Drug-Resistant Foodborne Campylobacteriosis in Humans: Is there a link to Antibiotic Use in Agricultural Animals?

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Objectives

• Try not to overwhelm you or me with size of the topic

• Review highlights of recently published systematic literature review on *Campylobacter* foodborne illness

• Suggest opportunities for improvements in research methods based on our findings

• Encourage us all to search for collaborative solutions
Disclosures & Research Team

• Funding
  • Animal Health Institute, August – October 2014
  • MUSC – salary support, all team members
  • Ralph H. Johnson VAMC – M.A. McCrackin

• Pre-Study Bias Discussion
  • All team members – no bias disclosed; all consume meat & dairy products
Background

• 2013 CDC Report
  › Drug-resistant *Campylobacter*
  › Drug-resistant non-typhoidal *Salmonella*

• What is the literature evidence for a link between antibiotics used in agricultural animals intended for food and antibiotic-resistant infections in humans?
Systematic Literature Review

SCOPUS & AGRICOLA search results (2005-2014) 
(n = 621)  
Additional publications identified through other sources  
(n = 46)

Articles remaining after 118 duplicates removed  
(n = 549)

Pre-2010 articles excluded  
(n = 354)

Title/Abstract Screen  
(n = 195)  
Articles excluded  
(n = 145)

Full-text articles assessed for eligibility  
(n = 50)  
Full-text articles excluded, with reasons  
(n = 14)

Articles included in qualitative synthesis  
(n = 36)

Findings: On-Farm & Processing Plant

- Production turkeys brooding to slaughter
- Therapeutic dosing with macrolide (Tylan®) in drinking water
- Increased prevalence of macrolide-resistant *Campylobacter coli* after treatments
- Detection post-chill very low
Findings: Turkeys & Tylosin

Findings: On-Farm & Processing Plants

- Conventional vs antibiotic-free (ABF) farms – no difference overall Campylobacter prevalence
- Swine exposed to antibiotics (feed, injection) showed higher prevalence of antibiotic resistance

Human Disease

- Transmission of *Campylobacter jejuni* clone SA to humans through raw cow’s milk
- Tetracycline resistance
- No information about antibiotic use on farm
- No information about prior antibiotic use in the people who became sick

Human Disease

- History of fluoroquinolone antibiotics taken in previous 12 months
- 2.4 times more likely for human infection with *Campylobacter*
- 3.8 times more likely for human infection with fluoroquinolone-resistant *Campylobacter*

Conclusions

• On farm antibiotic treatments increase colonization of animals with antibiotic-resistant *Campylobacter* spp.

• Antibiotic-resistant *Campylobacter* can be transmitted to humans in raw animal products

• Current literature is inadequately detailed to establish a causal relationship between antibiotic use in agricultural animals & antibiotic-resistant campylobacteriosis in humans
Knowledge (Data) Gaps

- Studies focus on 1 – 2 steps of the food production pathway
- No studies followed food production and processing chain from farm to fork
- Very few described antibiotic use on farm

Credit: CDC, Atlanta, GA
Research in the Future

- Standardized methods of culture & antibiotic resistance testing

Figure credit: USDA National Veterinary Accreditation On-line Training Program
Research in the Future

- Determine gold standard for genetic analysis – perhaps whole genome sequencing is the future
- Transparency about on farm antibiotic usage (drug, dose, duration)
- Details about prior antibiotic use in humans with foodborne illness
- Determine appropriate metrics for public policy development
Non-typhoidal Salmonella

- Effects of antimicrobial use in agricultural animals on drug-resistant foodborne salmonellosis in humans: A systematic literature review. Helke KL, McCrackin MA, Galloway AM, Poole AZ, Salgado CD, Marriott BP. Crit Rev Food Sci Nutr, 2016 Sep 7:0. [Epub ahead of print]
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