

Assessment of Antibiotic Prescription Pattern Using WHO Prescribing Indicators and AwaRe Categorization of Antibiotics

SIDRA MUSHTAQ¹, FATIMA JAVED², MUFAKHARA FATIMAH³, ZAEEM SOHAIL JAFAR⁴, SYEDA TAHIRA ZAIDI⁵, ASIA FIRDOUS⁶, AJAZ FATIMA⁷

¹Associate Professor Pharmacology, Independent Medical College Faisalabad

²Pharmacist, Independent Medical College Faisalabad

³Assistant Professor Pharmacology, Sahara Medical College, Narowal,

⁴Medical Officer, Sahara Medical College, Narowal

⁵Senior Demonstrator Pharmacology, Al-Aleem Medical College, Lahore,

⁶Assistant Professor Pharmacology, Lahore Medical & Dental College, Lahore,

⁷Professor Pharmacology, Lahore Medical & Dental College, Lahore,

Correspondence to Dr. Mufakhara Fatima, Email: dr.mufakhara@gmail.com, Tel. 03320422425,

ABSTRACT

Background: Medicines play a crucial role in the healthcare delivery of a hospital. The appropriate use of medicines gives us assessment of the quality of health services being provided in a particular region.

Aim: To evaluate the prescribing practices and antibiotic utilization patterns so that the extent of irrational use can be assessed by comparing them with published ideal values set by WHO.

Study design: Retrospective, cross-sectional study.

Place and duration of study: Teaching Hospital of Faisalabad: Independent University Hospital (IUH), from Jan 2018 to June/July 2018.

Methodology: 200 cases were selected through systematic random sampling from medicine/surgery wards and pharmacy registers. The standard World Health Organization prescribing indicators and AwaRe categorization of antibiotics were used to assess the prescribing practices of physicians/surgeons. Published ideal standards for each of the indicators were compared with study findings to identify extent of irrational drug use.

Results: Most of the facility indicators were met with. The Drug and Therapeutic Committee (DTC) was functional. The Standard treatment guideline booklets (STGs) and Essential Drugs List (EDL) of the hospital were available. 88% of the key drugs listed in EDL were available in stock. The expenditure on antibiotics compared to total medicines was 17%. Regarding prescribing indicators: the average number of drugs prescribed per encounter was 6 (optimal value 1.6–1.8). Average no of antibiotic per prescription amounted to almost 1 (0.925). % prescriptions with an antibiotic amounted to 72% (optimal value 20-26.8%). 72% antibiotics were prescribed from the EDL formulary of the hospital (optimal value 100%).

Conclusion: Regarding compliance with prescribing indicators and AwaRe categorization of antibiotics by WHO, significant deviation was observed. Education and training of physicians according to WHO parameters is required to ensure rational prescribing.

Keywords: Prescription pattern, WHO Prescribing Indicators, AwaRe Categorization

INTRODUCTION

Medicines play a crucial role in the healthcare delivery of a hospital. The appropriate use of medicines in this regard gives us assessment of the quality of health services being provided in a particular region.¹ It has been reported by WHO that almost 30 to 50% of all hospitalized patients are prescribed at least one antibiotic and as a result, bulk of the hospital budget almost 30%, is reserved for antibiotics².

Antibiotics over the past 50 years have brought evolutionary changes to the likely course of disease in patients with severe infections. However, the dissemination of resistant organisms due to inappropriate and irrational use is seriously threatening the effectiveness of antibiotics worldwide.

The association between resistance and inappropriate use of antimicrobials is well established; overuse is actually the key factor leading to AMR³ however very little information is available on antimicrobial use in developing countries compared to developed ones¹.

In this regard cross-sectional studies which evaluate drug utilization in our hospitals (DUE drug utilization evaluation) or prescription pattern monitoring studies, have important role to play to promote rational use of medicines⁴. Studies have pointed out important facts about misuse of medicines in this regard: almost 1.1 billion dollars cost was reported in USA for unnecessarily prescribed antibiotics and 20 billion dollars worth budget was allocated for the treatment of resistant infections⁵.

Data on antimicrobial consumption obtained thru retrospective analysis of case records of hospitals can provide an important tool for regions to better monitor the quality and quantity of antibiotics used at the national level; which can in turn guide policy makers for better regulations and interventions according to international guidelines¹.

WHO prescribing indicators^{6,7,8} and WHO AwaRe categorization of antibiotics⁹ has set a benchmark to assess the quality of healthcare provided in a facility. The indicators deal with following areas of antimicrobial use; facility, prescribing, and complementary drug use indicators^{6,10}. WHO is promoting implementation of these indicators especially in developing countries and it has successfully done so in 30 + such countries.

Similarly, to discourage the emergence of resistance and to promote rational prescribing of antibiotics, WHO in 2017 has classified the antibiotics into 3 major groups: Access, Watch and Reserve⁹.

Access group: This group contains antibiotics which have broad anti-bacterial spectrum especially against normally encountered infections, have comparatively low potential of developing resistance and therefore are first or second line agents for such cases. **Watch group:** This group includes antibiotics with which potential to develop resistance is higher. **Reserve Group:** Antibiotics strictly confined for treating multi-drug-resistant organisms i-e as "last resort" options; where other options have not worked or are contraindicated.

WHO considers this classification an important tool for antibiotic supervision. WHO specifies that to discourage irrational prescribing and resistance development, at least ≥60% antibiotics should be prescribed from Access group of antibiotics. Watch and

Received on 17-05-2021

Accepted on 03-10-2021

Reserve groups are top priority targets by WHO for studies involving monitoring and utilization reporting⁹.

The aim of this study was to assess the prescribing practices in the medicine and surgical wards of our hospital, and to compare these prescribing indicators with the optimal values set by WHO; so as to assist the hospital administrators to promote rational prescribing of medicine especially antibiotics.

METHODOLOGY

Place and Duration of Study: This study was conducted in a teaching hospital of Faisalabad; Independent University Hospital (IUH) after permission from Ethical Review Board. The IUH is a 550-bedded hospital with all specialties.

Data Collection: Purposively, six medical and surgery wards of the hospital were selected. Data was collected from prescription registration books retained in the wards and pharmacy. We used the standard indicator forms to collect data. The data was collected from Jan 2018 to June/July 2018. The sampling unit was the prescriptions records written for inpatients only.

Study design and Parameters: A retrospective analysis of prescriptions was done to assess the prescribing practices as well as antibiotic utilization patterns in detail.

The optimal values set by WHO for the facility indicators, prescribing indicators and WHO categorization of antibiotics in AWaRe⁹ were taken as benchmark. The prescribing indicators by WHO which were evaluated included:

Facility indicators: Working Drug and Therapeutic Committee (DTC), presence of Standard treatment guideline booklets (STGs), existence of Essential medicines list (EML) or Formulary list (FL) of the hospital, total number of antimicrobials on the FL/EML, availability of key antimicrobials in the hospital store, % expenditure on antibiotics compared to total medicines advised.

Prescribing Indicators: The average number of drugs prescribed per inpatient-day (optimal value 1.6–1.8), average number of antibiotics per inpatient-day, the percentage of encounters where an antibiotic was prescribed (optimal value 20.0–26.8%), the percentage of drugs prescribed from the Essential Drugs List (EDL) or formulary (optimal value 100%), prescribing of medicines by their INN or generic names (optimal value 100%) and number of antimicrobial sensitivity tests performed per hospital admission.

Antibiotic Utilization Patterns: (AWaRe Categorization by WHO): Percentage of antibiotics prescribed from Access, Watch and Reserve categorization of antibiotics by WHO (Optimal value \geq 60% from Access group).

Additional indicators: We also assessed additional indicators regarding antibiotic prescription patterns: the percentage share of antibiotics in prescriptions, most commonly prescribed individual antibiotics and combination of antibiotics.

The copies of the Essential Medicines List formulary of the hospital (EML), and standard treatment guidelines (STGs) were obtained from the pharmacy department. SSP V21.0 was used for data analysis. Descriptive statistics such as mean, frequencies, percentages, bar charts and pie charts are used to present and compare data with values set by WHO.

RESULTS

Facility/Hospital indicators: The Drug and Therapeutic Committee (DTC) is functioning on a regular basis since 2014. The STGs booklets (Standard Treatment Guideline) were available separately for physicians and surgeons and so is the formulary of essential medicine list of the hospital. Twenty five antimicrobials were listed in Formulary List (EDL). Out of these 25, 88% of these key drugs (22) were available in stock. 72% antibiotics were prescribed from the EDL formulary of the hospital. The expenditure on antibiotics compared to total medicines was 17%. (Table 1)

Table 1: WHO Hospital Indicators

Parameter	Results
Working Drug and Therapeutic Committee (DTC)	Yes
Presence of Standard Treatment Guideline booklets (STGs)	Yes
Existence of Essential Medicines List (EML) or Formulary list (FL) of the hospital	Yes (Though needs updating)
Total number of antimicrobials on the FL/EML	25 generics
Availability of a set of key antimicrobials in the hospital stores on the day	88%
% expenditure on antibiotics compared to total medicines advised	17%

DTC Drug and therapeutic committee, STGs Standard treatment guidelines, FL/ EML Formulary list/essential medicines list

WHO Prescribing Indicators: In total 1228 drugs were prescribed (n=200). The average number of medicines prescribed per inpatient day were 8 in medicine wards, while 4.3 in surgery wards; overall 6 medicines per prescription were prescribed, ranging between 2-16 medicines per prescription.

Out of 1228 drugs prescribed, 185 were antibiotics (n=200). Average no of antibiotic per prescription amounted to almost 1 (0.925). % prescriptions with at least one antibiotic amounted to 72% (optimal value 20-26.8%). Share of antibiotics prescribed from essential drugs list of hospital was 72% (optimal value 100%). The drug sensitivity testing and prescribing medicines by their generic names was totally lacking: 0% (optimal value 100%) (Table 2).

WHO AWaRe Categorization: Percentage of antibiotics prescribed from the Access group categorization of WHO amounted to only 25% (optimal value \geq 60%), while Watch group was predominantly prescribed in 72.5% patients (optimal value \leq 40%) (Table 2).

Table II: WHO Prescribing Indicators and AWaRe Classification Adherence in the Tertiary care Hospital Faisalabad (n = 200)

WHO Prescribing Indicators and AWaRe Categorization	Mean		Overall Mean (n=200)	Optimal level (WHO Criteria)
	Medicine	Surgery		
The average number of drugs per prescription	Mean =8 (Range 4-16)	Mean=4.3 (Range 2-10)	Mean= 6 (Range: 2-16)	1.6-1.8
Average number of antibiotic per prescription	0.88 Range (0-3)	0.97 Range (0-3)	0.925 Range (0-3)	----
% prescriptions with an antibiotic	68%	76%	72%	20 -26.8 %
% antibiotics from essential drugs list of hospital	75%	69%	72%	100%
% prescriptions with generic names of medicines	0%	0%	0%	100%
% of antibiotics from Access group	11.6%	38.5%	25.3%	\geq 60%
% of antibiotics from Watch group	87%	58%	72.9%	\leq 40% (Watch +Reserve)
% of antibiotics from Reserve group	0.011	3.1%	1.8%	

Table III: Prescribing patterns of antimicrobials

	Prescriptions with 0 antibiotic	Prescriptions with 1 Antibiotic	Prescriptions with 2 Antibiotics	Prescriptions with 3 Antibiotics
Surgery (n=100)	24%	58%	15%	3%
Medicine (n=100)	32%	49%	18%	1%
Over all (n=200)	28%	53.5%	16.5%	2%

Figure 1: Comparing Study Findings with Indicator's Optimal Values Set by WHO

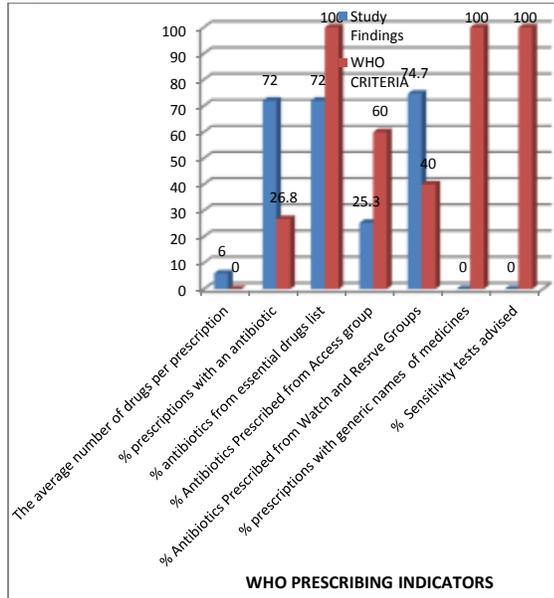


Figure II: Most commonly prescribed antibiotic groups (n=200)

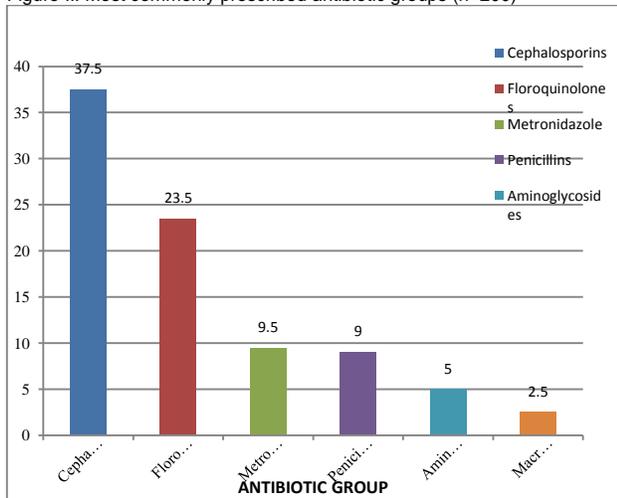
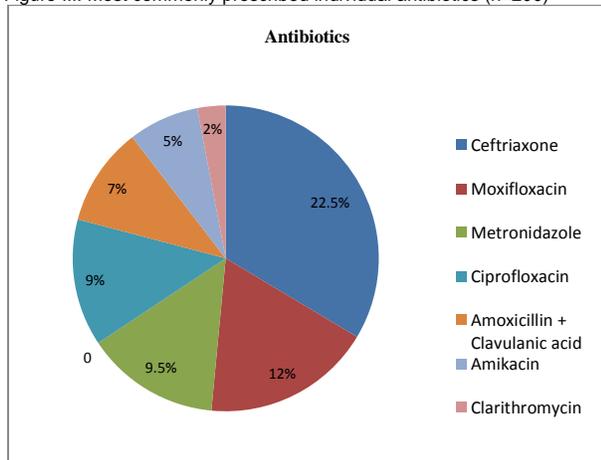


Figure III: Most commonly prescribed individual antibiotics (n=200)



Prescribing Patterns Of Antimicrobials: The data showed that cephalosporin was the most commonly prescribed antibiotic class (37.5%, n=200)(Figure II). Among cephalosporins, ceftriaxone (22.5%) was majorly prescribed. (Figure III). Floroquinolones were second on the list, being prescribed in 23.5% of patients: moxifloxacin and ciprofloxacin were the preferred options in this class of antibiotics. Metronidazole and penicillin use ranked next with 9.5% and 9% patients being prescribed respectively. In comparison aminoglycosides (5%) and macrolides (2.5%) were the least prescribed drugs.

Out of 144(72%) prescriptions with antibiotics, 107(53.5%) had one antibiotic, 33(16.5%) were prescribed two, and only 4(2%) had three antibiotics prescribed at a time (Table III). The patients admitted to the wards were also prescribed antimicrobial combinations. The most frequently prescribed antibiotic combination was 3rd generation cephalosporin with metronidazole (7%) in surgery; while in medicine fluoroquinolones with metronidazole combination (6%) was most frequent. 3% patients in the medicine wards were irrationally prescribed combination of 2 broad spectrum fluoroquinolones from the same generation

DISCUSSION

To promote rational use of medicines, the foremost step required especially in developing countries is to quantify the extent of irrational use. This is where such prescription pattern monitoring studies have important role to play. Prescription patterns explain the quality and quantity of drugs being recommended, give insight into recent trends among physicians/surgeons, and quantify the extent of adherence to WHO indicators like standard treatment regimens, overuse /underuse of recommended antibiotics, usage of drugs from essential medicine list, etc.¹¹

As WHO is promoting implementation of these indicators in developing countries, and it has successfully done so in 30 + such countries⁷, very limited number of data is available from our country regarding adherence to WHO Indicators. Therefore our study along with other such studies can provide a source of useful information in this regard to assess the prescription and hospital indicators. We also reported adherence with AWaRe Categorization of antibiotics by WHO to compare observed patterns of antibiotic use with current recommendations and guidelines.

Facility Indicators: The presence of DTC, FL and STGs in a health facility represents its devotion towards provision of quality health-care and rational use of medicines³. Drug and Therapeutic Committee is working regularly since 2014 in this hospital. The hospital has a formulary list of essential medicines, containing 25 generics of antimicrobials, but it needs updating as some common antibiotics were missing. STGs booklets are available separately for physicians and surgeons.

The availability of key antimicrobials is also necessary at hospital's pharmacy. On the day, almost 88 % of the key antibiotics were available in hospital pharmacy. This value is comparable with a study conducted in BVH where it was reported to be around 93.8⁶ In our study, % expenditure on antimicrobials compared to total medicine was 17%, compared to 12.2% in a study by Atif et al⁶.

Prescribing Indicators: The results of this study show that the average number of drugs prescribed per encounter were 6 (Table 1), which is very high compared to the recommended range of 1.6–1.8 drugs by WHO. Compared to our findings, the average number of drugs prescribed was lower in Bahawal Victoria Hospital, Pakistan⁷ (2.3). When compared with the values in other countries, India (5.6)¹² also documented a relatively higher number of drugs per prescription.

In this study, antibiotics were prescribed in 72% of hospitalizations (optimal value 20.0– 26.8%). This again implies excessive prescribing of antibiotics in this hospital. When

compared regionally, this value was relatively higher than Bangladesh (25%)⁶ while lower than Afghanistan(90%)¹³.

WHO puts great emphasis on optimal use of drugs by their generic names and from essential drug list issued by WHO for rational prescribing. Essential drug list contain drugs that are aged, reliable and cheaper than the other branded drugs¹⁴. As regards the recommendation of prescribing from the EDL, our results were comparable to study conducted in Bahawal Victoria Hospital, Pakistan⁷ (100 %); as 72% drugs were prescribed from formulary of the hospital in our study.

In stark contrast to the optimal value recommended by WHO i-e 100% regarding prescribing by generic names and or INNs; 0% drugs were prescribed by their generic names in this study. This is alarming as even in war torn country like Afghanistan¹³, 88% drugs are prescribed by generic names. Similarly % sensitivity tests conducted before antibiotic consumption was totally lacking (only 0.005, n=1)

AWARE Categorization Adherence: Our study found significant deviation from these criteria of antibiotic prescription. Access group use was very low: 25% only. Over use of Watch group of antibiotics was observed (72.5%): group which WHO emphasizes should be recommended only for specific, limited number of cases as the potential of developing resistance is higher.¹⁵

The WHO allows prescribing habits that differ from the proposed reference values in indicators like antibiotic use rate and average medicines prescribed per encounter as these are influenced by the severity of cases presenting at a health care facility¹⁶.

But adherence to facility indicators, prescribing from EDL, prescribing by generic names, % sensitivity tests recommended, recommendation of ≥60% prescription from Access group of antibiotics and less so from anti-microbials known for developing resistance are prioritized by WHO as benchmarks to assess the quality of care provided at a facility.

Most of the facility indicators were met with in this study. Some deviation in prescribing indicators was noted, while most significant deviation was found regarding AWaRe categorization. With Anti-Microbial Resistance (AMR) becoming a global phenomenon, while very few novel antibiotics are being produced; It becomes even more essential that last-resort antibiotics and those with higher resistance potential (Watch/RESERVE group) be reserved – for patients who truly need them¹⁷. We conclude that such monitoring studies can guide health facilities to adhere to International guidelines to promote rational use of antibiotics and to discourage spread of anti-microbial resistance.

CONCLUSION

The results thus show less than optimal antimicrobial prescribing patterns at this facility. Training of physicians and surgeons regarding adherence to WHO Indicators and AWaRe categorization of antibiotics can bridge this gap and promote the rational use of antimicrobials.

Conflict of interest: Nil

SM: Conception of work, Designed research methodology, Literature search, Data collection, analysis, interpretation, Drafting of manuscript, Critical review and Final approval of manuscript, **FJ:** Conception of work, Designed research methodology, Literature search, Data collection, analysis, interpretation, Drafting of manuscript, Critical review and Final approval of manuscript, **MF:** Conception of work, Designed research methodology, Literature search, Data collection, analysis, interpretation, Drafting of manuscript, Critical review and Final approval of manuscript, **ZS J:** Conception of work, Designed research methodology, Literature search, Data collection, analysis, interpretation, Drafting of manuscript, Critical review and Final approval of manuscript, **ST Z:** Conception of work, Designed research methodology, Literature search, Data collection,

analysis, interpretation, Drafting of manuscript, Critical review and Final approval of manuscript, **AF:** Conception of work, Designed research methodology, Literature search, Data collection, analysis, interpretation, Drafting of manuscript, Critical review and Final approval of manuscript, **AF:** Conception of work, Designed research methodology, Literature search, Data collection, analysis, interpretation, Drafting of manuscript, Critical review and Final approval of manuscript

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