Antibiotic Resistance and the Agriculture-Health Linkage

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Center for Health Impacts of Agriculture
Acknowledgment

- **CHIA Executive & Advisory Committees:**
  - John Baker
  - Eric Crawford
  - Fred Derksen
  - David DeWitt
  - Walter Esselman
  - Ian Gray
  - Jack Harkema
  - Karen Klomparens
  - Terrie Taylor
  - Ned Walker (co-leader)

- **MSU Institutions:**
  - OVPRGS
  - Provost June Youatt
  - CANR
  - CNS
  - CHM
  - COM
  - CVM
  - Dean of Graduate School

Center for Health Impacts of Agriculture
Our Center proposes to conduct research covering these 3 pathways by which agriculture affects health, with the goal of improving domestic and global health. MSU has the opportunity to become a global leader in agricultural health.
MSU Center for Health Impacts of Agriculture (CHIA): Research

- Antimicrobial resistance from antibiotic use in agriculture → environmental exposure pathways, human health impacts, & alternatives
- Impact of newly irrigated agriculture on malaria incidence, aflatoxin exposure, and child growth in Malawi
- New risk assessment paradigms for nutrients (trans-fats), carcinogens, and nutrient-toxin interactions
- Future potential areas: GMOs, emerging zoonoses, water resource linkages to food production and health... your suggestions
Antibiotics

Compounds that kill bacteria or slow their growth

- 1928: Alexander Fleming’s staphylococcus cultures in lab
  - *Penicillium* contaminating one dish destroyed bacteria
- “Mould juice” (penicillin) found to be effective for scarlet fever, pneumonia, meningitis, diphtheria, gonorrhea, syphilis, etc.

Today: >150 antibiotics developed

- Before antibiotics, infections caused >33% all deaths in US
- >200M lives saved by penicillin (Roberts & Ingram 2001)

Dangers of overuse

- Adverse GI effects
- Antibiotic-resistant bacteria
Antibiotic resistance recognized as national and global threat

- CDC and WHO have identified antibiotic resistance as one of greatest public health threats today
  - [http://www.cdc.gov/narms/](http://www.cdc.gov/narms/)

- Although *clinical* use/misuse is identified as the major cause, uses in animal agriculture may play role

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High antibiotic use / misuse can increase selection pressure on bacteria to evolve

**How Antibiotic Resistance Happens**

1. Lots of germs. A few are drug resistant.

2. Antibiotics kill bacteria causing the illness, as well as good bacteria protecting the body from infection.

3. The drug-resistant bacteria are now allowed to grow and take over.

4. Some bacteria give their drug-resistance to other bacteria, causing more problems.

Animal agriculture link to antibiotic resistance?

- Antibiotics used regularly in animal feed
  - Combat bacterial infections
  - Promote growth

- FDA steps in
  - Guidances #209, #213 (2013, 2014): voluntarily phase out growth promotion indications for “medically important antibiotics”
  - Proposed changes to Veterinary Feed Directive (VFD) on veterinarians in prescribing & administering antibiotics in feed

  - 85% *Salmonella* strains had no resistance to medically important antibiotics
  - 5-drug resistance (ampicillin, chloramphenicol, streptomycin, sulfonamide, & tetracycline) in *Salmonella* declined to 19.5% from...

- Antibiotic resistance associated with >23,000 deaths & 2 million illnesses in US each year
- Executive order: fed. government work domestically & internationally to reduce emergence & spread of antibiotic-resistant bacteria
- New interagency task force to develop 5-year action plan for “National Strategy for Combating Antibiotic-Resistant Bacteria” – experts in health & veterinary medicine
- NIH, BARDA, FDA: $20 million prize to develop rapid diagnostic test for health care providers to ID resistant bacterial infections in patients
- → MSU opportunities!