Chapter-1
Introduction

Antibiotics are organic substances produced by microorganisms and capable of inhibiting the growth or destroying another microorganism at low concentration. Our antibiotics are often extracted from other microorganisms. This is hardly shocking since, in their constant struggle for energy, they excrete these compounds to combat each other (Venter *et al.,* 2017). However, what is remarkable is the immense pace with which resistance grows. There is no question that human involvement plays a significant role in AMR development. About twice as many medically essential antibiotics are eaten by animals in the U.S.A. as humans. In animal feed, several tones of last-resort antibiotics are used every year (Venter *et al.,* 2017). These drugs have been isolated from numerous sources but principally from bacteria (tetracyclines, bacitracin, polymyxin, chloramphenicol, streptomycin) and fungi (cephalosporins, penicillins). The increased use of antibiotics in man and animals and the extension of uses to areas other than prophylaxis and treatment of diseases have helped to create serious problems. When antibiotics are introduced, they will surely have this effect because by creating a hostile environment for susceptible pathogen populations, they encourage the selective survival and multiplication of forms against which the antibiotics have little or no effect. This caused serious concern because it seemed possible that each new antibiotic will loosen its usefulness as pathogenic organisms become resistant to them.

Penicillin was the first antibiotic discovered accidentally in London by the scientist Alexander Fleming. A vital resource, responsible for saving millions of lives since their discovery, is antimicrobial drugs. During the 1960s and into the 1970s, immense optimism reigned due to the defeat of smallpox and polio (Venter & Henningsen, 2017). Less than fifty years later, however, WHO published its first Global Antimicrobial Resistance Study and concluded that we are heading into an action-free post-antibiotic era, where minor infections and minor injuries will be fatal again (Venter & Henningsen,2017). Unfortunately, because of the emergence and spread of antimicrobial resistance (AMR), a multi-faceted and complex issue affecting humans, animals, plants and the climate, some antimicrobials are rapidly losing their

effectiveness (Bright-Ponte *et al*., 2019). The unregulated prescription of antibiotics tends to be very dangerous to the population. It is difficult to acquaint with whether the excessive use of antibiotics or the genetic transformation of bacterial DNA is responsible for decreased antibiotic results (Chowdhury *et al.*, 2020). Different laws have been implemented so far to formulate the control of antibiotics. However, third world countries are still finding it difficult to implement the laws properly (Chowdhury *et al.*, 2020). Due to this AMR is a lot higher in third world countries. Moreover, people with low income cannot afford AB as it's a bit costly and for this reason eventually they end up not finishing the full course (Chowdhury *et al.*, 2020).

One Health is the collective collaboration of different disciplines in health science to achieve optimum health for humans, domestic animals, wildlife, plants, and our climate. Antimicrobial resistance factors include the use and misuse of antimicrobials in the human, animal, and environmental sectors, and the spread of resistant bacteria and determinants of resistance within and between these sectors and around the world (Mcewen & Collignon, 2018). Several of the types of antimicrobials used to treat bacterial infections in humans as well as for animals. It is rational to take a One Health approach when addressing this problem, given the significant and interrelated human, animal, and environmental dimensions of antimicrobial resistance. This means taking action to ensure the continuing efficacy of current antimicrobials by reducing improper use and controlling the spread of infection (Mcewen & Collignon, 2018).

Antibiotic resistance (AMR) is a threat to public and animal health; therefore, public health officials have increased communication efforts to reduce the indiscriminate use of antibiotics. Despite efforts to promote the adoption of prudent and judicious use guidelines for antibiotics, antibiotic-resistant bacteria continue to emerge. Antibiotic resistant is a worldwide problem and this is associated with indiscriminate use of too many antibiotics for inappropriate duration in human as well as in livestock.

By increasing antimicrobial use, the frequency of resistance escalated in many different bacteria especially in many developing countries where antimicrobials were readily available without prescription. Poor sanitation conditions aided spread and a

small healthcare budget prevented access to new effective but more expensive antibiotics.

Patients who receive AMs have an increased risk of acquiring infection from resistant microorganisms and such infections may be associated with increased mortality and morbidity Reduction in AM use is a comes true in the containment of AMR and can be address through changes in prescribing behavior. Improving the appropriate use of antibiotics requires the participation of all stakeholders administering antibiotics, including veterinarians. Moreover, implementing optimal prescribing practices would be a keystone of the One Health approach to reduce the inappropriate usage of antibiotics (Zhuo *et al.*, 2018).

Objective

- To assess and compare the practitioners' antimicrobial prescribing behaviors
- To explore practitioners attitude towards antimicrobial resistance, indiscriminate use and concept regarding possible effective solutions.
- To reveal the opportunities and challenges of implementing One Health approach for future interventions

Chapter-2

Review of Literature

Antibacterial agents are used to kill or inhibit the growth of microorganisms. Despite being a commonly used medicine, it is misused often. Studies found that in Bangladesh, 90% of antibiotics were prescribed without laboratory findings (Yashin *et al.*, 2018). Inappropriate usage of antibiotics is a concern nationally and globally. AMR was reported as a global threat in many studies. Antimicrobial resistance can cause diffusion of resistant microorganisms and major undesirable effects such as duration increase of hospitalization, the boost in hazard of drug toxicity, and extensive growth in the cost. Irrational and overuse of antibiotics can result in resistant bacterial strains and adverse reactions and can also result in an economic load on the nationwide health system (Jairoun *et al.,* 2019).

In a study conducted in Silcher Medical College in India, half of the participants agreed that poor quality, lower dosing, self-medication are the prominent causes of antibiotic resistance (Yashin *et al.,* 2018). Different factors, such as community knowledge and attitudes toward antibiotics, unfettered sale of antibiotics at pharmacies, and untroubled policies concerning the instruction of antibiotics, are responsible for self-medication. It is reported that around 75% of pharmacy customers purchase antibiotics based on the experiences of their family, relatives, friends who took medicine prescribed by a senior medical doctor (Priya *et al.,* 2019). A similar type of study conducted in Egypt showed that antibiotics are available without physicians' prescription (Wahed *et al.,* 2019). If the problem is not considered, approximately 10 million people could die due to antibiotic- resistant infection by 2050 (Priya *et al.,* 2019). Moreover, US Centers for Disease Control and Prevention reported, 'treatment of antibiotic-resistant infections adds $35 billion in health-care costs and 8 million hospital days per year in the US (Priya *et al.,* 2019). According to WHO, around 50 percent of all antibiotics are either not taken rightly or sold, dispensed, prescribed in the wrong way (Priya *et al.,* 2019).

Within their action plans to combat antimicrobial resistance, various countries and many international organizations have included a One Health solution. Improvements to the regulation and policy of antimicrobial usage, monitoring, stewardship, infection prevention, hygiene, animal husbandry and alternatives to antimicrobials are important steps (Mcewen & Collignon, 2018). New recommendations on the use of medically essential antimicrobials in food-producing animals have recently been introduced by the WHO, recommending that farmers and the food industry avoid regularly using antimicrobials to encourage growth and protect healthy animals from disease (Mcewen & Collignon, 2018). These recommendations seek to help maintain the efficacy of antimicrobials that are important for human medicine by reducing their use in animals (Mcewen & Collignon, 2018).

In the Gulf Cooperation Council (GCC) countries, antimicrobial resistance may have developed for a variety of reasons. One is the ease of access and availability in health care settings of broad-spectrum antibiotics, such as carbapenems and third- and fourth- generation cephalosporins and quinolones (Jairoun et al., 2019). The existence of antimicrobial management systems, especially in the inpatient environment, where broad- spectrum antimicrobial agents are used, is absent in most GCC countries (Jairoun *et al.*, 2019). A significant contributor to the current emergence of resistance may be the scarcity of clinical pharmacists and lists of infectious disease species. Collaboration among the Centers for Disease Control and Prevention, the U.S. Food and Drug Administration, the United States Department of Agriculture, and state and local health departments, NARMS (National Antimicrobial Resistance Monitoring System) uses an integrated "One Health" approach to monitor antimicrobial resistance in enteric bacteria from humans, retail meat, and food animals. By expanding surveillance catchment areas, examining new isolated sources, adding bacteria, adjusting sampling schemes, and modifying test antimicrobial agents, NARMS has adapted to changing needs and threats (Karp *et al.*, 2017).

A study suggests having more influence by senior faculty, medical representatives, public health experts and veterinarians to monitor and audit prescriptions and follow WHO guidelines (Priya *et al.*, 2019). Since students, especially medical students are the future antibiotic prescribers, their attitude, knowledge, and practice can greatly impact antibiotic resistance issues (Wahed *et al.,* 2019). The majority of the

physicians agreed that arranging educational programs and providing updated information with microbiology advice is crucial to overcome AMR. Public awareness would be a refreshing approach to curtail the development of resistance (Priya *et al.*, 2019). To get to the root of AMR and develop successful prevention and control strategies, a One Health approach that combines human, animal and environmental whole-genome sequencing surveillance data is important (Kahn, 2017). Moreover, antimicrobials' progress can help raise average life expectancy and ensure a healthier life for humanity. Besides, the supervision of infecticious diseases could be occupied in this way (Wahed *et al.*, 2019). Lastly, AMR is a genuinely global problem that only a global solution can fix (Venter *el al.*, 2017).

Chapter-3
Materials and Methods

Study design:

We carried out a cross-sectional survey among veterinarians and physicians who suggest antimicrobials in their everyday practices. Our target participants were all registered veterinarians and physicians involved in the clinical practices in the Chattogram district of Bangladesh. Wildlife veterinarians were excluded from our study as they were very small in number and were less likely to prescribe antimicrobials in the study area. There were almost 150 veterinary doctors providing veterinary services in Chattogram, associated with government veterinary hospitals, private clinics, different private companies, or served as freelance-practitioners. We employed purposive sampling to enroll participants from the target groups based on their willingness to participate. We drafted a semi-structured questionnaire that inquired into the barriers, attitudes, and practices of practitioners in the English language and provided to each practitioner through direct meetings between the periods of August to October in 2019. Before the interview, the purpose of the study was informed to all participants and oral consent was obtained from each of them. No incentives were given for participating in the survey.

Data collection tool:

The survey questionnaire was designed in collaboration with experienced veterinarians, physicians, relevant researchers, and epidemiologists. The questionnaire was intended to extract information on demographics, barriers and factors influencing antimicrobial prescription, perception of threat, causes of AMR, commonly used antimicrobials beliefs and attitudes towards antimicrobial resistance and stewardship. Data collection was performed with the assistance of a group of trained veterinary and medical students working as research intern under “One Health Center for Research and Action”. Most of the questions contained Likert-type responses measured on a 5-point scale from very important to least important but the questions regarding the perception of threat included strongly agree to strongly disagree. ‘Unsure’, ‘neutral’ and ‘other’ options were also provided in different close-ended questions.

Ethical considerations:

This study was carried out in accordance with the recommendations of the Chattogram Veterinary and Animal Sciences University's ethics committee. EC of CVASU Approval No: Memo No.- CVASU/Dir(R&E)EC/2019/126(12)

Data analysis:

The responses were entered in Microsoft Excel 2010 (Microsoft Corporation, Redmond, Washington, USA) then coded and analyzed using Statistical Package for Social Science (SPSS) software version 25. We performed descriptive statistics for determining the frequency distributions of items within each question and visualize the results.

Chapter-4

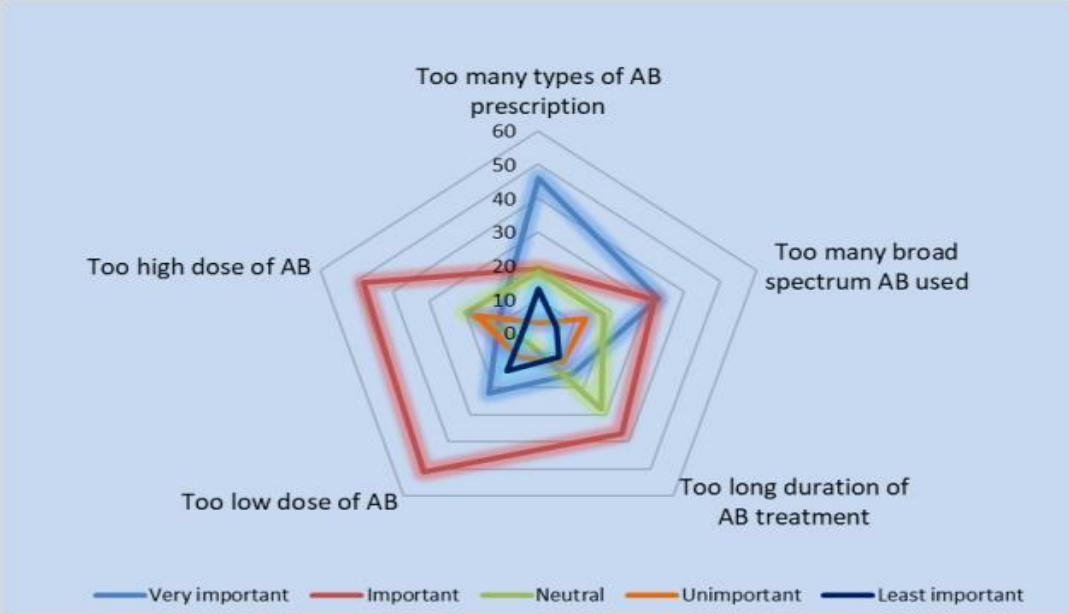
Results

The information was gathered from 200 doctors and 100 veterinarians working in either government or private sectors. The number of male participants was higher compared to the number of female participants for both physicians and veterinarians. 79% of physicians were male and 21% of female participants were female. Similarly, 88 per cent of Veterinarians were male and 12 per cent female. The medical education status was MBBS (about 81.35 per cent); the Veterinarians had a DVM degree and the percentage was 64. Moreover, 8.81 % of the physicians had an MPH/ MSc degree whereas the percentage is 33 for the veterinarians. Some of the physicians had an MD/ FCPS degree (5.70). 1.55% of the physicians and 2% of the veterinarians had Ph.D (Table-1).

Table 1: General Characteristics of survey respondents (Physicians and Veterinarians)

Variables	**Level**	**Physicians**		**Veterinarians**	
		N	%	N	%
Gender	Female	42	21	12	12
	Male	158	79	88	88
Educational status	DVM/MBBS	157	81.35	64	64
	MSc/MPH	17	8.81	33	33
	MD/FCPS	11	5.70	N/A	N/A
	PhD	3	1.55	2	2
	Others	5	2.59	NA	NA
Work experience	<2 years	52	37.96	46	50.55
	≥2 to 5 years	53	38.69	38	41.76
	>5 years	32	23.36	7	7.69
Field of work	Govt.	42	21	28	28
	Private sector	158	79	72	72

Moreover, 50.55% of the veterinarians had less than 2 years of work experience, 41.76% had 2 to 5 years, and 7% of them working for more than 7 years. Among physicians 37.96 % had less than two years, 38.69% had 2 to 5 years and 23.36% had more than 5 years of work experience. 21% of the physicians are doing government jobs, in the contrary; the percentage is higher for veterinarians which is 28%. 79% of the physicians and 72% of the veterinarians are working in the private sector (Table-1).



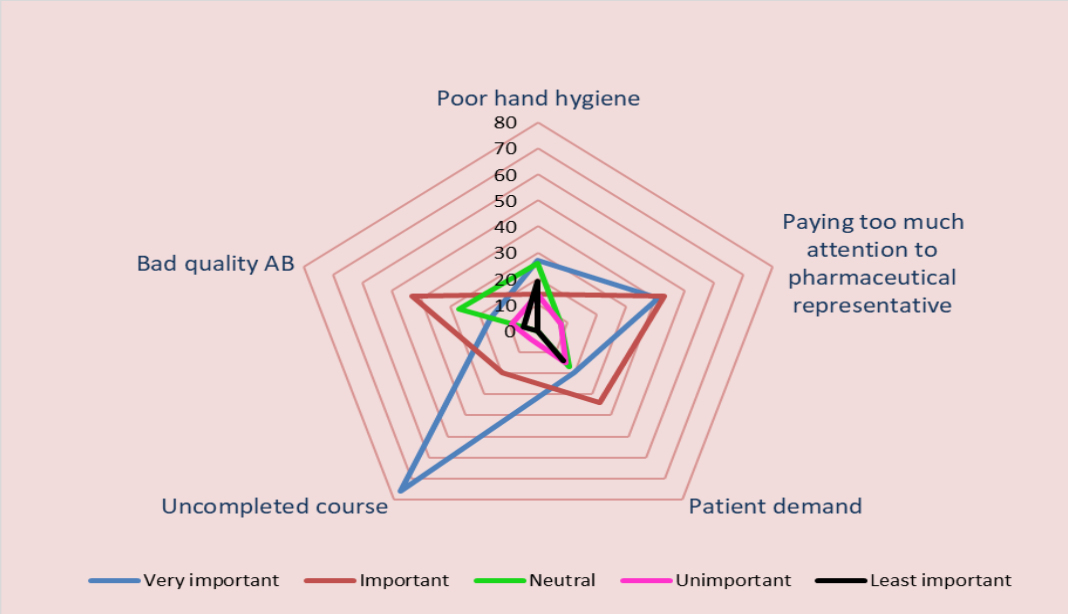
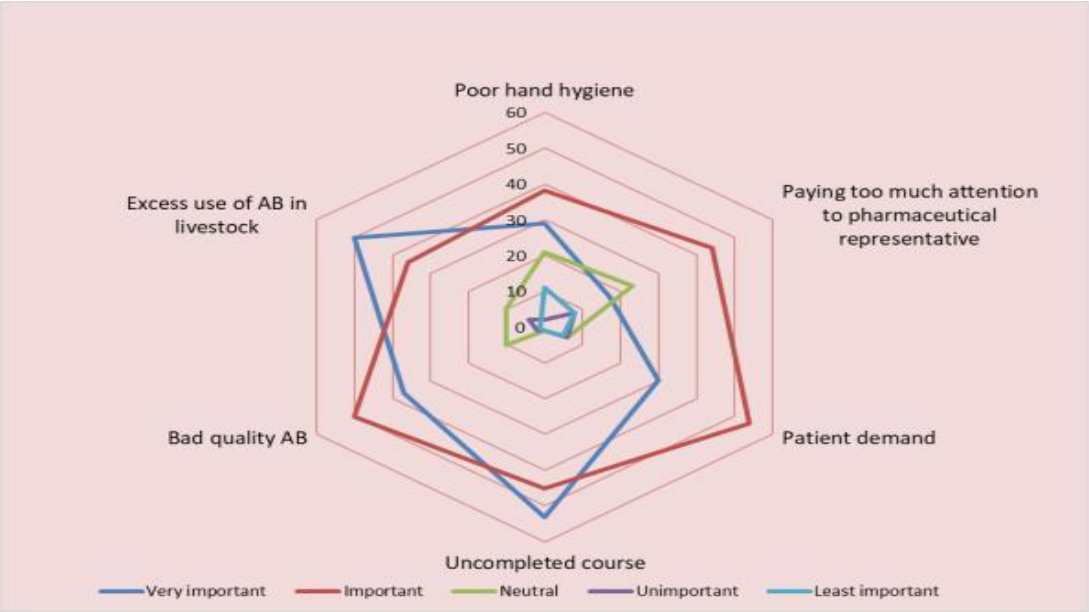


Figure 1(a): Perception of veterinarians of the most and least important cause of antibiotic resistance



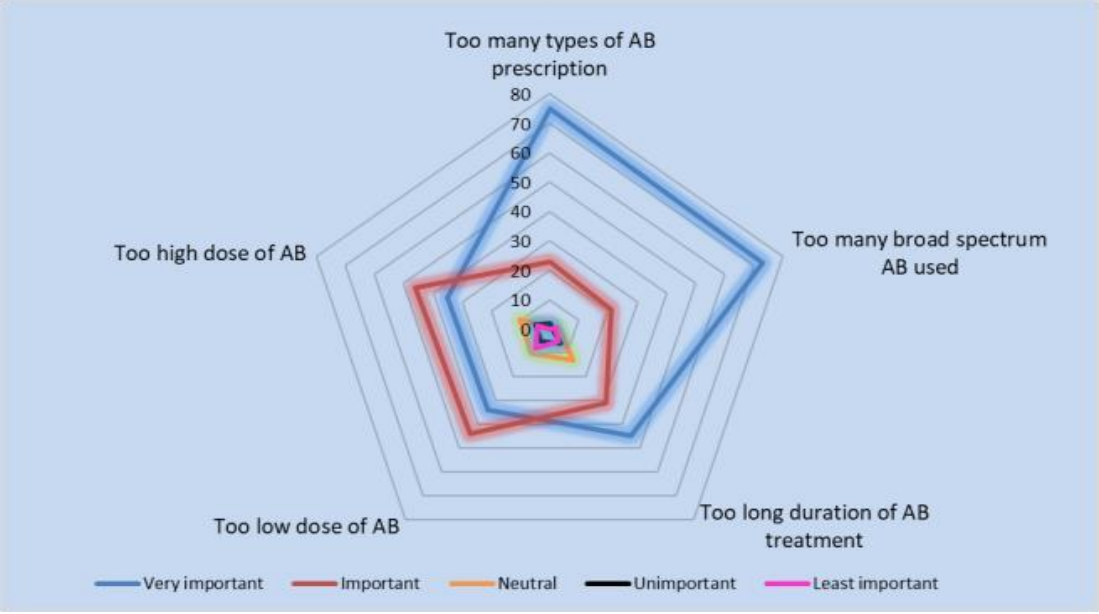


Figure 1(b): Perception of physicians of the most and least important cause of antibiotic resistance

Most of the veterinarians agreed that too many types of antibiotic prescription (nearly 50%) are “very important” causes leading to antibiotic resistance. Additionally, too high dose of AB that is around 20% and a too low dose of are other “important” causes. Beside them 35% of the respondent agreed that to long duration of antibiotic treatment & too many broad spectrum antibiotic used are also important cause of antibiotic resistance Both the physicians and Veterinarians had agreed that too many

types of antibiotic prescriptions are the major cause of antibiotic resistance. [Figure 1 (a)].

Participants were asked about their perception of the most and least important cause of antibiotic (AB) resistance. According to the physicians, the "very important" grounds that lead to antibiotic resistance are too many types of AB prescription (more than 75%) and usage of too many broad spectrums (nearly 70%). Another important cause is a too high dose of AB which is more than 20% [Figure 1 (b)]. Additionally Too low dose of antibiotic and too long duration of antibiotic treatment are also important cause of antibiotic resistance.

Physicians mentioned uncompleted course and excess use of AB in livestock are the very important reason behind AB resistance. Besides, the important factor includes poor hand hygiene, bad quality AB and patient demand. The uncompleted course is considered as the very important cause of AB resistance by the Veterinarians. Additionally, according to the Veterinarians, bad quality AB and paying too much attention to pharmaceutical representatives are the important causes of AB resistance. Patient demand is the least important in this regard. Both the physicians and Veterinarians had agreed that not completing the AB course fully is one of the prominent reasons leading to AB. [Figure 1 (b)].

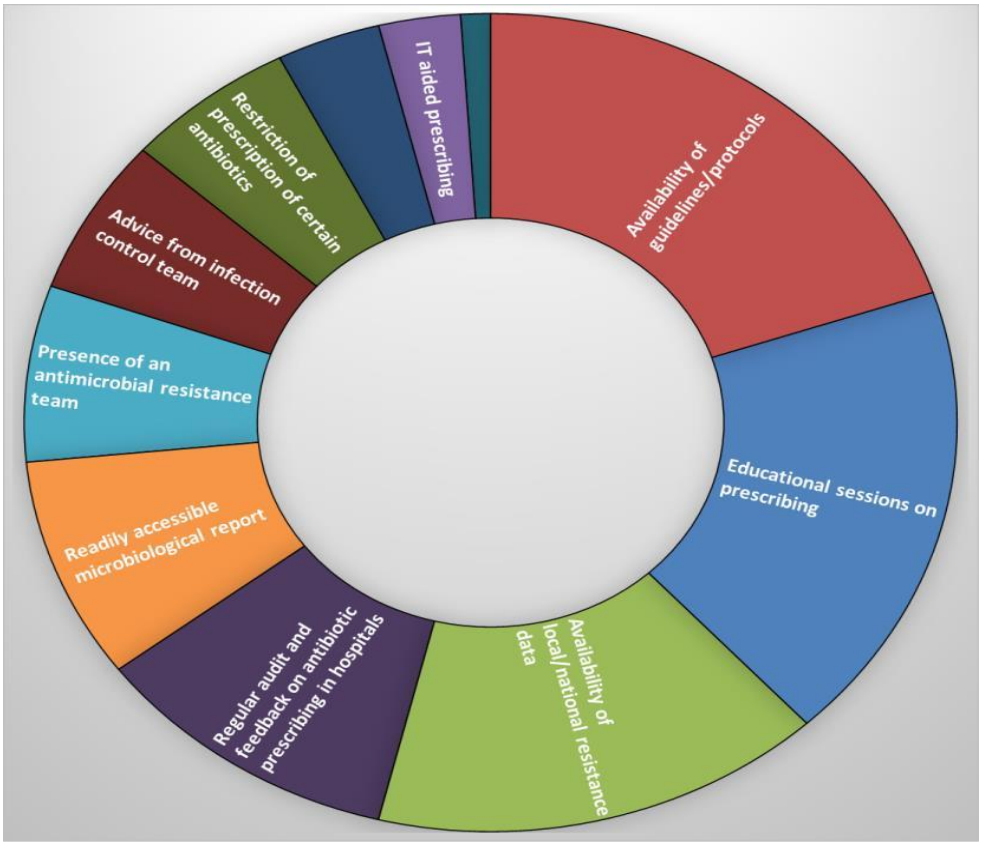


Figure 1(c): Factors identified as 'very helpful' by the physicians to improve AMR situation in Bangladesh. Larger area indicates more response to this factor.

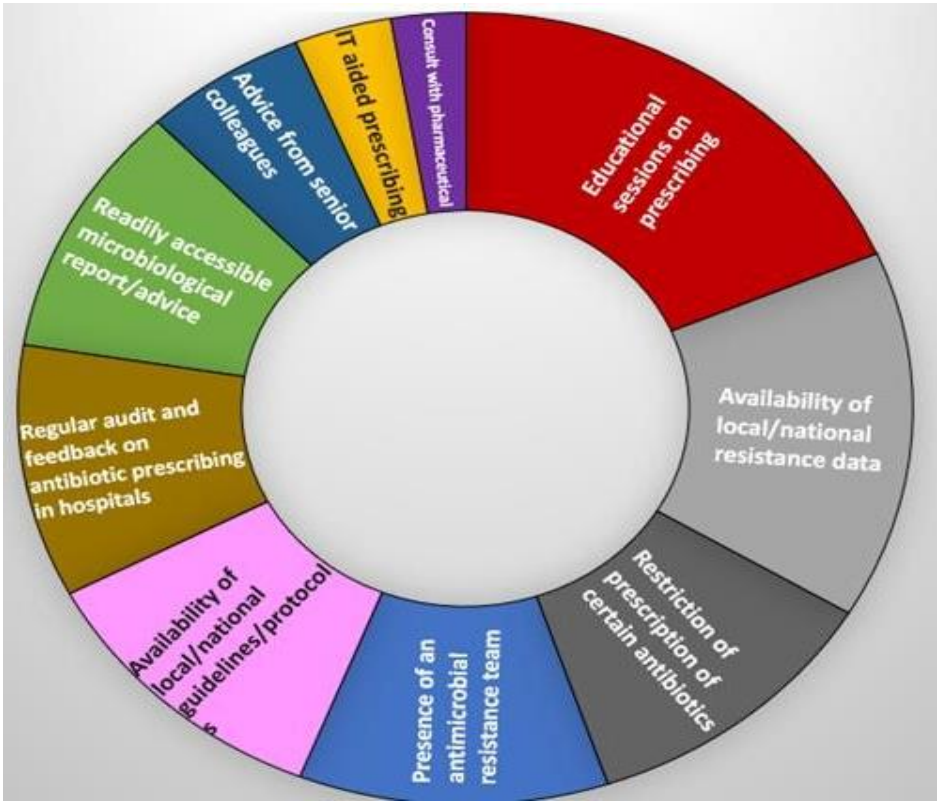


Figure 1(d): Factors identified as 'very helpful' by the veterinarians to improve AMR situation in Bangladesh. Larger area indicates more response to this factor.

The factors identified from the participants regarding the how to improve AMR situation in Bangladesh have been presented in Figure 1(c) and 1(d). Physicians and Veterinarians identified some factors to have a better AMR situation in Bangladesh. Physicians gave a higher response in the availability of proper guidelines and protocols (23%) to improve AMR situations in Bangladesh and the response rate for Veterinarians in this factor was nearly 20%. Importance should be given on educational sessions on prescribing (20%) and the availability of local/ national resistance data (15%) according to the physicians. Physician's response rate to the factor of regular audit and feedback on antibiotic prescribing in hospitals was around 13%. Another factor is a readily accessible microbiological report and the response rates were nearly 11%. The response rate for the presence of an antimicrobial resistance team, advice from the infection control team, and restriction of prescription for certain antibiotics are 9%, 4%, and 3 % accordingly. Besides, physicians and Veterinarians gave less importance (nearly 2%) to IT aided prescribing and seeking help from pharmaceuticals to improve the AMR situation in Bangladesh. It's visible that the response rate from both physicians and Veterinarians does not differ much.

The present study has identified the frequently used antibiotics for both the human and animal sector in the Chattogram region. It is found that Cefixim is the frequently used antibiotic for humans and the rate is around 60%. On the other hand, for large animals, Amoxicillin is a commonly used antibiotic (nearly 70%). For poultry and pets mostly used antibiotics are Ciprofloxacin and Ceftriaxon accordingly. Physicians also uses Ceftriaxon(nearly 55%), Azithromycin (50%), Cefuroxim (40%), Amoxicillin (nearly 30%), Ciprofloxacin (30%), Flucoxacin (more than 30%), Levofloxacin (20%), Co-amoxiciav (more than 10%), Merophenom (10%), Ofloxoxacin (less than 10%), Amicacin (10%),Cefradin (more than 10%), Linezolid (5%), Gentamycin (3%), Nitrofurantoin (nearly 2%), Moxifloxacin, Tetracyclin, Clidamycin, Clarithromycin, Cefuroxim+ Clavunic acid, doxycycline. Besides, the antibiotics used for large animals are Ceftriaxon (nearly 45%), Ciprofloxacin (nearly 28%), Gentamycin (50%), Penicillin (more than 50%), Oxytetracycline (55%), Ampicillin (more than 20%),Streptomycin (more than 50%),Colistin (5%), Pefloxacin (10%), Tylosin(5%), Cephalosporin (5%), and Cloxacillin(10%). From the result, its noticeable Amoxicillin, Ceftriaxon, Ciprofloxacin, Gentamycin, Doxycycline are the antibiotic that is used for both humans and large animals. [Figure 2].

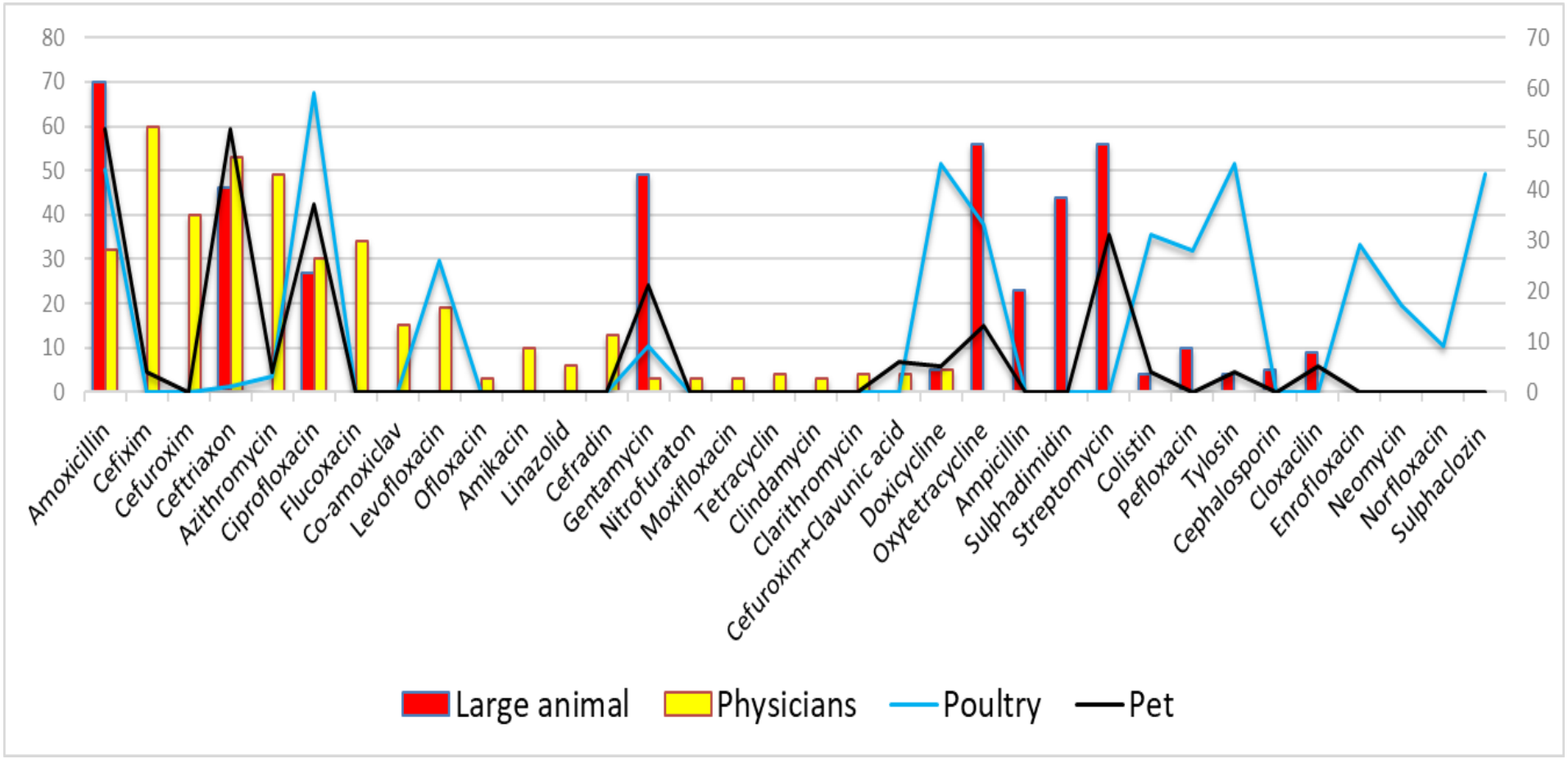


Figure 2: Frequently used antibiotics in human and animal sector in Chattogram region

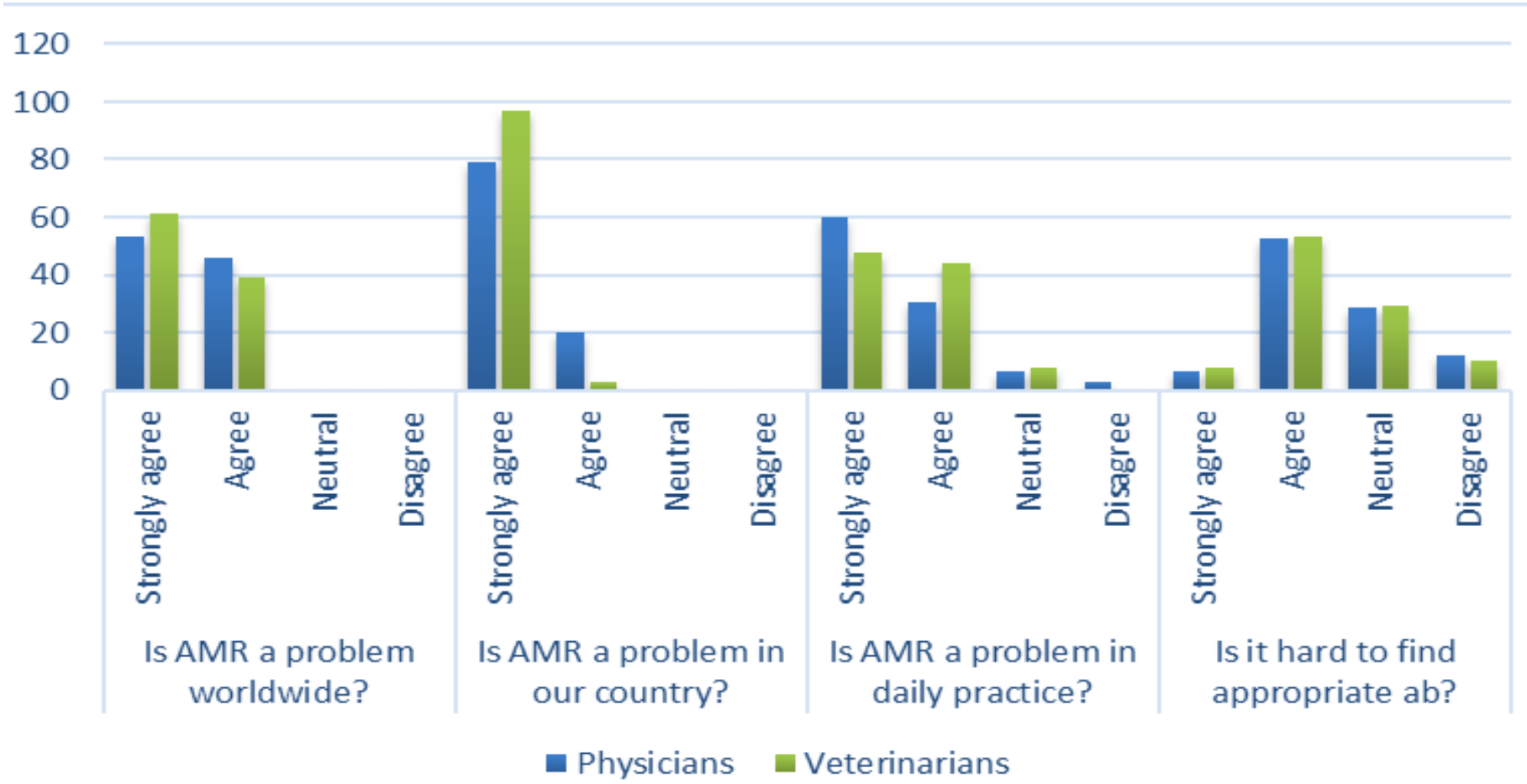


Figure 3: Perception of physicians and Veterinarians on some common topics of AMR

The result showed, both the Physicians and Veterinarians strongly agreed that AMR is a problem worldwide, in-country, and for daily practices. Around 50% of the physicians and Veterinarians agreed that it is hard to find appropriate antibiotics. On the other hand, around 8% of the Veterinarians and 10% of the physicians disagreed with this opinion. [Figure 3].

The response had been taken by physicians and Veterinarians based on the guidelines they follow while prescribing decisions. The response showed the highest percentage of prescribing decisions from previous experience and lowest from taking advice from the pharmaceutical company. From previous experience/ training/ knowledge 94.5 % of the physicians prescribe while the percentage is 90% for veterinarians. 87.5 % of the physicians use local- national guidelines for prescribing whereas, for Veterinarians, it is 45%. Around 78% of the physician and 75% of the Veterinarians take advice from senior colleagues. Besides, 51% of the physicians follow WHO/OIE/FAO guidelines for bacterial diseases whereas the percentage is less among Veterinarians (35%). Moreover, 30% of the physicians and 36% of the Veterinarians seek advice from online resources. Few of the physicians (15%) and Veterinarians (13%) take advice from pharmaceutical company. [Figure 4].

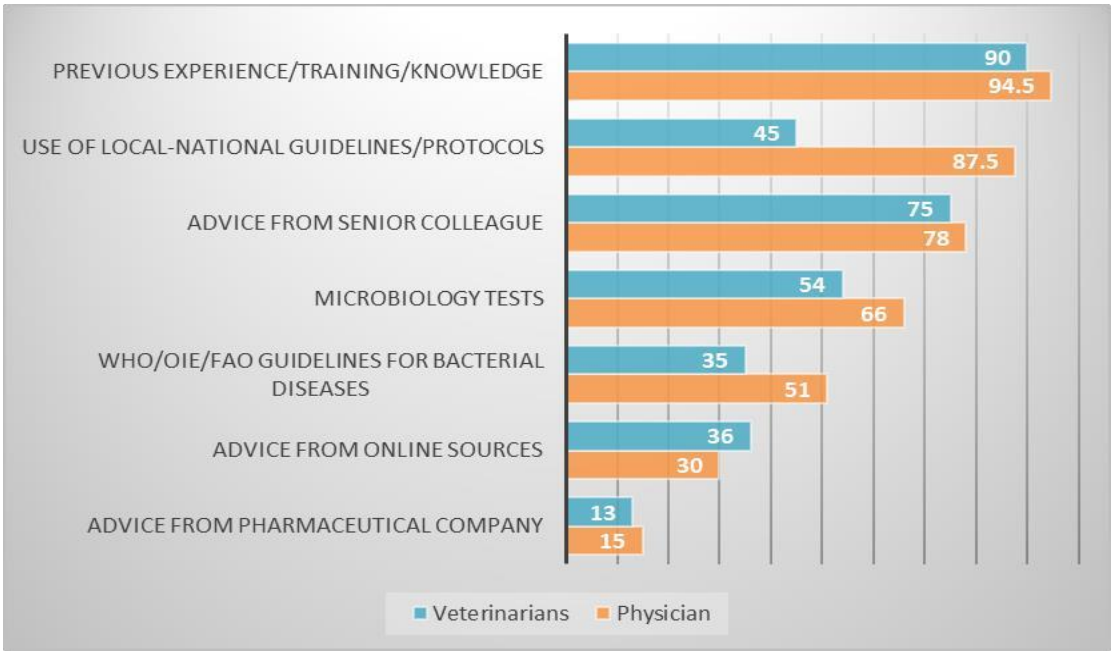


Figure 4: Response by physicians and Veterinarians to 'what guide your prescribing decision'

Chaapter-5
Discussion

Antimicrobial resistance presents an increasing apprehension globally for human and animal health (Zhuo*et al.,* 2018). Due to misuse and overuse of antibiotics, the world witnessed an enormous demonstration in the increase of microbial resistance to affect the health, economic load, elevated mortality rates, lengthened hospital stay, and the increased rate of different infections. In this study, we evaluated the AMR and AMU perspective among physicians and veterinarians with the opportunities of implementing ONE Health approach at Chattogram, Bangladesh. Physicians and Veterinarians strongly agreed that AMR is a problem worldwide, in-country, and for daily practices which is relevant to other studies conducted on this topic.

In this study, the data were collected from 200 were physicians and 100 Veterinarians. Among them, most (more than 70%) were male participants. Due to male dominance, we could collect fewer data from female practitioners. In another study in Chittor, the numbers of male participants were higher (Priya *et al.*, 2019). In present work, the majority of the veterinarians had less than 2 years of work experience, 41.76% had 2 to 5 years, and few of them working for more than 7 years. Among physicians 37.96 % had less than two years, the majority had 2 to 5 years and 23.36% had more than 5 years of work experience whereas in a different study in India, most of the physicians (70%) having working experience between 4-6 years and 10% of physicians having more than 7 years' experience, 10% physicians having between 1-3 (Priya *et al.*, 2019).

In the present work, physicians and Veterinarians were asked about their perception regarding the most important cause responsible for AMR. Both the respondents had agreed that too many types of antibiotic prescriptions, not completing the AB full course are the "very important" causes of antibiotic resistance. Besides, they agreed that too many doses of antibiotic are another "important" cause. A similar study held in Egypt where more than 70% of the physicians considered that inappropriate selection of antibiotics, not completing treatment, inapt duration of antibiotic therapy, the widespread use of antibiotics, lack of guidelines, and role of pharmaceutical

companies are the main factors, followed by the poor quality of antibiotics, mutations in microbes, and poor access to information concerning local antibiotic resistance patterns are the causes behind AMR (Wahed*et al.,* 2019). Besides, in another study conducted in India, the majority of the respondents admitted that it is important to know the resistance rate of bacteria in local settings and cultural sensitivity test is important for prescribing. Besides, respondents from all doctors agreed that patient's demand for antibiotics is the major reason that contributes toward the abuse of current antibiotics whereas in our study it was least important Priya et al., 2019). .

The response to "what guides them while prescribing decisions" showed the highest percentage of prescribing decisions from previous experience for both physicians and Veterinarians. Taking advice from pharmaceuticals got the least response from the participants. However, a regression analysis conducted on data from selected cities of Pakistan exposed different findings like ours (Priya*et al.,* 2019). According to them, the promotional tools of pharmaceutical companies had a substantial impact on physicians' prescribing practices. A different study in Andhra Pradesh, India got similar findings to Pakistan (Priya *et al.,* 2019).

Results of our study revealed that Cefixime is the frequently used antibiotic for humans and the rate is around 60%. On the other hand, for large animals, Amoxicillin is a commonly used antibiotic (nearly 70%). Amoxicillin, Ceftriaxone, Ciprofloxacin, Gentamycin, Doxycycline are the antibiotic that is used for both humans and large animals. On the contrary, penicillin and cephalosporin followed by macrolides were the most commonly used antibiotics found in a study in UAE (Jairoun *et al.*, 2019). Mass medication of animals with antimicrobials that are critically important to humans, such as third- generation cephalosporins and fluoroquinolones, and the long-term use of medically important antimicrobials, such as colistin, tetracyclines and macrolides, for growth promotion are major concerns in the animal health and agriculture sectors (Mcewen & Collignon, 2018). Mass medication of animals with antimicrobials that are critically important to humans, such as third-generation cephalosporins and fluoroquinolones, and the long-term use of medically important antimicrobials, such as colistin, tetracyclines and macrolides, for growth promotion are major concerns in the animal health and agriculture sectors (Mcewen & Collignon, 2018).

In the "very helpful", "helpful", criteria in Bangladesh, physicians and veterinarians identified some variables to have a better AMR situation. Respondents gave a higher response in the availability of appropriate guidelines and protocols to improve the situation of AMR in Bangladesh. In addition, importance should be given to prescribing training sessions and the availability of local/national resistance data. Physicians gave some response to regular audit and feedbacks on antibiotic prescribing in hospitals were around. However, physicians gave less importance (nearly 2%) to IT aided prescribing to improve the AMR situation in Bangladesh. In a study in Australia, respondents established an understanding of shared responsibility through acknowledging their own and own profession's responsibility for mitigating and managing AMU (Zhuo *et al.,* 2018). According to them, the importance of treatment guidelines should be given which was considered as "very helpful" by our participants as well (Zhuo *et al.,* 2018).

This study has some limitations. As the numbers of veterinarians are less, we could take less response from them. Besides, pharmacists, medical students and general people were not included. Moreover, we could only take response from those who were willing to participate. The ingrained shortcomings of survey study, such as recall bias, respondents' potentially deceptive responses, and systemic and random error in responses were inevitable. Nevertheless, survey analysis is a cost-efficient and effective way of obtaining population data.

Chapter-6
Conclusion

This study contains an efficient understanding of the perspective of physicians' and veterinarians concerning the overall aspect of AMR and provided the foundation for implementing One Health approach. The findings may use as baseline evidence to advocate successful strategies and action plans to resolve the AMR problem by strengthening Bangladesh's infection prevention practices. The findings might assist to deal with AMR related issues in future since it provides detailed information of knowledge and practices regarding antibiotic use among the respondents. Policy makers will get some assistance to improve some areas related to AMR. Although this study focused on prescribers in Chattogram, we believe that the results are of global relevance.

Chapter-7

Recommendation

1. Rational use of antibiotics.
2. Prescribing narrow spectrum drugs.
3. Prescribing antibiotics only when it’s needed.
4. Strong rules and regulations to monitor the market of antibiotics.
5. More comprehensive study at earliest basis to uncover the total scenario of this highly concerned issue.

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Questionnaire

A questionnaire on Knowledge & attitudes survey about antimicrobial resistance

1.Name 2. Employer/chamber name:

3.Designation: 4. Educational Status:

5. How many years have you been working?

Part A

6. Which spectrum of antibiotics do you prefer most?

☐ Narrow spectrum ☐ Broad spectrum

7. Are you interpreting microbiological results when prescribing antibiotic

☐ Regularly ☐ Frequently ☐ in special case ☐ never.

8. Do you prescribe more than one antibiotic in a single prescription?

☐ Regularly ☐ Frequently ☐ in special case ☐ never

09. Which help or guides your prescribing decision? (Tick all that apply)

- Previous experience/knowledge/training ☐1
- Seeking advice from a senior colleague ☐2
- Seeking advice from internet sources ☐3
- Seeking advice from microbiological result ☐4
- Advice from pharmaceutical company ☐5
- Use of local/national guidelines/policies/protocols ☐6
- WHO guidelines for bacterial diseases ☐7
- Other (please specify)….

10. Do you think you have enough sources ofinformation about antibiotics when you need it?

☐ Yes ☐ No, (please specify whichsources do you think would be useful…….)

11. Is there any restrictive policy in your hospital to apply antibiotic:

yes ☐1 No ☐2 Unsure☐3

12. I find it hard to select the correct antibiotic

☐ stronly agree ☐ agree ☐ neutral ☐ disagree ☐ strongly ☐ disagree

13. What proportion of antibiotics do you consider to be unnecessary or inappropriate prescriptions in your hospital/workplace?

No ☐$_1$<10% ☐$_2$11-20% ☐$_3$21-50% ☐$_4$>50% ☐$_5$Unsure ☐$_6$

Part B : Perceive importance of the problem of antibiotic resistance

14. Antimicrobial resistance is a problem in worldwide

☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

15. Antimicrobial resistance is a problem in your country

☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

16. Antimicrobial resistance is a problem in your daily practice

☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

17. The following scenarios are potential causes for resistance; please identify which, in your opinion, is the **most or least important cause**

	Very important	Important	Neutral	Unimportant	Least important
• Too many types of antibiotic prescriptions	☐$_1$	☐$_2$	☐$_3$	☐$_4$	☐$_5$
• Too many broad spectrum antibiotics used	☐$_1$	☐$_2$	☐$_3$	☐$_4$	☐$_5$
• Too long durations of antibiotic treatment	☐$_1$	☐$_2$	☐$_3$	☐$_4$	☐$_5$
• Too low a dose of antibiotics	☐$_1$	☐$_2$	☐$_3$	☐$_4$	☐$_5$
• Too high dose of antibiotics	☐	☐	☐	☐	☐
• Poor hand hygiene	☐$_1$	☐$_2$	☐$_3$	☐$_4$	☐$_5$
• Paying too much attention to pharmaceutical representative or advertising	☐$_1$	☐$_2$	☐$_3$	☐$_4$	☐$_5$
• Patient demand	☐	☐	☐	☐	☐
• Not complete the full course	☐	☐	☐	☐	☐

- the antibiotics are of bad quality ☐ ☐ ☐ ☐ ☐

18. In last year, have you received any training on antibiotic prescribing?
    yes ☐1 No ☐2 Unsure ☐3
    If yes, how many? _____
19. How was the training delivered (tick all that apply) ●Lecture ●Workshop ●web-based learning ●Informal education in workplace

Part C: Attitude about current and potential interventions to evaluate the problem of antibiotic prescribing

20. What measures do you think would be the most helpful in improving antibiotic prescribing?

	Very helpful	Helpful	Neutral	Unhelpful	Very unhelpful
• Educational sessions on prescribing	☐1	☐2	☐3	☐4	☐5
• Availability of local / national guidelines / policies / protocols	☐1	☐2	☐3	☐4	☐5
• Availability of local/national resistance data	☐1	☐2	☐3	☐4	☐5
• Computer-aided prescribing	☐1	☐2	☐3	☐4	☐5
• Presence of an antimicrobial management team	☐1	☐2	☐3	☐4	☐5
• Readily accessible microbiological report/advice	☐1	☐2	☐3	☐4	☐5
• Advice from senior colleagues	☐1	☐2	☐3	☐4	☐5
• Speaking to a pharmaceutical representative	☐1	☐2	☐3	☐4	☐5
• Restriction of prescription of certain antibiotics	☐1	☐2	☐3	☐4	☐5
• Restriction of prescription of all antibiotics	☐1	☐2	☐3	☐4	☐5
• Regular audit and feedback on antibiotic prescribing in your hospital/company	☐1	☐2	☐3	☐4	☐5
• Other (specify)……					

21. Please mention five common antibiotics you are frequently using (for physician)

……..

22. Please mention five common antibiotics you frequently use in poultry (for veterinarian)

…….

23. Please mention five common antibiotics you frequently use in pet (for veterinarian)

..... ……

24. Please mention five common antibiotics you frequently use in pet (for veterinarian)

……

Date & signature of the data collector

……

BRIEF BIODATA OF THE STUDENT

Dr Mohammad Arafat Rahman is a Candidate for the degree of MPH in One Health under the One Health Institutes, Chattogram Veterinary and Animal Sciences University. He conceded the Secondary School Certificate Examination (SSC) in 2008 form Kattali NHC High School, Chattogram and then Higher Secondary Certificate Examination (HSC) in 2010 from Govt. Hazi Muhammad Mohsin College, Chattogram. He obtained his MBBS form Chattogram Medical Collage in 2017. He is now Studying in Bangabandhu Sheikh Mujib Medical University as Phase A MD Student in Physical Medicine and Rehabilation Subject.