KNOWLEDGE, ATTITUDE AND PERCEPTIONS TOWARDS ANTIMICROBIAL USE IN SMALL ANIMALS AMONG VETERINARY PRACTITIONERS AND STUDENTS AT A UNIVERSITY VETERINARY TEACHING HOSPITAL IN MALAYSIA

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SUMMARY

Companion animals have been suggested as potential reservoirs of antimicrobial resistance. In Malaysia, qualitative study on the use of antimicrobials in small animals is limited. This study aimed to determine the knowledge, attitude, and perceptions towards antimicrobial use in small animals among veterinary practitioners and students at University Veterinary Teaching Hospital (UVH), Universiti Putra Malaysia. An online self-administered questionnaire was developed. All fourth and final year students, and practitioners from UVH small animal practice were invited to participate voluntarily. A total of 140, out of 238 invitees (59%) responded. Overall, the respondents showed desirable perceptions and attitude towards the issue of antimicrobial resistance and prudent use of antimicrobials. Only 66.4% of respondents were confident of their knowledge. Culture and sensitivity test, client compliance and clinical signs were the top most important factors being considered for antimicrobial prescription. Scientific literature was the most chosen source of information while antimicrobial stewardship guidelines appeared to be the least popular. Amoxicillin-clavulanate was the most chosen antibiotic for all the clinical scenarios of dog spay, feline upper respiratory tract disease (FURD), feline lower urinary tract disease (FLUTD) and surface pyoderma. Second commonly chosen antibiotic was the fluoroquinolones, mainly by veterinary students for FURD, FLUTD and pyoderma. Results suggest the needs for more training on the latest international or national guidelines on antibiotic choices according to the clinical conditions or body systems.

Keywords: antimicrobial prescription, antimicrobial resistance, antimicrobial stewardship, small animals

INTRODUCTION

Antimicrobial resistance (AMR) has become a global issue in both human health care and veterinary medicine in the recent decades. The issue is associated with the selection and spread of multidrug resistant organism in human, animal, and the environment, and is often attributable to the misuse of antimicrobial drugs as the main driver of resistance.

In Malaysia, the Ministry of Health, together with Ministry of Agriculture and Agro-based Industry have developed the Malaysian Action Plan on Antimicrobial Resistance to combat the problem of AMR. The action plan involves 4 primary objectives, including public awareness and education, surveillance and research, infection prevention and control, and optimization of antimicrobial drugs in human and veterinary medicine (Ministry of Health Malaysia, 2017). In line with this effort, the Department of Veterinary Service has published the Malaysian Veterinary Antimicrobials Guideline (MVAG) First Edition, 2021.

To date, however, there is no report on the antimicrobial use and prescription practice in companion animals in Malaysia. How far is the veterinarians' concern towards AMR issue while prescribing antimicrobial is unknown. Since veterinary school is the training ground for future veterinarians, survey amongst the school's instructors and students may provide a glimpse into the current status. This paper aims to report the knowledge, attitude, and perceptions towards antimicrobial use among veterinary students of the clinical years and small animal practitioners at a university veterinary teaching hospital.

MATERIALS AND METHODS

This cross-sectional study was conducted between August – September 2020 at the University Veterinary Hospital (UVH), Faculty of Veterinary Medicine, Universiti Putra Malaysia (UPM) following ethics approval (JKEUPM-2020-222). All small animal veterinary practitioners (veterinary officers and lecturers), and the fourth (4th) and final (5th) years students were invited to participate. The questionnaires were administered in Google form distributed via emails and messaging application. As students are yet to prescribe antibiotic, questions asked were to be answered based on their perspective as future veterinarians. Participation was voluntary with participants having the option of withdrawing at any point of time during the study. The data yielded remain anonymous and did not influence the academic grade of the participating students.

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Questionnaires

The questionnaire was developed, pilot tested on 5 veterinarians and 10 students, and revised base on their comments. Section 1 of the questionnaire asked on gender and years of study or practice. Section 2 asked degree of agreement to statements related to antimicrobial use and antimicrobial resistance by using 5-point Likert scale (1 = Strongly Agree, 2 = Agree, 3 = Not Sure, 4 = Disagree and 5 = Strongly Disagree). Section 3 asked frequency of practices related to antimicrobial prescription using 5-point Likert scale (1 = Always, 2 = Often, 3 = Sometimes, 4 = Rarely and 5 = Never). Section 4 asked on the importance of factors to be considered when prescribing antimicrobial using 5-point Likert scale (1 = Extremely Important, 2 = Very Important, 3 = Moderately Important, 4 = Slightly Important and 5 = Not Important). Section 5 asked on the sources of information and knowledge that may influence their prescription of antimicrobials.

The last section comprised of 4 clinical case scenarios:
1. a 9-month-old healthy dog for routine ovariohysterectomy (dog spay)
2. a sneezing, dull, inappetent and pyrexic cat with bilateral mucopurulent nasal discharge, bilateral conjunctivitis and enlarged submandibular lymph nodes (Feline upper respiratory tract disease; FURD)
3. a young neutered male cat from a multi-cat household, with pollakiuria, turgid but compressible bladder; brownish urine with pH of 6.5, protein 3+, numerous RBC and 10-15 WBC/hpf; the cat has no prior medical problem (Feline lower urinary tract disease; FLUTD-first occurrence)
4. a 9-month-old Golden Retriever with 2 weeks' history of pruritus and picture showing lesion of pyotraumatic dermatitis (surface pyoderma)

The respondents were asked whether they would prescribe antimicrobial; if yes, what antimicrobial drugs for each case. Respondents were given the choice whether to continue answering each of the clinical scenarios; if not, they will be directed to the submit button.

Data analysis

Cronbach's alpha test was performed to test for reliability of each question. Questions with Cronbach's alpha <0.7 were omitted from the analysis. Data were entered into Microsoft Excel, version 16.0 and exported into IBM SPSS, version 25.0 (IBM Corp, Armonk, New York, USA) for analysis. Descriptive analysis was used to calculate frequencies and percentages of all variables. The median score for questions that used 5-point Likert scale was calculated based on all responses, regardless of the demographic groups. To assess differences among the groups of students and practitioners, answers were merged into three categories: strongly agree/agree, neutral and strongly disagree/disagree; always/often, sometimes and rarely/never; extremely/very important, moderately important and slight/not important; and analysed using Kruskal-Wallis test, with significance set at 0.05.

RESULTS

One hundred and thirty out of 220 registered 4th and 5th years veterinary students in UPM, and 10 out of 18 small animal practitioners (veterinarians) completed the survey, giving an overall response rate of 59.0%. Twenty percent (n = 28/140) of the respondents were male while 80.0% (n = 112/140) were female. More than half of the respondents were 4th year students (63.6%, n = 89/140) while 29.3% (n = 41/130) were 5th year students and 7.1% were veterinarians.

More than 90.0% of the respondents perceived that antimicrobial resistance (AMR) is a significant problem in the country, and is a concern among veterinarians in the hospital (Table 1).

More than 90.0% students strongly agreed or agreed that improved use of vaccines, biosecurity and hygiene would decrease risk of AMR, but only 70.0% of veterinarians perceived the same. More than 80.0% agreed to the use of broad-spectrum antimicrobials as first-line antimicrobials, while 95.0% agreed to use of narrow spectrum antimicrobials after confirming pathogens and susceptibility. Close to 50.0% of 4th year students agreed to use of prophylactic antimicrobials in all cases undergoing surgery, while only 34.0% of the 5th year and 20.0% of veterinarians agreed. More than 90.0% respondents agreed they have been taught on the AMR issues and rational use of antimicrobials, however, only 66.4% were confident of their knowledge and use of antimicrobials. Only 58.4% of the 4th year students expressed confidence in their knowledge.

Overall, respondents have good attitude towards antimicrobial prescriptions, with no difference amongst 4th year students, 5th year students and veterinarians (Table 2). At least 80.0% of respondents claimed they would often weigh the patient, adhere to the recommended dose, ensure the appropriate duration and consider if an infection is self-limiting before prescribing antibiotics. All respondents claimed they would always or often ensure self and environment hygiene, before and after handling an animal. Nearly all respondents would always or often educate clients on the appropriate use of antibiotics, adherence to withdrawal periods and resistance-related issues.

Culture and sensitivity test, client compliance and clinical signs were considered as extremely or very important factors to be considered when prescribing antimicrobials by 95.7%, 91.4% and 89.3% of the respondents respectively. These were followed by the ease of administration (75.0%), financial constraint (68.6%) and cytology (64.3%).

A high proportion (82.9%, n = 116/140) of the respondents chose scientific literature as their source of knowledge for antimicrobial prescription, followed by undergraduate course notes (62.9%), seminars (58.6%), experiences (55.7%), online resources (54.3%), textbooks (50.0%), pharmaceutical companies (49.3%) and peers' recommendation (39.3%). Antimicrobial stewardship guidelines were the least chosen, by only 27.0% of the respondents.

Only 51.0% (n = 71/140) of the respondents continued the survey on clinical case scenarios. Seventeen respondents (24.0%) would prescribe antimicrobials for the dog spay (Table 3). All of the 41 respondents who continued to answer the second case of FURD would prescribe antibiotics. The antibiotic was prescribed by

57.0% (n = 20/35) and 41.0% (n = 13/32) of the respondents for the FLUTD-first occurrence and surface pyoderma case scenario, respectively.

The penicillin class, mainly amoxicillin-clavulanate were the most named antibiotic in all the four case scenarios (Table 3). Second most chosen antibiotic was the

Table 1: Perceptions on antimicrobial use and resistance

	Median scoreᵃ	Number (%) of students and veterinarians who strongly agree or agree to the statement				
		Overall (n=140)	4th year (n=89)	5th year (n=41)	Vets (n=10)	P-value*
Antimicrobial resistance is a significant problem in my country.	1	129 (92.1)	79 (88.8)	41 (100)	9 (90.0)	0.085
AMR is a concern among veterinarians in my training facilities.	1	131 (93.6)	85 (95.5)	37 (90.2)	9 (90.0)	0.488
Improved use of vaccines, biosecurity and hygiene will decrease risk of AMR.	1	128 (91.4)	84 (94.4)	37 (90.2)	7 (70.0)	0.039
Broad-spectrum antimicrobials are ideal to use as first-line antimicrobials.	1	117 (83.5)	73 (82.0)	36 (87.8)	8 (80.0)	0.676
Narrow spectrum antimicrobial should be used after etiological pathogens and susceptibility test is confirmed.	1	133 (95.0)	85 (95.5)	39 (95.1)	9 (90.0)	0.766
Prophylactic antimicrobials should be used in all cases undergoing surgery.	2	59 (42.2)	43 (48.3)	14 (34.1)	2 (20.0)	0.019
I have been taught on the AMR issues and rational use of antimicrobials.	1	136 (97.2)	86 (96.6)	41 (100)	9 (90.0)	0.222
I am confident in my knowledge and use of antimicrobials.	1	93 (66.4)	52 (58.4)	33 (80.5)	8 (80.0)	0.030

ᵃoverall median score (n=140), which can range from 1 (strongly agree) to 5 (strongly disagree)
*P-value of Kruskal-wallis test for difference among 4th year students, 5th year students and veterinarians

Table 2: Attitude and practices related to prudent use and prescription of antimicrobials

	Median scoreᵃ	Number (%) of students and veterinarians who would always/often conduct the following actions				
		Overall (n=140)	4th year (n=89)	5th year (n=41)	Vets (n=10)	P-value*
Weigh patients for which I prescribe antibiotic.	1	122 (93.9)	82 (92.1)	40 (97.5)	10 (100.0)	0.338
Adhere to recommended dose when prescribing/administering antibiotics for/to patients.	1	128 (98.5)	88 (98.9)	40 (97.6)	10 (100.0)	0.775
Ensure antibiotics are administered to patients for appropriate duration.	1	128 (98.5)	88 (98.9)	40 (97.6)	10 (100.0)	0.775
Consider whether an infection is self-limiting before prescribing antibiotics.	1	111 (85.4)	77 (86.2)	34 (82.9)	8 (80.0)	0.799
Ensure self and environment hygiene before and after handling/examining an animal (eg: wash hands, wear gloves, disinfect examination table and tools.	1	130 (100)	89 (100.0)	41 (100)	10 (100.0)	1.000

Educate clients on appropriate use of antibiotics, adherence to withdrawal periods and resistance-related issues.	1	129 (99.2)	88 (98.9)	41 (100.0)	10 (100.0)	0.751

[a]overall median score (n=140), which can range from 1 (always) to 5 (never)
*P-value of Kruskal-wallis test for difference among 4th year, 5th year and veterinarians

Table 3. Antimicrobial choices for each case scenario

		Dog spay	FURD	FLUTD	Superficial pyoderma
Number of respondents to the case scenario		71	41	35	32
Number of respondents that would prescribe antimicrobials for the case		17 (24%)	41 (100%)	20 (57%)	13 (41%)
Number of respondents that choose the following antimicrobial:					
Penicillin group	Amoxicillin	1	1	1	-
	Amoxicillin-clavulanate	16	28	15	8
1st generation cephalosporin	Cephalexin	-	-	-	1
Fluoroquinolones	Enrofloxacin	-	7	2	1
	Marbofloxacin	-	-	1	-
Aminoglycosides	Gentamycin (topical)	-	-	-	2
Tetracyclines	Doxycycline	-	5	-	-
Trimethoprim-sulphonamides	Trimethoprim	-	-	1	-
	Chloramphenicol (topical)	-	-	-	1

Note: FURD, feline upper respiratory tract disease; FLUTD, feline lower urinary tract disease.

second-generation fluoroquinolones, all prescribed by veterinary students for the 3 case scenarios of FURD, FLUTD and pyoderma. Others included doxycycline, trimethoprim, and topical gentamycin and chloramphenicol.

DISCUSSION

To our knowledge, this is the first survey of veterinary students and practitioners on their knowledge, attitude, and perception towards antimicrobial use in small animals in Malaysia. Overall, this survey showed that both students and practitioners at this university have desirable perceptions and attitude towards the issues of antimicrobial resistance and prudent use of antimicrobials.

Both students and practitioners provided responses that are consistent with good principles and practice related to prudent use of antimicrobial. It is noteworthy that all respondents claimed they would always or often ensure self and environment hygiene before and after handling or examining an animal, such as hand washing, wearing gloves and disinfecting examination table and tools. These practices of hand washing and disinfection between patients are basics for infection control and prevention, and integral to prevent nosocomial infections in hospitalised patients (Portner and Johnson, 2010).

Only 58.4% of the 4th year students expressed confidence in their knowledge compared to 80.5% of the 5th year students. This finding concurred with another survey by Smith et.al. (2019) on pre-final and final year veterinary students in South Africa. The fact that the 4th year students in this present study have completed their required didactic courses, their lack of confidence is likely explained by the lack of clinical exposure when compared to the 5th year students.

In this present study, culture and sensitivity test was the most chosen important factor to be considered when prescribing antibiotic. This finding differs from that on Nigerian veterinary students where only 52% of the students consider antibiogram of isolates when prescribing antibiotic (Anyanwu et.al., 2018). This finding may reflect the difference in the accessibility of test, cost consideration

and students' exposures. At a location or time where culture and sensitivity test are not easily accessible, cytology may be considered as an alternative. Cytology is fast and provides important information such as presence or absence of white blood cells and bacteria, and their significance (Bollig et al., 2022). Nevertheless, client may decline these diagnostic procedures, citing cost-constraint as the reason. However, resorting to affordable-only treatment approach would promote use of broad-spectrum antimicrobials, that would eventually induce antimicrobial resistance (Smith et.al., 2019).

The most cited source of knowledge for antimicrobial prescription in this survey was scientific literature (82.9%). The next popular choice was undergraduate course notes, which was mostly chosen by the veterinary students; only 3 veterinarians ticked this source. This may implies that students still rely on lecture notes as their basic reference. Antimicrobial stewardship guidelines was the least chosen source; by only 27.0% of respondents. This may be due to little awareness or exposure of available guidelines. In Malaysia, the first edition of veterinary antimicrobial guidelines was only published in 2021, which was after the period of this survey.

For the case scenarios, broad-spectrum antibiotics were the most prescribed antimicrobials with amoxicillin-clavulanate being the top choice in all four cases of dog spay, FURD, FLUTD and surface pyoderma. Similarly, beta-lactams were reported to be the most common drugs prescribed by small animal veterinarians in the United Kingdom (Hughes et.al., 2011) and United States (Wayne et.al., 2011). The predominant choice of this broad-spectrum antibiotic may be due to its common availability and trend of use. This dependence on broad-spectrum antibiotic contradicts the general recommendation to use a narrow-spectrum drug where possible (Weese et al., 2013). Client financial constraints may limit regular use of bacterial culture and sensitivity test prior to appropriate antibiotic prescription. In addition, client reluctance or failures to return for follow-up visits may prompt veterinarians to prescribe broad-spectrum antimicrobials for a sense of safety.

In the present study, only 24.0% of the 71 respondents that continue the survey would prescribe antimicrobials as surgical prophylaxis in the case scenario of a healthy 9-month-old dog for routine spay. Fortunately, majority of the respondents would not prescribe surgical prophylaxis antibiotic. Most gave the rationale that dog was healthy, and if surgical aseptic technique was maintained, antibiotic is not necessary. Antimicrobials should not be a replacement for adequate preoperative preparation, effective surgical practice, proper postoperative treatment, and adequate infection management strategies (Verwilghen and Singh, 2015).

Of the 41 respondents for the case scenario of FURD, all of them chose to prescribe antibiotic, mostly with the reason of suspecting bacterial infection due to presence of mucopurulent nasal discharge. Twenty-eight prescriptions were amoxicillin-clavulanate, and five were doxycycline. Based on the International Society for Companion Animal Infectious Disease (ISCAID) guidelines on respiratory diseases, doxycycline or amoxicillin is recommended as the first line antibiotic for empirical treatment, and to consider amoxicillin-clavulanate if there is high possibility

of beta-lactamase organism in that region (Lappin et al., 2017). In this survey, there were 5 prescriptions of second-generation fluoroquinolones from the 4th year students. This raise concerns, as the second-generation fluoroquinolones is considered critically important antimicrobials (MVAG, 2021), and should not be used as the first line drug.

For the case scenario of FLUTD-first occurrence, 20 out of 35 respondents who continued the survey would prescribe antimicrobials. Based on ISCAID guidelines on bacterial urinary tract infections, most cats do not have bacterial cystitis. Instead, feline idiopathic cystitis or urolithiasis were more common. It is recommended that NSAIDs to be considered at the start of 3-4 days while withholding antimicrobial therapy to wait for the result of urine aerobic culture and sensitivity (Weese et al., 2019). Amoxicillin alone or with clavulanate are appropriate as the first line antibiotic. Doxycycline can be considered as an alternative for non-compliant cats or cats that vomit on amoxicillin-clavulanate. Fluoroquinolones can be considered as the second line antibiotic if result of culture and sensitivity show the bacteria is resistant to the first line antibiotic.

For the case scenario of surface pyoderma, the respondents who chose to prescribe antimicrobial therapy were students; none of the veterinarians prescribe antimicrobials. Majority of the respondents would want to perform further test to confirm bacterial infection. The Australasian Infectious Disease Advisory Panel (AIDAP) recommended impression smear for cytological evaluation and initial treatment decision (Holloway et al., 2013). Surface pyoderma often respond well to topical therapy, such as chlorhexidine wipes. For uncomplicated surface bacterial pyoderma, topical antimicrobial such as 2% mupirocin and fusidic acid can be applied 1-2 times daily until cure. If there is no response to therapy, swab sample for culture and sensitivity should be considered. If systemic antimicrobial is required, cephalexin is appropriate as the first line antibiotic, while clindamycin as the second line. Fluoroquinolones should be avoided in staphylococcal pyoderma unless resistance has been shown.

The limitation of this study includes selection bias, as participation in this survey was voluntary. Results may be biased towards respondents that were more interested in the issues of antimicrobial resistance, and therefore may expressed more concerns and positive attitude on these issues. Similarly, respondents that self-selected to continue with the clinical case scenarios may have more interest or knowledge. Due to limited participation, results from this study may not reflect the true level of knowledge, attitude, and perceptions for each group of respondents, especially the veterinarians and 5th year students. Furthermore, this was a cross-section survey involving only one veterinary school. This precludes us from making broad generalisation across veterinary schools in Malaysia. Future studies should include other training institutions and private practitioners to better gauge the knowledge, attitude and practice of antibiotic prescription in small animals. To obtain higher participation, more engaging methods such as direct interview may be employed.

CONCLUSIONS

In conclusion, the veterinary students and practitioners in this survey have desirable perceptions and attitude towards the issue of AMR and prudent use of antimicrobials. Lower percentage of the 4th year students expressed confidence in their knowledge, and more of them agreed to prophylactic antimicrobials in all surgical cases. Amoxicillin-clavulanate and second-generation fluroquinolones, both considered critically important antimicrobials, were the top most chosen antibiotics. These results suggest the needs for more training and exposure to the latest international or national guidelines on antibiotic choices specific to the body systems or clinical conditions.

CONFLICT OF INTEREST

None of the authors of this paper has financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

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