PBS’ “To the Contrary”

Hidden Health Hazards: Combating the Crisis of Our Food and Water

Host: Bonnie Erbe

February 23rd, 2018

Panelists: Dr. Everly Macario, Dr. Lance B. Price, Dr. Emma Rosi

PLEASE CREDIT ANY QUOTES OR EXCERPTS FROM THIS PBS PROGRAM TO “PBS’ TO THE CONTRARY.”
EVERLY MACARIO: This is a wake-up call to all of us that antibiotic resistance is very real.

BONNIE ERBE: Now what is a super bug?

LANCE PRICE: That's a term that some of my colleagues don't like. I love it because people pay attention.

EMMA ROSI: We can really see the trash that we are putting out there in the environment. The fact of the matter is though is we find pharmaceuticals, personal care products, things that you can not see in places that look otherwise look very clean.

EVERLY MACARIO: I kept hearing a course of your child is very, very sick. Your child is very, very sick. Your child is very, very sick. And I didn't understand what was going on because how could they tell? We had just been there earlier in the day and they said we need to take him to the intensive care unit now.

BONNIE ERBE: Everly Marcario's one-and-a-half-year-old son Simon had contracted an antibiotic-resistance bacterium called mrsa.

EVERLY MACARIO: It was actually less than 24 hours, yes. Yes. From the time of his first symptoms to the time of his death. Less than 24 hours.

BONNIE ERBE: Most people who get mrsa do so in hospitals. But Simon died of what is called community associated mrsa. There's no proof of where he came in contact with it. It was 2004. Macario who has a PhD from the Harvard school of public health, and was a health communicator, never heard of mrsa until doctors told her the cause of her otherwise healthy son's death.

EVERLY MACARIO: He was completely healthy had no underlying diseases, and yet, he died. So this is a wake-up call to all of us that antibiotic resistance is real.

LANCE PRICE: There are parents, you know, hundreds if not thousands of parents that pace in hospital rooms and hospital hallways waiting for the doctors to find a drug to treat their sick child and they fail. The doctors fail because the kid is infected with something that is resistant to antibiotics and by the time they figure that out they've already succumbed to the infection.

BONNIE ERBE: Lance Price is a micro biologist who leads the antibiotic resistance action center or ARAC at George Washington University. There's more than a bit of irony in his career choice because he was raised in Texas on his father's cattle ranch.

LANCE PRICE: I definitely saw the impact of industrialization, you know, firsthand.

BONNIE ERBE: Animal food production is a major focus of Arac's fight against antibiotic resistance called one of the greatest public health threats of our time. Arac's arsenal includes, research, advocacy and science-based public policy.

LANCE PRICE: The CDC conservatively, very conservatively, estimates that at least 23,000 Americans die of drug resistant infections each year in the United States. So when people talk about this coming crisis, this the end of antibiotics as we know it or the post antibiotic era, and they ask when does this happen? When do we get there? I have to say look 23,000 Americans at least last year got there already.

BONNIE ERBE: Think about this for a minute... If it were any other condition more disease killing 23,000 Americans each year, there would be a very different reaction. Think about terrorism killing
23,000 Americans per year. If it were anything other than antibiotic-resistance, Americans would be in a panic. But they are not.

BONNIE ERBE: The world health organization, the centers for disease control and many public health experts agree we may soon live in a world where antibiotics are no longer a match for drug resistant bacteria often called super bugs.

BONNIE ERBE: What is a super bug?

LANCE PRICE: A term that some of my colleagues don't like. I love it because people pay attention. Super bug means it's bacteria that are resistant to our best antibiotics. And sometimes these are bacteria that are resistant to 25, 26 different antibiotics.

BONNIE ERBE: The public health consequences of losing antibiotics are almost incomprehensible. Standard medical procedures and most surgery could become extremely risky and even a simple cut could kill.

LANCE PRICE: The best treatment there are for bacterial infections are antibiotics. But if those infections are resistant to those treatments then the infection can progress. The doctor is going to guess what they can treat it with and if that guess is wrong that patient can die.

BONNIE ERBE: Along with his growing team, Dr. Price studies how he got here, and how bacteria spread and evolve.

LANCE PRICE: What we’re using are these really advanced genomic techniques, so we’re sequencing thousands of bacterial genomes now, we’re trying to close a knowledge gap so we are trying to understand what percentage of the drug resistant infections that we are dealing with people today are the result of using or abusing antibiotics in food animal production.

BONNIE ERBE: Overuse of antibiotics in human medicine also plays a role in the super bug problem. According to the C.D.C. One in three antibiotic prescriptions is unnecessary and drug companies aren’t keeping up with the need for new antibiotics focusing instead on more profitable drugs. But the top reason?

LANCE PRICE: The abusive way that we use antibiotics especially in food animal production where we’re just using tons of antibiotics every year. And that is happening globally not just in the United States that is driving the evolution of drug resistant bacteria.

BONNIE ERBE: The most recent FDA study finds approximately 70% of antibiotics sold in the U.S. went for food animal production.

LANCE PRICE: We produce nine billion food animals in the United States each year. I mean that is a lot of customers for antibiotics. They give antibiotics for reasons what you would expect for treating sick animals but most antibiotics are being used to prevent diseases that are occurring because of the way we are raising animals. We crowd them together under stressful unsanitary conditions and animals get sick and rather than change that system we just give them antibiotics.

BONNIE ERBE: Arac studies how foodborne bacteria and how these resistant strains of bacteria end up at the grocery store. Dr. price, please explain what is being done in your lab here?

LANCE PRICE: We buy chicken from the grocery store and put it into the broth and we try to encourage the growth of the bacteria that might be on there. To figure out what the bacteria is we need to streak it out on to these petri dishes and based on the color that it comes up, we can differentiate
e.Coli, this pink is e.Coli, from other bacteria for instance, or another bacteria. And these are also potentially dangerous bacteria that are in the food supply but the one we are focusing on is e.Coli. We find about 90% of the chicken that we test has e.Coli. And e.Coli is an indication of fecal contamination. This was shipped to us by our colleagues in California, where California just passed some legislation that is going to be even more restrictive than current federal regulations in terms of antibiotic use in animal production. And so we want to see whether that is going to have an impact on the kinds of bacteria on the food products. We are trying to determine whether these changes in policy in terms of antibiotic use in animals can actually have an impact on the kinds of infections that we see in people.

BONNIE ERBE: As ARAC studies add more evidence of the link between overuse of antibiotics in food animal production and super bugs, even Dr. price is sometimes surprised at his find findings.

LANCE PRICE: Once we have the bacteria of interest on a petri dish like this, then we'll take one little colony, so a little dot which has billions of cells and we'll streak it on to another petri dish and we will then drop antibiotics on to it. And we'll look to see which antibiotics kill it and which antibiotics it's resistant to. The scary thing is sometimes we look at the petri dishes and the bacteria have grown right up to the disk on all of the disks so that candidates that that bacteria is resistant to all those drugs.

BONNIE ERBE: Is everybody who eats factory farmed chicken and beef at risk for developing resistance to antibiotics?

LANCE PRICE: You know, this practice of using drugs in food animal production, abusing antibiotics in food animal production puts us all at risk, whether we're meat consumers or not, this is an ecological problem. These bacteria move from person to person. They move from the contaminated meat source, to the cutting board, to the faucet, to the countertop. And if you are a vegetarian eating in a restaurant where they also prepare meat you can still get exposed to drug resistant bacteria starting in food animal production.

BONNIE ERBE: Dr. Emma Rosi sees the problem of medicating food animals from a different perspective. She studies pharmaceuticals in our waterways.

EMMA ROSI: The sources of pharmaceuticals include us using them in our everd day lives, manufacturing, the way we raise our chickens and beef in this country we use antibiotics for this and so another source of pharmaceuticals to aquatic ecosystems whatever is done with that waste from the animals if we spread it on the land or put it into a lagoon, antibiotics associated with that waste then can enter aquatic ecosystems.

BONNIE ERBE: We will hear more about Dr. Rosi's studies eye openin studies about hidden dangers in our streams later in the program. Back at the lab, Dr. price stresses the urgency for lawmakers, pharmaceutical companies, and the meat and poultry industry to address the problem. But he says, there is one group taking the lead.

LANCE PRICE: What we’re seeing is the marketplace is actually getting ahead of policymakers where consumers are empowered and their demanding of retailers saying we don't want products from animals at that time are unnecessarily treated with antibiotics. And so you are seeing more and more products on the shelves that have the claim raised without antibiotics or organic.

BONNIE ERBE: The poultry industry is nearing a tipping point big producers such as Perdue and Tyson are changing to never ever antibiotic policies. But this doesn't hold true for all food animal producers. And for the first time since the FDA began tracking antibiotic use on U.S. farms in 2009, antibiotics sold domestically for use in food producing animals have declined, down 10% from 2015-2016. But, still, it remains higher than usage in 2009. Some restaurants, even fast food restaurants,
are opting to only serve food animals that have not been raised on antibiotics. Prices encouraged but he and other advocates say that oversight and legislation is still needed.

EVERLY MACARIO: It's been incredibly slow to get any legislation passed.

BONNIE ERBE: As a super mom against super bugs, Macario lobbies congress for laws that will stop the overuse of antibiotics in humans and in animals. And there's been some progress.

EVERLY MACARIO: The good news is that some legislation has passed. Farmers are not allowed, it is against the law for them to administer antibiotics to their food animals for growth promotion purposes. So that is a huge win. Before farmers would go to the feed store and get as much feed as they wanted with the antibiotics already in them. And now, a veterinarian must provide a prescription.

LANCE PRICE: This is a reversible trend. In some cases. We've seen very clear examples where when we stop using antibiotics in animals, we will see drug resistant bacteria that are resistant to that antibiotic quickly decrease in the animals. We've seen examples where removing the drug from the animals we see drug resistant bacteria decrease rapidly on poultry products and then we see drug resistant infections in people drop at the same rate.

EVERLY MACARIO: There are so many problems in the world and this one we can fix and we know we can fix it because Denmark has been a model in this area. They've removed all of their antibiotic practices in the raising of their food animals in their farms. And because of that, the rates of antibiotic resistant bacteria have decreased. So their antibiotics are more effective than before. So it worked in Denmark. I don't see why it cannot work in the rest of the world including the United States.

BONNIE ERBE: The key to change is education.

LANCE PRICE: We need to raise the literacy around antibiotics and antibiotic resistance throughout the country. Throughout the world, actually. I think people need to recognize that these are valuable resources that we are on the cusp of losing and we need to use them carefully.

BONNIE ERBE: But it's not just over medicated animals and people. Drugs are also in America's waterways.

EMMA ROSI: We are surprised to find concentrations that were high. For example, Amphetamine concentrations, Ibuprofen, Acetaminophen, caffeine, antibiotics those are found in the surface waters in Baltimore.

BONNIE ERBE: The dirty trash filled stream is not a pretty sight but the trash you see is not Dr. Emma Rosi’s main concern. She is focused on what you cannot see.

EMMA ROSI: That gray color that you see is typical of sewage getting into streams. Untreated sewage, small amounts of it are getting into the stream. And the trash you can’t see are the things that I study. Pharmaceuticals and personal care products, the sunscreens, the detergents, the antibiotics, the antihistamines, the antidepressants, the makeups, all those things that we use in our everyday lives, they end up washed down the drain and they can end up in streams.

BONNIE ERBE: Dr. Rosi works at the Cary institute in Mill brook, New York. She is an aquatic ecosystem ecologist studying the health of our fresh water rivers and streams. That work brings her to Maryland. Dr. Rosi is part of a team working on the Baltimore ecosystem study, a long-term ecological research program.
BONNIE ERBE: Here in Baltimore, researchers collect water from eight different stream sites and then they test it for metal, chemicals, for personal care products, and for pharmaceuticals.

EMMA ROSI: The stream I brought you to today is Gwynns run part of the Gwynns falls basin, and it is receiving water from neighborhoods in Baltimore where there is infrastructure that is failing. So there’s sewage pipes underground that are leaking. The sewage in these pipes are supposed to go to another river basin over to a wastewater treatment plant, but some of those pipes are leaking. What we find on any given day in this stream is residues of pharmaceuticals and personal care products associated with the sewage that’s getting into this stream. The stream has high concentrations of drugs in it on any given day.

BONNIE ERBE: Dr. Rosi stresses Baltimore is not the only place where sewage mixes with fresh water. She says she could do her work in just about any city in the country, especially cities where the pipes and infrastructure are more than 100 years old. But the ongoing ecological study offers an excellent opportunity to create a more holistic perspective on our waterways.

EMMA ROSI: I will take a pharmaceutical sample.

EMMA ROSI: All right. The little sample is pharmaceuticals and we started measuring those a couple years ago but now we’re taking them on a regular basis and now we measure 105 compounds. We have been measuring the weekly water chemistry, the water quality every week in these watersheds to understand how urbanization affects the quality of water, what is coming out of the watersheds. We started detecting pharmaceuticals and personal care products in river ecosystems. The able ability to detect them has only come about in the last 10 or 15 years. Chemists were able to detect very low concentrations of pharmaceuticals and personal care products, so things like ibuprofen and antibiotics and birth control pills so I was really interested to figure out whether or not these drugs would affect the aquatic insects, and the bacteria, and the algae that live in the ecosystems.

BONNIE ERBE: The problem is not limited to dirty streams.

EMMA ROSI: There are places where it’s beautiful where there’s no obvious trash where we still find pharmaceuticals and personal care products because you cannot see those and they come out of wastewater treatment plants or they come out of peoples’ septic fields.

BONNIE ERBE: Some of the reasons why the drugs and chemicals are ending up in our waterways may be surprising.

EMMA ROSI: All these things are turning up in surface waters because we use them in our everyday lives and then we wash them down the drains and they get into wastewater treatment plants. But wastewater treatment plants are not designed to remove these pharmaceuticals and personal care products so they end up being discharged into our rivers and lakes.

BONNIE ERBE: Wastewater treatment plants are excellent at eliminating the debris they were designed to remove. But most of them were built when the technology did not exist to detect these products in our water much less remove them. In fact, the federal government doesn't require testing and hasn’t set limits for drugs in water.

EMMA ROSI: Europeans are a little bit ahead of us in this in terms of their implementing the technologies. You can upgrade a wastewater treatment plant to deal with pharmaceuticals and personal care products but the problem is it’s very expensive, it is a very expensive technology and right now we are not invest unwilling maintaining our wastewater treatment plants as they are.
BONNIE ERBE: Dr. Rosi hopes her research helps make the case for updating wastewater treatment plants as well as investing in infrastructure. But for now, she continues to try to understand what the compounds are doing to our ecosystem.

EMMA ROSI: In order to study the effects of pharmaceuticals we can go to Baltimore and we can measure the concentrations of the pharmaceuticals in the environment but to isolate the effects of one compound or a combination of compounds out in the environment is challenging because there are so many different drugs that are in the water and other contaminates.

BONNIE ERBE: So Dr. Rosi built an artificial stream facility at the Cary institute in upstate New York. She visits a pristine stream on campus. This 360° view of the stream shows a vastly different scene than the one in Baltimore. The quality of the water here is the polar opposite of Gwyns run. This is where Dr. Rosi collects what she needs to populate the artificial streams, rocks with and without algae, aquatic insects, and other organisms, leaves and bacteria.

EMMA ROSI: There are 20 artificial streams and it's like a bath tub with an island in the middle of it so the water goes around with a paddle wheel. We have 20 of them. So then we can add very low concentrations of drugs to some streams and keep some for reference and this allows us to understand what the effects are, measure the effects of these drugs very low and controlled concentrations on things like aquatic insects, how quickly do they emerge? What is their behavior? What kind of bacteria are in the streams when we expose them to drugs versus those that are not? Using this technique we can then isolate the effects of these drugs or look at the combination of drugs on aquatic ecosystems.

BONNIE ERBE: Dr. Rosi is passionate about her work. She continues to perform a range of experiments on the effects of various drugs on aquatic ecosystems. The results of her studies have proven that even at very low concentration, drugs change organisms.

EMMA ROSI: Highlights things we found is Triclosan, which is the active ingredient in antibacterial soaps, and in toothpaste is a generalized antibacterial compound, but it also affects algae and fungi. When we added that to streams that had active bacterial communities, we added Triclosan and concentrations that we found out there in the environment and what we saw was that the bacterial communities we did not kill the bacteria, there were still lots of bacteria in the streams, but they completely, fundamentally shifted which bacteria were there.

BONNIE ERBE: and that, according to Dr. Rosi is significant. In fact, the FDA banned the use of Triclosan in soaps and suggests people use regular soap or alcohol-based hand sanitizers. Another significant study was on amphetamines in the waterways.

EMMA ROSI: We detected amphetamines in streams in Baltimore and used the same concentrations we detected in the streams of Baltimore and added them to our artificial streams and we saw the aquatic insects emerged sooner, we changed both the bacterial communities and the algaeic communities when we exposed them to amphetamine. It really showed that these communities are sensitive to very low concentrations of these drugs. We have published that pharmaceuticals and personal care products are ecological disruptors, so they disrupt the ecology of aquatic ecosystems.

BONNIE ERBE: Dr. Rosi says it's not just her work proving that drugs we ingest impact the environment. She references a study on the effect of birth control pills on a Canadian lake.

EMMA ROSI: They added very small concentrations of the active ingredient in birth control and the first thing that happened is that the male fish of a certain species started showing up with ovaries and
testis. They were intersex fish and the next year there were fewer male fish and the population ended up crashing because there were not enough males to allow for the population to go on.

BONNIE ERBE: As a scientist, Dr. Rosi wants her studies to be used to solve this problem and there is a good reason to believe it could.

EMMA ROSI: Many environmental problems we have are hard to tackle, this one is one that we can actually solve pretty readily.

BONNIE ERBE: What can we do about it?

EMMA ROSI: There is a lot of things we can do about keeping these drugs out of the environment. We can stop flushing them down the drain and don't take drugs that are expired medicine and do not put them down the drain. We can fix our infrastructure. We can upgrade our wastewater treatment plants. We can not use drugs when we don't need them. So there's a number of potential solutions. Once they get out in the environment it's hard to clean them up. We should prevent them from getting in.

BONNIE ERBE: So here is what you can do to help get antibiotics and pharmaceuticals out of our ecosystems. Check with state police, local law enforcement and pharmacies about prescription take back days. Many will incinerate the drugs to make sure they never go down a drain or are flushed down a toilet. Dr. Rosi says many people just do not understand or even know about these hidden dangers in our waterways.

EMMA ROSI: The concern that I have as a research scientist is that the health of our aquatic ecosystems is linked to things that people care about. If it affect the bugs and the algae they are at the base of the food web and the food chains and they supply the food for fish, that people care about, or birds, that people care about, and so if we affect the health of our aquatic eco-systems that ultimately can affect our health as well.

END