



Knowledge, Attitudes, and Practices of Antimicrobial Stewardship Among Healthcare Professionals in Bangladesh: A Cross-Sectional Survey



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Abstract

Background: Antimicrobial resistance (AMR) presents a significant global health threat, driven by the misuse and overuse of antibiotics. **Objective:** The purpose of the present study was to assess the knowledge, attitudes, and practices (KAP) regarding antimicrobial stewardship among healthcare professionals working in public hospitals in Bangladesh. **Methodology:** This cross-sectional survey was conducted at Communicable Disease Control (CDC) unit of the Directorate General of Health Services (DGHS) of Ministry of Health and Family Welfare, Dhaka, Bangladesh from September 2022 to October 2022 during a national orientation program for physicians from government healthcare facilities across Bangladesh. Physicians from facilities with indoor patient services were invited, excluding tertiary medical hospitals. The participants who agreed to take part in the survey through written consent were included in the study. A pre-tested, semi-structured questionnaire was designed to assess their knowledge, attitudes, and practices (KAP) regarding antimicrobial stewardship and AMR. **Results:** The survey involved 292 physicians, primarily male and aged between 25 and 35 years. The results revealed a high level of general awareness about AMR, with 95.2% acknowledging the role of antimicrobial stewardship programs (ASP) in reducing resistance. The participants uniformly agreed with the importance of infection prevention and control (IPC). However, there were significant gaps in understanding specific ASP-related concepts, such as Defined Daily Dose (DDD) and antibiograms, with 41.0% to 75.0% of respondents either unfamiliar with or unsure about these terms. Attitude related responses indicate strong support for educational programs and the integration of ASPs into hospital settings, with 99.0% advocating for training on rational antibiotic use. In practice, most respondents reported rational antibiotic prescribing, yet inconsistencies remain in areas like the choice of antimicrobials and adherence to stewardship principles. **Conclusion:** The findings have revealed a gap between knowledge and practice concerning AMR, emphasizing the need for targeted educational interventions, structured policies, enhanced training, and robust Antimicrobial Stewardship Programs implementation to mitigate AMR and improve patient outcomes in Bangladesh. [Bangladesh Journal of Infectious Diseases, June 2025;12(1):18-26]

Keywords: antimicrobial resistance; antimicrobial stewardship; KAP study; healthcare professionals; Antimicrobial Stewardship Programs

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Introduction

The relentless march of antimicrobial resistance (AMR) is one of our time's most pressing public health crises, threatening to render many of modern medicine's most potent weapons against infection ineffective. Globally, the misuse and overuse of antibiotics in human medicine and agriculture have accelerated the spread of resistance mechanisms among pathogens, heralding the arrival of an era where common infections could once again become fatal¹⁻⁴. The World Health Organization (WHO) has recognized AMR as a global health priority and advocates for comprehensive strategies, including the implementation of antimicrobial stewardship programs (ASPs) to manage and mitigate this risk⁵.

Antimicrobial stewardship encompasses coordinated interventions designed to improve and measure the appropriate use of antimicrobials by promoting the selection of the optimal antimicrobial drug regimen, dose, duration of therapy, and route of administration⁶. Effective stewardship is essential to improve patient outcomes, reduce healthcare costs, and slow the development of resistance⁷. Despite its critical importance, integrating antimicrobial stewardship programs into healthcare settings varies significantly across different regions and is influenced by a myriad of factors, including policy frameworks, healthcare infrastructure, and professional education⁸⁻¹⁰. Bangladesh, too, has stressed the importance of antimicrobial stewardship in its national strategic document on AMR and aimed to establish ASP in hospitals. Given that the impact of AMR is already severe in Bangladesh^{4,11-13}, with more than 26200 mortalities directly attributed to AMR annually¹⁴⁻¹⁵, implementing AMS in every healthcare facility is of utmost importance.

However, recent studies have suggested that while awareness of AMR is generally high among healthcare professionals, gaps in specific knowledge and practices still exist, impacting the effectiveness of stewardship initiatives¹⁶. Moreover, the attitudes and commitment of healthcare providers toward antimicrobial stewardship can significantly influence practice patterns, highlighting the need for targeted educational programs to foster behavioral changes¹⁷. Despite the importance of this information in developing antimicrobial stewardship interventions for hospitals, only one study was found to assess the awareness, perceptions, and practices of physicians regarding antimicrobial stewardship programs and AMR in Bangladesh.

The study was conducted in a few selected tertiary-level hospitals¹⁸. It identified a significant lack of awareness among participating physicians on AMR or antimicrobial stewardship programs, which has led to routinely prescribing broad-spectrum antibiotics without complying with microbiological tests. We have found several other KAP studies from Bangladesh that focused on the general aspect of AMR, where participants are either general people, veterinarians, or students. One of those studies found average knowledge (52.3%), moderate attitudes (67.8%), and good practices (50.6%) regarding antibiotic use and AMR among Bangladeshi nationals¹⁹. Another study compared the level of knowledge of AMR among veterinary and non-veterinary students²⁰. That study acknowledged that veterinary students had higher knowledge of AMR, but there were gaps in practice. Most studies have stressed the importance of conducting KAP studies among practitioners to plan tailored training programs and AMS interventions to modulate the attitude and practice.

To address these, our study aimed to assess the knowledge, attitudes, and practices (KAP) related to antimicrobial stewardship among Bangladeshi healthcare professionals in public hospitals nationwide. The study focuses on examining the level of knowledge on antimicrobial resistance and antimicrobial stewardship and seeks to identify the gaps in attitude toward AMR and the day-to-day clinical practices of those practitioners. By doing so, it aims to determine the need for specific tailored educational and other AMS interventions that can be most effectively applied to enhance the implementation of ASPs, thereby contributing to the national effort against AMR.

Methodology

Study Setting: This cross-sectional survey was conducted from September to October 2022 during a series of orientation programs, arranged by the Communicable Disease Control unit of the Directorate General of Health Services of Ministry of Health and Family Welfare, Dhaka, Bangladesh for physicians from government healthcare facilities across the country. All government healthcare facilities with indoor facilities from all districts excluding tertiary medical college hospitals were invited to send one physician from their facility preferably medical officer level to participate in this orientation program on Antimicrobial Resistance and Antimicrobial Stewardship. Before conducting the survey, written permission was obtained from the Directorate General of Health Services (DGHS) of Bangladesh.

Study Population and Data Collection: The study included every physician attending the orientation programs who consented to participate in this survey. The participants were asked to self-complete a pre-tested semi-structured questionnaire. The questionnaire consists of three main segments designed to assess the knowledge, attitudes, and practices (KAP) related to antimicrobial stewardship among healthcare professionals. The knowledge section included questions on definitions and concepts related to antimicrobial resistance and stewardship. It also had questions to assess how familiar participants are with different aspects of AMS implementation. The attitudes section gauged the participants' perceptions and beliefs about antimicrobial use and resistance. The practices section explored the respondents' actual prescribing behaviours and adherence to stewardship principles. The questionnaire was adapted from similar well-structured surveys and tailored to the context of Bangladesh with an aim to capture a comprehensive picture of the current state of antimicrobial stewardship among healthcare professionals in the country. A briefing was given before to address any confusion regarding the questions, and written consent was obtained.

Data Entry and Cleaning: All the completed questionnaires were later entered into an Excel database. Two data entry staff entered all the forms, and the information was later compared to prevent mistakes, ensure completeness, and avoid missing data. Despite this effort, the entered data again underwent data cleaning to check for any discrepancies or mistakes during data entry.

Statistical Analysis: Data analysis was carried out using STATA version 17²¹. All the open-ended questions were coded and categorised. Descriptive statistics were then conducted according to the type of questions and responses. Graphs were created as necessary. No comparative analysis was conducted as the participants were from similar settings.

Ethical Considerations: The questionnaire form did not include any name or person identifiers. Nowhere during the data analysis or manuscript preparation was the respondents' identification revealed. Written consent was taken. Written permission from authority was obtained.

Results

In total, 292 healthcare professionals provided consent to participate and completed the survey to assess their knowledge, attitudes, and practices

(KAP) regarding antimicrobial stewardship (AMS). The respondents were predominantly male (61.0%), aged between 25 and 35 (66.4%), and primarily medical officers (91.8%). Participants were from healthcare facilities all over the country, with most coming from Dhaka (19.2%), Chattogram (17.5%), and Rajshahi (16.4%) divisions (Table 1).

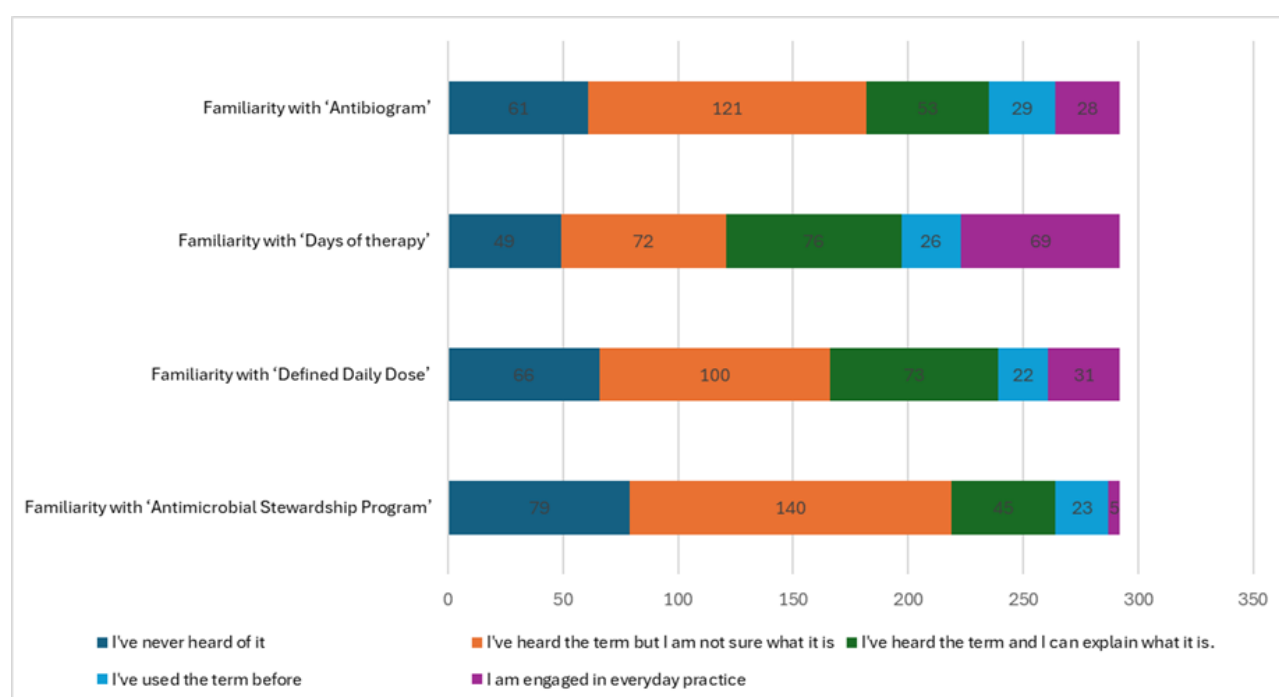
Table 1: Baseline characteristics of the participants (N=292)

Variables	Frequency	Percent
Gender		
• Male	178	61.0
• Female	114	39.0
Age Group		
• 25 to 35 Years	194	66.4
• 35 to 45 Years	87	29.8
• More than 45 Years	11	3.8
Workplace by Division		
• Dhaka	56	19.2
• Chattogram	51	17.5
• Khulna	32	11.0
• Rajshahi	48	16.4
• Barisal	24	8.2
• Rangpur	36	12.3
• Mymensingh	24	8.2
• Sylhet	21	7.2
Designation		
• Medical Officer (residential/ indoor/ outdoor)	268	91.8
• Consultant	17	5.8
• Health Managers	7	2.4

Knowledge: The survey assessed the respondents' knowledge of different aspects of AMR and antimicrobial stewardship. Knowledge of the general aspect of AMR was high, with 94.9% of participants agreeing or strongly agreeing that AMR means bacteria can defeat the antibiotics designed to kill them. All except 4 participants disagreed that antibiotics cure viral infections, and only 5 participants expressed the need for antibiotic treatment for patients with common cold. The majority (95.2%) agreed that AMS would reduce antimicrobial resistance, and 256(87.7%) participants identified IPC to complement AMS implementation. Conversely, conceptions about the combination of antibiotics were not shared among participants, with 65.8% agreeing that a combination of antibiotics prevents AMR, highlighting an area for educational intervention (Table 2).

Table 2: Responses to Questions on Knowledge of Antimicrobial Resistance and Antimicrobial Stewardship (N=292)

Questions	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Antimicrobial Resistance means that bacteria develop the ability to defeat the antibiotics designed to kill them	7(2.4%)	5(1.7%)	3(1.0%)	105(36.0%)	172(58.9%)
Antibiotics cure viral infections	210(71.9%)	78(26.7%)	3(1.0%)	0(0.0%)	1(0.3%)
Patients with common cold symptoms need antibiotic treatment	144(49.3%)	138(47.3%)	5(1.7%)	4(1.4%)	1(0.3%)
Combination Antibiotic Therapy can prevent AMR	21(7.2%)	60(20.6%)	19(6.5%)	141(48.3%)	51(17.5%)
Irrational use of antimicrobials can lead to antimicrobial resistance	3(1.0%)	1(0.3%)	0(0.0%)	45(15.4%)	243(83.2%)
Changes in antimicrobial prescribing practices could reduce antimicrobial resistance	18(6.2%)	27(9.3%)	11(3.8%)	140(48.0%)	96(32.9%)
Antimicrobial stewardship programs reduce antimicrobial resistance	2(0.7%)	0(0.00%)	12(4.1%)	153(52.4%)	125(42.8%)
IPC and AMS complement each other	4(1.4%)	12(4.1%)	20(6.9%)	159(54.5%)	97(33.2%)
Antimicrobial stewardship programs improve patient care and safety	2(0.7%)	6(2.1%)	6(2.1%)	136(46.6%)	142(48.6%)

**Figure I: Familiarity with AMS Related Terminologies (N=292)**

The survey evaluated familiarity with key AMS concepts, and the results revealed a lack of understanding regarding key AMS terms, including the Antimicrobial Stewardship Program (ASP), Defined Daily Dose (DDD), Days of Therapy (DOT), and antibiogram (Figure I). Around 27.0% of participants had never heard of the term 'Antimicrobial Stewardship Programs (ASP)' while 48.0% were unsure of its meaning. Only 15.4% could explain ASP, and a mere 1.0% engaged in daily practice. Regarding Defined Daily Dose (DDD), 25.0% could explain it, and only 10.6% used it daily. Meanwhile, for Days of Therapy (DOT), 26.0% could explain it, and 23.6%

used it regularly. Concerning antibiograms, 20.9% had never heard of the term, and 41.4% were unsure of its meaning (Figure I).

Participants showed mixed levels of knowledge on some quantitative antimicrobial resistance information. Around 66.8% could correctly estimate the proportion of *Salmonella typhi* resistance to ciprofloxacin, and 56.2% accurately identified the global mortality rate due to AMR in 2019. However, only 50.0% correctly estimated the proportion of carbapenem-resistant Enterobacteriaceae (Figure II).

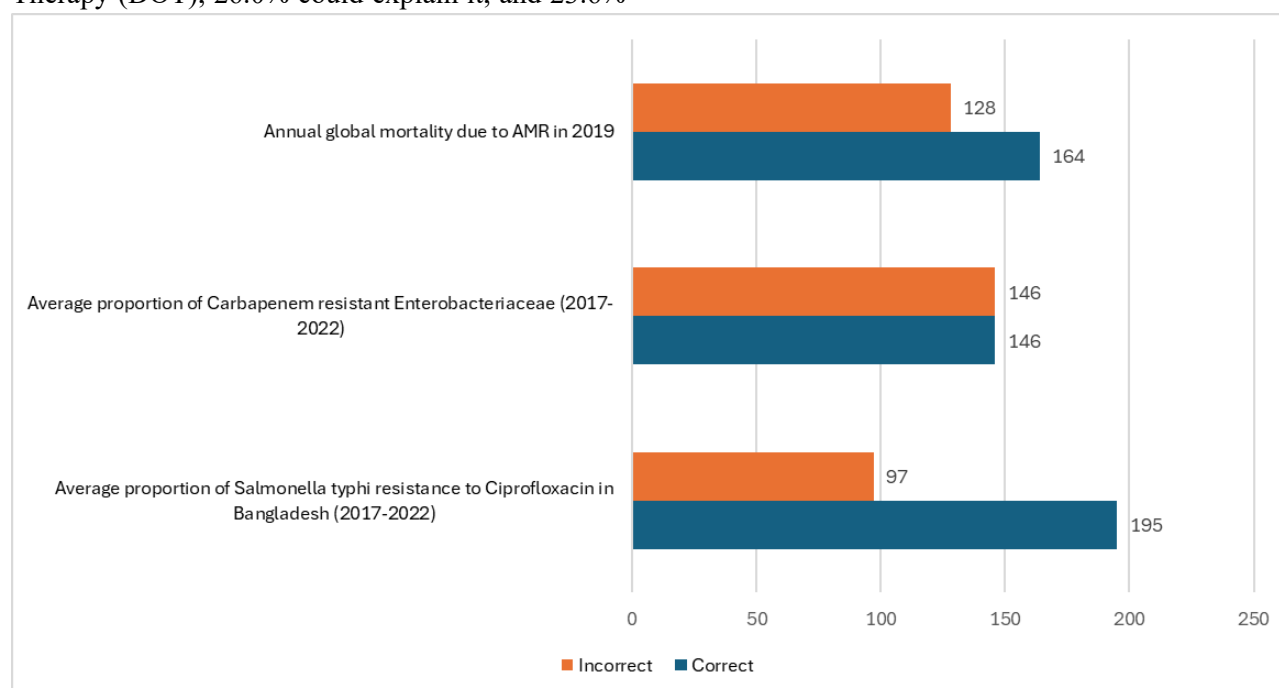


Figure II: Responses to Quantitative Questions on AMR (N=292)

Table 3: Responses to Questions on Attitude Toward Antimicrobial Resistance and Antimicrobial Stewardship (N=292)

Questions	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
AMR is a significant public health problem in Bangladesh	2(0.7%)	1(0.3%)	2(0.7%)	84(28.8%)	203(69.5%)
Antibiotic resistance is a serious health issue problem in my facility	0(0.0%)	28(9.6%)	33(11.3%)	146(50.0%)	85(29.1%)
Antibiotics are overused in my facility	1(0.3%)	59(20.2%)	52(17.8%)	132(45.2%)	48(16.4%)
The cost of an antibiotic must be considered before the prescription	3(1.0%)	15(5.1%)	15(5.1%)	161(55.1%)	98(33.6%)
By limiting the use of antibiotics, good patient care would not be impaired	9(3.1%)	35(12.0%)	10(3.4%)	158(54.1%)	80(27.4%)

Questions	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
There is a need to establish an antibiotics policy in my facility (hospital) to achieve rational antibiotic usage	5(1.7%)	2(0.7%)	4(1.4%)	105(36.0%)	176(60.2%)
Sample should be taken for culture and sensitivity test before giving antibiotics empirically and antibiotics should be changed according to the sensitivity report.	4(1.4%)	6(2.1%)	7(2.4%)	102(34.9%)	173(59.3%)
Need to establish educational programs/training on the rational use of antibiotics in my facility	2(0.7%)	0(0.0%)	1(0.3%)	116(39.7%)	173(59.3%)
Need to establish a standard treatment guideline on antibiotic use in all facilities	3(1.0%)	0(0.0%)	1(0.3%)	69(23.6%)	219(75.0%)
Need antimicrobial stewardship program to improve patient care and safety	4(1.4%)	0(0.0%)	1(0.3%)	139(47.6%)	148(50.7%)
Antimicrobial Resistance (AMR) should be addressed with One Health Approach	0(0.0%)	2(0.7%)	2(0.7%)	150(51.4%)	138(47.3%)

Attitudes: The survey explored healthcare professionals' attitudes towards AMR and AMS. A significant majority (69.5%) strongly agreed that antibiotic resistance is a major public health issue in Bangladesh. Additionally, 79.1% of respondents perceived antibiotic resistance as a severe problem within their facilities, and 61.6% agreed that antibiotics are overused in their hospitals. There was strong support for integrating cost considerations into antibiotic prescriptions, with 88.7% agreeing or strongly agreeing on its importance. Similarly, 81.5% supported limiting antibiotic use to ensure good patient care, and 96.2% endorsed the need for an antibiotics policy within their facilities. Training and education were also prioritized, with 99.0% agreeing that educational programs on rational antibiotic use are necessary. Likewise, 75.0% advocated for establishing standard treatment guidelines for antibiotic use across all facilities, reflecting a broad consensus on the need for structured policies and

continuous education to combat AMR effectively (Table 3).

Practices: The practical application of AMS principles was assessed through various scenarios. Most respondents (88.7%) reported rationally prescribing antibiotics, considering drug, dose, and duration. Additionally, 84.3% indicated that patient demands did not influence their antibiotic prescription practices, and 81.5% adhered to the practice of obtaining a culture and sensitivity test report before prescribing antibiotics. Switching from intravenous to oral antibiotics when medically appropriate was a common practice among 87.3% of respondents. However, there was less uniformity regarding choosing antimicrobials based on the type of disease, with 70.2% of participants not basing their choices solely on drug availability. Furthermore, 70.6% of participants agreed with not using broad-spectrum antibiotics as a first-line treatment, demonstrating room for improvement in adherence to AMS principles (Table 4).

Table 4: Responses to Practice Related Questions on Antimicrobial Resistance and Antimicrobial Stewardship (N=292)

Questions	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Prescribing antibiotics rationally	7(2.4%)	9(3.1%)	17(5.8%)	169(57.9%)	90(30.8%)
Prescribing antibiotics not	4(1.4%)	18(6.2%)	24(8.2%)	120(41.1%)	126(43.2%)

Questions	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
influenced by patient demand					
Antibiotic is prescribed according to the cause of infection, not on the availability of the drug	7(2.4%)	51(17.5%)	29(9.9%)	133(45.6%)	72(24.7%)
Switch from IV to Oral if the condition permits	3(1.0%)	21(7.2%)	13(4.5%)	195(66.8%)	60(20.6%)
Culture and Sensitivity Reports must be done if the facility is available	4(1.4%)	32(11.0%)	18(6.2%)	131(44.9%)	107(36.6%)
Broad-spectrum antibiotics are not preferred	13(4.5%)	56(19.2%)	17(5.8%)	138(47.3%)	68(23.3%)

Discussion

The results of this survey underscore a critical insight into the current state of knowledge, attitudes, and practices regarding antimicrobial resistance and stewardship among healthcare professionals. While most participants demonstrated a firm grasp of the principles underpinning antimicrobial resistance and stewardship, few discrepancies in specific knowledge areas and application practices suggest targeted opportunities for intervention.

The high level of agreement on the importance of antimicrobial stewardship programs is encouraging, indicating a general recognition of their role in combating AMR. However, the survey revealed substantial gaps in the understanding of specific AMS terms, such as Antimicrobial Stewardship Programs (ASP), Defined Daily Dose (DDD), Days of Therapy (DOT), and antibiograms. A significant proportion of respondents, ranging from 41% to 75%, had never heard of these terms or were unsure of their meanings. This lack of familiarity underscores the necessity of structured education programs that emphasize the importance of ASPs and provide detailed, actionable knowledge about these critical concepts.

Moreover, our findings revealed that while the theoretical understanding of AMR is robust, practical application in clinical settings is less consistent in a few areas. This observation aligns with research suggesting that knowledge does not always translate into practice, particularly in environments where the pressures of clinical workload and systemic constraints may influence prescribing behavior²². It points to the need for systemic changes, including integrating stewardship

principles into the clinical workflow and greater support for healthcare providers in making antimicrobial decisions.

The variability in responses concerning specific stewardship practices, such as the judicious choice of antimicrobial agents and the optimization of dosing strategies, mirrors findings from other studies indicating a gap between general awareness and detailed, actionable knowledge^{9, 23}. This gap underscores the necessity of structured education programs that reinforce the importance of ASPs and delve into the nuanced decision-making processes required in everyday clinical practice. Interestingly, the survey highlighted a strong consensus on the need for ASPs to reduce healthcare costs and improve patient outcomes. This reflects a growing recognition, as noted in the literature, that effective antimicrobial stewardship is not just a clinical priority but also an economic imperative, given the significant costs associated with treating drug-resistant infections²⁴.

Only one KAP study was conducted in Bangladesh to assess the physicians on AMR and AMS¹⁸. However, comparing our results with those of this study was difficult due to several factors. Many of the questions in the questionnaire of this study were different than ours. It included several questions concerning how an ASP program should run in a hospital and its impact on clinical practices. This study involved in-person interviews and a self-completed questionnaire. Furthermore, the study was conducted in 11 tertiary hospitals, while our study participants were all from primary/secondary tier public hospitals with indoor facilities. Despite these differences, few comparisons can be made with the responses to comparable questions. Around 38.5% percent of participants in this study

considered AMR a problem in their facility, and only 64% considered AMR a global problem. In contrast, most of our study participants were aware of this crucial issue and considered AMR a problem everywhere. The majority of participants in our study considered a culture sensitivity test to be done before antibiotics can be given, and around 87% of our participants considered switching from IV to oral antibiotics if the situation permits. Results from their study were different in these aspects, with only 30.9% routinely checking laboratory results before choosing antibiotics. Overall, this study's results were less encouraging than ours. However, it is difficult to conclude due to different study settings, questionnaires, and slightly different study methodologies. The discussion cannot be separated from the limitations inherent in a survey-based study. While providing valuable insights, self-reporting of data in our survey may have introduced biases, such as the over-reporting of adherence to stewardship practices. Future studies could benefit from incorporating more objective practice measurements, such as prescription audits or direct observation.

Finally, our study affirms the critical role of knowledge and attitudes in shaping antimicrobial prescribing practices and highlights the potential of targeted educational interventions. Enhancing antimicrobial stewardship education in formal curricula and through continuing professional development appears essential for bridging the gap between knowledge and practice. This approach, coupled with systemic support for stewardship practices, could significantly advance the fight against AMR, aligning with global health objectives to sustain antimicrobial therapies' efficacy for future generations.

Conclusion

The cross-sectional survey of physicians working in public hospitals in Bangladesh has identified a substantial awareness and positive attitude towards AMS among healthcare professionals, albeit with few notable gaps in knowledge and practice. There is a strong endorsement for continuous education, structured policies, and rational antibiotic use to mitigate AMR. Addressing these gaps through targeted training and policy implementation could significantly enhance AMS practices, ultimately improving Bangladesh's patient outcomes and public health.

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None

Conflict of Interest

We declare that we have no conflict of interest.

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Authors' contributions

Conceptualization and methodology: Aninda Rahman, Hurul Jannat, Piash Kumer Deb, SM Shahriar Rizvi; Manuscript Writing: Aninda Rahman; Questionnaire preparation: Hurul Jannat, Aninda Rahman, Piash Kumer Deb, SM Shahriar Rizvi; Data collection: Piash Kumer Deb, Hurul Jannat, SM Shahriar Rizvi; Data analysis: Aninda Rahman. All authors revised the manuscript for important intellectual content, approved the final version, and agreed to be accountable for all aspects of the work.

Data Availability

Data are available from the corresponding author upon reasonable request and subject to approval by the relevant institutional authorities.

Ethics Approval and Consent to Participate

Ethical approval for the study was obtained from the Institutional Review Board. As this was a prospective study the written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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References

1. Salam MA, Al-Amin MY, Salam MT, Pawar JS, Akhter N, Rabaan AA, et al., editors. Antimicrobial resistance: a growing serious threat for global public health. Healthcare; 2023: MDPI.
2. O'Neill J. Review on antimicrobial resistance: tackling drug-resistant infections globally: final report and recommendations. 2016.
3. Sulis G, Sayood S, Gandra S. Antimicrobial resistance in low-and middle-income countries: current status and future

directions. Expert review of anti-infective therapy. 2022;20(2):147-60.

4. Faiz MA, Basher A, editors. Antimicrobial resistance: Bangladesh experience. Regional Health Forum; 2011.

5. World Health O. Global action plan on antimicrobial resistance. World Health Organization; 2015.

6. Dyar OJ, Huttner B, Schouten J, Pulcini C. What is antimicrobial stewardship? Clinical microbiology and infection. 2017;23(11):793-8.

7. File Jr TM, Srinivasan A, Bartlett JG. Antimicrobial stewardship: importance for patient and public health. Clinical infectious diseases. 2014;59(suppl 3):S93-S6.

8. Barlam TF. The state of antibiotic stewardship programs in 2021: The perspective of an experienced steward. Antimicrobial Stewardship & Healthcare Epidemiology. 2021;1(1):e20-e.

9. Spellberg B, Srinivasan A, Chambers HF. New societal approaches to empowering antibiotic stewardship. Jama. 2016;315(12):1229-30.

10. Hwang S, Kwon KT. Core elements for successful implementation of antimicrobial stewardship programs. Infection & chemotherapy. 2021;53(3):421-.

11. Ahmed I, Rabbi MB, Sultana S. Antibiotic resistance in Bangladesh: A systematic review. International Journal of Infectious Diseases. 2019;80:54-61.

12. Ahmed D, Nahid MA, Sami AB, Halim F, Akter N, Sadique T, et al. Bacterial etiology of bloodstream infections and antimicrobial resistance in Dhaka, Bangladesh, 2005–2014. Antimicrobial resistance & infection control. 2017;6:1-1

13. Afroz H, Hossain MM, Fakruddin M. A 6-year retrospective study of bloodstream Salmonella infection and antibiotic susceptibility of Salmonella enterica serovar Typhi and Paratyphi in a tertiary care hospital in Dhaka, Bangladesh. Tzu Chi Medical Journal. 2014;26(2):73-8.

14. Murray CJ, Ikuta KS, Sharara F, Swetschinski L, Aguilar GR, Gray A, et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. The Lancet. 2022;399(10325):629-55.

15. Global Research on AntiMicrobial resistance p. The burden of antimicrobial resistance (AMR) in Bangladesh. 2022.

16. Sethi PP. KAP survey of practicing doctors on antimicrobial stewardship based on openWHO course Medicine newsletter 'ODE TO MEDICINE' View project Antimicrobial Stewardship View project.

17. Charani E, Castro-Sánchez E, Sevdalis N, Kyrtasis Y, Drumright L, Shah N, et al. Understanding the determinants of antimicrobial prescribing within hospitals: the role of “prescribing etiquette”. Clinical Infectious Diseases. 2013;57(2):188-96.

18. Sumon SA, Anwar MMU, Akther FM, Priyanka AS, Tamanna T, Rahman A, et al. Perceptions of antibiotic stewardship programmes and determinants of antibiotic prescribing patterns among physicians in tertiary hospitals in Bangladesh: implications for future policy and practice. Journal of Hospital Infection. 2024;144:56-65.

19. Azim MR, Iftakhar KMN, Rahman MM, Sakib QN. Public knowledge, attitudes, and practices (KAP) regarding antibiotics use and antimicrobial resistance (AMR) in Bangladesh. Heliyon. 2023;9(10).

20. Chapot L, Sarker MS, Begum R, Hossain D, Akter R, Hasan MM, et al. Knowledge, attitudes and practices regarding antibiotic use and resistance among veterinary students in Bangladesh. Antibiotics. 2021;10(3):332-.

21. StataCorp. Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC.; 2021.

22. Wojcik G, Ring N, McCulloch C, Willis DS, Williams B, Kydonaki K. Understanding the complexities of antibiotic prescribing behaviour in acute hospitals: a systematic review and meta-ethnography. Archives of Public Health. 2021;79:1-19.

23. Goff DA, Kullar R, Goldstein EJC, Gilchrist M, Nathwani D, Cheng AC, et al. A global call from five countries to collaborate in antibiotic stewardship: united we succeed, divided we might fail. The Lancet Infectious Diseases. 2017;17(2):e56-e63.

24. Smith R, Coast J. The true cost of antimicrobial resistance. BMJ (Clinical research ed). 2013;346.