

Assessing the Knowledge, Attitude and Practice of Anti-microbial resistance (AMR) among the adult Drug sensitive –Tuberculosis patients in BRAC DOTS center in Dhaka city

Final report of Summative learning project presented to BRAC James P Grant School of Public Health

Student's name : Abdullah Salman

Student Id: 24167021

Supervisor: Dr. Ataur Rahman

Designation: Director, CPSD BRAC JPG

Co-Supervisor: Dr. Shayla Islam

Email: shayla.i@brac.net

Mentor : Zumana Hayat Khan

Email: zumana.hayat@bracu.ac.bd

Mentor : Redwanul Islam

Email: redwanul.islam@bracu.ac.bd

IRB Approval No: MPH-2024-003

MPH 20th Cohort, 2024

In partial fulfillment of the requirements for the degree of Master of Public Health (MPH)

Table of contents

Sl no.	Part	Page number
1	Abstract	3
2	Introduction	4-7
3	Methodology	7-11
4	Results	12-32
5	Discussion	33-35
6	Public Health Implications	35-36
7	Limitations	36
8	Conclusion	36
9	Acknowledgement	36-37
10	References	37-39
11	Annex	39-47

1. Abstract

Introduction: Tuberculosis (TB) remains a significant public health challenge globally. Moreover it is burdened by the growing threat of antimicrobial resistance (AMR). In Bangladesh, Anti microbial Resistance contributes to treatment failures, particularly among drug-sensitive TB (DS-TB) patients. Additionally, lack of knowledge regarding AMR among the adult TB patients often result in treatment non-adherence. This non-adherence often creates implementation challenges in the Directly observed treatment shortcourse (DOTS) program. To mitigate the implementation challenges, targeted educational interventions are needed that can be integrated into the DOTS program. Understanding the knowledge, attitude, and practice (KAP) levels regarding AMR among the adult Drug Sensitive-TB patients is crucial for designing targeted interventions to mitigate resistance.

Objective: This study aimed to assess the knowledge, attitude and practice (KAP) of AMR among adult DS-TB patients in BRAC DOTS center in Dhaka city. Also it tried to see the socio-demographic factors influencing this KAP level.

Methods: A quantitative cross-sectional study was conducted among 128 adult DS-TB patients from Dhaka city enrolled in the BRAC DOTS program. It was done using a structured KAP questionnaire validated by Institute of Health Economics, Dhaka University . Participants were selected through simple random sampling based on their registration number. Data were analyzed using descriptive statistics and ordered logistic regression to determine associations between KAP levels and socio-demographic factors.

Results: The majority of participants demonstrated moderate knowledge (46.9%) and attitudes (44.5%) toward AMR, while 58.6% reported good practices. Higher education, internet access, and urban residency were significantly associated with better KAP levels. Ordered logistic regression analysis showed that reading AMR-related articles in the Newspaper or in the internet significantly improved knowledge , attitudes and practice of AMR. Moreover individuals having higher education were more likely to have positive attitude towards AMR. Respondents living in the urban area were more likely to have better practices towards AMR than the respondents from peri-urban area . Despite this, critical gaps were identified, such as unawareness about Antibiotics treating bacterial infection infections and the importance of completing antibiotic course.

Conclusion: The study highlights the need for targeted educational interventions to address misconceptions and improve AMR-related KAP among DS-TB patients. Integrating AMR education into DOTS programs, focusing on peri-urban areas, and leveraging digital platforms can enhance patient behavior and support Bangladesh's efforts to achieve the End TB Strategy goals.

2.Introduction:

2.1Background: Tuberculosis (TB) remains as the leading cause of death among all infectious diseases worldwide (Lee et al., 2012). In 2023 around 10.8 million people got diagnosed with TB. In addition to that, “Multi-Drug resistant Tuberculosis” or “MDR-TB” poses a significant threat to the global health. (WHO, 2024). Bangladesh ranks seven in Global TB Burden with 3.5% of all TB cases. It is also listed as a country with rising number of MDR-TB cases (Ferdous et al., 2023). Multidrug resistant tuberculosis is a subset of Antimicrobial Resistance. Multi-drug resistance Tuberculosis spread widely and fast. Afterwards it create life threatening disability or death (WHO, 2024). Globally AMR was responsible for an estimated 4.95 million deaths in 2019 (AMR Collaborators, 2019). And bacterial AMR alone was responsible for 1.27 million deaths (AMR Collaborators, 2019). This issue is particularly severe in low and middle-income countries like Bangladesh (Noman et al., 2024). In Bangladesh there is significant resource constraints, inadequate healthcare systems and poor antibiotic management that exacerbate the problem (Azim et al., 2023). In addition to that , according to the World Bank’s estimate , AMR may result in 1 trillion USD additional healthcare costs by 2050 (Dalbanjan et al., 2024). By 2030 it is projected to cause gross domestic product loss of USD 1 trillion to USD 3.4 trillion (WHO,2024).

Bangladesh is listed among one of the high burden countries of Multidrug resistant Tuberculosis (WHO, 2024). BRAC runs the largest Directly Observed Treatment Short course (DOTS) program all across Bangladesh (May et al. 2011). In Bangladesh, 1.4% of the new Tb patients and 29% of the previously treated drug-sensitive Tb cases tend to be Multi-drug resistant (Eurosurveillance Editorial team, 2013) Although the ratio may not tell the full extent of the MDR Tb burden in Bangladesh, the total number of MDR Tb cases in Bangladesh is quite high (WHO,2024). It is estimated to be 1900 new and 2300 previously treated Tb patients (Eurosurveillance Editorial Team, 2013). Challenges in TB control in Bangladesh include DOTS non adherence, TB case detection, financial constraints at household level, resource constraints in TB care delivery and sub-optimal diagnostic coverage (WHO, 2024). Even in Global TB control patient’s non adherence to anti TB therapy is one of the biggest challenges (Lemma et al. 2024). Patient’s non-adherence often leads to treatment failure and MDR-TB. (Mekonnen et al., 2018). A case control study conducted in Bangladesh by Flora et al. found that “non adherence to Tuberculosis treatment was strongly associated with Multi-Drug resistant Tuberculosis” (Flora et al. , 2013) . Most commonly it was seen that “poor knowledge about Tuberculosis and Anti Tubercular drug resistance” have higher odds of treatment non adherence (Lemma Tirore et al. , 2022). Even in Bangladesh ,the DOTS patient’s non-adherence to treatment often resulted into MDR-TB (Flora et al. , 2013). These non-adherence was associated with the lack of patient’s knowledge regarding Tuberculosis . However currently there is no educational intervention regarding Antimicrobial resistance available for the Drug sensitive Tb patients in the BRAC DOTS program in Bangladesh (Sultana et al. , 2022).).

2.2 Literature gap: All around the world it is seen that two of the biggest reasons behind Antibiotic resistance are unsupervised misuse and often times, overuse of Antibiotic medicine (Coque et al. , 2023). The principal factors contributing to AMR in Bangladesh

can be categorized into two groups. One is coming from the supply side which is the healthcare workers another one focuses on the demand side which is the consumer behavior **(Hoque et al. 2020)**. Tuberculosis patients are long term consumers of Antibiotic medicines . The treatment of Drug sensitive tuberculosis requires regular consumption of antibiotics for at least 6 months **(Rabahi et al. , 2017)**. The patients knowledge about antibiotics, their beliefs and attitudes towards antibiotic play a big role in the development of AMR **(VITHAYATHIL et al. , 2019)** . Also their expectations and past experiences impact on their behavior of using antibiotics **(Davey 2002)**. Various studies have seen that the “use of Antibiotics without prescription” is a leading cause of Antibiotic resistance **(Mohanna et al. 2010)**. Poor knowledge and lack of awareness often times contribute to the irrational and unsupervised antibiotic use **(Aponte-González et al. 2019)**. Also it was seen that antibiotics from previous prescription which were stored by family members or relatives are often times used by the patients. They use this antibiotic without prescription that is regarded as a big contributing factor to the “development of AMR” **(Reynolds et al. , 2008)**. A recent study has shown that the global antibiotic consumption has increased by 65% from the year 2000 to 2015 **(Klein et al. , 2018)**. As the drug sensitive Tuberculosis patients have to take Antibiotic drugs for prolong time , a very effective aspect of preventing the development of AMR is changing the behavior of the patients **(Cars et al., 2008)** . Bangladesh is listed among one of the high burden countries of Multidrug resistant Tuberculosis **(WHO, 2024)**. As MDR Tb commonly develops in previously drug sensitive Tb patients, the newly diagnosed Tb patients must be educated on MDR Tb in order to prevent the risk of AMR. A quasi experimental study conducted in Indonesia saw that health education MDR Tb among the Drug sensitive Tb patients have overall positive effect in the control of MDR Tb **(Malini et al. 2021)** .

But to make an educational intervention on AMR for Drug sensitive Tb patients in Bangladesh, their knowledge attitude and practice of AMR needs to be thoroughly understood **(Azim et al. , 2023)** . Previously several studies have been conducted on the knowledge, attitude and practice of AMR among Bangladeshi people **(Azim et al., 2023)**. A few studies saw the Knowledge, Attitude and Practice level of AMR among the general population of Bangladesh **(Raihan et al., 2024)** . Most of the other studies have focused on targeted groups such as healthcare workers, public university students, veterinary students, poultry farmers and city dwellers **(Azim et al. , 2023)** . Some studies have even been conducted on the patients of Out patient department from Dental Colleges **(Uddin et al. 2023)**. But no study to assess the knowledge, attitude and practice level of AMR has been conducted among the Drug sensitive Tb patients of the BRAC urban DOTS program.

To meet the "End-TB Strategy" goals, Bangladesh must enhance patient support in the DOTS program. We must focus on AMR education **(Bhatia et al., 2022)**. Educational initiatives promoting correct Antibiotic practices effectively control AMR **(Finch et al., 2004)**. It also improves adherence and reduces treatment failures **(Dooley et al., 2011)**. A study in Bangladesh showed a 20% reduction in non-compliance among TB patients following educational interventions **(Hossain et al., 2023)**. However, no research has yet been done to assess the knowledge, attitudes, and practices of DOTS-enrolled TB patients **(Azim et al., 2023)**.

2.3 Rationale: To reduce the risk of AMR and the rise of MDR-Tb, the Tuberculosis patients require education on Antimicrobial resistance. In order to do that, we need to know the existing level of knowledge, Attitude and practice level of AMR among the adult Tuberculosis patients in Bangladesh. Also, to design an educational intervention appropriate for the Tuberculosis patients, we need to understand what socio-demographic factors are associated with their level of knowledge, attitude and practice (KAP) of AMR. If we can understand how their education level, their self reported financial situation, access to the internet and social media and other relevant factors the implementers of the DOTS program can create an educational intervention to increase their knowledge, Attitude and Practice level of AMR. Also it is important to know if the KAP level varies among various age and gender groups so that the educational intervention can be properly curtailed for everyone. The study therefore aims to assess the Knowledge, Attitude and Practice level of AMR among the adult Drug sensitive Tuberculosis patients currently enrolled in the BRAC DOTS program in Dhaka city. These adult drug sensitive TB patients are the major target group for the educational intervention on AMR. Therefore by knowing their knowledge, Attitude and practice level on AMR, educational sessions on AMR can be made. Also based on this study, the educational intervention on AMR can be designed in such a manner that it can be integrated into the BRAC DOTS program. This will enhance the patient adherence to the BRAC DOTS program. Ultimately this will result in reducing the risk of AMR among the adult DS-TB patients. Also as this educational intervention on AMR will serve as a patient support system for the BRAC DOTS program. Therefore this study also tries to help in creating the patient support system for the adult DS-TB patients.

2.4 Research questions

General question:

What is the Knowledge, Attitude and Practice level of Antimicrobial resistance (AMR) among the adult Drug sensitive DOTS patients in BRAC DOTS center in Dhaka city?

2.5 Research objectives:

General objective:

To assess the knowledge, attitude and practice (KAP) of AMR among adult DS-TB patients in BRAC DOTS center in Dhaka city.

Specific objectives:

1) To measure the knowledge, attitude and practice level of AMR among adult DS-TB patients at BRAC DOTS center in Dhaka city.

2) To evaluate the relationship between the socio-demographic factors (age, gender, wealth, occupation and education groups) and the knowledge, Attitude and practice level of the adult DS-TB patients at BRAC DOTS center in Dhaka city.

3) To analyze the association of socio-demographic factors with Knowledge, Attitude and Practice level of AMR among adult DS-TB patients at BRAC DOTS center in Dhaka city.

3.Methodology

3.1 Study design: The study used a quantitative cross sectional survey design to assess the knowledge, attitude and practices (KAP) of Antimicrobial resistance (AMR) among Adult TB patients in the BRAC urban DOTS center. It also tried to analyze the association between the KAP level and the socio-demographic factors.

3.2 Study Settings: The study was conducted in Kamrangirchor BRAC DOTS center and LalBagh BRAC Tb diagnostic center in Dhaka from November 26 2024 to December 11 2024. These sites covered the Kamrangirchor area where the largest number of Drug sensitive Tb patients (531 patients) came from in BRAC Urban DOTS program.

3.3 Study Population

This study was conducted on adult drug-sensitive (DS) TB patients who are currently under treatment in the BRAC urban DOTS center in Dhaka city. The study population will be identified based on the following inclusion and exclusion criteria:

Inclusion Criteria

1. **Age:** Patients aged from 18 years and above.
2. **Treatment Duration:** Both ongoing patients and new patients enrolled in the BRAC urban Drug sensitive DOTS program in Dhaka city.

Exclusion Criteria

1. **Severe Illness or Cognitive Impairment:** Patients who are critically ill or have cognitive impairments that limit their ability to participate in the survey or understand the questionnaire.
2. **Language Barrier :** Patients only who can speak Bangla

3.4 Sample size and Sampling

Sampling

A **simple random sampling** was done using the patient ID number registered in BRAC DOTS center registry book. For simple random sampling, Epitools website was used.

Sample Size

The sample size has been calculated considering the followings:

Confidence Level (Z-score): For a 95% confidence level, $Z = 1.96$

Margin of Error (d): **10% margin**** ($p = 0.10$). **Due to time and resource constraints the margin of Error is considered to be 10%.**

Expected Proportion (p): Since the proportion is unknown, we are assuming the prevalence of AMR awareness level is, $p = 50\%$, ($p = 0.5$), $q = 1 - p = 0.5$

$$\text{Unadjusted sample size, } n' = \frac{(z^2)pq}{d^2} = \frac{(1.96^2) \times 0.5 \times 0.5}{(0.10^2)} = 96.04$$

Estimated non response rate = $25\% = 0.25$ (Due to busy population and data collection during day time)

$$\text{Adjusted sample size, } n = \frac{96.04}{0.75} = 128.05 = 128$$

Total sample size $n = 128$ respondents

Sampling procedure

1. In the BRAC DOTS center in Kamrangirchar, Dhaka city currently there are 531 adult Drug Sensitive TB patients receiving DOTS therapy .
2. Each of the adult TB patients has an ID registered in the BRAC DOTS center.
3. From 531 adult DS-TB patient ID, 128 patient ID was be selected using simple random sampling. For this selection, Epitools software was used.
4. Based on their contact information for the ID number, they were be contacted for the survey. They arrived in the Kamrangirchar DOTS center and Lalagh Tb Diagnostic center for the survey during the study period . Data will be collected from them in the DOTS center.

3.5 Data Collection Instrument

A structured KAP questionnaire validated, tested and approved by the Institute of Health Economics, University of Dhaka was used (**Azim et al., 2023**). This structured questionnaire gathered information about the participants' socio-demographic details and their knowledge, attitudes, and practices regarding antibiotic use and antimicrobial resistance (AMR). The questionnaire was created after reviewing similar studies from other places and making necessary adjustments to fit the context of Bangladesh. It was divided into four sections:

1. **Socio-demographic details:** This included questions about the participant's gender, age, residence, marital status, education, occupation, income, and media exposure.

2. **Knowledge about antibiotics and AMR:** This section had eight questions focused on understanding what the participants knew about antibiotics and AMR. All of the 8 questions were used for scoring.
3. **Attitudes toward antibiotic use and AMR:** This section also contained eight questions designed to measure the participants' opinions and attitudes. Attitude scores were derived from all of the 8 questions.
4. **Self-reported practices related to antibiotic use:** There were 12 questions, where the first four were Practice score indicators. Based on the first four questions, the patients practice was scored.

Participants answered knowledge questions with “yes,” “no,” or “don’t know,” while attitude questions used options like “agree,” “disagree,” or “neutral.” For practice-related questions, answers were mostly “yes” or “no.” For example, the survey asked about how often participants took antibiotics, with options such as “with a doctor's prescription,” “self-medication,” or “suggested by friends.” (Azim et al. , 2023).

The scoring manuals for these questions are given in the annexure 4. In the original study done by Azim et al., to ensure the reliability a psychometric analysis was done. In that psychometric analysis, factor analysis and Cronbach’s alpha was used to assess the validity and the reliability. Factor analysis showed good validity of the questionnaire tool as the factor loadings exceeded the recommended threshold. Cronbach’s alpha measured the reliability of the questionnaire tool. The values ranged from 0.5 to 0.6. This indicated that the scales reliably measured the intended concepts (Azim et al. 2023).

3. 6 Explaining the variables and their measurements

The details of the dependent variable and the independent variables are given in the table below:

Dependent/Outcome variable		
SN	Name of the Variable	Description
1	Knowledge level of AMR	Code: Knowledge_level Type: Categorical Knowledge level is based on the total score of knowledge on AMR. Knowledge level will be categorized based on the following criteria: 1.High = 7-8 points , 2.Medium= 4-6 points , 3. Low= 0-3 points
2	Attitude level towards AMR	Code: Attitude_level Type: Categorical

		Attitude level is based on total score of Attitude towards AMR. It is categorized based on following criteria 1. Positive=7-8 points , 2. Moderate = 4-6 point, 3. Negative= 0-3 points
3	Self reported practice of AMR	Code: Practice_level Type: Categorical Practice level is based on total score of Practice towards AMR. It is categorized based on the following criteria: 1. Good = 4 2. Medium= 2-3 3. Poor=0-1
Independent/Predictor variables are given in the Annex 3.		

3.7 Data Collection Procedure

Data was collected through face-to-face interviews conducted by trained data collectors using Kobo Toolkit. Interviews were conducted in private areas within BRAC urban DOTS centers to ensure confidentiality and comfort for participants. All data collectors received training on survey administration and sensitivity when discussing health behaviors. The Data collection period was from November 26 to December 10 2024.

3.8 Data Quality Assurance

Data was collected by trained Data collectors. The reliability of the Data collectors were checked during the pretesting of the questionnaire. For minimizing bias data was collected from 9.30 am to 2.00 pm so that both working male and female participants can join the interview. Each day dataset was observed and checked by the Supervisor to ensure there is no Duplication of data, adherence to protocol and Transparency of Data collection. Audit trails were done to check the robustness of the data. With the help of the supervisor, the entire process was strictly monitored.

3.9 Data Analysis

Knowledge total score	High ($\geq 80\%$)	Medium ($>40\% - <80\%$)	Low (≤ 40)
8 points	7-8 points	4-6 points	0-3 points
Attitude total score	Positive ($\geq 80\%$)	Moderate ($>40\% - <80\%$)	Negative (≤ 40)
8 points	7-8 points	4-6 points	0-3 points
Practice total score	Good ($\geq 80\%$)	Medium ($>40\% - <80\%$)	Poor (≤ 40)
4 points	4 points	2-3 points	0-1 points

A scoring system to measure people's knowledge, attitudes, and practices (KAP) toward antibiotics was followed based on a previously peer reviewed and published research approved by Institute of Health Economics, University of Dhaka (**Azim et al., 2023**). Each correct answer, showing good knowledge, a positive attitude, or a good practice, was given 1 point. Incorrect answers, negative attitudes, neutral responses, or poor practices received 0 points. Based on their total scores the participants were classified into 3 categories.

We used an ordered logit regression model to figure out what factors might influence people's knowledge, attitudes, and practices toward antibiotic use and antimicrobial resistance (AMR). Since the KAP scores (high, moderate, or low) are ordered categories, this model helped us explore the relationships between these scores and other factors.

3.10 Ethical Considerations

Ethical approval was obtained from an Institutional Review Board (IRB) of BRAC James P Grant School of Public Health prior to data collection. Informed consent was obtained from all participants, who had been assured of the confidentiality of their responses. Participants were informed of their right to withdraw from the study at any time without any consequences. No harm was done to the participants during the study

4. Results

4.1 Socio demographic and Background characteristics

The study included data from 128 respondents. It was seen that nearly half (49.2%) of the study population fell within the age range of 18-27 years. Among the participants 51.6% were female and 48.4% were male. This indicated a nearly balanced gender representation. Nearly three fourth (75%) of the respondents hailed from urban areas of old Dhaka whereas only 25% were residents of peri-urban areas near the Kamrangirchor. The mean age of the respondents were 30.3 years with a standard deviation of 10.4 years.

Regarding educational qualifications, 89.8% of the participants had at least some form of formal education. Among them, 22.7% had studied upto primary school. Another 22.7% studied upto Secondary School Certificate (SSC) whereas 17.9% studied only upto Junior School or High School (class 6-8). A smaller but notable proportion (13.3%) of the study population had the opportunity to achieve upto some level of University education (Undergraduate, Graduate or Postgraduate level). However, 10.2% of the respondents had not received any formal education at school. This reflected a varying range of educational background among the population.

The data regarding marital status showed that 65.6% of the participants were married. However 32.8% of the respondents were single.

In case of the occupations of the respondents, the largest segment (34.4%) comprised of semi-skilled workers such as Garments worker, Tailors, Shopkeepers and jobs as such. This was followed by homemakers (28.9%) and students (14.8%). However 9.4% of the respondents were skilled salaried workers meaning they were engaged in Jobs such as Banker, Teacher, Business manager in which a certain educational qualification is required. Moreover 7.8% of the respondents were participants of unskilled labors such as Rickshawpuller, Day laborers and contractual construction workers.

The data on the self reported financial situation was obtained based on the following criteria: **1) Surplus:** Those who had some leftover of earnings after last month's expenditure, **2) Breakeven:** Those who had equal income and expenditure for the month, **3) Moderate deficit:** Those who had to loan some amount of money to meet the ends **4) High Deficit:** Those who had at least one family member starving in the family. Based on the last month's self reported financial situation, it was revealed that 46.1% of the participants had a Break even income. However 21.9% of them faced moderate deficits. Only 10.9% of the respondents experienced some surplus in their last months income. This shows that the study population had varying economic background.

Most of the respondents (67.2%) had access to internet and used it frequently.

The study populations health-related media exposure pattern reflected that social media was the most frequently used source. At least 25 % of the respondents depended on Social media daily. This was followed by television (19.5%) and Newspaper (12.5%) usage.

Awareness of health-related issues varied among the study population. It was seen that only 70.3% reported that they received education on Tuberculosis during the DOTS service. Among the study population, 47.7% were unsure if Tuberculosis treatment had antibiotics in it. Moreover only 40.6% correctly identified Tuberculosis as a bacterial disease.

These findings reflect a mix of socio-economic, educational, and occupational characteristics among the study participants, providing a comprehensive overview of the surveyed population. The details are listed in the **Table 1. The margin of error is considered 10% **.**

Table 1: Socio-demographic and background of Surveyed population

	Age	Percentage (N)
	18-27	49.2% (63)
	28-37	26.6% (34)
	38-47	16.4% (21)
	48-57	6.3% (8)
	58 & above	1.6% (2)
	Mean (SD) Age years	30.3 ± 10.4 years
	Gender	
	1. Male	48.4% (62)
	2.Female	51.56% (66)
	Education	
	No Education	10.2% (13)
	Primary (Class 1-5)	22.7% (29)
	High School (Class 6-8)	17.9% (23)
	Secondary (Class 9-10)	22.7% (29)
	Higher Secondary (Class 11-12)	13.3% (17)
	University	13.3% (17)

	Mean(SD) Education in years	7.9 ± 4.5 years
	Occupation	Percentage (N)
	Skilled	9.4% (12)
	Semi-skilled	34.4% (44)
	Unskilled	7.8% (10)
	Unemployed	4.7% (6)
	Student	14.8% (19)
	Homemaker	28.9% (37)
	Self reported financial situation	
	Surplus	10.9% (14)
	Break Even	46.1% (59)
	Moderate Deficit	21.9% (28)
	High Deficit	21.1% (27)
	Residence	Percentage (N)
	Urban	75.0% (96)
	Sub-urban	25.0% (32)
	Internet exposure	
	Has internet access	67.2% (86)
	Exposure to AMR awareness campaign	
	Have not been to AMR awareness campaigns before	98.4% (126)
	Have read AMR related articles in newspaper or the internet	
	No	75.8% (97)

	Exposure to AMR related education by anyone	
	No	55.5% (71)
	Received education about Tuberculosis	Percentage (n)
	Yes	70.3% (90)
	Does Tuberculosis treatment have Antibiotic medicine in them	
	Yes	39.1% (50)
	No	13.3% (17)
	Don't know	47.7% (61)
	Is Tuberculosis caused by bacteria	
	Yes	40.6% (52)
	No	2.3% (3)
	Don't know	57.0% (73)
	Marital Status	Percentage (n)
	Single	32.8% (42)
	Married	65.6% (84)
	Divorced, Widow and Others	1.6 % (2)

Media exposure

Using media for Health related news	Television	Radio	Newspaper	Social Media

Daily	13.3%	0.8%	5.5%	25.0%
Weekly	0.00%	0.00%	2.3%	3.1%
Occasionally	19.5%	9.4%	12.5%	34.4%
Never	67.2%	89.8%	79.7%	37.5%

Media exposure (At least one form)	Male	Female
Yes	58.5	41.5
P value	0.117	P < 0.10

Exposure to AMR based education and received education on Tuberculosis

Exposure to AMR awareness campaign	Male	Female	P value < 0.10	Urban	Peri Urban	P value < 0.10

Have been to AMR awareness campaigns before	50.0	50.0	No	50.0	50.0	No
Have read AMR related articles in newspaper or the internet						
Yes	61.3	38.7	0.10 *	80.7	19.4	No
Exposure to AMR related education by anyone						
Yes	47.4	52.6	No	80.7	19.3	No
Received education about Tuberculosis						
Yes	50.0	50.0	No	75.6	24.4	No

4.2 Patients knowledge on Antimicrobial resistance and antibiotic use

Table 2.1: Knowledge level on AMR

Knowledge level of AMR	Percentage	Number
Low	44.5%	57
Medium	46.9%	60
High	8.6%	11

Table 2.2: Questions regarding knowledge on AMR (P <0.10 margin of error)

Sl. No	Question	Male Correct response	Female Correct response	P value	Urban	Peri-Urban	P value
201.	Antibiotics are effective for the treatment of bacterial infections	38.8	61.2	0.08	83.6	16.3	0.07
202.	Antibiotics are effective for the treatment of viral infections	37.5	62.5	0.35	75.0	25.0	1.0
203.	Loss of effectiveness of an antibiotic is antibiotic resistance	46.8	53.1	0.8	75.0	25.0	1.00
204.	Antibiotic resistance increases due to missing of an antibiotic dose	46.3	53.6	0.5	76.83	23.17	0.5
205.	The more we use antibiotic, the higher the risk that resistance develops	48.9	51.0	0.9	75.5	24.5	0.9
206.	Antibiotic resistance can develop due to use of antibiotic without doctor's prescription	50.7	49.3	0.5	77.5	22.5	0.5
207.	After feeling better, one can stop a partially completed antibiotic dose	48.9	51.1	0.9	77.8	22.2	0.26
208.	Antibiotic resistance can develop due to misuse of antibiotic	47.2	52.8	0.75	77.8	22.2	0.41

Almost half of the participants (46.8%) demonstrated medium level of knowledge about Antimicrobial resistance (AR). However only a small portion (8.6%) of the respondents showed high level of knowledge on AMR. Nonetheless, 44.5% of the participants had low knowledge on AMR (**Table 2.1**). Also for each specific question the knowledge levels were seen based on the respondents gender and residence. **Table 2.2**.

4.3 Patients attitude towards Antimicrobial resistance and antibiotic use

Table 3.1 Attitude towards antibiotics usage and AMR

Attitude level of AMR	Percentage	Number
Negative	40.63%	52
Moderate	44.53%	57
Positive	14.84%	19

Table 3.2 Questions regarding Attitude towards AMR (P < 0.10 margin of error)

SI No.	Questions	Male	Female	P value	Urban	Periurban	P value
301	Antibiotics are safe, so they can commonly be used	48.5	51.5	0.99	83.3	16.7	0.03
302	Without prescription, sale of antibiotics should be banned	48.4	51.6	0.9	77.4	22.6	0.30
303	Surplus/ unused antibiotics can be saved for future use or to give someone else	42.5	57.5	0.05	78.16	21.84	0.23
304	Antibiotics speed up the recovery from most coughs and colds	72.7	27.3	0.01	77.3	22.7	0.78
305	It is okay to take antibiotics based on the suggestion of a medicine seller	45.6	54.4	0.49	76.5	23.5	0.68
306	I should take antibiotics to avoid getting a more severe illness, when I suffer from cough and cold	58.5	41.5	0.12	70.7	29.3	0.44
307	Antibiotic speeds up recovery when I get a fever	61.1	38.9	0.07	72.2	27.8	0.65
308	If a doctor does not prescribe an antibiotic when I think one is needed, I will go to another doctor	46.2	53.9	0.51	76.9	23.1	0.53

Most of the respondents (44.53%) had a moderate level attitude towards antibiotic use and AMR. But it was seen that the proportion of respondents with positive attitude (14.84%) was notably lower than those with negative attitude (40.63%) **Table 3.1**.

The Attitude level questions responses were further seen based on gender and residence of the respondents (**Table 3.2**)

4.4 Self-reported practice towards antibiotic usage and AMR among the patients

Table 4.1

Practice level of AMR	Percentage	Number
Poor	10.94%	14
Medium	30.47%	39
Good	58.59%	75

Table 4.2 Questions regarding practice (p < 0.10 margin of error)

Sl No	Questions	Male	Female	P val	Urban	PeriUrban	P val
401	Before using antibiotics, do you ask a doctor?	48.6	51.4	0.94	76.6	23.4	0.34
402	Do you always fulfill the antibiotic course?	47.3	52.7	0.68	81.7	18.3	0.004
403	How do you mostly intake antibiotics?	47.6	52.4	0.69	74.8	25.24	0.89
404	After taking some doses of antibiotics, if you feel better, do you still complete the full dose of treatment?	45.2	54.8	0.13	79.8	20.2	0.01

Based on the findings, it was seen the amazingly a significant proportion (58.59%) of the study population demonstrated good practices regarding AMR. However, 10.94% exhibited poor practice towards AMR while 30.47% had moderate level of practice (Table 4.1). The correct responses for the practice related questions were listed based on gender and residence on the table above (**Table 4.2**).

4.5 Variation of the Knowledge, Attitude and Practice level among various socio-demographic groups

Table 5: Variation in KAP levels across socio-demographic groups

Groups	Knowledge level			Attitude level				Practice level				
	High	Medium	Low	Positive	Moderate	Negative		Good	Medium		Poor	
Gender												
Male	11.29	35.48	53.23	19.35	38.71	41.94		56.45	32.26		11.29	
Female	6.06	57.58	36.36	10.61	50.00	39.39		60.61	28.79		10.61	
X ² value	6.38	P Value	0.041 *	X ² value	2.61	P value	.27	X ² value	.23	P value	0.889	
Age-groups												
18-27	11.11	39.68	49.21	12.70	46.03	41.27		60.82	28.57		11.11	
28-37	8.82	61.76	29.41	8.82	55.88	35.29		61.76	26.47		11.76	
38-47	4.76	47.62	47.62	33.33	33.33	33.33		57.14	38.10		4.76	
48-57	0	37.50	62.50	12.50	25.00	62.50		50.00	37.50		12.50	
58 & above	0	50.00	50.00	0.00	0.00	100.0		0.00	50.00		50.00	
X ² value	6.8	P value	0.55	X ²	12.6	P	0.13	X ²	5.9		P	0.65
Education												
No Education	7.69	15.38	76.92	7.69	38.46	53.85		23.08	61.54		15.38	
Primary	0.00	51.72	48.28	10.34	27.59	62.07		58.62	27.59		13.79	
High School	0.00	65.22	34.78	13.04	52.17	34.78		56.52	34.78		8.70	

Secondary		10.34	37.93	51.72	13.79	51.72	34.48		65.52	24.14		10.34
Higher Secondary		17.65	47.06	35.29	5.88	52.94	41.18		58.82	29.41		11.76
University		23.53	52.94	23.53	41.18	47.06	11.76		76.47	17.65		5.88
χ^2		21.78	P value	0.01*	χ^2	20.47	P	0.02*	χ^2	10. 5	P	0.39
Occupatio n												
Skilled		16.67	41.67	41.67	25.00	41.67	33.33		50.00	33.33		16.67
Semi- Skilled		4.55	43.18	52.27	13.64	52.27	34.09		61.36	31.82		6.82
Unskilled		0.00	40.00	60.00	20.00	20.00	60.00		40.00	30.00		30.00
Unemploye d		0.00	83.33	16.67	16.67	33.33	50.00		66.67	33.33		0.00
Student		15.79	47.37	36.84	21.05	47.37	31.58		68.42	21.05		10.53
Homemake r		10.81	48.65	40.54	8.11	43.24	48.65		56.76	32.43		10.81
χ^2	9.08	P value	0.52	χ^2	7.51	P value	0.67	χ^2	6.9	P value	0.73	
Self reported financial situation												
Surplus		21.43	42.86	35.71	28.57	35.71	35.71		50.00	35.71		14.29
Breakeven		10.17	40.68	49.15	8.47	47.46	44.07		59.32	27.12		13.56
Moderate deficit		3.57	46.43	50.00	21.43	42.86	35.71		57.14	39.29		3.57
High deficit		3.70	62.96	33.33	14.81	44.44	40.74		62.96	25.93		11.11
χ^2	7.93	P value	0.24	χ^2	5.00	P value	0.54	χ^2	3.42	P value	0.75	

Marital status											
Single		14.29	38.10	47.62	16.67	52.38	30.95	66.67	23.81	9.52	
Married		5.95	51.19	42.86	14.29	41.67	44.05	54.76	34.52	10.71	
Divorced		0.00	100.0	0.00	0.00	0.00	100.00	100.00	0.00	0.00	
Widowed		0.00	0.00	100.0	0.00	0.00	100.00	0.00	0.00	100.0	
χ ²	5.81	P	0.45	χ ²	4.98	P	0.54	χ ²	10.67	P value	0.09*
Residence											
Urban		9.38	47.92	42.71	14.58	46.88	38.55	63.54	28.13	8.33	
Peri-urban		6.25	43.75	50.00	15.63	37.50	46.88	43.75	37.50	18.75	
χ ²	0.64	P value	0.72	χ ²	0.90	P	0.64	χ ²	4.67	P value	0.09*
Internet exposure											
Has internet access		11.63	50.00	38.37	15.12	48.84	36.05	63.95	27.91	8.14	
No internet access		2.38	40.48	57.14	14.29	35.71	50.00	47.62	35.71	16.67	
χ ²	5.58	P	0.061**	χ ²	2.46	P	0.29	χ ₂	3.73	P	0.155

T- test for the years in Education between male and female respondents

Gender	Mean educational years	SD	P value
Male	7.89	4.81	0.9782
Female	7.90	4.25	

The table above shows the variation of knowledge, attitude and practice levels of AMR across different socio-demographic groups. This offers a comprehensive insight into how social factors influence the adult DS-TB patients awareness and behavior towards AMR.

Based on the data a notable Gender difference was seen. **However only knowledge level of AMR was statistically significant with Gender (P= 0.04). Rest were not statistically significant.** It revealed that males exhibit lower level of knowledge score (53.2%). However only 36.4% of the females fell in the low knowledge level group. Here the females also displayed slightly better practice levels (60.6%) than the males (56.5%). Overall, females did better than males in having average knowledge, moderate attitude and good practice of AMR. This reflected that females are more prone to proactive behavior towards AMR.

Age also emerged as a critical factor. Younger individuals particularly the members of the 28-37 age group showed higher proportion of having medium knowledge level of AMR (61.8%). Interestingly, older adults especially those above the age of 58 struggled with knowledge and practice of AMR. This may indicate a potential generational gap in information access and adaptability. **However, none of the values from age was statistically significant.**

Education played a decisive role in determining the knowledge, attitude and practice levels of AMR. **Both knowledge of AMR (P= 0.01) and attitude of AMR (P= 0.02) were statistically significant.** We saw that University graduates showed the best level of knowledge, attitude and practice scores. They accounted for 23.5% in the high knowledge level group. Also they consisted of 76.5% in the good practice of AMR group. In contrast, individuals with no formal education largely populated the low-knowledge of AMR (76.9%) group and poor practice category. This emphasized the empowering effect of education on their behavior towards AMR.

The data also showed that the employment status of the participants also effected the KAP levels of AMR. **However none of the values were statistically significant.** Skilled workers maintained balanced scores across the knowledge, attitude and practice levels of AMR. The homemakers showed a similar response. However, students showed promising practice scores (68.4%) . Interestingly unemployed individuals showed good level of practice 66.7%. Overall, this data suggested that job roles involving structured routines may enhance consistent behavior towards AMR.

Income stability proved to be a very influential factor. **But none of the values were statistically significant.** It was seen those with surplus income exhibit more high level of knowledge (21.4%) and good practices (50%) towards AMR. But individuals who experienced financial deficits struggled across all the levels. These results showed that financial stability enables an individual to attain healthier attitude and practices towards AMR. Interestingly marital status reveled distinct patterns in knowledge, attitude and practice level of AMR. Single individuals exhibited better KAP levels. We saw that 14.3% of the Single individuals showed high level of knowledge and 66.7% of them showed good practices. Conversely widowed and the divorced individuals showed the lowest scores . This reflects that isolation and reduced information flow had reductive impact on the KAP levels of AMR.

Residential background highlights the urban-rural divide. **But only the results for practice level were statistically significant (P=0.09)** . Urban residents fare better, with 63.5% practicing good behaviors compared to 43.8% in peri-urban areas. This contrast underscores the role of urban infrastructure in promoting better living conditions and access to educational campaigns. Finally, internet access stands out as a transformative factor. Individuals with internet access demonstrate markedly better scores, with 11.6% in high-knowledge and 63.9% in good practices. In contrast, those without internet access face significant challenges, with 57.1% in the low-knowledge category and only 47.6% practicing good behaviors.

Moreover the education in year were almost equal (Male 7.89, Female = 7.90) . However the values were not statistically significant (P=0.98) .

Overall, the findings underscore the interplay of education, internet connectivity, financial security, and social context in shaping knowledge, attitudes, and practices.

4.6 Results from ordered logistic regression

Table 6.1 Model 1: Outcome variable is Knowledge level of AMR

Variables	Odds ratio		P value (Adjusted)	95% Confidence Interval (adjusted)
	Adjusted	Unadjusted		
Age (Age group 18-27 is reference)	1.08	1.09	0.732	.7018089 - 1.65559
Gender (Male is reference)	0.59	0.62	0.295	.2246215 - 1.573692
Education in years (No education is the reference)	0.83	0.69	0.220	.624949 - 1.114295
Occupation (Skilled salaried worker is the reference)	0.97	0.89	0.806	.7630451- 1.234046

Self reported financial situation (Surplus income is the reference)	1.17	1.01	0.468	.7659568-1.785917
Marital status (Single is the reference)	0.7979	1.10	0.619	.3278853-1.94202
Residence (Urban is the reference)	1.1695	1.37	0.713	.5073834-2.695848
Internet exposure (Having internet access is the reference)	1.38	2.31	0.465	.5744879-3.361162
Exposure to AMR awareness campaign (Exposure to the Awareness campaign is the reference)	1.46	0.70	0.798	.0810621 - 26.25002
Read AMR based articles in internet or Newspaper (Reading AMR based article is the reference)	4.57*	6.07*	0.003*	1.700278 - 12.32298

Received AMR related education from anyone (Received AMR based education is the reference)	1.74	2.15	0.183	.7695366 - 3.95875
Received education on Tuberculosis	1.0212	1.62	0.962	.4334333 - 2.406121
			Margin of error p < 0.10	

Model 1 : In this regression model, the outcome variable is the knowledge level of AMR of the adult DS-TB patients of the BRAC DOTS program. This model is statistically significant . The likelihood ratio chi-squared value is 27.06 (p= 0.0076) which is less than the margin of error (p<0.10) . The pseudo R-squared value is 0.1141. This indicated that approximately 11.41% of the variance in knowledge levels is explained by the predictors. Among the independent variables, only **Reading AMR based articles** is the statistically significant predictor (OR- 4.577, p= 0.003) . This suggests that individuals who read AMR based articles are 4.5 times more likely to have higher knowledge level regarding AMR and antibiotic use. Other variables including gender, age, education level, marital status, occupation, last months income, residence, internet access receiving education about AMR and participation in AMR awareness campaigns do not significantly effect the knowledge of AMR. Their P value exceed 0.1 and odds ratio 0.594 to 1.745. This reflects weak or negligible relationship . Residence in urban area and having internet access show slightly positive but non significant association. Similarly receiving AMR education indicates an influence (OR = 1.75) but not statistically significant.

Table 6.2 Model 2: Outcome variable is Attitude level of AMR

Variables	Odds ratio		P value (Adjusted)	95% Confidence Interval (Adjusted)
	Adjusted	Unadjusted		
Age	0.87	1.06	0.520	.5665346 - 1.333223

Gender	.62	1.11	0.325	.2411915 - 1.601925
Education	.70	0.69	0.015*	.5287369 - .9346175
Occupation	1.19	1.11	0.129	.9485569 - 1.517596
Self reported financial situation	0.91	0.98	0.653	.6047837 - 1.370841
Marital status	1.46	1.81	0.389	.614121 - 3.493661
Residence	1.08	1.27	0.853	.4692248- 2.495291
Internet exposure (Having internet access is the reference)	0.79	1.58	0.620	.330248 - 1.936536
Exposure to AMR awareness campaign	0.91	0. 57	0.944	.0584071- 14.07604
Read AMR based articles in internet or Newspaper	2.58	3.65	0.039*	1.047402 - 6.335428
Received AMR related education from anyone	1.08	1.61	0.854	.4794357 - 2.429132
Received education	.93	1.26	0.864	.4081029 - 2.12092

regarding Tuberculosis				
			Margin of error p < 0.10	

Model 2: In this model, the outcome variable is the **Attitude level** of AMR among the participants. The table summarizes the results of an ordered logistic regression analysis among the 128 participants observations. The model has a likelihood ratio chi-squared value of 20.87 (p= 0.0523) . This indicates that the model is statistically significant. The pseudo R squared value is 0.0808. This indicates that approximately 8.08% of the variance in attitude level is explained by the predictors. Among the variables only **Education level** and **Reading of AMR based articles** prove to be statistically significant. For the education level the odds ratio is 0.703 and the p value is p=0.015 . This indicates that for the increase of each level formal of education there is 29.7% less odds of having negative attitude towards AMR. Similarly, reading AMR- based articles significantly increases the likelihood of positive attitudes towards AMR. The odds of having positive attitude towards AMR and Antibiotic usage is 2.5 times higher in the ones who read AMR based articles than those who do not read AMR based articles. Other variables do not significantly impact attitude towards AMR. Their p values exceed 0.10 and their odds ratio range from 0.621 to 1.464 reflecting a weak or no association.

Table 6.3 Model 3: Outcome variable is Practice level of AMR

Variables	Odds ratio		P value (Adjusted)	95% Confidence Interval (adjusted)
	Adjusted	Unadjusted		
Age	1.09	1.19	0.699	.7159398- 1.645885
Gender	.66	0.86	0.421	.2389013- 1.81974
Education	.89	0.77	0.444	.6635613- 1.197112
Occupation	1.03	0.98	0.796	.8033071- 1.330606
Self reported financial situation	.74	0.88	0.205	.4624576 - 1.180441

Marital status	1.52	1.77	0.375	.6000787 - 3.872481
Residence	2.46**	2.31**	0.034*	1.070879 - 5.644397
Internet exposure (Having internet access is the reference)	1.45	0.69	0.413	.5972492 - 3.503423
Exposure to AMR awareness campaign	0.41	0.29	0.556	.0214658 - 7.906064
Read AMR based articles in internet or Newspaper	3.40**	3.73**	0.033*	1.103897- 10.49351
Received AMR related education from anyone	0.75	1.27	0.525	.3059356 - 1.829446
Received education regarding Tuberculosis	0.61	0.96	0.284	.2416433 - 1.516787
			Margin of error p < 0.10	

Model 3: In this model the outcome variable is the practice level of AMR among the participants. This table represents the results of the ordered logistic regression analysis that explores the factors influencing the practice level among the respondents. The model has a likelihood ratio chi-squared value of 19.79 (p=0.0713). The pseudo R squared value is 0.0842. This indicates that this model explains 8.42% of the variance in practice levels. This model is statistically significant as it is within the margin of p<0.1 . The overall model highlights two significant predictors , **Residence** and **Reading AMR based articles**.

In this model Residence in Urban area was taken as reference. Those who live in urban area are 2.46 times more likely to have good practice of AMR than those who live in Peri-urban areas ($p=0.034$). Moreover, the odds of having good practice of AMR are **3.4 times** higher among those who read AMR based articles than those who do not read AMR based articles ($p=0.33$). This indicates that those who read AMR based materials in the internet or the newspaper are over three times more likely to adapt better AMR related practices. Other variables do not show statistically significant association with practice levels. Their odds ratio range from 0.411 to 1.524 and their p values exceed 0.10. This reflects weak or no association.

Table 6.4 Model 4: Outcome variable is Practice level of AMR, where Knowledge level of AMR and Attitude Level of AMR is an independent variable

Variables	Odds ratio		P value (Adjusted)	95% Confidence Interval (adjusted)
	Adjusted	Unadjusted		
Age	1.15	1.19	0.525	.7404486- 1.802191
Gender	0.99	0.86	0.992	.3236176- 3.056871
Education	1.10	0.77	0.583	.7869775- 1.531298
Occupation	0.94	0.98	0.640	.7119772- 1.23229
Last Month's income	0.72	0.88	0.207	.4306496 - 1.200293
Marital status	1.52	1.77	0.417	.5518248- 4.201964
Residence	3.02	2.31**	0.018*	1.205232 - 7.555097
Internet exposure (Having internet access is the reference)	1.73	0.69	0.276	.6434787 - 4.677744

Exposure to AMR awareness campaign	0.34	0.29	0.481	.0160097 - 7.023622
Read AMR based articles in internet or Newspaper	1.70	3.73	0.402	.0.4929-5.8404
Received AMR related education from anyone	0.47	1.27	0.133	.1790012- 1.255001
Received education regarding Tuberculosis	0.62	0.96	0.345	.2318585- 1.667716
Knowledge Level of AMR	5.02	5.78	0.000*	2.159156- 11.68762
Attitude level of AMR	3.08	4.01	0.002*	1.529588- 6.212072

Margin of error $p < 0.10$

Model 4: In this model the outcome variable is practice level. However unlike the previous models , in this model the predictor is the **Knowledge level of AMR** and **Attitude level of AMR**. Therefore along with the other predictors this model is trying to see if knowledge and attitude of AMR has any effect over the practice level of AMR. This table presents the results of this ordered logistic regression based on the data of 128 observations. The model is statistically significant ($p= 0.000$) with chi-squared value is 54.11. The pseudo R-squared value is 23.04. This indicates that approximately 23.04% of the variance in practice level is explained by the predictors.

In this model the **Knowledge level, Attitude level and Residence** are seen to be significant predictors of practice of AMR.

It is seen that Higher knowledge level of AMR is strongly associated with better practice levels of AMR. The Odds ratio is 5.02 ($p=0.000$). This indicates that the odds of having good practice of AMR is 5.02 times higher in those who have higher knowledge than those who have low level knowledge on AMR. Similarly, attitude towards AMR has a significant effect on the practice of AMR. The odds ratio is 3.08 (**$p=0.002$**). This suggests that the odds of having a good practice of AMR is 3.08 times higher in those with

positive attitude towards AMR than those who have a negative attitude towards on AMR. Moreover, individuals who's residence in the urban area have a 3.02 time higher odds of having good practice of AMR than those who reside in the peri-urban areas (**p=0.018**).

Based on the above mentioned regression models it is seen that Reading AMR based articles , having higher education level and living in urban areas have a positive effect on the knowledge and attitude level of AMR. And having better knowledge and attitude towards AMR increases the odds of having good practice of AMR among the adult DS-TB patients in the BRAC DOTS program.

5. Discussion

The findings in this study provides revealing insights into the knowledge, attitude and practice of Antimicrobial usage and Antimicrobial resistance among the adult Drug sensitive TB patients of BRAC urban DOTS program in Dhaka city. It also shows the variation of the KAP level across various socio-demographic groups. Moreover it reflects how various socio-demographic factors effect these KAP levels. This discussion critically analyzes the results of the study and compares with other relevant studies done in Bangladesh and abroad.

In this study almost half of the participants exhibited medium level of knowledge on AMR (46.8%) . However 44.5% of the respondents demonstrated low level of knowledge on AMR. In contrast , in a previous study conducted on the general population of Bangladesh, 52.3% of the respondents showed medium level of knowledge on AMR. This shows that the level of knowledge on AMR among the adult TB patients is lower than the General population level. Moreover the Attitude level of most of the respondents were moderate level (44.5%). In comparison , the general population of Bangladesh exhibited higher level of moderate attitude (67.8%). Therefore the attitude level for the adult TB patients was also lower than the general population level. However, 58.6% of the adult TB patients demonstrated good practice of AMR. Interestingly this is higher than the level of the general population which was found to be 50.6% (**Azim et al. ,2023**) .

The study revealed that socio-demographic factors such as education, occupation and access to the internet played impactful roles in forming the knowledge, attitude and practice of AMR among the respondents. Higher education recipients had better attitude of AMR in this study. Also those who had University level education were more in the group of high knowledge of AMR among the respondents. This finding matched with the results of another study conducted in the Italy (**Scaiola et al. , 2015**) . Similarly another study conducted among the general population in Bangladesh indicated that individuals with higher level of education showed better KAP levels (**Azim et al. , 2023**).

Gender differences were also notably seen among the respondents knowledge, attitude and practice level of AMR. Among the 128 participants, females demonstrated better level of KAP of AMR than the males. This finding aligns with findings from studies done

in Australia and Sri Lanka. In those studies female participants showed more responsible attitudes towards Antibiotic resistance and usage (**Sakeena et al. , 2019**). However, another study conducted in Bangladesh saw that males have 5% higher likelihood of showing better attitude towards AMR (**Azim et al. 2023**). These gender-based variations highlight the importance for targeted educational interventions for specific groups among the DOTS recipients.

Urban residents consistently outperformed peri-urban residents in all forms of KAP levels of AMR. Participants from urban areas near the old Dhaka were 2.46 times more likely to practice good AMR behaviors compared to the participants hailing from Peri-urban areas of Kamrangirchor near the Buriganga river. This paralleled the findings from studies done in Ethiopia and Pakistan . The study in Ethiopia noted that urban residents had better healthcare access . This allowed them to have more information regarding health. That resulted in better informed practices (**Gebeyehu et al. 2021**). Similarly, the study done in Pakistan exhibited disparity in antibiotic dispensing practices between Urban and rural areas (**Ahmed et al. , 2022**).

Access to internet was exhibited as a transformative factor. Those who had access to internet showed markedly better knowledge, attitude and practice levels of AMR. This finding was consistent with another study in Bangladesh where it was shown that there is positive influence of digital media on public awareness in AMR (**Azim et al. 2023**). Moreover, those who read AMR related articles in the newspaper or the internet were more likely to have higher knowledge, positive attitude and better practices of AMR. This highlights the importance of ICE materials for the adult DS-TB patients in the DOTS program. As reading AMR based articles or picture based educational materials have positive effect on their behavior, it would be impactful to have interventions such as these. However previous studies also showed gaps among respondents actively seeking information on AMR (**Azim et al. 2023**). This underscores the importance of awareness campaigns or educational sessions for the adult patients in the DOTS program.

Despite moderate levels of knowledge among the 128 participants, there was critical misconception regarding AMR. 54.4% males and 45.6% females didn't know that Antibiotics are used for treating bacterial disease . These results align with studies done Spain (Vazquez-Lago et al., 2011). It also parallels with a study done in Bangladesh (**Azim et al. , 2023**). In these studies it was shown that misconceptions about the effectiveness of antibiotics and their proper use were prevalent among the study population. Addressing these gaps would require tailored educational interventions. They would specifically focus on the basics of antibiotics use and the consequences of misuse.

A considerable proportion of the respondents (44.5%) exhibited moderate attitude level towards AMR. Notably 67.9% believed that surplus antibiotics could be saved for future use. This misconception was also reported in a study done on veterinary practices in Bangladesh (**Sarker et al. , 2024**). Positive attitude was associated with higher education level as well as reading AMR based articles. This emphasized the need of educational intervention for better AMR related attitudes.

Based on the data, the study saw that 58.6% of the participants demonstrated good practices. Most of them exhibited self reported practices such as consulting doctors before using antibiotics and completing prescribed courses in given timeline. Similarly in Bangladesh among the general population, we saw such good practice of AMR (Azim et al. , 2023). However, this finding differed from the studies conducted in Pakistan and Australia. In those studies, non-compliance with prescribed courses were more prevalent (Ahmad et al., 2022; Sakeena et al. , 2019). In this case the high adherence rate might happen because of the DOTS program and the active participation by the CHWs from BRAC urban DOTS program.

In the regression analysis we saw that reading AMR based articles in the newspaper or in the internet had significantly positive effect on the Knowledge, Attitude and Practice level on the AMR. Also, higher education had a positive association with better and positive Attitude towards Antibiotic usage. These findings are supported by another study done by Lambert et al. , where we saw the effectiveness of educational interventions led by community pharmacists in improving the KAP levels of AMR (Lambert et al. , 2022). In a similar way, in a study conducted in Bangladesh identified education and media exposure as key factors influencing AMR related awareness and behaviours (Azim et al. , 2023).

Interestingly, residence in urban areas also emerged as a significant predictor for good practice of AMR. This aligns with findings from studies conducted in Ethiopia (Gebeyehu et al., 2021). This also had similarities with the findings from a study conducted in Pakistan (Ahmed et al., 2022).

In the model 4 of the regression analysis where Practice level of AMR was the outcome variable and Knowledge and Attitude of AMR was used as predictors, it was seen that higher Knowledge and positive Attitude level of AMR are significantly associated with good practice of AMR. When knowledge and Attitude levels are used as explanatory variables, all the other predictors become insignificant. This means that if we want to improve the practice level of AMR, the best way to do that is to increase the knowledge and attitude of AMR. This finding was parallel to another study done in Bangladesh, where Knowledge and Attitude level of AMR showed positive correlation with good practice of AMR (Azim et al. 2023).

However, socio-demographic variables such as age, gender, marital status, occupation , monthly income did not prove to be significant predictors in the regression analysis. Therefore educational interventions tailored for adult DS-TB patients remain significantly impactful in order to change their behavior towards AMR.

6. Public health Implications

The results underscore the urgent need of educational interventions to improve the knowledge, attitude and practice of AMR among the adult Drug sensitive Tb patients enrolled in the BRAC urban DOTS program. This education on AMR should be integrated in the DOTS service for the convenience of the adult DS-TB patients.

1. Education on AMR integrated with DOTS program: An educational session about what is AMR, what is its consequences and recommended behaviors promoting good attitude and practice of AMR should be given to the adult drug sensitive patients.

2. Information, Education and Communication materials on Antimicrobial resistance: As it is seen that those who read articles on AMR show positive knowledge, attitude and practice, it is justified to develop ICE materials to enhance the KAP levels.

3. Emphasis on the Peri-urban areas: It is seen that residents of the urban areas are performing better in the KAP levels than the residents of Peri-urban areas. Therefore the interventions should be more focused on the peri-urban areas to improve the knowledge, attitude and practice of AMR.

All of these will improve the implementation of DOTS program in the BRAC urban DOTS operation and help us achieve the End TB strategy by establishing robust patient support system.

7. Limitations

The study had multiple limitations. Firstly, due to time and resource constraints the margin of error was set to 10% . Therefore the p value of the study was considered $p < 0.10$ to be significant. Moreover the study was conducted only on the adult Drug sensitive patients of BRAC urban DOTS program in Dhaka city. Therefore the findings of this study is not generalizable over all the Tuberculosis patients enrolled in BRAC DOTS program. The sample was only representative for the patients from Dhaka city. Lastly, this was a cross sectional study. Therefore no causal inference couldn't be drawn . To achieve plausible results with temporality and establish causation, further quasi-experimental or Randomized controlled trial can be done to assess the effect of educational interventions to improve the knowledge, attitude and practice of AMR.

8. Conclusion

This study adds to the growing body of evidence highlighting the socio-demographic determinants of KAP towards AMR. By comparing the findings with global studies, it becomes evident that addressing AMR requires a holistic approach that integrates education, infrastructure development, and regulatory measures. Future research should focus on longitudinal studies to evaluate the long-term impact of targeted interventions, ensuring sustainable improvements in antibiotic use and resistance management.

9. Acknowledgement

Firstly the author acknowledges the relentless help from the adult Tuberculosis patients who willingly supported this study by providing their valuable time and information.

The study acknowledges the kind and robust supervision of Dr. Ataur Rahman who helped in formalizing and conceptualizing the study. Without his keep supervision this

study could never have been possible. The author also acknowledge the kind and helpful guidance of Professor Dr. Malay Kanti Mridha, Assistant Professor Dr. Tanvir Hasan , Deputy Director Dr. Santhia Ireen and the professors of BRAC James P Grant School of Public Health for formatting the research question . The authors are indebted to BRAC DOTS program officials, particularly District Manager Mosarrul Haque and the Field organizers for helping the researchers contact the patient and arranging the room for Data collection inside the DOTS center. The author thanks his mentors Zumana Hayat Khan and Redwanul Islam for their kind and generous guidance in this SLP. The author thanks the Research Assistants Borsha Biplob and Sumaiya Israt Nuba for their constant support in the data collection from the adult drug sensitive Tb patients in Kamrangirchor area. Lastly, the author thanks his family for their support during the SLP period. Without their support this study could have never been possible.

10. References:

1. Ahmad, T., Khan, F. U., Ali, S., Rahman, A. U., & Khan, S. A. (2022). Assessment of without prescription antibiotic dispensing at community pharmacies in Hazara Division, Pakistan: A simulated client's study. *PLoS ONE*, 17(2), e0263756. <https://doi.org/10.1371/journal.pone.0263756>
2. Antimicrobial Resistance Collaborators. (2022). Global burden of bacterial antimicrobial resistance in 2019: A systematic analysis. *The Lancet*, 399(10325), 629-655. doi: 10.1016/S0140-6736(21)02724-0.
3. Aponte-González, J., González-Acuña, A., Lopez, J., Brown, P., & Eslava-Schmalbach, J. (2019). Perceptions in the community about the use of antibiotics without a prescription: Exploring ideas behind this practice. *Pharm Pract (Granada)*, 17(1), 1394. doi: 10.18549/PharmPract.2019.1.1394. PMID: 31015877; PMCID: PMC6463418.
4. Azim, M. R., Iftakhar, K. M. N., Rahman, M. M., & Sakib, Q. N. (2023). Public knowledge, attitudes, and practices (KAP) regarding antibiotics use and antimicrobial resistance (AMR) in Bangladesh. *Heliyon*, 9(10), e21166. doi: 10.1016/j.heliyon.2023.e21166
5. Bhatia, V., Rijal, S., Sharma, M., Islam, A., Vassall, A., Bhargava, A., ... & Raviglione, M. (2023). Ending TB in South-East Asia: Flagship priority and response transformation. *The Lancet Regional Health-Southeast Asia*, 18.
6. Cars, O., Högberg, L. D., Murray, M., Nordberg, O., Sivaraman, S., Lundborg, C. S., ... & Tomson, G. (2008). Meeting the challenge of antibiotic resistance. *Bmj*, 337.
7. Coque, T., Graham, D. W., Pruden, A., So, A., & Topp, E. (2023). Bracing for Superbugs: Strengthening environmental action in the One Health response to antimicrobial resistance.
8. Dalbanjan, N. P., Kadapure, A. J., & SK, P. K. (2024). A comprehensive review on latent role of stress proteins in antibiotic resistance. *The Microbe*, 100151.
9. Davey, P., Pagliari, C., & Hayes, A. (2002). The patient's role in the spread and control of bacterial resistance to antibiotics. *Clin Microbiol Infect.*, 8(Suppl 2), 43-68. doi: 10.1046/j.1469-0691.8.s.2.6.x. PMID: 12427207.

10. Dooley, K. E., Lahlou, O., Ghali, I., Knudsen, J., Elmessaoudi, M. D., Cherkaoui, I., & El Aouad, R. (2011). Risk factors for tuberculosis treatment failure, default, or relapse and outcomes of retreatment in Morocco. *BMC Public Health*, 11, 1-7.
11. Eurosurveillance Editorial Team. (2013). WHO publishes Global tuberculosis report 2013. *Eurosurveillance*, 18(43), 20615.
12. Ferdos, M. A., & Islam, M. T. (2023). Tuberculosis burden in Bangladesh: Progressions and challenges of continuing control intervention. *Saudi Journal of Medicine*, 8(8), 446-456.
13. Finch, R. G., Metlay, J. P., Davey, P. G., & Baker, L. J. (2004). Educational interventions to improve antibiotic use in the community: Report from the International Forum on Antibiotic Resistance (IFAR) colloquium, 2002. *Lancet Infect Dis.*, 4(1), 44-53. doi: 10.1016/s1473-3099(03)00860-0. PMID: 14720568.
14. Flora, M. S., Amin, M. N., Karim, M. R., Afroz, S., Islam, S., Alam, A., & Hossain, M. (2013). Risk factors of multi-drug-resistant tuberculosis in Bangladeshi population: A case-control study. *Bangladesh Medical Research Council Bulletin*, 39(1), 34-41.
15. Gebeyehu, E., Bekele, A., & Kebede, E. (2021). Knowledge, attitudes, and practices of antibiotic use and antimicrobial resistance among urban and rural residents in Ethiopia. *Antimicrobial Resistance and Infection Control*, 10(1), 34.
16. Hoque, R., Ahmed, S. M., Naher, N., Islam, M. A., Rousham, E. K., Islam, B. Z., & Hassan, S. (2020). Tackling antimicrobial resistance in Bangladesh: A scoping review of policy and practice in human, animal and environment sectors. *PloS one*, 15(1), e0227947.
17. Hossain, M. R., Islam, M. S., Akter, S., Anisuzzaman, A. H. M., Abdullah-Al-Maruf, M., & Mohammed, N. (2023). Impact of education on non-compliance and MDR TB risk: Specialized hospital study. *Saudi Journal of Medicine*, 8(12), 659-663.
18. Klein, E. Y., Van Boeckel, T. P., Martinez, E. M., Pant, S., Gandra, S., Levin, S. A., Goossens, H., & Laxminarayan, R. (2018). Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. *Proc Natl Acad Sci U S A.*, 115(15), E3463-E3470. doi: 10.1073/pnas.1717295115.
19. Lambert, M., Smit, C. C. H., De Vos, S., & Taxis, K. (2022). A systematic literature review and meta-analysis of community pharmacist-led interventions to optimise the use of antibiotics. *British Journal of Clinical Pharmacology*, 88(6), 2617–2641. <https://doi.org/10.1111/bcp.15254>.
20. Lemma Tire, L., Ersido, T., Beyene Handiso, T., & Shiferaw Areba, A. (2024). Non-adherence to anti-tuberculosis treatment and associated factors among TB patients in public health facilities of Hossana town, Southern Ethiopia, 2022. *Frontiers in Medicine*, 11, 1360351.
21. Lee, C. H., Lee, M. C., Lin, H. H., Shu, C. C., Wang, J. Y., Lee, L. N., & Chao, K. M. (2012). Pulmonary tuberculosis and delay in anti-tuberculous treatment are important risk factors for chronic obstructive pulmonary disease. *PloS one*, 7(5), e37978.
22. Malini, H., Huriani, E., Lenggogeni, D. P., & Herlina, S. (2021). Health education on multidrug-resistant tuberculosis prevention among tuberculosis patients. *International Journal of Public Health Science*, 10(1), 27-32.

23. May, M., & Rhatigan, J. (2011). BRAC's tuberculosis program: Pioneering DOTS treatment for TB in rural Bangladesh. *Harvard Business Publishing*.
24. Mekonnen, H. S., & Azagew, A. W. (2018). Non-adherence to anti-tuberculosis treatment, reasons and associated factors among TB patients attending at Gondar town health centers, Northwest Ethiopia. *BMC Research Notes*, 11, 1-8.
25. Mohanna, M. (2010). Self-medication with antibiotic in children in Sana'a City, Yemen. *Oman medical journal*, 25(1), 41.
26. Noman, M. Z. I., Islam, S., Aktar, S., Parray, A. A., Amando, D. G., Karki, J., ... & Hossain, S. A. S. (2024). Healthcare seeking behavior and delays in case of Drug-Resistant Tuberculosis patients in Bangladesh: Findings from a cross-sectional survey. *PLOS Global Public Health*, 4(1), e0001903.
27. Rabahi, M. F., Silva, J. L. R. D., Ferreira, A. C. G., Tannus-Silva, D. G. S., & Conde, M. B. (2017). Tuberculosis treatment. *Jornal brasileiro de pneumologia*, 43(06), 472-486.
28. Raihan, M. A., Islam, M. S., Islam, S., Islam, A. M., Ahmed, K. T., Ahmed, T., ... & Lamisa, A. B. (2024). Knowledge, attitudes, and practices regarding antibiotic use in Bangladesh: Findings from a cross-sectional study. *PloS one*, 19(2), e0297653.
29. Reynolds, M. (2020). A Systematic Review to Examine the Effectiveness of Antibiotic Educational Programs in Outpatient Settings at Reducing Antibiotic Prescribing?.
30. Sakeena, M. H. F., Bennett, A. A., Carter, S. J., & McLachlan, A. J. (2019). A comparative study regarding antibiotic consumption and knowledge of antimicrobial resistance among pharmacy students in Australia and Sri Lanka. *PloS one*, 14(3), e0213520. doi: 10.1371/journal.pone.0213520.
31. Sarker, M. S., Nath, S. C., Ahmed, I., Siddiky, N. A., Islam, S., Kabir, M. E., & Bupasha, Z. B. (2024). Knowledge, attitude, and practice towards antibiotic use and resistance among the veterinarians in Bangladesh. *PloS one*, 19(8), e0308324.
32. Scaioli, G., Gualano, M. R., Gili, R., Masucci, S., Bert, F., & Siliquini, R. (2015). Antibiotic use: A cross-sectional survey assessing the knowledge, attitudes, and practices amongst students of a school of medicine in Italy. *PloS one*, 10(4), e0122476.
33. Sultana, S., Salwa, M., Towhid, M. I. I., Islam, S. S., & Haque, M. A. (2022). Challenges for tuberculosis control at selected primary healthcare centers in Bangladesh: A mixed-method study. *Indian Journal of Tuberculosis*, 69(2), 134-140.
34. Uddin, M. S., Ahsan, T., & Sultana, H. (2023). Antibiotic Consumption Behaviour of Dental Patients Attending in Tertiary Hospital: Antibiotic Consumption Behaviour of Dental Patients. *Bangladesh Medical Research Council Bulletin*, 49(2), 91-97.
35. VITHAYATHIL, D. M. D., Dharman, D., Manohar, D., Merlin, N. J., Dharan, S. S., Vasavan, A., & Vinod, V. A. (2019). Students initiated ADR reporting activity in pharmacy colleges-a survey. *International Journal of Research in Hospital and Clinical Pharmacy*, 1(3), 78-81.
36. World Health Organization. (2024). Global tuberculosis report 2024.

11. ANNEX

1. Main Dataset (Attached with the zip file)

2. Do file of the statistical analysis (Attached with the zip file)

3. Explanatory variables

1	Age of the respondent	Categorical	age_category	The age of the patient in years. It has been classified into the following groups: 18-27 28-37 38-47 48-57 58 & above
2	Residence of the respondent	categorical	q2_Residence	The residence of the respondents were categorized into 2 categories: 1. Urban: If the patient lived within Kamrangirchor area 2. Peri-Urban: If the patient lived across the river Buriganga and had to cross the bridge
3	Gender of the respondent	Categorical	q3_Gender	Categorized as 1.Male 2. Female 3. Others

4	Education level of the respondent	Categorical	Education_category	Years spent in Education. No Education= 0 years Primary= 1-5 years High School = 6-8 years Secondary = 9-10 Higher Secondary = 11-12 University = 13 and above
5	Occupation	Categorical	q7Type_of_occupation	Five types of occupation: 1. Skilled Salaried worker: Individuals with training and educational degree, mostly desk jobs. Has a fixed salary every month. 2. Semi skilled: Some level of education with a job that doesn't require much qualification. No fixed salary per month. 3. Unskilled: Individuals with temporary jobs 4. Unemployed: No jobs 5. Student: Enrolled in any educational degree 6. Housewife: Home makers

6	Last months income	Categorical	q9Financial_situation_last_mont	Surplus: Had excess of income Break even: Income was equal to expenses Moderate deficit: Had to loan some money High deficit: At least one member of the family starved
7	Internet access	Categorical	q26Internet_access	Had internet access or not
8	Exposure to AMR awareness campaign	Categorical	q29AMR_awareness_campaign	Ever been to any AMR awareness campaign
9	Reading AMR Based article	Categorical	q30Reading_AMR_based_article	Reading AMR based article in the internet or newspaper
10	Education on AMR	Categorical	q31AMR_based_education	Has anyone ever given any education on AMR
11	Education on Tuberculosis	Categorical	q15_1Received_education_about_	Has anyone given education about Tuberculosis
12	Antibiotics in Tuberculosis treatment	Categorical	q18Antibiotics_in_AntiTB_drugs	Does Tuberculosis medicine have antibiotics in them
13	Tuberculosis is a Bacterial disease	Categorical	q19TB_Bacterial_disease	Is tuberculosis a Bacterial disease

14	Effect of Antibiotics on Bacterial diseases	Categorical	effect_bacterial	201. Antibiotics are effective for the treatment of bacterial infections 1. Yes 2.No 3. Don't know
15	Effect of Antibiotics on Viral diseases	Categorical	effect_viral	202. Antibiotics are effective for the treatment of viral infections 1. Yes 2.No 3. Don't know
16	Defining Antibiotic	Categorical	defi_antibiotic	203. Loss of effectiveness of an antibiotic is antibiotic resistance 1.Yes 2.No 3. Don't know
17	Reason for Antibiotic resistance	Categorical	reason_antibiotic_resis	204. Antibiotic resistance creases due to missing of an antibiotic dose 1.Yes 2.No 3. Don't know

18	Risk of AMR	Categorical	risk_resistance	205. The more we use antibiotic, the higher the risk that resistance develops 1.Yes 2.No 3. Don't know
19	Risk of resistance	Categorical	resis_without_prescription	206. Antibiotic resistance can develop due to use of antibiotic without doctor's prescription 1.Yes 2.No 3. Don't know
20	Partially completing Antibiotic course	Categorical	stop_using_anti	207. After feeling better, one can stop a partially completed antibiotic dose 1.Yes 2.No 3. Don't know
21	Total knowledge score	discrete	Knowledge_Total_score	Sum of Score of q201 to q208. Total score out of 8 points
22	Total Attitude score	discrete	Attitude_total_score	Sum of Score of q301 to q308, total score out of 8 points
23	Total Practice score	discrete	Total_Practice_Score	Sum of Score of q401 to q404, total score out of 4

4. Scoring Manual

The Scoring manual is given below:

Knowledge of AMR Questions

Sl. No	Question	Codes			Correct response	Points
		Yes=1	No=2	Don't know=3		
201.	Antibiotics are effective for the treatment of bacterial infections	Yes=1	No=2	Don't know=3	Yes=1	1
202.	Antibiotics are effective for the treatment of viral infections	Yes=1	No=2	Don't know=3	No=2	1
203.	Loss of effectiveness of an antibiotic is antibiotic resistance	Yes=1	No=2	Don't know=3	Yes=1	1
204.	Antibiotic resistance increases due to missing of an antibiotic dose	Yes=1	No=2	Don't know=3	Yes=1	1
205.	The more we use antibiotic, the higher the risk that resistance develops	Yes=1	No=2	Don't know=3	Yes=1	1
206.	Antibiotic resistance can develop due to use of antibiotic without doctor's prescription	Yes=1	No=2	Don't know=3	Yes=1	1
207.	After feeling better, one can stop a partially completed antibiotic dose	Yes=1	No=2	Don't know=3	No=2	1
208.	Antibiotic resistance can develop due to misuse of antibiotic	Yes=1	No=2	Don't know=3	Yes=1	1
	Total score					8

Attitude of AMR questions

Sl No.	Questions	Codes			Correct Response	Points
		Agree=1	Disagree=2	Neutral=3		
301	Antibiotics are safe, so they can commonly be used	Agree=1	Disagree=2	Neutral=3	Disagree=2	1
302	Without prescription, sale of antibiotics should be banned	Agree=1	Disagree=2	Neutral=3	Agree=1	1
303	Surplus/ unused antibiotics can be saved for future use or to give someone else	Agree=1	Disagree=2	Neutral=3	Disagree=2	1
304	Antibiotics speed up the recovery from most coughs and colds	Agree=1	Disagree=2	Neutral=3	Disagree=2	1
305	It is okay to take antibiotics based on the suggestion of a medicine seller	Agree=1	Disagree=2	Neutral=3	Disagree=2	1
306	I should take antibiotics to avoid getting a more severe illness, when I suffer from cough and cold	Agree=1	Disagree=2	Neutral=3	Disagree=2	1
307	Antibiotic speeds up recovery when I get a fever	Agree=1	Disagree=2	Neutral=3	Disagree=2	1
308	If a doctor does not prescribe an antibiotic when I think one is needed, I will go to another doctor	Agree=1	Disagree=2	Neutral=3	Disagree=2	1
	Total score					8

Practice of AMR questions

Sl No.	Questions	Codes					Correct Response	Point
401	Before using antibiotics, do you ask a doctor?	Yes=1	No=2	---	---	---	Yes=1	1
402	Do you always fulfill the antibiotic course?	Yes=1	No=2	---	---	---	Yes=1	1
403	How do you mostly intake antibiotics?	1. Physician's prescription	2. Self-medication	3. Suggested by friends/relatives	4. Suggested by medicine seller	5. According to previous prescription	1. Physician's prescription	1
404	After taking some doses of antibiotics, if you feel better, do you still complete the full dose of treatment?	Yes=1	No=2	---	---	---	Yes=1	1
	Total score							4