

ISSUE BRIEF

BETTER BACON

WHY IT'S HIGH TIME THE U.S. PORK INDUSTRY STOPPED PIGGING OUT ON ANTIBIOTICS



OVERVIEW

Antibiotic resistance is one of the world's greatest health threats.¹ At least 2 million Americans each year suffer infections due to drug-resistant bacteria resulting in more than 23,000 deaths, according to 2013 estimates.² Experts predict that global annual deaths from antibiotic-resistant infections will climb into the millions if urgent action is not taken.³

According to leading health authorities, including the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO), the unnecessary use of medically important antibiotics* is a major driver of this crisis.^{4,5,6} Widespread antibiotic overuse in U.S. livestock production, including the pork industry, is a key contributor.

* "Medically important antibiotics" are antibiotic classes that are used in human medicine as well as in animal agriculture. The World Health Organization maintains a list of Medically Important Antimicrobials, last updated in 2017. It is available at http://www.who.int/foodsafety/areas_work/antimicrobial-resistance/cia/en/.

As resistance worsens, serious infections caused by drug-resistant bacteria are becoming harder and sometimes impossible to treat with antibiotics. This includes food-borne diseases like those caused by Salmonella as well as pneumonia, urinary tract infections, and blood poisoning.

Our key findings reveal:

- **The U.S. pork industry accounts for 37 percent of all U.S. livestock sales of medically important antibiotics.** We also estimate that around 27 percent of all medically important antibiotics sold in the United States, including those sold for human use, are for pig production.
- **The conventional pork industry feeds medically important antibiotics to entire herds of animals even when no pigs are sick**—a practice strongly discouraged by the World Health Organization. The industry has long asserted it needs to feed antibiotics to herds to keep them healthy. Despite the very heavy use of antibiotics relative to other countries, however, U.S. producers report that many diseases are more prevalent in pig herds today than in 2000. Heavy use of medically important antibiotics in pigs that are not sick is unnecessary and is apparently failing to stop the rise of infections.
- **Overuse of antibiotics occurs within a markedly changed U.S. pork industry, dominated by larger, more specialized farms, and by fewer businesses, which dictate production practices.** These entities have the power to catalyze much-needed change in how antibiotics are used throughout the pork production chain.
- **U.S. pork producers use twice as much antibiotics per kilogram of animal as do U.K. producers, for example, and seven times the levels used in Denmark or the Netherlands.** Yet Denmark and the Netherlands produce pigs at an industrial scale similar to that of the United States.
- **Robust information on the use of antibiotics in livestock production, including in pigs, remains scarce in the United States.** The lack of clear data unnecessarily hampers public and government efforts to reduce antibiotic overuse.

Thanks to flawed antibiotics practices and policies in the U.S. pork industry, bringing home the bacon can also bring home superbugs. The irresponsible use of antibiotics on pig farms has created ripe conditions for drug-resistant bacteria—as well as the genes that foster resistance—to multiply and spread from farms to people. Supermarket

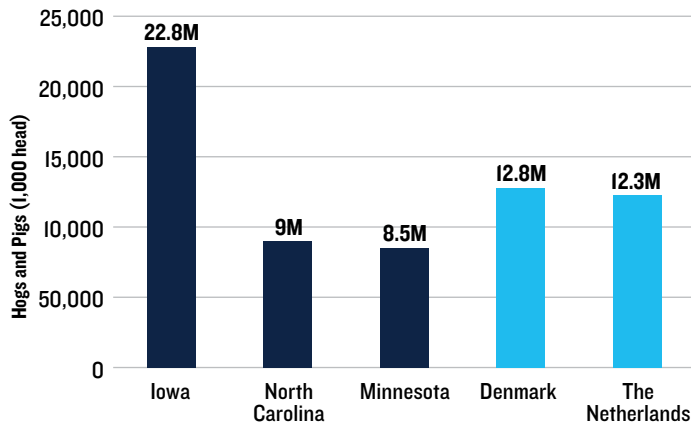
pork chops can carry drug-resistant bacteria straight to the kitchen counter. Pig farmers and pork industry workers can carry antibiotic resistance into their homes and communities. Contaminated soil, air, and water near these farms also can transport bacteria and genes from the farms to the outside world.

The heavy use of antibiotics in U.S. pork production is avoidable. Unfortunately, the U.S. federal government has failed to address the issue effectively. While a Presidential Advisory Council established goals for the reduction of antibiotic use in human medicine, it failed to establish such goals for animal agriculture. The U.S. Food and Drug Administration (FDA) and U.S. Department of Agriculture (USDA) have failed to collect detailed information on antibiotic use in animal agriculture, although such data could highlight variations in practice and lead to benchmarks to improve performance. The FDA continues to allow the routine use of antibiotics in livestock when there are no sick animals, under the guise of “disease prevention.” Both the FDA and industry acknowledge that the FDA’s discontinuation of most “growth promotion” claims will have limited effect on the volume of livestock antibiotic sales.

A WHO-commissioned analysis shows that if livestock industries can kick the antibiotics habit, it could significantly cut down on antibiotic resistance and improve public health.^{7,8} Responsible pork producers use antibiotics only sparingly to treat sick animals or occasionally to control disease outbreaks. They don’t use them to compensate for poor facility conditions or for a lack of good animal husbandry. To promote herd health while avoiding antibiotics, responsible producers can make use of a suite of best practices demonstrated in Denmark and the Netherlands and by U.S. leaders in responsible antibiotic use (described further below), which have eliminated the routine use of antibiotics through common sense measures.

It’s time for the U.S. pork industry to adopt responsible antibiotic use practices. By that we mean that medically important antibiotics should be used only to treat pigs that have been diagnosed with a particular bacterial infection by a licensed veterinarian, to control disease outbreaks among pigs in contact with sick animals, or in relation to a medical procedure such as surgery. Medically important antibiotics should not be used routinely when animals are not sick.

FIGURE 1. INVENTORY OF TOP 3 PIG-PRODUCING U.S. STATES, DENMARK AND THE NETHERLANDS, DECEMBER 2017



SNAPSHOT OF THE U.S. PORK INDUSTRY

The United States is the world’s third-largest consumer and producer of pork.^{9,10,11} In 2017, U.S. slaughterhouses processed 121 million mature pigs, generating just over 25 billion pounds of pork.¹²

Currently, around 73 million pigs live on U.S. farms.¹³ Production is heavily concentrated in a few counties in a few states.¹⁴ Iowa, North Carolina, and Minnesota account for more than 55 percent of the total (Figure 1).^{15,16}

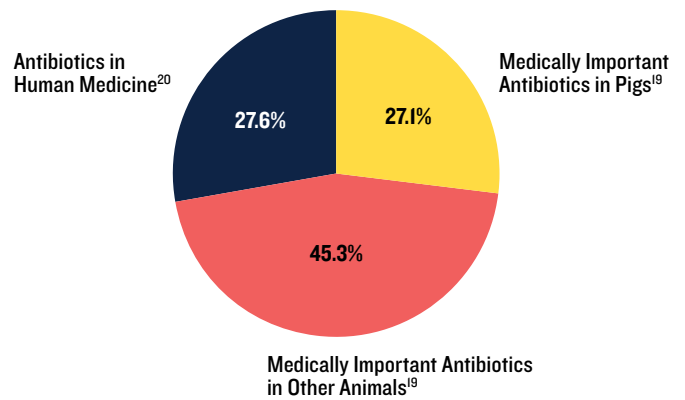
OVERUSE OF ANTIBIOTICS IN U.S. PIG PRODUCTION HELPS SPREAD ANTIBIOTIC RESISTANCE THAT THREATENS HUMAN HEALTH

Because the overuse of medically important antibiotics hastens the spread of antibiotic resistance, it must be curbed in food animal production. That is the rationale behind the WHO’s recent recommendation against using these precious medicines when there is no confirmed disease—that is, for growth promotion and, except under very special circumstances, for disease prevention.¹⁷ According to the FDA, 18.4 million pounds of medically important antibiotics were sold for use in animal agriculture in 2016, with pork accounting for the second-largest share by a distance.¹⁸

Almost the Same Amount of Medically Important Antibiotics Are Sold for Pigs as for Treating Sick People

The latest FDA report on antibiotic sales is the first to estimate medically important antibiotic sales by animal sector in the United States. Chicken production, for example, accounts for just 1.1 million pounds of antibiotics

FIGURE 2. MEDICALLY IMPORTANT ANTIBIOTICS SOLD (U.S.) FOR PIG PRODUCTION, OTHER LIVESTOCK PRODUCTION, AND HUMAN MEDICINE



sold, compared with sales for pig production (6.9 million pounds) or cattle production (8.0 million pounds).¹⁹ Antibiotics sold for pig production are nearly equal to the 7.0 million pounds of antibiotics sold for human medicine in 2015.²⁰ Assuming human antibiotic sales remained level in 2016, we calculate that pork production alone accounts for 27.1 percent of the more than 25 million pounds of medically important antibiotics sold that year for any purpose (Figure 2).²¹

Unfortunately, federal officials have yet to collect any detailed information on how the pork industry uses these antibiotics.²² Despite the data gap, we do know the pork industry not only administers medically important antibiotics to treat disease and to control the spread of disease, but also gives those same antibiotics to herds of pigs for “disease prevention” when there is no clinical disease present. FDA does report that 95 percent of sales of medically important antibiotics for livestock in 2016 were additives to animal feed or drinking water, the typical routes through which antibiotics for disease prevention are delivered to herds of animals.²³ Until January 2017, medically important antibiotics also could be legally added to pig feed to speed up animal growth.^{24,25}

Mass administration of important antibiotics to groups of animals, at low levels in their feed or drinking water, heightens the risk of resistance.²⁶ The basic principle at work is this: The greater the number of individuals (animal or human) given antibiotics, the more bacteria that are exposed to those drugs, and the more likely that drug-resistant strains of bacteria will emerge and spread.²⁷ There is also evidence that antibiotics ingested by mouth expose more bacteria to them than do drugs delivered by injection.^{28,29}

Medically Important Antibiotics Are FDA-Approved for Pigs That Are Not Sick

Table A lists medically important antibiotics that remain FDA-approved and labeled for use in pig feed. Despite the 2017 ban on their use in animal feed for growth promotion, antibiotics from each class continue to be added legally to pig feed at similar low levels to “prevent” disease even when no animals are sick. In addition, two specific antibiotics, lincomycin (a lincosamide) and virginiamycin (a streptogramin), are listed in the Code of Federal Regulations as being used for disease control but carry label language that is more consistent with disease prevention—i.e., use of the drug in the absence of disease.

TABLE A. DRUG CLASSES STILL APPROVED FOR FEED USE IN PIGS THAT ARE NOT SICK		
Drug Class	Human Applications of Medically Important Antibiotics ^a	Approved in feed as:
Lincosamides	As clindamycin, used to treat a wide variety of bacterial infections of the lungs, skin, blood, female reproductive organs, and internal organs ^b	Lincomycin (CFR §558.325)
Macrolides	Treatment of severe <i>Campylobacter</i> infection, whooping cough, chlamydia, and pneumonia in children allergic to amoxicillin ^b	Tilmicosin (CFR §558.618); and tylosin (CFR §558.625)
Streptogramins	Treatment of resistant infections, like MRSA, that are unresponsive to other antibiotics ^b	Virginiamycin (CFR §558.635)
Sulfonamides	Treatment of urinary tract infections, food-borne illness due to <i>Salmonella</i> , and other ailments ^b	Sulfamethazine, combined with tylosin (CFR §558.630)
Tetracyclines	Treatment of atypical pneumonia, Lyme disease, pelvic inflammatory disease, chlamydia, gram-negative infections ^b	Chlortetracycline (CFR §558.140)

a World Health Organization, *Critically Important Antimicrobials for Human Medicine*, 3rd Revision, 2011, apps.who.int/iris/bitstream/10665/77376/1/9789241504485_eng.pdf.

b David Gilbert et al., *The Sanford Guide to Antimicrobial Therapy 2016*, Antimicrobial Therapy, Inc., 2016.

There are particular strains of gram-negative bacteria responsible for rising numbers of deaths in U.S. hospitals; because they already are resistant to almost every available antibiotic, these strains are getting dangerously close to becoming untreatable altogether. Tetracyclines are among the antibiotics that the CDC considers important for treating potentially life-threatening gram-negative bacterial infections.³⁰ The health imperative is to keep tetracyclines as effective as possible for as long as possible, in part by

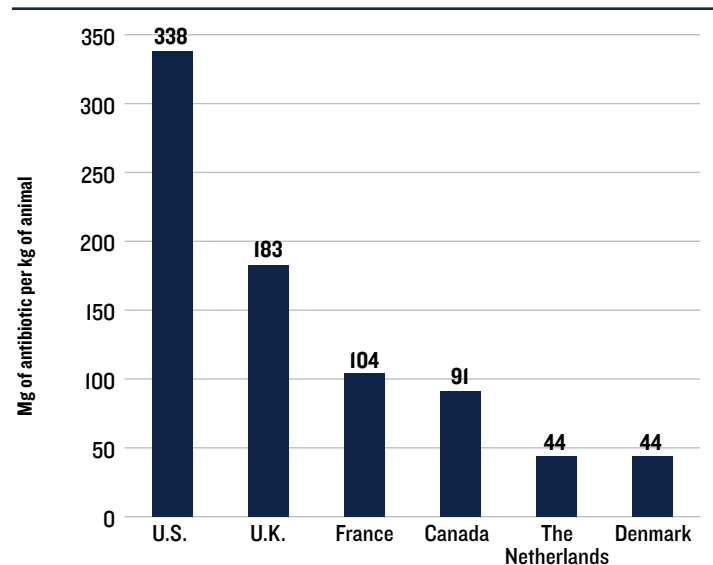
curbing their overuse for other purposes. Yet, as a class, tetracyclines alone account for 70 percent of all medically important antibiotics sold for use in food-producing animals, including pigs.

The U.S. Pork Industry Uses Antibiotics More Heavily Than Do Pork Producers in Other Developed Nations

The U.S. pork industry uses antibiotics much more intensively in pig production than do other industry leaders. Specifically, U.S. producers use about double the antibiotics per kilogram of pig as are used in the United Kingdom, more than three times as much as in France, and more than seven times the levels used in Denmark or the Netherlands. (Figure 3).

The FDA began reporting on antibiotic sales for use in U.S. pig production only last year. In 2016, nearly 8.4 million kilograms of both medically important (88 percent) and non-medically important (12 percent) antibiotics were sold for use in pig production. To facilitate comparison with other countries with pork industries of different sizes, it is useful to assess these sales against the total weight of the animal population, i.e. in milligrams per kilogram (mg/kg). A methodology that uses an average animal weight to allow a fair comparison is now being widely used across major pork-producing nations in Europe as well as Canada.^{31,32} The United States does not release official numbers using this methodology, but to allow comparison, we use the latest FDA sales figures to calculate weight-adjusted consumption of antibiotics in the U.S. pork sector.³³

FIGURE 3. MEDICALLY IMPORTANT ANTIBIOTICS FOR PIG PRODUCTION (mg/kg) IN THE U.S., CANADA AND SELECT E.U. COUNTRIES



Source: Figure 3 is based on two tables found on the NRDC website, at <https://www.nrdc.org/resources/better-bacon-why-its-high-time-us-pork-industry-stopped-pigging-out-antibiotics>. Table 1 shows the mg/kg calculation for the United States, and describes the sources for the underlying data on sales of medically important antibiotics for pig production, as well as data on the numbers of slaughtered pigs and breeding sows. Table 2 provides similar calculations for Canada as well as for European Union members included on Figure 3. Refer to the two tables as well for important caveats to the analysis, including some variation between the countries in the years for which data are available to derive the numerator and denominator in the mg/kg calculation.



U.S. PIG FARMS ARE RESERVOIRS OF ANTIBIOTIC RESISTANCE

The CDC points to “strong evidence that antibiotic use in food-producing animals can harm public health.”³⁴ The health threat occurs because widespread farm use of antibiotics creates a microbial environment on and around those farms that serves as a reservoir, or repository, of antibiotic resistance.^{35,36,37,38,39,40} Residues of antibiotics fed to pigs, as well as other livestock, are excreted via the animals’ manure.⁴¹ Pig farm manure is typically collected in tanks or lagoons, then spread or sprayed onto adjacent fields. When dispersed into the environment, that pig manure can carry not only antibiotic residues but also antibiotic resistance genes and drug-resistant bacteria.

Bacteria living in these resistance-rich pig farm environments can exchange antibiotic resistance genes with other bacteria, much as they do in a person’s or an animal’s gut. Antibiotic resistance also can be transmitted from these farm reservoirs to the human population through various routes, including via workers, on the tires of delivery trucks, or through direct contact with contaminated meat, air, water, and soil, as we discuss below.

Antibiotic-resistant bacteria are found on pork meat. Improperly cooked meat can spread drug-resistant bacteria to people, as can the improper handling of raw meat in the kitchen.

The National Antimicrobial Resistance Monitoring System (NARMS) tracks antibiotic resistance among bacteria collected from supermarket meat. In 2015, for example, 100 percent of the *Enterococcus* and 45 percent of the *E. coli* bacteria that NARMS isolated from retail pork chops were antibiotic-resistant.⁴² In 2015, 13 percent of *Enterococcus* were resistant to three or more antibiotics, up from 8 percent five years earlier.⁴³

NARMS also regularly tests for levels of antibiotic resistance among bacteria found on hogs waiting to be slaughtered. Of the four types of bacteria tested in 2014, 21.9 percent to 59.0 percent were resistant to three or more antibiotics.⁴⁴ NARMS even identified one

Salmonella bacterium that was resistant to eight out of nine antibiotics.⁴⁵ Even resistant bacteria that don’t directly sicken a human can spread resistance to more dangerous bacteria in a person’s home or gut, increasing the risk of a serious infection in the future.

Antibiotic-resistant bacteria on pigs colonize and infect farmers and workers.

The people who work directly with farm animals can carry antibiotic-resistant bacteria.^{46,47,48,49,50,51,52,53} They also suffer drug-resistant infections at a higher rate than average, as detailed below. A growing proportion of these infections are resistant to multiple antibiotics. These workers can also unwittingly spread antibiotic resistance genes and resistant bacteria to their families and communities.

Several recent studies have focused on resistance-related health risks among pig farm workers in particular. A study of more than 1,300 Iowans determined that people working on pig farms were six times more likely to be carriers of multidrug-resistant *S. aureus* than were Iowans not exposed to pigs.⁵⁴ In particular, pig workers and their children are more highly colonized with methicillin-resistant *S. aureus* (MRSA) than the general public.^{55,56,57,58} A separate study examined workers from 22 industrialized pig operations and found that 45.5 percent were carriers of MRSA.⁵⁹ Of all the *Staphylococcus* bacteria carried by these workers, 82 percent were found to be resistant to tetracycline, the antibiotic most widely used in pig production. A third study, somewhat earlier and more limited, looked at 20 workers from two pig operations in Iowa and Illinois and found 45 percent of them were colonized with MRSA bacteria.⁶⁰

Slaughterhouse workers face elevated risks as well. One recent study found 21.6 percent of them were carrying *S. aureus* bacteria; the *S. aureus* isolated were resistant to more than 2.5 times the number of antibiotic classes than were *S. aureus* from the slaughterhouse workers’ neighbors.⁶¹ Nearly 22 percent of these workers specifically carried MRSA.⁶²

Resistance spreads via air, water, and soil.

Studies of soil from farmland where pig manure has been dispersed find levels of certain drug-resistance genes that are up to six times higher than average—and these genes persist in the soil for up to 16 months.⁶³ Runoff from these fields can carry contaminants into drinking water supplies, including groundwater, lakes, creeks, and rivers.^{64,65} Manure dust can become airborne and carry resistance genes or resistant bacteria with it.⁶⁶

When people are exposed to antibiotic resistance via contaminated air, water, and soil, it can threaten their health and that of their communities.⁶⁷ A 2013 study found that Pennsylvanians living closer to swine farms and fields treated with swine manure had higher rates of antibiotic-resistant skin infections, including those caused by MRSA.^{68,69} A 2016 study from North Carolina identified methicillin-resistant (MRSA) and methicillin-sensitive *S. aureus* bacteria in surface waters adjacent to fields sprayed with manure from industrial-scale pig operations.⁷⁰

Overuse of Antibiotics Is Linked to a Changed U.S. Pork Industry

Pig farms are now fewer, larger, and more specialized.

The U.S. pork industry is following the poultry industry's footsteps toward an industrialized model. Traditional operations raised pigs on one farm from birth to slaughter. Now, those operations make up less than one-fourth of all U.S. pig operations.⁷¹

Today's pig farms are increasingly specialized to a single phase of production. Some operations exclusively manage sows and piglets up to weaning age. The piglets then travel to nursery or feeder operations, where they remain until they reach a weight of 10 to 60 pounds. Finally, they are transported to finishing operations (also called grower/finisher operations), which raise feeder pigs to a slaughter weight of around 280 pounds.

The industry is also concentrating more pigs on fewer farms. Today, a few thousand mega-farms—those with more than 5,000 pigs—produce more than 93 percent of all U.S. pigs.⁷² Meanwhile, the number of pig farms has dropped by 75 percent, from 268,140 in 1990 to a mere 68,300 farms in 2012.^{73,74} As previously mentioned, the pig mega-farms are often clustered in particular counties or regions.⁷⁵

The pork industry's shift to fewer, clustered farms with far more pigs per farm—along with greater farm specialization and more frequent transport of pigs between farms—are changes associated with many adverse impacts. This model has made pigs and pig farms vulnerable to more and bigger outbreaks of disease unless efforts to reduce these underlying risk factors are undertaken.^{76,77} Other adverse impacts include more air and water pollution, decreased quality of life, and, of course, more reliance on antibiotics.⁷⁸

With fewer players, each exerts greater control over pig production.

The ownership of pigs is increasingly concentrated in the hands of fewer businesses.⁷⁹ In 1992, farmers who housed and raised pigs on behalf of absentee owners accounted for just 5 percent of U.S. pig production.⁸⁰ In 2009, these "contract" farmers produced 71 percent of all U.S. pigs and 79 percent of the pigs in finishing operations.⁸¹ That same year, just 40 businesses owned or controlled at least three-quarters of the more than 100 million U.S.-produced pigs—and their share likely has continued to rise in subsequent years, according to USDA economists.^{82,83}

Vertical integration is a business strategy whereby meat companies use their market power to tie together two or more functions of production, processing, or marketing by buying them outright or signing legally binding contracts. Vertically integrated pork companies often own slaughterhouses and/or feed mills near their pigs.⁸⁴ It is common for integrated companies to require the pig farms they contract with to purchase feed only from the feed mills that they own. Sometimes the contractors don't even know what antibiotics have been mixed into that feed.⁸⁵

Smithfield Foods offers a good example of vertical integration. It began in 1936 as a single slaughterhouse.⁸⁶ Today, with more than \$14 billion in annual sales, Smithfield is the world's largest hog producer and pork processor.⁸⁷ In 1990 it started buying sow farms as well; the company now owns around 29 percent of the entire U.S. sow inventory, plus their piglets.⁸⁸ It continues to own slaughterhouses and feed mills as well.

The rising concentration of pig ownership means that relatively few businesses exert an outsize degree of control or power over the entire U.S. pork sector.⁸⁹ Large integrators can dictate practices for contractors—and other market players over whom they have leverage—including practices around the use of antibiotics.

Higher Levels of Antibiotic Use Haven't Reduced Disease in U.S. Pig Herds

In recent years, nearly every major infectious disease has become more prevalent on pig farms, according to the USDA's most recent swine farm surveys.⁹⁰ Table B highlights the rising prevalence of bacterial diseases. Important infections caused by viruses, such as swine flu and porcine respiratory and reproductive syndrome (PRRS), are more common as well and can often lead to subsequent bacterial infections.

The industry claims that antibiotics are needed to reduce the incidence of infections in its herds. As larger facilities raise more pigs in confined settings and the risk of disease rises, it's no surprise that producers regularly use more antibiotics to try to mitigate that risk. The issue is that their increased reliance on antibiotics does not solve the underlying problem.

We know that antibiotic sales for use in animal agriculture in the United States have been increasing since 2009; we also know that sales of medically important antibiotics for pork production made up 37 percent of total livestock antibiotic sales in 2016. Meanwhile, since 2000, the rates of many infectious diseases on pig farms also have increased, sometimes markedly. U.S. pig herds are much sicker, or at least pig farmers report as much. These sicker herds coincide with the shift in industry structure toward fewer production entities and bigger farms.^{91,92,93,94}

The regular and heavy use of antibiotics does not seem to work well to prevent or reduce infections, even as it puts the future efficacy of essential human medicines at risk. Prominent swine veterinarians recently described why the increasingly industrial structure and conditions of the U.S. pork sector have created greater vulnerability for the industry: They increase the risk of infection on farms while at the same time undercutting the sector's ability to deal with infectious diseases.^{95,96} Operators should therefore be taking stronger action to address those underlying conditions while avoiding antibiotic use. The rising rates of infection on pig farms indicate that overuse of antibiotics alone cannot overcome the disease pressure created by these conditions.

Pork Production Without Routine Antibiotics Is Scalable and Profitable

Denmark and the Netherlands are two of Europe’s largest livestock producers. They have profitable, growing, export-oriented pig industries even though the use of medically important antibiotics for disease prevention and for growth promotion is prohibited. Though small countries, Denmark and the Netherlands each have more pigs than any U.S. state except Iowa. And their production takes place under confined, indoor conditions, as does the vast majority of U.S. production.

From 1994 to 2016, Denmark reduced all antibiotic use in livestock and poultry by 49 percent. Antibiotic use in Danish pig production has fallen 27 percent just since 2009, while the weight of pork produced has increased by about 2.4 percent.⁹⁷ Decreased use of tetracyclines, pleuromutilins, and penicillins has led the way.

Denmark’s phaseout of routine antibiotic use has been achieved through relatively straightforward changes in animal management and biosecurity, including more frequent housecleaning, improved ventilation, and reduced animal densities.^{98,99,100,101} Table C describes several of these measures to prevent diseases before they start.^{102,103,104,105,106,107,108} The Danish government gives farmers and veterinarians resources to promote better antibiotic stewardship. This includes funding a Pig Research Centre, which conducts practical research on vaccination, on the development of better pig feed, and on biosecurity improvements.¹⁰⁹ The Centre also released a step-by-step producers’ manual on antibiotic reduction.¹¹⁰



As recently as 2010, the Netherlands was among Europe’s heaviest users of antibiotics per kilogram of food-producing animal.¹¹¹ A series of health crises from 2004 to 2009, including an outbreak of pig-associated MRSA that landed swine veterinarians and farmers in hospitals, inspired calls for change.¹¹² The Dutch government took several aggressive actions. The Netherlands Veterinary Medicines Institute (SDa) was launched in 2010. Within just two years, the SDA collected data on antibiotic use from 40,000 Dutch farms, including pig farms.¹¹³ These data identified the veterinarians and farms that prescribed or used the most antibiotics. Overall Dutch farm use of antibiotics decreased by 64 percent from 2009 to 2016, while use in pork production specifically dropped 57 percent in the same period.¹¹⁴

TABLE B. RISING DISEASE PREVALENCE ON SPECIALIZED PIG FARMS, 2000-2012

(based on answers given to USDA by operators of different kinds of pig farms)

Bacterial infections	Phase of operation	% of farm sites knowing of or suspecting disease*		% Increase, 2000-12
		% Swine 2000	% Swine 2012	
Scours (diarrhea) caused by <i>E. coli</i>	Nursery	24.0%	32.4%	35%
Glässer’s disease (<i>Haemophilus parasuis</i>)	Nursery	7.3%	24.3%	233%
	Finisher	5.4%	29.4%	444%
Greasy pig disease (<i>Staphylococcus hyicus</i>)	Pre-weaning	25.9%	39.8%	54%
	Nursery	25.3%	33.5%	32%
<i>Mycoplasma pneumonia</i>	Sows	14.2%	31.2%	120%
	Nursery	19.6%	30.7%	57%
	Finisher	29.0%	58.8%	103%
<i>Streptococcus suis</i> (meningitis)	Pre-weaning	29.8%	46.9%	57%
	Nursery	31.6%	65.2%	106%

* Reflects producer opinion, as expressed to an USDA interviewer, which may or may not have been confirmed by a veterinarian or laboratory diagnosis.

Source: USDA. Animal and Plant Health Inspection Service. Swine 2012 - Part III: Changes in the U.S. Swine Industry, 1995-2012. August 2017. pp 60-72.

TABLE C. KEEPING PIGS HEALTHY WHILE BEING GOOD STEWARDS OF ANTIBIOTICS

Improvement Category	Explanation	Concrete Actions
Biosecurity	Good biosecurity can help reduce risks that new disease will be introduced to “clean” farms in the first place.	<ul style="list-style-type: none"> • Minimize visitors. • Regiment how workers change into clean shoes and clothes. • Clean, disinfect, and perhaps limit the frequency of trucks delivering feed and new pigs to a pig site. • To limit airborne disease spread, keep pig sites no closer than 1.5–2 miles from each other.
Nutrition	Suboptimal nutrition adds to animal stress and risk of disease. Optimal nutrition protects against it.	<ul style="list-style-type: none"> • Give lower-protein feed to piglets immediately after weaning to lessen the stress of transitioning off sow’s milk.
Hygiene	Clean, disinfected pig housing prevents spread of infectious agents.	<ul style="list-style-type: none"> • Move groups of pigs together (all-in, all-out production) to allow thorough cleaning between herds and to help prevent disease from spreading between groups or farms.
Pig immunity	Younger piglets, right after weaning, have immature immune systems. Later weaning, as well as vaccine use, can boost immunity and reduce disease.	<ul style="list-style-type: none"> • Wean piglets later. Doing so at 20 days helps reduce diarrhea (scours) and significantly impacts growth and mortality, compared with piglets weaned at 15 days. In 2013, the European Commission established 28 days as the minimum weaning age for piglets. • Administer vaccines to help immunize piglets against diarrhea (scours) due to some strains of <i>E. coli</i> or <i>Lawsonia</i> bacteria.
Reduce density	Reducing the stocking density of pigs in the absence of antibiotics may improve animal health and growth by reducing stress.	<ul style="list-style-type: none"> • Reduce stocking density to ensure at least 3 m³ of air space per pig.

Some U.S. Companies Are Kicking the Antibiotics Habit

Some American companies have proved that raising pigs without routine antibiotics can be good business. Niman Pork, Applegate, and Meyer Natural Pork are three growing U.S. companies that have committed to raising and/or marketing pork exclusively from pigs raised without any antibiotics. (Sick pigs on these farms that do require treatment with antibiotics typically are diverted elsewhere and sold as conventional pork.)

In addition, Chipotle and Panera lead the way by only sourcing meat raised with responsible antibiotics use practices, according to the annual *Chain Reaction* antibiotics scorecard.¹¹⁵ Chipotle’s meat, including its pork, for example, comes from animals raised without the routine use of antibiotics. According to Steve Ells, Chipotle founder and former CEO, “Good animal husbandry reduces the need for antibiotics in livestock and promotes better animal welfare.”¹¹⁶

On the other hand, none of the largest conventional U.S. pork companies have a comprehensive policy on responsible antibiotic use that applies across all of their various brands or pork product lines. However, there are some glimmers of hope. In February 2016 Tyson Foods, the 14th-largest U.S. pig producer, launched its niche Open Prairie™ line of pork products, which sources from pigs raised without any antibiotics. The company predicts the line could eventually constitute 5 percent of its total production, with up to 1 million slaughtered hogs annually.¹¹⁷ In early 2017, Smithfield similarly launched its Pure Farms™ brand of fresh pork products from pigs that never received antibiotics.

THE PATH FORWARD

The scientific consensus for moving forward is clear: Aggressive action must be taken to reduce antibiotic overuse, in animal agriculture as well as in human medicine.^{118,119,120,121,122} In terms of pork production, significant reduction in antibiotic use is the goal, especially for the drugs that are important to human medicine.

Prospects for federal administrative or legislative action are currently dim in the United States. That said, there is hope in other arenas. Thanks to consumer demand and actions by producers and fast-food chains, about half of the poultry industry has committed to eliminating the routine use of antibiotics. California and Maryland have restricted the routine use of antibiotics. And San Francisco now requires that retailers report on antibiotic use practices associated with the meat they sell in the city: which uses of antibiotics are allowed, which are prohibited, and how much antibiotics are used for producing a particular product line. This will provide more information for consumers and empower them to make more antibiotic-safe choices. These positive developments point the way forward for better antibiotic stewardship in the U.S. pork industry.

Governments: More cities can follow San Francisco’s lead and help inform consumers about the use of antibiotics in the production of meat products sold within their limits. More states can join California and Maryland in restricting the routine use of antibiotics.

Consumers: Consumers should continue to demand that companies and restaurants commit to ending the routine use of medically important antibiotics in their pork supply chains. They can do this through their purchases, via their support for better choices by government buyers like their school districts, and by petitioning companies to support better antibiotic use practices. Consumers should use their purchasing power to bring home the bacon—as well as the ribs, pork chops and sausage—from brands and companies that are using antibiotics responsibly. They should look for labels like “USDA Organic” or “No antibiotics administered” (or similar statements such as “No antibiotics ever”). They should be wary of any labels that talk about “growth promotion.” Where consumers cannot find the kind of products with these labels, they should ask their retailer or restaurant to offer more meat produced with responsible antibiotic practices. Consumer demand has made a huge difference in antibiotic use in the chicken industry, and it can help change the pork industry as well.

Producers and food companies: Producers and food companies can commit to producing and buying pork that is raised without the routine use of antibiotics. We have seen the impact such action has had on the chicken industry. Companies like Chipotle, Panera, and Subway have modeled such commitments in the pork sector, but unfortunately, not enough companies have joined them yet. There’s a lot of room for leadership.

In the absence of meaningful federal action, the actions taken by state and local governments, consumers, producers, and food companies can help reduce the threat to human health posed by antibiotic resistance.

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