Do Farm Animals Spread Antimicrobial Resistance?

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A recent study by Scottish researchers challenges the prevailing view that the widespread use of antibiotics in farm animals is a significant cause of antimicrobial resistance (AMR) in humans. The results from a whole-genome sequencing study published in *Science* by Alison E. Mather, of the Wellcome Trust Sanger Institute, and her colleagues (doi:10.1126/science.1240578) of *Salmonella* Typhimurium DT104 (DT104) in Scotland showed that this is not always the case. The findings seem to contradict hundreds of other studies that link farm animals to AMR in people.

Mather and her colleagues analyzed samples of DT104 collected from people and farm animals living in Scotland from 1990 to 2011, when DT104 caused a global multidrug-resistant epidemic in both groups. They found that human DT104 isolates distinctly differed from those of farm animals. The rate at which bacterial genes jumped from animals to people and vice versa was remarkably low. People infected with DT104 also carried more antibiotic-resistant genes than did the farm animals.

Rather than local farm animals being the source of DT104 in Scotland, people probably became infected with antibiotic-resistant *Salmonella* through international travel, by eating imported food, or from other environmental sources, the findings suggest. “The study challenges current views on the contribution of the local animal reservoir as a source of *Salmonella* and AMR in humans,” the authors concluded (p. 1515).

An accompanying press release entitled “Local animals' role in human drug-resistant *Salmonella* may previously have been overstated” was soon picked up by Web sites representing agricultural and veterinarian interests. Lance Price, of George Washington University and director of the TGen Center for Food Microbiology and Environmental Health in Flagstaff, Arizona, found the media spin “disheartening.” Price notes that the study confirms that DT104 did not originate with Scottish livestock in this unique set of Scottish samples. “That does not mean that farm animals in general do not spread DT104 elsewhere. That's a big difference,” he says. He worries that the study could mistakenly lead to the conclusion that no food animals anywhere can be blamed for causing antibiotic-resistant illnesses in people.

Scotland imports much of its meat and poultry. The researchers did not test imported products. “When studying the source of a foodborne pathogen, it would be important to analyze these,” Price says.

Veterinarian Wondwossen Gebreyes, at The Ohio State University, says that it’s no surprise that DT104 infections differed for people and local animals in Scotland. “That could happen anywhere because pathogens move in many different ways, and our food often originates far from local sources,” Gebreyes says. But the results “should not be generalized globally,” he adds. Worldwide, DT104 remains a documented drug-resistant foodborne pathogen that moves between animals and people.

Gebreyes and Price agree that reducing antibiotics in people and animals limits the selective pressure for AMR. “That important point could be lost if the results of this paper are misunderstood,” warns Gebreyes.

Mather told *BioScience*, “Our data do challenge current views, but, in the paper, we advocate minimizing the use of antimicrobials in livestock. Farmers will be allowed to use antibiotics only to prevent disease in their animals—not to fatten them up.”

Meanwhile, studies continue to document that antibiotic resistant bacteria from livestock do infect people. Among the latest, reported in *PLOS ONE* (doi:10.1371/journal.pone.0067641), nose swabs of livestock workers in North Carolina detected multidrug-resistant *Staphylococcus aureus* in workers on farms that use antibiotics but not in workers at antibiotic-free farms. Resistance to tetracycline, the most common antibiotic given to livestock, was 19 times more prevalent in workers at farms using antibiotics than at antibiotic-free farms.

A new study performed for the Pew Charitable Trusts showed that 80% of all antibiotics sold in the United States are fed to farm animals, often to promote growth (www.hsph.edu/research/centers-and-institutes/johns-hopkins-center-for-a-livable-future/_pdf/news_events/events/CLF-PEW-for%20Web.pdf). According to the report, the National Antimicrobial Resistance Monitoring System, which tracks antibiotic-resistant bacteria in retail meats, found that 43% of *Salmonella* isolated from chicken breasts, 34% from ground turkey, and 43% from ground beef were resistant to three or more classes of antibiotics. Multidrug-resistant *Escherichia coli* from humans and food animals rose from 7.2% in the 1950s to 63.6% in the early 2000s.

In December, the Food and Drug Administration announced a major step in curbing widespread use of antibiotics in livestock. Farmers will be allowed to use antibiotics only to prevent disease in their animals—not to fatten them up.

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doi:10.1093/biosci/bis026