ConsumerReports®

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ConsumerReports®

FOOD SAFETY AND SUSTAINABILITY CENTER

BUILDING A HEALTHIER FOOD SYSTEM

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About Consumer Reports' Food Work and Its Food Safety and Sustainability Center

Consumer Reports has been concerned about the quality and safety of the food supply since its earliest years. It did pioneering research on the presence of nuclear fallout in the American diet (Strontium-90) in the 1950s and 1960s, which helped build support for the Test Ban Treaty of 1963. The magazine's 1974 landmark series on water pollution played a role in the Safe Drinking Water Act. The organization has been testing meat and poultry for pathogens and antibiotic resistance for more than 15 years and has used its research to successfully fight for reforms such as the 2010 campylobacter standard for chicken and turkey, the 2011 Food Safety Modernization Act, and improvements to the salmonella standards.

In 2012, Consumer Reports launched its Food Safety and Sustainability Center to fight for sweeping, systemic change and address the root causes of problems plaguing the food system. The Center's work focuses on issues including foodborne illness and antibiotic resistance; pesticide use; heavy metals (mercury, lead, arsenic); truth and transparency in labeling; and promoting more sustainable agricultural practices that advance the marketplace, such as animal welfare, organic farming, and fair trade. At the core of the Center's work is the principle that there is a clear intersection between how food is produced and the impact on public health.

Current Contributors to the Consumer Reports Food Safety and Sustainability Center

The following individuals are currently associated with Consumer Reports Food Safety and Sustainability Center. Highlights of their roles and expertise are provided below.

CR Scientists

Dr. Urvashi Rangan leads Consumer Reports' Consumer Safety and Sustainability Group and serves as the Executive Director of its Food Safety and Sustainability Center. Dr. Rangan directs all of the organization's food-safety testing and research in addition to the scientific risk assessments related to food and product safety, which she translates into actionable recommendations for lawmakers and consumers. She is an environmental health scientist and toxicologist and is a leading expert, watchdog, and spokesperson on food labeling and food safety. Dr. Rangan received her Ph.D. from the Johns Hopkins School of Public Health.

Charlotte Vallaeys is a senior policy analyst and writer for the Consumer Reports' Food Safety and Sustainability Center. She focuses on sustainability and justice in the food system and works on a variety of food policy and food safety issues, including food labeling and organic policy. She regularly attends National Organic Standards Board meetings as a watchdog for the organic label and has done work for the National Organic Coalition. She previously worked as Policy Director at The Cornucopia Institute. She received her master's degree in theological studies from Harvard University, where she studied social and environmental ethics, and a master's of science in nutrition from the Friedman School of Nutrition Science and Policy at Tufts University.

Dr. Doris Sullivan is the Associate Director for Product Safety in Consumer Reports' Consumer Safety and Sustainability Group. She oversees product safety testing, research, and prioritization. She is also an expert in compiling and analyzing large datasets. She received her Ph.D. in chemistry from Boston University and completed postdoctoral research at the Free University of Brussels and University of Pennsylvania.

Dr. Michael K. Hansen is a Senior Scientist with Consumers Union, the policy and advocacy arm of Consumer Reports. He works primarily on food safety issues, including pesticides, and has been largely responsible for developing the organization's positions on the safety, testing and labeling of genetically engineered food and mad cow disease. Dr. Hansen served on the Department of Agriculture's Advisory Committee on Agricultural Biotechnology from 1998 to 2002 and on the California Department of Food and Agriculture Food Biotechnology Advisory Committee from 2001 to 2002.

Dr. Keith Newsom-Stewart is a Statistical Program Leader at Consumer Reports. During his tenure, he has worked on a wide range of projects, including those related to meat, seafood, and poultry safety and food additives. He specializes in linear and nonlinear mixed models, experimental design, and analysis of complex surveys. Prior to coming to CR, he worked for the Cornell Biometrics Unit and College of Veterinary Medicine. His educational background is in statistics, general biology, and genetics. He is an adjunct math professor at Western Connecticut State University and a member of the American Statistical Association.

CR Communications

Jennifer Shecter is the Director of Content Impact & Corporate Outreach. In this capacity, she manages the center's partnerships and relationships, coordinates its overall public service activities, and pursues strategic initiatives to build support for its mission. She has been with Consumer Reports for more than a decade, serving first in its Communications Department, promoting food and product safety issues, then working as the Senior Adviser to the President—writing speeches, op-eds, and briefing materials—and advising on key organizational issues.

CR Advisers

Chantelle Norton is an artist and designer and is a lead designer of Consumer Reports' Food Safety and Sustainability Center reports. She has worked in many fields of design, from fashion to print to costume to graphic design. She lives in the Lower Hudson Valley with a medley of animals, including her pet chickens. Her latest paintings take the chicken as muse and feature portraits of her feathered friends in landscapes inspired by the Hudson Valley and Ireland.

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Peeling Back the ‘Natural’ Label

Companies can slap that magic word on processed food packages even if what’s inside contains artificial ingredients. If you find that outrageous, now’s the time to join us in letting the FDA know how you feel.

Published in Consumer Reports March 2016

Do you ever buy one brand of cereal, chips, or juice over another because you see “natural” on the label and assume it’s better? Sure you do, and you have plenty of company. A recent nationally representative Consumer Reports survey found that more than half of consumers seek out “natural” foods, often in the false belief that they’re produced without genetically modified organisms, hormones, pesticides, or artificial ingredients. In fact, for processed foods, that term has no clear meaning and is not regulated by any agency.

That’s why we petitioned the Food and Drug Administration in 2014 to ban the use of “natural” on labeling so that shoppers aren’t misled. (We have also asked the Department of Agriculture to ban the use of “natural” on meat and poultry because it is currently not well-defined or meaningful.)

The FDA has responded by asking the public to comment on how the word “natural” should—or should not—be used on food labels, citing Consumer Reports’ petition as one of the reasons it’s taking that important step. The more than 3,600 comments the agency had received when we went to press illustrate the confusion and frustration many people feel when faced with the natural labeling found on store shelves now.

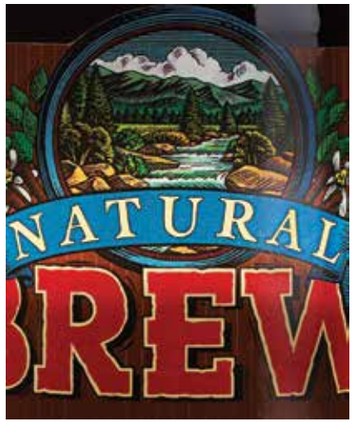
“The use of the word ‘natural’ is a deceptive marketing ploy to reel in unaware consumers. People are led to believe it is the same as ‘organic,’ which it surely is not,” wrote one Florida resident.

Consumer Reports’ food-safety experts agree; in fact, we have long argued that consumers should not be duped by “natural” labels that currently aren’t backed by meaningful standards. “Ideally, we’d like to see federal regulators ban the natural label, but if they don’t get rid of it, then they must give it real meaning,” says Urvashi Rangan, Ph.D., director of the Consumer Reports Food Safety & Sustainability Center.

What do we believe that should look like? For foods regulated by the FDA, we believe the “natural” label should be reserved for foods that are organic and contain no artificial ingredients. We also believe verification should be required to ensure that foods labeled “natural” truly meet that definition, like the process currently used for the term “organic,” Rangan says.

But some in the food industry oppose labeling changes. For instance, the Grocery Manufacturers Association filed a petition with the FDA arguing that the agency should continue to allow the natural label to be used on products containing GMOs.

That’s why it’s so important for consumers to voice their opinions to government officials. You can sign our updated petition calling for a ban of the term “natural” or for giving it a meaningful definition, at ConsumersUnion.org/natural. We will submit it to the FDA on May 10.



CONFUSED? NATURALLY!

The need for change is underscored by our latest findings. In December 2015 the Consumer Reports National Research Center conducted a survey of a nationally representative sample of 1,005 adults to get their take on natural labeling. This is a sampling of what they told us:

62% of shoppers said they usually buy foods labeled ‘natural.’

But nearly **two-thirds** believe the natural label means more than it does.

And **nearly half** incorrectly believe that natural claims on labels have been independently verified.

What SHOULD natural mean?

For processed foods, people told us:

85% No chemicals were used during processing.

84% No artificial ingredients or colors.

84% No toxic pesticides.

82% No GMOs.

87% of shoppers who buy foods labeled ‘natural’ said they would pay more if the term met all of their expectations.

Other priorities

The majority of shoppers consider these things important or very important.(Compared with last year, more shoppers considered these things very important.)

91% Supporting local farmers.

89% Reducing exposure to pesticides in foods.

88% Protecting the environment from chemicals.

84% Providing better living conditions for animals.

A PANDORA’S PACKAGE: WHAT’S INSIDE MAY SURPRISE YOU

These products contain some ingredients that you probably don’t think of as natural. We are not asserting that any of the products violate any laws, but we do believe that the government’s lack of meaningful standards allows for misleading uses of the natural label.

DEL MONTE FRUIT NATURALS

As you’d expect, these snacks are made with fruits such as peaches, pears, and cherries. But they also contain the artificial preservatives potassium sorbate and sodium benzoate, which are made from industrial chemicals.

ALEXIA SWEET POTATO FRIES

The label says “All Natural.” But these fries contain xanthan gum, an ingredient extracted from a “slime” (we’re not making that up!) produced from bacteria. Xanthan gum can be used as a thickening agent or to give foods a “fatty mouth feel.”

KRAKUS POLISH SLICED HAM

The label says that this ham comes “with Natural Juices.” What does that really mean? It’s difficult to imagine because the ingredients listed on the packaging (in addition to ham, water, and salt) include five artificial chemicals used in part to cure and preserve the meat.

NATURAL BREW DRAFT ROOT BEER

Its dark-brown shade comes in part from caramel color. We know from our research that certain types of that artificial coloring contain a possibly carcinogenic chemical called 4-methylimidazole (4-Mel). The company would not say what type of caramel color it used. We have petitioned the federal government to set limits for that chemical in food. We don’t believe any food additive should elevate people’s cancer risk.

TYSON GRILLED & READY FROZEN SOUTHWESTERN CHICKEN BREAST STRIPS

“All natural except for corn syrup solids” appears on the front, but the ingredient list shows that the strips contain corn sweeteners dextrose and maltodextrin. When we asked whether they came from GMO corn, Tyson responded that the government’s “natural requirements do not address GMO.” The strips also contain citric acid, typically a lab-produced additive derived from bacteria.

KRAFT NATURAL CHEESE

This “natural” cheese contains cellulose powder—a substance typically created when pieces of wood, cotton, or bamboo are cooked in a caustic solution at high temperatures—which is supposed to keep shreds of cheese from sticking together. Kraft did not respond to inquiries about the source of its cellulose powder. And to inhibit mold growth it contains the antifungal natamycin, which is also used as a pesticide.

WESSON VEGETABLE OIL

The bottle displays a “Pure & 100% Natural” claim, but the oil is made from soybeans genetically engineered to withstand herbicides. Oils like this one that are not labeled as “expeller pressed” or “cold pressed” are often made using a solvent called hexane. That process can release n-hexane, which is classified as a hazardous air pollutant by the Environmental Protection Agency, which has identified vegetable-oil production as a major source.

Note: We bought these products in December 2015 and January 2016 in Massachusetts and New York. We contacted each company with specific questions about the ingredients or how they were produced or processed. If we didn’t receive a response, we followed up with at least one phone call and two email messages.

Where GMOs hide in your food

New Consumer Reports' tests find genetically modified organisms in many packaged foods—including those labeled 'natural'

Published on Consumer Reports Online October 2014

More than 70 percent of Americans say they don't want genetically modified organisms in their food, according to a recent Consumer Reports National Research Center survey of 1,000 adults. The trouble is, it's hard to avoid them. Consumer Reports' tests of breakfast cereals, chips, soy infant formulas, and other popular products found that GMOs lurk in many packaged foods—including some that carry labels suggesting that they don't have these controversial ingredients.

In more than 60 countries, manufacturers must label foods that contain genetically modified ingredients. But GMO labeling isn't required in the U.S. Yet our survey found that 92 percent of Americans want genetically modified foods to be labeled. And concerns about the potential health and environmental risks of GMOs coupled with an unwillingness on the part of the federal government to mandate labeling are leading many states to take action on their own.

Vermont recently passed legislation requiring GMO labeling, and similar actions are being considered in more than two dozen other states, including Colorado and Oregon, where residents will begin voting on a GMO-labeling ballot initiative in late October. "Federal law already requires labeling that lets consumers know whether foods have been previously frozen, made from concentrate, pasteurized, or irradiated, and we believe the label should also say if food is genetically engineered," says Jean Halloran, director of Food Policy Initiatives at Consumers Union, the policy arm of Consumer Reports.

WHAT ARE GMOS, ANYWAY?

Genetically modified organisms are created by deliberately changing the genetic makeup of a plant or animal in ways that could never occur in nature. The majority of GMO crops currently on the market have been genetically engineered to produce their own pesticides and/or withstand herbicides that normally would kill them. Farmers use the herbicides to control weeds.

SAFETY CONCERNS

You may be surprised to know that the federal government has not mandated that genetically modified organisms be proved safe before they're used in your food. But safety assessments are mandatory in other major developed countries, including China, Japan, and the countries of the European Union. Some animal studies suggest that GMOs may cause damage to the immune system, liver, and kidneys. "There hasn't been enough research to determine whether GMOs are harmful to people," says Michael Hansen, Ph.D., senior scientist at Consumers Union and an authority on genetic engineering. "But scientists around the world agree that GMOs have the potential to introduce allergens and create other unintended changes that may affect health."

The use of genetically modified seeds has steadily grown over the last two decades. That has led to about a 10-fold increase in farmers' use of glyphosate, a weedkiller better known as Roundup, which is made by Monsanto—a company that also produces genetically modified seeds—because the herbicide won't harm their GMO crops. But that in turn has created a new problem for farmers to battle: a rising number of "superweeds" that have now become immune to glyphosate. "This defeats one of the major reasons why GMOs were introduced in the first place," Hansen says.

THE FOOD INDUSTRY'S TAKE

Companies that produce genetically modified organisms and their allies in the food industry argue that genetic engineering is just an extension of traditional breeding, which humans have been doing for thousands of years. But that process involves the transfer of DNA between closely related plants or animals. Genetic engineering techniques, on the other hand, move genetic material from any organism to any other organism.

There is fierce opposition to GMO labeling from many seed manufacturers and big food companies, which have spent nearly $70 million in California and Washington state alone to defeat GMO-labeling ballot initiatives. One of the major arguments they make is that stamping foods with a statement such as "contains GMO ingredients" implies that those foods are inferior to other conventional or organic foods when there's no evidence that genetically modified organisms are harmful. "Our position is that GMO foods should be labeled, period," Halloran says. "Consumers have the right to know what's in their food so that they can make informed choices." (Learn what you can do to support mandatory GMO labeling.)

GMOS ARE FOUND IN SURPRISING PLACES

GMO labeling should be required in the U.S., but in the meantime some food manufacturers are choosing not to use genetically modified ingredients and are noting that on their products' packaging. To see how many foods have GMOs and whether you can trust the claims you see on food packages, we bought more than 80 different processed foods containing corn or soy between April and July 2014. (Corn and soy are the two most widely grown genetically engineered crops in the U.S.) We tested at least two samples of each product, each sample from a different lot, to measure the GMO content. Then we compared our results with any non-GMO-related claims.

Genetically modified corn and soy are used in a wide variety of foods. Nearly all of the samples we tested of the products that did not make any non-GMO-related claim on the package did, in fact, contain substantial amounts of genetically modified corn or soy. They included many familiar foods, such as Kellogg's Froot Loops, General Mills Corn Chex, Jiffy Corn Muffin Mix, Doritos Oven Baked Nacho Cheese chips, and Boca Original Vegan Veggie Burgers. Four of the products in this group were soy-based infant formulas: Enfamil ProSobee Soy Infant Formula, Gerber Good Start Soy, Similac Soy Isomil, and Similac Go & Grow Soy Infant formula.

Because our tests represented only a small slice of the market, we can't draw conclusions about all products containing corn or soy, or about every product for a given brand. But until genetically modified organism labeling becomes mandatory, our test results can help you decode the meaning behind the claims you see on grocery store shelves.

Organic claims

This indicates that a third party has certified that the product complies with USDA Organic guidelines, which forbid the use of genetically modified organisms. Our tests found that products with organic ingredients—such as Amy's All American Veggie Burgers, 365 Everyday Value Organic Corn Tortillas, and Soy Dream Vanilla Frozen Dessert—qualified as non-GMO. Many of the products that make organic claims also make some kind of non-GMO claim on their packaging.

Non-GMO Project Verified seal

All of the products we tested with this seal qualified as non-GMO. That means the product had no more than 0.9 percent genetically modified organisms. (In EU countries, products that have ingredients that contain more than 0.9 percent genetically modified organisms are required by law to carry GMO labeling.) The Non-GMO Project certifies manufacturers' products through third-party testing. Among the products we tested that carried this seal were Post Grape Nuts Original cereal and Silk Original soymilk.

Uncertified non-GMO claims

These claims made by the manufacturer—which may include the words "No GMO" and "Non-GMO"—have no standard definition and don't require independent verification. Even so, most of the products we tested containing nonorganic corn or soy that made an uncertified claim met non-GMO standards. These included Clif Builder's Chocolate Peanut Butter Bar and Bob's Red Mill Golden Corn Flour.

The exception was Xochitl Totopos de Maiz original corn chips. The package read "No GMO" and "All Natural." But our tests showed that the amount of genetically modified corn in the six samples we tested averaged more than 75 percent. The manufacturer said it uses corn from a supplier that provided test results with many of the deliveries Xochitl received indicating that the corn was non-GMO. When we tested samples from two packages of Xochitl Totopos de Maiz Organic White Corn Chips, which were also labeled "No GMO," we found that the product met non-GMO standards.

Natural claims

More than 60 percent of people in our national survey said they believed that "Natural" means "No GMOs." But that's not what our tests found. Virtually all of the samples we tested of products that made only a "Natural" claim did have a substantial amount of GMOs, although since we did our testing some manufacturers have removed the "natural" claim or have become Non-GMO Project Verified.

"The confusing nature of this claim is just one reason we are asking the government to ban the use of 'natural' labels on food," says Urvashi Rangan, Ph.D., director of the safety and sustainability center at Consumer Reports.

EAT THE PEACH, NOT THE PESTICIDE

Our new produce guidelines show you how to make the best choices for your health and for the environment

Published on Consumer Reports Online March 2015

Across America, confusion reigns in the supermarket aisles about how to eat healthfully. One thing on shopper's minds: the pesticides in fruits and vegetables. In fact, a recent Consumer Reports survey of 1,050 people found that pesticides are a concern for 85 percent of Americans. So, are these worries justified? And should we all be buying organics—which can cost an average of 49 percent more than standard produce?

Experts at Consumer Reports believe that organic is always the best choice because it is better for your health, the environment, and the people who grow our food. The risk from pesticides on conventional produce varies from very low to very high, depending on the type of produce and on the country where it's grown. The differences can be dramatic. For instance, eating one serving of green beans from the U.S. is 200 times riskier than eating a serving of U.S.-grown broccoli.

"We're exposed to a cocktail of chemicals from our food on a daily basis," says Michael Crupain, M.D., M.P.H., director of Consumer Reports' Food Safety and Sustainability Center. For instance, the Centers for Disease Control and Prevention reports that there are traces of 29 different pesticides in the average American's body. "It's not realistic to expect we wouldn't have any pesticides in our bodies in this day and age, but that would be the ideal," says Crupain. "We just don't know enough about the health effects."

If you want to minimize your pesticide exposure, see our risk guide. (Download our full scientific report, "From Crop to Table (http://www.consumerreports.org/content/dam/cro/news_articles/health/CR_FSASC_FromCroptoTableP-esticides_Mar2015.pdf).") We've placed fruits and vegetables into five risk categories—from very low to very high. In many cases there's a conventional item with a pesticide risk as low as organic. Below, you'll find our experts' answers to the most pressing questions about how pesticides affect health and the environment. Together, this information will help you make the best choices for you and your family.

29
Number of pesticides in the average american's body

Our risk guide for conventional produce

This tool shows the risk of pesticide exposure from eating 48 fresh conventional fruits and vegetables from 14 different countries. Analyzing 12 years of data from the Department of Agriculture's Pesticide Data Program (http://www.ams.usda.gov/AMSv1.0/pdp), Consumer Reports' scientists, in consultation with Charles Benbrook, Ph.D., of Washington State University, placed each produce-country combination into one of five risk categories. Risk assessment included the number of pesticide residues on each food, the frequency with which they were found, and the toxicity of the pesticides. The risk categories correlate with the number of daily servings of that fruit or vegetable.

We also took into account the typical serving size of the food and the weight of the person eating that food. Our analysis is based on the risk to a 3½-year-old child, estimated to weigh 35.2 pounds, because children are especially vulnerable to the dietary risks from pesticides and the EPA is required to consider the effects of pesticides on children. The risks to adults would be lower.

We recommend buying organic for any produce-country combination in the medium or higher risk categories. We found that all organic produce falls into the low-or very low-risk categories. Conventional items in the low or very low categories are essentially equivalent to organic.

How do you know where your produce is from?

By law, supermarkets are required to tell consumers where the fruits and vegetables they're buying were grown. It's usually not difficult to find the country of origin, but that information is not always in the same place.

Here's where to look.

On produce stickers

On signs posted near fruits and vegetables sold loose in markets

On the package of produce sold in bags and boxes, like apples, mushrooms, and prewashed lettuce

On the box the fruit or vegetable was shipped in.

How risky are pesticides?

There's data to show that residues on produce have actually declined since 1996, when Congress passed the Food Quality Protection Act (http://www.epa.gov/pesticides/regulating/laws/fqpa/). This law requires that the EPA ensure that levels of pesticides on food are safe for children and infants.

Every year, the Department of Agriculture tests for pesticide residues on a variety of produce. In its latest report, more than half of the samples had residues, with the majority coming in below the EPA tolerance levels. "Conventionally grown fruits and vegetables are very safe," says Teresa Thorne, spokesperson for the Alliance for Food and Farming (AFF), an organization that represents conventional and organic produce growers.

But that's not the whole story. Looking at specific produce items, you see that progress has been made for some but not others. Grapes and pears, for example, once would have been in the high-risk or very high-risk categories but now rank low. But others, such as green beans, have been in the higher-risk categories for the past 20 years.

And there's more to consider than just the amount of pesticides on the apple you eat. "Tolerance levels are calculated for individual pesticides, but finding more than one type on fruits and vegetables is the rule—not the exception," says Urvashi Rangan, Ph.D., a toxicologist and executive director of the Food Safety and Sustainability Center.

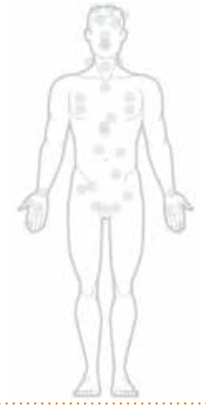
Our survey found that a third of Americans believe there's a legal limit on the number of different pesticides allowed on food. But that's not the case. Almost a third of the produce the USDA tested had residues from two or more pesticides. "The effects of these mixtures is untested and unknown," Rangan says.

What's the evidence that pesticides hurt your health?

A lot of the data comes from studies of farmworkers, who work with these chemicals regularly. Studies have linked long-term pesticide exposure in this group to increased risk of Alzheimer's and Parkinson's disease; prostate, ovarian, and other cancers; depression; and respiratory problems. There's some suggestion that adults and children living in farm communities could also be at risk for chronic health problems.

The rest of us may not handle the stuff, but we are exposed

13 health risks from pesticide exposure

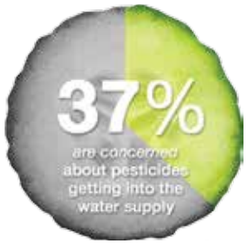


ADHD in kids
Alzheimer's disease
Birth defects
Breast cancer
Cancers (other)
Depression
Fertility issues
Immune system damage
Low IQ in kids
Ovarian cancer
Parkinson's disease
Prostate cancer
Respiratory problems

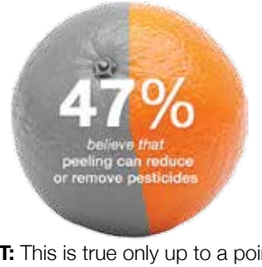
Myth Busting

A recent survey from the Consumer Reports National Research Center of 1,050 Americans found that consumers have some misconceptions about pesticides and organic produce. Here, we separate the facts from the myths.

FACT: Local is a term that is broadly defined. Organic, on the other hand, is a strictly regulated term, so you can trust that you're getting produce grown with minimal if any synthetic pesticides.



FACT: When we asked about Americans' major pesticide concerns, for most people water contamination didn't rise to the top of the list. But according to a U.S. Geological Survey report, the majority of streams in the U.S. contain pesticides or pesticide residues.



FACT: This is true only up to a point. The USDA measures pesticide residues for the edible portion of a fruit or vegetable. That means inedible peels and rinds are removed.

through food, water, and air. The fact that pesticide residues are generally below EPA tolerance limits is sometimes used as "proof" that the health risks are minimal. But the research used to set these tolerances is limited.

In a 2010 report on environmental cancer risks, the President's Cancer Panel (an expert committee that monitors the country's cancer program) wrote: "The entire U.S. population is exposed on a daily basis to numerous agricultural chemicals. ... Many of these chemicals have known or suspected carcinogenic or endocrine-disrupting properties." Endocrine disruptors can block or mimic the action of hormones, even at low doses. "Endocrine effects aren't sufficiently factored into the EPA pesticide-tolerance levels," Crupain says. "And there's concern they could cause reproductive disorders; birth defects; and breast, prostate, and other hormone-related cancers."

Who may be at greatest risk from pesticide exposure?

Aside from farmworkers, it's children. A child's metabolism is different from an adult's, so toxins can remain longer in a child's body, where they can do more damage. Pesticide exposure can affect children's development at many stages, starting in the womb. "Fetuses, babies, and kids are more vulnerable to the effects of pesticides because their organs and nervous systems are still developing," says Philip Landrigan, M.D., director of the Children's Environmental Health Center at the Icahn School of Medicine at Mount Sinai Hospital in New York. And children's risk is concentrated because they eat more food relative to their body weight than adults.

The health risks to children are significant. Even small amounts of pesticides may alter a child's brain chemistry during critical stages of development. One study of 8- to 15-year-olds found that those with the highest urinary levels of a marker for exposure to a particularly toxic class of pesticides called organophosphates (OPs) had twice the odds of developing attention deficit hyperactivity disorder as those with undetectable levels. Another study found that at age 7, children of California farmworkers born to mothers with the highest levels of OPs in their bodies while they were pregnant had an average IQ 7 points below those whose moms had the lowest levels during pregnancy. That's comparable to the IQ losses children suffer due to low-level lead exposure.

The risk to adults is lower but still worrisome. "Pesticide exposure likely increases the risk, first, of cancerous tumor development, and, second, your body not being able to control a tumor growth," says Charles Benbrook, Ph.D., a research professor at the Center for Sustaining Agriculture and Natural Resources at Washington State University and a consultant to Consumer Reports. In addition, research has linked endocrine disrupters with fertility issues, immune system damage, and neurological problems. "However, unlike cancer, quantifying those effects is difficult at this time," Crupain says.

Does eating organic mean I won't be eating any pesticides?

There are two groups of agricultural pesticides: synthetic and

natural. Synthetics are created in labs, and natural ones are substances that occur in nature. The majority of synthetic pesticides (and all of the most toxic ones) used in conventional farming are banned in organic farming, but pesticide drift can mean chemicals sprayed on conventional crops may find their way to nearby organic farms. Still, all of the organic produce in our analysis fell into the very low-risk or low-risk categories.

USDA organic standards allow for the use of certain natural pesticides and very few synthetic ones. "But you can't compare conventional and organic farming in an oranges-to-oranges kind of way," says Michael Sligh, a farmer, founding chairman of the National Organic Standards Board, and Just Foods Program director at Rural Advancement Foundation International.

Natural pesticides are usually less toxic than synthetic ones. " 'Pesticide' is a broad term used to refer to a range of substances from the very, very limited low-toxic ones allowed in organic farming to the highly toxic chemicals that can be used in conventional farming," he says. "They are very different. Before a pesticide is even approved for use in organic farming, it must be evaluated for potential adverse effects on humans, animals, and the environment, and prove it's compatible with a system of sustainable agriculture. And farmers must follow integrated `pest-management plans that require that they use any approved organic pesticide as a last resort and develop strategies to avoid repeated use." Those differences have implications for personal health but also for the health of farmworkers and the planet. "Folks need to understand the multiple benefits they are getting when they choose organic," he says, "and the multiple choices they are making when they don't."

Can you wash away pesticides?

About half of the people in a recent Consumer Reports survey believe that peeling fruit or vegetables removes or reduces pesticides and 43 percent think you can remove them by washing. And they're right—sort of. Rinsing can remove the surface residues, as well as dirt and bacteria. But you can't completely wash away the pesticides—or the risk. Pesticides can stick to soft skins, and the wax coating used on some produce can trap pesticide residues. And some pesticides are systemic, that is they are taken up by the plant's root system and get into the fruit or vegetable flesh so they can't be washed off. What's more, the USDA measures pesticide residues after produce has been rinsed in cold running water and/or inedible peels and rinds are removed. So the pesticide residues used to calculate our dietary risk guide are those that remain after the fruit or vegetable has been prepped the way you would at home.

Wash your produce—conventional and organic—in running water. You don't need any special washes. Researchers at the Connecticut Agricultural Experiment Station compared rinsing fruit and vegetables in plain water for one minute with washing them with vegetable washes (four different ones) and a solution of dishwashing soap and water. Water alone was as effective as any of the washes or soap. Rubbing produce with soft skins like peaches or using a vegetable brush on harder items like potatoes or carrots will help remove residues, dirt and germs.

Should I skip conventionally grown produce?

No. The risks of pesticides are real, but the myriad health benefits of fruits and vegetables are, too. A 2012 study estimated that increasing fruit and vegetable consumption could prevent 20,000 cancer cases annually, and 10 cases of cancer per year could be attributed to consumption of pesticides from the additional produce. Another study found that people who ate produce at least three times per day had a lower risk of stroke, hypertension, and death from cardiovascular disease.

"We believe that organic is always the best first choice," says Consumer Reports' Rangan. "Not only does eating organic lower your personal exposure to pesticides, but choosing organic you support a sustainable agriculture system." However, your primary goal is to eat a diet rich in fruits and vegetables—ideally five or more servings a day—even if it's a type that falls into our very high-risk category. If organic produce is too pricey or not available, our analysis shows that you often have a lowrisk conventional option.

Caramel color: The health risk that may be in your soda

It's the most common coloring in foods and drinks—and it can contain a potential carcinogen. Here's what Consumer Reports found when it tested soft drinks that have caramel color.

Published on Consumer Reports Online February 2014

Caramel color, added to many soft drinks and some foods to turn them brown, may sound harmless, even appetizing. But in no way does it resemble real caramel. Some types of this artificial coloring contain a potentially carcinogenic chemical called 4-methylimidazole (4-MeI). Under California's Proposition 65 law, any food or beverage sold in the state that exposes consumers to more than 29 micrograms of 4-MeI per day is supposed to carry a health-warning label. In recent Consumer Reports' tests, each of the 12-ounce samples of Pepsi One and Malta Goya had more than 29 micrograms per can or bottle. While we cannot say that this violates California's Prop 65, we believe that these levels are too high, and we have asked the California Attorney General to investigate.

Caramel color is the single most used food coloring in the world, according to a 2013 report from market research firms Mintel and Leatherhead Food Research. "There's no reason why consumers should be exposed to an avoidable and unnecessary risk that can stem from coloring food brown," says Urvashi Rangan, Ph.D., toxicologist and executive director of Consumer Reports' Food Safety & Sustainability Center. "Manufacturers have lower 4-MeI alternatives available to them. Ideally there would be no 4-MeI in food."

THE RISKS

In 2007, a federal government study concluded that 4-MeI caused cancer in mice and the

International Agency for Research on Cancer determined the chemical to be "possibly carcinogenic to humans" in 2011. There's no federal limit for levels of 4-MeI in foods and beverages, but as of January 7, 2012 California requires manufacturers to label a product sold in the state with a cancer warning if it exposes consumers to more than 29 micrograms of 4-MeI per day. In this case, the exposure comes from consumption.

The California Office of Environmental Health Hazard Assessment used 29 micrograms as the cut off point because that's the level they determined poses a one in 100,000 risk of cancer—that is, no more than one excess cancer case per 100,000 people who are exposed to that amount daily for a lifetime.

Consumer Reports' experts think even that risk is too high. "It's possible to get more than 29 micrograms of 4-MeI in one can of some of the drinks we tested. And even if your choice of soft drink contains half that amount, many people have more than one can per day," says Rangan. "Given that coloring is deliberately added to foods, the amount of 4-MeI in them should pose a negligible risk, which is defined as no more than one excess cancer case in 1 million people." To meet that risk level, Consumer Reports' experts say a soft drink would need to contain about 3 micrograms or less per can.

HOW WE TESTED

Consumer Reports* tested 81 cans and bottles of various popular brands of soft drinks from five manufacturers between April and September 2013. We purchased the products from stores in California and the New York metropolitan region. In December 2013, we bought and tested 29 new samples, again from the same areas, of those brands that had initially tested above 29 micrograms per can or bottle in either location.

WHAT WE FOUND

While our study was not large enough to recommend one brand over another, both rounds of testing found that the level of 4-MeI in the samples of Pepsi One and Malta Goya purchased in both locations exceeded 29 micrograms per can or bottle. The products we purchased in California did not have a cancer-risk warning label.

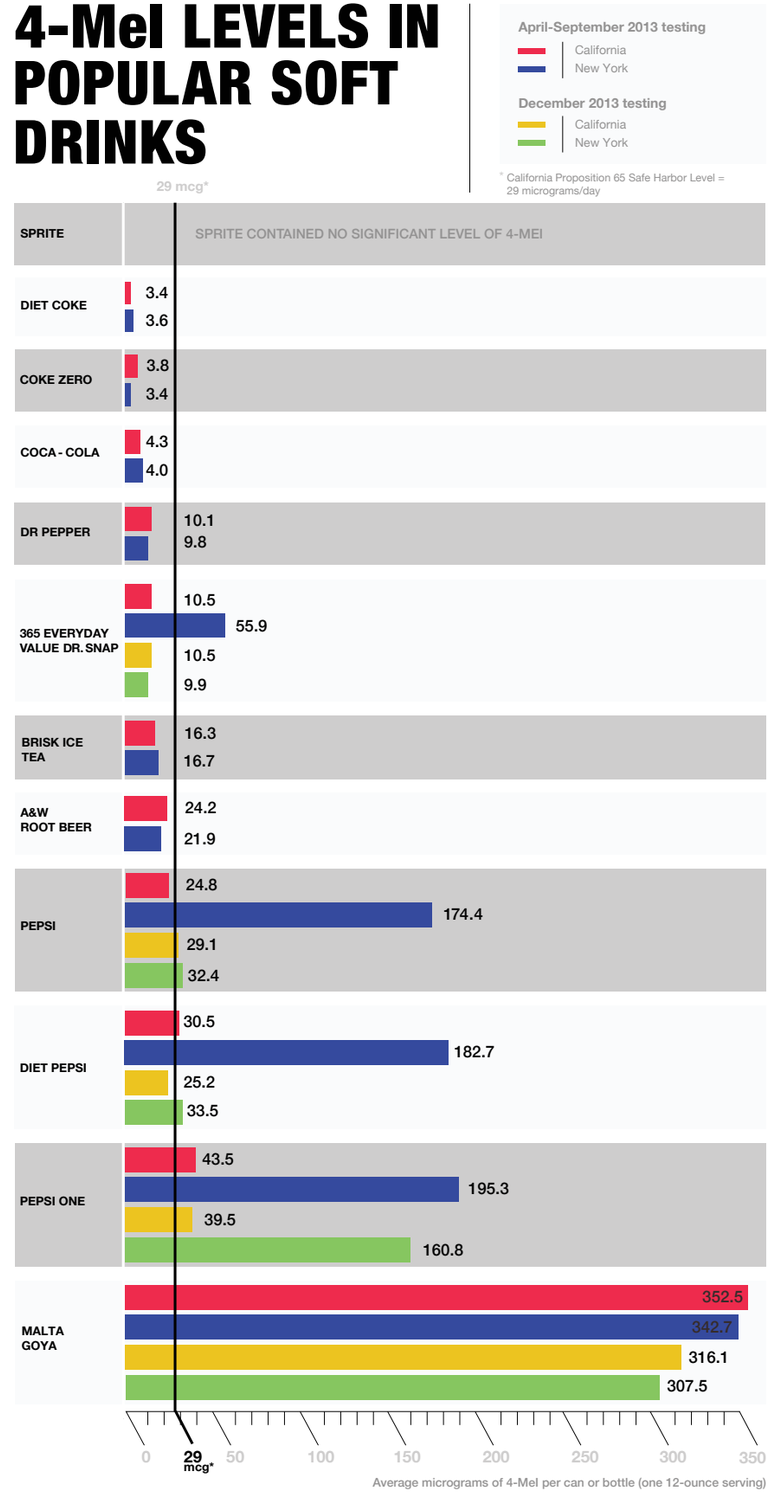
In our initial testing, some of the other brands we bought in California had average levels around or below 29 micrograms per can, but the New York area samples of those same brands tested much higher. In our second test, though, the levels in the New York samples had come down. For example, regular Pepsi from the New York area averaged 174 micrograms in the first test and 32 micrograms in the second. "The fact that we found lower amounts of 4-MeI in our last round of tests suggests that some manufacturers may be taking steps to reduce levels, which would be a step in the right direction," says Dr. Rangan

On average, three of the brands—Coke, Diet Coke, and Coke Zero—came in under 5 micrograms per can in our tests, a level Consumer Reports' experts believe is more acceptable. Sprite, a clear soda that was tested as a control, showed no significant levels of 4-MeI. (See following chart.)

These brands of soft drinks all contained varying levels of 4-MeI.

* Editor's Note: Consumer Reports partnered with the Johns Hopkins Center for a Livable Future to do the testing and the risk assessment. This project was made possible by donations to the Consumer Reports' Food Safety & Sustainability Center.

4-MeI LEVELS IN POPULAR SOFT DRINKS



Consumer Reports purchased popular brands of soft drinks that had caramel color listed as an ingredient on their label (except for Sprite, which was tested as a control). In two test periods, we tested a total of 110 samples of 12 brands from multiple lots. The samples were purchased from grocery stores in California and the New York metropolitan region from April 2013 to December 2013. Consumer Reports partnered with the Johns Hopkins Center for a Livable Future (CLF) to conduct the testing and risk assessment. We used two independent laboratories to perform the analysis of 4-MeI in soft drink samples using High-Performance Liquid Chromatography coupled with Tandem Mass Spectrometry (HPLC-MS/MS).

For our initial test (April 2013 to September 2013), we tested samples from two lots of each brand from both locations and from a third if there was more than a 20 percent variation in 4-MeI levels. Based on initial results, new samples of Pepsi One and Malta Goya were purchased representing a total of 11 additional lots, from California, and tested to confirm the earlier findings. Finally, in December 2013 we purchased and tested samples from both California and the New York metropolitan region of those brands where there were any results above 29 micrograms in our initial tests of products from either location. These were: regular Pepsi Diet Pepsi, Pepsi One, Malta Goya, and 365 Everyday Value Dr. Snap regular.

To avoid 4-MeI, check ingredient lists for "caramel color" or "artificial color."

WHAT MANUFACTURERS SAY

Because California's regulations took effect two years ago, we contacted PepsiCo and Goya in early January 2014 to ask whether their products sold in California were in compliance with the state's law. A spokesperson for PepsiCo said in an e-mail, "When the regulatory requirements changed in California, PepsiCo moved immediately to meet the new requirements." She also said reformulated products containing lower levels of 4-MeI would be available nationwide by February 2014. Goya did not provide a response to our questions.

After we informed PepsiCo of our test results, the company issued a statement that said that Proposition 65 is based on per day exposure and not exposure per can. It also cited government consumption data that shows that the average amount of diet soda consumed by people who drink it is 100 milliliters per day, or less than a third of a 12-ounce can. For that reason, they believe that Pepsi One does not require cancer-risk warning labels—even if the amount of 4-MeI in a single can exceeds 29 micrograms.

Consumer Reports says there is analysis of government data that shows higher levels of daily consumption of soft drinks generally. "No matter how much consumers drink they don't expect their beverages to have a potential carcinogen in them. And we don't think 4-MeI should be in foods at all. Our tests of Coke samples show that it is possible to get to much lower levels," says Rangan.

WHAT CONSUMER REPORTS IS DOING

Based on our results, Consumers Union, the policy and action arm of Consumer Reports, is taking several actions. First, we are alerting the California Attorney General's office of our test findings regarding Pepsi One and Malta Goya. We are also petitioning the Food and Drug Administration (FDA) to set a federal standard for 4-MeI and in the meantime to require manufacturers to list the type of caramel color they use on their products' ingredient lists. That's important because there are four types of caramel coloring. Only the two made with ammonia compounds can contain 4-MeI. However, manufacturers can use the general term "artificial color" interchangeably with "caramel color." "Europe has labeling requirements and consumers in the United States should have the right to make an informed choice about what they are drinking and eating," says Dr. Rangan.

In a statement from the agency, the FDA said it does not believe that 4-MeI from caramel color at levels currently in food pose a risk. However, they appreciated Consumer Reports' tests and are currently doing their own tests of foods, including sodas, for 4-MeI. They are also reviewing new safety data on 4-MeI to determine what, if any, regulatory action needs to be taken.

WHAT YOU CAN DO

To express your concern about caramel color in food to the FDA, go to Consumers Union's website *NotInMyFood.org*.

If you want to limit your exposure to 4-MeI, for now the only option is to consume few if any products that list "caramel color" or "artificial color" on their labels. "Clearly, it's feasible for manufacturers to reduce levels of 4-MeI in their products right now," says Dr. Rangan. "But until a federal standard is set or there is more transparency in labeling, you may want to read ingredient lists carefully."

Sour news about syrup

Published in Consumer Reports January 2013

Pancake syrup is far less expensive than pure maple syrup, but those savings come at a price. Caramel color is often used to give the syrups their amber hue, and some types can contain 4-MeI—a potential carcinogen. This chemical has been shown to cause cancer in mice, and the International Agency for Research on Cancer, part of the World Health Organization, says that it may cause cancer in people as well.

Consumer Reports tested four brands of pancake syrup that contained caramel color and one brand of pure maple syrup as a control. In earlier tests, we measured 4-MeI levels in soft drinks from manufacturers such as Coca-Cola, Goya, and PepsiCo. (See the results of that study at *ConsumerReports.org/cro/caramelcolor0114*.) For both tests, we purchased samples in California and the New York metro area.

All of the pancake syrup samples contained 4-MeI. (See table at right.) The average levels ranged from 11.5 to 38 micrograms per ¼ cup, the serving size specified on the label. (Though 4-MeI can form during the heating process that converts maple sap to syrup, our samples had less than 1 microgram per serving, an amount our experts deem insignificant.)

Although neither our syrup nor our soft drink test was large enough to draw conclusions about individual brands or to recommend one brand over another, the samples of Hungry Jack (J.M. Smucker) and Aunt Jemima (Quaker Oats, owned by PepsiCo) contained somewhat higher average levels of 4-MeI than the samples of other syrups. In our test of soft drinks, we found the highest 4-MeI levels in the samples of Malta Goya (Goya Foods) and Pepsi One (PepsiCo). For example, the average levels per 12 ounces in our December 2013 test for the California and New York samples respectively were 316.1 and 307.5 micrograms in Malta Goya and 39.5 and 160.8 micrograms in Pepsi One.

Pancake syrups can contain 4-MeI, a potential carcinogen.

The amount of 4-MeI in syrups is much less of a concern than the amount in soft drinks because people tend to consume soft drinks more often, in many cases daily. On average, adults and children who eat pancake syrup regularly do so about twice a week, according to our analysis of data from the National Health and Nutrition Examination Survey and a national survey of 974 parents conducted recently by Consumer Reports.

Two weekly servings of a pancake syrup with the lowest average level in our tests (Log Cabin Original) would pose a negligible cancer risk, defined as 1 in 1,000,000. That means that if one million people were exposed to a given level of 4-MeI daily over a lifetime, no more than one excess cancer would occur in that group as a result. Two weekly servings of any of the syrups in our tests would still be close to negligible.

But for people who have pancake syrup daily, as 4 percent of children between the ages of 1 and 5 do, according to our survey, risk increases. At the highest average 4-MeI level we found, the risk would be 10 times higher than negligible, or one excess case of cancer in 100,000 people who ate that amount daily over a lifetime. According to our experts, that's the point where risk becomes significant. And if consumed daily, none of the pancake syrups had low enough 4-MeI levels to reach the negligible risk level.

The types of caramel color that can have 4-MeI (class III and class IV) also are used in products from soy sauce to baked goods. Every little bit adds up, increasing risk.

The fact that we found little 4-MeI in some of the samples of soft drinks and pancake syrups we tested suggests that it is possible for manufacturers who use caramel color to minimize the 4-MeI in their products. Consumer Reports is urging the Food and Drug Administration to set standards for 4-MeI in foods. Companies should also be required to list the type of caramel color that they use so that consumers can avoid 4-MeI if they choose.

PHOTO: GETTY IMAGES

WHAT WE FOUND IN TESTS

Consumer Reports tested a total of 28 samples of pancake syrups that listed caramel color on the label and pure maple syrup (as a control). We purchased our samples at grocery stores in California and the New York tristate area in May 2012 and April through July of 2013. (The maple-syrup samples were bought in New York.) Because there was little regional variation in our samples, the table lists averages for the products purchased in both locations. Our study provides a snapshot of the market, but it was not large enough to recommend one brand over another, or to be indicative of levels that would always be found in any given brand.

Brand (MANUFACTURER) Average 4-Mel (micrograms) in ¼ cup	
Hungry Jack Original (J.M. Smucker)	38.0
Aunt Jemima Lite (Quaker Oats)	33.0
Aunt Jemima Original (Quaker Oats)	30.1
Mrs. Butterworth's Original (Pinnacle Foods)	21.0
Log Cabin Original (Pinnacle Foods)	11.5
Maple Grove Farms 100% Pure Maple Syrup (B&G Foods)	0.7

Editor's note: Consumer Reports teamed up with the Johns Hopkins Center for a Livable Future to do the testing and risk assessment. This project was made possible by donations to the Consumer Reports' Food Safety & Sustainability Center.

UPDATE FROM OUR LABS ON CARAMEL COLOR

Published in Consumer Reports September 2015

You may have heard that some types of caramel coloring in soft drinks, pancake syrup, and other foods contain a potential carcinogen called 4-Mel. Now Goya and Pepsi, two companies with products that had high levels of 4-Mel in samples we tested in 2013, seem to have made improvements.

WHAT'S THE RISK?

Lifetime daily exposure to 29 micrograms (mcg) of 4-Mel carries a risk of one excess cancer case in 100,000. But because caramel color is in many foods, it's not difficult to exceed that amount. An analysis of national soda intake from Consumer Reports and Johns Hopkins University found that on any given day, almost 60 percent of people ages 16 to 44 drink soda, consuming an average of two cans per day.

WHAT WE FOUND

We repeated our 2013 tests with samples purchased in California and the New York metropolitan area. Five of the six new samples of Malta Goya had no detectable 4-Mel. (In our 2013 tests, all of the samples had more than 300 mcg.) Better, but the outlier had 274 mcg. When we tested nine cans of Pepsi Max (similar to the discontinued Pepsi One, which had the second highest levels of 4-Mel in our 2013 tests), the results ranged from 22 to 29 mcg. Most California samples of Pepsi and Diet Pepsi had around 3 mcg; two had levels around 24 mcg. Six New York samples had 22 to 27 mcg.

WHAT IT MEANS

Ideally, there would be no 4-Mel in food, but the risk is very low when levels are under 5 mcg per serving. Goya and Pepsi have the ability to get there; they just need to be more consistent about doing so.

Arsenic in your juice

How much is too much? Federal limits don't exist.

Published in Consumer Reports January 2012

Arsenic has long been recognized as a poison and a contaminant in drinking water, but now concerns are growing about arsenic in foods, especially in fruit juices that are a mainstay for children.

Controversy over arsenic in apple juice made headlines as the school year began when Mehmet Oz, M.D., host of "The Dr. Oz Show," told viewers that tests he'd commissioned found 10 of three dozen apple-juice samples with total arsenic levels exceeding 10 parts per billion (ppb). There's no federal arsenic threshold for juice or most foods, though the limit for bottled and public water is 10 ppb. The Food and Drug Administration, trying to reassure consumers about the safety of apple juice, claimed that most arsenic in juices and other foods is of the organic type that is "essentially harmless."

But an investigation by Consumer Reports shows otherwise. Our study, including tests of apple and grape juice, a scientific analysis of federal health data, a consumer poll, and interviews with doctors and other experts, finds the following:

In our tests, apple and grape juice had arsenic and lead at varying levels.

- Roughly 10 percent of our juice samples, from five brands, had total arsenic levels that exceeded federal drinking-water standards. Most of that arsenic was inorganic arsenic, a known carcinogen.
- One in four samples had lead levels higher than the FDA's bottled-water limit of 5 ppb. As with arsenic, no federal limit exists for lead in juice.
- Apple and grape juice constitute a significant source of dietary exposure to arsenic, according to our analysis of federal health data from 2003 through 2008.
- Children drink a lot of juice. Thirty-five percent of children 5 and younger drink juice in quantities exceeding pediatricians' recommendations, our poll of parents shows.
- Mounting scientific evidence suggests that chronic exposure to arsenic and lead even at levels below water standards can result

in serious health problems.
• Inorganic arsenic has been detected at disturbing levels in other foods, too, which suggests that more must be done to reduce overall dietary exposure.

Our findings have prompted Consumers Union, the advocacy arm of Consumer Reports, to urge the FDA to set arsenic and lead standards for apple and grape juice. Our scientists believe that juice should at least meet the 5 ppb lead limit for bottled water. They recommend an even lower arsenic limit for juice: 3 ppb.

"People sometimes say, 'If arsenic exposure is so bad, why don't you see more people sick or dying from it?' But the many diseases likely to be increased by exposure even at relatively low levels are so common already that its effects are overlooked simply because no one has looked carefully for the connection," says Joshua Hamilton, Ph.D., a toxicologist specializing in arsenic research and the chief academic and scientific officer at the Marine Biological Laboratory in Woods Hole, Mass. As our investigation found, when scientists and doctors do look, the connections they've found underscore the need to protect public health by reducing Americans' exposure to this potent toxin.

MANY SOURCES OF EXPOSURE

Arsenic is a naturally occurring element that can contaminate groundwater used for drinking and irrigation in areas where it's abundant, such as parts of New England, the Midwest, and the Southwest.

But the public's exposure to arsenic extends beyond those areas because since 1910, the U.S. has used roughly 1.6 million tons of it for agricultural and other industrial uses. About half of that cumulative total has been used since only the mid- 1960s. Lead-arsenate insecticides were widely used in cotton fields, orchards, and vineyards until their use was banned in the 1980s. But residues in the soil can still contaminate crops.

For decades, arsenic was also used in a preservative for pressure-treated lumber commonly used for decks and playground equipment. In 2003 that use was banned, (as was most residential use) but the wood can contribute to arsenic in groundwater when it's recycled as mulch.

Other sources of exposure include coalfired power plants and smelters that heat arsenic-containing ores to process copper or lead. Today the quantity of arsenic released into the environment in the U.S. by human activities is three times more than that released from natural sources, says the federal Agency for Toxic Substances and Disease Registry.

The form of arsenic in the examples above is inorganic arsenic. It's a carcinogen known to cause bladder, lung, and skin cancer in people and to increase risks of cardiovascular disease, immunodeficiencies, and type 2 diabetes.

The other form that arsenic takes is organic arsenic, created when arsenic binds to molecules containing carbon. Fish can contain an organic form of arsenic called arsenobetaine, generally considered nontoxic to humans. But questions have been raised about the human health effects of other types of organic arsenic in foods, including juice.

Use of organic arsenic in agricultural products has also caused concern. For instance, the EPA in 2006 took steps to stop the use of herbicides containing organic arsenic because of their potential to turn into inorganic arsenic in soil and contaminate drinking water. And in 2011, working with the FDA, drug company Alpharma agreed to suspend the sale of Roxarsone, a poultry-feed additive, because it contained an organic form of arsenic that could convert into inorganic arsenic inside the bird, potentially contaminating the meat. Or it could contaminate soil when chicken droppings are used as fertilizer. Other arsenic feed additives are still being used.

WHAT OUR TESTS FOUND

We went shopping in Connecticut, New Jersey, and New York in August and September, buying 28 apple juices and three grape juices. Our samples came from ready-to-drink bottles, juice boxes, and cans of concentrate. For most juices, we bought three different lot numbers to assess variability. (For some juices, we couldn't find three lots, so we tested one or two.) In all, we tested 88 samples.

Five samples of apple juice and four of grape juice had total arsenic levels exceeding the 10 ppb federal limit for bottled and drinking water. Levels in the apple juices ranged from 1.1 to 13.9 ppb, and grapejuice levels were even higher, 5.9 to 24.7 ppb. Most of the total arsenic in our samples was inorganic, our tests showed.

As for lead, about one fourth of all juice samples had levels at or above the 5-ppb limit for bottled water. The top lead level for apple juice was 13.6 ppb; for grape juice, 15.9 ppb.

The following brands had at least one sample of apple juice that exceeded 10 ppb: Apple & Eve, Great Value (Walmart), and Mott's. For grape juice, at least one sample from Walgreens and Welch's exceeded that threshold. And these brands had one or more samples of apple juice that exceeded 5 ppb of lead: America's Choice (A&P), Gerber, Gold Emblem (CVS), Great Value, Joe's Kids (Trader Joe's), Minute Maid, Seneca, and Walgreens. At least one sample of grape juice exceeding 5 ppb of lead came from Gold Emblem, Walgreens, and Welch's. Our findings provide a spot check of a number of local juice aisles, but they can't be used to draw general conclusions about arsenic or lead levels in any particular brand. Even within a single tested brand, levels of arsenic and lead sometimes varied widely.

Arsenic-tainted soil in U.S. orchards is a likely source of contamination for apples, and finding lead with arsenic in juices that we tested is not surprising. Even with a ban on lead-arsenate insecticides, "we are finding problems with some Washington state apples, not because of irresponsible farming practices now but because leadarsenate pesticides that were used here decades ago remain in the soil," says Denise Wilson, Ph.D., an associate professor at the University of Washington who has tested apple juices and discovered elevated arsenic levels even in brands labeled organic.

Over the years, a shift has occurred in how juice sold in America is produced. To make apple juice, manufacturers often blend water with apple-juice concentrate from multiple sources. For the past decade, most concentrate has come from China. Concerns have been raised about the possible continuing use of arsenical pesticides there, and several Chinese provinces that are primary apple-growing regions are known to have high arsenic concentrations in groundwater.

A much bigger test than ours would be needed to establish any correlation between elevated arsenic or lead levels and the juice concentrate's country of origin. Samples we tested included some made from concentrate from multiple countries including Argentina, China, New Zealand, South Africa, and Turkey; others came from a single country. A few samples solely from the U.S. had elevated levels of lead or arsenic, and others did not. The same was true for samples containing only Chinese concentrate.

The FDA has been collecting its own data to see whether it should set guidelines to continue to ensure the safety of apple juice, a spokeswoman told us.

The Juice Products Association said, "We are committed to providing nutritious and safe fruit juices to consumers and will comply with limits established by the agency."

ANSWERING A CRUCIAL QUESTION

We also wanted to know whether people who drink juice end up being exposed to more arsenic than those who don't.

So we commissioned an analysis of data from the National Health and Nutrition Examination Survey (NHANES), conducted annually by the National Center for Health Statistics. Information is collected on the health and nutrition of a nationally representative sample of the U.S. population, based on interviews and physical exams that may include a blood or urine test. Officials and researchers often use the data to determine risk factors for major diseases so certain. Organic standards prohibit the use of synthetic fertilizers and most pesticides, but organic juices still may contain arsenic if they're made from fruit grown in soil where arsenical insecticides were used.

Need a home-treatment system? Contact NSF International at *www.nsf.org/certified/DWTU* or 800-673-8010 for info on systems certified to lower arsenic levels to no more than 10 ppb. The University of Georgia Cooperative Extension discusses treatment technologies at *aesl.ces.uga.edu/publications/watercirc*. (Click on "Removal of Arsenic from Household Water.")

If you're concerned, get tested. Ask your doctor for a urine test for you or your child to determine arsenic levels. Don't eat seafood for 48 to 72 hours before being tested to avoid misleadingly high levels from "fish arsenic." For a medical toxicologist in your area who can interpret results, call the American Association of Poison Control Centers at 800-222-1222.

How to reduce your family's risk

Test your water. If your home or a home you're considering buying isn't on a public water system, have the home's water tested for arsenic and lead. To find a certified lab, contact your local health department or call the federal Safe Drinking Water Hotline at 800-426-4791. To find contact information for your public water system, go to *cfpub.epa.gov/safewater/ccr/index.cfm*.

Limit children's juice consumption. Nutrition guidelines set by the American Academy of Pediatrics can help. The academy recommends that infants younger than 6 months shouldn't drink juice; children up to 6 years old should consume no more than four to six ounces a day and older children, no more than 8 to 12 ounces a day. Diluting juice with water can help meet those goals.

Consider your food. Buying certified organic chicken makes sense because organic standards don't allow the use of chicken feed containing arsenic. But for juice and other foods, it's not

SAMPLES We tested juice from bottles, cans, and juice boxes that we bought in three states.

and develop public health policy. In fact, data on lead in the blood of NHANES participants were instrumental in developing policies that have successfully resulted in lead being removed from gasoline.

Our analysis was led by Richard Stahlhut, M.D., M.P.H., an environmental health researcher at the University of Rochester with expertise in NHANES data, working with Consumer Reports statisticians. Ana Navas-Acien, M.D., Ph.D., a physician- epidemiologist at Johns Hopkins University's Bloomberg School of Public Health, also provided guidance. She was the lead author of a 2008 study in the Journal of the American Medical Association that first linked low-level arsenic exposure with the prevalence of type 2 diabetes in the U.S.

Stahlhut reviewed NHANES data from 2003 through 2008 from participants tested for total urinary arsenic who reported their food and drink consumption for 24 hours the day before their NHANES visit. Because most ingested arsenic is excreted in urine, the best measure of recent exposure is a urine test.

Following Navas-Acien's advice, we excluded from our NHANES analysis anyone with results showing detectable levels of arsenobetaine, the organic arsenic in seafood. That made the results we analyzed more likely to represent inorganic arsenic, of greatest concern in terms of potential health risks.

Over time, people who ingest even low arsenic levels can become sick.

The resulting analysis of almost 3,000 study participants found that those reporting apple-juice consumption had on average 19 percent greater levels of total urinary arsenic than those subjects who did not, and those who reported drinking grape juice had 20 percent higher levels. The results might understate the correlation between juice consumption and urinary arsenic levels because NHANES urinary data exclude children younger than 6, who tend to be big juice drinkers.

"The current analysis suggests that these juices may be an important contributor to dietary arsenic exposure," says Keeve Nachman, Ph.D., a risk scientist at the Center for a Livable Future and the Bloomberg School of Public Health, both at Johns Hopkins University. "It would be prudent to pursue measures to understand and limit young children's exposures to arsenic in juice."

Robert Wright, M.D., M.P.H., associate professor of pediatrics and environmental health at Harvard University who specializes in research on the effect of heavy-metals exposure in children, says that findings from our juice tests and database analysis concern him: "Because of their small size, a child drinking a box of juice would consume a larger per-bodyweight dose of arsenic than an adult drinking the exact same box of juice. Those brands with elevated arsenic should investigate the source and eliminate it."

A CHRONIC PROBLEM

Arsenic has been notoriously used as a poison since ancient times. A fatal poisoning would require a single dose of inorganic arsenic about the weight of a postage stamp. But chronic toxicity can result from long-term exposure to much lower levels in food, and even to water that meets the 10-ppb drinking-water limit.

A 2004 study of children in Bangladesh suggested diminished intelligence based on test scores in children exposed to arsenic in drinking water at levels above 5 ppb, says study author Joseph Graziano, Ph.D., a professor of Environmental health sciences and pharmacology at Columbia University. He's now conducting similar research with children living in New Hampshire and Maine, where arsenic levels of 10 to 100 ppb are commonly found in well water, to determine whether better nutrition in the U.S. affects the results.

People with private wells may face greater risks than those on public systems because they're responsible for testing and treating their own water. In Maine, where almost half the population relies on private wells, the U.S. Geological Survey found arsenic levels in well water as high as 3,100 ppb.

And a study published in 2011 in the International Journal of Environmental Research and Public Health examined the long-term effects of low-level exposure on more than 300 rural Texans whose groundwater was estimated to have arsenic at median levels below the federal drinking-water standard. It found that exposure was related to poor scores in language, memory, and other brain functions.

WARNING SIGNS

Chronic arsenic exposure can initially cause gastrointestinal problems and skin discoloration or lesions. Exposure over time, which the World Health Organization says could be five to 20 years, could increase the risk of various cancers and high blood pressure, diabetes, and reproductive problems.

Signs of chronic low-level arsenic exposure can be mistaken for other ailments such as chronic fatigue syndrome. Usually the connection to arsenic exposure is not made immediately, as Sharyn Duffy of Geneseo, N.Y., discovered. She

Our test findings of apple and grape juice

There's no federal limit for arsenic or lead in juice. In our tests, 25 percent of samples exceeded the 5-ppb lead limit for bottled water, and 10 percent exceeded the 10-ppb limit for arsenic in drinking water. Most arsenic we detected was inorganic. Our tests don't offer conclusions about overall levels in any juice type or brand. We tested three lots of most juices. Smaller containers are noted. For more details see *www.ConsumerReports.org/juicebox.*

Juice (in alphabetical order)	Total arsenic[1] (ppb)	Lead (ppb)
365 Everyday Value Organic 100% Apple Juice (Whole Foods)[2]	7.0 to 7.1	3.5 to 3.8
America's Choice 100% Apple Juice (A&P)	1.4 to 4.4	0.5 to 5.6
Apple & Eve 100% Apple Juice (6.75-ounce juice boxes)	5.0 to 10.5	1.9 to 3.4
Gerber 100% Apple Juice (4-ounce bottles)	5.8 to 9.7	3.4 to 13.6
Gerber Organic 100% Apple Juice (4-ounce bottles)	5.5 to 5.7	2.2 to 2.3
Gold Emblem 100% Apple Juice (CVS)	3.1 to 9.4	2.9 to 5.6
Gold Emblem 100% Grape Juice (CVS)	5.9 to 7.5	6.5 to 8.6
Great Value 100% Apple Juice (Walmart)	10.1 to 13.9	3.7 to 5.1
Great Value 100% Apple Juice (Walmart, 10-ounce bottles)[3]	5.5	3.4
Great Value 100% Apple Juice with fiber Not from Concentrate (Walmart)	2.9 to 3.9	0.1 to 0.2
Joe's Kids 100% Apple Juice (Trader Joe's, 6.75-ounce juice boxes)	4.1 to 5.7	5.3 to 9.7
Juicy Juice 100% Apple Juice Non Frozen Concentrate[4]	1.9 to 4.2	1.4 to 2.2
Juicy Juice 100% Apple Juice	1.7 to 3.0	0.8 to 2.3
Juicy Juice 100% Apple Juice (10-ounce bottles)	1.7 to 1.9	1.1 to 3.5
Juicy Juice 100% Apple Juice (6.75-ounce bottles)	1.3 to 2.8	1.4 to 2.8
Lucky Leaf 100% Apple Juice[2]	2.3 to 3.2	0.8 to 1.2
Minute Maid 100% Apple Juice (10-ounce bottles)	6.2 to 6.7	4.2 to 6.5
Minute Maid 100% Apple Juice (juice box packaged for McDonald's)	2.0 to 5.6	0.8 to 5.3
Mott's Original 100% Apple Juice	4.0 to 7.9	2.1 to 3.8
Mott's Original 100% Apple Juice (4.23-ounce juice boxes)	4.0 to 10.2	0.6 to 0.7
Mott's Original 100% Apple Juice (6.75-ounce juice boxes)	2.1 to 2.8	0.6 to 1.3
Nature's Own 100% Apple Juice[2]	2.3 to 2.4	0.9 each
Old Orchard 100% Apple Juice Frozen Concentrate[4]	1.6 to 4.8	0.6 to 1.3
Red Jacket Orchards 100% Fuji Apple Juice	1.3 to 1.8	0.1 to 0.2
Rite Aid Pantry 100% Apple Juice	1.1 to 6.4	0.4 to 2.6
Seneca 100% Apple Juice Frozen Concentrate[4]	2.3 to 4.4	0.9 to 5.5
Tropicana 100% Apple Juice (15.2-ounce bottles)	1.5 to 2.1	0.5 to 1.0
Walgreens 100% Apple Juice	4.0 to 6.8	2.3 to 6.9
Walgreens 100% Grape Juice	9.7 to 24.7	10.1 to 15.9
Welch's 100% Apple Juice Pourable Concentrate[4]	1.1 to 4.1	0.6 to 1.3
Welch's 100% Grape Juice	7.1 to 12.4	3.5 to 9.2

[1]Includes organic and inorganic arsenic. [2]Two lots tested. [3]One lot tested. [4]Reconstituted; assumes no arsenic or lead from added water.

visited a doctor in 2007 about pain and skin changes on the sole of her left foot. She was referred to a podiatrist and eventually received a diagnosis of hyperkeratosis, in which lesions develop or thick skin forms on the palms or soles of the feet. It can be among the earliest symptoms of chronic arsenic poisoning. But she says it was roughly two years before she was finally referred to a neurologist, who suggested testing for arsenic. She had double the typical levels.

"Testing for arsenic isn't part of a routine checkup," says Duffy, a retiree. "When you come in with symptoms like I had, ordering that kind of test probably wouldn't even occur to most doctors."

Michael Harbut, M.D., chief of the environmental cancer program at Karmanos Institute in Detroit, says, "Given what we know about the wide range of arsenic exposure sources we have in this country, I suspect there is an awful lot of chronic, low-level arsenic poisoning going on that's never properly diagnosed."

Emerging research suggests that when arsenic exposure occurs in the womb or in early childhood, it not only increases cancer risks later in life but also can cause lasting harm to children's developing brains and endocrine and immune systems, leading to other diseases, too.

Case in point: From 1958 through 1970, residents of Antofagasta, Chile, were exposed to naturally occurring arsenic in drinking water that peaked at almost 1,000 ppb before an arsenic removal plant was installed. Studies led by researchers at the University of California at Berkeley found that people born during that period who had probable exposure in the womb and during early childhood had a lungcancer death rate six times higher than those in their age group elsewhere in Chile. Their rate of death in their 30s and 40s from another form of lung disease was almost 50 times higher than for people without

Consumers Union wants federal limits for arsenic and lead in juice.

that arsenic exposure.

"Recent studies have shown that early-childhood exposure to arsenic carries the most serious long-term risk," says Joshua Hamilton of the Marine Biological Laboratory. "So even though reducing arsenic exposure is important for everyone, we need to pay special attention to protecting pregnant moms, babies, and young kids."

OTHER DIETARY EXPOSURES

In addition to juice, foods including chicken, rice, and even baby food have been found to contain arsenic—sometimes at higher levels than the amounts found in juice. Brian Jackson, Ph.D., an analytical chemist and research associate professor at Dartmouth College, presented his findings at a June 2011 scientific conference in Aberdeen, Scotland. He reported finding up to 23 ppb of arsenic in lab tests of namebrand jars of baby food, with inorganic arsenic representing 70 to 90 percent of those total amounts.

Similar results turned up in a 2004 study conducted by FDA scientists in Cincinnati, who found arsenic levels of up to 24 ppb in baby food, with sweet potatoes, carrots, green beans, and peaches containing only the inorganic form. A United Kingdom study published in 2008 found that the levels of inorganic arsenic in 20-ounce packets of dried infant rice cereals ranged from 60 to 160 ppb. Rice-based infant cereals are often the first solid food that babies eat.

Rice frequently contains high levels of inorganic arsenic because it is among plants that are unusually efficient at taking up arsenic from the soil and incorporating it in the grains people eat. Moreover, much of the rice produced in the U.S. is grown in Arkansas, Louisiana, Mississippi, Missouri, and Texas, on land formerly used to grow cotton, where arsenical pesticides were used for decades.

"Initially, in some regions rice planted there produced little grain due to these arsenical pesticides, but farmers then bred a type of rice specifically designed to produce high yields on the contaminated soil," says Andrew Meharg, professor of biogeochemistry at the University of Aberdeen, in Scotland. Meharg studies human exposures to arsenic in the environment. His research over the past six years has shown that U.S. rice has among the highest average inorganic arsenic levels in the world—almost three times higher than levels in Basmati rice imported from low-arsenic areas of Nepal, India, and Pakistan. Rice from Egypt has the lowest levels of all.

Infant rice cereal for the U.S. market is generally made from U.S. rice, Meharg says, but labeling usually doesn't specify country of origin. He says exposure to arsenic through infant rice cereals could be reduced greatly if cereal makers used techniques that don't require growing rice in water-flooded paddies or if they obtained rice from low-arsenic areas. His 2007 study found that median arsenic levels in California rice were 41 percent lower than levels in rice from the south-central U.S.

SETTING A STANDARD

Evidence of arsenic's ability to cause cancer and other life-threatening illnesses has surged because some of the diseases linked to it have latency periods of several decades. Only recently have scientists been able to more fully measure the effects in populations that were exposed to elevated levels of arsenic in drinking water many years ago.

The Environmental Protection Agency periodically revises its assessment of the toxicity of various chemicals to offer guidance on drinking-water standards. Based on such a review, the agency changed the water standard for arsenic to 10 ppb, effective in 2006, from the 50-ppb limit it set in 1975. The EPA had proposed a 5-ppb limit in 2000, so the current limit is a compromise that came only after years of haggling over the costs of removing arsenic. Since 2006, New Jersey has had a 5-ppb threshold, advising residents that water with arsenic levels above that shouldn't be used for drinking or cooking.

For known human carcinogens such as inorganic arsenic, the EPA assumes there's actually no "safe" level of exposure, so it normally sets exposure limits that include a margin of safety to ideally allow for only one additional case of cancer in a million people, or at worst, no more than one in 10,000. For water with 10 ppb of arsenic, the excess cancer risk is one in 500.

Debate over that standard is likely to begin anew. The agency's latest draft report, from February 2010, proposes that the number used to calculate the cancer risk posed by ingesting inorganic arsenic be increased 17-fold to reflect arsenic's role in causing bladder and lung cancer. The proposal "suggests that arsenic's carcinogenic properties have been underestimated for a long time and that the federal drinking-water standard is underprotective based on current science," says Keeve Nachman, the Johns Hopkins scientist.

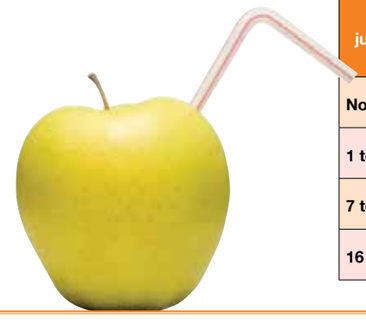
Each year the FDA tests a variety of foods and beverages for arsenic and other contaminants. It also started a program in 2005 to test for specific toxins such as arsenic and lead in domestic and imported products. So far that program has tested 70 samples of apple juice and concentrate. And the agency can alert inspectors at U.S. ports to conduct increased surveillance for products suspected to pose risks. Currently there's an alert for increased surveillance of apple concentrate from China and six other countries "where

How much juice do children drink?

Too many children drink too much juice, according to our poll of parents. One in four toddlers 2 and younger and 45 percent of children ages 3 to 5 drink 7 or more ounces of juice a day.

The American Academy of Pediatrics cautions that to help prevent obesity and tooth decay, children younger than 6 should drink no more than 6 ounces a day, about the size of a juice box. (Infants younger than 6 months shouldn't drink any.) The possible presence of arsenic or lead in juices is all the more reason to stick with those nutrition-based limits.

Our findings are from 555 telephone interviews in October with parents, who were asked about children's juice consumption the previous day. Totals don't equal 100 percent because some said they didn't know how much juice their kids drank.



Amount of juice consumed	Children 2 and under	Children 3 to 5	Total children 5 or younger
None	40%	22%	31%
1 to 6 oz.	28	26	27
7 to 12 oz.	18	29	23
16 oz. or more	8	16	12

we have a suspicion there may be high levels of arsenic in their products," says FDA spokeswoman Stephanie Yao. But in fiscal 2010, the agency conducted physical inspections of only 2 percent of imported food shipments.

Consumers Union urges federal officials to set a standard for total arsenic in apple and grape juice. Our research suggests that the standard should be 3 ppb. Concerning lead, juice should at least meet the bottled-water standard of 5 ppb. Such standards would better protect children, who are most vulnerable to the effects of arsenic and lead. And they're achievable levels: 41 percent of the samples we tested met both thresholds.

Moreover, the EPA should impose stricter drinking-water standards for arsenic, Consumers Union believes. (The drinkingwater threshold for lead is 15 ppb, which acknowledges that many older homes have water pipes or solder with lead.) Officials should also ban arsenic in pesticides, animal-feed additives, and fertilizers.

As our tests show, sources of lead haven't been eliminated, but dramatic progress has been made: Since the 1970s, average blood lead levels in children younger than 6 have dropped by about 90 percent, thanks to a federal ban on lead in house paint and gas. The U.S. should be equally aggressive with arsenic, suggests Joseph Graziano at Columbia University. "We tackled every source, from gasoline to paint to solder in food cans," he says, "and we should be just as vigilant in preventing arsenic from entering our food and water because the consequences of exposure are enormous for adults as well as children."

WHAT WE TESTED Our analysis found varying levels of arsenic in more than 60 rices and rice products—cereals, crackers, and more.

Arsenic in your food

Our findings show a real need for federal standards for this toxin

Published in Consumer Reports November 2012

Organic rice baby cereal, rice breakfast cereals, brown rice, white rice—new tests by Consumer Reports have found that those and other types of rice products on grocery shelves contain arsenic, many at worrisome levels.

Arsenic not only is a potent human carcinogen but also can set up children for other health problems in later life. Following our January investigation that found arsenic in apple and grape juices, we recently tested more than 200 samples of a host of rice products. They included iconic labels and store brands, organic products and conventional ones; some were aimed at the booming glutenfree market.

The results of our tests were even more troubling in some ways than our findings for juice. In virtually every product tested, we found measurable amounts of total arsenic in its two forms. We found significant levels of inorganic arsenic, which is a carcinogen, in almost every product category, along with organic arsenic, which is less toxic but still of concern. Moreover, the foods we checked are popular staples, eaten by adults and children alike.

Though rice isn't the only dietary source of arsenic—some vegetables, fruits, and even water can harbor it—the Environmental Protection Agency assumes there is actually no "safe" level of exposure to inorganic arsenic.

No federal limit exists for arsenic in most foods, but the standard for drinking water is 10 parts per billion (ppb). Keep in mind: That level is twice the 5 ppb that the EPA originally proposed and that New Jersey actually established. Using the 5-ppb standard in our study, we found that a single serving of some rices could give an average adult almost one and a half times the inorganic arsenic he or she would get from a whole day's consumption of water, about 1 liter.

We also discovered that some infant rice cereals, which are often a baby's first solid food, had levels of inorganic arsenic at least five times more than has been found in alternatives such as oatmeal. Given our findings, we suggest limiting the consumption of rice products. Use our chart and recommendations on page 31.

Our study was a snapshot of the market, with many products purchased in the New York metropolitan area and online, to gauge the extent of arsenic's presence in everyday foods. It can't be used for overall conclusions about specific brands. Still, we found important trends:

- White rice grown in Arkansas, Louisiana, Missouri, and Texas, which account for 76 percent of domestic rice, generally had higher levels of total arsenic and inorganic arsenic in our tests than rice samples from elsewhere.
- Within any single brand of rice we tested, the average total and inorganic arsenic levels were always higher for brown rice than for white.
- People who ate rice had arsenic levels that were 44 percent greater than those who had not, according to our analysis of federal health data. And certain ethnic groups were more highly affected, including Mexicans, other Hispanics, and a broad category that includes Asians.
- Reducing arsenic in food is feasible. We examined the efforts of two food companies trying to tackle the problem and learned about methods being used to try to reduce arsenic in products.
- Based on these findings, our experts are asking the Food and Drug Administration to set limits for arsenic in rice products and fruit juices as a starting point.

Rice producers argue that concerns about dietary exposure to arsenic in rice are overblown. "There is no documented evidence of actual adverse health effects from exposure to arsenic in U.S.-grown rice," says Anne Banville, a vice president at the USA Rice Federation, a trade association representing the $34 billion rice industry. "And we believe the health benefits of rice must be properly weighed against the risks of arsenic exposure, which we believe are minimal."

But scientists warn of complacency. "We already know that high concentrations of arsenic in drinking water result in the highest known toxic substance disease risks from any environmental exposure," says Allan Smith, M.D., Ph.D., a professor of epidemiology at the University of California, Berkeley. "So we should not be arguing to wait for years until we have results of epidemiologic studies at lower arsenic intake, such as from rice consumption, to take action." His studies of arsenic in public water in Chile and Argentina helped show that it causes lung and bladder cancer and other diseases. Such long-term studies that track health effects of exposure to arsenic in rice have only recently begun in the U.S. Researchers at the Dartmouth Children's Environmental Health and Disease Prevention Research Center in late 2011 published a small but informative study that indicated consuming slightly more than a half-cup of cooked rice per day resulted in a significant increase in urinary arsenic levels, comparable to the effects of drinking a liter of water containing the federal maximum of 10 ppb arsenic. The authors say their results suggest "many people in the U.S. may be exposed to potentially harmful levels of arsenic through rice consumption."

The USA Rice Federation says it is working with the FDA and the EPA as they examine and assess arsenic levels in food and has supplied rice samples to those agencies for research. It also says some of its member companies may be doing their own testing. One rice company shared with us details of how it

is taking matters into its own hands. Grant Lundberg, CEO of Lundberg Family Farms in Richvale, Calif., which sells rice and rice products, says the company is testing more than 200 samples of the many varieties of rice in its supply chain and plans to share the results with FDA scientists.

"We're committed to providing safe food, to really listening to our consumers, and dealing with this problem very openly because doing the research needed to assess what the risks really are is the only way to go," Lundberg says.

FIELD TESTS Grant Lundberg, a rice producer in Richvale, Calif., has begun extensive testing for arsenic.

TRACING ARSENIC'S SOURCES

The USA Rice Federation tells consumers that there is no reason to be concerned about arsenic in food. Its website states that arsenic is "a naturally occurring element in soil and water" and "all plants take up arsenic."

But "natural" does not equal safe. Inorganic arsenic, the predominant form of arsenic in most of the 65 rice products we analyzed, is ranked by the International Agency for Research on Cancer (IARC) as one of more than 100 substances that are Group 1 carcinogens. It is known to cause bladder, lung, and skin cancer in humans, with the liver, kidney, and prostate now considered potential targets of arsenic induced cancers.

Though arsenic can enter soil or water due to weathering of arsenic-containing minerals in the earth, humans are more to blame than Mother Nature for arsenic contamination in the U.S. today, according to the federal Agency for Toxic Substances and Disease Registry. The U.S. is the world's leading user of arsenic, and since 1910 about 1.6 million tons have been used for agricultural and industrial purposes, about half of it only since the mid-1960s. Residues from the decades of use of lead-arsenate insecticides linger in agricultural soil today, even though their use was banned in the 1980s. Other arsenical ingredients in animal feed to prevent disease and promote growth are still permitted. Moreover, fertilizer made from poultry waste can contaminate crops with inorganic arsenic.

Studies show that arsenic can cause cancer in humans.

Rice is not the only source of arsenic in food. A 2009-10 study from the EPA estimated that rice contributes 17 percent of dietary exposure to inorganic arsenic, which would put it in third place, behind fruits and fruit juices at 18 percent, and vegetables at 24 percent. A more complete study by the European Food Safety Authority found cereal products could account for more than half of dietary exposure to inorganic arsenic, mainly because of rice.

Rice absorbs arsenic from soil or water much more effectively than most plants. That's in part because it is one of the only major crops grown in water-flooded conditions, which allow arsenic to be more easily taken up by its roots and stored in the grains. In the U.S. as of 2010, about 15 percent of rice acreage was in California, 49 percent in Arkansas, and the remainder in Louisiana, Mississippi, Missouri, and Texas. That south-central region of the country has a long history of producing cotton, a crop that was heavily treated with arsenical pesticides for decades in part to combat the boll weevil beetle.

"Extensive surveys of south central U.S. rice, by more than one research group, have consistently shown that rice from this region is elevated in inorganic arsenic compared to other rice-producing regions," says Andrew Meharg, professor of biogeochemistry at the University of Aberdeen in Scotland and co-author of the book "Arsenic & Rice." "And it does not matter relative to risk whether that arsenic comes from pesticides or is naturally occurring." High levels of arsenic in soil can actually reduce rice yields. Meharg, a leading researcher in the field, notes the Department of Agriculture has invested in research to breed types of rice that can withstand arsenic. That may help explain the relatively high levels of arsenic found in rice from the region, though other factors such as climate or geology may also play a role.

WHAT OUR TESTS FOUND

We tested 223 samples of various rice products that we bought mostly in April and May, many from stores in the New York metropolitan area and online retailers. The samples covered a variety of rice-containing food categories, including infant cereals, hot cereals, ready-to-eat cereals, rice cakes, and rice crackers. We bought products often used by people on glutenfree or other special diets, including rice pasta, rice flour, and rice drinks.

We tested at least three samples of the foods and beverages for total arsenic. We measured specific levels of inorganic arsenic. And we checked for two forms of organic arsenic, called DMA and MMA.

Though inorganic arsenic is considered the most toxic, concerns have been raised about potential health risks posed by those two organic forms, which the International Agency for Research on Cancer has labeled "possibly carcinogenic to humans." We found DMA in the

A CEO reworks his toddler formulas

Jay Highman, the CEO and president of Nature's One, an Ohio company that made the nation's first organic baby formula, says he was concerned when a study published in February implicated his formula as containing arsenic. The problem: organic brown rice syrup, one of the ingredients.

"We had always been known for having the highest standards for the cleanest, purest ingredients, and overnight we became a poster child for arsenic in rice," Highman says. He resolved that he would find a way to eliminate arsenic contamination in the rice syrup.

Highman searched for the purest source for rice and found that he had to go outside of the U.S. to find rice with the lowest possible arsenic content. He declined to disclose his source for fear larger companies "will start devouring our supply chain." He worked with his syrup supplier to develop a filtration process that would eliminate detectable levels of arsenic.

By July, he said the combination of more pristine rice and the new filtration process produced brown rice syrup that met his goal. We included samples of two Nature's One dairy formulas and one soy formula in our tests.

The original powdered samples we tested of dairy- and soy-based formulas had inorganic arsenic that averaged 40.6 ppb for dairy and 77.7 ppb for soy.

When we tested the new versions of the two dairy formulas, the levels were either undetectable or nearly so. The company says its new formulation has use-by dates of January 2014 (Dairy with DHA & ARA), July 2015 (Dairy), or later.

Highman says he has been reworking the soy formula and hopes to produce a product that has lower levels of arsenic. If he can't get it lower, Highman says he will create a non-dairy formula without soy. Meanwhile, an interim soy version we tested did have somewhat lower levels of arsenic, but it had higher levels of cadmium, another toxin.

ARSENIC SLEUTH Jay Highman's company makes dairy and soy-based formulas.

PHOTO: ROBERT DURELL

PHOTO: BILLY DELFS

32 rices we tested, which include choices from the south central states and elsewhere, including California, India, and Thailand.

In brands for which we tested both a white and a brown rice, the average total and inorganic arsenic levels were higher in the brown rice than in the white rice of the same brand in all cases. Among all tested rice, the highest levels of inorganic arsenic per serving were found in some samples of Martin Long Grain Brown rice, followed by Della Basmati Brown, Carolina Whole Grain Brown, Jazzmen Louisiana Aromatic Brown, and Whole Foods' 365 Everyday Value Long Grain Brown. But we also found samples of brown rice from Martin and others with inorganic arsenic levels lower than that in some white rice.

Though brown rice has nutritional advantages over white rice, it is not surprising that it might have higher levels of arsenic, which concentrates in the outer layers of a grain. The process of polishing rice to produce white rice removes those surface layers, slightly reducing the total arsenic and inorganic arsenic in the grain.

In brown rice, only the hull is removed. Arsenic concentrations found in the bran that is removed during the milling process to produce white rice can be 10 to 20 times higher than levels found in bulk rice grain.

We also tested for lead and cadmium, other metals that can taint food. The levels we found were generally low overall. Based on our recommended limits for rice products, even the few samples with elevated lead and cadmium should not contribute significantly to dietary exposure.

CEREALS CAUSE CONCERN

Worrisome arsenic levels were detected in infant cereals, typically consumed between 4 and 12 months of age.

Among the four infant cereals tested, we found varying levels of arsenic, even in the same brand. Gerber SmartNourish Organic Brown Rice cereal had one sample with the highest level of total arsenic in the category at 329 ppb, and another sample had the lowest total level in this category at 97.7 ppb. It had 0.8 to 1.3 micrograms of inorganic arsenic per serving. Earth's Best Organic Whole Grain Rice cereal had total arsenic levels ranging from 149 ppb to 274 ppb, but higher levels of inorganic arsenic per serving, from 1.7 to 2.7 micrograms.

Within brands, brown rice had higher arsenic than white.

So what's a parent to do? To reduce arsenic risks, we recommend that babies eat no more than 1 serving of infant rice cereal per day on average. And their diets should include cereals made of wheat, oatmeal, or corn grits, which contain significantly lower levels of arsenic, according to federal information.

The EPA sets limits for a carcinogen based on how many extra cases of cancer would be caused by exposure to the toxin at a certain level. The limit is designed to minimize that risk. For our recommendations, we used the latest available science to choose a moderate level of protection that balances safety and feasibility, similar to the EPA's approach for water. Our scientists made these calculations using standard estimates of weight, typical daily consumption of individual rice products over a lifetime, and the range of levels of inorganic arsenic we found. For our recommendations for children, we paid particular attention to their levels of consumption during this critical phase of their development.

According to federal data, some infants eat up to two to three servings of rice cereal a day. Eating rice cereal at that rate, with the highest level of inorganic arsenic we found in our tests, could result in a risk of cancer twice our acceptable level.

For children and pregnant women, risks are heightened. Keeve Nachman, Ph.D., a risk scientist at the Center for a Livable Future in the Johns Hopkins Bloomberg School of Public Health, says, "The more we learn about arsenic's additional effects on the developing brain, the more concerned I am by these levels of arsenic being found in infant and toddler rice cereal."

Ready-to-eat cereals, which are popular with adults as well as children, also gave us cause for concern. For instance, Barbara's Brown Rice Crisps had inorganic arsenic levels that ranged from 5.9 to 6.7 micrograms per serving. Kellogg's Rice Krispies, at 2.3 to 2.7 micrograms, had the lowest levels for the category in our tests.

Rice drinks in our tests showed inorganic arsenic levels of up to 4.5 micrograms per serving. Based on those results, our scientists advise that children under the age of 5 should not have rice drinks as part of a daily diet. In the United Kingdom, children younger than 4½ years are advised against having rice milk because of arsenic concerns.

"This is a time when cells are differentiating into organs and many other important developmental things are going on, so getting exposed to a toxicant like arsenic in utero or during early childhood can cause damage that may not appear until decades later," says Michael Waalkes, laboratory chief at the Division of the National Toxicology Program. He is one of the authors of a June 2012 report funded in part by the National Institutes of Health that concluded early life exposure to arsenic produces a wide range of cancers and other diseases.

DIET CHANGES ARSENIC RISK

If rice truly is an important source of arsenic exposure, then people who eat rice should have greater arsenic levels in their body, on average, than people who do not. To find out, we analyzed data collected annually by the National Center for Health Statistics for the National Health and Nutrition Examination Survey (NHANES). The survey contains information on the health and nutrition of a nationally representative sample of the U.S. population, based on interviews and physical exams, which may include blood and urine tests.

Our data analysis was led by Richard Stahlhut, M.D., M.P.H., an environmental health researcher at the University of Rochester, who is experienced in NHANES analysis, and Ana Navas-Acien, M.D., Ph.D., a physician-epidemiologist with expertise in arsenic research at Johns Hopkins University's Bloomberg School of Public Health. Working with Consumer Reports statisticians, they reviewed NHANES data from 2003 through 2010 from participants age 6 or older whose urine was tested for arsenic and who had reported what they'd had to eat or drink from midnight to midnight the day before their examination. A urine test is the best measure of recent arsenic exposure because most of it is excreted in urine within a few days after ingestion.

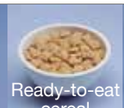
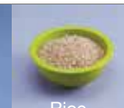
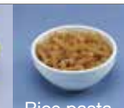
Because seafood contains a form of organic arsenic called arsenobetaine, generally considered nontoxic to humans, we then excluded from our analysis anyone who reported eating seafood during the 24-hour period and those with detectable levels of arsenobetaine in their urine. The remaining participants therefore were more likely to have had exposure to inorganic arsenic, which poses the greatest potential health risks.

Our resulting analysis of 3,633 study participants found that on average, people who reported eating one rice food item had total urinary arsenic levels 44 percent greater than those who had not, and people who reported consuming two or more rice products had levels 70 percent higher than those who had no rice.

"Despite our taking into account other common sources of arsenic, and no matter which way we sliced the data, we see a very strong association between rice consumption and arsenic

Limit your exposure

To reduce arsenic exposure, consider limiting rice in your family's diet to the quantities noted here. Our scientists based these recommendations on a person eating just one product per day or Limit your exposure per week over a lifetime. If you eat more than one type, your risk would increase. Vary your diet to include non-rice products. If you exceed these limits one week, you can cut back the next.

Rice product	 Infant cereal	 Hot cereal	 Ready-to-eat cereal	 Rice drink	 Rice	 Rice pasta	 Rice crackers	 Rice cakes
Approximate serving size uncooked	¼ cup	¼ cup	1 cup	1 cup	¼ cup	2 oz.	16-18 crackers	1-3 cakes
Children	**1** serving/day	**1¾** servings/ week	**1½** servings/ week	–	**1¼** servings/ week	**1½** servings/ week	**½** serving/day	**1** serving/week
Adult	NA	**2½** servings/ week	**3** servings/ week	**½** serving/day	**2** servings/ week	**3** servings/ week	**1** serving/day	**2⅓** servings/ week

How to cut your arsenic risk

► **Test your water** If your home is not on a public water system, have your water tested for arsenic and lead. To find a certified lab, contact your local health department or call the federal Safe Drinking Water Hotline at 800-426-4791.

► **Change the way you cook rice** You may be able to cut your exposure to inorganic arsenic in rice by rinsing raw rice thoroughly before cooking, using a ratio of 6 cups water to 1 cup rice for cooking and draining the excess water afterward. That is a traditional method of cooking rice in Asia. The modern technique of cooking rice in water that is entirely absorbed by the grains has been promoted because it allows rice to retain more of its vitamins and other nutrients. But even though you may sacrifice some of rice's nutritional value, research has shown that rinsing and using more water removes about 30 percent of the rice's inorganic arsenic content.

► **Eat a varied diet** Some vegetables can accumulate arsenic when grown in contaminated soil. To help, clean vegetables thoroughly, especially potato skins. Some fruit juices such as apple and grape juice are high in arsenic, as our previous tests showed. To prevent obesity and tooth decay, pediatricians advise that infants younger than 6 months shouldn't drink juice; children up to age 6 should have no more than 4 to 6 ounces a day and older children no more than 8 to 12 ounces. Like grape juice, wine also can be a source of exposure, according to data collected in the FDA's Total Diet Study, which provides more complete information about arsenic content in a variety of foods.Go to *fda.gov* and search for "total diet study analytical results."

► **Experiment with other grains** Vary your grains, especially if you eat more than two or three servings of rice per week. Though not arsenic-free, wheat and oats tend to have lower levels than rice. And quinoa, millet, and amaranth are among other options for those on a gluten-free diet, though they have not been studied as much.

exposure," says Stahlhut, who along with Navas-Acien led a similar analysis of NHANES data for our January 2012 article on arsenic in juice. That analysis found that study participants who reported drinking apple or grape juice had total urinary arsenic levels that were on average nearly 20 percent higher than those who didn't. Consumers Union, the advocacy arm of Consumer Reports, urged the FDA to set a 3 ppb limit for total arsenic in apple and grape juice.

"These findings show that rice is an important source of arsenic exposure for the U.S. population," says Navas-Acien. The associations were even stronger for rice compared with juice and are consistent with the relatively high levels of arsenic, including inorganic arsenic, measured in rice samples, she says. She says the results underscore the need for monitoring arsenic in food and establishing safety standards. A new study of NHANES data from Dartmouth researchers also shows that rice consumption can contribute to increased urinary arsenic levels in children.

WHAT SHOULD BE DONE

Consumers Union believes a standard for arsenic should be set for rice, and industry should accelerate efforts to reduce arsenic levels in rice. They should also develop types of rice that take up less arsenic, and use rice with the lowest possible arsenic in products for young children, such as infant rice cereal.

Our scientists are also asking regulators to prohibit agricultural practices that may lead to increases in arsenic in rice:

- The EPA should phase out use of pesticides containing arsenic.
- The USDA and the EPA should end the use of arsenic-laden manure as fertilizer.
- The FDA should ban the feeding of arsenic-containing drugs and animal byproducts to animals.

To find out more about what Consumers Union is doing on the subject and to get involved, go to *ConsumersUnion.org/arsenic.* On the international stage, a group advising the World Health Organization is meeting in 2014 to consider proposed arsenic standards for rice. Limits of 200 ppb (inorganic) for white rice and 300 ppb (total or inorganic) for brown rice are under discussion.

After the concerns raised by our juice story, the FDA says it is confident in the overall safety of apple juice. "FDA has made significant progress in developing a proposed action level for arsenic in apple juice and is nearing completion of this work," the agency says in a statement.

Within brands, brown rice had higher arsenic than white.

The FDA also says it is studying arsenic in rice and rice products to determine the level and types of arsenic typically found and to identify ways to reduce it.

"The need for a standard for arsenic in food is long overdue," says Trudy Bialic, director of public affairs for PCC Natural Markets, a Seattle-area chain that is America's largest food co-op. "Certainly there are excellent and committed people in FDA's ranks, but it's shameful the agency has not addressed this problem more systematically, leaving us to figure it out on our own to protect ourselves."

Arsenic in food

How to read the table There is no federal limit for arsenic in most foods, but there is a federal limit of 10 parts per billion for arsenic in drinking water. The most protective standard in the country is New Jersey's at 5 ppb. At that limit, drinking a liter of water would expose you to 5 micrograms of inorganic arsenic. That provides a yardstick by which you can compare the ranges of inorganic arsenic per serving detected in the samples we tested of the products below. Overall, inorganic arsenic ranged in our samples from 11 percent to 87 percent of the total arsenic we found. The overall average was 55 percent.

Our tests don't offer general conclusions about overall arsenic levels in any brand or rice product category. We tested at least three samples of products (many bought in the New York metro area and online in April and May). Serving sizes generally used are specified by the government for each category. For more details, go to *ConsumerReports.org/cro/arsenicinfood.* At least one sample exceeded New Jersey drinking water limit (5 micrograms of inorganic arsenic per liter).

■ At least one sample exceeded New Jersey drinking water limit (5 micrograms of inorganic arsenic per liter).

Product	Origin	Total arsenic (ppb)[1]	Inorganic arsenic (micrograms/serving)[2]
RICE (45 g, about ¼ cup uncooked)			
365 Everyday Value Long Grain Brown (Whole Foods)	[3]	210 to 282	7.4 to 8.4
365 Everyday Value Organic Indian Basmati White (Whole Foods)	India	82.2 to 99.9	2.9 to 3.5
365 Everyday Value Organic Thai Jasmine White (Whole Foods)	Thailand	104 to 150	2.7 to 3.0
Archer Farms Organic Basmati (Target)	India	54.7 to 81.7	1.3 to 2.2
Archer Farms Organic Jasmine (Target)	Thailand	112 to 121	2.7 to 3.9
Cajun Country Enriched Long Grain	LA	328 to 348	4.8 to 5.2
Cajun Country Popcorn Long Grain	LA	350 to 436	3.9 to 5.3
Canilla Extra Long Grain Enriched	U.S.	198 to 431	3.2 to 7.2
Carolina Enriched Extra Long Grain	AR,LA,TX	144 to 236	3.4 to 4.8
Carolina Jasmine Enriched Thai Fragrant Long Grain	Thailand	119 to 159	3.0 to 3.2
Carolina Whole Grain Brown	AR,LA,TX	277 to 318	6.4 to 8.7
Della Basmati Brown	AR	308 to 568	5.9 to 9.4
Della Basmati White	AR	191 to 227	3.5 to 4.5
Doguet's Brown	U.S.	283 to 342	5.6 to 6.4
Doguet's Enriched Long Grain	U.S.	124 to 219	3.3 to 4.4
Goya Enriched Medium Grain	[3]	196 to 297	3.8 to 5.1
Great Value Brown (Walmart)	U.S.	212 to 344	5.2 to 6.8
Great Value Parboiled (Walmart)	U.S.	138 to 239	4.1 to 4.4
Jazzmen Louisiana Aromatic Brown	LA	237 to 295	4.7 to 8.6
Jazzmen Louisiana Aromatic White	LA	168 to 209	3.2 to 4.1
Lundberg California White Basmati	CA	64.3 to 75.5	1.3 to 1.6
Lundberg Short Grain Brown	CA	169 to 204	3.8 to 5.4
Mahatma Extra Long Grain Enriched	U.S.	129 to 284	3.4 to 4.9
Market Pantry Enriched Long Grain White (Target)	AR,LA,TX	184 to 254	4.0 to 4.6
Martin Long Grain Brown	MO	113 to 455	3.7 to 9.6
Martin Long Grain Enriched	MO	133 to 193	2.3 to 3.4
Rice-Select Organic Texmati White	TX	330 to 917	3.8 to 4.8
Texas Best Organics Long Grain Brown	TX	252 to 287	4.2 to 7.6
Texas Best Organics Long Grain White	TX	138 to 226	3.2 to 4.3
Trader Joe's White Basmati From India	India	75.9 to 86.0	2.5 to 2.9
Uncle Ben's Original Enriched Parboiled Long Grain	U.S.	220 to 246	5.9 to 6.3
Uncle Ben's Whole Grain Brown	U.S.	209 to 285	5.7 to 6.7
INFANT CEREAL (15 g, about ¼ cup uncooked)			
Beech-Nut Homestyle Rice	—	110 to 130	0.8 to 1.0
Earth's Best Organic Whole Grain Rice	—	149 to 274	1.7 to 2.7
Gerber Rice	—	232 to 264	1.6
Gerber SmartNourish Organic Brown Rice	—	97.7 to 329	0.8 to 1.3

Product	Origin	Total arsenic (ppb)[1]	Inorganic arsenic (micrograms/serving)[2]
HOT CEREAL (40 G, ABOUT ¼ CUP UNCOOKED)			
Bob's Red Mill Brown Rice Farina Creamy Rice	—	100 to 215	2.3 to 6.8
Bob's Red Mill Organic Brown Rice Farina Creamy Rice	—	131 to 165	3.0 to 4.3
Cream of Rice	—	80.4 to 97.5	1.8 to 2.0
READY-TO-EAT CEREAL (30 G, ABOUT 1 CUP)			
Arrowhead Mills Organic Sweetened Rice Flakes	—	398 to 963	3.6 to 3.9
Barbara's Brown Rice Crisps	—	326 to 376	5.9 to 6.7
General Mills Rice Chex Gluten Free	—	246 to 344	3.8 to 4.0
Kellogg's Rice Krispies	—	168 to 196	2.3 to 2.6
Kellogg's Rice Krispies Gluten Free	—	123 to 126	2.5 to 2.7
Trader Joe's Crisp Rice Cereal	—	212 to 243	2.9 to 3.0
RICE CAKES & CRACKERS (30 G, ABOUT 1-3 RICE CAKES, 16-18 CRACKERS)			
Asian Gourmet Plain Rice Cracker	—	113 to 208	1.2
Edward & Sons Organic Brown Rice Snaps Unsalted Plain Rice Cracker	—	102 to 199	1.8 to 3.2
Lundberg Brown Rice Organic Rice Cake	—	161 to 195	2.2 to 3.1
Quaker Lightly Salted Rice Cake	—	205 to 239	2.7 to 3.4
Suzie's Whole Grain Thin Cakes	—	249 to 397	4.1 to 8.4
RICE PASTA (55 G, ABOUT 2 OZ. DRY)			
Annie Chun's Maifun Rice Noodles	—	82.8 to 98.4	2.6 to 3.1
DeBoles Rice Spirals	—	271 to 300	6.9 to 7.5
Tinkyada Brown Rice Pasta Shells	—	190 to 249	4.2 to 5.7
Trader Joe's Organic Brown Rice Pasta Fusilli	—	347 to 384	5.9 to 6.9
RICE FLOUR (30 G, ABOUT ¼ CUP)			
Arrowhead Mills Organic Brown	—	361 to 565	4.3 to 5.5
Arrowhead Mills Organic White	—	180 to 424	1.8 to 3.0
Goya Enriched	—	161 to 254	2.1 to 2.9
RICE DRINKS (240 ML, 1 CUP)			
Pacific Rice Low Fat Plain Beverage	—	17.1 to 18.0	3.1 to 3.9
Rice Dream Classic Original Rice Drink	—	20.9 to 68.2	2.9 to 4.5
RICE SYRUP (30 ML, 2 TABLESPOONS)			
Lundberg Sweet Dreams Eco-Farmed Brown	—	176 to 193	5.4 to 5.9
Lundberg Sweet Dreams Organic Brow	—	167 to 180	4.6 to 5.8
RICE VINEGAR (15 ML, 1 TABLESPOON)			
Asian Gourmet Plain	—	4.6 to 7.3	0.1

[1] Includes organic and inorganic arsenic. [2] The sum of the arsenic species, arsenite, and arsenate. [3] Information on rice origin was not provided to us by the manufacturer.

For calculations of inorganic arsenic, all values reported as less than the reporting limits were applied as 100% of the reporting limits.

Arsenic in Your Rice: The Latest

Two years after Consumer Reports released groundbreaking findings, we have new data and guidelines. They're important for everyone but especially for gluten avoiders.

Photograph by Grant Cornett

Published in Consumer Reports January 2015

In late 2012 we released our original report on arsenic in rice, in which we found measurable levels in almost all of the 60 rice varieties and rice products we tested. Two of the biggest questions consumers asked us afterward: "Are there any types of rice that are lower in arsenic?" and "Do other grains, such as quinoa, contain arsenic, too?" We now have the answers.

Anyone who eats rice needs to be aware that they may be exposing themselves to inorganic arsenic (IA), a carcinogen. But people who avoid gluten need to be especially alert because so many gluten-free products contain rice.

Our latest tests determined that the IA content of rice varies greatly depending on the type of rice and where it was grown. This time around we also looked at grains other than rice—gluten-free ones such as amaranth and quinoa, as well as wheat. As a whole, those grains were lower in arsenic than rice.

Arsenic has two chemical forms, inorganic and organic (which can be less toxic), and is naturally part of the minerals in the earth's crust. Arsenic also has been released into the environment through the use of pesticides and poultry fertilizer. (Chickens can be fed arsenic.) Therefore, it's in soil and water. Rice tends to absorb arsenic more readily than many other plants.

In very large amounts, arsenic can kill quickly. But of greater concern for most people is that regular exposure to small amounts can increase the risk of bladder, lung, and skin cancer, as well as heart disease and type 2 diabetes.

What We Found

Scientists at our Food Safety and Sustainability Center tested 128 samples of basmati, jasmine, and sushi rice for arsenic. We combined the data with the results of our 2012 tests and data from the Food and Drug Administration's analysis of arsenic in rice for a total of 697 samples of rice. We also looked at the IA levels in 114 samples of nonrice grains. Next, we analyzed FDA data on the IA content of 656 processed rice-containing products (many gluten-free). Our findings and advice:

- **There's no federal limit** for arsenic in rice or rice products. Since 2012, our food-safety experts have been calling on the FDA to set one. Meanwhile, use our point system (below) to reduce your arsenic exposure without eliminating rice.
- **White basmati rice** from California, India, and Pakistan, and sushi rice from the U.S. on average has half of the IA amount of most other types of rice.

Our findings led us to treat those specific rices from those areas differently from other types of rice and rices grown in other regions. Based on our data, we calculated that consumers could have about twice as many weekly servings as we previously recommended if that was the only rice product someone ate. For adults, that adds up to 4½ servings per week; children could have 2¾ servings.

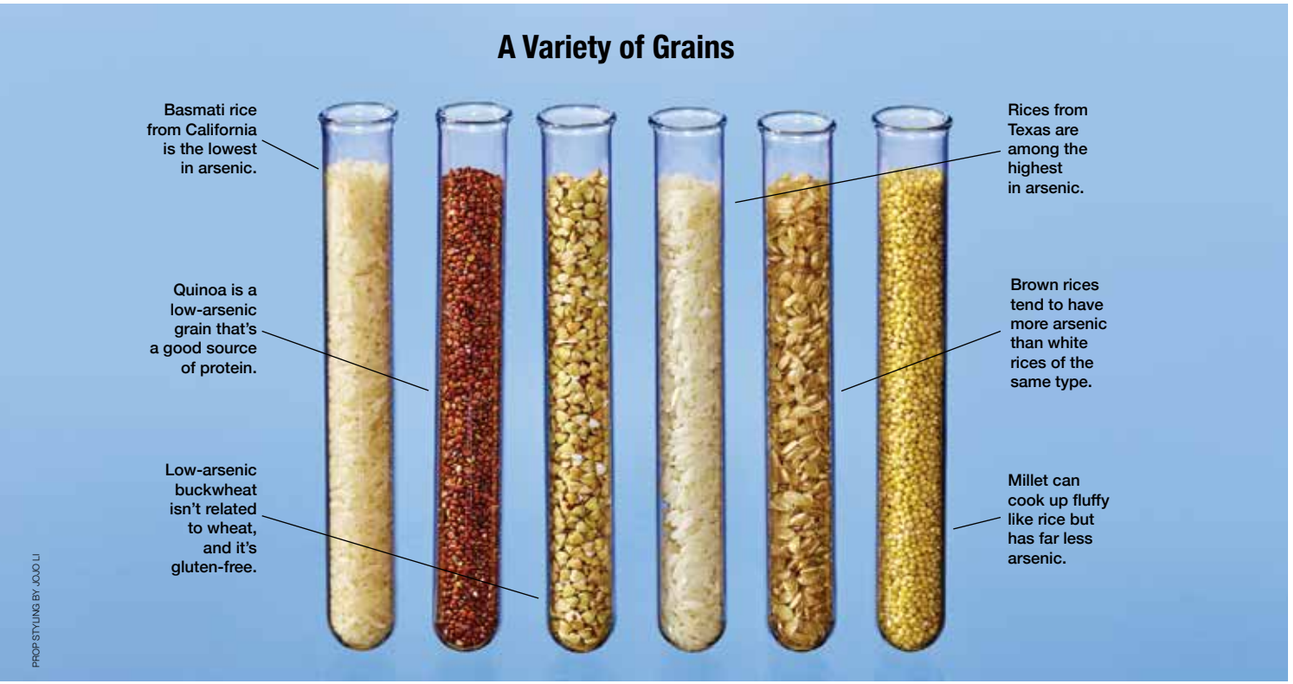
- **Brown rice** has 80 percent more IA on average than white rice of the same type. Arsenic accumulates in the grain's outer layers, which are removed to make white rice. Brown has more nutrients, though, so you shouldn't switch entirely to white. Brown basmati from California, India, or Pakistan is the best choice; it has about a third less IA than other brown rices.
- **All types of rice** (except sushi and quick cooking) with a label indicating that it's from the U.S., Arkansas, Louisiana, or Texas had the highest levels of IA in our tests. For instance, white rices from California have 38 percent less IA than white rices from other parts of the country.
- **Organic rice** takes up arsenic the same way conventional does, so don't rely on organic to have less arsenic.
- **The gluten-free grains** amaranth, buckwheat, millet, and polenta or grits had negligible levels of IA. Bulgur, barley, and farro, which contain gluten, also have very little arsenic.
- **Quinoa** (also gluten-free), had average IA levels comparable to those of other alternative grains. But some samples had quite a bit more. Though they were still much lower than any of the rices, those spikes illustrate the importance of varying the types of grains you eat.
- **Children should rarely eat** hot rice cereal or rice pasta. Our analysis found that those foods can have much more IA than our 2012 data showed. Just one serving of either could put kids over the maximum amount of rice they should have in a week. Rice cakes supply close to the weekly limit in one serving. Rice drinks are also high in arsenic, and children younger than 5 shouldn't drink them instead of milk.

The New Rice Rules: 7 Points per Week

We used our new data and analysis to assign a point value to types of rice foods. On average, we recommend getting no more than 7 points per week. Risk analysis is based on weight, so a serving of any food will give children more points than adults.

Products	Serving Size	Child Points[1]	Adult Points[1]
Infant Rice Cereal	¼ cup uncooked	1¼	NA
Rice Cereal, Hot	¼ cup uncooked	8¼	3½
Rice Cereal, Ready to Eat	1 cup	4½	2¼
Rice Drinks	1 cup	4	2
White Basmati[2] or Sushi Rice	¼ cup uncooked	2½	1½
All Other Rice	¼ cup uncooked	5½	3½
Rice Pasta	2 ounces uncooked	7¼	3
Rice Cakes	1 to 3 rice cakes	6¼	2½
Rice Crackers	16 to 18 crackers	2¾	1¼
Cake or Muffin Mix	2 to 3 ounces	3¾	1½
Brownie Mix	1 to 2 ounces	1¼	½
Cookies	1 to 3 cookies	1¾	¾
Rice Pudding	about ⅓ cup	1¾	¾
Pie- or Pizza-Crust Mix	2 ounces	2	1
Snack Bars (Cereal, Granola, or Energy)	1- to 2-ounce bar	2¾	1¼

[1] To afford the most protection, we used the arsenic levels at the highest end of the range in our analysis for each food. [2] From California, India, or Pakistan.



The great fish debate

The government wants us to eat more seafood. But consuming too much of certain species could put you at risk for mercury exposure. A Consumer Reports exclusive.

Published in Consumer Reports October 2014

When you grill a piece of salmon or have a fish taco for lunch, you're getting a good source of highprotein food that provides important nutrients. And if you're a woman who is pregnant or nursing, that fish contains important fuel for your baby's brain development.

In fact, fish is seen as such a beneficial food that the Food and Drug Administration and Environmental Protection Agency recently came out with proposed new guidelines recommending that women of childbearing age and young children eat more of it. But if Americans follow those guidelines without careful attention to which species they are consuming, they could end up taking in too much mercury.

The latest federal proposal encourages women who are pregnant, breast-feeding, or trying to become pregnant to eat between 8 and 12 ounces of fish per week, and suggests a minimum weekly quota for young children, too. This marks the first time those agencies have set a firm minimum level for weekly fish consumption, including shellfish.

Though the agencies say consumers should seek out fish that are low in mercury, almost all seafood contains the toxin in varying amounts, and getting too much of it can damage the brain and nervous system. That is especially true for fetuses, but children and adults who eat too much high-mercury seafood also can suffer harmful effects such as problems with fine motor coordination, speech, sleep, and walking, and prickly sensations.

Consumer Reports' food-safety experts analyzed

PHOTO: GETTY IMAGES

Good choices if you want more fish

Below are low-mercury fish that anyone can eat frequently. We have also considered environmental and sustainability concerns for these recommended lists, which are a result of our analysis of FDA data. A few fish, such as clams and anchovies, appear to be low in mercury but didn't make our lists because the FDA tested so few samples.

Lowest-mercury fish

A 132-pound person can safely eat 36 ounces per week.
A 44-pound child can safely eat 18 ounces per week.

Wild and Alaska salmon (canned or fresh) | Shrimp (most wild and U.S. farmed) | Sardines | Tilapia[1] | Scallops[2] | Oysters[2] | Squid[1] (domestic)

Low-mercury fish

A 132-pound person can safely eat 18 ounces per week.
A 44-pound child can safely eat up to 6 ounces per week.

Haddock | Pollock | Flounder and sole (flatfish) | Catfish[1,3] | Trout[3]

Atlantic mackerel | Atlantic croaker | Mullet | Crawfish (domestic) | Crab[2]

[1]You may want to consider country of origin and choose domestic rather than imported if possible.

[2]Always follow any local alerts regarding when shellfish can be safely harvested and eaten. Eating shellfish raw always carries additional risks of foodborne illness, and it's not recommended for vulnerable groups.

[3]If wild caught (which includes being fished from local rivers and lakes), check with your state health department for information about PCBs especially for these fish; it's a good idea to check for anything on this list if you are concerned about PCBs.

How much canned tuna can you safely eat?

Ounces of canned tuna that are safe per week by body weight.*

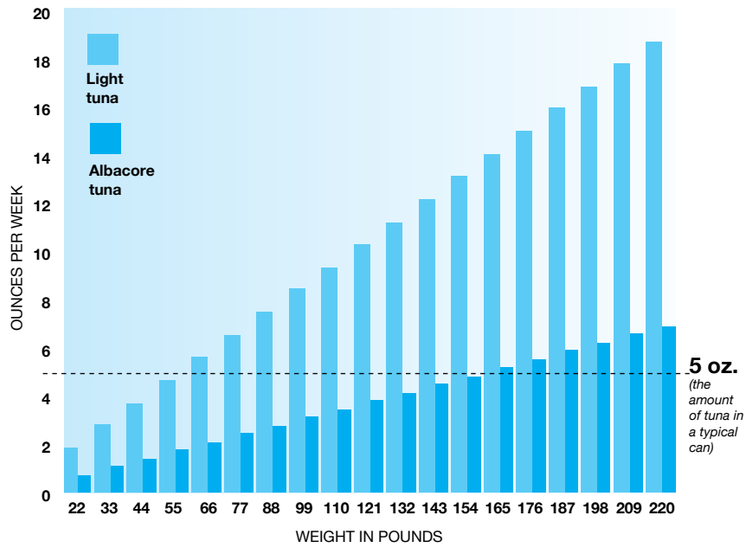


*Chart does not take other mercury exposure into account

Swim away from these

The FDA and EPA say most women and young children should avoid the first four highest mercury fish below. They're considering adding the last two to the list. If you are a frequent consumer of any type of fish-24 ounces or more per week-CR suggests that you avoid the fish below as well.

Swordfish
Shark
King mackerel
Gulf tilefish
Marlin
Orange roughy

To minimize your mercury intake, limit your consumption of these higher-mercury fish.

Grouper
Chilean sea bass
Bluefish
Halibut
Sablefish (black cod)
Spanish mackerel (Gulf)
Fresh tuna (except skipjack)

ILLUSTRATIONS: JOE MCKENDRY

PHOTO: JAVIER LARREA/GETTY IMAGES

the FDA's own data that measures mercury levels in various types of seafood. From that we identified almost 20 seafood choices that can be eaten several times per week, even by pregnant women and young children, without worrying about mercury exposure.

However, CR disagrees with the recommendations from the FDA and EPA on how much tuna women and children may eat. (We don't think pregnant women should eat *any*.) We also believe the agencies do not do enough to guide consumers to the best low-mercury seafood choices. To make decisions easier for consumers, our chart on page 37 gives advice about good low-mercury choices.

"We're particularly concerned about canned tuna, which is second only to shrimp as the most commonly eaten seafood in the U.S.," says Jean Halloran, director of food policy initiatives for Consumers Union, the advocacy arm of Consumer Reports. Given its popularity and its mercury content, canned tuna accounts for 28 percent of Americans' exposure to mercury, according to an analysis by an EPA researcher published in 2007.

HOW MUCH IS TOO MUCH?

When the FDA and EPA last issued recommendations about seafood, in 2004, they advised women of childbearing age to eat no more than 12 ounces of fish per week because of concerns about exposure to mercury.

Though the agencies are still recommending that upper limit, they now are adding minimum weekly quotas, in part because recent research the FDA conducted indicated that one in five pregnant women had eaten no fish at all in the previous month and the majority of those who did had less than 4 ounces per week. In announcing the updated advice, the FDA's acting chief scientist, Stephen Ostroff, M.D., said, "The latest science strongly indicates that eating 8 to 12 ounces per week of a variety of fish lower in mercury during pregnancy benefits fetal growth and development." The proposed guidelines will be discussed in upcoming public meetings.

Other than the new advice on minimum weekly fish consumption, most of the other federal recommendations are essentially the same ones given in 2004. The agencies advise that young children and women of childbearing age avoid four fish with the highest mercury levels: swordfish, shark, king mackerel, and tilefish from the Gulf of Mexico. They are also considering adding marlin and orange roughy to that list.

Our safety experts agree that those women and children should avoid high-mercury seafood. We also suggest that *anyone* who eats 24 ounces or more of fish per week should steer clear of high-mercury choices.

The dietary safety limit for methylmercury (a form of mercury that builds up in fish and shellfish) set by the EPA is 0.1 microgram per kilogram of body weight per day. Based on that, a blood level of 5.8 micrograms per liter of blood is what the agency considers a maximum acceptable level. But that guideline was set more than a decade ago. Some scientists and consumer safety advocates believe it should be changed because several studies published since then say adverse effects could occur at lower mercury blood levels.

Deborah Rice, a former senior risk assessor for the EPA, thinks the limit should be lowered. Rice, who co-wrote the EPA document that established the current limit in 2001, says, "Based on newer studies showing harm from mercury at lower doses, there is no question that 5.8 micrograms is too high." She suggests that the acceptable level should be lowered to 2 or 3 micrograms of mercury per liter of blood.

But even using the EPA's current levels, some of the agencies' advice on fish consumption still causes concern. For instance, the new recommendations allow pregnant women to have up to 6 ounces of albacore (white) tuna weekly.

The average mercury levels in the FDA data we analyzed indicated that a 125-pound woman would exceed the EPA's "safe" consumption limit for mercury by eating just 4 ounces of albacore tuna. A 48-pound child would exceed the limit eating any more than 1.5 ounces (about a third of a can).

The agencies also include canned light tuna as a lower-mercury choice that consumers can eat to meet the minimum weekly fish quota. According to the National Fisheries Institute, light tuna accounts for about 70 percent of canned-tuna consumption in the U.S. Though canned light tuna on average has only a third of the mercury that albacore has, the FDA's data show that 20 percent of the samples it tested since 2005 contained almost double the average level the agency lists for that type of tuna. And the highest level of mercury in its samples of canned light tuna exceeded the average mercury level for king mackerel.

There's no way for pregnant women to tell which cans have the higher spikes of mercury, which can potentially damage the brain of an infant in the womb at a critical stage of development. "The brain undergoes a series of complex developmental stages that need to be completed in the right sequence and at the right time," explains Philippe Grandjean, M.D., an adjunct professor at the Harvard School of Public Health and a leading researcher. A mother's intake of methylmercury when she eats fish could reach the fetus within hours and may leave a permanent deficit at a critical time, he says.

Consumer Reports has said for some time that canned light tuna is not a good low-mercury choice and that pregnant women should not eat any tuna at all. Nothing in the new federal testing data or advice has given us cause to change that view, which also is shared by some scientists, such as Rice.

In fact, our recent analysis of the FDA's mercury testing data has prompted us to add a new piece of cautionary advice about another form of tuna. Certain types of tuna—such as yellowfin and big eye tuna, also known as "ahi"—used in sushi are especially high in mercury. FDA data show that many samples have levels comparable to shark and swordfish, which FDA advises pregnant women and other vulnerable groups to avoid entirely.

Our food-safety experts are recommending that young children, women of childbearing age, and anyone who eats a lot of fish—24 ounces per week or more—should avoid eating sushi made with tuna and opt instead for sushi made with low-mercury fish.

The FDA's view

In a statement to Consumer Reports, the FDA explained the rationale for its advice. "Based on a review of the latest science, we have concluded that it is possible for pregnant and breast-feeding women, and women who might become pregnant, to increase growth and developmental benefits to their children by eating more fish than these groups of women typically do," the agency said. "This can be done while still protecting them from the potentially harmful effects of methylmercury in fish."

How does mercury get into fish?

Mercury levels in the northern Pacific Ocean have risen about 30 percent over the past 20 years and are expected to rise by 50 percent more by 2050 as industrial mercury emissions increase, according to a 2009 study led by researchers at the U.S. Geological Survey and Harvard University.

Mercury-containing plants and tiny animals are eaten by smaller fish that are then gobbled up by larger fish, whose tissue accumulates mercury. That's why larger, longer-living predators such as sharks and swordfish tend to have more of the toxin than smaller fish such as sardines, sole, and trout.

In comments submitted to federal health officials earlier this year, a group of scientists and policy analysts pointed out that a 6-ounce serving of salmon contains about 4 micrograms of mercury vs. 60 micrograms for the same portion of canned albacore tuna—and 170 micrograms for swordfish.

When you eat seafood containing methylmercury, more than 95 percent is absorbed, passing into your bloodstream. It can move throughout your body, where it can penetrate cells in any tissue or organ.

BOTTOM RIGHT: GETTY IMAGES

More help online

A useful tool to help you make safer seafood choices is the "Got Mercury?" calculator, which can be found at *ConsumerReports.org/cro/mercury1014.* Enter the types and amount of fish you plan to eat for the week, along with your body weight, and you'll see whether you'll be exceeding the safe dietary limit for mercury.

Sick from sushi: A fish lover feels the effects of mercury

Richard Gelfond liked to play tennis, but he noticed he was having trouble keeping his balance. That's when he decided it was time to seek medical advice about the mysterious symptoms he'd been experiencing, which included a feeling of numbness in his lips and tingling in his feet.

Gelfond, of New York City, who is chief executive officer of the innovative motion picture company Imax, consulted several doctors, who also were baffled until one of them finally asked him whether he ate a lot of seafood.

He certainly did. Gelfond often had fish for lunch and dinner as part of a low-calorie, low-cholesterol diet. And he primarily ate swordfish, tuna steaks or sushi, and Chilean sea bass, all of which of mercury. The blood test his doctor ordered revealed that Gelfond's mercury level was 13 times as high as the 5.8 micrograms of mercury per liter of blood that EPA officials consider a safe level.

"When my test results finally came back, my balance had gotten so bad I couldn't cross the street without help, but I never suspected it was caused by all of those tuna steaks, swordfish tacos, I was eating as part of what I thought was a healthier diet," Gelfond says.

Almost 10 years have passed since he received the diagnosis of mercury poisoning, and Gelfond says he still loves fish. But he's careful to choose lower-mercury options such as flounder, scallops, and shrimp, and he opts for sushi made with salmon rather than tuna. Though his blood mercury level has dropped to 15 micrograms, symptoms such as feeling off-balance still occasionally resurface, especially when he is tired.

As a physician and professor of environmental and occupational medicine at Rutgers Robert Wood Johnson Medical School, Michael Gochfeld, M.D., Ph.D., has been involved in mercury research for 40 years and says he has seen patients suffering mercury poisoning symptoms at blood levels of only 40 or 50 micrograms per liter, but another patient he evaluated recently had no symptoms even though he had a mercury blood level of 150 micrograms from frequent consumption of a variety of fish that he caught himself.

When patients show symptoms, Gochfeld advises that they stop eating fish altogether at first, then begin incorporating low-mercury fish into their diet after their mercury blood levels drop to low levels, which usually occurs within three to six months. For most patients, the symptoms will go away as the mercury level falls, but in serious cases, health might improve but not necessarily return to normal.

Because of his experience, Gelfond provided funding to a center at Stony Brook University in New York to research health effects from dietary exposure to mercury. "I was sure what happened to me could be happening to others," Gelfond says. "I wanted to raise public awareness about the risks of mercury overexposure for adults so that they could be diagnosed more quickly than I was."

PHOTO: AXEL DUPEUX

HOOKED
Imax CEO Richard Gelfond still has some problems from mercury exposure.

How you can take action

The FDA and EPA are seeking feedback on their proposed guidelines on fish before they are made final. Consumer Reports believes the agencies should:

- Advise pregnant women to avoid eating any tuna, including canned light tuna.
- Delete its recommendation that women of childbearing age can safely eat up to 6 ounces of canned white (albacore) tuna per week.
- Include anyone who eats more than 24 ounces of fish per week among the vulnerable groups and develop advice for them to avoid overexposure to mercury.

Make *your* voice heard by asking the agencies to improve their advice about tuna consumption and require that their cautionary advice be posted where fish is sold so that it's easier to make the right choices to minimize mercury exposure. To submit comments online, go to *regulations.gov* and type FDA-2014-N-0595 in the search field.

How Safe Is Your Shrimp?

Consumer Reports' guide to choosing the healthiest, tastiest, and most responsibly sourced shrimp

Published in Consumer Reports June 2015

Americans love shrimp. Each of us eats, on average, almost 4 pounds per year, making shrimp more popular than tuna. Once considered a special-occasion treat, shrimp has become so ubiquitous that we now expect to find it on the menu whether we're at a pricey steak house or a fast-food joint.

In fact, Americans eat about three times more shrimp than we did 35 years ago. To satisfy our insatiable appetite, the U.S. has become a massive importer: About 94 percent of our shrimp supply comes from abroad, from countries such as India, Indonesia, and Thailand.

But our love affair with shrimp does have a downside. Most of the shrimp we import is "farmed"—grown in huge industrial tanks or shallow, man-made ponds that can stretch for acres. In some cases 150 shrimp can occupy a single square meter (roughly the size of a 60-inch flat-screen television) where they're fed commercial pellets, sometimes containing antibiotics to ward off disease. If ponds aren't carefully managed, a sludge of fecal matter, chemicals, and excess food can build up and decay. Wastewater can be periodically discharged into nearby waterways. "Bacteria and algae can begin to grow and disease can set in, prompting farmers to use drugs and other chemicals that can remain on the shrimp and seep into the surrounding environment," says Urvashi Rangan, Ph.D., executive director of the Consumer Reports Food Safety and Sustainability Center. Those shrimp-farming practices raise a variety of concerns—not just about how safe shrimp are to eat but also about the environmental damage that can be caused by farming them that way.

For shoppers the dilemma starts at the grocery store, where it's difficult to know what to buy. Labels and names can be confusing, meaningless, or—worse—deceptive. Sellers may not always tell (or even know) the truth about the origins of the shrimp they offer. And the allure of a label proclaiming that shrimp are "natural" or "wild" can obscure the fact that some expensive varieties aren't necessarily fresher or more flavorful.

That's why Consumer Reports decided to take an in-depth look at shrimp from a testing, tasting, and shopping viewpoint. We unearthed some worrisome findings, including bacteria and antibiotic residues on some samples. But there was also good news, in that there are plenty of healthful choices available.

There's no foolproof way to make sure you won't get sick from the bacteria on shrimp, but following our safe-prep rules will certainly improve your odds. And to make sure you're buying the cleanest, most responsibly fished or raised shrimp—and that you're getting what you pay for at the fish counter—use our guide on these pages.

WHAT OUR TESTS SHOWED: BACTERIA AND OTHER PROBLEMS

Despite America's massive intake of shrimp, the Food and Drug Administration tested only 0.7 percent of foreign shrimp shipments last year. To do our own testing, Consumer Reports bought 342 packages of frozen shrimp—284 raw and 58 cooked samples— at large chain supermarkets, big-box stores, and "natural" food stores from 27 cities across the U.S. (We didn't include fresh, never-frozen shrimp because they account for only a small percentage of the shrimp that consumers buy.)

We tested for bacteria such as salmonella, vibrio, staphylococcus aureus, and E. coli. We also looked for drug residues to see whether antibiotics were used in raising the shrimp. Antibiotics—none of which are approved by the U.S. for shrimp farming—are problematic because their use can ultimately lead to bacteria becoming antibiotic-resistant, meaning that at some point the antibiotic may no longer work to treat common human ailments.

Our findings provided some cause for concern. In 16 percent of cooked, ready-to-eat shrimp, we found several bacteria, including vibrio and E. coli. Those bacteria can potentially cause illnesses such as food poisoning—which could include diarrhea and dehydration—and, in rare instances, can even prove fatal. In 11 samples of raw imported farmed shrimp, we detected antibiotics. And in seven raw shrimp samples (six farmed and one wild), we found MRSA—methicillin-resistant staphylococcus aureus, a bacteria that can cause infections that are often difficult to treat.

Overall, 60 percent of our raw shrimp tested positive for bacteria, but it's important to keep those findings in perspective. By comparison, in 2013, when we tested raw chicken breasts, 97 percent of the samples contained bacteria, says Rangan, who oversaw both the shrimp and chicken studies.

Compared with the chicken samples, far fewer shrimp contained salmonella, which is often responsible for outbreaks of food poisoning. But concerningly, we found vibrio on many shrimp samples. "Vibrio is the most common cause of food poisoning from eating raw oysters," Rangan says. "And even though most bacteria on shrimp would be killed during the cooking process, our test results raise real questions about how shrimp is raised, processed, and regulated."

SHOULD YOU BUY FARMED SHRIMP AT ALL?

The shrimp business can be extraordinarily lucrative when it's done on a large scale. A medium-sized shrimp farm in Southeast Asia can produce close to a million pounds of shrimp per year—a powerful incentive for farmers to maximize production.

But evidence shows that those vast overseas operations may use antibiotics similar to those that humans rely on to treat infections. For example, they may use tetracyclines. Although many countries permit the use of antibiotics for shrimp farming, foreign shrimp destined for the U.S. market are not allowed to be raised using them. In addition, overseas shrimp farmers may also be using pesticides such as toxic organophosphates, and antifungals such as Gentian violet, which may cause cancer. Not only aren't those chemicals permitted by the U.S. for shrimp farming, but they can also put your health at risk and damage the environment.

One reason farmers turn to antibiotics is that shrimp in crowded farms are extremely susceptible to diseases, such as Early Mortality Syndrome (EMS), which can wipe out entire harvests. In 2013, EMS was reported to have reduced Thailand's shrimp output by 50 percent. But there's a strange illogic here: According to Donald Lightner, Ph.D., a professor of veterinary science and microbiology at the University of Arizona, EMS doesn't respond to antibiotics. In fact, our experts say that some of the most devastating shrimp diseases are caused by viruses, against which antibiotics don't work.

It's the FDA's job to inspect shrimp coming into the U.S. to make sure it doesn't contain any drugs or chemicals that aren't permitted in imported shrimp. But in our tests, 11 samples of farmed shrimp from Vietnam, Thailand, and Bangladesh tested positive for one or more antibiotics: Nine tested positive for oxytetracycline, three contained enrofloxacin, and two contained sulfa antibiotics. According to the FDA, if those drugs had been detected in even one shrimp, the entire shipment would have been refused entry into the U.S.

The small quantities of antibiotics we found probably wouldn't affect a typical consumer's health, says Michael Crupain, M.D., M.P.H., director of the Consumer Reports Food Safety and Sustainability Center. But farming shrimp with antibiotics has the potential to cause harm down the road: Antibiotics don't kill off all bacteria, and those that do survive can multiply. If those resistant bacteria cause infections, certain antibiotics that once treated them will no longer work. What's more, resistance can be transferred to other bacteria, including those that cause common human infections. In fact, the national Centers for Disease Control and Prevention estimates that antibiotic-resistant infections contribute to 23,000 deaths and more than 2 million illnesses in the U.S. each year.

We found the antibiotic-resistant bacteria MRSA on six samples of farmed shrimp from Vietnam, Bangladesh, and Ecuador, and on one wild sample from the U.S. MRSA can make you sick. "It's spread through contact, so if MRSA gets on your skin while you're preparing raw shrimp, it can potentially cause an infection, especially if you have an abrasion or cut," Crupain says. MRSA causes serious skin and blood infections. And about 11,000 people in the U.S. die as a result of MRSA each year. We found more MRSA on shrimp than we found in our studies of pork, chicken, and ground turkey.

When it comes to safety and sustainability, responsibly caught U.S. wild shrimp is our top choice.

So which farmed shrimp should you buy? Consumer Reports recommends buying farmed shrimp raised without chemicals, including antibiotics. That can include shrimp farmed in large outdoor ponds that mimic the natural habitat or in tanks that constantly filter and recycle water and waste. Consumer Reports has evaluated organizations and stores that certify whether farmed shrimp—both domestic and imported—have been raised without drugs and chemicals. We recommend farmed shrimp labeled Naturland, Aquaculture Stewardship Council, or Whole Foods Market Responsibly Farmed. Another common certification is Best Aquaculture Practices, but we found antibiotics on four samples with that label.

ARE WILD SHRIMP A BETTER CHOICE?

One reason farmed shrimp is so popular is that it can be cheaper than wild shrimp, which

Dirty Shrimp: What we found

Consumer Reports tested 284 samples of raw shrimp purchased at stores around the country and tested them for bacterial contamination. The last column shows the percentage of samples that contained at least one of the following bacteria: vibrio, staphylococcus aureus, E. coli, listeria, or salmonella—bacteria that can potentially make you sick. Our experts say more should be done to prevent contamination, but note that cooking should kill the bacteria.

COUNTRY OF ORIGIN	PRODUCTION TYPE	NO. OF SAMPLES TESTED	PERCENT WITH BACTERIA
Bangladesh	Farmed	12	83%
India	Farmed	43	74%
Indonesia	Farmed	36	69%
Ecuador	Farmed	18	61%
Vietnam	Farmed	40	58%
Thailand	Farmed	41	42%
Argentina	Wild	12	33%
U.S.	Wild	55	20%

The 8,000-Mile Trip to America's Dinner Plate

Most of our shrimp is imported, and the majority of it is farmed. Farming can be done responsibly, but when it isn't, a variety of unhealthy, environmentally hazardous, and unappetizing problems can arise, like the ones below.

1. A Shrimp Pond in Asia or South America

Trouble can begin before a farm is stocked with a single shrimp; to make way for ponds, natural coastal areas can be damaged. Tens of thousands of shrimp hatchlings may be added, and the crowded farm can produce a vast amount of waste. If the farm isn't managed properly, bacteria can grow and disease can break out.

2. What's in That Pond

To keep ponds productive and control disease, overseas farmers sometimes use antibiotics and other chemicals. The Food and Drug Administration requires processors to ensure that shrimp intended for the U.S. market aren't raised with unapproved substances. "But enforcement is practically nonexistent," says Jean Halloran, director of food policy initiatives for Consumers Union, the policy arm of Consumer Reports. The FDA regularly inspects fewer than 2,000 of the hundreds of thousands of foreign facilities that export food to the U.S. each year.

3. The Processing Plant

This is where shrimp are deheaded, shelled, deveined, and packed into tidy packages. The FDA requires processors to identify potential health hazards in their own plants. "But some of the bacteria we found, such as staphylococcus aureus, can come from handling," says Michael

Crupain, M.D., M.P.H., director of the Consumer Reports Food Safety and Sustainability Center. "This suggests that processors may not be practicing good hygiene, such as washing hands or wearing gloves."

4. Welcome to America

The FDA examines only 3.7 percent of the shrimp shipments coming into the country—and "examined" may simply mean reading the shipping label, not actually testing the shrimp. In 2014 the FDA tested just 0.7 percent of foreign shrimp shipments. In Consumer Reports' tests, several farmed shrimp from Thailand, Vietnam, and Bangladesh tested positive for antibiotics, and 28 percent of uncooked shrimp tested positive for vibrio, a potential pathogen.

5. Your Supermarket in Anytown, U.S.A.

Supermarkets are required to specify where shrimp comes from. But because of complexities in the law, the package may not list every stop along the way, especially if the shrimp is breaded or otherwise "substantially transformed." See Consumer Reports videos on shrimp at ConsumerReports.org/ cro/shrimp0615.

ILLUSTRATIONS BY ZELA LOBB

is caught in the ocean. Our tests suggest that wild shrimp from U.S. waters may be worth the higher price. Of all the shrimp we tested, they were among the least likely to harbor any kind of bacteria or contain chemicals.

But it's worth considering the environmental implications of going wild. According to Amanda Keledjian, a marine scientist at the nonprofit conservation group Oceana, "Nets dragged along the ocean floor can severely damage the sea bottom and anything that lives there." Estimates vary, but at least 1 to 3 pounds of other species—including endangered sea turtles—can be killed for every pound of shrimp caught in the wild. To minimize the impact, a U.S. federal law requires shrimpers, with some exceptions, to outfit their nets with devices that allow other sea life to escape. But, says Rangan, "A law on Louisiana's books prohibits the enforcement of those rules."

Still, when it comes to safety and sustainability, responsibly caught U.S. wild shrimp is our top choice. Consumer Reports recommends buying wild shrimp certified by the Marine Stewardship Council, an organization that ensures shrimpers are fishing responsibly; shrimp from Whole Foods Market; and those listed as "Best Choices" or "Good Alternatives" on Monterey Bay Aquarium's Seafood Watch Guide, at seafoodwatch.org.

WHICH TASTES BETTER—WILD OR FARMED?

Shrimp connoisseurs, from celebrity chefs to seasoned shrimpers, claim to detect a striking difference between wild and farmed shrimp, and there's some science to support their claims. The CSIRO Division of Food Science and Technology in Sydney analyzed wild and farmed shrimp to investigate why they can taste different. Sure enough, wild shrimp had far higher levels of compounds called bromophenols, which the researchers equated with a "briny, oceanlike" flavor.

But don't assume that briny means better. To conduct a small tasting, Consumer Reports purchased 24 packages of seven types of frozen shrimp from Whole Foods Markets near our Yonkers, N.Y., headquarters. They included Atlantic white, Key West pink, and Gulf white shrimp, all caught in the U.S., as well as farmed shrimp from Thailand, Ecuador, and Vietnam. Sizes varied, but the difference in price was startling; it ranged from $10 per pound for farmed shrimp from Ecuador to $19.99 per pound for wild-caught Gulf white shrimp and wild-caught Key West pink shrimp.

Overall, our tasters found very little difference between the farmed and wild shrimp. But they did note that some wild shrimp had a taste of iodine—a flavor that our experts say is probably due to higher levels of bromophenols. The intensity of that flavor varied; it was stronger in shrimp from the Gulf of Mexico and milder in shrimp from the Florida Keys and the Atlantic.

"Nutritionally, whether you choose wild or farmed shrimp, they pack the same major nutrients," says Amy Keating, R.D., a nutritionist at Consumer Reports. In a 3-ounce serving of cooked shrimp, you'll get 101 calories, 19 grams of protein, 1 gram of fat, and 179 milligrams of cholesterol, making shrimp a healthy, low-fat source of protein.

CAN YOU TRUST THE LABELS ON SHRIMP?

Not always. "If a shrimp label says 'Organic,' ignore it," Rangan advises. "There are no U.S. standards for the organic label when it comes to seafood, unlike for produce and meat." The same goes for labels proclaiming that a package of shrimp is "Natural" or "Environmentally Aware." We also picked up a bag of shrimp labeled "Chemical-free" (a claim that is not regulated), which tested positive for the antibiotics oxytetracycline and sulfamethoxazole. "Antibiotics are chemicals," Rangan says. "Producers should be honest about how their shrimp is raised."

The Department of Agriculture requires supermarkets and warehouse clubs to state whether shrimp is wild or farmed, along with its country of origin. But a 2014 Oceana study found that even those common classifications can be inaccurate. Oceana bought 143 shrimp samples from 111 vendors nationwide and ran DNA

SHRIMP BY THE NUMBERS

18 Million
Number of servings of cooked shrimp Americans eat daily

10
Number of legs on a shrimp, making them decapods

1 gram
Amount of fat in 3 ounces of cooked shrimp

4,000+
Number of different types of shrimp known to exist

19 grams
Amount of protein in a 3-ounce serving of cooked shrimp

PHOTO: WILLIAM MAHAR/GETTY IMAGES

SIX POPULAR SHRIMP

WHITE SHRIMP (Litopenaeus setiferus)

Description
White shrimp are prized for their sweet, tender meat and easy-to-peel shells. Commercial fishing for these warm-water critters began in 1709.

Where It's From
They're harvested from North Carolina to Texas, with most from the Gulf of Mexico and Mississippi River Delta in Louisiana.

WHITELEG SHRIMP (Litopenaeus vannamei)

Description
Whiteleg shrimp, also called Pacific white shrimp, have a translucent body that often has a bluish-green hue.

Where It's From
They are native to the eastern Pacific Ocean, but they're farmed in the U.S. and abroad.

BROWN SHRIMP (Farfantepenaeus aztecus)

Description
Brown shrimp have reddish-brown shells with dark green and red tail-fan appendages. Along with white shrimp, they are the most commonly sold U.S. wild-caught shrimp.

Where It's From
They come primarily from the Gulf of Mexico and may also be called summer, redtail, or golden shrimp.

ROCK SHRIMP (Sicyonia brevirostris)

Description
Rock shrimp are often called the "little shrimp with a big lobster taste." Named for their rock-hard shells, they were viewed as a throwaway catch until a machine was developed in the late 1960s to split their tough shells and devein them.

Where It's From
Most of the U.S. catch comes from the east coast of Florida near Cape Canaveral.

SPOT PRAWN (Pandalus platyceros)

Description
Spot prawns are the largest coldwater shrimp sold and tend to be expensive.

Where It's From
They are wildcaught off the coasts of Alaska, California, Washington, and British Columbia.

TIGER SHRIMP (Penaeus monodon)

Description
Also known as giant tiger prawn and black tiger shrimp or prawns. They are the most important farmed seafood commodity in Asia in terms of financial value. The U.S. is one of Asia's main export markets.

Where It's From
These relatively large shrimp live along the coasts of Australia, South East Asia, South Asia, and East Africa.

Truth, Lies, and Crustaceans

We wanted to find out what fishmongers really know about the shrimp they're selling, so our mystery shoppers went shopping for shrimp near our Yonkers, N.Y., headquarters. Here are a few choice tidbits fish sellers told us:

We Asked "Are these shrimp organic?"
The Seller's Answer "Yes, they're organic."
The Truth There are no organic standards for shrimp, or for any seafood, in the U.S.

We Asked "Why is wild shrimp more expensive?"
The Seller's Answer "Wild shrimp is more expensive because it's better for you."
The Truth According to our dietitians, farmed and wild shrimp have the same basic nutritional profile. But from a safety and sustainability standpoint, this fishmonger is right; our experts say that sustainably fished U.S. wild shrimp is the best choice.

We Asked "Why are antibiotics used in shrimp farming?"
The Seller's Answer "Antibiotics are used to make the shrimp taste better."
The Truth Antibiotics are used to combat or prevent disease— but shouldn't be.

We Asked "Should I wash my hands after handling raw shrimp?"
The Seller's Answer "No, you don't have to wash your hands after handling shrimp."
The Truth You should always wash your hands after touching raw shrimp. It can harbor bacteria that could make you sick.

How to Choose

WILD When buying wild shrimp, look for shrimp that are certified by the Marine Stewardship Council. We also recommend wild shrimp listed as "Best Choice" or "Good Alternative" at seafoodwatch.org/ seafood-recommendations. Avoid shrimp caught in Louisiana—the only state that does not enforce the federal law requiring shrimpers to use a device that allows sea turtles to escape from shrimp nets.

FARMED When buying farmed shrimp, look for shrimp with these certifications: Naturland, Aquaculture Stewardship Council, or Whole Foods Responsibly Farmed.

► For more on labels you can trust, see "The Lowdown on Shrimp Labels," on page 47.

SAFE SHRIMP PREP

Even with the best possible shrimp, proper kitchen handling is important. From store to stovetop, oven, or barbecue, here's how to handle and prepare it safely:

Keep it cold. Bacteria multiply at temperatures above 40° F, so don't let shrimp warm up before cooking. Make them one of the last items you place in your grocery cart. And if you're buying shrimp at the seafood counter, ask for a bag of ice to keep them chilled. Consider keeping a cooler in your car for the ride home. Then put the shrimp on ice or in the fridge until you're ready to cook them.

If you buy them frozen, defrosting and refreezing will degrade the quality but shouldn't pose a health risk as long as they remain below 40° F.

Work quickly when shelling or deveining so that shrimp spend less time in your warm hands. Keep them on ice or in a bowl of ice water whenever possible.

Dispose of uncooked veins and shells properly to contain any bacteria on them.

Immediately wash your hands and any kitchen utensils that have come in contact with raw shrimp. That reduces the risk of spreading bacteria from the shrimp to any other food you're serving.

PHOTO: GETTY IMAGES

tests to figure out exactly what type, or species, they'd purchased. It turned out that 30 percent of the labels were misleading in some way. For example, in some cases farmed white-leg shrimp (the most commonly farmed shrimp globally) were sold as wild shrimp. "This is seafood fraud, especially given the far higher price of wild shrimp," says study author and senior scientist Kimberly Warner, Ph.D. Oceana even found a small banded coral shrimp, which is not meant to be eaten, mixed into a bag of salad-sized shrimp.

How can a consumer make smart choices given those shady shrimp sellers? Marianne Cufone, an environmental attorney and executive director of the Recirculating Farms Coalition, says there are some clues that might help you distinguish wild from farmed. "Wild shrimp often vary in size, shape, and color because they don't all have identical genetics," she says. "Batches of farmed shrimp often all hatch at the same time, eat the same food, and live in the same environment, so they're more likely to look the same." Cufone's second tip: "Look for poop, or what is politely called a vein." Frequently, shrimp farmers stop feeding shrimp before harvesting them so that the vein empties. If you see a dark line, there's a better chance it's a real wild shrimp.

WHICH IS BETTER: 'FRESH' OR FROZEN?

Another confusing choice for consumers is whether to buy frozen shrimp or the "fresh" shrimp at the seafood counter. For the most part, it doesn't really matter. If you're buying from a gourmet seafood store or seaside market, you may find truly fresh shrimp. But the majority of shrimp are frozen soon after they are caught. Steven Wilson, deputy director of the NOAA Fisheries Office of International Affairs and Seafood Inspection, says there's a chance that the glistening tray of shrimp at the seafood counter in your store was previously frozen, then thawed. In fact, it may be the same shrimp that's in the freezer case—just defrosted.

RAW OR COOKED?

According to a 2015 Consumer Reports National Research Center survey of 1,015 U.S. adults, more than a quarter of buyers prefer their shrimp precooked. Though buying cooked shrimp may be convenient, it does not guarantee safety. In our tests, we found concerning bacteria, including vibrio and staphylococcus aureus, in a few of our cooked samples. If you want to be extra careful, you can buy raw shrimp, handle it properly, and cook it yourself to kill any bacteria.

Note: Funding for this project was provided by The Pew Charitable Trusts. Any views expressed are those of Consumer Reports and its advocacy arm, Consumers Union, and do not necessarily reflect the views of The Pew Charitable Trusts.

PHOTO: ANDRE BARANOWSKI/GETTY IMAGES

The Lowdown on Shrimp Labels

Here's what to look for in labels. We believe that your best choice is responsibly caught U.S. wild shrimp, including those recommended by seafoodwatch.org.

TRUST

Marine Stewardship Council indicates that wild shrimp are caught using sustainable fishing practices. This can include outfitting nets with devices that allow other animals to escape.

Aquaculture Stewardship Council indicates shrimp are raised without antibiotics and according to guidelines that protect the environment. This label also ensures that shrimp farms do not use forced labor. However, the guidelines permit the use of certain chemicals, including some pesticides, and don't limit the number of shrimp in a pond.

Naturland indicates that shrimp are farmed following guidelines that prohibit overstocking of shrimp ponds and the use of chemicals, including antibiotics, pesticides, and disinfectants. Shrimp are fed food made of sustainably caught fish meal, and farms do not use forced labor.

Whole Foods Market Responsibly Farmed certifies that shrimp are raised in conditions that protect the environment, without antibiotics, and with limited use of chemicals. But there's no limit on the density of shrimp in ponds. This label is found only at Whole Foods Market stores.

DON'T TRUST

Turtle Safe This claim is not backed by a consistent set of standards.

Natural This term has no official definition for shrimp. Ignore it.

Organic There is no approved standard for organic seafood in the U.S.

Sustainable There is no regulated definition of "sustainable." Any seller can make this claim.

Environmentally Aware An easy claim to make, but it's not backed by a consistent set of standards to ensure that shrimp were sustainably caught or farmed.

No hormones There is no government or official definition for this term on shrimp.

No antibiotics On meat and poultry, this term means what it says, but when it comes to shrimp, the term is not defined by the FDA.

Where We Stand on Shrimp

About 94 percent of America's shrimp is imported, but in 2014 the Food and Drug Administration examined only 3.7 percent of foreign shrimp shipments. Consumer Reports' own tests found evidence of unhealthy contaminants in storebought shrimp, including E. coli and vibrio (bacteria that can potentially make you sick) and trace amounts of antibiotics that are prohibited in imported shrimp. And although we didn't find every unapproved antibiotic in our tests, there is concern that foreign shrimp farmers may sometimes use them, including chloramphenicol and malachite green. Those farming practices are damaging to the environment and have long-term health consequences for consumers.

To keep consumers safe, Consumer Reports believes the FDA should do the following:

- **Significantly step up inspections** at U.S. ports and at overseas shrimp farms and processing plants that supply shrimp.
- **Increase laboratory testing** of imported shrimp for antibiotics, none of which are permitted. Antibiotic overuse is a problem because it weakens the effectiveness of lifesaving drugs, such as tetracyclines. The FDA should ensure that they are able to detect antibiotics at the lowest levels modern technology allows.
- **Add vibrio** to the list of bacteria the FDA tests for in shrimp. Also require producers to control vibrio contamination, both at shrimp farms and at processing plants that shell, devein, and package shrimp. Freezing is thought to kill vibrio, but 28 percent of the uncooked frozen shrimp samples we tested contained the bacteria.
- **Reject all shrimp imports that test positive** for MRS A—bacteria that can cause infections that are difficult to treat.

Find out more about our test results at GreenerChoices.org.

ILLUSTRATION BY KEITH NEGLEY

How safe is that chicken?

Most tested broilers were contaminated

Published in Consumer Reports January 2010

You would think that after years of alarms about food safety—outbreaks of illness followed by renewed efforts at cleanup—a staple like chicken would be a lot safer to eat. But in our latest analysis of fresh, whole broilers bought at stores nationwide, two-thirds harbored salmonella and/or campylobacter, the leading bacterial causes of foodborne disease. That's a modest improvement since January 2007, when we found that eight of 10 broilers harbored those pathogens. But the numbers are still far too high, especially for campylobacter. Though the government has been talking about regulating it for years, it has yet to do so.

The message is clear: Consumers still can't let down their guard. They must cook chicken to at least 165° F and prevent raw chicken or its juices from touching any other food.

Each year, salmonella and campylobacter from chicken and other food sources infect 3.4 million Americans, send 25,500 to hospitals, and kill about 500, according to estimates by the national Centers for Disease Control and Prevention. But the problem might be even more widespread: Many people who get sick don't seek medical care, and many of those who do aren't screened for foodborne infections, says Donna Rosenbaum, executive director of Safe Tables Our Priority, a national nonprofit food-safety organization. What's more, the CDC reports that in about 20 percent of salmonella cases and 55 percent of campylobacter cases, the bugs have proved resistant to at least one antibiotic. For that reason, victims who are sick enough to need antibiotics might have to try two or more before finding one that helps.

Consumer Reports has been measuring contamination in store-bought chickens since 1998. For our latest analysis, we had an outside lab test 382 chickens bought last spring from more than 100 supermarkets, gourmet- and natural-food stores, and mass merchandisers in 22 states. We tested three top brands—Foster Farms, Perdue, and Tyson—as well as 30 nonorganic store brands, nine organic store brands, and nine organic name brands. Five of the organic brands were labeled "air-chilled" (a slaughterhouse process in which carcasses are refrigerated and may be misted, rather than dunked in cold chlorinated water).

Among our findings:

• Campylobacter was in 62 percent of the chickens, salmonella was in 14 percent, and both bacteria were in 9 percent. Only 34 percent of the birds were clear of both pathogens. That's double the percentage of clean birds we found in our 2007 report but far less than the 51 percent in our 2003 report.

• Among the cleanest overall were air-chilled broilers. About 40 percent harbored one or both pathogens. Eight Bell & Evans organic broilers, which are air chilled, were free of both, but our sample was too small to determine that all Bell & Evans broilers would be.

• Store-brand organic chickens had no salmonella at all, showing that it's possible for chicken to arrive in stores without that bacterium riding along. But as our tests showed, banishing one bug doesn't mean banishing both: 57 percent of those birds harbored campylobacter.

• The cleanest name-brand chickens were Perdue's: 56 percent were free of both pathogens. This is the first time since we began testing chicken that one major brand has fared significantly better than others across the board.

• Most contaminated were Tyson and Foster Farms chickens. More than 80 percent tested positive for one or both pathogens.

• Among all brands and types of broilers tested, 68 percent of the salmonella and 60 percent of the campylobacter organisms we analyzed showed resistance to one or more antibiotics.

DIRTY BIRDS

As they're raised, chickens can peck at droppings and insects that carry salmonella and campylobacter. The bacteria settle in their intestines, usually without harm, and the chickens contaminate their environment with infected feces. When thebirds are slaughtered, intestinal bacteria can wind up on their carcasses.

To minimize contamination, processors of poultry (and of meat and seafood) follow federally mandated procedures collectively known as HACCP (pronounced hass-ip), which stands for Hazard Analysis and Critical Control Point. Those measures are in effect in slaughterhouses and processing plants and are the consumer's main protection against contaminated chicken. HACCP, implemented for poultry

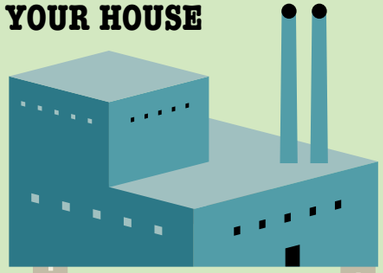
Science lesson: A little bit can make you sick

As few as 15 salmonella or 400 campylobacter organisms can make you ill. The salmonella found in raw poultry, meats, seafood, and produce can cause nausea, vomiting, abdominal cramps, diarrhea, fever, and headache, sometimes followed by arthritis symptoms. Campylobacter is found mainly in raw chicken. It wasn't recognized as a human pathogen until 1977, but it is now one of the most common causes of bacterial foodborne illness. The usual symptoms are diarrhea, often with fever, abdominal pain, nausea, headache, and muscle pain. Rarer are complications such as arthritis, meningitis, and Guillain-Barré syndrome, a potentially fatal neurological condition.

PLAY IT SAFE
Use one cutting board for raw chicken (or other meat) and one for other foods. Immediately after preparation, use hot, soapy water and paper towels to wash and dry your hands and anything you or raw chicken might have touched.

FROM HENHOUSE TO YOUR HOUSE

The government's food-safety rules require chicken processors to identify "critical control points" where contamination might occur, then establish procedures for preventing, eliminating, or reducing those hazards. As our tests show, nothing guarantees a clean chicken. The contamination rate can vary with what the birds are fed, the preventive measures used, growing conditions, and the time of year, says Michael Doyle, Ph.D., director of the University of Georgia's Center for Food Safety. The procedures differ among plants; those outlined here are a possible scenario.



▲ **Processing plant**

◄ **On the road** Chickens travel to the processing plant in cages. Filth can spread.

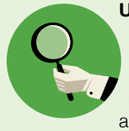
▲ **In the hatchery** Some chicks are contaminated with salmonella from their mothers or their own shells during hatching. Others ingest bacteria from their surroundings. Live birds infected with campylobacter or salmonella usually show no symptoms. To reduce the risk to people, some companies vaccinate hens and chicks against salmonella.

▲ **In the chicken house** Usually a new flock of thousands of chicks is trucked to a house run by a farmer according to the poultry producer's specifications. Chickens habitually peck the ground, ingesting bacteria from litter and feces, and could be exposed to vermin. Companies try to keep germ carriers away and continuously monitor the flocks' general health. Antibiotics are used to prevent or treat illness and might also be given to speed chickens' growth. But treated birds can't be sold as USDA-certified organic.

In the processing plant Birds are stunned, killed, and bled.

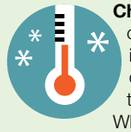
Scalding Hot water loosens feathers for easier plucking. Some bacteria on feathers, feet, and skin are killed, but others float from one bird to another. Carcasses are washed. **Critical control point** Check temperature and pH of water.

Defeathering A machine's rubber fingers pluck feathers and remove the outermost layer of skin. Contaminated fingers can spread bacteria from carcass to carcass.

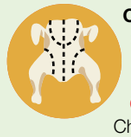


USDA visual inspection After internal organs are removed, a Department of Agriculture inspector checks carcasses and viscera for signs of disease, bruises, and other defects.

Washing Birds are sprayed with chlorinated water or other washes to reduce bacteria and are checked for visible fecal matter. Chickens that pass muster are chilled; those that fail are reprocessed or discarded. **Critical control point** Record chlorine level and adjust if necessary.



Chilling To prevent spoilage, carcasses are submerged in icy chlorinated water or air-chilled to lower their internal temperature to 40° F or less. When chickens emerge, USDA inspectors grade them for quality. At this stage, the USDA conducts salmonella testing, and the plant conducts one test for E. coli per 22,000 birds. **Critical control point** Monitor chlorine level of chiller or temperature of air-chill room; check internal temperature of birds.



Cut-up and packaging area Birds are cut into pieces if necessary, packaged, and shipped. **Critical control point** Check for metal fragments in packaged poultry.

▲ **After processing** Companies take steps to ensure their packaged chickens are properly refrigerated during shipping and delivery to market. Federal regulations require transport at a temperature no higher than 40° F.

▲ **In the store** Improper temperature or handling can introduce bacteria or cause them to multiply.

▲ **In your kitchen** Cooking chicken thoroughly, to at least 165° F, and washing anything that comes in contact with raw chicken greatly reduces risk.

Talk the talk

Certified Humane Raised and Handled. For starters, the chicken had access to clean food and water, according to third-party inspectors with expertise in animal welfare.

Free-range, free-roaming. The chicken has had access to the outdoors, even if that means only that the door to the chicken house was left open briefly each day.

Fresh. The carcass's internal temperature hasn't dropped below 24° F. Still, the chicken might be partly frozen.

Kosher. The chicken was prepared according to Jewish dietary laws. Salt was added as part of the process.

Natural. The chicken was "minimally processed" in a way that didn't fundamentally alter the raw product. It has no artificial ingredients, preservatives, or added color.

No antibiotics administered. Don't assume this was verified unless you also see the label "USDA organic."

No hormones. Pointless; the USDA prohibits the use of hormones in raising poultry.

USDA organic. A USDA-accredited certifier has checked that the chicken company followed standards: Chickens were raised without antibiotics, ate 100 percent organic feed with no animal byproducts, and could go outdoors (though they might not have). For more about labels, go to our affiliate Web site at *www.GreenerChoices.org*.

and meat plants in 1997, requires companies to spell out where contamination might occur and then institute procedures to prevent, reduce, or eliminate it.

Inspectors for the U.S. Department of Agriculture's Food Safety and Inspection Service (FSIS) monitor chicken companies' HACCP plans. They inspect carcasses and viscera for tumors, bruises, and other defects. During testing periods, they also pluck a broiler a day off the line and test it for the presence of salmonella. Plants that produce more than 12 salmonella-positive samples over 51 consecutive days of production fail to meet the FSIS-established performance standard, which triggers an FSIS review of the plant's HACCP plan. The plant would be expected to fix any problems; penalties are possible. To further motivate chicken processors to clean up their act, the USDA has begun publicly posting processors' salmonella test results online. (The data isn't archived, making it hard to assess a processor's performance over time.)

With this gentle prodding, poultry plants have improved, FSIS data indicate. Yet only 82 percent of broiler plants demonstrate what the FSIS calls "consistent process control." By the end of 2010, 90 percent of eligible plants should be able to meet that standard, according to FSIS projections. That still leaves campylobacter. As we went to press in November, an FSIS spokesperson said that baseline data on the prevalence of campylobacter in broiler and turkey carcasses had been collected and were being analyzed and that draft performance standards based on those findings and a risk assessment would be ready by the year's end. FSIS testing for campylobacter would follow.

Carol L. Tucker-Foreman, distinguished fellow at the Consumer Federation of America's Food Policy Institute and a former USDA official, cited "at least a decade of promises and failures to develop campylobacter baseline data and a standard." But she acknowledged that the FSIS could deliver a report on baseline data by the end of 2009. "It is essential," she added, "to have a performance standard for campylobacter."

BEHIND THE NUMBERS

At 14 percent, the overall salmonella incidence is within the range we've seen in the past 12 years. In previous tests, the incidence ranged from 9 percent to 16 percent overall. Campylobacter incidence has varied more. Now it's 62 percent overall; in our previous tests it ranged from 42 percent to 81 percent.

When we took bacteria samples from contaminated chicken and analyzed their resistance to common antibiotics, most bugs could resist at least one antibiotic, and some evaded multiple classes of drugs. If a patient needs treatment, that might leave a doctor with poorer odds of choosing an effective antibiotic to fight infections that might be more stubborn.

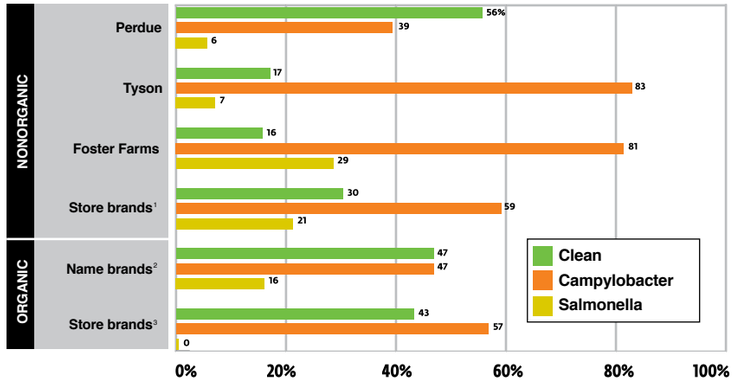
The good news: All of the antibiotics were effective against 32 percent of the salmonella samples and 40 percent of the campylobacter samples. Back in January 2007, we reported that those figures were just 16 percent and 33 percent.

It's not surprising that we found antibiotic-resistant bacteria even in organic chickens, which are raised without antibiotics. "Chickens grown under organic conditions are given exposure to the outdoors, which provides contact with vermin such as rodents, insects, and birds that can carry and transmit these bacteria to chickens," said Michael Doyle, Ph.D., director of the University of Georgia's Center for Food Safety. Moreover, once genes

GERM COUNT

Levels of contamination

Below, the percentages of broilers that tested positive for campylobacter, salmonella, or neither (clean). We analyzed 70 chickens from each major brand, 66 from nonorganic store brands, 62 from organic name brands, and 44 from organic store brands. Figures are averages for store brands (both organic and nonorganic) and for organic name brands. Totals may exceed 100 percent because some broilers harbored both pathogens.



[1] AJ's, Acme, Albertsons, America's Choice, Diebergs, Earth Fare, Fiesta, Fresh & Easy, Giant, Giant Eagle, Harris Teeter, Harry's, Hill Country Fare, Jewel, King Sooper, Kroger Value, Market Pantry, Nature's Promise, Publix, Roundy's, Safeway, Schnucks, Shaws, Shop 'n Save, Sweetbay, Tops, Wegmans, White Gem, Wild Harvest, Whole Foods. [2] Bell & Evans, Coastal Range, Coleman, D'Artagnan, Eberly's, MBA Brand Smart Chicken, Mary's, Pollo Rosso, Rosie. [3] Central Market HEB, O Organics (Safeway), Pacific Village (New Seasons), Private Selection Organic Fred Meyer, Private Selection Organic King Sooper, Private Selection Organic Kroger, Trader Joe's, Wegmans, Whole Foods.

Resistance to antibiotics

Some antibiotics important for humans are fed to nonorganic chickens to speed growth or prevent or treat illness. But bacteria may evolve to become immune to antibiotics, at which point the drugs become less effective in treating people. We took 53 salmonella samples and 103 campylobacter samples from chickens and determined what percentage of samples resisted antibiotics that usually work against those pathogens. "Resistant" indicates the percentage of bacteria that could survive a normal dose of the drug. Each color represents a class of antibiotics. Within classes, drugs are in alphabetical order.

Salmonella drug	Resistant[1]
Gentamicin	4%
Kanamycin	17
Streptomycin	34
Cefoxitin	28
Ceftiofur	30
Ceftriaxone	0[2]
Amoxicillin/clavulanic acid	28
Ampicillin	30
Chloramphenicol	2
Nalidixic acid	2
Sulfisoxazole	21
Tetracycline	49
One or more drugs	**68**

Campylobacter drug	Resistant[3]
Ciprofloxacin	18%
Nalidixic acid	21
Tetracycline	49
One or more drugs	**60**

[1] Tested drugs that were effective against salmonella: Amikacin, Ciprofloxacin, and Trimethoprim/Sulfamethoxazole. [2] 17% of samples were somewhat resistant: Ceftriaxone inhibited bacterial growth but didn't stop it. [3] Tested drugs that were effective against campylobacter: Gentamicin, Azithromycin, Erythromycin, Telithromycin, Clindamycin, and Florfenicol.

THE AIR-CHILLED OPTION **These broilers are subjected to cold air, and sometimes mist, to inhibit microbial growth. As a group, the 32 air-chilled birds we analyzed, all of them also organic, proved especially clean.**

for antibiotic resistance are in the gene pool of microbes, they can persist in the soil for years, even after the antibiotics are no longer in use.

THE SAFEGUARDS IN PLACE

Despite modest improvement in some numbers, our findings suggest that most companies' safeguards might be inadequate. To tease out what might account for Perdue's and Bell & Evans' relative success, we asked those companies as well as Tyson and Foster Farms whether they have added any food-safety measures in the past few years. We didn't reveal our test results.

Bruce Stewart-Brown, Perdue's vice president of food safety and quality, and a doctor of veterinary medicine, told us the company has increased its salmonella vaccinations over the past few years. That's designed to prevent chicks from picking up the bacterium from their mothers. Further protections, Stewart-Brown said, include an "all-in, all-out production model." Translation: Flocks are cleared out completely. Between flocks, farmers dry the empty chicken houses (which kills bacteria) and often use a product that temporarily changes the pH of the ground (to make it inhospitable to bacterial growth). Birds on each farm are the same age, so there are no older birds to contaminate newly arrived younger ones. "We also work closely with the farmers that raise our poultry," he said. "We make sure they isolate any other species of animals that might transfer microbiology to our chickens, use footwear and clothing control programs, and closely regulate visitation by outsiders."

Stewart-Brown also says that Perdue has implemented 25 food-safety steps at its processing plants.

Tom Stone, director of marketing at Bell & Evans, which produced those clean chickens, said the company has started packaging its products with a machine that seals the edges with film and shrinks the material, so there's no need for a "diaper" under the chicken to sop up fluids. "Our chickens are air-chilled and carry the 'No Retained Water' statement," he said.

But listen to Foster Farms and Tyson and you'd think they would have been as clean. Robert O'Connor, vice president of technical services at Foster Farms and a doctor of veterinary medicine, cited the company's use of "the most technologically advanced and proven systems available." Tyson spokesman Gary Mickelson said his company's safeguards include keeping hatcheries sanitized, vaccinating some breeder stock against salmonella, and ensuring proper refrigeration during product delivery.

Our own experts say that controlling the spread of bacteria is a matter of being vigilant and taking many small steps, from hatchery to store, rather than relying on one magic bullet. A May 2008 release of USDA compliance guidelines for the poultry industry recommends 37 "best practices," including controlling litter moisture in chicken houses and continuously rinsing carcasses and equipment in processing plants. Chicken producers that follow good practices in the hatchery and on the farm and abide by those government guidelines should be able to produce fewer chickens that harbor salmonella, though not necessarily campylobacter.

WHAT YOU CAN DO

Too often, America's food-safety net has holes. Although Perdue chickens were cleaner than other big brands in our tests, and most air-chilled organic brands were especially clean, our tests are a snapshot in time and no type has been consistently low enough in pathogens to recommend over all others. Buying cleaner chicken may improve your odds if you fail to prepare chicken carefully. If you choose organic, be aware that it cost us up to $4.55 more per pound than the rest.

Whatever bird you buy, one slipup and you're at risk. Most important is to cook chicken to at least 165° F. Even if it's no longer pink, it can still harbor bacteria, so use a meat thermometer. The Polder THM-360, $30, and Taylor Weekend Warrior 806, $16, were excellent in our tests. Other tips:

- Make chicken one of the last items you buy before heading to the checkout line.
- Choose chicken that is well wrapped and at the bottom of the case, where the temperature should be coolest.
- Place chicken in a plastic bag like those in the produce department to keep juices from leaking.
- If you'll cook the chicken within a couple of days, store it at 40° F or below. Otherwise, freeze it.
- Thaw frozen chicken in a refrigerator, inside its packaging and on a plate, or on a plate in a microwave oven. Never thaw it on a counter: When the inside is still frozen, the outside can warm up, providing a breeding ground for bacteria. Cook chicken thawed in a microwave oven right away.
- Don't return cooked meat to the plate that held it raw.
- Refrigerate or freeze leftovers within 2 hours of cooking. For more ways to help ensure that your food is safe, go to our Web site at *www.BuySafeEatWell.org*.

Sickened by chicken?

Within a few days of eating salad at a Minnesota restaurant in February 2009, Michele Lundell, a supervisor for a company that makes plastic tubing, experienced diarrhea, fever, and headache. "I kept getting sicker and sicker," she recalled. A test confirmed campylobacter. After her doctor prescribed antibiotics, Lundell said, she felt better for about a day, but then "all the same symptoms came back." She said she was hospitalized for six days. A Minnesota Department of Health investigation found that 10 people who had eaten at the restaurant were stricken with campylobacter and that the lettuce was most likely contaminated by raw or undercooked chicken. Lundell said she hasn't fully recovered. "It's hard to believe," she said, "that a person goes out to eat and gets so sick that it changes your life."

CASE STUDY **Michele Lundell, 53, of Apple Valley, Minn., became ill from campylobacter.**

PHOTOGRAPH BY JOE TRELEVEN

The high cost of cheap chicken

97 percent of the breasts we tested harbored bacteria that could make you sick. Learn how to protect yourself.

Published in Consumer Reports February 2014

When you shop at your favorite grocery store, you probably assume that the food on display is safe to take home. But in the poultry aisle, that simple assumption could make you very sick. Consumer Reports' recent analysis of more than 300 raw chicken breasts purchased at stores across the U.S. found potentially harmful bacteria lurking in almost all of the chicken, including organic brands. In fact, we were conducting our research when news of the national salmonella outbreak linked to three Foster Farms chicken plants became public. In that case 389 people were infected, and 40 percent of them were hospitalized, double the usual percentage in most outbreaks linked to salmonella.

What's going on with the nation's most popular meat? (We buy an estimated 83 pounds per capita annually.) Though 48 million people fall sick every year from eating food tainted with salmonella, campylobacter, E. coli, and other contaminants, "more deaths were attributed to poultry than to any other commodity," according to an analysis of outbreaks from 1998 through 2008 by the national Centers for Disease Control and Prevention (CDC). Here's what you should know before buying your next package of chicken:

DANGEROUS BACTERIA

It's unrealistic to expect that the uncooked chicken you buy won't contain any potentially harmful bacteria. That's one reason we advise you to prevent raw chicken or its juices from touching any other food and to cook it to at least 165˚ F. Yet some bacteria are more worrisome than others—and our latest tests produced troubling findings. More than half of the samples contained fecal contaminants. And about half of them harbored at least one bacterium that was resistant to three or more commonly prescribed antibiotics.

Public-health officials think that the resistance to antibiotics in general is such a major concern that last September the

48 million people fall sick each year from eating tainted food.

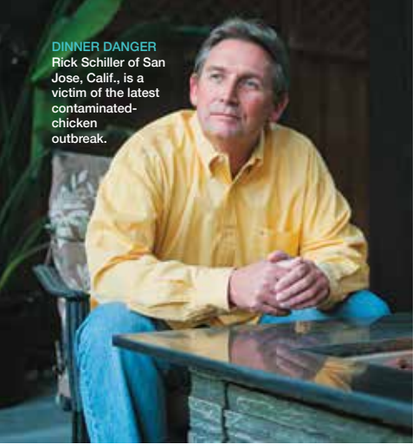
CDC released a landmark report outlining the dire threat it poses to our health. Antibiotic-resistant infections are linked to at least 2 million illnesses and 23,000 deaths in the U.S. each year. And if antibiotic-resistant bacteria continue their scary spread, they could lead to deadly infections after routine surgery or even a seemingly innocuous cut because the drugs that doctors prescribe will have lost their effectiveness.

Our tests showed that those resistant bacteria are commonly found in chicken at your local grocery store. We collected samples in July 2013, months before the Foster Farms salmonella outbreak triggered a public-health alert from the Department of Agriculture (USDA). It turned out that we had purchased a package of the tainted chicken and that our tests found a strain of salmonella (known as Heidelberg) that matched one of those linked to the outbreak.

Salmonella bacteria come in many strains. To understand their differences, think of all of the different breeds of dogs, says Lance Price, Ph.D., a professor in environmental and occupational health at the George Washington University School of Public Health and Health Services in Washington, D.C. "All dogs are the same species, but a Chihuahua and a pit bull behave

CHICKEN INVESTIGATION The Foster Farms facility in Livingston, Calif., is one of three plants linked to a salmonella outbreak that made headlines across the country last fall.

LEFT: GETTY IMAGES; RIGHT: ASSOCIATED PRESS



DINNER DANGER
Rick Schiller of San Jose, Calif., is a victim of the latest contaminated-chicken outbreak.

differently," he says. The drug-resistant Heidelberg strain of salmonella associated with the Foster Farms outbreak is more likely than other strains to cause disease. Antibiotic resistance by itself doesn't make a pathogen more virulent, but when it occurs in a virulent strain such as the Heidelberg, something inherently dangerous suddenly becomes even worse—a bacterium that Price says acts "like a pit bull with rabies."

Most of the illnesses caused by Foster Farms chicken produced symptoms typical of any salmonella infection—nausea, vomiting, severe stomach cramps, diarrhea, and a low-grade fever, says Christopher Braden, M.D., director of the division of foodborne, waterborne, and environmental diseases at the CDC. What was different was that the outbreak sent about twice as many people to a hospital as a typical salmonella outbreak does. About 20 percent of people with salmonella end up hospitalized; almost 40 percent of those sickened by the Foster Farms produced chicken did, Braden says. Rick Schiller, 51, was one of those unlucky victims. Last September the San Jose, Calif., resident woke up at 2 a.m. "I've never felt so sick in my life," he recalls. In addition to vomiting and diarrhea, he had terrible stomach pain. His symptoms worsened during the next few days, and his abdominal pain became so severe that his fiancée rushed him to an emergency room.

Schiller's doctor ordered a stool culture, which revealed salmonella Heidelberg. It was one of the strains identified in the Foster Farms outbreak. Schiller had bought two packages of Foster Farms chicken thighs, and his fiancée prepared a meal for him using one of them. The other package, which was still in his freezer, had a plant code that matched one associated with the outbreak.

TAINTED CHICKEN

Our investigation suggests that potentially harmful bacteria are common on raw chicken. We bought 316 chicken breasts from major national grocery chains, bigbox stores, and regional markets in 26 states, and tested them for six bacteria. They were salmonella, campylobacter, and staphylococcus aureus, which are some of the most common

Bacteria can live on surfaces for hours and even for days.

bacterial causes of food poisoning; E. coli and enterococcus, which are typical measures of fecal contamination; and klebsiella pneumoniae, a bug that's naturally present in our stomach but that can cause infections such as pneumonia. Where we found those bacteria in our chicken samples, we conducted additional tests to determine what the strains were and whether they were resistant to antibiotics.

We tested 252 samples from conventionally produced chickens and 64 from brands that use no antibiotics in raising chickens, including 24 organic samples. (See "The Bacteria Count," on page 58.) Our findings were similar to what the Food and Drug Administration sees in its National Antimicrobial Resistance Monitoring System of retail meat. Here are more highlights from our exclusive study:

- Every one of the four major brands we tested (Perdue, Pilgrim's, Sanderson Farms, and Tyson) contained worrisome amounts of bacteria, even the chicken breasts labeled "no antibiotics" or "organic."
- Almost none of the brands was free of bacteria. And we found no significant difference in the average number of types of bacteria between conventional samples and those labeled "no antibiotics" or "organic."
- More than half of the chicken breasts were tainted with fecal contaminants (enterococcus and E. coli), which can cause blood and urinary-tract infections, among other problems.
- Enterococcus was the most common bacterium we found, occurring in 79.8 percent of our samples. Next was E. coli, in 65.2 percent of them; campylobacter, 43 percent; klebsiella pneumoniae, 13.6 percent; salmonella, 10.8 percent; and staphylococcus aureus, 9.2 percent.
- About half of our samples (49.7 percent) tested positive for at least one multidrug-resistant bacterium, and 11.5 percent carried two or more types of multidrug-resistant bacteria.
- Of the 65.2 percent of samples testing positive for E. coli, 17.5 percent of the bugs were "ExPEC" bacteria, a nasty type of E. coli that's more likely than other types to make you sick with a urinary-tract infection.

A NEW LEVEL OF CAUTION

How does all of that contamination make its way into those nicely packaged chicken breasts displayed on store shelves? According to public-health expert J. Glenn Morris Jr., M.D., director of the Emerging Pathogens Institute at the University of Florida, it's perfectly common for a chicken's intestinal tract to carry salmonella and/or campylobacter, and when they're contained there, they don't harm the animal. But they can be transferred to the meat during the slaughtering process. Or if a chicken living in cramped conditions regularly comes into contact with feces, the bacteria can cling to its skin and make their way onto your dinner plate.

THE MOST MISLEADING LABEL

A Consumer Reports survey on chicken safety found that more than half of the 1,005 U.S. residents polled thought that "natural" chickens didn't receive antibiotics or genetically modified feed. Forty-two percent thought the word meant that the birds were raised outdoors. More than one-third thought "natural" was equal to "organic." But it doesn't mean any of those things. You should simply ignore "natural" claims.

The most obvious way that people become infected with bacteria from raw chicken is through cross-contamination in the kitchen, Morris says. You take it out of the package, get bacteria on your hands, then touch the handle of your faucet, trash bin, or kitchen cabinet. Once they have bacteria on them, the pathogens can live on those surfaces for hours and sometimes days.

Even if you keep your kitchen very clean, you could still be exposed to illness-causing bacteria if you don't cook the chicken to an internal temperature of 165° F. It's vital that you check using a meat thermometer.

In spite of those warnings, the latest salmonella outbreak shows just how difficult it can be to prevent spreading bacteria from chicken and making people sick. In October a Costco store in California recalled more than 22,000 cooked rotisserie Kirkland Signature Foster Farms chickens and 951 Kirkland Farm containers

Confusing chicken labels decoded

Read labels carefully. Terms are sometimes misleading, and chicken produced in different ways are often sold next to each other (in packages labeled "natural" and "no antibiotics," for example), according to a new Consumer Reports shopping survey. For more details about these labels and others, go to GreenerChoices.org.

► ORGANIC
The chicken was fed a vegetarian diet with feed produced without genetically modified organisms or toxic synthetic pesticides. Chickens cannot be organically raised with antibiotics, though they can be treated up until their first day of life. Access to the outdoors is required, but there are no specific standards for the size of the outdoor area, the size of the door leading there, or the amount of time the birds spend outdoors. Annual inspections are required.

► NO ANTIBIOTICS
Never given antibiotics, including in the egg. "Raised without antibiotics" means the same thing. No inspections are required.

► CERTIFIED HUMANE
The chickens are raised according to guidelines from Humane Farm animal Care. There are standards for the environment the birds are raised in and for minimizing their stress and injuries during transportation and slaughter. They may or may not have access to the outdoors. Annual inspections are required.

► NO HORMONES
Hormone use is prohibited in chickens, so even if a product doesn't come with this claim, it will be free of added hormones as well as steroids.

► AMERICAN HUMANE CERTIFIED
Requirements to minimize stress and suffering of the birds are very close to the basic industry standard. Birds are not required to have access to the outdoors. Inspections are required.

► CAGE-FREE
Essentially meaningless. No chickens raised for meat in the U.S. are kept in cages. Neither does it mean that the birds have access to the outdoors. No inspections are required.

► NATURAL
Meaningless. The product is minimally processed and contains no artificial ingredients, but no inspection is required to verify that. (See "The Most Misleading Label," above).

► FREE-RANGE
There is no definition of "outdoors." And there are no requirements as far as the size of the outdoor area (it can be a small concrete slab), the size of the door to the outside, or the amount of time the birds spend there. Chickens can still be raised in crowded conditions. No inspections required.

► NO GMOS
If you see the "Non GMO Project Verified" label, the feed contains less than 0.9 percent of GMO crops. Verification is required.

► PASTURE-RAISED
although not a legal definition, it should mean that the birds are raised on grassy pastures. "Animal Welfare approved" is the only verified label requiring that animals are pasture-raised. But products with that label are not widely available.

PHOTO: JEFF SINGER

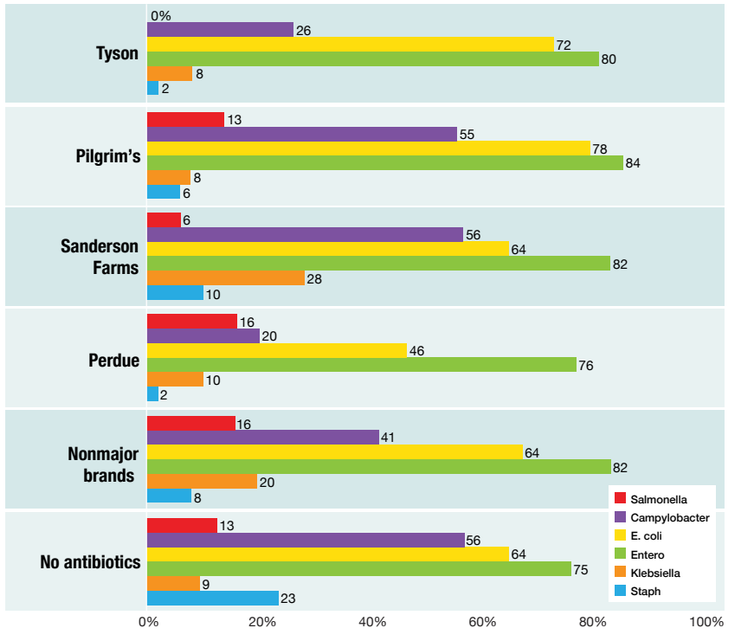
PHOTO: GETTY IMAGES

THE BACTERIA COUNT

Below, the percentage of chicken breasts that tested positive for campylobacter, salmonella, enterococcus, E. coli, staph, and klebsiella. We analyzed 316 raw samples of skinless, boneless chicken breasts, thin-sliced breasts, breast tenderloins, and skin-on, bone-in breasts from the four major brands (Perdue, Pilgrim's, Sanderson Farms, and Tyson); nonmajor brands (including store brands and minor brands), as well as a sampling of "no antibiotics" and "organic" brands. Samples were purchased in 26 states throughout the U.S.

Levels of contamination

Overall there was no difference in the total occurrence of all bacteria between conventional brands and those labeled "no antibiotics" or "organic." All contained worrisome levels of bacteria.



Resistance to antibiotics

Our tests reveal that superbugs can be found in about half of the chicken we tested, from stores across the country. Our test results found that 49.7 percent of our samples contained at least one multidrug-resistant bacterium, and 11.5 percent had at least two. (Multidrug-resistant bacteria are defined as those that are resistant to three or more classes of drugs that they would normally be susceptible to.) The adjacent table shows the percentage of each bacteria that was multidrug-resistant. The bacteria we found were significantly more resistant to classes of antibiotics approved by the FDA for chicken production than for those not approved for such use.

Bacteria	% multidrug-resistant
Salmonella	38.0
Campylobacter	13.0
E. coli	40.0
Enterococcus	26.0
Klebsiella pneumonia	8.5
Staphylococcus aureus	3.6*

*One staph aureus was a methicillin-resistant staph aureus (MRSA).

PHOTO: GETTY IMAGES

of rotisserie chicken soup, leg quarters, and chicken salad after discovering that some of the cooked birds may have harbored strains of the outbreak-related salmonella. But neither Costco nor Foster Farms recalled the raw chicken sold to consumers.

Christopher Braden of the CDC hesitates to put the blame for the Foster Farms outbreak on the victims. The theory that the people sickened in the outbreak had all handled the raw meat in a careless way, "doesn't ring true to me," he says, not with an outbreak that big.

According to James R. Johnson, M.D., a professor of medicine in the division of infectious diseases and international medicine at the University of Minnesota, you don't have to ingest a lot of bacteria to become sick. It's possible that simply touching the plastic wrapping on the outside of chicken packages might expose you to harmful bacteria, Johnson says.

A 2010 study led by CDC scientists found that 13 percent of children younger than 3 were potentially exposed to raw meat or poultry products while riding in a grocery store shopping cart.

THE BETTER CHICKEN TO BUY

Our tests did not find brands or types of chicken breasts that had less bacteria than the rest. At the moment, the only way to protect yourself from becoming sick is to remain vigilant about safe handling and cooking, says Urvashi Rangan, Ph.D., toxicologist and executive director of the Consumer Reports Food Safety and Sustainability Center. (See "Do You Practice Chicken Safety?" on page 61.) For more on food safety and sustainability, go to *ConsumerReports.org/cro/chicken0214*.

Still, there are good reasons for selecting chickens raised without the use of antibiotics. Buying those products supports farmers who keep their chickens off unnecessary drugs, and that's good for your health and preserves the effectiveness of antibiotics. Chickens without antibiotic resistance to salmonella and other dangerous pathogens can't pass antibiotic-resistant bugs on to you, says Robert Lawrence, M.D., the Center for a Livable Future Professor at the Johns Hopkins Bloomberg School of Public Health.

A GOOD DRUG GONE WRONG

Antibiotics are perhaps one of modern medicine's greatest tools, but the rise of antibiotic resistance threatens to undermine the disease-fighting power of those miracle drugs. If bacteria such as the ones found in our chicken samples become resistant to even more drugs, it could mean that antibiotics we now use to treat lifethreatening illnesses from salmonella and other foodborne infections could become useless.

Most deaths associated with antibiotic-resistant bacteria arise from the misuse of antibiotics for people, but the use of antibiotics in agriculture also plays an important role, says Braden at the CDC. In the 1940s farmers noticed that poultry that had been fed antibiotics grew faster than those raised without them. That discovery led them to start feeding chickens low doses of antibiotics to promote growth, not just to treat the sick ones, and thus allowed farmers to increase production. But research suggests that this practice, now widespread, might not be that cost-effective, says Michael Crupain, M.D., M.P.H., director of the Consumer Reports Food Safety and Sustainability Center.

And from a biological perspective, says Lawrence at Johns Hopkins, giving antibiotics to animals that aren't sick is an invitation to disaster. Low-level exposure to antibiotics kills off the bacteria most vulnerable to the drugs and allows those resistant to antibiotics to flourish. As a result, the practice essentially breeds antibiotic-resistant bacteria in chickens, Lawrence says. They end up with campylobacter, salmonella, and enterococcus that are resistant to antibiotics. Those bacteria can spread to people, whose infections then can't be treated successfully with antibiotics, he says.

About 80 percent of all of the antibiotics sold in the U.S. each year are used in animal production, but that information is not tracked in any systematic way. "We don't have good data on how the antibiotics are used on the farms," Braden says. The chicken industry uses that uncertainty to argue that their practices aren't driving the antibiotic-resistance problem. The National Chicken Council says that there are several published, peer-reviewed risk assessments showing that any threat to human health from antibiotic use in livestock and poultry production is negligible, if it exists at all. Tom Super, the council's vice president of communications, adds that, according to the FDA guidance process, the chicken industry is phasing out the use of antibiotics for growth purposes if it's medically important for treating people. He also contends that antibiotics for humans are currently used only minimally for chickens.

Even if farms feed chickens an antibiotic that's not used by humans, any resistance that develops may still have consequences for people. "Antibiotics come in families, and if one in a group is used, there may be resistance that emerges that also makes the organism resistant to others in that group, which may be used to treat humans," says Robert Tauxe, M.D., M.P.H., deputy director of the division of foodborne, waterborne, and environmental diseases at the CDC.

"Antibiotics need to be used judiciously," Braden says. "It doesn't matter if they're used on a farm or in humans." "Judicious" means that the drugs are given to chickens to treat a specific disease for which the antibiotic is known to be effective. Using antibiotics for growth promotion is not judicious use, he says.

Given all of this, eliminating antibiotics in chicken production, except to treat sick birds, might seem like a no-brainer. But implementing a ban has proved to be challenging. "The FDA has tried to put in place programs to reduce antibiotic use and has had major push-back from industry," Morris says. Louise Slaughter, a microbiologist who is also a Democratic congresswoman from New York, has introduced legislation for the fourth time to halt the overuse of antibiotics in agriculture. But those proposed rules face stiff opposition from the chicken industry and pharmaceutical firms.

TAKING ANIMALS OFF DRUGS

What happens when a country takes its livestock off antibiotics?

In 2000 Denmark's pork industry ceased using antibiotics to promote the growth of its animals.

Instead of eviscerating the nation's pork industry, those moves contributed to a 50

BROILER FARM Thousands of chickens are raised together on a farm in Texas.

The price of chicken

Here's how the cost of chicken breasts stack up. These are median prices based on what we paid when shopping for our tests.

CONVENTIONAL
$3.68 per pound

WITHOUT ANTIBIOTICS
$5.49 per pound

ORGANIC
$6.99 per pound

percent rise in pork production, according to a 2012 article in the journal Nature. Frank Aarestrup, D.V.M., Ph.D., head of the EU Reference Laboratory for Antimicrobial Resistance and author of the article, attributes Denmark's success to three factors: laws banning the improper use of antibiotics, a robust system of surveillance and enforcement, and rules that prevent veterinarians from profiting from selling antibiotics to farmers.

"Farmers and their livestock can thrive without the heavy use of antibiotics," Aarestrup wrote. "With a little effort, I believe that other countries can and must help their farmers to do the same."

CHICKEN'S HIDDEN COST

Most chicken raised in the U.S. today comes from large-scale commercial farms optimized to produce the most meat at the lowest cost. To meet domestic and global demand, the industry slaughters almost 9 billion chickens a year.

A new USDA rule currently under consideration could make many changes in poultry production that food-safety advocates consider alarming and dangerous. It could increase the maximum line speeds at slaughter plants to 175 chickens a minute from the current maximum of 140 birds a minute. The new rule could also reassign some of the USDA inspectors' duties to plant employees. Unlike federal inspectors, the plant employees are paid by the company, so they would have an incentive to overlook problems that might slow the lines down.

The rule would transfer more responsibility for safety to the companies that produce the chickens, allowing them to police themselves, says Tony Corbo, senior lobbyist at Food & Water Watch, a nonprofit group.

The USDA disputes the notion that the proposed new rule would have an impact on safety. And according to Dan Engeljohn, Ph.D., of the USDA, a government inspector would still be able to stop a line "if he has evidence to believe that the plant is not exercising good process control."

As of July 2013 a pilot project was being tested in 24 poultry plants. The chicken industry considers the test, called the HIMP (for HACCP-Based Inspection Models Project), a success, and backs the proposal to adopt the new rule. But the Government Accountability Project, a nonprofit whistle-blower group, has released affidavits from federal inspectors working at HIMP plants, which allege that they were pressured to overlook possible food-safety concerns to keep the lines running.

And a Government Accountability Office report from August 2013 found that the USDA never followed through on promises to thoroughly evaluate the program's performance at the plants involved in the pilot project and therefore lacked the necessary data to deem it a success. Yet despite this analysis, the USDA is moving forward on plans to expand the program. Advocates including Consumers Union, the advocacy arm of Consumer Reports, say that if these new rules are adopted, the bacteria problem will only get worse.

Making chicken safer will require revamping the way it's raised.

WHAT NEEDS TO HAPPEN

Making chicken safer to eat will require a revamping of the way that it's raised and processed. As we went to press, the USDA announced a plan to attack the problem of salmonella in meat and chicken. We are still reviewing it. In the meantime, these are our recommendations:

- The FDA should prohibit antibiotic use in food animals except for the treatment of sick ones. To that end, Congress should pass the Preservation of Antibiotics for Medical Treatment Act.
- The National Organic Program should eliminate the loophole allowing antibiotics to be used in the chicken eggs up until the first day of life in organic chicken broilers.
- The USDA should classify strains of salmonella bacteria that are resistant to multiple antibiotics and known to have caused disease as "adulterants," so that chickens tainted with those strains can't be sold.
- The USDA's proposed rule to increase maximum line speeds and reduce the number of USDA inspectors at slaughter plants should be dropped.
- Congress should give the USDA authority to recall meat and poultry products that are tied by DNA fingerprinting to disease outbreaks. Currently, it doesn't have the authority to do so.
- The USDA should speed up its efforts to set strict levels for allowable salmonella and campylobacter in chicken parts. The agency expects to put that proposal out for public review and feedback this year. We say that the standards can't come soon enough.

Note: Support for this project was provided by The Pew Charitable Trusts. Any views expressed are those of Consumer Reports and its advocacy arm, Consumers Union, and do not necessarily reflect the views of The Pew Charitable Trusts.

DO YOU PRACTICE CHICKEN SAFETY?

Check out how your buying and cooking habits stack up against those of 1,005 respondents in a recent Consumer Reports survey.

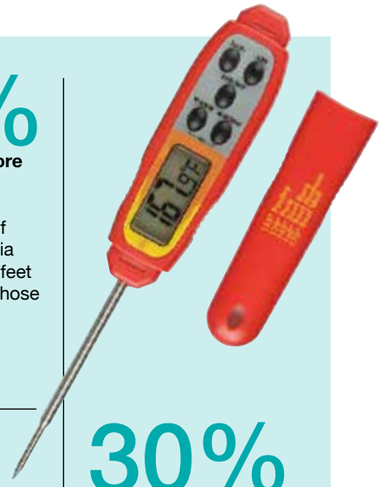
57%
use a cutting board designated for raw meat
TIP Get two boards to prevent cross-contamination.

93%
wash their hands after handling raw poultry
TIP Wash for 20 seconds using warm water and soap every time you touch raw meat—frozen or fresh—even if it means multiple washings.

32%
buy chicken last at the store
TIP Keeping chicken cold prevents bacteria overgrowth, so hit the meat section last.

72%
wash chicken before cooking
TIP Stop. That can increase your risk of getting sick. Bacteria can spread up to 3 feet from the sink, and those areas might not get disinfected.

65%
put chicken in a plastic bag at the store
TIP It's always a good idea to prevent the juices from contaminating other food.



30%
use a meat thermometer
TIP Get one—82 percent said they cooked chicken to 165° F, the recommended internal temperature. But without a thermometer, you don't know.

USDA PHOTO BY BOB NICHOLS

PHOTOS: GETTY IMAGES; RIGHT: KANA OKADA

Talking Turkey

Our new tests show reasons for concern

Published in Consumer Reports June 2013

In our first-ever lab analysis of ground turkey bought at retail stores nationwide, more than half of the packages of raw ground meat and patties tested positive for fecal bacteria. Some samples harbored other germs, including salmonella and staphylococcus aureus, two of the leading causes of foodborne illness in the U.S. Overall, 90 percent of the samples had one or more of the five bacteria for which we tested.

Adding to the concern, almost all of the disease-causing organisms in our 257 samples proved resistant to one or more of the antibiotics commonly used to fight them. Turkeys (and other food animals, including chickens and pigs) are given antibiotics to treat acute illness; but healthy animals may also get drugs daily in their food and water to boost their rate of weight gain and to prevent disease. Many of the drugs are similar to antibiotics important in human medicine.

That practice, especially prevalent at large feedlots and mass-production facilities, is speeding the growth of drug-resistant superbugs, a serious health concern. People sickened by those bacteria might need to try several antibiotics before one succeeds.

Among our findings:

- Sixty-nine percent of ground-turkey samples harbored enterococcus, and 60 percent harbored Escherichia coli. Those bugs are associated with fecal contamination. About 80 percent of the enterococcus bacteria were resistant to three or more groups of closely related antibiotics (or classes), as were more than half of the E. coli.
- Three samples were contaminated with methicillin-resistant staphylococcus aureus (MRSA), which can cause fatal infections.
- Ground turkey labeled "no antibiotics," "organic," or "raised without antibiotics" was as likely to harbor bacteria as products without those claims. (After all, even meat from organic birds can pick up bacteria during slaughter or processing.) The good news is that bacteria on those products were much less likely to be antibiotic-resistant superbugs. For details on our results, go to *ConsumerReports.org/turkey0613*.

The Food and Drug Administration, which regulates approval of human and animal antibiotics, analyzes bacteria levels in ground turkey and other retail meats, as we've done. In 2011 the agency found even higher rates of contamination than ours.

FROM BARN TO BURGER

Conventionally raised turkeys are fed mostly corn and soybean meal plus a vitamin and mineral supplement. They usually get FDA-approved antibiotics that may be given in low doses without a prescription. Before the birds are killed, antibiotics must be withdrawn to ensure that residues clear from the birds' systems.

But harm may already have been done. Although the antibiotics eventually kill off vulnerable barnyard bugs, bacteria that are immune to their effects can flourish and spread. They can exchange genetic material with other bugs, further accelerating antibiotic resistance. And bacteria on turkeys can develop resistance to similar drugs that aren't even given to turkeys.

Some bacteria that end up on ground turkey, including E. coli and staph aureus, can cause not only food poisoning but also urinary, bloodstream, and other infections.

Antibiotics aren't allowed in turkeys labeled "organic," "no antibiotics," or "raised without antibiotics." (Sick birds may be treated, but they're then sold to nonorganic markets.) Organic birds must eat only certified organic feed and pasture, which means no genetically modified organisms; and production of those birds must not contribute to contamination of soil or water. Producers of organic and free-range turkeys must demonstrate to the Department of Agriculture that they've allowed birds "access to the outside," though that phrase is not specifically defined and some birds may not venture outdoors.

Such steps are among the requirements for raising a food animal sustainably—without drugs and in a way that's more healthful for animals and people. Indeed, when we focused on antibiotic use, our analysis showed that bacteria on turkey labeled "no antibiotics" or "organic" were resistant to significantly fewer antibiotics than bacteria on conventional turkey. We also found much more resistance to classes of antibiotics approved for use in turkey production than to those not approved for such use. Consumers Union, the advocacy arm of Consumer Reports, believes that the FDA should ban all antibiotics in animal production except to treat illness.

A SALMONELLA SUPERBUG

When any food animal is slaughtered, the bacteria that normally live in its gut without causing harm can wind up on its carcass. To limit contamination, federal law requires processors to create a Hazard Analysis and Critical Control Point plan. For turkey processors, HACCP includes steps for washing and chilling carcasses throughout processing to reduce the growth of harmful bacteria and contamination of the finished product.

But HACCP doesn't require

GERM COUNT

We found many samples of turkey that harbored germs, especially the fecal bacteria enterococcus and E. coli. (Some forms of E. coli can cause severe illness, but our tests didn't differentiate among the forms. In any case, you don't want E. coli in your food.)

LEVELS OF CONTAMINATION

Bacterium	Positive samples
Enterococcus	69%
Escherichia coli	60
Staphylococcus aureus	15
Salmonella	5
Campylobacter	0

HOW RESISTANT TO ANTIBIOTICS?

We determined whether samples of four bacteria isolated from our tested ground turkey could survive exposure to as many as 16 antibiotics at levels usually effective against those bugs. The antibiotics we tried differed with each bug and included ampicillin, ceftriaxone, ciprofloxacin, tetracycline, and others often used to treat the illnesses those bacteria cause. Classes are groups of similar antibiotics. Three of the 39 samples of staph aureus harbored MRSA, a potentially deadly bacterium.

BUGS IMMUNE TO DRUGS

Bacterium	Samples tested	Resisted one or more antibiotic classes	Resisted three or more antibiotic classes
Enterococcus	178	177	144
Escherichia coli	155	135	82
Staphylococcus aureus	39	34	8
Salmonella	12	11	8

'NO ANTIBIOTICS' TURKEY VS. OTHERS

Bacteria from turkey labeled "no antibiotics," "organic," or "raised without antibiotics" were less likely than bacteria from unlabeled turkey to resist the drugs that could help cure illness. (We found too little salmonella on the tested turkey to substantiate a difference between labeled and unlabeled turkey.)

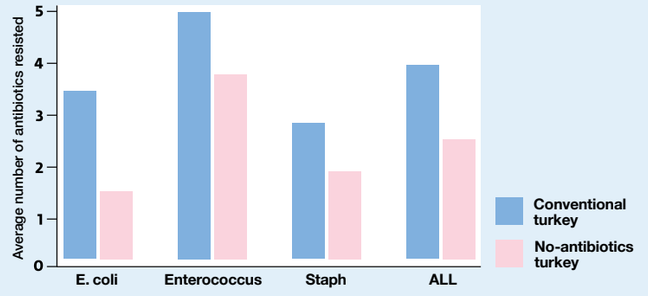


PHOTO: GETTY IMAGES

eradication of harmful bacteria. In fact, salmonella is permitted in up to half of the ground-turkey samples that the USDA's Food Safety and Inspection Service (FSIS) tests at processors' plants. And bugs that remain can keep growing until the turkey is cooked.

In 2011 Cargill Value Added Meats Retail announced two voluntary recalls of a total of 36 million pounds of conventionally raised ground turkey—among the largest recalls of poultry meat in U.S. history—due to possible contamination with a resistant strain of salmonella Heidelberg. The superbug was traced to a Cargill establishment in Springdale, Ark. In all, 136 people fell ill during that outbreak, according to the national Centers for Disease Control and Prevention, and one of those victims died.

"As we've publicly stated over the past year and a half, no stone was left unturned in our efforts to determine the originating source of salmonella Heidelberg associated with the ground-turkey recalls, yet to this day we do not know the origin of the bacteria linked to outbreak of illnesses," said Mike Robach, vice president of corporate food safety and regulatory affairs for Cargill in Minneapolis. He provided a long list of steps that Cargill has taken since the outbreak to make its ground turkey safer.

In the wake of the recalls, the FSIS required all ground-poultry processors to review and update their safety procedures, paying special attention to the sanitation of equipment. The agency told us that it also plans to conduct a risk assessment of salmonella and campylobacter (another foodpoisoning bacterium) in ground-turkey products. The goal: a new standard for salmonella and, possibly, campylobacter.

Eight ground-turkey samples in our tests, conducted a year after the recalls, harbored salmonella that resisted three or more antibiotic classes. One of those samples came from a package of turkey processed at Cargill's Springdale plant. It harbored a strain of salmonella Heidelberg that was not the outbreak strain but resisted the same antibiotics. Even a finding of the outbreak strain, the FSIS said, "likely would not trigger a specific follow-up action by FSIS if steps were previously taken for the affected establishment to regain control of its operations."

Slip up during handling and you risk illness.

Consumers Union says the current salmonella standard isn't strict enough, and is urging the USDA to allow no more than 12 percent contamination in ground-turkey samples, a standard most of the industry already meets.

Any improvement will come too late for consumers such as Diana Goodpasture, 66, of Akron, Ohio. She was sickened with salmonella Heidelberg from ground turkey in June 2011 and was hospitalized for five days. "I've had complications ever since then," she says. "I'm still seeing a gastroenterologist. I don't know that I'll ever be well."

WHAT YOU CAN DO

Common slip-ups while handling or cooking ground turkey can put you at risk of illness. Although the bacteria we found are killed by thorough cooking, they can produce toxins that may not be destroyed by heat. Take the following precautions:

- Buy turkey labeled "organic" or "no antibiotics," especially if it also has a "USDA Process Verified" label, which means that the USDA has confirmed that the producer is doing what it says. Organic and no-antibiotics brands in our tests were: Coastal Range Organics, Eberly, Giant Eagle Nature's Basket, Harvestland, Kosher Valley, Nature's Place, Nature's Promise, Nature's Rancher, Plainville Farms, Wegmans, Whole Foods, and Wild Harvest.
- Consider other labels, such as "animal welfare approved" and "certified humane," which mean that antibiotics were restricted to sick animals.
- Be aware that "natural" meat is simply minimally processed, with no artificial ingredients or added color. It can come from an animal that ate antibiotics daily.
- Know that no type of meat—whether turkey, chicken, beef, or pork—is risk free.
- Buy meat just before checking out, and place it in a plastic bag to prevent leaks.
- If you will cook meat within a couple of days, store it at 40° F or below. Otherwise, freeze it. (Note that freezing may not kill bacteria.)
- Cook ground turkey to at least 165° F. Check with a meat thermometer. (Some whole cuts of meat may need thorough cooking, too.)
- Wash hands and all surfaces after handling ground turkey.
- Don't return cooked meat to the plate that held it raw.

Note: Funding for this project was provided by The Pew Charitable Trusts. Any views expressed are those of Consumer Reports and its advocacy arm, Consumers Union, and do not necessarily reflect the views of The Pew Charitable Trusts.

What's in that pork?

We found antibiotic-resistant bacteria—and traces of a veterinary drug

Published in Consumer Reports January 2013

Our analysis of pork-chop and ground-pork samples from around the U.S. found that yersinia enterocolitica, a bacterium that can cause fever, diarrhea, and abdominal pain, was widespread. Some samples harbored other potentially harmful bacteria, including salmonella. And there are more reasons to be concerned about "the other white meat."

DID YOU KNOW?

Years ago, trichinosis was the main fear about eating pork. But the risk from that parasite was largely eradicated by changes in industry practices (legislation banned the feeding of certain raw foods to hogs) and public awareness of the risks of eating undercooked meat.

Some of the bacteria we found in 198 samples proved to be resistant to antibiotics commonly used to treat people. The frequent use of low-dose antibiotics in pork farming may be accelerating the growth of drug-resistant "superbugs" that threaten human health.

About one-fifth of the 240 pork products we analyzed in a separate test harbored low levels of the drug ractopamine, which the U.S. approved in 1999 to promote growth and leanness in pigs. It's commonly used in pigs raised for food in the U.S. but is banned in the European Union, China, and Taiwan. Our food-safety experts say that no drugs should be used routinely in healthy animals to promote growth. Here are details from our tests:

- Yersinia enterocolitica was in 69 percent of the tested pork samples. It infects about 100,000

PHOTO: FOTOSEARCH

Americans a year, especially children. We found salmonella, staphylococcus aureus, or listeria monocytogenes, more common causes of foodborne illness, in 3 to 7 percent of samples. And 11 percent harbored enterococcus, which can indicate fecal contamination and can cause problems such as urinary-tract infections.

- Some of the bacteria we found were resistant to multiple drugs or classes of drugs. That's worrisome, because if those bugs make you sick, your doctor may need to prescribe more powerful (and expensive) antibiotics.
- Ground pork was more likely than pork chops to harbor pathogens. That's to be expected, since grinding meat provides another opportunity for contamination.
- Some antibiotic claims you'll see on packaging are misleading. And a "no hormones added" claim might be true but is meaningless, because hormones aren't allowed in pork production.

BUGS IN PIGS

All animals (humans included) have bacteria on their skin and in their gastrointestinal tract. Some are beneficial, including the probiotic kind, which help digestion. Others, such as salmonella, can be harmful to people, but affected animals might not become ill. Confining animals in less-than-clean quarters can allow bad bacteria to proliferate.

An animal's muscles (meat), blood, and brain are normally sterile. But during slaughter and processing, meat can become contaminated with bacteria from the animal's skin or gut and from workers, equipment, or the environment. Contamination is especially likely to occur if processing lines run too fast or if sanitary practices aren't followed. Once bacteria are on meat, improper storage can encourage them to multiply.

To minimize contamination, the federal government requires processors of meat, poultry, and seafood to create safety and inspection procedures collectively known as HACCP (pronounced hass-ip), which stands for Hazard Analysis & Critical Control Points. Implemented for meat and poultry plants in 1997, HACCP is officially the consumer's first line of protection against contaminated pork. However, inspectors spot-test for a limited number of pathogens. Yersinia enterocolitica, for example, isn't among them. And the Department of Agriculture can't require a recall if HACCP plans fail to meet goals.

Many samples of pork harbored yersinia bacteria.

"Very low contamination levels in hog carcasses indicate that companies' practices are adequately controlling pathogens," a USDA spokeswoman told us. But our tests showed that some harmful bacteria can make their way into your kitchen.

Moreover, the bacteria we found often continued to multiply even in the presence of some drugs designed to kill them or stop them from reproducing. Thirteen of 14 staphylococcus samples we isolated from pork were resistant to one or more antibiotics. So were six of eight salmonella samples, 12 of 19 enterococcus samples, and 121 of 132 yersinia samples. One sample was identified as MRSA, a drug-resistant and sometimes fatal staph.

PIGS ON DRUGS

Some 80 percent of all antibiotics sold in the U.S. are given to animals raised for food. Often, those drugs aren't used to treat infections but are fed continuously in low doses to promote growth and prevent infections that can spread in the cramped quarters in which most farm animals live. A single barn from a large hog-production facility can hold 2,000 or more pigs, creating ideal conditions for the spread of antibiotic-resistant bacteria.

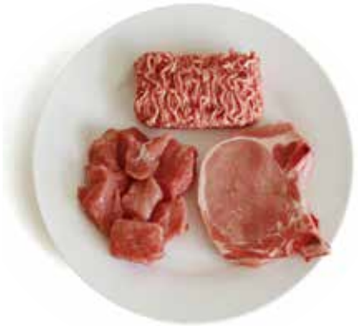
"When you give low-dose antibiotics for growth promotion or for prophylaxis of infection, you end up killing off the susceptible bacteria, whether they're E. coli, salmonella, campylobacter, or other bacteria," says Robert S. Lawrence, M.D., director of the Center for a Livable Future at the Johns Hopkins Bloomberg School of Public Health in Baltimore. "And you continue to select for those bacteria that, through spontaneous mutations or transfer of genes from other resistant bacteria, allow them to be resistant to antibiotics." Lawrence cited recent laboratory research at Boston University suggesting that the continual exposure to low doses of antibiotics causes enough stress in bacteria to increase the rate of spontaneous mutations that render the bugs resistant to drugs, a process known as mutagenesis.

Mutant bacteria in animals can cause not only foodborne illness but also other treatment-resistant problems, such as infections of the skin or urinary tract. That's because the bugs don't just end up in the meat you buy. They can also wind up in fertilizer or contaminate the environment. And they can spread from person to person.

Another drug fed to animals, ractopamine, is given to as many as 60 to 80 percent of pigs raised in the U.S., by one estimate. It was originally developed (but never approved) as an asthma treatment for humans and was later found to boost pigs' growth and lean muscle mass.

The U.S. pork industry says ractopamine is safe. "Ractopamine is approved and used in 26 other countries, including some of the Asian countries," says Dave Warner, director of communications for the National Pork Producers Council, an industry group. "The issues with China and Taiwan have nothing to do with the safety of the product. Countries that have banned pork or meat from animals fed ractopamine are doing it to protect their domestic pork industries. This is not about food safety."

Keep uncooked pork away from other foods.



The European Food Safety Authority, which advises the European Union on food policy, concluded that it couldn't establish a safe level for ractopamine in food after reviewing the only study of its effect on humans (involving just six men). But it noted that drugs like ractopamine can cause restlessness, anxiety, a fast heart rate, and other conditions. And FDA documents show that it increases the risk of injury and lameness in pigs. Warner emphasized that the U.S. pork industry uses ractopamine at levels that meet FDA and international food-safety standards. Indeed, although we found the drug at detectable levels in about 20 percent of our 240 pork samples, all had less than 5 parts per billion. That's well below the FDA's limit of 50 ppb in muscle tissue and the international limit of 10 ppb adopted in July 2012 by the Codex Alimentarius Commission, a program of the United Nations.

We asked three of the nation's largest pork producers—Smithfield Foods, Tyson, and JBS USA, which makes the Swift Premium and Swift Premium Natural brands—about their use of ractopamine. Keira Lombardo, vice president of investor relations and corporate communications at Smithfield, called it "a safe and effective FDA-approved feed supplement that has been widely used in the hog farming industry for many years." Lombardo and a JBS spokeswoman, Margaret McDonald, told us their companies produce pork with and without ractopamine according to their customers' specifications.

Some food companies, including Chipotle Mexican Grill, Niman Ranch, and Whole Foods, say they don't sell any meat from pigs raised with ractopamine. Consumers Union, the policy and advocacy arm of Consumer Reports, has pressed for a ban of the drug, citing insufficient evidence that it's safe.

WHAT YOU CAN DO

These steps can help you minimize the risk of foodborne illness or discourage the routine use of antibiotics in agriculture:

- When cooking pork, use a meat thermometer to ensure that it reaches the proper internal temperature, which kills potentially

PHOTO: GETTY IMAGES

GERM COUNT

Per-capita consumption of pork Levels of contamination in the U.S. is about 50 pounds per year, based on 2009 Department of Agriculture data.

We tested 148 samples of meat from pork chops and 50 from ground pork, and found that almost 70 percent tested positive for yersinia enterocolitica, which can infect people who eat raw or undercooked pork.

Enterococcus, staphylococcus aureus, salmonella, and listeria monocytogenes were less common in the samples we tested. Twenty-three percent of the samples harbored none of the tested bacteria.

The pork samples we analyzed came from many brands, but we lacked enough samples within each brand to say whether one was more or less contaminated than another.

LEVELS OF CONTAMINATION

Bacterium	Samples testing positive
Yersinia enterocolitica	69%
Enterococcus	11
Staphylococcus aureus	7
Salmonella	4
Listeria monocytogenes	3

Big brands we tested: Denmark, Farmer John, Farmer John California Natural, Farmland, Hempler's, Hormel, Hormel Natural Choice, Nature's Promise, Nature's Rancher, Northwest Finest, Roseland, Smithfield, Swift Premium, and Tender Choice.

Store brands we tested: Angelo Caputo's, Bashas', Bristol Farms, Butera, Dominick's, Edmar, El Toreo Market, Food 4 Less, Fred Meyer, Fresh & Easy, The Fresh Market, Giant, Meijer, PCC Natural Markets, Publix, Ralphs, Safeway, Save-a-Lot, Sprouts Farmers Market and Farmers Market Old Tyme, Ultra Foods, Viet Wah, Vons, Walmart, Wegmans, Weis, Whole Foods, and Winn Dixie.

How resistant to antibiotics?

Some antibiotics used to treat infections in people are also fed to pigs to speed their growth or prevent illness. But bacteria may evolve to become immune to antibiotics, at which point the drugs become less effective in treating people infected by those bugs. We tested whether samples of salmonella, staphylococcus aureus, enterococcus, and yersinia enterocolitica that we isolated from pork chops and ground pork could survive exposure to up to 13 antibiotics at levels that are usually effective against those bacteria. The antibiotics we used differed with each bug but included amoxicillin, penicillin, tetracycline, streptomycin, and others.

BUGS IMMUNE TO DRUGS

Bacterium	Samples tested	Samples resistant to one or more antibiotics	Details
YERSINIA ENTEROCOLITICA	132	121	Fifty-two of those were resistant to two or three antibiotics
STAPHYLOCOCCUS AUREUS	14	13	Nine of those were resistant to two to four antibiotics
ENTEROCOCCUS	19	12	—
SALMONELLA	8	6	Three of those were resistant to five antibiotics

harmful bacteria: at least 145° F for whole pork and 160° F for ground pork.

- As with other meats, keep raw pork and its juices separate from other foods, especially those eaten raw, such as salad.
- Wash your hands thoroughly after handling raw meat.
- Choose pork and other meat products that were raised without drugs. One way to do that is to buy certified organic pork, from pigs raised without antibiotics or ractopamine. Another option is to buy from Whole Foods, which requires that producers not use either type of drug.
- Look for a clear statement regarding antibiotic use. "No antibiotics used" claims with a USDA Process Verified shield are more reliable than those without verification. Labels such as "Animal Welfare Approved" and "Certified Humane" indicate the prudent use of antibiotics to treat illness.
- Watch out for misleading labels. "Natural" has nothing to do with antibiotic use or how an animal was raised. We found unapproved claims, including "no antibiotics residues," on packages of Sprouts pork sold in California and Arizona, and "no antibiotic growth promotants" on Farmland brand pork sold in several states. We reported those to the USDA in June 2012, and the agency told us it's working with those companies to take "appropriate actions." When we checked in early November, Sprouts had removed the claim from its packages.
- If your local supermarket doesn't carry pork from pigs raised without antibiotics, consider asking the store to carry it. To find meat from animals that were raised sustainably—humanely and without drugs—go to *eatwellguide.org*. To learn about the new Consumers Union campaign aimed at getting stores to sell only antibiotic-free meat, go to *NotinMyFood.org*.

A MODEL EXAMPLE
Cows at Georgia's Fort Creek Farm are raised on grass and are not fed antibiotics.

How Safe Is Your Beef?

If you don't know how the ground beef you eat was raised, you may be putting yourself at higher risk of illness from dangerous bacteria. You okay with that?

Published in Consumer Reports October 2015

The American love affair with ground beef endures. We put it between buns. Tuck it inside burritos. Stir it into chili. Even as U.S. red meat consumption has dropped overall in recent years, we still bought 4.6 billion pounds of beef in grocery and big-box stores over the past year. And more of the beef we buy today is in the ground form—about 50 percent vs. 42 percent a decade ago. We like its convenience, and often its price. The appetite persists despite solid evidence—including new test results here at Consumer Reports—that ground beef can make you seriously sick, particularly when it's cooked at rare or medium-rare temperatures under 160°F. "Up to 28 percent of Americans eat ground beef that's raw or undercooked," says Hannah Gould, Ph.D., an epidemiologist at the Centers for Disease Control and Prevention (CDC). All meat potentially contains bacteria that—if not destroyed by proper cooking—can cause food poisoning, but some meats are more risky than others. Beef, and especially

PHOTOGRAPH, LEFT: EVAN KAFKA

ground beef, has a combination of qualities that can make it particularly problematic—and the consequences of eating tainted beef can be severe.

Indeed, food poisoning outbreaks and recalls of bacteria-tainted ground beef are all too frequent. Just before the July 4 holiday this year, 13.5 tons of ground beef and steak destined for restaurants and other food-service operations were recalled on a single day because of possible contamination with a dangerous bacteria known as E. coli O157:H7. That particular bacterial strain can release a toxin that damages the lining of the intestine, often leading to abdominal cramps, bloody diarrhea, vomiting, and in some cases, life-threatening kidney damage. Though the contaminated meat was discovered by the meat-packing company's inspectors before any cases of food poisoning were reported, we haven't always been so lucky. Between 2003 and 2012, there were almost 80 outbreaks of E. coli O157 due to tainted beef, sickening 1,144 people, putting 316 in the hospital, and killing five. Ground beef was the source of the majority of those outbreaks. And incidences of food poisoning are vastly underreported. "For every case of E. coli O157 that we hear about, we estimate that another 26 cases actually occur," Gould says. She also reports that beef is the fourth most common cause of salmonella outbreaks—one of the most common foodborne illnesses in the U.S.—and for each reported illness caused by that bacteria, an estimated 29 other people are infected.

THE RISKS OF GOING RARE

It's not surprising to find bacteria on favorite foods such as chicken, turkey, and pork. But we usually choose to consume those meats well-cooked, which makes them safer to eat. Americans, however, often prefer their beef on the rare side. Undercooking steaks may increase your risk of food poisoning, but ground beef is more problematic. Bacteria can get on the meat during slaughter or processing. In whole cuts such as steak or roasts, the bacteria tend to stay on the surface, so when you cook them, the outside is likely to get hot enough to kill any bugs. But when beef is ground up, the bacteria get mixed throughout, contaminating all of the meat—including what's in the middle of your hamburger.

Also contributing to ground beef's bacteria level: The meat and fat trimmings often come from multiple animals, so meat from a single contaminated cow can end up in many packages of ground beef. Ground beef (like other ground meats) can also go through several grinding steps at processing plants and in stores, providing more opportunities for crosscontamination to occur. And then there's the way home cooks handle raw ground beef: kneading it with bare hands to form burger patties or a meatloaf. Unless you're scrupulous about washing your hands thoroughly afterward, bacteria can remain and contaminate everything you touch—from the surfaces in your kitchen to other foods you are preparing.

"There's no way to tell by looking at a package of meat or smelling it whether it has harmful bacteria or not," says Urvashi Rangan, Ph.D., executive director of the Center for Food Safety and Sustainability at Consumer Reports. "You have to be on guard every time." That means keeping any raw meat on your countertop from touching other foods nearby and cooking ground beef to at least medium, which is 160° F. Eating a burger that's rarer can be risky. In one 2014 E. coli outbreak, five of the 12 people who got sick had eaten a burger at one of the locations of an Ohio pub chain called Bar 145°, which was named for the temperature "of a perfectly cooked medium-rare burger," according to the company's website.

PUTTING BEEF TO THE TEST

Given those concerns about the safety of ground beef, Consumer Reports decided to test for the prevalence and types of bacteria in ground beef. We purchased 300 packages—a total of 458 pounds (the equivalent of 1,832 quarter-pounders)—from 103 grocery, big-box, and natural food stores in 26 cities across the country. We bought all types of ground beef: conventional—the most common type of beef sold, in which cattle are typically fattened up with grain and soy in feedlots and fed antibiotics and other drugs to promote growth and prevent disease—as well as beef that was raised in more sustainable ways, which have

A Tale of Two Cows

All cattle begin their lives roaming pastures, grazing on grass. But once they are about a year old, their lives change dramatically depending on whether they are conventionally raised or 100 percent grass-fed cows.

Conventional	grass-fed

WHERE THEY LIVE

For the first year or so, cattle are raised on pasture. Then they're moved to crowded feedlots, where each cow is confined to as little as 23 square feet. The space they occupy has no vegetation and can become muddy and covered in manure.

Cattle spend their entire lives grazing on grassland. The size of the herd is naturally limited by the acreage of the grassland. Thus, these animals are not subjected to the crowded, disease-promoting conditions of feedlots.

DIET

In the feedlot, corn and soy are the primary foods. But the cows may also be fed candy, chicken coop waste, and the slaughterhouse remains of pigs and chickens. They may also be given plastic pellets, which are used as substitutes for the fiber they'd normally get from grazing on grass.

Cows eat grass and forage (such as legumes, cabbage, kale, and mustard plants) that grow in the pasture. Hay and silage (compacted grass) are used in winter or when forage is not top quality.

DRUGS

Antibiotics, hormones, and other drugs can be given to the cattle to promote growth and prevent disease.

Though grass-fed animals may be given antibiotics, their living conditions and diet generally make the need for them much less likely. Organic grass-fed cattle can't be given antibiotics or hormones, and the American Grassfed Association's labeling program prohibits those drugs, too.

SLAUGHTER

Large meat-processing plants slaughter as many as 400 head of cattle in an hour. Inhumane rapid processing may increase the chances of bacteria contaminating the meat.

Grass-fed farms generally take their animals to smaller regional plants, where slaughter practices may be more humane. Animal welfare certification labels verify humane practices.

LABELS TO LOOK FOR

BASIC	GOOD	BETTER	BEST

No Antibiotics

Producers must provide the Department of Agriculture with paperwork showing that no antibiotics were used during the animal's life, but independent verification of those claims is not required. Beef with these labels can be fed grain, and there are no standards for humane treatment of the animals. Reliable terms are "no antibiotics administered" and "raised without antibiotics." If the package also says "USDA Processed Verified," a no antibiotics claim is more trustworthy. But beware of labels such as "no antibiotics used for growth promotion," which can still mean that antibiotics were used.

Grass-Fed

The USDA requires that beef labeled "grass-fed" or "100 percent grass-fed" come from animals that have never been given grain and have access to pasture during the grazing season. Though the producer must provide written documentation and a signed affidavit, there is no required independent verification of the label. USDA grass-fed standards allow for antibiotic use, so look for grass-fed beef that also carries a no antibiotic claim. USDA Never Ever 3 seal is ideal because it guarantees that there are no antibiotics as well as no growth promotants (such as hormones) and no animal byproducts in the feed.

Organic

Cattle are fed organic feed (no pesticides, synthetic fertilizer, or genetically engineered ingredients). They are not given antibiotics, hormones, or other drugs. Animals must be given access to pasture for most of their lives, but feed-lots and grain feeding during their last few months are allowed.

American Grassfed Association

The animals are never given grain and have continuous access to pasture or a grass-based forage when the weather does not allow for pasture access. Antibiotics and growth hormones are prohibited. The Association verifies those practices. Pesticides and herbicides are allowed on the pastures the animals feed on, and they can also be fed genetically engineered alfalfa.

Grass-Fed Organic

With this combination of labels, you get meat from cattle that have not been fed grain and eat only organically grown grass and forage. Antibiotics, hormones, and other drugs are prohibited. If the package also has the Animal Welfare Approved seal, the Certified Humane seal, or the Global Animal Partnership (GAP) 5 or 5+ seal, animal welfare standards also apply.

important implications for food safety and animal welfare. At a minimum, sustainably produced beef was raised without antibiotics. Even better are organic and grass-fed methods. Organic cattle are not given antibiotics or other drugs, and they are fed organic feed. Grass-fed cattle usually don't get antibiotics, and they spend their lives on pasture, not feedlots.

We analyzed the samples for five common types of bacteria found on beef—clostridium perfringens, E. coli (including O157 and six other toxin-producing strains), enterococcus, salmonella, and staphylococcus aureus.

The routine use of antibiotics in farming has contributed to the rise of antibiotic-resistant bacteria, so once-easy-to-treat infections are becoming more serious and even deadly. We put the bacteria we found through an additional round of testing to see whether they were resistant to antibiotics in the same classes that are commonly used to treat infections in people. Last, we compared the results of samples from conventionally raised beef with the sustainably raised beef to see whether there were differences in the presence of antibiotic-resistant bacteria between the products.

The results were sobering. All 458 pounds of beef we examined contained bacteria that signified fecal contamination (enterococcus and/or nontoxin-producing E. coli), which can cause blood or urinary tract infections. Almost 20 percent contained C. perfringens, a bacteria that causes almost 1 million cases of food poisoning annually. Ten percent of the samples had a strain of S. aureus bacteria that can produce a toxin that can make you sick. That toxin can't be destroyed—even with proper cooking.

Just 1 percent of our samples contained salmonella. That may not sound worrisome, but, says Rangan, "extrapolate that to the billions of pounds of ground beef we eat every year, and that's a lot of burgers with the potential to make you sick." Indeed, salmonella causes an estimated 1.2 million illnesses and 450 deaths in the U.S. each year.

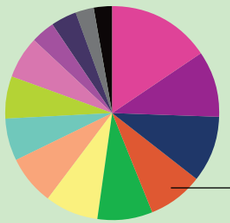
One of the most significant findings of our research is that beef from conventionally raised cows was more likely to have bacteria overall, as well as bacteria that are resistant to antibiotics, than beef from sustainably raised cows. We found a type of antibiotic-resistant S. aureus bacteria called MRSA (methicillin-resistant staphylococcus aureus), which kills about 11,000 people in the U.S. every year, on three conventional samples (and none on sustainable samples). And 18 percent of conventional beef samples were contaminated with superbugs—the dangerous bacteria that are resistant to three or more classes of antibiotics—compared with just 9 percent of beef from samples that were sustainably produced. "We know that sustainable methods are better for the environment and more humane to animals. But our tests also show that these methods can produce ground beef that poses fewer public health risks," Rangan says.

COWS: THEY ARE WHAT THEY EAT

The majority of beef (about 97 percent) for sale comes from "conventionally raised" cattle that begin their lives grazing in grassy pastures but are then shipped to and packed into feedlots and fed mostly corn and soybeans for three months to almost a year. The animals may also be given antibiotics and hormones. That practice is considered to be the most cost-efficient

FOODS THAT MAKE US SICK

Food poisoning strikes an estimated 48 million people in the U.S. each year. Beef is a top cause of outbreaks, causing more of them than chicken or pork.

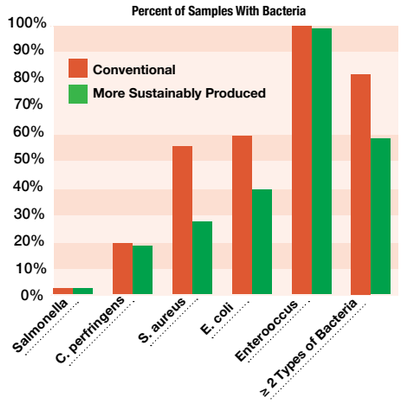


Fish	17%
Dairy	11%
Other	11%
Beef (all types)	9%
Mollusks	9%
Chicken	8%
Vegetable Row Crops	7%
Pork	7%
Fruits	7%
Turkey	4%
Grains-Beans	4%
Seeded Vegetables	3%
Eggs	3%

Source: Centers for Disease Control and Prevention.

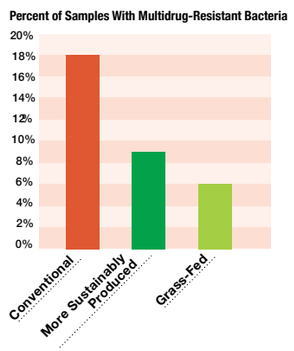
HOW MUCH BACTERIA IS IN BEEF?

We tested 300 samples of conventional (181 samples) and more sustainably produced (119 samples) of raw ground beef purchased at supermarkets, big-box, and "natural" food stores in 26 metropolitan areas across the country. We classified beef as being more sustainably produced if it had one or more of the following characteristics: no antibiotics, organic, or grass-fed. Here are the percentages of samples in each type that contained each of the five bacteria we tested for and the samples that contained two or more types of bacteria.



WHERE SUPERBUGS LURK

Superbugs are bacteria that are resistant to three or more classes of antibiotics, making infections caused by them difficult if not impossible to treat. In our tests of 300 samples of raw ground beef, we found that conventional beef was twice as likely to be contaminated with superbugs than was all types of sustainably produced beef. But the biggest difference we found was between conventional and grass-fed beef. Just 6 percent of those samples contained superbugs.



Join Consumer Reports' Fight for Better Beef

Improvements in the way beef is labeled, processed, and inspected can go a long way to making beef safer. Consumer Reports believes the government should do the following:

1 **Beef up inspection practices.** By law, meat slaughter and processing plants are subject to continuous inspection by the government. But due to staff cuts, one inspector may shuttle between a dozen or more plants. The Department of Agriculture should ensure that every plant has a dedicated inspector. In addition, the USDA conducts periodic random sampling for toxin-producing E. coli and salmonella, but the plants are given notice at least a day in advance for those inspections. That practice should stop because it gives the plant a chance to make changes that improve their test results temporarily.

2 **Protect the public from salmonella.** E. coli O157 and other toxin-producing strains of the bacteria are considered adulterants, which means it is illegal to sell raw ground beef that tests positive for them. Salmonella is different—beef passes inspection if up to 7.5 percent of the samples tested are contaminated with the bad bug. The USDA should ban the sale of beef with disease-causing, antibioticresistant salmonella.

3 **Prohibit chicken waste in cattle feed.** Cattle in feedlots are sometimes fed waste from the floors of chicken coops, which consists of spilled chicken feed and manure. Because chicken can be fed cattle waste, there's a risk that spilled feed could transmit mad cow disease when it's fed back to the cattle. And chicken manure can carry salmonella and other bacteria. The advocacy arm of Consumer Reports, together with other organizations, asked the Food and Drug Administration to stop that practice in 2009, but the agency has not taken action.

4 **Crack down on the "natural" label.** In June 2014, we filed a petition with the USDA and the FDA to ban use of the natural label on meat because it is misleading. According to a 2014 Consumer Reports national survey, 60 percent of consumers believe meat labeled "natural" was raised without antibiotics and that the animal wasn't given artificial ingredients in its food; 68 percent think it means no artificial growth hormones. None of that is true. The word "natural" can be used on packages of beef from cattle that were raised on a feedlot, fed genetically modified grain or grain grown with pesticides, or given antibiotics or hormones.

5 **Expand humane treatment to the requirements for "organic" labels.** In our survey, more than half of consumers think "organic" means that animals go outdoors and have plenty of indoor space, too. Although these cattle must have access to pastures for most of their lives, they can still be sent to feedlots before slaughter.

6 **Ban antibiotic use for disease prevention.** This practice leads to antibiotic resistance and makes the drugs less effective for treating infections in people. Sick animals should get antibiotics, but producers should improve living and sanitary conditions to prevent illness.

ACT Want to stop antibiotic use in healthy animals? There's a bill in Congress to do just that. We'll help you contact your member of Congress at **Consumers Union.org/MeatWithoutDrugs**

WHAT'S BETWEEN YOUR BUN? For optimal safety, choose sustainable beef and cook it well.

PHOTO: GETTY IMAGES

way to fatten up cattle: It takes less time, labor, and land for conventionally raised cattle to reach their slaughter weight compared with those that feed on grass their whole lives. "The high-carbohydrate corn and soy diet causes cattle to become unnaturally obese creatures that would never exist in nature," says farmer Will Harris, who decided 20 years ago to switch to raising grass-fed cattle at White Oak Pastures, his 2,500-acre fifth-generation family farm in Bluffton, Ga. "Conventional cattle reach 1,200-plus pounds in 16 to 18 months. On our farm, it takes 20 to 22 months to raise an 1,100-pound animal, which is what we consider slaughter weight."

Cows' digestive systems aren't designed to easily process high-starch foods such as corn and soy. Cattle will gain weight faster on a grain-based diet than on a grass-based one. But it also creates an acidic environment in the cows' digestive tract, which can lead to ulcers and infection. Research shows that this unnatural diet may also cause the cattle to shed more E. coli in their manure. In addition, cattle may be fed a variety of other substances to fatten them up. They include candy (such as gummy bears, lemon drops, and chocolate) to boost their sugar intake and plastic pellets to substitute for the fiber they would otherwise get from grass. Cattle feed can also contain parts of slaughtered hogs and chickens that are not used in food production, and dried manure and litter from chicken barns.

Conventional cattle farmers defend their methods, however. "If all cattle were grass-fed, we'd have less beef, and it would be less affordable," says Mike Apley, Ph.D., a veterinarian, professor at Kansas State University College of Veterinary Medicine, and chair of the Antibiotic Resistance Working Group at the National Cattlemen's Beef Association, a trade group. "Since grass doesn't grow on pasture year-round in many parts of the country," he says, "feedlots evolved to make the most efficient use of land, water, fuel, labor, and feed."

LIFE ON THE FEEDLOT

Farmers such as Will Harris are also concerned about the humaneness of crowding cows into feedlots. "Animals that have never been off grass are put into a two-story truck and transported for 20-plus hours with no food, water, or rest," Harris says. The animals are crowded into pens; the average feedlot in the U.S. houses about 4,300 head of cattle, according to Food & Water Watch's 2015 Factory Farm Nation Report. On some of the country's biggest feedlots, the cattle population averages 18,000.

"You always know when you're approaching a feedlot. The unmistakable stench hits you first, then you see the hovering fecal dust cloud, followed by the sight of thousands of cattle packed into pens standing in their own waste as far as you can see," says Don Davis, a cattle farmer in Texas and president of the Grassfed Livestock Alliance. The manure contains potentially dangerous bacteria that gets on the cattle's hides and can be transferred to the meat during slaughter. The conditions also stress the cattle, which makes them more susceptible to disease, and any illness that develops can quickly spread from animal to animal.

To control for that, cattle are often fed daily low doses of antibiotics to prevent disease. According to Apley, cattle in feedlots are given antibiotics to prevent coccidiosis, a common intestinal infection, but he notes that those drugs aren't medically important for people. He also said that cattle are given an antibiotic called tylosin to ward off liver abscesses. That drug is in a class of antibiotics that the World Health Organization categorizes as "critically important" for human medicine. What's more, in our tests we found that resistance to classes of antibiotics used to treat people was widespread. Three-quarters of the samples contained bacteria that were immune to at least one class of those drugs.

Antibiotics were also given to cattle to promote weight gain (although just how the drugs do that is unknown), but in 2013 the Food and Drug Administration issued voluntary guidelines to stop that practice. Previously, ranchers could buy those drugs over-the-counter and give them to their animals, but the FDA has proposed that antibiotics be used only under the supervision of a veterinarian. "That doesn't mean, though, that antibiotics can't be used for disease prevention anymore," says Jean Halloran, director of Food Policy Initiatives at Consumer Reports. "Vets can still authorize their use to 'ensure animal health,' so the status quo of feeding healthy animals antibiotics every day can continue." Widespread daily and unnecessary use of antibiotics in healthy animals in turn fuels the spread of antibiotic-resistant bacteria, which has become a serious public-health threat.

MEAT MONOPOLY

More than 80 percent of beef produced in the U.S. is processed by four companies. Cattle can

Should You Have the Steak Instead?

Steaks and roasts are less likely to make you sick than ground beef is because the bacteria that might be present on the surface of the meat is more easily killed during cooking. That's why you can safely serve those cuts medium rare—145° F. Just be sure to flip the steak twice during cooking to make sure that the heat is evenly distributed. The exception is beef that's been mechanically tenderized, a process in which a machine punctures the meat with blades or needles to break down the muscle fibers. That can drive bacteria into the center of the meat. A 2013 Canadian study concluded that the risk of illness from eating mechanically tenderized beef is about five times that of intact cuts of beef. Some retailers label the mechanically tenderized beef they sell, and starting in May 2016, U.S. meat producers will be required to do so. Until then, unless you're sure that your steak has not been tenderized, cook it to 160° F.

Protein Portion Control

Ground beef is a great source of protein, but eating too much red meat can increase your risk of heart disease, colon cancer, and type 2 diabetes. Grass-fed beef can be leaner and slightly lower in artery-clogging saturated fat and slightly higher in healthy polyunsaturated fats than grain-fed beef is. But even so, you want to keep your portions small (about 3 to 4 ounces) and swap out beef at least a few times per week with other protein sources. Check out the protein substitutes below, which are lower in total fat and saturated fat. You also might want to consider going meatless one day per week to help lower your disease risk (and save money—beef is generally more expensive than many alternative sources of protein).

	Grass-Fed Burger	Tofu	Shrimp	Chicken Breast
Protein	22 grams	18 grams	15 grams	26 grams
Total Fat	14 grams	10 grams	1 gram	3 grams
Saturated Fat	6 grams	1 gram	0 grams	1 gram

Nutrition information is based on 4 ounces, raw.

be slaughtered at high-speed rates—as many as 400 head per hour. Those slaughterhouses use a variety of methods to destroy bacteria on the carcass after the hide has been removed, such as hot water, chlorine-based, or lactic acid washes. But when so many cattle are being processed, sanitary practices may get short shrift. The result is that bacteria from cattle's hides or digestive tracts can be transferred to the meat. "USDA has a presence in these plants to do inspections—though it's against the companies' wishes," says Patty Lovera, assistant director of Food & Water Watch. "The economic power of the Big Four gives them a lot of political weight to push back against USDA inspectors' efforts to enforce existing rules and to fight against any tighter safety standards being enacted." And, she adds, "the sheer volume of beef that big-company plants crank out means that a quality control mistake at a single plant can lead to packages of contaminated beef ending up in stores and restaurants across 20 or 30 states."

THE BETTER BURGER STARTS HERE

Cattle can have a healthier (and more humane) upbringing if they graze in pastures for most—if not all—of their lives. "The most sustainable beef-production systems don't rely on any daily drugs, don't confine animals, and do allow them to eat a natural diet," Rangan says. And what's good for cows is good for people, too. "Our findings show that more sustainable can mean safer meat." That's why Consumer Reports recommends that you buy sustainably raised beef whenever possible. Sustainable methods run the gamut from the very basic 'raised without antibiotics' to the most sustainable, which is grass-fed organic. (See "Labels to Look For," on page 71.) "We suggest that you choose what's labeled 'grass-fed organic beef' whenever you can," Rangan says. Aside from the animal welfare and environmental benefits, grass-fed cattle also need fewer antibiotics or other drugs to treat disease, and organic standards and many verified grass-fed label programs prohibit antibiotics. Sustainably raised beef does cost more (see "Why Grass-Fed Costs More," on the facing page), but it's the safest—and most humane—way for Americans to enjoy our beloved burgers ... cooked to medium, of course.

WHY GRASS-FED COSTS MORE

When we purchased our test samples of ground beef, we paid an average of about $2.50 more for grass-fed beef and $3 more for grass-fed organic beef per pound than we did for conventional supermarket beef. (See below for the average prices we paid for each type of beef in our tests.) According to those figures, if you bought 2 pounds of ground beef each week, it would cost you an additional $260 to $310 per year to switch to grass-fed. The reason grass-fed beef is pricier has to do with beef producers' profit margin: It can take a farmer up to a year longer (and an extra year's worth of food, care, and labor) to get a grass-fed animal to reach slaughter weight than for a conventionally raised one. Grass-fed cattle also tend to be smaller at slaughter, so there's less meat to sell per head. "Using antibiotics, hormones, and feedlots produces obscenely cheap beef," says grass-fed rancher Will Harris. "When you don't use them, your production costs are higher, so your prices need to be higher, too." So when you shop and spend, consider the benefits of supporting sustainable methods in place of conventional ones.

Conventional	**$4.95** per lb.
Without Antibiotics	**$6.55** per lb.
Organic	**$5.62** per lb.
Grass-Fed	**$7.38** per lb.
Grass-Fed Organic	**$7.83** per lb.

What's in a Name?

GROUND BEEF. This can come from meat and fat trimmings from multiple animals, as well as other beef components, such as esophagus, diaphragm, or cheek of the animal. The maximum amount of fat by weight it can contain is 30 percent.

HAMBURGER. This is made from meat trimmings and other beef components. It can't exceed 30 percent fat, but unlike ground beef, pure beef fat can be added to reach the desired level of fat content.

PURE BEEF PATTIES. Also called 100 percent beef patties, these are similar to ground beef but can contain partially defatted chopped beef. Regular "beef patties" can also contain defatted beef, and organ meats, water, binders, fillers, and extenders. Those latter ingredients must be listed on the label.

GROUND CHUCK. When you see a cut of beef denoted on the label—such as chuck, round, or sirloin—the meat and meat trimmings come from that part of the animal. No beef components can be added. However, it can still contain meat from multiple animals.

80/20. This refers to the percent of lean meat and fat by weight in the ground beef. Common lean-to-fat percentages are 70/30, 80/20, and 90/10. That doesn't tell you the percent of calories from fat in the beef, however. For example, 51 percent of the calories in 90/10 beef come from fat.

LEAN/EXTRA LEAN. "Lean" must have less than 10 grams of total fat and less than 4.5 grams of saturated fat per 3.5-ounce serving. "Extra Lean" meat must contain less than 5 grams of total fat and less than 2 grams of saturated fat.

COW CARE When you see Animal Welfare Approved and Certified Humane labels on beef packages, you can trust that the animals were treated well.

How to Handle Beef: From Store to Table

Until we have more robust regulations in place, the undue burden falls on consumers to treat raw beef (or any meat) carefully. That means you have to always assume it's contaminated with bacteria and take appropriate precautions. The best practices include:

Pick it up last at the supermarket. You want it to stay cold as long as possible, so visit the meat case last. Bag it separately from other foods, and put it in a chilled cooler or on ice if you're traveling more than a short distance home.

Keep it cold at home, too. Bacteria multiply rapidly in what federal health off icials call the "Danger Zone": temperatures between 40° F and 140° F. Use an appliance thermometer to make sure that your refrigerator stays no warmer than 37° F. If you don't use ground beef within two days, freeze it. Defrost frozen meat in the refrigerator—not out on the counter.

Don't allow it to touch other foods. Use separate plates and utensils for raw and cooked meats. Always wash your hands with soap and water after handling raw meat, as well as thoroughly sanitize sinks or any other surfaces that came in contact with the meat. Plastic cutting boards should be washed in the dishwasher.

Turn up the heat. The safest temperature for ground beef is 160° F. You can't tell by the meat's color whether it has reached that temperature, so use a meat thermometer. If you're reheating leftover burgers or a casserole with ground beef, get it to 165° F.

Take "rare" out of your vocabulary. Rare is risky, and even medium-rare is, especially for kids, who are more susceptible to food poisoning. Medium may be too inexact when ordering out. To be safe, specify that you want 160° F when ordering a burger. In one study of 385 restaurants in eight states, just 12 percent always used a thermometer to measure burgers' cooked temperatures. And 12 percent of all burgers were served at an unsafe temperature.

Be very careful if you grind it yourself. It might sound like a safer bet than buying prepackaged meat, but any pathogens on whole cuts would be spread throughout the batch of meat you grind at home. Bacteria also can linger in the equipment you use, increasing the odds of cross-contamination in your kitchen. So wash in hot soapy water or, preferably, in the dishwasher.

Funding for this project was provided by The Pew Charitable Trusts. Any views expressed are those of Consumer Reports and its advocacy arm, Consumers Union, and do not necessarily re ect the views of The Pew Charitable Trusts.

PHOTOGRAPH, LEFT: EVAN KAFKA

MAKING THE WORLD SAFE FROM SUPERBUGS

In this final installment of our 3-part series, we review the progress—and work yet to be done—to stop the antibiotic overuse in meat and poultry production that gives rise to dangerous bacteria. Plus, learn what protections consumers deserve and should demand.

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One of the greatest medical discoveries of the 20th century happened by accident. In 1928 scientist Alexander Fleming found mold growing in one of his petri dishes—then noticed that the bacteria all around it had been destroyed. That bacteria-killing mold was the first form of penicillin—and we as a society embarked on a brave new world in medicine. Suddenly, deadly diseases such as tuberculosis, scarlet fever, bacterial meningitis, and diphtheria could be cured with a pill. Surgery for heart disease and organ transplants, as well as chemotherapy, could succeed because those miracle drugs wiped out the infections that arose after treatment.

But less than 100 years after that breakthrough, antibiotics are losing their lifesaving effectiveness. Their overuse has allowed bacteria to evolve so that they are almost impervious to the drugs. That has led to the rise of "superbugs"—which include methicillin-resistant staphylococcus aureus (MRSA) and bacteria resistant to three or more types of antibiotics. And as the number of superbugs increases, the development of new antibiotics to kill them has lagged. At least 2 million Americans fall victim to antibiotic-resistant infections every year; 23,000 die. "The antibiotics we've relied on for decades are becoming less effective—and we risk turning back the clock to a time where simple infections killed people," says Tom Frieden, M.D., M.P.H., director of the Centers for Disease Control and Prevention.

Over this past year, Consumer Reports has investigated the dangers of antibiotic overuse in hospitals and doctors' offices. (See our August and September 2015 issues.) But nowhere are the drugs more inappropriately employed than in the meat and poultry industries. About 80 percent of the antibiotics sold in the U.S. are given to animals raised for food—including hogs, cattle, chickens, and turkeys. The most recent data from the Food and Drug Administration show that more than 32 million pounds of antibiotics were sold for use in food animals in the U.S. in 2013—up 17 percent from just four years earlier.

Recently, several meat and poultry producers, such as Tyson, and restaurant chains, like McDonald's and Subway, have pledged to reduce the production or sale of meat or poultry from animals raised with antibiotics. "But whether such measures will end up significantly reducing antibiotic use remains to be seen," says Gail Hansen, D.V.M., who has more than 25 years of experience in veterinary public health and infectious disease.

"In the last few years we've witnessed some of the bacteria most commonly found in food—germs such as salmonella and campylobacter—become increasingly resistant to some important antibiotics," says Robert Tauxe, M.D., M.P.H., deputy director of the CDC's Division of Foodborne, Waterborne, and Environmental Diseases. Those resistant strains can cause infections that are "more severe, longer lasting, and harder to treat," Tauxe says. In fact, our calculations using data from the CDC show that about 20 percent of people sickened by an antibiotic-resistant bug don't pick it up in the hospital or from another person—they get it from their food.

SUPERBUGS IN YOUR MEAT

Four years ago, Ruby Lee of Sandy, Ore., wound up fighting for her life against a superbug. She was only 10 months old when her parents rushed her to the emergency room with severe diarrhea and a high fever. "Ruby was so sick the first five days that she barely moved," says her mother, Melissa Lee. "We were terrified of losing her." Doctors eventually determined that Ruby's illness was part of a salmonella Heidelberg outbreak involving ground turkey that sickened 135 other people in several states. That bacteria was resistant to several antibiotics, but luckily Ruby's doctors found one that still worked.

Even just handling contaminated meat poses a risk. Ken Koehler, 55, always cooked his burgers to well-done. But he still got sick during a 2011 outbreak of salmonella typhimurium linked to ground beef. Public health officials told him that he may have gotten the resistant bacteria on his hands when shaping the raw meat into patties. Bedridden for weeks, the Old Orchard Beach, Maine, resident counts the experience as one of the worst of his life. Antibiotics tackled the infection, but recovery was slow. "It was a month before I could eat a full meal," he says. "My digestive system is still not back to normal."

Ruby and Ken's stories aren't isolated incidents. Information on cases like these is often incomplete, but according to data from the CDC, at least six multistate outbreaks of food poisoning involving antibiotic-resistant bacteria have occurred since 2011. The largest one, linked to Foster Farms chicken, began in spring 2013 and continued through summer 2014, infecting 634 people in 29 states. About 40 percent were sick enough to be hospitalized—double the usual percentage in salmonella outbreaks.

"Antibiotic-resistant bacteria are all too prevalent in our meat supply," says Urvashi Rangan, Ph.D., executive director of the Food Safety and Sustainability Center at Consumer Reports. "Multistate outbreaks get a lot of attention, but the data underestimate the total number of illnesses because there are many more that occur at the local level." For example, this past August, pork contaminated with salmonella immune to four antibiotics sickened 152 people in Washington state. "Over the years, we've tested hundreds of packages of supermarket meat, poultry, and shrimp, and found multidrug-resistant bacteria in samples from every type of

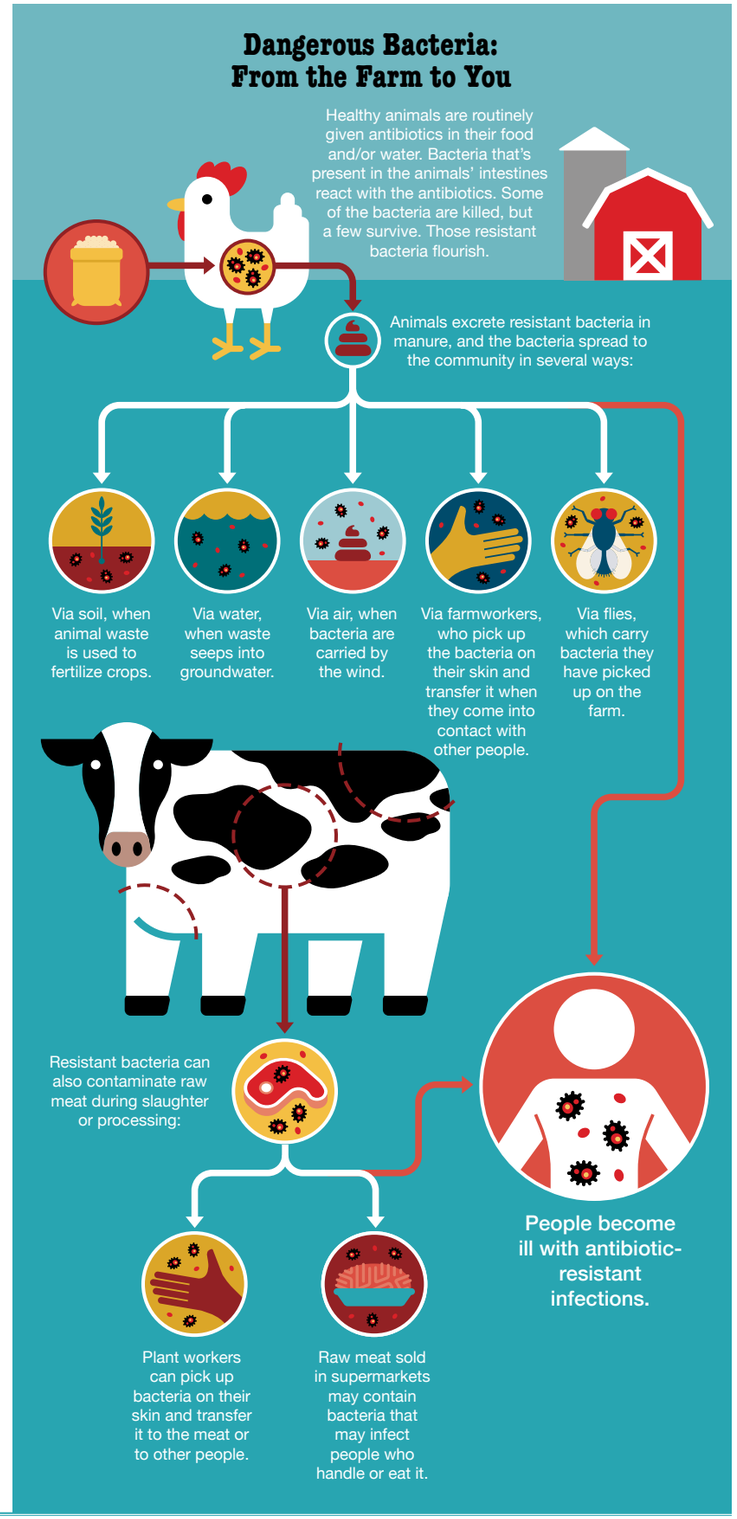


ILLUSTRATION BY JUDE BUFFUM

animal," Rangan says. (See "Our Flawed Food Supply," on page 82.)

WHY ANIMALS ARE DRUGGED

The practice of feeding drugs to animals dates back some 70 years. Thinking it would be easier to study nutrition in "sterile" chicks, a group of researchers fed them antibiotics with the intent of wiping out their gut bacteria. The "rather unexpected result," according to the 1946 study, was that the chicks grew faster. By 1950, researchers had discovered that when given antibiotics, animals reached market weight sooner while consuming less feed. "At the time, they didn't know why the animals grew faster," Gail Hansen says. "We still really don't." But the profit advantage seemed clear, and adding the drugs to feed became standard practice. But research from the past 15 years suggests that today, antibiotics probably don't work well to promote growth, at least in some animals. According to Hansen, that may be because animals farmed today differ genetically from those of yesteryear or because any effect from the antibiotics declined as bacteria grew resistant to the drugs.

The other reason producers give healthy animals low doses of antibiotics is to keep them from getting sick. Under pressure from large processors, over the past few decades small to midsized farms have increasingly been replaced by industrial-scale farms and feedlots that confine thousands of animals together, according to a recent analysis of Department of Agriculture farm census data by Food & Water Watch. In such crowded conditions disease can spread rapidly.

These days farmers often have little say in how their animals are raised. "The majority of food animals now are raised under contracts with major meat-producing companies that require farmers to use feed supplied by the company that may be premixed with antibiotics," Hansen says. "Many have no idea how much and what kind of drugs their animals get." Most of the antibiotics given to animals are in the form of drug-laced feed or water, according to the FDA.

What has experts most concerned is the use of antibiotics that are important in human medicine or similar to ones that are.

WHY RESISTANCE IS RISKY

Antibiotics do have their place on the farm: to treat sick animals. When the drugs are used in therapeutic doses, antibiotic resistance is less likely to occur. But the low doses given to animals routinely are problematic. "The combination of frequent antibiotic use and the conditions the animals are raised in creates a hospitable environment for superbugs to develop and proliferate," Rangan says. The drugs can kill off weaker bacteria in the animals' digestive tracts, leaving a few hardy survivors to multiply. Those bacteria, as well as certain antibiotic residues, are excreted in manure, which is the perfect medium for antibiotic-resistant bacteria to grow. Over time, you wind up with colonies of almost indestructible superbugs. "On industrial farms, the animals are literally surrounded by their own waste," Rangan says. So those bacteria get on the animals' hides and skin, and can contaminate the meat we eat when the animals are slaughtered. And, Rangan says, the bacteria continue to reproduce and spread resistance to other bacteria in the animal waste and can get into our environment if the waste is not well-managed.

The problem doesn't just lie with the bacteria that cause foodborne illness. Once resistant bacteria are in the environment, they can mingle with other bacteria and share genetic material, which could contribute to additional antibiotic-resistant infections in hospitals and communities.

What has experts most concerned is the use of antibiotics that are important in human medicine or similar to ones that are. For example, tetracyclines are used in people, but certain types are used primarily in animals. If bacteria develop resistance to the animal drugs, they may also become resistant to the human tetracyclines. When resistant infections occur, doctors have limited options to treat them. For example, the strain of salmonella that sickened Ken Koehler was resistant to nine of the 15 antibiotics the CDC tested it against while investigating the outbreak.

Animal-only antibiotics are also a concern. A group of antibiotics called ionophores that are fed to animals are not generally important in human medicine. But there is a possibility that their long-term use could lead to problems with human drugs. And their use helps make it possible to continue to raise livestock and poultry in crowded conditions, where bacteria can quickly reproduce.

Which Chains and Producers Have the Best Practices?

Consumer Reports' food-safety experts reviewed the antibiotic-use policies of popular chain restaurants and meat and poultry producers. The best policy bans human and animal antibiotics for growth promotion and disease prevention, as well as other drugs (beta-agonists and hormones) in all types of meat. Any routine drug use makes it possible for producers to avoid correcting conditions that can make animals sick in the first place. If a company permits the use of one of those drugs in at least one of the animals it raises or one type of meat it serves, you'll see "Allows" in the Other Drugs column. Though some of the companies here have pledged to make changes in antibiotic use in the future, these are their practices at press time. Not all brands or companies are represented. For more details go to GreenerChoices.org.

CHAIN RESTAURANTS	Antibiotics for Growth Promotion	Antibiotics for Disease Prevention	Other Drugs
Applebee's	ALLOWS	ALLOWS	ALLOWS
Burger King	BANS	ALLOWS	ALLOWS
Chick-fil-A [1]	ALLOWS	ALLOWS	[2]
Chili's	ALLOWS	ALLOWS	ALLOWS
Chipotle Mexican Grill	BANS	BANS	BANS
Dunkin' Donuts [1]	ALLOWS	ALLOWS	ALLOWS
KFC	ALLOWS	ALLOWS	[2]
McDonald's [1]	ALLOWS	ALLOWS	ALLOWS
Outback Steakhouse	ALLOWS	ALLOWS	ALLOWS
Panera Bread deli turkey [1]	ALLOWS	ALLOWS	BANS
Panera Bread beef, chicken, pork, roasted turkey	BANS	BANS	BANS
Pizza Hut	ALLOWS	ALLOWS	ALLOWS
Starbucks	ALLOWS	ALLOWS	ALLOWS
Subway [1]	ALLOWS	ALLOWS	ALLOWS
Taco Bell	ALLOWS	ALLOWS	ALLOWS
Wendy's	[3]	ALLOWS	ALLOWS

[1] Company has announced eliminating at least some antibiotic use, but the policy is not yet widely implemented. [2] Hormone and beta-agonist use legally prohibited in chicken. [3] Bans human but not animal antibiotics. [4] Bans antibiotic use in chicken but not in beef or pork.

Brand (Company) MEAT AND POULTRY PRODUCERS	Antibiotics for Growth Promotion	Antibiotics for Disease Prevention	Other Drugs
Angus Pride (Cargill)	BANS	ALLOWS	ALLOWS
1855 Black Angus (JBS)	ALLOWS	ALLOWS	ALLOWS
Applegate (Hormel)	BANS	BANS	BANS
Aspen Ridge (JBS)	BANS	BANS	BANS
Bell & Evans chicken	BANS	BANS	[2]
Black Canyon Angus Beef (National Beef Packing)	ALLOWS	ALLOWS	ALLOWS
Blue Ribbon Beef (JBS)	BANS	ALLOWS	ALLOWS
Butterball	BANS	ALLOWS	BANS
Clear River Farms (JBS)	BANS	BANS	BANS
Coleman Natural (Perdue)	BANS	BANS	BANS
Foster Farms Fresh & Natural	BANS	ALLOWS	[2]
Foster Farms Simply Raised	BANS	BANS	[2]
Gerber's Amish Farm	BANS	BANS	[2]
Hatfield (Clemens)	BANS	ALLOWS	ALLOWS
Honeysuckle White (Cargill)	BANS	ALLOWS	BANS
Hormel Foods	ALLOWS	ALLOWS	ALLOWS
Meadowland Farms (Cargill)	ALLOWS	ALLOWS	ALLOWS
Nature Raised Farms (Tyson Foods)	BANS	BANS	BANS [2]
Niman Ranch (Perdue)	BANS	BANS	BANS
Open Prairie Natural Angus (Tyson Foods)	BANS	BANS	BANS
Perdue chicken	BANS	[3]	[2]
Perdue Harvestland	BANS	BANS	BANS
Pilgrim's (JBS) [1]	BANS	ALLOWS	[2]
Sanderson Farms	ALLOWS	ALLOWS	[2]
Shady Brook Farms (Cargill)	BANS	ALLOWS	BANS
Smart Chicken (Tecumseh Farms)	BANS	BANS	[2]
Smithfield	[3]	ALLOWS	ALLOWS
Sterling Silver (Cargill)	ALLOWS	ALLOWS	ALLOWS
Strauss	BANS	BANS	BANS
Swift (JBS)	BANS	ALLOWS	ALLOWS
Tyson Foods [1]	[4]	ALLOWS	ALLOWS

ILLUSTRATIONS BY JUDE BUFFUM

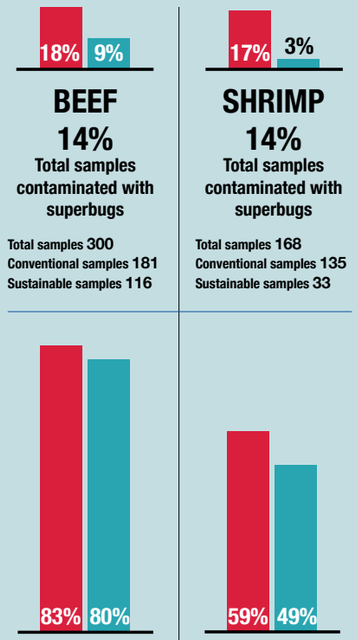
INDUSTRY PUSHBACK

Trade groups representing the meat and poultry industry mostly say that the drugs are not widely overused and that they do not put human health at risk. "An important point that's often missing in this discussion is that antibiotics are really needed to both ensure animal health and welfare as well as food safety," says Christine Hoang, D.V.M., assistant director of animal and public health at the American Veterinary Medical Association. Hoang says that the industry is already phasing out use of antibiotics for growth promotion and that drugs used for disease prevention are necessary. As for antibiotic resistance, she says the jury is still out. "The science that is available is unclear on how use of antibiotics in animals relates to human health and resistant infections in the community," Hoang says. The association has gone on record as saying that the use of the drugs in food production "plays an extremely small role." Other organizations that represent the animal agriculture industry echo that view. For example, the Animal Agriculture Alliance says that "layers of protection have been put in place to ensure that animal antibiotics don't affect public health."

Lance Price, Ph.D., a professor of environmental and occupational health at George Washington University in Washington, D.C., categorically disagrees. "As a microbiologist, I have dedicated my career to studying bacteria, and I know that those notions are false," he says. "Studies dating back to the 1960s have repeatedly shown how antibiotic use in food-animal production contributes to the growing crisis of antibiotic-resistant infections in people."

Our Flawed Food Supply

Over the past three years, we've tested four types of meat for bacterial contamination. We found superbugs in all of them. And in most of our tests, we saw differences between meat raised conventionally and meat that was more sustainably produced, without antibiotics. The number and type of bacteria we tested for vary, so the results from one test can't be compared with those from another.



Funding for these projects was provided by The Pew Charitable Trusts. Any views expressed are those of Consumer Reports and its advocacy arm, Consumers Union, and do not necessarily reflect the views of the Pew Charitable Trusts.

Consumer Reports' tests show that, in general, meat and poultry from animals raised without antibiotics are less likely to harbor multidrug-resistant bacteria than meat from animals that get the drugs routinely. For example, in our most recent tests, we found that ground beef from conventionally raised cows was twice as likely as that from cows raised without antibiotics to contain superbugs. "Those results suggest that farming practices can profoundly affect the safety of our food," Rangan says.

What happens on the farm also has implications for our health overall. Research shows that resistant bacteria bred on the farm wind up reaching people in a surprising number of ways. For example, farm workers can pick up antibiotic-resistant bacteria handling animals and manure; even if the germs don't make them sick, they can still pass them along to other people.

Disposing of the more than 700 billion pounds of manure generated by industrial farming creates a health hazard as well. Some is used as commercial fertilizer and can spread superbugs to crops and taint streams and groundwater. Studies also suggest that resistant bacteria can be picked up and transmitted by flies and spread by the wind. In one study, for example, rural Pennsylvania residents living near fields fertilized with manure from pig farms were up to 38 percent more likely to develop MRSA infections than others in their community.

GOVERNMENT LOOPHOLES

In 2013, the FDA announced a voluntary plan to change the way veterinary antibiotics are labeled and sold. The plan is voluntary, the FDA says, because "it is the fastest, most efficient way to make these changes." People need a prescription for antibiotics, but currently almost all of the drugs are available over the counter for use in food animals. By the end of 2016, though, the FDA's plan calls for requiring a veterinarian's approval before feeding animals antibiotics that are important in human medicine. And those drugs will no longer be labeled for use for growth promotion.

'Farming practices can profoundly affect the safety of our food.'

But that doesn't mean food producers will immediately cut back on antibiotics. Under the FDA plan, they can continue to use them by saying they're to prevent disease. "That's a pretty big loophole," says Laura Rogers, deputy director of the Antibiotic Resistance Action Center at George Washington University's Milken Institute School of Public Health. "In fact, it has the potential to make the FDA plan meaningless." What's more, producers are free to use other drugs to promote growth.

Indeed, for certain veterinary antibiotics, label directions—the dosages used and the way they are administered—for preventing disease are the same as those for promoting growth, according to a 2014 analysis by The Pew Charitable Trusts. What that means is that "the spigot of drugs can keep flowing," says Rogers, who at the time of the study directed Pew's campaign on human health and industrial

'I look for "no antibiotics" labels.'

Her daughter, Ruby, had a bout with salmonella when she was just 10 months old, and that had a big effect on Melissa Lee's groceryshopping habits. "Before, I bought what was on sale or what looked good," she says. "Now I look for no antibiotics and no hormones. What goes in our bodies makes a big difference."

Meat-Label Lingo: What It Means and Doesn't Mean

Shopping for "no antibiotics" meat and poultry can be confusing. Some of the labels can be misleading or opaque. To empower you while shopping, we have investigated the claims. For more label ratings, go to GreenerChoices.org.

No Antibiotics Used Routinely

ANIMAL WELFARE APPROVED No antibiotics are used for growth promotion or disease prevention. Sick animals can be treated with antibiotics. Animal welfare and hygiene practices are fully addressed.

CERTIFIED HUMANE No antibiotics are used for growth promotion or disease prevention. Some animal welfare and hygiene practices are addressed.

GAP STEPS 1-5+ (SOLD AT WHOLE FOODS) No antibiotics are used. Animal welfare and hygiene practices are addressed to varying degrees.

NO ANTIBIOTICS/RAISED WITHOUT ANTIBIOTICS The drugs aren't used for any purpose. Similar claims: "no antibiotics administered," "no antibiotics ever," and "never given antibiotics." Though those claims on their own are accurate, the ones accompanied by the USDA Process Verified shield are more reliable.

ORGANIC Animals can't be given antibiotics. Sick animals treated with antibiotics can't be labeled organic. The exception is chickens: They can be given antibiotics in the egg or on the day they hatch but not afterward.

Antibiotics May Be Used

AMERICAN HUMANE ASSOCIATION Neither animal nor human antibiotics are used for growth promotion, but both can be used for disease prevention. Some animal welfare and hygiene practices are addressed.

GRASSFED Don't assume all grass-fed beef is raised without routine antibiotics; look for a no-antibiotic or organic label as well. Also, the American Grassfed Association seal means no antibiotics, and the claim is verified.

NATURAL/ALL NATURAL This has nothing to do with antibiotics, hormones, or other drugs, or how the animal was raised. In fact, "natural" on meat and poultry means only that it contains no artificial ingredients or added color and is only minimally processed.

NO HORMONES This doesn't mean no antibiotics or other growth promotants. By law hormones can't be used in poultry or hogs, so packages of meat from those animals with this claim are no different from those without it.

PHOTOGRAPH BY PETE STONE

Protections That Consumers Deserve and Should Demand

The changes recommended by the Food and Drug Administration to reduce antibiotic use in livestock and poultry, and the changes that certain players in the food industry have made, are good first steps, but government and industry must do more to create meaningful change. These are the steps Consumer Reports recommends.

THE GOVERNMENT SHOULD

Ban the routine use of antibiotics important to human medicine. The FDA has issued voluntary guidelines that phase out the use of these drugs for growth promotion but still allow their use for disease prevention with a veterinarian's approval. That leaves the door open to animals getting antibiotics routinely. At a minimum, the FDA should prohibit all uses of medically important antibiotics except for the responsible treatment of sick animals. Congress should pass the Preservation of Antibiotics for Medical Treatment Act to require the FDA to move in that direction, and state legislatures should establish similar requirements. Ideally, CR believes, no drugs should be given to healthy animals routinely.

Improve monitoring of antibiotic use. Right now, because of inadequate and untimely data, it's very difficult to measure how well programs to reduce the use of antibiotics are working—and it's impossible to identify problem areas. The FDA, working with the Department of Agriculture, should collect more detailed data from feed mills and veterinarians on the actual use of antibiotics in food animals—including the particular drug, animal species, and purpose for which the drug was used—and publicly release the data. Congress should pass the Delivering Antimicrobial Transparency in Animals Act or similar legislation that would make that mandatory.

Prohibit misleading labeling. The USDA requires producers making a no-antibiotics claim to submit paperwork that states that animals were raised without antibiotics. But the agency has approved some claims that imply "no antibiotics," when in fact they can still be used for disease prevention. One example, found on turkey, is "no antibiotics used for growth promotion" accompanied by the USDA Process Verified shield. The claim does not mean "no antibiotics," but the shield gives a false sense of credibility. The USDA should not approve such claims unless antibiotics are never used. The department should also address the misleading use of the "natural" label, which can be used on meat and poultry raised with antibiotics and other drugs.

THE FOOD INDUSTRY SHOULD

Implement more sustainable agriculture practices. The vast majority of animals are raised or finished in crowded, confined, and unsanitary conditions, where they are susceptible to disease outbreaks. Drug use in animal agriculture will be more likely to decline if changes are made to the way animals are raised.

Use clear and meaningful labels. Those such as the USDA Organic seal, or a true "no antibiotics" claim accompanied by a USDA Process Verified shield, are reliable because they are independently verified. Other labels, which either prohibit antibiotic use or allow antibiotics only for the treatment of sick animals, include Animal Welfare Approved, Global Animal Partnership, and American Grassfed. Companies should not use the "natural" label.

Offer consumers more sustainable options. Grocery stores and restaurants—large chains in particular—should phase out the sale of meat and poultry raised with the routine use of antibiotics and other drugs. They should use their purchasing power to encourage suppliers to raise animals in more humane and hygienic conditions.

farming.

Government actions have been "weak baby steps," according to Price. "Until we take a stronger stand, we're not leading the world in protecting important antibiotics," he says. "We are just supporting an industry trying to maximize profits at the expense of causing drug-resistant infections in people."

PROGRESS ON POULTRY

If you've read the headlines about companies pledging to reduce antibiotic use over the past year, you might think that the marketplace is solving the problem, even without tough regulations. Last spring, for example, McDonald's announced that it would move toward serving chicken raised without antibiotics important to human medicine within two years, Tyson said it would phase out those drugs in chicken, and Wal-Mart called on its vast chain of suppliers to adopt guidelines for "responsible use of antibiotics." And in the fall, Subway pledged to stop all antibiotic use, starting with poultry but expanding to other animals within 10 years. But a closer look reveals a lot of wiggle room in the way some of those pledges are phrased. "When a company says it will stop selling or producing meat or poultry with antibiotics important in human medicine, it can mean they simply switch to using other drugs like ionophores for disease prevention," Rangan says. "That can increase our exposure to bacteria because it allows animals to continue to be raised in conditions that promote the bugs' growth and spread." And, she adds, claims such as "sustainable" and "responsible antibiotic use" aren't regulated. Companies are free to define them as they see fit. "Moreover, some of these changes won't take place for many years."

Much of the progress in reducing antibiotic use has been in chicken, not in other animals. Certain chicken producers, including Perdue and Tyson Foods, have pledged to reduce their use of antibiotics and are already making changes. For example, Perdue says that 96 percent of its chickens are not given antibiotics used in human medicine; more than half receive no antibiotics ever. To achieve that, the company had to "relook at virtually everything," says Bruce Stewart-Brown, D.V.M., senior vice president of food safety, quality, and live production at Perdue. Changes include constructing cleaner hatcheries, using probiotics (which may help foster the growth of healthy bacteria) in the birds, and expanding the use of vaccinations to prevent disease.

Even when it comes to chickens, though, Rogers points out that not every pledge involves eliminating all antibiotics. "When people say, 'Good job, you're almost there,' I say, 'Whoa, we're so far from almost there,' " she says. "There's been a lot of 'me too' on chicken, but until it's verified to be raised without antibiotics and there is movement when it comes to turkey, pork, and beef, it's far from time to raise the victory flag."

"It's good that change is taking place, but it's moving too slowly," Rangan says. "Ideally not only would all meat be raised without any routine antibiotics, but we also would raise animals for food differently. Crowded conditions and unsanitary practices on factory farms are a big part of what makes daily antibiotics and other drugs necessary in the first place."

'Legislation is important.'

Before Ken Koehler got severely ill from ground beef tainted with antibiotic-resistant salmonella, he had never heard of antibiotic resistance. "I've gotten quite an education since," he says. "The majority of antibiotics are used on healthy animals, and it's creating strains of bacteria that are dangerous because most antibiotics won't work against them. I support legislation to ban antibiotic use in healthy animals."

CONSUMERS AS CHANGE-MAKERS

The biggest driver of change, the CDC's Tauxe says, is likely to be consumer demand: "It comes down to millions of consumers making choices every day about what food to buy and the level of safety they want for their families."

More than one-quarter of Americans report that they are buying meat and poultry raised without antibiotics more often than they did a year ago, according to a nationally representative survey of 1,008 adults from the Consumer Reports National Research Center in September 2015. Almost half said that they check products for a "no antibiotics" claim.

And it is becoming easier to find those products. The percentage of labels on meat and poultry packaging with claims about animals raised without antibiotics more than doubled between 2011 and 2014, according to a recent report from the market research firm Mintel. Meat and poultry sold at Whole Foods, for example, never comes from animals treated with antibiotics, but Consumer Reports' shoppers have also found a wide selection of no-antibiotic products at chains across the U.S., including Giant, Hannaford, Publix, QFC, Ralphs, and Trader Joe's.

But consumers don't always know what they're buying in their quest for no-antibiotic meat. "We also see quite a bit of confusion about what claims mean," says Julia Gallo-Torres, a senior analyst at Mintel. The report found that one of the top factors people consider, for example, is whether a product is "all natural." But that claim doesn't indicate anything about how an animal is raised or whether drugs are used. Two reliable claims to look for: "organic" and "no antibiotics administered." The box on page 83 defines the most common antibiotic-related claims on meat and poultry packaging.

Some argue that changing current farming practices to make antibiotics unnecessary would make meat prohibitively expensive for the average consumer to buy. But that assumption is not always true. A 1999 report from the National

PHOTOGRAPH BY SEAN ALONZO HARRIS

Research Council (the most recent data available) found that if all routine use of antibiotics were eliminated, the cost to consumers would be about $10 per year—around $14 in today's dollars.

Farms in the U.S. and around the world are proving that it's possible to raise all types of livestock without the excessive use of drugs. For example, Niman Ranch, one of the largest suppliers of sustainable meat in the U.S., eschews factory farming. Instead it relies on a network of more than 700 family ranchers and farmers that supply the company with meat raised according to its strict standards, which include never using antibiotics. "If your animals are living in a healthy environment—they are given enough space and not stressed—and you vaccinate them against routine diseases, then antibiotics aren't needed," says Paul Willis, a hog farmer who was one of the founders of Niman Ranch. Willis says that sick animals would still be treated with antibiotics, but their meat could not be sold under the Niman Ranch label. But he says that rarely happens. "We take care of our animals," Willis says. "I haven't had a really sick pig that needed antibiotics for years."

Scandinavian countries are modeling how it can work on a large scale. For example, Denmark stopped the use of antibiotics for growth promotion in broiler chickens and pigs about 15 years ago without harming the animals' health or the farmers' incomes. And in 2009, the Netherlands, one of the world's largest meat exporters, set a goal of halving the amount of antibiotics farmers use in four years; it met that goal a year early.

"Europe has no more disease in livestock that we have here. They haven't seen a difference in animal growth," Hansen adds. "That experience proves that it is possible to maintain a thriving agriculture industry using far less drugs."

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ACT

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