UNIVERSITI PUTRA MALAYSIA

PRESCRIPTION PATTERNS, ATTITUDE AND PERCEPTION ON ANTIMICROBIAL USE AMONGST SMALL ANIMAL PRACTITIONERS IN KLANG VALLEY

NG KIAN KHAI

PRESCRIPTION PATTERNS, ATTITUDE AND PERCEPTION ON ANTIMICROBIAL USE AMONGST SMALL ANIMAL PRACTITIONERS IN KLANG VALLEY

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A project paper submitted to the
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Certification

It is hereby certified that I have read this project paper entitled "Prescription patterns, attitude and perception on antimicrobial use amongst small animal practitioners in Klang Valley", by Ng Kian Khai and in my opinion it is satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the course VPD 4999 - Final Year Project.

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ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999 - Projek Ilmiah Tahun Akhir.

CORAK PRESKRIPSI, SIKAP AND PERSEPSI TERHADAP PENGGUNAAN ANTIMIKROB DI KALANGAN PENGAMAL VETERINAR HAIWAN KESAYANGAN DI LEMBAH KLANG

Oleh

Ng Kian Khai

2021

Penyelia: Profesor Madya Dr. Chen Hui Cheng

Penggunaan antimikrob adalah antara faktor penyumbang kepada kerintangan antimikrob (AMR). Di Malaysia, kajian mengenai penggunaan antimikrob pada haiwan kesayangan adalah terhad. Kajian ini bertujuan untuk mengenalpasti corak preskripsi, sikap and persepsi terhadap penggunaan antimikrob di kalangan pengamal veterinar haiwan kesayangan di Lembah Klang. Satu soal selidik dibina untuk mengumpul respons daripada pengamal veterinar haiwan kesayangan secara sukarela. Sejumlah 35 respons, kebanyakannya daripada responden wanita (71.4%), telah diterima. Hanya 13 daripada 35 (37.1%) responden melaporkan kewujudan garis panduan preskripsi antimikrob di amalan klinik mereka. Secara keseluruhan, responden menunjukkan persepsi dan sikap yang positif terhadap penggunaan antimikrob secara berhemah. Kekangan kewangan dan tanda klinikal (skor median 5 daripada 5) dikenalpasti sebagai faktor terpenting yang mempengaruhi preskripsi antimikrob, diikuti jangkaan klien, kultur dan ujian kerentanan, sitologi dan kesenangan memberi drug (skor median 4 daripada 5).

Cephalosporins generasi pertama merupakan antimikrob yang sering dipreskripsi dalam senario klinikal pioderma, manakala penisilin merupakan antimikrob yang sering dipreskripsi dalam tiga senario lain, iaitu *feline upper respiratory disease* (FURD), *feline lower urinary tract disease* (FLUTD) dan *ovariohysterectomy* (OHE). Sumber rujukan yang paling popular ialah artikel jurnal (82.9% daripada jumlah responden), sumber atas talian (82.9%) dan pendidikan berterusan/seminar (82.9%), manakala nota kursus peringkat ijazah sarjana muda merupakan sumber yang kurang popular di kalangan responden.

Kata kunci: penggunaan antimikrob, preskripsi antimikrob, veterinar, haiwan kesayangan, soal selidik

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfillment of the course VPD4999 - Final Year Project.

PRESCRIPTION PATTERNS, ATTITUDE AND PERCEPTION ON ANTIMICROBIAL USE AMONGST SMALL ANIMAL PRACTITIONERS IN KLANG VALLEY

by

Ng Kian Khai

2021

Supervisor: Associate Professor Dr. Chen Hui Cheng

Antimicrobial use is commonly agreed to be one of the factors that contribute to antimicrobial resistance (AMR). In Malaysia, the study of antimicrobial use in small animal practice is limited. The aim of the study is to describe the prescription patterns, attitude and perception on antimicrobial use among small animal practitioners in Klang Valley. A questionnaire was developed to collect response from small animal veterinarians. A total of 35 responses were collected. Majority of the respondents were female (71.4%). Only 13 out of 35 (37.1%) respondents reported that their veterinary practice had antimicrobial use guidelines. In general, the respondents showed positive perception and attitude towards the prudent use of antimicrobial. Financial constraint and clinical signs (median score 5 out of 5) were ranked the most important factor influencing antimicrobial prescription, followed by client expectation, bacteriology culture and sensitivity test, cytology and ease of administration (median score 4 out of 5). First generation cephalosporin was the most prescribed antimicrobial in clinical

scenario of canine pyoderma, while penicillin were the most prescribed antimicrobial in three clinical scenario namely feline upper respiratory disease (FURD), feline lower urinary tract disease (FLUTD) and ovariohysterectomy (OHE). The most referred source of information were journal articles (82.9% of respondents), online resources (82.9%), and continuing education/seminars (82.9%), while undergraduate notes (40.0%) was the least referred source.

Keywords: antimicrobial use, antimicrobial prescription, veterinary, small animal, survey

1.0 Introduction

Antimicrobial resistance (AMR) has become a global issue in both human health care and veterinary medicine in the recent decades. It is a known fact that the emergence of multidrug-resistant bacteria would reduce the efficacy of antimicrobial treatment, therefore, posing a great challenge to veterinary practices and public health (Walther et al., 2016). The increment of AMR in both human and animal strains is usually associated with misuse of antimicrobial drugs in public health care and veterinary practices. Besides, studies also acknowledge that drug-resistant bacteria are capable of surviving in the environment and remain infective towards healthy individuals through fecal-oral route (Schaufler et al., 2015). Meanwhile, AMR in food-animal industries are usually given priority due to food safety reason. This often results in the potential of small animal being a source of AMR being ignored (Dickson et al., 2019). In addition, transmission of drug-resistant bacteria between human and household animal was evident (Ljungquist et al., 2016).

In order to combat AMR, the Ministry of Health Malaysia has developed the Malaysia Action Plan on Antimicrobial Resistance (MyAP-AMR) to reduce the spread of AMR. The action plan involves 4 primary objectives, including public awareness and education, surveillance and research, infection prevention and control, and optimization of the usage of antimicrobial drugs in human and veterinary medicine (Ministry of Health Malaysia, 2017). However, the implementation of these strategies is dependent on every health care professional.

In Malaysia, there are currently limited established guidelines to facilitate the correct usage of antimicrobial drugs by small animal practitioners. Furthermore,

the antimicrobial prescription pattern is not known due to limited AMR studies in small animal practice. Thus, this study aims to identify the attitude, perception and antimicrobial prescription pattern in small animal practice in the Klang Valley.

This study aims to: 1) determine the attitude and perception of veterinarians towards antimicrobial use in small animal practice, and 2) describe the antimicrobial prescription patterns and factors influencing prescription of antimicrobial in small animal practitioners.

The null hypothesis of the study is the attitude and perception on antimicrobial use amongst small animal practitioners in Klang Valley show no concern towards AMR risk.

2.0 Literature review

A number of cross-sectional studies on antimicrobial use and AMR has been conducted in several countries, including South Africa (Chipangura et al., 2017), Australia (Hardefledt et al.,2017), United States (Ekakora & Okafor, 2019), Denmark (Jessen et al., 2017), and Portugal (Alcantara et al., 2021). While different conclusions were reached, the ultimate purpose across these studies was to provide insight to more judicious use of antimicrobial and antimicrobial resistance risk.

A study on antimicrobial usage patterns by Alcantara et al. (2021) on small animal veterinarians in Portugal discovered majority of veterinarians in Portugal preferred prescription based on clinical signs and experience, described as empirical-oriented, than prescription based on protocol guidelines, described as protocol-oriented. Regardless of their attitude, the efficacy of antimicrobial to achieve positive clinical result was identified as the main drivers to prescribe antimicrobial in both empirical and protocol-oriented veterinarians. The study also concluded that protocol-oriented veterinarian posed a more prudent attitude on antimicrobial prescription compared to empirical-oriented veterinarians.

Hardefledt et al. (2017) discovered good compliance of Autraslia Infectious Disease Advisory Panel (AIDAP) and British Small Animal Veterinary Association (BSAVA) guidelines on surgical prophylaxis in Australian veterinarians. Overall, 90% of the surgical prophylactic antimicrobials were drugs of low or medium importance (e.g.: penicillin, 1st generation cephalosporin) suggesting positive output from national antimicrobial guideline. However, the

study also reported use of antimicrobial by 25% of veterinarians in routine spay and desexing procedure where prophylactic antimicrobial is not indicated.

Another study conducted in a veterinary teaching hospital in United States recognized evidence-based approach by veterinarians when prescribing antimicrobial (Ekakoro & Okafor, 2019). Ekakoro and Okafor (2019) also reported low level of AMR awareness amongst veterinary clinicians and expressed concerns over non-judicious antimicrobial use by some clinicians. The study then suggested the implementation of antimicrobial stewardship programme and increase emphasis on AMR in the current curriculum of vet schools. A study in South Africa found off-label use of antimicrobial and use of antimicrobial of high importance before resorting to laboratory test amongst small animal practitioners (Chipangura et al., 2017). The authors concluded that lack of knowledge and experience, resources, regulatory and financial support collectively contributed to the antimicrobial resistance in South Africa (Chipangura et al., 2017).

On the other hand, studies in Denmark (Jessen et al., 2017) discovered reduction in the use of important broad-spectrum drug, such as third generation cephalosporin, since the publication of national antimicrobial guideline. Nevertheless, the study also identified limited availability of drugs as one of the barriers faced by veterinarians to comply to the guidelines.

3.0 Materials and Methods

3.1 Research design, study location and study population

This was a cross-sectional, questionnaire-based qualitative study aimed to describe the prescription patterns, attitude and perception on antimicrobial use amongst small animal practitioners. The location of study involved veterinary small animal clinics in Klang Valley area.

The respondents of this study were consisted of small animal practitioners in Klang Valley. Populations that met the inclusion criteria had been invited to participate voluntarily. The inclusion criteria were consisted of small animal veterinary practitioners in Klang Valley area regardless of gender, nationality, and ethnic. Respondents who did not practice in small animal field, and refuse to participate in the questionnaire has been excluded from this study.

3.2 Sampling method and subject recruitment

A set of questionnaire was developed in google form. The questionnaire was distributed via online platform such as e-mail and *Whatsapps* application. The respondents were invited to participate in the study voluntarily. The distributed questionnaire was answered by the respondents based on their current prescription habits, attitude, and perception on antimicrobial in small animal practice.

3.3 Questionnaire

The questionnaire comprised of questions regarding demographics, antimicrobial prescription practice in respondents' premises. The questionnaire

consisted of 5 sections: (1) questions addressing respondents' demographic info namely gender, experience in small animal field, primarily attending cases (medical cases, surgical cases, mixed of both cases), and availability of antimicrobial use guidelines or policy at their premise; (2) Seventeen questions with 5-point likert scale (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5-Strongly disagree) to indicate their agreement towards statement regarding AMR issues and prescription practice; (3) six questions with 5-point likert scale (1=Not important, 2=Less important, 3=Important, 4=Very important, 5=Extremely important) to determine the factors that influence antimicrobial choices; (4) Four scenario-based question: canine pyoderma, ovariohysterectomy (OHE), feline upper respiratory disease (FURTD), and feline lower urinary tract disease (FLUTD). There respondents were asked about their decision to prescribe antimicrobial in these given clinical scenarios. If antimicrobial drug were prescribed, they were asked to specify the generic name or trade name of the drug, dose, route of administration, frequency and duration of treatment; (5) Source of information and knowledge or references on prescription.

3.4 Data analysis

The data were summarized and statistical analysis were performed using Microsoft Excel and SPSS software. Descriptive analyses were used to compute frequency and percentage of all variables. For 5-point likert scale questions, the data were presented as median.

4.0 Results

4.1 Respondents' demographic info

A total of 35 responses were collected. The respondents consisted of 71.4% female (n=25) and 28.6% male (n=10) small animal veterinarians. Twenty-two (62.9%) of the respondents had 1 to 5 years of experience, while the remaining respondents (n=13, 37.1%) had more than 6 years of experience.

Twenty-six (74.3%) respondents attend to mix of both surgical and medical cases, while 1 (2.9%) and 8 (22.9%) respondents primarily attend to surgical and medical cases respectively. . In terms of prescription frequency, most of the respondents prescribe antimicrobial 3-4 (22.9%) and 5-6 cases (40%) per 10 cases they handle.

In terms of antimicrobial guidelines or policy in premise, only 13 (37.1%) respondents affirmed guidelines or policy were available at their work place. The antimicrobial guidelines or policy mentioned by the respondents were Antibiotic Prescribing Detailed Guidelines by Australian Infectious Diseases Advisory Panel (AIDAP), Plumb's Veterinary Drug Handbook, Monthly Index of Medical Specialities (MIMS) and BSAVA Small Animal Formulary by British Small Animal Veterinary Association (BSAVA).

Table 1.1 Respondents' demographic distribution (n=35)

Gender	n	%	Cumulative %
Female	25	71.4	71.4
Male	10	28.6	100

Experience in small animal field	n	%	Cumulative %
< 2 years	2	5.7	5.7
1-2 years	10	28.6	34.3
3-5 years	10	28.6	62.9
6-10 years	6	17.1	80
11-15 years	1	2.9	82.9
16-20 years	5	14.3	97.1
>20 years	1	2.9	100

Primarily attend to	n	%	Cumulative %
Surgical cases	1	2.9	2.9
Medical cases	8	22.9	25.7
Mixed of both cases	26	74.3	100

Prescription frequency	n	%	Cumulative %
Not involved in prescription	0	0	0
1-2 out of 10 cases	3	8.6	8.6
3-4 out of 10 cases	8	22.9	31.4
5-6 out of 10 cases	14	40	71.4
7-8 out of 10 cases	9	25.7	97.1
9-10 out of 10 cases	1	2.9	100

Availability of guideline or policy in premise	n	%	Cumulative %
No	22	62.9	62.9
Yes	13	37.1	100

4.2 Respondents' perception on antimicrobial use

In terms of AMR awareness, the responses leaned towards disagreement (median score 2 out of 5) to the statement describing AMR is not a problem in small animal practice; while the respondents were neutral towards the statement addressing there is limited evidence of antimicrobial use in small animal contributed to AMR in human medicine (median score 3 out of 5).

In terms of surgical prophylactic antimicrobial use, majority of the respondents disagree that the risk of complication is too high if antimicrobial is not administered (median score 2 out of 5). The respondents were neutral towards the statement describing prophylactic antimicrobial is necessary in all surgical cases (median score 3 out of 5).

In terms of antimicrobial spectrum, the respondents showed agreement towards the described principles on use of broad-spectrum (median score 4 out of 5) and narrow-spectrum antimicrobial (median score 5 out of 5). The responses were leaned towards agreement on the statement suggesting other diagnostic work-up are also crucial when prescribing antimicrobial (median score 4 out of 5) .

Table 1.2 Median scores of respondents' perception on antimicrobial use

	Median[a]
Antimicrobial resistance (AMR) is more of a problem in food animals, not in small animal practice.	2
There is little research proving that antimicrobials used in small animals contribute to AMR in humans.	3
Broad-spectrum antimicrobials are usually ideal for first-line antimicrobials.	4
Narrow-spectrum antimicrobials are usually prescribed after etiological pathogens and susceptibility tests are confirmed	5
Prophylactic antimicrobial should be prescribed in all surgical cases.	3
The risk of complication is too high if prophylactic antimicrobial is not prescribed after an elective surgery (i.e: spay and neuter).	2
Apart from bacterial culture and susceptibility test, it is important to conduct other further diagnostic test (e.g: diagnostic imaging, urinalysis) when prescribing antimicrobial.	4

[a] The median closer to score 5 indicate more agreement towards the statement, vice-versa.

4.3 Respondents' attitude on antimicrobial use

It was reported that the respondents were in strong disagreement (median score 1 out of 5) to prescribe based on teleconsult. The responses were leaning towards agreement on statements that described different prescription practice, namely weigh the animal (median score 5 out of 5), prescribe antimicrobial after ruling out non-bacterial cause or proven bacterial involvement (median score 4 out of 5), consider the involvement of aetiological agent (median score 4 out of 5), consider self-limiting factor of the disease (median score 4 out of 5), switch antimicrobial if patient does not response to previous antimicrobial treatment (median score 4 out of 5), and educate clients on appropriate administration of antimicrobial (median score 4 out of 5). However, the respondents' attitudes are

neutral (median score 3 out of 5) towards prescription based on culture and sensitivity test.

Table 1.3 Median scores of respondents' attitude on antimicrobial use

	Median[a]
I can prescribe antimicrobial(s) based on teleconsult.	1
I always weigh the animal when prescribing antibiotics.	5
I prescribe antimicrobial after ruling out non-bacterial cause or proven bacterial involvement.	4
I consider which pathogen might be involved when prescribing a specific antimicrobial.	4
I consider self-limiting factor of an infection when prescribing antimicrobial.	4
I prescribe antimicrobial(s) based on culture and sensitivity tests.	3
I switch antimicrobial(s) if patients does not respond to previous antimicrobial treatment.	4
I always educate/show clients on the appropriate and correct way to administer antimicrobial.	4

[a] The median closer to score 5 indicate more agreement towards the statement, vice-versa.

4.4 Factors influencing respondents' antimicrobial prescription

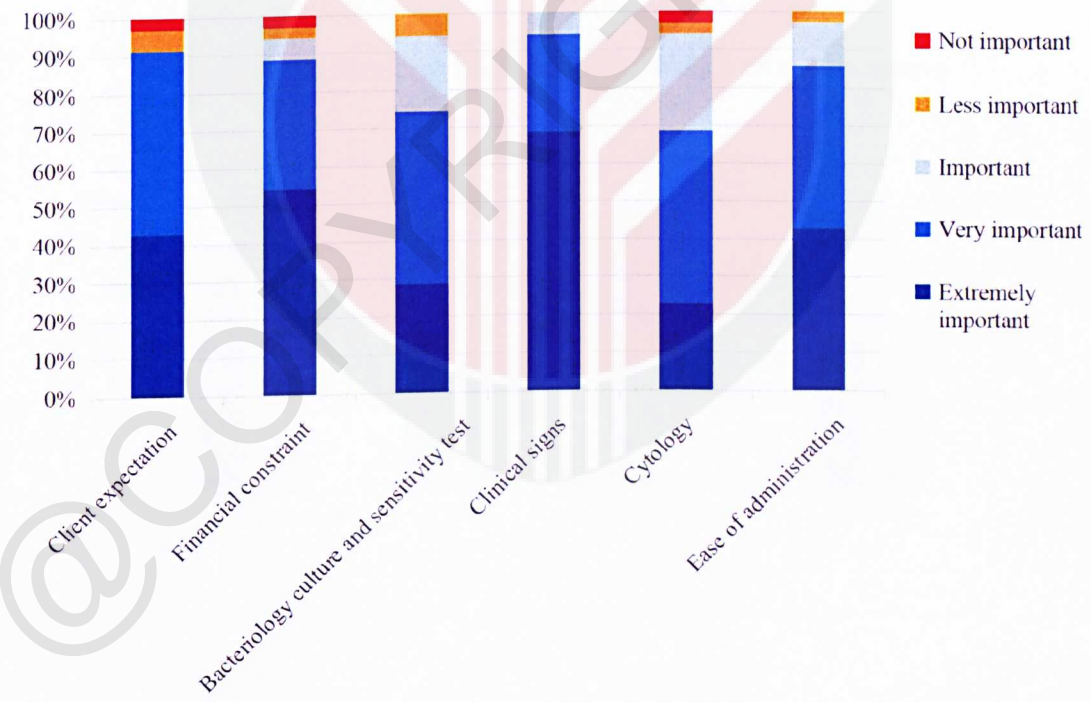
Financial constraint and clinical signs are reported to be the most important factors (median score of 5 out of 5) perceived by the respondents. The second most important factors are client expectation, bacteriology culture and sensitivity test, cytology and ease of drug administration with median score 4 out of 5. Generally, the respondents perceived all these 6 aspects as crucial factors to be considered when prescribing antimicrobial, as every factors are ranked as important by more than 90% of the respondents.

Table 1.4 Median scores for factors influencing antimicrobial prescription

Factors	Median[a]
Client expectation	4
Financial constraint	5
Bacteriology culture and sensitivity test	4
Clinical signs	5
Cytology	4
Ease of administration	4

[a] The median score closer to 5 indicate the more important the factor is perceived by the respondent, vice-versa.

Figure 1.1 Factors influencing antimicrobial prescription

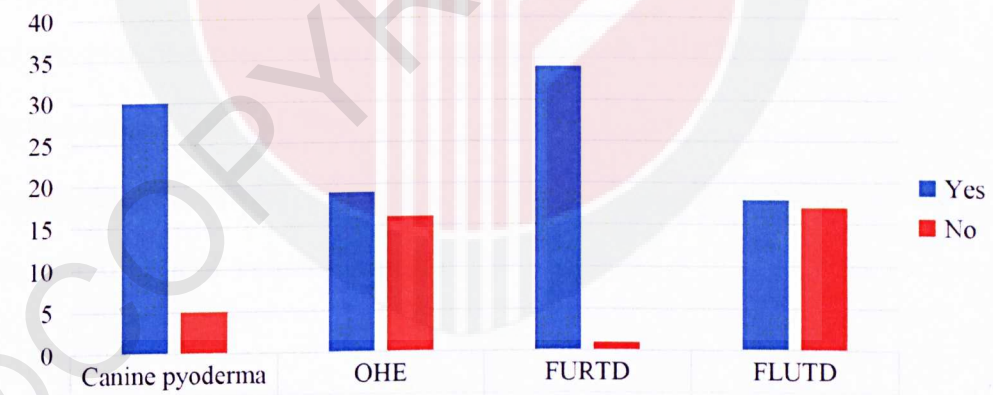


4.5 Clinical scenario

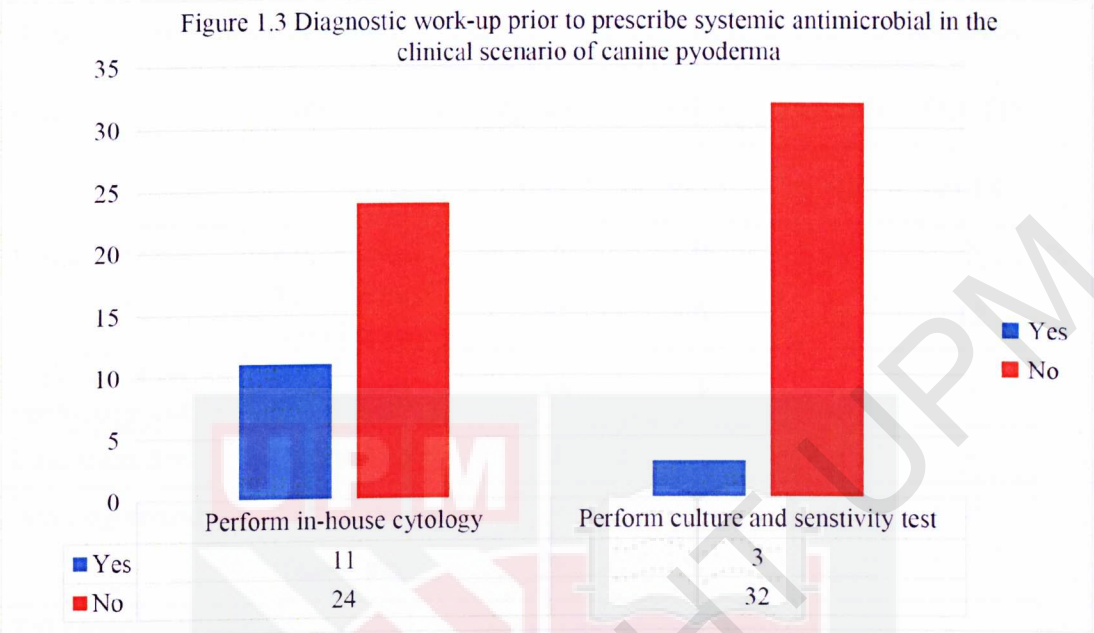
Thirty (85.7%) out of 35 respondents would prescribe antimicrobial in the clinical scenario of canine pyoderma; 19 (54.3%) out of 35 respondents would prescribe antimicrobial for ovariohysterectomy (OHE) procedure; 34 (97.1%) out of 35 respondents would prescribe antimicrobial to treat FURTD; 18 (51.4%) out of 35 respondents would prescribe antimicrobial in the clinical scenario of FLUTD.

In the scenario of canine pyoderma, only 11 (31.4%) and 3 (8.5%) respondents will perform in-house cytology and culture & sensitivity test prior to prescribe antimicrobial.

Figure 1.2 Antimicrobial prescription in each clinical scenario



	Canine pyoderma	OHE	FURTD	FLUTD
Yes	30	19	34	18
No	5	16	1	17



In the clinical scenario of canine pyoderma, the most prescribed antimicrobial is 1st generation cephalosporin (48.5%); broad-spectrum penicillin is the most frequently prescribed antimicrobial in the clinical scenario of OHE (78.9%) and FLUTD (72.2%); the most prescribed antimicrobial in FURTD are penicillins (41.7%) and tetracyclines (41.7%).

Overall, broad-spectrum penicillins are reported as the most prescribed antimicrobial in 3 out of 4 clinical scenarios,

Table 1.5 Summary of antimicrobial prescriptions in four clinical scenarios

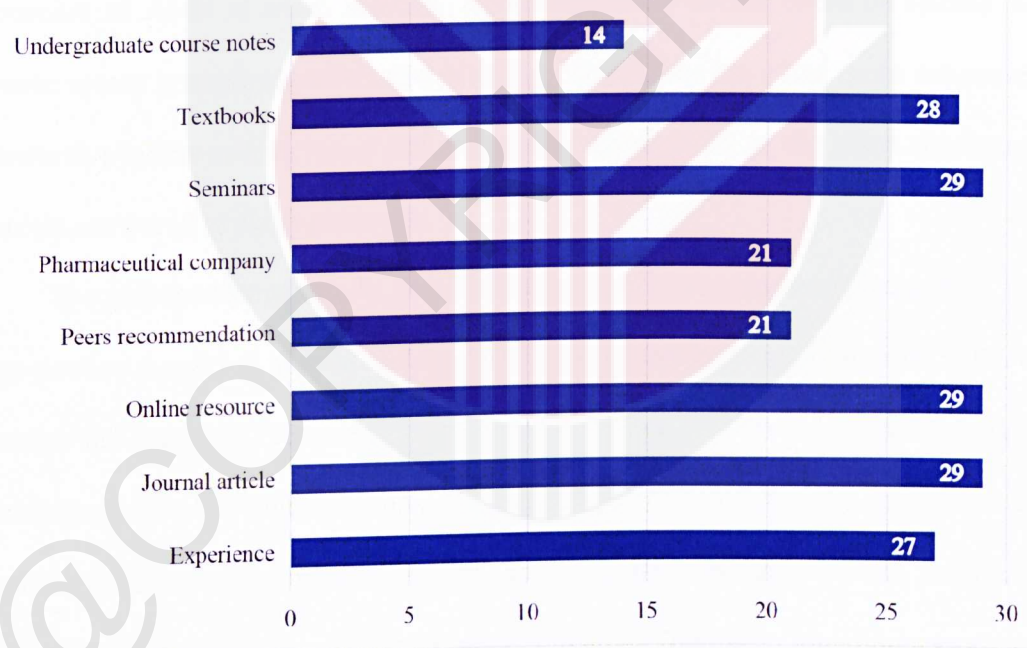
Class	Antimicrobial	Pyoderma	OHE	FURTD	FLUTD
		n=33[a]	n=19[a]	n=36[a]	n=18
Penicillin	Amoxicillin	1	9	2	1
	Amoxicillin - clavulanate	11	6	13	12
1st generation cephalosporin	Cephalexin	16	3	-	-
Lincosamides	Clindamycin	1	-	-	-
Aminoglycosides	Azithromycin	-	-	4	-
	Neomycin	2	-	-	-
3rd generation cephalosporin	Ceftriaxone	-	1	-	-
Tetracyclines	Doxycycline	-	-	15	-
Fluoroquinolones	Enrofloxacin	-	-	1	4
	Marbofloxacin	-	-	-	1
Others	Chlorhexidine	2	-	-	-

[a] Multiple prescriptions were possible for each scenario, therefore the number of prescriptions was used as a denominator.

4.6 Respondents' source of references on antimicrobial use

The most popular sources of reference on antimicrobial use are online resources, journal article, and seminars (82.9%, n=29/35); followed by textbook (80%, n=28/35), experience (77.1%, n=27/35), pharmaceutical company and peers recommendation (60%, n=21/35). Undergraduate course notes (40%, n=14/35) is the least referred source of information on antimicrobial use by the respondents.

Figure 1.4 Distribution of respondents' source of information regarding antimicrobial use



5.0 Discussion

Despite AMR issue in companion animal is often overlooked (Dickson et al., 2019), the respondents perceive AMR as a significant issue in small animal practice shown by their disagreement on the statement that denied existence AMR issue in small animal practice. This finding is contrary to the qualitative study in Australia which reported small animal veterinarians perceive small animal field has minimal contribution to AMR (Norris et al., 2019). One explanation to the phenomena could be due to bias. As participation in the study was on voluntary basis, the responses may be biased towards respondents who were more aware or concern of AMR in small animals. Another possible reason could be related to more recent graduates participated in study, where they have had more exposure towards prudent antimicrobial use and small animal AMR in the latest academic scope compared to older graduates.

The respondents generally perceived the use of prophylactic antimicrobial in an elective surgery (i.e. spay and neuter) is not necessary in relation to its risk. A study in Denmark revealed significant reduction in use of perioperative antimicrobial when veterinarians adhere to the principle of minimal prophylactic antimicrobial use in clean surgery as suggested in the Danish national antimicrobial guidelines (Hopman et al., 2019). Therefore, the perception is considered positive towards reduction of AMR risk.

Majority of respondents also perceived broad-spectrum and narrow-spectrum antimicrobial as ideal first line option and second-line option respectively. It is recommended by American College of Veterinary Internal Medicine (ACVIM) to categorize drug into first-line, second-line and third-line antimicrobial accordingly

in order to facilitate proper choice of drug for antimicrobial treatment. First-line antimicrobial is generally described as conventional drugs with narrower-spectrum (e.g: simple penicillins, tetracyclines, sulphonamides) which expected to be used frequently to treat most infections; while second-line antimicrobial is described as newer drug with extended-spectrum of coverage compared to first-line antimicrobial, which considered as reserved drugs when culture and sensitivity indicates resistance towards first-line antimicrobial (Morley et al., 2005). The distinctive result could be due to different interpretation on definition of broad or narrow spectrum with respect to first or second-line antimicrobial. In general practice, the practitioners could anticipate first-line antimicrobial as "broad-spectrum" due to its effectiveness to a wide range of pathogen species. While second-line antimicrobial is prescribed based on culture and sensitivity test, the effectiveness against a specific type of organism which could not be achieved by first-line antimicrobial, could be interpreted as "narrow-spectrum". This major misconceptions by practitioners ought to be corrected through continuing education in order to facilitate appropriate prescription.

The respondents also possess a good attitude in their prescription practice. Based on the survey, respondents are committed to ensure their prescriptions are appropriate through various practice, namely weigh the patient, proven bacterial involvement or/and rule out non-bacterial cause, consider specific pathogen involved and self-limiting factor, consider to switch antimicrobial if empirical treatment fails, and ensure client competency in antimicrobial administration through client education. These mentioned practices are essential to ensure

adherence to general principles of appropriate antimicrobial use suggested by Weese et al. (2013).

Clinical signs and financial constraint were considered by respondents to be the most important factors, followed by client expectation, culture and sensitivity test, cytology, and ease of administration. A study in the United Kingdom revealed that clinical signs was ranked the most important factor amongst small animal practitioners when prescribing antimicrobial (Hughes et al., 2011). Although clinical signs can be indicative of bacterial infection in skin disease, however, it may be non-specific in other non-infectious origin condition, for instance, neoplasia. Therefore, other factor such as the result of culture and sensitivity test or/and cytology should be taken into consideration when prescribing antimicrobial (Hughes et al., 2011) It is also suggested to have at least suspected pathogens that is likely to cause the infection in order to make appropriate decision on antimicrobial prescription (BSAVA, 2011). Multiple studies have identify clients' financial constraint could be one of the possible barriers preventing clinicians from performing further diagnostic tests (Mateus et al., 2014; Jessen et al., 2017; Hardefeldt et al., 2018a; Bourely et al., 2018; Hopman et al., 2019). This could explain why clients' financial factor will be prioritized over cytology and bacteriology culture and sensitivity test.

Based on the clinical scenario questions, broad-spectrum penicillins were the most prescribed antimicrobial in 3 out of 4 scenario (OHE, FURTD, and FLUTD). Similar findings of broad-spectrum penicillins being the most prescribed were also report in studies in Australia (Hardefeldt et al.,2017), Italy (Escher et al., 2010), United Kingdom (Hughes et al., 2011) and United States (Wayner et al.,

2011). This frequent use of broad-spectrum antimicrobial in current small animal practice is the opposite of general principle of antimicrobial use, which the spectrum of antimicrobial therapy should be as narrow as possible (Weese et al., 2013).

In the clinical scenario of canine pyoderma, majority of the respondents (85.7%) decided to prescribe antimicrobial. Clinical expert and *Danish antimicrobial use guidelines for companion animal practice* suggested cytological evaluation is necessary to confirm bacterial pyoderma; while culture & sensitivity test is recommended for all cases for which systemic antibiotic therapy is considered (Danish Veterinary Association, 2018). While only very small portion of respondents agreed to perform in-house cytology (31.4%, n=11) and culture & sensitivity test (8.5%, n=3) prior to their prescription, the most suggested reason not to perform these tests were due to time and cost constraint. This finding is similar to study by Hopman et al. (2019), citing unwillingness or inability of client to pay and wait for extra diagnostic test when the dog was healthy otherwise. This also subsequently explains the second most common reason given, i.e. the respondents would only opt for cytology and sensitivity test after empirical antimicrobial treatment failed. The top choices of antimicrobial were first generation cephalosporin (48.5%) and penicillins (36.4%) which parallel to the recommended first line antimicrobial by *ISCAID guidelines on superficial bacterial folliculitis* (ISCAID, 2014).

In the clinical scenario of ovariohysterectomy (OHE), 19 respondents out of 35 (54.3%) would prescribe antimicrobial as post-surgical prophylaxis. The most common reason was they were not confident that aseptic surgical technique can be

maintained throughout the surgery. According to guidelines, prophylactic antimicrobial is not indicated in ASA class I patient who undergoes a clean surgery, provided aseptic technique could be maintained throughout the surgery (Danish Veterinary Association, 2018; BSAVA, 2017). Considering majority of the respondents had less than 5 years of experience, the decision is understandable to avoid post-op complication in patient. The argument is also supported by a study on Australian veterinary surgeons regarding surgical prophylactic antimicrobial which reveals lower compliance to principle suggested in guidelines of fresh graduates compare to older graduates (Hardefelt et al., 2017). The remaining 16 respondents who would not prescribe antimicrobial suggested they were confident to maintain aseptic technique throughout the surgery. The most prescribed antimicrobial was amoxicillin-clavulanate, parallel to the recommended drug when prophylactic antimicrobial is indicated due to breach of asepsis according to *Antimicrobial Prescribing Detailed Guidelines* (AIDAP, 2013). However, one respondent would prescribe ceftriaxone as prophylactic antimicrobial, which raise the concern towards prudent use of antimicrobial due to the fact that third generation cephalosporin is reserved as critically important antimicrobial in human medicine (WHO, 2018) and should be used cautiously.

In the clinical scenario discussing about FURTD, 34 (97.1%) out of 35 respondents would prescribe antimicrobial. The most common reasons were clinical signs had indicated bacterial involvement in this scenario. According to *Antimicrobial use Guidelines for Treatment of Respiratory Tract Disease in Dogs and Cats*, doxycycline is recommended as the first-line antimicrobial to treat suspected acute upper respiratory infection, while the alternative first-line option

would be amoxicillin/amoxicillin-clavulanate when *mycoplasma* and *Chlamydophila felis* are not highly suspected (ISCAID, 2017). Overall, most of the antimicrobial prescriptions in this scenario are rational, with doxycycline (41.7%) and penicillin (41.7%) being the top choices of antimicrobial.

In the clinical scenario describing first occurrence of FLUTD, 18 (51.4%) out of 35 respondents would prescribe antimicrobial. The most given reasons were suspected bladder infection and to prevent ascending infection. Based on the survey, the most prescribed antimicrobial was amoxicillin and amoxicillin-clavulanate, which is the empirical treatment choice recommended by the *ISCAID guidelines for diagnosis management of bacterial urinary tract infection in cats and dogs* (ISCAID, 2019). According to the guideline, aerobic bacterial urine culture is always necessary in all cases of cats as the causes are commonly non-infectious origin (i.e: feline idiopathic cystitis and urolithiasis) rather than bacterial infection. Initial NSAIDs treatment to relieve clinical signs and withholding antimicrobial treatment while pending the result of culture is reasonable in cat (ISCAID, 2019). Therefore, the decision of not prescribing antimicrobial by the remaining 17 respondents is also justified as majority of them claim more diagnostic test would be necessary to more accurately evaluate the condition of the patient.

The main source of references by majority of respondents (82.9%, n=29/35) are journal articles, online resources, and seminars. A survey on veterinary clinicians of veterinary teaching hospital in United States reported peer-reviewed scientific literature were ranked the most important as their source of references (Ekakoro & Okafor, 2018). On the other hand, the same study also revealed only

very small proportion of veterinarians consider online resource as an important source of information. The difference in findings could be due to COVID-19 pandemic outbreak. It is believed that online resources and online seminars have become a feasible approach to obtain information during the period of Movement Control Order (MCO) announced by local authorities. In additional, study in Australia also discover continuing education is one of the most common sources of information by 46% of Australian veterinarians (Hardefelt et al., 2017).

6.0 Conclusion

Based on the survey, the perception and attitude of small animal veterinarians on antimicrobial use showed their concern towards AMR risk. Clinical signs and financial constraint were ranked the most important factors in antimicrobial prescriptions. Broad spectrum penicillin is the most prescribed antimicrobial in 3 out of the 4 clinical scenarios. The most referred source of information were journal articles, online resources, and continuing education.

7.0 Recommendation

Random sampling technique should be used to collect response based on the Malaysian Veterinary Council (MVC) full list of registered small animal veterinarians in order to provide a more accurate result representing the population of practitioners in Klang Valley.

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