

From Hoof to Hand:
Antibiotic Use in Livestock and Antibiotic Resistance in
Humans

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There's a lot of ways to tell people they're going to die. I've told people they're going to die because their heart has failed. I've told people they're going to die because their kidneys have failed. But I have to say that the most...mad reaction I get is when I tell patients or patients' families that their loved ones are going to die because we do not have antibiotics. (Hung 2009)

With the above anecdote, Dr. Deborah Hung opened her 2009 presentation for the National Academy of Sciences in which she discussed new methods for battling antibiotic resistance. Unfortunately, the situation she describes is becoming common in today's hospitals. The problem is not that we have an antibiotic shortage, but that microbes develop mechanisms to resist antibiotics faster than we can create new ones. It is generally accepted that we have brought this problem upon ourselves, as the overuse of antibiotics promotes these so-called "superbugs." These superbugs kill more and more people every day; currently, the most well-known superbug, Methicillin-Resistant *Staphylococcus aureus* (MRSA), kills more Americans per year than AIDS (Klevens et al. 2007).

The United States government has recognized antimicrobial-resistant diseases as a pressing issue and has taken action to regulate the administration of antibiotics. While it is

understood that misuse and overprescription of antibiotics in hospitals is a major cause of antibiotic resistance, not many people recognize that antibiotic use on farms can also exacerbate the problem. In response to recent events and research, Representative Louise Slaughter introduced the Preservation of Antibiotics for Medical Treatment Act of 2009 (PAMTA). This act calls for regulation and a decrease of nontherapeutic antibiotic use in livestock or, in other words, the use of antibiotics when animals are not ill. Slaughter believes that this bill is necessary to stop the spread of antibiotic-resistant microbes in the United States (Slaughter 2009).

Many opponents of this act state that there is simply not enough scientific proof to show that restrictions on antibiotic use in farming will help end the problem of antibiotic resistance. Further they argue that restrictions will cause farmers to unnecessarily lose animals and money to disease (Eckholm 2010; Peeples 2009). Of particular interest are the claims of two veterinary experts, Dr. Scott Hurd and Dr. Liz Wagstrom, who gave separate interviews in February 2010 on behalf of the National Pork Board. The National Pork Board is an organization that collects research and provides information regarding pork production and consumption to American pork producers (About Us 2009). These interviews were intended to inform the public about antibiotic use in pork production and its relation to the problem of antimicrobial resistance. Dr. Scott Hurd is a professor at Iowa State University with a focus in microbiology and drug resistance in animals. He is also a former Deputy Undersecretary of Food Safety for the U.S. Department of Agriculture (USDA) (H. Scott Hurd, DVM, PhD). Dr. Liz Wagstrom is the Assistant Vice President, Science & Technology for the National Pork Board. Hurd firmly asserted that he does not believe antibiotics in pork production are causing any harm to humans and that antibiotics

are necessary to avoid unhealthy animals. Wagstrom explained there are misconceptions about antibiotic use in pork production and declared that research in Denmark shows that a ban on antibiotic use would do little to help human health (Hurd 2010; Wagstrom 2010).

While they do not directly address PAMTA, Hurd and Wagstrom mislead the audience into thinking that restrictions on antibiotic use in agriculture will do little to help curtail the spread and generation of antibiotic-resistant microbes in humans. Hurd's claim that not enough research exists to show a relation between antibiotic use on farms and antibiotic-resistant diseases in humans is unfounded. Both Hurd and Wagstrom use unrepresentative data from a Danish study that is actually too limited and involves too many factors. Finally, both lead the audience astray by providing a vast amount of information regarding the safety of American pork, which is basically irrelevant to the issue of antibiotic resistance.

Antibiotic Use in Livestock

Farmers have been using antibiotics for years to keep meat healthy and reasonably priced. Because livestock tend to live in closed quarters where disease is rampant and can spread easily, farmers must administer antibiotics to prevent disease and ensure healthy meat. Additionally, antibiotic use can increase growth in animals and lessen the need for feed, which keeps meat prices low. Antibiotics also maximize productivity, because farmers are able to maintain more animals with the money they save on feed, and they need less space to raise livestock since antibiotics keep disease from spreading (AVMA 2010).

Of course, any administration of drugs is carefully regulated. Two government groups, the Federal Drug Administration (FDA) and the United States Department of Agriculture (USDA), lead this regulation in the United States. They carry out actions such as approving the antibiotics that are used, carefully monitoring the use of antibiotics in livestock to ensure they are used properly, and inspecting meat for antibiotics after processing. Oversight is also provided locally, as producers who raise livestock work closely with veterinarians to ensure that they are administering antibiotics correctly. Producers take care to abide by FDA and USDA regulations and to listen to the advice of their local veterinarians (Hurd 2010; Wagstrom 2010).

How Pathogens Acquire Antibiotic Resistance in Humans

So how does antibiotic use in animals relate to antibiotic resistance in humans? First, one must understand how pathogens are able to resist antibiotics. Antibiotics used in medicine are actually derived from microbes themselves. Living conditions are harsh in the microbial world, and microbes produce antibiotics to help themselves survive. These antibiotics are generally toxins that enable microbes to defend themselves against predator microbes and compete for resources. As a result, to stay alive, microorganisms develop mechanisms to resist the effects of the antibiotics they produce themselves and the antibiotics others use. They can easily adapt these resistance mechanisms to target man-made antibiotics. Examples of these mechanisms include excretion systems that enable pathogens to basically pump out any substance that might harm them or thick membranes that prevent antibiotics from entering cells. Those that are not resistant to certain antibiotics can also acquire resistance mechanisms through genetic transfer, which is the

uptake of random DNA from the environment or other microbes. The DNA may contain the genes necessary to render the antibiotics ineffective, and thus another resistant strain is born (Madigan et al. 2008).

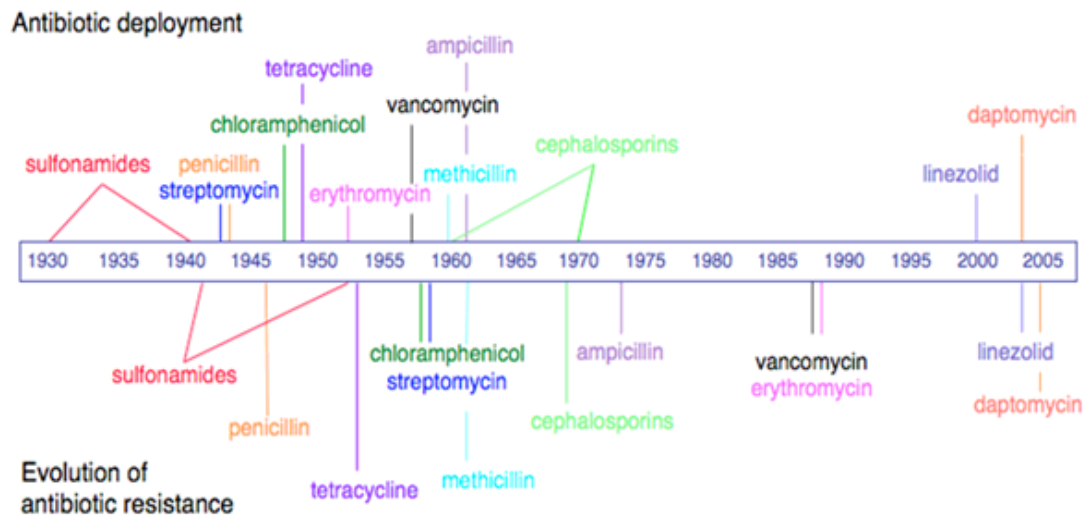


Figure 1 (from Hung 2009): The top portion of this chart depicts when various antibiotics were discovered and used, and the bottom portion shows when strains were found to be resistant to particular antibiotics

Of course, microbes cannot be resistant to every antibiotic, so the new antibiotics we use do kill most nonadapted pathogens. However, there are a few random strains that are able to resist the antibiotic, survive, and proliferate. As a result, these rare resistant pathogens are now dominant in the population and can spread and infect people, and now we cannot kill this strain of pathogen with the same antibiotic as before. To add to the creation of drug resistance, genetic transfer of drug-resistant genes can occur between strains or even between species of microbes (Frieden 2010).

We attribute this problem of drug resistance to overuse and misuse of antibiotics. Antibiotic-resistant microbes were not a major problem earlier because we could simply

find a new antibiotic and kill the resistant strain with it. However, as Figure 1 shows, this would only set off a new cycle of resistance selection and we would soon return to the same problem; new microbes would simply become resistant to the new drug, or worse, already resistant strains would also acquire resistance to the new drug. To make matters worse, doctors have often overprescribed antibiotics because this method is the easiest way to treat an infection with unknown cause. This situation is illustrated in the case of throat infections, where the first thing many doctors do is prescribe various antibiotics even though the illness could very well be a viral infection, in which case antibiotics will be ineffective. As a result, the microbes exposed to these antibiotics are given a chance to develop a resistance to these antibiotics (Frieden 2010). This excess use of antibiotics has brought us where we are today: left with little innovation in the field of antimicrobial discovery and faced with an alarmingly vast number of multidrug-resistant superbugs.

Current Efforts to Stop Antibiotic-Resistant Diseases in Humans

Antibiotic resistance is a pressing problem because we are depleting our only methods of fighting off severe illnesses: antibiotics. Thomas Frieden, the director of the Center for Disease Control and Prevention (CDC), explained in a speech addressing the problem of antibiotic resistance that the infections caused by antibiotic-resistant microbes can make people seriously ill or even kill them. Battling these infections often requires using antibiotics that are not only less effective but more toxic to humans (Frieden 2010). Another negative consequence of antibiotic resistance is the financial burden it creates for hospitals. Frieden stated that “In a 2008 study of attributable medical costs for antibiotic-resistant infections, it was estimated that infections in 188 patients from a single healthcare

institution cost between \$13.35 and \$18.75 million dollars” (as cited in Frieden 2010).

Given these dire consequences, the government and other healthcare groups have taken action to quell drug-resistant pathogens.

The initial solution that we have for defeating superbugs is the obvious one: find new antibiotics. However, there has recently been a dry spell in new antibiotic discovery. This year, only one antibiotic has been developed, and given how fast microbes can develop resistance, it will not be useful for long (Gaynes 2010). There is currently much research under way to discover new ways to target pathogens and kill them. Methods such as using exotic antibiotics that most pathogens have never encountered, targeting essential proteins, and others are currently being investigated (Walsh & Fischbach 2009). However, as promising as this research sounds, we still face the problem of creating new microbes resistant to the new antibiotics we make. In other words, simply creating new antibiotics to defeat antibiotic-resistant pathogens will never provide a real solution.

We are now aware that we cannot fully rely on new antibiotics to solve this problem of antibiotic resistance, and many policy proposals have been made to address the problem of antibiotic overuse. The major groups in charge of health and disease prevention are involved in this massive effort to stop the spread of drug-resistant diseases and prevent the creation of new ones. These associations include the CDC, the FDA, and the USDA. All of these groups have issued statements that acknowledge that the pressing problem of antibiotic resistance is due to overuse of antibiotics everywhere, including agriculture. As a result, they have all put forth efforts to restrict the administration of antimicrobials and do further research about antibiotic resistance. For example, the CDC has created the “Get Smart” program to educate professionals and the general public about proper antibiotic

use. The CDC is also working in collaboration with the USDA and the FDA to support the National Antimicrobial Resistance Monitoring System (NARMS). This system follows and researches the spread of antibiotic resistance in hospitals (Frieden 2010). In regard to antibiotic use on the farm, the CDC has included a “Get Smart on the Farm” program to address individuals in agriculture and inform them about how to appropriately distribute antibiotics and limit their use. The USDA has issued a report suggesting increased surveillance of disease on farms and resistant strains and calls for a limit on antimicrobial availability. Finally, the FDA supports the guidelines prescribed in PAMTA to reduce antimicrobial use and believes they will help the situation (Smart: Know When Antibiotics Work 2010; FDA Issues 2010; Akkina & Johnson 2007).

Most stewardship programs are focused on healthcare settings, as that is where the obvious connection to antibiotic resistance is, but in light of recent research, PAMTA specifically targets the issue of antibiotic use on farms. The act aims to reduce the spread of drug-resistant microbes from animals to humans and to preserve the effectiveness of the antibiotics we have (Slaughter 2009). Specifically, the bill is an amendment to the Federal Food, Drug and Cosmetic Act as dictated by the FDA. This amendment will provide the Secretary of Health and Human Services with the power to deny “nontherapeutic” application of any new “critical” antibiotics unless it can be proven that they will not result in harm to humans. The bill defines “critical antibiotic” as a drug that is used on livestock that also acts as an antibiotic medical treatment in humans. Nontherapeutic applications include “any use of the drug as a feed or water additive for an animal in the absence of any clinical sign of disease in the animal for growth promotion, feed efficiency, weight gain, routine disease prevention, or other routine purpose” (H.R. 1549). Thus, the bill does not

aim to ban all antibiotic use in agriculture, just the use of human-related drugs in applications not associated with the treatment of illness.

The Link between Agricultural Antibiotics and Antibiotic Resistance in Humans

Dr. Scott Hurd was interviewed by the National Pork Board to give his expert opinion on the matter of antibiotic resistance in animals and humans. When asked to address the fear that antibiotic resistance in humans is due to antibiotic use in livestock production, Hurd stated that “there is lot of concern, but it is largely unfounded based on the science” (Hurd 2010). He believes that American pork is perfectly safe and there is no evidence to prove resistant microbes can pass from animals to humans. However, contrary to Hurd’s beliefs, there have been a vast number of credible studies that have shown a link between antibiotic use in farms and antibiotic resistance in humans.

Of particular interest is a 2000 study led by Dr. Henrik Wegener that provided strong data to disprove Hurd’s argument that decreased antibiotic use on farms will not aid in decreasing antibiotic resistance in humans. Dr. Wegener is a prominent Danish scientist with a master’s degree in food science and a Ph.D. in microbiology from the Royal Veterinary and Agricultural University in Copenhagen (Henrik Caspar Wegener, 2010). His study was cited in an article in *Science* written by Dan Ferber in 2000. It was carried out in 1999 and it monitored the spread of drug-resistant *Salmonella* from food to humans in Denmark. Wegener and his colleagues were able to prove that a strain of *Salmonella* that was resistant to ciprofloxacin, the antibiotic that is routinely used to treat food poisoning from *Salmonella*, was linked to overuse of a closely related antibiotic called enrofloxacin on a specific Danish pig farm (as cited in Ferber 2000). This study shows that it was the

use of enrofloxacin on the farm, not ciprofloxacin in the hospital, that led to resistance in this strain of *Salmonella*. The ability of this *Salmonella* strain to adapt its enrofloxacin-resistance to defend itself against ciprofloxacin is direct evidence of how drug resistance in animals can easily pass to humans.

More evidence regarding the prevalence of antibiotic resistance in the United States was provided in an article published in 2001 by the *New England Journal of Medicine*. This study, carried out by David G. White and his colleagues, showed that drug-resistant *Salmonella* was present in commercially sold meats. White reported that out of the 200 meat samples taken from supermarkets in the Washington, D.C., area, “Eighty four percent of the isolates were resistant to at least one antibiotic, and 53 percent were resistant to at least three antibiotics.” Furthermore, many of these strains were pathogens known to cause diseases in humans. White attributed this resistance to the use of antibiotics on farms. His evidence for this was one of the resistant strains found in packages of ground turkey and beef that were processed in three different plants, so these resistant strains did not come from processing facilities but from the animals themselves (White 2001). If meat commonly contains antibiotic-resistant strains, then these strains could easily spread to humans through improper cooking or by simply handling the meat and forgetting to wash one’s hands. Despite the evidence provided by Wegener and White, Hurd still claims that resistant bacteria in animals cannot pass to humans.

Additionally, Hurd does not address how resistant *genes* from animal-related bacteria can still pass to other microbes. Not many people are aware that we have microbes living on us and inside of us called commensals. Often referred to as “good” bacteria, commensals are not harmful to us when we are healthy and carry out many useful

processes to keep us healthy such as helping us digest food, secreting vitamins, and keeping “bad” pathogens from growing inside of us by crowding them out (Frank 2010). However, while these bacteria are beneficial, many fear that resistant strains that we consume may pass their resistance mechanisms to the bacteria that live in our gut, which is entirely possible due to the high rate of genetic transfer among microbes and the fact that gut microbes are closely related to pathogens (Ferber 2000; Frank 2010). Evidence of this genetic transfer occurring was found by Rob Willems (1999). He found that a transposon, or genetic element that can literally jump from one genome to another, that carried vancomycin resistance was almost identical in both animal bacteria and human gut bacteria, suggesting that this DNA was passed between animals and humans (Willems 1999). This process of gene transfer poses threat to people with compromised immune systems, whom commensals can infect. If these bacteria develop antibiotic resistance, people with these infections cannot be treated and will suffer greatly (Ferber 2000). Furthermore, if antibiotic resistance can pass to microbes in our digestive tract, then it could easily pass to harmful pathogens in the environment. The microbial world is a complex place, and seemingly harmless farm microbes with antibiotic resistance could easily come in contact with life-threatening pathogens, and resistance genes could spread and create a new, deadly strain of pathogen.

Overall, studies have shown that antibiotic use in livestock will select for drug resistance in microbes. These resistant strains can pass to humans through handling or consumption. The resistant genes accumulated in these strains can also spread to other microbes, including our own commensal bacteria and maybe even dangerous pathogens. In

light of the data provided by Wegener, White, and other researchers, Hurd was incorrect to claim there is no evidence to show antibiotic resistance in animals can spread to humans.

What Can Be Learned from “the Danish Experiment”

As of 1998, Denmark completely banned “growth promoter antibiotics” in the production of livestock. As the name implies, these are antibiotics meant to supplement feed and increase the size of animals meant to be used as a food source. As a result, Denmark was used by many researchers as a model to study the effects of such a limitation on antibiotic use in agriculture, commonly referred to as the “Danish Experiment.” The most notable of these studies was performed by the World Health Organization (WHO) in 2002 and included a comprehensive report on the effects of this antibiotic ban in Denmark on animal health, human health, economics, and the environment (WHO 2002). An international group of experts with a range of backgrounds carried out the research for this report to keep the analysis relatively unbiased. Data from these reports have been widely cited in arguments from both sides of the antibiotic debate. Even Dr. Hurd and Dr. Wagstrom used information from Denmark to support their claims. However, after one reads the WHO report, it turns out that the evidence that Hurd and Wagstrom use to support their claims was either taken out of context or not very representative data in the first place, which renders their arguments unconvincing.

Both Hurd and Wagstrom claim that the data from Denmark show that a decrease in antibiotic usage does not impact human health and in some cases has led to more cases of disease. It is true that preliminary data from the WHO’s research showed that restrictions on antibiotic usage may have been linked to increased cases of illness in

Denmark. However, in its portion on human health, the WHO stated that “Data from healthy humans however are relatively sparse on which to assess the effect of the termination of antimicrobial growth promoters on the carriage of antimicrobial resistant bacteria,” and that “Further larger studies are needed to determine how much of an effect the discontinued use of antimicrobial growth promoters in Denmark will have on the carriage of antimicrobial resistance in the intestinal tract of humans in the community” (2002). In other words, the WHO was able to gather only a small amount of data on how the restriction of antibiotic use affected the spread of antibiotic resistance in humans, and more studies with more subjects would be needed to make any conclusions. Thus, the data that Hurd and Wagstrom have used to support their claims are not representative and, as a result, cannot properly prove their point that antibiotic restrictions will not affect human health. Additionally, the WHO reported that decreased antibiotic use in Denmark led to some positive impacts on human health as well. These consequences included a definite decrease in antibiotic-resistant strains of *E. coli* isolated from cows and a decrease in human cases of streptogramin-resistant *E. faecium* (WHO 2002). Again, these data were noted as not representative, but if Hurd and Wagstrom were willing to state the negative effects of the antibiotic ban on humans as fact, should they not note the positive effects as well?

Hurd also claims that one harmful impact of the restriction of antibiotic use will be an increase in illness and mortality among pigs. He stated that his personal experience in Denmark showed that more pigs have fallen ill and died from illness due to this decrease in antibiotics. However, the WHO report explains that the pig deaths that Hurd is referring to would have happened regardless of the ban on antibiotics. The reported increase in deaths

was mostly due to infant pigs falling ill. The health of these pigs primarily depended on two drugs, olaquinox and carbadox. The report states that the EU took these two drugs off the market in 1999 because they might have been poisonous to humans (WHO 2002). Thus, while Hurd correctly reported an increase in swine mortality in Denmark, it was not due to the ban of nontherapeutic antibiotics in general but to the limitation of two specific drugs that would have been banned anyway.

Wagstrom sheds light on another negative outcome of Denmark's antibiotic ban: the increased use of human-related antibiotics to treat sick pigs. According to Wagstrom, as more pigs became ill in Denmark, there was a great increase in permitted therapeutic antibiotics important to human health. This created a problem because if more human-related antibiotics are used, then antibiotic resistance will more likely spread from animals to humans. Wagstrom states that if growth promoter antibiotics, which are not widely used in humans, were used in animals in the first place they would not become ill and antibiotic resistance would be better avoided. However, the WHO reports that only the use of some human-related antibiotics increased in pigs and the use of others remained the same. Furthermore, the report stated that "total therapeutic use in 2000 and 2001 was similar to 1994, the peak year of therapeutic use before any antimicrobial growth promoters were terminated" (WHO 2002). Contrary to Wagstrom's claim, some human-related antibiotics were still being preserved, and the use of these antibiotics did increase but not to a level that was higher than before the ban. Finally, her argument is also irrelevant in regard to the United States, as the proposed restrictions on antibiotic use in PAMTA would include only human-related, or critical, antibiotics. Thus, all noncritical antibiotics could still be administered for disease prevention and there would actually be a decrease in human-

related antibiotic use in livestock. Hurd and Wagstrom cite proof from the Danish experiment to show that a limitation on antibiotics in agriculture will not help humans and antibiotics are necessary for the well-being of livestock. However, this evidence is taken out of context and does not properly reflect the message the WHO report was trying get across. In fact, the WHO stated, “We conclude that under conditions similar to those found in Denmark, the use of antimicrobials for the sole purpose of growth promotion can be discontinued” (WHO 2002), contradicting Hurd and Wagstrom’s claim that these growth promoters are necessary for animal health.

A False Sense of Confidence

Hurd and Wagstrom both assert that everything that is done during pork production, including the current use of antibiotics, ensures the safety of the meat, but the fact that meat is safe for consumption has nothing to do with the problem of antibiotic resistance. In fact, it appears that Hurd and Wagstrom are trying to show that since current regulations for antibiotic use result in safe meat, these regulations do not need to be changed, but that is simply not the case in regard to antibiotic resistance in humans. Hurd describes the meticulous inspection of meat products for antibiotic residues so no antibiotics make it into food. Wagstrom describes how there is oversight from both the USDA and FDA during the entire process of pork production. She explains that every producer strictly adheres to these rules and anyone who disobeys the rules is severely fined (Hurd 2010; Wagstrom 2010). While assuring the public that pork is safe to eat creates a sense of confidence in the consumption of meat, it does not address the main purpose of the interviews: educating the public about antibiotic resistance in animals and in humans.

Yes, there may be no antibiotics in the meat, but there are still antibiotic-resistant bacteria that can infect humans, as White's research shows (White, 2001). Also, the regulations that Wagstrom cited to maintain the safety of pork are evidently not enough to curb the threat of antibiotic resistance. This is obvious in both the FDA's and the USDA's support of PAMTA and other restrictions on antibiotic use (Sharfstein 2009; Akkina & Johnson 2007). In the end, the food produced by livestock may be safe to eat by some standards, but that does not mean that it is free of antibiotic-resistant bacteria, which could easily cause disease or spread resistant genes to other strains.

Wagstrom makes an illogical argument when she discusses the link between human cases of MRSA and porcine MRSA in order to assuage the fears of antibiotic-resistant bacteria passing from animals to humans. She first explains that according to studies in Denmark, where nontherapeutic antibiotics in livestock have been banned, there has actually been a tenfold increase of MRSA in humans. However, she then goes on to explain that research has found an MRSA strain unique to pigs, which is not a contributor to human cases of MRSA, so humans shouldn't worry about getting MRSA from pigs (Wagstrom 2010). Using Wagstrom's logic, one could say that the human cases of MRSA have nothing to do with pig MRSA and thus with the use of antibiotics in pigs. So the tenfold increase that she says happened in Denmark despite the antibiotic ban means nothing, as antibiotic use in animals would not affect human MRSA. This hole in Wagstrom's logic renders her argument questionable. Did she actually do enough research to say that restrictions in animal antibiotic use will not help end antibiotic resistance in humans? Both the use of irrelevant information and illogical arguments make Hurd and

Wagstrom's arguments against the regulation of antibiotics in livestock misleading and weak.

Ending “Factory-Farming” and Finding Alternatives to Antibiotics

Hurd and Wagstrom make a point that current antibiotic use needs to be upheld because restrictions will lead to more sick animals and thus unhealthy meat on America's tables. Increased sickness in animals will not only harm humans but make animals suffer when they do not need to. They assert that antibiotics use in agriculture is not excessive and for the most part is meant for preventative care. However, would this preventative care be necessary if producers were not using so-called “factory farming” techniques? The bigger problem that should be addressed is the inhumane way that livestock are raised to make a profit.

A “factory farm,” formally referred to as a Confined-Animal Feeding Operation (CAFO), is a livestock production site that feeds animals systematically in an enclosed space to prepare them for food production. Wastes produced by these animals are simply washed away and stored on site in ponds outside or underground, making conditions very unsanitary. There is also poor ventilation in holding areas, which makes it hard for animals to breathe and easy for microbes to proliferate and spread (Issues: Factory Farming). It is commonly known that a large amount of the meat sold commercially comes from CAFOs (Nierenberg 2005: 5).

With such overpopulated and unclean conditions, it is no wonder that animals are so susceptible to illness and require antibiotics. Thus, Hurd and Wagstrom were right in saying that antibiotics are necessary to keep pigs healthy in America, but that is only

because producers have forced them into such unhealthy living conditions in the first place. Hurd and Wagstrom may be able to claim that American meat is healthy, but how about when the animals are alive? Are antibiotics any substitute for fresh air, room to roam, and clean living quarters?

Ending factory-farming methods and reducing the use of antibiotics requires a sacrifice of profits on the part of livestock farmers and spending on the part of meat consumers. Antibiotics are able to reduce feed costs and the cost of housing animals, as they can supplement food and enable farmers to use less space to keep animals. This results in lower meat prices for consumers. As reluctant as many farmers are to reduce the use of antibiotics, there are plenty of alternatives to using antibiotics to keep animals healthy. James MacDonald and Sun Ling Wang discuss the results of some of these alternatives in “Broiler Producers Search for Alternatives to Antibiotics.” It was found by the USDA in 2006 that many “broiler” chicken, or non-egg-laying chicken, farms have been able to avoid nontherapeutic antibiotics by carrying out Hazard Analysis and Critical Control Point (HACCP) plans. These plans are routines carried out to detect and avoid any potential food safety hazards in a facility. In addition to these plans, producers that did not use nontherapeutic antibiotics used other methods to avoid animal illness, such as frequent sanitation, improved ventilation, and routine disease testing. Since about 44 percent of broiler producers were reported to not use nontherapeutic antibiotics, it is obvious that these alternative methods were successful for this large percentage of farms and enabled them to continue production (Macdonald & Wang 2006). These simple sanitation and pathogen testing practices could easily be applied to other livestock raised in factory-farming conditions. These findings prove contrary to Hurd and Wagstrom’s belief that

preventative antibiotics are required to keep animals healthy, and expose another method of disease prevention that they failed to address.

Breaking Free from the Vicious Cycle of Antibiotic Resistance

As Christopher T. Walsh and Michael A. Fischbach put it in their article in *Scientific American* referring to the problem of antibiotic resistance, “humans may never definitively win this race against time, but for the past century new therapies have kept us a step ahead of the pathogens. Every effort must be made to retain our lead” (2009). These words expose the dire situation we have placed ourselves in by overusing and misusing antibiotics; we can no longer depend on new drugs to save us from resistant pathogens. Every effort must be made to preserve the antibiotics we have now and prevent the spread and creation of drug-resistant strains. Contrary to what Hurd and Wagstrom may argue, this includes decreasing the use of antibiotics in farming, despite how unrelated to the issue it may seem. It is evident in this report that antibiotic resistance can indeed spread from the farm to humans no matter how much we inspect meat and carefully handle it. We must take care to educate ourselves and support actions such as PAMTA and the “Get Smart” program that aim to reduce antibiotic use to ensure our ability to fight drug-resistant pathogens. Hopefully, the combination of our limitations on antibiotic use and the discovery of new antibiotics will make it so Dr. Hung will never again have to tell a patient that he will have to die because there are no antibiotics to fight his disease.

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