Residue & Resistance: Antibiotics in Meat

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The Centers for Disease Control & Prevention (CDC) issued an alarming report the first week of April 2018 about a superbug nicknamed "nightmare bacteria", scientifically named Carbapenem-Resistant *Enterobacteriaceae* (CRE), that is resistant to antibiotics. To give you a point of reference, you are probably more familiar with other superbugs such as Methicillin-Resistant *Staphylococcus aureus* (MRSA) in people and Methicillin-Resistant *Staphylococus pseudointermedius* in pets (MRSP).

While the CDC could have focused on a number of superbugs, the organization chose to focus on carbapenemase-producing strains for this study, in part because of their propensity to spread and their establishment in many U.S. states. The study results illustrated that 1 in 10 (11%) people were asymptomatic carriers of CRE, meaning they can spread the bacteria within the community. One expert called it, "human mosquitoes". So, the notion that superbugs are only contained to hospital settings is false. Indeed, it is well-known that MRSA and MRSP have breached the hospital/veterinary community boundary.

Fortunately, the CDC launched an ambitious containment strategy that could potentially reduce the number of nightmare bacteria cases in one area by 76% over three years. While this is promising, it is a defensive strategy. So, what can we do offensively to help combat these superbugs for us and our companion pets?

First and foremost, you could limit the amount of antibiotics you and your pets take. This is not saying to avoid taking an antibiotic if it is necessary. However, the doctor or veterinarian needs to be careful. Each class of antibiotic is for a specific bacterium, but some classes build resistance in the body to other classes of antibiotics. As the CDC points out, "The use of antibiotics is the single most important factor leading to antibiotic resistance around the world. Antibiotics are among the most commonly prescribed drugs used in human medicine. However, up to 50% of all the antibiotics prescribed for people are not needed or are not optimally effective as prescribed."

You might be thinking to yourself, "Oh good; I already limit antibiotic drug use in my household."

That's great; but you may not be aware of the often overlooked incidental and continuous ingestion of antibiotic residue.

For a long time, feed animals were not given antibiotics to treat an actual bacterial infection. Concentrated animal feeding operations (CAFO) were notorious for continuously giving non-veterinary prescribed (over-the-counter) antibiotics (or antimicrobials) for growth promotion and as a prophylaxis to stop the potential spread of diseases.

Every so often over the past 40 years, the U.S. Food and Drug Administration (FDA) has tried to limit the use of antibiotics in feed animals. Finally, the organization had the ability to implement changes that took effect in 2017. The FDA states, "…a process begun in 2013 to transition antimicrobial drugs with importance in human medicine (medically important antimicrobials) that are used in the feed or drinking water of food-producing animals to veterinary oversight and eliminate the use of these products in animals for production (e.g., growth promotion) purposes."

This ban is only a small step. Antimicrobials – which include antibiotics – can still be used for sub-therapeutic (preventative) purposes.

Critics point to a comparative ban on antibiotics in the European Union. Even though the ban was instituted in 2006, many farmers were found to still be using antibiotics to fatten their livestock. The FDA has an excellent report that has tracked sales of antimicrobials for use in food-producing animals. In 2016 – the year before the ban took effect – the amount of antimicrobials sold for feed animals was over 30 million pounds. As a point of reference, the Pew Charitable Trusts reports that 7.7 million pounds of antibiotics were prescribed to humans in 2011. 2017's numbers on antimicrobials sold for feed animal use should be out in December 2018. We will definitely keep an eye out for it.

It should be noted that in the early 2000's, the FDA made it illegal to give poultry fluoroquinolones because of evidence that they spawn resistance to the bacterium, *Campylobacter*. However, Danofloxacin, a fluoroquinolone, is approved to treat and control respiratory disease in cattle that are infected as well as in cattle that are at high-risk of developing disease. Enrofloxacin is approved for the same purposes in cattle, as well as to treat and control respiratory disease in swine. Both need a veterinary prescription and are given as injectables.

Another safeguard – the U.S. National Residue Program (NRP) for Meat, Poultry, and Egg Products – is administered by the U.S. Department of Agriculture's (USDA) Food Safety and Inspection Service (FSIS). This inspection team samples animal products for all sorts of chemicals from antibiotics to pesticides. The overall results show that less than 1% of the samples violate the stated threshold of allowable levels. Comparing the violative list to the non-violative list (chemical being detected, but below threshold level) is disturbing and confusing in terms of food safety and hygiene issues.

Both lists are disproportionately filled with antimicrobial drugs. In 2017, the inspector-generated sampling program showed that the predominant violative residues were the antibiotics ceftiofur (27%) and penicillin (21%). On the non-violative side, penicillin came in at 12% with 88 samples detected as low-grade positive and ceftiofur was 4% with 32 samples. Two other antibiotics – tulathromycin and oxytetracycline – had non-violative listings of 182 and 141 detected samples, respectfully. The moral of the story is humans and pets are continuously ingesting antibiotics at some level through commercial meat, milk and poultry, which can lead to antibiotic resistance.

You might be thinking to yourself, "Oh good; I only buy antibiotic-free meat, milk and poultry."

That's great and definitely a good step forward. But, there is also the environmental consideration.

Like humans, animals do not fully metabolize antibiotics: 75–80% of tetracyclines, 60% of lincosamides, and 50–90% of macrolides are excreted unchanged. Agricultural waste is therefore expected to contain high levels of antibiotics; numerous studies have confirmed the presence of high levels of antibiotics in agricultural waste from a variety of animals.

You might be thinking to yourself, "Oh good; the U.S. government has containment laws ~~and~~ with the new limitation of antibiotics in feed animals."

Yes and no; the waste from years ago still exists. Additionally, waste still gets into groundwater, rivers, soil and plants. The laws protecting humans and pets from agricultural waste in waterways have been weak and ineffective for years and are currently being dismantled by the current head of the Environmental Protection Agency (EPA). Yes; some states do have additional laws to augment the federal laws. For instance, all of Wisconsin's CAFOs are required to have Clean Water Act permits, but

one activist from the state notes that water contamination from dairies is still a widespread and growing threat to public health throughout the country, and presumably elsewhere.

While this article has focused on antibiotic residue, antibiotic resistance must also be considered. Antibiotic resistance involves the transfer of antibiotic resistance genes from livestock to humans and companion animals. Numerous studies have shown that the bacteria in cattle, pigs and poultry are building up resistance to antibiotics. Additionally, other studies have also demonstrated the presence of antibiotic-resistant organisms and antimicrobial resistance genes in animal manure. The bacteria have mutated and become stronger to survive, so that the antibiotics in our arsenal may no longer be effective.

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