DOI: 10.7860/JCDR/2026/82509.22459

Original Article

Pharmacology Section

Pattern of Antimicrobial Drug Usage among Inpatients of a Government Medical College Hospital in Kerala, India: A Cross-sectional Study

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ABSTRACT

Introduction: Antimicrobial Resistance (AMR) has become a global emergency threatening to once again make infectious diseases the number one killer of mankind. Antimicrobial Stewardship (AMS) programs require baseline antimicrobial use and microbial drug resistance patterns to formulate rational antimicrobial use policies. However, information about the pattern of antimicrobial drug use among inpatients of government medical colleges in Kerala is scarce.

Aim: To describe the antimicrobial use pattern among inpatients of a government medical College Hospital in Kerala.

Materials and Methods: A medical-record-based cross-sectional study of antimicrobial use among inpatients admitted to Government Medical College Hospital, Alappuzha, Kerala, India was conducted on a single calendar day (16th January 2019). Data was collected in a structured case record form and expressed as counts (%) or median (25th percentile, 75th percentile). Summary statistics were prepared using Microsoft Excel® spreadsheets.

Results: Among 210 (107 female) inpatients admitted on 16th January 2019, 137 (65.2%) received at least one empiric antimicrobial despite being indicated in 118 (56.2%) only. Among inpatients prescribed antimicrobials, each received a median of 1 drug for treatment over a median of 3 (0,8) days of therapy. A total of 55 (40%) of antimicrobial use was for surgical prophylaxis in different specialties, but for much longer than recommended by guidelines. Details of culture and sensitivity tests were available in only 10 (4.3%) inpatient records, precluding any change in empiric to definitive antimicrobial therapy in virtually all cases. Third-generation cephalosporins, belonging to the watch group of World Health Organisation (WHO) Access, Watch and Reserve (AWaRe) classification, were the most widely used class of antimicrobials. Topical moxifloxacin was the most common antimicrobial prescribed for ocular disorders. Antimicrobial use from the access category was achieved in roughly 50% of cases, which was much below the target of 60% set by WHO for the period of 2019-23.

Conclusion: The present study found unindicated use as well as prophylactic overuse of antimicrobials, especially from the WHO watch category of drugs, among inpatients at a Medical College Hospital. Defensive clinical practice and lack of faith in infection control systems may be contributing factors to this phenomenon. Regular, prospective and collaborative monitoring of antimicrobial use patterns in all tertiary care hospitals may help in strengthening AMS and combating AMR.

Keywords: Antimicrobial stewardship, Drug utilisation, Inpatients

INTRODUCTION

Antimicrobial Resistance (AMR) is a global health emergency threatening to once again make infectious diseases the number one killer of mankind. The World Health Organisation (WHO), along with other global health agencies, claim that people may already be living in a post-antibiotic era. Multidrug-resistant (MDR) organisms, especially the ESKAPE (*Enterococcus, Staphylococcus*, *Klebsiella*, *Acinetobacter*, *Pseudomonas* and *Enterobacter*) pathogens, are increasingly causing life-threatening infections mandating the use of toxic and costly drugs such as tigecycline and colistin [1].

India is not immune to this global problem. Pan-drug-resistant infections are being increasingly reported from several parts of India [2-6]. National data on AMR is being collected by surveillance programs linking microbiology laboratories in several hospitals across the country. The National Centre for Disease Control (NCDC) has published antimicrobial treatment guidelines, which have been updated recently [7,8]. However, these guidelines cannot be followed blindly throughout the country but need to be adapted to suit the antibiogram of each state and ideally every hospital. The Government of Kerala also published a state antimicrobial policy as part of the Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) [9].

Antimicrobial Stewardship (AMS) program, along with rigorous infection control practices, has been shown to limit the selection and spread of AMR [10,11]. The WHO had introduced the Access, Watch and Reserve (AWaRe) classification of antimicrobials in 2019 to support AMS programs by promoting the use of access category drugs while restricting unwarranted use of watch and reserve category drugs [12]. Though the surveillance of the antibiogram of MDR microorganisms is being strengthened, the pattern of antimicrobial drug use in the country and each state is not readily available. Therefore, it is necessary to study the baseline pattern of antimicrobial drug use in each state and ideally every healthcare Institution with respect to both quantity and quality. An AMS program will be successful only if both AMR and antimicrobial use pattern are continuously monitored in an institution.

Though several studies exploring the quantitative and qualitative pattern of antimicrobial drug use in private healthcare institutions from Kerala are available [13-15], such studies among inpatients of government sector teaching hospitals are scarce [16]. The data from government sector teaching hospitals forms the backbone of antimicrobial policy decisions of the government and aids in monitoring their effective implementation in these institutions, where the majority of future healthcare professionals are trained. Therefore, the present study was conducted to describe the antimicrobial use

pattern among inpatients of a Government Medical College Hospital in Kerala. The primary objective of the study was to estimate the proportion of inpatients prescribed at least one empiric antimicrobial as part of their treatment. The secondary objectives of the study were;

(a) to estimate the number of empiric antimicrobial(s) prescribed per inpatient as part of their treatment,

(b) to describe the pattern and necessity of empiric antimicrobial(s) prescribed with respect to patients' provisional diagnoses,

(c) to describe the pattern of definitive antimicrobial(s) prescribed in inpatients with respect to the patients' culture and sensitivity reports, and

(d) to describe the pattern of antimicrobial(s) prescribed in inpatients at discharge from the hospital.

MATERIALS AND METHODS

The present study was a medical record-based cross-sectional study of antimicrobial use patterns among inpatients of Government Medical College Hospital Alappuzha, Kerala, India and was conducted on a single calendar day (16th January 2019). The study was conducted after approval from the Institutional Ethics Committee (IEC 32/2019). Waiver of informed consent was obtained because the study did not involve the collection of patient's name or address.

Inclusion and Exclusion criteria: Data was collected retrospectively from the medical records of all patients who were admitted to the above hospital on a single calendar day (16th January 2019). Medical case records without a specified diagnosis were excluded from the study.

Sample size calculation: A study of antimicrobial use patterns in patients done in a tertiary care hospital in Kerala had estimated the proportion of patients receiving an antimicrobial to be 27% [17]. Using this proportion as the baseline, to detect a difference of 5% with α=0.05, the minimum sample size required was calculated to be 303 using the formula:

$n = Z^2_{1-\alpha/2}\, p(1-p)/d^2$

$= 1.96 \times 1.96 \times 0.27 \times 0.73/(0.05)^2$

$= 303.$

However, to account for the large number of inpatient admissions in our 750-bedded (in 2019) hospital, assuming that 10% of the inpatient records may not provide complete information in one or other aspects, the final sample size was adjusted to 335 medical records. However, the Institutional Research Committee (IRC) opined that collecting data of only 335 inpatients may induce selection bias in the study and directed the authors to collect data of all inpatients who got admitted on a single calendar day. Based on the directive of the IRC, it was decided to collect data from the medical records of all inpatients admitted on a single calendar day.

Study Procedure

The investigators visited the medical records library of the hospital and collected data of inpatients admitted on 16th January 2019 using a structured case record form. The month of January was chosen for the study to provide a baseline pattern of antimicrobial use, avoiding the seasonal rise in febrile illness during the monsoon and winter months. The date of 16th January was chosen because it was a Wednesday in a week without holidays, thereby avoiding the undue crowding of patients on Mondays, around holidays or weekends. Among demographic details, only the age, gender and Inpatient (I.P.) number of patients were collected to ensure traceability of data and to prevent data duplication. Data collected included the provisional diagnosis, number, name and Days Of Therapy (DOT) with empiric and definitive antimicrobial(s) based on documented microbial culture and sensitivity reports, if available, and similar data regarding antimicrobial(s) prescribed at discharge. Based on the provisional diagnosis of a patient, the NCDC and KARSAP guidelines were referred to check whether an empiric antimicrobial was indicated and necessary [7,9]. Wherever both guidelines concurred that an antimicrobial was not indicated, that case was defined as antimicrobial not indicated. Antimicrobial use was deemed as indicated if at least one of the above guidelines recommended an empiric antimicrobial in accordance with the provisional diagnosis. The top 10 antimicrobials prescribed among inpatients during hospitalisation and at discharge were also classified according to the AWaRe classification [12].

STATISTICAL ANALYSIS

Data was collected in a structured case record form and entered in Microsoft Excel® spreadsheets. Qualitative data were expressed as counts (%) for proportions. Quantitative data were expressed as mean±SD or median (25th percentile, 75th percentile) for normally versus non normally distributed data, respectively. Summary data for the preparation of tables and figures was obtained from Microsoft Excel®.

RESULTS

The medical records of all patients admitted from 12 a.m. on 16-01-2019 to 12 a.m. on 17-01-2019 were collected from the medical records library. Despite a bed-strength of 750, only 210 inpatients sought admission that day, among whom 107 (50.9%) were females. Eight patients died in the hospital during treatment. The characteristics of the inpatients recruited in the study, along with their admitting departments, are shown in [Table/Fig-1]. The median duration of inpatient treatment was 3 (2,7) days, indicating the rapid turnover of patients. Out of 210 inpatients, 137 (65.2%) patients were prescribed at least one empiric antimicrobial for treatment for a median of 3 (0,8) days of therapy. A median of 1 (1, 2) drug was prescribed per inpatient among those who were prescribed antimicrobials (n=137). However, details of culture and sensitivity reports were available in only 10 (4.3%) inpatient records and did

Patient characteristics	Median (1st Quartile, 3rd Quartile) or n (%) (n=210)
Age (years)	50 (26, 65)
Gender distribution (n)	103 males, 107 females
Pregnancy	26 (12.4%)
Presence of renal dysfunction [n (%)]	43 (20.5%)
Presence of hepatic dysfunction [n (%)]	12 (5.7%)
Predisposition to Immunosuppression (History of diabetes/anticancer drug use/ tuberculosis) [n (%)]	57 (27.1%)
Duration of inpatient treatment (days)	3 (2, 7)
Admitting department	General Medicine (75), Obstetrics & Gynaecology (32), Ophthalmology (22),
	Paediatrics (20),
	General Surgery (15),
	Orthopaedics (11),
	Urology (12)
	Cardiology (9), Otorhinolaryngology (7), Nephrology (7)
Proportion of inpatients prescribed at least one empiric antimicrobial [n (%)]	137 (65.2%)
Proportion of inpatients prescribed more than one empiric antimicrobial [n (%)]	61 (29%)
Number of empiric antimicrobials prescribed per inpatient (n=137)	1 (1, 2) Range: 1 to 4
Days of therapy with antimicrobial	3 (0, 8)
Availability of culture and sensitivity report [n (%)]	10 (4.3%)

[Table/Fig-1]: Characteristics of admitted patients included in the study.

not result in any change in antimicrobial therapy in virtually all cases, probably due to clinical improvement of the patients. Therefore, the secondary objective of the pattern of definitive antimicrobial use could not be ascertained.

The classification of inpatients into 9 diagnostic categories based on the primary provisional diagnosis for antimicrobial use is shown in [Table/Fig-2]. An antimicrobial was not indicated in 92 (43.8%) cases according to both NCDC and KARSAP guidelines, but was prescribed in 21 (22.8%) of such cases. Further classification of these cases is presented in [Table/Fig-3]. Empiric antimicrobials were also used for prophylaxis of elective surgical (n=55) and trauma (n=16) cases, details of which are presented in [Table/Fig-4]. Barring ophthalmological disorders, the group of 3rd generation cephalosporins was the most widely prescribed empiric antimicrobial class with the longest mean of 9.4±5.6 days of therapy for acute lower respiratory tract infections [Table/Fig-2]. Topical moxifloxacin was the most common antimicrobial prescribed for ophthalmological disorders for a mean of 11.6±6.3 days of therapy. The carbapenem, meropenem, was added to ceftriaxone in cases of sepsis [Table/Fig-2].

Patients with renal calculus recorded the highest proportion (5/9) of unindicated antimicrobial use without any documented evidence of urinary infection [Table/Fig-3] followed by cancer patients with metastatic disease (5/11). This was followed by patients with Gastrointestinal (GI) (4/17), neurological (3/14), and cardiovascular (4/27) disorders. Interestingly, unindicated antimicrobial use was not observed in patients with ophthalmological and obstetric and gynaecological disorders [Table/Fig-3]. In the majority of the patients, 3rd generation cephalosporins were the most widely used antimicrobial class, with cefotaxime being commonly prescribed.

Third generation cephalosporins, once again, were the most widely used antimicrobial class for prophylaxis of trauma and elective surgical cases [Table/Fig-4]. However, cefotaxime was the most prescribed 3rd generation cephalosporin with the longest mean of 12.2±4 days of therapy in general surgical cases. Obstetric patients received prophylactic treatment with the conservative combination of ampicillin and metronidazole for a mean of 5.5±3.9 days of therapy. Topical moxifloxacin was the most common drug used for surgical prophylaxis of cataract surgery for a mean of 2.2±0.8 days of therapy. However, in all cases of elective surgery, the period of antimicrobial prophylaxis was longer than that recommended in guidelines [7,9].

A bidirectional bar graph showing the top 10 antimicrobials prescribed among inpatients during hospitalisation and at discharge, with their colours coded according to the AWaRe classification is depicted in [Table/Fig-5] [12]. Antimicrobials were prescribed at discharge to 68 patients and their distribution is shown in [Table/Fig-5]. The majority of the drugs prescribed belonged to the Watch (Yellow) category, and a single drug (Linezolid) from the Reserve (Red) category. Antimicrobial use from the Access (Green) category was achieved in roughly 50% of cases, which was much below the target of 60% use from the Access category set by WHO for the period of 2019-23 [12].

DISCUSSION

The present study showed widespread empiric use of antimicrobials among inpatients in a Medical College Hospital in Kerala, which was rarely supplemented by adequate identification of causative organisms or determination of their antimicrobial susceptibility. Further, the practice of unindicated use and prophylactic overuse of antimicrobials, especially from the WHO watch category of drugs, has been documented in the present study. The duration of

Provisional diagnostic categories	Common cases	Most used antimicrobial class	Name of most used empiric antimicrobials	Route of administration	Days of therapy (Mean±SD)
Antimicrobial Not Indicated (n=92)	Presented in [Table/Fig-3]				
Surgical Prophylaxis (n=54)	Presented in [Table/Fig-4]				
Trauma (n=17)	Presented in [Table/Fig-4]				
Neurological (n=3)	Febrile seizure	3rd generation cephalosporins	Ceftriaxone	Intravenous (i.v.)	4.5±2.6
Respiratory (n=12)	Acute Lower respiratory tract infection	3rd generation cephalosporins	Ceftriaxone	i.v.	9.4±5.6
Gastrointestinal (n=14)	Acute gastroenteritis	3rd generation cephalosporins	Ceftriaxone	i.v.	8.4±5.2
Genitourinary (n=5)	Urinary tract infection	3rd generation cephalosporins	Ceftriaxone	i.v	6.6±3.9
Eye disorder (n=3)	Corneal ulcer	Fluoroquinolone	Moxifloxacin	Topical	11.6±6.3
Skin and soft tissue (n=8)	Surgical site Infection	3rd generation cephalosporins	Ceftriaxone	i.v.	6.8±4.6
Sepsis (2)	Urosepsis, Catheter associated sepsis	Carbapenem	Meropenem	i.v.	7±1.4

[Table/Fig-2]: Classification of antimicrobial use in categories of provisional diagnosis.

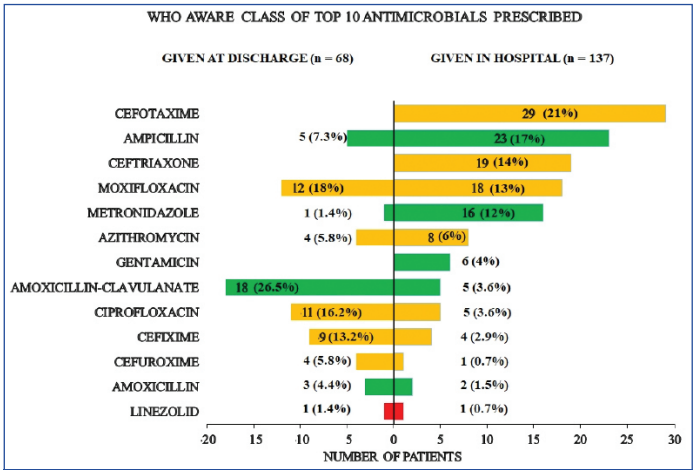
Diagnostic categories (n=92)	Common cases	Proportion received empiric antimicrobial	Most used antimicrobial class	Most used empiric antimicrobial	Route of administration	Days of therapy (Mean±SD)
Cardiovascular (n=27)	Acute coronary syndrome, Acute LVF	4 (14.8%)	3rd generation cephalosporins	Cefotaxime	i.v.	6±4.6
Neurological (n=14)	Acute cerebrovascular accident	3 (21.4%)	3rd generation cephalosporins	Cefoperazone + Sulbactam	i.v.	8.6±1.2
Obstetric & gynaecological (n=12)	Pregnancy under evaluation	0 (0%)	NA	NA	NA	NA
Cancer (n=11)	Cancer metastasis	5 (45.5%)	Penicillins	Amoxicillin	Oral	9.4±9.5
Renal (n=9)	Renal calculus	5 (55.6%)	3rd generation cephalosporins	Cefotaxime	i.v.	4±1.6
Opthalmological (n=2)	Optic neuritis, Congenital Nystagmus	0	NA	NA	NA	NA

Gastrointestinal (n=17)	Viral hepatitis, Upper GI bleeding	4 (23.5%)	3rd generation cephalosporins	Cefotaxime	IV	3.5±1.7

[Table/Fig-3]: Classification of cases where antimicrobial use was not indicated as per guidelines.

Elective and trauma cases	Common cases	Most common antimicrobial class	Name of prophylactic antimicrobial	Route of administ ration	Days of therapy (Mean±SD)
General Surgery (n=5)	Haemorrhoidectomy	3rd generation cephalosporins	Cefotaxime	i.v.	12.2±4
Orthopaedics (n=2)	Tendon repair, Anterior cruciate ligament Repair	3rd generation cephalosporins	Cefotaxime	i.v.	2±2.8
Obstetrics and Gynaecology (n=24)	Vaginal delivery, Emergency caesarean section, Incomplete abortion	Penicillins Nitroimidazoles	Ampicillin and Metronidazole	i.v. i.v.	5.5±3.9
Ophthalmology (n=17)	Cataract surgery	Fluoroquinolone	Moxifloxacin	Topical	2.2±0.8
Urology (n=6)	Transurethral Resection of Prostate	3rd generation cephalosporins	Cefotaxime	i.v.	6.2±4.2
Trauma (n=17)	Fracture long bone, Closed globe eye injury	3rd generation cephalosporins	Cefotaxime	i.v.	10.8±7.0

[Table/Fig-4]: Prophylactic antimicrobial use in trauma and elective surgical cases.



[Table/Fig-5]: Top 10 antimicrobials prescribed with their AWARE class.

antimicrobial prophylaxis for elective surgeries also exceeded that recommended in guidelines.

Previous studies have also documented widespread overuse of antimicrobials in inpatients as well as outpatients in India [17-20]. In the present study, 65.2% of inpatients received at least one empiric antimicrobial. This was comparable to the overall antimicrobial prescription rate of 69.4% reported in a previous study by Indira KS et al., from rural and urban health settings in India [18]. Interestingly, in the above study, only 47.6% of patients received antimicrobials in a city in Kerala [18]. Another study by Singh SK et al., across several tertiary care hospitals in India, found that 57.4% of inpatients overall received at least one antimicrobial [21]. The present study is an uncommon study from Southern India conducted in inpatients of a tertiary care teaching hospital in the government sector. Other studies have mostly studied outpatients or inpatients from specific wards of private healthcare Institutions [20,22]. In any circumstance,

Author's name and year published	Region	Sample size and setting	Objective	Common parameters studied			Conclusion
				Proportion received empiric antimicrobial n (%) [Single/ Multiple antibiotics]	Most frequently prescribed antimicrobial group	Most frequently prescribed antimicrobial	
Present study	Kerala, India	210 inpatients in a government medical college	Proportion, pattern and rationality of antimicrobial use	137 (65.2%) [Single 76 (36%), Multiple 61 (29%)]	Cephalosporins	Ceftriaxone	Therapeutic and prophylactic overuse of antimicrobials
Parathoduvil AA et al., 2022 [16]	Kerala, India	1186 inpatients in a government medical college	To study the prescription pattern of antibiotics and to assess their rationality	589 (49.6%) [Single 364 (61.8%) Multiple 225 (38.2%)]	Cephalosporins	Cefotaxime	Process of prescription auditing must be enhanced
Mani S and Hariharan TS, 2017 [13]	Kerala, India	2100 outpatients and inpatient of private medical college hospital	610 (29%)	610 (29%) [Single 393 (64%) Multiple 217 (36%)]	Penicillins	Ampicillin	Need for strict implementation of antibiotic policy and antibiotic treatment guidelines.
Anand N et al., 2016 [20]	Karnataka, India	1076 ICU inpatients in private medical college	To study the drug utilisation patterns of AMAs and their cost and rationality	865 (80.4%) [Single 1 (0.2%) Multiple 864 (99.8%)]	Cephalosporins	Ceftriaxone	Need for institution specific AMA policy and regular training and audit with active feedback
Singh SK et al., 2019 [21]	Multicentric, India	1750 inpatients in 16 private tertiary care hospitals	To assess antimicrobial prescribing patterns and their regional variation	1005 (57.4%)	Penicillins with Beta lactamase inhibitors	Piperacillin + Tazobactam	High levels of antibiotic use underline the need for antibiotic stewardship
Bhattacharjee S et al., 2025 [37]	Multicentric, India	3974 inpatients in 8 tertiary care government medical colleges	Point prevalence survey of antimicrobial use patterns	2369 (59.6%) [Single 1065 (44.95%), Multiple 1304 (55.05%)]	Cephalosporins	Ceftriaxone	Common use of broad-spectrum and Watch group of antibiotics with significant regional variations
Demoz GT et al., 2020 [38]	Ethiopia	822 inpatients in a tertiary care hospital	To investigate prescribing patterns of antibiotics	822/1571 (52.3%) [Single: 403 (49%) Multiple: 419 (39%)]	Cephalosporins	Ceftriaxone	Need for developing an ASP, and developing institutional guidelines

Ahiabu MA et al., 2016 [39]	Eastern region, Ghana	1600 Outpatients from 4 healthcare facilities	To assess antibiotic prescription practices in primary health-care settings	60% prescriptions had antibiotics	Penicillins	Amoxycillin	High prescription rates of antimicrobials
Amaha ND et al., 2018 [40]	Eritrea	100 inpatients of a tertiary care teaching hospital	To investigate the antibiotic use in hospitalised patients	79 (79%) [Single: 61 (77%) Multiple: 18 (23%)]	Penicillins	Ampicillin	Longer duration of antibiotic use needs to be addressed by developing STGs

[Table/Fig-6]: Comparison of results of present study with selected previous studies.

the indigenous rate of antimicrobial prescription is much higher than the global average of 34% reported from a study conducted across 53 countries [23]. Despite a bed strength of 750, only 210 patients sought admission in our hospital on the day of the study. However, this may have provided a rare opportunity to estimate the baseline use of antimicrobials in the hospital without undue overcrowding and consequent time constraints for the treating doctors. It is unlikely that the remaining beds were unoccupied but may have had inpatients admitted on previous days, thus maintaining high bed-occupancy rates. Further, the short median period of hospitalisation indicates rapid turnover of patients not unlike other Medical College Hospital in the country. The presence of patients with major organ dysfunction as well as predisposition to immunosuppression was comparable to other studies and may not be the sole reason for overuse of empiric antimicrobials [21].

The relative lack of culture and sensitivity reports in the medical records precluded any change from empiric to definitive antimicrobial therapy. This is not uncommon in Indian hospitals, as was reported in a study conducted by Singh P et al., where positive culture reports were obtained in only 25% of cases [24]. It may be related to several factors, including but not limited to infection in inaccessible sites, previous antimicrobial therapy before referral, absence of growth in culture and/or failure to record these results in the medical records.

Previous studies have shown that among antibacterials, beta-lactam antibiotics were the most used drug class in inpatients. For example, a multi-centric study conducted by Singh SK et al., found that penicillins together with β-lactamase inhibitors were the most frequently used antibacterials [21]. However, the pattern of use has shifted to successive generations of cephalosporins over the years. A previous study by Chandy SJ et al., had shown that cephalosporins were being commonly prescribed in private healthcare institutions [19]. Similarly, another study in primary care physicians showed that cephalosporins were being overused in private healthcare institutions compared to government sector institutions [25]. Overuse of 3rd generation cephalosporins seen in the present study seems to be the reflection of a growing trend in the country [20,22,26]. This may indicate the spread of AMR to previously used antimicrobials as well as a shift in attitude and practice of treating doctors [21]. Moreover, the convenience of twice or single day dosing of most cephalosporins compared to thrice daily dosing of penicillins may improve patient satisfaction, but at the expense of the spread of AMR.

In the present study, the majority of patients who underwent elective surgeries, except obstetric and gynaecological cases, were prescribed surgical prophylaxis with 3rd generation cephalosporins, especially cefotaxime. However, guidelines for surgical prophylaxis recommended the use of single intravenous dose of the 1st generation cephalosporin, cefazolin [27]. Cefazolin availability has decreased in the Indian pharmaceutical market due to a lack of manufacturer interest, presumably due to low profitability following drug price control orders [28]. In such a scenario, it is expected that treating surgeons may shift from 1st to 2nd generation parenteral cephalosporins such as cefuroxime. In contrast, the shift to cefotaxime may be related to regular government supply of this drug for general medical disorders and/or broader spectrum of coverage. Whatever may be the reason(s), prolonged antimicrobial prophylaxis has not been shown to reduce the risk of surgical-site infections, but is associated with longer length of hospital stay, in resource-limited healthcare systems [29].

The majority of ophthalmological cases were prescribed moxifloxacin eye drops for both prophylaxis and treatment of ocular infections, similar to previously reported studies [30,31]. The prophylactic use of ampicillin with metronidazole in obstetrics aligns with the WHO policy of using the Access group of antimicrobials while covering for aerobic as well as anaerobic gram-negative organisms. The use of antimicrobials in the puerperal period has been well documented in earlier times [32,33]. In the present study too, all cases of uneventful vaginal delivery as well as Lower Segment Caesarean Section (LSCS) were prescribed prophylactic antimicrobials for a mean of 5.5 days. However, in a randomised controlled trial, Garala NJ and Nambiar SS have questioned the routine use of prophylactic antimicrobials in vaginal delivery, even when conducted using a medio-lateral episiotomy, in the absence of perineal tears [34]. The above study has pointed out the lack of clinical benefit in using prolonged antimicrobial prophylaxis with respect to the incidence of puerperal infections and duration of hospital stay [34]. Moreover, such prolonged use has also been shown to adversely affect the neonatal microbiome, the effects of which may even persist into adulthood [35]. Therefore, it is not surprising that neither the NCDC nor KARSAP guidelines mention antimicrobial prophylaxis for normal vaginal delivery [8,9]. However, the use of antimicrobial prophylaxis in LSCS has proven clinical benefit and remains recommended [36]. The results of the present study have been compared with similar studies done previously from different regions in [Table/Fig-6] [13,16,20,21,37-40].

Limitation(s)

The present study was a medical record-based study with the limitation of missing relevant data unless it is documented in the case-sheets by treating doctors. The number of patients admitted on the chosen single calendar day was found to be lower than the calculated sample size. This was beyond the control of investigators. However, the study could not be extended to more days for fear of inducing selection bias if recruiting an uneven number of patients from different departments. On the bright side, the whole course in the hospital of each studied inpatient could be followed.

CONCLUSION(S)

The present study showed high and prolonged use of empiric antimicrobials as well as surgical prophylaxis among inpatients of a Government Medical College hospital in Kerala, with minimal use of microbiological culture and sensitivity reports. The study also showed overuse of the WHO watch category of antimicrobials, not unlike private healthcare Institutions in Kerala. Further studies are needed to explore the factor(s) underlying this practice. It may be due to several factors, including but not limited to lack of regular updation with guidelines, defensive practice, fear of losing patients to peers, patient expectations, lack of antimicrobial stewardship, perceived lack of hygiene and low faith in infection control practices in the government sector. Intersectoral programs are needed to target such factors to contain AMR and preserve antimicrobials for the future of mankind.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Oct 03, 2025
- Manual Googling: Nov 26, 2025
- iThenticate Software: Nov 28, 2024 (6%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? No
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Sep 30, 2025**
Date of Peer Review: **Oct 23, 2025**
Date of Acceptance: **Dec 01, 2025**
Date of Publishing: **Feb 01, 2026**