OPEN ACCESS

Saudi Journal of Medical and Pharmaceutical Sciences

Abbreviated Key Title: Saudi J Med Pharm Sci
ISSN 2413-4929 (Print) | ISSN 2413-4910 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article **Pharmacology & Therapeutics**

Analysis of Antibiotic Use in Indoor Patients in a Tertiary Medical College Hospital from a Suburban Area

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DOI: https://doi.org/10.36348/sjmps.2025.v11i02.007 | **Received:** 13.01.2025 | **Accepted:** 17.02.2025 | **Published:** 22.02.2025

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Abstract

Background: Antibiotic overuse and misuse significantly contribute to antimicrobial resistance (AMR), particularly in developing countries like Bangladesh. Despite national and international efforts to combat this issue, inappropriate antibiotic prescriptions remain common in hospital settings. This study aimed to assess the quality of antibiotic prescriptions and identify the reasons behind irrational antibiotic use at Gonoshasthaya Samaj Vittik Medical College Hospital. ***Methods:*** A retrospective cross-sectional study was conducted involving 1007 patients admitted to the Pediatrics, Medicine, Surgery, and Obstetrics & Gynecology departments of Gonoshasthaya Samaj Vittik Medical College Hospital from October 2021 to December 2021. Data were collected through medical record reviews, and antibiotic use was analyzed based on the Standard Treatment Guidelines (STG) for Bangladesh. The rationality of prescriptions was determined by comparing them against the policy-cited choices or microbiological culture and sensitivity results. ***Results:*** Antibiotics were prescribed in 90.2% of cases, with 99.5% being administered empirically and only 0.5% based on culture sensitivity tests. Preoperative surgical prophylaxis was the most common reason for antibiotic use (39.3%). Approximately 34.2% of antibiotic use was deemed inappropriate, with incorrect duration being the most frequent cause (32.4%). Antibiotic misuse was highest in the Surgery (61.2%) and Medicine (56.1%) departments, while the Obstetrics & Gynecology department had the lowest misuse rate (1%). ***Conclusion:*** Irrational antibiotic use is a major issue in Bangladesh, contributing to growing resistance. Strict adherence to antibiotic guidelines, especially in surgical and medical wards is essential to curb misuse. This study highlights the need for ongoing audits and the development of hospital-specific antibiotic guidelines to combat AMR effectively.

Keywords: Antimicrobial resistance, Antibiotic guideline, Antibiotic misuse, Developing country.

INTRODUCTION

The most frequently prescribed medications among hospitalized patients are antibiotics [1]. Over the past 15 years, there has been a global increase in antibiotic usage, particularly in low and middle-income countries [2,3]. This rise in antibiotic consumption is correlated with an increased prevalence of antimicrobial resistance (AMR) [4,5]. Currently, South and Southeast Asia are identified as hotspots for antimicrobial resistance [6]. Bangladesh is one of the countries affected [7]. Thus AMR has become a restrained pandemic for the past few decades [8]. AMR is responsible for the death of 700,000 people every year and according to WHO, this number may reach ten million within the next twenty-five years [9].

Antibiotic guidelines provide recommendations to healthcare providers regarding appropriate antibiotic use, aiming to minimize unnecessary prescriptions. These guidelines play a crucial role in combating antibiotic-resistant bacteria, promoting high-quality clinical practices, and reducing unnecessary healthcare expenditures [10].

In developing countries, 44-97% of antibiotics are prescribed to hospitalized patients, a staggering proportion that is largely unnecessary and inappropriate [11]. The rapid escalation in antimicrobial resistance rates in these nations can be attributed to several factors, including the global overuse of antibiotics [12], their utilization in non-medical sectors, [13,14] substandard medication quality, [15] public unawareness, [16] and national economic challenges such as malnutrition, chronic or recurrent infections, inadequate healthcare services, and the unaffordability of expensive drugs [17,18]. Numerous investigations have underscored the detrimental effects of unnecessary antibiotic administration by healthcare providers, self-medication practices among patients, and the excessive use of antibiotics in agriculture throughout the country, positioning Bangladesh among the nations grappling with antibiotic resistance in South Asia [19].

Gram-positive bacteria as well as gram-negative bacteria are now becoming resistant to antibiotics very quickly. The new challenge is to treat multidrug-resistant gram-positive and gram-negative bacteria, which are sometimes untreatable with conventional antibiotics, [20] which is mainly due to the lack of initial organism identification and culture sensitivity testing in most healthcare centers, along with the unnecessary and widespread use of broad-spectrum antibiotics. In addition to poor infection control, resistant bacteria can easily spread to other patients and the environment [21]. It is now a well-established fact that the environment plays a pivotal part in acting as a storehouse of AMR organisms and spreads antimicrobial-resistant genes (ARG) [22].

In 2019, WHO identified that only 32 antibiotics were in development to combat WHO-identified important pathogens, with only six of them being original. The scarcity of quality antibiotics has now become a critical issue, hindering development across various sectors, particularly in healthcare [23].

According to data from various medical institutes, the majority of doctors in Bangladesh prescribe antibiotics for respiratory tract infections (57.9%), fever (54.2%), urinary tract infections (50.9%), postoperative infections (36.9%), and meningitis (32.2%). Furthermore, according to most of them (70%), inadequate diagnosis and the resistance of most microorganisms have led to an increase in the use of antimicrobials [24].

A study conducted by Bangabandhu Sheikh Mujib Medical University (BSMMU), observed that the antimicrobial sensitivity pattern indicates resistance to the most common antibiotics [24]. A study conducted at the neonatal intensive care unit (NICU) of BSMMU revealed that 77.4% of organisms treated for neonatal sepsis were multidrug-resistant and 51.6% of organisms were extended drug-resistant [25].

The World Health Assembly endorsed the Global Action Plan on antimicrobial resistance (AMR) in May 2015 and the political declaration of the high-level meeting of the General Assembly on AMR in September 2017 [26,27]. Both initiatives recognize AMR as a global threat to public health, acknowledging the overuse and misuse of antimicrobials as primary drivers for the development of resistance, as well as the need to optimize their use. Many countries worldwide have developed and implementing their national action policies on AMR [28]. The Bangladesh Government has also recently developed a National Standard Treatment Guideline (STG) [29]. Several audits on antibiotic use have been conducted in Bangladesh, revealing common findings of irrational usage [30-32]. Therefore, this study aimed to assess the quality of antibiotic prescriptions and explore the reasons behind irrational antibiotic use at Gonoshasthaya Samaj Vittik Medical College Hospital.

METHODOLOGY & MATERIALS

A retrospective cross-sectional study was conducted at Gonoshasthaya Samaj Vittik Medical College Hospital, Dhaka, Bangladesh from October 2021 to December 2021. In this study, we included 1007 patients admitted to the Pediatrics, Medicine, Surgery, and Obstetrics & Gynecology departments of Gonoshasthaya Samaj Vittik Medical College Hospital.

Data Collection

Data retrieval took place through a review of medical records spanning from October to December 2021. The data collection process involved the use of a semi-structured questionnaire. The analysis of the prescriptions relied on the guidelines outlined in the Standard Treatment Guideline (STG) regarding antibiotic usage for common infectious diseases in Bangladesh. Antibiotic prescriptions were deemed appropriate if they adhered to the recommended choices stated in the policy and/or were based on microbiological culture and sensitivity results.

Statistical Analysis

All data were recorded systematically in preformed data collection form. Descriptive analysis was performed for frequency distribution and percentage. Inferential statistics were performed by t-test and ANOVA test. A p-value <0.05 was considered as significant. Statistical analysis was performed by using SPSS 22 (Statistical Package for Social Sciences) for Windows version 10.

Ethical Considerations

Ethical considerations were upheld at every stage of this study. Approval was obtained from the Institutional Review Board of Gonoshasthaya Samaj Vittik Medical College, Dhaka, Bangladesh

RESULTS

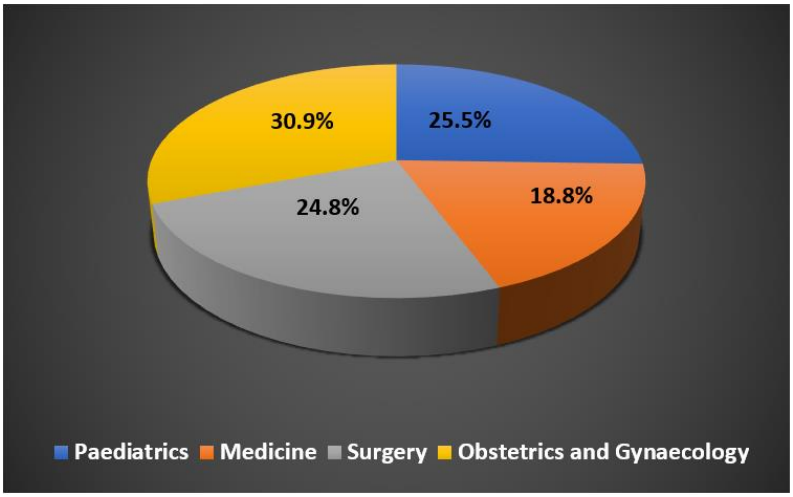

Figure 1: Departments-wise distribution of patients

Figure 1 shows that a total of 1007 files were analyzed, out of which 257 were admitted to the pediatric department, 189 to the medicine department, 250 to the surgery department & 311 to the obstetrics & gynecology department.

Table 1: Age and sex distribution of the patients (n=1007)

Variables	Category	Frequency	Percentage
Age	< one month	53	5.3
	one month to < five years	181	18.0
	five years to <eighteen years	93	9.2
	eighteen years to < forty-five years	526	52.2
	≥forty-five years	154	15.3
Sex	Male	358	35.6
	Female	649	64.4

Table 1 shows the age and sex distribution of the patients (n=1007). The majority of patients belonged to the 18 to 45 years of age group (52.2%), followed by 1 month to 5 years of children (18%), ≥forty-five years (15.3%), and 5 years to less than 18 years (9.2%). Most of our patients were female (64.4%) compared to males (35.6%). The male and female ratio was 1:1.81 in our study.

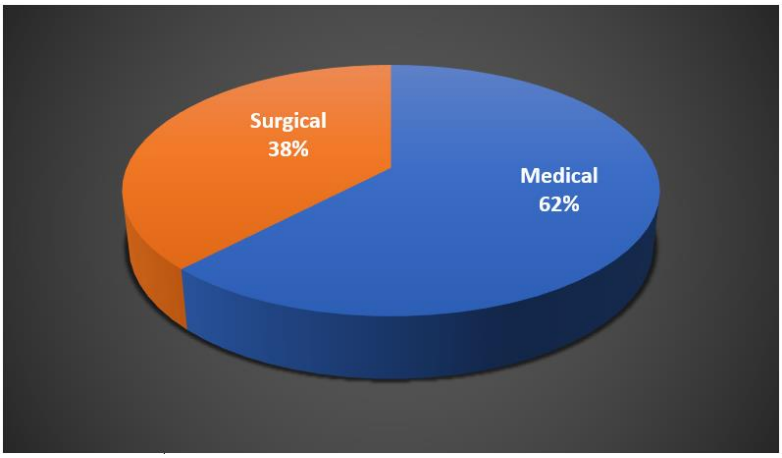

Figure 2: Treatment procedure (n=1007)

Figure 2 shows that out of 1007 patients admitted to the hospital, 625 (62.1%) received medical treatment, while the remaining 382 (37.9%) underwent surgical treatment.

Table 2: Characteristics of prescribing antibiotics (n=1007)

Prescribing antibiotics	Category	Frequency	Percentage
Documented	Yes	908	90.2
	No	99	9.8
Mode of prescribing antibiotics	Empirically	1002	99.5
	After doing CST	5	0.5

Table 2 shows the characteristics of prescribing antibiotics (n=1007). In our study, we found that prescribing antibiotics was documented in 90.2% of cases, 99.5% of hospitalized patients received antibiotics empirically, and only 0.5% of antibiotics were used based on culture sensitivity tests.

Table 3: Causes of using antibiotics empirically (n=1007)

Causes	Frequency	Percent
Presumptive diagnosis of bacterial infections	319	31.7
Medical prophylaxis	266	26.4
Preoperative surgical prophylaxis	396	39.3
Irrational prescription for a noninfectious disease	8	0.8
Unclear	18	1.8

In Table 3, we found out 31.7% (319 cases) of antibiotics were used for presumptive bacterial infection, 26.4% (266 cases) for medical prophylaxis, 39.3% (396 cases) for preoperative surgical prophylaxis, and 0.8% for noninfectious diseases.

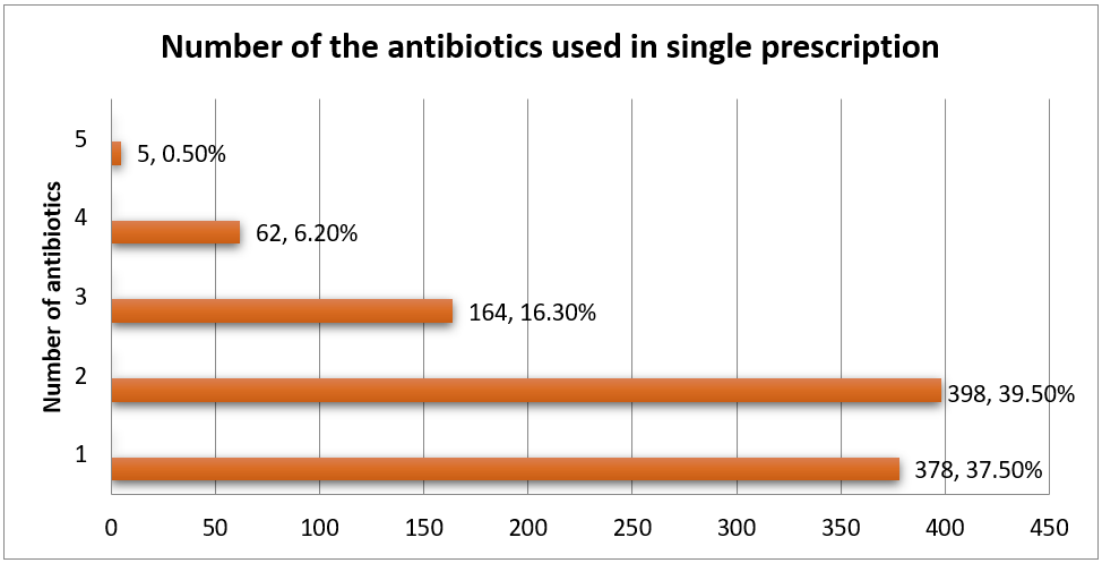

Figure 3: Number of antibiotics used in a single prescription

The graph shows that most of the patients (39.5%) received two antibiotics, followed by 37.5% who received one antibiotic, and 16.30% received three antibiotics. Only 6.20% & 0.50% of patients received 4 & 5 antibiotics respectively.

Table 4: Rationality of antibiotic use (n=1007)

Antibiotic use	Appropriate n(%)	Inappropriate n(%)
By choice	734 (72.9%)	273 (27.1%)
By dose	755 (75%)	252 (25%)
By duration	681 (67.6%)	326 (32.4%)
Overall use	633 (65.8%)	344 (34.2%)

Table 4 shows that 65.8% antibiotic was used appropriately (by choice, dose & duration). It also shows that the most common cause of misuse of antibiotics was the wrong duration of action (32.4%).

Table 5: Overall use of antibiotics and associated factors

Associated factors	Category	The overall use of antibiotic		Total	P value
		Appropriate	Inappropriate		
Department	Pediatrics	175 (68.1%)	82 (31.9%)	257 (100%)	<.001
	Medicine	83 (43.9%)	106 (56.1%)	189 (100%)	
	Surgery	97 (38.8%)	153 (61.2%)	250 (100%)	
	Obs & Gyne	308 (99%)	3 (1%)	311 (100%)	
Age	< 1 month	48 (90.6%)	5 (9.4%)	53 (100%)	<.001
	1 month to 5 years	110 (60.8%)	71 (39.2%)	181 (100%)	
	5 - 18 years	55 (59.1%)	38 (40.9%)	93 (100%)	
	18 - 45 years	371 (70.5%)	155 (29.5%)	526 (100%)	
	≥ 45 years	79 (51.3%)	75 (48.7%)	154 (100%)	
Sex	Female	478 (73.7%)	171 (26.3%)	649 (100%)	<.001
	Male	185 (51.7%)	183 (48.3%)	358 (100%)	
Treatment procedure	Medical	406 (65%)	219 (35%)	625 (100%)	.247
	Surgical	257 (67.3%)	125 (32.7%)	382 (100%)	
Documented Antibiotic	Yes	613 (67.5%)	295 (32.5%)	908 (100%)	.001
	No	50 ((65.2%)	49 (33.8%)	99 (100%)	

Table 5 shows that 99% of antibiotics were used appropriately in the gynecology & obstetrics ward where the highest misuse (61.2%) in the surgical ward. We also found that 90.6% of antibiotics were used correctly in those under one month of age, most misused in those over 45 years of age.

DISCUSSION

This retrospective cross-sectional study was conducted at Gonoshasthaya Samaj Vittik Medical College Hospital. In this study, 1007 admitted patients were selected who received antibiotics. This antibiotic audit has revealed a level of inappropriate antibiotic use in hospitals. Female patients (64.4%) were more prevalent in our study, as we included patients admitted to the gynecology & obstetrics department.

Higher percentages of prescribed antibiotics were documented (90.2%). In our study, almost all patients received antibiotics empirically (99.5%). In the study done by Thomas M *et al*, it was shown that empirical use of antibiotics was more in primary hospitals (100%) than tertiary hospitals (78%) although the percentage was not that much less [33]. Chowdhury MK *et al* also documented increased use of empirical antibiotics (88%) [34].

In the current study, 39.3% of empirical antibiotics were used as preoperative surgical prophylaxis, 31.7% for presumptive bacterial infection, almost one-fourth (26.4%) due to medical prophylaxis, and 0.8% in case of noninfectious diseases. Abula T & Kadir M in their study showed that 32% of patients received antibiotics for surgical prophylaxis & 38.8% for treatment on an empirical basis [35]. Another study found that 24.6% of empirical antibiotic use was for surgical prophylaxis and 37% for medical reasons [36].

The present study reported that most of the patients received double antibiotics (39.5%), on the other hand, a fourth of the patients received at least three or more antibiotics. The findings of our study strongly correlate with a study done by Demoz GT *et al* where 39% of patients received two antibiotics & 12% received more than two antibiotics per prescription [37].

This study found that 34.2% of overuse of antibiotics were found to be inappropriate. We observed most of the inappropriate use of antibiotics was due to improper duration of antibiotic use (32.4%). An Egyptian study showed that the inappropriate antibiotic use in a major university hospital in Egypt (about 1500 beds) was 20% [38].

In contrast, another study conducted in Lahore, Pakistan from March to April 2017 showed that 70.3% of hospital-admitted patients received inappropriate antimicrobial therapy [39].

In this study, we found that inappropriate antibiotic use in the gynecology and obstetrics ward was only 1%. In pediatric wards, 68.1% of antibiotics were used appropriately (Age below 1 month to 18 years). Out of this 90.6% of antibiotics were used appropriately in children less than one month of age. This is because the standard NICU guidelines for children below one month of age are strictly followed in the pediatric department. Antibiotic use in the NICU is a good example of why antibiotics should be used in every hospital according to proper antibiotic guidelines.

In surgical wards 61.2% and in medicine wards 56.1% antimicrobial was used inappropriately in our study. A study in Switzerland showed that the misuse of antibiotics was higher in the surgical department than in the medicine department (58% vs 34%) [40]. Similar results were observed from the study group of Moss *et al*, where they showed that the most misused antibiotic was in surgical prophylaxis, with

only 5% of prescriptions meeting all the requirements and 22% meeting none of them [41].

Limitations of the study

Our study was a single-center study. The study period was short. After evaluating those patients, we did not follow up with them for the long term and did not know other possible interference that may happen in the long term with these patients.

CONCLUSION AND RECOMMENDATIONS

In our study, we found that misuse of antimicrobials is a major health problem in Bangladesh. Antibiotics are being used indiscriminately in various medical college hospitals. A similar picture is seen in Gonoshasthaya Samaj Vittik Medical College Hospital resulting in resistance to many life-saving antibiotics. We are entering the Pre-antibiotic Era; we are going to leave our grandchildren in a situation where no effective antibiotic would be available for them. To prevent antibiotic resistance, each medical college should develop antibiotic guidelines based on the antibiotic sensitivity of that hospital. Our research will facilitate the development of an appropriate antimicrobials guideline in Gonoshasthaya Samaj Vittik Medical College in the future. Strategies should be developed involving all healthcare professionals to prevent unnecessary and misuse of antimicrobials all over the country.

So further study with a longitudinal study design including a larger sample size and involving all healthcare professionals needs to be done to develop strategies to prevent unnecessary misuse of antimicrobials all over the country.

Authors' Contribution: The study concept and study design were given by Dr. Farida Yesmin. A questionnaire was developed by Dr. Kona Chowdhury. Data statistical analysis and interpretation were done by Dr. Mohammad Abul Bashar. Data was collected by Dr. Farida Yesmin, and Dr. Kona Chowdhury Drafting of the manuscript was done by Dr. Farida Yesmin. Critical revision for valuable intellectual content was done by Dr. Tarafder Shahniam Ahmed and Dr. Sharmila Huda.

Acknowledgement: All authors contributed substantially to the work; and have read and agreed to the published version of the manuscript.

Funding: No funding sources.

Conflict of Interest: None declared.

Ethical approval: This study was approved by an ethical review committee.

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