Evidence supports ban on growth promotion use of antibiotics in farming

November 15 2011

In a review study, researchers from Tufts University School of Medicine zero in on the controversial, non-therapeutic use of antibiotics in food animals and fish farming as a cause of antibiotic resistance. They report that the preponderance of evidence argues for stricter regulation of the practice. Stuart Levy, a world-renowned expert in antibiotic resistance, notes that a guiding tenet of public health, the precautionary principle, requires that steps be taken to avoid harm.

"The United States lags behind its European counterparts in establishing a ban on the use of antibiotics for growth promotion. For years it was believed that giving low-dose antibiotics via feed to promote growth in cows, swine, chickens and the use of antibiotics in fish farming had no negative consequences. Today, there is overwhelming evidence that non-therapeutic use of antibiotics contributes to antibiotic resistance, even if we do not understand all the mechanisms in the genetic transmission chain," says Levy, MD, professor of molecular biology and microbiology and director of the Center for Adaptation Genetics and Drug Resistance at Tufts University School of Medicine.

For the past 70 years, humans have relied on antibiotics to combat bacterial infections such as streptococcus, meningitis, tuberculosis and urinary tract infections. The misuse and overuse of antibiotics, however, has contributed to antibiotic resistance, making antibiotics less effective at saving lives. Levy and co-author Bonnie Marshall summarize and synthesize the findings of a large number of studies assessing the link between antibiotic resistance and the use of non-therapeutic antibiotics

in livestock and fish farming. Highlights include the following.

The use of non-therapeutic antibiotics is widespread

- According to estimates, antibiotics are eight times more likely to be used for non-therapeutic purposes than for treating a sick animal.

Current practices set the stage for the rapid spread of antibiotic-resistant bacteria

- The long-term administration of antibiotics in animal feed creates an optimal environment for antibiotic resistance genes to multiply. Essentially, treated animals become "factories" for the production and distribution of antibiotic-resistant bacteria such as Salmonella and Methicillin-resistant Staphylococcus aureus (MRSA), a troubling infection that is resistant to common antibiotics.
- Bacteria can transfer antibiotic resistance to other bacteria, and multiple different resistance genes can be linked together in this process. Thus, even if farmers turn to antibiotics that are not commonly used to treat people, these drugs – given over long periods of time – can also promote resistance. Several studies demonstrated that antibiotic-resistant bacteria can easily spread from animals to people in close contact with animals, such as veterinarians, slaughterhouse workers, farmers, and the families of farmers.
- As much as 90 percent of antibiotics given to livestock are excreted into the environment. Resistance spreads directly by contact and indirectly through the food chain, water, air, and manured and sludge-fertilized soils.

- The broad use of antibiotics in fish food in farm fishing, particularly overseas, leads to leaching where it can be washed to other sites, exposing wild fish to trace amounts of antibiotics.

The consequences of antibiotic resistance are great

- According to the Centers for Disease Control and Prevention, antibiotic-resistant infections cause longer and more expensive hospital stays, and greater risk of death. Each year in the US antibiotic-resistant infections result in $20 billion in additional health care costs and $8 million in costs in additional hospital days. If antibiotics are ineffective, patients may end up paying more in search of alternative drugs, and enduring a wider range of side effects.

Bans on the use of non-therapeutic antibiotics are effective in diminishing antibiotic resistance

- Bans in several European countries have led to decreases in antibiotic resistance. Bans in Denmark and Germany have not only decreased the presence of antibiotic-resistant bacteria in farm animals, they have decreased the presence of these bacteria in humans.
- Alternative farming practices such as reducing animal crowding, improving hygiene, and improving use of vaccines have been shown to compensate for some of the growth benefits conferred by non-therapeutic antibiotics.

Levy and Marshall also highlight areas of study that may improve our understanding of the link between antibiotic use in animals and the spread of antibiotic-resistant bacteria. Modern genetic techniques are helping, they report, but there are still gaps in our understanding at each

stage of the transmission chain.

"Aquaculture, or fish farming, has been relatively understudied, yet water is a prime medium for the spread of antibiotic-resistant bacteria," says first author Bonnie Marshall, MA, MT (medical technology), senior research associate in the Levy laboratory at Tufts University School of Medicine.

"While the use of non-therapeutic antibiotics remains contentious, the evidence is strong enough to merit precaution. Antibiotics save lives. When infections become resistant to primary antibiotics, and alternative antibiotics must be used, health care costs increase. As more infections become more resistant to more antibiotics, we run the risk of losing more of our arsenal of antibiotics, resulting in needless deaths. It's important to consider what we stand to gain versus what we stand to lose," concludes Levy.

The Food & Drug Administration (FDA) has already taken some steps toward stricter regulation of non-therapeutic antibiotic use, acknowledging that the practice is in conflict with protecting the public health and proposing measures to limit the use of these drugs in animals. Levy and his colleagues in the field of infectious disease have called for antibiotics to be classified by the FDA as "societal drugs," establishing specific regulations to protect the efficacy of the drugs.

Levy is president of the international Alliance for the Prudent Use of Antibiotics, and is a fellow of the American College of Physicians, the Infectious Disease Society of America, the American Academy of Microbiology and the Association for the Advancement of Science. He has published more than 300 papers, edited four books and two special journal editions devoted to antibiotic use and resistance, and is author of The Antibiotic Paradox: How Miracle Drugs Are Destroying the Miracle. He is also co-founder and chief scientific officer of Paratek

Pharmaceuticals, Inc. Dr. Levy received the 2011 Hamao Umezawa Memorial Award from the International Society of Chemotherapy, given in recognition of his lifetime contributions in the field of antibiotic resistance.

Bonnie Marshall was supported in part by The Pew Charitable Trusts. Stuart Levy is a consultant to the Pew Charitable Trusts.

More information: Marshall BM, Levy SB. *Clinical Microbiology Reviews*. "Food Animals and Antimicrobials: Impacts on Human Health." October 2011, 24(4), 718-733, doi: 10.1128/CMR.00002-11

Provided by Tufts University