



Community Awareness, Attitudes, and Knowledge Regarding the Use and Resistance of Antibiotics

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Abstract

Background: Antibiotic resistance is a major global public health concern and has been attributed to abuse and misuse of antibiotics. The following factors help explain this in Bangladesh: self-medication, limited physical access to healthcare, and antibiotic misperceptions. The current level of knowledge about antibiotic resistance among the public population remains relatively low, and therefore there is a requirement for highly targeted campaigns.

Objective: The purpose of this research is to measure the local knowledge and perceptual understanding of antibiotic consumption and antibiotic resistance in South Keranigonj, Dhaka, Bangladesh.

Methods: A cross-sectional study was carried out at Basundhara Ad-Din Medical College Hospital in the period of January 2023 and January 2024. The authors employed a structured questionnaire to sample 100 participants from different demographic backgrounds. For the analysis of the collected data, frequency distributions and percentages were applied as a part of the descriptive statistics.

Results: The study found that 52% of respondents believed antibiotics could speed up recovery from a cold, and 43% thought antibiotics were effective against viral infections. While 88% recognized that antibiotics could cause side effects, 36% believed it was acceptable to stop taking antibiotics when feeling better. Knowledge about antibiotic resistance was moderate, with 56% of participants having a middle level of knowledge. Furthermore, 70% preferred to rest and wait for infections to resolve, and 67% ensured they had a prescription when buying antibiotics.

Conclusion: The designed study tends to reveal a few significant gaps in public awareness towards antibiotic use and resistance. Inaccurate beliefs about antibiotic efficacy against viral infections and non-adherence to scheduled use of antibiotics are common. Climbing up the awareness ladder through formal and informal education, along with better communication from health care providers and community-based awareness regarding antibiotic resistance, are some of the strategies that need to be implemented in Bangladesh.

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Introduction

Antibiotic resistance is slowly, but steadily, becoming one of the world's biggest problems, threatening to render ineffective many easily available and essential antibiotics [1]. This occurs when bacteria are capable of developing immunity to those chemicals, be it drugs that are used to kill or stop their growth. Antibiotic resistance is attributed to the improper use of antibiotics in humans and the wrong dosage of antibiotics in veterinary uses [2]. Antibiotic resistance was listed by the World Health Organization as one of the top 10 global health threats; the organization said this problem will turn the clock back on medical advancement [3]. Superficial bacterial infections that used to be easily manageable at one time with antibiotics are today a nightmare because they are much harder to cure and take a longer time; patients suffering from infections remain hospitalized, healthcare costs increase exponentially, and death rates due to infections rise [4]. In Bangladesh, antibiotic resistance is rising. Some reasons for the inefficient usage of antibiotics in the country include weak health care facilities, people's self-prescribing of antibiotics, and poor knowledge of the adverse effects of improper antibiotic use [5]. Several researchers have pointed out that antibiotics are often prescribed for viral diseases, including the common cold and flu, which cannot be treated through antibiotics [6]. Also, the general public usually drops out of the prescribed courses of antibiotics, hence the emergence of the resistant bacteria. Another cause of this misuse is the availability of antibiotics for sale without prescriptions [7]. Another contributing factor towards antibiotic resistance in Bangladesh includes poor health facilities, high population density, and compromised and weak regulatory policy implementation [8]. Even though a recent concept among the working population in the sphere, the general population seems to lack adequate knowledge about antibiotic [9]. However, since promoting rational use of antibiotics depends largely on people's awareness, it is important to measure knowledge, attitude, and practice on antibiotic use among the population [10]. This cross-sectional study was carried out in Basundhara Ad-din Medical College Hospital in South Keranigonj, Dhaka, with the aim of assessing the community awareness, knowledge, and attitude toward antibiotic usage and antibiotic resistance. The study took place between January 2023 and January 2024, and data was obtained from 100 participants of different ages and genders. With this study, we attempt to map the extent of awareness of antibiotics and the misconceptions that people hold with the tenet views of informing health interventions. These interventions would involve efforts to increase public awareness on matters to do with the appropriate use of antibiotics, the risks and consequences of antibiotic resistance, and the part that health care workers can play in slowing down this trend [7]. It is important to gain insight into how the public thinks about antibiotics and resistance, and specifically what knowledge and behavior gaps exist

if interventions to contain antibiotic resistance are to be effective. To fill these gaps, awareness creation approaches should also be complemented by a strengthening of healthcare policies that prevent the conferment of antibiotics when they are not needed. In addition, engagement of the health care professions in pursuing patients' & public health education is important in order to encourage appropriate use of antibiotics. The results gathered in this investigation will pave the way for future research and public health interventions directed at preventing the further emergence of AMR in Bangladesh and elsewhere.

Materials and Method

This research has been carried out in Basundhara Ad-Din Medical College Hospital of South Keranigonj, Hasnabad, Dhaka, Bangladesh. The study timeframe stretches from January 2023 to January 2024. The sample consists of 100 participants, of which there are male and female participants from different fields and educational levels. The survey questions covered questions to assess the demographic characteristics of participants, their perception of antibiotics, myths about antibiotics and antibiotic resistance, and their behavior. Interview data were obtained from a self-administered interviewer-administered questionnaire adapted from previous studies designed to assess the participants' knowledge about antibiotics, their usage, possible side effects, as well as their understanding of antibiotic resistance. Data collected were analyzed using descriptive techniques that include frequency distributions as well as percentages.

Results

The study revealed a diverse demographic profile, with an average age of 32.58 years (± 13.37). Among the respondents, 55% were male and 45% female. In terms of occupation, 46% were service holders, 26% were students, 13% were businessmen, and 15% were housewives. Educationally, 39% had an undergraduate degree, 33% were graduates, 23% had secondary education, and 5% had completed primary education. Regarding antibiotic usage, 52% of participants reported using multiple antibiotics, followed by 22% using Metronidazole, 15% Azithromycin, 6% Ciprofloxacin, 4% Cefixime, and 1% Cefradine.

As presented in Table 2, 52 percent of the respondents participated in the belief that antibiotics could help relief a cold quickly and 43 per cent thought that antibiotics worked against viral infections such as influenza and Rhinitis. With regard to the knowledge about the effects of antibiotics in Table 3, 88 percent of the Participants replied that antibiotics may cause side effects such as diarrhoea, whereas only 87 percent of the Participants had the knowledge that antibiotics may cause bacterial resistance. However, 36% of the health care workers interviewed stated that it is okay to stop antibiotics once they feel better.

Table 1: Demographic profile among the study cases

Age (Years)		32.58 ± 13.37
Variable	Frequency	Percentage
Sex		
Male	55	55%
Female	45	45%
Occupation		
Student	26	26%
Service holder	46	46%
Businessman	13	13%
Housewife	15	15%
Education		
Primary	5	5%
Secondary	23	23%
Undergraduate	39	39%
Graduate	33	33%
Following which antibiotics are taken by Self		
Azithromycin	15	15%
Cefixime	4	4%
Ciprofloxacin	6	6%
Cefradine	1	1%
Metronidazole	22	22%
Multiple antibiotics	52	52%

Table 2: Misunderstandings of respondent regarding the proper use of antibiotics.

Variable	Frequency	Percentage
Antibiotics may facilitate a faster recovery during a cold	52	52%
Desires to use antibiotics during a cold	38	38%
Antibiotics are effective in treating fevers in viral infections (influenza, cough, rhinitis, and conjunctivitis)	43	43%

Table 3: Level of knowledge on antibiotics and antibiotic resistance among the respondents

Variable	Frequency	Percentage
Level of knowledge on antibiotics and antibiotic resistance		
Antibiotics frequently lead to adverse effects as diarrhea.	88	88%
The use of antibiotics adversely affects the body's natural bacterial flora	77	77%
After completing a partial course of antibiotics if one feels better, can immediately stop the treatment.	36	36%
Bacteria may be resistance to antibiotic treatments.	87	87%
A greater use of antibiotics in the community leads to an elevated risk of the development and spread of resistance	84	84%
The pharmacy personnel make an effort to explain to me that individuals may develop resistance to antibiotics	44	44%
The use of antibiotics in livestock can potentially compromise the effectiveness of antibiotic therapies available for human	58	58%
Spreading of resistance from animals to humans is possible.	67	67%
The transmission of resistance from human to humans is possible.	56	56%
Individuals returning from international travel may risk the transmission of resistance to their home country	50	50%
Use of antibiotics in the last twelve months.	69	69%

Table 4: General attitudes and perception of respondents regarding antibiotic use and antibiotic resistance

Variable	Frequency	Percentage
General attitudes of respondents on acquisition, use and hygienic practices to reduce antibiotic resistance and its spread		
Is anyone in your home currently on antibiotics?	48	48%
In cases of infection, I often prefer to take a cautious approach, prioritizing rest and take it easy to determine if the infection resolves spontaneously.	70	70%
I usually practice hand hygiene, either through hand washing or the application of alcohol-based hand rub, to minimize the risk of transmitting common infections.	73	73%
I ensure that I have a doctor's prescription whenever I buy antibiotics from pharmacies.	67	67%
Perception of respondents on the role of health professionals in antibiotic use and antibiotic resistance		
Physicians consistently perform a comprehensive assessment to determine if a patient requires antibiotics.	77	77%
Physicians often prescribe antibiotics in response to a patient's expectations.	32	32%
When a doctor prescribes antibiotics, they make it a priority to offer guidance on how to use them correctly.	67	67%
The pharmacy team takes the time to ensure that I understand how to use antibiotics correctly.	19	19%

Table 5: knowledge, attitude and awareness of the general public on antibiotic use and resistance among the study cases (N=100)

Variable	Frequency	Percentage
Low Knowledge	15	15%
Middle Knowledge	56	56%
High Knowledge	29	29%

Table 6: Knowledge distribution based on age, gender, profession and education level (N=100)

Age (Years)	Low Knowledge	Middle Knowledge	High Knowledge	P value
	(15)	(56)	(29)	
Sex				
Male (55)	9 (16.36%)	33(60%)	13 (23.63%)	0.425
	6 (13.33%)	23(51.11%)	16 (30.76%)	
Female (45)	9 (16.36%)	33(60%)	13 (23.63%)	
	6 (13.33%)	23(51.11%)	16 (30.76%)	
Occupation				
Student (26)	0	16 (61.53%)	10 (38.46%)	0.142
Service holder (46)	7 (15.21%)	26 (56.52%)	13 (28.26%)	
Businessman (13)	3(23.07%)	7 (53.84%)	3 (23.07%)	
Housewife (15)	5 (33.33%)	7 (46.67%))	3 (20%)	
Education				
Primary (5)	3 (60%)	2 (40%)	0	0.05
Secondary (23)	5 (21.73%)	11 (47.82%)	7 (30.43%)	
Undergraduate (39)	2 (5.12%)	24 (61.53%)	13 (33.33)	
Graduate (33)	5 (15.15%)	19 (57.57%)	9 (27.27%)	

Table7: Knowledge and misunderstandings about the use of antibiotics and antibiotic resistance (N=100)

Variable	Knowledge			P value
	Low	Middle	High	
	(15)	(56)	(29)	
Misconception regarding the use of antibiotics				
Antibiotics may facilitate a faster recovery during a cold (52)	11 (21.15%)	32 (61.53%)	9 (17.3%)	0.015
Desires to use antibiotics during a cold (38)	10 (26.31%)	24 (63.15%)	4 (10.52%)	0.001
Antibiotics are effective in treating fevers in viral infections (influenza, cough, rhinitis, and conjunctivitis) (43)	12 (27.90%)	26 (60.46%)	5 (11.62%)	0.000
Level of knowledge on antibiotics and antibiotic resistance				
Antibiotics frequently lead to adverse effects as diarrhea (88)	12 (13.63%)	50 (56.81%)	26 (-29.54%)	0.585
The use of antibiotics adversely affects the body's natural bacterial flora (70)	10 (12.98%)	14 (18.18%)	23 (29.87%)	0.298
After completing a partial course of antibiotics if one feels better one can immediately stop the treatment (36)	12 (33.33%)	20 (55.55%)	4 (11.11%)	0.000
Bacteria may be resistance to antibiotic treatments (87)	8 (9.19%)	50 (55.17%)	29 (32.18%)	0.000
A greater use of antibiotics in the community leads to an elevated risk of the development and spread of resistance (84)	8 (9.52%)	48 (57.14%)	28 (33.33%)	0.001
The pharmacy personnel make an effort to explain to me that individuals may develop resistance to antibiotics (44)	6 (13.63%)	22 (50%)	16 (36.36%)	0.355
The use of antibiotics in livestock can potentially compromise the effectiveness of antibiotic therapies available for human (58)	6 (10.34%)	28 (48.27%)	24 (41.37%)	0.005
Spreading of resistance from animals to humans is possible (67)	4 (5.97%)	39 (58.2%)	24 (35.82%)	0.001

The transmission of resistance from human to humans is possible (56)	2 (3.25%)	33 (58.92%)	21 (37.5%)	0.001
Individuals returning from international travel may risk the transmission of resistance to their home country (50)	6 (12%)	24 (48%)	20 (40%)	0.05
Use of antibiotics in the last twelve months (69)	11 (15.94%)	33 (47.82%)	25 (36.23%)	0.033
General attitudes of respondents on acquisition, use and hygienic practices to reduce antibiotic resistance and its spread				
Is anyone in your home currently on antibiotics? (48)	13 (27.085%)	25 (52.08%)	10 (20.83%)	0.003
In cases of infection, I often prefer to take a cautious approach, prioritizing rest and take it easy to determine if the infection resolves spontaneously (70)	3 (4.28%)	40 (57.14%)	27 (38.57%)	0.000
I usually practice hand hygiene, either through hand washing or the application of alcohol-based hand rub, to minimize the risk of transmitting common infections (73)	6 (8.21%)	40 (54.79%)	27 (36.98%)	0.001
I ensure that I have a doctor's prescription whenever I buy antibiotics from pharmacies (67)	15 (22.38%)	15 (22.38%)	29 (43.28%)	0.001
Perception of respondents on the role of health professionals in antibiotic use and antibiotic resistance				
Physicians consistently perform a comprehensive assessment to determine if a patient requires antibiotics (77)	6 (7.79%)	45 (58.44%)	26 (33.76%)	0.001
Physicians often prescribe antibiotics in response to a patient's expectations (32)	10 (31.25%)	18 (56.25%)	18 (56.25%)	0.002
When a doctor prescribes antibiotics, they make it a priority to offer guidance on how to use them correctly (67)	4 (5.97%)	40 (59.70%)	40 (59.70%)	0.001
The pharmacy team takes the time to ensure that I understand how to use antibiotics correctly (19)	3 (15.78%)	13 (68.42%)	3 (15.78%)	0.356

Regarding attitudes, 70% preferred to rest and wait for infection resolution, while 73% practiced hand hygiene to avoid infections. A total of 67% ensured they had a prescription when purchasing antibiotics. Knowledge levels showed 56% had moderate knowledge, 29% had high knowledge, and 15% had low knowledge about antibiotics and resistance.

In Table 5, contrasts different misconceptions, knowledge level, and practice concerning antibiotic use, such as whether or not antibiotics may help one recover more quickly, whether or not antibiotics are effective in viral infections, and whether or not patients know that partial courses of antibiotics may cause harm.

Discussion

The results of the present survey raise awareness of several significant deficits regarding the knowledge and perception of the general population concerning the proper consumption of antibiotics and the dangers posed by antibiotic resistance. One interesting result was that misconceptions regarding the use of antibiotics to treat viral diseases were identified. About 52% of the respondents felt that antibiotics may help cure colds faster, while 43% felt antibiotics were useful in treating fevers that are caused by viruses, including influenza, cough, rhinitis, and conjunctivitis. These misconceptions are in line with results obtained by other authors, including Petersen & Hayward (2016) [11], who reported a general lack of understanding of the general public about viral diseases and the role of antibiotics in treatment. One of the many known causes of antibiotic misuse is the prescription of antibiotics for viral illnesses; this results in antibiotic use for purposes that are unnecessary and using antibiotics, which exposes

bacteria to it, thus promoting the development of resistance. However, there are certain misconceptions the study recorded as follows: The larger part of the respondents evidenced a moderate level of awareness regarding the repercussions of misuse of antibiotics. For example, knowledge questions included, 'Antibiotics can have side effects disproportionately manifesting as diarrhea, true or false?' to which 88% of the participants gave a correct answer. Another question was, 'Bacteria can become resistant to antibiotics, true or false?' to which 87% of participants answered correctly. They suggest that these figures are quite high, which, in a way, indicates that there is a fairly good level of awareness among the public. The same observation was made by Azim et al. (2023) [12], who established retained knowledge of antibiotic side effects and resistance despite known misconceptions of correct use of antibiotics. But the disturbing result revealed in this study was that 36% of them agree the practice of ceasing antibiotic use as soon as one feels better is appropriate. That is why this practice is especially dangerous since a population of partially resistant bacteria remains, which reproduce and disseminate, forming resistance. This trend of non-adherence to the length of antibiotic regimens suggested has been a significant factor for resistance in other nations, according to Pechère et al. (2014) [13], who report compliance issues in both the first world and the developing world. Another interesting finding that the study gave out is the level of education in as much as it had an effect on the understanding of antibiotics and antibiotic resistance. This fact-finding is in line with other similar studies, which have provided evidentiary proof of an inverse relationship between education and increased knowledge of public health. For

example, Huh et al. (2018) [7] revealed that people with high education reveal better knowledge of antibiotic resistance threats and appropriate antibiotic utilization. However, despite what it seemed, education improved knowledge but did not enhance practices, as revealed by a shocking 32% of the respondents who stated that physicians often prescribe antibiotics in line with the expectations of the patients. The result of this finding is clinical licensure with regard to Wang et al. (2022) [15] study, where they argued that patient demands and expectations caused physicians to overprescribe antibiotics. Of all aspects highlighted in the study, one that should worry everyone is the view that pharmacy personnel are not effectively communicating with patients regarding the correct use of antibiotics. Just 19% of the respondents said that pharmacy staff actually took their time to educate them on how to use antibiotics appropriately. This is a sensitive area for intervention since the pharmacists work closely with the rest of the society, especially in the dispensing of the right antibiotics. The same was evidenced by a study by Otieno et al. (2022) [16]; in the same vein, it noted that most of the pharmacy staff failed to offer proper counselling in the right use of antibiotics. Such a gap explains why there is a need for special intervention through awareness sessions among healthcare providers and pharmacists that will enable them to engage and make the patients understand the risks associated with misuse. Moreover, the cross-sectional aspect of the research shows that the development of the survey regarding the knowledge of the community about the antibiotic usage in livestock was highly unnoticed. However, the level of awareness of the public was still relatively low in regard to the consequences of antibiotic resistance because only 58% of the respondents understood that the antibiotics given to the livestock posed a threat to human antibiotic therapies. For instance, Mulchandani et al. (2023) [17] have also observed that antibiotic consumption in animals is one of the main sources of the development of the resistant bacteria prevalent today, as acquired from animal products, contact, or the environment. Community health interventions regarding this situation could reduce the social consequences connected with antibiotic resistance.

Evidently, this study paints a rather rosy picture of the public's stock of knowledge on antibiotic resistance, but it also reveals key gaps. For example, consumer myths about antibiotics, inadequate adherence to prescribed courses, and poor information from healthcare providers remain prevalent causes of antibiotic resistance. Enhancing such interventions will be important in reducing the rising trend of antibiotic resistance in Bangladesh as well as in other parts of the world.

Conclusion

This work therefore stresses the importance of increasing public health awareness on the use of antibiotics and the emergence of the resistance issue. Misconceptions, which

include the fact that antibiotics can cure viral infections, should therefore be corrected through relevant awareness programs. Physicians and pharmacy personnel have the challenging roles of informing the appropriate use of antibiotics to patients. Thus, there is a necessity to improve the awareness of stakeholders regarding the antibiotic risks and misuse associated with antibiotic resistance, an important aspect in fighting this world ailment.

References

1. WHO. (2023, November 21). Antimicrobial Resistance. World Health Organization; World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance>
2. Uddin, T. M., Chakraborty, A. J., Khusro, A., et al. Antibiotic Resistance in microbes: History, mechanisms, Therapeutic Strategies and Future Prospects. *Journal of Infection and Public Health* 14 (2021): 1750–1766.
3. Environment, U. (2023). Bracing for Superbugs: Strengthening environmental action in the One Health response to antimicrobial resistance. UNEP - UN Environment Programme. https://www.unep.org/resources/superbugs/environmental-action?gad_source=1&gclid=Cj0KCQiAu8W6BhC-ARIsACEQoDC94efoldPFYLLUhst4tgpVvjy2WgygTugjRey_CeqaTu7xmJlVeF4aAuCGEALw_wcB
4. Ventola, C. L. The Antibiotic Resistance Crisis: Part 1: Causes and Threats. *Pharmacy and Therapeutics*, 40 (2015), 277.
5. Kabir, H., Hasan, M. K., Akter, N., et al. Antibiotics administration without prescription in Bangladesh. *IJID Regions* 7 (2023): 11–17.
6. Daniels, K. (2017, October 5). Do antibiotics help fight common colds? Nih.gov; Institute for Quality and Efficiency in Health Care (IQWiG). <https://www.ncbi.nlm.nih.gov/books/NBK279540/>
7. Huh, K., Chung, D. R., Kim, S. H., et al. Factors affecting the public awareness and behavior on antibiotic use. *European Journal of Clinical Microbiology & Infectious Diseases: Official Publication of the European Society of Clinical Microbiology* 37 (2018), 1547-1552.
8. Matin, M. A., Khan, W. A., Karim, M. M., et al. What influences antibiotic sales in rural Bangladesh? A drug dispensers' perspective. *Journal of Pharmaceutical Policy and Practice* 13 (2020).
9. Tangcharoensathien, V., Chanvatik, S., Kosiyaporn, H., et al. Population knowledge and awareness of antibiotic use and antimicrobial resistance: results from national household survey 2019 and changes from 2017. *BMC Public Health* 21 (2021).

10. Makhdom, N., Islam, N., Rumi, M. H., et al. Knowledge, Attitude and Practice of Rural People on Antibiotic Usage: Bangladesh Perspective. *Journal of Health Management*, 44 (2022): 097206342210880.
11. Petersen, I., & Hayward, A. C. Antibacterial prescribing in primary care. *Journal of Antimicrobial Chemotherapy* 60 (2016), i43–i47.
12. Azim, M. R., Iftakhar, K. M. N., Rahman, M. M., et al. Public knowledge, attitudes, and practices (KAP) regarding antibiotics use and antimicrobial resistance (AMR) in Bangladesh. *Heliyon*, 9 (2023): e21166.
13. Pechère, J.-C., Hughes, D., Kardas, P., et al. Non-compliance with antibiotic therapy for acute community infections: a global survey. *International Journal of Antimicrobial Agents*, 29 (2014): 245-253.
14. Wang, S. Y., Cantarelli, P., Groene, O., et al. Patient expectations do matter - Experimental evidence on antibiotic prescribing decisions among hospital-based physicians. *Health Policy* 45 (2022).
15. Otieno, P. A., Campbell, S., Maley, S., et al. A Systematic Review of Pharmacist-Led Antimicrobial Stewardship Programs in Sub-Saharan Africa. *International Journal of Clinical Practice* 22 (2022): e3639943.
16. Mulchandani, R., Wang, Y., Gilbert, M., et al. Global trends in antimicrobial use in food-producing animals: 2020 to 2030. *PLOS Global Public Health* 3 (2023): e0001305.