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Irrational Use of Antibiotics and Antibiotic Resistance in Southern Rural Bangladesh: Perspectives from Both the Physicians and Patients

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Authors' contributions

This work was carried out in collaboration between all authors. Authors KBS and AS designed the questionnaire, performed literature search and statistical analyses and wrote the first draft of the manuscript. Authors NHH and RU designed the study, wrote the protocol, RU supervised the study and wrote the final draft. All authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Aims: Antibiotic resistance is one of the widely recognized public health challenges in Bangladesh. The present study was aimed to analyze the current status of irrational use of antibiotics in rural Bangladesh and to explore the views from both physicians' and patients' perspective.

Study Design: Population based survey.

Place and Duration of Study: The survey was conducted among 6,000 patients and 580 physicians in the rural areas of Dhaka and Rajshahi divisions of Bangladesh from July 2012 to December 2012.

Methodology: The survey followed a face-to-face interview protocol. 24 Upazila Health Complexes and 112 Union Health Centers of Dhaka and Rajshahi divisions were conveniently surveyed by trained volunteer interviewers. Two separate survey questionnaires were developed for physician and patient survey.

Results: From the physician survey it was found that significantly more doctors prescribe

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antibiotics in suspected infections ($P<.0001$). Around forty-four (44.1) percent doctors prescribe antibiotics in cold and fever before diagnosis. A significant proportion of physicians never receive any feedback about the antibiotic they prescribe (31.9%, $P<.0001$) and more than 50% doctors claimed that they receive feedback occasionally, not always ($P<.0001$). According to the physician's patient non-compliance is the main cause of antibiotic resistance in the country (68.8%). Though 48.6% patients think that it is important to strictly follow the doctor's prescription, a significant percentage believe that it is not always necessary (26.7%, $P<.0001$) and more than 50% patient stop taking the antibiotic as soon as the symptoms disappear, while only 25.2% patient complete their full course. Only 6.3% patients consult their doctor if they miss the dose of an antibiotic and more than 50% take the next dose on time ($P<.0001$). When a drug does not work the patient usually consider the doctor is incompetent (25.6%) and many (24.5%) believe that the quality of the drug is not up to the mark.

Conclusion: The result of this survey indicates that the antibiotics are used among the rural people in irrational way. To overcome this situation close supervision of the relevant authority is required in order to minimize the growing antibiotic resistance in Bangladesh.

Keywords: Antimicrobial resistance; Bangladesh; overuse; patient compliance; rational use of antibiotic.

1. INTRODUCTION

Antibiotics are drugs which have saved and still saving hundreds of thousands lives every year. But the other side of the coin offers us "antibiotic resistance" which is a serious and one of the most threatening healthcare problems worldwide [1-6]. There are two hypotheses; [7] with sufficient evidence behind the cause of prevailing resistance problem of antibiotics. While according to the first one - resistance is an ancient and genetically rich natural phenomenon, according to the second hypothesis- widespread antibiotic resistance is a modern phenomenon which is linked to human use of the drug. However, whether it is a modern or ancient phenomenon, it is obvious that low cost pharmaceuticals, preventative medication with broad spectrum antibiotics and overuse of these drugs contribute significantly to the emergence of bacterial drug resistance [1,8,9].

Antibiotics are irrationally used in Bangladesh like many other developing countries which results from widespread availability of these drugs, causing inappropriate use and ultimately resulting in steady increase in antibiotic resistance [10,11]. As a Third World country most of the people live under the poverty line. People are encouraged to buy drugs from unofficial distributors because drugs are often not available in government hospitals. Moreover, many people; especially the poor, largely rely on informal healthcare providers [12] and factually they are not qualified enough to offer quality health service for the community [13]. However, the patients have access to drug, both non-prescription, including nutritional supplements and over the counter (OTC) drugs, and prescription items.

The main objective of this study was to explore whether the antibiotic administration is rational or not among the rural people of Bangladesh as well as to determine the awareness of rural people toward the rational use of antibiotics. Physician's perspective regarding prescribing antibiotics and facts finding about antibiotic resistance was also studied in the present survey.

2. METHODOLOGY

2.1 Participants

Twenty-four Upazila Health Complexes and 112 Union Health Centers of Dhaka and Rajshahi divisions (Fig. 1.) were conveniently surveyed as part of our ongoing nationwide survey [14] from July 2012 to December 2012. The survey was aimed to analyze the overall situation with regards to antibiotic usage both from patient's and physician's perspective. A total of 580 physicians and 6,000 patients were surveyed. Though it was possible to conduct the survey in a much smaller population, we preferred to work with a large sample size due to high population density in the country as well as to get high statistical power and accuracy from the study. The survey followed a face-to-face interview protocol and all the participants were informed about the purpose of the study by responsible interviewer before they answered the questions and it was also made clear to the participants before question answering that the survey is voluntary.

A registered physician practicing in the Upazila Health Complexes and Union Health Centers were included in the study. A patient coming to the Upazila Health Complexes or Union Health Centers with such a case where antibiotic has been prescribed, aged 18 and above 18 years, both male and female and permanently living in the study area were surveyed. Any patient visiting the area of the study but not living permanently was excluded from the survey. Patients under the age of 18 years were excluded from the study for the purpose of convenience.

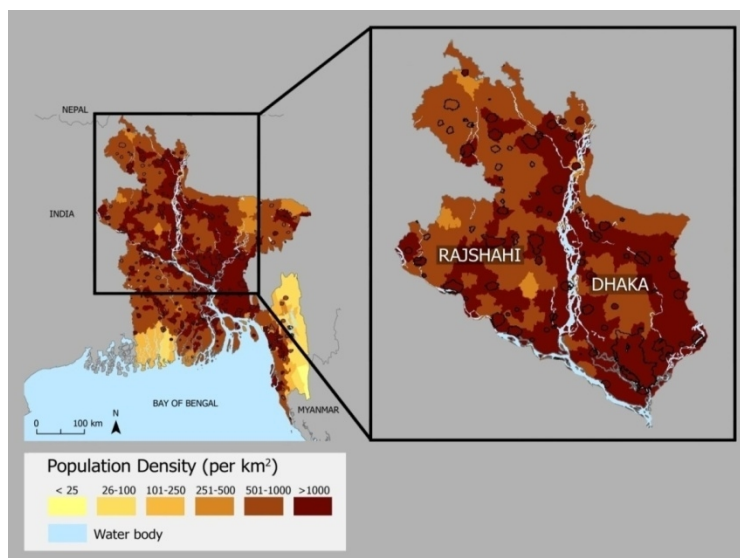


Fig. 1. Area of Southern Bangladesh (Rajshahi and Dhaka Division) where the survey has been conducted

2.2 Questionnaire Design

The survey questionnaire which consisted of open, close ended and multiple choice questions was developed based on information drawn from relevant literatures pertaining to

rational use of antibiotics at the primary healthcare level of some developing countries. Separate questionnaires were prepared for physician and patient survey. Questionnaire for physicians covered their tendency to make antibiotic prescription in terms of frequency, disease severity, justification of the ground of antibiotic prescription at any given clinical condition and other relevant information. On the other hand, questionnaire for patient survey covered basic questions related to their illness, their trend to stick to doctor's prescription and related information. All the volunteer interviewers who were 4th year Bachelor of Pharmacy students from the Department of Pharmacy, Stamford University Bangladesh were trained to answer the potential respondents about the purpose and other details of the study. Questionnaires were given only to the spontaneously interested candidates during the survey. The survey questionnaires were pilot-tested prior to the main survey. No multi-response answers for single-response questions were considered for data interpretation. The interviewer had the theoretical as well as practical knowledge of data collection techniques.

2.3 Statistical Analyses

Statistical analyses were performed using MedCalc statistical software for Windows, Belgium (Version 12.7.2). Patient's demography is reported as frequency distribution using univariate analysis. Descriptive statistics are reported as odds ratios with 95% confidence interval. A *P* value <0.05 was considered as significant.

3. RESULTS AND DISCUSSION

Socio-demographic characteristics of the patients participated in the study are presented in Table 1 from which it is evident that representation of patients from different age, sex, educational level and socio-economic status was ensured.

Table 1. Socio-demographic characteristics of the patients

Socio-demographic Characteristics		Frequency (N=6000)	Percentage (%)
Sex	Male	3890	64.83
	Female	2110	35.17
Age (in years)	18-30	2469	41.15
	31-40	1365	22.75
	41-50	981	16.35
	51-60	712	11.87
	≥ 60	473	7.88
Education	No education	1576	26.27
	Below SSC	2238	37.30
	SSC-HSC	1251	20.85
	Graduate or above	935	15.58
Occupation	Business	718	11.97
	Service	557	9.28
	House Wife	1089	18.15
	Student	1463	24.38
	Farmer	2105	35.08
	Others	68	1.13

3.1 Physicians' Survey

It was found that most of the doctors prescribe antibiotics in suspected infection (61.0%, OR: 2.82, CI: 2.22-3.58, $P<.0001$) rather than being confirmed about the infection. Again, according to majority of the doctors, though not significant ($P=0.0599$), they prescribe antibiotics in cold and fever before diagnosis. It was found that more than 50% of the physicians do not always receive any feedback about completion of dosage regimen from their patients (OR: 5.80, CI: 4.40-7.65, $P<.0001$). Moreover, a significant proportion of physicians claimed that they never receive any feedback from their patients in this regard ($P<.0001$). According to their response, the prime cause of antibiotic resistance in Bangladesh is patient's non-compliance with the prescription (68.8%, OR: 29.76, CI: 20.64-42.92, $P<.0001$), whereas antibiotic overuse is the second main issue which causes the resistance problem, according to them. Responses from the physicians about antibiotic prescription, patient adherence with the prescription and cause antibiotic resistance are summarized in Table 2.

Table 2. Responses regarding antibiotic prescription from the physician survey

Query	Response (n= 580)	%	OR (95% CI), P^*
In which situation you prescribe an antibiotic?	Confirmed infection	35.7	-
	Suspected infection	61.0	2.82 (2.22-3.58), <0.0001
	Others	3.3	0.06 (0.04-0.1), < 0.0001
Do you prescribe antibiotic in Cold/Fever/ARI before diagnostic tests?	Yes	44.1	-
	No	49.7	1.25 (1-1.57), 0.0599
	Occasionally	6.2	0.08 (0.06-0.12), < 0.0001
Do you receive feedback about the antibiotic prescription from your patient?	Always	15.9	-
	Not always	52.2	5.80 (4.40-7.65), <0.0001
	Never (no reporting)	31.9	2.48 (1.87-3.30), <0.0001
What do you think is the main reason of antibiotic resistance?	Wrong selection of antibiotics	6.9	-
	Non-compliance with the prescription	68.8	29.76 (20.64-42.92), <0.0001
	Overuse	14.5	2.29 (1.54-3.40), <0.0001
	Others	9.8	1.47 (0.97-2.24), 0.0727

*Abbreviations: OR: Odd ratio, CI: Confidence interval

3.2 Patient's Survey

It was found from patient's survey that cold, fever and acute respiratory infections (ARIs) were prevalent (41.91%) causes that brought the patients to a physician, followed by diarrhea which was found to be as high as 25.3%. A significant portion of patients believe that it is not always important to follow the prescription (26.7%, $P<.0001$). Almost 50% patient stop taking the prescribed medication just after the symptoms disappear (OR: 3.02, CI: 2.79-3.26, $P<.0001$), while only 25.2% patient complete the dosage regimen as prescribed by their physicians. In case a patient misses a dose of the drug only 6.3% patients consult immediately with their doctor and most of them (51.2%) take the next dose as per the time schedule, whereas, a significant portion of patients (23.0%, OR: 4.44, CI: 3.94-5.01, $P<.0001$) just double the next dose of the drug. Patient's perspective about

antibiotic use, adherence with the prescription and knowledge of antibiotic use are summarized in Table 3.

Table 3. Selected responses from patient survey

Query	Response (n= 6000)	%	OR (95% CI), P*
Do you think you should strictly follow the prescription of your doctor?	No	14.7	-
	Yes	48.6	5.49 (5.03-5.99), <0.0001
	Not always	26.7	2.11 (1.93-2.32), <0.0001
	No answer	10.0	0.64 (0.58-0.72), <0.0001
When you stop taking the antibiotic prescribed by your doctor?	After completion of full course	25.2	-
	After disappearance of the symptoms	50.4	3.02 (2.79-3.26), <0.0001
	When I feel comfortable	15.8	0.56 (0.51-0.61), <0.0001
	No answer	8.6	0.28 (0.25-0.31), <0.0001
What do you do when you miss a dose of the drug?	Consult my doctor immediately	6.3	-
	Double the next dose	23.0	4.44 (3.94-5.01), <0.0001
	Take next dose on time	51.2	15.60 (13.90-17.52), <0.0001
	Start from next day	13.4	2.30 (2.03-2.62), <0.0001
	No answer	6.1	0.97 (0.83-1.12), 0.6497
If your drug does not work, fail to cure infection, how you interpret the situation	The doctor is not qualified, I should change the doctor	25.6	-
	Quality of drug is not good	24.5	0.94 (0.86-1.02), 0.1644
	Doctor prescribed wrong medicine	20.9	0.77 (0.71-0.84), <0.0001
	No answer	29.0	1.19 (1.10-1.29), <0.0001

*Abbreviations: OR: Odd ratio, CI: Confidence interval

Antibiotics are one of the most used drugs worldwide [15]. Irrational use of these agents is associated with allergic reactions, toxicities, super infection and more importantly the development of antimicrobial resistance. Antibiotics are, frequently prescribed irrationally in terms of type, dose, duration and indication. In Bangladesh, misuse and waste of antibiotics appear to be frequent. Over the counter availability of all types of antibiotics has worsened the situation. Development of a progressively antibiotic resistant microbial ecosystem in Bangladesh is thought to be evoked due to widespread and irrational use of antibiotics [16].

As per standard procedure, identification of pathogen is necessary for prescribing an antibiotic. But the present study found that only 35.7% physicians prescribe antibiotics when the infection is ascertained by diagnostic tests. Some of the common causes that contribute to the development of antimicrobial resistance are unnecessary use of antimicrobial drugs, inappropriate dose and inadequate duration of therapy [17]. The present study supports the previous findings [17,18]. Health workers in many developing countries including Bangladesh have almost no access to objective health information [19]. Over-statements and misinformation is very common in Bangladesh, which greatly influences doctors' prescribing behaviors. Currently, drug companies are the only organizations in Bangladesh to provide information to health personnel and the information supplied is often not consonant with recommendations from public health bodies [20]. Along with bribe in the form of cash, a large number of doctors accept various gift items including free air ticket for foreign trips, computers, mobile phones, air conditioners, table lights, telephones, towels,

calendars, paperweights, pens and what not. Ultimate result is prescriptions of inappropriate or unnecessary and expensive medicines [21]. Recent study showed that about half of the antibiotics were sold without any prescriptions, and even ordinary people without any knowledge of medicine asked the drug seller for specific antibiotics [18]. Rural people do not always do what the prescribers advise them to do. Financial ability, however, is not the sole influence, as it was observed that people who could pay did not always purchase all the prescribed drugs [22] and this survey finding also complies with previous results. Among all other causes of antibiotic resistance there could be three causes those are responsible for antibiotic resistance; first, inappropriate prescriptions [23] which are prevalent in the country due to poor consulting period (a mean of only 54 seconds was recorded in a Bangladeshi study in 1994) of doctors in Bangladesh [24] and it is estimated that more than half of medicines are inappropriately prescribed, dispensed or sold [25]. Second, because patients often travel long distances and incur large expenses for medical care, they are unlikely to return for follow-up visits, and finally, because many drugs are expensive, indigent patients purchase incomplete regimens whenever possible and discontinue treatment when symptoms disappear but before the pathogen is eliminated [26].

To improve the overall antibiotic use, especially in developing countries, international agencies like World Health Organization (WHO) and International Network for Rational Use of Drugs (INRUD) have applied themselves to evolve standard drug use indicators [27,28]. However, we have seen earlier that in the 3rd meeting of World Healthcare-Associated Infections Forum (HAI) recommended to include training in bacterial resistance with other priority actions for the human and veterinary healthcare communities. They also argued for priority based actions to be taken for the general population including conduction of awareness campaigns [29]. We recommend that Bangladesh should adopt its own policy to reduce the problems associated with antibiotic resistance, educate people to use drugs in a rational way and encourage the physicians to be more evidence oriented before prescribing an antibiotic.

4. CONCLUSION

The results of this study represent the current situation of antibiotic use in the rural area of Bangladesh. Similar study should be conducted throughout the country to get the current antibiotic prescribing pattern and usage scenario throughout the country. Educational interventions to promote rational use of antibiotic and awareness of deleterious impact of irrational prescribing habit on the community and all members of the health care system are needed. Mass awareness campaigns or public healthcare campaigns should be introduced to address the use and misuse of antibiotics.

CONSENT

As it was a non invasive questionnaire based survey only oral consent was taken from the participants.

ETHICAL APPROVAL

All information provided by the respondents was held in strict confidence, and the study eliminated the possibility of future identification of the respondents. The study posed no risk to participants, as questionnaire did not include any sensitive questions and it took around 10 min in average for participant to answer questions. There were no incentives for

participation in the study. Participants did not benefit personally through their participation in the study. The study protocol was approved by the Institutional Ethics Committee, Stamford University Bangladesh (Reference number: SUB/SHUM/12.04).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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