Surveillance of Antibiotic-Resistant Bacteria from Wastewater Effluents Across the United States

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Background

public health

Infections With 'Nightmare Bacteria' Are On The Rise In U.S. Hospitals

MARCH 05, 2013 2:56 PM ET

By RYAN JASLOW / CBS NEWS / March 5, 2013, 3:18 PM

CDC: Deadly drug-resistant bacteria on rise in U.S. hospitals

ELSEVIER

Water Research

Volume 37, Issue 8, April 2003, Pages 1685–1690

Antibiotic resistance of *E. coli* in sewage and sludge

F.F Reinthaler, J Posch, G Feierl, G Wüst, D Haas, G Ruckenbauer, F Mascher, E Marth

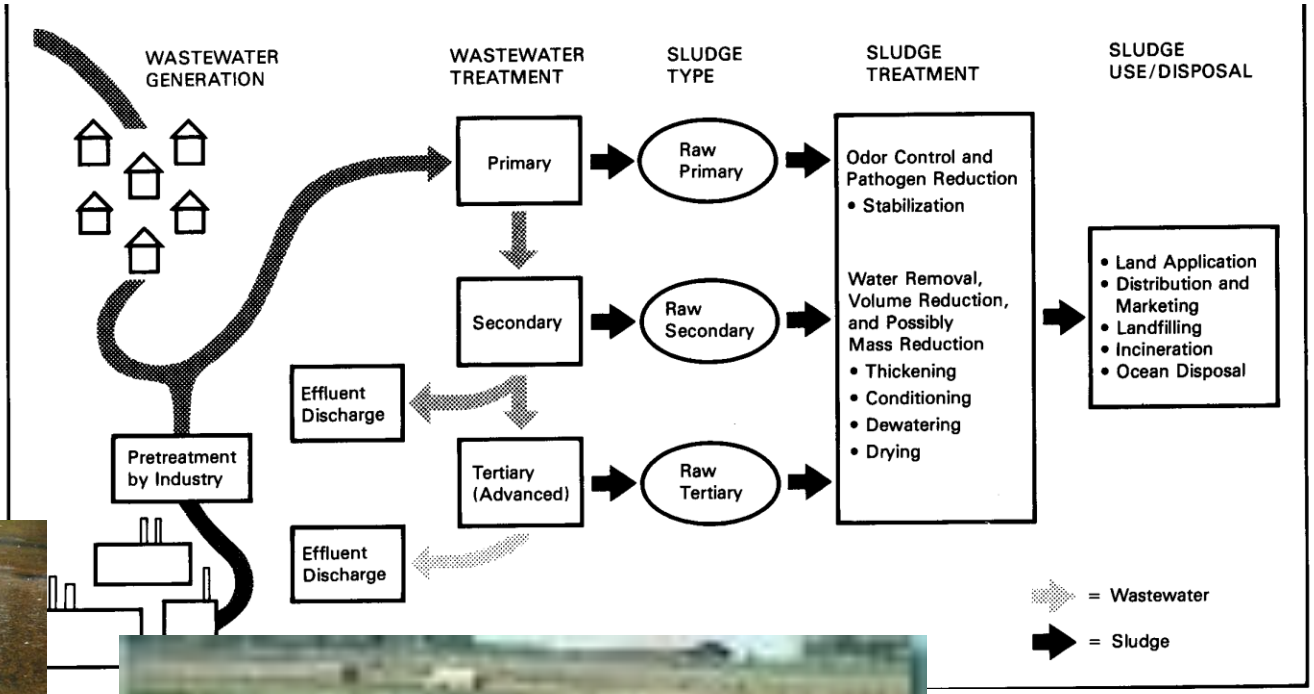
Occurrence of Antibiotic-Resistant Uropathogenic *Escherichia coli* Clonal Group A in Wastewater Effluents

Laura A. Boczek[1], Eugene W. Rice[1], Brian Johnston[2] and James R. Johnson[2]

Carbapenem-Hydrolyzing GES-5-Encoding Gene on Different Plasmid Types Recovered from a Bacterial Community in a Sewage Treatment Plant

Delphine Girlich[a], Laurent Poirel[a], Rafael Szczepanowski[b], Andreas Schlüter[c] and Patrice Nordmann[a]

Schematic of Wastewater Treatment



EPA Regulations that Govern Wastewater Treatment and Biosolid Land Application

Clean Water Act (CWA)
Enacted October 18, 1972 (PL 92-500)

EPA Wastewater and Biosolid Regulations

- Clean Water Act (CWA) 1972
  - Water quality standards for receiving waters based upon use and health and impact of aquatic and human life
- National Pollutant Discharge Elimination System Permit Program (NPDES)
- 40 CFR part 503
  - Residuals management

Why Do We Treat and Regulate Wastewater?

- The goal of disinfection is to kill or inactivate waterborne fecal indicators and pathogenic bacteria, viruses, parasites, etc.

- The purpose of wastewater disinfection is to protect water quality and downstream uses – still linked to protecting public health
  - Supplement Potable Supplies
  - Recreation
    - Crop Irrigation
    - Fish Farming

2 Surveillance Studies

- First Surveillance study conducted in 2003, focused on antibiotic-resistant *E. coli* related to uropathogenic infections from 7 geographically dispersed regions of the US
- Further studied these organisms for presence of extended spectrum β-lactamase production (ESBL)
- Second Study conducted 2013 focused on Carbapenem resistant *E. coli* from 7 geographically dispersed regions of the US

Findings of Research To Date

- 1st Study survey demonstrated *E. coli* resistant to common antibiotics (trimethoprim-sulfamethoxazole) for treatment of urinary tract infections was widespread across the US, and 92% of these isolates were also resistant to at least one other antibiotic
- ESBL production was also present in nearly half of these isolates
- 2nd study carbapenem resistant *E. coli* are widespread in wastewaters in the US
- 25% of antibiotic-resistant *E. coli* were CRE

Future Research

- Determine if archived samples also confer resistance to carbapenem antibiotics
- Examine biosolid residuals for presence of antibiotic-resistance profiles of emerging concern, CRE
- Determine the disinfection efficacy related to these organisms, are they more resistant to commonly used wastewater and drinking water disinfectants, making them more resilient and resistant to treatment

Disclaimer

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Thanks For Your Attention!

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