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EVALUATION OF DRUG UTILIZATION PATTERN AND COST ANALYSIS OF PATIENTS ATTENDING DERMATOLOGY OUTPATIENT DEPARTMENT AT TERTIARY CARE TEACHING HOSPITAL OF SOUTH GUJARAT

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Drug utilization pattern, Dermatology, Cost, ATC/ DDD classification, WHO prescribing indicator

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ABSTRACT: Evaluation of drug utilization patterns and cost analysis (direct and indirect) at the dermatology department help to implement guidelines/policy regarding rational prescription and reduce the cost burden on the health care system. The 250 patients' prescriptions attending the dermatology outpatient department were analyzed using WHO core drug use indicators. Prescribed drugs were classified according to ATC/DDD classification system, the PDD/DDD ratio of drugs was calculated, and direct and indirect costs per encounter were done. The average drug per prescription was 3.3±1, the percentage of drugs prescribed by generic name was 95.52%, the percentage of utilization of scheduled drugs from the National List of Essential Medicines (NLEM) (2022) was 98.79%, the percentage of scheduled drugs from the WHO essential list (2019) was 46.73%. Patient's care indicators where average consulting time was 7min±1min, average dispensing time was 7min±2min, percentage of drug dispensed was 95.04%, and patient's knowledge about correct dosage is 10%. Antifungal (26.66%) class of drugs were prescribed maximum followed by antihistaminic (25.42%) in participants. Among prescribed drugs, 41.66% of drugs had a PDD/DDD ratio of 1. The average total cost per prescription was 56.33 INR, average indirect cost per patient was 168.46 INR. The percentage of the cost borne by the hospital was 65.64% and the percentage borne by the participant was 34.35%.Such results indicate that prescriptions were more towards rationality, reducing the ADR, drug-drug interactions, and direct and indirect cost burden to patients and the health system.

INTRODUCTION: Drug utilization research was defined by WHO in 1977 as "the marketing, distribution, prescription, and use of drugs in a society, with special emphasis on the resulting medical, social, and economic consequences" [1]. The appropriate diagnosis followed by rational prescribing of drugs is the most crucial phase of pharmacotherapy of any disease [2].

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Irrational prescription of drugs is a common occurrence in clinical practice and the cost of such irrational drug use is enormous in developing countries in terms of both, may given the high incidence of skin diseases and the economic burden that it poses, there is a need to evaluate the present epidemiology and prescribing pattern of skin disorders.

The principal aim of this drug utilization study is to facilitate the rational use of drugs in population [3]. In the past fifteen years, economic growth in India has risen very fast, but the distribution of wealth is unequal. Divergent clusters of non-communicable and communicable diseases have been seen. Skin diseases are also major causes of morbidity due to

the presence of physical symptoms as they can cause anxiety, depression, anger and embarrassment, which lead to social isolation and absenteeism at work. They are extremely frequent and may affect the quality of life [4]. The ATC/DDD classification system is a tool for monitoring drug utilization and research to improve the quality of drug use, presentation, and comparison of drug consumption statistics at national and international levels [5]. The rational use of a drug implies prescribing a well-documented drug at an optimal dose, with the correct information, and at an affordable cost for the individual patient. Based on epidemiological data on a disease can estimate to what extent drugs are properly used, overused, or underused, which can be calculated by PDD/DDD ratio [1, 4].

There is an error of omission which includes dosage, special instructions regarding medicine, follow-up, *etc*., and commission includes unnecessary drugs, prescribing costly drugs when alternative cheaper drugs are available at the institute, *etc* [6]. Over a period of time, due to the introduction of newer drugs changing, the pattern of adverse cutaneous drug reactions continuously. A common group of drugs has reaction rates >1% [7]. The Indian Council of Medical Research (ICMR), New Delhi, Government of India, initiated the rationality of prescriptions across India. As a part of the ICMR Rational Use of Medicines Centres (ICMR RUMC) network a PAN India program was started in different regions under the National Virtual Centre Clinical Pharmacology (NvCCP)'s activity [6].

Pharmacoeconomics is a branch of health economics which is particularly focused on costs, benefits of medical technology, avoiding wastage of resources, and irrational distribution of medical resources. This helps to allocate resources to maximize net health benefits. Developing countries are still lagging in health financing and making new policies. In India, publications of pharmacoeconomic studies have been few, but the trend has increased since 2007 [8]. Periodic audit of prescriptions is an important tool for improving therapeutic efficacy and decreasing adverse drug reactions and cost burdens in drug utilization studies. Patient compliance and adherence to treatment are primarily dependent on the cost (direct and indirect) of treatment in India. As most skin diseases require a longer duration of treatment which leads to detrimental effects on the quality of life of the general population by increasing the suffering in terms of physical, social, and psychological, as well as it increases the cost burden to patients, society as well as the government.

So, it is necessary to analyze costs (direct and indirect) to find out the burden to the patient and institute in monetary terms. Prescribed drugs purchased from private medical stores, consulting/admission fees counted as direct costs borne by the patient other than that expenditure such as cost of travel, loss of daily wages, cost related to any adverse cutaneous drug reaction management, etc., counting as an indirect cost [9].

Considering the above, this study was planned to evaluate the institute's drug prescribing patterns and cost analysis of skin diseases to generate a recent database at local and global levels. It can help in the determination of the pattern and profile of drug use and the extent to which alternative drugs are being used, comparison of the observed patterns of drug use for the prevention and treatment of a certain disease with guidelines or current recommendations, and may improve the awareness and helpful for future guidelines.

MATERIALS AND METHODS: This cross-sectional observational study was conducted after the Institutional Review Board's (IRB) approval. 250 participants were enrolled as per inclusion and exclusion criteria. All data collected for the study purpose were kept confidential.

Confidentiality was maintained by hiding the identity of the patients (by giving the code number), and details were not divulged to any party.

Inclusion Criteria: Patients of any age and gender attending the outpatient dermatology department. The participant who was ready to give written informed consent.

Exclusion Criteria: Patients who were not willing to participate. The patients' written informed consent was taken, and data were recorded in a case record form (CRF).

Details were recorded in the CRF including, demographic details like age, gender, *etc*., and OPD number/ MRD number. Relevant history and diagnosis were noted. Prescription details like total number of drugs prescribed, name of drugs (generic/ brand) and their dosage, whether single/FDC, prescribed from hospital pharmacy/ outside the pharmacy, duration of treatment, *etc*. The cost of the various drugs was obtained from the hospital pharmacy/ outside the hospital pharmacy.

Drug utilization patterns were assessed by the WHO, core drug use indicators [10]

Key prescribing indicators

- Average number of drugs per prescription (encounter).
- Percentage of drugs prescribed by generic name.
- Average number of antibiotics per prescription.
- Percentage utilization of scheduled drugs from the National List of Essential Medicines (NLEM) (2022).
- Percentage of scheduled drugs from the World Health Organization (WHO) essential list (2019).
- Percentage of drugs prescribed from hospital drug list.
- Percentage of drug dispensed from the hospital schedule.

Patient Care Indicators:

- Average consulting time.
- Average dispensing time.
- Percentage of drugs actually dispensed.
- Patient's knowledge of the correct dosage.

Facility Indicators:

- Availability of a copy of the essential drug list or formulary.
- Availability of key drugs.

Calculation of the above parameters by using the following formulas:

Average no. of drugs per prescription (encounter) Average = Total number of drugs prescribed / Total number of encounters surveyed × 100

Note: FDC as a single drug and vitamin, mineral considerations as a drug

Percentage of encounters with an antibiotic prescribed Percentage = Number of encounters with an antibiotic prescribed / Total number of encounters surveyed × 100

Percentage of Encounters with an injection prescribed Percentage = Number of encounters with injection was prescribed / Total number of encounters surveyed × 100

Percentage of drugs prescribed by generic name Percentage = Number of drugs prescribed by generic name / Total number of drugs prescribed × 100

Percentage of drugs prescribed from the national essential list of medicines (NLEM) of India 2022 [11] Percentage = Number of drugs prescribed from NLEM, 2022 / Total number of drugs prescribed ×100

Percentage of drugs prescribed from WHO List of essential medicine, 2019 [12] Percentage = Number of drugs prescribed from WHO List of essential medicine, 2019 / Total number of drugs prescribed × 100

Percentage of drugs dispensed from the hospital drug store Percentage = Number of drugs dispensed from the hospital drugstore / Total number of drugs prescribed × 100

Classification of prescribed drugs was done according to the anatomical therapeutic chemical (ATC)/daily defined dose (DDD) classification system and the PDD/DDD ratio was calculated [5, 13].

PDD (prescribed daily dose) of a drug = average of total daily dose / time

Cost analysis was done by using the following parameters [3, 9],

- Average total cost per prescription.
- Average indirect cost per prescription.
- Average cost borne to the hospital per encounter.
- Average total cost borne by the participant.
- Percentage of the cost borne by the hospital.
- Percentage of the cost borne by the participant.

Descriptive statistical analysis has been done by using Microsoft 365 Excel version 2211.

RESULTS: This cross-sectional observational study analyzed data from 250 enrolled participants at a tertiary care teaching hospital. In our study, out of 250 participants, 138 (55.20%) were male and 112 (44.80%) were female participants.

Age Distribution of Study Participants: Among 250 participants, 25.20% were 31-40 years of age group followed by 21-30 years (23.60%), 11-20 years (20.8%), 41-50 years (12.40%), 51-60 years (7.6%) and 0-10 years (6.8%) **Fig. 1.**

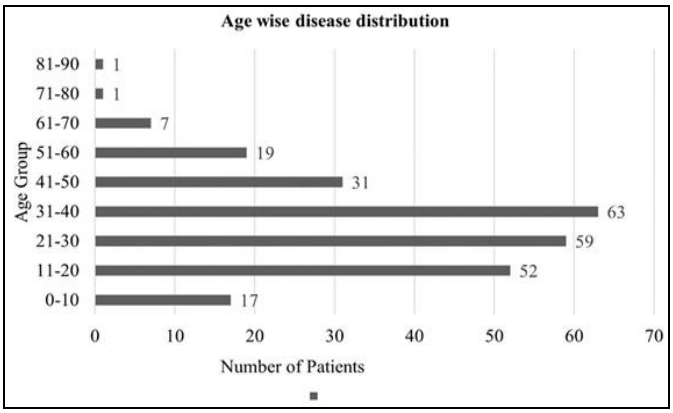

FIG. 1: AGE-WISE DISTRIBUTION OF STUDY PARTICIPANTS

Disease Distribution in Study Participants: Tinea infections found highest among 100 (40.0%) participants followed by scabies 26 (10.4%), eczema 18(7.2%), dermatitis 15, pityriasis infections 12, acne vulgaris + telogen effluvium 12, pruritus 10, lichen planus 8, urticaria 7, furuncle 6, pigmented purpuric dermatitis 5, hair fall 4, intertrigo 4, acanthasis nigricans 4, alopecia areata 3, vitiligo 3, pomphyloma 3 and others (including herpes zoster, pemphigus vulgaris, onychomycosis, *etc*.) found in 10 participants **Fig. 2.**

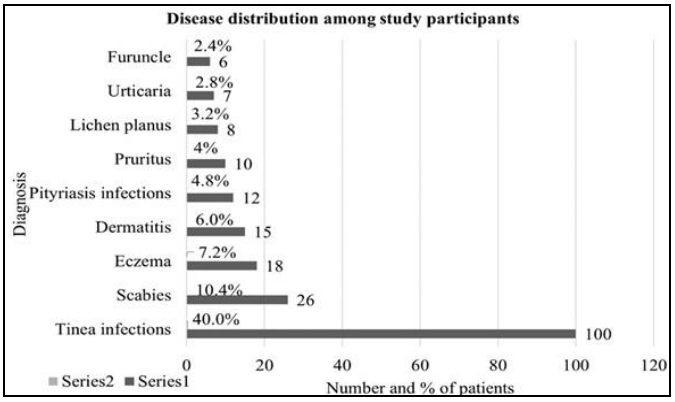

FIG. 2: DISEASE DISTRIBUTION AMONG PARTICIPANTS

Analysis of Drug Prescribing Pattern:

TABLE 1: WHO CORE DRUG USE INDICATORS FOR DRUG UTILIZATION PATTERN ANALYSIS

WHO core drug use indicators	Result
Prescribing indicators	
The average number of drugs per prescription	3.30
Percentage of drug prescribed by generic name	95.52%
The average number of antibiotics per prescription	0.05 (5.21%)
The percentage of drug prescribed from the hospital schedule	95.52%
The percentage of drug dispensed from the hospital schedule	95.04%
The percentage utilization of scheduled drugs from the National List of Essential Medicines (NLEM) (2022)	98.79%
The percentage of scheduled drugs from the WHO essential list (2019)	46.73%
Patient's care indicators	
average consulting time	7min±1min
average dispensing time	7min±2min
percentage of drugs actually dispensed	95.04%
patient's knowledge of the correct dosage	10%
Facility indicators	
availability of a copy of the essential drug list or formulary	yes
availability of key drugs	95.04%

Average number of drugs per prescription was 3.30, drug prescribed by generic name was 95.52% (789/826), antibiotics per prescription was 5.21%, drugs prescribed from the hospital schedule were 95% (785/826), utilization of scheduled drugs from the National List of Essential Medicines (NLEM) (2022) was 98.79% (816/826), scheduled drugs from the WHO essential list (2019) were 46.73% (386/826). Patient's care indicators were average consulting time was 7min, average dispensing time was 7 min, drugs actually dispensed were 95.04%, and patient's knowledge about correct dosage was 10%. A copy of the essential drug list or formulary was available at OPD. The availability of key drugs for skin and subcutaneous diseases (like, fluconazole, itraconazole, steroids, antihistamines,

ointments, *etc*.) was available at the dispensary of the hospital **Table 1.** Among a prescribed class of drugs antifungal class (fluconazole, itraconazole, clotrimazole, miconazole, *etc*.) of drugs were most commonly prescribed, followed by antihistamines (chlorpheniramine, levocetirizine), supplements (multivitamins, iron, *etc*.), antiparasites (ivermectin, dapsone, *etc*.), antibiotics (doxycycline, moxifloxacin, azithromycin, *etc*.), antacids (pantoprazole, famotidine), steroids (betamethasone, clobetasone) and others (retinoids, white petroleum jelly, calamine lotion, *etc*.) **Table 2 Fig. 3.**

TABLE 2: ANALYSIS OF DIFFERENT CLASSES OF DRUGS PRESCRIBED

Class of drug	Total number of drugs in a class	Percentage
Antifungals	221	26.76%
Antihistamines	210	25.42%
Adsorbents and others	144	17.43%
Supplements	85	10.29%
Antiparasites	49	5.93%
Antimicrobials	43	5.21%
Steroids	59	7.14%
NSAIDs	10	1.21%
Retinoids	5	0.61%
Total	826	100.00%

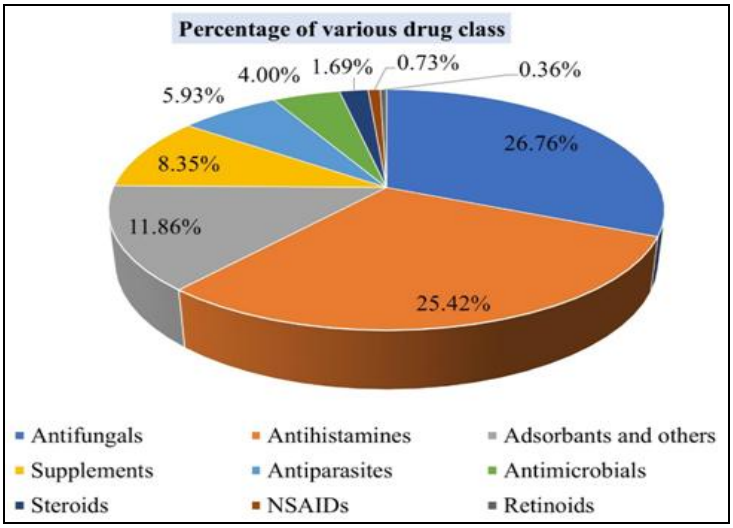

FIG. 3: ANALYSIS OF DIFFERENT CLASSES OF DRUG PRESCRIBED

TABLE 3: ATC CODE AND PDD/DDD RATIO OF DRUG PRESCRIBED AMONG PARTICIPANTS

ATC/DDD classification of drugs prescribed among study participants					
S. no.	**ATC Code**	**Drug**	**PDD**	**DDD**	**PDD/DDD ratio**
1	J02AC02	Itraconazole	200mg	100mg	2
2	R06AE09	Levocetirizine	10mg	5mg	2
3	A02BC01	Omeprazole	40mg	20mg	2
4	A02BD04	Amoxyclavulanic acid	1.87g	1.0g	1.8
5	J01FA10	Azithromycin	500mg	300mg	1.66
6	R06AB04	Chlorpheniramine	20mg	12mg	1.66
7	A02BA03	Famotidine	40mg	40mg	1
8	B03BB	Folic Acid	5mg	5mg	1
9	P02CA03	Albendazole	400mg	400mg	1
10	P02CF01	Ivermectin	12mg	12mg	1
11	A01AB22	Doxycycline	200mg	100mg	1
12	J02AC01	Fluconazole	150mg	200mg	0.75
13	B03AE02	Iron+multivitamin+folic acid	-	-	-
14	B03BAA11EA	MVBC	-	Multiple components	
15	A12AA20	Calcium	-	-	-
16	G01AF02	Clotrimazole cream 1%	-	0.1g	-
17	D07XC01	Betamethasone valerate cream 0.1%	-	-	-
18	L04AD02	Tacrolimus	-	-	-
19	M01AE01	Ibuprofen	-	-	-
20	P03AC04	Permethrin lotion 1%	-	-	-
21	A07AA01	Neomycin	-	-	-
22	D04AX	Calamine	-	-	-

23	A11HA05	Biotin	-	-	-
24	D01AE15	Terbinafine cream 1%	-	-	-

The PDD/DDD ratio of albendazole, folic acid, famotidine, ivermectin, and doxycycline was 1. PDD/DDD ratio of itraconazole, pantoprazole, and levocetirizine was 2, amoxyclavulanic acid was 1.8, chlorpheniramine and azithromycin were 1.66, and fluconazole was 0.75. Among prescribed drugs, 50% had more than 1 ratio, 41.66% had a ratio of 1, and 8.33% had less than 1. **Table 3 Fig. 4.**

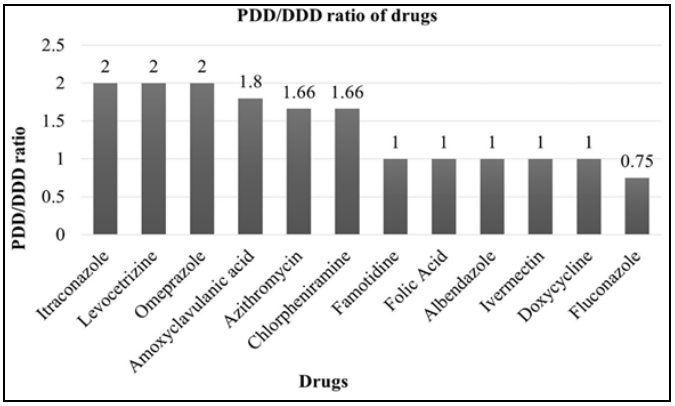

FIG. 4: PDD/DDD RATIO OF DRUG PRESCRIBED AMONG PARTICIPANTS

Cost Analysis: Average total cost per prescription was 56.33 INR, the average indirect cost (including loss of daily wages, transport expenses, or if any) per patient was 168.46 INR, the average total cost borne to the hospital per patient was 36.98 INR and average total cost borne to the patient for drug purchasing outside hospital pharmacy was 19.35 INR. The cost borne by the hospital was 65.64% and the cost borne by the participant was 34.35%. **Table 4.**

TABLE 4: COST ANALYSIS PER ENCOUNTER

Cost analysis of the prescription among the study participants	
Parameter	Value (In INR)
Average total cost per prescription	56.33
Average indirect cost per prescription	168.46
Average cost borne to the hospital per encounter	36.98
Average total cost borne by participant	19.35
Percentage of cost borne by hospital	65.64%
Percentage of cost borne by participant	34.35%

DISCUSSION: In India, commonly encountered skin conditions are fungal skin infections, eczema, dermatitis, urticaria, acne, *etc.* Improvement in hygienic practices and considered easily treatable diseases such as scabies and fungal skin diseases can be significantly controlled. Increased magnitude of the burden of skin diseases with negligible improvement in the age-standardized years lived with a disability is a matter of concern as a substantial portion of these years lived with a disability are amenable to prevention and treatment [4]. Previously, WHO reported that more than 50% of the medicines were prescribed and dispensed inappropriately. Irrational prescriptions increased drug-drug interactions, adverse drug reactions (ADR), and the emergence of drug resistance-like health hazards [14]. A study conducted by Chetna *et al.* showed that major cutaneous ADR were maculopapular rash followed by urticaria, pruritus, atopic dermatitis, *etc.*, for these reactions suspected class of drugs were antimicrobial agents followed by NSAIDs, steroids, *etc* [7]. Drug utilization pattern analysis is necessary to address all these issues in the dermatology department. To improve prescribing patterns, WHO in collaboration with other international networks developed a simple tool for quickly and reliably assessing a few critical aspects of pharmaceutical use in the health care system, which is WHO, core drug use indicators divided into various indicators, namely, key prescribing indicators, patient care indicators, and the facility care indicators [15]. The availability of

skin and subcutaneous disease treatment is governed by the cost of medications in resource-poor settings [4]. As a part of the pharmacoeconomic study, this study documented cost (direct and indirect) analysis. Irrational prescription pattern increases the direct cost burden to either the patient or the hospital pharmacy [16].

In our study, regarding skin infections the male: female ratio was 1.23, which was in accordance with 1.41 in a similar study conducted by Khobragade *et al.,* and 1.09 in another study by Herakal *et al* [3, 17]. Among 250 participants, 25.20% were 31-40 years of age group followed by 21-30 years (23.60%), 11-20 years (20.8%), 41-50 years (12.40%), 51-60 years (7.6%) and 0-10 years (6.8%) in this study similar to other studies same scenario noted [3, 18].

In our study, tinea infections were found highest among all participants (40.0%) followed by scabies (10.4%), eczema (7.2%), dermatitis (6.0%), pityriasis infections (4.8%) in contrast to studies conducted by Bhandari S. & Khan GM *et al.* showed different distribution like dermatophytosis was the most common dermatological disorder (33.16%) followed by eczema (18%), tinea skin infections (21.1%) and similar with fungal infection (39.6 %) in the study of Indurkar *et al.* Poor hygiene and hot and humid conditions can cause variation in the disease distribution in our study participants [19, 18, 3].

The average drug per prescription was 3.30 in this study, whereas 2.7, 3.6, 3.73, 3.86, and 5.13 and in other studies conducted byBadar VA *et al.,* Syiem RP *et al.,* Khobragade *et al.,* Sangeetha Lakshmi GNS *et al.* and Anuj Kumar Pathak *et al.,* respectively [20, 21, 3, 22, 23]. Among 250 patients, a total of 826 drugs were prescribed; out of these, the most common class of drugs prescribed were antifungals (26.76 %), the second most common class of drugs were antihistamines (25.42%), followed by antimicrobials (5.21%), supplements (8.35%), steroids (1.69%), adsorbents (11.86%), were noted. In the same direction as other studies, antifungal 71.9%, second antihistaminic 24% [20]. As antihistamines reduce tissue histamine levels and cases of non-specific symptoms like itching, prescribing rate of antihistaminics was high [21]. The prescription of a drug with a generic name improves the quality of the prescription [6]. 95.52% of drugs were prescribed by generic name, which was different from other studies like Patil *et al.* none of the drugs was prescribed by generic name [24].

Antibiotics per prescription were 5.21% higher in other studies, such as 23.17%, 14% [1, 21]. Among these neomycin (topical cream), doxycycline (tablet), moxifloxacin (tablet), azithromycin (tablet), amoxy-clavulanic acid (tablet and syrup), clindamycin (topical cream/ ointment).

Providentially, in the NLEM and WHO list of essential medicines (2019), dermatologic diseases are receiving more attention, and these are lists of cost-effective medicines. That serves as a platform for advocacy [4]. In this study, 98.79% of drugs were scheduled from the National List of Essential Medicines (NLEM) (2022), the same direction as other studies, 92.27% [3]. Scheduled drugs from the WHO essential list varied in different studies, 46.73% in this study, 90.30%, 68.90%, and only 23.87% [3, 2, 18].

Implementing a formulary in OPD and hospital pharmacies may incorporate the prescribing generic name of the drug [16]. Drugs prescribed from the hospital schedule was 95.04%, drugs dispensed from the hospital pharmacy were 95.04% in accordance with Khobragade *et al.,* 88.29% of drugs were prescribed from the hospital pharmacy, and the remaining 11.71% of drugs were prescribed from outside the hospital pharmacy [3].

The average consulting time and dispensing time were 7min, drugs dispensed from hospital pharmacy were 95.04%, and patient's knowledge of correct dosage was 10% in the present study. Facility indicators like the availability of copies of essential drug lists or formulary and key drugs (like, azoles, antihistamines, ointments, *etc*.) are also fulfilled. Increasing utilization of the ATC/DDD classification system and the DDD (defined daily dose) as a measuring unit indicates the system's usefulness internationally. DDD was the technical unit of measurement developed for drug utilization studies to deal with the objections against traditional units of measurement. Access to standardized and validated information on drug use is essential to allow an audit of patterns of drug

utilization, identification of problems, educational or other interventions, and monitoring of the outcomes of the interventions [12]. PDD/DDD ratio of 57.89% of drugs had 1, followed by 36.84% was >1 and very few drugs, *i.e.*, 5.14% had <1which were same direction in our study results show that 50% of drugs had more than 1, 41.66% drugs had PDD/DDD ratio 1 and 8.33% drugs had less than 1 [3]. More than one ratio indicates the overutilization of the drugs, while less than 1 ratio indicates the underutilization of drugs.

The average total cost per prescription was 56.33 INR in our study in accordance with 212.77 INR, 135.6 INR and 487.50 INR [3, 7, 20]. The average indirect cost per patient was 168.46 INR. The average cost borne to the hospital per encounter was 36.98(65.64%) INR and the average total cost borne by participants was 19.35(34.35%) INR, which were lower than 145.6 INR (68.3%) and 67.17(31.7%) respectively[3]. This justifies as the drugs prescribed were small in numbers, and only essential drugs were prescribed in this study. More than 90% of drugs were available at hospital pharmacy and drug waste was limited. Drugs were provided free to the patients, reducing their cost burden too. Being a tertiary care government hospital, most patients were from low socioeconomic backgrounds; thus, providing free drugs helps improve compliance. In the current scenario, high demand and the number of dermatologists are limited in rural and slum areas; patients may be subjected to expend an indirect cost and time to attend dermatologists. Direct and indirect cost analysis will help implement alternative healthcare delivery methods, such as telecommunication to reduce the indirect cost burden [16].

CONCLUSION: An insight into changing trends in the prescription pattern is fulfilled by drug utilization pattern analysis. This observational study concluded that antifungals, antihistaminics, and adsorbents were the most common drugs prescribed. Prescriptions encountered with steroids or antibiotics were few. A study proved that dermatologists followed rationality, reducing the emergence of antimicrobial drug resistance and other health hazards. More than 90% of drugs were prescribed by their generic name, mentioned in the National List of Essential Medicines (NLEM), and were dispensed free of cost to the patients from the hospital pharmacy. This is an encouraging sign and must be encouraged. Such a rational prescribing pattern increases optimal drug utilization and health outcomes and has ensured less economic burden to patients, healthcare facilities, and society.

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