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Original Research Article

Cost analysis of antimicrobial drugs using a common commercial drug manual: an insight into rational prescribing

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ABSTRACT

Background: At present, there are a lot of drug industries that manufacture their own brand for a given drug molecule. A thorough knowledge of cost of different brands of the drug molecule is necessary for doctors so that they can prescribe the affordable drug brand to the patient. This can improve the compliance and therapy outcome. The aim is to analyse the cost variation of drug molecules available in market and their comparison with drugs available in Jan Ausadhi Kendra.
Methods: Cross sectional descriptive study, using current index of medical specialities (CIMS) 2023 drug manual, the relevant details of some commonly used anti-microbials were obtained. The cost ratio and the percentage cost variation of different drugs were calculated.
Results: The highest cost ratio was for tablet Fluconazole and least for tablet Atazanavir 300 mg. The maximum % cost variation was for tablet Fluconazole and least for Injection Caspofungin. Some of the costly drugs in Janaushadhi store were tablet Norfloxacin-Tinidazole, Moxifloxacin, Cefuroxime, Azithromycin and Piperacillin-Tazobactam injection respectively.
Conclusion: Since there is a wide price variation in different brands of a given same anti-microbial agent, the clinicians need to focus on the cheapest drug brands available in the drug market so that they can reduce the cost burden on patients and improve the patient compliance.

Keywords: Anti-microbials, Cost ratio, Cost variation

INTRODUCTION

Pharmaceutical industry forms an important part of the present-day health-care sector. In the developing countries like India. Cost of the drug plays a remarkable role in the patient care. There is a wide variation in the cost of various brands of the same generic drug.[1] It is hard for many patients to afford standard medicines in developing countries like India; which finally lead to poor patient compliance. Even significant percentage of high-income respondents stated cost related non-compliance.[2] In order to combat the issue of high cost and affordability, Government of India introduced the "Pradhan Mantri Bhartiya Janaushadhi Pariyojna".[3] Under this Jan Aushadhi scheme, a significant number of allopathic medical stores were opened; which would provide medicines to the common people at an affordable price. Although the number of PMBJP stores has increased to over 800, but the numbers of medicines available are only around 200 out of the planned list of 600. "National Pharmaceutical Pricing Authority" is another price regulatory body introduced by the Indian government. Poor patient compliance or non-compliance badly affects the therapeutic outcome and increases health care expenditure. This can lead to the emergence of various deadly communicable diseases like Tuberculosis, Malaria

etc.[4] Clinician's must have proper cost awareness to avoid prescribing expensive medicines. To promote the rational use of drugs, optimising the cost of therapy is very essential. To treat various infectious diseases, there are various anti-microbial agents under different brands and formulations with wide variation in cost in India. It is a challenge for the clinicians to deliver good quality patient care at the minimum and affordable cost.[5] Pharmacoeconomic evaluations are to be performed to combat the high cost of drugs.

The rationale of this study was to observe the percentage cost variation and to find the less costly anti-microbial agent; in order to promote rational chemotherapy of infectious diseases.

METHODS

The study was Conducted in the department of Pharmacology in collaboration with department of Central Pharmacy, Uttar Pradesh University of Medical Sciences, between 2023 to 2024. It was cross sectional descriptive comparative study, commenced as per the approval of Institutional Ethical Committee. All the data were analysed using SPSS version 28.

With the help of drug data book, CIMS 2023, the price of some of the commonly used anti-microbial agents were obtained. The maximum & the minimum cost in Rupees (INR) of a particular antimicrobial agent manufactured by various pharmaceutical companies in the same strength were noted. The price of 10 tablets, 10 capsules or 1 injection was recorded. Simultaneously, the price list of the drugs available in Jan Ausadhi Kendra. The cost ratio; which is the ratio of the cost of the costliest brand to cheapest brand of the same generic antimicrobial agent was calculated. This shows us how many times the costliest brand costs more than the cheapest brand of a given drug molecule. Paediatric and topical antimicrobial preparations were not analysed in this study.

Cost variation (%)=(Maximum cost-Minimum cost)÷Minimum cost)×100, Cost ratio=maximum cost÷minimum cost.

Cost variation with respect to minimum price = (minimum cost of generic drug-cost of medicine in Jan Aushadhi store).

RESULTS

This study points out that there is a drastic variation in the prices of different brands of same antimicrobial agent in Indian market. The overall highest cost ratio (1:132.3) and percentage cost variation (13135.29) was found for Fluconazole (150 mg) tablet, followed by cost ratio (1:102.6) and percentage cost variation (10156.41) for Cefpodoxime (200 mg) tablet. Other significant percentage cost variations were: Mebendazole 100 mg tablet (5700.00), Cefuroxime 250 mg tablet (5354.55), Doxycycline 100 mg tablet (4665.40), Levofloxacin 500 mg tablet (3283.03), Metronidazole 400 mg tablet (3232.59), Injection Piperacillin-Tazobactam 4.5 g (2039.13), Injection Arte-ether 150 mg (1879.17), Injection Amphotericin-B 50 mg (1492.00), Nitrofurantoin 100 mg tablet (1130.00), Norfloxacin-Tinidazole 400/600mg tablet (1573.06), Moxifloxacin 400 mg tablet (1026.76), Ofloxacin 400 mg tablet (897.86). The overall lowest cost ratio (1:1.05) and percentage cost variation (5.11) was found for injection Caspofungin 50 mg.

Table 1: Cost analysis of some orally taken anti-bacterials, anti-fungals, anti-virals, anti-protozoals, anti-helminthics, anti-malarial drugs.

S. no	Category	Drug name	Dose (mg)	Dosage form	Maximum	Minimum	Jan Aushadhi		Cost ratio	% Cost variation
					Cost (RS) (a)	Cost (RS) (b)	Price (RS)	Cost Variation wrt Min Price		
1	Anti-fungal	Fluconazole	150	Tablet	450	3.4	23.2	-19.8	1:132.3	13135.29
2		Griseofulvin	250	Tablet	37.7	12.43	NA	NA	1:3.03	203.3
3		Itraconzole	100	Tablet	425	175	NA	NA	1:2.4	142.86
4		Ketoconazole	200	Tablet	260	57.9	NA	NA	1:4.5	349.05
5		Voriconazole	200	Tablet	20064.6	4400	NA	NA	1:4.6	356.01
6		Itraconazole	100	Capsule	812.5	72	NA	NA	1:11.3	1028.47
7		Terbinafine	250	Tablet	250.7	99	NA	NA	1:2.5	153.23
8		Clotrimazole	100	Tablet	125	29.93	NA	NA	1:14.2	317.64
9	Anti-Viral	Acyclovir	400	Tablet	991	269.2	31.6	67.4	1:2.7	171.92
10		Ganciclovir	500	Tablet	20250	16500	NA	NA	1:1.2	22.73
11		Entecavir	0.5	Tablet	1413.45	723	NA	NA	1:1.9	95.5
12		Ribavirin	200	Tablet	820	283.4	NA	NA	1:2.9	189.34
13		Amantadine	100	Tablet	110	72.5	NA	NA	1:1.5	51.72
14		Oseltamivir	75	Tablet	572	451	NA	NA	1:1.3	26.83

Continued.

S. no	Category	Drug name	Dose (mg)	Dosage form	Maximum Cost (RS) (a)	Minimum Cost (RS) (b)	Jan Aushadhi Price (RS)	Jan Aushadhi Cost Variation wrt Min Price	Cost ratio	% Cost variation
15		Lopinavir + Ritonavir	200/50	Tablet	920.6	463	NA	NA	1:1.9	98.83
16		Atazanivir	300	Tablet	751	700	NA	NA	1:1.07	7.29
17		Abacavir	300	Tablet	783.3	481.5	NA	NA	1:1.6	62.68
18		Lamivudine	100	Tablet	350	76	NA	NA	1:4.6	360.53
19		Didanosine	250	Tablet	416.6	288	NA	NA	1:1.5	44.65
20		Efavirenz	600	Tablet	2070	220	141	79	1:9.4	840.91
21		Nevirapine	200	Tablet	195.8	133.5	NA	NA	1:1.5	46.67
22		Tenofovir	300	Tablet	833.3	327	178	149	1:2.6	154.83
23		Indinavir	400	Tablet	257.4	180	NA	NA	1:1.4	43
24		Nelfinavir	250	Tablet	400	240	NA	NA	1:1.7	66.67
25		Zidovudine	300	Tablet	240	90.47	NA	NA	1:2.7	165.28
26	Antiprotozoal	Metronidazole	400	Tablet	149.3	4.48	4	0.48	1:33.3	3232.59
27		Tinidazole	500	Tablet	97.9	24.04	NA	NA	1:4.1	307.24
28	Antihelminthic	Albendazole	400	Tablet	270	75	NA	NA	1:3.6	260
29		DEC	150	Tablet	43.48	25.3	NA	NA	1:1.7	71.86
30		Ivermectin	6	Tablet	177	99.5	NA	NA	1:1.8	77.89
31		Levamisole	150	Tablet	420	51.2	NA	NA	1:8.2	720.31
32		Mebendazole	100	Tablet	290	5	NA	NA	1:58	5700
33		Praziquantel	600	Tablet	850	228.12	NA	NA	1:3.7	272.61
34	Antimalarial	Artemether + Lumifantrine	80/480	Tablet	300	108	33.33	74.67	1:2.8	177.78
35		Chloroquine Phosphate	250	Capsule/Tablet	25	5.2	5.65	-0.45	1:4.8	380.77
36		Quinine	300	Tablet	80	42.25	28	14.25	1:1.9	89.35
37		Hydroxy Chloroquine	200	Tablet	158.3	55	27	28	1:2.9	187.82
38	Anti-bacterial drugs	Cefpodoxime	200	*Tablet*	2000	19.5	NA	NA	1:102.6	10156.41
39		Cefixime	200	Tablet	582	49.52	NA	NA	1:11.7	1075.28
40		Sulfamethoxazole + Trimethoprime	800/160	Tablet	36.125	6.14	NA	NA	1:5.9	488.36
41		Sulfasalazine	500	Tablet	64.85	54.74	19	35.74	1:1.2	18.47
42		Silver Sulfadiazine		Cream	34	14	NA	NA	1:2.4	142.86
43		Norfloxacin + Tinidazole	400/600	Tablet	261.5	15.63	33	-17.37	1:16.7	1573.06
44		Ciprofloxacin + Tinidazole	250/300	Tablet	98.15	28.95	22	6.95	1:3.4	239.03
45		Levofloxacin	500	Tablet	981.08	29	27	2	1:33.8	3283.03
46		Moxifloxacin	400	Tablet	800	71	108	-37	1:11.3	1026.76
47		Amoxicillin	500	Capsule	143.9	53	29	24	1:2.7	171.51
48		Cephalexin	250	Tablet	120.8	19.18	21.3	-2.12	1:6.3	529.82
49		Cefuroxime	250	Tablet	1200	22	56	-34	1:54.5	5354.55
50	Anti-Bacterial drugs	Cefuroxime	500	Tablet	862	48	104.5	-56.5	1:17.9	1695.83
51		Azithromycin	500	Tablet	358.33	65	81	-16	1:5.5	451.28
52		Doxycycline	100	Tablet	325	6.82	12	-5.18	1:47.6	4665.4
53		Clindamycin	300	Capsule	370	135	90	45	1:2.7	174.07
54		Nitrofurantoin	100	Tablet	123	10	16	-6	1:12.3	1130
55		Clofazimine	100	Capsule	204.28	23.52	NA	NA	1:8.6	768.54
56		Thalidomide	100	Capsule	777.83	491.96	NA	NA	1:1.5	58.11
57		Rifampicin+ Isoniazid	450/300	Tablet	81.5	34.5	30	4.5	1:2.3	136.23
58		Cefadroxil	500	Tablet	68.6	33.1	18.75	14.35	1:2	107.25
59		Ciprofloxacin	500	Tablet	156	34.65	17	17.65	1:4.5	350.22

Continued.

S. no	Category	Drug name	Dose (mg)	Dosage form	Maximum Cost (RS) (a)	Minimum Cost (RS) (b)	Jan Aushadhi Price (RS)	Jan Aushadhi Cost Variation wrt Min Price	Cost ratio	% Cost variation
60		Ofloxacin+Ornidazole	200/500	Tablet	120	31.92	22.5	9.42	1:3.7	275.94
61		Ofloxacin	400	Tablet	531.46	53.26	22	31.26	1:9.9	897.86

Per Oral: *NA: Not available, Parental Route

Table 2: Cost analysis of some IV anti-bacterial, anti-fungal & anti-malarial.

S. no.	Category	Drug name	Dose	Route of administration	Maximum Cost	Minimum Cost	Jan Aushadhi Price	Jan Aushadhi Cost variation wrt min price	Cost ratio	% cost variation
1	Anti-Fungal	Amphotericin B	50 mg	IV	4457.59	280	NA	NA	1:15.9	1492
2		Caspofungin	50 mg	IV	10500	9990	NA	NA	1:1.05	5.11
3	Antimalarial	Arte-ether	150	IV	475	24	15	9	1:19.7	1879.17
4		Artesunate	60	IV	247	170	21	149	1:1.4	45.29
5	Antibacterial	Cefoperazone+Sulbactum	500/500	IV	343	95	44	51	1:3.6	261.05
6		Ceftriaxone+Sulbactum	1000/500	IV	150	90	40	50	1:1.7	66.67
7		Ceftriaxone + Tazobactum	1000/125	IV	256	118.8	44.46	74.34	1:2.1	115.49
8		Ceftriaxone	1000	IV	98	43.92	24	19.92	1:2.2	123.13
9		Cefotaxim +Sulbactum	1000/500	IV	74	68.15	23	45.15	1:1.09	8.58
10		Cefotaxim	1000	IV	80.35	27.1	16	11.1	1:2.9	196.49
11		Ampicilline	500	IV	13	4.24	6	-1.76	1:3.1	206.6
12		Amoxicilline/Clavulanic Acid	250/125	IV	284	109	NA	NA	1:2.6	160.55
13		Piperacilline/Tazobactum	4000/500	IV	960.47	44.9	140	-95.1	1:21.4	2039.13
14		Amoxicilline/Clavulanic Acid	1000/200	IV	214.4	113.91	55	58.91	1:1.9	88.22
15		Imipenem/Cilostatin	500/500	IV	2100	538	NA	NA	1:3.9	290.33
16		Meropenem	1000	IV	3400	400	214	186	1:8.5	750
17		Gentamicin	80	IV	16.9	4.99	2.25	2.74	1:3.4	238.68
18		Amikacin	250	IV	68	9.55	16.4	-6.85	1:7.1	612.04
19		Linezolid	600	IV	451.34	207	110	97	1:2.2	118.04

DICUSSION

When the patients take the medications as prescribed by the treating doctor, they are said to be "Adherent to Medications". Poor compliance badly affects the clinical outcomes & increases healthcare expenses. A strong link between poor compliance and anti-microbial resistance has been established in chronic infection like tuberculosis.6 Since our country is a slow developing country; there exists a significant portion of people living under poverty. This poverty disaster itself leads to spread of various communicable diseases and it becomes therefore essential to prevent and control these infections.

Factors that are responsible for poor compliance with antibiotic therapy are cost of drugs, side effects, rapid improvement of symptoms, forgetfulness, illiteracy, lack of transference, frequent dosing and patient beliefs. The highest percentage cost variation & cost ratio was found for Tablet Fluconazole 150 mg followed in descending order by drugs like Cefpodoxime (200 mg) tablet, Mebendazole 100 mg tablet, Cefuroxime 250 mg tablet, Doxycycline 100 mg tablet, Levofloxacin 500 mg

tablet, Metronidazole 400 mg tablet, Injection Piperacillin-Tazobactam 4.5 g, Injection Arte-ether 150 mg, Injection Amphotericin-B 50 mg, Nitrofurantoin 100 mg tablet, Norfloxacin-Tinidazole 400/600 mg tablet, Moxifloxacin 400 mg tablet, Ofloxacin 400 mg. The lowest percentage cost variation & cost ratio was found for Injection Caspofungin 50 mg.

In India, there are lot of brands for the same drug molecule. As a result, there exists a wide variation in the cost of a drug which is sold under numerous brand names. Higher cost of medicines is one of the reasons responsible for treatment non-compliance.[7] This is responsible for many adverse health outcomes.[8] Decrease in medicine cost has been positively related to favourable health condition by the after effect of improved treatment adherence.[9] It is the duty of every prescribing clinician to seriously consider the cost of medicines and to not prescribe costly medicines. It has also been established that there is no correlation between quality of medicine and its corresponding price.[10] In a big country like India, most of the patients are paying out of their pockets and are not covered by insurance schemes.[11] As far as possible, clinicians must prescribe generic drugs.

The data was mainly obtained from the CIMS book and CIMS web source. The paediatric medicines and Topical medications were not considered in this study.

CONCLUSION

Pharmacoeconomics should be an integral part of the education curriculum of undergraduates and postgraduates. This will increase the awareness of impact of cost of therapy on the treatment adherence and successful treatment of the patient. Making use of drug manuals like CIMS will reduce the cost of medications. The “Pharma Vision” has been introduced by the government of India to make India a global leader in the drug manufacture segment. In addition, government has also put in place the mechanisms such as Drug Price Control Order (DPCO) and the National Pharmaceutical Pricing Authority (NPPA) to address the issues of affordability and availability of medicines.

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