

Veterinary antimicrobial stewardship in South Africa

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Abstract

The purpose of this article is to inform on the current initiatives being taken in South Africa by the Department of Health, Department of Agriculture, Forestry and Fisheries (DAFF), South African Animal Health Association (SAAHA) as well as other professional and private bodies to implement veterinary antimicrobial stewardship holistically where veterinary, medical and environmental professionals work together to tackle the increasing problem of antimicrobial resistance. Initiatives taken by the National Department of Health are discussed, as well as actions taken by the veterinary profession and the animal health industry. It can be seen that common actions unite all these bodies in following antimicrobial stewardship, such as the implementation of a national antimicrobial use and resistance use program, awareness campaigns on prudent antimicrobial use to the public, limiting the use of antimicrobials by practising good hygiene and pre-registration requirements for all antimicrobials, be they for human or veterinary use. This article also serves as a follow-up article to previous research undertaken on the volumes of antimicrobials used in food animals by the author.

Keywords: Veterinary, medical, antimicrobial resistance, antimicrobial stewardship, responsible use, multidisciplinary approach

1. Introduction

Antimicrobial resistance has escalated rapidly to become a major public health crisis globally.¹ The overuse and inappropriate use of antimicrobials in humans, animals and crops has dramatically accelerated the emergence of antimicrobial resistance. Antimicrobial resistance is now a major threat to human and animal health and is placed in the same risk category as climate change and overpopulation. As a result, various organisations and stakeholders worldwide have taken certain measures to address antimicrobial resistance using a combined approach of creating awareness of the implications of resistance to human and animal health as well promoting responsible antimicrobial stewardship that allows for both favourable therapeutic outcomes while at the same time limiting the rate of emergence of resistant pathogens. As part of these measures, as an example, all member states of the World Health Organisation (WHO) and the Office International des Épizooties (OIE) have committed their countries to developing and implementing National Action Plans to control antimicrobial resistance based on the WHO/Food and Agriculture organisation (FAO)/OIE tripartite alliance's Global Action Plan for antimicrobial resistance that was published in 2015.²

In addition, the World Veterinary Association in collaboration with the World Organization for Animal Health selected the topic "Antimicrobial resistance – from awareness to action" as the theme for World Veterinary Day on 29 April 2017. This specific topic was selected because action to tackle antimicrobial resistance has not yet matched the magnitude of the threat. There is now general consensus among international and national organisations that the awareness created of this problem during

the past few decades must now be driven to translate to meaningful action.²

2. Veterinary antimicrobial resistance management in South Africa

As a country, South Africa is also in the process of addressing antimicrobial resistance as a top priority with various governmental departments, associations and the statutory veterinary board playing important roles

2.1. National Department of Health

The National Department of Health, South Africa's Ministry of Health, as part of its mandate to promote health, has drafted and implemented its South African Antimicrobial Resistance Strategy Framework, which is meant to be active from 2014 to 2024³. The objectives of this Strategy are to provide a framework for managing antimicrobial resistance, to limit further increases in resistant microbial infections, promote rational antimicrobial use and to improve patient outcomes. The Department of Health is taking a multidisciplinary approach to the antimicrobial resistance issue with this Strategy, which encompasses within its framework the Department of Agriculture Forestry and Fisheries (DAFF), Department of Science and Technology, laboratory services, clinician bodies, civil bodies such as the Treatment Action Campaign (TAC) and Médecins sans Frontières and the regulatory agencies, of which the South African Veterinary Council (SAVC) which is the statutory body regulating veterinarians in South Africa and the Medicines Control Council (MCC) is included within this group. Please refer to **Figure 1** for the strategic framework of this antimicrobial resistance (AMR) strategy.

| | | | |
|-----------------------------|--|---|---|
| Strategic objectives | Governance National Intersectoral Committee Health establishment and district AMS committees and teams | | |
| | Surveillance National surveillance system for: <ul style="list-style-type: none"> • resistant bacteria • Antimicrobial usage • Medication error reporting structures • Antimicrobial quality | Prevention & Control IPC activities in the community and hospitals Immunisation against preventable infections IPC strengthening in public health (water & sanitation etc.) | Antimicrobial Stewardship Policies & Protocols Formulary restrictions Pre-authorisation Antimicrobial prescription forms National prescribing guidelines Stewardship at point-of-care Diagnosis of infection Appropriate antibiotic choice Dose optimization, de-escalation and discontinuation |
| | Legislative and policy reform for health systems strengthening Control of use and prescribing of antimicrobials in animal health Minimum standards and norms for health care quality systems and process (National Core Standards) | | |
| | Education Incorporate AMR strategies into medical, nursing and allied health student curricula AMR/AMS CPD programmes for healthcare professions Sustained public health campaigns | | |
| Strategic enablers | Communication Patient advocacy as part of a patient-centred care approach Partnership with media, industry and other relevant stakeholders | | |
| | Research – IPC, AMS interventions, diagnostics | | |

Figure 1: Strategic framework for the AMR national strategy³

The short to medium term goals in meeting the above objectives of this Strategy include:

- Strengthen governance at Health Establishment levels.
- Develop an antimicrobial resistance map for South Africa through data sharing between the private and public sector laboratory services.
- Ensure that the equipment and infection prevention and control resources required to practice effective hand hygiene are available all times at all Health Establishments.
- Ensure availability of antimicrobials according to the Essential Drugs List at all Health Establishments.
- Review antimicrobials used in feed additives in animal health.
- Development of a strategy and operational plan for the integration and implementation of antimicrobial resistance and infection prevention and control training into the undergraduate and postgraduate medical curriculums of healthcare professionals in South Africa.

- Design an awareness campaign relating to antimicrobial resistance based on past successful campaigns.³

Table 1 below sets out the third goal of the AMR national strategy which is to optimise surveillance and early detection of the AMR implementation plan.

Table 1: Goal 3 – Optimise surveillance and early detection of AMR implementation plan³

| | | Responsibility | | |
|--|--|---|---|-------------|
| Output | Activity | Lead | Supporting | Time-frame |
| Develop National Surveillance System | | | | |
| A baseline consolidated national surveillance report on AMR and hospital acquired infections (HAI) for South Africa for human health | Consolidation of existing data from public and private sectors national on AMR as resistance maps surveillance available to public on web | NICD | Implementation partner | June 2016 |
| | Utilise trends from AMR, Resistance Maps and antimicrobial consumption data to advise NDOH on EML and formularies | MAC | Directorate of Affordable Medicines | Ongoing |
| Establish national surveillance and reporting process at National NDOH for human health | Establish reporting system data warehouse repository for surveillance data of AMR and HAI's | NICD | Implementation partner | July 2016 |
| | Determine the definitions and standards for reporting HAI's at health establishment level | NICD | Implementation partners | Jan 2016 |
| | Capacitate health establishments to implement quality assurance for reporting of HAI data | Head of health Provinces | Implementation partners | June 2016 |
| | Publish national surveillance reports on HAI and AMR | NICD | Implementation partner | Ongoing |
| | Health establishment utilise trends from AMR, resistance maps, and antimicrobial consumption data to support prudent use of antimicrobials at facility level | Head of health provinces/ CEOs of hospitals | Implementation partners | 2016 - 2019 |
| A consolidated national surveillance report on AMR for South Africa for animal health | Engage with DAFF to reintroduce national longitudinal antimicrobial surveillance in animals | Veterinary laboratories/DAFF | MAC | March 2016 |
| Medication error reporting system | Establish medication error definitions and reporting process | Directorate of Affordable Medicines | Pharmaceutical and therapeutic committees | March 2016 |
| | Health establishments report medication errors | Head of health provinces/ CEOs of hospitals | Pharmaceutical and therapeutic committees | 2016-2019 |
| Develop Early Warning System | | | | |
| Develop sentinel organisms early warning systems | Regulate prescribed reporting of sentinel organisms through Notifiable Diseases regulations | NICD | | Jan 2016 |
| | Determine standards for EWS reporting | NICD | | Jan 2016 |
| | Laboratories to report against EWS organisms | NHLS/ South African Society for Clinical Microbiology | Implementation partners | 2016 – 2019 |

Figure 2 below schematically explains the complex inter-relation between antibiotic

use in humans, animals and the environment.

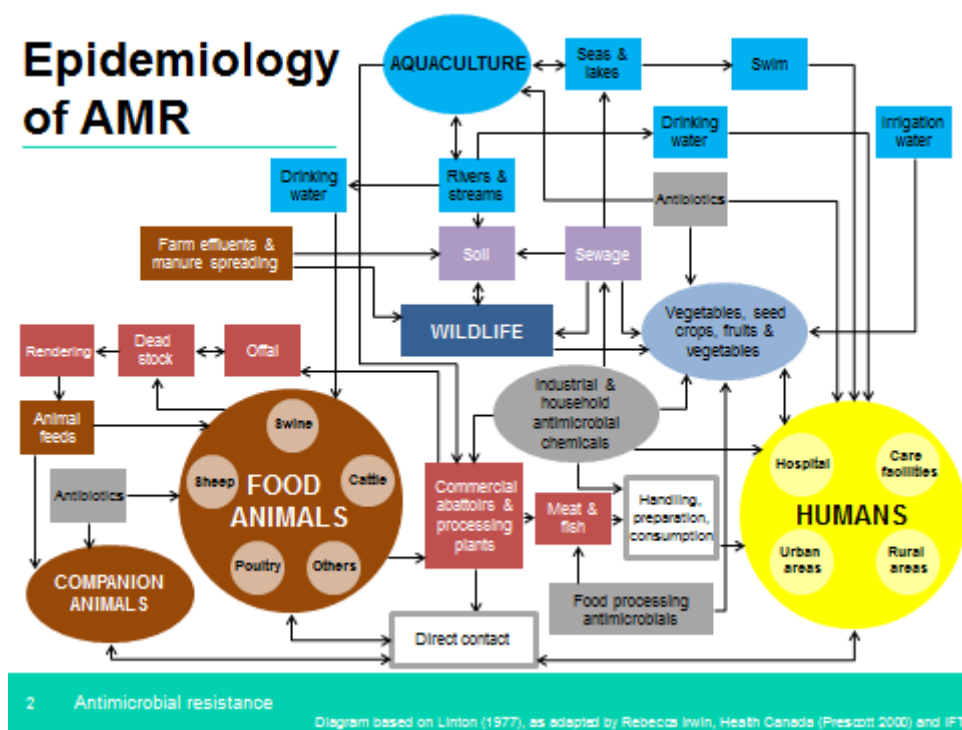


Figure 2: The complex inter-relation between antibiotic use in humans, animals and the environment

2.2. From a veterinary perspective

DAFF, the South African Animal Health Association (SAAHA), the SAVC and the South African Veterinary Association (SAVA) have also been deeply involved in measures to address antimicrobial resistance in South Africa within the veterinary profession and at all levels of animal health. Food security and the management of antimicrobial resistance are complicated by the somewhat fragmented and varied legislation in South Africa that regulates animal health. This fragmented legislation has been recognised by some of the relevant regulatory authorities and incorporated to a certain extent within new strategies and policies.

2.2.1. State Veterinary Services

As an example of this process, State Veterinary Services in DAFF has rolled out the South African Veterinary Strategy⁴ from 2016 to 2026. The purpose of this Veterinary Strategy is to fulfill certain mandates required of the State Veterinary Services. According to section 27(1) (b) of the South African Constitution, 'everyone has the right to have access to sufficient food and water among others' and 'the state must take reasonable legislative and other measures, within its available resources, to achieve the realisation of these rights.' The state guarantees the right to sufficient healthy food of animal origin, through various policies, strategies and Acts which govern state veterinary services in South Africa. These include the Animal Diseases

Act, 1984 (Act no. 35 of 1985) and the Meat Safety Act, 2000 (Act no. 40 of 2000), as amended. Other Acts also directly or indirectly regulating food safety and security are also mentioned within this Veterinary Strategy, and which will be named and elaborated on later in this article. The purpose of this veterinary strategy is to therefore provide an effective cohesive veterinary service in South Africa. The Veterinary Strategy states the need for an integrated antimicrobial resistance programme between DAFF and the Department of Health. It is recommended that the existing OIE and WHO programmes be used as guidelines. The following areas need to be attended to in order to address antimicrobial resistance:

- Clear definition and scope of antimicrobials
- Use and distribution of veterinary medicines and other antimicrobials
- Surveillance on antimicrobial resistance
- Use of biosecurity and management practices to limit the use of antimicrobials
- Prohibition of the use of compounded medicines in food producing animals
- Restrict antimicrobial use to therapeutic use only and not prophylactic use
- Advice to end users at point of sale on prudent use of antimicrobials
- Veterinary inspection of cooperatives
- Accountability of pharmacists for the drugs that they dispense
- Reconsideration of direct sales of drugs to farmers from pharmaceutical companies
- Compulsory drug registers⁴

Table 2 below sets out the prioritisation of the Veterinary Strategy short, medium and long term objectives.

Table 2: Prioritisation of Veterinary Strategy short, medium and long term objectives

| | Core Strategy | Short term (1-3 years) | Medium term (3-5 years) | Long term (5-10 years) |
|----------------|---|--|--|---|
| Founda tion | Strengthening of the veterinary authority for better governance | <ul style="list-style-type: none"> - Establish specialised legal support team - Establish national risk analysis unit - Develop system of authorisation - Veterinary and para-veterinary professional development | <ul style="list-style-type: none"> - Develop joint programmes with stakeholders | <ul style="list-style-type: none"> - Restore national chain of command for all aspects of veterinary services (changes in structuring) |
| Pillar 1 | Strengthening competencies for animal health | <ul style="list-style-type: none"> - Address the challenges of implementation of the Animal Diseases Act (Act 35 of 1984) - Improve animal disease surveillance system | <ul style="list-style-type: none"> - Run pilot project for brucellosis control in cattle (develop model) - Develop and implement control programmes for other animal diseases | <ul style="list-style-type: none"> - Establish effective and efficient administration for animal disease control |
| Pillar 2 | Strengthening competencies for veterinary public health, feed and food safety | <ul style="list-style-type: none"> - Define veterinary services' contribution to the national antimicrobial resistance strategy framework - Consult and implement VPH strategic implementation plan (incl IML) | <ul style="list-style-type: none"> - Develop a single Veterinary Medicine Act - Revise Meat Safety Act (Act 40 of 2000) | <ul style="list-style-type: none"> - Establish effective and efficient administration for food safety system |
| Pillar 3 | Strengthening competencies for veterinary laboratory diagnostics | <ul style="list-style-type: none"> - Laboratory approval plan, including SANAS accreditation, to be further developed and consulted | <ul style="list-style-type: none"> - Expand laboratory capacity under veterinary services | <ul style="list-style-type: none"> - Expand laboratory capacity under veterinary services |
| Pillar 4 | Development and implementation of an Animal and Products Identification, Recording and Traceability (AIRT) System | <ul style="list-style-type: none"> - Policy for individual animal identification and value chain traceability to be developed and consulted - Draft legislation - Provide framework for animal identification - Develop government controlled database | <ul style="list-style-type: none"> - Implement legislation - Establish effective and efficient administration for AIRT system - Run pilot project on cattle | <ul style="list-style-type: none"> - Comprehensive animal movement recording and relevant controls |
| Pillar 5 | Strengthening competencies for animal welfare | <ul style="list-style-type: none"> - Update/revise legislation - Establish national animal welfare unit - Animal Welfare Strategic Implementation Plan further developed and consulted | <ul style="list-style-type: none"> - Develop welfare guidelines for the keeping of various animal species and industries - Develop welfare guidelines for the various types of slaughter for the various animal species. | <ul style="list-style-type: none"> - Implementation of all animal welfare legislation and standards |

2.2.2. Dual registration system in South Africa

In South Africa, there is a dual registration system of over the counter products versus scheduled veterinary medicines. Over the counter products, known as stock remedies or farm feeds

locally, are regulated by the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, (Act no. 36 of 1947) in DAFF. Act 36/1947 historically came into existence to enable farmers to have direct access to various stock remedies for tick borne diseases and practices within the scope of animal husbandry, in areas and at times

where access to a veterinarian was simply not practical/available and where based on his/her observations, the farmer was able to diagnose the condition without the need for a veterinary prescription. Sulphonamides, tetracyclines, macrolides, ionophores, quinoxalines, glycolipids, polipeptides, streptogramins, oligosaccharides, phosphonic acid, nitroimidazoles and polymeric compounds are registered in various dosage forms such as injectables, water soluble powders, in feed premixes, tablets, enteral solutions, topical preparations and intramammary suspensions for use in both food and companion animals. Indications for these antimicrobials include treatment of disease, prophylaxis or prevention of disease, metaphylaxis in treating a group of animals which has sick and healthy animals as well as for growth promotion.¹ Such antimicrobials are freely available to the end-user who may be a member of the public or a farmer, in an open shop or a farmers cooperative.¹

Act 36/1947 has recently been working on guidelines in collaboration with the South African Animal Health Association (SAAHA) to facilitate and benchmark the registration of stock remedies in terms of safety, efficacy and quality.⁵ As a result of this collaboration, one of the guidelines that has been drafted although not yet implemented is the guideline for the registration of antimicrobials.⁶ The availability of effective and safe antimicrobials is essential for animal health in both livestock and companion animals, and for sustainable and economically viable animal production. However, use will inevitably select for antimicrobial resistance and this guideline has taken this into consideration. This guideline was therefore compiled to address the safety and efficacy data requirements of an indication/indications using an appropriate dosage regimen of an antimicrobial, also taking into account the concerns about the spread of antimicrobial resistance.⁶

The Medicines and Related Substances Control Act, Act 101 of 1965 is responsible for the registration and regulation of all scheduled veterinary medicines. These include scheduled veterinary antimicrobials as determined in the scheduling regulations of Act 101. Scheduled veterinary antimicrobials have a Schedule 4 status (main group prescription medicines). This Act is administered by the National Department of Health and registration of drugs is confirmed at meetings of the MCC that consists of a panel of experts who have been appointed by the Minister of Health to undertake such a function.¹

There are two amendment Acts which have amended Act 101/1965, these are Act 72 of 2008 and Act 14 of 2015.⁷ These amendment Acts to Act 101/1965 include within their scope medical devices, *in vitro* diagnostics (IVDs) and complementary medicines. As soon as the Amendment Acts are implemented which may be in the latter half of 2017, a new regulatory body called the South African Health Products Regulatory Agency (SAHPRA) will replace the current MCC. The purpose of these amendment Acts is to have an agency with its own autonomy outside of the Department of Health that may appoint its own internal staff for review and processing of medicine dossiers in order to facilitate the registration of safe and efficacious and high quality human and veterinary medicines to fulfill the mandate of having such medicines available to the end users. Previously under the original Act 101/1965, veterinarians were exempt from needing a licence to dispense and compound medicines from the Director-General Health, as is the case with other healthcare professionals. However, the amendment Act 14 of 2015 requires that veterinarians must also be licensed to compound and dispense veterinary medicines.⁷

2.2.3. Harmonisation of registration requirements between Act 101/1965 and Act 36/1947

It is recognised in South Africa that this dual registration system is not ideal because of the incongruence of registration requirements and processes and the duplication of certain systems. There have been ongoing discussions to combine Act 36/1947 and Act 101/1965 into one regulatory agency for veterinary products for the last three decades! Such an undertaking however, is of a political nature where the Minister of Health and Minister of Agriculture need to liaise in order to initiate this and so far has not been accomplished. However, a task team established by the MCC, called the Veterinary Products Policy Task Team (VPPTT), is currently harmonising the technical registration requirements for the Acts, using the Veterinary International Conference of Harmonisation (VICH) guidelines.⁸ The VICH GL27 which is the Guidance on Pre-Approval Information for Registration of New Veterinary Medicinal Products for Food Producing Animals with Respect To Antimicrobial Resistance is one of the VICH guidelines that was recommended for adoption by the VPPTT to harmonise Act 36/1947 and Act 101/1965 requirements.⁸

2.2.4. South African Animal Health Association

The South African Animal Health Association (SAAHA) is the trade association representing the interests of stakeholders on all matters pertaining to animal health in South Africa.⁵ SAAHA is committed to promoting and supporting an economically viable and innovation driven animal health industry, contributing to a healthy, secure and safe food supply through a high level of health and welfare of all animals and the environment. Within this mandate, SAAHA liaises closely with Act

36/1947. There was pressure from various bodies for all over-the-counter antibiotic stock remedies to be transferred to Act 101/1965, to be regulated as scheduled veterinary medicines. This request was within the context of the start of the roll out of the South African Antimicrobial Resistance Strategy Framework, initiated and driven by the Department of Health. At present SAAHA is working with the Registrar of Act 36/1947 to draft an antibiotic resistance proposal, for submission to the Department of Health, motivating the need for over the counter antimicrobials to still be available to farmers, due to the negative consequences on animal health and welfare if farmers were not immediately able to timely treat their stock for various regionally important tick borne diseases and animal husbandry problems.⁵

SAAHA drafted a proposal motivating that these antibiotics remain with Act 36/1947 but with more control over the sales of these so as to promote and implement antibiotic stewardship.⁹ Within this proposal, SAAHA stated that it supports the prudent and controlled use of antibiotics in animal health, as one of the methods of reducing antibiotic resistance, as well as Health for Animals key message of 'As Much as Necessary, as Little as Possible'. The key proposals that were submitted to the Department of Health were as follows:

- That all sales staff who wish to recommend and/or dispense antibiotics for sale are to be trained on the responsible use of antibiotics in an approved and monitored course.
- Sales of such products are to be recorded by the dispenser.
- All intensive operations are to have a Responsible Veterinarian who is responsible for all medicaments used in the intensive operation and prudent use of antibiotics.

- Antibiotics are to be divided into classes whose criteria will determine how they will be used, such as free use on the one hand through to no use in veterinary medicine if the medicine is only registered in human pharma.
- In principle SAAHA members are willing to report sales quantities of antibiotic products by antibiotic class. However in order to obtain better data, it is preferable that non-SAAHA members also be required to report their sales quantities of antibiotic products.
- SAAHA recommends that the above proposal is supported by a comprehensive antibiotic resistance surveillance program which is managed by DAFF.⁹

There has not been any feedback yet from the Department of Health regarding this proposal.

2.2.5. South African Veterinary Council

As mentioned earlier, the South African Veterinary Council (SAVC) is the statutory body that regulates veterinarians by means of the Veterinary and Para-Veterinary Professions Act, 1982 (Act no. 19 of 1982). In Section 10 of its Rules, the SAVC has very specific guidelines on the compounding and use of veterinary medicines.¹⁰ These Rules stipulate that compounding may only be done in the absence of an acceptable registered alternative, including extra-label use of human medicines. Such practices should under no circumstances circumvent the registration requirements of Act 101/1965 and Act 36/1947. A veterinarian may only use compounded veterinary medicine for a food producing animal, including wildlife intended for human consumption, subject to the following:

- The use of the compounded medicine is limited to the emergency management of a new disease/condition or the management of a disease/condition to which no local registered product exists, or is not readily accessible at the time;
- The reason for compounding is not an attempt to enhance growth promotion in any food producing species in the absence of disease;
- The withdrawal period associated with its use as prescribed by the veterinarian must be approved in writing by the Food Safety and Security Committee of the Veterinary Council or the Veterinary Clinical Committee of the Medicines Control Council, as the case may be, or in accordance of the requirements of the Foodstuffs, Cosmetics and Disinfectants Act, Act 54 of 1972 or hundred and twenty (120) days, or otherwise ten times the half-life of the medicine, unless another withdrawal period is set by one of the two Committees;
- The food produced by the animal is unsuitable for human consumption until the withdrawal time is approved by either or both of the Committees above or a withdrawal time of 120 days or ten times the half life is met;
- Medicines prohibited for use in food producing species may not be used in compounded medicines; and
- It is not intended for continued, sustained and/or frequent use on any one farm, by any one farm owner, by any one farm manager, by any one veterinarian or by any one person as this is defined as manufacturing, unless the use of

the compounded medicine is justified and substantiated.¹⁰

The SAVC has also recommended that colistin not be used in food producing animals at all, unless the veterinarian can justify its use at the hand of a sensitivity test and as a very last resort to treat an animal. Any conduct to the contrary would be regarded by Council as unprofessional conduct. This is due to the discovery in early 2016 of the mcr-1-gene-containing plasmid in the Enterobacteriaceae family that may result in colistin resistance is transferable via the food chain and environmental contamination and may potentially spill over between humans and animals. Treatment of carbapenemase-producing bacteria (CPE) of the family Enterobacteriaceae in humans commonly necessitates use of the last line of antibiotic defence, namely colistin. Where resistance to colistin exists in CPE, it effectively renders the infection untreatable. CPE have now spread throughout South Africa^{2,12,13}

2.2.6. South African Veterinary Association

The South African Veterinary Association (SAVA), a voluntary professional association, also promotes responsible antimicrobial use. SAVA's purpose is to serve its members and to further the status and image of the veterinarian.¹¹ SAVA has various working groups and bodies such as the Medicines Committee (MEDCO), Ruminant Veterinary Association of South Africa (RuVASA), Poultry Group, Wildlife Group, Pig Veterinary Society and South African Equine Vets Association (SAEVA) to mention a few, as well as its provincial branches. These various Groups and Associations have adopted various antimicrobial guidelines to follow antimicrobial stewardship.¹¹ As an organisation, the SAVA has also been the most active in

ensuring with the correct use of antimicrobials, with the country's first prudent use guidelines being published in 2002.

2.2.7. South African National Veterinary Surveillance and Monitoring Programme

The South African National Veterinary Surveillance and Monitoring Programme (SANVAD) for Resistance to Antimicrobial Drugs was created in 2003. This association was started as a result of the appeal made by the OIE to member countries to undertake efforts to establish national programmes for the management of antimicrobial resistance. International standards for the detection and quantification of antimicrobial resistance in animal bacteria were established by the OIE in May 2002 and South Africa took cognisance of these standards. In order to develop and standardize a practical surveillance and monitoring programme in South Africa, a network of participating laboratories was set up and training was provided to laboratory technologists to make use of the new methodologies published in 2003 in the OIE International Standards on Antimicrobial Resistance. A pilot study was undertaken and completed in 2001 in South Africa to determine whether a surveillance programme could be managed with the aid of reagents prepared in-house. As a result of this research, a final decision was taken to perform antimicrobial surveillance in South Africa with standardized, commercially-produced microdilution panels, due to logistical considerations.¹

2.2.8. South African Antimicrobial Stewardship Programme

There is also veterinary representation on the South Africa Antimicrobial Stewardship Programme (SAASP). The objectives of SAASP are as follows:

- Provide leadership, advocacy for, and strengthening of, antibiotic stewardship in the public and private sectors of human and animal health in South Africa.
- Direct appropriate training in antibiotic stewardship in all sectors of human and animal health care.
- Harmonize existing national antibiotic prescribing guidelines and develop guidelines for those infections not already covered, for adult and paediatric practice, incorporating principles of antibiotic stewardship and optimal diagnostic testing into one document.
- Identify gaps in current knowledge and the necessary operational research/audit that will inform practice. Provide feedback on the results of these studies to stakeholders, so as to implement change.
- Engage with the National Department of Health and industry to address the economic issues and systemic obstacles surrounding antibiotic costs and stewardship.^{12,13}

3. Conclusion

It can be seen from the initiatives taken by the various governmental departments and veterinary professional bodies and trade associations, that the actions to practice responsible antimicrobial use are either the same or similar. The main actions to co-ordinate together to holistically address veterinary antimicrobial resistance and by extension antimicrobial resistance in the human health sector and the environment in South Africa are:

- The running of an antimicrobial resistance surveillance program

which is managed by DAFF but in partnership with the Department of Health.

- Veterinary pharmaceutical companies to regularly report the sales quantities of antimicrobial products by antimicrobial class expressed in kg of active pharmaceutical ingredient.
- Prudent use guidelines in animal health to be in accordance with or the adopted OIE or VICH guidelines but to ensure that these guidelines are practical and applicable in South Africa.
- Pre-registration requirements for antimicrobials to be in accordance with VICH guideline and applied to both Act 101/1965 and Act 36/1947 i.e. harmonisation of registration.
- More control and training on the sales of over-the-counter antimicrobials.
- Advice to end users at point of sale on prudent use of antimicrobials.
- Use of biosecurity and management practices to limit the use of antimicrobials
- Ensure that the use of compounded medicines in food producing animals is only in accordance with Veterinary Council rules.
- Awareness program of antimicrobial resistance and prudent antimicrobial use to all stakeholders in animal health and to the public.
- Introduction of more information on antimicrobial stewardship at the veterinary undergraduate and post-graduate levels.

Veterinarians and para-veterinarians have a crucial role to play in combatting antimicrobial resistance through regulating and supervising the prudent use of antimicrobials, professional advice to farmers and pet owners on rational use - it has been noted with great concern that some pet owners administer antibiotics left over from their prescription or from other animals! The interrelationship of antimicrobial resistance between human health, animal health and the environment has been established beyond question. The approach to antimicrobial resistance must therefore be multi-disciplinary and cross-functional by all stakeholders in both human and animal health, it cannot be tackled in isolation. Antimicrobial resistance has become an all-consuming problem in all aspects of human and animal life, but if a co-ordinated effort is made by all stakeholders, then we will have a powerful tool to wield against this problem.

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5. Conflict of interest

Neither of the authors of this article has a financial or personal relationship with organisations that could inappropriately influence the contents of this article.

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