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Original Research Article

Cost variation analysis of oral anti-diabetic drugs

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ABSTRACT

Background: Diabetes Mellitus is a chronic metabolic disorder, one of the major causes of morbidity, mortality and needs lifelong treatment. There are large numbers of oral anti-diabetic drugs available for the treatment of type 2 diabetes mellitus. There are numerous brands available for each of the individual oral anti-diabetic drug. Thus, a study was planned to find out cost variation among different brands of same active oral anti-diabetic drug.

Methods: Cost of a particular drug being manufactured by different companies, in the same strength and dosage forms was obtained from the price list provided by the pharmaceutical companies in Current Index of Medical Specialities (CIMS) (October 2017- January 2018). The difference in the maximum and minimum price of the same drug manufactured by different pharmaceutical companies and percentage variation in price was analyzed.

Results: Percentage cost variation of the commonly used drugs found was seen highest with Sulfonylureas (Glimepiride - 562%) followed by Metformin (492%) which was followed by Pioglitazone (488%), DPP-4 inhibitor Teneligliptin (231%), α- glucosidase inhibitors (Voglibose 284%), Meglitinides (Repaglinide 0.5mg 154%) and lowest was seen with Repaglinide 2mg (15%).

Conclusions: There is very wide cost variation among different brands of the same oral anti-diabetic drugs manufactured in India. The average percentage cost variation of different brands of the same oral anti diabetic drugs manufactured in India is very wide. The appraisal and management of marketing drugs should be directed toward maximizing the benefits of therapy and minimizing negative personal and economic consequences.

Keywords: Brands, Cost variation, Cost ratio, Oral anti-diabetic drugs, Pharmacoeconomics

INTRODUCTION

Diabetes Mellitus is a chronic metabolic disorder, one of the major causes of morbidity, mortality and needs lifelong treatment.[1]

Diabetes mellitus is reaching possibly epidemic proportions in India. India had 69.2 million people living with diabetes (8.7%) as per the 2015 data-an increase of over 10 million from 2011 when estimates suggested that about 50.8 million people in the country were suffering from the disease.[2] By the year 2030, over 100 million people in India are likely to suffer from diabetes.[3] The level of morbidity and mortality due to diabetes and its potential problems are enormous, and pose significant healthcare burdens on both families and society.[4] Diabetes is now being shown to be associated with a spectrum of problems and to be occurring at a relatively younger age within the country.[5-7]

For type 2 diabetes mellitus, lifelong treatment is required. In case of absence of appropriate treatment, it can lead to microvascular and macrovascular complications. These can affect the longetivity of life as well as the quality of life.[8] For successful treatment, appropriate drug regime with regular follow up and the proper compliance to the

treatment play an important role. For the treatment of a condition which requires lifelong treatment, various factors can affect the compliance.

Drug cost can play an important role in long term compliance to the treatment. In India, where majority of the population is not covered by any insurance, the cost of treatment expenses is mainly out of pocket. Significant fraction of population is dragged below the poverty line every year due to these out of pocket expenses for the treatment.

It is a chronic disorder which needs lifelong treatment. Cost association is very large with treatment of diabetes. Type 1 diabetes mellitus is to be treated with insulin whereas in Type 2 diabetes, oral anti diabetic dugs are used. Drug should be selected on the basis of its efficacy, major side effects and also on patients' clinical characteristics like body mass index (BMI), presence of other disease, financial background/ socioeconomic status.

There are over 20,000 drug formulations are available in Indian market with different brand names.[9] Sometimes it is difficult for physician to select appropriate drug because of unavailability of information on comparative drug prices.

Indian pharmaceuticals market is the third largest market in terms of volume and thirteenth largest market in terms of value. Indian pharmaceuticals market is dominated by branded generics which constitutes about 70 to 80 percent of the market.[10] India being the largest provider of generic drugs globally accounts for 20 percent of global exports in terms of volume.

In India, health insurance schemes are significantly underutilized and majority of the health care costs are afforded by the patients.[11] India is one of those countries who have highest out of pocket (OOP) expenses on health care. About 65% of Indian population do not have access to essential medicines.[12]

This study was aimed at comparing and analyzing the costs of various brands of the same generic oral anti diabetic drugs, so that authors can study their cost variations. Awareness of the cost variations among oral anti diabetic drugs can be applied to ensure more economical treatment regimen to improve the treatment adherence and the rate of success of therapy.

METHODS

In this study, authors analyzed anti diabetic drugs and tablet formulations. Current Index of Medical Specialities (CIMS) (October 2017- January 2018) was used to analyze the prices of oral anti diabetic drugs. The cost of a particular oral anti diabetic drug in the same dose and dosage forms being manufactured by different companies was compared.

The cost of drugs in Indian rupee (INR) for 10 tablets was calculated for each brand. The difference between the maximum and minimum costs of the same drug manufactured by different pharmaceutical companies was calculated. The percentage cost variation and cost ratio were then calculated for each individual drug strength formulation. The percentage variation in the cost of the drugs was calculated using the following formula:[13]

$$\text{Percentage cost variation} = \frac{\text{Price of most expensive brand} - \text{Price of least expensive brand}}{\text{Price of least expensive brand}} \times 100$$

Cost ratio is calculated by the ratio of most expensive brand to least expensive brand of the same drug.[12] It helps to know how many times the most expensive formulation is costlier than the least expensive formulation of the same drug. Exclusion criteria: The drugs manufactured by only one company; drugs with no cost information were excluded. Fixed dose combinations containing more than two anti diabetic agents were also excluded.

Statistical analysis

The data collected was entered in Microsoft Excel 2007. Cost ratio and percentage cost variation were calculated. The data represented in the form of tables and charts.

RESULTS

In this study we analyzed cost of various brands of 11 individual and eight fixed dose combinations of oral anti-diabetic drugs. Percentage cost variation is higher with drugs have more no. of brands.

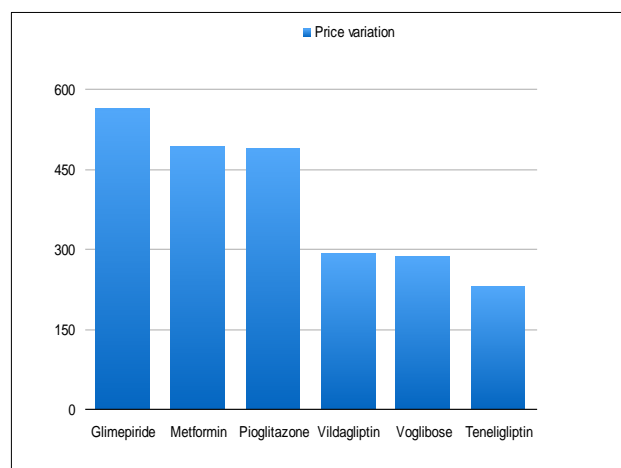### *Six categories of individual oral anti-diabetic drugs*

Figure 1: Cost variation among different oral anti-diabetic drugs.

Overall, among the six categories of oral anti-diabetic drugs available in the Indian market, the maximum price variation was seen highest with sulfonylureas

(Glimepiride- 562%) followed by Metformin (492%) which was followed by Pioglitazone (488%), DPP-4 inhibitor Tenegliptin (231%), α- glucosidase inhibitors (Voglibose 284%), meglitinides (Repaglinide 0.5mg 154%) and lowest was seen with Repaglinide 2mg (15%) (Figure 1).

The price variation between sulfonylureas was shown in Table 1. In this group, Glimepiride (2mg) showed maximum price variation of 562%, while Glipizide (2.5mg) showed minimum price variation of 81%. The cost ratio ranged from 1.81 for Glipizide 2.5mg to 4.38 for Glimepiride 2mg.

Table 1: Cost variation among Sulfonylureas.

Drug	Formulation	Strength in mg	Least expensive price (INR)	Most expensive price (INR)	Cost ratio	Cost variation (%)	No. of brands
Glibenclamide	Tab	2.5	2.82	6	2.13	113	3
	Tab	5	16	37	2.7	170.2	4
Gliclazide	Tab	40	15	38	2.53	153	9
	Tab	80	30	60	2	100	12
	SR	30	31	69	2.22	122	06
	SR	60	52	120	2.3	130	07
Glimepiride	Tab	1	8	53	3.73	562	48
	Tab	2	24	124	4.13	416	48
	Tab	4	30.5	133.7	4.38	338	12
Glipizide	Tab	2.5	2.75	5	1.81	81	02
	Tab	5	4.36	12	2.75	175	06
	Tab	10	10.36	22	2.12	112	02

Table 2: Cost variation among Biguanides, Thiazolidinediones and DPP-4 inhibitors.

Drug	Formulation	Strength in mg	Least expensive price (INR)	Most expensive price (INR)	Cost ratio	Cost variation (%)	No. of Brands
Metformin	Tab	500	6	35.5	5.92	492	36
	SR	500	9.9	22.15	2.23	124	20
	SR	1000	18.9	38	2.01	101	13
Pioglitazone	Tab	15	11.9	70	5.8	488	14
	Tab	30	21.9	112	4.1	411	14
Tenegliptin	Tab	20	60	199	3.31	231	09

Table 3: Cost variation among meglitinides.

Drug	Formulation	Strength in mg	Least expensive price (INR)	Most expensive price (INR)	Cost ratio	Cost variation (%)	No. of brands
Voglibose	Tab	0.2	19.5	75	3.8	284	31
	Tab	0.3	29.5	110	3.7	272	29
Acarbose	Tab	25	42	67.2	1.59	60	5
	Tab	50	75	117	1.56	56	6

Table 2 shows price variation in Biguanides (Metformin), Thiazolidinediones (Pioglitazone) and Dipeptidyl peptidase - 4 inhibitors (Tenegliptin) groups of drugs. Among these, Metformin (500 mg) and Pioglitazone (15mg) showed maximum price variation of 492% and 488% respectively. The cost ratio of Metformin ranged from 2.01 for 1000mg to 5.92 for 500mg. The cost ratio for the most expensive 1000mg and least expensive 500mg tab was 6.3. The cost ratio of Pioglitazone ranged from 4.1 for 30mg to 5.8 for 15mg.

Among Meglitinide group, Repaglinide (0.5 mg) showed maximum price variation of 154 % whereas Repaglinide 2 mg showed minimum price variation of 15%. (Table 3). The cost ratio ranged from 1.15for Repaglinide 2mg to 2.54 for 0.5mg. The cost ratio for the most expensive Repaglinide 2mg and least expensive Repaglinide 0.5mg was 4.09.

Among the α- glucosidase inhibitors Voglibose 0.2mg showed maximum price variation of 284% and Acarbose 50mg showed minimum price variation of 56% (Table 4).

The cost ratio ranged from 1.56 for Acarbose 50mg to 3.8 for Voglibose 0.2mg. The cost ratio for the most expensive

Acarbose 50mg and least expensive Voglibose 0.2mg was 6.

Table 4: Cost variation among α- glucosidase inhibitors.

Drug	Formulation	Strength in mg	Least expensive price (INR)	Most expensive price (INR)	Cost ratio	Cost variation (%)	No. of brands
Voglibose	Tab	0.2	19.5	75	3.8	284	31
	Tab	0.3	29.5	110	3.7	272	29
Acarbose	Tab	25	42	67.2	1.59	60	5
	Tab	50	75	117	1.56	56	6

Table 5: Cost variation among fixed dose combinations.

Drug	Formulation	Strength in mg	Least expensive price (INR)	Most expensive price (INR)	Cost ratio	Cost variation (%)
Glibenclamide+ Metformin	Tab	5 + 500	12	30	2.5	150
Gliclazide +Metformin	Tab	30 + 500	26.9	80	2.97	197.3
	SR	60 + 500	44.1	129	2.92	192.5
	SR	80 + 500	35	89	2.54	154.2
Glimepiride +Metformin	Tab	1 + 500	18	60	3.33	233
		2 + 500	30	71	2.36	136
		2 + 1000	45	90.75	2.01	101
	SR	1 + 500	27	98.5	3.64	264
	SR	2 + 500	41	134	3.26	226
Glipizide + Metformin	Tab	2.5 + 500	3.35	8.9	2.65	165
	Tab	5 + 500	6.72	14	2.08	108
Pioglitazone + Metformin	Tab	15 + 500	35	77	2.2	120
		30 + 500	48.5	69.55	1.43	43.4
	SR	15 + 500	20.9	45.95	2.2	120
	SR	30 + 500	31.9	69.3	2.17	117
Pioglitazone + Glimepiride		15+1	20	70	3.5	250
		15+2	30	120	4	300
Voglibose + Metformin	Tab	0.2+500	35	83	2.37	137
	Tab	0.3+500	45	323	7.17	617
Vildagliptin + Metformin	Tab	50+500	198	270	1.36	36

In Fixed dose combinations, total 8 combination preparations were analyzed. In this, Glimepiride + Metformin (1mg + 500mg) combination showed the maximum variation of 346%, while Vildagliptin + Metformin (50mg + 500mg) showed minimum variation of 2.33% (Table 5).

DISCUSSION

Diabetes is a complex, chronic illness requiring long duration and expensive treatment. This affects not only patient's quality of life but also imposes huge economic burden to both the family and society. It was evident from literature that rise in burden of diabetes can be due to high price variation among different brands of same drug.[13-15]

The compliance of patient also is significantly dependent on the cost of the prescribed medicines and higher cost means the compliance will be less.[16] Selection of cost effective brand will improve the compliance and the consequence of the treatment.

There is a wide variation in the pricing of oral anti diabetic agents. In this study Glimepiride 2mg (562%) showed the highest price variation followed by Metformin 500mg (492%) among all oral anti diabetic agents.

The National pharmaceutical pricing authority (NPPA), of Government of India controls drug prices in Indian market. It fixes the ceiling price of a drug based on essentiality of a drug and the pharmaceutical companies fix the price for

their products equal to or below the ceiling price for that formulation; however, they cannot sell any medicine given in the drugs prices control order (DPCO) list at a cost higher than that fixed under this order.[17]

The DPCO, 2017 list of price-controlled drugs includes only Glimepiride and Metformin. The cheapest Glimepiride 1mg in India is for INR 8 per 10 tablets and the costliest for INR 53 per 10 tablets. Thus, a patient on the cheapest Glimepiride 1mg would be saving INR 45. Among oral anti diabetic drugs, only 2 drugs out of the total 11 drugs i.e. Gliclazide (30/60/80 mg) and Metformin 500mg were included in the WHO model list of essential Medicines.[18] while other newer and more effective drugs were not included in the list. There is a huge price variation of 492% with Metformin 500mg even though it is mentioned in WHO model list and DPCO.

Glimepiride (1mg) and Metformin (500mg) is the most commonly used fixed dose combination. This also showed high price variation 233% and high cost ratio of 3.33. This is unlike the findings of Jadhav et al who reported glipizide 2.5mg+metformin 400mg to have maximum price variation of 400%.[13]

It is high time that a greater number of oral anti-diabetic agents to be covered under DPCO. In case of noncompliance to DPCO, more stringent actions must be ensured. Physicians should thus prescribe the low-cost drugs and should not be influenced by pharmaceutical industries. Even though government of India has insisted on prescribing drugs by their generic name there has been indifference among prescribing physicians towards the same. Among oral anti-diabetic drugs, only 2 drugs out of the total 11 drugs i.e. Gliclazide (30/60/80mg) and Metformin 500mg were included in the WHO model list of essential Medicines.[18] Government order for prescribing drugs by their generic name dose not ensure that brand with lower cost will be dispensed by the pharmacist. There is a general belief among the common people including a fraction of prescribing physicians that costlier branded drugs are superior then their generic equivalents. The costly brand of same generic drug is scientifically proved to be in no way superior to its economically cheaper counterpart.[16] It is the need of the hour that the government has to take appropriate actions to regulate the prices which can be affordable by a common man. Undergraduate and postgraduate medical education curriculum must include pharmacoeconomics to ensure provision of better and economical health related services.

Provision of readily available drug manual with comparative drug prices can ensure the doctor's awareness about the cost variations among same generic medications. This can play an important role in decreasing patient's drug expense. Decreased drug cost is an important factor for improved adherence to the medication regimen.[13] It has been found that there is wide cost variation among different brands of the same generic anti-diabetic drugs in Indian market.

CONCLUSION

There is wide price variation of different brands of the same generic anti-diabetic drug in Indian market. Cost of a drug plays an important role in treatment of diabetes as it follows a long course and adherence to the treatment is related with drug cost. To decrease the wide cost variation among different brands of anti-diabetic drugs; it is high time to generate physician awareness about impact of cost effectiveness of drug regimen and for regulation of drug prices by the concerned agencies.

REFERENCES

1. Shrivastava SR, Shrivastava PS, Ramasamy J. Role of self-care in management of diabetes mellitus. J of Diab Metabol Disorde. 2013 Dec;12(1):14.
2. Kaveeshwar SA, Cornwall J. The current state of diabetes mellitus in India. The Australasian Med J. 2014;7(1):45.
3. International Diabetes federation. Diabetes atlas. 6th Edition. Available at: www.idf.org/diabetesatlas
4. Misra A, Khurana L. Obesity-related non-communicable diseases: South Asians vs White Caucasians. Int J Obes (Lond). 2011;35(2):167-87.
5. Mohan V, Shah S, Saboo B. Current glycemic status and diabetes related complications among type 2 diabetes patients in India: data from the A1chieve study. JAPI (Suppl). 2013;61:12-5.
6. Mohan V, Seshiah V, Sahay BK, Shah SN, Rao PV Banerjee S. Current status of management of diabetes and glycaemic control in India: Preliminary results from the DiabCare India 2011 Study. Diabetes. 2012;61:a645-a677.
7. Anjana RM, Ali MK, Pradeepa R, Deepa M, Datta M, Unnikrishnan R, Rema M, Mohan V. The need for obtaining accurate nationwide estimates of diabetes prevalence in India - rationale for a national study on diabetes. Indian J Med Res. 2011;133:369-80.
8. Sakthivel S. Access to essential drugs and medicines. In: Commission on Macroeconomics and Health. Financing and delivery of health care services in India. New Delhi: Ministry of Health & Family Welfare, Government of India; 2005:185-210.
9. Shukla AK, Mehani R. Cost analysis of antiepileptic drugs available in India. Int J Basic Clin Pharmacol. 2016;5:1636-40.
10. Shukla AK, Sharma P. Cost variation study of antidepressant drugs. Int J Basic Clin Pharmacol. 2016;5:1816-21.
11. Singh A, Kumar H. Cost analysis study of second generation antihistamines used in the treatment of allergic rhinitis in India. Int J Basic Clin Pharmacol. 2016;5(4):1228-33.

12. Jadhav NB, Bhosale MS, Adhav CV. Cost analysis of study of oral antidiabetic drugs available in Indian market. Int J Med Res Health Sci. 2013;2(!):63-9.
13. Standards of Medical Care in Diabetes. American Diabetes Association Diabetes Care. 2014 Jan;37(1):S14-S80.
14. Lalan HN, Borde MK, Ray IM, Deshmukh YA. Cost Variation Study of Antidiabetics: Indian Scenario. Indian J Appl Res. 2014;4(5):420-1.
15. Rao KS, Nundy M, Dua AS. National commission on macroeconomics and health. financing and delivery of health care services in India. New Delhi: Ministry of Health and Family Welfare, Government of India, Delivery of Health Services in the Private Sector. 2005;89-104.
16. Morgan SG, Lee A. Cost-related non-adherence to prescribed medicines among older adults: a cross-sectional analysis of a survey in 11 developed countries BMJ Open. 2017;7:e014287.
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.