

## Cost analysis of antifungal drugs available in India: A pharmacoeconomic perspective

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### Abstract

**Introduction:** Fungal infections are common and treatment imposes economic burden on the patients. The compliance of the patient may be significantly dependent on the cost of the prescribed medicines, especially in developing countries like India. Therefore, this study was conducted to analyze cost variation of drugs used for fungal infections.

**Aim and Objectives:** To evaluate the cost of different brands of anti-fungal drugs available in India, and to analyze the variations in cost of same dosage of different brands of the same active drug.

**Material and Methods:** Cost of a particular drug that is manufactured by different companies, in the same strength, number and dosage forms was obtained from Current Index of Medical Specialties, July-October 2016 and Drug Today, July-September 2016 and were analysed. Cost range, cost ratio and percentage cost variation were calculated. Correlation between percentage cost variation and number of companies manufacturing the drug was analysed by linear regression and Spearman correlation analysis.  $p < 0.05$  was considered statistically significant.

**Result:** The costs of a total of 8 antifungal drugs available in 18 different formulations were analysed and a substantial variation in cost was found. Fourteen drugs had percentage cost variation more than 100%, fluconazole 150 mg (10214%) had maximum percentage cost variation while griseofulvin 500 mg (42%) had minimum percentage cost variation. There was a linear relationship between no. of manufacturing companies and percentage cost variation and Spearman correlation analysis showed a statistically significant positive correlation between these two variables.

**Conclusion:** The present study shows wide variation in the cost of the different brands of the same antifungal drugs manufactured by different companies. This adds to the economic burden for the patients. Ideally, generic drugs should be prescribed to decrease the healthcare cost and to enhance the compliance. Hence, the stakeholders should aim at decreasing the cost variation among different brands while maintaining the therapeutic efficacy.

**Keywords:** Pharmacoeconomics, Antifungal, Cost analysis, Brands, Cost variation

### Introduction

The incidence of fungal infections is on continuous rise because of immunosuppression due to cancer chemotherapy, organ transplant, AIDS, corticosteroid overuse and indiscriminate use of broad spectrum antibiotics. Infections caused by pathogenic fungi that are limited to the hair, nails, epidermis, and mucosa are referred to as superficial fungal infections.<sup>(1)</sup> While systemic fungal infections are life threatening, superficial fungal infections are considered important because of their worldwide distribution, epidemiology and morbidity.<sup>(2)</sup> These superficial fungal infections are sometimes drug resistant and infections of nails and hair require long-term therapy significantly increasing the cost of therapy, hence the treatment of fungal infection can impose economic burden on the patient.<sup>(3)</sup> Therefore due consideration should be paid to the financial condition of the patient while choosing the therapy for the treatment, as in India health care costs are borne by the patients themselves.

Indian pharmaceutical industry is one of the largest pharmaceutical markets in the world. It has a large number of branded formulations as well as generic brands of the same drug. There is a substantial variation in drug costs that creates problems to both the prescriber

as well as the patient.<sup>(4)</sup> The wide variation in the costs of the same drug along with ignorance and insufficient information on drug costs, quality and bioequivalence, makes it difficult for the physician to prescribe the most cost effective treatment.<sup>(5)</sup>

Rational use of medicines not only involves prescribing a medication that is appropriate to the clinical need, at the proper dose, for the proper duration but also at an affordable cost since compliance of the patient may significantly depend on the cost of the prescribed medicines.<sup>(6)</sup> Improvement in compliance can reduce the total healthcare cost involved in the management of a particular condition. Therefore, pharmacoeconomics plays a major role while prescribing medicines and cost of therapy should be an important consideration in selecting the drug therapy as it leads to increased adherence to the therapy. "Pharmacoeconomics identifies, measures, and compares the costs and consequences of pharmaceutical products and services"<sup>(7)</sup> and describes the economic relationship involving drug research, drug production distribution, storage, pricing and use by the people.

In the Indian market there are various antifungal drugs of different brands that are available. This creates a lot of problem for the physician to decide the drug of

choice for individual patients. Also in the literature very few studies are available which compare the cost of drugs of different brands and their various formulations, especially antifungal drugs. Therefore, the present study was planned which compares costs of different brands of antifungal drugs available in India.

### Aim and Objectives

The objective of the study was to evaluate the cost of common antifungal drugs available, number of manufacturing companies for each and, to analyse the difference in cost of different brands of the same active drug by calculating percentage variation of cost.

### Material and Methods

The cost of a particular drug in the same strength, number, and dosage forms being manufactured by different companies was obtained from Current Index of Medical Specialties, July-October 2016<sup>(8)</sup> and Drug Today, July-September 2016<sup>(9)</sup> as these are readily available sources of drug information. The drugs being manufactured by only one company or being manufactured by different companies; however, in different strengths were excluded. Topical formulations and fixed dose combinations were also excluded.

Cost range, cost ratio and percent cost variation were calculated per ten dosages for oral formulations and per unit dosage for injectable formulations. The cost range was expressed as minimum cost per ten dosages to maximum cost per ten dosages. The cost ratio was calculated as quotient of maximum cost over minimum cost. Cost ratio gives an idea about how many times is the costlier brand expensive than the cheapest brand of the same drug. Percentage cost variation<sup>(10)</sup> per ten

dosages for oral formulations and per unit dosage for injectable formulations was calculated as follows:

$$\text{Cost variation (\%)} = \frac{[(\text{Maximum cost} - \text{Minimum cost}) / \text{Minimum cost}] \times 100^{(10)}}{1}$$

In addition, any association between the percentage cost variation and the number of companies manufacturing the drug was analyzed by linear regression and Spearman correlation analysis.  $p < 0.05$  was considered statistically significant.

### Result

The costs of a total of 8 antifungal drugs available in 18 different formulations were analyzed and a substantial variation in cost was observed. Of 18 drug formulations studied, percentage cost variation of 14 drug formulations was more than 100% out of which 6 had this variation more than 1000%. Cost ratio was also observed to be very high and 13 drug formulations had this ratio more than 2. Fluconazole 150 mg had maximum percentage cost variation of 10214% and cost ratio of 103.14 with the highest number of 174 companies manufacturing it (Table 1 and Fig. 1) while griseofulvin 500 mg had minimum percentage cost variation of 42% and cost ratio of 1.42 (Table 1 and Fig. 2).

There was a linear relationship seen in linear regression analysis between no. of manufacturing companies and percentage cost variation ( $p < 0.0001$ ) and Spearman correlation analysis showed a significant positive correlation between these two variables ( $r = 0.64, p < 0.004$ ). The percentage cost variation increased as the no. of manufacturing companies increased (Fig. 3).

**Table 1: Cost variation among various brands of antifungal drugs**

Drugs	Formulations	Dose (mg)	Manufacturing companies	Cost range* (INR)	Cost ratio	Cost variation (%)
Amphotericin B <sup>#</sup>	1	50	6	263.50 – 452.95	1.72	71.90
Amphotericin B Liposomal <sup>#</sup>	1	50	11	2847.61 – 7900.00	2.77	177.43
Griseofulvin	3	250	14	12.72 – 57.91	4.55	355.27
		375	4	18.51 – 57.90	3.13	212.80
		500	5	35.00 – 49.70	1.42	42.00
Ketoconazole	1	200	21	25.90 – 347.00	13.40	1239.77
Fluconazole	5	50	21	9.52 – 265.62	27.90	2690.13
		100	4	36.92 – 158.75	4.30	329.98
		150	174	4.37 – 450.70	103.14	10213.50
		200	6	266.35 – 546.50	2.05	105.18
		400	10	29.00 – 550.00	18.97	1796.55
Itraconazole	2	100	32	50.38 – 812.50	16.13	1512.74
		200	16	180.00 – 740.00	4.11	311.11
Terbinafine	2	250	47	27.21 – 440.00	16.17	1517.05
		500	4	156.00 – 260.00	1.67	66.67
Caspofungin <sup>#</sup>	1	50	11	7980.00 – 11452.80	1.44	43.52
Voriconazole	1	200	16	4940.00 – 18240.57	3.69	269.24

Voriconazole <sup>#</sup>	1	200	13	1812.55 – 7200	1.43	42.90
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INR = Indian National Rupee; \* Cost calculated per 10 dosages for oral and per unit dosage for injectable (#) formulations

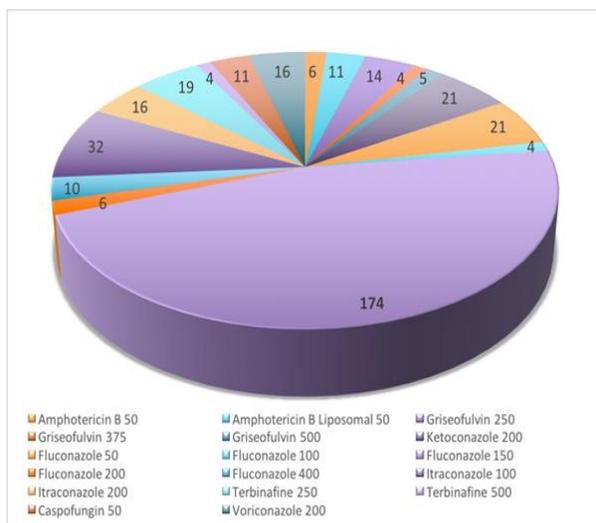


Fig. 1: No. of companies manufacturing antifungal drugs

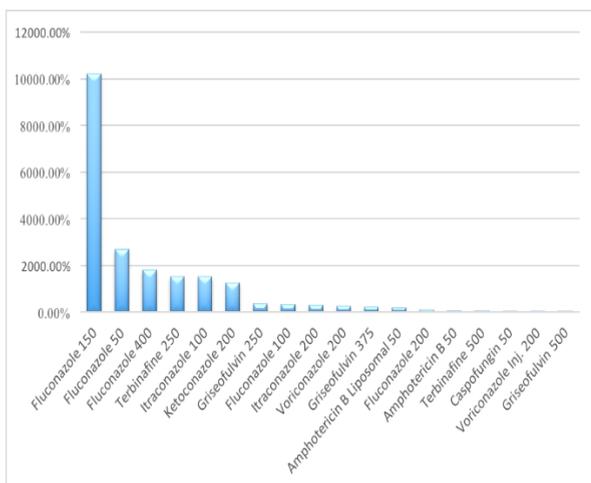


Fig. 2: Cost variation (%) among various brands of antifungal drugs in descending order

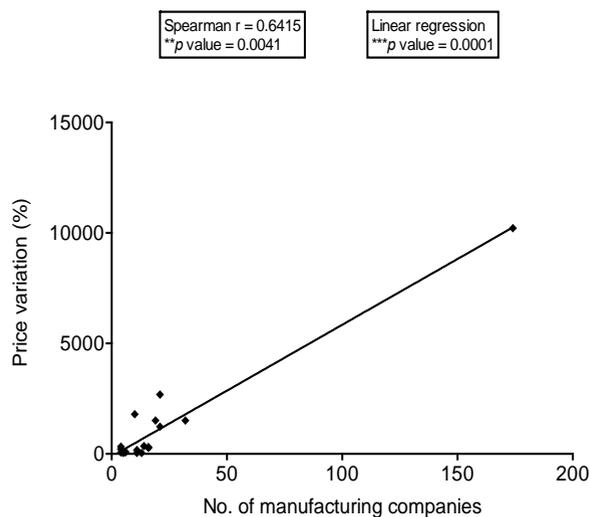


Fig. 3: Correlation between no. of manufacturing companies and percentage cost variation

### Discussion

The study revealed that various antifungal formulations of different brands available in India have huge cost variation. Although superficial infections are not life threatening, chronic fungal infections of the skin and nails are associated with considerable morbidity and their long term treatment imposes economic burden on the patients. The cost of drugs is one of the important factors responsible for patient’s compliance.

One of the major causes of the high cost of medicines is prescription by brand names. For some medicines, the difference in cost between the branded and generic product varies from less than two-fold to more than 100-fold. Lack of information on comparative drug costs and quality, makes it difficult for the health-care providers to prescribe the most economical treatment which is also an important factor in rational drug prescribing. Ignorance about the cost of drugs has also been highlighted in a meta-analysis which also found that the doctors acknowledge that awareness of cost information would improve their prescription pattern.<sup>(11)</sup> Therefore, such studies comparing the cost of different class of drugs and their different brands can provide some knowledge to prescriber about the cost of different drugs in the specific disease condition.

Generic drugs are substantially lower in cost than the branded drugs and healthcare cost can be reduced to some extent if physicians prescribe drugs in generics.<sup>(12)</sup> Generic drugs are widely believed to be bio-equivalent and they have same therapeutic effects as the innovator products.<sup>(13)</sup> Sometimes physicians are concerned about the quality of medication and this might be a reason for prescribing costly brand.<sup>(14)</sup> Although the generic medicines are produced in similar facilities as branded

ones according to good manufacturing practices,<sup>(15)</sup> these are considered as inferior in their therapeutic efficacy and quality to branded products.<sup>(16,17)</sup> There is a need for incorporating analysis of prescription costs in the medical curriculum and by providing updated and complete information regarding bioequivalence, quality and cost of the pharmaceutical preparation to the doctors.

This study also revealed that cost variation was positively correlated to the number of companies manufacturing a particular drug. Competition usually brings about a decline in costs of the products and is expected to decrease the cost variation. However, on the contrary in the present study, it was observed that more is the number of companies manufacturing a particular formulation wider is the cost variation and vice versa. The pricing practices of the drug manufacturers indicate that information on product quality and costs would force firms to compete on the cost level, thus reducing pharmaceutical product pricing to the “true market cost”.<sup>18</sup> Pharmaceutical manufacturers cite the high cost of research and development as a reason for the excessive pricing of drugs. However, considerable money is spent on product promotion and overhead cost.<sup>(19)</sup>

Results of this study indicate that there is an urgent need of controlling cost variation among different brands of available antifungal drugs. Drug costs are controlled according to Drug Cost Control Order 2013 (DPCO).<sup>(20)</sup> Ceiling cost of drugs are fixed by National Pharmaceutical Pricing Authority (NPPA) Government of India in accordance with DPCO 2013. A medicine that is included in DPCO cannot be dispensed at a cost higher than that fixed by the government. In spite of these efforts to prevent unjustifiable pricing of drugs, there exists a wide variation of drug costs within one drug with the availability of various brands. Introducing cost control is not the end point of effort to reduce the cost burden of treatment, but there is a need for regular monitoring. The list of drugs under DPCO should be dynamic and revised periodically in accordance with the availability of newer, more efficacious and safer drugs.

The government of India has recently started generic drug stores all over the country where medicines are available at cheaper rates.<sup>(21)</sup> The quality of generic medicines available in these stores at cheaper rates should be tested and compared with popular brands to build confidence among prescribers, pharmacists, and consumers for promoting the use of generic drugs.

Pharmacoeconomic analysis would help in therapeutic decision making, formulary decision making, program justification, drug policy decisions and treatment guidelines ultimately benefitting the society in terms of availability of affordable drugs and reduction in healthcare expenses.

## Conclusion

There is a wide variation in the cost of various brands of antifungal drugs available in India. For rational

drug use, cost is an equally important factor which commonly gets ignored while prescribing. Therefore, such studies comparing the cost of different brands of a class of drugs can aid in the prescription of drugs affordable to the common man. Generic drug prescribing can decrease the expenditure of patient on the drug and compliance can be improved. Adequate information should be provided to the physicians regarding cost, bioequivalence and quality of drugs.

Therefore, there is a need for coordinated action from regulatory authorities, pharmaceutical companies, physicians, pharmacists and the general public at large to address the problem of huge variation in the cost of the drugs.

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