Using medicines responsibly

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The responsible use of medicines is a key area in which veterinary professionals can have a positive sustainability impact, for animal health and welfare, public health and environmental wellbeing. Here we summarise the two main issues associated with the use of veterinary medicines – antimicrobial resistance, and medicine residue impacts on the environment, and suggest a framework for veterinary professionals to leverage their unique influence to address these issues.

Veterinary medicine use is a sustainability issue, in the broad sense to include people, animals and the environment. Medicines can impact these One Health 'domains' in two main ways – by promoting resistance in bacteria and other infectious agents, and secondly and more directly, as environmental residues.

Antimicrobial resistance

Antimicrobial resistance (AMR) is amongst the most significant and pressing challenges facing human health. Amongst the resistant microorganisms causing the biggest problems are resistant bacteria. Antibiotic resistance has been described as the 'Silent Pandemic' for good reason – it is a growing problem, with predictions that it will claim 10 million lives a year globally by 2050 (O'Neill, 2016).

Amongst the drivers of AMR is antibiotic use in animals (Tang *et al*., 2017), and use in animals is also a precursor to diffuse environmental pollution with antibiotic residues, resistant organisms and resistance genes, with human, animal and environmental repercussions (Moran, 2019).

In people, AMR is a risk to both our health and our global economy. We can be exposed to these infections in clinical settings, via animals, our food and the environment, all thanks to the 'resistome' – the reservoir of resistance genes accumulating in our environment, both naturally and as a result of selection pressure, which bacteria of many different taxa can 'dip in' to, to share and exchange genetic information.

In our domestic species, AMR can have animal welfare consequences, and antibiotic resistance itself can actually increase medicine use as we deploy longer courses or different antimicrobial agents to tackle intractable infections. Other forms of drug resistance pose significant welfare problems, such as anthelmintic resistance affecting farm animals and horses, and flea treatment resistance affecting companion animals, as just two examples. There are also socioeconomic consequences of resistance in our patients – these infections impact our clients' wellbeing, in some cases represent a zoonotic threat, and can impact multiple owners sharing the same premises.

In the environment, antibiotic residues and their metabolites have been found to affect a number of plant, animal and bacterial species (Sarmah *et al*., 2016).

AMR has also been detected in wildlife species such as vulture populations, attributed to scavenging on the carcasses of livestock, raising concerns for the heath and conservation of vultures and also human and domestic animal health, as these birds may represent reservoirs of multi-drug resistant strains (Blanco *et al*., 2020).

Medicine residues

Medicine residues can impact the environment. There are widely publicised, potential risks to insects and aquatic ecosystems of pet parasiticide residues, the agents of which have been detected at toxic levels in English rivers (Perkins *et al*., 2020). The BVA have an excellent position paper on this issue. Other paraciticides such as ivermectin used in farm settings have toxic effects, with residues having an adverse impact on dung beetle populations. Dung beetles are considered to be 'ecosystem engineers' for assisting nutrient cycling, pasture growth, soil health and carbon sequestration, and also providing an important feed source for species such as the curlew (Dung Beetle Trust, n.d.; Dung Beetles For Farmers, n.d.).

And as a final example of residue risks, the livestock use of certain non-steroidal anti-inflammatory drugs has been associated with deaths in vultures in Asia and Europe, and toxicity in other species (Cuthbert *et al*, 2007; Herrero-Villar *et al*., 2020).

Much evidence is still required around the ecosystem impacts of AMR and medicine residues, but the evidence we do have suggests many are accumulating in our environment with the potential to impact organisms at every trophic level of the ecosystem. This demands our judicious use of medicines, and for us at Vet Sustain, this means deploying a risk based approach and applying the precautionary principle in our prescribing behaviour.

Veterinary professionals as agents of change

Veterinary professionals are powerful agents of change in these problems. Figure 1 is relevant to all aspects of sustainability, including medicine use, and it shows that as veterinary professionals, we have multiple spheres of influence that we can leverage.

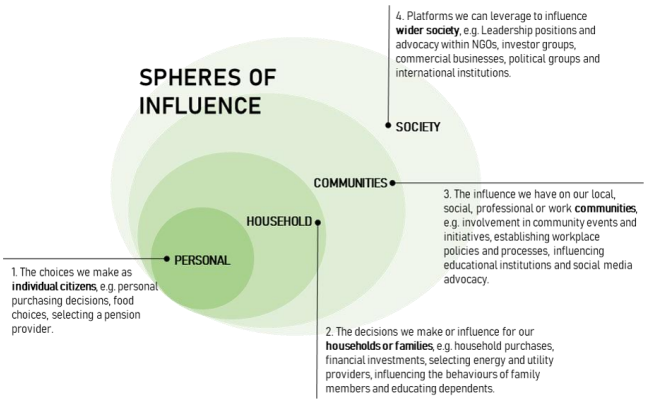

Figure 1: *The spheres of influence (Vet Sustain, 2021)*

Firstly, we are in control of our own behaviours around our consumption of medicines as patients and animal owners, noting that medical practitioners are often pressured by their patients to prescribe antibiotics. We also hold influence within our communities, for example our workplaces, through responsible prescribing and creating or complying with a practice responsible medicine use policy. We can also extend this to our professional community – as members of BVA, RCVS, VDS as examples, communities of professionals can empower and enable

each other to adopt more sustainable practices. And at societal level, using our collective voice as members of the veterinary community, we can influence the ways in which medicines are utilised by the public.

So we've discussed the problems through a One Health lens, and we hopefully feel empowered as veterinary professionals that we have several spheres of influence to leverage. But what can we practically do in our work?

A framework for action

The '3Rs' represents a simple framework for organising our thinking around prescribing policy. The 3Rs was first proposed by Russel and Burch (1959) for reducing, replacing and refining the use of animals in research, and has been widely adopted in this context, but it can also been applied to medicine use (Higham, n.d.). Such a framework can complement the many excellent tools available from the BVA and its species divisions and the RCVS, which provide more detail.

The 3Rs stands for Reduce, Replace, and Refine. The first principle of 'Reduce' nudges us to seek opportunities to reduce the need for certain treatment approaches, such as routine prophylaxis, by addressing underlying risk and prescribing on the basis of risk factors such as seasonality, in-contact animals, geography, lifestyle factors and animal factors. We can also be aware of defensive prescribing, which is when we prescribe in fear of the consequences of not treating. In these instances we should instead seek alternative actions such as diagnostic testing.

It may be that we choose to target for reduction the medicines that present a greater risk to public health of AMR, such as the WHO's highest priority critically important antibiotics, or to target medicines that could risk the environment in terms of eco-toxic residues. Such medicines could be physically labelled in the dispensary to encourage their use as second-line treatments following a work-up. Of vital importance to the 'reduce' principle, is collecting usage data – for example using the new e-medicine book for ruminants from AHDB, so we can monitor our progress over time.

The second principle is Replace, and this is chiefly about replacing antimicrobial use where possible with sustainable solutions for preventing ill health, such as husbandry and management changes, breeding and genetics, vaccination and alternative treatment approaches, such as and the manual removal of ticks, as examples. Instead of arbitrary medicine use reductions in pursuit of targets, this principle nudges us to address the underlying drivers of medicine use, which may entail significant changes or adaptations to husbandry and management systems.

The third principle is Refine. When medicines are necessary for animal health and welfare, we can ensure we are selecting the most appropriate treatment by utilising diagnostic tests such as culture and sensitivity, and can encourage client compliance with correct administration, storage, handing and disposal through education. This advice should include measures to protect the environment from drug residues, such as not bathing an animal or allowing it to swim after a topical treatment. In addition, accommodating neurodiversity in our

communication may also support compliance – on which there is commentary from the human health field (Nicolaidis, 2012).

So in summary, our use of medicines is a One Health issue, and the use of some veterinary medicines can have consequences affecting human health, animal health and welfare, and ecosystems. Secondly, we – as veterinary professionals – are critical stakeholders in the impacts of medicines, and we can leverage our multiple spheres of influence to help mitigate the animal and public health consequences of AMR as well as reduce the ecological footprints of medicine use. Finally, we can consider the principles Reduce, Replace and Refine with each prescription or at practice level, as a simple framework for responsible use practice.

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