Title: Responsible antibiotic use in laying flocks

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- Thank you very much to Emma Youngs and John Tasker for helping me put this webinar together, very grateful for their time and expertise here. So my name is Henrietta Kodilinye-Sims. I own Surrey Poultry Vet a poultry vet in practise. And I'm a teaching fellow at the University of Surrey at the veterinary school there I'm in charge of the productional teaching and I'm also education lead for the BVPA too. So many contributors really to well for this and thank you also to to the editors and the reviewers as well.

So the learning objectives, on completion of this module you should be able to define the key areas in laying hen management when there's inappropriate antibiotic use you should be able to use the plan prevent protect principles that are really helpful way of actually of summarising and sort of categorising prevention things. Parenchyma facts in your, in your minds. You should be able to establish these principles for direct application of your flocks as well. And we're just going to show you how to calculate and compare antibody usage as well for those flocks. And finally the last trio of principles, Monitor Measure Manage a really helpful way of thinking about informing flock health planning, and trying to improve that client relationship in the future. Because if we can work together with our farmers and then really we should be able to convince them to try some new, innovative ways of managing their animals so that we can reduce the requirement for antibiotics.

So when do we use antibiotics in laying flocks? To be honest, they tend to be used quite infrequently to be honest, but laying birds may be more prone to bacterial infections during certain times. So for example, when they are coming into lesser point-of-lay that's what we call it. When they're naturally changing their feathers, or particularly if if there's environmental circumstances we're not expecting so extremely cold weather or extremely hot weather, things like that as well. So that's they're all going to predispose birds to bacterial infections.

Now the most common ones are Colibacillosis, which are are E. Colli bacterial infections particularly egg peritonitis really and Mycoplasma synoviae now that causes double whammy of infections. So it causes respiratory signs and joint infections as well but also will cause shell abnormalities itself and that's quite an easy one to spot because of the sort of range of critical signs that it causes. Brachyspira species can be a problem, particularly if it's in a farm that has got endemic problems so we know there's repeat problems there and it often will cause problems with their earlier lay rather later lay And then finally Erysipelas and Pasteurella. So these are two bacterial infections that often cause acute mortality They're seen sporadically in free-range flocks that are present in the soil. So they're quite difficult to get rid of once they're in a free range box, but fortunately there are vaccinations that we can use to prevent them.

So if we think about the key areas in the bird's life, where there's the potential for inappropriate or avoidable antibiotic use. We'll go through them one by one but the first thing we're going to start talking about is transfer of pullets to the site and settling in, as you can imagine that's quite a

stressful time in the bird's life really. They're being handled, they're being vaccinated, being transported and put in a brand new environment. There's a lot of mental and physiological stress potentially is going to go on there that if they do see pathogens on route then they're gonna be more susceptible to them. So we often see a check in body weight so sort of body wakes improving and then it plateaus off before it goes up again. So that's like a check-in body weight and they can off some because of the time of transfer it's also coinciding with their point of lay because that's when they're transferred at point of lay so that sort of timing double whammy together is quite inconvenient for the birds and it can really predispose them to infections. The enteritis is the most common effect of that. And we've also got to think about changes in environment and all the stress and the change in diet too because then there'll be putting on the next ration. And that's a big change to intestinal microbiota, we know that stress causes changes in microbiota and then we're doing the change in diet as well. So it is quite a really challenging time for the birds and the management has got to be right to get them through it which is perfectly possible but it takes a lot of effort. So there's often a pressure on the vet from the client to prescribe and feed antibiotics during this period because that's the easiest way of getting the birds through it in order to prevent enteritis and weight loss. But actually there's a lot of evidence against prophylactic use of antibiotics. I'm sure, you know, a lot of them already we know that antibiotic treatment actually triggers a dysbiosis. So we are definitely going to be impacting upon the bird's ability to fight off infections naturally. And therefore really management is the key and there's a really useful video by the Laying Hen Welfare Foundation. So please do have a look at that. The link is on this webinar, it's got some really good tips for farmers to manage those birds at transfer and keep them, keep their immune systems up.

So we look at the Plan. Prevent. Protect. We're going to go through this quite a lot during this webinar. They've got to make sure that they're using vaccination and good environment to really reduce stress those birds and protect those birds from infection. So you can get Erysipelas, Pasteurella, Mycoplasma and E.coli vaccines and they should all be given in rear and encouraged to be given in rear so that you're preventing those problems. Later down the line. They've got to try design the pens to reduce stress. So for example, you know, giving them options for shelter, perching enrichment, the more they can express natural behaviours the less stressed they are going to be. We talking about prevention now. Ensuring the drinkers nest boxes are really clean and tidy. The parasite burden is low they've got red mite under control cause red mite suck blood. So that's going to cause anaemia and again immunosuppression. And protecting them you can use oregano supplements and other supplements in the water and feed to try and encourage appetite and promote gut health. There's lots of good evidence of positive gut health effects and in vitro anti-parasitic activity but there isn't actually very good evidence for In-vivo anti-parasitic activity at this time. So you can use multivitamins as well to try and support the immune system and organic acids as well to really improve that intestinal environment and encouraging good bacteria. Just got to be a little bit aware that with all these products that you're putting in water lines you are potentially compromising water hygiene as well because if it's good for the gut bacteria it's probably good for the woodland bacteria too. So they do need to also follow through with a good water sanitising protocol as well to prevent knock on effects of trying to throw too much at them. It's also trying to see the birds, or the environment with good bacteria. So seeding the birds will be something like using Aviguard or Broilact for example so that you're really try to reduce the chances of bacterial translocation. Cause you are out competing them with a probiotic.

On to the next one now, bacterial peritonitis. So standard egg peritonitis there are a lot of you may have heard of when it comes to small flock holders infection. So it's usually called by E.Coli in the parent name. It can either be from bacterial translocation through the gut or ascending from the

oviduct. And I think back to your translocation from the gut it's something that people forget about with this because often it's called egg peritonitis. People just assume, therefore it has to be due to the reproductive tract. Whereas actually it doesn't, there's many ways of getting E.Coli onto the bird. They can breathe it in as well. So other disease challenges that may be involved is often quite complicated. They could have ORT underlying or Erysipelas Pasteurella or they could simply have enteritis that's increasing their susceptibility. So also need to look at other factors as well. It may not just be a really simple case of just bacterial peritonitis. Stress very, very important underlying factor with this it's a multifactorial disease anyway really so high worm burden and parasite loads they're going to really impact the birds ability to mount immune systems, bullying poultry terrible at bullying. So that is a major factor, heat stress or cold stress as well. The shed's layouts are important too. So if they're having to fight over nest boxes or they're having to wait to lay their eggs when really they should be laying there all stresses or also going to be predisposing these birds to. And don't forget the importance of water quality, you're potentially feeding the birds with pathogens if you've got poor water quality. So that's something that's very important. And usually you need a really thorough investigation because it is multifactorial often just as symptoms and postmortems and not enough, no they often need a full site visit so they can really assess all these other factors that might be contributing. And it may not just be one size fix all and and one factor it's, it's quite likely to be a whole list of things that needs changing. And I think it's managing those clients' expectations that it's unlikely to be a quick fix just giving them antibiotics this time is not going to prevent it for the next time. And that's a treatment it's not a prevention. Yeah. There's still those underlying factors there. The birds are still going to get ill.

So with regards to planning E.Coli vaccinations in rear is really helpful to try and prevent those E.Colli infections and thorough vaccinations with those other primary pathogens that can be in the mix too we've spoken about already. I'd highly encourage people to really use the production data from their previous flocks to try and work out what sort of pathogens these birds might be exposed to. So for example, that might be that, you're suspicious of Mycoplasma or something in the previous year based on previous data. Well, let's protect against that then so that we don't have it in the mix for next time. So with regards to prevention, encouraging clients to really monitor their birds to weigh them regularly and to look at egg size weekly, if possible so they can really trend how the birds are doing and they can get ahead of the curve as well. So if there's something starting to subclinical they're going to all likely to pick it up and they can really discuss with their nutritionist to try and make sure that those diets are optimised for those specific birds. If egg size gets too large, that can be stressful on the birds systems and also cause prolapses as well. It's not just body weight that's important, it's monitoring egg size as well that they need to remember so encourage clients to use lots of enrichment, to reduce stress and reduce likelihood of pecking of course pecking injuries are open wounds. That's another route for something like E.Coli infection. Providing dust baths for lice control and using things like diatomaceous earth inside those baths will really reduce those parasite levels as well. And ensure clients are keeping the environment and particularly the nest boxes clean as well is really important to reduce their exposure to pathogens. Calming aids can be used in times of high stress or if they're struggling with pecking there's been mixed evidence for them but I'd say they're well worth trying at times of stress. So we've got protection, using organic acids. We've spoken about them before, really good to to promote good gut health, just got to be careful and make sure they will just sanitise frequently. There are part if whether or not they're using supplements I would say because we want to really make sure that we're not feeding the birds E.Coli and other pathogens. So oregano oil again can be used to help promote feed intake. And if they do need to use antibiotics, need to make sure that they are chosen carefully based on culture sensitivity testing and the addressing all the factors so for example, if they are ranging out and about and it's

just extremely wet weather and there's lots of puddles in the range, and there's really no point in trying to give them a medication in water because they're just going to under dose themselves and that's going to predispose to adequate resistance. Equally if it's really dry weather and there's no water source, external water sources then they're going to be drinking a lot of water. So that'd be a really good time to prescribe an antibiotic that's that's in water. So look at the whole situation, look at the sensitivity look at the birds environment as well, and and their likely behaviour based on that environment. And just be aware that when you're ordering in feed medication you you're often buying it in larger quantities. So you may have some excess feed medicated feed that the birds are going to be eating when they don't need it. So I'd say, if you can do an in well water medication you can be far more, you can control the dosing far better. I would suggest.

So we're under more and more as an industry to prevent beak trimming. The problem is that birds can be quite cannibalistic. The less birds have beak trimmed, the more likely we are to, to have wounds and cannibalistic behaviours, if the birds are not well managed they've really got to be well managed in order to prevent these kinds of behaviours. Obviously when there's even influenza outbreaks and we're in a housing order, then, however we try and manage the birds in that acute change in environment for those birds is potentially going to kick off some further pecking. So birds that are not beak trimmed this period they're going to struggle. So antibiotic sprays often used inappropriately I would say they're often use either prophylactically or they use the one-off they're not used as a proper course. I'd suggest more antiseptic sprays better than antibiotic sprays. And you also got to be aware that potentially you're trying to nurse these birds properly, would be good for their welfare. But actually when farmers are very busy just spraying them and chunking them the hospital pen may not actually be better for their welfare. You know, that you're taking them out of their flock that's causing a stress to them. If you're leaving them with women's as well then that may be leaving them in pain or distress. So although it's difficult for the farmers it might actually sometimes be more appropriate but colouring is is the best option. So once the behaviour becomes established it's also very difficult to stop it, which is makes management on farm very difficult. So really prevention is better than cure. So encourage clients to really monitor their feather cover there's various feather covering or feather grading information and charts that are available. I think the breed companies are a good place to go for that. And you can use for the cover as well as the egg size and bird weight in that flock health planning discuss your lighting plans as well as the birds are brought into lay and the pullet reps. So that's the breeze breed companies. They use you really good source of advice here as well and about the light intensity as well, not just the number of hours, I'd say it's important. To encourage clients to pick calmer breeds. They are breeding better or more calm behaviours into these birds. So I'd encourage them to explore that as well.

So ensuring that the range is well-drained got good cover is appealing to the birds. It's going to encourage them to range. Now we need to really encourage them out of their shed into the range so that they can be away from each other. And they're not sat in there in the shed board pecking, get them out, really encourage them using planting up the range with trees and providing other cover for them as well and long grass, for example. And finally enjoying the diets appropriate. If the diet is not nutritionally balanced then the birds will look for other sources and that includes feathers and pecking too. So don't underestimate diets involvement in this as well. So really focus on providing environment enrichment early as said prevention is better than cure. We don't want them starting to get the idea of pecking on the rearing site that's going to make them a real challenge during laying. So frequently changing toys to prevent them getting bored. They're very intelligent species. So just dangling so many pecking blocks in there is probably not going to enrich their lives enough. You've got to keep trying to change it up to keep stimulating them mentally. Encourage frequent worming treatment as well. So ideally I'd want to prefer farmers treated based on where make

counsellor, regular women count screening and treatment if required, that's going to help ensure that faeces are well-formed because if they have parasites and they end up with some soft faeces and diarrhoea there will be some faeces at the back of their feathers. And that's going to be like a red shining beacon to many birds around them. And they can turn to try and try and peck at that. Encourage early uses of calming aids and those high stress situations, and do have a look at this video by the Laying Hen Welfare Foundation on pecking prevention and other distresses, the link is available on the webinar.

Next, we're going to talk about enteritis. So this can be caused by bacteria viruses, protozoa or quite often actually a combination as well. Sometimes it's just simply a dysbiosis but other times there's a really overwhelming challenge of a primary packaging. It's really useful to look at culled and performing testal scrapes. You do both intestinal scrapes and wet snares as well for microscopic exam because motile protozoa are going to be picked up better on wet smears whereas the static protozoa that burrow into gut walls and cells then the better off picked up on the testal scrapes. So many of these problems are going to lead to secondary issues so they might get primary enteritis and then secondary peritonitis they'll have dirty eggs as well. And that's going to cause downgrading of eggs from a class A to class B and can potentially stimulate back pecking as well. So it's really important to try and prevent our clients usually want antibiotics immediately which I can't blame them because birds do often look pretty sorry for themselves. They're huddling. There may also be some sudden mortality as well and don't forget things like water quality and feed factors for example either quality of feed or consistency and how it's presented and feed interruptions as well. If there's a breakdown, for example, and the environment they're really important underlying factors because any of those are going to have acute effects on the intestinal flora or or expose them to primary pathogens.

So with regards to planning is enteritis something that happens in your client's flock. Does it happen repeatedly? Does it happen at specific times in the flock or during specific seasons? Challenge your clients at the end of a flock to look back and reflect and think actually what happened or what went wrong or what went well as well so that they can use that as part of the flock health planning for the next flock as well. And I think that's a really important preventative strategy. So often the flock goes out and everyone goes, Oh, they gone. And then they're in for the next one. But actually they've got a six week turnaround usually between flocks to really think about what happened what went well, what were badly so that you can use it to influence how you're going to deal with the next flock. So encourage use of probiotics such as Broilact and Aviguard to proactively reduce risks of enteritis particularly use a transfer or following any antibiotic use to receive that gut bacteria discuss coccidiosis vaccination if they haven't had already. So most commercially we put it to be honest are well vaccinated, including for coccidiosis, but but it's worth with asking the question and ensure those drinker lines in the housing is well cleaned between crops because you do not want carry over of pathogens between you don't want the new birds being exposed to pathogens unnecessarily. You can test the water using microbial or for chemical tests. So just take a water sample and send off the lab to ask for type of viable counts and colour forms. That's really useful and identifying common issues. And if they're on a borehole then we know that's more risk of bird health that means water because it's likely to contain more abnormalities like metals or, or imbalance of salts or bacteria as well.

So we've already spoken about the drink lines of the poultry house but try and encourage these organic acids as well to promote gut health and potentially oregano oils too. Just, just remember the potential consequences of poor water hygiene of that. So follow through with a good sanitizer. Second to last one, we'll talk about poor eggshell quality. Now this is often actually underlying

you've got infectious bronchitis virus or Mycoplasma challenge that you've that you just haven't found haven't identified so often it could be quite difficult to convince the client that actually there's something else underlying. It's not just nutritional problem. There's some really useful charts available that show the different eggshell quality defects and they tell you the differentials for each type of, of defect. So they're well worth having a look at as well and having them with you in the car astrology can be really useful in diagnosing or ruling out certain bias challenges. Just be aware that with serology you need about two weeks to serum convert. So you may have false negatives. If the condition is very acute or the birds simply haven't converted yet. So it's always worth if you cant take paired serum samples, obviously if you can't afford to take some now, wait, two weeks why don't you take a shed that is affected and a shed this unaffected, because you may see a difference between the two and can extrapolate but just you need to think very carefully about the results you're getting, however useful test it is. Now calcium levels can often be quite difficult to assess and very difficult to address as well if they're depleted. But we'll talk about that in a minute.

So flocks are in a high challenge area for potential pathogens like infectious bronchitis then making sure that they're vaccinating, not just in rear but also in lay can be very helpful. and there are some vaccines that are allowed to be given or licenced to be given to birds during lay and often really high-risk areas they might need to be given frequently in lay not just once. So with previous flocks is a tested Mycoplasma positive then birds should be vaccinated in rear before they get to the laying site. And we're looking at calcium really ensure that it's not just calcium, that's gotta be right. It's gotta be a calcium phosphorous phosphate ratio and that the phytase as well and vitamin D are also appropriate. So it's really helpful to consult nutritionist and bring them in as well through the add value to to the health advice of these birds. Don't overfeed calcium it can be tempting to just throw calcium out there but actually it can reduce egg quality as well. So just be aware of that. Now we're talking about protection. So early introduction really frequent eases of additional calcium sources can be crucial because by the time problems are obvious, then actually additional dietary calcium can make little impact. So ensure both calcium grit the mechanical grit is available there are two different types of things, So calcium grit is there to provide calcium and it will sit as a depo in that gizzard and mechanical grit is there for mechanical digestion. So it will help grind up the calcium and make calcium available but it also help grind up other particles in the feed as well in order to aid adjustment of those two. So they are mutually exclusives. Now having a good ratio of find a large possible calcium is the most ideal situation to provide. So about a third fine calcium and two thirds large particle calcium, and it helps maintain the depo of calcium in the gizzard, but also helps ensure that calcium is available when it needs to be for that bird. And the bird will be laying down it's eggshell and calcifying its eggshell late in the afternoon evening overnight. So they do need to make sure they need to have calcium available in the afternoon. Now vitamin D supplementation is going to increase calcium, calcium is options, so that can be given as well. And just to always remember the, although it is difficult and free range laying farms bio security is really crucial in reducing the risk of Mycoplasma introduction. That's going to predispose to these poor eggshell qualities.

So last but not least drops in egg production. Another the final reason for often inappropriate or avoidable antibiotic use. So there's many possible causes. You've got poor early weights or birds coming into lay far too quickly, drops and feed intake, environmental stresses, worm burden and other pathogen challenges So for example, viral bacterial protozoa these are all going to predispose to to production drops because the birds are going to require those calories. They're going to need them elsewhere for fighting infection. So you gotta really investigate thoroughly because it is so multifactorial As I've said already and frequently antibiotics won't help because you haven't fixed those underlying factors and all they'll help temporarily and it'll just come back again. So I would strongly recommend the full investigations for viruses for pathogens and environmental aspects take

place so go and do a site visit and going to have a really look at all those other risk factors and take some swabs as well for PCR, blood samples, astrology. They can be very useful as well. Just remember what I said previously about alarm making sure there's enough time for serum conversion so you don't get false negatives on the serology. Check that you're using the right source, the right tests. So for example you don't want to use wooden swaps for performing PCR tests. That's not going to work. You need to use the plastic round swabs for that and make sure you're testing the right type of birds as well. You want to test birds that have got the most severe disease because they are are most likely to show specific conversion. So then have a look. Is there actually a true increase in seconds or is it that there's poor eggshell quality that's causing cracks? Or is it that the the eggs are just dirtier or there's some blood on them due to due to pecking or diarrhoea. Now, if you have high numbers of floor eggs why is it that the birds don't want to go into the next boxes? Are there red mites that are going to bite them when there in the nest boxes So they don't want to go there? Is there any, is there too much competition for them? Is the lighting and privacy not good enough for the nest boxes? The birds would actually rather lay on the floor. So if you're seeing floor eggs and that's causing an increase in seconds, then have a look at the whole picture always review the history from previous flocks. Is there a specific disease that actually has occurred before that you can vaccinate against that's going to prevent some of these problems. Are there particular drops at a specific time points in the laying cycle as well that might point to nutritional underlying causes and you can bring in a nutritionist and look at supplementation potentially to try and get them past it. So data collection through the flock can be really useful to guide actions and try and set up early interventions rather than letting problems get out of control. So assessing body weight at placement, so sorry at transfer and then frequently throughout the flock or so using the egg wakes, egg weights sorry and egg production figures as well. There are parameters that are really useful in guide and inform rational changes.

Don't just stick to the plan because the plan may not suit those birds in that situation. Routine infectious bronchitis vaccination and regular maybe required to the laying cycle again because they can cause production drops as well try and avoid vaccinating birds when they're coming into lay or are nearing peak production because they're two quite stressful periods anyway for bird system. And you may get a less efficacious reaction to the vaccination at that point. Now with God's protection, trying to make sure the client is routinely submitting either burst post-mortem for worms screening or or faeces for well-made monitoring worm burdens can cause massive drops in egg production do not underestimate the effects of these internal parasites. With regards to laying ability Capillaria can actually not be seen with the naked eye. When you're looking at postmortems you do need to perform a test and a wall scrapes that because they are too small. So when you're doing post mortem examination if you can't see anything, if nothing's obvious and do some wall scrapes as well and have a look at Capillaria. Supplements can be really helpful if they if they used correctly and practically. So for example, during times of heat stress then encouraging feed intake and fighting electrolytes is can be really useful for those birds. Heat stress is another good common cause of production drops and encouraging our clients to contact you quickly. Don't wait until the drop has become chronic in the first instinct of a drop. Do get encouraged them to contact you? It might be just a simple phone call saying actually, Oh there has been a heat wave this this week perhaps that's the cause that's fair enough. But it might be actually that there is not as simple as that and something that needs investigating before it becomes too chronic. So let's decide you do need to treat these birds antibiotics, which medicines are you going to use? So you're going to have trouble convincing your client to treat with anything other than something that has a zero day egg withdrawal. Let's the honest, and that leaves you with a few options.

So if you look at the table, this has been summarised in the European Medicines Agencies guidelines and categorizations of antibiotic. So we should really be starting with the drugs in category D first of all. So narrow spectrum penicillin the penicillin G is licenced for the zero day egg withdrawal. If there's evidence of resistance to that, for example based on culture sensitivity testing, then I look at category C and I'm with Macrolides and Pleuromutilins such as Tylosin and Tiamulin are all licenced with zero day withdrawal. If there's resistance to them then a category B Colistin has zero egg withdraw but just be aware that many of the retailers will not accept eggs from birds being treated with Colistin. So you don't have too much choice, I would say but culture and sensitivity testing is really important and thinking carefully about using the cascade as well. Now, if you have a look at B the RUMA's taskforce report from 2020 the summary on the attaches cyclins accounted for about 60% of the uses in, in laying hens. And I suspect most of that was used in laying hands before the onset of laying. So in rear about one if you have a look at the next biggest class that will be a Tiamulin that was used. And that's probably because it's licenced for Mycoplasma same with the Macrolides in the next class. Again, that's licenced Mycoplasma. So you can see E.Coli Mycoplasma infections clearly have predominated in 2020, and they'd be the drugs that are most most frequently being used. So not going to focus too much on these calculations but they are here available. If you need to, to work them out in a nutshell. And there's a good tip. Do you make sure you prescribe the quantity of medication required rather than by the bag or by the pot. And do you try and encourage clients to return on this medication for disposal. So they're not just kept in the back office and given potentially willy nilly without your knowledge at another point. So when you're calculating in-feed medications as well do you make sure you calculate the amount of medicated feed required based on the expected food consumption and weights of these body of these birds so that you minimise any excess medicated feed that's made. Females are actually available now to make medicated feed by the by the bag rather than by the tongue. So there's no excuse nowadays for ordering by the tongue and having a massive amount of excess medicated feed. So measure dosing units achieve far more accurate dosing than using Header Tanks. And I would strongly recommend clients use these automated medicating units, for example, the dosatron. But if you do not have that luxury and you're stuck with using header tanks, there's a few rules you have to remember to really make it work.

So you've got water coming in at the top of the tank and filling up the tank and then you got water going out to the bottom. Don't forget there's always going to be a little reservoir of water underneath the water out pipe. Underneath this lower sucks aspect that's going to sit in that tank and the lower, the water out pipe, the smaller that reservoir is going to be. Now whatever medications go into the bottom and end up in the reservoir, they going to be wasted. All right. So we need to take into account of that and we're working out the amount that's going to be put into the medication tank. So next thing to do is think about how long a time period do you want to give this medication over? So let's say it's eight hours. For example, you need to work out the amount of water those birds are likely to drink in eight hours and you're going to fill that tank up in the green section fill it up with that quantity of water. And then you're going to switch off this this water in pipe. So the burst should drink up all the green water that's medicated. You do have to have to know the estimate, the amount of water in the yellow reservoir section and medicate that as well as the green, because otherwise you're gonna be under-dosing those birds. And then when the tank has been drunk out affectively then you're going to switch off the water out supply. You're going to drain the tank. So ideally tanks should have plugs at the bottoms. They can be completely emptied. And then you've got to switch back on the incoming and outgoing flows again with and let it fill up with just plain water. So do not ever allow tanks to continuously refill or the solutions can be continuously diluted and tanks should ideally never be allowed to go completely empty. So if you

think if you calculate the amount of the birds are going to drink, for example in eight hours, I would try and get it into them. I would go and check though that tank in about six hours or seven hours, really try and make sure that birds are never going to go thirsty. Don't forget that different weather is going to have different effects as well. So in the summer you might find the birds drink up your eight hour volume in six hours. Clients have got to be very vigilant, make sure that those are never going to be running out of water. So with regards to monitoring all the birds under your care have you made the right diagnosis as well? Have you considered all the alternatives? So bacterial, viral, protozoa the non-infectious that do need to do further tests to try and diagnosis this underlying causes? Can you select the best and correct antibiotic dose or the rate or the regime and duration as well? Have you thought about all the alternatives as well? So have you thought about diet and management changes? You thought about vaccination as well to prevent these recurring long-term. Is it a condition that's likely that is actually responding to treatment or is it not responding? If it's not responding, then you probably need to go back and think about what are the underlying factors that could be there that may have been missed or not contributing or ones that are a lot best and now there are new underlying factors that have occurred. So for example, has the weather changed since since all this began? Now really a acute time infectious situations may need really immediate treatment but cultural sensitivities may may indicate different, different antibiotic choices. So you can use direct sensitivities potentially to get rapid results. So if you send us off to the lab and just tell them you're really desperate result is there a chance to diet sensitivity? I'd say that that evidence is better than nothing. Then you just giving an antibiotic and guessing and if you can get results of the lab quickly then you can get those sort of those preliminary results back in 24 hours while you wait for the full sensitivity profile not saying to rely on them, but they can be useful and really highly infectious acute situations but I wouldn't use that method routinely. So are you measuring the antibiotics usage on this site? And we'll talk a little bit about that on the next slide and how to work out antibiotic use but this is usually published as daily doses per a hundred chicken days at risk sounds very complicated but that information is provided directly to the British Egg Industry Council, not a factory, just it represents an average of the number of daily doses administered per bird over a hundred day period.

Now, any usage where they mg/kg dosage does not match the licence values has got to be justified as well. So if we're measuring antibiotic usage in the layers if you're looking at a daily usage it's going to be the total mass of antibiotic in milligrammes over bird days. And over a year, it's going to be that total mass in milligrammes of antibiotic over the mean daily population of birds that are in there multiplied by 365. So for example, a flock of 5,000 chickens treated with an antibiotic for three days, it's going to be about it's going to be 15,000 daily doses. It's 5,000 times by three. Now the standard reporting metric is daily bird doses per hundred days at risk. If you want to learn more about that, then look at the RUMA's measuring antibiotic use link on the on the page.

So finally, we'll look at managing this antibiotic usage. Now flock health planning is really, really important good flop health plans that actually tailored to the site. They're not just generic and for the species but tailored to site, come to the enterprise as well will really help clients engage with it and achieve those lower disease levels. They include their own chromic antimicrobial usage as well so that they can, I've got something to aim for and set some really smart, achievable targets. They've got to be achievable in order to achieve this prevention reduction. You've got to really encourage clients to engage with it and just try and really think positively about it. Manage clowning client's expectations because it does take a lot of time and work and planning to really achieve many of these prevention and protection protocols. Aim for really small achievable reductions so that you can keep clients on board with the process that's that's ongoing and then set the next smart target for the next period. I think we've really got to think that little and often and tortoise is going to win

this race rather than the hare. So educating clients about antibiotics and best practises is also obviously really going to help and encouraging collaboration. So running layer client groups, trying to educate them and get them to collaborate with each other. You're trying to get them to come up with the ideas themselves as well, running workshops like that, instead of just dictating to them like I'm doing to you now that I should really help get them invested in the process, along with you.

I think there's a lot we can do together further reading these are really good useful guides to have a look at so I strongly recommend you have a look at these or and some of them you can download as well just have them on your phone, in your downloads stored files that you can refer to them as and when you need to or print them off and keep them in a file in your car, they're terribly useful. And here are here are the references.

So thank you so much for listening. Realised it's been a bit of a mammoth and information overload and we're quite aware that there's a lot of writing on this slides, but hopefully, they are actually resource for you to use as well. So don't put them off keep them with you we made them as a resource, not just a background to this talk, so thank you very much for your time.