Research Article

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EVALUATION OF PHARMACOECONOMICS AND PRESCRIPTION TRENDS OF ANTIHYPERTENSIVE MEDICATIONS AT VARIOUS CLINICAL SETTINGS OF HYDERABAD, PAKISTAN

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ABSTRACT

Pharmacoeconomics is the branch of health-economics where cost and outcomes are compared for patient's treatment therapies and services in a health care system. Hypertension is one of the most common serious medical conditions in Pakistan and throughout the world. A large number of antihypertensive medications alone or in combinations are being prescribed. Pharmaco-economic studies are helpful in prescribing the most appropriate medication with required outcomes at minimum cost. Objective of study was to assess the prescription trends and cost-effectiveness among different classes of antihypertensive medications prescribed at different clinical setups of Hyderabad, Pakistan. A Prospective observational study was carried out at cardiac OPD of Liaquat University Hospital, Hyderabad from April 2018 to April 2019. According to inclusion and exclusion criteria, 400 prescriptions containing antihypertensive Drugs were collected via purposive sampling technique for pharmacoeconomic analysis during the study period. In Government setting, Monotherapy (83%) was more frequent than combination therapy (17%). The most frequent and the most cost-effective monotherapy was Enalapril maleate 5 mg having cost/day 4 Rs. In combination therapies, Lisinopril 20 mg + HTZ 12.5 mg was the most frequent. Spironolactone 50 mg + furosemide 40 mg was found to be the most cost-effective combination with cost/day 5 Rs. In private settings, the trends of antihypertensive monotherapy (75.5%) were more frequent than combination therapy (24.5%). The most frequent monotherapy was Telmisartan 40 mg while the most frequent antihypertensive combination was Amlodipine besylat 10 mg + Valsartan 160 mg. Metoprolol tartarate 100 mg and lisinopril 5 mg were cost-effective monotherapies with cost/day 5 Rs each and the combination of candesartancelexetil 16 mg + HTZ 12.5 mg was the most cost-effective. It is concluded from the current study that the prescription trends of antihypertensive medications were relatively cost-effective at Government setting but overall, the antihypertensive treatment cost was high which puts a substantial economic burden on patients.

Keywords: Hypertension, Antihypertensive medications, Pharmacoeconomics, cost-effective.

INTRODUCTION

Pharmacoeconomics has been defined as specialized sub-discipline of health economics which involves the analysis, description and comparison of costs and outcomes of pharmaceutical products and services to the society and the health care system[1]. It involves the use of methods of economic evaluation[2]. It is an important and valuable tool for therapeutic decision-making processes and development of formulary[3]. Basically, the primary goal of Pharmacoeconomics is to allocate the pharmaceutical resources and services with an aim of decreasing expenditures and optimizing the outcomes[4]. It also struggles for bringing about optimization in the utilization of health care resources with a focus on increasing efficacy at a low cost without decreasing the quality[5]. It helps in reducing economic burden on the society by lowering the cost of drug therapies and services[6]. It can be applied for assessing the cost values of new drug treatments, therapies and drugs and comparing them with their existing alternatives[7]. It has become integral part of pharmaceutical companies, different privates and Government due to high costs of drugs[8]. The cost of medications continues to increase over a period of time which makes it unaffordable for the people as majority of population is below the poverty line[9]. There are four methods of Pharmacoeconomics analysis. Cost-effectiveness analysis (CEA) is the most frequently used economic method for medicines. A comparison is made between costs of the treatments with associated patient outcomes where costs are measured in monetary units[10]. It gives information about cost-effective medications and their alternatives which are least in costs but high in efficacy[11]. Cost minimization analysis (CMA) compares the treatment cost between two different alternatives, which are equivalent[12]. It is helpful in assuring the least expensive medication[13]. Cost Utilization analysis (CUA) method is used for comparing the consequences of different treatment procedures by using those units which are related with the well-being of a person[14]. Cost Benefit analysis (CBA) is a connection between benefits and cost to the patient, which assess the expenditure and benefits gain[15]. High blood pressure commonly known as hypertension is chronic disease resulting into various cardiovascular complications particularly stroke, Ischemic heart disease, congestive heart failure, peripheral arterial disease and aortic aneurysm[16]. It causes a substantial economic burden on society and health care system due to its chronicity[17]. The prevalence of hypertension is increasing, and the cost of antihypertensive medications is also increasing therefore there is always a need of cost- effective medications for effective management of this disease[18]. According to the literature, 18.9% patients suffers from hypertension globally but, published data on prevalence of the disease is not available in developing country like Pakistan, which can estimate the national hypertensive survey of patients with age group of 15 years and above[19]. The pharmacoeconomic analysis of antihypertensive medications can be carried out for understanding economic burden of hypertension as it is found to be the most expensive disease[20].

Methodology

The prospective, observational and non-interventional study carried out at OPD of Liaquat University Hospital, Hyderabad and different private clinics of Hyderabad for the duration period of about 01 year (April 2018 – April 2019). The approval was taken from the M.S of the Liaquat University Hospital, Hyderabad. Prescriptions containing with prescribed antihypertensive drugs were included for study regardless of any age and gender difference. On the basis of inclusion and exclusion criteria, sample of 400 prescriptions (200 each) was collected by purposive sampling technique from cardiac outpatient department of Government hospital (Liaquat University Hospital) and different private clinics of Hyderabad. In pharmacoeconomic, cost-effective analysis was performed. The cost of medications was calculated and confirmed. The treatment outcomes were recorded by obtained ranges of blood pressure i.e. systolic and diastolic blood pressure, later on the recorded ranges were compared with guidelines of hypertension JNC-8. The analysis of data was done by SPSS version 21.0.

RESULTS

Out of total 400 sample prescriptions, 200 prescriptions were collected from Government hospital and 200 prescriptions were collected from private clinics (Table 1). Demographic information obtained from collected data showed that in Government setting, 140 (35%) were males and 60 (15%) were females and in private settings, 64 (16%) were males and 136 (34%) were females (Table 2).

Table 1: Distribution of sample between Government and Private Settings (n = 400)

S. No.	Clinical settings	Frequency (n = 400)	Percentage (100%)
1	Government hospital	200	50%
2	Private clinics	200	50%

Table 2: Gender distribution between Government and Private Settings (n = 400)

S. No.	Gender	Clinical settings	Frequency (n = 400)	Percentage (100%)
1	Male	Government Hospital	140	35
2	Female	Government hospital	60	15
Private settings				
3	Male	Private clinics	64	16
4	Female	Private clinics	136	34
5	Total		400	100

According to the findings of this study, among 200 prescriptions, 166 (83%) prescriptions were prescribed with monotherapy while 34 (17%) prescriptions were prescribed with combination therapies (Table 3).

Table 3: Prescription Status

S. No.	Therapy	Frequency (n = 200)	Percentage (100%)
1	Monotherapy	166	83
2	Combination therapy	34	17
3	Total	200	100

In monotherapy at Government hospital, total 13 medications were prescribed. Among these, Enalapril maleate 5 mg (24.09%) was the most frequently prescribed medication followed by carvidolol 6.25 mg (13.85%). Enalapril maleate 5 mg and Metoprolol tartarate 25 mg were least in cost (4 Rs cost/day) while carvidolol 6.25 mg was highest in cost (25 Rs cost/day) (Table 4).

Table 4: Prescription trends and cost/day of various medications prescribed as monotherapy (n = 166)

S. No.	Generic name	Frequency (n = 166)	Percentage (100%)	Cost/day (Rs)
1	Enalapril maleate 5 mg	40	24.09	2 x 2 = 4
2	Metoprolol 25 mg	5	3.01	2 x 2 = 4
3	Valsartan 40 mg	5	3.01	5
4	Lisinopril 5 mg	5	3.01	7
5	Nebivolol 2.5 mg	7	4.21	9
6	Bisoprolol fumarate 2.5 mg	19	11.44	9
7	Spironolactone 100 mg	6	3.61	10
8	Nebivolol 5 mg	12	7.22	11
9	Ramipril 2.5 mg	14	8.43	12
10	Ramipril 5 mg	10	6.02	14
11	Loasratn 50 mg	5	3.01	15
12	Bisoprolol 5 mg	15	9.03	17
13	Carvedilol 6.25 mg	23	13.85	5 x 5 = 25

Table 5 shows the most cost-effective monotherapy. The cost of Enalapril maleate 5 mg and Metoprolol tartarate 25 mg (4 Rs cost/day) was same but Enalapril maleate 5 mg was more cost-effective than Metoprolol tartarate 25 mg because former had more stable BP (120/80-130/90) which were mentioned in the prescriptions. Due to its high cost, carvidolol 6.25 mg was least cost effective although most of its prescriptions showed significant stability in BP.

Table 5: Cost effective monotherapy among various medications prescribed as monotherapy (n = 166)

S. No.	Generic name	Frequency (n = 166)	Cost/day (Rs)	Systolic/Diastolic ranges (mmHg)
1	Enalapril maleate 5 mg	40	2 x 2 = 4	120/80-130/90
2	Metoprolol 25 mg	5	2 x 2 = 4	120/80-155/90
3	Valsartan 40 mg	5	5	125/85-130/90
4	Lisinopril 5 mg	5	7	120/80-130/85
5	Nebivolol 2.5 mg	7	9	115/66-132/85
6	Bisoprolol fumarate 2.5 mg	19	9	115/60-134/94
7	Spironolactone 100 mg	6	10	121/83-135/90
8	Nebivolol 5 mg	12	11	125/85-159/101
9	Ramipril 2.5 mg	14	12	115/66-132/85
10	Ramipril 5 mg	10	14	125/80-155/96
11	Loasratn 50 mg	5	15	126/84-130/85
12	Bisoprolol 5 mg	15	17	120/74-152-81
13	Carvedilol 6.25 mg	23	5 x 5 = 25	111/75-148/95

In combination therapy at Government hospital, total 5 medications were prescribed. The most frequent combination therapy was Lisinopril 20 mg + HTZ 12.5 mg (29.41%) followed by Spironolactone 50 mg + furosemide 40 mg (20.58%). Amlodipine 5 mg + valsartan 160 mg was highest in cost (24 Rs) while Spironolactone 50 mg + furosemide 40 mg was least (5 Rs) (Table 6).

Table 6: Prescription trends of combination drugs and cost/day of various medications (n = 34)

S. No.	Combination drugs	Frequency (n = 34)	Percentage (100%)	Cost/day (Rs)
1	Spironolactone 50 mg + furosemide 40 mg	7	20.58	5
2	Lisinopril 20 mg + HTZ 12.5 mg	10	29.41	11
3	Losartan potassium 50 mg + HTZ 12.5 mg	6	17.64	16
4	Amlodipine 5 mg + valsartan 80 mg	6	17.64	17
5	Amlodipine 5 mg + valsartan 160 mg	5	14.70	24

The most cost-effective combination therapy was Spironolactone 50 mg + furosemide 40 mg having cost (5 Rs cost/day) and BP (111/75-139/80). Amlodipine 5 mg + valsartan 160 mg was the least cost-effective as it was costly (Table 7).

Table 7: Cost effective combination therapy among medications prescribed as combination therapy (n = 34)

S. No.	Generic name	Frequency (n = 34)	Cost/day (Rs)	Systolic/diastolic ranges
1	Spironolactone 50mg + furosemide 40mg	7	5	111/75-139/80
2	Lisinopril 20mg + HTZ 12.5mg	10	11	121/83-154/96
3	Losartan potassium 50mg + HTZ 12.5mg	6	16	120/85-135/80
4	Amlodipine 5mg + valsartan 80mg	6	17	146//79-149/79
5	Amlodipine 5mg + valsartan 160mg	5	24	168/96-188/116

Out of 200 prescriptions collected from different private clinics, 151 (75.5%) prescriptions were prescribed with monotherapy whereas 49 (24.5%) prescriptions were prescribed with combination therapies (Table 8).

Table 8: Prescription Status

S. No.	Therapy	Frequency (n = 200)	Percentage (100%)
1	Monotherapy	151	75.5
2	Combination therapy	49	24.5

Total 14 medications were prescribed as monotherapy in 151 prescriptions. Among these, telmisartan 40 mg (15.23%) followed by nebivolol 5 mg (13.24%). The cost of Metoprolol tartarate 100 mg and lisinopril 5 mg (5 Rs) was lowest while the cost of ramipril 10 mg (28 Rs) was highest (Table 9).

Table 9: Prescription trends and cost/day of various medications prescribed as monotherapy (151)

S. No.	Generic name	Frequency (n = 151)	Percentage (100%)	Cost/day (Rs)
1	Metoprolol tartarate 100 mg	6	3.97	5
2	Lisinopril 5 mg	8	5.29	5
3	Atenolol 50 mg	10	6.62	6
4	Amlodipine besylate 10 mg	15	9.93	6
5	Nebivolol 2.5 mg	12	7.94	7
6	Valsartan 80 mg	6	3.97	8
7	Bisoprolol fumarate 5 mg	8	5.29	9
8	Telmisartan 20 mg	8	5.29	10
9	Nebivolol 5 mg	20	13.24	11
10	Ramipril 2.5 mg	10	6.62	12
11	Telmisartan 40 mg	23	15.23	15
12	Perindopril 4 mg	6	3.97	15

13	Nebivolol 10 mg	10	6.62	21
14	Ramipril 10 mg	9	5.96	28

Table 10 shows the cost-effective monotherapy. The most cost-effective monotherapy was lisinopril 5 mg with a marked stability in BP (125/85-130/80) and lowest cost (5 Rs cost /day). Ramipril 10 mg was the least cost-effective as it was the most expensive medication among all.

Table 10: Cost effective monotherapy among various medications prescribed as monotherapy (151)

S. No.	Generic name	Frequency (151)	Cost/day (Rs)	Systolic/diastolic ranges (mmHg)
1	Metoprolol tartarate 100 mg	6	5	120/80-140/90
2	Lisinopril 5 mg	8	5	125/85-130/80
3	Atenolol 50 mg	10	6	123/84-130/80
4	Amlodipine besylate 10 mg	15	6	121/70-130/80
5	Nebivolol 2.5 mg	12	7	130/90-160/110
6	Valsartan 80 mg	6	8	130/80-140/90
7	Bisoprolol fumarate 5 mg	8	9	125/90-150/100
8	Telmisartan 20 mg	8	10	120/80-130/90
9	Nebivolol 5 mg	20	11	130/90-140/95
10	Ramipril 2.5 mg	10	12	120/80-140/90
11	Telmisartan 40 mg	23	15	120/70-160/100
12	Perindopril 4 mg	6	15	120/90-135/95
13	Nebivolol 10 mg	10	21	125/80-135/90
14	Ramipril 10 mg	9	28	130/85-145/100

In combination therapy, 11 medications were prescribed in 49 prescriptions. The most frequently prescribed combination was amlodipine besylate 10 mg + valsartan 160 mg (16.32%) followed by amlodipine 10 mg + valsartan 160 mg (14.28%). The cost of candesartan celexetil 16 mg + HTZ 12.5 mg (8 Rs) was lowest and the cost of amlodipine 10 mg + valsartan 160 mg (28 Rs) was highest (Table 11).

Table 11: Prescription trends and cost/day of various medications prescribed as combination therapy (49)

S. No.	Generic name	Frequency (n = 49)	Percentage (100%)	Cost/day (Rs)
1	Candesartan celexetil 16 mg + HTZ 12.5 mg	3	6.12	8
2	Perindopril 4 mg + amlodipine 5 mg	2	4.08	11
3	Telmisartan 40 mg + amlodipine 5 mg	3	6.12	16
4	Losartan potassium 50 mg + HTZ 12.5 mg	1	2.04	16
5	Telmisartan 40 mg + amlodipine 10 mg	4	8.16	17
6	Amlodipine 5 mg + valsartan 80 mg	6	12.24	22
7	Amlodipine besylate 10 mg +valsartan 160 mg	8	16.32	22
8	Telmisartan 50 mg + HTZ 12.5 mg	5	10.20	22
9	Perindopril 8 mg + amlodipine 5 mg	6	12.24	23
10	Telmisartan 80 mg + amlodipine 5 mg	4	8.16	24
11	Amlodipine 5 mg + valsartan 160 mg	7	14.28	28

The most cost-effective combination therapy among all was candesartan celexetil 16 mg + HTZ 12.5 mg and the combination of amlodipine 5 mg + valsartan 160 mg was the least cost effective (Table 12).

Table 12: Cost effective combination therapy among various medications (49)

S. No.	Generic name	Frequency (n = 49)	Cost/day (Rs)	Systolic/diastolic ranges (mmHg)
1	Candesartan celexetil 16 mg + HTZ 12.5 mg	3	8	135/85-145/100
2	Perindopril 4 mg + amlodipine 5 mg	2	11	130/90-150/100
3	Telmisartan 40 mg + amlodipine 5 mg	3	16	125/84-140/90
4	Losartan potassium 50 mg + HTZ 12.5 mg	1	16	128/80-135/85
5	Telmisartan 40 mg + amlodipine 10 mg	4	17	130/85-135/90
6	Amlodipine 5 mg + valsartan 80 mg	6	22	125/80-138/85
7	Amlodipine besylate 10 mg +valsartan 160 mg	8	22	120/80-140/95
8	Telmisartan 50 mg + HTZ 12.5 mg	5	22	130/90-140/100
9	Perindopril 8 mg + amlodipine 5 mg	6	23	120/90-150/110
10	Telmisartan 80 mg + amlodipine 5 mg	4	24	130/90-145/100
11	Amlodipine 5 mg + valsartan 160 mg	7	28	130/90-150/105

DISCUSSION

Hypertension is one of the most prevalent chronic medical conditions in Pakistan and it is estimated that every second person (≥ 18 years) is found to be suffering from this disease[21]. It is considered as the major risk factors for various health conditions including cardiovascular diseases, chronic kidney disease and cerebrovascular disease[22]. Our study shows that most of the patients were prescribed with monotherapy in both settings (Government hospital and Private clinics). Male patients are affected more than female patients in Government hospital during the study period. In monotherapy antihypertensive medications, BBs are prescribed more than ACE inhibitors whereas such comparison could not be made in combination therapies. Same results were seen in a study carried out by *et al*[23]. The present study shows that overall cost of antihypertensive medications is

high. The cost-effective study shows that the most cost-effective antihypertensive classes at both settings are Angiotensin converting enzyme inhibiters and beta blockers. Similar observations were seen in a study conducted by Ambrosioni E[24]. This study also shows that low cost drugs are prescribed frequently at Government hospital while in private settings prescriptions of costly medications are more frequent which may be due to the increased use of ARBs, ACE inhibitors and CCB (Amlodipine) more specifically n combination therapies. Reportedly, we have not found any Pharmacoeconomically data related with Government and private settings.

CONCLUSION

This study concludes that generally cost of antihypertensive medications is higher and it puts a substantial economic burden on patients. Our study showed that most of the patients were prescribed with monotherapy in both settings. The low-cost drugs are prescribed frequently at Government hospital while in private settings prescriptions of costly medications are more frequent which may be due to the increased use of ARBs, ACE inhibitors and CCB (Amlodipine). The lower cost of treatment increases the therapy follow-ups, hence patient's health and life style.

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