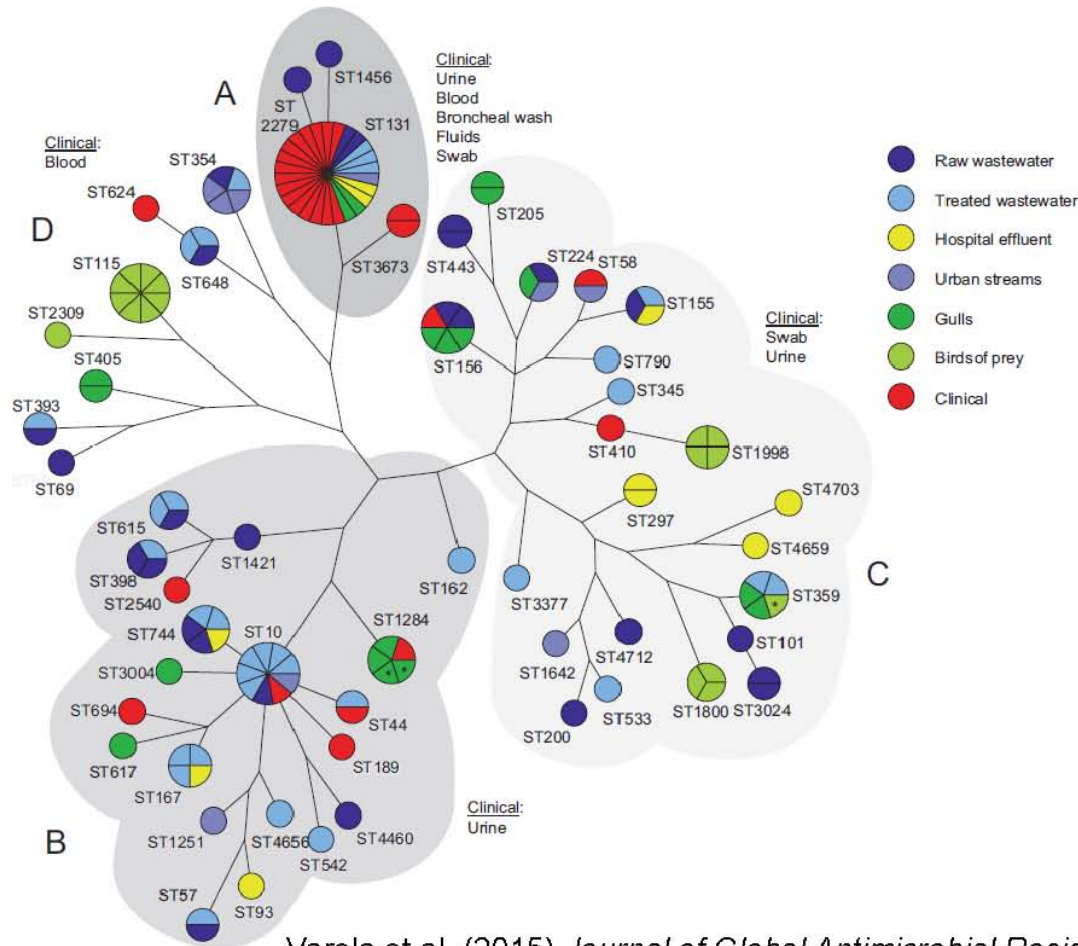


ARG determination quantitative PCR



Fortunato et al. (in press) Environmental Pollution

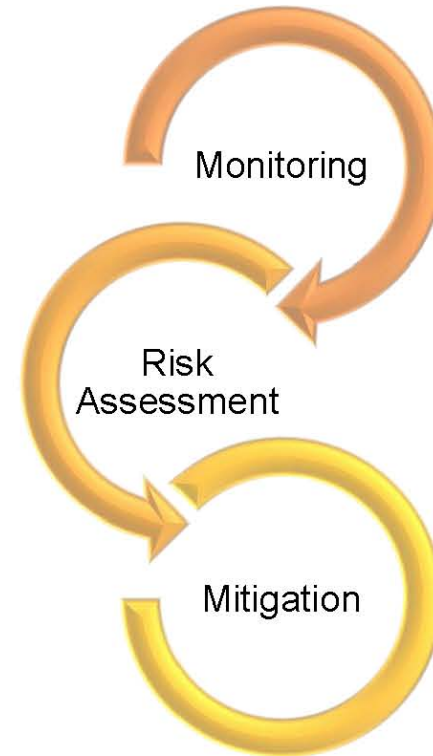
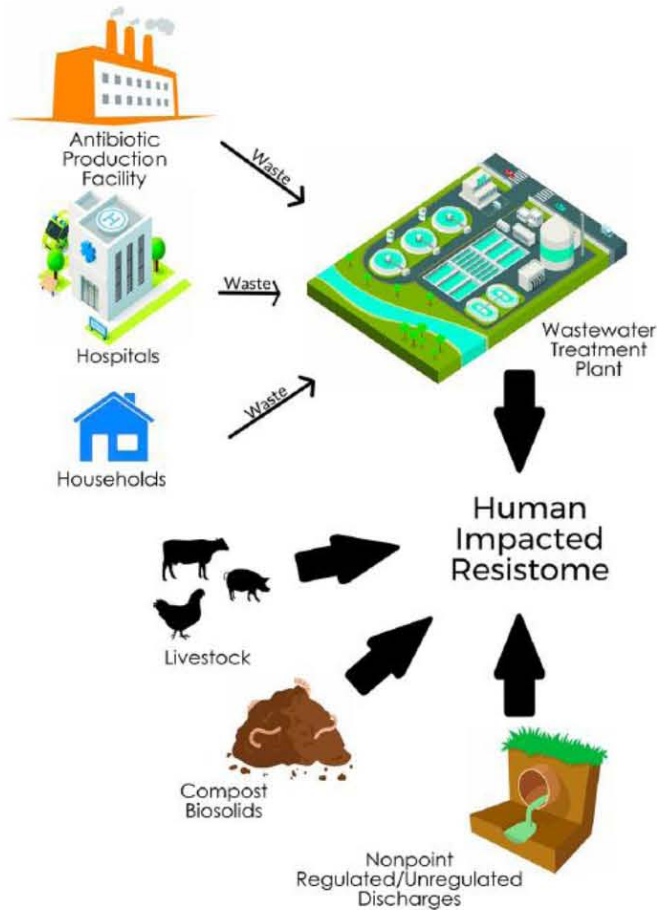
# Close relatedness among clinical, gull and wastewater *E. coli* isolates



Varela et al. (2015) *Journal of Global Antimicrobial Resistance*, 3(4), 286-289.

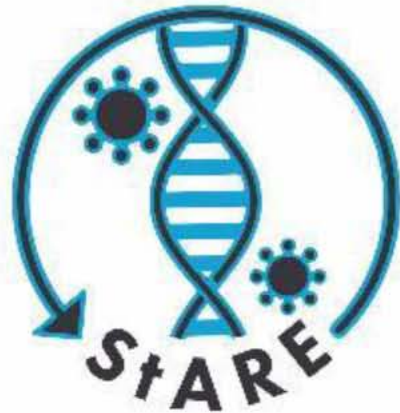
# How to mitigate dissemination?

## Environmental matrices that should be monitored



Vikesland et al. (2017) Environmental Science and Technology 51, 13061-13069

# Acknowledgments



# FCT

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