Antibiotic Resistance and the Environment...

...What we Know and What we Need to Know!

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Antimicrobial Resistance is a major public health problem.
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**INAP**

**IRELAND’S NATIONAL ACTION PLAN ON ANTIMICROBIAL RESISTANCE 2017 - 2020**

- **Strategic Objective 1:** Improve awareness and knowledge of antimicrobial resistance
- **Strategic Objective 2:** Enhance surveillance of antibiotic resistance and antibiotic use
- **Strategic Objective 3:** Reduce the spread of infection and disease
- **Strategic Objective 4:** Optimise the use of antibiotics in human and animal health
- **Strategic Objective 5:** Promote research and sustainable investment in new medicines, diagnostic tools, vaccines and other interventions

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**Centre for Health from Environment**

**OÉ Gaillimh**
NUI Galway

**Ryan Institute**
Antimicrobial Resistance is a major public health problem.
Different types of antimicrobial resistant bacteria.

Carbapenemase-producing Enterobacteriaceae (CPE) are resistant to almost all available antibiotics.

Treatment of infection with CPE very difficult.

Different types of carbapenemase enzymes – most common in Ireland and the U.K. are KPC, OXA-48 and NDM.

January 2017 - first report of death due to an untreatable infection caused by NDM-producing Klebsiella pneumoniae

CAUSES OF ANTIBIOTIC RESISTANCE

Antibiotic resistance happens when bacteria change and become resistant to the antibiotics used to treat the infections they cause.

- Over-prescribing of antibiotics
- Patients not finishing their treatment
- Over-use of antibiotics in livestock and fish farming
- Poor infection control in hospitals and clinics
- Lack of hygiene and poor sanitation
- Lack of new antibiotics being developed

www.who.int/drugresistance
#AntibioticResistance
European Surveillance of Antimicrobial Consumption Network (ESAC-Net) Surveillance data - 2016

Antibiotic consumption in community and hospital sector:

Ireland: 26.1 DDD/1000 inhabitants/day

EU/EEA Average: 23.4 DDD/1000 inhabitants/day


Antimicrobial Resistance - Humans

Antimicrobial Resistance - Humans

Figure 1: Carbapenemases detected in clinical isolates of Enterobacterales in Ireland Sept 2012 to Dec 2017.

In 2013, estimated global consumption of all antimicrobials in food producing animals was **131,109 tons**. Projected to reach **200,235 tons** by 2030.

Ireland: **103.4 tonnes in 2016**

Levels varied from **8mg/PCU** in Norway to **318mg/PCU** in China

Ireland: **52.1 mg/PCU**

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Antimicrobial Resistance - Animals

Figure 12: Frequency distribution of E. coli isolates completely susceptible and resistant to one to eleven antimicrobial classes in fattening pigs in Member States in 2015 (Source: EFSA, ECDC 2017)

Where Antimicrobials and Antimicrobial Resistant Bacteria Go
What we Know and What we Need to Know

• Current waste water treatment processes do not remove all antimicrobial resistant organisms (AROs)

• What level and type of waste water treatment is effective for the removal of AROs?

• Integrated constructed wetlands are a natural alternative to conventional wastewater treatment processes but are they effective at removing AROs?
What we Know and What we Need to Know

• Dispensing raw sewage in the vicinity of recreational bathing areas is a major risk for transmission of antimicrobial resistant organisms.

• Do current drinking and bathing water quality regulations protect public health?

Source: EPA, Urban Waste Water Treatment in 2017
Land spreading of organic wastes (animal manure and sewage sludge) is an important part of the circular economy. Studies have shown land spreading of manures increased the proliferation of ARO and abundance of antimicrobial resistance genes in soils\textsuperscript{1,2}.

What we Know and What we Need to Know

• Retail meats: 99% of chicken meats, 33% of pork products and 14% of beef products contaminated with AROs¹

• What is the level of AROs in manures from different sources?

• What treatment is effective at removing them?

• What impact does application have on soil?

Antimicrobial Resistance and the Environment –
Sources, persistence, Transmission and risk management (2017-HW-LS-1)
AREST: 2018-2021
Antimicrobial Resistance and the Environment – Sources, persistence, Transmission and risk management

Project Team

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The AREST project will:

• Map hotspots of drivers of AMR in selected local authority areas: Galway City Council, Galway County Council, Fingal County Council and Cork County Council.

• Assess the relative contributions of various sectors (healthcare, agriculture) to ARO in the environment.

• Assess efficiencies of treatment processes for removal of ARO from drinking water, wastewater and manure.

• Develop a risk ranking protocol to assess the relative contribution of various sectors on the sources and levels of AROs in the environment.
The AREST project will:

• Generate national level data on the key sources, hot spots and drivers of AMR in the environment from various sectors which will inform priority areas for action.

• Provide evidence of the extent of contamination of the environment with antimicrobial resistant organisms to support policy decisions and engage with health, agriculture and the local authority sectors on AMR.

• Produce engaging visual representations of data that will strongly support wider communication with the public and policy makers.

• Embed the “One Health” concept and build the capacity of Ireland’s research community to support Ireland’s National Action Plan on AMR.
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