



ISSN (E): 2277- 7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.03  
TPI 2018; 7(7): 221-227  
© 2018 TPI  
www.thepharmajournal.com  
Received: 27-05-2018  
Accepted: 29-06-2018

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## Pharmacoeconomic Evaluation: Cost minimization analysis of different brands of calcium supplements in Kanpur

**Shipra Omar and Sneha Sharma**

### Abstract

Calcium supplements are commonest kind of drugs among all medication as they are used to treat many diseased conditions. The financial burden of supplements were around one fifty billion dollars in year 2009. The main aim of the study was to perform a pharmacoeconomics survey and analyze the cost minimization analysis of calcium supplement drugs having same efficacy but differ in their brand name and cost. A total number of 150 prescriptions were reviewed and followed up at the outpatient department and pharmacy of a memorial hospital. Where the most commonly prescribed drugs were Shelcal, Ambrocal, Supracal, Cipcal, Telcal, and Dailycal. Among which shelcal was found to be the costliest (190 rupees) and most prescribed (32.66%) drug among all. Whereas the cheapest drug with same efficacy was dailycal (39 rupees) and was prescribed to only 7.33% patients only. Cost minimization analysis shows that among all six medications the most prescribed drugs were three times costlier than least prescribed drugs. Which would be increasing the per prescription cost burden leading to loose in medical adherence of these drugs. It is the fact that drugs with same efficacy and same generic formula will ultimately produce same effect. So the study concluded that, the cheaper drugs should be prescribed to patients rather than the costlier drugs and it should be the duty of health care professionals to consider the pharmacoeconomics value of drugs while prescribing the drugs.

**Keywords:** Pharmacoeconomics, Cost minimization analysis, adherence, per prescription burden

### Introduction

Calcium plays a vital role in development of bones and teeth. It is also used in blood clotting functions, heart, nerves etc. its supplements are basically used for treatment and prevention of hypocalcaemia, osteoporosis, rickets, osteomalacia, premenstrual syndrome, in pregnant women, high blood pressure in pregnancy, high cholesterol levels, act as antacids in heartburns etc. [1].

Vitamin D3, main component increases the gut absorption of calcium [2, 3], and absorption of calcium in bones as well. Due to abnormal absorption of calcium deficiency of vitamin D in body takes place [4].

Despite various side effects like, gas, constipation, bloating, loss of appetite, mood changes, bone, muscle pain, chest pain, calcium supplements are indicated in several of prescriptions for prevention of several of diseases and disorders. [5] Several indications for calcium and vitamin D3 are:

**Osteoporosis:** it is a major problem in elderly patients. It is characterized by low bone mass with articular cartilage disruption which further leads to increased risks of fracture. According to European Union report, about 3.5 fractures occur yearly. According to assets of year 2010, fractures lead to approximately 43000 deaths [6].

Here, calcium is essential part of bone. So, calcium rich diet, calcium supplements play important role in increasing bone mass and decreasing the risk of osteoporosis [7]. Vitamin D which is plays important role in absorption of calcium is synthesized in skin while exposed to UV rays and is less absorbed by body from diet.

D3 is major biologically active circulating metabolite which increases the gut absorption of calcium and regulates the level of parathyroid hormone for maintaining the homeostasis of calcium between bones and blood [8].

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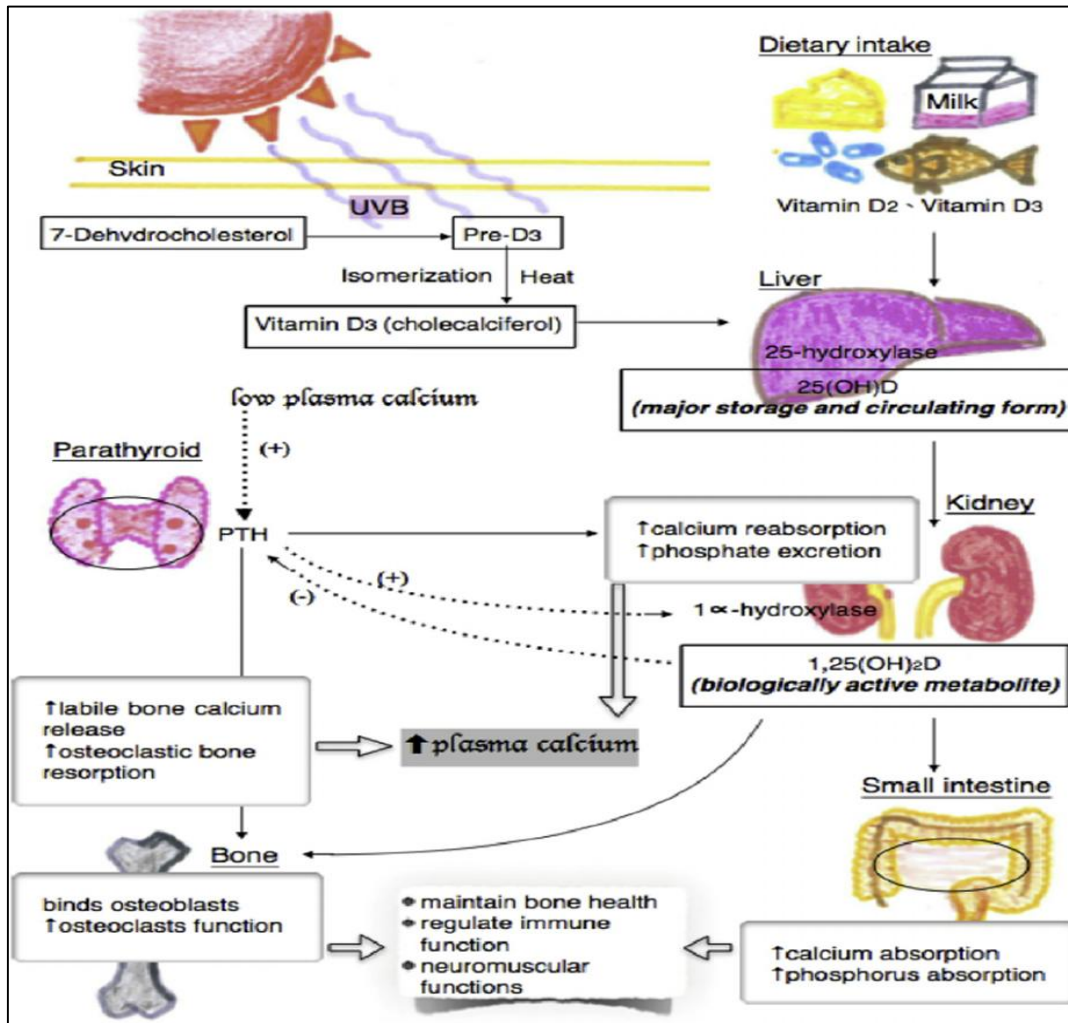


Fig 1: Diagram of vitamin D synthesis and its functions in calcium homeostasis between bones and blood [9].

According to a US surgeon, in ratio of 1:2 each women beyond the age of 50, is at major risk of osteoporosis related fractures. In which approx 50% of population has the risk of hip fractures.

The approximate actual direct cost of fracture is 12.2 billion dollars which is approximately similar to that of expenses of coronary heart disease (11.6 billion US dollars) [10].

The indication of vita D and calcium in postmenopausal

women is very common. More than 50% of post menopausal women are taking calcium supplements. And due to which the annual global sale of these supplements is up to billion dollars [11].

Jackson *et al.*, estimated that in randomized clinical trials more than 36000 females of age 50-79 were taking calcium and vitamin D3 supplements BD [12].

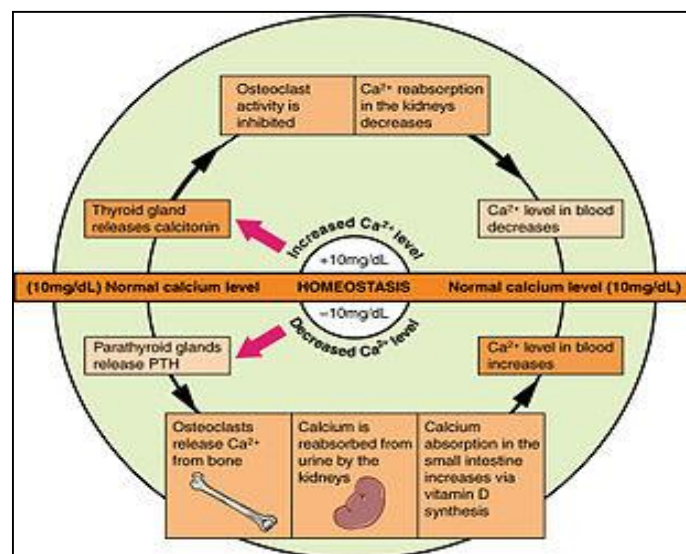


Fig 2: Diagram of homeostasis of calcium in postmenopausal women [13].

**Pharmacoeconomic Studies:** It is the study of needs and choice. It is basically the skill that is used in daily livelihood.

- Pharmacoeconomics is applied basically on healthcare which helps to make the tough decision to health care professionals.
- It estimates the supply and demand of health care system.
- Basically pharmacoeconomics is the study of cost of medication therapy to society and health care system.
- It estimates the measures and comprises the consequences of cost of medicines and other pharmaceutical products [14].

It is the framework of all systematic and objective processes which helps in taking decisions to make more choices in everyday living in regards to health. Since all the economic evaluations are similar in costs as they all measure the input 'cost' and determine the output 'benefits' [15].

**Health economics:** it is the study that estimates the persons' behavior, markets and firms of medical health care, and focuses on input which is meant to be cost and output which is meant to be the consequences of health care dissertation study i.e. medicines, machines, procedures, services and other programs.

**Pharmacoeconomics:** - It is the study that analyses the individual behavior, markets and firms reliable for use of pharmaceutical product, program which focuses on the cost that is the input and the output that is the result [16].

Pharmacoeconomic studies are divided into four parts

- Cost minimization analysis
- Cost effective analysis
- Cost benefit analysis
- Cost utility analysis

**1. Cost minimization analysis:-** It is defined as the study which determines the less cost effective substitutes when compared with two or more treatment alternatives. On comparison the substitutes must have same safety and efficacious value. Once the outcome (consequences) is confirmed, cost can be identified and compared and measured simultaneously. It is the simplest method of comparing the alternative treatments with similar therapeutic value. Another comprehensive method is the most suitable method that should be employed is Cost effective analysis. As Cost minimization analysis only shows the cost saving of health care treatment [17].

**2. Cost effective analysis:-** It is the method of pharmacoeconomic study which compares the input and outcome of two or more drug therapies. It is different from cost benefit analysis which measures the cost in monetary terms. It is usually used in health services somewhere but it is inappropriate to determine the health effects. It is expressed in the form of ratio where gain in health of individual is denominator while the cost associated with improvement in health is the numerator. Here the most commonly used term is measured in quality adjusted life years. It is somewhat similar to cost utility analysis. It generally has four quadrants. The first quadrant is comparatively more effective and expensive quadrant. While second quadrant is expensive and less effective and quadrant three is both less expensive and less effective quadrant and more than all, quadrant four is less

effective and most expensive of all. [18]

The ratio is generally expressed as average cost effective ratio or as incremental cost effective ratio. Average cost effective analysis is defined as the total health care cost and which is further divided by clinical outcomes in monetary terms. [19]

While incremental cost effective analysis determines the cost of treatment of both the alternatives and their clinical effects when compared with the alternatives. [20]

**3. Cost benefit analysis:-** it is basically the comparison between the cost and benefits of healthcare projects if they should be undertaken. [21]

**4. Cost utility analysis:-** it is the method of measuring health as combination of quality of health and duration of life. It was originated to help the decision makers to compare the output and input of health if there are very different health benefits. [22] It is attached with the monetary term of analysis. [23,24]

In all four methods, cost minimization analysis is the simplest of all. It is used commonly for health services. It is used when the outcomes of the study are similar and cannot be considered separately. [14]

It can only be compared by comparing the same generic to different brand name of drug. Manufacturer should be taken the approval of FDA for the generic medicine. Drugs compared having same pharmacological action, same efficacy, same dosing and same route of administration and same pharmaceutical properties, only cost of medication remains which is needed to be compared amongst all. [15]

Here, the aim of the study was to estimate the cost minimization analysis of calcium (500 mg) and vitamin D3 (250 IU) supplements used in various diseases and disorders.

### Material and Methods

This study was conducted in the Memorial Hospital, Ratan Lal Nagar, Kanpur, Uttar Pradesh India.

In this study, 150 subjects were recruited after the approval of hospital ethical committee. Both male and female subjects were recruited.

The clinical and medication record files were followed regularly for the need to study to analyze the prescribing patterns of medication.

Subjects under the age of 18 were excluded from the study, as per the instructions of health committee of hospital.

Patients who were not willing to provide the information and were not interested were also excluded from the study.

Six different brands of the drug i.e. calcium salt along with vitamin D3 were followed up to perform the cost minimization analysis.

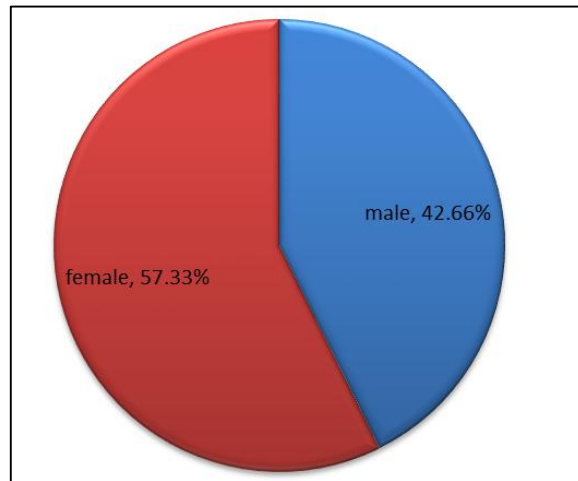
### Result

The study was conducted at outpatient department of a memorial hospital, Kanpur. Here, in the study, six famous brands of calcium supplements were taken to analyze the pharmacoeconomics of the products.

A total of 150 subjects were followed up in this study along with their medical record file and prescriptions.

### Subjects characteristics

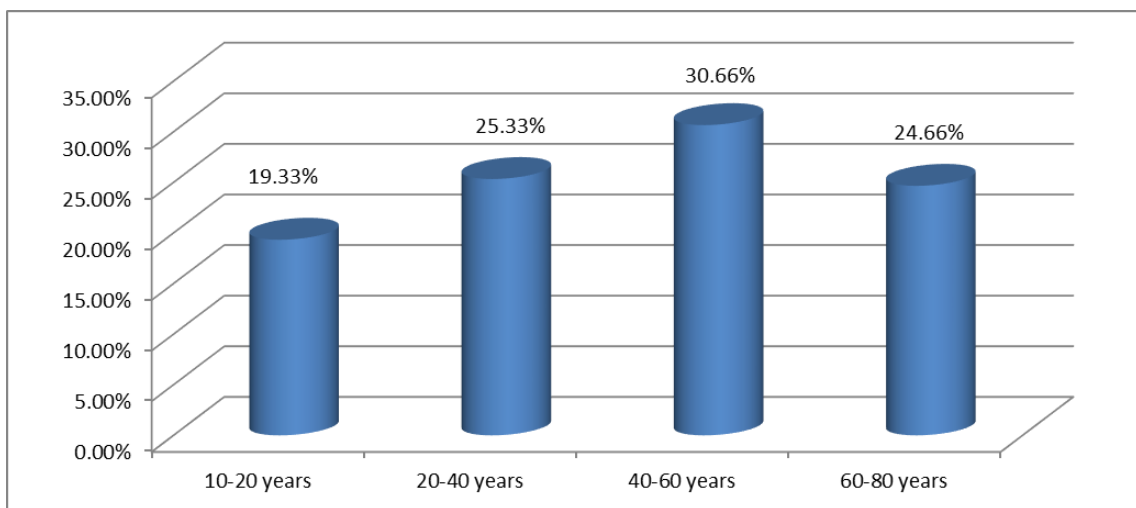
Total numbers of 150 subjects were enrolled in the study according to the inclusion and exclusion criteria. In total 150 subjects, 64 (42.66%) were male and (57.33%) were female.



**Fig 3:** Distribution of subjects on the basis of gender.

In total number of subjects, 29 (19.33%) patients were of the age group from 10-20 years, 38(25.33%) patients were of age group between 20-40 years, 46(30.66%) patients were from

the age group 40-60 years and about 37(24.66%) patients were from the age group between 60-80 years.

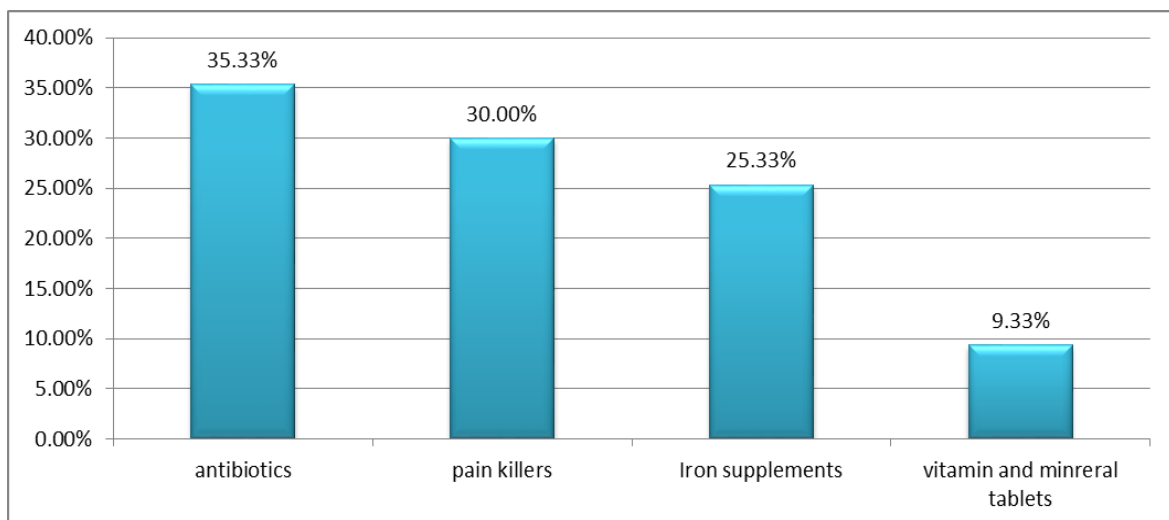


**Fig 4:** distribution of subjects on the basis of their age

**Prescribing patterns of calcium supplements**

In this study, among 150 subjects, 53(35.33%) patients were prescribed calcium supplements with antibiotics, 45(30.00%) patients were prescribed calcium supplements along with

painkillers, 38(25.33%) patients were prescribed calcium supplements with iron folic acid tablets, and 14(9.33%) patients were prescribed calcium supplements along with vitamin and mineral tablets.



**Fig 5:** Distribution of patients on the basis of prescribing patterns of calcium supplements.

**Cost minimization analysis:** - To compare drugs falling under same pharmacological criteria. Frequency obtained was as follows:

**Most frequently prescribed calcium supplement drugs**

In this study, 49(32.66%) patients were prescribed shelcal,

11(7.33%) patients were prescribed dailycal, 10(6.66%) patients were prescribed cipcal, 33(22.00%) patients were prescribed supracal, 29(19.33%) patients were prescribed ambrocal, and 18 (12.00%) patients were prescribed telecal, which shows that shelcal was the most prescribed drug in the hospital followed by supracal and ambrocal.

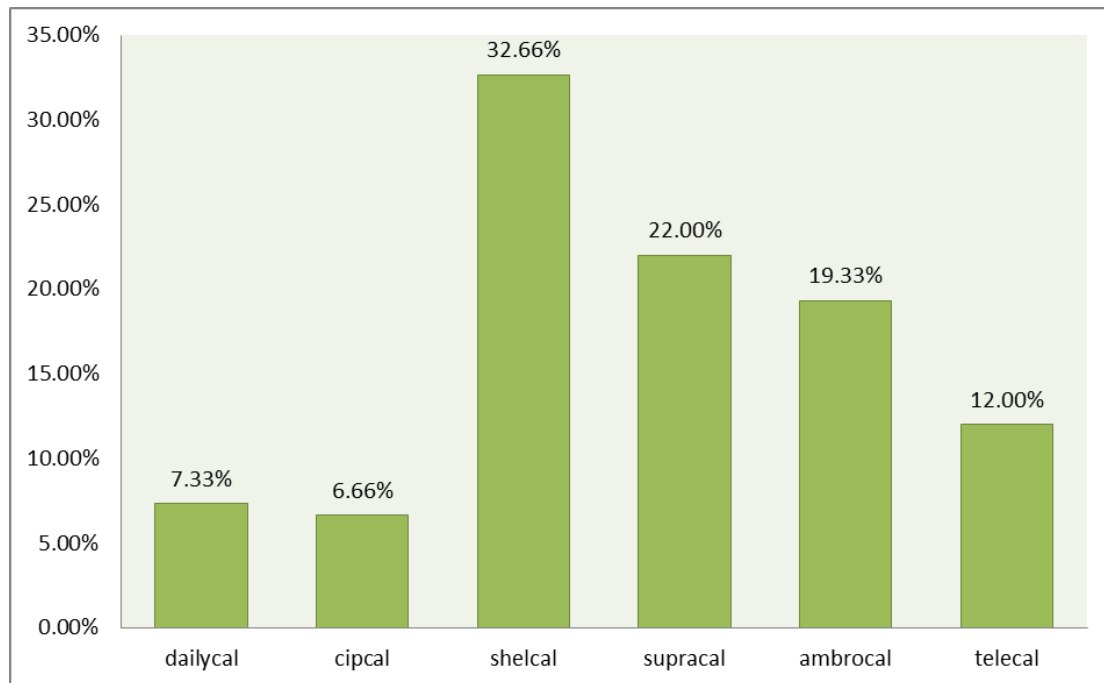


Fig 6: Distribution on the basis of most prescribed drug

**Costliest drug prescribed**

In this study, the costliest drug prescribed was shelcal with m.r.p. 190 INR per strip followed by supracal having m.r.p 159 INR per strip, ambrocal having m.r.p 125 INR, cipcal

with m.r.p 64 INR per strip, telecal with 60INR m.r.p per strip, dailycal with 39 INR per strip. Here, the order of costliest drug to the cheapest drug is mentioned below: Shelcal> supracal> Ambrocal> Telecal> Dailycal>Cipcal

Table 1: CMA of drugs by mean unit cost method

Brand name of Most prescribed drugs	Generic name of drugs	Dosage form	Cost per strip	Brand name of least prescribed drugs	Generic name of drugs	Cost per strip
Shelcal	Calcium with vitamin D3	Tablet	190	Telecal	Calcium with vitamin D3	60
Supracal	Calcium with vitamin D3	Tablet	159	Dailycal	Calcium with vitamin D3	39
Ambrocal	Calcium with vitamin D3	Tablet	125	Cipcal	Calcium with vitamin D3	64
Sum total			474			163

Total mean cost (most prescribed drugs) =  $\frac{190+159+125}{3} = 158$

Total mean cost (least prescribed drugs) =  $\frac{60+39+64}{3} = 54.3$

In the above method the total mean cost of most prescribed drugs is 2.9 ~3 times more expensive than least prescribed drugs. If the cost of drugs other than the study drugs is assumed constant, in such case the cost therapy would be three times higher when costlier drug will be prescribed

instead of cheaper drugs. Nevertheless, these drugs are used along with antibiotics, NSAIDs, analgesics.

In this study, different brands of calcium supplements were prescribed to the patients. The cost for each brand for a strip was recorded and the mean unit cost of drugs was calculated by categorising the drugs into least prescribed and most prescribed drugs.

In this study the mean unit cost of most prescribed drugs 158rupees while those of least prescribed drugs was 54.3 rupees.

Table 2: Average and projected unit cost of most prescribed and less prescribed drugs

Projected cost of most prescribed drugs	Average cost of most prescribed drugs	Number of patients	Average cost of least prescribed drugs	Projected cost of least prescribed drugs
23,700	158	150	54.3	8,145
237,000	158	1500	54.3	81,450
2,370,000	158	15000	54.3	814,500

As the cost of therapy of most prescribed drugs i.e. costlier drugs is three times higher than the other study drugs thus, if we projected the cost of therapy in hundreds of people, the cost burden would definitely thousands times higher than those cheaper drugs.

Therefore in view of cost minimization therapy, the drugs like telecal, dailycal, cipcal should be used in practice than shelcal, ambrocal and supracal.

### Discussion

This study was first approved by Hospital ethical committee. According to the study, 150 subjects were followed up along with their medical record file.

In most developing countries like India, drugs are being prescribed by their brand names. According to their scenario billions of drugs are being registered but there is no clause for registering of drugs by their m.r.p price despite of DPCO act.<sup>[24]</sup>

Many of studies have shown the wide price variation in between the different brands of drugs having same generic formula. Thus the main aim of the study was to analyze the pharmacoeconomics analysis of calcium supplements.

In our study, the wide difference was found that, the costliest drug i.e. shelcal having m.r.p 190 rupees and the cheapest drug dailycal having the m.r.p price 39 rupees. That shows the variation of about 151 rupees per prescription.

This further illustrates that; health care professionals should also consider pharmacoeconomics at the time of prescribing drugs. The data was mainly collects by the outpatient department and the pharmacy of the memorial hospital Kanpur and from Drug today, CIMS also.

As the present study, a cost effective analysis was done on the calcium supplements in the treatment of osteoporosis.<sup>[25]</sup> But the cost minimization analysis was not yet done on calcium supplements.

As it was important, because many of the brands are available and are having very deviation in m.r.p values. Indian population face many of difficulties during payments of medications, the reason behind is that they are aware much about various health policies and govt. schemes and they need to pay the bills by their own pockets.

In India, due to various microbial issues and low bio-equivalence is the major issue that has been observed in generic medicines. Therefore, branded medicines are preferred more by Indian population over generic drugs.

Since branded drugs have wide variety of variance in their prices, physicians should always consider the prices of drugs while prescribing them. Costlier drugs prescription usually leads to prescription non adherence. This can be increased by prescribing same efficacy drugs of other cheap brands. It will ultimately lower the overall per prescription burden and simultaneously increases the medication goal of physician.

### Conclusion

Calcium plays a vital role in development of bones and teeth. It is also used in blood clotting functions, heart, nerves etc. its supplements are basically used for treatment and prevention of hypocalcaemia, osteoporosis, rickets, osteomalacia, premenstrual syndrome, in pregnant women, high blood pressure in pregnancy, high cholesterol levels, act as antacids in heartburns etc.

Now a days, osteoporosis s the major problem arising in geriatrics, and post-menopausal women. It is predicted that about 90 billion of patients in India would be suffering by

calcium deficiency and osteoporosis.

The above study concluded that there are many of the drugs that are available in the market having same drug efficacy and clinical outcomes but are cheaper in cost. By this study, the outcome illustrated that, cheaper drugs could also be prescribed to the patients rather than the costly drugs that will further increase the overall drug adherence and therapeutic outcomes of the particular disease. It will also decrease the health related cost burden per prescription. It should be the major responsibility of the health care professionals to prescribe the drugs that are lower in cost and having same clinical value.

### Acknowledgement

I sincerely owe my heartfelt thanks to LDKMC memorial hospital for conducting the hassle free study. My ecstatic thanks to the hospital staff and the pharmacists for their positive cooperation and work.

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