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Original Research Article

## Rational use and cost variation analysis of antifungal drugs available in the Indian market: a pharmacoeconomic study

Pramod Kumar Manjhi, Chakrapani Kumar\*, Akhilesh Kumar Rana

Department of Pharmacology, All India Institute of Medical Sciences, Patna, Bihar, India

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**\*Correspondence:**

Dr. Chakrapani Kumar,

Email: [drcpkumar10@gmail.com](mailto:drcpkumar10@gmail.com)

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### ABSTRACT

**Background:** Fungal infections are the 4<sup>th</sup> most common skin disease affecting 984 million people. Fungal infections are mostly associated with the use of broad-spectrum antibiotics, corticosteroids, anticancer/immunosuppressant drugs, indwelling catheters and implants, and the emergence of AIDS. The aim of this study was to analyze the rational use, cost ratio, and percentage cost variations in different brands of the commonly prescribed antifungal drugs available in the Indian market.

**Method:** The maximum and minimum price of each brand of the drugs given in Indian rupees (INR) was noted by using 'Drug Today' (January to April 2021, volume II). The cost range, cost ratio, and the percentage cost variation for individual drug brands were calculated. The cost of tablets/capsule/injection was calculated and the cost ratio and percentage cost variation of various brands was compared.

**Results:** After calculation of cost ratio and percentage cost variation for each brand of antifungal agents, tab Itraconazole 100 mg had a maximum percentage cost variation of 733.33% and a cost ratio of 8.33 while tab Griseofulvin 250 mg had a minimum percentage cost variation of 16.98% and cost ratio of 1.16.

**Conclusions:** The present study shows there was a wide variation in the cost of the different brands of antifungal drugs manufactured by pharmaceutical companies which increases the economic burden. The clinicians prescribing these drugs should be aware of rational use and cost variation to reduce cost of drug therapy and improve patient compliance.

**Keywords:** Rational use, Fungal infection, Antifungal drugs, Cost ratio, Percentage cost variation

### INTRODUCTION

The world health organization (WHO) has defined rational use of drugs as: "Patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community."<sup>1</sup> This is also referred to, in brief, as the five 'right's, i.e., the right drug at the right dose by the right route at the right time for the right patient.<sup>2</sup>

A major step toward rational use of medicines was taken in 1977 when the WHO established the 1<sup>st</sup> model list of essential medicines to assist countries in formulating their own national lists. The present definition of rational use

was agreed upon at an international conference in Kenya in 1985. In 1989, the international network for the rational use of drugs was formed to conduct multidisciplinary intervention research projects for promoting more rational use of medicines. A review of all published intervention studies with adequate study design was presented at the 1<sup>st</sup> international conference for improving the use of medicines in Thailand in 1997.<sup>3</sup> The opening remarks by the WHO on its "rational medicine use" webpage summarize the existing situation: "Irrational use of medicines is a major problem worldwide. WHO estimates that more than half of all medicines are prescribed, dispensed or sold inappropriately and that half of all patients fail to take them correctly. The overuse, underuse or misuse of medicines results in wastage of scarce

resources and widespread health hazards.”<sup>4</sup> Such misuse of medicine and the resultant wastage has a skewed distribution in low-income countries, as evidenced by a much larger share of medical spending in the total health expenditure in these countries compared to that in the high and middle-income countries.<sup>5</sup>

An estimated 20-25% of the world’s population has some form of fungal infection, usually an anthropophilic trichophyton infection, making fungal infections the most common type of infection worldwide.<sup>6</sup> Fungal infections of the skin were the 4<sup>th</sup> most common skin disease in 2010 affecting 984 million people.<sup>7</sup> It is more prevalent in tropical and subtropical countries like India where the heat and humidity are high for the most part of the year. There are several reports on intra-continental variability of the global incidence because of the change in climatic conditions across the world.<sup>8</sup> Fungal infections constitute a serious threat to human health and life.<sup>9</sup> Dermatophytes are fungi that cause superficial infections of the skin, commonly referred to as tinea infections. Transmission of these infections can be via the person-to-person spread, soil contact, or animal contact. Fungal infections of the scalp are referred to as tinea capitis; tinea pedis is a superficial fungal infection of the foot; groin infections are referred to as tinea cruris, and most other superficial skin infections due to tinea are categorized as tinea corporis.<sup>10</sup>

Antifungal therapy has undergone a tremendous transformation in recent years.<sup>11</sup> The current therapeutics agents can be broadly classified into two groups: first, the naturally occurring antifungal antibiotics such as polyenes and echinocandins, and second, synthetic drugs including azoles and fluorinated pyrimidines.<sup>12</sup>

The incidence of fungal infections is on the 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>13</sup> While systemic fungal infections are life-threatening, superficial fungal infections are considered important because of their worldwide distribution, epidemiology, and morbidity.<sup>14</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 an economic burden on the patient.<sup>15</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.

In the Indian market, there are various antifungal drugs of different brands are available. This creates a lot of problems for the physician to decide the drug of choice for individual patients. Also in the literature, very few studies are available that compare the cost of drugs of different brands and their various formulations, especially

antifungal drugs. Therefore, the present study was planned which compares the costs of different brands of antifungal drugs available in India.

## METHODS

Price in INR of antifungal drugs manufactured by different pharmaceutical companies in India, in the different strengths was obtained by using Drug Today (January-April 2021, volume II) as they are a readily available source of drug information and are updated regularly. The cost of tablets/capsules/injections was calculated. The costs of drugs were also cross-checked at a pharmacy or retail drug store. The difference in the maximum and minimum price of the same drug formulation manufactured by different pharmaceutical companies and percentage variations in prices were calculated. The cost ratio, calculated as the ratio of the costlier brand to that of the cheapest brand of the same drug, is calculated as follows;

### Cost ratio

Price of the costlier brand/ price of the cheapest brand

The percentage cost variation of each drug should be calculated as follows,

Percentage cost variation=[(Maximum cost-minimum cost)/ minimum cost]×100

Maximum and minimum percentage cost variation and cost ratio of a particular drug was noted down.

### Inclusion criteria

Antifungal drugs from branded manufacturing companies and drugs of the same and different strengths were included. Dosage forms of antifungals tablet/capsule/injection were included.

### Exclusion criteria

Antifungal drugs in combinations with other groups of drugs, fixed-dose combinations of antifungal drugs, and drugs with no price information were excluded from the study.

## RESULTS

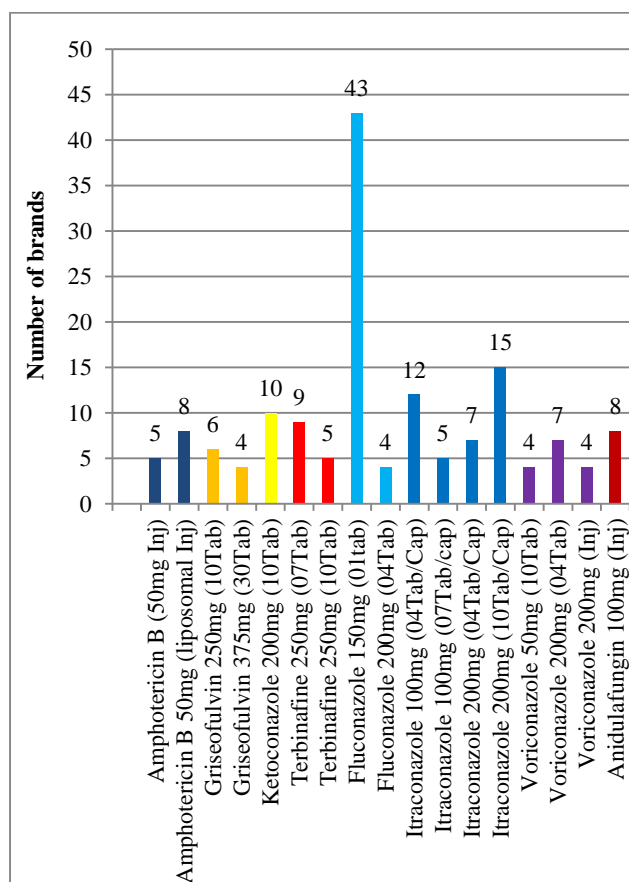
The costs of a total of 8 antifungal drugs available in 17 different formulations were analyzed and a substantial variation in cost was observed. Out of 17 drug formulations studied, the percentage cost variation of 11 drug formulations was more than 100% out of which 2 drug formulations had more than 500%. The cost ratio was also observed to be very high and 11 drug formulations had this ratio of more than 2. Tab itraconazole 100 mg had a maximum percentage cost variation of 733.33% and cost ratio of 8.33 while tab griseofulvin 250 mg had a minimum

percentage cost variation of 16.98% and cost ratio of 1.16. Among injectables, inj Amphotericin B 50 mg liposomal had a maximum percentage cost variation of 244.97 and cost ratio of 3.44 and, inj Amphotericin B 50 mg had a

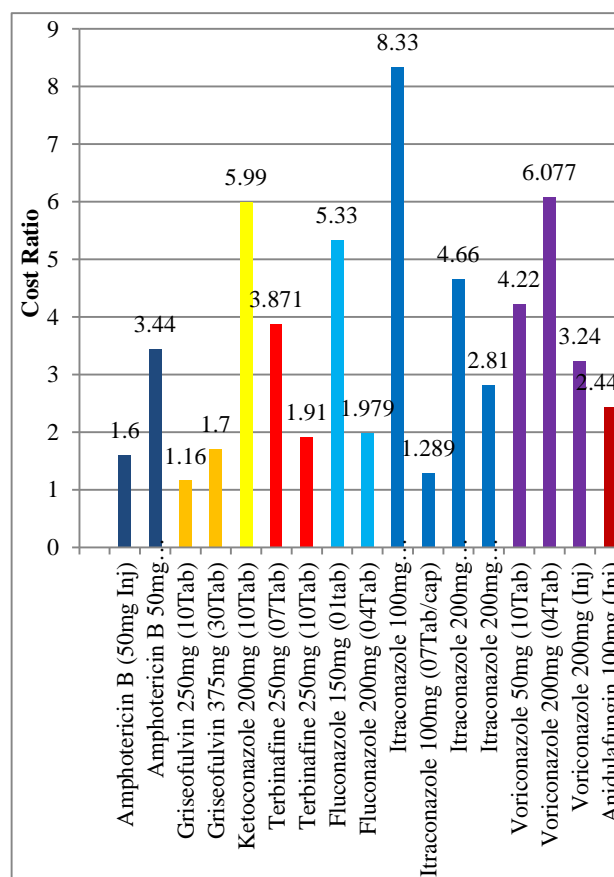
minimum percentage cost variation of 60.72 and cost ratio of 1.60. We preferred those drugs that possessed a cost ratio of less than 2 and a percentage cost variation of less than 100.

**Table 1: Cost ratio and percentage cost variation of antifungal drugs available in the Indian market.**

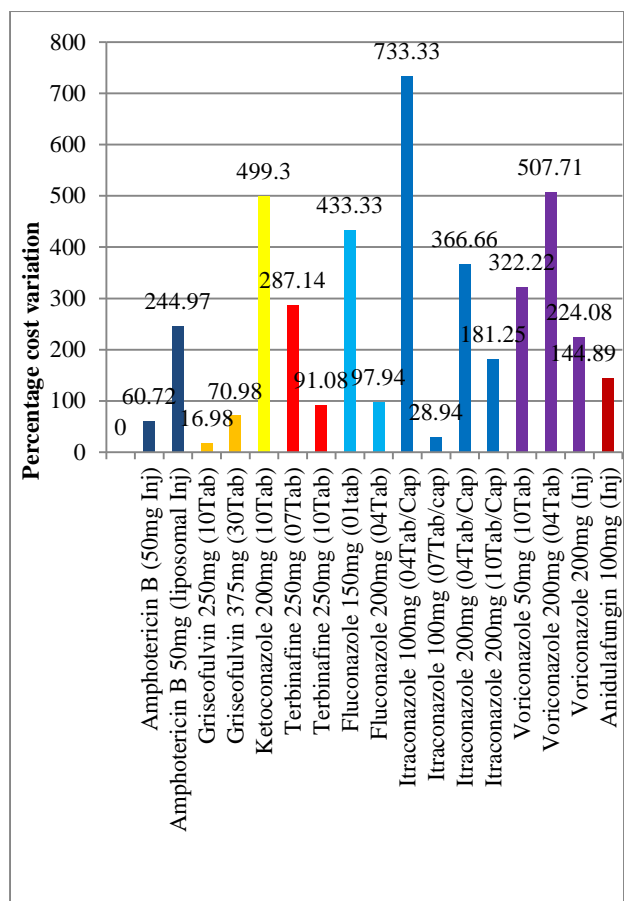
Generic drugs and strength	Dosage form	No. of brands	Cost range (INR)	Cost ratio	Percent cost variation (%)
Amphotericin B 50 mg	Inj	5	280-450	1.60	60.72
Amphotericin B 50 mg liposomal	Inj	8	2290-7900	3.44	244.97
Griseofulvin 250 mg	10 tab	6	15.54-18.18	1.16	16.98
Griseofulvin 375 mg	30 tab	4	57.90-99	1.70	70.98
Ketoconazole 200 mg	10 tab	10	57.90-347	5.99	499.30
Terbinafine 250 mg	07 tab	9	70-271	3.871	287.14
Terbinafine 250 mg	10 tab	5	157-300	1.910	91.08
Fluconazole 150 mg	01 tab	43	06-32	5.33	433.33
Fluconazole 200 mg	04 tab	4	78.76-155.9	1.979	97.94
Itraconazole 100 mg	04 tab/cap	12	39-325	8.33	733.33
Itraconazole 100 mg	07 tab/cap	5	76-98	1.289	28.94
Itraconazole 200 mg	04 tab/cap	7	75-350	4.66	366.66
Itraconazole 200 mg	10 tab/cap	15	160-450	2.81	181.25
Voriconazole 50 mg	10 tab	4	450-1900	4.22	322.22
Voriconazole 200 mg	04 tab	7	648-3938	6.077	507.71
Voriconazole 200 mg	Inj	4	1914-6203	3.24	224.08
Anidulafungin 100 mg	Inj	8	4900-12000	2.44	144.89



**Figure 1: Number of brands of different antifungal drugs.**



**Figure 2: Cost ratio of different antifungal drugs.**



**Figure 3: Percentage cost variation of different antifungal drugs.**

## DISCUSSION

The study revealed that various antifungal drugs of different brands available in India have huge cost variations. 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 an economic burden on the patients. The cost of drugs is one of the important factors responsible for patient compliance. Generic drugs are substantially lower in cost than branded ones and healthcare costs can be reduced to some extent if physicians prescribe generics.<sup>16</sup> Generic drugs are widely believed to be bio-equivalent and they have the same therapeutic effects as the innovator products.<sup>17</sup> Sometimes physicians are concerned about the quality of medication and this might be a reason for prescribing costly brands.<sup>18</sup> Although the generic medicines are produced in similar facilities as branded ones according to good manufacturing practices, these are considered inferior in their therapeutic efficacy and quality to branded products.<sup>19-21</sup> There is a need for incorporating an 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.

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>22</sup> The ceiling cost of drugs is fixed by the 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 endpoint of the 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>23</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 in promoting the use of generic drugs. The pharmacoeconomic analysis would help in therapeutic decision making, formulary decision making, program justification, drug policy decisions, and treatment guidelines ultimately benefitting society in terms of availability of affordable drugs and reduction in healthcare expenses.

## CONCLUSION

There was a wide variation in the cost of various brands of antifungal drugs available in India. For rational drug use, the cost is an equally important factor that commonly gets ignored while prescribing. Therefore, such studies comparing the cost of different brands of a class of drugs can help in the prescription of drugs affordable to the common man. Generic drug prescribing can decrease the expenditure of patients on the drug and compliance can be improved. Adequate information should be provided to the physicians regarding cost, bioequivalence, and quality of drugs. The physician should always remember that he/she should not avoid treating the patients with a particular drug because it is expensive and should rather balance his/her therapeutic decisions in prescribing a particular drug by considering the patient's socioeconomic status. There is a strong need to create awareness about this huge price variation among the general public, healthcare providers, healthcare payers, government agencies, policymakers, and pharmacists for appropriate intervention to reduce the economic burden on patients as well as the healthcare system.

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