Research Article

Antimicrobial Use Practices and Resistance Awareness Among Commercial Broiler Farmers in Cumilla District, Bangladesh: A Cross-Sectional Survey

Md. Rimon Bhuiyan[1,2*]

[1]Department of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh; [2]Faculty of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh.

Abstract | Unregulated antimicrobial use (AMU) in intensive poultry farming is a primary driver of antimicrobial resistance (AMR) in Bangladesh. District-level data on AMU practices and AMR awareness among commercial broiler farmers in Cumilla, southeastern Bangladesh, are absent from the literature. A cross-sectional survey was conducted from November 2025 to January 2026 among 51 commercial broiler farmers across four upazilas of Cumilla district (Daudkandi, Debidwar, Burichang, and Chandina). Face-to-face interviews using a structured, pre-validated questionnaire assessed knowledge, attitudes, and practices (KAP) on AMU and AMR. All results are reported as descriptive frequencies and percentages. AMU was reported on all 51 farms (100%). Veterinary prescriptions were obtained by only 47.1% of farmers. Among 51 farmers surveyed, 92.2% were unaware of antimicrobial residues and withdrawal periods. Antibiotic use during the brooding period was near-universal (98.0%), and only 7.8% maintained withdrawal periods before sale. A total of 70.6% sold broilers during or immediately after AMU. Critically important antimicrobials (CIAs)- including ciprofloxacin (62.7%) and colistin (41.2%)- were widely used without diagnostic confirmation. Only 11.8% of farmers demonstrated knowledge of AMR. Broiler farmers in Cumilla district demonstrate pervasive AMU coupled with critical gaps in AMR knowledge and antibiotic stewardship. These findings, limited to four upazilas (n=51), underscore the need for targeted farmer education, expanded veterinary access, and stricter AMU regulatory enforcement at the district level.

Editor | Muhammad Abubakar, National Veterinary Laboratories, Park Road, Islamabad, Pakistan.
Received | June 08, 2026; **Accepted** | July 01, 2026; **Published** | July 27, 2026
***Correspondence** | Md. Rimon Bhuiyan, Department of Veterinary and Animal Sciences, Faculty of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh; **Email:** mdrimonbhuiyan1999@gmail.com, s1911168127@ru.ac.bd
Citation | Bhuiyan, M.R., 2026. Antimicrobial use practices and resistance awareness among commercial broiler farmers in Cumilla District, Bangladesh: A cross-sectional survey. *Veterinary Sciences: Research and Reviews*, 12(2): 177-189.
DOI | https://dx.doi.org/10.17582/journal.vsrr/2026/12.2.177.189
Keywords | Antimicrobial resistance (AMR), Broiler farming, Antimicrobial use (AMU), Knowledge attitudes practices, Antibiotic stewardship

Introduction

Antimicrobial resistance (AMR) is a critical threat to global health security, disproportionately affecting low- and middle-income countries (LMICs) including Bangladesh (WHO, 2021). The livestock sector- particularly commercial broiler farming- has emerged as a major reservoir of AMR through widespread, poorly regulated antimicrobial use (AMU) (Van Boeckel *et al*., 2015; Masud *et al*., 2020). In Bangladesh, the poultry sector is the second-largest national industry, with approximately 150,000 commercial farms supplying 37% of total animal protein intake (Hamid *et al*., 2017; Hassan, 2022; DLS, 2023). This rapid expansion has intensified AMU without commensurate improvements in veterinary oversight or farmer education (Hassan *et al*., 2021). Critically, the relationship between AMR emergence and poorly governed AMU in food animals is not simply one of exposure volume but is mediated through interconnected determinants of farmer behaviour: Knowledge deficits that prevent recognition of AMR risk, permissive attitudes toward prophylactic antibiotic use, and deeply embedded practices shaped by economic dependency on dealer networks and inadequate veterinary access (Chandler *et al*., 2016; Laxminarayan *et al*., 2013). Without addressing all three behavioural domains simultaneously, stewardship interventions targeting a single dimension- such as prescribing alone- are unlikely to produce sustained AMU reduction at the farm level (Kirchhelle, 2018; Rodrigues *et al*., 2017).

Broiler production is particularly susceptible to irrational AMU: Compressed production cycles, high pressure for rapid weight gain, and heavy financial dependence on input dealers for feed, chicks, and medicines on credit collectively promote prophylactic and sub-therapeutic antibiotic use without clinical justification (Poudel *et al*., 2024; Masud *et al*., 2020; Begum *et al*., 2014). The resulting antibiotic pressure facilitates selection and dissemination of resistant pathogens through the food chain and environment, compounding AMR risk (Hedman *et al*., 2020; Kousar *et al*., 2021). Despite Bangladesh's National Action Plan (NAP) on AMR (2021-2026) (Jhora, 2021), farm-level implementation of stewardship principles remains inadequate (Imam *et al*., 2020). Prior KAP studies in Bangladesh have documented poor knowledge and widespread sub-therapeutic AMU (Hassan *et al*., 2021; Islam *et al*., 2023; Raihan *et al*., 2026; Imam *et al*., 2020), yet several analytical gaps persist. First, most existing studies were conducted in northern districts (Rajshahi, Bogura) and do not capture southeastern Bangladesh, where the poultry sector has expanded rapidly without commensurate regulatory infrastructure. Second, prior studies have largely reported frequencies without systematically interpreting how structural drivers- such as dealer-credit dependency- mediate between individual knowledge deficits and observed AMU practices. Third, none of the published district-level surveys from Bangladesh have integrated a conceptual framework explicitly linking the knowledge-attitude-practice (KAP) continuum with contextual enablers and barriers, limiting their utility for designing targeted interventions (Ajzen, 1991; Fishbein and Ajzen, 2011). The present study addresses these gaps by applying an adapted KAP framework grounded in the Theory of Planned Behaviour (TPB) (Ajzen, 1991), which posits that behaviour (AMU practices) is predicted by the interplay of knowledge (informing beliefs), attitudes (evaluative dispositions toward AMU and AMR), and perceived behavioural control (structural access to veterinarians and regulated medicines). This framework guided questionnaire design, structured interpretation of results, and identification of policy-actionable leverage points within the district-level AMU governance system.

Cumilla district in southeastern Bangladesh hosts a rapidly expanding commercial poultry sector supplying regional and Dhaka-based markets. However, AMU patterns among broiler farmers in this district have not been previously characterised. A related district-level study from Rajshahi identified significant AMU knowledge gaps (Islam *et al*., 2022), and a broader multi-district KAP survey across Bogura, Rajshahi, and Munshiganj similarly documented widespread AMU without prescription (Raihan *et al*., 2026); yet Cumilla remains uncharacterised. This research presents cross-sectional KAP data from four upazilas of Cumilla district, aimed at documenting AMU practices and AMR awareness to inform evidence-based stewardship interventions at the district level.

Materials and Methods

Study design and period

A cross-sectional survey was conducted from November 2025 to January 2026. The manuscript was prepared and submitted in February 2026, ensuring that data collection preceded submission.

Study area and sampling

The study was conducted across four upazilas of Cumilla district, Bangladesh: Daudkandi, Debidwar, Burichang, and Chandina. These upazilas were selected on the basis of the concentration of registered commercial broiler operations. A total of 51 broiler

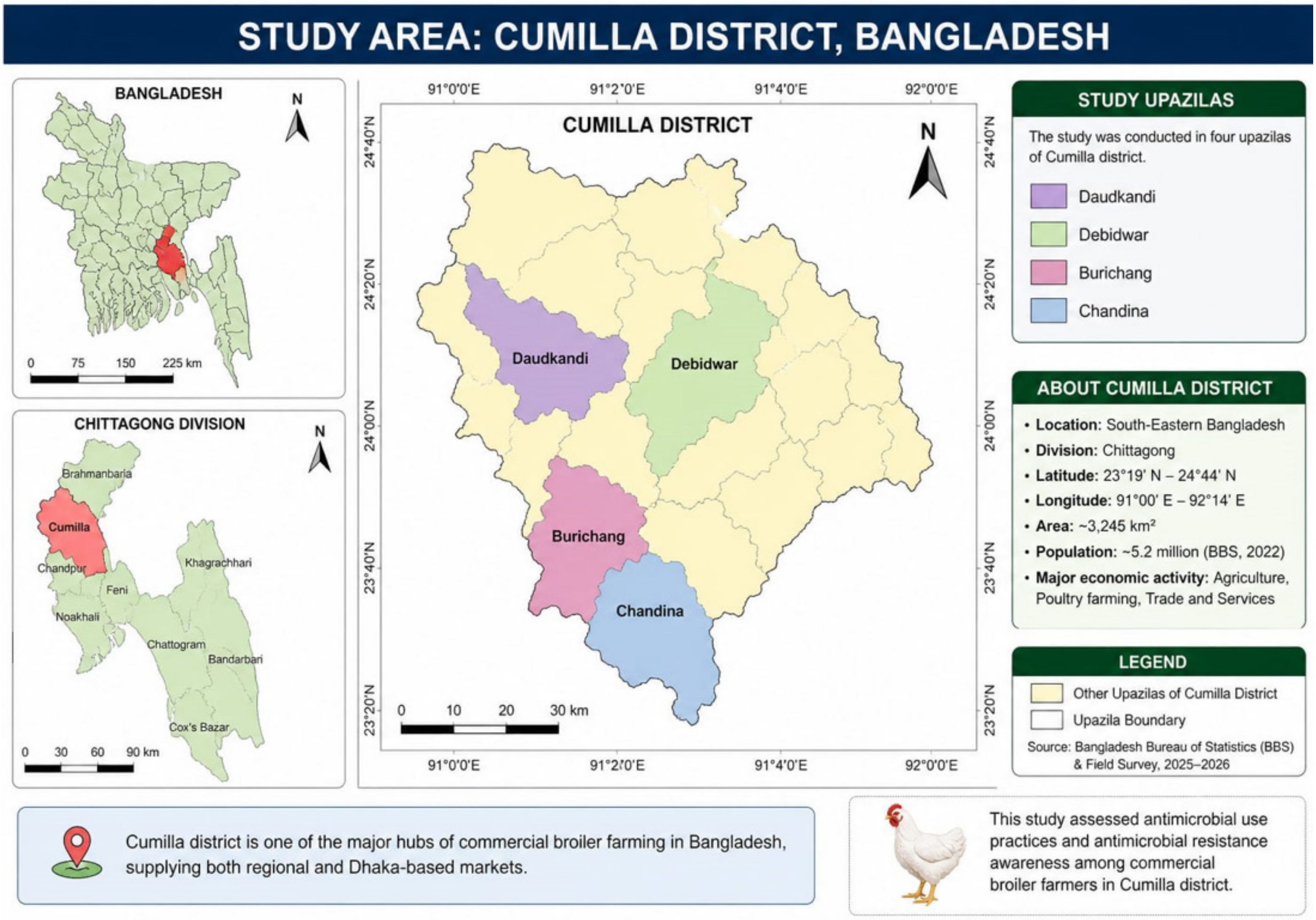

Figure 1: *Study area map of Cumilla district, Bangladesh. The map illustrates the geographic location of Cumilla District within Bangladesh and highlights the four study upazilas- Daudkandi, Debidwar, Burichang, and Chandina- where the cross-sectional survey of commercial broiler farmers was conducted (BBS, 2022; Chowdhury et al., 2022).*

farmers were enrolled by purposive sampling. Inclusion criteria were: (i) active commercial broiler farming at the time of survey; (ii) direct daily involvement in farm management decisions; and (iii) willingness to provide verbal informed consent. Farmers engaged exclusively in layer or backyard poultry production were excluded (Figure 1).

Data collection

Data were collected through face-to-face interviews in Bengali by trained enumerators using a structured, pre-validated questionnaire adapted from previously published instruments (Alhaji *et al*., 2018; Caudell *et al*., 2020). The questionnaire encompassed five domains: (i) sociodemographic and farm characteristics; (ii) knowledge of AMU and AMR (10 binary yes/no items); (iii) attitudes toward AMU and AMR (8 items: yes/no/no-idea or agree/disagree/no-idea response options); (iv) AMU practices (12 items); and (v) specific antimicrobials used. Verbal informed consent was obtained and documented by the interviewer before each interview. All data were anonymised prior to analysis.

Ethical considerations

This study was an observational survey involving no biological samples, no clinical interventions, and no collection of personal identifiers. Participation was entirely voluntary, and farmers could withdraw at any time without consequence. Formal ethics committee review was not required under applicable national guidelines for observational social surveys. Verbal informed consent was obtained and recorded for all participants, and data were fully anonymised prior to analysis.

Statistical analysis

Data were entered in Microsoft Excel 2019 and analysed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequencies and percentages, to one decimal place) were used to summarise all categorical responses.

Pearson chi-square tests (χ^2(df)= x, p=value) were applied exclusively to binary (yes/no) outcome variables to assess statistically significant deviation from equal distribution; Fisher's exact test was applied where expected cell counts were fewer than five. Multi-category response items (e.g., information source, flock size distribution) are presented as descriptive frequencies only- no inferential statistics were applied. Two-tailed $p<0.05$ was considered statistically significant.

Results

Sociodemographic and farm characteristics

Of 51 broiler farmers surveyed, 92.2% (n= 47) were male (Table 1). Most farmers (39.2%, n= 20) were aged 31–40 years, and secondary education was the most common level of schooling (35.3%, n= 18). Broiler farming was the primary livelihood for 70.6% (n=36) of respondents, with 62.7% (n=32) reporting 6-10 years of farming experience. A majority (62.7%, n=32) earned BDT 15,000–30,000 per month. All farms operated under intensive systems, with 52.9% (n=27) using continuous production. The most common flock size category was 500- 1,000 birds (33.3%, n=17). Biosecurity compliance was poor: only 13.7% (n=7) of farmers wore protective clothing during farm work.

Table 1: *Sociodemographic and farm characteristics of broiler farmers in Cumilla district, Bangladesh (n=51).*

Variable	Category	n	(%)
Sex	Male	47	(92.2)
	Female	4	(7.8)
Age of farmer (years)	18–30	11	(21.6)
	31–40	20	(39.2)
	41–50	12	(23.5)
	>50	8	(15.7)
Educational qualification	Primary	7	(13.7)
	Secondary	18	(35.3)
	Intermediate	16	(31.4)
	Honours or above	7	(13.7)
	No formal education	3	(5.9)
Main occupation	Broiler farming	36	(70.6)
	Other occupation	15	(29.4)
Farming experience (years)	0–5	10	(19.6)
	6–10	32	(62.7)
	>10	9	(17.6)
Monthly household income (BDT)	<15,000	7	(13.7)
	15,000–30,000	32	(62.7)
	>30,000	12	(23.5)
Flock size (birds)	<500	7	(13.7)
	500–1,000	17	(33.3)
	1,001–2,000	14	(27.5)
	2,001–3,000	8	(15.7)
	>3,000	5	(9.8)
Production system	Continuous	27	(52.9)
	All-in-all-out	24	(47.1)
Ranging system	Intensive	51	(100.0)
Protective uniform worn	Yes	7	(13.7)
	No	44	(86.3)

Knowledge of AMU and AMR

General awareness of antimicrobials was reported by 58.8% (n=30) of farmers (Table 2). However, AMR-specific knowledge was critically deficient. Only 11.8% (n=6) of farmers knew that misuse or overuse of antibiotics could contribute to AMR ($p<0.001$), and 92.2% (n=47) were unaware of both antimicrobial residues ($p<0.001$) and withdrawal periods ($p<0.001$). A widespread and clinically significant misconception was identified: 80.4% (n=41) of farmers incorrectly believed that antibiotics are effective against viral infections ($p<0.001$). General awareness of antimicrobials and knowledge of prescription authority are reported descriptively only, as these represent single-proportion estimates without a pre-specified comparison (Figure 2). These findings are consistent with the KAP framework applied in this study (Ajzen, 1991): The large proportion of farmers with general antibiotic awareness (58.8%) who nonetheless lack specific knowledge of AMR causation (11.8%) suggests that surface-level familiarity with antimicrobials does not translate into an understanding of resistance mechanisms. This knowledge-action gap is a theoretically important finding- within the Theory of Planned Behaviour, inadequate knowledge of consequences undermines the formation of negative attitudes toward irrational AMU, which in turn removes a key cognitive barrier to unsafe practices (Fishbein and Ajzen, 2011; Ajzen, 1991). The nearly universal misconception that antibiotics can treat viral infections (80.4%) is particularly consequential, as it provides a cognitive justification for routine prophylactic antibiotic administration during respiratory disease episodes of likely viral aetiology, directly increasing antibiotic pressure without therapeutic rationale (Imam *et al*., 2020; Roess *et al*., 2013).

Table 2: *Knowledge of broiler farmers on antimicrobial use and resistance- Cumilla district, Bangladesh (n=51).*

Knowledge item	Response	n (%)	Statistic
Aware of antimicrobials?	Yes	30 (58.8)	Descriptive only
	No	21 (41.2)	
Know who can issue a prescription?	Yes	21 (41.2)	Descriptive only
	No	30 (58.8)	
Know about antimicrobial residues?	Yes	4 (7.8)	p<0.001
	No	47 (92.2)	
Gives antibiotics to whole flock when one bird is sick?	Yes	50 (98.0)	p<0.001
	No	1 (2.0)	
Believes antibiotics can be given without a vet prescription?	Yes	17 (33.3)	p=0.017
	No	34 (66.7)	
Antibiotics are effective against bacterial diseases?	Yes	48 (94.1)	p<0.001
	No	3 (5.9)	
Antibiotics are effective against viral diseases? (misconception)	Yes	41 (80.4)	p<0.001
	No	10 (19.6)	
Knows that misuse/overuse of antibiotics causes AMR?	Yes	6 (11.8)	p<0.001
	No	45 (88.2)	
Knows about antibiotic withdrawal period?	Yes	4 (7.8)	p<0.001
	No	47 (92.2)	

$\chi^2(1)$=statistic, p=value: Pearson chi-square tests applied to binary items against null expectation of equal proportions. 'Descriptive only' = single-proportion estimate; no inferential test applied. df=degrees of freedom.

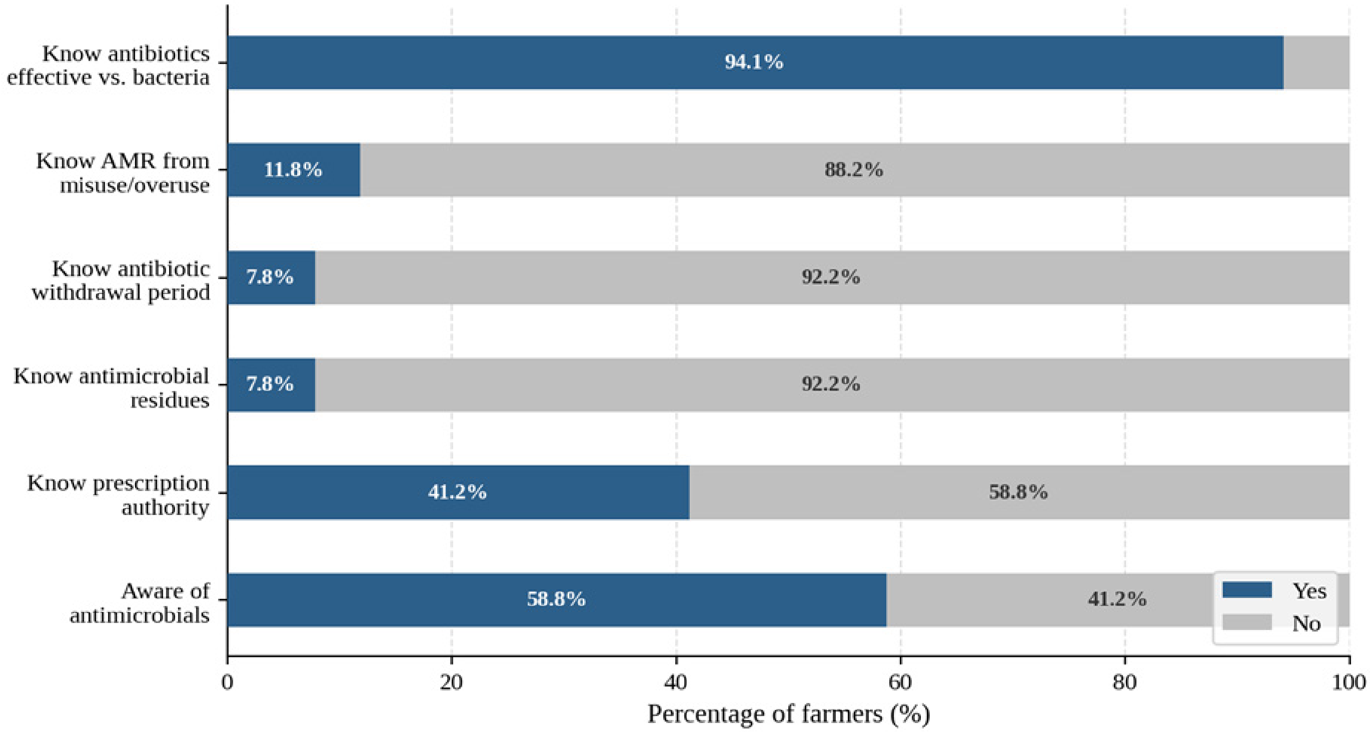

Figure 2: *Knowledge of broiler farmers on AMU and AMR- Cumilla district, Bangladesh (n=51).*

Attitudes toward AMU and AMR

Most farmers (96.1%, n=49) believed antimicrobials should be used as a preventive measure rather than being restricted to clinically sick animals only (Table 3). Only 11.8% (n=6) agreed that antibiotic misuse could cause AMR (p < 0.001), while 86.3% (n= 44) had no idea about this relationship. The public health significance of AMR was unknown to 92.2% (n= 47) of respondents. Although 70.6% (n= 36) agreed that accurate dosing is important (p= 0.003), fewer than 2% (n= 1) had any awareness of herbal or non-antibiotic alternatives. Three-category attitude items are presented as descriptive frequencies without chi-square testing. The near-consensus belief in preventive AMU (96.1%) is theoretically important within the KAP framework: when farmers perceive prophylactic antibiotic administration as normatively appropriate, attitude-change interventions that rely solely on providing factual information about AMR are unlikely to modify practice, because the normative attitude itself- that prophylaxis is desirable and standard- must also be addressed (Ajzen, 1991; Chandler *et al*., 2016). The almost complete absence of awareness of non-antibiotic alternatives (<2%) further illustrates that the attitudinal space for voluntarily reducing AMU is currently very narrow, and structural alternatives must be provided alongside educational messaging to enable behavioural change (McKernan *et al*., 2021; Rodrigues *et al*., 2017).

Table 3: *Attitudes of broiler farmers toward antimicrobial use and resistance- Cumilla district, Bangladesh (n=51).*

Attitude item	Response	n (%)	Statistic
Antimicrobials should be used for sick animals only?	Yes	1 (2.0)	Descriptive only
	No	49 (96.1)	
	No idea	1 (2.0)	
Antimicrobials should be used to prevent disease?	Yes	49 (96.1)	Descriptive only
	No	1 (2.0)	
	No idea	1 (2.0)	
Antimicrobials should be used as growth promoters?	Yes	3 (5.9)	Descriptive only
	No	16 (31.4)	
	No idea	32 (62.7)	
Misuse/overuse of antibiotics may cause AMR?	Agree	6 (11.8)	p<0.001
	Disagree	1 (2.0)	
	No idea	44 (86.3)	
AMR is not a significant public health concern?	Agree	0 (0.0)	Descriptive only
	Disagree	4 (7.8)	
	No idea	47 (92.2)	
Relationship between poultry AMU and resistance development?	Agree	4 (7.8)	Descriptive only
	Disagree	0 (0.0)	
	No idea	47 (92.2)	
An accurate dose of antimicrobial should be used?	Agree	36 (70.6)	p=0.003
	Disagree	1 (2.0)	
	No idea	14 (27.5)	
Herbal/medicinal drugs can replace antimicrobials?	Agree	1 (2.0)	Descriptive only
	Disagree	0 (0.0)	
	No idea	50 (98.0)	

χ^2(1)=statistic, p=value applied only to Likert agree/disagree items where a binary contrast was meaningful. Three-category items are presented as descriptive frequencies only.

AMU practices

AMU was reported on all 51 farms (100%) (Table 4). Veterinarians were the primary AMU information source for 47.1% (n= 24) of farmers, followed by dealers (19.6%, n= 10) and self-experience (15.7%, n= 8). Despite veterinarian availability, only 47.1% (n= 24) of farmers obtained a formal veterinary prescription (p= 0.672- not significantly different from chance). AMU was administered through drinking water by 94.1% (n= 48) of farms (p<0.001). Brooding-period AMU was near-universal (98.0%, n= 50; p<0.001), reflecting an entrenched prophylactic practice.

Table 4: *Antimicrobial use practices among broiler farmers in Cumilla district, Bangladesh (n=51).*

Practice item	Response	n (%)	Statistic
Antibiotic use in farm (any)	Yes	51 (100.0)	Universal no test applicable
Primary source of AMU information	Veterinarian	24 (47.1)	Descriptive only
	Dealer	10 (19.6)	
	Self/experience	8 (15.7)	
	Salesman	5 (9.8)	
	Friend/neighbour	4 (7.8)	
Purchase source	Pharmacy	24 (47.1)	Descriptive only
	Dealer	23 (45.1)	
	Company directly	4 (7.8)	
Veterinary prescription obtained?	Yes	24 (47.1)	p=0.672
	No	27 (52.9)	
Route of AMU administration	Through water	48 (94.1)	p<0.001
	Through feed	3 (5.9)	
Read antibiotic prospectus before use?	Yes	25 (49.0)	p=0.888
	No	26 (51.0)	
Used antibiotics during brooding period?	Yes	50 (98.0)	p<0.001
	No	1 (2.0)	
Sought veterinary advice on withdrawal period?	Yes	5 (9.8)	p<0.001
	No	46 (90.2)	
Withdrawal period maintained before sale?	Yes	4 (7.8)	p<0.001
	No	47 (92.2)	
Stopped AMU when birds appeared clinically better?	Yes	43 (84.3)	p<0.001
	No	8 (15.7)	
Sold broilers during/immediately after AMU?	Yes	36 (70.6)	p=0.003
	No	15 (29.4)	

χ^2(1)=statistic, p=value applied to binary items only. Multi-category items (information source, purchase source) are presented as descriptive frequencies only. df=1 throughout.

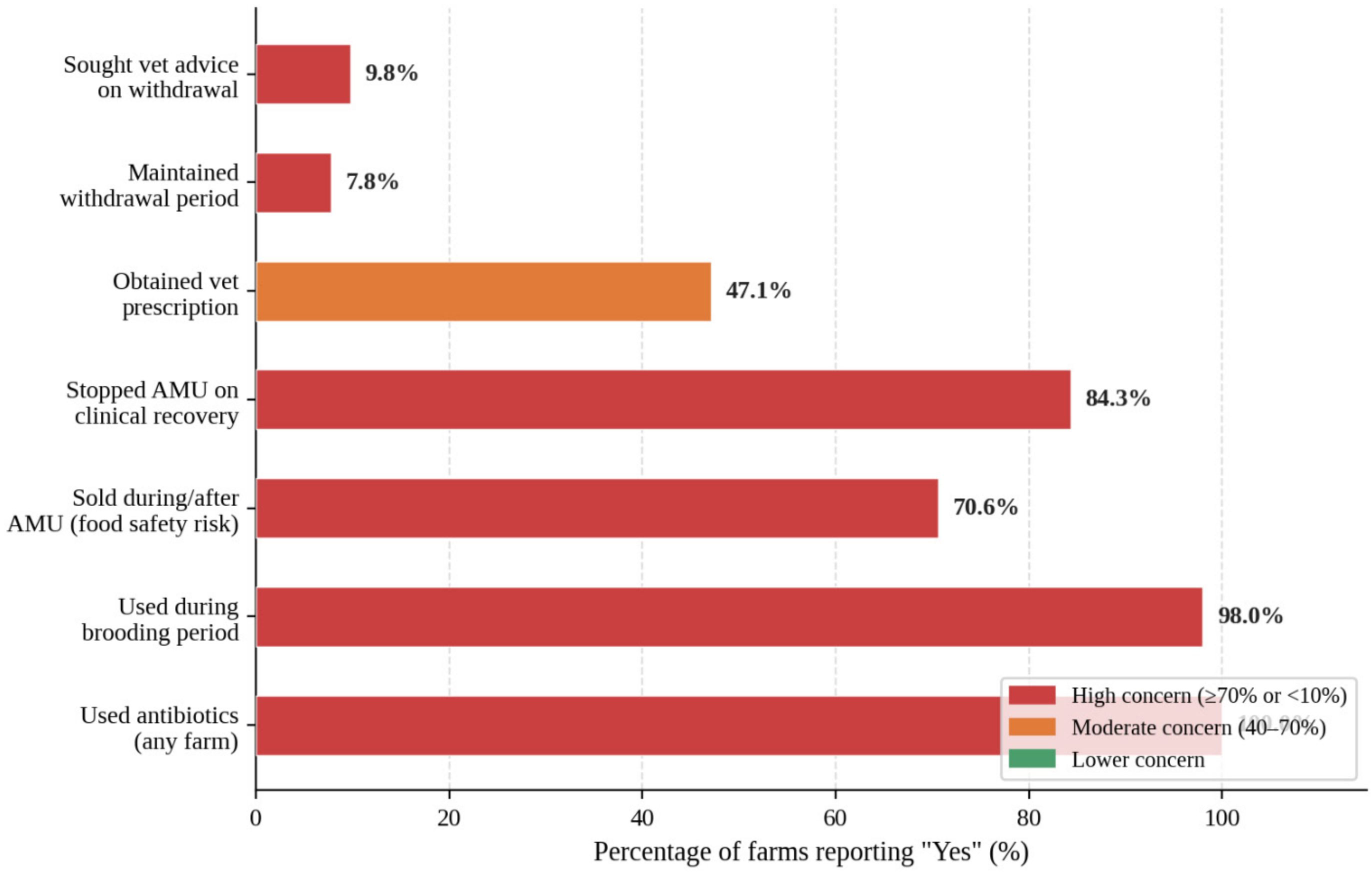

Figure 3: *Antimicrobial use practices among broiler farmers- Cumilla district, Bangladesh (n=51).*

Withdrawal period compliance was critically poor: only 9.8% (n=5) sought veterinary guidance ($p<0.001$), and only 7.8% (n=4) actually maintained withdrawal periods before sale ($p<0.001$). Most farmers (84.3%, n=43) discontinued AMU upon apparent clinical recovery rather than completing a defined course ($p<0.001$). Critically, 70.6% (n=36) sold broilers during or immediately after AMU ($p=0.003$), posing direct food safety risks from antibiotic-residue-contaminated meat reaching consumers (Figure 3).

Antimicrobials used

Fourteen distinct antimicrobial agents were identified across the 51 farms (Table 5). Ciprofloxacin was the most frequently reported agent (62.7%, n=32), followed by amoxicillin (60.8%, n=31), doxycycline (52.9%, n=27), and tylosin (47.1%, n=24). Colistin and levofloxacin were each used by 41.2% (n=21) of farms. Of the 14 agents identified, six are classified by the WHO as CIAs- ciprofloxacin, levofloxacin, and enrofloxacin (fluoroquinolones), colistin (polymyxin), and gentamicin and neomycin (aminoglycosides)- and were all used routinely without diagnostic confirmation or prescription (WHO, 2021) (Figures 4 and 5).

Table 5: *Antimicrobials used by broiler farmers in Cumilla district, Bangladesh (n=51), ranked by frequency of use.*

Antimicrobial agent	Drug class	n	(%)	WHO category†
Ciprofloxacin	Fluoroquinolone	32	(62.7)	CIA
Amoxicillin	Aminopenicillin	31	(60.8)	IA
Doxycycline	Tetracycline	27	(52.9)	IA
Tylosin	Macrolide	24	(47.1)	HIA
Colistin	Polymyxin	21	(41.2)	CIA
Levofloxacin	Fluoroquinolone	21	(41.2)	CIA
Erythromycin	Macrolide	20	(39.2)	HIA
Gentamicin	Aminoglycoside	19	(37.3)	CIA
Neomycin	Aminoglycoside	19	(37.3)	CIA
Tilmicosin	Macrolide	18	(35.3)	HIA
Enrofloxacin	Fluoroquinolone	15	(29.4)	CIA
Oxytetracycline	Tetracycline	14	(27.5)	IA
Florfenicol	Phenicol	10	(19.6)	IA
Chlortetracycline	Tetracycline	10	(19.6)	IA

† WHO classification of Critically Important Antimicrobials (6th revision, 2019): CIA = Critically Important Antimicrobial; HIA = Highly Important Antimicrobial; IA = Important Antimicrobial (WHO, 2021).

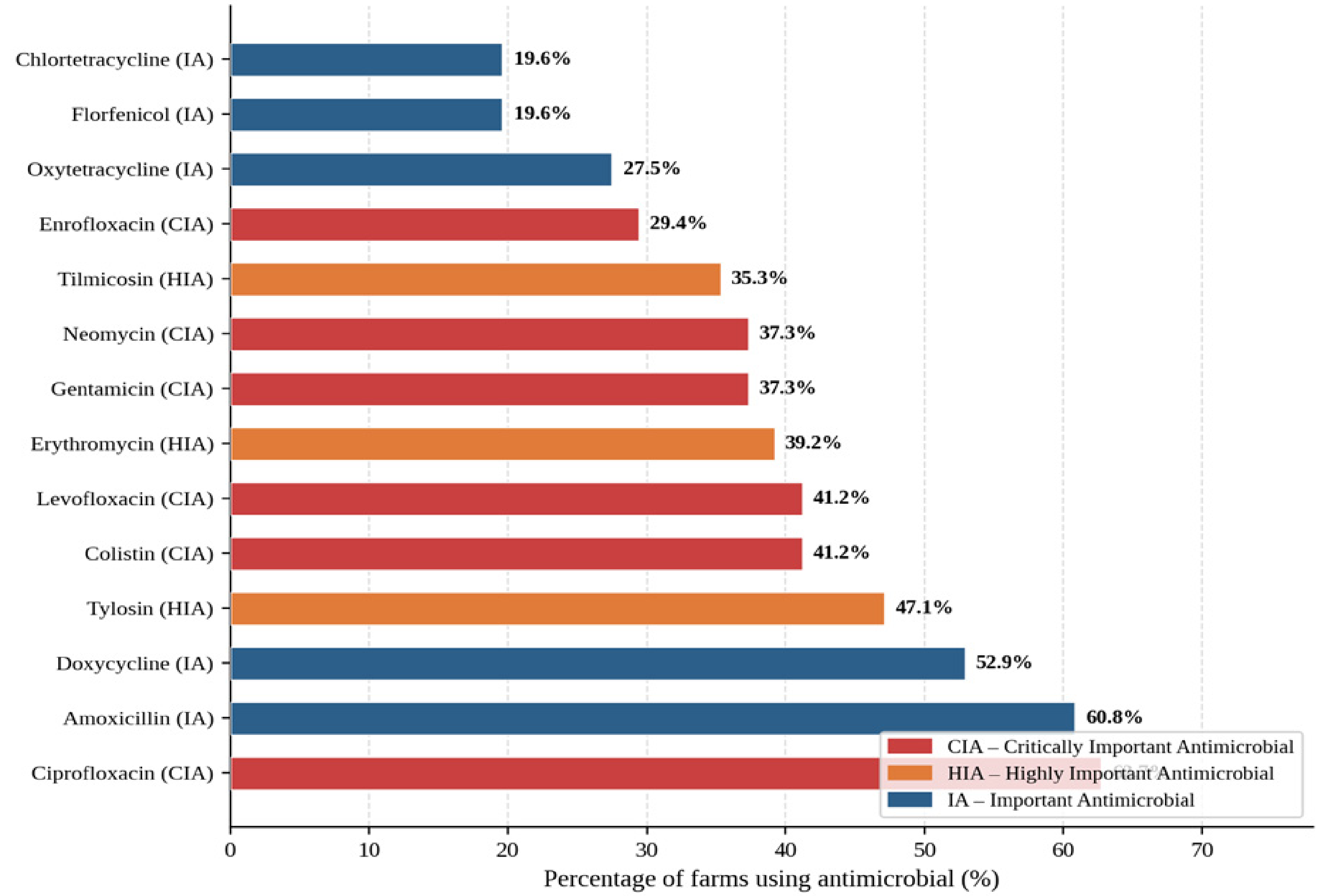

Figure 4: *Antimicrobials used by broiler farmers classified by WHO category- Cumilla district, Bangladesh (n=51).*

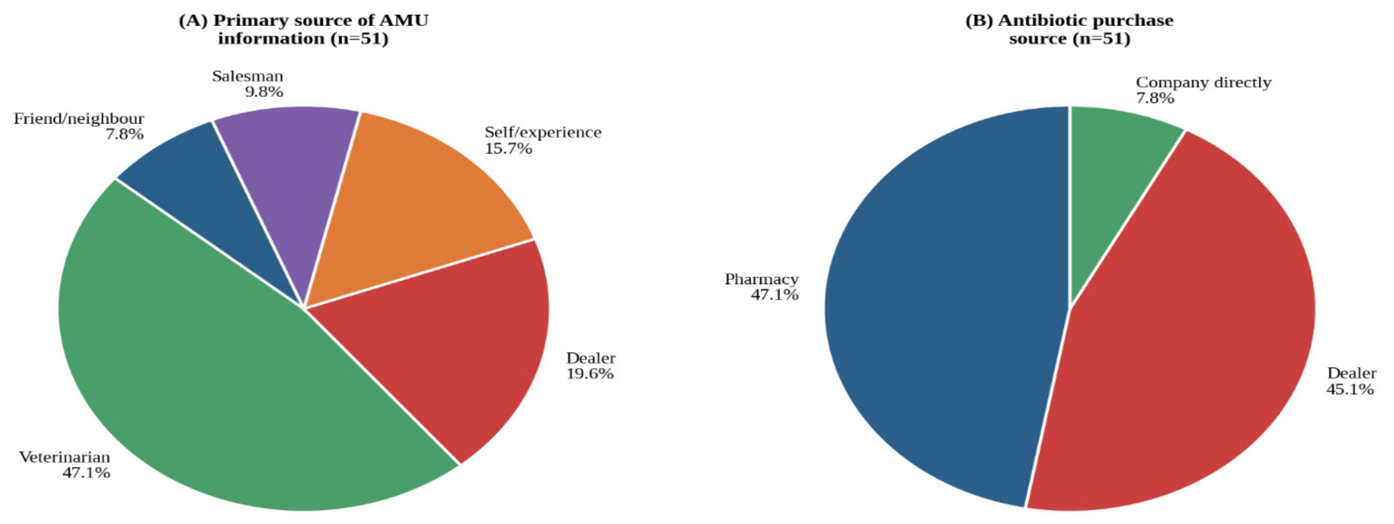

Figure 5: *Sources of AMU information and antibiotic purchase among broiler farmers- Cumilla district, Bangladesh (n=51).*

Discussion

This cross-sectional survey documents pervasive, poorly regulated AMU among commercial broiler farmers across four upazilas of Cumilla district, characterised by universal antibiotic use, insufficient veterinary prescription compliance (47.1%), near-absent withdrawal period adherence (7.8%), and routine use of WHO-classified CIAs without diagnostic justification. While these findings cannot be extrapolated to the broader Cumilla district or Bangladesh nationally- given the purposive sample of 51 farmers from four upazilas- they reveal structural vulnerabilities in farm-level AMU governance that are consistent with patterns documented in other Bangladeshi districts (Hassan *et al.*, 2021; Islam *et al.*, 2022; Raihan *et al.*, 2026) and in comparable South Asian settings (Poudel *et al.*, 2024; Habiba *et al.*, 2023). Interpreted through the Theory of Planned Behaviour (Ajzen, 1991), these aggregate findings point to a three-part failure: (i) knowledge deficits that prevent farmers from perceiving irrational AMU as harmful; (ii) deeply entrenched pro-prophylaxis attitudes shaped by decades of dealer-led AMU normalisation; and (iii) structural barriers to prescription-based AMU rooted in inadequate veterinary access and dealer-credit dependency (Masud *et al.*, 2020; McKernan *et al.*, 2021). Each of these barriers independently justifies regulatory and educational intervention; their co-occurrence suggests that single-lever policies- such as a prescription requirement alone, without concurrent expansion of accessible veterinary services- are unlikely to achieve meaningful AMU reduction in this setting (Kirchhelle, 2018; Laxminarayan *et al.*, 2013). The Bangladesh NAP on AMR (2021-2026) explicitly calls for reduced non-prescription AMU and expanded veterinary stewardship capacity (Jhora, 2021), yet these data suggest farm-level implementation in southeastern districts remains nascent, underscoring the need for urgent district-specific action plans with accountability mechanisms.

A particularly notable finding is the association between dealer dependence and CIA use. In this study, 19.6% of farmers identified dealers as their primary AMU information source, and dealers were the predominant purchase source for 45.1% of farms. This dealer-farmer financial relationship- characterised by credit-based supply of feed, chicks, and medicines- is associated with economic incentives for dealers to promote antibiotic sales over stewardship (Masud *et al.*, 2020; Begum *et al.*, 2014). In this context, 62.7% of farms used ciprofloxacin and 41.2% used colistin- both WHO CIAs- routinely and without veterinary prescription or microbiological indication. Fluoroquinolones are among the most important treatments for serious *Salmonella* and Campylobacter infections in humans, while colistin is a last-resort option for carbapenem-resistant Enterobacteriaceae (WHO, 2021; Liu *et al.*, 2016). Their widespread, unmonitored use in broiler flocks suggests a potential pathway from dealer-driven commercial incentives to CIA selection pressure in food-producing animals- a pattern that may warrant specific regulatory attention beyond general AMU stewardship campaigns (McKernan *et al.*, 2021; WHO, 2016).

The near-universal prophylactic AMU during brooding (98.0%) and the widespread misconception that antibiotics treat viral infections (80.4%) compound this concern. These patterns- also documented by Imam *et al.* (2020) and Roess *et al.* (2013) in Bangladeshi and South Asian contexts- suggest that antibiotics are used as a default disease management strategy irrespective of pathogen type, which may increase selection pressure without therapeutic benefit. The combination of frequent CIA use and the sale of broilers during active AMU (70.6%) raises food safety concerns regarding potential antibiotic residues in the food supply, consistent with concerns raised by Bacanlı (2024) and Hedman *et al.* (2020).

This study has several important limitations that should be considered when interpreting the findings. First, the purposive sample of 51 farmers from four upazilas is small and not randomly selected, which means findings cannot be generalised to Cumilla district as a whole or to Bangladesh more broadly. Second, self-reported data are subject to recall bias and social desirability bias, potentially leading to underreporting of non-compliant practices. Third, no microbiological sampling was conducted; therefore, an association between AMU practices and actual resistance phenotypes in local broiler flocks or retail meat cannot be established from this data alone. Future studies integrating laboratory-based AMR surveillance with KAP assessments, and employing random sampling frames, would substantially strengthen the evidence base for AMR policy in this region. Regarding the first limitation, purposive sampling introduces selection bias because participant enrolment was based on the researcher's judgement rather than a probability-based sampling frame. Specifically, farmers operating in areas with higher concentrations of registered commercial operations may differ systematically from smaller or more geographically dispersed producers in terms of access to veterinary services, dealer relationships, and AMU scale. This means the observed prevalence of CIA use, prescription behaviour, and AMR knowledge cannot be assumed representative of all commercial broiler farmers in Cumilla district (Dohoo *et al.*, 2009; Patton, 1990). Future studies should employ random sampling from a complete sampling frame of all registered commercial broiler farms in the district to produce population-representative estimates and enable formal hypothesis testing of KAP associations. Regarding the second limitation, the use of face-to-face interviews is an established limitation in AMU KAP research, as it creates the conditions for both recall bias (farmers may not accurately remember which antimicrobials were used or when withdrawal periods began) and social desirability bias (farmers may under-report practices they perceive to be non-compliant or stigmatised, such as using antibiotics in feed or selling broilers during active AMU) (Rousham *et al*., 2018; Otte *et al*., 2019). In the present study, the self-reported withdrawal period compliance rate of 7.8% is likely to represent an upper bound, as social desirability pressures in face-to-face interviews may still have led some farmers to report compliance they did not maintain. Techniques such as anonymous self-completion questionnaires, farm record review, or direct observation of farm practices may yield more accurate behavioural data in future studies (Rousham *et al*., 2018). Regarding the third limitation, the absence of biological sampling means that this study describes a risk profile for AMR rather than directly measuring resistance. The documented prevalence of CIA use- particularly fluoroquinolones and colistin- without prescription or microbiological confirmation is consistent with known drivers of resistance selection in broiler flocks (Van Boeckel *et al*., 2015; Liu *et al*., 2016), but a direct causal link between the observed AMU practices and resistance phenotypes in local poultry or retail meat cannot be inferred from KAP data alone (Hedman *et al*., 2020). Integrated surveillance studies combining KAP assessments with antimicrobial susceptibility testing of poultry-associated isolates (e.g., *Salmonella, Campylobacter, Escherichia coli*) from farms and markets in Cumilla district would substantially strengthen the evidence base and provide the microbiological data needed to quantify the local public health burden attributable to broiler-associated AMR (Islam *et al*., 2023; Manges *et al*., 2019).

Conclusion

This study provides the first documented evidence of AMU practices and AMR awareness among commercial broiler farmers in Cumilla district, Bangladesh. The findings reveal a critical public health risk rooted in the convergence of dealer-driven CIA use, universal prophylactic AMU during brooding, poor withdrawal period compliance, and near-absent AMR knowledge. The most actionable priority is restricting unrestricted over-the-counter dealer access to CIAs- particularly ciprofloxacin and colistin- alongside targeted farmer education and expansion of affordable rural veterinary services. These measures should be embedded within Bangladesh's National Action Plan on AMR (2021-2026) and implemented at the district level through coordinated engagement of the Department of Livestock Services, the Bangladesh Veterinary Association, and local government authorities.

Acknowledgement

The author gratefully acknowledges all commercial broiler farmers who voluntarily participated in this study and shared their valuable information.

Novelty Statement

This study provides the first district-level evidence on antimicrobial use (AMU) practices and antimicrobial resistance (AMR) awareness among commercial broiler farmers in Cumilla district, Bangladesh. The findings highlight critical gaps in antibiotic stewardship and provide evidence to support targeted AMR interventions and policy development.

Ethical considerations

This observational survey involved no biological samples, no clinical interventions, and no collection of personal identifiers. Participation was entirely voluntary. Formal ethics committee approval was not required under applicable national guidelines. Verbal informed consent was obtained and documented for all participants prior to interview. Data were fully anonymised before analysis.

Informed consent

Verbal informed consent was obtained from all participants prior to data collection.

Funding

This study received no external funding.

Data availability

Individual-level raw survey data are presented in Appendix Table A. Additional data are available from the corresponding author upon reasonable request.

Generative AI and AI assisted technology statement

The author declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The author have declared no conflict of interest.

References

Ajzen, I., 1991. The theory of planned behavior. Organ. Behave. Hum. Decision Process., 50(2): 179-211. https://doi.org/10.1016/0749-5978(91)90020-T

Alhaji, N.B., Haruna, A.E., Muhammad, B., Lawan, M.K. and Isola, T.O., 2018. Antimicrobials usage assessments in commercial poultry and local birds in North-central Nigeria: Associated pathways and factors for resistance emergence and spread. Prevent. Vet. Med., 154: 139-147. https://doi.org/10.1016/j.prevetmed.2018.04.001

Bacanlı, M.G., 2024. The two faces of antibiotics: an overview of the effects of antibiotic residues in foodstuffs. Arch. Toxicol., 98(6): 1717-1725. https://doi.org/10.1007/s00204-024-03760-z

Bangladesh Bureau of Statistics (BBS), 2022. Population and housing census 2022: Preliminary report. Statistics and Informatics Division, Ministry of Planning. http://www.bbs.gov.bd/

Begum, I.A., Alam, M.J., Rahman, S. and Van Huylenbroeck, G., 2014. An assessment of the contract farming system in improving market access for smallholder poultry farmers in Bangladesh. For Inclusive Market Access, p. 39.

Caudell, M.A., Dorado-Garcia, A., Eckford, S., Creese, C., Byarugaba, D.K., Afakye, K., Chansa-Kabali, T., Fasina, F.O., Kabali, E., Kiambi, S. and Kimani, T., 2020. Towards a bottom-up understanding of antimicrobial use and resistance on the farm: A knowledge, attitudes, and practices survey across livestock systems in five African countries. PLoS One, 15(1): e0220274. https://doi.org/10.1371/journal.pone.0220274

Chandler, C., Hutchinson, E. and Hutchison, C., 2016. Addressing antimicrobial resistance through social theory: An anthropologically oriented report.

Chowdhury, S., Fournié, G., Blake, D., Henning, J., Conway, P., Hoque, M.A., Ghosh, S., Parveen, S., Biswas, P.K., Akhtar, Z. and Islam, K., 2022. Antibiotic usage practices and its drivers in commercial chicken production in Bangladesh. PLoS One, 17(10): p.e0276158. https://doi.org/10.1371/journal.pone.0276158

DLS, 2023. Livestock economy at a glance. Dhaka: Directorate of Livestock Services, Ministry of Fisheries and Livestock, Government of Bangladesh.

Dohoo, I.R., Martin, S.W. and Stryhn, H., 2009. Veterinary epidemiologic research. Charlottetown: VER, Incorporated. 2: 402.

Fishbein, M. and Ajzen, I., 2011. Predicting and changing behavior: The reasoned action approach. Psychology press. https://doi.org/10.4324/9780203838020

Habiba, U.E., Khan, A., Mmbaga, E.J., Green, I.R. and Asaduzzaman, M., 2023. Use of antibiotics in poultry and poultry farmers-a cross-sectional survey in Pakistan. Front. Publ. Health, 11: 1154668. https://doi.org/10.3389/fpubh.2023.1154668

Hamid, M.A., Rahman, M.A., Ahmed, S. and Hossain, K.M., 2017. Status of poultry industry in Bangladesh and the role of private sector for its development. Asian J. Poult. Sci., 11(1): 1-13. https://doi.org/10.3923/ajpsaj.2017.1.13

Hassan, M.M., Kalam, M.A., Alim, M.A., Shano, S., Nayem, M.R.K., Badsha, M.R., Al Mamun, M.A., Hoque, A., Tanzin, A.Z., Nath, C. and Khanom, H., 2021. Knowledge, attitude, and practices on antimicrobial use and antimicrobial resistance among commercial poultry farmers in Bangladesh. Antibiotics, 10(7): 784. https://doi.org/10.3390/antibiotics10070784

Hassan, M.S., 2022. Analysis of the Bangladesh poultry industry and Internship experience from Mokam Poultry.

Hedman, H.D., Vasco, K.A. and Zhang, L., 2020. A review of antimicrobial resistance in poultry farming within low-resource settings. Animals, 10(8): 1264. https://doi.org/10.3390/ani10081264

Imam, T., Gibson, J.S., Foysal, M., Das, S.B., Gupta, S.D., Fournié, G., Hoque, M.A. and Henning, J., 2020. A cross-sectional study of antimicrobial usage on commercial broiler and layer chicken farms in Bangladesh. Front. Vet. Sci., 7: 576113. https://doi.org/10.3389/fvets.2020.576113

Islam, M.S., Hossain, M.J., Sobur, M.A., Punom, S.A., Rahman, A.T. and Rahman, M.T., 2023. A systematic review on the occurrence of antimicrobial-resistant *Escherichia coli* in poultry and poultry environments in Bangladesh between 2010 and 2021. BioMed. Res. Int., 2023(1): 2425564. https://doi.org/10.1155/2023/2425564

Islam, M.Z., Islam, M.S., Kundu, L.R., Ahmed, A., Hsan, K., Pardhan, S., Driscoll, R., Hossain, M.S. and Hossain, M.M., 2022. Knowledge, attitudes and practices regarding antimicrobial usage, spread and resistance emergence in commercial poultry farms of Rajshahi district in Bangladesh. PLoS One, 17(11): p.e0275856. https://doi.org/10.1371/journal.pone.0275856

Jhora, S.T., 2021. Fleming's warning and the future pandemic. Bangladesh J. Med. Microbiol., 15(2): 1-4. https://doi.org/10.3329/bjmm.v15i2.57811

Kirchhelle, C., 2018. Pharming animals: A global history of antibiotics in food production (1935–2017). Palgrave communications, 4(1). https://doi.org/10.1057/s41599-018-0152-2

Kousar, S., Rehman, N., Javed, A., Hussain, A., Naeem, M., Masood, S., Ali, H.A., Manzoor, A., Khan, A.A., Akrem, A. and Iqbal, F., 2021. Intensive poultry farming practices influence antibiotic resistance profiles in Pseudomonas aeruginosa inhabiting nearby soils. Infect. Drug Resist., pp. 4511-4516. https://doi.org/10.2147/IDR.S324055

Laxminarayan, R., Duse, A., Wattal, C., Zaidi, A.K., Wertheim, H.F., Sumpradit, N., Vlieghe, E., Hara, G.L., Gould, I.M., Goossens, H. and Greko, C., 2013. Antibiotic resistance the need for global solutions. Lancet Infect. Dis., 13(12): 1057-1098. https://doi.org/10.1016/S1473-3099(13)70318-9

Liu, Y.Y., Wang, Y., Walsh, T.R., Yi, L.X., Zhang, R., Spencer, J., Doi, Y., Tian, G., Dong, B., Huang, X. and Yu, L.F., 2016. Emergence of plasmid-mediated colistin resistance mechanism MCR-1 in animals and human beings in China: A microbiological and molecular biological study. Lancet Infect. Dis., 16(2): 161-168. https://doi.org/10.1016/S1473-3099(15)00424-7

Manges, A.R., Geum, H.M., Guo, A., Edens, T.J., Fibke, C.D. and Pitout, J.D., 2019. Global extraintestinal pathogenic *Escherichia coli* (ExPEC) lineages. Clin. microbiol. Rev., 32(3): 10-1128. https://doi.org/10.1128/CMR.00135-18

Masud, A.A., Rousham, E.K., Islam, M.A., Alam, M.U., Rahman, M., Mamun, A.A., Sarker, S., Asaduzzaman, M. and Unicomb, L., 2020. Drivers of antibiotic use in poultry production in Bangladesh: Dependencies and dynamics of a patron-client relationship. Front. Vet. Sci., 7: 78. https://doi.org/10.3389/fvets.2020.00078

McKernan, C., Benson, T., Farrell, S. and Dean, M., 2021. Antimicrobial use in agriculture: critical review of the factors influencing behaviour. JAC-antimicrobial resistance, 3(4), p.dlab178. https://doi.org/10.1093/jacamr/dlab178

Otte, J., Nugent, R. and McLeod, A., 2019. Transboundary animal diseases: Assessment of socio-economic impacts and institutional responses. Livestock Policy Discussion Paper No.9. Rome: FAO.

Otte, M.J., Nugent, R. and McLeod, A., 2004. Transboundary animal diseases: Assessment of socio-economic impacts and institutional responses. Rome, Italy: Food Agric. Organ. (FAO), pp.119-126.

Patton, M.Q., 1990. Qualitative evaluation and research methods.

Poudel, A., Sharma, S., Dhital, K., Bhandari, S., Rajbhandari, P.G., Napit, R., Puri, D. and Karmacharya, D.B., 2024. Antimicrobial stewardship hindered by inadequate biosecurity and biosafety practices, and inappropriate antibiotics usage in poultry farms of Nepal–A pilot study. PLoS One, 19(3): p.e0296911. https://doi.org/10.1371/journal.pone.0296911

Raihan, Z., Uddin, M.N., Islam, M.S., Gupta, S.D., Anwer, M.S., Sarker, S. and Haque, M.H., 2026. Knowledge, Attitudes and Practices on Antimicrobial Usage and Resistance Among Broiler and Layer Poultry Farmers in Bangladesh: Lessons for Future Improvement. Vet. Med. Sci., 12(1): p.e70776. https://doi.org/10.1002/vms3.70776

Rodrigues, C.M., Pinto, M.V., Sadarangani, M. and Plotkin, S.A., 2017. Whither vaccines? J. Infect., 74: S2-S9. https://doi.org/10.1016/S0163-4453(17)30184-6

Roess, A.A., Winch, P.J., Ali, N.A., Akhter, A., Afroz, D., El Arifeen, S., Darmstadt, G.L., Baqui, A.H. and Bangladesh Projahnmo Study Group, 2013. Animal husbandry practices in rural Bangladesh: potential risk factors for antimicrobial drug resistance and emerging diseases. Am. J. Trop. Med. Hyg., 89(5): 965. https://doi.org/10.4269/ajtmh.12-0713

Rousham, E.K., Unicomb, L. and Islam, M.A., 2018. Human, animal and environmental contributors to antibiotic resistance in low-resource settings: Integrating behavioural, epidemiological and One Health approaches. Proc. R. Soc. B: Biol. Sci., 285(1876): p.20180332. https://doi.org/10.1098/rspb.2018.0332

Van Boeckel, T.P., Brower, C., Gilbert, M., Grenfell, B.T., Levin, S.A., Robinson, T.P., Teillant, A. and Laxminarayan, R., 2015. Global trends in antimicrobial use in food animals. Proc. Natl. Acad. Sci., 112(18): 5649-5654. https://doi.org/10.1073/pnas.1503141112

WHO, 2016. Global action plan on antimicrobial resistance: Recommended monitoring of antimicrobial use through surveillance and research. Geneva: World Health Organization.

WHO, 2021. Monitoring global progress on antimicrobial resistance: Tripartite AMR country self-assessment survey (TrACSS) 2019–2020: Global Analysis Report. Geneva: World Health Organization.