

Antimicrobial Resistance on Family Farms, Africa

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Sarah Gregory] Hello, I'm Sarah Gregory, and today I'm talking with Dr. Christian Ducrot, a senior researcher at France's National Research Institute for Agriculture, Food, and Environment. We'll be discussing antimicrobial resistance on family farms in Africa.

Welcome, Dr. Ducrot.

[Christian Ducrot] Hello. Thank you for inviting me.

[Sarah Gregory] Your article is about AMR on small family farms in Africa. You're in France. How did you become interested in AMR in Africa?

[Christian Ducrot] In fact, I had been invited as the editor for a special issue on antimicrobial resistance of the journal on Tropical Breeding and Veterinary Medicine. And doing that, I realized that most papers were about the screenings for antimicrobial resistance on foodborne pathogens on animals and animal products (and mostly in Africa), with high levels of antimicrobial resistance, even on the wild animals. Also, there were some papers with interviews of farmers that mention use of antimicrobials without advice and without prudent rules, in fact. So these elements kept my attention and I discussed with other colleagues from CIRAD working on veterinary issues in developing countries, and we decided to investigate this question through already published papers and reports.

[Sarah Gregory] Are small farms a lot more common than big agriculture there?

[Christian Ducrot] In fact, what I know from Africa is that small farms—better say, family farms—are the dominant way of farming, in fact, in Africa. They represent a huge proportion of people living in rural areas. And in fact, intensive farms or more productive farms are less frequent, in fact. And all of these small farms, they have quite a diversified production with food crops, poultry, and livestock, and then for when the animals are used either for milk, eggs, meat. But also it's a part of their income or even their savings, and also they use these animals for transportation and for manure for as a fertilizer.

[Sarah Gregory] What is the situation on these family African farms regarding AMR?

[Christian Ducrot] The big issue for these farms is that in Africa, large territories are lacking an organized system to train and to advise farmers, for example, a network of veterinarians or paravets. So for larger farms, they can handle that difficult situation and they find advice elsewhere. But for small farmers, in fact, they just need to call on themselves to cure their animals without good training for that. And this is the main issue of that question, and we will see that it's important for a question of antimicrobials.

[Sarah Gregory] Okay. So this is counterintuitive—family farms, less big agriculture. One would think there would be very little AMR. What is causing this?

[Christian Ducrot] The main reason is that farmers use antimicrobials without good knowledge of that and without advice. So in fact, they are going to the market and they buy in the open markets (like black markets), where they buy various kinds of antimicrobials and they use them without good knowledge of the way they should be used. For example, they can treat their whole flock for prevention and even to promote growth of the animal, and not to treat specific animals.

They may not respect exactly the dosage, they may not respect the length for the treatment. So all of these elements are very important to increase the risk of resistance to antimicrobials.

[Sarah Gregory] And what geographic locations of these papers did you look at?

[Christian Ducrot] In fact, there were no specific locations because we analyzed all literature as we got, and there were good papers that collected studies that were in Africa, in different places of Africa. And also we had other papers we found about antimicrobial resistance and also about qualitative interviews of farmers about the way they used antimicrobials. So they were more common in countries with stronger research capacities, because in these countries there was more work done on these questions.

[Sarah Gregory] You talked about these papers. How did you gather the data and information you needed? Were they given to you? Did you search them out?

[Christian Ducrot] Reviews were already done on that subject, so we went to already published literature, in fact. And also we used the report issued by the World Organisation for Animal Health. In fact, they have a report about mentioning the quantity of antimicrobial sales every year. And in that report, they also mention illegal sales and also some undocumented imports of antimicrobials. So we used this report and also other papers that we found on the internet.

[Sarah Gregory] What kinds of livestock are affected by AMR there? You mentioned everything. Is that what it is?

[Christian Ducrot] If I analyze the studies that we found, they were dealing mainly with poultry, but there are also quite a lot of papers about cattle, sheep and goat, and even pigs. And even sometimes wild animals, because it's a bushmeat, in fact, and researchers investigated also the resistance of antimicrobials in that bushmeat. And they found resistance also in bushmeat.

[Sarah Gregory] How would that happen?

[Christian Ducrot] Well, I think it means that when you use a lot of antimicrobials on the animals, in fact, you can increase the risk of resistance on these animals. And then through the manure, all these resistant genes and bacteria are spreading in the environment and in the water, and then wild animals can get infected themselves, the same way as humans also can get infected through the contact with animals that were treated with antimicrobials and that what got antimicrobial resistance.

[Sarah Gregory] I see. So on that note, explain the chain from antimicrobial use to AMR to AMR in animal food products.

[Christian Ducrot] In fact, when you use antimicrobials in a non-appropriate way, you are going to increase the risk of resistance. Because, in fact, if we can make a parallel, the same way viruses can mute and escape, for example, immunity (we can see that from COVID for the moment), the same way bacteria mutes usually and some may become resistant to antimicrobials. So you have in the body of the animal, and you can just think about the intestine of the animals with billions of bacteria within the intestines, so we...you treat the animal with antimicrobials. So this antimicrobial is in the intestine and is going to kill a huge amount of bacteria, so it is going to kill the bacteria that are sensible to the antimicrobial and the bacteria will mute to the bacteria that were resistant, they will survive and will become very predominant. So this animal will have resistance to microbes in the intestine and is becoming a carrier of resistance of antimicrobials. And then, in the manure...when you touch the animal or animal products via the slaughterhouse,

part of this manure will become in contact with meat and with humans, and it can spread like that resistance of a bacteria resistant to antimicrobials from the animal to humans or to the environment.

[Sarah Gregory] That sounds like from touching and breathing. But does AMR impact people consuming these animal products?

[Christian Ducrot] In fact, when there's good cooking of products, in fact it will destroy the resistant bacteria. So no problem if there is a good cooking. Now before cooking the products, you touch it with your hands, so you can touch...you can get infected in your hands. And there are also some products that you don't cook. For example, you can drink cold milk and you can get infected like that also.

[Sarah Gregory] Ah, I see. Okay.

What types of illnesses are antimicrobials used to treat in livestock?

[Christian Ducrot] Antimicrobials should be used to treat exclusively bacterial diseases, but in fact, as I explained at the beginning, in fact farmers don't know exactly why their animals are sick and what is the disease. So when they see respiratory disorders or, for example, lameness or intestinal disorders, they are going to use the antimicrobials even if it's not appropriate. So in fact...the antimicrobials, in fact, in practice are used to treat a huge number of different diseases, even if it's not appropriate, in fact.

[Sarah Gregory] Okay. Your article mentions that although some studies show that antimicrobial use in Africa is declining, antimicrobial resistance in animal food products is still high. Why do we think this is?

[Christian Ducrot] Maybe we could stop saying that the decreasing use of antimicrobials is to be confirmed. Because for me, it's not sure because the antimicrobial use is not measured efficiently. It's probably underestimated, and you can't measure illegal sales. And illegal sales seems to be quite important in developing countries, like in Africa (in some countries of Africa).

[Sarah Gregory] Are there certain animals that are treated more with antimicrobials, such as chickens or pigs or cows? Or is it just, "here's a pill for everyone"?

[Christian Ducrot] Well in fact, I'm not specialized enough to give you a proper answer. What I know is that they are used for all these species, and I don't know exactly which proportion, in fact. I can't answer you more precisely than that.

[Sarah Gregory] Alright. I think we've sort of gone over this a little bit, but do you have more to say about how the illnesses are transmitted from livestock and food products to humans?

[Christian Ducrot] Maybe. What I can add is that in fact, when you have bacteria in the intestines that are resistant to antimicrobials and there is a special device, in fact, and these bacteria can exchange the resistant genes with other bacteria, even from different species and different families through...mostly through the what we call the plasmid. It's a bit of flagellin that is carrying the resistance to antimicrobials and it gets spread from bacteria to bacteria. So it means that when you have a carrier of resistance, it can even go spread further and more efficiently from bacteria to bacteria. So it increases the problem, in fact.

[Sarah Gregory] Are there certain bacteria that are more resistant to antimicrobials than others?

[Christian Ducrot] What I can tell is that resistance is mostly studied of foodborne pathogens because it's quite dangerous pathogens for humans. And so there were studies on *Escherichia coli*, *Salmonella*, *Campylobacter*, and on these bacteria we find quite a lot of resistance to antimicrobials. For the others, I can't tell you exactly.

[Sarah Gregory] Okay. I imagine veterinary access is scarce, as you said, especially in rural areas in Africa. You talked about the black market. How are farmers accessing and administering these antimicrobial medicines?

[Christian Ducrot] What I know is that you can find quite easily antimicrobials in markets everywhere in Africa, and they are open markets, in fact, even if it's forbidden because you should have the antimicrobials with a prescription. But in fact, in these markets you can go and buy antimicrobials, whatever you want.

[Sarah Gregory] So are farmers being scammed into buying antimicrobials that are counterfeit—that are not actually the real thing?

[Christian Ducrot] Well, well I don't know but I presume that farmers are not aware of the source of antimicrobials they buy, in fact. If they don't know that it's counterfeit, I don't know that or believe they don't know.

[Sarah Gregory] So with these black market ones that are possibly counterfeit, what would be the possible outcomes of using medications to treat livestock that aren't actually the real thing?

[Christian Ducrot] It may happen that it has no good effect if there is a real bacterial disease. It will not treat correctly the animals. This is a one thing. And the other one is that it's also mentioned that it is increasing the risk of resistance to antimicrobials, in fact, what is said in various publications.

[Sarah Gregory] What are some other specific challenges that these farmers face?

[Christian Ducrot] So the main challenge that I said already is that farmers have little access to good advice. This is one thing. But another challenge is that if the prevalence of resistance to antimicrobials is very high like it is now, it might result in the restrictive rules for use of antimicrobials and it would be very difficult for farmers because when they really need antimicrobials, they would not be able to get it. The rules are too strong, in fact. So we have to keep that in mind also. We have to work on the fact that farmers need to have good advice from veterinarians, and if they need to get access to antimicrobials when they need it very urgently, of course.

[Sarah Gregory] You mentioned rules. What are the regulations that are in place in Africa for antimicrobial use in livestock?

[Christian Ducrot] As far as I know, there are regulations that require a prescription made by a veterinarian to get antimicrobials, like in Europe for example. The problem is that the controls are scarce and the rules are not applied in the field. There is also another rule when you use an antimicrobial, it's called the "withdrawal period" after the end of the treatment. And the withdrawal period is a period at the end of a treatment, and during this treatment you are not allowed to sell eggs or meat or milk to the markets because there are still residues of the antimicrobials. And this rule is very important so that consumers don't feed residues of antimicrobials. And as we learned from these papers in Africa, that it's not respected most of the time.

[Sarah Gregory] Africa is a huge geopolitical place—lots of countries and lots of different kinds of politics. Not all of them friendly to sharing data and building health care infrastructure. The logistics of solving this seems daunting. Are there any ways you see to move forward and begin to solve this?

[Christian Ducrot] Well, I agree that it seems out of reach but we need to do something, in fact, and we plead for various complementary means. The first thing, we need varied global actions and we count for that on international organizations such as the WHO or the OIE (the World Animal Health Organisation) or the FAO. Because in fact for them, antimicrobial resistance is a key issue and a very important topic for public health. So they have a lot of actions worldwide and they can push the states that are not acting efficiently. So that is the first thing. The second one is that we think that to be efficient, we need also local actions that we expect to enlarge progressively. And these local actions should be done...should be built involving all the stakeholders, the farmers, and also the industry and the organization of over farming activities. And they should also include the question of training of farmers and the advice with veterinary services. And then the third point goes on the states are lacking a good support for these actions. Maybe we think that we could base also some actions on private support through public/private partnerships because private companies have an interest in the farming activities, and maybe they can provide the help on the long run for us to do that so antimicrobials will be used more efficiently, and also to provide advice to farmers. So that are the things we think that could be done.

[Sarah Gregory] Going back to antimicrobials for a minute, just for clarity, there are instances when they are needed, right? I mean it's just not completely out of the question to be using them. It's just how they're used, right?

[Christian Ducrot] Of course. Bacterial diseases require the use of antimicrobials if you want to cure the animal. For example, some infections of the respiratory tract, for example a bacteria called *Pasteurella*, or for example on the udder of cows (these are just two examples). Of course we need antimicrobials. It is very important to keep in mind that farmers need to get access to antimicrobials with a prescription and by a veterinarian, of course it is very important.

[Sarah Gregory] We've talked about the topic of One Health before on this podcast many times. I think you may have covered this a little bit in your previous answer, but can you briefly describe how that approach would be helpful in the case of AMR and family farms in Africa?

[Christian Ducrot] Yes. What I explained already that the antimicrobial resistance issue is important for animals, but also it is important for human health because we have the same kind of problems with the treatment of human diseases. So I think a concerted action between health authorities and agriculture authorities might be a good point to increase, in fact, awareness of the society concerning antimicrobial use, and also could involve the training of people when using antimicrobials. It's not only a veterinary issue. And also another action that could be done also altogether for humans and animals is that question of illegal sales of drugs. And actions could be done on both sides at the same time, in fact. So these are the points that I see that are very directly One Health issues, and I explained already in fact these antimicrobial resistance spread between animals and humans and vice versa, and are spreading also to the environment.

[Sarah Gregory] Was there anything that surprised you when you were looking at these papers about AMR in Africa?

[Christian Ducrot] I was very surprised to see that level of antimicrobial resistance, because in fact there's not so much intensive farming in Africa compared to other continents like Asian or European countries, for example, and also there's less density of animals. I was expecting a lower prevalence of resistance to antimicrobials. And on the contrary, based on available data of course, levels of antimicrobial resistance are the highest in Africa compared to the other continents. So I was very surprised.

[Sarah Gregory] Dr. Ducrot, tell us a little bit about your job, where you work, and what you like most about it.

[Christian Ducrot] In fact, I am a veterinarian. At the beginning of my career I was a veterinary practitioner, and then I moved rapidly to research and I became an epidemiologist. And why did I do that? Because I wanted to work on preventing diseases, in fact, better than curing animals. And so I became a researcher, and I am a researcher at the National Institute for Agronomic Research in France. And what I like in fact is understanding better the reasons why diseases are spreading, and after that what I like is trying to help at finding options, in fact, to control these diseases.

[Sarah Gregory] And what is France like in the Fall? What are some of your favorite activities? Is it beautiful right now?

[Christian Ducrot] I'm living in Montpellier in the south of France, close to the Mediterranean Sea. And so in Fall, it's very nice and the weather is still very good these days. It's cold in the morning, but very warm in the afternoon and it's sunny most of the time (not today). And because it's becoming a bit colder, the leaves are turning yellow and red. It's very nice, for example, in the vineyard around Montpellier. And what I like to do is hiking and riding my bicycle in the countryside and also along the seaside. These are my activities on the weekends.

[Sarah Gregory] That sounds beautiful. Well thank you so much for taking the time to talk with me today, Dr. Ducrot.

[Christian Ducrot] Thank you very much.

[Sarah Gregory] And thanks for joining me out there. You can read the October 2021 article, Antimicrobial Resistance in Africa—How to Relieve the Burden on Family Farmers, online at [cdc.gov/eid](https://www.cdc.gov/eid).

I'm Sarah Gregory for *Emerging Infectious Diseases*.

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