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Original Research Article

Assessment of Cost Minimization Analysis of Antimalarials in India

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Abstract

Aim: To assess the cost difference of various branded and generic antimalarial drugs available in the Indian market.

Material & Methods: The present observational research was carried out in the Department of Pharmacology, SKMCH, Muzaffarpur, Bihar, India for the duration of 6 months. The minimum and maximum cost in rupees (INR) of an antimalarial drug manufactured by different pharmaceutical companies in the same dose strength was noted among all the above sources.

Results: Highest cost ratio was seen with Chloroquine 500 mg, Mefloquine 250 mg and Sulfadoxine – Pyrimethamine 500+25 mg. Lowest cost ratio was seen with Quinine 600 mg, Chloroquine 250 mg and Sulfadoxine – Pyrimethamine 750+37.5 mg.

Conclusion: This study reveals the need to further improve the drug price regulatory mechanism concerning antimalarials available in India to improve patient compliance and thus cure rates of malaria.

Keywords: Antimalarial drugs, Compliance, Cost ratio, Percent cost variation

Introduction

Despite being a largely preventable and treatable disease, malaria is responsible for an estimated 800,000 deaths globally each year [1], with the majority of morbidity and mortality occurring in young children in sub- Saharan Africa. In addition to its impact on health, malaria imposes a heavy economic burden on individuals [2] and entire economies [3].

The government of India launched the national malaria control programme in April 1953. Initially the programme was a success as the number of malaria cases significantly declined. [4] The programme was changed to national malaria eradication programme in 1958. The incidence dropped further to a mere 49151 cases, with no deaths by 1961. [5]

Pharmacoeconomics involves identifying, measuring, and comparing the costs and consequences of pharmaceutical products and services. [6] There are four basic types of pharmacoeconomic studies; cost-minimization analysis, cost-effectiveness

analysis, cost-utility analysis, and cost-benefit analysis. [7, 8] Cost-minimization analysis also called cost analysis measures and compares input costs and assumes outcomes to be equivalent. Thus, in the cost-minimization analysis cost of two or more alternatives is compared without regard to outcome.

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. Non-compliance 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. [9]

Studies conducted in past show a wide variation in cost of branded and generic versions of same drug. [10, 11]

Hence, the present study was undertaken to assess the cost difference of various branded and generic antimalarial drugs available in the Indian market.

Material & Methods:

The present observational research was carried out in the Department of Pharmacology, SKMCH, Muzaffarpur, Bihar, India for the duration of 6 months.

Methodology

The prices of various antimalarial drugs were recorded from sources such as CIMS (Current Index of Medical Specialities). The minimum and maximum cost in rupees (INR) of an antimalarial drug manufactured by different pharmaceutical companies in the same dose strength was noted among all the above sources. The cost of 10 tablets/capsules, one bottle of syrup/drops, and that of one ampoule/vial were calculated. For artemisinin-based oral formulations cost was calculated for 3 days as per WHO and NVBDCP recommendations.

The cost ratio is defined as the ratio of the maximum cost of the drug to the minimum cost of the drug. It was calculated for all the included antimalarial drugs. This indicates the cost inflation in the prescribed drug with the same chemical compound but with different commercial brands. Cost ratio expresses the cost of drugs in proportion to the costliest and cheapest brand of the drug available in the market. Fixed drug combinations were also evaluated in the same manner as above.

Results:

Cost distribution of various oral antimalarial formulations of antimalarials were given by Table 1.

Table 1: Cost distribution of various oral antimalarial formulations

Sr. No.	Drug	Formulation	Strength	No of tablets	Minimum cost(rs)	Maximum cost(rs)
1	Chloroquine	Tablet Tablet	250 mg 500 mg	10 10	34 5.27	56 253
2	Amodiaquine*	Tablet	200mg	10	5	-
3	Mefloquine	Tablet Tablet	250 mg 300 mg	10 10	14.99 26.31	678.2 680.2
4	Quinine	Tablet Tablet	600 mg 2.5 mg	10 10	78.36 8.20	133.71 21.40
5	Primaquine	Tablet Tablet	7.5 mg 15 mg	10 10	13.3 7.8	45.81 60.29
6	Sulfadoxine-	Tablet	500 mg +	10	9.2	362

			25 mg			
7	Pyrimethamine	Tablet	750 mg + 37.5 mg	10	23.81	45.72
8	Proguanil	Tablet	100 mg	10	38.9	80.29
9	Sulfamethoxazole-	Tablet	500 mg + 25 mg	10	26.7	197.19

Among the 9 oral formulations there is a gross difference between minimum and maximum cost in most of the formulations. Highest cost ratio was seen with Chloroquine 500 mg, Mefloquine 250 mg and Sulfadoxine – Pyrimethamine 500+25 mg. Lowest cost ratio was seen with Quinine 600 mg, Chloroquine 250 mg and Sulfadoxine – Pyrimethamine 750+37.5 mg.

Table 2: Cost distribution of various artemisinin based oral formulations

Drug	Formulation	Strength	No of tablets	Minimum Cost (Rs)	Maximum Cost (Rs)
Arteether*	Tablet	50 mg	6	115.01	-
Artemether	Capsule Tablet	40 mg 50 mg	6 6	107.92 24	130.28 209.07
Artesunate	Tablet	100 mg	6	121	1200
Artemether-Lumefantrine	Tablet Tablet	80 mg + 480 mg 20 mg + 120 mg	6 6	45.0 52	228.62 111.3
Arteether-Lumefantrine	Tablet Tablet	80 mg + 480 mg 20 mg + 120 mg	6 6	55.81 65.92	180.82 77.72
Artesunate Sulfadoxine Pyrimethamine	Tablet Tablet	100 mg + 500 mg + 25 mg 200 mg + 750 mg +25 mg	3 3	14.22 182.12	190 300
Artesunate-Amodiaquine*	Tablet	100 mg + 300 mg	6	117.92	-
Artesunate Mefloquine	Tablet	100 mg + 200 mg	6	298.72	480
Arterolane-Piperaquine*	Tablet Tablet	150 mg + 750 mg 37.5 mg + 187.5 mg	3 3	197 78	- -

Table 2 Shows cost distribution of various artemisinin based oral formulations. Among the 14 artemisinin based oral formulations there is a significant difference between minimum and maximum cost in most of the formulations.

Cost ratio of various artemisinin based oral formulations were given by Table 3.

Table 3: Percentage of cost variation of various artemisinin based oral formulations

Drug	Strength	Percentage of cost variation
Arteether	50 mg	-
Artemether	40 mg	20.62 %
Artesunate	50 mg	769.27 %

	100 mg	900.21 %
Artemether-Lumefantrine	80 mg + 480 mg 20 mg + 120 mg	385.72 % 114.81 %
Arteether Lumefantrine	80 mg + 480 mg 20 mg + 120 mg	230.42 % 19.80 %
Artesunate Sulfadoxine-Pyrimethamine	100 mg + 500 mg + 25 mg 200 mg + 750 mg + 25 mg	1168.91 % 61.62 %
Artesunate-Amodiaquine	100 mg + 300 mg	-
Artesunate-Mefloquine	100 mg + 200 mg	60.55 %
Arterolane-Piperaquine 14	150 mg + 750 mg 37.5 mg + 187.5 mg	- -

Highest cost ratio was seen with Artesunate - Sulfadoxine – Pyrimethamine 100+500+25 mg, Artesunate 100 mg and Artesunate 50 mg. Lowest cost ratio was seen with Artemether 40 mg, Arteether – Lumefantrine 20+120 mg, Artesunate - Sulfadoxine – Pyrimethamine 200+750+25 mg and Artesunate – Mefloquine 100+200 mg.

Percentage of cost variation of various parenteral antimalarial formulations is given in Table 4 respectively. Highest percentage of cost variation was seen with Arteether 150 mg, Quinine 300 mg and Quinine 600 mg. Lowest percentage of cost variation was seen with Artesunate 120 mg, Artemether 80 mg and Artesunate 60 mg.

Table 4: Percentage of cost variation of various parenteral antimalarial formulations

Drug	Strength	Percentage of cost variation
Chloroquine	40mg	156.82 %
Quinine	300 mg 600 mg 75 mg	1260.62% 1052.39 % 822.30 %
Arteether	120 mg 150 mg	- 2372.8 %
Artemether	80 mg	37.73 %
Artesunate	60 mg 120 mg	135.83 % 11.74 %
Alpha- Beta Arteether	150 mg	280.46 %

Discussion:

People living in developing countries pay heavy cost of medicines. In India, more than 80% health financing is borne by patients. [12-14] The situation becomes more complex due to the presence of number of brands with variety of names and prices. [15]

The primary studies of costing data identified estimated the costs of single interventions in the absence of other anti-malaria interventions, with the exception of a study by Picard et al [16]. However estimates of the costs and cost-effectiveness of combined interventions were possible in model-based studies [17, 18].

Anti-malaria interventions will increasingly be deployed as part of wider health system strengthening packages leading to possible economies of scope: witness the IPTi studies by Manzi et al [19] where the cost of a course of intermittent preventive treatment was

reduced due to its administration alongside the already existing (and therefore not an additional financial cost) Expanded Programme on Immunization.

India has a high incidence of malaria because of unstable malaria transmission with increased intensity of transmission during rains and poor or absent immunity to malarial parasite among the Indian population. [20, 21] Given the magnitude of malaria in our country antimalarial drugs should be made available at prices which will not be an economic burden on the largely poor population of our country. In India many pharmaceutical companies sell a drug in different generic and brand names and this has led to wide variation in the price of generic and branded formulation of these drugs.

The cost-effectiveness literature is also lacking in the evaluation of combined malaria interventions. Apart from the studies by Akhavan et al [22] and Mills [23] on the evaluation of national or district level malaria control programmes, only one study considers simultaneously deployed interventions.

An expensive brand can cost a patient more than ten times the price of a cheaper brand of the same drug. This reflects a serious concern in the context of India where 50-90% of cost of medicines are still borne by the patient themselves. This high cost of purchasing medicines is a significant factor leading to poor compliance. [24-25] Clinician's false belief of effectiveness or superiority of branded drugs over generic drugs often results in prescription of costly drugs, when cheaper alternatives are readily available.

A significant price variation among injectable antimalarial for example there is significant cost ratio and cost variation of Artemether injection 150mg/2ml (cost ratio = 16.96 and % cost variation = 1596). 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 drug cost control order 2013 (DPCO). [26]

In a study in coastal and western Kenya Ngugi et al [27] evaluated the cost to employers of distributing ITNs to employees to be $15.80 per net delivered in 2002 prices. 48% of the costs were classified as tradable and 52% as non-tradable. The exchange rates were 1 USD = 78 KSH in 2002 and 1 USD = 82 KSH in 2009.

Medication compliance refers to the extent of conformity to treatment recommendation with respect to the timing, dosage, frequency and duration of a prescribed medicine. It can also be described as the degree to which a patient correctly follows medical advice. Other factors contributing to patient's non-compliance include: drug formulation, improvement of symptoms, frequent dosing, side effects of drugs, etc. [7, 8, 28]

Conclusion:

This study reveals the need to further improve the drug price regulatory mechanism concerning antimalarials available in India to improve patient compliance and thus cure rates of malaria.

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