Volume : 5 | Issue : 10 | October 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

Original Research Paper

# Cost Variation Analysis of Beta Blockers Used for Cardiovascular Medicine Available in Indian Market: An Economic Perspective

Medical Science

KEYWORDS :

| | |
|---|---|
| **Prakash Kumar** | Assistant Professor , RIMS , Ranchi |
| **Nidhi Singh** | Consultant, CH Hospital, Dhurwa ,Ranchi |
| **Manoj Kumar** | Assistant Professor , RIMS , Ranchi |
| **Ashok Kumar Sharma** | Associate Professor , RIMS , Ranchi |

## ABSTRACT

*Beta blockers are commonly used drugs in day to day cardiology practice. In India different spharmaceutical companies manufacture same formulation of drugs under different brand names and huge price variation exists between each brands. Cardiovascular diseases are chronic condition and patients need long term treatment to sustain a quality life. In these scenario costly medicines puts economic burden on the patients and the health care system.*

***Aim:****is to evaluate the cost of commonly used Beta blockers in cardiology practice of different brand names of one compound and the difference in cost of different brands of the same active drug by calculating percentage variation of cost.*

*Methods:Cost of a particular beta blocker in the same strength and dosage forms being manufactured by different companies was obtained from latest "Current Index of Medical Specialties", "Indian Drug Review", MonthlyIndex of Medical Specialtiesand Drugs monitor. Percentage variation in cost is calculated.*

***Results:*** *Percentage variation of costis highest in case of 50mg Metoprolol tartare = 871.43% and in combination drug highest variation is of Atenolol + Amlodipine (50 + 5 mg) = 673.79%.Out of 36 single formulations 26 and out of 46 combinations 20 show more than 100% variation in cost.*

***Conclusion:*** *In developing countries like India where most of the patients pays for health care themselves prescribing costly branded drug in place of their cheaper economic counterpart generic drug; put additional economic burden to the patients and their families. Appropriate steps must be taken by the regulatory authorities and health care giver must take active part, to overcome this situation with better knowledge, aptitude and practice of rational prescribing.*

## INTRODUCTION:

Beta-blockers their full correct name is beta-adrenoceptor blocking drugs, but they are commonly just called beta-blockers. In 1964, Sir James W. Black [1] synthesized the first clinically significant beta blockers—propranolol and pronethalol; it revolutionized the medical management of angina pectoris [2] and is considered by many to be one of the most important contributions to clinical medicine and pharmacology of the 20th century [3].He received Novel prize on 1988[4].There are several types of beta-blocker. They include non-selective beta blockers e. g. - propranolol, carvedilol and selective beta ($\beta_1$) blockerse. g. - atenolol, bisoprolol, metoprolol, nebivolol. Each type has more than one brand names and verities of formulation. In cardiology practice beta blockers are commonly used for management of verities of conditions like myocardial infraction, angina pectoris (except Prinzmetal's angina), atrial fibrillation, cardiac arrhythmias, congestive heart failure, hypertension (although they are generally not preferred for this use), mitral valve prolapse, acute aortic dissection, hypertrophic obstructive cardiomyopathy, Marfan syndrome (treatment with propranolol slows progression of aortic dilation and its complications), Postural orthostatic tachycardia syndrome, phaeochromocytoma (in conjunction with $\alpha$-blocker), theophylline overdose and symptomatic control (tachycardia, tremor) in anxiety and hyperthyroidism either alone or in combination[5]. They are among the top 200 selling drug list all over the world [6].

In developing countries like India, pharmacoeconomics plays an important role in medicine practice. Cost of the prescribed medicine is an essential part of rational drug prescription as it is an important factor influencing compliance and adherence to the prescribed treatment. Many branded formulation of same drug available in Indian market with large difference in selling price. Prescribing drugs by brand name is a common practice among Indian physicians. In this situation patient's finance get adversely affected if costly brands are prescribed specially in cardiovascular diseases where long term treatment is needed for most of cases.

Very few studies are available in Indian perspective, where comparisons of the cost of drugs of different brands are done. Therefore, decision was mead to carry out the present study which compares the cost of different brands of beta blockers one of the commonly used commonly in cardiology practice. Focus of the study is on cost effectiveness analysis of different available brands of beta blockers available in Indian market.

**Aim:**

To evaluate the cost of commonly used Beta blockers in cardiology practice of different brand names of one compound and the difference in cost of different brands of the same active drug by calculating percentage variation of cost.

**Objectives:**

This Pharmacoeconomic study is designed with the main objectives of,

To find commonly used Beta blockers in cardiology practice either singly or in combination and the No. of the brands available for each.

To evaluate the cost of commonly used Beta blockers of different generic classes and doses in cardiology practice.

To evaluate the difference in cost of different brands of the same formulation by calculating percentage variation of cost.

## MATERIALS AND METHODS:

Cost of a particular beta blocker (cost per10 tablets/cap-

Volume : 5 | Issue : 10 | October 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

sules) in the same strength and dosage forms being manufactured by different companies was obtained from latest "Current Index of Medical Specialties" July - October2016,[7] "Indian Drug Review" (IDR) 2016, [8] MonthlyIndex of Medical Specialties September 2016,[9] and Drugs monitor 2016[10] as they are regularly updated and readily available source of drug information. Crosschecking with retail drug stores was done.

**Percentage cost variation was calculated as follows:**
% cost variation = [(Max cost - Min cost) × 100] / Min cost

The drug formulation being manufactured by only one company was excluded.

**RESULTS:**
The prices of commonly used beta blockers (36 single + 46 combination preparations) manufactured by different pharmaceutical companies were analyzed. **Table 1** shows percentage cost variation of 36 commonly used beta blockers used as a single drug therapy. Overall Metoprolol tartrate (50mg) shows maximum price variation of 871.43% and Carvedilol Extended Release (10mg) shows minimum price variation of 8%. Among each group of preparationsprice variations are 466.67% for Propranolol 10mg, 524.71% for Atenolol 50mg, 237.32% for Bisoprolol 5 mg, 400% for Carvedilol 3.125mg, 300% for Metoprolol succinate 25mg, 871.43%, for Metoprolol tartrate 50mg and 245.57% for Nebivolol 2.5mg.

**Table: 1. percentage cost variation of commonly used beta blockers used as a single drug therapy.**

| Drug | No of formulation | Doses(mg) | No of manufacturer | Min. Price (₹) | Max. Price (₹) | % price variation |
|---|---|---|---|---|---|---|
| Propranolol | 4 | 10 mg | 19 | 3 | 17 | 466.67 |
| | | 20 mg | 18 | 9.7 | 27.7 | 185.57 |
| | | 40 mg | 19 | 9.35 | 36 | 285.03 |
| | | 80 mg | 4 | 22 | 46.5 | 111.36 |
| Propranolol (SR) | 3 | 40 mg (SR) | 18 | 15.4 | 78 | 406.49 |
| | | 60 mg (SR) | 4 | 31 | 43 | 38.71 |
| | | 80 mg (SR) | 6 | 35.5 | 60 | 69.01 |
| Inj. Propranolol | 1 | 1mg X 1ml | 3 | 100 | 130 | 30.00 |
| Atenolol | 4 | 12.5 mg | 5 | 2 | 9.5 | 375.00 |
| | | 25 mg | 43 | 5.28 | 27.07 | 412.69 |
| | | 50 mg | 65 | 6.07 | 37.92 | 524.71 |
| | | 100 mg | 33 | 11.42 | 54.78 | 379.68 |
| Bisoprolol | 3 | 2.5 mg | 8 | 17.5 | 49.5 | 182.86 |
| | | 5 mg | 9 | 20.9 | 70.5 | 237.32 |
| | | 10 mg | 6 | 44.8 | 123.5 | 175.67 |
| Carvedilol | 4 | 3.125 mg | 25 | 7 | 35 | 400.00 |
| | | 6.25 mg | 22 | 12 | 45 | 275.00 |
| | | 12.5 mg | 25 | 22 | 61.15 | 177.95 |
| | | 25 mg | 16 | 42 | 100 | 138.10 |
| Carvedilol (ER) | 3 | 10 mg | 3 | 50 | 54 | 8.00 |
| | | 20 mg | 2 | 80 | 90 | 12.50 |
| | | 40 mg | 2 | 110 | 150 | 36.36 |
| Metoprolol succinate | 4 | 12.5mg | 3 | 24.5 | 60 | 144.90 |
| | | 25mg | 31 | 20 | 80 | 300.00 |
| | | 50 mg | 34 | 31.7 | 110 | 247.00 |
| | | 100 mg | 12 | 68 | 102 | 50.00 |
| Metoprolol tartrate | 3 | 25mg | 21 | 10.67 | 42.5 | 298.31 |
| | | 50 mg | 23 | 7 | 68 | 871.43 |
| | | 100 mg | 6 | 30.15 | 90.6 | 200.50 |
| Metoprolol tartrate (XR) | 4 | 12.5mg | 8 | 16 | 27.5 | 71.88 |
| | | 25mg | 15 | 26.6 | 59 | 121.80 |
| | | 50 mg | 19 | 30 | 163 | 443.33 |
| | | 100 mg | 10 | 65 | 197 | 203.08 |
| Inj Metoprolol | 1 | 1mg X 1 ml | 3 | 11.25 | 13.6 | 20.89 |
| Nebivolol | 2 | 2.5 mg | 18 | 15.8 | 54.6 | 245.57 |
| | | 5 mg | 24 | 49.6 | 99 | 99.60 |

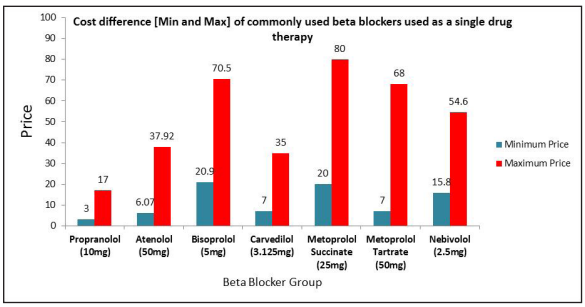


**Fig 1: Cost difference [Min and Max] of commonly used Beta blockers used as a single drug therapy.**

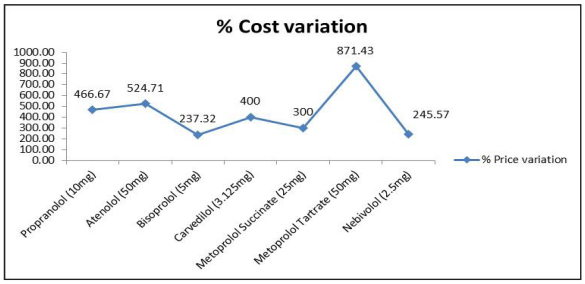


**Fig 2: Percentagecostvariationofcommonlyused Beta blockers used as a single drug therapy.**

**Table 2**percentage cost variation of (46) commonly used beta blocker combinations. Overall Atenolol + Amlodipine (50 + 5 mg) show maximum price variation of 673.79% and Atenolol + Chlorthalidone (100 + 25 mg) show minimum price variation of 2.86%. Among combinations Propranolol + Alprazolam (10 + 0.25) mg show percentage variation of 172.73%, Atenolol + Amlodipine (50 + 5) mg shows percentage variation of 673.79%, Bisoprolol + Hydrochlorothiazide (2.5 + 6.125) mg shows percentage variation of 266.67%, Metoprolol + Hydrochlorothiazide (100 + 12.5) mg shows percentage variation of 356.17% and Nebivolol + Hydrochlorothiazide (5 + 12.5) mg shows percentage variation of 133.33%.

**Table: 2. percentage cost variation of commonly used beta blocker combinations.**

| Drug | No of | Doses(mg) | No of | Min. Price | Max. Price | % price variation |
|---|---|---|---|---|---|---|
| Propranolol + Alprazolam | 2 | (20 + 0.25) | 33 | 10 | 60 | 500 |
| | | (10+0.25 | 11 | 11 | 30 | 172.73 |
| Propranolol + Clonazepam | 1 | (20 + 0.5) | 2 | 36 | 45.37 | 26.03 |
| Propranolol + Etizolam | 1 | (20 + 0.5) | 2 | 43 | 46 | 6.98 |
| Propranolol + Diazepam | 2 | (20 + 2.5) | 3 | 13.5 | 16.5 | 22.22 |
| | | (10 + 2.5) | 2 | 10 | 11 | 10 |
| Propranolol + Flunarizine | 2 | (40 + 10) | 3 | 78.5 | 82 | 4.46 |
| | | (40 + 5) | 3 | 56 | 59 | 5.36 |
| Atenolol + Hydrochlorothiazide | 2 | (50 + 12.5) | 5 | 8.3 | 48.1 | 479.52 |
| | | (25 + 12.5) | 2 | 7.3 | 15.11 | 106.99 |
| Atenolol + Hydrochlorothiazide + | 1 | (50 + 25 + 2.5) | 3 | 11.68 | 14.25 | 22.00 |
| Atenolol + Indapamide | 2 | (50 + 2.5) | 4 | 29.71 | 46.7 | 57.19 |
| | | (50 + 1.25) | 2 | 30 | 49 | 63.33 |
| Atenolol + Chlorthalidone | 3 | (100 + 25) | 2 | 70 | 72 | 2.86 |
| | | (50 + 12.5) | 3 | 28 | 45.5 | 62.5 |
| | | (25 + 12.5) | 2 | 23.55 | 25.25 | 7.22 |
| Atenolol + Nifedipine | 2 | (50 + 20) | 3 | 20 | 39.5 | 97.5 |
| | | (50 + 20 SR) | 8 | 18.05 | 65.97 | 265.48 |
| Atenolol + Amlodipine | 3 | (50 + 5) | 131 | 10.3 | 79.7 | 673.79 |
| | | (50 + 2.5) | 3 | 20 | 37.5 | 87.5 |
| | | (25 + 5) | 11 | 11 | 40.33 | 266.64 |
| Atenolol + Amlodipine besylate | 1 | (50 + 5) | 17 | 18 | 39.31 | 118.39 |
| Bisoprolol + Hydrochlorothiazide | 3 | (5 + 12.5) | 2 | 63.25 | 84.5 | 33.60 |
| | | (5 + 6.25) | 5 | 40 | 85 | 112.5 |
| | | (2.5 + 6.25) | 6 | 15 | 55 | 266.67 |
| Bisoprolol + Amlodipine | 2 | (5 + 5) | 3 | 69 | 83.5 | 21.01 |
| | | (5 + 2.5) | 3 | 42.45 | 66.5 | 56.65 |
| Metoprolol + Ramipril | 2 | (50 + 5) | 10 | 77.5 | 180 | 132.26 |
| | | (25 + 2.5) | 8 | 59.5 | 125 | 110.08 |
| Metoprolol + Telmisartan | 2 | (50 + 40) | 17 | 55 | 150.25 | 173.18 |
| | | (25 + 40) | 17 | 51 | 109 | 113.73 |
| Metoprolol + Olmesartan | 2 | (50 + 20) | 5 | 88 | 126.3 | 43.52 |
| | | (25 + 20) | 4 | 75 | 113.5 | 51.33 |
| Metoprolol + Hydrochlorothiazide | 3 | (100 + 12.5) | 2 | 27.15 | 29.71 | 9.43 |
| | | (50 + 12.5) | 9 | 22.7 | 103.55 | 356.17 |
| | | (25 + 12.5) | 11 | 35 | 53.5 | 52.86 |
| Metoprolol Succinate + Amlodipine | 3 | (50 + 5) | 17 | 53 | 95 | 79.25 |
| | | (25 + 5) | 5 | 40.78 | 86.3 | 112.11 |
| | | (25 + 2.5) | 4 | 29 | 55.5 | 91.38 |
| Metoprolol Tartrate + Amlodipine | 3 | (50 + 5) | 19 | 38 | 138.57 | 264.66 |
| | | (25 + 5) | 12 | 30 | 94 | 213.33 |
| | | (25 + 2.5) | 7 | 40 | 92.85 | 132.13 |
| Metoprolol + Cilnidipine | 1 | (50 + 10) | 3 | 79 | 90 | 13.92 |
| Nebivolol + Hydrochlorothiazide | 1 | (5 + 12.5) | 14 | 57 | 133 | 133.33 |
| Nebivolol + Amlodipine | 1 | (5 + 5) | 6 | 63.15 | 97.4 | 54.24 |
| Nebivolol + S - Amlodipine | 1 | (5 + 2.5) | 10 | 65 | 118 | 81.54 |

Volume : 5 | Issue : 10 | October 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

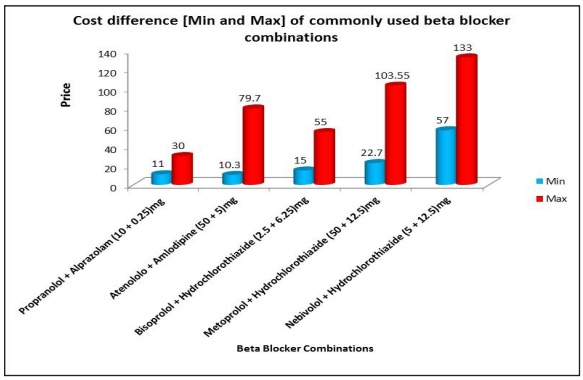


**Fig 3: Cost difference [Min and Max] of commonly used Beta blockercombinations.**

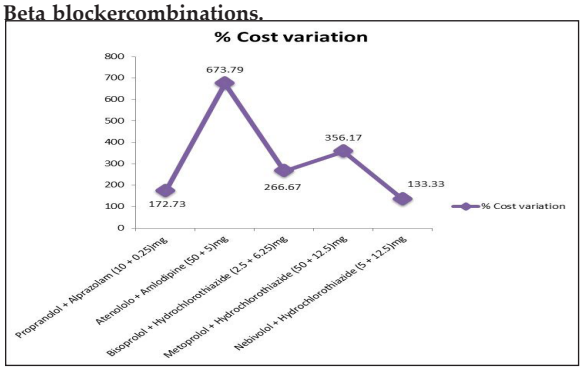


**Fig 4: Percentage cost variation of commonly used Beta blocker combinations.**

**DISCUSSION:**

Our study findings showed a very high fluctuation in the minimum and maximum price of Beta blockers (Fig. 1&3) which is being manufactured by several companies across the different brands. The percentage variation in the cost was above 100% with most of the commonly used Beta blockers (Fig. 2) and also with combination of Beta blockers with other drugs (Fig. 4). Other similar studies on oral antidiabetic drugs, antidepressants, antibiotics, anti-epileptics also found similar results[11-14].

India faces the challenge of providing affordable and quality medicine to its own population in spite of the fact that we export medicines to various countries at low cost. Though more than one lac formulation of medicine flooding the Indian market; there is no solid system for medicine registration in our country. Verities of strength of a particular drug and different combinations are manufactured by more than one companies and sold under different brand names apart from the invertor company. This situation led to huge price variation among the drug marketed [15]. To make the scenario worst it creates dilemma among the prescribers in terms of which brand to prescribe. Physician gets the information through the medical representatives about the different brands. Companies are offering a lucrative offer to the physician to promote a particular brand[16]. Wide variations in price of different formulations have severe economic implication. Most of the patients in our country are not covered by quality health insurance and they have to buy the health care service including the medicine out-of-pocket. More than 80% of health finance is born by patients themselves [15]. In present situation patients unnecessarily pay more if costly brands are prescribed by the physician, as costlier same generic drug is no way superior to its economically cheaper counterpart in terms of clinical outcome or recovery [17].

Many poor families frequently face choice between buying medicine and buying food. In such situation price of the drug do matter. Situation gets grimmer as most of the Indian physicians are not aware of the cost difference of same drug of different brands. Physician could serve the health economy better if price list of different formulation of same drug under different brand names are readily available to them. Rational prescribing involves selection of a cost effective treatment and studies established that providing a manual of comparative drug prices annotated with prescribing advice to physicians reduced their patient's drug expense [18]. Often pharmacists do not dispense the same brand as prescribed by the doctor and try to substitute it-with other alternatives, quoting the reason of non-availability. This is often done with vested interest for economic gains as some brands have a higher profit margin[19].

In cardiology practice where most of the diseases follow a chronic course and need long term treatment to sustain a quality life, appropriate knowledge of price variation of different drugs used in day to day practice would be very helpful for patients and their families.

There is urgent need of a concreate action from regulatory authorities, care givers and general public at large to address the issue of price variation in Indian pharmaceutical market. Government of India issues Drug price control order (DPCO) in order to fix price of drugs. Once a drug is under DPCO it cannot be sold at price higher than fixed by the Government. We found that only 3beta blockers in our study i.e. - atenolol (50mg/100mg), metoprolol (25mg /50mg/inj 1mg/ml), and propranolol (10mg/40mg) were included in the DPCO list 2015[20]. Among the combinations Metoprolol +Amlodipine (25 + 5) mg and Atenolol + Amlodipine (50 + 5) mg, were on the list. We have checked latest list till 15th September 2016 online [21]. We found in our study, price variation with above drugs eventhough the price is less than the ceiling price quoted by DPCO. Strict vigilance from regulatory authorities is needed in this matter and at the same time drugs like bisoprolol, carvedilol and nebivolol should also come under the DPCO list.

A great initiative from Government of India is undergoing where opening of generic drug stores in some parts of India where generic medicinesmanufactured by public sector companies are sold[22].More and more generic medicine shop are needed but at the same the quality of generic medicines available in these stores at cheaper rates should be tested and compared with popular branded drugs and results should be widely published. Studies involving comparative evaluation on quality of branded and their generic counterpart may be made mandatory for the generic manufacturer and their reports should be made public to promote generic use and prescription.

**CONCLUSION:**

Our study findings show a wide variation in the prices of different brands of commonly used beta blockers in cardiology practice in Indian Market (Table 1 and 2).There is a strong need to create awareness about this huge price variation among the general public, health care providers, health care payers, government agencies, policy makers, pharmacists for appropriate intervention to reduce economic burden on patients as well as to the healthcare system. Results of our study make the prescriber informed about various brands and their price variations. So the prescriber can chose the cost effective beta blocker for a patient to achieve rational prescribing.

**Financial Support and Sponsorship: Nil.**
**Conflicts of Interest:** There are no conflicts of interest.

**Ethical committee approval:** Not Required.

**ACKNOWLEDGEMENT:** None

## REFERENCES

1. Black JW, Crowther AF, Shanks RG, Smith LH, Dornhorst AC (1964). "A new adrenergic betareceptor antagonist".The Lancet. 283 (7342): 1080–1081.
2. van der Vring JA, Daniëls MC, Holwerda NJ, Withagen PJ, Schelling A, Cleophas TJ, Hendriks MG (June 1999). "Combination of calcium channel blockers and beta blockers for patients with exercise-induced angina pectoris: a double-blind parallel-group comparison of different classes of calcium channel blockers. The Netherlands Working Group on Cardiovascular Research (WCN)".Angiology. 50 (6): 447–54.
3. Stapleton MP (1997). "Sir James Black and propranolol.The role of the basic sciences in the history of cardiovascular pharmacology".Texas Heart Institute Journal. 24 (4): 336–42.
4. Tore Frängsmyr (1989). "Sir James W. Black: The Nobel Prize in Physiology or Medicine". Les Prix Nobel. Nobel Foundation.Retrieved 25 August 2007.
5. https://en.wikipedia.org/wiki/Beta_blocker DOA: 24/09/2016
6. http://www.pharmacy-tech-test.com/top-200-drugs-to-memorize.html DOA: 24/09/2016
7. Current Index of Medical Specialties, July – October 2016:88-128.
8. Monthly Index of Medical Specialties, September 2016, Volume 45, No. 7:61-84.
9. Indian Drug Review 2016, Issue 3, Pg: 31- 47.
10. Drugs Monitor, 2016, Volume 2, Issue 2, Pg 199 – 235.
11. Reddy PS. Drug - Cost analysis title : a calm look on cost analysis of different brands of anti-epileptic drugs 2011;16(March):64–6.
12. Paunikar AP, Bhave KA. Cost analysis of oral antidepressant drugs available in India. Natl J Physiol Pharm Pharmacol. 2015; 5(5): 367-371.
13. Zubin S, Apurva D, Vishali L. Pharmacoeconomic study of various brands of antibiotic medication in india. World Journal of Pharmaceutical Research. 2015; 4(3):1600–6.
14. Lalan HN, Borde MK, Ray IM. Cost Variation Study of Antidiabetics : Indian Scenario 2014 ;( May):2013–4.
15. Kamath L and Satish GR: Cost Variation Analysis of Antihypertensive Drugs Available in Indian Market: An Economic Perspective. Int J Pharm Sci Res 2016; 7(5): 2050-56.
16. Francis P A. Code for pharma marketing. Available at: http://www.pharmabiz.com/ArticleDetails.aspx?aid=85907&sid=3 DOA: 25/09/2016
17. Das SC, Mandal M, Mandal SC. A critical study on availability and price variation between different brands: Impact on access to medicines. Indian J Pharm Sci 2007; 69(1): 160-3.
18. Steven Reichert, Todd Simon, Ethan A. Halm. Physicians' Attitudes about Prescribing and Knowledge of the Costs of Common Medications. Arch Intern Med 2000; 160:27992803.
19. Jadhav NB, Bhosale MS, Adhav CV. COST ANALYSIS STUDY OF ORAL ANTIDIABETIC DRUGS AVAILABLE IN INDIAN MARKET. IJMRHS. 2013; 2(1): 63-69.
20. Compendium of notified ceiling prices of scheduled drugs – 2015 NPPA. Available from - http://www.nppaindia.nic.in/ceiling price. DOA: 25/09/2016
21. DPCO LIST- Rishab Healthcare.Avaiable from - http://rishabhealthcare.com/dpco-list-rishab-healthcare DOA: 25/09/2016
22. Kotwani A. Will generic drug stores improve access to essential medicines for the poor in India? J Public Health Policy 2010; 1:178-84.