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An investigation of antimicrobial usage patterns by small animal veterinarians in South Africa

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ABSTRACT

Aim: At present very little information is available on antimicrobial use patterns in small animal veterinary practice in South Africa. The aim of this study was firstly to provide some indication of antimicrobial use patterns, and secondly to ascertain if the country's small animal veterinarians make use of prudent use guidelines to optimise their antimicrobial use in order to minimise the development of antimicrobial resistance.
Methodology: In order to understand use patterns, a questionnaire was circulated to registered South African veterinarians, whose responses were evaluated by descriptive statistics. The prevalence of antimicrobial resistance was evaluated for dogs from samples submitted for culture and susceptibility testing for the period 2007–2013 from the only faculty of Veterinary Science in the country. The resistance data was organized into contingency tables and yearly trends in resistance evaluated by means of a chi-square. The use of antimicrobials from the survey were compared to the laboratory result to ascertain the degree of prudent use of the antimicrobials in small animal practice in a developing country.
Results: The responses from the questionnaire indicated that South African veterinarians predominantly (91.16%) used antimicrobials empirically before resorting to laboratory testing and that antimicrobial compounding and off label use (86.19%) of human registered medication was common practice. A worrying finding was that a large number of clients attempted antimicrobial treatment of their pets prior to seeking veterinary assistance. In terms of monitored resistance, annual prevalence of resistance was above 10% and multiple drug resistance was above 50% for all the isolates.
Conclusion: It is concluded that antimicrobial resistant bacteria are present in small companion animal practice in South Africa which requires better implementation of prudent use guidelines.

1. Introduction

Antimicrobials are important in small companion animal veterinary medicine for both the treatment and/or prevention of diseases. However continuous and repeated use of antimicrobials has resulted in the selection of resistant bacterial populations, as bacteria try to adjust and survive in the unfavourable antimicrobial conditions (Rodríguez-Rojas et al., 2013; Boerlin and White, 2013). While a number of factors have been linked to the development of antimicrobial resistance, the most common is antimicrobial misuse which includes under dosing, off label usage and misdiagnosis (Phillips et al., 2004; Ungemach et al., 2006).

Antimicrobial misuse creates a selective evolutionary pressure that enables resistant bacteria to increase in numbers while susceptible bacteria are killed (Boerlin and White, 2013). Resistant bacteria selected through injudicious use of antimicrobials in companion animals can have a double impact of first making future treatment ineffective as well as having the potential to spread to people through the exchange of resistance genes with bacteria resident in or on the human host. (Guardabassi et al., 2004). Guardabassi et al. (2004) described the role of companion animals as a reservoir of potentially resistant zoonotic bacteria citing strains of *Staphylococcus intermedius,* Campylobacter, Salmonella

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and *Escherichia coli.* Gortel et al. (1999) have also reported that methicillin resistant *S. aureus* (MRSA) has been isolated in family members and pets in the same household.

With the development of resistance being inevitable, there is need for the regular monitoring of both use trends as well as to ascertain changes in resistance patterns. The epidemiological data gathered can then be used to determine resistance patterns in a specific area in order to provide information that can be included in future treatment protocols (Boerlin and White, 2013). The goal of antimicrobial monitoring and surveillance should therefore be aimed at providing resistance trends that will ultimately be used to evaluate resistance containment interventions. In South Africa there is a paucity on resistance monitoring data from small animal practice. While a comprehensive report was put together by the South African National Veterinary Surveillance and Monitoring Programme for Resistance to Antimicrobial Drugs (SANVAD), the report focused on farm production animals (Van Vuuren et al., 2007). The same also applies to use pattern, with information in the region being from a 2008 survey of antimicrobial usage in South Africa with specific reference to food animals (Eagar et al., 2012).

Due to the paucity of information in small animal medicine in South Africa, for the following study we evaluate compliance with prudent use practices by South African veterinarians using an online questionnaire together with the analysis g of susceptibility records of clinical samples submitted for bacterial culture and susceptibility testing from the only Faculty of Veterinary Science in South Africa.

2. Methodology

2.1. Data collection

To ascertain compliance with antimicrobial prudent use guidelines, the study made use of a cross sectional online survey. The target population for the survey was the 1120 registered veterinarians with the South African Veterinary Council (SAVC) in 2014.

The questionnaire consisting of 19 closed and 5 open questions was loaded onto Google forms (supplementary information) and sent out electronically. While the target population was small animal practices, the databases of email addresses was not differentiated by practice types, with the result that one specific question requested the respondents to state the type of practice they worked in. On opening the link, respondents had access to the questionnaire where closed questions were compulsory i.e. the questionnaire was not captured for analysis if any closed questions remained unanswered. The open questions were optional.

Susceptibility data was collated from laboratory data of historic records from canine patients samples submitted to the bacteriology laboratory, Faculty of Veterinary Science, University of Pretoria; for bacterial culture and susceptibility testing for the period 2007–2013. The bacteriology laboratory is part of the only animal teaching referral hospital in South Africa with a catchment area that covers mainly the Gauteng province but the laboratory accepts samples from the rest of the country. Bacterial culture and antimicrobial sensitivity is performed by experienced technicians supervised by a veterinary microbiologist. The laboratory used a standard Kirby Bauer method to determine antimicrobial susceptibility. Each isolate was tested for antimicrobial susceptibility using a panel of the following standardized antimicrobials: amikacin; amoxicillin/ampicillin (A/A); carbenicillin; ceftazidime; ceftiofur; chloramphenicol; doxycycline/oxytetracycline (D/oxy); enrofloxacin; gentamicin; imipenem; penicillin G; piperacillin and trimethoprim-sulphamethoxazole (TMS). Secondary data was collected from all available canine records at the bacteriology laboratory and captured onto Microsoft Access where information about antimicrobial susceptibility was captured. Response per bacterial isolate were grouped into the percentage susceptibility for the same organ systems specified on the questionnaire.

2.2. Statistical analysis

The recording and editing of the questionnaire and resistance data was undertaken using Microsoft Excel and evaluated through descriptive statistics. The resistance data was further organized into a contingency table with one row for each time period and two columns for resistance and susceptibility. Prevalence of resistance was calculated as the number of bacterial isolates found to be resistant, expressed as a percentage of the total number of isolates. Statistical analysis was performed using SPSS software. The chi-square ($\chi 2$) test was undertaken to test for significant changes in antimicrobial resistance among all isolate over the period.

3. Results

3.1. Questionnaire based responses

One hundred and eighty-one completed questionnaires were received. With 1120 registered small animal veterinarians being the target, the survey response was 16.16%. Responses were received from eight provinces as follows; Eastern Cape 7.02% (n = 12), Free State 4.09% (n = 7), Gauteng 39.18% (n = 67), KwaZulu Natal 20.46% (n = 35), Mpumalanga 1.75% (n = 3), North West 3.51% (n = 6), Northern Cape 0.58% (n = 1), Western Cape 23.39% (n = 40). The majority of the responses were from veterinarians with a bachelor's degree (63.54%, n = 115); 21.55% (n = 39) with a post-graduate honours in veterinary science (equivalent to post-graduate diploma; BVSc-Hons); 3.31% (n = 6) with Masters in Veterinary Science (Research Based); 1.66% (n = 3) with Masters in Science (Research Based); 7.18% (n = 13) specialists and 3% (n = 5) PhD holders. Respondents that worked in full time small animal practice constituted 77.9% (n = 141) while 22.1% (n = 40) were part time small animal veterinarians. Only 55.25% (n = 100) of the respondents worked in small animal practice, 22.1% (n = 40) predominantly small animal (more time spent on small animal practice) and 19.34% (n = 35) in mixed practice (equal time of small and large animal practice). A summary of the respondents' answers is presented in Table 1.

In order to ascertain if the veterinary profession was applying any pre-determined selection criteria in the antimicrobials used, respondents were asked to indicate if they preferred any specific antimicrobial class for an infection in particular organ systems. For this selection, respondents were limited to one particular antimicrobial choice per organ system. The percentage selection per organ systems is presented in Table 2. Respondents were also limited to the musculoskeletal, respiratory, genitourinary, eye, gastrointestinal, ear and skin conditions.

One of the concerns with antimicrobial use, is the potential for the treatment duration to be incorrect. In order to understand the general periods of treatment, respondents provided an indication of the duration they treated for, for the same organ systems as mentioned above (Table 3). Treatment periods were variable, and dependent on the organ system. In general none of the respondents treated skin and respiratory infections for less than 3 days or GIT infections for over 21 days. For treatment of the other organ systems, treatment was more intermediate in duration and lasted from 1 to 3 weeks.

3.2. Antimicrobial culture and susceptibility records

The isolates were tested for susceptibility against the commonly used antimicrobials which are; amikacin; A/A; carbenicillin;