

# Antibiotic prescribing pattern in different clinical departments at Kathmandu Medical College Teaching Hospital

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## Abstract

**Background:** Antibiotics have transformed the practice of medicine for good; by making once lethal infections treatable. However, antimicrobials have been overused both in prophylaxis and therapy. Patients unnecessarily exposed to antibiotics are at risk for serious adverse events while increasing the chances of antimicrobial resistance. Patients with infections caused by drug-resistant bacteria are at increased risk of worse clinical outcomes and even death. It is therefore imperative to use our arsenal of antibiotics wisely.

**Objectives:** A prospective cross sectional study was carried out with the aim of identifying prescription pattern of antibiotics in different medical units at Kathmandu Medical College Teaching Hospital, Sinamangal. Investigating the prescription pattern of doctors and providing them necessary feedback plays a vital role in improving the prescription quality and promoting the rational prescription pattern.

**Methodology:** A study was carried out on in-patient prescription data collected at random from patients admitted in different clinical departments at the hospital. Information on medication use was obtained for the patients prescribed at least one antibiotic during their hospital stay. The antibiotic prescribing practices of different departments was compared by using the percentage method.

**Results:** The antibiotics most commonly prescribed were Ceftriaxone, Amoxicillin + Cloxacillin, Azithromycin, and Cefixime among others. Ceftriaxone was found to be prescribed in 108 cases accounting 16.8% of the total antibiotic prescribed.

**Conclusion:** The study highlights the current practice of antibiotics usage in clinical settings. Based on the current study it was concluded that Cephalosporins are the mostly used antibiotics in in-patient settings.

**Key words:** Antibiotics; Antimicrobial resistance; Antimicrobial stewardship; Drug utilization review; Prescription monitoring

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## INTRODUCTION

The advent of antibiotics has turned lethal infections into treatable ones and has since then saved numerous lives. Antibiotics and vaccines together have drastically reduced mortality due to infectious diseases. Unfortunately, antibiotics, the miracle drugs of the 20<sup>th</sup> century are used extensively and even unnecessarily.

The overuse of antibiotics both in prophylaxis and therapy is seen all over the world. The global antibiotic

consumption has soared by 36% in the 2000 to 2010 period<sup>1</sup>. Center for Disease Control (CDC) in United States claims that a large percentage of antibiotics are misused in outpatient settings and that every 1 in 3 antibiotic prescriptions are unnecessary<sup>2</sup>. A 2006 to 2012 study in inpatients conducted at over 300 hospitals in United States showed that over 55% of patients received antibiotics during their stay<sup>3</sup>. Extensive mistreatment with antimicrobial drugs has been reported in the recent years, and nearly half of all antibiotic drug prescriptions have been found to be poorly selected<sup>4</sup>. Thus extensive use of antibiotics has resulted in unnecessary exposure to antibiotics, placing patients at risk for serious adverse effects while increasing antimicrobial resistance (AMR). There is a causal association between antimicrobial usage in hospital and antimicrobial resistance<sup>5</sup>. The growth of

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multiple-drug-resistant (MDR) bacterial pathogens can be traced to the overuse of broad-spectrum antimicrobial products both prophylactically and therapeutically<sup>6</sup>. Patients with infections caused by drug-resistant bacteria are at increased risk of worse clinical outcomes and even death, and consume more health-care resources than patients infected with non-resistant strains of the same bacteria<sup>7</sup>. Antibiotic resistance is not only a problem for the individual patient, it also reduces the effectiveness of established treatment and has become a major threat to public health by increasing the complexity and cost of treatment and reducing the probability of successful outcome<sup>8</sup>. With the antimicrobial resistance emerging as a global problem, and with more and more drug resistant strains of bacteria on the rise, it is getting imperative that we use our arsenal of antibiotics wisely to prevent the microbes from turning into drug resistant superbugs. In February 2017, WHO published a list of world's most dangerous superbugs for which new antibiotics are urgently required<sup>9</sup>. Interventions to promote rational antibiotic use are therefore crucial for preserving the effectiveness of available drugs<sup>10</sup>.

Developing and following antibiotic prescribing guidelines and protocols is a well established intervention to maintain effectiveness of current drugs<sup>11</sup>. Another intervention aimed at decreasing the overuse of antibiotics and optimizing their rational and prudent use is the commencement of antibiotic stewardship programs (ASPs) in hospitals<sup>12</sup>. But majority of the hospitals here in Nepal lack proper guidelines and protocols on antibiotic use. Also the concept of antibiotic stewardship program is relatively new here<sup>13</sup>. It is thus solely the decision of the clinician to decide on the antibiotic therapy. Thereby, in absence of ASPs and antibiotic prescribing guidelines, the antibiotics can be overused and misused even in instances where they are not absolutely needed.

Conducting drug utilization research can provide useful information to health care providers and policy makers<sup>14</sup>. The study of the antibiotic prescribing patterns helps to monitor, evaluate and suggest changes in the clinician's prescription habits for efficient patient care<sup>15</sup>. This study was carried out to describe the types and characteristics of antibiotics prescribed in different clinical wards and to identify prescribing pattern of antibiotics in KMCTH, a tertiary care teaching hospital in Kathmandu, Nepal.

## METHODOLOGY

A cross-sectional study was carried out on in-patient prescription data. The data was collected at random from patient medical case records (patient cardex) for patients

admitted in major clinical departments namely Medicine, Gynecology, Surgery, Paediatrics, Orthopaedics, ENT and Neurosurgery at Kathmandu Medical College Teaching Hospital (KMCTH) in Sinamangal from December 2016 to July 2017. Inpatients (both sexes) admitted in different clinical departments at KMCTH were included in the study. Patients brought to the emergency department, who died during their treatment who left against medical advice and patients in Intensive Care Unit (ICU), Critical Care Unit (CCU) were excluded from the study. Information on medication use was obtained from 388 inpatients prescribed at least one antibiotic during their stay in the hospital. The following information was noted for each of the patients including patient age, sex, diagnosis, specialty, and the prescribed antibiotic related information such as name of antibiotics, dose and their dosage forms. The data was then entered into and analyzed through Microsoft Excel.

An approval from the Institutional Review Committee of KMCTH was obtained prior to the study. The antibiotic prescribing practices of different departments was compared by using the percentage method. Analysis was carried out further to identify the number of cases where antibiotics were prescribed as monotherapy and the cases where multiple antibiotics were prescribed. The antibiotic used in maximum number of cases was analyzed and also department wise survey of the top five antibiotics used by the department was done.

## RESULTS

A total of 37 different antibiotics were prescribed. The most common antibiotics prescribed in our study were Ceftriaxone, Amoxicillin+Cloxacillin, Azithromycin, Cefixime, Cloxacillin among others. Ceftriaxone was found to be prescribed in 108 cases accounting for 16.8% of total antibiotics prescribed as shown in Table 1. Ceftriaxone was among the top three most prescribed antibiotics in all the five clinical departments prescribing maximal antibiotics.

## DEPARTMENT WISE SURVEY OF ANTIBIOTICS USED

The Department of Gynaecology and Obstetrics, Medicine, Surgery, Paediatrics and Orthopaedics respectively used maximal antibiotics. The top three antibiotics prescribed by the different departments are shown in Figure 1.

The Department of Gynaecology and Obstetrics used the combination of Amoxicillin and Cloxacillin the most. Ceftriaxone was the top most prescribed antibiotic in the Department of Medicine and the Department

of Surgery. Similarly, the maximal used antibiotics in the Department of Paediatrics and the Department of Orthopaedics were Amoxicillin+ Clavulanic acid and Cefuroxime respectively.

**MONOTHERAPY VERSUS POLYETHERAPY**

Among 388 prescriptions for antibiotics 199 (51.3%) were prescribed as monotherapy and 189 (49.7%) were prescribed as polytherapy. Further subdividing the polytherapy groups it was seen that 142 (36.6%) prescriptions contained two antibiotics, 34 (8.8%) prescriptions contained three antibiotics and 13 (3.4%) prescriptions contained four or more than four antibiotics as shown in Figure 2. These accounted for a sum total of 641 antibiotics prescribed for 388 inpatients.

**AGE AND SEX WISE USAGE OF ANTIBIOTICS**

Out of the total 388 prescriptions for antibiotics it was seen that 164 belonged male patients and 224 belonged to female patients. We also found that the antibiotics were prescribed maximally for the age group 21-30 years old patients as shown in Figure 3.

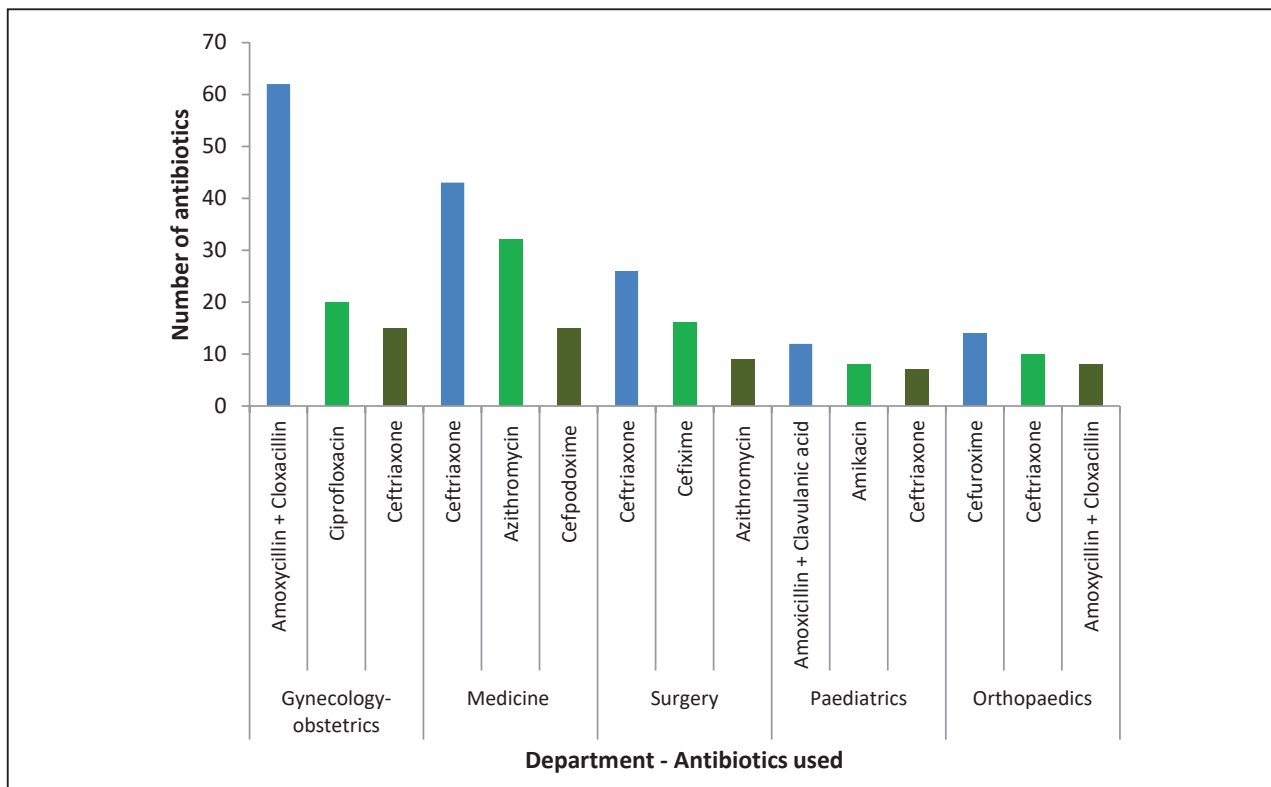
**ROUTE OF ADMINISTRATION**

Among the 641 antibiotics prescribed 338 were administered in injection form and 295 prescriptions

were given orally in either tablet, capsule, suspension or syrup form while remaining eight antibiotics were administered topically. Figure 4 shows the different routes through which the antibiotics were administered to the patients.

**Table 1: Top ten antibiotics prescribed for the inpatients**

S.No.	Commonly prescribed Antibiotics	Frequency	Percentage
1	Ceftriaxone	108	16.8 %
2	Amoxicillin + Cloxacillin	83	12.9 %
3	Azithromycin	64	10.0 %
4	Cefixime	41	6.4 %
5	Cloxacillin	39	6.1 %
6	Ciprofloxacin	34	5.3 %
7	Cefpodoxime	29	4.5 %
8	Amoxicillin + Clavulanic acid	28	4.4 %
9	Amikacin	25	3.9 %
10	Cefotaxime	23	3.6 %
	Others (27 antibiotics)	167	26.1 %
	<b>Total</b>	<b>641</b>	<b>100.0 %</b>



**Figure 1:** Top 3 antibiotics prescribed by top 5 antibiotic prescribing departments

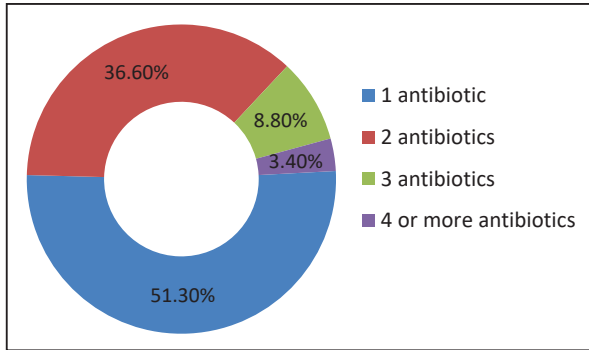


Figure 2: Monotherapy Vs Polytherapy

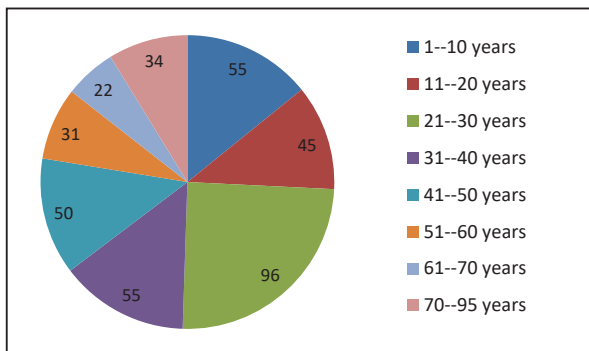


Figure 3: Antibiotic use according to age groups

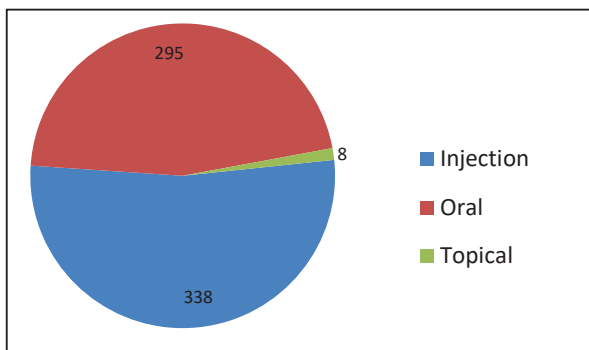


Figure 4: Route of administration of antibiotics

## DISCUSSION

The most commonly prescribed antibiotics comprised of Ceftriaxone, Amoxicillin + Cloxacillin, Azithromycin, Cefixime and Cloxacillin. Ceftriaxone, the third generation Cephalosporin, was used in 108 cases accounting for 16.8% of all antibiotics used. A similar study conducted in 2013 in ICU patients in India also showed that Ceftriaxone was prescribed in most of the patients and accounted for 23% of antimicrobial therapy<sup>16</sup>. Another study conducted by Vandana AB et al. in 2010 observed that Cefotaxime was the most prescribed antibiotic<sup>17</sup>. Other studies have also similarly pointed out that Cephalosporins are the most widely

utilized first line antibiotics<sup>18</sup>. In 2002 a study conducted by Shankar *et al.* in Nepal showed Ampicillin, Amoxicillin, Metronidazole, Ciprofloxacin and Benzylpenicillin as the five most commonly prescribed antibiotics<sup>15</sup>. Similarity in the type of antibiotic prescribed in the different studies points out that India and Nepal have similar disease prevalence and similar prescribing patterns. This reflects a change in prescription pattern over a period of time which is due to change in the pattern of infections with resistant organisms and the varying susceptibility of the microorganisms to antibiotics.

The fixed dose combination (FDC) of Amoxicillin+Cloxacillin was the second most used antibiotic in our study. When compared to the study by Shankar *et al.* conducted in 2002, Amoxicillin alone was ranked as the second most prescribed antibiotic<sup>15</sup>. The reason for the increased use of Amoxicillin combination with the antistaphylococcal drug Cloxacillin is attributed to increased infections by Beta-lactamase producing strains of Staphylococci as a result of increased antimicrobial resistance.

In our study it was observed that the patients admitted in Gynaecology-Obstetrics were prescribed maximum antibiotics. This may be due to the fact that 29 percent of patients were from Gynaecology-Obstetrics Department. This was followed by Medicine and Surgery departments which comprised 21 percent and 16 percent of the patients respectively. Also another finding seen in our study was that the age group between 21-30 years was the group for which antibiotics were mostly prescribed, this can be related to the fact that most of the pregnant women belonged to this age group and while undergoing caesarean section were given some antibiotics prophylactically.

Our study showed that Amoxicillin+ Cloxacillin, Ciprofloxacin and Ceftriaxone were the most prescribed antibiotics by the department of Gynecology and Obstetrics. Penicillins and Cephalosporins high use may be attributed to their relative safety in obstetric use. Ceftriaxone may have been used more for the treatment of Sexually Transmitted Diseases (STDs) as per Center for Disease Control and Prevention (CDC) recommendations<sup>19</sup>. A 5 year long study done in Thailand found Ampicillin to be equally effective as Ceftriaxone in preventing caesarean section surgical site skin infections<sup>20</sup>. There seems to be a need to carry on similar studies here in the future so that narrow spectrum drugs can replace the broad spectrum ones in clinical use, thereby decreasing the emergence of AMR.

Both Medicine and Surgery departments used Ceftriaxone the most. Basnyat *et al.* in a 2015 study mentioned that several studies across different healthcare facilities showed evidence of inappropriate prescribing of antibiotics in Nepal and it was particularly true for Ceftriaxone amongst others<sup>21</sup>. Ceftriaxone is overused not only for fever of unknown origin, but also for meningitis, pneumonia, urinary tract infections, and many other infections. The overuse of Ceftriaxone has caused common gram-negative bacteria, like *Klebsiella* and *Escherichia coli* to acquire antimicrobial resistance through production of 'Extended-Spectrum Beta-Lactamases' (ESBL) rendering the organisms no longer susceptible to Ceftriaxone<sup>22</sup>.

Azithromycin a broad spectrum macrolide was used more by Medicine and Surgery. This may be due to the fact that Azithromycin is preferred in respiratory, enteric and genitourinary infections the commonly occurring infections in Nepal<sup>23,24</sup>. CDC also recommends Azithromycin for the treatment of different STDs<sup>19</sup>. Azithromycin being a drug with long plasma half life achieving higher tissue concentrations and having broad spectrum of action may be preferred in various surgeries<sup>25,26</sup>.

We found that the FDC of Amoxicillin+Clavulanic acid was the top most used antibiotic by the department of Paediatrics, followed by Amikacin and Ceftriaxone. This seems to be in line with CDC which has ranked this FDC as the first line antibiotic in different paediatric infections like- sinusitis, acute otitis media and urinary tract infections<sup>27</sup>.

Cefuroxime, Ceftriaxone and Amoxicillin+Cloxacillin combination were the most used medicines by Orthopaedics department. Literature review also shows that intravenous Cefuroxime is the most commonly used antibiotic for both pre and post-operative cases for patients undergoing internal fixation of fractures<sup>28,29</sup>. Yeap *et al.* suggested that Cephalosporins are by far the most popular choice of antibiotics for prophylaxis in orthopaedic surgeries<sup>28</sup>, which was also the case in this study.

In our study, we found that 199 prescriptions out of 388 were prescribed as monotherapy for antibiotics. Prescribing antibiotics as monotherapy is a good practice aimed at decreasing the antimicrobial resistance. Since the modern day antibiotics can cover a spectrum of organisms in mixed infections, single agents are preferred today. However, combinations of antibiotics

in different scenarios are more effective in preventing the emergence of resistance and at times also show synergistic effects<sup>30</sup>. At times when empiric coverage is a must, combination therapy may be necessary<sup>31</sup>. The use of combination therapy involving more than 3 agents was seen in only 47 prescriptions, this shows that antimicrobial therapy use was fairly rational.

Out of 641 antibiotics prescribed 338 were administered in injection form and 295 prescriptions were given orally while remaining eight antibiotics were administered topically. The relatively high use of injectable form of antibiotics can be because our study was conducted in in-patients where the use of injectable medicines is relatively high owing to the severity of the cases. This may also be attributed to the belief in the superiority of intravenous antibiotics which is widespread among health professionals and patients alike<sup>32</sup>. It could also be because the physicians usually opt for IV medications at first and continue them till patient discharge as suggested by Cyriac *et al.*<sup>33</sup> This is also so in-part because our study identified Ceftriaxone as the mostly used antibiotic which comes in injectable form only. The high use of injectable drugs can sometimes contribute to infections and even lead to sepsis, especially if they are given via intramuscular route<sup>34</sup>. Though not adequately investigated the chances of injectable drugs causing healthcare associated infections is high in our cases because they are not prepared in aseptic laminar flow hoods, rather at the patient bed-side itself, where the load of pathogenic organisms is high.

In South East Asia region the antibiotic prescribing is relatively high owing to higher incidence of infectious diseases owing to environmental factors and lack of proper sanitation measures. We also have a high burden of water borne diseases. We also cannot deny the fact that even the patients by the time they require hospitalization are exposed to different antibiotics as a result of self medication from the chemists shop before seeing a medical practitioner itself<sup>35</sup>. To discourage this sort of practices WHO is celebrating World Antibiotic Awareness Week 2017 with the slogan: Our time with antibiotics is running out. Always seek the advice of a healthcare professional before taking antibiotics<sup>36</sup>. With Nepal lacking registered pharmacists in most of the drug stores, patient counseling with regards to proper use of antibiotics is often missing and patients many a times do not take the complete course of antibiotics as prescribed. This coupled with the ease of obtaining antibiotics from drug stores in Nepal is an important contributor to AMR<sup>35</sup>.



As a strategy to decrease the incidence of antimicrobial resistance a certain antibiotics should be reserved as "last hope" antibiotics which only senior consultants should be allowed to prescribe and antimicrobial stewards should have their final say on use of such drugs. UK had similarly listed Colistin as the last hope antibiotic, whose use is now soaring with the rise of the infections caused by the superbugs<sup>37</sup>. Global Antibiotic Resistance Partnership (GARP)-Nepal in outlining the prime strategies to improve antibiotics use at national level has focused on the importance of improving hospital infection control and establishing antimicrobial stewardship<sup>21</sup>. Antimicrobial stewardship program is known to promote the appropriate use of antimicrobials, improve patient outcomes, reduce microbial resistance, and decrease the spread of infections caused by multidrug-resistant organisms<sup>12</sup>. Medical colleges are best suited to work as exemplary models to establish and run infection prevention and control programs and antimicrobial stewardship programs with adequate professional manpower to accomplish the task.

## CONCLUSION

Based on the results it was concluded that the Cephalosporin group of antibiotics is the most frequently prescribed antibiotics, with Ceftriaxone being the

maximally used drug. Infectious disease burden being high here, it was seen that the antibiotics is highly used in hospital settings. Lack of development of prescribing guidelines and protocols for prescribing the antibiotics in individual hospitals is an important factor contributing to the misuse and over use of antibiotics thereby leading to antimicrobial resistance. There appears to be a crucial need for starting antibiotic stewardship program which will monitor the patient's on antibiotic therapy in real time and give constructive feedback to the physicians regarding their choice of antibiotics in therapy. Then only we can attain the mission of ensuring that every patient gets optimal antibiotic therapy. Hospitals' lacking antibiotic prescribing guidelines and protocols and the delay in initiating the antibiotic stewardship program is a huge problem in our hospital settings and we should soon be able to overcome this milestone for threat of antimicrobial resistance is real.

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