Human Use and Discharge

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Drivers of AR

“Antibiotic resistance (AR)” = Mutations or acquisition of genes that reduce/eliminate the effectiveness of antibiotics

“One-Health” assumes human, animal and ecosystem health are interconnected, and health solutions must cross the interfaces

Antibiotic use

Industry

Humans

Agriculture

Wastes to environment, including fecal matter

Human AR exposure in developed countries


Antibiotic use, wastes and waterborne AR

- Large animal feedlot lagoons = An analogue for human discharges/exposures without local waste treatment

- 27 feedlot lagoons in KS and NE
- None, therapeutic vs. non-therapeutic use
  - If antibiotics were used, AR is gained in the whole herd
  - Wastes are driving AR spread?

Untreated domestic and industrial wastes drive AR

- AR in the Almendares River in Cuba
- Antibiotics are used very prudently
- Industrial and domestic wastes dominate environmental AR exposures

Human migration and $bla_{NDM-1}$ dispersal

- NDM-1 protein = multi-resistance
- First noted in Delhi (2008), but now global
  - Very mobile (plasmids)
  - Pilgrimages to pristine locations
- Compare $bla_{NDM-1}$ in water between urban areas and pilgrimage sites

Population increases from 300k to 1.0-1.5M
Seasonal $bla_{NDM-1}$ exposures

Visitors have more $bla_{\text{NDM-1}}$ in their wastes than residents.

http://www.bbc.co.uk/news/health-28368313
Carbapenem-resistant isolates of apparent fecal origin include numerous bla<sub>NDM-1</sub> positive pathogens.
Observations

- Antibiotic use and regionally poor water quality drive the global spread of AR
- Developed countries are complacent because of locally clean water
  - AR is massively discharged in wastes where management is limited
  - International travel (human, wildlife) spreads local AR to global scales
- “One Health” strategies must include:
  - “Wastes” and globally improved water quality
  - International environmental surveillance

http://www.bbc.co.uk/news/health-27695242
http://www.creativefibrotech.com/frp-toilet-modules.html