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Letter to the Editor

Superbugs: the ever growing threat in our food supply

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Dear Editor,

Antibiotic resistance is rapidly rising. Many bacterial infections are now very difficult, and sometimes impossible, to treat. Gram negative bacteria are the pointy end of this growing problem, including very common bacteria such as *E. coli*.[1,2]

Antibiotic resistance is proportional to use. The more antibiotics used, the more resistance develops and spreads. This is both in individuals (e.g. with pneumococcus) and for populations in different countries.[3–5]

With many common bacteria, transmission is almost entirely human-to-human (e.g. pneumococcus, gonococcus, meningococcus). Thus, any antibiotic resistance seen in these bacteria will be almost entirely due to antibiotics used in the human sector. However with some other bacteria, the resistance seen is almost entirely due to what has occurred in the agriculture sector. Examples are non-typhoid salmonella and campylobacter. In developed countries these bacteria are almost entirely acquired from food animals (via foods). These are zoonoses, and thus almost all the antibiotic resistance is a result of what happens with antibiotic use in food animals. Vegetarians are also at risk because water, food crops and fields (via manure) can be contaminated with resistant bacteria. There is also the additional chance of cross contamination of non-meat products from meats along the food chain.[6]

There are other bacteria where the risk of acquisition from animal sources is more difficult to precisely define, but appears to be quite important. Examples are *E. coli* and Enterococcus.[6–12] We also sometimes get surprises. Until recently *Staphylococcus aureus* and MRSA were thought to be almost fairly exclusive human pathogens. However, in many countries (e.g. The Netherlands and Denmark), MRSA is now found frequently in pigs and these strains infect people.[13] *Clostridium difficile* is now clearly associated with food animals and people are infected with strains found in these animals. There are increasing numbers of people with community onset *C. difficile* infections. Foods are a likely way these bacterial strains were acquired.[14–16]

Resistant *E. coli* are a major concern because *E. coli* is the most common bacterial pathogen causing serious infections in people. Bloodstream infection rates vary from 25–60 per 100 000 people per year.[17] This is just the tip of the iceberg, for every such serious and life threatening bloodstream infection, there are likely to be about a hundred other infections (e.g. urinary tract infections). What is now very disconcerting is the increasing multi-resistance resistance worldwide in *E. coli*.[1,7,11,12]

Much of this resistance in *E. coli* (especially to third generation cephalosporins and fluoroquinolones) is related to resistance that develops in bacteria carried by food animals – especially poultry.[1,3,6,7,9,11,12] This resistance results from the misuse of antibiotics in these animals. Worldwide each year, billions of chicken are injected with third generation cephalosporins just before or after hatching (with ceftiofur) and/or fed fluoroquinolones in their drinking water (e.g. enrofloxacin) for nearly all their lives.

Antibiotics have been used for over 60 years as growth promoters. They are also used for prophylaxis (called 'metaphylaxis' when large numbers of animals or entire herds are treated at the same time).[18] This is in stark contrast to what happens in human medicine, where individual patient use is the norm. It effectively means that huge numbers of animals are treated continuously for most of their life with either in-feed or in-water antibiotics. It explains why over 70% of all antibiotics used in most countries are used in food animals. Some of these prophylactic antibiotics are last-line or 'critically important' classes of antibiotics for humans, such as the fluoroquinolones and third and fourth generation cephalosporins.[8]

While there is ongoing debate on what proportion of antibiotic resistant bacteria infecting people come from food animals, it appears to be substantial. An example of where good practice can help people with serious infections is Australia. It is the only country that has banned the use of fluoroquinolones in food animals. It is not coincidental that Australia has also one of the lowest resistance rates in campylobacter, salmonella and *E. coli* to fluoroquinolones in the world.[19]

In Europe and elsewhere there is abundant evidence that the routine use of third and fourth generation cephalosporins in food animals has contributed to the epidemic of ESBL and other resistant *E. coli* occurring in community onset infections.[1,3,6,7,9,11,12] In Holland between 20–50% of all bloodstream infections caused by ESBL *E. coli* are the same strains as found in poultry.[12] Around the world, hundreds of millions of chickens, if not billions, are injected with antibiotics such as aminoglycosides and third generation cephalosporins each year. In addition, most chickens receive fluoroquinolones for most of their relatively short life (~35 days). Thus it is not surprising that we are seeing astronomically high levels of antibiotic resistant *E. coli* in poultry in countries such as China[21] and even in many areas of Europe.[1,6,7] In Europe, the resistance patterns of *E. coli* in blood cultures from humans correlates better with what is seen in poultry than it does with human antimicrobial consumption.[3]

There is overwhelming evidence around the world that using antibiotics in food animals, causes resistant bacteria to develop in large numbers and that these bacteria are transmitted to people via the food and water. There is also ample evidence that resistant bacteria, such as ESBL *E. coli*, cause substantially increased mortality and morbidity in humans.[20]

We need more vigorous action to stop the use of third generation cephalosporins in food animals in Australia, so that we don't get the same problem that is occurring elsewhere. We need to be vigilant to ensure that foods imported into this country are not tainted with superbugs such as ESBL *E. coli*. We urgently need action to stop the use worldwide of critically important antibiotics such as fluoroquinolones and third generation cephalosporins in food animals and the overall ongoing excessive use and abuse of large volumes of antibiotics in food animals.

Conflict of interest

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