



**Cost variation study of various brands of drugs used in treatment of acne vulgaris, available in India: A pharmaco-economic study**

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**Abstract:**

**Background:** The modalities for treatment of acne vulgaris range from topical agents to systemic and hormonal therapy. It is difficult for physician to know exact cost of each drug. The present study was planned to analyse cost of various brands of drugs available, thereby enabling physicians to prescribe accessible and affordable drugs and improving patient compliance.

**Objectives:** To find out and compare cost of drugs used in treatment of acne vulgaris in same dose and dosage form being manufactured by various pharmaceutical companies, to evaluate percentage variation of cost and cost ratio.

**Methods:** An observational, analytical study. Price in INR (Indian National Rupees) of drugs used in treatment of acne vulgaris, available in India will be obtained from Current Index of Medical Specialties, National Pharmaceutical Pricing Authority Pharma Sahi Daam app website for cost variation analysis and cost ratio. The data analysed using Microsoft Excel software.

**Results:** Different brands of same drug showed wide variation in price. Highest percentage cost variation in CIMS was observed with Capsule Doxycycline 100mg (5294.68%) and lowest for tretinoin gel 0.03%. (1.19%). According to NPPA, highest variation was seen with clindamycin 1% gel 20gm (645.84%) and lowest for

clindamycin cream 1% 15gm (14.67%). Cost ratio of drugs CIMS: highest – Capsule Doxycycline 100mg (53.95), lowest for tretinoin gel 0.03%. (1.01). NPPA: highest- clindamycin 1% gel 20gm (7.45), lowest: clindamycin cream 1% 15gm (1.66).

**Conclusion:** Physicians must prescribe cost effective medicines to improve patient compliance and treatment outcomes. The price of drugs should be regulated to ensure accessibility and affordability drugs and reduce burden on health care system.

**Keywords:** Acne, Cost Ratio, Pharmacoeconomic study.

### Introduction

Acne vulgaris is a disorder of the pilosebaceous units found on face, chest and back caused by *Propionibacterium acnes*.<sup>[1]</sup> Acne is estimated to affect 9.4% of the global population, making it the eighth most prevalent disease worldwide.<sup>[2]</sup> It is the most common skin disorder in the United States.<sup>[3]</sup> Acne presents with a pleomorphic array of lesions, consisting of comedones, papules, pustules, nodules with varying extent and severity. Acne could resolve in due course of time or present with lifelong sequelae of pitted or hypertrophic scars.<sup>[1]</sup> Acne is principally a disorder of adolescence with more than 85% affected.<sup>[1]</sup> However the prevalence of adult patients with acne is also on the rise. Acne affects the psychological well-being of the individual and has a significant impact on the economic aspects of the individual, since the treatment is prolonged.<sup>[4]</sup> As per the Global Burden of Disease study done in 187 countries in 2010, acne was in the top ten most prevalent diseases worldwide, with skin conditions being top cause of years lived with disability.<sup>[5,6]</sup>

With the ongoing COVID-19 Pandemic, regular and prolonged wearing of masks is extremely important to prevent its spread further. Studies have shown that long time mask wearing may result in increased incidence of

acne flare because of higher temperature and humidity on the facial skin surface as a result of expired air and perspiration. Thus, it is critical that patients with acne should not touch their face or itch the lesions and take proper therapeutic measures. Wearing of masks is a must to prevent COVID-19 transmission and it must be followed to combat the pandemic.<sup>[7-9]</sup> In a study done to find out adverse skin reactions to personal protective equipment among health care workers during COVID-19 Pandemic acne was found to be the most reported adverse skin reaction.<sup>[10]</sup>

The therapeutic options available for treatment of acne target the pathological factors responsible for causing it namely follicular epidermal hyper proliferation, excess sebum production, inflammation and presence & activity of *Propionibacterium acnes*. The acne regimen of a patient is tailored according to the severity of the condition- modalities ranging from cleansing, topical agents, systemic and hormonal therapies.<sup>[1]</sup> Topical treatment is the mainstay for mild to moderate acne vulgaris as well as for maintenance therapy for all grades of acne severity.<sup>[6,11,12]</sup>

Pharmacoeconomics is the description and analysis of the costs of drug therapy to healthcare systems and society. Pharmacoeconomic studies weigh the cost of alternative drugs and drug regimens against the results they accomplish to direct choices and strategies about which drugs should be used in general. The two fundamental components of pharmacoeconomic studies are measures of costs and measures of outcomes that are combined into a quantitative measure or ratio<sup>[13]</sup>. With the Indian pharmaceutical market having over 20,000 formulations, both branded and generic – branded, it becomes difficult for the physician to choose the most cost-effective drug for therapy.

Cost of therapy is the most important criterion in deciding compliance of the patient and hereby also affects the success of the treatment. With enormous cost variations in same drugs of different brands, it is important that cost analysis studies are done to help identify cheaper alternatives. This would enable affordability of treatment amongst all and reduce the dropouts from long term therapies. Optimizing the cost of therapy also helps to promote the rational use of drugs.<sup>[14]</sup>

This study will enable us in identifying the cost variation and cost-effective formulations for treatment of acne and play a pivotal role in choosing the cost-effective alternatives available in the market. It would enable diminish health and medicine related costs on the patients, thereby decreasing stress and improving compliance and treatment outcome. It would likewise empower physicians to prescribe generic and cost-effective medications better suited to their patient's needs.

Only a few studies are available in the Indian set up which compare the cost of different brands of drugs for acne vulgaris. Thus, the current study was undertaken for cost variation analysis of the available drugs for treatment of acne vulgaris.<sup>[6]</sup>

### **Aims and Objectives**

1. To list the available dosage forms in different strengths of various drugs used for treatment of acne vulgaris, marketed in India.
2. To find out and compare the cost of a particular drug used in treatment of acne vulgaris, in the same dose and dosage forms being manufactured by different companies.
3. To evaluate the variation of cost among different brands for the same dosage and same active drug by calculating percentage variation of cost and cost ratio.

### **Materials and Methods.**

**Study Design:** An observational, analytical study comparing costs of different formulations of acne medications.

- Price in INR (Indian National Rupees) of drugs used in treatment of acne vulgaris manufactured by different companies, in the same strength and dosage forms was obtained from "Current Index of Medical Specialties" (CIMS) October-January 2020-21, NPPA website, DPCO 2020 and Jan Aushadhi drug list for cost variation analysis and cost ratio comparison.

Approval from Institutional Ethics Committee taken.

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### **Selection Criteria**

**Inclusion criteria:** The cost of a particular drug used in treatment of acne vulgaris in the same dose and dosage forms being manufactured by different companies was compared.

### **Exclusion criteria**

1. Drug formulation with no price information.
2. Drugs used for types of acne or acneiform eruptions other than acne vulgaris was not included.

### **Analysis of Data**

Analysis of data collected was carried out for:

-To identify the minimum price (INR), and maximum price (INR) (of a particular drug manufactured by various pharmaceutical companies in the same strength)

-The cost ratio: The ratio of the cost of the costliest to cheapest brand of the same generic drug will be calculated. This tells, how many times costliest brand costs more than the cheapest one in each generic group.

Cost Ratio = Cost of costliest brand / Cost of cheapest brand

The following formula was used to analyze the percentage cost variation.

% Cost variation of drugs due to different brands =

$$\frac{(\text{Price of most expensive brand} - \text{Price of least expensive brand})}{(\text{Price of least expensive brand})} \times 100$$

Cost in INR of different brands was also noted from NPPAs “Pharma Sahi Daam” app.

Ceiling price in INR was noted from Jan Aushadhi and DPCO list (2020)

### Statistical analysis

The data obtained from the mentioned sources were analysed using Microsoft Excel® software. The price variations have been expressed in percentages and the results have been shown in tables, bar charts.

## Results

### Cost Variation

This study highlighted the wide variation in the prices of different brands of the same drug used for the treatment of acne vulgaris available in the Indian pharmaceutical market. The highest percentage of cost variation in CIMS was for Capsule Doxycycline 100mg (5294.68%) and the lowest was for Tretinoin gel 0.025% (1.19%). The highest cost variation in topical medications was for Clindamycin (1%) gel 20gm (1220%) and lowest was for Tretinoin gel 0.03% (1.19%). In systemic therapy highest percentage of cost variation in CIMS was for Capsule Doxycycline 100mg (5294.68%) whilst lowest was of azithromycin 500mg tab (9.74%). As far as hormonal therapy for acne is concerned highest percentage of cost variation was found with Tab dexamethasone 0.5mg (940.29%) and lowest was of Spironolactone Tab 25mg (41.33%).

(Fig 1,2). Amongst the 9 Fixed dose combinations analysed the highest cost variation was found with Tretinoin (0.025%) with Clindamycin (1%) 10gm gel (363.39%) and lowest was of Clindamycin (1%) with Nicotinamide (4%) ointment 15gm (7.14%) (Fig 3).

When the price variation with respect to NPPA was considered, it was found that the highest percentage variation was with Clindamycin (1%) gel 20gm (645.85%) and lowest was for Clindamycin (1%) cream 15gm (14.67%) both overall as well as for topical medication. In the systemic therapy highest variation seen with Tab doxycycline 100mg (615.55%) and lowest was of Tab minocycline 100mg tab (79.86%). (Fig 4,5). In the FDC group highest percentage variation was with Clindamycin (1%) and adapalene (0.1%) 15 gm gel (551.69%) and lowest was with Clindamycin (1%) and adapalene (0.1%) 15gm cream (31.11%). (Fig 6).

### Cost Ratio

Cost ratio is the ratio of the cost of the costliest to the cheapest formulations of the same drug, which tells us by how many times the cost of the most expensive drug is higher than the cheapest one for each drug considered for evaluation. Cost ratio of drugs CIMS: highest – Capsule Doxycycline 100mg (53.95), lowest for tretinoin gel 0.03%. (1.01). (Fig 7) NPPA: highest- clindamycin 1% gel 20gm (7.45), lowest: clindamycin cream 1% 15gm (1.66) (Fig 8).

Fig 1: Percentage Cost Variation as per CIMS.

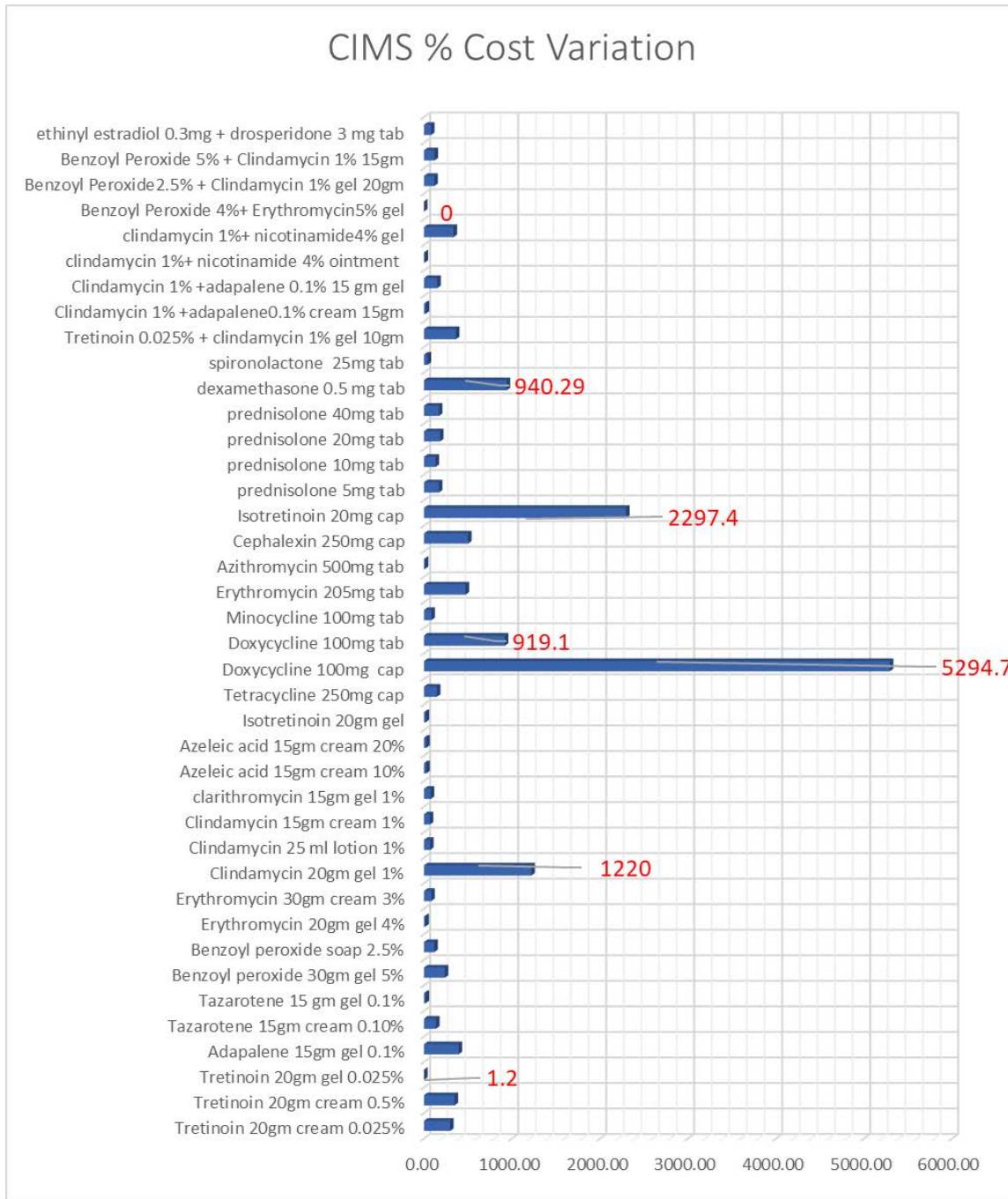




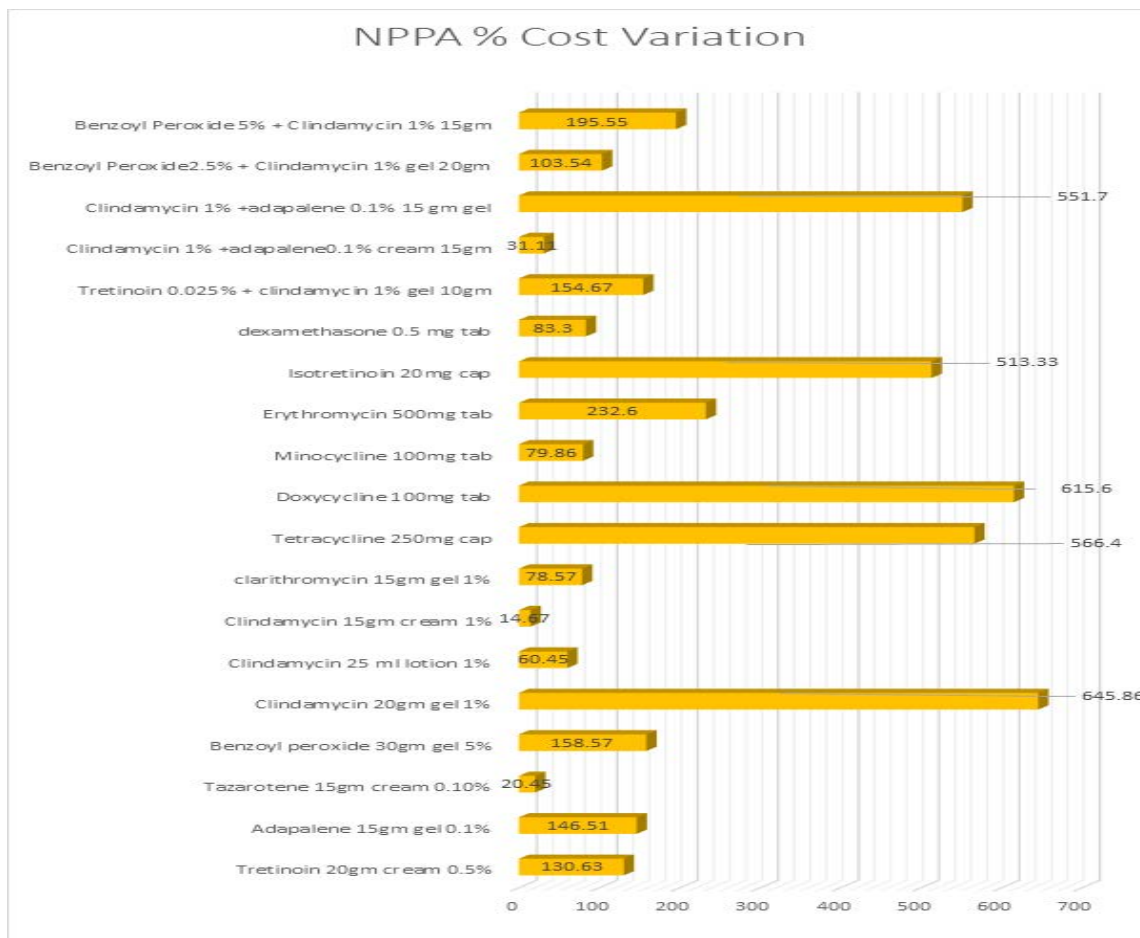
Fig 2: Current Index of Medical Specialties.

Sr No	DRUG	Quantity	dosage form	strength	min cost	max cost	% cost variation	cost ratio
	TOPICAL PREPARATIONS							
1	Tretinoin	20g	cream	0.025%	52.9	210	296.98	3.97
2	Tretinoin	20g	cream	0.05%	49.2	220	347.15	4.5
3	Tretinoin	20g	gel	0.025%	84	85	1.2	1.01
4	Adapalene	15g	gel	0.10%	74.9	370	393.9	4.9
5	Tazarotene	15g	cream	0.10%	112	265	136.6	2.4
6	Tazarotene	15g	gel	0.10%	95	112.68	18.61	1.2
7	Benzoyl peroxide	30g	gel	5.00%	35	118	237.14	3.37
8	Benzoyl peroxide	75g	soap	2.50%	59	128	116.9	2.17
9	Erythromycin	20g	gel	4%	36.2	42	16.0	1.16
10	Erythromycin	30g	cream	3%	66	121	83.3	1.83
11	Clindamycin	20g	gel	1%	15	198	1220	13.2
12	Clindamycin	25ml	lotion	1%	53	90	69.8	1.70
13	Clindamycin	15g	cream	1%	55	91.4	66.2	1.66
14	clarithromycin	15g	gel	1%	39.5	70	77.2	1.77
15	Azeleic acid	15g	cream	10%	134.6	169	25.6	1.26
16	Azeleic acid	15g	cream	20%	169.7	215	26.7	1.27
17	Isotretinoin	20mg	gel		129.8	155	19.4	1.19
	SYSTEMIC THERAPY							
		Per tab						
1	Tetracycline		cap	250mg	0.686	1.699	147.67	2.48
2	Doxycycline		cap	100mg	0.846	45.64	5294.7	53.95
3	Doxycycline		tab	100mg	0.682	6.95	919.1	10.19
4	Minocycline		oral	100mg	36	66.215	83.93	1.84
5	Erythromycin		oral tab	250mg	1.15	6.586	472.70	5.73
6	Azithromycin		tab	500mg	21.66	23.77	9.74	1.10
7	Cephalexin		cap	250mg	2.66	16	501.5	6.02
8	Isotretinoin		cap	20mg	13	311.66	2297.4	23.97
	HORMONAL THERAPY							
1	prednisolone		tab	5mg	0.39	1.05	169.23	2.69
2	prednisolone		tab	10mg	0.73	1.704	131.5	2.31
3	prednisolone		tab	20mg	1.24	3.5	182.25	2.82
4	prednisolone		tab	40mg	2.52	6.8	169.84	2.69
5	dexamethasone		tab	0.5mg	0.151	1.575	940.29	10.4
6	spironolactone		tab	25mg	2.25	3.18	41.33	1.41

Fig 3: Current Index of Medical Specialties (FDC)

	FDC							
1	Tretinoin 0.025% + clindamycin 1%	10g	gel	0.025% 1%,	48.9	226.6	363.39	4.63
2	Clindamycin 1% +adapalene0.1%	15gm	cream	0.1% 1%,	99	119	20.2	1.2
3	Clindamycin 1% +adapalene 0.1%	15gm	gel	0.1% 1%,	79	198	150.6	2.51
4	clindamycin 1%+ nicotinamide 4%	15gm	ointment	1% 4%	112	120	7.14	1.1
5	clindamycin 1%+ nicotinamide4%	15gm	gel	1% 4%	39	170	335.9	4.4
6	Benzoyl Peroxide 4%+ Erythromycin5%	15gm	gel	4% 5%	81.12	-	-	-
7	Benzoyl Peroxide2.5% + Clindamycin 1%	20gm	gel	2.5% 1%	156	339	117.31	2.17
8	Benzoyl Peroxide 5% + Clindamycin 1%	15gm	cream	5% 1%	198	435	119.7	2.20
9	ethinyl estradiol 0.3mg + drospidone	21	tab	0.03mg 3mg	30	54.23	80.77	1.81

Fig 4: Percentage Cost Variation as per NPPA.



### NPPA

The Pharma Sahi Daam app was developed by National Pharmaceutical Pricing Authority (NPPA), Ministry of Chemicals and Fertilizers, Government of India and was launched in August 2016 with the aim to make medicines available to all at affordable prices. It gives the MRP (Maximum Retail Price) by NPPA of various scheduled drugs on real time basis.

Fig 5: National Pharmaceutical Pricing Authority.

SR NO	DRUG	Qua ntity	dosage form	strengt h	N MIN COST	N MAX COST	% price variation	cost ratio
TOPICAL PREPARATIONS								
1	Tretinoin	20g	cream	0.025 %	143	single brand	-	-
2	Tretinoin	20g	cream	0.05%	80	184.5	130.63	2.30
3	Adapalene	15g	gel	0.10%	107.5	265	146.51	2.46
4	Tazarotene	15g	cream	0.10%	220	265	20.45	1.20
5	Benzoyl peroxide	30g	gel	5.00%	70	181	158.57	2.58
6	Benzoyl peroxide	30g	gel	2.5%	112.2	Ceiling price		
7	Benzoyl peroxide	75g	soap	2.50%	75	single brand		
8	Clindamycin	20g	gel	1%	36.2	270	645.85	7.45
9	Clindamycin	25ml	lotion	1%	67.86	108.88	60.45	1.60
10	Clindamycin	15g	cream	1%	75	86	14.67	1.14
11	clarithromycin	15g	gel	1%	70	125	78.57	1.78
12	Isotretinoin	20m g	gel		133.33	single brand		
SYSTEMIC THERAPY		Per tab						
13	Tetracycline		cap	250mg	0.7	4.66	566.43	6.7
14	Doxycycline		tab	100mg	0.95	6.76	615.56	7.2
15	Minocycline		oral	100mg	28.8	51.8	79.86	1.8
16	Erythromycin		oral tab	500mg	38.75	128.87	232.57	3.33
17	Azithromycin		tab	500mg	57.98	single brand		
18	Isotretinoin		cap	20mg	4.875	29.9	513.3	6.13
HORMONAL THERAPY								
19	prednisolone		tab	5mg	0.56	Ceiling price		
20	prednisolone		tab	10mg	0.97	Ceiling price		
21	prednisolone		tab	20mg	1.95	Ceiling price		
22	prednisolone		tab	40mg	2.8	Ceiling price		
23	dexamethasone		tab	0.5mg	0.12	0.22	83.3	1.83
24	spironolactone		tab	25mg	3.18	single brand		



Fig 6: National Pharmaceutical Pricing Authority (FDC).

	FDC							
25	Tretinoin + clindamycin	10g	gel	0.025% 1%	89	226.66	154.67	2.55
26	Clindamycin +adapalene	15g	cream	1%, 0.1%	135	177	31.1	1.31
27	Clindamycin +adapalene	15g	gel	1%, 0.1%	49.87	325	551.69	6.51
28	clindamycin+ nicotinamide	15g	ointment	1% 4%	75	single brand		
29	clindamycin+ nicotinamide	15g	gel	1% 4%	68.1	170	149.63	2.5
30	Benzoyl Peroxide + Clindamycin	20g	gel	2.5% 1%	198	403	103.53	2.03
31	Benzoyl Peroxide + Clindamycin	15g	cream	5% 1%	167.4	494.75	195.5	2.96
32	ethinyl estradiol + drospieridone		tab	0.03mg 3mg	267	542.3	103.1	2.03

Fig 7: Cost Ratio as per CIMS.

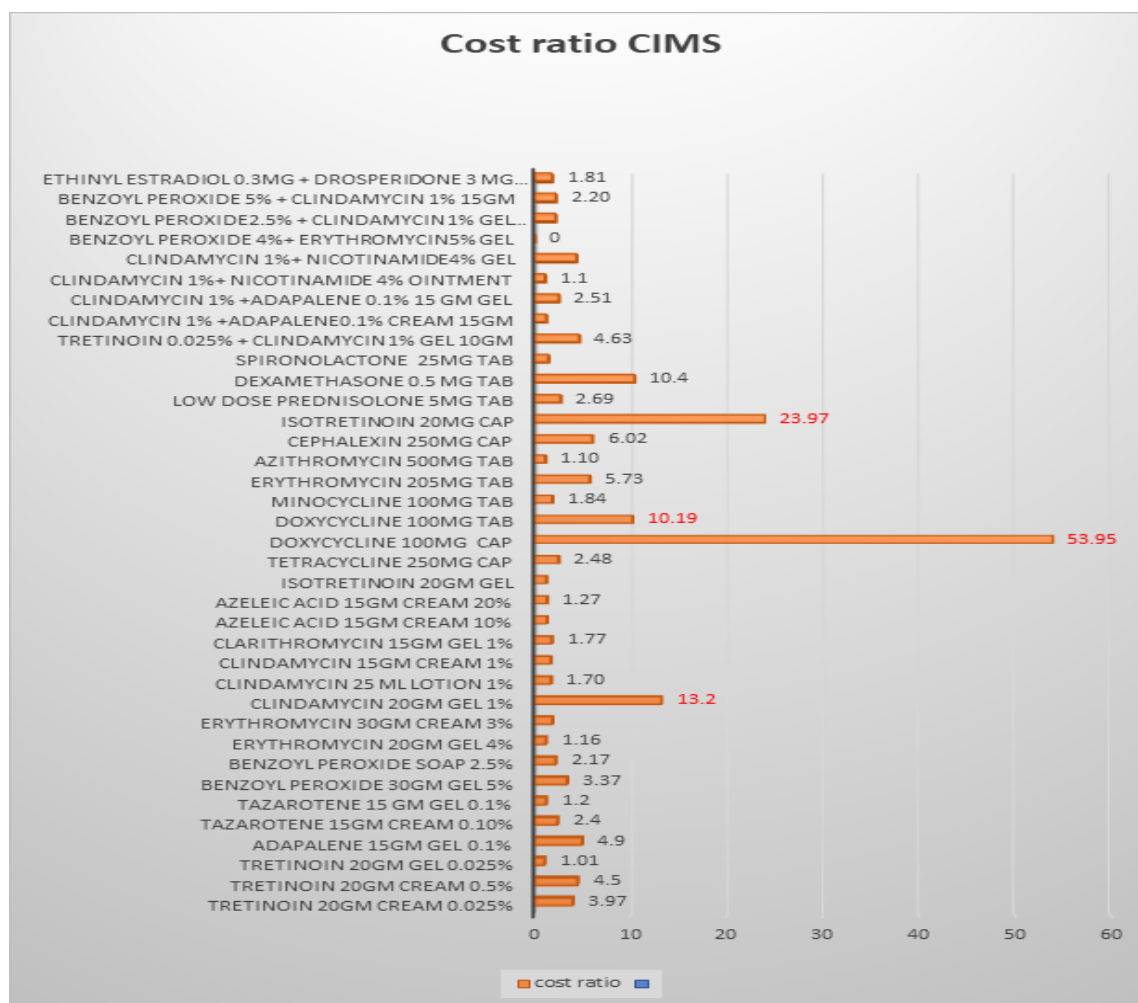
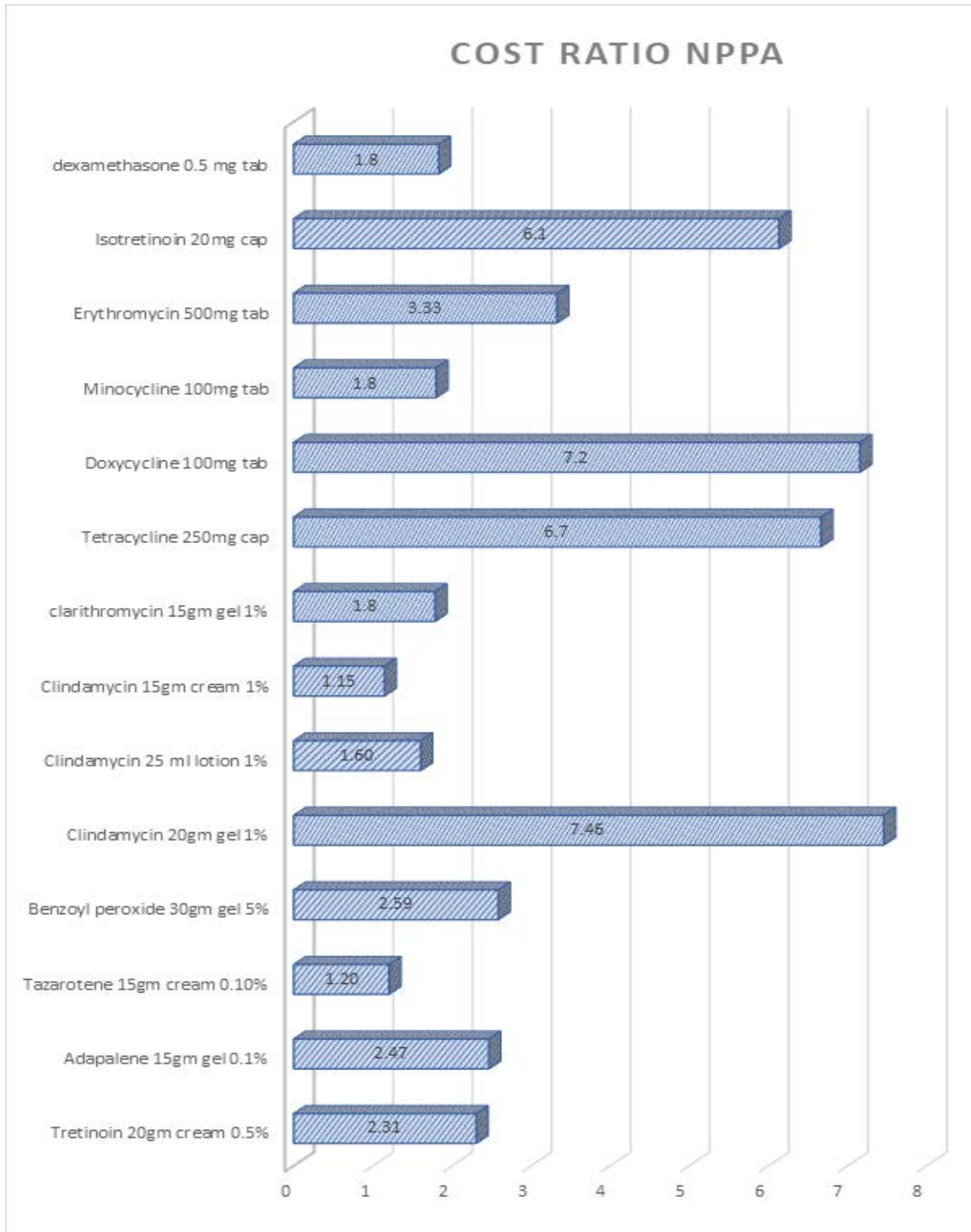


Fig 8: Cost Ratio as per NPPA.



DPCO- Drug Prices Control Order

Fig 9: DPCO (updated list 30.9.2020) included the following drugs.

Drug	Strength Dosage form	Cost INR
Doxycycline	100mg tab	2.5
Doxycycline	100mg cap	0.97
prednisolone	5 mg tab	0.56
prednisolone	10 mg tab	0.97
prednisolone	20 mg tab	1.95
prednisolone	40 mg tab	2.80
Benzoyl peroxide 2.5 %	30 gm gel	112.2

Drug prices in India are controlled by DPCO [Drug Prices Control Order], 1995. [6] In this study only 7 out of 40 formulations studied had price cap as per DPCO, amongst which benzoyl peroxide 2.5% had maximum cost (Rs 112.2) and tab prednisolone 5mg tab had minimum cost (0.56).

**Jan Aushadhi Scheme**

Fig 10: Drugs that was present in the Jan Aushadhi scheme.

Drug	Strength Dosage form	Jan aushadhi scheme Cost INR per tab
Doxycycline	100mg cap	1.3
erythromycin	250mg tab	1.7
Azithromycin	500mg tab	14
cephalexin	250mg cap	3
prednisolone	5mg tab	0.33
prednisolone	10mg	0.6
dexamethasone	0.5 mg tab	0.1
spironolactone	25mg tab	1
Clindamycin 1% + adapalene 0.1% 15 mg gel	Gel 15gm	32

In this study only 9 out of the 40 formulations studied were included in this scheme, in which Clindamycin 1% + adapalene 0.1% 15mg gel was costliest (Rs32) and dexamethasone 0.5mg tab (Rs 0.1) was the cheapest available drug.

**Discussion**

An estimated two billion people have no access to essential medicines, effectively shutting them off from the benefits of advances in modern science and medicine. [15] There is a lack of appreciation of the large differences in cost between drugs of various brands. Clinician’s ignorance of drug costs results in unknowingly

prescribing the costlier variant even when cheaper alternatives are available. This often causes non-compliance or nonadherence to the treatment. [16-17] Non-compliance leads failure of treatment and emergence of resistance. It also affects quality of life and finally increases the burden on health economics. It is also noted in a study that as a result of high out of pocket cost of

drugs a large number of people do not refill the prescriptions they are given or take the drugs less often than recommended. [18]

Acne is a chronic condition and treatment is prolonged. In this study a considerable cost variation was seen. There was a huge difference in maximum and minimum prices with a very high cost -ratio. The highest percentage variation in CIMS was for Capsule Doxycycline 100mg (5294.68%). The next significant ones being Capsule isotretinoin with percentage variation of 2297.4% followed by Clindamycin 1% 20 gm gel (1220%). There were 22 formulations out of 40 evaluated in CIMS that showed cost variation greater than 100%.

Studies of cost variation have been carried out for anti-asthmatics, anti-hypertensives, antimicrobials and they have shown a wide price variation among various brands of drugs. A study conducted by Dr Vishaka et al showed that the maximum price variation amongst topical medications for treatment of acne was with Clindamycin 1% 10gm gel which is similar to our study. The percentage variation in cost was above 100% for 8 out of 25 formulations considered. [16]

However, in study conducted by Dr Amit et al cost variation was high, they found percentage cost variation for Capsule doxycycline 458.33% whereas in our study it was much higher 5294.68%.

### **Ceiling price**

The NPPA controls price of drugs using a market-based mechanism. However, it so happens that select formulations of a particular drug are under price control whilst a few others with different dosage strengths, or FDC's are not. This enables the companies to exploit these non-regulated formulations. The ceiling price is based on average of price of top brands of a particular drug in the market having market share of at least 1%. On further contemplation, we realise that those expensive

formulations commanding more than 1% of market share, will all in all raise the ceiling price. Thus, it is important that all drug formulations must be regulated.

To combat this uncertainty in prices it is essential for the government to keep revising its policies time and again along with promoting generic medicines. Schemes like the Pradhan Mantri Bharatiya Janaushadhi Pariyojana (PMBJP), a campaign launched by the Department of Pharmaceuticals, Government of India, provides quality medicines at affordable prices to the masses. The Januashadi scheme thus provides generic drugs, which are available at lesser prices but are equivalent in quality and efficacy as expensive branded drugs. [19-20] However it is of utmost importance that maximum drugs are included in such schemes and their availability is ensured. Using generic medicine or the cost effective generic branded medicine could help reduce economic stress not just on the patient but on the health care system as a whole.

### **Conclusion**

The present study showed that prices of different brands of drugs used in the treatment of acne vulgaris available in India are highly variable. Government should look into the pricing control policy of drugs manufactured by various companies in India to ensure uniform pricing. More drugs must be included in government schemes. The accessibility and affordability of drugs is of utmost importance. Awareness amongst the patients and physicians will help them choose the cost-effective medications of same quality and efficacy thereby improving compliance and treatment outcomes. It will also encourage rational prescribing along with decreasing overall stress on the health care system.

**Strength:** The prices of drugs both topical and systemic used in treatment of acne vulgaris have been extracted

from most of the sources of pricing information like CIMS, NPPA, JAS and DPCO.

**Limitations:** Drugs used for types of acne or acneiform eruptions other than acne vulgaris was not included since data would have been extensive to assess brands from all sources of pricing information considered in our study.

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