



ORIGINAL RESEARCH PAPER

Pharmaceutical Science

COST VARIATION ANALYSIS OF ANTIMALARIAL DRUGS : A REVIEW

KEY WORDS: Cost Ratio, Cost Analysis, Pharmacoeconomics, Malaria

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ABSTRACT

Background: Malaria has been a major issue in India for ages. There are numerous antimalarial brands available on the market. Costly medications can place an economic burden on patients, resulting in lower compliance or even noncompliance. Noncompliance leads to insufficient therapy, which increases morbidity. Increases in patient pharmaceutical costs were found to be related to worse adherence to prescribed medicine. As a result, this study was conducted to analyze the cost variation of malaria drug-therapy. **Methods:** Price in Indian rupees (₹) of antimalarial drugs manufactured by different pharmaceutical companies in India, in the same strength and in same dosage form were obtained from Current index of medical specialties (CIMS) January-April 2023. Cost ratio and cost variation percentage were calculated and data was analysed. **Results:** The highest cost ratio and percentage cost variation were observed for Quinine injection 300mg/ml, with a cost ratio of 7 & a percentage cost variation of 599.65%. The lowest cost ratio was found for Mefloquine tablet 250mg injection, with a cost ratio of 1.01 and a percentage cost variation of 1.35%. Overall, the injectable antimalarial medications showed a considerable cost ratio and cost variation **Conclusions:** Ceiling cost of drugs are fixed by national pharmaceutical pricing authority (NPPA) government of India in accordance with DPCO 2023. Despite this there exists a wide variation of drug costs within one drug with the availability of various brands

INTRODUCTION

Malaria has been a problem in India for centuries. Details about this ailment can be found in ancient Indian medical texts such as the Atharva Veda and the Charaka Samhita. Malaria afflicted almost one-quarter of India's population in the late nineteenth and early twentieth century. In the late 1960s malaria cases in urban areas started to multiply. As a result, in 1976, 6.45 million cases were recorded by the national malaria eradication programme (NMEP), highest since resurgence. But due to advancement in the pharmacological agents in recent times and proper implementation of NVBDCP, incidence of malaria in India has declined to significant level. The World Malaria Report (WMR) 2020 released by WHO, which gives the estimated cases for malaria across the world, based on mathematical projections, indicates that India has made considerable progress in reducing its malaria burden.(1) India is the only high endemic country which has reported a decline of 17.6% in 2019 as compared to 2018. In 2022 in India, there were over 45 thousand reported cases of malaria. In 2021 however, the number of cases were higher with over 160 thousand cases.(2) The Government of India has developed a National Framework for Malaria Elimination (2016-2030) and a

National Strategic Plan (NSP, 2017-2022) with the aim to eliminate malaria (zero indigenous cases) in all Category 1 and 2 districts by 2022.(3)

Treatment of malaria aims at completely curing the patient, preventing progression to severe disease, preventing malaria relapse (due to survival of exo-erythrocytic forms in hepatocytes in P.vivax and P.ovale) and recrudescence (due to persistence of erythrocytic forms in P.falciparum), interrupting the transmission of malaria and preventing drug resistance. In all settings, suspected malaria should be confirmed with a parasitological test. The following drugs are used for Malaria - 1. Clinical curative: Artemisinin derivatives, chloroquine, amodiaquine, mefloquine, quinine, lumefantrine, Doxycycline, clindamycin, sulphonamides,

pyrimethamine and primaquine. Given the magnitude of Malaria in our country antimalarial drugs should be supplied at government sectors and at private pharmacies at prices which will not create economic burden on the largely poor population.

There are innumerable brands of antimalarial present in the market. Malaria can be extremely fatal if not treated promptly. Patients from poor socioeconomic background must have access to the correct drug at the nominal price. Costly drugs can lead to economic burden which results in decreased compliance or even non-compliance. Noncompliance leads to incomplete treatment which tends to increase morbidity. There is a gross variation in the cost of different brands of same generic drugs available in India. Increase in the patient medication cost was found to be associated with decreased adherence to prescription medication.

Pharmacoeconomics is the branch of health economics that focuses on weighing the costs and benefits of a particular intervention in comparison with an analogous alternative.(4) Cost analysis is the study in which comparison of costs of two or more alternative medication is made without regard to outcome. Similar studies conducted in past show a wide variation in cost of branded and generic versions of same drug. Hence, the present study was conducted to assess the cost variation amongst the various brands of antimalarial drugs available in India in recent years.

METHODS

Price in Indian rupees (INR) of antimalarial drugs manufactured by different pharmaceutical companies in India, in the same strength and in same dosage form were obtained from Current index of medical specialties (CIMS) January to April 2023 .The cost of 10 tablets/capsules and that of one ampoule/vial was calculated. Those formulations for which price was not mentioned were excluded from study. Those formulations manufactured by only one pharmaceutical company were not considered for analysis.

The cost ratio, calculated as the ratio of the costliest brand to that of the cheapest brand of the same drug, calculated as follows:

- Cost ratio = Price of the costliest brand /Price of the least costly brand.

Percentage cost variation was calculated as follows:

- Percent cost variation = (maximum cost - minimum cost/ minimum cost) X 100

RESULTS (TABLE 1)

The examination of data demonstrated that there was a large disparity in the costs of various brands of antimalarial medications available in India. The highest cost ratio and percentage cost variation were observed for Quinine injection 300mg/ml, with a cost ratio of 7 and a percentage cost variation of 599.65%. The lowest cost ratio was found for Mefloquine tablet 250mg injection, with a cost ratio of 1.01 and a percentage cost variation of 1.35%. Overall, the injectable antimalarial medications showed a considerable cost ratio and cost variation. For instance, Artesunate 60 mg injection had a cost ratio of 4.11 and a percentage cost variation of 310.71, followed by

injectable antimalarial medications showed a Arteether 150mg-2ml injection with a cost ratio of 1.69 and a percentage cost variation of 69.49. On the other hand, oral antimalarial medications had a low-cost ratio and cost variation. The highest cost ratio was observed for the Quinine, with a cost ratio of 2.85 and a percentage cost variation of 185, and the lowest was observed for mefloquine tablet 250mg injection, with a cost ratio of 1.01 and a percentage cost variation of 1.35%.

DISCUSSION

People living in developing countries pay heavy cost of medicines. In India, more than 80% health financing is borne by patients. (5-7)The situation becomes more complex due to the presence of number of brands with variety of names and prices.(8) The price variation assumes significance when the cost ratio exceeds 2 and percentage cost variation exceeds 100. By this fact the above analysis showed that there is not much significant price variation among oral antimalarial drugs. The maximum variation shown by oral antimalarial was found to be for with a cost ratio of 2.85 and a percentage cost variation of 185 while other most of the oral drugs all showed cost ratio less than 2 and % cost variation less than 100. But

Table 1: Cost ratio and percentage cost variation of antimalarial drugs

Sr. No	Drug	Formulations	Dose &dosage formulation (quantity)	Number of companies	Least expensive (₹)	Most expensive (₹)	Cost ratio	%Cost variation
1	Arteether	3	inj. 150mg/2ml-2ml	17	59	100	1.69	69.49
			inj. 75mg/ml-1ml	6	34	61	1.79	79.41
			inj. 75mg/2ml-2ml	3	56	102.46	1.83	82.96
2	Artemether	3	inj. 80mg-1 ml	1	77	77	1.00	0.00
			inj. 150mg/2ml	1	78	78	1.00	0.00
			cap 40mg x6tabs	1	130	130	1.00	0.00
3	Artemether + Lumefantrine	4	tab. 80+480mg x6 tabs	26	108	230	2.13	112.96
			tab. 40+240mg x 6tabs	6	66	106.1	1.61	60.76
			syp. 40+240 mg 30ml	7	100	153	1.53	53.00
			syp. 20+120mg 60ml	4	135	210	1.56	55.56
4	Artesunate	3	inj. 60mg	14	56	230	4.11	310.71
			inj. 120mg	1	437	437	1.00	0.00
			tab. 50mg x4 tabs	1	84	84	1.00	0.00
5	Chloroquine	3	tab 250mg x10 tabs	2	8.9	12.49	1.40	40.34
			tab 500mg x 5	2	8.65	11.74	1.36	35.72
			inj. 64.5mg/ml					
			2ml	1	3.8	3.8	1.00	0.00
			5ml	1	9.52	9.52	1.00	0.00
		30ml	2	20.55	32.66	1.59	58.93	
6	Hydroxy Chloroquine	1	tab. 200mg x10 tabs	5	58.9	66.66	1.13	13.17
7	Mefloquine	1	tab 250mg 6tabs	2	312	316.22	1.01	1.35
8	Primaquine	4	tab. 2.5mg x10 tabs	2	11.81	23.6	2.00	99.83
			tab. 7.5 x10 tabs	2	22	23.7	1.08	7.73
			tab. 15mg x7tabs	3	50	64	1.28	28.00
			tab. 45mg x10tabs	1	31.5	31.5	1.00	0.00
9	Quinine	4	tab. 100mg x10tabs	2	20	57	2.85	185.00
			tab. 300mg x10tabs	5	53	58	1.09	9.43
			tab. 600mg x10tabs	1	132.75	132.75	1.00	0.00
			inj. 300mg/ml	4	20.01	140	7.00	599.65
10	Sulphadoxine Pyrimethamine	2	tab. 500+25mg x2tabs	1	4.98	4.98	1.00	0.00
			tab. 750+37.5mg x 2tabs	1	9.05	9.05	1.00	0.00

there was large price variation among injectable antimalarial for example there is considerable cost ratio and cost variation of Quinine injection 300mg/ml, with a cost ratio of 7 and a percentage cost variation of 599.65%. This finding is in accordance with the findings of a study done by Kumar et. Al which reports that there was considerable price variation among injectable antimalarials(9). Injectable antimalarials are often the choice of drug when dealing with critically ill malaria patients specially when suffering from complicated malaria. So, such significant price variation creates economic burden on poor patients. This often leads to non-compliance or abrupt cessation of treatment which adds on the morbidity and mortality due to malaria. The treating physician should be made aware of the cheapest drug available among the

various brands so that the patient bears lesser burden of treatment cost. Costs of drug are controlled by the Drugs (Prices Control) Amendment Order, 2022 .(8)

CONCLUSION

Ceiling cost of drugs are fixed by national pharmaceutical pricing authority (NPPA) government of India in accordance with DPCO 2023. Despite this there exists a wide variation of drug costs within one drug with the availability of various brands. Also, the national pharmaceutical pricing authority (NPPA) should act strictly to ensure that the prices of antimalarial drugs and their combinations are brought under control so that all patients irrespective of the economical class should be able to afford these medicines and get treated completely.

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