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EVALUATION OF RATIONAL USAGE OF ANTIMICROBIAL AGENTS IN THE MEDICINE DEPARTMENT AT TERTIARY TEACHING CARE HOSPITAL, GUJRAT

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ABSTRACT:

Background: Prescription of drugs which needs to be continuously assessed and refined according to disease progression. It is not only reflects the physician's knowledge about drugs but also know the pathophysiology of diseases and attitude towards rational prescribing.

Methods-: Retrospective study was carried out by collecting 350 prescriptions containing antimicrobial agents of the indoor patients admitted in the wards of medicine department at Sir Sayajirao General (SSG) Hospital, Vadodara. The data was collected by using case record form specially prepared for the study.

Results: In our study, total 350 prescriptions containing 539 antimicrobial drugs were prescribed in-patients during study period. Average number of antimicrobials per prescription was 1.54.486 (90.16%) and 53(9.53%) antimicrobials were prescribed by using generic name and trade name respectively. 313(58.07%) and 226(41.93%) antimicrobial agents were prescribed for parenteral administration as well as oral route respectively.188(53.71%) prescriptions constitute single antimicrobial agents, while 162(46.28%) prescriptions contain either two or more than two antimicrobial agents. Among all prescriptions, 4 % and 20% of them were without the age and address of the patient. Superscription was not mentioned in 45% of the prescriptions. Inscription, subscription and signature were inadequate in 11%, 13% and 22% of the prescriptions respectively. As per modified kunin's criteria, 74.39% of the patients received antimicrobial therapy appropriately in Medicine department.

Conclusion: Present study highlighted that large number of prescriptions did not conform to the pattern of typical prescription and lack in their rationality.

INTRODUCTION: Prescription order is an important transaction between the physician and the patient ¹. It is an order for a scientific medication for a person at a particular time ².

It brings into focus the diagnostic acumen and therapeutic proficiency of the physician with instruction for palliation or restoration of the patients health ¹. It not only reflects the physician's knowledge of pharmacology and pathophysiology of diseases but also his / her skill in diagnosis and attitude towards selecting the most appropriate cost effective treatment ¹. The prescribing behaviour of the doctor depends upon the input from various sources like patients, academic literatures, professional colleagues, commercial publicity and

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government regulations. Various prescribing errors are result of ineffective use of these inputs and are very common in clinical practices³. The study of prescribing patient is a component of medical audit which seeks monitoring, evaluation and necessary modifications in the prescribing practice of the prescribers to achieve the rationale and cost effective medical care. Antimicrobials are among the most commonly prescribed drugs on worldwide basis.

Many a times desire of the physician to do something for the patient and to prescribe a "Pill for every ill" leads to over prescribing. Various studies indicate that out of total drugs prescribed, 28 to 42% of the drugs are antimicrobial agents. Around 50% of these prescriptions of antimicrobial agents are not needed, are inappropriate or are in wrong doses. The fear of physician whether he is missing any occult infection also makes him to use antibiotic "umbrella" for protecting him and his patient⁴. The extremely high efficacy of antimicrobial agents has proved to be a boon and curse. The double edged sword has now many more edges; the sharpest is the development of resistance to antimicrobial agents⁵.

With widespread use of antibiotics, the prevalence of resistance has increased⁶. The association of resistance with the use of antimicrobials agents has been documented both in patient⁷ and outpatient setting⁸. Wide spread irrational usage of antimicrobial agents and their shortage of supply in the government hospitals, low purchasing capacity of patients and incidence of antimicrobial resistance complicates the outcome of the therapies⁹. It was found out in some studies, link between rates of antimicrobial agent's prescription and resistance in the communities^{10,11}.

In general practice antimicrobial agents usage is highest among children and approximately 70% of all the antimicrobial agents prescribed in children are for URTI¹². As in other developed countries the most frequent type of misuse is prescribing antimicrobial agents for infections, which are commonly caused by virus¹³. Moreover there seems to be a large variation between physicians in antimicrobial prescribing¹⁴. Rational drug prescribing has been shown to reduce the cost of treatment, adverse drug reactions¹⁵.

Despite advances in control of drug regulation and availability of drugs, the irrational drug prescribing is still worldwide concern. In the view of the emerging worldwide threat of bacterial resistance, there are increasing need to identify determinants and patterns of antimicrobial prescribing to identify where the clinical practice can be improved¹⁶.

With this background, the present study was designed to evaluate the practice of rational prescription in patients (cases) admitted in various wards of Medicine Department of Sir Sayajirao Hospital, Vadodara.

The data generated from this study would be helpful to communicate with the prescribers and suggest the various lacunae observed to improve the prescribing practice. Thus it will ultimately benefit the patients with fewer incidences of adverse effects with minimal rise in resistance strain of bacteria and reduction in the cost of therapy.

MATERIAL AND METHOD:

Study setting: This retrospective study was carried out by collecting prescriptions of the indoor patients admitted in the wards of medicine department at Sir Sayajirao General (SSG) Hospital, Vadodara to evaluate rational usage of antimicrobial agents from October 2005 to June 2006(09 months study). Total 350 prescriptions containing antimicrobial agents were collected from the hospital record section for the study. The patients who were admitted and received antimicrobial therapy were randomly selected and included in the study. Prescriptions were collected irrespective of the indications.

Study design: The data were collected by using case record form specially prepared for the study. The Case Record Form contain patient's information such as name, age, sex, address, date of admission, date of discharge, name of antimicrobial agent, dosage form, dose, frequency, route of administration, duration of treatment, use of anti-microbial for therapeutic or prophylactic purpose, complaints for which the consultation was sought, provisional/confirmed diagnosis, investigations, drug interactions, drug allergies, refill instructions.

Patients taking other drugs for any existing diseases were not counted in the prescriptions. Only antimicrobial agents prescribed for any types of bacterial infections were included in the proforma.

The antimicrobial agents were divided into following major groups for the study; (1) β -lactams = β -lactams (except cephalosporins) + vancomycin (2) cephalosporins, (3) aminoglycosides, (4) fluoroquinolones, (5) sulfonamides and (6) metronidazole (7) macrolides.

Selection of indications:

A) For format of prescription- (1) Patient identity: Name and address of the patient. (2) Date on which the prescription was issued. (3) Superscription symbol: Rx meaning "take thou" or "recipe". (4) Inscription: This includes the name of drugs, dose, dosage forms, total amount of medication prescribed. (5) Subscription: the dispensing and compounding instructions to the pharmacist as regards to form and quantities to be dispensed or supplied. (6) Transcription or Signa: the direction to the patient for use of drugs. (7) Prescriber's identity: Name, address and qualification.

B) Following basic drug use indicators were used in the study¹⁷.

- 1) Total numbers of the antimicrobial agents prescribed irrespective of number of prescription.
- 2) Mean numbers of the antimicrobial agents per prescriptions.
- 3) Numbers of antimicrobial agents prescribed by generic vs. trade name
- 4) Numbers of antimicrobial agents administered orally or parenterally
- 5) Numbers of prescription with one or more than one antimicrobial agents.
- 6) Prescribing frequency of antimicrobial agents. Proportions of the different antimicrobial agents prescribed for different systems were calculated.

C) Analysis of rationality of administration of AMA was done by modified Kunin's criteria¹⁸.

- I. Agree with the use of therapy given as in the prescription. The treatment is appropriate in terms of choice of drug, dose, dosage regimen, duration of therapy.
- II. Agree with the use of therapy but a potentially fatal infection cannot be ruled out.
- III. Agree with the use of therapy but a different (usually less expensive and toxic) combination of therapy is preferred.
- IV. Agree with the use of therapy but a modified dose, dosage regimen and duration would be recommended.
- V. Disagree with the use of therapy, administration is unjustified or unnecessary use of drugs.

Category I & II essentially indicate "Appropriate" therapy. Category III & IV indicate that there is some major deficiency in the choice or use of drugs by the doctor managing the problem.

These indicators are highly standardized in terms of their definition and facilitate the quick and reliable assessment of drug use in health care¹⁹.

Also Parameters like interactions (include drug-drug, drug-disease, food-drug interactions), Overprescribing (unnecessary use or duplication of drugs and dosage form as far as therapeutic or pharmacologic effect is concerned) and Banned drug formulations (which are banned by Drug Controller General of India) were checked.

Data were analyzed by using Microsoft excel sheet.

RESULTS:

A) Evaluation for format of prescription:

Patient's identity: Name, age and address of the patients were found in 100%, 96% and 80% of prescriptions, respectively. Date of writing prescriptions were mentioned in all of prescriptions.

Superscription: Superscription (Rx) was not found in 45% of prescriptions. In many prescriptions it was replaced by the word 'Adv' indicating advice.

Inscription: All the prescriptions contain dosage form along with their name, however dosage strength were absent in 11% of prescriptions.

Subscriptions: 13% of prescriptions were found to be with inadequate subscription. However, in our study, only those prescriptions were identified as having inadequate subscription in which it was very difficult for the pharmacist to ascertain the total amount of medication to be dispensed with.

Transcriptions or signature: Instructions to the patient were inadequate in 22% of the prescriptions. Directions regarding total amount of drug to be dispensed were inadequate in 13% of the prescriptions. However in these prescriptions latin words like o.d, t.d.s, q.d.s were written. Instructions regarding refilling of prescription were not given in all the cases.

Prescriber identity: Name and qualification of the prescriber were known in 100 % of the prescriptions. All prescriptions were signed by prescriber.

B) Evaluation for rational drug therapy: Total 350 prescriptions of the patients admitted in the wards of medicine department were studied. Total numbers of antimicrobial agents prescribed in the medicine wards were 539. Average number of antimicrobials per prescription was 1.54.

The results are summarized to study frequency of prescribing patterns of antimicrobial agents in different systems in accordance with diagnosis as well as prescribing frequency of antimicrobial agents by using table for the wards.

(A) Preference of antimicrobial agents: During study period, the highest numbers of antimicrobial agents prescribed were from β -lactam groups (except CP) 159(29.49%) and cephalosporins 156(28.94%) while sulfonamides were the least (09; 1.67%) prescribed agents. Total included numbers of groups of antimicrobial agents, highest number

of prescribed was from cephalosporins group of drugs 81(51.92%) for respiratory tract infections. Also among the total numbers from β -lactam group prescribed, ampicillin (67.29%) was prescribed for extensively, while piperacillin (0.63%) has very low preference in prescriptions (**Table 2**). Among the cephalosporins, cefotaxime (22.53%) was prescribed almost constitutively, while cefadroxyl (1.28%) was not prescribed frequently (**Table 2**).

From the group of metronidazole (69; 12.80%) prescribed, highest numbers were prescribed for respiratory tract infections (28.98%), while lowest were prescribed for genitourinary tract infection (1.45%), for prophylactic purpose (1.45 %) and none for either cardiovascular or soft tissue infections (**Table 1**).

From the total numbers of fluoroquinolones (65; 12.05%) prescribed, highest numbers were prescribed for respiratory tract (32.30%) and gastrointestinal tract infections (32.30%), while lowest were for cardiovascular diseases (1.54%) and none for soft tissue infections (**Table 1**). However, ciprofloxacin (63.07%) was prescribed extensively while gatifloxacin (4.62%), ofloxacin (4.62%) and norfloxacin (4.62%) have very low preference in prescription (**Table 2**).

Among the total numbers of tetracycline groups 33(6.12%), highest numbers were prescribed for miscellaneous infections(54.55%), while the lowest(3.03%) were for cardiovascular diseases, gastrointestinal tract infections, genitourinary tract infections and prophylactic purposes .While none of them were for either hepatobilliary tract diseases or soft tissue infections (**Table 1**).From the tetracycline group only doxycycline (**Table 2**) was prescribed.

However, aminoglycosides 25(4.64%), macrolides 23(3.33%) and sulfonamides 09(1.67%) have very low frequency of prescription. All the three antimicrobials were mainly prescribed for respiratory tract infection (**Table 1**). However, among the total numbers of aminoglycosides, amikacin (60%) and gentamicin (40%) were prescribed (**Table 2**).

While from the macrolides group, azithromycin (78.26%) and erythromycin (21.74%) were prescribed and from sulfonamides group, only cotrimoxazole (1.67%) was prescribed (Table 2).

(B) Frequency of prescribing patterns of antimicrobial agents in accordance with diagnosis (Table 1):

Among the total number of 539 antimicrobial agents, 231(42.85%) were prescribed in respiratory infections which was highest in number and

11(2.04%) in soft tissue infections which was lowest in number. In most common respiratory tract infection, highest numbers were prescribed from cephalosporins followed by β -lactam group, fluoroquinolones and macrolides. In hepatobiliary disease, highest number drugs were prescribed from β -lactam group and cephalosporins followed by metronidazole. In miscellaneous infections, highest numbers were prescribed from β -lactam and cephalosporins groups followed by tetracyclines. However for soft tissue infections, antimicrobial agents from β -lactam group and cephalosporins were prescribed.

TABLE 1: FREQUENCY OF PRESCRIBING PATTERNS OF ANTIMICROBIAL AGENTS IN DIFFERENT SYSTEMS IN ACCORDANCE WITH DIAGNOSIS IN MEDICINE WARDS.

Antimicrobial Agents prescribed	Total Prescribed No (%)	RS No (%)	CNS No (%)	CVS No (%)	GIT No (%)	GUT No (%)	HBT No (%)	MISC No (%)	PROPH No (%)	Soft tissue No (%)
β -lactams (except CP)	159 (29.49)	60 (37.74)	15 (9.43)	07 (4.40)	4 (2.52)	07 (4.40)	34 (21.18)	23 (14.47)	04 (2.52)	5 (3.15)
Cephalosporins	156 (28.94)	81 (51.92)	14 (8.97)	07 (4.48)	12 (7.69)	07 (4.48)	34 (21.79)	23 (14.74)	04 (2.56)	05 (3.20)
Metronidazole	69 (12.80)	20 (28.98)	09 (13.04)	00 (0.0)	11 (15.94)	01 (1.45)	14 (20.29)	13 (18.84)	01 (1.45)	00 (0.0)
Fluoroquinolones	65 (12.05)	21 (32.30)	02 (3.07)	01 (1.54)	21 (32.30)	05 (7.69)	07 (10.76)	05 (7.69)	05 (4.61)	00 (0.0)
Tetracyclines	33 (6.12)	09 (27.27)	09 (6.06)	01 (3.03)	01 (3.03)	01 (3.03)	00 (0.0)	18 (54.55)	01 (3.03)	00 (0.0)
Aminoglycosides	25 (4.64)	14 (56)	5 (20)	1 (4)	00 (0.0)	00 (0.0)	02 (08)	02 (08)	01 (04)	00 (0.0)
Macrolides	23 (3.33)	21 (91.3)	00 (0.0)	01 (4.35)	00 (0.0)	00 (0.0)	01 (4.35)	00 (0.0)	00 (0.0)	00 (0.0)
Sulfonamides	09 (1.67)	05 (55.56)	00 (0.0)	00 (0.0)	01 (11.11)	01 (11.11)	00 (0.0)	01 (11.11)	00 (0.0)	01 (11.11)
Total	539 (100)	231 (42.85)	49 (9.09)	18 (3.33)	50 (9.27)	22 (4.08)	92 (17.06)	89 (16.51)	16 (1.8)	11 (2.04)

RS-Respiratory system; CNS-Central nervous system; CVS-Cardio vascular system; GIT-Gastrointestinal tract; HBT-Hepato biliary tract; GUT- Genitourinary tract; PROPH-Prophylaxis; MISC:-Miscellaneous including- Pyrexia of unknown origin, Malaria, Myasthenia gravis, Tetanus, Poisoning; CP- Cephalosporins.

TABLE 2: PRESCRIBING FREQUENCY OF ANTIMICROBIAL AGENTS

Sr. No	Antimicrobial agents	No (%)	Sr. No	Antimicrobial agents	No (%)
1	β-lactam (Except CP)			Sparfloxacin	09(13.84)
	Ampicillin	107(67.29)		Levofloxacin	06(9.23)
	Amoxicillin	20(12.3)		Ofloxacin	03(4.62)
	Crystalline penicillin	16(10.06)		Gatifloxacin	03(4.62)
	Cloxacillin	08(5.03)	5	Norfloxacin	03(4.62)
	Coamoxy-clav	07(4.40)		Tetracycline	
	Piperacillin	01(0.63)		Doxycycline	33(6.12)
2	Cephalosporins		6	Aminoglycosides	
	Cefotaxime	130(22.53)		Amikacin	15(60)
	Ceftriaxone	21(13.46)		Gentamicin	10(40)
	Cefixime	03(1.92)	7	Macrolides	
	Cefadroxyl	02(1.28)		Azithromycin	18(78.26)

3	Metronidazole			Erythromycin	05(21.74)
	Metronidazole	69(12.80)	8	Sulfonamides	
4	Fluroquinolones			Cotrimoxazole	09(1.67)
	Ciprofloxacin	41(63.07)		Total	539

Out of the 539 antimicrobial agents prescribed, 486(90.16%) were prescribed by generic name while rests 53(9.83%) were prescribed by trade name, 313(58.07%) and 226(41.93%) antimicrobial agents were prescribed for parenteral administration as well as oral route respectively,

188(53.71%) prescriptions constitute single antimicrobial agents, while 162(46.28%) prescriptions contain either two or more than two antimicrobial agents (**Table3**). Switch on therapy from parenteral to oral route was employed in 15% of prescriptions(**Table3**).

TABLE 3: PRESCRIPTION ANALYSIS

Total no. of prescriptions	350
Total numbers of antimicrobial agents prescribed	539
Mean numbers of the antimicrobial agents per prescriptions	1.54
Antimicrobial administered by parenteral route	313(58.07)
Antimicrobial administered by oral route	226(41.93)
Antimicrobial agents prescribed by generic name	486(90.16)
Antimicrobial agents prescribed by trade name	53(9.83)
No. of prescriptions with one antimicrobial agents	188(53.51)
No. of prescriptions with more than one antimicrobial agents	162(46.28)
Switch on therapy from parenteral to oral route	15%

No banned drug formulations and interactions (drug-drug, drug-food, and drug-disease) were found out during a study period. Over prescribing (19%) was found out during analysis like e.g. ciprofloxacin and tinidazole for diarrhoea, antibiotic for viral fever etc. In some cases, use of an antimicrobial was suddenly switched over to another antimicrobial after 1 or 2 days uses

neglecting its duration make its inappropriate use. Duration of therapy was irrational in 24% prescriptions i.e. short in 15%, prolonged in 9% of the prescriptions. As per Kunin’s modified criteria, 74.39% of the patients received antimicrobial therapy appropriately while 25.60% inappropriately in Medicine department (**Table4**)

TABLE 4: ANALYSIS OF CASE SHEET FOR USE OF ANTIBIOTICS AS PER PER KUNIN’S CRITERIA.

Speciality	Appropriate			Subtotal
	I	II		
Medicine Department	305(56.58%)	96(17.81%)		401(74.39%)
	Inappropriate			
	III 25(4.63%)	IV 45(8.34%)	V 68(12.61%)	138(25.60%)
Total				539(100)

DISCUSSION: The results obtained after auditing of the prescriptions indicate that irrationality was found in prescription writing. Prescribers do not adhere to the ideal pattern of the prescription writing and these prescriptions are not explicit in their contents. Replacement of Rx sign with the word ‘Advice’ in large number of prescriptions is indicative of changing pattern of the prescriptions. Prescriber’s identity and patient’s information was all most present in all prescriptions. In many prescriptions latin words like o.d, t.d.s, q.d.s were used for direction, also dosage form were incomplete, i.e Tab, inj, cap were written.

Uses of acronyms were not justifiable. Legibility of prescriptions was good, however clarity of instructions were inadequate in some cases. In our study, we have observed that, highest numbers of antimicrobial agents were prescribed for respiratory tract infections. Among the total numbers of antimicrobial agents prescribed, highest numbers were prescribed from cephalosporins and β-lactam group. Among them cefotaxime and ampicillin were commonly prescribed. The reason may be due to their broad spectrum of activity and less incidences of adverse effects.

Also physician's choice and easier availability in hospital pharmacy may also dictate a rather heavy use of a particular drug. A study carried out in eastern Nepal reported that, gentamicin, ampicillin, crystalline penicillin, cefotaxime were the most commonly prescribed²⁰.

A study carried out in tertiary hospital Chandigarh reported that, penicillin and cephalosporins were prescribed more frequently followed by quinolones, aminoglycosides and metronidazole²¹. We observed the antimicrobial prescribing pattern which is in consonance with the studies carried out at these places. The type of antibacterial used at each centre depend on many factors like the patient profile, type of infection, availability of antibacterial, susceptibility patterns, the prescriber's awareness on rational antimicrobial use etc. Variations in the antimicrobial susceptibility between different regions have been described and may result in different prescribing practices²².

Such statistics form an important index of ongoing antimicrobial audit as they indicate the changes in the pattern of usage accordance with the susceptibility patterns of bacteria. They also indicate the extent of use of newer antimicrobial agents. Factors contributing to the preferential uses of the above antimicrobial agents in the wards may be due to their low cost with better safety profile and ease of their availability from the hospital pharmacy.

Data analysis in our study showed that the numbers of prescriptions with two or more than two antimicrobial agents per prescriptions were low as compared to those with a single antimicrobial agent. Mean number of drugs per prescription was 1.54. This indicates a large numbers of prescriptions in our study were for single drugs. A study carried out in teaching hospital of eastern Nepal reported that, mean number of the drugs per prescriptions was 5.26, while prescriptions with two or more than two antimicrobial agents per prescriptions were very high as compared to prescriptions with single antimicrobial agent²⁰.

These figures are quite high as compared to our study. A study carried out in a teaching hospital Pondicherry reported that, mean numbers of antimicrobial agents prescribed per prescription were 2.1²³. This is somewhat higher than that

reported in our study. Average number of the drugs per prescription is an important index of the scope for review and educational intervention in prescribing practices. It is preferable to keep the mean number of drug per prescription as low as possible. Since highest figures always leads to increased risk of drug – drug interaction²⁴.

In our study, it was found that, 58.07% antimicrobial agents were prescribed for parenteral administration, while only 41.93% were for oral route. In a study, carried out in Yemen reported that, 25 to 60 % of patients received drugs by injection²⁵. These figures are quite similar to our study. The excessive use of injectable is common in many developing countries²⁶. Unnecessary use of parenteral antimicrobial adds to cost of therapy and also increases the risk of blood borne infections. Preference to parenteral route over oral route observed in our study could be due to study conducted in the indoor patients.

In our study, it was found that, 90.16% antimicrobial agents were prescribed by generic name, while 9.83% by using trade name. A study carried out in a teaching hospital Pondicherry reported that 43.9% antimicrobial agents were prescribed by generic name, while 56.1% by using trade name²³. These figures suggest quite different trends in prescribing drugs by generic vs. trade name in respect to our observations. These show that apparent control over the prescribing habits of the physicians for indoor patients at our hospital. The most probable reason for such prescribing may be due to easier availability of antimicrobial agents in our hospital pharmacy as well as proper communication between the prescribing physicians and the hospital authority.

As per Kunin's modified criteria, 74.39% of patients received antimicrobial therapy appropriately in the Medicine department.

This report is somewhat similar to reported by Deshmukh vs *et al*²⁷ was 66.2%. In medicine department antimicrobial agents were used indiscriminately in patients of cirrhosis of liver, hepatosplenomegaly, viral hepatitis, pyrexia of unknown origin. There is no rationale for antimicrobial use in pyrexia of short duration (viral fever) without localizing signs except in toxic patients²⁸.

Over prescribing was found only in 19% of the prescriptions, a figure far less than that reported by other Indian researchers²⁹. This may leads to unnecessary increase in cost of therapy which puts unnecessary burden on limited resources available.

Intravenous to oral switch therapy is inappropriate for critically ill patients who require intravenous antibiotic therapy and should not be considered in patients who have the inability to absorb drugs. These exceptions constitute a very small percentage of hospitalized patients for which intravenous to oral switch therapy is not ideal³⁰. In present study switch on therapy was used only in small number of patients' i.e. 15%. This report is similar to reported by Deshmukh vs *et al*²⁷ was 16.15%.

Such type of studies provides necessary feedback to prescribing physicians and may prove useful to formulate antibiotic policy to policy makers.

CONCLUSION: It is concluded from the above study that irrationality was found in the prescription writing. This study highlights the problem of indiscriminate use of antimicrobial agents, duration of therapy and regarding proper format of prescriptions. Though irrationality was there but one of the positive finding was majority of antimicrobial drugs prescribed by using generic name at a satisfactory level. The results of study call for interventional strategies to promote rational drug therapy. More emphasis needs to be laid on teaching the art of writing a prescription to undergraduate and postgraduate medical students. A week's posting in clinical pharmacology and therapeutics if possible, should be taught over during internship and this period should be utilized in teaching prescription writing and rational drug therapy.

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