Antibiotic usage at a primary health care unit in Bangladesh.

Fahad B.M. [1], Matin A[2], , M.C. Shill[3], Asish K.D.[4]

1. B.Pharm, North South University, Dhaka, Bangladesh. 2. PharmD, (USA), Assistant Professor, North South University, Dhaka, Bangladesh , 3. B.Pharm, Coordinator- In-Patient Department Pharmacy, Square Hospitals Ltd. , Dhaka, Bangladesh, 4. PhD, Associate Professor, Pharmacy Discipline, Khulna University, Khulna, Bangladesh.

RESEARCH

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Corresponding Author:
Arif Matin.
House 17, Road 3, Sector 3, Uttara, Dhaka-1230, Bangladesh.
Email: arifmatin@gmail.com

Abstract

Background
Antibiotics are one of the most expensive and frequently used medications in clinical settings. To achieve a better of antibiotic usage in Bangladesh, a pilot study was carried out at a primary health care unit in Bangladesh.

Method
The study involved the analysis of treatment records for 150 in-patients at a Primary Health Complex in Bangladesh from January 2009 to June 2009.

Results
Antibiotic prescription was the highest for those aged 5 to 11, and above 65 years. Males had 20% more antibiotics than females. The highest prescribed antibiotic was Ceftriaxone (30.19%) followed by Cefixime (18.87%), and Amoxycillin (16.98%). Antibiotics were most frequently prescribed for physical assault, general weakness, acute watery diarrhea, acute trauma, gastrointestinal symptoms and respiratory diseases. Two or more antibiotics were used in 8-19% of cases and were prescribed mostly for physical assault, gastrointestinal symptoms and acute watery diarrhea. The average cost of each prescription was Bangladeshi Taka (BDT) 238.50 and the antibiotics accounted for BDT 136.30. The group who received antibiotics paid on average BDT 105.90 more than the group not receiving an antibiotic.

Conclusion
These results suggest possible antibiotic misuse in some diagnoses and age groups.

Key Words
Antibiotics, Usage pattern, Primary Health Care, Bangladesh, Prescription, Diagnoses.

Background

One of the most costly, frequently and commonly used categories of medications is antibiotics. Not only do these drugs have the potential for adverse effects but inappropriate use may also lead to resistant infections. [1-3] For the past two decades antibiotic resistance has become a major problem in the public health as the prevalence of multi-drug resistant bacteria is growing and the availability of new antibacterial agents is limited. [4,5] Bacterial resistance is one of the major causes of failure in the treatment of infectious diseases and results in increased morbidity, mortality, and costs.[6] The literature suggest that this global phenomenon needs to monitored and tackled.[7]

Studies conducted in Bangladesh suggested that *Pseudomonas aeruginosa* responsible for wound, urine, ear, throat and other infections were more than 50% resistant to commonly used antibiotics used

in Bangladesh[8] including ciprofloxacin, gentamicin, ceftriaxone, cefixime and azithromycin. Azithromycin was 100% ineffective in wound and urine infections, while ceftriaxone and cefixime was 100% ineffective in tracheal infections.[8] Another study in Bangladesh also reports that *E.Coli* was resistant in 40% of cases to commonly used ceftriaxone, levofloxacin, ciprofloxacin, amoxicillin and ampicillin and 95% resistant to azithromycin. *Klebsiella pneumoniae* also showed similar patterns[9]

Inappropriate prescribing and use of antimicrobial agents continue to be global problems; reasons include the demand for antibiotic treatment even when not indicated. Lack of understanding about the ineffectiveness of antibiotics against viral illness and the worldwide and uncontrolled availability of antibiotics are contributing factors. Moreover the clinician's desire to satisfy the patient, and pressure to address the wants of the individual rather than to consider the overall population. [10-12] The problem of antibiotic resistance has also been linked with overuse of antibiotics in Bangladesh due to iself-prescribing and over-the-counter availability. [9] But adequate data has not presented to provide robust evidence. Although some hospitals in Bangladesh have maintained records of their antibiotic usage this data is rarely reported in literature and there have been no studies to assess and examine the usage pattern of antibiotics in primary care units of Bangladesh. This pilot study aims to explore the prescribing patterns of antibiotics at one primary healthcare unit.

Method

Retrospective treatment and medication record data of 150 patients who were admitted as in-patients at a primary health Complex were collected from January 2009 to June 2009 with an average of 25 patient records per month. The first 150 cases were selected based upon availability of complete patient records with adequate documentation. However incomplete patient records were excluded. Records were maintained by the superintendent Nurse in charge. All diagnoses and treatment decisions were made by the Resident Medical Officer (RMO) or authorized physicians or surgeons at the hospital. The treatment record sheets included age, sex, diagnosis and medication prescribed. The number of antibiotics and their percentages prescribed in all patients were analyzed by age group and by gender. Also the cost of antibiotics, the types and number of antibiotics used, and details of antibiotics when used in combination were also noted. Finally the top 7 diagnoses where the antibiotic usage was the highest were identified and their prescribing patterns were studied.

Results

Comparing antibiotic usage pattern at various age groups

Table 1 and Figure 1 compares the amount of antibiotics prescribed at various age groups. It shows that antibiotics were most commonly prescribed in patients older than 65 years of age and also in young children between the ages of 5 to 11 years. Antibiotic prescriptions were relatively uncommon for people aged 35 to 49 and 50 to 65.

Comparing antibiotic usage pattern by gender:

Table 2 shows the variations of the amount of antibiotics in females vs. males. The male group received 20% higher percentage of antibiotics.

Comparing antibiotic usage pattern of various antibiotics:

Table 3 and Figure 2 show the extent of usage of various antibiotics that are available in Bangladesh. Ceftriaxone, a third generation cephalosporin is by far the most used antibiotic (30.2%, 95%CI: 22.2 -39.5%). Following it is cefixime, another third generation cephalosporin and it was used 18.9% of the time (95%CI: 12.5-27.4%). Amoxycillin, ciprofloxacin, metronidazole and cefuroxime follows the list. The least used antibiotics were Cefepime and Erythromycin.

Comparing antibiotic usage pattern in the top 7 Diagnoses (based on highest antibiotic usage)

Physical assault, general weakness, acute watery diarrhea, acute trauma, gastrointestinal distress (GID), respiratory diseases and post partum cases in descending order were the top seven classes of diagnoses which resulted in most frequent antibiotic prescriptions. Ceftriaxone, Cefixime and other cephalosporins were most frequently used in physical assaults, while in general weakness and acute traumas Amoxycillin usage was very prominent too in addition the previously mentioned antibiotics. Both Ciprofloxacin and Metronidazole were used in 50% (95%CI: 23.7to 76.3%) of all acute watery diarrhea cases while Ceftriaxone was used in 20% (95%CI: 4.6 to 52.1%) of the cases. In 28.6% (95%CI: 11.3 to 55.0%) of GID cases Ceftriaxone was used. Amoxycillin seemed to be the most commonly used antibiotic (57.4%, 95%CI: 25.0 to 84.2%) in respiratory diseases

followed by Ceftriaxone (14.3%, 95% CI: 0.5 to 53.4%) and other cephalosporins (14.3%, 95%CI: 0.5 to 53.4%). Ampicillin was prescribed in all post partum cases (95%CI: 29 to 100%) while Amoxycillin, ciprofloxacin and metronidazole were prescribed in 50% (95%CI: 9.5 to 90.6%) of all cases.

Analysis of amount of antibiotic used and detailed Analysis of combination antibiotic therapy usage

Table 4 shows the frequency of combination antibiotic therapy in various diagnoses. Antibiotic usage was highest in March 2009. This probably occurred because of the high prevalence of diarrhea in March [35]. A combination of two antibiotics were prescribed for 12.7% of the total population of patients (95%CI: 8 – 19%) while 3 antibiotic combination were received by 0.01% (95%CI: 0.06 to 5%). These combinations were mostly generated in January and March 2009. Combination therapies were most common in patients diagnosed with physical assault with 22.7% (95%CI: 9.7 to 43%) of all combination therapies being prescribed in this class. Other cases where combination therapies were mostly used were acute watery diarrhea (95%CI: 6.7 to 39.1%), GID (95%CI: 3.9to 34.2%) followed by those with General Weakness and Partum cases.

Analysis of Cost profile of antibiotic usage

Figure 3 shows the contribution of the cost of antibiotics on the total prescription costs at various time periods. On an average, antibiotics accounted for Tk.136.3, while the total cost for the total prescription were Tk.238.5. The prescription costs averaged around Tk.102 where antibiotics had not been prescribed. The cost of total prescription for the group of patients who were receiving antibiotics was compared with those who were not receiving antibiotics. Paired t-test analysis revealed that the difference in the two groups were Tk.105.9 (p value of 0.049) with the antibiotic group incurring a cost of Tk.241.9 (where antibiotic itself accounted for Tk.134.9) while the average prescription costs for the non antibiotic group were Tk.148.2 which is almost half of the antibiotic group.

Discussion

Antibiotic usage is not closely monitored in Bangladesh, as in other developing regions of the world. Many authors have proposed restriction of antibiotic as over-the-counter medications.[13-20] Hospitals also account for antibiotic misuse worldwide due to non-evidence based practice.[21-25] Our study confirms that 71.14% (95% CI: 63.4-77.8) of total patients received antibiotics which is high compared to reports on antibiotic usages in other parts of Asia, Europe, or USA.[26-29] Antibiotics prescription rates in this study was found out to be particularly high in the geriatric and pediatric populations perhaps because the geriatric population are prone to infections [26] it probably accounted for the 100% (95% CI: 55.7-100%) prevalence antibiotics in all the prescriptions. But antibiotic usage is also particularly high among the age group of 5 to 11 years of age possibly because care givers of the children are more likely to insist upon an antibiotic prescription as they perceive it to be a panacea for their children's ailments. The patterns of antibiotic prevalence variations with age deduced in our study seemed to be consistent with previous published data. [30] In this study males were prescribed 20% more antibiotics compared to females. (p=0.0071) Higher prevalence of antibiotics in males also has been observed in previous studies. [30] These findings cannot be fully explained although we hypothesise that gender biased medical decisions may be a root cause because of the male dominance in the Bangladeshi culture.

In our research it was observed that cephalosporins accounted for more than 55% of total antibiotic used, where the highest uses were by Ceftriaxone, Cefixime, and Cefuroxime. This probably explains why Ceftriaxone and Cefixime have abnormally high resistances. [8, 9] This is probably a result of aggressive marketing practices on the physicians combined with inadequate knowledge of current treatment guidelines. Following the high usage of cephalosporin was Amoxycillin's usage. Probably its low cost made it the antibiotic of choice.

The diagnoses for which antibiotics were most common prescribed showed an interesting pattern. Physical assault accounted for the highest antibiotic usage. Acute water diarrhea caused a high antibiotic generation as well. It is an established fact that a bacterial etiology in acute watery diarrhea accounts for only around 25% cases. [31] Furthermore, established guidelines [32] suggest that antibiotics should not be the choice of treatment in most diarrhea cases. Antibiotic usages in respiratory diseases and Gastrointestinal Disease were also very high. But guidelines suggest reserving antibiotic use only if positive infection was observed. [33] Though conclusive statements cannot be made about the rationale for antibiotic prescription at this centre, there is not sufficient evidence for strong indications in all cases.

We note the higher cost of prescriptions for those who received antibiotics. Antibiotics constituted more than

half the cost of the total prescription. The government does not bear the cost of such medications but the patients may perceive pressure to comply having been admitted to hospital and despite their low income. The primary care centre hosting this study serves a population of low income rural people. The average daily income is in the range of Taka 50 for the majority of the rural population, [34] thus paying TK.105.9 extra is a burden.

Conclusion

These results suggest possible antibiotic misuse in some diagnoses and age groups, which add to the total cost of the prescriptions of the patients. We propose additional studies at other primary health care units situated in other parts Bangladesh to make generalisable conclusions for the whole country.

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PEER REVIEW

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests

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Figures and Tables

Table 1: Antibiotic Usage in different Age groups						
Age	Total Patient number	Number of Patients with Antibiotics	% Cases where antibiotics were prescribed	CI*(%)	Male	Female
<1	4	3	75.00	28.91 to 96.6	3	1
1 to 4	4	3	75.00	28.91 to 96.6	2	2
5 to 11	5	5	100.00	51.1 to 100	3	2
12 to 19	21	15	71.43	49.8 to 86.5	9	12
20 to 34	53	40	75.47	62.3 to 85.2	27	26
35 to 49	37	21	56.76	40.9 to 71.3	21	16
50 to 65	19	13	68.42	45.8 to 84.8	9	10
>65	6	6	100.00	55.7 to 100	6	0
Unknown	1					
Total	149	106	71.14	63.4 to 77.8	80	69
*CI=Confidence interval calculated by modified Wald method, at 95% confidence level						

Figure:1

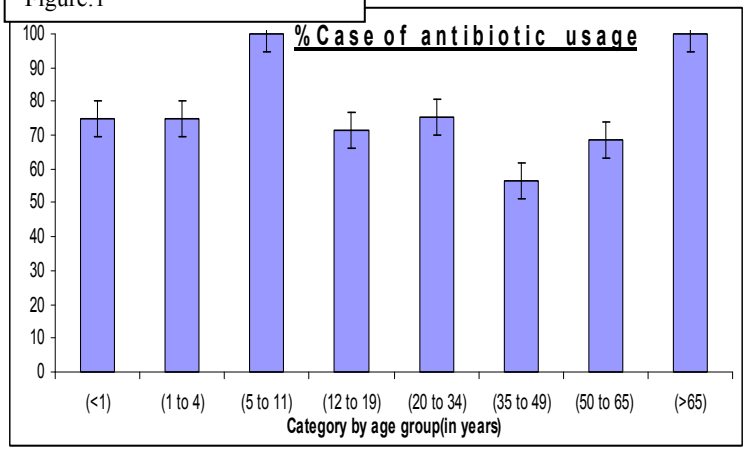

Table 2: Antibiotic Usage by gender					
Sex	Total	Antibiotic Cases	% Cases where antibiotics were prescribed	CI*(%)	Age range
Male	80	64	80	69.9 to 87.4	3months-90yrs
Female	70	42	60	48.3 to 70.7	10months-60years
Total	150	106	70.66667	62.9 to 77.4	3months-90yrs
The difference between the Male and Female antibiotic usage is 20%(95%CI:6%-34%), which is statistically significant (p-value is 0.0071(<0.05), calculated by unpaired t-test, t-value=2.7325, D.F=148)					

Table 3: Antibiotic Usage of different types of antibiotics			
Type of antibiotic	**Number**	**% Cases where antibiotics were prescribed**	**CI*(%)**
Total Antibiotics	106	100	
Ceftriaxone	32	30.19	22.2 to 39.5
Cefixime	20	18.87	12.5 to 27.4
Amoxycillin	18	16.98	10.9 to 25.3
Ciprofloxacin	11	10.38	5.7 to 17.8
Metronidazole	10	9.43	5.0 to 16.7
Cefuroxime	8	7.55	3.7 to 14.4
Azithromycin	6	5.66	2.4 to 12.1
Cloxacillin	6	5.66	2.4 to 12.1
Ampicillin	4	3.77	1.2 to 9.6
Flucloxacillin	4	3.77	1.2 to 9.6
Levofloxacin	4	3.77	1.2 to 9.6
Gentamicin	3	2.83	6.1 to 8.4
Cephradine	2	1.89	0.1 to 7
Cefepime	1	0.94	<1 to 5
Erythromycin	1	0.94	<1 to 5
*CI=Confidence interval calculated by modified Wald method, at 95% confidence level			

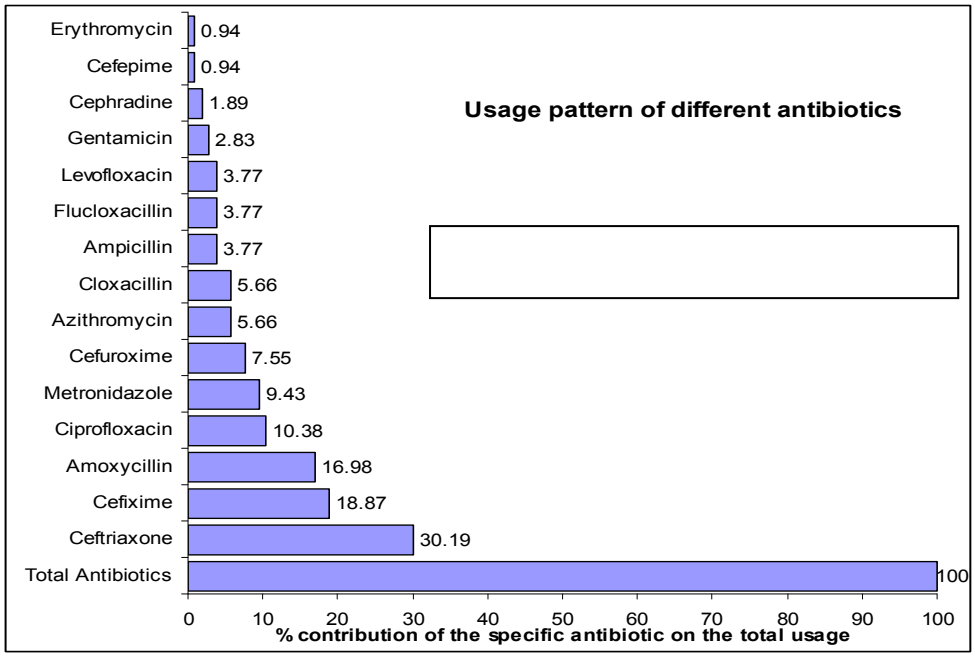

Table 4: Usage pattern of combination antibiotic therapy in different diagnoses			
Diagnoses	Number of cases	% of cases	CI*
Physical Assault	5	22.7	9.7 to 43.9
AWD	4	18.2	6.7 to 39.1
GI Distress	3	13.6	3.9 to 34.2
GW	2	9.1	1.3 to 29
Post Partum	2	9.1	1.3 to 29
Trauma	2	9.1	1.3 to 29
Ante Partum	1	4.5	<.01 to 23
Others	3	13.6	3.9 to 34.2
Total	22	100.0	
*CI=Confidence interval calculated by modified Wald method, at 95% confidence leve			

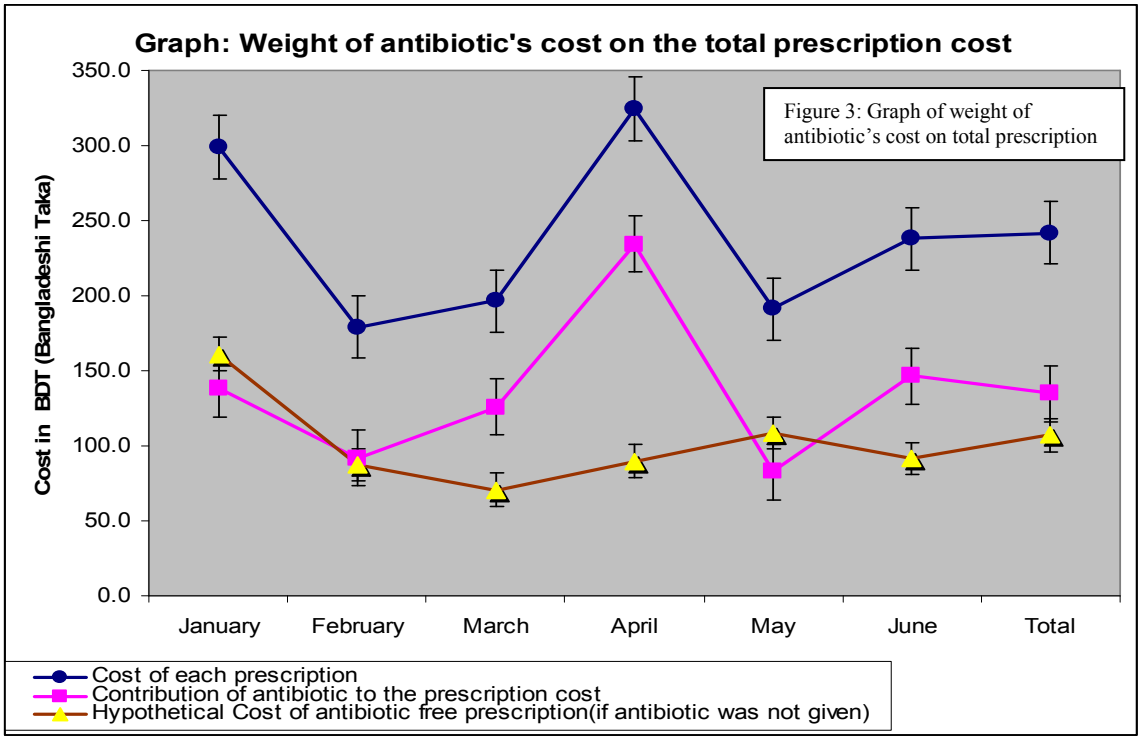

Figure 3: Graph of weight of antibiotic's cost on total prescription