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Cost Ratio and Price Variation Analysis of Quinolone Antimicrobials Available in Indian Pharmaceutical Market

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<p>Sanoop J*, Sara Yeldhos, Priyanka S</p> <p><i>Department of Pharmacy Practice, Karpagam college of Pharmacy, S.F.762, Pollachi Main Road, Othakkalmandapam, Coimbatore-641032, Tamil Nadu, India (Affiliated to The Tamil Nadu Dr.M.G.R Medical University).</i></p> <p>Submission: 24 December 2019 Accepted: 29 December 2019 Published: 30 January 2020</p>		



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ABSTRACT

Bacterial infections require precise and cost-effective treatment for improving patient compliance and also to reduce the unfair economic burden on the patient. There are several Quinolone antimicrobial drug formulations available in India, Hence the present study was planned to evaluate the cost ratio and price variation of Quinolone antimicrobials available in the Indian Pharmaceutical market. The cost of 10 oral Quinolone Antimicrobial drugs available in India was obtained from CIMS, July to Oct 2019. The cost ratio and percentage price variation were calculated and compared. The highest cost ratio and percentage price variation was found for the drug Ofloxacin 400mg [28.82 and 2782.05] and least for Ciprofloxacin 1000mg [1.51 and 51.14]. Another significant percentage price variations were seen with Levofloxacin 500mg (2080.17), Moxifloxacin 400mg (1026.76), Norfloxacin 400mg (420.67), Ciprofloxacin 750mg (418.65) and other lowest percentage price variations was seen with Sparfloxacin 200mg (60.83), Balofloxacin 100mg (67.66), and Ciprofloxacin 100mg (80.64). The variations in the prices of the drug among different brands of drugs indirectly increase the healthcare costs and the problem is often magnified in developing countries like India and the regulatory authorities should exercise their powers in controlling the prices of branded drugs especially in the case of lifesaving antimicrobial drugs. Generic drug substitution and clinical pharmacist intervention in choosing cost-effective choices of drugs can make a huge impact on healthcare costs, thereby enhancing the quality of patient care.

INTRODUCTION

The development of Quinolone as a separate class of antimicrobials begins from the discovery of Nalidixic acid in the year of 1962 followed by the introduction of Norfloxacin, the first Quinolone and then followed by Ciprofloxacin in which both are pharmacokinetically superior and also offers an extended spectrum of activity when compared to Nalidixic acid^[1]. Gram-positive and Gram-negative bacteria causing urinary tract infections, including complicated and nosocomial infections and those caused by multiresistant strains can be treated by the newer quinolones (Ciprofloxacin, Enoxacin, Norfloxacin, Ofloxacin, Pefloxacin, and Fleroxacin)^[2]. Antibiotics like Quinolones act as a barrier to bacterial topoisomerase type II and also to the catalytic activity of DNA gyrase and topoisomerase IV resulting in bacterial chromosome disruption^[3]. The lifesaving antimicrobial drugs should be made available at the market at all times and are of great priority in all countries who are adversely affected by various infectious diseases. Various barriers are causing restricted access to these drugs in the market which include, finance, drug pricing, selection, supply, and distribution of drugs are very crucial in this regard^[4].

India is still a developing country and comprises mostly middle-class families or belongs to a poor socioeconomic background and as per the planning commission report, 29.5% of Indians among 1.21 billion people live below the poverty line^[5]. Although drugs do not provide a complete cure but plays an important role in maintaining, protecting, and restoration of health, in recent years there is a huge increase in the number of pharmaceuticals available in the market but there is no subsequent improvement in the health is observed which in turn increases the cost of health care. The problem is magnified in developing countries that are affected by limited economic resources and those countries that lack an organized drug policy^[6]. Generic drugs are available at reduced costs and these are marketed after the expiry of patent or marketing rights of the patented drug^[7]. Rational prescribing plays an important role in the successful implementation of the rational use of drugs^[8]. Elimination of various legal barriers to promote generic drug substitution and prescribing may not produce the desired effect as the pharmacists rely upon the profit obtained from selling drugs^[9]. The prices of various brands of the same drug are highly variant and are way too high placing an unfair economic burden on the consumer^[10]. Hence the present study was conducted to evaluate the cost ratio and price variation of Quinolone antimicrobials available in the Indian pharmaceutical market.

MATERIALS AND METHODS

1. Price in Indian rupees (INR) of Quinolone antimicrobials manufactured by different pharmaceutical companies in India, in the same strength were obtained from CIMS, July to Oct 2019.
2. The cost of 10 oral Quinolone antimicrobials available under different brands in the Indian pharmaceutical market was analyzed.
3. The cost of 10 tablets was calculated for each strength in a generic group.
4. Cost ratio gives the ratio of the cost of costliest to the cheapest brand of Quinolone antimicrobial drugs of the same strength available in the Indian market and it gives an idea about how many times the costliest brand costs more than the cheapest brand available in each generic group.

$$\text{Costratio} = \left[\frac{\text{Maximum brandcost}}{\text{Minimum brand cost}} \right]$$

5. Percentage price variation for each strength of the same generic group was calculated using the equation,

$$\text{Percentagepricevariation} = \left[\frac{\text{Maximum brand cost} - \text{Minimum brandcost}}{\text{Minimum brandcost}} \right] \times 100$$

6. The drug Manufactured by or a definite strength of drug manufactured by a single company are excluded.
7. The different brands of the drug whose price is not disclosed in CIMS, July to Oct 2019 are excluded.
8. Fixed-dose combinations and other formulations are not analyzed.
9. The number of formulations and the number of trades of Quinolone antimicrobial drugs in the Indian pharmaceutical market were analyzed.

RESULTS

The study shows that there is a gross variation in the cost of different brands of Quinolone Antimicrobials available in the Indian pharmaceutical market. The highest cost ratio and

percentage price variation was found for the drug Ofloxacin 400mg [28.82 and 2782.05] and least for Ciprofloxacin 1000mg [1.51 and 51.14].

Other significant percentage price variations were seen with Levofloxacin 500mg (2080.17), Moxifloxacin 400mg (1026.76), Norfloxacin 400mg (420.67), Ciprofloxacin 750mg (418.65) and other lowest percentage price variations was seen with Sparfloxacin 200mg (60.83), Balofloxacin 100mg (67.66), and Ciprofloxacin 100mg (80.64) and for other Quinolone antimicrobial drugs (Table-1).

The number of formulations and trades of each Quinolone antimicrobial drugs in the Indian market is shown in our analysis (Table -2).

Table No. 1: Drug costs, cost ratio and percentage price variation of Quinolone antimicrobials available in India

Sr. No.	Drug	Strength	Maximum price(INR)	Minimum price(INR)	Cost ratio	Percentage price variation
1.	Ciprofloxacin	100mg	25.20	13.95	1.80	80.64
		250mg	40.30	12.50	3.22	222.40
		500mg	66.54	14.72	4.52	352.03
		750mg	308.65	59.51	5.18	418.65
		1000mg	128.56	85.06	1.51	51.14
2.	Gemifloxacin	320mg	580	178	3.25	225.84
3.	Levofloxacin	250mg	75.00	40.00	1.87	87.50
		500mg	981.08	45.00	21.80	2080.17
		750mg	134.42	57.00	2.35	135.82
4.	Lomefloxacin	400mg	185.00	97.50	1.89	89.74
5.	Moxifloxacin	400mg	800.00	71.00	11.26	1026.76
6.	Norfloxacin	200mg	38.42	13.60	2.82	182.50
		400mg	68.00	13.06	5.20	420.67
7.	Ofloxacin	100mg	42.00	20.00	2.10	110
		200mg	66.55	26.13	2.54	154.68
		400mg	594.28	20.62	28.82	2782.05
8.	Pefloxacin	400mg	49.50	24.06	2.05	105.73
9.	Sparfloxacin	100mg	60.30	28.70	2.10	110.10
		200mg	96.50	60.00	1.60	60.83
10.	Balofloxacin	100mg	140.00	83.50	1.67	67.66

Table No. 2: Number of formulations and trades of Quinolone antimicrobials available in India

Sr. No.	Drug	Number of Formulations	Strength (mg)	Number of Manufacturing Companies
1.	Ciprofloxacin	3	100mg	4
			250mg	25
			500mg	32
			750mg	4
			1000mg	2
2.	Gemifloxacin	2	320	11
			325	2
3.	Levofloxacin	3	250mg	27
			500mg	47
			750mg	22
4.	Lomefloxacin	1	400	3
5.	Moxifloxacin	3	400	12
6.	Nalidixic acid	2	500	1
7.	Norfloxacin	2	100	1
			200	3
			400	6
8	Ofloxacin	5	100	11
			200	46
			400	26
			600	1
			800	1
9.	Pefloxacin	2	400	2
10	Sparfloxacin	1	100	4
			200	18
11.	Balofloxacin	1	100	2

DISCUSSION

According to this study, we have identified the difference in the cost of various brands of the same Quinolone antimicrobial drugs in the Indian pharmaceutical market. This variation in the prices of the drug can become a major factor for noncompliance, where compliance is a major factor in treating bacterial infections. This wide variation in the prices of drugs also places an economic burden on the patient with a poor socioeconomic background.

Drug Price Control Order (DPCO) is an order issued by the government of India to fix the prices of drugs and one cannot sell the drug at a higher price than the rate fixed by the

government. Therefore it is beneficial and profitable to bring all the lifesaving drugs and other combinations of drugs under the Drug Price Control Order (DPCO)^[11].

National Pharmaceutical Pricing Authority (NPPA) is a government regulatory agency that fixes the maximum ceiling prices of pharmaceutical drugs in India. The medicines entering the price control via DPCO is governed by the National List of Essential Medicines (NLEM)^[12].

In a developing country like India, the regulatory authorities should exercise their powers in controlling the price of branded drugs especially in the case of life-saving antibacterial drugs. The prescribers should also be known about the differential pricing of the drugs and indulging information regarding the price variation aspects among prescribers can make a favorable outcome in a developing country like India for attaining optimum healthcare and economic benefits.

CONCLUSION

There is a huge variation in the prices of various brands of Quinolone antimicrobials available in India and this increased cost of drugs places an unfair economic burden on the patient and can also lead to noncompliance. The prescriber should also take the patient's economic status into concern in planning the pharmacotherapy and readily available price variation analysis reports of various classes of drugs in the clinical settings become the need of the hour.

Clinical pharmacists are in the position to make appropriate suggestions and interventions in reducing the healthcare costs of the patients and can also guide the prescribers in prescribing the cost-effective choices of drugs in treating the condition when clinically relevant, thereby enhancing the quality of patient care.

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	<p><i>Sanoop.J</i> <i>Pharm.D</i> <i>Department of Pharmacy Practice, Karpagam College of Pharmacy, Coimbatore, Tamil Nadu, India-641032</i></p>
	<p><i>Sara Yeldhos</i> <i>Pharm.D</i> <i>Department of Pharmacy Practice, Karpagam College of Pharmacy, Coimbatore, Tamil Nadu, India-641032</i></p>
	<p><i>Priyanka.S</i> <i>Pharm.D</i> <i>Department of Pharmacy Practice, Karpagam College of Pharmacy, Coimbatore, Tamil Nadu, India-641032</i></p>

