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Knowledge, attitude and practice towards antibiotic use and resistance among the veterinarians in Bangladesh — Source link





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2 among the veterinarians in Bangladesh

3 Running title: Knowledge, attitude and practice towards antibiotic use and
4 resistance

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18

19

20

21 **Abstract**

22 **Background**

23 The emergence of antimicrobial resistance (AMR) is growing public health concern around the
24 world. When a number of studies have emphasized the Knowledge, Attitude and Practice (KAP)
25 regarding antibiotic use and resistance in humans, little attention has been paid to the veterinary
26 sector. The aim of this study was to understand the KAP towards antibiotic use and resistance
27 among the veterinarians in Bangladesh.

28 **Methods**

29 A cross-sectional online based questionnaire survey was conducted from August to September
30 2020 among the registered veterinary practitioners. A self-administered Google form
31 questionnaire consists of 46 questions on knowledge, attitude and practice regarding antibiotic
32 use and their resistance.

33 **Results**

34 A total of 208 registered veterinarians participated in this study. 85.1% of the participants were
35 male and 55% of the participants had a Masters degree. Around 50% of the veterinarians were
36 poultry practitioners. All respondents were familiar with antimicrobials. 91.35% of the
37 participants knew that antibiotics can not cure viral infections while 97.6% believed that frequent
38 antibiotic prescription rendered them less effective. Participants claimed that only they are
39 eligible to prescribe drugs for the treatment of animals. Of the total participants, 87.02% believed
40 that a local antimicrobial guideline would be more effective than an international one while

41 around 80% disagreed with adding antibiotics with feed/water as a growth promoter in livestock.
42 However, gaps in practices were highlighted, suggesting training deficiencies.

43 **Conclusion**

44 The study for the first time conducted in Bangladesh dictates the future interventions like
45 courses, workshops, and seminars on antibiotic usage and resistance are needed to ameliorate the
46 awareness and change the behavior of veterinarians with regards to the rational use of antibiotics
47 while also considering individual motivations and justifications for using antibiotics.

48

49 **Introduction**

50 The global development of intensive farming has led to an upsurge in antimicrobial use (AMU)
51 that leads to the emergence and spread of antimicrobial resistance (AMR) [1]. Irrational use of
52 antibiotics in animals are considered one of the key drivers of AMR evolution [2]. Antibiotics
53 are used as therapeutic as well as growth promotion purposes in animal farming practices.
54 Worldwide consumption of antibiotics in animals are very high and it is expected to rise 67% by
55 2030 [1]. Most antibiotics are used in both human and animals interface, so the emergence of
56 resistance through veterinary use is likely to have consequences on human health [3–5].
57 Bangladesh has been experiencing a high incidence of AMR [6,7]. Misuse and abuse of
58 antibiotics are common both in humans and in animals in Bangladesh [6, 8–10]. A study with 73
59 poultry farms in Bangladesh reported higher usage of antibiotics without prescribing by
60 registered veterinarians. The same study found the presence of residual antibiotics in 26% of the
61 tested samples [10]. A study report revealed that majority of the antibiotics used in the poultry

62 farms were falls under Watch and Reserve group rather than Access [11]. Studies identified
63 registered veterinarians also concerned with prescribing of higher classes of antibiotics [12,13].
64 The WHO recommends an overall reduction of medically important antimicrobial use in food-
65 producing animals, as well as a complete cessation for disease prevention and growth promotion
66 of food-producing animals [14]. The Government of Bangladesh has enacted “animal and fish
67 feed act 2010” which prohibited the use of antibiotics in animal and fish feed [15], but
68 subsequent studies showed that such laws were not properly enforced and the use of antibiotics
69 with animal feeds is quite common [8–10]. This shows that unless raising awareness,
70 motivational and ownership among the veterinarians, farmers, feed sellers, drug sellers, misuse
71 of antibiotics in livestock will most likely continue to persist.

72 And any change in practice must start with the animal healthcare providers, followed by changes
73 in the antibiotic usage among the farmers. To make effective and sustainable strategies,
74 recommendations and treatment guidelines to maximize the therapeutic efficacy and reduce
75 AMR in both human and animals, assessing the knowledge, attitude and practice (KAP) of
76 veterinary practitioners are pertinent. Many countries has already been conducted similar studies
77 to do deep this issue in a numbers perspective related to human and animals [16–20]. On the
78 other hand, such study is still lacking from Bangladesh. In Bangladesh, the KAP regarding
79 antibiotic use and resistance among veterinary students has been reported previously [21].
80 Therefore, in this study, we have explored the KAP of the veterinarians of Bangladesh regarding
81 antibiotic use and resistance. To our best knowledge, this is the first antibiotic KAP study among
82 the Bangladeshi veterinarians.

83

84

85 **Materials and methods**

86 A cross-sectional study was conducted for two months from August to September, 2020 among
87 the registered veterinary practitioners of Bangladesh listed by the Bangladesh Veterinary Council
88 (BVC)-government regulatory body of veterinary legislation and certification for veterinary
89 practices in Bangladesh and practicing at field level to treat and prescribe the antibiotics for the
90 animals.

91 **Questionnaire development**

92 An online based maximum 20 minutes long questionnaire was developed using the Google
93 Forms platform by a multidisciplinary team consisting of microbiologist, public health specialist
94 and epidemiologist. The questionnaire comprised of four sections: the first one consisted of the
95 demographic information of the veterinarians, second section included 14 questions on
96 knowledge on antibiotics and AMR, third section contained 14 questions on attitudes and fourth
97 section had 18 questions on practices regarding antibiotic use and their resistance. The majority
98 of the answers were in multiple choice format. The questionnaire was pretested among the
99 scientists at the Antimicrobial Resistance Action Center (ARAC), Bangladesh Livestock
100 Research Institute (BLRI). The questionnaire was circulated to the participants and requested
101 them to provide the comments, suggestions and criticism. Finally, minor changes has been made
102 in compliance with participants response and was circulated to the participants. All the
103 participants in the pilot study were not allowed or included in the final survey. At all the stages
104 of data collection and analysis, we maintained anonymous information for the survey. The
105 participation in the survey was completely non-compulsory and unpaid. The study protocol was

106 reviewed and approved by the ARAC, Animal Health Research Division, BLRI, Bangladesh
107 (Approval no: 05/06/2020:06).

108 **Data collection**

109 Through social media like Facebook, LinkedIn etc. the questionnaire was posted and circulated
110 in different veterinary professional groups. The social media based survey was launched on
111 August 05, 2020. In mid-September, 2020, the online questionnaire link of questionnaire was
112 also messaged or emailed to each registered veterinarian to boost the response rate.

113 **Statistical analysis**

114 Quantitative data were entered into MS excel-2013 (Microsoft Corporation, Redmond, WA
115 98052, USA) and analyzed in STATA/IC-13 (StataCorp, 4905, Lakeway Drive, College station,
116 Texas 77845, USA). Descriptive analysis was conducted to determine the frequency and
117 percentage of responses regarding knowledge, attitude and practices. We used Chi-square test or
118 the Fisher exact test to identify the potential association between qualitative variables with
119 different age groups of the veterinary practitioners. The statistical significance was set at p
120 <0.05 .

121

122 **Results**

123 **Participants' characteristics**

124 A total number of 208 veterinarians responded and took part in the questionnaire survey from all
125 eight administrative divisions of Bangladesh. Most of the participants were male (N=177;

126 85.1%), and 93.75% (N=195) were below 36 years of age. About 44% (N=92) had a Doctor of
 127 Veterinary Medicine (DVM) degree while about 55% (N=114) had a Master's degree. Half of
 128 the veterinarians were poultry practitioners and the rest were large, small and pet animal
 129 practitioners. Around 31% (N=65) had an experience of greater than 5 years. Detailed
 130 characteristics of the participants are presented in Table 1.

131 **Table 1. Sociodemographic characteristics of the participants**

Characteristic	Number (n)	Percentage (%)
Gender		
Male	177	85.10
Female	31	14.90
Education		
DVM	92	44.23
Masters	114	54.81
PhD	2	0.96
Age		
25-30 Years	109	52.40
31-35 Years	86	41.35
36-40 Years	12	5.77
Above 40 Years	1	0.48
Field of expertise		
Poultry practitioner	108	51.92
Pet animals' practitioner	18	8.65
Large & Small Animals' Practitioner	82	39.42
Type of Service		
Private Services	155	74.52
Governmental service	53	25.48
Years of practice		
0-1 Year	39	18.75
1-3 Year	63	30.29
3-5 Years	41	19.71
Above 5 Years	65	31.25
Job location (Division)		
Dhaka	59	28.37
Chittagong	71	34.13
Rangpur	17	8.17
Khulna	3	1.44
Rajshahi	30	14.42
Barisal	8	3.85
Mymensingh	15	7.21
Sylhet	5	2.40

132

133 Knowledge on antibiotics and AMR

134 Almost all respondents were familiar with antimicrobials and antibiotics, but 17.31% were
 135 unaware that antibiotics are different from antimicrobials (Table 2). Although most participants

136 (91.35%) knew that antibiotics cannot cure viral infections, 33.65% believed the use of
 137 antibiotics would speed up recovery from common cold, cough, and other viral infections. All of
 138 the vets were aware of antibiotic resistance and 97.6% knew that frequent prescription of
 139 antibiotics can render them less effective. However, some practitioners (6.73%) were unaware of
 140 the concept of antibiotic susceptibility testing. In addition, the knowledge of antibiotics,
 141 appropriate uses, resistance, antibiotics efficacy with organisms and effectiveness of biosecurity
 142 for reduction of antibiotics use were pointed out similar depth of clear perception in all
 143 categorized different aged vets (Table 3).

144 **Table 2. Veterinarian’s knowledge on antibiotic use and resistance**

Questions	Number (n)	Percentage (%)
1. Are you familiar with antimicrobials? (Ans-Yes)		
Yes	208	100
No	0	0
2. Are you familiar with antibiotics? (Ans-Yes)		
Yes	207	99.52
No	1	0.48
3. Do you think antibiotics are different from antimicrobials? (Ans-Yes)		
Yes	169	81.25
No	36	17.31
Blank/No Answer	3	1.44
4. Do you know about antibiotic withdrawal period? (Ans-Yes)		
Yes	206	99.04
No	2	0.96
5. Do you know about antibiotic susceptibility testing? (Ans-Yes)		
Yes	193	92.79
No	14	6.73
Blank	1	0.48
6. Do you know about antibiotic resistance? (Ans-Yes)		
Yes	208	100.00
No	0	0.00
7. Do you know any antibiotics that are prohibited to use in livestock? (Ans-Yes)		
Yes	197	94.71
No	10	4.81
Blank	1	0.48
8. Antibiotics can be used to cure infections caused by bacteria (Ans -True)		
TRUE	205	98.56
FALSE	2	0.96
Blank	1	0.48
9. Antibiotics can be used to cure infections caused by viruses (Ans-False)		
TRUE	15	7.21
FALSE	190	91.35
Blank	3	1.44
10. Do you think the use of antibiotics will speed up the recovery of cold, cough, and other diseases caused by the common flu virus? (Ans-No)		
Yes	70	33.65
No	138	66.35
11. Do you think frequent prescription of antibiotics will decrease their efficacy? (Ans-Yes)		
Yes	203	97.60
No	4	1.92

12. Do you think antibiotics should be used for disease prevention? (Ans-No)		
Yes	18	8.65
No	190	91.35
13. Do you think antibiotic drug residues and drug resistance will occur when antibiotics are Not used prudently? (Ans-Yes)		
Yes	188	90.38
No	19	9.13
14. Do you think biosecurity and improved hygiene can reduce the use of antibiotics? (Ans-Yes)		
Yes	208	100.00
No	0	0.00

145

146 **Table 3. Relationship between veterinarian’s knowledge on antibiotic use/resistance to age**
 147 **groups**

Knowledge Statements	Univariate analysis			
	Age groups			P value
	25-30=1	31-35=2	>36	
1. Do you know ‘antimicrobial’? (Ans-Yes)				
Yes	109 (100)	86 (100)	13 (100)	
No				
2. Are you familiar with the concept of antibiotics? (Ans-Yes)				
Yes	109 (100)	85 (98.88)	13 (100)	
No	0	1 (01.12)	0	0.49
3. Do you think that antibiotic is different from antimicrobials? (Ans-Yes)				
Yes	88 (80.73)	70 (81.40)	11 (84.62)	
No	20 (18.35)	14 (16.28)	02 (15.38)	
Blank/No Answer	01 (0.92)	02 (02.33)	0	0.905
4. Do you know about antibiotic withdrawal period? (Ans-Yes)				
Yes	108 (99.08)	85 (98.84)	13 (100)	
No	01 (0.92)	01 (01.16)	0	0.921
5. Do you know about antibiotic susceptibility testing? (Ans-Yes)				
Yes	101 (92.66)	82 (95.35)	10 (76.92)	
No	08 (07.34)	03 (03.49)	03 (06.73)	
Blank	0	01 (01.16)	0	0.078
6. Do you know about antibiotic resistance? (Ans-Yes)				
Yes	109 (100)	86 (100)	13 (100)	
No				
7. Do you know any antibiotics that are prohibited to use in livestock? (Ans-Yes)				
Yes	105 (96.33)	80 (93.02)	12 (92.31)	
No	04 (03.67)	05 (05.81)	01 (07.69)	
Blank	0	01 (01.16)	0	0.702
8. Antibiotics can be used to cure infections caused by bacteria (Ans - True)				
True	107 (98.17)	85 (98.84)	13 (100)	
False	02 (01.83)	0.00	0	
Blank	0	01 (01.16)	0	0.518
9. Antibiotics can be used to cure infections caused by virus (Ans-False)				
True	09 (08.26)	06 (06.98)	0	
False	98 (89.91)	79 (91.86)	13 (100)	
Blank	0	01 (01.16)	0	0.81
10. Do you think the use of antibiotics will speed up recovery of cold, cough and other diseases caused by common flu virus? (Ans-No)				
Yes	42 (38.53)	25 (29.07)	03 (23.08)	
No	67 (61.47)	61 (70.93)	10 (76.92)	0.269
11. Do you think frequent prescribe of antibiotics will decrease the efficacy of drug? (Ans-Yes)				

Yes	107 (98.17)	83 (96.51)	13 (100)	
No	01 (0.92)	03 (03.49)	0	
Blank	01 (0.92)	0.00	0	0.583
12. Do you think antibiotic should be used for disease prevention? (Ans-No)				
Yes	08 (07.34)	07 (08.14)	03 (23.08)	
No	101 (92.66)	79 (91.86)	10 (76.35)	0.158
13. Do you think antibiotic drug residues and drug resistance will occur when antibiotics are not used prudently? (Ans-Yes)				
Yes	104 (95.41)	75 (87.21)	09 (69.23)	
No	05 (04.59)	11 (12.79)	03 (23.08)	
Blank	0	0.00	01 (07.69)	0.0001
14. Do you think biosecurity and improved hygiene can reduce the use of antibiotics? (Ans-Yes)				
Yes	109 (100)	86 (100)	13 (100)	

148

149 **Attitude towards antibiotic use and resistance**

150 Out of the 208 participants, 207 opinioned that only veterinarians are eligible to prescribe drugs
 151 for animals (Table 4). Moreover, nearly all agreed that antibiotic abuse is prevalent in veterinary
 152 practices in Bangladesh. Practitioners also had a positive attitude towards vaccination for the
 153 purpose of preventing diseases and for reducing the use of antibiotics in animals. Most
 154 practitioners (99.04%) felt that national guideline on rational antibiotic use is necessary and
 155 87.02% believed a local antimicrobial guideline would be more useful than an international one.
 156 Around 80% disagreed with adding antibiotics with feed/water as a growth promoter in poultry
 157 and livestock. Regarding the major reasons of antibiotic resistance, irrational use of antibiotics
 158 was identified as the primary cause by 94.71%, followed by over-the-counter use, low dose, low-
 159 quality antibiotics, and waste disposal of antibiotics (Fig 1). Besides, the attitude towards
 160 antibiotics use and resistance among different aged group vets were varied especially in middle
 161 aged vets (31-35 years). The lack of exposure and training regarding antibiotics in middle aged
 162 vets has impacts on attitude regarding antibiotics and resistance. Importantly, all vets group
 163 showed indifference attitude if individual or animal could not be treated with antibiotics.

164 Besides, almost all practitioners agreed that vaccination could reduce the use of antibiotics and
 165 resistance (Table 5).

166 **Table 4. Practitioner’s attitude towards antibiotic use and resistance**

Questions	Number (n)	Percentage (%)
1. In your opinion, only veterinarians are eligible to prescribe drugs for animals		
Yes	207	99.52
No	1	0.48
2. At present, there is abuse of antibiotics		
Yes	205	98.56
No	3	1.44
3. Antibiotic resistance affects you and your family’s health		
Agree	206	99.04
Disagree	0	0.00
Neutral	2	0.96
4. When a disease in an individual can’t be treated with antibiotics, how serious do you think it could be?		
Very serious	119	57.21
Serious	53	25.48
Less serious	11	5.29
Not serious at all	24	11.54
Blank	1	0.48
5. When a disease in an animal cannot be treated with antibiotics, how serious do you think it could be?		
Very serious	114	54.81
Serious	60	28.85
Less serious	10	4.81
Not serious at all	22	10.58
Blank	2	0.96
6. Do you think vaccination can prevent disease?		
Yes	207	99.52
No	1	0.48
7. Do you think vaccination can reduce the use of antibiotics?		
Yes	203	97.60
No	5	2.40
8. Is it necessary to establish a law on “Rational use of antibiotics” at the national level?		
Yes	206	99.04
No	2	0.96
9. A local antimicrobial guideline would be more useful than an international one		
Yes	181	87.02
No	26	12.50
Blank	1	0.48
10. It is important to add antibiotics with feed/water as a growth promoter in livestock		
Agree	10	4.81
Disagree	165	79.33
Neutral	32	15.38
Blank	1	0.48
11. Inappropriate use or half course of antibiotics leads to antibiotic resistance		
Agree	203	97.60
Disagree	1	0.48
Neutral	3	1.44
Blank	1	0.48
12. An appropriate withdrawal period is needed before selling to avoid antibiotic residue in food animals?		
Agree	205	98.56
Disagree	0	0.00
Neutral	2	0.96
Blank	1	0.48
14. Have you ever attended any training/conference/seminar/workshop on antimicrobial resistance?		
Yes	127	61.06
No	81	38.94

167 **Fig 1. Major reasons of AMR indicated by the veterinarians**

168 **Table 5. Relationship between veterinarian’s attitude on antibiotic use/resistance and age**
 169 **groups**

Attitude Statements	Univariate analysis			
	Age group			P value
	25-30=1	31-35=2	>36	
1. In your opinion, only veterinarians are eligible for drugs prescriptions for animals?				
Yes	108 (99.08)	86 (100)	13 (100)	
No	01 (0.92)	0.00	0	0.634
2. At present, there is abuse of antibiotics				
Yes	107 (98.17)	85 (98.84)	13 (100)	
No	02 (01.83)	01 (01.16)	0	0.837
3. Antibiotic resistance affects you and your family’s health				
Agree	108 (99.08)	85 (98.84)	13 (100)	
Disagree	0	0.00	0	
Neutral	01 (0.92)	01 (01.16)	0	0.921
4. When a disease in individual can't be treated with antibiotics, how serious do you think it could be?				
Very serious	67 (61.47)	46 (53.49)	06 (46.15)	
Serious	24 (22.02)	26 (30.23)	03 (23.08)	
Less serious	09 (08.26)	02 (02.33)	0	
Not serious at all	08 (07.34)	12 (13.95)	04 (30.77)	
Blank	01 (0.92)	0.00	0	0.104
5. When a disease in animal cannot be treated with antibiotics, how serious do you think it could be?				
Very serious	64 (58.72)	44 (51.16)	06 (46.15)	
Serious	28 (25.69)	29 (33.72)	03 (23.08)	
Less serious	08 (07.34)	02 (02.33)	0	
Not serious at all	08 (07.34)	10 (11.63)	04 (30.77)	
Blank	01 (0.92)	01 (01.16)	0	0.177
6. Do you think vaccination can prevent disease?				
Yes	108 (99.08)	86 (100)	13 (100)	
No	01 (0.92)	0.00	0	0.634
7. Do you think vaccination can reduce the uses of antibiotics?				
Yes	105 (96.33)	85 (98.84)	13 (100)	
No	04 (03.67)	01 (01.16)	0	0.443
8. Is it necessary to establish a law on “Rational use of antibiotics” at the national level?				
Yes	107 (98.17)	86 (100)	13 (100)	
No	02 (01.83)	0.00	0	0.4
9. A local antimicrobial guideline would be more useful than international one				
Yes	91 (83.49)	79 (91.86)	11 (84.62)	
No	17 (15.60)	07 (08.14)	02 (15.38)	
Blank	01 (0.92)	0.00	0	0.472
10. It is important to add antibiotic with feed/water as growth promoter in livestock				
Agree	02 (01.83)	08 (09.30)	0	
Disagree	89 (81.65)	67 (77.91)	09 (69.23)	
Neutral	17 (15.60)	11 (12.79)	04 (30.77)	
Blank	01 (0.92)	0.00	0	0.134
11. Inappropriate use or half course of antibiotics leads to antibiotic resistance				
Agree	108 (99.08)	85 (98.84)	10 (76.92)	
Disagree	0	0.00	1 (07.69)	
Neutral	0	01 (01.16)	02 (15.38)	
Blank	01 (0.92)	0.00	0	0.0001
12. An appropriate withdrawal period is needed before selling to avoid antibiotic residue in food animal?				
Agree	108 (99.08)	84 (97.67)	13 (100)	
Disagree	0	0.00	0	
Neutral	0	02 (02.33)	0	
Blank	01 (0.92)	0.00	0	0.44
14. Have you ever attended any training/conference/seminar/workshop on antimicrobial resistance?				
Yes	69 (63.30)	49 (56.98)	09 (69.23)	
No	40 (36.70)	37 (43.02)	04 (30.77)	0.549

170

171 **The practice of the veterinarians regarding antibiotic prescribing**

172 The majority (70.19%) of the veterinarians reported that they sometimes prescribe antibiotics
173 over the phone or without examining the animals (Table 6). Also, only 9.1% of the practitioners
174 always or often recommend antimicrobial susceptibility testing before prescribing an antibiotic
175 agents. Half of the participants prefer broad-spectrum antibiotics while the other half prefer
176 narrow-spectrum antibiotics. Results also show that antibiotics constitute a large percentage of
177 daily prescribed drugs. Moreover, combined antibiotic therapy is also preferred to single therapy
178 by about 65% of the practitioners, and old generation antibiotics are preferred to new generation
179 antibiotics by most (63.46%) as a first-line treatment. Some practitioners (25.96%) reported
180 prescribing antibiotics without determining the bodyweight of the animals. Most practitioners
181 (74.52) do not mention the antibiotic withdrawal period in the prescriptions. When exploring the
182 factors considered by the vets while prescribing antibiotics, the severity of the disease was found
183 to be the most important factor (Fig 2). The vets also considered other factors such as availability
184 of an antibiotic in the local market, culture sensitivity test report, economic status of the owner,
185 and owners' demand for antibiotics. There was no significant variation in relation with
186 practitioners age and antibiotic practices. But, young veterinarians were more concerned
187 regarding drug choice, antibiotic susceptibility testing, resistance patterns with compared to
188 middle aged vets where experienced vets group showed same level of expertise (Table 7).

189

190

191

192 **Table 6. Practice of veterinary practitioner's regarding antibiotic and resistance**

Questions	Number (n)	Percentage (%)
1. Do you prescribe antibiotics over phone or without seeing/examining animals?		
Often/Always	6	2.88
Sometimes	146	70.19
Never/rarely	56	26.92
2. Do you have facilities in your area to test antimicrobial sensitivity?		
Yes	93	44.71
No	115	55.29
3. How often on a first visit to a farm you suggest antimicrobial susceptibility testing if you suspect a bacterial infection is present?		
Often/Always	19	9.13
Sometimes	104	50.00
Never/rarely	85	40.87
4. How often do you carry out antimicrobial susceptibility testing, when a pathogen has not responded to the first antibiotic used?		
Often/Always	41	19.71
Sometimes	111	53.37
Never/rarely	56	26.92
5. How often do you encounter a poor clinical response to an antimicrobial used?		
Often/Always	19	9.13
Sometimes	170	81.73
Never/rarely	17	8.17
Blank	2	0.96
6. How commonly do you feel that poor clinical response may be due to antimicrobial resistance?		
Often/Always	76	36.54
Sometimes	124	59.62
Never/rarely	7	3.37
Blank	1	0.48
7. How often have you had to change an antimicrobial agent because of resistance confirmed on antimicrobial susceptibility testing?		
Often/Always	50	24.04
Sometimes	118	56.73
Never/rarely	39	18.75
Blank	1	0.48
9. Which spectrum of antibiotics do you prefer most?		
Broad spectrum	104	50.00
Narrow spectrum	104	50.00
10. What percentage of your daily prescriptions has antibiotics?		
<20	54	25.96
20% to 40%	95	45.67
40% to 60%	59	28.37
Above 60%	0	0.00
11. Do you mention withdrawal period in the prescription?		
Yes	53	25.48
No	155	74.52
12. Do you suggest keeping drug register of animals?		
Yes	155	74.52
No	52	25.00
Blank	1	0.48
13. Do you prefer combine antibiotics to ensure therapeutic success?		
Yes	135	64.90
No	73	35.10
14. Do you administer antibiotics to animals without determining their body weight properly?		
Yes	54	25.96
No	153	73.56
Blank	1	0.48
15. Do you consider whether an infection is self-limiting before prescribing antibiotics?		
Yes	162	77.88
No	44	21.15
Blank	2	0.96
16. As the first line of treatment, do you choose new generation antibiotics rather than older generations like penicillin?		
Yes	76	36.54
No	132	63.46
17. Do you consult with other veterinarian/other educational resources when in doubt of a drug's mechanism of action?		
Yes	199	95.67

No	9	4.33
18. Do you suggest clients to vaccinate their animals against preventable diseases?		
Yes	205	98.56
No	3	1.44

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195 **Fig 2. Factors considered by veterinarians while prescribing antibiotics**

196 **Table 7. Relationship between veterinarian's practice on antibiotic use leads to antibiotic**

197 **resistance and age groups**

Practice Statements	Univariate analysis			P value
	Age groups			
	25-30=1	31-35=2	>36	
1. Do you prescribe antibiotics over phone or without seeing/examining animals?				
Often/Always	05 (04.59)	01 (01.16)	0	
Sometimes	70 (64.22)	67 (77.91)	09 (69.23)	
Never/rarely	34 (31.19)	18 (20.93)	04 (30.77)	0.231
2. Do you have facilities in your area to test antimicrobial sensitivity?				
Yes	46 (42.20)	43 (50.00)	04 (30.77)	
No	63 (57.80)	43 (50.00)	09 (69.23)	0.321
3. How often on a first visit to a farm you suggest antimicrobial susceptibility testing if you suspect a bacterial infection is present?				
Often/Always	08 (07.34)	10 (11.63)	01 (07.69)	
Sometimes	57 (52.29)	41 (47.67)	06 (46.15)	
Never/rarely	44 (40.37)	35 (40.70)	06 (46.15)	0.854
4. How often do you suggest antimicrobial susceptibility testing, when a pathogen has not responded to the first antibiotic used?				
Often/Always	25 (22.94)	14 (16.28)	02 (15.38)	
Sometimes	60 (55.05)	44 (51.16)	07 (53.85)	
Never/rarely	24 (22.02)	28 (32.56)	04 (30.77)	0.492
5. How often do you encounter a poor clinical response to an antimicrobial used?				
Often/Always	14 (12.84)	05 (05.81)	0	
Sometimes	82 (75.23)	75 (87.21)	13 (100)	
Never/rarely	11 (10.09)	06 (06.98)	0	
Blank	02 (01.83)	0.00	0	0.185
6. How commonly do you feel that poor clinical response may be due to antimicrobial resistance?				
Often/Always	48 (44.04)	24 (27.91)	04 (30.77)	
Sometimes	56 (51.38)	60 (69.77)	08 (61.54)	
Never/rarely	05 (04.59)	01 (01.16)	01 (07.69)	
Blank	0	01 (01.16)	0	0.118
7. How often have you had to change an antimicrobial agent because of resistance confirmed on antimicrobial susceptibility testing?				
Often/Always	23 (21.10)	23 (26.74)	04 (30.77)	
Sometimes	65 (59.63)	46 (53.49)	07 (53.85)	
Never/rarely	21 (19.27)	16 (18.60)	02 (15.38)	
Blank	0	01 (01.16)	0	0.839
8. What are the factor/factors you consider for prescribing antibiotics?				
Severity of the disease	53	32.00	6	
Culture sensitivity test report	5	4.00	2	
Economic status of the owner	1			
Availability at the local market	3			
Owner's demand, Severity of the disease, Availability at the local market	1			
Severity of the disease, Culture sensitivity test report	9	4.00		
Severity of the disease, Availability at the local market, Culture sensitivity test report	10	6.00		
Severity of the disease, Availability at the local market	4	11.00		
Economic status of the owner, Severity of the disease	5	2.00		

Economic status of the owner, Severity of the disease, Availability at the local market, Culture sensitivity test report	8	8.00	1	
Economic status of the owner, Severity of the disease, Availability at the local market	7	11.00	1	
Availability at the local market, Culture sensitivity test report		1.00		
Economic status of the owner, Availability at the local market			1	
Economic status of the owner, Severity of the disease, Culture sensitivity test report	1	1.00		
Owner`s demand, Economic status of the owner, Severity of the disease	1			
Owner`s demand, Economic status of the owner, Severity of the disease, Availability at the local market	2	3.00	1	
Owner`s demand, Economic status of the owner, Severity of the disease, Availability at the local market, Culture sensitivity test report		2.00	1	
Owner`s demand, Economic status of the owner, Severity of the disease, Availability at the local market, Culture sensitivity test report				0.059
9. Which spectrum of antibiotics do you prefer most?				
Broad spectrum	55 (50.46)	41 (47.67)	08 (61.54)	
Narrow spectrum	54 (49.54)	45 (52.33)	05 (38.46)	0.664
10. What percentage of your daily prescriptions has antibiotics?				
<20	29 (26.61)	21 (24.42)	04 (30.77)	
20% to 40%	48 (44.04)	41 (47.67)	06 (46.15)	
40% to 60%	32 (29.36)	24 (27.91)	03 (23.08)	
Above 60%	0	0.00	0	0.972
11. Do you mention withdrawal period in the prescription?				
Yes	35 (32.11)	16 (18.60)	02 (15.38)	
No	74 (67.89)	70 (81.40)	11 (84.62)	0.087
12. Do you suggest keeping drug register of animals?				
Yes	83 (76.15)	65 (75.58)	07 (53.85)	
No	26 (23.85)	21 (24.42)	05 (38.46)	
Blank	0	0.00	01 (07.69)	0.072
13. Do you prefer combine antibiotics to ensure therapeutic success?				
Yes	70 (64.22)	57 (66.28)	08 (61.54)	
No	39 (35.78)	29 (33.72)	05 (38.46)	0.919
14. Do you administer antibiotics to animals without determining their body weight properly?				
Yes	28 (25.69)	22 (25.58)	04 (30.77)	
No	80 (73.39)	64 (74.42)	09 (69.23)	
Blank	01 (0.92)	0.00	0	0.95
15. Do you consider whether an infection is self-limiting before prescribing antibiotics?				
Yes	93 (85.32)	59 (68.60)	10 (76.92)	
No	16 (14.68)	25 (29.07)	03 (23.08)	
Blank	0	02 (02.33)	0	0.032
16. As the first line of treatment, do you choose new generation antibiotics rather than older generations like penicillin?				
Yes	34 (31.19)	36 (41.86)	06 (46.15)	
No	75 (68.81)	50 (58.14)	07 (53.85)	0.22
17. Do you consult with other veterinarian/other educational resources when in doubt of a drug`s mechanism of action?				
Yes	104 (94.41)	83 (96.51)	12 (92.31)	
No	05 (04.59)	03 (03.49)	01 (07.69)	0.615
18. Do you suggest clients to vaccinate their animals against preventable diseases?				
Yes	108 (99.08)	86 (100)	11 (84.62)	
No	01 (0.92)	0.00	02 (15.38)	0.01

198

199 Discussion

200 The present study explored the knowledge, attitude, and practice of the Bangladeshi veterinary
 201 practitioners regarding antibiotic use and resistance. It was found that some vets had gaps in
 202 knowledge in certain crucial concepts, for example, many practitioners considered antibiotics

203 and antimicrobials to be the same. Failure to differentiate between antimicrobials and antibiotics
204 and their roles can be a major reason for inappropriate antibiotic prescribing such as prescribing
205 antibiotics for viral infections. Another surprising finding was that although most knew that
206 antibiotics cannot cure viral infections, one-third of the vets believed antibiotics would speed up
207 cold, cough, or other viral infections. However, there is no evidence that antibiotics can cure
208 viral infections or speed up recovery of viral infections such as common cold [22,23].

209 Nearly all veterinarians were aware of antibiotic withdrawal period and considered it important
210 to maintain an appropriate withdrawal period prior to selling animals treated with antibiotics in
211 order to avoid antibiotic residues in animals. However paradoxically, while prescribing
212 antibiotics, only one out of four practitioners mentioned the withdrawal period in the
213 prescriptions. This may happen probably because practitioners do not have the knowledge of the
214 withdrawal periods of the specific antibiotics they prescribe, or because they think the farmers
215 will not understand or follow instructions related to withdrawal periods anyway. Studies have
216 shown that most Bangladeshi farmers do not have knowledge on antibiotic withdrawal period
217 [10,11]. Non adherence to the required withdrawal periods may result in the presence of residual
218 antibiotics in food animal products [24]. Antibiotic residues can be toxic to humans as well as
219 may contribute to the development of AMR [24,25].

220 Prescribing antibiotics based on the results of susceptibility testing is recommended to make sure
221 that the prescribed regimen is effective against the infection. However, in this study, such
222 practice was not often followed by the practitioners even after the initial treatment failed. This
223 can partially be explained by the fact that most areas of Bangladesh did not have any facility to
224 test antimicrobial sensitivity, as reported by the veterinarians. The absence of susceptibility data
225 can also promote combined antibiotic therapy since the vets may want to prescribe more than

226 one drug for maximizing the chance of therapeutic success with the hope that if one drug is
227 found ineffective, the others will work. A study of the veterinary surgeons of the United
228 Kingdom also reported similar findings where the surgeons only occasionally carried out
229 susceptibility testing [26].

230 The use of antibiotics for disease prevention of animals by farmers and poultry dealers have been
231 reported in Bangladesh [8], although such practices are not recommended [14]. Most
232 veterinarians in this study do not consider the use of antimicrobials for disease prevention.
233 Instead, the participants have shown a very positive attitude towards vaccination for both
234 infection prevention and lowering the use of antibiotics. Given the fact that about half of the
235 most significant animal diseases are of viral origins [27], vaccination can be very effective and
236 efficient in lowering the occurrences of infectious diseases in animals and will subsequently
237 confer financial gains to the farmers as well as help to minimize unnecessary use of antibiotics.
238 Vaccines have also been recommended for infection prevention by WHO [14].

239 Participants were knowledgeable about antibiotic resistance, its causes, and its consequences.
240 However, unless such knowledge is translated into practice, no real benefit will be achieved. We
241 have identified a number of inappropriate practices by the veterinarians including excessive
242 antibiotic prescribing, prescribing antibiotics over the phone without examining animals, not
243 relying on susceptibility testing, not mentioning antibiotic withdrawal period in prescription, etc.

244 This survey revealed the varied difference in knowledge, attitude and practice of antibiotics use
245 among different aged group of veterinarians in Bangladesh. It was not conclusively established
246 the variation of predefined questions answer with the different aged group of vets. From this
247 study it revealed that old aged vets with higher training or field based training have a higher
248 knowledge of appropriate use of antibiotics and AMR. The difference has observed among vets

249 aged groups that possibly could have the link to work experiences over time. To understand the
250 perceptions and barriers, further investigation is required to appropriate use of antibiotics in
251 livestock and in poultry among the vets subpopulation. It would help the policy makers and
252 academicians to ensure proper training and impart practical field based knowledge of appropriate
253 use of antibiotics and AMR to the vets students, young vets and all level aged groups of vets.

254 Another major problem is Bangladeshi farmers rely more upon village doctors, traditional
255 healers and drug sellers and consider government veterinarians as the last resort for seeking
256 health services for their livestock [9]. This trend needs to change and qualified veterinarians
257 should be the primary source of advice in order to promote rational antibiotic use. Veterinarians
258 should also play an active role in dispelling misconceptions of the farmers surrounding
259 antibiotics, and themselves should adopt the appropriate practices. The government should focus
260 on implementing the laws pertaining to judicious use of antibiotics, as well as recruiting more
261 qualified veterinarians so that farmers can have easy access to them.

262

263 **Limitations**

264 A few limitations were witnessed during conduct the current study. The number of participants
265 in the survey was low that may be due to several factors such as unwillingness to participate or
266 lack of internet accessibility. Sometimes respondents may have declined to share information
267 they considered inappropriate or mistaken, resulting in an under-reporting of certain aspects on
268 antibiotics and AMR knowledge and practices. The study could not meet the exact proportional
269 number of respondents with anticipated geographic locations due to freedom of choice of the
270 respondents.

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274 **Conclusion**

275 The study findings suggest policy guidelines and advocacy to the public and private veterinarians
276 in improving prudent use of antibiotics. Antimicrobial stewardship program in the public and
277 private veterinary hospitals are needed to be initiated to promote the rational use of antibiotics.
278 Improved knowledge and awareness of the veterinarians through continuous education and
279 training can enhance the rational use of antibiotics. Dissemination of regularly updated national
280 antibiotic use guidelines in food animals, understanding the role of good biosecurity and
281 vaccination practices in disease prevention, including antimicrobial susceptibility testing at
282 affordable costs with easy accessibility are the significant factors that need attention to combat
283 the rising AMR in veterinary sector in Bangladesh.

284

285 **Disclosure of potential conflicts of interest**

286 The authors declare that they have no conflict of interest.

287 **Supporting Information**

288 **S1 Text. Questionnaire for KAP survey on antibiotics and AMR.**

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293 **References**

- 294 1. Van Boeckel TP, Brower C, Gilbert M, Grenfell BT, Levin SA, Robinson TP, et al.
295 Global trends in antimicrobial use in food animals. *Proc Natl Acad Sci USA*. 2015;
296 112(18):5649–54. <https://doi.org/10.1073/pnas.1503141112>
- 297 2. Holmes AH, Moore LSP, Sundsfjord A, Steinbakk M, Regmi S, Karkey A, et al.
298 Understanding the mechanisms and drivers of antimicrobial resistance. *Lancet*. 2016;
299 387(10014):176–87. [https://doi.org/10.1016/s0140-6736\(15\)00473-0](https://doi.org/10.1016/s0140-6736(15)00473-0)
- 300 3. Aidara-Kane A, Angulo FJ, Conly J, Minato Y, Silbergeld EK, McEwen SA, et al. World
301 Health Organization (WHO) guidelines on use of medically important antimicrobials in
302 food-producing animals. *Antimicrob Resist Infect Control*. 2018; 7(1):1–8.
303 <https://doi.org/10.1186/s13756-017-0294-9>
- 304 4. Jim O’Neill. Tackling Drug-Resistant Infections Globally: Final Report and
305 Recommendations. 2016. <https://apo.org.au/node/63983>
- 306 5. Tang KL, Caffrey NP, Nóbrega DB, Cork SC, Ronksley PE, Barkema HW, et al.
307 Restricting the use of antibiotics in food-producing animals and its associations with
308 antibiotic resistance in food-producing animals and human beings: a systematic review
309 and meta-analysis. *Lancet Planet Heal*. 2017; 1(8):e316–27.
310 [https://doi.org/10.1016/s2542-5196\(17\)30141-9](https://doi.org/10.1016/s2542-5196(17)30141-9)
- 311 6. Ahmed I, Rabbi MB, Sultana S. Antibiotic resistance in Bangladesh: A systematic review.
312 *Int J Infect Dis*. 2019; 80:54–61. <https://doi.org/10.1016/j.ijid.2018.12.017>
- 313 7. Hasan B, Faruque R, Drobni M, Waldenström J, Sadique A, Ahmed KU, et al. High
314 prevalence of antibiotic resistance in pathogenic *Escherichia coli* from large- and small-
315 scale poultry farms in Bangladesh. *Avian Dis*. 2011; 55(4):689–92.
316 <https://doi.org/10.1637/9686-021411-reg.1>
- 317 8. Masud A Al, Rousham EK, Islam MA, Alam MU, Rahman M, Mamun A Al, et al.
318 Drivers of Antibiotic Use in Poultry Production in Bangladesh: Dependencies and
319 Dynamics of a Patron-Client Relationship. *Front Vet Sci*. 2020; 7(February):1–9.
320 <https://doi.org/10.3389/fvets.2020.00078>
- 321 9. Roess AA, Winch PJ, Ali NA, Akhter A, Afroz D, El Arifeen S, et al. Animal husbandry
322 practices in rural Bangladesh: Potential risk factors for antimicrobial drug resistance and
323 emerging diseases. *Am J Trop Med Hyg*. 2013; 89(5):965–70.
324 <https://doi.org/10.4269/ajtmh.12-0713>
- 325 10. Saiful IK., Shiraj-Um-Mahmuda S, Hazzaz-Bin-Kabir M. Antibiotic usage patterns in
326 selected broiler farms of Bangladesh and their public health implications. *J Public Heal*

- 327 Dev Ctries J Public Heal Dev Ctries. 2016; 2(3):276–84. <http://www.jphdc.org/>
- 328 11. Ferdous J, Sachi S, Al Noman Z, Hussani SMAK, Sarker YA, Sikder MH. Assessing
329 farmers’ perspective on antibiotic usage and management practices in small-scale layer
330 farms of Mymensingh district, Bangladesh. *Vet World*. 2019; 12(9):1441–7.
331 <https://doi.org/10.14202/vetworld.2019.1441-1447>
- 332 12. Rahman MA, Rahman MM, Abdullah MS, Sayeed MA, Rashid MH, Mahmud R, et al.
333 Epidemiological assessment of clinical poultry cases through the government veterinary
334 hospital-based passive surveillance system in Bangladesh: a case study. *Trop Anim Health*
335 *Prod*. 2019; 51(4):967–75. <https://doi.org/10.1007/s11250-018-1782-5>
- 336 13. Sarker MS, Ahaduzzaman M, Ghosh SK, Sayeed MA, Bary MA. Crosssectional survey
337 on prescribing patterns for food animal medications in Bangladesh. *J Dairy Vet Anim Res*.
338 2016; 3(4):151-153. <https://doi.org/10.15406/jdvar.2016.03.00089>
- 339 14. World Health Organization. WHO guidelines on use of medically important
340 antimicrobials in food-producing animals. World Health Organization. 2017. pp. 1–88.
341 [https://apps.who.int/iris/bitstream/handle/10665/258970/9789241550130-](https://apps.who.int/iris/bitstream/handle/10665/258970/9789241550130-eng.pdf?sequence=1%0Ahttp://apps.who.int/iris/bitstream/handle/10665/258970/9789241550130-eng.pdf?sequence=1)
342 [eng.pdf?sequence=1%0Ahttp://apps.who.int/iris/bitstream/handle/10665/258970/9789241](http://apps.who.int/iris/bitstream/handle/10665/258970/9789241550130-eng.pdf?sequence=1)
343 [550130-eng.pdf?sequence=1](http://apps.who.int/iris/bitstream/handle/10665/258970/9789241550130-eng.pdf?sequence=1)
- 344 15. Bangladesh National Parliament (BNP). *Bangladesh Gazette*. 2013; 205: 2811-2818.
- 345 16. Hughes LA, Pinchbeck G, Callaby R, Dawson S, Clegg P, Williams N. Antimicrobial
346 prescribing practice in UK equine veterinary practice. *Equine Vet J*. 2013; 45(2):141–7.
347 <https://doi.org/10.1111/j.2042-3306.2012.00602.x>
- 348 17. Cattaneo AA, Wilson R, Doohan D, LeJeune JT. Bovine veterinarians’ knowledge,
349 beliefs, and practices regarding antibiotic resistance on Ohio dairy farms. *J Dairy Sci*.
350 2009; 92(7):3494–502. <https://doi.org/10.3168/jds.2008-1575>
- 351 18. Barden LS, Dowell SF, Schwartz B, Lackey C. Current attitudes regarding use of
352 antimicrobial agents: Results from physicians’ and parents’ focus group discussions. *Clin*
353 *Pediatr (Phila)*. 1998; 37(11):665–72. <https://doi.org/10.1177/000992289803701104>
- 354 19. De Briyne N, Atkinson J, Pokludová L, Borriello SP, Price S. Factors influencing
355 antibiotic prescribing habits and use of sensitivity testing amongst veterinarians in Europe.
356 *Vet Rec*. 2013; 173(19):475. <https://doi.org/10.1136/vr.101454>
- 357 20. Busani L, Graziani C, Franco A, Di Egidio A, Binkin N, Battisti A. Survey of the
358 knowledge, attitudes and practice of Italian beef and dairy cattle veterinarians concerning
359 the use of antibiotics. *Vet Rec*. 2004; 155(23):733–8. PMID: 15623086
- 360 21. Chapot L, Sarker MS, Begum R, Hossain D, Akter R, Hasan MM, et al. Knowledge,
361 Attitudes and Practices Regarding Antibiotic Use and Resistance among Veterinary
362 Students in Bangladesh. *Antibiotics*. 2021 Mar; 10(3):332.
363 <https://doi.org/10.3390/antibiotics10030332>
- 364 22. Allan GM, Arroll B. Prevention and treatment of the common cold: making sense of the
365 evidence. *CMAJ*. 2014; 186(3):190–9. <https://doi.org/10.1503/cmaj.121442>

- 366 23. Kenealy T, Arroll B. Antibiotics for the common cold and acute purulent rhinitis.
367 Cochrane Database Syst Rev. 2013 June 4; CD000247.
368 <https://doi.org/10.1002/14651858.cd000247.pub3>
- 369 24. Kaneene JB, Miller R. Problems associated with drug residues in beef from feeds and
370 therapy. Rev Sci Tech. 1997; 16(2):694–708. <https://doi.org/10.20506/rst.16.2.1055>
- 371 25. Beyene T. Veterinary Drug Residues in Food-animal Products: Its Risk Factors and
372 Potential Effects on Public Health. J Vet Sci Technol. 2015; 07(01).
373 <https://doi.org/10.4172/2157-7579.1000285>
- 374 26. Coyne LA, Latham SM, Dawson S, Donald IJ, Pearson RB, Smith RF, et al.
375 Antimicrobial use practices, attitudes and responsibilities in UK farm animal veterinary
376 surgeons. Prev Vet Med. 2018; 161(October):115–26.
377 <https://doi.org/10.1016/j.prevetmed.2018.10.021>
- 378 27. Brun A. Vaccines and vaccination for veterinary viral diseases: A general overview.
379 Methods Mol Biol. 2016; 1349:1–24. https://doi.org/10.1007/978-1-4939-3008-1_1

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