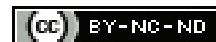


The Indian Battle of Selecting a Brand versus Generic Medicine Continues: A Cost Variation Study of Oral Fluoroquinolones

PALLAVI DHANVIJAY¹, SHRIKANT MANWATKAR², SANTOSH KUMAR³, ANIL KOPARKAR⁴, ARVIND KUMAR⁵, SURJEET DWIVEDI⁶, RAHUL MERKHED⁷, TEJBIR SINGH⁸



ABSTRACT

Introduction: According to the World Health Organisation (WHO), the rational use of medicine occurs when the medication received by the patient is appropriate to the clinical need, at the proper dose, for the appropriate duration and at the lowest cost that the patient can afford. Fluoroquinolones are widely prescribed medications in India. After being included in the Drug Price Control Order (DPCO) list and having ceiling prices set for a few fluoroquinolones, there is a need to assess the pricing of fluoroquinolones in the market.

Aim: To evaluate the cost variation of different brands and generic medicines of oral fluoroquinolones and their combinations in India.

Materials and Methods: A cross-sectional descriptive analytical study was carried out in December 2022 and August 2024 as a follow-up to observe improvements in the situation. Authors from different locations in India (Command Hospital, Air Force, Bangalore; AIIMS Gorakhpur; and INHS Ashvini) collaborated to utilise commercial drug directories for the study. The costs of

specific oral fluoroquinolones were obtained from the “Current Index of Medical Specialties (CIMS) April-July 2022 and Drug Today April-July 2022,” as well as the latest CIMS April-July 2024 and Indian Drug Review May-June 2024, which are all authentic commercial drug directories. To compare the prices of branded drugs with the corresponding generics, the prices of the generic formulations available in Jan Aushadhi Kendra (JAK) were used.

Results: In 2022, Norfloxacin (400 mg) and Tinidazole (600 mg) had the highest percentage variation (3,233.33%), followed by Ofloxacin (200 mg) and Ornidazole (500 mg) with 2,364.28%. In 2024, the percentage cost variation was highest for Ofloxacin (200 mg) and Ornidazole (500 mg), with 1,029.73%, followed by Norfloxacin (400 mg) and Tinidazole (600 mg). In 2022, 16 out of 25 formulations showed more than 100% variation.

Conclusion: A wide cost variation in the formulations of oral fluoroquinolones was noted. There is a need to sensitise all stakeholders to this cost variation in order to achieve the goal of safe, affordable and effective medications for all.

Keywords: Affordable, Drug, Medication, Pharmacoeconomics, Rational

INTRODUCTION

The WHO defines the rational use of medicine as the provision of medication that aligns with the patient’s clinical needs, administered at the correct dosage, for the appropriate period and at the lowest cost affordable to the patient [1,2]. Hence, cost consideration by the prescriber is an important criterion, along with other criteria of rational prescription, while achieving an affordable therapeutic cure. India is known as the “pharmacy of the world” [3]. The Indian pharmaceutical industry encompasses around 3,000 drug companies and more than 10,500 manufacturing units [4]. There are over 60,000 generic brands across 60 therapeutic categories available [5]. Indians consume Rs. 56,000 crore in medicines through private pharmacists [6]. The second leading cause of rural debt in India is healthcare, after dowry [7,8]. Although not universal, the Medical Council of India (MCI) recommends that doctors write generic prescriptions [9]. The prescribing doctor expects a certain treatment outcome. The doctor must protect the patient by prescribing an affordable, good-quality generic or brand that matches their needs [10]. Otherwise, therapy may fail. Failure to comply due to the cost of an unaffordable brand could result in antibiotic resistance or failure to treat infectious diseases [11].

Fluoroquinolones are among the most valuable and widely used antibiotics. About 30% of the global pharmaceutical market consists of fluoroquinolones. Levofloxacin and ciprofloxacin account for 65% (\$3.3 billion) of fluoroquinolone sales [12]. The National Pharmaceutical Pricing Authority (NPPA) of India has imposed a ceiling on drug costs via the DPCO to regulate soaring drug prices. Pharmaceutical companies can only price drugs below the

ceiling set. The 2024 DPCO list includes levofloxacin, ciprofloxacin, moxifloxacin and ofloxacin. JAK is an Indian government program that provides affordable generic medications, helping to make healthcare more affordable in India [13].

In India, cost variation studies are scarce [14-16]. Few research studies have investigated fluoroquinolone cost variation in the past [17-20], highlighting the issue of high variation. After the inclusion of certain fluoroquinolones in the DPCO list [13] and the setting of ceiling prices, an assessment of the situation is necessary as it will provide insight into current conditions. In this first-of-its-kind study, a situation analysis is being conducted in 2022 and will be compared to data from 2024. Additionally, none of the studies have compared cost variation with the prices set by the NPPA list in India. Hence, a study was planned to evaluate the cost variation in oral fluoroquinolone brands and generics available in India, either as a single drug or in combination. This study aimed to evaluate the difference in the cost of various brands of specific fluoroquinolones with respect to cost ratio and percentage variation in costs between the years 2022 and 2024. The secondary objectives were to determine if generic drugs were cheaper than brand-name drugs and to compare price differences with the maximum prices set by the DPCO for the medicines on the list for 2022 and 2024.

MATERIALS AND METHODS

A cross-sectional descriptive analytical study was carried out between December 2022 and August 2024 to provide a perspective on the latest information across the two-year study period. Authors from different locations in India collaborated to use commercial

drug directories for the study. The research was conducted at Command Hospital (Air Force) in Bengaluru, Karnataka, India. Ethical committee clearance was obtained (IEC Certificate No: CHAFB/IEC/77/2024) for the study.

Data collection: The costs of oral fluoroquinolones, both as single medications and in combinations, of the same strength and dosage form manufactured by different companies were obtained from the CIMS for April to July 2022 [21] and "Drug Today" for April to July 2022, along with the latest CIMS for April to July 2024 and "Indian Drug Review" for May and June 2024. All of these are authentic commercial drug directories [22-24]. The Bureau of Pharma PSUs of India (BPPI) websites were reviewed for generic drug pricing to compare branded and generic prices [25]. This study utilises JAK for generic medication costs. The ceiling costs of fluoroquinolone tablets were taken from the NPPA list for April 2022 and May 2024 and compared to the maximum prices after extrapolating for 10 tablets [26,27]. The difference between the maximum and minimum prices of drug formulations manufactured by different pharmaceutical companies was calculated, along with the cost ratio and percentage of cost variation [17].

$$\text{Cost ratio} = \frac{\text{Maximum cost}}{\text{Minimum cost}}$$

Percentage of cost variation was calculated as follows:

$$\% \text{ Cost variation} = \frac{\text{Maximum cost} - \text{Minimum cost} \times 100}{\text{Minimum cost}}$$

STATISTICAL ANALYSIS

A simple descriptive analysis was performed on all the data collected, which was entered into Microsoft 365 (Version 2407) Excel spreadsheets.

RESULTS

[Table/Fig-1] illustrates the cost variation of oral fluoroquinolones in INR (Indian Rupees), cost ratio and percentage variation in cost from 2022 to 2024. Of the 25 drug formulations, levofloxacin 500 mg exhibited the greatest variance, at 11,048.64% in 2022 and 2,080.18% in 2024, with the cost for 10 tablets being Rs. 8.80 (2022) and Rs. 45.00 (2024) and Rs. 981.08, respectively. From 2022 to 2024, this broad fluctuation improved dramatically (11,048.64% vs. 2,080.18%). Although the variation is still considerable, it indicates a false positive change towards the improvement of variation. The minimum cost for levofloxacin has increased from Rs. 8.80 to Rs. 45.00, while the maximum price has remained the same. Hence, despite the percentage variation decreasing from 11,048.64% to 2,080.18%, this does not represent a true improvement. Only 4 of the 25 formulations had less than 25% cost variance in 2022 and none of the formulations in 2024 had a variance of less than 25%. The cost ratio and percentage variation are improving; however, the overall scenario remains comparable.

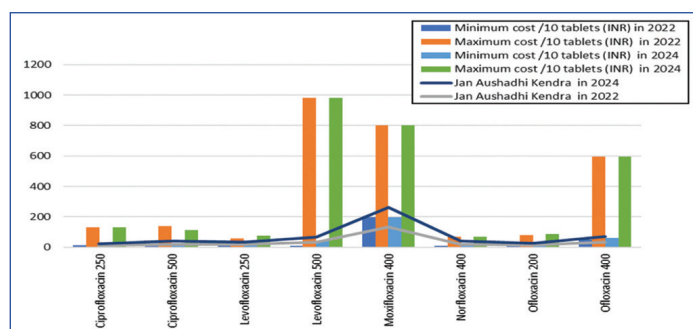
[Table/Fig-2,3] compares JAK generic prices to the minimum and maximum costs for 10 tablets of each formulation. In 2022, five JAK (generic) formulations cost less than their branded counterparts, one was equally priced and two were more expensive. In 2024, JAK generics of six formulations cost less than the branded versions, while two branded formulations were cheaper than their generic counterparts. This shows that generics were cheaper than the minimum branded prices for ciprofloxacin 250 mg, levofloxacin 250 mg, moxifloxacin 400 mg, ofloxacin 200 mg and ofloxacin 400 mg in both 2022 and 2024. However, in 2022, the price of ciprofloxacin 500 mg was equal to the minimum branded price and in 2024, the generic was not cheaper than the minimum branded price. For levofloxacin 500 mg, the generic was not cheaper than

S. No.	Drug and dose (mg)	In the year 2022				In the year 2024				
		Minimum cost/10 tablets (INR) 2022	Maximum cost/10 tablets (INR) 2022	Cost ratio 2022	% Variation in cost 2022	Minimum cost/10 tablets (INR) 2024	Maximum cost/10 tablets (INR) 2024	Cost ratio 2024	% Variation in cost 2024	Change in % variation
1	Balofloxacin 100	83	140	1.69	68.67	83.5	140	1.68	67.66	-1.01
2	Ciprofloxacin 100	12.52	25.2	2.01	101.28	12.75	25.2	1.98	97.65	-3.63
	Ciprofloxacin 250	12.5	131.05	10.48	948.40	12.5	131.05	10.48	948.40	0.00
	Ciprofloxacin 500	20	137.5	6.88	587.50	16.87	112.28	6.66	565.56	-21.94
	Ciprofloxacin 750	59.51	308.65	5.19	418.65	55	142.94	2.60	159.89	-258.76
	Ciprofloxacin 1000	120	120	1.00	0.00	85.06	186	2.19	118.67	118.67
3	Gemifloxacin 320	100	718	7.18	618.00	100	580	5.80	480.00	-138.00
4	Levofloxacin 250	23	59	2.57	156.52	37.5	75	2.00	100.00	-56.52
	Levofloxacin 500	8.8	981.08	111.49	11048.64	45	981.08	21.80	2080.18	-8968.46
	Levofloxacin 750	11	132.5	12.05	1104.55	76	135	1.78	77.63	-1026.91
5	Lomefloxacin 400	90	185	2.06	105.56	106	185	1.75	74.53	-31.03
6	Moxifloxacin 400	196.9	800	4.06	306.30	196.9	800	4.06	306.30	0.00
7	Norfloxacin 100	13.5	17	1.26	25.93	13.25	18.8	1.42	41.89	15.96
	Norfloxacin 200	23.4	39	1.67	66.67	5.57	44.72	8.03	702.87	636.21
	Norfloxacin 400	10.71	68	6.35	534.92	10.4	68	6.54	553.85	18.93
	Norfloxacin 800	41.06	97.5	2.37	137.46	NA	NA	NA	NA	-
8	Ofloxacin 100	20	50.6	2.53	153.00	20	61.05	3.05	205.25	52.25
	Ofloxacin 200	24.95	80.52	3.23	222.73	30	88.5	2.95	195.00	-27.73
	Ofloxacin 400	48.95	594.28	12.14	1114.06	62.4	594.28	9.52	852.37	-261.68
9	Pefloxacin 400	24.06	49.5	2.06	105.74	24.06	49.5	2.06	105.74	0.00
10	Prulifloxacin 600	240	792.7	3.30	230.29	NA	NA	NA	NA	-
11	Sprafloxacin 100	28.76	60.3	2.10	109.67	28.76	82.47	2.87	186.75	77.09
	Sprafloxacin 200	48.1	250	5.20	419.75	30.85	150	4.86	386.22	-33.53
	Sprafloxacin 300	150	150	1.00	0.00	NA	NA	NA	NA	-
	Sprafloxacin 400	150	173.4	1.16	15.60	153.86	153.86	1.00	0.00	-15.60

[Table/Fig-1]: Variation of cost of single drug therapy of fluoroquinolones in 2022 and 2024.

S. No.	Drug and dose (mg)	In the year 2022				In the year 2024			
		Minimum cost/10 tablets (INR)	Maximum cost/10 tablets (INR)	Jan Aushadhi Kendra (JAK)	Generic cheaper than branded	Minimum cost/10 tablets (INR)	Maximum cost/10 tablets (INR)	Jan Aushadhi Kendra (JAK)	Generic cheaper than branded
1	Ciprofloxacin 250	12.5	131.05	11	Yes	12.50	131.05	11	Yes
2	Ciprofloxacin 500	20	137.5	20	Equal	16.87	112.28	20	No
3	Levofloxacin 250	23	59	18	Yes	37.50	75.00	18	Yes
4	Levofloxacin 500	8.8	981.08	33	No	45.00	981.08	33	Yes
5	Moxifloxacin 400	196.9	800	132	Yes	196.90	800.00	132	Yes
6	Norfloxacin 400	10.71	68	21	No	10.40	68.00	21	No
7	Ofloxacin 200	24.95	80.52	14	Yes	30.00	88.50	14	Yes
8	Ofloxacin 400	48.95	594.28	35	Yes	62.40	594.28	35	Yes

[Table/Fig-2]: Cost variation of single drug between brand (Minimum and Maximum) vs generics.



[Table/Fig-3]: Cost variation of fluoroquinolone Brands (min vs max) vs generic in single drug.

the branded version in 2022, but it was cheaper in 2024, whereas for norfloxacin 400 mg, the situation was reversed.

[Table/Fig-4] displays the minimum and maximum costs per 10 tablets in INR, cost ratio and percentage cost variation of oral fluoroquinolone combinations in various formulations. Twenty-five formulations were noted. In 2022, norfloxacin 400 mg and tinidazole 600 mg had the highest percentage variation (3,233.33%), followed by ofloxacin 200 mg and ornidazole 500 mg with 2,364.29%. In 2024, the highest percentage cost variation was observed for ofloxacin 200 mg and ornidazole 500 mg, at 1,029.73%, followed by norfloxacin 400 mg and tinidazole 600 mg. In 2022, 16 of the 25 formulations showed more than 100% variation. The percentage difference is improving and there are numerous combinations that are currently unavailable.

S. No.	Drug combination dose (mg)	In the year 2022				In the year 2024				% decrease in variation
		Minimum cost/10 tablets (INR)	Maximum cost/10 tablets (INR)	Cost ratio	% Variation in cost	Minimum cost/10 tablets (INR)	Maximum cost/10 tablets (INR)	Cost ratio	% Variation in cost	
1	Ciprofloxacin+Ornidazole 500+500	92.40	105.80	1.15	14.50	105.80	105.80	1.00	0.00	100.00 ↓
2	Ciprofloxacin+Tinidazole 250+300	35.82	72.50	2.02	102.40*	31.08	79.67	2.56	156.34*	-52.68 ↑
3	Ciprofloxacin+Tinidazole 500+600	22.80	155.96	6.84	584.04*	25.00	155.96	6.24	523.84*	10.31 ↓
4	Norfloxacin+Tinidazole 400+600	3.15	105.00	33.33	3233.33*	15.30	105.00	6.86	586.27*	81.87 ↓
5	Norfloxacin+Ornidazole 400+500	50.00	50.00	1.00	0.00	NA	NA	NA	NA	NA
6	Norfloxacin+Nitazoxanide 400+500	99.00	99.00	1.00	0.00	NA	NA	NA	NA	NA
7	Norfloxacin+Tinidazole+Probiotic 400+600+Varies	97.71	97.71	1.00	0.00	60.00	97.71	1.63	62.85	-
8	Norfloxacin+Metronidazole+Probiotic 400+500+Varies	67.00	67.00	1.00	0.00	NA	NA	NA	NA	NA
9	Ofloxacin+Probiotics 200+Varies	42.00	60.00	1.43	42.86	NA	NA	NA	NA	NA
10	Ofloxacin+Probiotics 400+Varies	80.00	80.00	1.00	0.00	NA	NA	NA	NA	NA
11	Ofloxacin+Tinidazole 100+300	50.00	167.00	3.34	234.00*	NA	NA	NA	NA	NA
12	Ofloxacin+Tinidazole 200+600	39.00	143.00	3.67	266.67*	48.00	143.00	2.98	197.92*	25.78 ↓
13	Ofloxacin+Tinidazole 200+300	58.07	162.50	2.80	179.83*	162.50	162.50	1.00	0.00	100.00 ↓
14	Ofloxacin+Tinidazole 200+500	69.68	69.68	1.00	0.00	NA	NA	NA	NA	NA
15	Ofloxacin+Tinidazole 300+600	62.50	62.50	1.00	0.00	NA	NA	NA	NA	NA

[Table/Fig-5] compares JAK generics to the minimum and maximum costs of 10 pills for branded formulations of oral fluoroquinolone combinations. In both 2022 and 2024, only one generic formulation was priced lower than the minimum cost of the branded formulations. One generic formulation, namely moxifloxacin 400 mg and cefixime 400 mg, was exclusively available through JAK and was not listed in drug formularies; hence, it could not be compared.

[Table/Fig-6] compares oral fluoroquinolone formulations on the NPPA list for April 2022 and May 2024, detailing the maximum cost per 10 pills and ceilings in rupees. The cost of all formulations, except for moxifloxacin 400 mg and cefixime 400 mg, listed by the NPPA in April 2022 exceeded the ceiling pricing, as they were not included in the drug formularies in 2024.

[Table/Fig-7] illustrates the comparison of cost variation for oral fluoroquinolones included in the NPPA list for April 2022 and May 2024, along with their ceiling prices, in a visual manner.

DISCUSSION

In India, different pharmaceutical companies, including the manufacturers, sell the same drug under various brand names. This results in a single formulation being available under different brand names and at different prices. Few studies have examined the cost variance of medication formulations available in the market. The significant cost variance of medications has puzzled prescribing clinicians, who presume that cheaper formulations may lack pharmacological efficacy [28] and may fail to treat disorders [29]. Therapy failure can lead to patient distrust of the clinician and to health

16	Ofloxacin+Tinidazole 400+600	97.45	97.45	1.00	0.00	97.45	97.45	1.00	0.00	NA
17	Ofloxacin+Ornidazole 200+500	7.00	172.50	24.64	2364.29*	18.50	209.00	11.30	1029.73*	56.45 ↓
18	Ofloxacin+Ornidazole 100+250	53.00	53.00	1.00	0.00	NA	NA	NA	NA	NA
19	Ofloxacin+Ornidazole+Probiotics 200+500	72.64	1180.00	16.24	1524.45*	108.00	119.90	1.11	11.02	99.28 ↓
20	Ofloxacin+Nitazoxanide 200+500	89.00	117.70	1.32	32.25	89.00	117.70	1.32	32.25	0.00
21	Levofloxacin+Ornidazole 250+500	65.00	107.88	1.66	65.97	72.18	113.00	1.57	56.55	14.28 ↓
22	Levofloxacin+Ornidazole 500+500	89.50	89.50	1.00	0.00	80.00	89.50	1.12	11.88	NA
23	Levofloxacin+Azithromycin 250+250	128.70	176.00	1.37	36.75	128.70	199.00	1.55	54.62	-48.63 0
24	Levofloxacin+Azithromycin 500+500	228.50	290.40	1.27	27.09	228.50	290.40	1.27	27.09	0.00
25	Norfloxacin+Probiotics 500+Varies	89.00	89.00	1.00	0.00	17.80	70.97	3.99	298.71*	NA

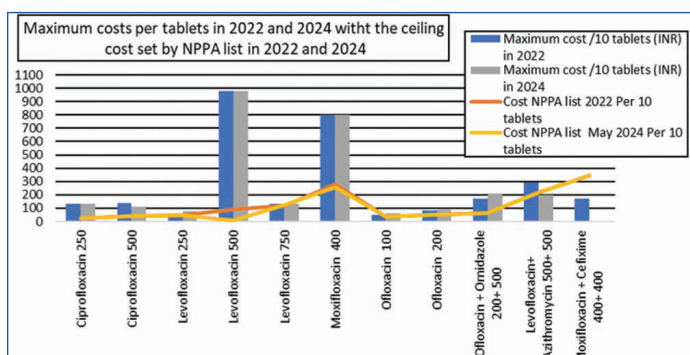
[Table/Fig-4]: Variation of cost of combinations drugs of Fluoroquinolones in 2022 and 2024.

S. No.	Drug combination	Dose (mg)	In the year 2022				In the year 2024			
			Minimum cost/10 tablets (INR)	Maximum cost/10 tablets (INR)	Generic drug (Jan Aushadhi Kendra) (JAK)	Generic cheaper than branded	Minimum cost/10 tablets (INR)	Maximum cost/10 tablets (INR)	Generic drug (Jan Aushadhi Kendra) (JAK)	Generic cheaper than branded
1.	Ciprofloxacin+Tinidazole	250+300	35.82	72.50	28.00	Yes	31.08	79.67	28	Yes
2.	Ciprofloxacin+Tinidazole	500+600	22.8	155.96	39.00	No	25.00	155.96	39	No
3.	Ofloxacin+Ornidazole	200+500	7.00	172.5	27.50	No	18.50	209.00	27.50	No
4.	Norfloxacin+Tinidazole	400+600	3.15	105.00	40.00	No	15.30	105.00	40	No
5.	Moxifloxacin+Cefixime	400+400	NA	NA	170.00	NA	NA	NA	170	NA

[Table/Fig-5]: Comparison of Fluoroquinolone drug combinations available at Jan Aushadhi Kendra (JAK) with minimum and maximum costs per 10 tablets.

S. No.	Drug	Dose (mg)	In the year 2022				In the year 2024			
			Maximum cost/10 tablets (INR)	NPPA list April 2022 per tablet	Cost NPPA list 2022 per 10 tablets	Max cost more than NPPA ceiling cost	Maximum cost/10 tablets (INR)	Cost NPPA list May 2024 per tablets	NPPA list May 2024 per 10 tablets	Max cost more than NPPA ceiling cost
1.	Ciprofloxacin	250	131.05	2.30	23.0	Yes	131.05	2.2	22	Yes
		500	137.50	4.05	40.5	Yes	112.28	4.25	42.5	Yes
2.	Levofloxacin	250	59.00	4.90	49.0	Yes	75.00	4.82	48.2	Yes
		500	981.08	8.95	89.5	Yes	981.08	8.99	8.99	Yes
		750	132.50	12.14	121.4	Yes	135.00	12.45	124.5	Yes
3.	Moxifloxacin	400	800	28.13	281.3	Yes	800.00	25.82	258.2	Yes
4.	Ofloxacin	100	50.6	3.55	35.5	Yes	61.05	3.55	35.5	Yes
		200	80.52	5.26	52.6	Yes	88.50	5.26	52.6	Yes
5.	Ofloxacin+Ornidazole	200+500	172.5	6.6	66.0	Yes	209	6.6	66.0	Yes
6.	Levofloxacin+Azithromycin	500+500	290.4	21.77	217.7	Yes	199	21.77	217.7	Yes
7.	Moxifloxacin+Cefixime	400+400	170.00	34.46	344.6	No	NA	34.46	344.6	NA

[Table/Fig-6]: Comparison of maximum of costs of oral fluoroquinolones in 2022 and 2024 with ceiling prices issued by NPPA list April 2022 and May 2024.



[Table/Fig-7]: Comparison of cost variation of oral Fluoroquinolones included in NPPA list April 2022 and May 2024 with its ceiling prices.

consequences that could have been prevented if the medication were not counterfeit. In 2021, many pharmaceuticals failed to meet FDA quality standards, resulting in the cancellation of licenses for 46 Indian pharmaceutical companies [30]. Patients may lose wages and incur out-of-pocket costs if they opt for a more expensive brand. High drug costs can lead to non-compliance, therapeutic failure and antibiotic resistance, especially in the case of fluoroquinolones.

According to Article 21 of India's Constitution, every individual has the right to health care [31]. The Indian government has consistently provided this right. The DPCO governs drug prices in India. The government issues the DPCO under Section 3 of the Essential Commodities Act, 1955, to set and regulate the prices of essential bulk drugs and their formulations. The NPPA regulates the prices of medicines in India [13]. It periodically adjusts the prices of controlled bulk medications and formulations. The NPPA also recovers overcharges and regulates the pricing of decontrolled medicines.

The recent NPPA list allows pharmaceutical companies to set prices below the ceiling [4]. As a result, these medicines should be sold at lower prices. The latest NPPA list was issued in May 2024 and on April 22, prior to present study analysis. Present study investigation indicated that all formulations with NPPA list ceiling prices from April 2022 had prices that exceeded the CIMS and IDR ceiling prices from April to July 2022. A similar situation was observed in 2024.

Despite efforts to control drug pricing, certain studies have found considerable cost disparities for various pharmaceuticals of pharmacoeconomic relevance in India. Hetawal P et al., found substantial cost variations for fluoroquinolones in their analysis

conducted in 2021 and 2022 [18]. A similar trend was observed in present study. Six of the seven fluoroquinolones on the NPPA list in April 2022 (10 out of 11 formulations) had prices above the ceiling. This was also true for moxifloxacin 400 mg and cefixime 400 mg, which were exclusively available through JAK, a government initiative. Upon reassessment in 2024, present analysis found no changes in this situation. No studies were found comparing fluoroquinolone cost variation to NPPA list prices.

Present study discovered a notable improvement in price variation from 2022 to 2024; however, the cost variation was still far from achieving the dream of affordability and the expected ceiling prices set by the NPPA. Chawan VS et al., observed a similar issue in 2015 in their research titled "Fluoroquinolones in India: Are We Prescribing It Right? A Cost Variation Study" [17]. Dhanvijay PV and Manwatkar SK obtained similar results in 2020 [19]. This situation is concerning in India, the "pharmacy of the world" and a developing nation. India did an excellent job of distributing COVID-19 vaccinations internationally at a low price, demonstrating that Indians can afford high-quality, non-spurious drugs.

The promotion of generic pharmaceuticals is an effective alternative strategy to lower patient medication costs. Generic medications are claimed to be the same as and bioequivalent to brand-name drugs in terms of dosage, intended use, effects, side-effects, route of administration, risks, safety and strength. However, the efficacy and bioequivalence of generic drugs have been questioned in comparison to branded drugs. In 2008, India launched the Jan Aushadhi Scheme to provide cheaper generic medications to the public. Jan Aushadhi generics are reported to have comparable therapeutic efficacy to branded medications. However, there is a common misconception that generic medications are always inexpensive. Present study observations indicated that not all JAK formulations were the cheapest. Hetawal P et al., and Atal S et al., found similar results [18,32].

Prescribers' skepticism regarding the efficacy of generic drugs must be addressed [33,34]. Regular quality assurance studies can determine the exact drug content in the claimed product and formulation drug content analyses are essential to rule out counterfeit pharmaceuticals. This approach will help make safe, inexpensive and effective pharmaceuticals accessible to everyone.

Incorporating pharmacoeconomics as a practical lesson in undergraduate and postgraduate medical curricula, where students compute the cost of their prescriptions, may assist them in understanding its implications and fostering the necessary mindset. Information about bioequivalence should be included in CIMS and IDR books, along with cost data. Increasing public awareness of this significant price range will help healthcare providers, payers, government agencies, policymakers and pharmacists to collaborate and take action.

Limitation(s)

This analysis utilised ready reckoner drug formulary pricing. Since these are Maximum Retail Prices (MRPs) and do not include pharmacy discounts or exemptions, the actual market rates at which these pharmaceuticals are supplied to consumers remain unknown. Additionally, the materials may lack certain drug brands.

CONCLUSION(S)

There is a wide cost variation in the formulations of oral fluoroquinolones in India in the years 2022 and 2024. The costs of all the formulations of oral fluoroquinolones listed in the NPPA list of April 2022 and the NPPA list of May 2024 were not within the set ceiling prices. Although improvements have been observed, we are still far from the goal of affordable medication for all, as outlined by the ceiling prices set by the NPPA. There is a need to sensitise all stakeholders to achieve the vision of safe, affordable and effective

medications for everyone. Future studies should be conducted at regular intervals to assess the situation and any improvements in the cost variation of this essential medicine, fluoroquinolone, to ensure that healthcare is accessible and affordable to those in need.

REFERENCES

- [1] World Health Organization: Promoting rational use of medicines [Internet]. [cited 2024 Apr 22]. Available from: <https://www.who.int/activities/promoting-rational-use-of-medicines>.
- [2] Mohanta GP, Manna PK. Rational use of medicines- Indian perspective! *Int J Risk Saf Med.* 2015;27(Suppl 1):S47-48. Doi: 10.3233/JRS-150684.
- [3] Financial express: Why is India the Pharmacy of the World? [Internet]. 2021. [cited 2022 Dec 05]. Available from: <https://www.financialexpress.com/lifestyle/health/why-is-india-the-pharmacy-of-the-world/2337554/>.
- [4] Pharmaceutical Companies in India, Indian Pharma Industry- IBEF. India Brand Equity Foundation. [Internet]. [cited 2022 Dec 05]. Available from: <https://www.ibef.org/industry/pharmaceutical-india>.
- [5] Research and Information System for Developing Countries RIS. T C J. Bulk Drug Industry in India: Challenges and Prospects [Internet]. [cited 2022 Dec 05]. Available from: <https://www.ris.org.in/en/bulk-drug-industry-india-challenges-and-prospects>.
- [6] The Hindu GA. A historic move to make drugs affordable. [Internet]. 2012. [cited 2022 Dec 05]. Available from: <https://www.thehindu.com/opinion/op-ed/a-historic-move-to-make-drugs-affordable/article2991869.ece>.
- [7] Umamaheswari A, Prabu SL, Puratchikody A. Drug affordability in India-An analytical review. *MOJ Bioequiv Availab.* 2017;3(6):153-57. Doi: 10.15406/mojbb.2017.03.00053.
- [8] Meena DK, Jayanthi M. Cost analysis of different antibiotic brands available in indian market with reference to national list of essential medicines. *Indian J Community Med.* 2021;46(1):93-96. Doi: 10.4103/ijcm.IJCM_296_20.
- [9] Roy V, Rana P. Prescribing generics: All in a name. *Indian J Med Res.* 2018;147(5):442-44. Doi: 10.4103/ijmr.IJMR_1940_17.
- [10] Charan J, Saxena D, Chaudhri M, Dutta S, Kaur RJ, Bhardwaj P. Opinion of primary care physicians regarding prescription of generic drugs: A cross-sectional study. *J Fam Med Prim Care.* 2021;10(3):1390-98. Doi: 10.4103/jfmpc.jfmpc_2157_20.
- [11] Poudel AN, Zhu S, Cooper N, Little P, Tarrant C, Hickman M, et al. The economic burden of antibiotic resistance: A systematic review and meta-analysis. *PLoS One.* 2023;18(5):e0285170. Doi: 10.1371/journal.pone.0285170. PMID: 37155660; PMCID: PMC10166566.
- [12] Majalekar PP, Shirote PJ. Fluoroquinolones: Blessings or curses. *Curr Drug Targets.* 2020;21(13):1354-70. Doi: 10.2174/1389450121666200621193355.
- [13] Narula S. Current drug pricing status in India. *Pharmacoeconomics.* 2015;1(1):e101. Doi: 10.4172/2472-1042.1000E101.
- [14] Advani M, Seetharaman R, Pawar M, Naik B. A cost-variation analysis of drugs available in the Indian market for the management of diabetic nephropathy. *Cureus.* 2022;14(10):e29942. Doi: 10.7759/cureus.29942.
- [15] Mukthambika B, Hiray RS, Gadhade J, Mailagire R. Cost variation study of various brands of drugs used in COVID-19 patients in India: A pharmacoeconomic study. *Int J Pharmacol Res.* 2021;11(6):e5615. Doi: 10.7439/ijpr.v11i6.5615. Available from: <https://doi.org/10.7439/ijpr.v11i6.5615>.
- [16] Kolasani BP, Malathi DC, Ponnaluri RR. Variation of cost among anti-cancer drugs available in Indian market. *J Clin Diagn Res.* 2016;10(11):FC17-20. Doi: 10.7860/JCDR/2016/22384.8918.
- [17] Chawan VS, Gawand KV, Badwane SV. Fluoroquinolones in India- Are we prescribing it right: A cost variation study. *Natl J Physiol Pharm Pharmacol.* 2015;5(4):306-08. Doi: 10.5455/njppp.2015.5.1604201547.
- [18] Hetawal P, More S, Gupta K, Mishra PS. Cost variation study of various brands of oral fluoroquinolones available in India: An economic perspective. *Pharmacol Clin Phar Res.* 2022;7(2):47-58. Doi: 10.15416/pcpr.v4i3.37669. Available from: <https://doi.org/10.15416/pcpr.v4i3.37669>.
- [19] Dhanvijay PV, Manwatkar SK. Cost variation analysis study of Fluoroquinolones in India: Dilemma of the prescribing doctors "which brand to choose?" *Saudi J Med Pharm Sci.* 2020;6(1):102-09. Doi: 10.36348/sjmps.2020.v06i01.015.
- [20] Sinha DP, Sinha B, Kumar S, Chandra A. Study of price variation analysis of fluoroquinolones eye drops manufactured by various pharmaceutical companies in India. *Int J Basic Clin Pharmacol.* 2021;10(5):561-63. Available from: <https://doi.org/10.18203/2319-2003.ijbcp20211653>.
- [21] CIMS (Current Index of Medical Specialties). India. CIMS Medical India Pvt., Ltd., April - July 2022.
- [22] Drug Today India April- July 2022- Ready reckoner of current medical formulations. 2022. Drug Today India. 2022;2.
- [23] CIMS (Current Index of Medical Specialties). India. CIMS Medical India Pvt., Ltd., April to July 2024.
- [24] CIMS IDR Drug Triple I Compendium. India. CIMS publisher edition 2024;3.
- [25] Pharmaceuticals & Medical Devices Bureau of India (PMBI). [Internet]. [cited 2024 Aug 04]. Available from: <https://janaushadhi.gov.in/ProductList.aspx>.
- [26] Drug Control Department, Government of Kerala [Internet]. [cited 2022 Jun 22]. Available from: <https://dc.kerala.gov.in/en/drugs-under-price-control/>.
- [27] Drug Control Department, Government of Kerala [Internet]. [cited 2024 Jul 25]. Available from: <https://dc.kerala.gov.in/en/drugs-under-price-control/>.
- [28] Tandel KR, Patel NM, Zaiwala SM, Chavda NB, Dhanani JV. A study of knowledge, attitude, and practice on generic drugs among teaching faculties at a tertiary care teaching hospital in South Gujarat, India. *Natl J Physiol Pharm Pharmacol.* 2018;8(6):810-10. Doi: 10.5455/njppp.2018.8.0101713012018.

- [29] Prasad M, Chakraborty A, Deep N. Knowledge, attitude, and practice of generic drugs among doctors in a tertiary care hospital. *Innovare J Med Sci.* 2019;1;01-03. Available from: <https://doi.org/10.22159/ijms.2019.v7i4.34408>.
- [30] ETHealthworld. The need for better quality/compliance in Indian pharmaceuticals. [Internet]. 2022. [cited 2022 Dec 05]. Available from: <https://health.economicstimes.indiatimes.com/news/pharma/the-need-for-better-quality/compliance-in-indian-pharmaceuticals/94839674>.
- [31] Academike Article 21 of the Constitution of India: Understanding Right to Life and Personal Liberty from Case Laws- Academike Explainer. [Internet]. 2021. [cited 2022 Dec 05]. Available from: <https://www.lawctopus.com/academike/article-21-of-the-constitution-of-india-right-to-life-and-personal-liberty/>.
- [32] Atal S, Mathur A, Balakrishnan S. Cost of treating bacterial infections in india: A cost minimization analysis to assess price variations. *Biomed Pharmacol J.* 2020;13(2):765-78. Available from: <https://dx.doi.org/10.13005/bpj/1941>.
- [33] Čatić T, Avdagić L, Martinović I. Knowledge and attitudes of physicians and pharmacists towards the use of generic medicines in Bosnia and Herzegovina. *Med Glas Off Publ Med Assoc Zenica-Doboj Cant Bosnia Herzeg.* 2017;14(1):25-32. Doi: 10.17392/867-16.
- [34] Gupta SK, Nayak RP, Shivanranjani R, Vidyarthi SK. A questionnaire study on the knowledge, attitude, and the practice of pharmacovigilance among the healthcare professionals in a teaching hospital in South India. *Perspect Clin Res.* 2015;6(1):45-52. Doi: 10.4103/2229-3485.148816.

PARTICULARS OF CONTRIBUTORS:

1. Classified Specialist Pharmacology, Department of Pharmacology, Medical Training Centre, Bengaluru, Karnataka, India.
2. Classified Specialist Surgery, Department of General Surgery, Command Hospital Air Force, Bengaluru, Karnataka, India.
3. Classified Specialist ENT, Department of ENT, INHS ASVINI, Mumbai, Maharashtra State, India.
4. Additional Professor, Department of PSM, All India Institute of Medical Sciences, Gorakhpur, Uttar Pradesh, India.
5. Classified Specialist Surgery, Department of Neurosurgery, Command Hospital Air Force, Bengaluru, Karnataka, India.
6. Classified Specialist Surgery and Oncosurgery, Department of Oncosurgery, Command Hospital Air Force, Bengaluru, Karnataka, India.
7. Classified Specialist Surgery and Vascular Surgery, Department of Vascular Surgery, Command Hospital Air Force, Bengaluru, Karnataka, India.
8. Classified Specialist Surgery, Department of General Surgery, Command Hospital Air Force, Bengaluru, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Shrikant Manwatkar,
P165/4, Golden Jubilee Officers Enclave, Command Hospital Air Force,
Bengaluru-560007, Karnataka, India.
E-mail: shrikantxy@gmail.com

PLAGIARISM CHECKING METHODS: [\[Jain H et al.\]](#)

- Plagiarism X-checker: Sep 16, 2024
- Manual Googling: Dec 14, 2024
- iThenticate Software: Dec 17, 2024 (12%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? NA
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Sep 08, 2024**

Date of Peer Review: **Nov 21, 2024**

Date of Acceptance: **Dec 19, 2024**

Date of Publishing: **Mar 01, 2025**