Title: Monitoring and Benchmarking Antibiotic Use

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- Hello, my name is Fraser Broadfoot. And during this presentation, I'm gonna be talking to you about monitoring and benchmarking antibiotic use and why it's such an important thing for you to understand. So a little bit about me. I work at the Veterinary Medicines Directorate and I lead on the antibiotic stewardship and the antibiotic usage activities. And that's within the Anti-microbial Resistance Policy and Surveillance Team. So this involves working with the different UK livestock sectors on improving the availability of antibiotic usage data and the availability of benchmarking data. I also work with various UK sector antibiotic stewardship groups. And these are groups that are really focused on encouraging responsible antibiotic use in the livestock sectors and also companion animal sectors, as well as focusing on preventing disease. So that's the main the key focus of these groups. We also collect antibiotic use and sales data which we include in our annual report which is called the VARSS Report. And I'm also part of various other initiatives. And one interesting one is an international antibiotic benchmarking initiative called the AACTING Group which looks into providing guidelines for the collection, the analysis, and the reporting of antibiotic usage data and benchmarking. And I'll talk about that later in the presentation.

So before we start, I'd like to thank RCVS Knowledge for editing this presentation. And I'd also very much like to thank Naomi Bull from the VMD, and Grace O'Gorman from NOAH who reviewed this presentation and provided some excellent feedback. So let's talk about what we're here to learn. So, there's a few things that we can be talking about. So certainly we can be exploring the why. So why is it important to monitor antibiotic use. Then we need to consider what exactly does need to be collected and measured 'cause there are lots of things that can be measured, and there are lots of different ways of measuring antibiotic use. We'll talk about where the data comes from for antibiotic sales data, as well as antibiotic usage data. And we'll explain how the data is analysed and it's remarkable how many different ways there are to analyse antibiotic usage data. Something that you would think would be quite simple is actually quite complex. And there's lots of different ways of doing essentially the same thing. So we'll start with the why.

One of the important things in terms of why you're monitoring antibiotic use is that you want to measure trends, you want to measure the effects of control measures, as well as you'll see in this presentation. And you've probably already aware there've been lots of activities that a bit that have gone on the livestock activities, livestock sectors have been very engaged in this area occurred at lots of activities relating to improving antibiotic use. But if you don't measure it, then how can you know whether those activities are effective. So it's always important to to measure things in order to understand them better. We know that the publication of data can drive behaviour, especially if it's used to benchmark antibiotic use. So if a farmer can really understand their use, relative to another similar farm type, then that can stimulate the vet farmer conversation and improve behaviours and stimulate positive behaviours. It can be used to identify risk factors.

So, if you're collecting data then you can understand, which routes of administration are the most commonly used ones. You can look at which active ingredients are the most commonly used. And then you can also look at the species where the antibiotics are the most commonly used and that can help mean that you can identify where the main risks are. And without collecting that data you wouldn't necessarily know that information. I think it's really important to take a proactive approach in monitoring antibiotic sales and antibiotic use. And this really inspires public confidence that this is a public health issue. And so it's important that we are acting and that we are, we are monitoring it and we are taking action and also also monitoring how are we getting on. So it's definitely important to provide reassurance. And target setting is an interesting one too, which I'll bring up later.

So we have, in the past we have used our sales data to set targets which affected, you may say we want to reduce by this much, over this many years. We don't tend to use the sales data for this so much. We're not using sales data targets anymore. But what we are doing is the livestock industries have set their own targets. So they've set sector specific targets relating to antibiotic use. And I'll talk about this later, but certainly the antibiotic sales and the usage data is really important in order to allow the livestock sectors to set these targets. So lots of good reasons, and benchmarking I have already already mentioned, and I'll talk about this later as well. So this is the kind of data that we see published. So this has been taken from our annual report which is called the UK VARSS report. This is looking at sales of antibiotics for use in food producing animals. And it's using a metric which is called the milligramme per kilogramme metric. And I'm gonna go into detail as to what that means. But it's effectively a measure of amount of active ingredient of antibiotics relative to the weight of the livestock population. And what you can see from this graph is that there has been some very significant reduction.

So antibiotic uses would use 45% since 2015. And you can see a lot of that happened between 2015 and 2017. So there's really been a lot of engagement in this area from the livestock sectors. The other important concept to consider is that the one thing is we look at total antibiotic use, but we also look at the use of specific antibiotics. And these are the ones that are called Highest Priority Critically Important Antibiotic. And you can see that the class is along the left here. So, the Highest Priority Critical Antibiotics are the fluoroquinolones and the quinolones in general. The third and fourth generation cephalosporins, or anything higher generation than that. So that could include fifth generation but I think any of those are being used yet. Colistin, or the polymyxins in general but colistin is the main one that's looked at. And what you can see is that if you look at the sales of these in the UK in 2015, compared to 2018, then there has been a 74% reduction. So there's been an even bigger reduction in these Highest Priority Critical Antibiotics, Critically Important Antibiotics. And that's because the industry has been really focused and we've been really focused on reducing the use of these particular antibiotic classes. And that is for protecting human health. And I'll explain the reason for that in the next slide.

So what is a Highest Priority Critical Antibiotic? There are actually lots of different definitions as to what is a Highest Priority Critical Antibiotic, but we tend to use the one that's, the advice from the AMEG group, which looked at this from a European context. So what did they consider? Well, they considered a few things. Firstly, they considered the need for that particular antibiotic, or that particular antibiotic class in human medicine. So is for example, is this particular class you used as a last resort antibiotic for a serious human disease, or weather where there are relatively few treatment options available for treating that condition. In which case, if you did get resistance, then that could be a real human health issue. They also considered the risk of resistant bacteria, or resistance genes spreading. So this, in other words, if you're going to give an antibiotic in an animal what is the likelihood of resistance developing to the bacteria within that animal? And then what's

the likelihood of those resistant bacteria or the resistance genes within those bacteria spreading from animals to people. So that's something that they considered. They also considered the availability and the use of antibiotics in animals. So they did take a holistic approach. So they considered the risks of resistance developing in people, and they also consider the risks to animal health of resistance developing in animals, and the availability of alternative antibiotics in animals. But I'll talk more now about the resistance transfer aspects of the second part of that list.

So when you look at bacteria, there are certain bacteria that are more veterinary pathogens. There are certain bacteria that are more prevalent in people. But the ones that they considered the most were those bacteria that can pass from animals to people. So these are zoonotic bacteria. So if an antibiotic commonly causes resistance say in a salmonella or a compylobacter, which is a zoonotic bacteria, then that means it's more likely that that resistant bacteria will then pass from animals to people. So that was something that they considered. Also, if you look at some bacteria such as E-coli, these are often commensal bacteria. So they don't necessarily cause clinical disease but they are reservoirs of resistance genes and they can pass from animals to people. And even if the bacteria in question doesn't cause disease then if the resistance gene is on a mobile genetic elements, such as the plasmid, and that's what this picture at the top here shows. If the resistance gene is on the plasmid then it can pass from one bacteria to another. And it may be that the bacteria that it was originally in is a harmless bacteria, like a commensal E.coli but then potentially that resistance gene could transfer to a more harmful bacteria and cause disease problems.

So if there's a resistance genes in a mobile genetic element like a plasmid, then that also is considered higher risk. So this is the infographic I've included a link at the bottom of this slide which was produced as part of this AMEC analysis. So the AMEC group has four categories. Category A, these represent human only medicine. So these products are only licenced in people. And then you have categories B, C, and D, and effectively the category D is considered the lowest risk group, in terms of resistance developing and spreading to people. Followed by category C, and followed by category B. So the idea is if there is a clinically effective option within category D, then that's the ideal one to choose. If not, then you move up to category C, and if not and only as a last resort, then you move to category B. And as you'll see in the next picture these are critically important in human medicine. And they should only be used where there is no clinically effective alternatives within category C and D. And there you should also be based on anti antimicrobial susceptibility testing, wherever possible. So these are the last resort antibiotics. And I'll explain a little bit more in the next slide as to why that is.

So firstly, the third and fourth generation, cephalosporins. So we said that they look at how are they used in people. So third and fourth generation cephalosporins are essential for severe invasive infections, such as acute bacterial meningitis. And secondly, the resistance can be, is often transferable so that can be transferred in plasmids. So those two things put the third and fourth generation cephalosporins into the highest risk category. The second one down is polymyxins, and primarily we're talking about colistin here. So colistin is used as a last resort antibiotic for treating some severe gram-negative infections often in these serious critical care patients. And also, colistin resistance has been shown to be present on a plasmid, on a mobile, there's a mobile colistin resistance gene that can spread on a plasmid. So, that's why colistin is put as a Highest Priority Critical Antibiotic. And then thirdly, you have the quinolones and the fluoroquinolones. And these are also used in humans for treating severe multidrug resistant gram-negative infections. And they do select resistance in Campylobacter and Salmonella, which as I said are zoonotic bacteria. So that increases the risk that the resistance will transfer from animals to people. So I hope that's given a brief explanation of what we're talking about when we talk about an HP-CIA. So an HP-CIA is

effectively a category B using the AMEC categorization. And there's a lot more detail in the links that we've provided on this presentation if you want to find out more.

So let's move on to where, so where does the data come from? So this is a very simple mapping out of how medicines are generally supplied to vet practises and to animals. So the pharmaceutical company will generally supply to a veterinary wholesaler that's not always the case. I mean there are some examples of medicines being supplied directly to veterinary practises. But in general, they're supplied to the veterinary wholesalers. The veterinary wholesalers then supply to the vet practise or to the Feedmill. And then the vet practise will then supply that medicine to the producer, or will write a prescription for the medicine to be delivered to the producer via a Feedmill, or a pharmacy, for example. And then the producer will then generally administer the antibiotics to the animal. Obviously sometimes as a vet, you've gone to a farmer and directly administer as well. So the reason why I'm going through this is just to explain what we mean when we talk about antibiotic sales data.

So we collect antibiotic sales data, and this represents what the pharmaceutical companies sell out to the wholesalers. And we have been collecting antibiotic sales data since 1993. So we've been collecting it for a long time, and it became a statutory requirement since 2005, and it's a really reliable and complete dataset. So we often one of the things that people look at straight away when we publish our VARSS Report is what, what is the antibiotic sales figure? That doesn't mean it doesn't have limitations. We know that it has limitations. So, not all antibiotics that are sold by a pharmaceutical company will necessarily be used. There can be some wastage, products can be expired, they can go out of date. So just 'cause it's sold doesn't mean it's necessarily used. And similarly, a product could be sold to a veterinary wholesaler in one year and used the following year. So just 'cause it's sold in one particular calendar 'cause we generally look at it in a calendar year basis, it doesn't mean that it's necessarily being used. One of the biggest limitations is that a lot of products are licenced for more than one species. So it's not possible to accurately work out how much has been given to each species using the sales data. So, here's a table that comes from our VARSS Report. And from if I asked you how much is given to pigs, it would be very difficult for you to know. I mean, there are definitely some pig only products. So you could tell me that, but a lot of the pig products are pig and poultry licenced products. And so you can't tell from this table how much has been given to the pigs, and how much has been given to the poultry. And it's even even worse when you're looking at cattle products or sheep products. So, okay, there are some cattle only products, and there's some intramammary products for cattle only and there are a few others. But the majority of cattle products will be lumped in this multiple food producing animal species. Because a lot of these, these injectable products are licenced for sheep, for cows, and often from other species too. And sometimes they're licenced for companion animals as well. So, the sales data is really useful. It's the most, it's a very reliable data set, and it's a complete dataset but it does have some limitations. And so increasingly what we're doing, is we're trying, we're working with the different sectors to get antibiotic usage data.

Now, most people when we talk about usage data assume that we're talking about data that comes from the farm, because that's where the antibiotics get used. And that would be logical. But generally, when you hear people talking about usage data there's a slightly looser definition that's used. So usage data, as long as it's split by species. And that's one of the key things then usage data can come from the vet practise data. So what's the vet practise is prescribed or delivered onto that farm, that's usage data. And also what the Feedmill has delivered onto the farm could also be considered usage data. So a lot of usage data does come from vet practise data. In order for this vet practise data to be useful though, it is important that it's split by species. And this is a particular issue for some of these beef farms which a lot of beef farms have sheep too. And so in order for you

to be able to work out how much has gone to the cows and how much going to the sheep, then it's important that data can be extracted. So we're recommending that practises do have separate sub-accounts on these mixed farms for the sheep and for the cows. And that when they prescribe a medicine, then they allocate it to that particular species. And that would allow then allow mean that it's possible to use that data to understand antibiotic usage. Also for using the vet data, it's also important to always link the products in your practise management system to a standard identifier. And the veterinary medicine number is the one that we usually, the one that we recommend for that. Because if you have products in there that free text then it's very difficult to extract that data. And then also it needs to be able to, you need to be able to convert it into standard units, such as millilitres, or litres of products, gramme or kilogramme of products, or in the case of boluses or intramammary maybe of number of items. So I'll talk a bit more about this later in the presentation.

I did want to highlight in this presentation that there are lots of different systems out there internationally looking into a monitoring antibiotic use, and looking into benchmarking antibiotic use. There are lots of different systems, and there was a website called the AACTING website. So there's an international group called the AACTING Group which looks into these, all these systems. And this website is really useful, it gives you a very good overview of the different systems that are out there, and a good overview of some of the different methods of monitoring antibiotic use as well. So I'd recommend you look at that if it's an area that you're interested in.

So, at beginning I did say that there are lots of different ways of monitoring antibiotic use a surprising number of ways. And I'm going to talk about, go through some touch on some of these now. So there are two essential components of any metric for monitoring antibiotic use. Firstly, the one that we called the numerator. And this relates to how much antibiotic has been given. So the common one that you see relates to weight of active ingredients. So that would relate to milligrammes of active ingredient. And I'll talk a bit more about how this works later. However, some other other systems look at number of antibiotic courses that has been administered, which is sometimes called a course dose. And then there are other systems still that look at the number of days in which animals had been under treatment. And this is usually called a daily dose. Sometimes these are, if you get records from farm records then you can measure the actual number of courses administered, or the actual number of days in which an animal was under treatment. However usually, the systems are using estimated figures. So these are called defined daily dose, or defined course days figures. So I'll just explain a bit what that means. Give us a simple example. So let's say you had a dairy farm and there were 30 intramammary lactating cow tubes that were used. So if you say that on average, when you treat with intramammary lactating cut tubes, on average you would get one per day to the cow. So say if 30 tubes were used, one tube is given per day, then that would relate to 30 daily doses. However, in intramammary course of a lactating cow course you would give three tubes on average. So therefore if you use the 30 tubes that would represent 10 course doses. And so this is a measure of either the days exposure, or the number of courses that are given. So let's move on to the next part.

The second really important part to consider is the denominator. So when you're measuring antibiotic use what you want to know is the, you need to compare it with the animal population. Because it could be the antibiotic use has gone up, but then it could also be that the animal numbers have gone up too. And so what we really to know is relative antibiotic use. So how antibody use has got up relative to the animal population. So one way of doing this is to look at the number of animals. So you could, in the example I gave before, you could look at the number of tubes per dairy cow. So in that case, you would look at the average number of dairy cows that are on a particular

farm. And then you could compare the number of tubes for dairy cow, or the number of courses per dairy cow So that's an example of using an animal based denominator.

When I talk about average number, just to explain what that means, effectively what that would mean if you were looking at the average number of dairy cows, you would look at the number of dairy cows on each day during the recording period, maybe that's a year. You'd look at how many dairy cows they were on each day. And then you take an average to get the average number. Another concept that you sometimes hear about is something called animal days. And effectively one animal day means that one animal has been on the farm for one day. So the idea of this is it takes into account the number of animals that are on the farm, and also the number of days that each animal has been on the farm. This is effectively the same as saying the average number of animals multiplied by the number of days within the recording period. So they said that so they are kind of linked.

Other metrics, there are also other metrics where people look at the number of animals slaughtered as well. The animal based metrics can be useful, especially if you're looking at a uniform age range, or uniform population. So an example I gave you with dairy cows, then it's quite a useful metric. So in the example, in the one I gave before if there were 10 intramammary course doses and there were a 100 dairy cows, then you could say that on average there's 0.1 course doses per dairy cows. So that's a useful metric in that situation. However, if you have a mixed population on a farm with a mixture of different ages, and or even a mixture of different species, then generally people use weight of the animal population rather than number. And that's where you get things like milligramme per kilogramme type metrics, which I'll talk about. And so, the weights that you use do vary depending on the different metrics too. So some metrics look at slaughter weight, they look at the weight of the animals when they were slaughtered. Others look at average life weight. So the average weight of the animals while they were alive. And then other other ones look at the average weight of the animals at the time of treatment. Most of these measures, they don't, you could ideally, you'd collect actual weights from the farm, but a lot of these measures collect standardised weight. So you collect the animal numbers and then you based on the animal type in the animal category, you assign them a particular weight, using national averages. So the other thing to consider is the reporting period. Generally, we were talking about annual reporting, annual reporting is what we generally looking at. Sometimes you can also look at usage at a batch level as well. But once you get this kind of data, then you can create lots of different types of metric. So, one of the common ones is milligrammes of active per kilogramme per year. And in this you could, the kilogramme could be based on a number of things, but in this case, I'm saying that the kilogramme is based on the estimated weight at time of treatment. And this is actually what we use for our sales data analysis. This is the milligramme per PCU methodology that we'll talk about next. You could also have a metric based on defined daily doses per a 1000 animals per day. Let's say that could be based on the average, average live weights when you're working out the daily doses, then how that would work is you'd look at the average dose for a particular product, which is often in milligrammes per kilogramme. And then you would look at the number of animals and you'd multiply that by the average live weight. And then you would estimate the number of doses that are administered based on that information. This is a metric that's commonly used in people where you have defined daily doses per a 1000 people per day. Again, they look at the number of people in total. And then they look, they take an average weight of each person and they use that to estimate the number of daily doses per people, per person, per 1000 people.

I should say the concept of daily dose, I didn't mention it earlier, but long acting products. If you give a product, a long acting product, say an injection that lasts for three days then that counts as three

daily doses. 'Cause even though you've only given one injection the animal is exposed to that antibiotic for three days. A third metric that I put on there is if you actually have accurate farm level data you can do something like actual daily doses. So the number of days in which each animal has been exposed to an antibiotic, and then you add that together, and then you divide that by the number of animal days. And you can make that into a percentage that effectively gives you the percentage of time in which an animal has been exposed to an antibiotic. That's a metric that's used by the laying hen sector. So I did tell you there's lots of different ways of doing this, and I hope that that's at least given you a flavour of some of the different methods that are out there.

So let's go into a bit more detail as to what we do without national sales monitoring. So this is called the milligramme per PCU methodology. And PCU is a slightly confusing term but it stands for Population Correction Unit, but it's effectively a milligramme per kilogramme type measure. So this is a metric that's been devised by the ESVAC group, which is a European group. And it's a calculation that's for designed for food producing animals. So it's an, we collect the amount of antibiotic that's sold a year. Horses are included. I know that horses are companion animals in this country but across Europe, horses are considered a food animal. So horses are included in this metric. And tablets are excluded. And that's because it's assumed that that the tablets are mostly given to dogs and cats. So tablets are excluded, and topicals are also excluded. And there's interesting one should topicals be excluded or not. I'm not sure about this, but if you look at the total weight of topical use, it's quite quite small. So they represent about 1% of the antibiotics that are sold. So even if you did add topicals they wouldn't really make that much of a difference.

So what we do is with the sales data is we collect we click from the pharmaceutical company. They tell me how many packs of each product that is sold. And then we convert this into millilitres of product, or units of products in the case of boluses or kilogrammes of product. So we convert it into the standard units. And then we look on the summary of product characteristics for each of the products that are licenced. And we take out the concentration which is in milligrammes per mil, or milligrammes per bolus, or milligrammes per kilogramme, depending on the product. So we take that figure from the licence summary, the licence document which is the summary of product characteristics. And then you multiply one by the other and that gives you the total amount of milligrammes that's used or sold for each particular, every single product and every single pack size. And then we add that together to get the final milligrammes. So there are sometimes as it can be a little bit more complicated than that. There are some products that you think if you look on their SPCs, they're coming international units. And in that case you need to multiply it by an international unit factor to convert the international unit into milligrammes. And there are also some products which are converted into products, a small number of products, for example penethemate is converted in the body into benzyl penicillin. And the benzyl penicillin is the what gives the anti-microbial activity. So in those products, we multiply by a project factor to get our final milligrammes which relates to the milligramme of active ingredient. And all of these international unit factors and pro-drug factors are defined by ESVAC. But ultimately, it's quite a simple calculation. We then get the total milligrammes and we divide this by the kilogramme weights of animal population. So this is based on national data. So we collect national statistics on the number of living animals, the number of slaughter animals in a calendar year. And then we multiply that by a standardised weight which is defined by ESVAC, which I'll show on the next slide. And these weights are intended to represent the average weight at time of treatment. Sometimes this can cause confusion, and 'll try and overcome that next. There are some adjustments made for animals that are exported or imported from other European countries. This is because some of the measures look at the number of slaughter animals. And if an animal has been reared in one country and then moves across the border and is slaughtered in another country, then you would want that weight to be assigned to the country of

origin, because that's where the antibiotics would have been used and vice versa. So there is some adjustment there as well. And as I've already mentioned, companion animals this is a food producing animal metrics.

So companion animals are not included in this metric. So here are the different weights that are used by ESVAC. So they've got different categories. I mentioned, some of them are slaughter animals like slaughter cows, slaughter heifers. Some of them look at the number of living animals, like the average number of living dairy cows the average number of cells, and then a weight as assigned. So often people look at this and say, well, a dairy cow isn't 425 kilogrammes, which is true. However, the weight there is intended to represent the average weight at time of treatment, and often, a lot of animals they're treated with antibiotics, sometimes in more cases when they're younger. So this weight is intended to represent an average rate of treatment, not an adult weight. There are not all categories over here if you look down the list, you'll see that laying hens are not represented in this weight, gamebirds are not represented either, even though we collect the the sales data from these species. So, it's not a perfect metric but it is a standardised metric. And I think has been a really useful one for for monitoring trends over time. And this is the annual report which is called the ESVAC Report. And this report gives us, gives you the milligramme for per PCU figures from all 31 countries in the European region. So it's a really, really interesting report. You can see the UK on the right hand side here. And there is a lot of variability between use, of use between different countries in the European region. But having said that there is also a lot of variability in species of variability and production types too. So you've got to take that into account as well. But I think this is a really useful report to look at. And certainly there has been, as we've seen in the UK there have been some substantial reductions across many countries around Europe. So things look like they're moving in the right direction.

I did also want to touch a little bit on this concept of industry ownership. So I've already shown you that there's been some very significant reductions in antibiotic use. And a lot of this has been down to the fact that the industries have taken a high degree of ownership and accountability and really responsibility for the AMR issues. So there's been this creation of these sector, specific groups, and the purpose of these groups has been to discuss responsible antibiotic use, disease prevention, all the important things that you need to consider. Biosecurity, husbandry, disinfection, and lots of things that these groups have to consider. The other important part of these groups is that they've been looking into collecting antibiotic usage data. So the way this works with the antibiotic usage data is that the sector association or the sector body have been collecting the antibiotic usage data from the farm businesses, or from the vets, it depends on the situation. And they've been collating that data. And then we're provided the VMD have been provided with these annual aggregated data. So we publish the antibiotic usage data in our annual report. But this data is being collected by the sectors themselves. It's not being collected by us. And the other important thing is that this data has fed into these sector targets.

So, as I mentioned before, the livestock sectors have been taking another example of taking ownership, and they've been creating their own sector targets. And as well as being based on, reducing levels of antibiotics, some of the targets are also much broader than in scope than that. So some of them are based on increasing data collection. Some of them are based on increasing training, monitoring health and welfare. So these were very broad targets, but certainly having the sales and usage data was important to feed into those targets. So this is a few examples. So the meat poultry industry were really the first one to, they were the first ones to collect and publish antibiotic usage data. And this has been coordinated through the British Poultry Council stewardship scheme. And you can see that there's been some very significant reductions. This shows you from 2014 and

certainly between 2014 and 2017, there was some really big reductions in the meat poultry sector. So, the broiler sector reduced by 64% since 2014, turkeys by 81%, and ducks not shown here but there'd been reductions of 88% in ducks too. And also some significant reductions in these Highest Priority Critical Antibiotics as well. And this is a graph showing some of the pig data. So the pig sector followed up. They created an electronic medicines book, which was AHDB Pork managed to create it and manage this system. And this is where farmers have to submit their antibiotic usage data quarterly. And you can see from this data that there's been some really, this graph here is showing the set the reductions in the sales of these highest priority critically important antibiotics. And there's been a really big reduction in these, especially in colistin. There was a lot of a big movement to get colistin usage down. And you can see that that's been really successful. And the pig sector has also reduced their overall use by 60%, since 2015 as well. And really this has created a lot of momentum so that the poultry sector and the pig sector were the first to publish their data. But with the creation of these sector targets and the fact we started publishing this data this created a lot of momentum. And you can see now that in our current antibiotic usage report, we have data representing not only meat poultry in pigs, but also the laying hen sector, gamebird sector, and the salmon, and trout sectors. And we're seeing some really significant movement in terms of antibiotic reduction. So the gamebirds sectors reduced 49% since 2015, just as an example. And one of the things that data collection has bought has created is also the ability to benchmark farms.

So certainly the electronic medicine book for pigs has this ability. And this means that a farm, this is a hypothetical example, but let's say this farm in particular was using 20 milligrammes per kilogramme. Let's just say, no, no, sorry. The sector average is 20 milligrammes per kilogramme. And this farm is using seven milligrammes per kilogramme. Then that shows that that farm is below average. But obviously in some situations the farms could be above average. And so it means that the farmer can understand the relative use, compared to similar farm types around the country. And this has been shown to really help inform this the vet farmer conversation.

So what are the key benefits of antibiotic usage benchmarking? Well, certainly monitoring trends is important. We've talked about this before with this if you don't monitor things then you don't know how things are going. And certainly as well as nationally, it's important, this is done at a farm level. So that the farms really understand, how they're going, where the things were improving, whether things are not improving. 'Cause then they can make changes if they don't understand that then it's harder for them to make the changes. It can also be used to identify these persistently high using farms. So it's important. I put the word persistently high using farms 'cause we're not talking about, if there is a particular disease outbreak on a farm then we certainly don't want antibiotic treatments to be withheld when they need it. So that's not responsible use. That's not what we're talking about here. But if there is a persistently high usage, every quarter, the usage remains higher every year, the usage remains high. Then that suggests that there might be a problem on that farm. And that will, should hopefully stimulate the vet and the farmer to have a conversation as to where things can be improved. So is there an area looking at the farm management of an area husbandry, looking at biosecurity. So hope, so the fact that this has been recognised means that you can have these, it's easy to have these conversations and encourage things to improve. Sharing best practises is also important. So looking at the low users, if you analyse that, you can try and understand what is it about these particular farms that make them low users. And you can get, you can encourage these farms to share best practise to share what they do that allows them to be a low user. So, what both of these things are important. And really, it's just to promote the vet farmer conversation. As I said, already provides a stimulus for change. I should say that it's important that you, when benchmarking that you only compare like for like farm. So there's no point comparing a calf rarer with a finisher farm, because there are different farm types. And so it's not very, very meaningful. So it's always

important you compare like for like farms. And the other thing I wanted to just mention is that the purpose of benchmarking is not to give a farmer a competitive advantages, it's not to have product being marketed, say this is a low antibiotic, low antibiotic product. That's not the purpose of this. The purpose of this is that it should be remained pre-competitive. And the purpose of this is it's a tool to help the industry reduce use overall and to help farmers understand their use and to stimulate the vet farmer conversation. And I think it's important that it remains that way.

So, there are lots of different benchmarking methods, and different sectors have created their own benchmarking methods, their own benchmarking tools. And I've put a few links on this slide. I should say that sometimes more than one metric is needed, because different, I said there were lots of different metrics, and they do often tell different things. And I'll give you one example. So if you look at the dairy sector, they have a milligramme per kilogramme metric, but they also have a metric based on average number of intramammary courses for dry cow and for lactating cow therapy. And the reason why they went for two different metrics is that intramammary treatments, although there were lots of intramammary treatments being given and courses being given, the amount of active ingredient per course, is relatively low when you compare with injectables and orals. So they tend to get a little bit lost in a milligramme per kilogramme metric. And so it was decided that these should be separated out into a separate certain course-based metric. Similarly, with sheep, the core metric is a milligramme per kilogramme type metric for benchmarking. But they also have an additional metric for monitoring antibiotic use in the lambs, in the young lambs, 'cause then in a milligramme per kilogramme metric, then obviously the volume of antibiotic you're giving to the lambs, the lambs less than one week will relatively low. So it will be a bit hidden in the metrics. So that's why it's recommended that that separated out.

So let's summarise, and I hope this has been a useful presentation for you, and it's really highlighted to you the importance of collecting antibiotic sales and usage data. And you can definitely get involved in that using your vet data, because that's an important source of usage data. We talked about what data is needed, where it is collected, how it has analysed. We've talked about the Highest Priority Critically Important Antibiotics for human use, and why it's important to reserve these as a last resort when using them in animals. We've talked about industry ownership on a number of levels in terms of the formation of stewardship groups, in terms the collection of data, in terms of setting of targets. And we also talked about antibiotic benchmarking and why it is so valuable in stimulating this whole vet farmer conversation. However, there are improvements that can be made. So we are working, looking to refine and improve our existing data collection systems. There are also some sectors where we don't have as much data. And you'll probably notice from the previous graph when I showed you the usage data, I didn't show any data from the cattle sector, or from the sheep sectors. There is data out there. We know that there is, we have reported on some datasets for data for cattle and we know that there are other data sets out there. But there's no one nowhere where this is all kind of being brought together in one. So, I mentioned earlier that AHDB have launched the electronic medicines book for pigs, but they have also not now just recently launched a Medicine Hub for cattle and sheep. And hopefully this will provide the means in which we can help to bring some of this data that is out there available. And if you want to get involved in sharing some of your practise data with the electronic, with the Medicines Hub for cattle and sheep, then AHBD would be very happy to speak to you. There are other things that we can do. So we've talked about how we can monitor antibiotic use. We are also interested in understanding getting more detail. So if you can understand reason for use that's really important. And I know some of the sectors are collecting some really good reason for use data, which improves our understanding. Treatment outcomes is an important thing to monitor. So, that might give us an indication as to whether there is clinical resistance out there as well. So that's something that we're interested in

better understanding. Certainly linking to, linking the sales, the usage and the resistance data. So the VMD, we do collect and report on resistance data and I'm trying to link these two things together is an important area to consider. And there is definitely some more scope to integrate data sets. I've mentioned before that the idea is, that antibiotic use is reduced in a responsible way and so that it doesn't adversely affect health or welfare. And secondly, the targets that was the approach that the sectors took when setting targets. But there is more that can be done to try and integrate some of these datasets on antibiotic sales use and health and welfare, and productivity as well.

So here, just to finish this presentation here are some references. So I've included a reference to the VARSS Report at the top, which is our annual report. That includes data on sales and resistance. This comes out around October, November, every year. So I encourage you to keep an eye out for that. I've got a link here to the AMEC Report which is the one that looks into Highest Priority Critical Important Antibiotics, and how these are defined. I've included a link to the ESVAC Report, and you can also find more details on antibiotic monitoring on this site as well. We did produce a guide to the milligramme per PCU calculation, 'cause we had lots of people asking us about this calculation and what it really means. So we produced a guide here. So I've included a link here. And then finally, I've included a link to the sector targets, which I've mentioned during this presentation. So I hope this was a useful overview. And if you do have any questions then we're always happy to be contacted. So do get in touch with the VMD and the AMR team is always happy to speak to people if they have any questions about some of the issues that are raised during this presentation. So thank you.