Assessment of Antibiotic Prescribing Patterns at Outpatient Pharmacy Using World Health Organization Prescribing Indicators

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Abstract

Background: Overuse of antibiotics is a common problem in health care, which leads to unnecessary expenditure on drugs, raised risk of adverse reactions, and the development of antimicrobial resistance. Inappropriate prescribing habits lead to ineffective and unsafe treatment, worsening of disease and increment of health care costs. The aim of this study was to assess antibiotic prescribing patterns using World Health Organization prescribing indicators at the outpatient Pharmacy Department of University of Gondar referral hospital, Gondar, Northwest Ethiopia. **Methods:** A retrospective cross-sectional study was conducted. One-year prescription data was collected from prescription and prescription registration books retained at the pharmacy store. World Health Organization/International Network of Rational Use of Drugs prescribing indicators were utilized to measure rational use of drugs with due focus on antibiotics prescribing patterns. The collected data was analyzed using SPSS version 20. **Results and Discussion:** A total of 968 drugs were prescribed from 600 patient encounters. The average number of drugs per encounter was 1.6. The percentage of encounters in which an antibiotics and injections were prescribed was 69.7% and 6.3% respectively. Amoxicillin (28.5%) followed by ciprofloxacin (12%) and metronidazole(11.1%) were the most commonly prescribed antibiotics. The percentage of drugs prescribed from essential drugs list and by generic name was 95.3% and 96%, respectively. Rate of antibiotics prescribing showed deviation from the standard recommended by World Health Organization whereas polypharmacy, injectable prescribing pattern, uses of brand names, and prescription of drugs from the National Essential Drugs List were not found to be a significant problem though there were slight deviations from the standard. **Conclusion:** Interventions aimed at improving the antibiotic prescribing patterns need to be implemented so as to prevent the inappropriate use of antibiotics and avoid further complications.

Keywords

antibiotics, prescribing pattern, antimicrobial resistance, prescribing indicators

Background

Antibiotics are medications that can destroy or inhibit the growth of bacteria by either selectively killing or inhibiting the development of disease-causing bacteria.[1,2] Currently, they are the most commonly prescribed drugs in hospitals worldwide. Antibiotics play a pivotal role in combating disease and maintaining health especially in developing countries where infectious diseases are still a big challenge. However, in recent years their benefit is facing a great challenge due to the emergence of antibiotic resistance. Currently, it is found that many microbes have become resistant to the most commonly available and effective first line agents mainly due to inappropriate prescribing practices.[3-5]

The consumption of antibiotics has increased worldwide with most of this occurring in low- and middle-income

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countries.[6] Antibiotics prescription varies significantly between countries as shown by 1 out of 2 hospitalized patients receiving antibiotics in Africa and Asia while 1 out of 3 patients in Europe receives antibiotics.[7] In many African countries, including Ethiopia, it is a common practice to prescribe multiple medications in a single prescription paper, which is referred to as polypharmacy, and in the current study it refers to using 5 and more medications in a single prescription paper.

A study conducted on 26 primary care facilities in Cameroon showed that from the total 30 096 prescription papers reviewed, 11 035 (36.7%) had at least 1 antibiotic prescription.[3] Another study conducted in Lesotho showed that the average number of medicines prescribed per prescription was 3.8 of which antibiotics constitute 37.6%.[8]

Many studies conducted in Ethiopia also showed that antibiotics were among the most commonly prescribed groups of medications.[9-11]

Antibiotic resistance is a global health crisis and is one of the greatest challenges for public health and affects both developing and developed countries.[12-14] Inappropriate prescribing habits lead to ineffective and unsafe treatment, worsening/prolongation of diseases and cost increments due to further complication of diseases and the need for further treatment. Inappropriate prescribing also reduces the quality of medical care and leads to wastage of resources.[15]

In developing countries antibiotics are prescribed for 44% to 97% of hospitalized patients often unnecessarily or inappropriately.[16,17] It is estimated that half of all medicines in Africa are used inappropriately including two third of antibiotics.[18,19]

According to a Centers for Disease Control and Prevention report on "antibiotic resistance threats in the United States," it is estimated that antibiotic resistance is responsible for more than 2 million infections and 23 000 deaths each year in the United States, at a direct cost of $20 billion.[20]

Many studies conducted in Ethiopia have shown that most of the bacteria that cause infections to human beings and animals have developed considerable degree of resistance to commonly used first-line antibiotics.[7,21] The current study was aimed at assessing antibiotics prescribing pattern at university of Gondar comprehensive and specialized hospital using the WHO prescribing indicators.

Methods and Materials

Study Area and Period

The study was conducted at the University of Gondar comprehensive and specialized hospital outpatient Pharmacy Department. The hospital is a governmental hospital located in Gondar town, central Gondar zone, Amhara regional state, Ethiopia. Gondar is located at 727 km away from Addis Ababa; capital city of the country and 185 km from Bahirdar, the capital city of the region. University of Gondar comprehensive and specialized hospital is one of the oldest and respected teaching hospitals in the country currently serving more than 4.1 million people of the central Gondar zone and people from neighboring regions. The study was conducted from March 5, 2019 to June 10, 2019.

Study Design

A retrospective cross-sectional study was conducted. Data were collected using a prequalified check list. World Health Organization/International Network of Rational Use of Drugs (WHO/INRUD) prescribing indicators with their standard values were utilized to measure rational use of drugs with due focus on antibiotics prescribing patterns.[22,23]

Population

Source Population. All prescription papers (23 000) that were dispensed between March 1, 2018 and March 30, 2019 at the Outpatient Pharmacy Department of University of Gondar Comprehensive and Specialized Hospital.

Sample Size Determination and Sampling Procedure

WHO's "How to investigate drug use in health facilities" recommends at least 600 encounters to be included in a cross-sectional survey involving a drug use survey.[22] Because of financial constraints to include more encounters, 600 prescription papers for a 1-year period were studied per the WHO recommendation.[22] Specific prescription papers were selected using systematic random sampling method, using prescription numbers as a reference for a sampling frame. The total number of prescription papers dispensed between March 1, 2018 and March 30, 2019 were 23 000 and from thus dividing this with the number of the sample size "600" gave us the sampling interval "38." Every prescription paper has its unique identification number and thus all of the prescriptions dispensed during the study period were arranged in ascending order and every "38th" prescription paper was selected.

Data Collection Procedures

Data were collected from prescription papers and prescription registration books. A structured check list adopted from WHO prescribing indicators guideline and similar literatures were used after modifying it to fit to the current study.[22] The check list contains information to assess the validity of prescription papers, patient-related information, and medications-related information. Prescription papers in

which the handwriting of the prescriber was illegible to identify the medication clearly and prescription papers that did not contain a medication (those containing medical supplies only) were excluded.

Data Processing and Analysis

The collected data were entered in to SPSS version 20 and analyzed. As the study was conducted in a hospital setting, all the drugs dispensed require a valid prescription paper. In the statistical analysis, frequencies, averages/means, and percentages were calculated. Percentage of encounters in which an antibiotic was prescribed was calculated to measure the overall use of commonly overused and costly forms of drug therapy. It was calculated by dividing the number of patient encounters in which an antibiotic was prescribed by the total number of encounters surveyed (600), multiplied by 100.

Data Quality Assurance

Pretest of the data collection tool was conducted on 30 prescription papers in order to assess the adequacy of the questionnaire to determine the parameters in question. The collected data were checked for completeness, accuracy, and consistency at the end of each day.

Definition of Terms

Antibiotics include penicillins, other antibacterials, antileprosy drugs, anti-infective dermatologcal drugs, anti-infective ophtalmological agents, antidiarrhoeal drugs with streptomycin, neomycin, nifluroxazide, or combinations.[22]

Combination of drugs indicates 2 or more drugs that are prescribed for a given health condition. For example, triple therapy for *Helicobacter pylori*–induced peptic ulcer is counted as one.

Ethical Consideration

Ethical clearance of the study was obtained from University of Gondar Institutional Review Board and was administered to respective stakeholders at the pharmacy.

Results

Completeness of the Prescription

Demographic data of patients (age and sex) as well as date of prescription were mentioned in all the prescriptions reviewed. However, none of the prescriptions contained patient weight and height data. Drug-related information, such as name of the drug, strength, frequency and duration of treatment, prescriber, and dispenser information were

Table 1. Sociodemographic Characterstics of Sampled Patients at University of Gondar Comprehensive and Specialized Hospital Outpatient Pharmacy Department Between March 2018 and March 2019.

Characteristics	Frequency	Percentage
Gender		
Male	242	40
Female	358	60
Age, years		
<5	46	7.7
5-14	60	10
15-30	302	50.3
31-44	87	14.5
45-64	85	14.2
>65	19	3.2

Table 2. Summary Report of Number of Drugs per Encounter at University of Gondar Comprehensive and Specialized Hospital Outpatient Pharmacy Department Between March 2018 and March 2019.

Number of Drugs per Encounter	Frequency	Average (%)
One drug	335	55.8
Two drugs	168	28.0
Three drugs	91	15.3
Four drugs	6	1.0

also completely mentioned in all of the prescriptions reviewed. The diagnosis of ailments was recorded in 212 (35.3%) of the prescription papers.

Drug-Related Outcomes

As shown in Table 1, the majority of the prescriptions (358, 60%), were prescribed for females. Majority of the patients were between the ages of 15 and 30 years.

A total of 968 medicines were prescribed with an average number of drugs per encounter found to be 1.6. Out of all prescriptions, 335(55.8%) of them had only 1 drug per prescription while 6 prescriptions contained 4 drugs (Table 2). The total number of encounters prescribed with antibiotics and injection were 418(69.6%) and 38(6.3%) respectively. About 95% of the drugs (923, 95.3%), were prescribed from the essential drug list of Ethiopia.[23] The details are shown in Table 3.

Antibiotics Prescribing Pattern

From the total 600 prescription papers reviewed 968 medicines were prescribed from which 567 (58.5%) were antibiotics (Figure 1).

Table 3. Summary Report of Prescribing Indicators at University of Gondar Comprehensive and Specialized Hospital Outpatient Pharmacy Department Between March 2018 and March 2019.

Prescribing Indicators	Total Number of Drugs	Average (%)	WHO Standard Value
1. Average number of drugs per encounter	968	1.6	(1.6-1.8)
2. Percentage of encounters with antibiotics	418	69.6	(20-26.8)
3. Percentage of encounters with injection	38	6.3	(13.4-24.1)
4. Percentage of drugs prescribed by generic name	929	96	100
5. Percentage of drugs from essential drug list	923	95.3	100
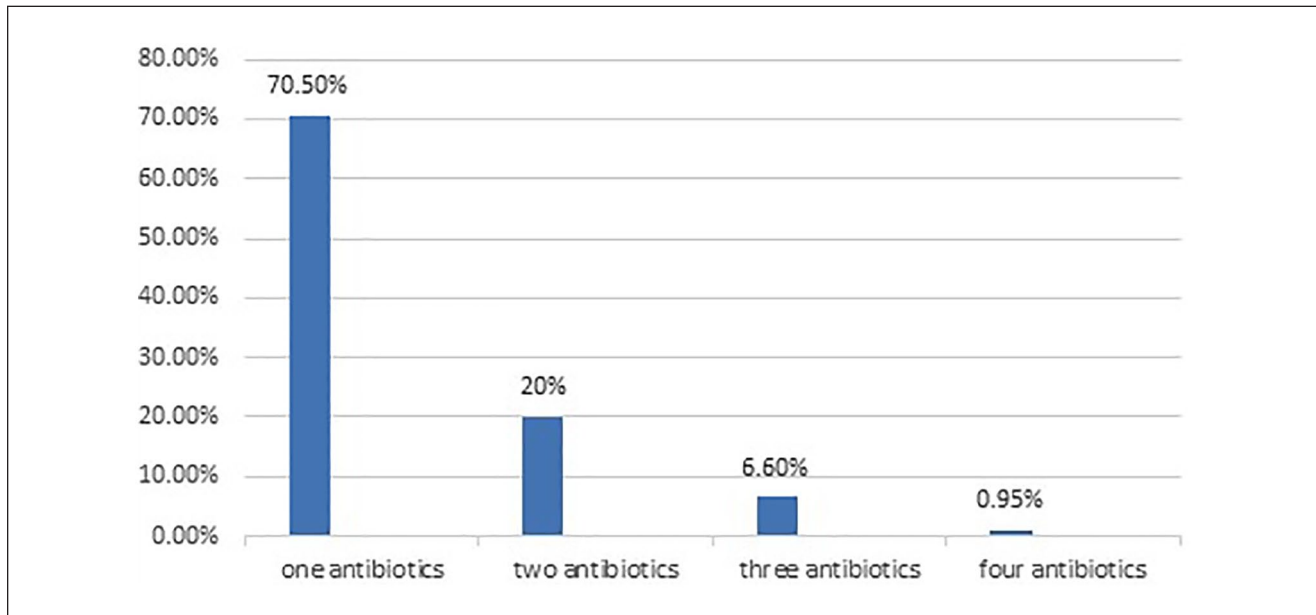
Figure 1. Total number of antibiotics per prescription at University of Gondar Comprehensive and Specialized Hospital Outpatient Pharmacy Department between March 2018 and March 2019.

By antibiotics category, penicillin was the most frequently prescribed (217, 38.2%) category of antibiotics followed by macrolides (84, 15%; Figure 2).

By specific types of antibiotics, amoxicillin was the most frequently prescribed antibiotic (162, 28.6%), followed by ciprofloxacin (66, 12%) and metronidazole (63, 11.1%; Table 4).

Among the total 212 prescriptions for which the diagnosis was written, 162 contained antibiotics. Among the 162 prescriptions, gastrointestinal tract infections (44, 28%) were the most common diagnosis for frequently prescribed antibiotics followed by lower respiratory tract infections (30, 19.4%; Table 5).

Majority of antibiotics were prescribed by oral route (476, 84%) followed by parenteral route (39, 4%). Regarding the dosage form of antibiotics, capsule (255, 45%) and tablets (231, 40.7%) were the most commonly prescribed dosage forms.

Discussion

Completeness of Prescriptions

All the 600 prescriptions contain patient information (name, age, and sex). This was greater than a study conducted in Addis Ababa and earlier in Gondar in which only 25% and 85% of the prescriptions contain patient information (age and sex), respectively.[9,6] However, only 35.3% of the prescriptions contained patient diagnosis information, which is much lower than the standard value (100%). But this finding was better than a similar study conducted earlier in Gondar in 2011, which was only 1.4%.[6] Regarding the drug-related information in this study, all the prescriptions contain the correct name, strength, duration, frequency, and dosage form of the drugs (100%). This was better than a study conducted earlier in Gondar, which was 79%.[6] This could be attributed to improvements in prescribing and dispensing practice by health professionals, which could in
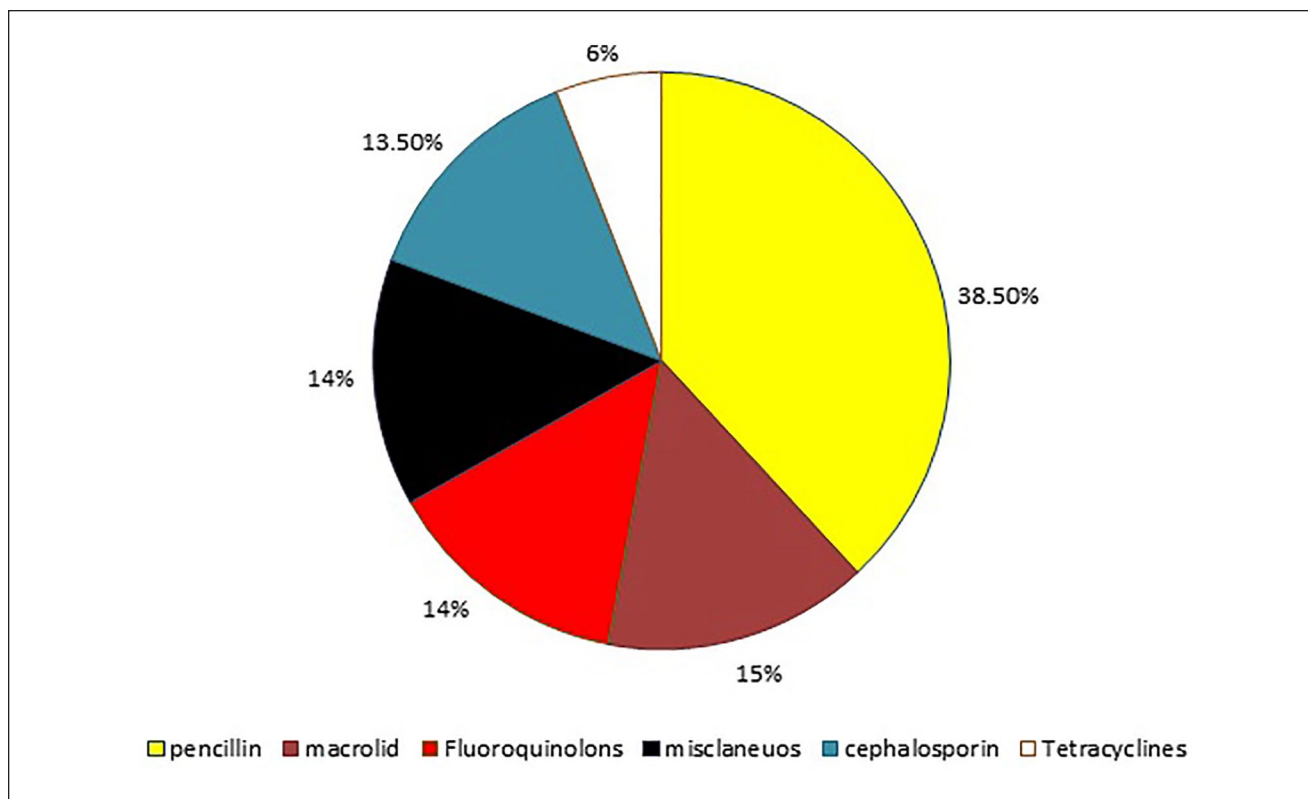
Figure 2. Most commonly prescribed classes of antibiotics at University of Gondar Comprehensive and Specialized Hospital Outpatient Pharmacy Department between March 2018 and March 2019.

Table 4. Summary of Most Commonly Prescribed Antibiotics at University of Gondar Comprehensive and Specialized Hospital Outpatient Pharmacy Department Between March 2018 and March 2019.

Common Antibiotics	Frequency	Percentage
Amoxicillin	162	28.6
Ciprofloxacin	67	12
Metronidazole	63	11
Azithromycin	59	10.4
Ceftriaxone	37	6.5
Cephalexin	36	6.3
Amoxicillin + clavulanate	33	5.8
Doxycycline	32	5.6
Cloxacillin	26	4.5
Clarithromycin	25	4.4
Trimethoprim-Sulfamethoxazole	16	2.8
Norfloxacin	13	2.2

Table 5. Summary of Common Diagnosis for Frequently Prescribed Antibiotics at University of Gondar Comprehensive and Specialized Hospital Outpatient Pharmacy Department Between March 2018 and March 2019.

Diagnosis	Frequency	Percentage
1. Gastrointenstinal infection	44	27.5
2. Lower respiratory infection	30	19.0
3. Sexually transmitted diseases	29	18.1
4. Upper respiratory infection	27	17.0
5. Urinary tract infection	21	13
6. Skin and soft tissue infection	10	6.1

turn be due to continuous professional developments and revolutionary practices executed by the hospital and specially the pharmacy department.

Average Number of Drugs per Encounter

In the current study, the average number of drugs per encounter was 1.6, which is within the range recommended by WHO (1.6-1.8).[24] This finding was lower than a similar study conducted in Addis Ababa, Hawassa, Ghana, and earlier in Gondar, in which the average number of drugs per encounter was 2.0, 1.9, 3.5, and 1.77, respectively.[6,9,11,25] The lower the number of drugs prescribed per encounter; it is a positive sign of good prescribing practice. It reduces polypharmacy and in turn minimizes disease complication due to drug-drug interactions and adverse drug reaction.

In this study the most common indications for antibiotic prescription was respiratory tract infections (57, 36%) followed by gastrointestinal tract infections (44, 27.5%) and sexually transmitted diseases (29, 18.125%). This result was consistent with a similar study conducted in Addiss

Ababa in which respiratory tract infections were the most common indications for antibiotics (24.5%).[9] This could be due to the fact that respiratory tract infections such as tonsillitis and pharyngitis, which usually occur due to problems in personal hygiene, are very common in Ethiopia and antibiotics are the mainstream treatment, which makes them being frequently prescribed.

Use of Antibiotics

In the current study, percentage of antibiotics per prescription was found to be 69.6%, which is much higher than the ideal value recommended by WHO (20-26.8).[22] This finding was much heigher than earlier study conducted in Gondar on drug use practice in which only 29.3% of the prescriptions contained an antibiotic.[6] It was also higher than similar studies conducted in Addis Ababa and southern ethiopia, in which antibiotics constitute 38% and 58.1%, respectively.[9,26]

In this study, penicillins were the most frequently prescribed classes of antibiotics (38.5%) followed by macrolides (15%) and fluoroquinnolones (14%). This finding was consistent with a similar study conducted in Addis Ababa and Dessie, in which penicillins (51.9%) were the most commonly prescribed groups of antibiotics followed by fluoroquinolones (18.3%).[9,10] A similar finding was reported by a study in Kenya in which penicillins (46.9%) followed by cephalosporines (45.8%) were the most commonly prescribed classes of antibiotics.[27] A study conducted in Bangladesh, however, reported that cephalosporins were the most frequently prescribed groups of antibiotics followed by macrolids.[28] By specific antibiotics, amoxicillin (28.5%) followed by ciprofloxacin (12%) and metronidazole (11.1%) were the most frequently prescribed antibiotics in the current study. This finding was consistent with similar study conducted in Ghana, in which amoxicillin (22.5%) followed by ciprofloxacin (18.4%) being the most frequently prescribed antibiotics.[25] Amoxicillin was also found to be among the commonly prescribed antibiotics in studies conducted in Addis Ababa and Dessie.[9,10] But this was different from a study done in Kenya, in which ceftriaxone was the most frequently prescribed antibiotics (39.7%) followed by benzyl penicillin (29%).[27] This might be due to regional variation in bacterial susceptibility/resistance, prescribing habit and the difference in prevalence of infectious diseases in diferrent countries.[29,30]

Prescribing by Generic Name

The average percentage of drugs prescribed by generic name in this study was 96%, which was slightly lower than the standard recommended by WHO (100%). This result was similar with a study done in Hawassa, Addis Ababa, and Wolyta sodo in which generic prescribing constituted 98.14%, 98.7% and 94%, respectively.[9,11,26] A similar study in Kenya however reported that only 62.5% drugs were prescribed by generic name.[27] This may be due to differences in the 2 countries' medication procurement policy in which the Ethiopian procurement policy promotes procurement by generic name or it could be due to economical differences between the people in the 2 countries in which people in Kenya may be able to afford brand medications unlike many Ethiopians for whom the intern will influence the choice of brand/generic products by physicians.

Prescription of Injectable Dosage Forms

Percentage of encounters with an injection prescribed was calculated to measure the overall level use of commonly overused and costly forms of drug therapy. The percentage of drugs prescribed by injection in this study was 6.3%, which is found to be lower than the acceptable range recommended by WHO (13.4%-24.1%).[25] It was much lower than a similar study conducted earlier in Gondar, Dessie, Hawassa and Wolayta which was found to be 28.7%, 37.5%, 38.1%, and 50%, respectively.[6,10,11,26]

Prescribing From National Essential Drugs List

In this study the percentage of drugs prescribed from the essential drugs list was 95.3%, which was not far from the ideal value of (100%) set by WHO. This result was consistent with a similar study conducted in Hawassa (96.6%) and southern Ethiopia 94.1%.[11,26] However, it was much heigher than another study conducted in Lesotho, which was 79%.[8] The current finding showed good prescribing practice and it could be due to a strict follow-up by the hospital management and/or it could be due to the pharmaceutical procurement policy of the country, which is based on the Essential Drugs List of the country and this limits prescribers not to prescribe drugs out of the list because only drugs from the Essential Drugs List are available in the health care facility.

Limitation of the Study

The study was conducted only at outpatient pharmacy and thus does not include antibiotics utilization at inpatient departments and thus may not correctly indicate the entire antibiotics utilization pattern in the hospital. The data were also collected only by reviewing the prescription papers and registry books, which does not include interviews with prescribers and/or patients and thus does not assess factors contributing to the current practice. The study also does not include review of the medical chart of patients to further evaluate if the prescriptions were rational and appropriate to the current diagnosis.

Conclusion

Antibiotics prescribing pattern in the current study has showed a deviation from the standard recommended by WHO. This calls for sustained interventional strategies and periodic audit at all levels of health care to avoid the negative consequences of inappropriate antibiotics prescribing. On the other hand, polypharmacy, injectable prescribing, use of brand name, and prescribing drugs in the Essential Drugs List were not found to be a significant problem in this study, though there was a slight deviation in comparison to the standard values recommended by WHO.

Recommendations

The hospitals need to encourage systematic monitoring of antibiotic use through institution of programs to promote rational drug use. The hospital's Drug and Therapeutic Committee should be strengthened to control antibiotic use and regularly provide clinicians with up-to-date information regarding rational antibiotic prescribing practice. The ministry of health should update and disseminate national standard treatment guidelines, encourage targeted, problem-based in-service educational programs and regular continuing education for health professionals.

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