Communication

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Common Barriers, Attitudes, and Practices of Veterinary Practitioners Regarding Antimicrobial Resistance and Stewardship in Chattogram, Bangladesh

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Abstract: The perceived risk of antimicrobial-resistant pathogens creates the necessity for understanding the role of the prescriber groups. Hence, we conducted a cross-sectional survey among veterinary practitioners to assess their understanding regarding antimicrobial prescribing and the issue of antimicrobial resistance (AMR) in livestock. We collected responses from 100 veterinarians engaged in the large animal, poultry, and pet animal care practices. Proportions were calculated for categorical variables and the results were visualized. We revealed two key barriers: a lack of enough information and of training on the proper prescription of antimicrobials. Prescribing a wide variety of antimicrobials and doing incomplete courses of antimicrobial treatments were two very important causes pointed out by the respondents for the development of antimicrobial resistance. A number of highest-priority critically important antimicrobials (HP-CIAs) of human health were found to be used by veterinary practitioners. In addition to clinical features like types of organisms and severity of the disease, the availability of drugs in the local market and the economic conditions of farmers have the potential to influence the decisions of veterinarians in prescribing antimicrobials. The professional development of veterinarians and the maintenance of strong coordination are crucial to ensure the proper engagement of veterinarians as the front-line fighters for tackling the AMR issue.

Keywords: Antimicrobial resistance, antimicrobial stewardship, perception, questionnaire survey, veterinary practitioners.

1 Introduction

Drugs that kill or suppress different types of disease-causing pathogens are called antimicrobials. Antibiotics are an important group of those that act against bacteria. When antimicrobials are introduced, they create a hostile environment for susceptible pathogen populations, which facilitate selective survival, and subsequently, the development of antimicrobial-resistant microorganisms. Antimicrobial resistance (AMR) is an alarming global health crisis. Currently, Bangladesh is located in a high-risk zone assessed by the World Health Organization (WHO) [1]. Infections caused by resistant microbes might be associated with increased treatment costs and unexpected morbidity and mortality. Considering the high impact of AMR, by 2050, livestock production is expected to fall by 11% in low-income countries [2]. Indiscriminate use of antibiotics in livestock production as a growth promoter together with the prophylaxis and treatment of diseases, has exacerbated the AMR problem. Statistics showed that more medically important antibiotics were used in the agriculture sector than in human medicine, and the rate was over 70 percent of the total of medically important antibiotics used in the USA [3]. However, the implementation of policies can restrict this growing risk [2]. As a result, in May 2017, Bangladesh introduced its national action plan (BNAP) for antimicrobial resistance containment based on the global action plan endorsed by the WHO. BNAP prioritizes the sensible use of antimicrobials by the establishment and the implementation of standard treatment guidelines

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and antibiotic stewardship protocol in both the veterinary and the human health sectors [4]. Although the BNAP aligns well with the WHO global action plan (GAP), gaps in financing, antimicrobial stewardship, and operational, and monitoring and evaluation frameworks still exist.

Despite the efforts to promote the culture of cautious use of antimicrobials, antimicrobial-resistant microbes continue to emerge. The situation is further exacerbated by the aggressive marketing strategies of pharmaceutical companies, prescriptions by unqualified dispensers, the inadequate knowledge and lack of awareness of the general public, and the absence of proper regulations [5] morbidity burden in Bangladesh. In this perspective piece, the problem of antibiotic resistance has been analyzed by critically evaluating literature data, and based on the author's experience. Areas covered: The underlying causes of this resistance are numerous including irrational and inappropriate use of antibiotics aggravated by aggressive marketing, over-the-counter dispensing, prescribing by the unqualified providers, lack of awareness in the general population, and inadequate implementation of relevant regulations. Expert opinion: Although Bangladesh is making some progress toward containing antibiotic resistance, the pace of this progress is insufficient. Public awareness is crucial for the full implementation of the regulations. Given that it is more a social than a medical problem, the health sector is unable to tackle the problem on its own. An integrated approach is required that identifies the roles and relative importance of each sector (human, animal, and environment). The veterinary sector is one of the major sectors of concern that can lead to the proliferation of antimicrobial-resistant microbes and thus play a key role in safeguarding both human and animal health. As a result, the fourth objective of BNAP focuses on the optimized use of antimicrobials, throughout the veterinary sector, which is critical in curbing the AMR issue [6] the World Health Organization (WHO). Thus, the success of the existing and future interventions requires the active participation of veterinarians as key players in administering antimicrobials in animals.

Even though researchers have investigated different antimicrobial resistance patterns of microorganisms and resistant genes, there have been very few studies focusing on the role of veterinarians regarding AMR in Bangladesh. Nevertheless, one study found that misinformation and misconception regarding antibiotic action and resistance are prevalent among healthcare providers, including veterinarians, in Bangladesh [7] in-depth interviews with 46 community HCPs in one urban and one rural area Gazipur and Mirzapur districts respectively. Therefore, this study attempted to understand the common barriers,

practices, and the frame of mind of field veterinarians from different disciplines towards the different use of antimicrobials and antimicrobial resistance. Results could be used as baseline evidence to advocate the efficient interventions and action plans to tackle the AMR issue through improving the antimicrobial stewardship practices in Bangladesh.

2 Materials and methods

2.1 Study Design

We carried out a cross-sectional survey among veterinarians who prescribe antimicrobials in their everyday practice. Our target participants were all registered veterinarians involved in the treatment of large animals, poultry, and pet animals in the Chattogram district of Bangladesh, as well as intern doctors working in the teaching veterinary hospital under the Chattogram Veterinary and Animal Sciences University (CVASU), the only specialized veterinary university in the country. Wildlife veterinarians were excluded from our study as they were a few in numbers and were less likely to prescribe antimicrobials in the study area. As far we know, during the time of the study, 150 veterinary doctors were providing veterinary services in the Chattogram district. Those were associated with government veterinary hospitals, private clinics, different private companies, or were serving as freelance practitioners. The number of intern veterinarians was 53 at the time of the survey. We did a deliberate sampling in order so we can get representatives from all target-based groups to participate. We also took into account their willingness to take part in the study. We drafted a semi-structured questionnaire in the English that inquired about the barriers, viewpoints, and practices of veterinarians. The questionnaire was given to each practitioner in an in-person meeting between the periods of August to October in 2019. The number of respondents we could contact was subject to time and resource constraints. Therefore, we contacted 120 veterinarians and got complete responses from 86 of them. On the other hand, among intern veterinarians, we only reached out to 20 who were actively engaged in clinical medicine practice at a veterinary hospital, and received responses from 14 of them. Before the interview, the purpose of the study was explained to all participants and verbal consent was obtained from each of them. No incentives were given for participating in the survey.

Ethical approval: The conducted research is not related to either human or animals use.

2.2 Data Collection Tool

The survey questionnaire, attached in the Appendix, was designed in collaboration with experienced veterinarians, relevant researchers, and epidemiologists. The questionnaire was intended to extract information on the demographics of the participants, barriers and factors influencing antimicrobial prescription, perception of threat, causes of AMR, commonly used antimicrobials beliefs, and attitude toward antimicrobial resistance and stewardship. Data collection was performed with the assistance of a group of veterinary students. They were trained on data collection methods and different types of questions in a questionnaire through lectures and field practices, and were working as research interns under the “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 had answers on a scale from “strongly agree” to “strongly disagree”. ‘Unsure’, ‘neutral’ and ‘other’ options were also provided in different close-ended questions.

2.3 Data Analyses

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

2.4 Results

Among total veterinary participants, 32% were engaged in the private sector, 23% in the government livestock department, 18% declared themselves as freelance-practitioners, 14% were interning doctors who had completed their academic courses and were working in different veterinary hospitals, and the remaining 13% were duty doctors in different institutional or private vet clinics. The majority of the participants (89%) were male and 11% were female. 61% of the respondents acknowledged that they have faced difficulties in selecting the correct antimicrobials when giving a prescription and 63% of them also pointed out the scarcity of adequate sources of information on the use of antimicrobials. More than half of all the participants (67%) claimed that they did not receive any formal professional

training from their respective employer or veterinary council on antimicrobial prescribing or AMR in the last year.

During prescribing, the practitioners seek help from different available sources for selecting the right antimicrobials. Our participants mostly used their previous knowledge and experience (90%) and also took advice from senior practitioners (75%). All sources acknowledged by the participants are shown in Figure 1.

Figure 1: Different sources used by the veterinarians for selecting antimicrobials

The understanding of the participants regarding the contribution of different factors for the development of AMR are presented in Figure 2. Prescription of the wide varieties of antimicrobials and the ignorance of farmers to complete the full course of the drugs were two very important factors selected by the respondents of the study, which lead to the rise of AMR.

Figure 2: Perception of veterinarians to the most and least important causes of antimicrobial resistance

Figure 3 represented that amoxicillin, oxytetracycline, ciprofloxacin, and gentamicin were extensively prescribed by all groups of veterinarians. Ceftriaxone, penicillin, and streptomycin were mainly prescribed for large and small animals, whereas colistin, tylosin, and levofloxacin were mostly used in the poultry sector.

Figure 3: List of commonly prescribed antimicrobials in large animals, poultry, and pet animals

Figure 4: Factors considered by veterinarians during the prescription of antimicrobials

We also elucidated different factors that influence the selection of antimicrobials by the participants. The type of organism, the severity of the disease, the availability of drugs in the local market, and the economic status of the farmers were the most considered factors by the practitioners when prescribing antimicrobials. All clinical and non-clinical factors recognized by the participants are shown in Figure 4.

All respondents of this study either strongly agreed or agreed with the statement that AMR is a global problem, a national problem, as well as problematic for their own daily practices. 33% of the respondents have regularly advised the farmers to keep records of drugs that they have used. Only 10% of the respondents advised poultry farmers to maintain the withdrawal period of the antibiotics that is the suggested time after administering the antibiotic, before the consumption of food animals or the food derived from the animals.

3 Discussion

The results disclosed common barriers that impact the prescribing decision of a veterinarian. We included participants having a wide range of experience, from new emerging practitioners to more senior professionals practicing in different sectors of veterinary medicine. A few intern doctors who had engaged in field practice have participated in this survey. The respondents stated that they struggled with the selection of the right antimicrobials in their daily practices and claimed that there was a scarcity of adequate information sources to guide their antimicrobials prescribing. This finding highlighted the professional communication gaps that lead to inappropriate use of antimicrobials, especially by new practitioners. Around 50% of the practitioners used previous knowledge and experience and advice from senior practitioners for prescribing antimicrobials as proper prescribing guidelines were not available in Bangladesh, a scenario that was also found in India [8]. The findings of a previous study echoed similar results of the lack of antimicrobial prescribing policies and found only 28% of respondents followed available guidelines [9]. The European Platform for Responsible Use of Medicines in Animals (EPRUMA), Australasian Infectious Disease Advisory Panel guidelines and the British Small Animal Veterinary Association guidelines are serving as the source of information for supporting the prescribers in Europe and Australia. Most of our study participants did not receive any formal professional training from their respective employer or veterinary council on antimicrobial prescribing or AMR in the last year. In Bangladesh, such training sessions are generally hosted by various governmental, non-governmental, and corporate actors. For instance, the Department of Livestock Services Bangladesh provides residential training for all government veterinarians. Non-government organizations, for example the Bangladesh AMR Response Alliance, arranges a residential trainings throughout the year on antimicrobial stewardship for both veterinarians and physicians. The annual Continuing Education for the Veterinarians of Bangladesh (CEVET), organized by the veterinary council, veterinary association, and the Food and Agriculture Organization (FAO) also holds sessions on antimicrobial use and AMR. It is open for all professionals, as well as intern, veterinarians. Moreover,

private companies also arrange different short training sessions, lectures, and/or seminars for their employees every year. However, it is still a challenge for regulatory bodies in Bangladesh to provide uniform guidelines, training, and other means of information sources. Studies conducted in other countries also expressed the necessity of guidelines for responsible antimicrobial prescription [10,11]. Thus, training modules should be field-oriented and interactive as traditional teaching methods and study materials often fail to create long-lasting impact [12]. However, regular dissemination of updated data and monitoring field practice is also highly recommended to dictate the prescribing approach.

The prescribers recognized the possible causes of AMR and ranked them based on the role of each cause. They mostly identified the causes related to their own practices under the “very important” and “important” categories, as well as the farmers’ role in not completing the full course of antimicrobials and poor hand hygiene. Non-compliance with the scheduled course of antimicrobials is a common behavior of farmers in Bangladesh [13]. Moreover, poor personal hygiene practices of farmers, especially hand-washing, contribute to the transmission of AMR to humans. A study in Bangladesh found that the practice of washing hands was rare among farmers. They would often drink and eat immediately after animal handling without proper washing [14]. In addition, the participants in our study also pointed out the role of pharmaceutical companies in encouraging the use of more drugs as an important cause of AMR development. Aggressive marketing strategies of the pharmaceutical companies compel their representatives to undertake unethical approaches, such as using incentives in order to persuade them, emotional blackmail, or serving family members to promote the use of their products through practitioners’ prescriptions [15]. Sales representatives also visit farms to provide drug schedules and even treatment advice to encourage farmers to use antimicrobials [16]. The marketing of drugs to farm level is also present in India [8]. Competitive marketing policies of pharmaceutical companies put pressure on the prescribers’ decision for using antimicrobials at the cost of patients, as found in a study in the UK [17]. A study conducted in Flanders and the Netherlands also found that pharmaceutical companies could regulate the antimicrobial prescribing decisions for over half of the farm animal practitioners [18]. In Bangladesh, pharmaceutical marketing schemes significantly affect the prescription behavior of physicians too [19]. The low quality of the drugs available on the market was also marked as an important factor by some of the participants. A few small companies that have no

production plants, import drugs from foreign countries and repack them with their labeling before marketing. The quality of drugs highly deteriorates in this process of packaging and marketing. These companies are persisting on the market by providing higher discounts to dispensers and rewards to doctors. The persistence of such harmful business practices is linked to the fact that antimicrobial production, prescription, and use are not properly monitored and regulated by laws in Bangladesh [13]. Another group of stakeholders that our findings could not incorporate were drug dispensers. Drug dispensers in the rural areas of Bangladesh are able to sell antibiotics without qualified veterinarians’ prescriptions due to the absence of legal barriers [20]. These factors stand as some of the barriers to the application of antimicrobial stewardship and could potentially divert the prescriber’s behavior away from the standard approach. Our findings revealed the diversity of the problem and the contribution of different stakeholders from production to the application of antimicrobials. Consequently, it creates a demand for multi-sectoral engagement and multidimensional strategies to challenge the threat.

Participants were found to be using different critically important antimicrobials (CIA) of human health in veterinary practice, especially gentamicin, colistin, ciprofloxacin, ceftriaxone, azithromycin, amoxicillin-clavulanic acid, and ampicillin. Some of the highest priority critically important antimicrobials (HP-CIAs), namely quinolones, macrolides, 3rd and 4th generation cephalosporins [21] are also frequently used in poultry and large animals. WHO does not recommend the use of HP-CIAs as the first choice of antimicrobials, and suggests their uses to be reserved for conditions where other classes of antimicrobials are ineffective or the response is poor [21]. Moreover, the American Veterinary Medical Association (AVMA) called for abstinence from the use of aminoglycosides, including gentamicin, in food-producing animals because the FDA has not been able to establish a safe withdrawal time for cattle. In addition, the extra-label use of gentamicin is considered illegal in cattle [22].

We explored a set of different factors that influenced a veterinarian’s daily practice of antimicrobial prescribing. Other than the types of organisms and clinical signs, a number of non-clinical factors also contribute to motivating a veterinarian’s drug choice during treatment, primarily the availability of drugs in the local market and the economic status of the farmers. Veterinary dispensaries are not available in different locations and wide ranges of drugs are not frequently found in rural areas of Bangladesh [16]. Veterinarians are, therefore, bound to prescribe the locally available drugs. A similar scenario where the

local availability of drugs in influencing prescription attitude was also found in a study conducted in India [23]. Farmers mostly preferred local untrained animal health workers to treat their animals so as to pay a small amount of money compared to a licensed veterinarian [8]. Furthermore, psychological and contextual factors can have considerable effects on the practices of antimicrobial stewardship by veterinarians [24]. Our participants also reported the owners' demands as impacting their decisions during prescribing antimicrobials. This finding echoes the results of the studies which found that the decisions of a veterinarian are influenced by the expectations of farmers and farm infrastructures [10,25]. The situation is also quite prevalent in human medicine practices [26,27]. Usually, farmers prefer the antimicrobials that lead to the quick recovery of their animals [7]. Therefore, during prescribing antimicrobials, veterinarians often feel pressured to satisfy animal owners for the quicker recovery of animals, especially in poultry practice. As a consequence, veterinarians often prescribe higher antimicrobials as a delayed recovery would add to the financial burdens of the farmers and would contribute to a poor reputation of the veterinarian infield practice.

The respondents were also concerned about the extent of negative impact and risks created by AMR globally, nationally, as well as in their own practices. This type of concern was also found to be common in another qualitative study conducted in Bangladesh [7] and a quantitative study that included doctors, veterinarians, and dentists in Australia [28]. This awareness indicates the alertness and scope of veterinarians regarding active participation for a better solution to this crisis.

There were several limitations to this study that may have influenced our conclusion. The survey was not based on a random selection of practitioners, which may have introduced bias. Moreover, any errors in administering drugs by the practitioners themselves could not be accounted for in our study, as this study primarily looked into the attitudes and practices of the veterinarians. However, to the best of our knowledge, this is the first survey specifically focused on Bangladeshi veterinarians regarding their attitudes and practices towards antimicrobial usage and prescription. As a result, there was a scarcity of enough local literature to compare the findings. We included participants from the Chattogram district of Bangladesh, where the veterinary sector is in huge demand. Chattogram is the second-largest and one of the busiest cities in the country. To meet the growing

demand for poultry and dairy within the city, a few farming zones were established in the rural areas around the city. As mentioned in the Methodology section, the country's only specialized veterinary university is located in this city and many veterinarian graduates from this university are joining the field every year. Many pet clinics are also located in this city, unlike most parts of the country. However, practitioners from other districts have not been taken into account in our study, which could be a potential avenue for future research. Nevertheless, our findings might facilitate the regulatory bodies to optimize strategies focusing on the veterinarian's role and for proper implementation of the national action plan.

4 Conclusions

This study provides a systematic understanding of the perceptions of veterinarians regarding the overall aspects of AMR, as well as an understanding of their perceived roles as antimicrobial stewards. The findings might help to explore the challenges and opportunities to ensure the maximum contribution of veterinarians as frontline fighters towards the success of the national action plan to halt the spreading of AMR.

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Author Contribution:

Md. Sahidur Rahman: Designed the experimentation, performed data collection, analyzed data, and wrote the first draft of the manuscript. Nazifa Rafa: Wrote the first draft of the manuscript and edited the final manuscript. Both the authors read and approved the final manuscript.

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APPENDIX

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 cases never.

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

Regularly Frequently in special case never

9. Which helps 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
- Use of laboratory test 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 of information about antibiotics when you need them?

Yes No, (please specify which sources do you think would be useful.....)

11. Is there any restrictive policy in your hospital to apply antibiotic: yes₁ No₂ Unsure₃

12. How confident are you about your knowledge of antibiotics?

very confident confident neutral (I have no idea)

a bit confident not at all confident

13. I find it hard to select the correct antibiotic

I strongly agree I agree neutral I disagree

I strongly disagree

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

No₁ <10%₂ 11-20%₃ 21-50%₄ >50%₅ Unsure₆

Part B: Perceive importance of the problem of antibiotic resistance

16. Antimicrobial resistance is a problem worldwide

Strongly agree Agree Neutral Disagree Strongly disagree

17. Antimicrobial resistance is a problem in your country

Strongly agree Agree Neutral Disagree Strongly disagree

18. Antimicrobial resistance is a problem in your daily practice

Strongly agree Agree Neutral Disagree Strongly disagree

19. 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 duration of antibiotic treatment	1	2	3	4	5
Too low a dose of antibiotics	1	2	3	4	5
Too high a dose of antibiotics					
Poor hand hygiene	1	2	3	4	5
Paying too much attention to pharmaceutical representatives or advertising	1	2	3	4	5
Patient demand					
Not complete the full course					
the antibiotics are of bad quality					
Others.....					

20. In last year, have you received any training on antibiotic prescribing? yes ☐₁ No ☐₂ Unsure ☐₃

If yes, how many? _____

21. How was the training delivered (tick all that apply) ●Lecture ●Workshop ●web-based learning ●Informal education in workplace

23. Please mention five common antibiotics you frequently use in livestock (if you practices)

.....

24. Please mention five common antibiotics you frequently use in poultry (if you practices)

.....

25. Please mention five common antibiotics you frequently use in pet (if you practices)

.....

26. What are the factors you consider for prescribing antibiotics? (Check all that apply)

- a) Type of organism/disease ☐₁
- b) Severity of the disease ☐₂
- c) Positive culture sensitivity test report ☐₃
- d) Antibiotic resistance ☐₄
- e) Drug instructions ☐₅
- f) Owner's demand ☐₆
- g) Economical status of the owner ☐₇
- h) Availability at the local market ☐₈
- i) Symptom ☐₉
- j) Other (specify).....

Date & signature of the researcher

.....