Int. J. Pharm. Investigation, 2024; 14(4):1273-1278.
https://www.jpionline.org

Original Article

Pharmaco-economic Evaluation of Drugs Used in Respiratory Diseases in a Tertiary Care Teaching Hospital

Sanatkumar Bharamu Nyamagoud*, Agadi Hiremath Viswanatha Swamy, Triveni Jagadish Umarani, Sai Meghana Gummadi

Department of Pharmacy Practice, KLE College of Pharmacy (A Constituent Unit of KLE Academy of Higher Education and Research, Belagavi), Hubballi, Karnataka, INDIA.

ABSTRACT

Background: Respiratory infections refer to any disease of airways and lungs which affects the respiratory system of humans. The nasal cavities, pharynx, larynx, trachea, bronchi and bronchioles, the tissues of the lungs and the respiratory muscles of chest cage are all susceptible to respiratory system diseases. To evaluate cost-benefit and cost-effective analysis of medications used in respiratory tract diseases, an observational prospective study was conducted for 120 patients. **Materials and Methods:** The patient data and other socioeconomic details were collected. The current index of medical specialists, updated version in March 2022, was used for Cost benefit and Cost effectiveness study. Regression analysis was used for the statistical analysis. **Results:** Among the 120 participants studied, 74 (61.66%) were male and 46 (38.34%) were female. Out of these participants, 89 had a C/B ratio of less than 1, 30 had a C/B ratio greater than 1 and 1 had a C/B ratio equal to 1. The Cost-Effectiveness Analysis (CEA) of various drugs indicated that among bronchodilators, Asthalin is more cost-effective than Duolin; among corticosteroids, Budecort is more cost-effective than Hydrocort; and among anti-tuberculosis medications, AKT-4 is more cost-effective than Ethambutol. **Conclusion:** The common medications prescribed in our study were Asthalin (bronchodilators). Out of 120 study participants 89 patients were cost benefited from the treatment. The CEA results showed that Asthalin, Budecort and AKT-4 are more cost-effective than Duolin, Hydrocort and Ethambutol. The study found that Asthalin is the most effective treatment for respiratory tract diseases among participants, according to CBA and CEA.

Keywords: Cost Benefit Analysis, Cost Effective Analysis, Quality Adjusted Life Years, Respiratory tract infections.

Correspondence:
Dr. Sanatkumar Bharamu Nyamagoud
Assistant Professor, Department of Pharmacy Practice, KLE College of Pharmacy Practice, KLE College of Pharmacy (A Constituent Unit of KLE Academy of Higher Education and Research, Belagavi), Hubballi, Karnataka, INDIA.
Email: dr.sanathnyamagoud@gmail.com

Received: 10-06-2024;
Revised: 06-07-2024;
Accepted: 27-08-2024.

INTRODUCTION

The pharmacoeconomic analysis is an important tool for evaluating the cost-effectiveness of medical interventions. It is used to assess the value of a medical intervention by comparing its costs with its benefits.[1,2] Pharmacoeconomic analysis can help in evaluating the cost-effectiveness and Benefits of interventions for respiratory diseases.[3]

The morbidity and mortality causes of respiratory infections are unclear; however, recent statistics show that the British Thoracic Society has previously estimated the cost of respiratory disease in the UK to be £6.6 billion in 2004.[4] In 2015, Mycobacterium tuberculosis-infected over 10.4 million people worldwide and killed 14% of the patients. Respiratory diseases directly contribute to 10% of the total (DALYs) disability-adjusted life years in the human workforce, in addition to the mortality toll.[5]

Asthma, pulmonary fibrosis, lung carcinoma (lung cancer) COPD, cystic fibrosis, are considered non-communicable respiratory disorders, as opposed to infectious diseases like tuberculosis and pneumonia.[6] These respiratory diseases are diagnosed very differently and are treated with bronchodilator, corticosteroids and antibiotics.[7]

This is especially of concern in lower- and middle-income nations like India and China and the nations across several continents, such as the Pacific Asia, Latin America and South Africa.[8] In spite of constant increase in the burden of Respiratory Tract Infections (RTI), the treatment options are limited.[9] Additionally, as different pharmaceuticals have different modes of delivery, additional research is necessary to improve the absorption and effectiveness of presently prescription medications.[10] The cost of medications had always been the major barrier to receive effective treatment. The incessantly rising expense of the treatments influences the compliance of the patients and the prescribing patterns.

DOI: 10.5530/ijpi.14.4.140

Pharmacoeconomic analysis can be divided into full economic analyses that look at the costs and effects of two or more interventions, as well as partial analyses that only look at the costs or effects of one intervention.[11] Cost-Effectiveness Analysis (CEA) is a systematic method used in economics and healthcare to assess the relative value of different interventions or treatments. It is a form of economic evaluation that aims to provide an objective framework for decision-making by comparing the costs and outcomes of various alternatives.[12]

In Cost-Effectiveness Analysis (CEA), the Incremental Cost-Effectiveness Ratio (ICER) is a crucial metric used to compare different interventions by quantifying the additional cost required per unit of health gain when comparing one intervention against another.[13] The widely used measure of health gain in health economics is the "Quality-Adjusted Life Year" (QALY), which quantifies both the quantity and quality of life lived by an individual. It combines the length of life with its perceived health-related quality, where 1 QALY represents a year of life lived in perfect health or a certain equivalent quality of life improvement.[14] The "Incremental Net Benefit" (INB) serves as an additional measure in cost-effectiveness analysis, offering valuable insight into the likelihood that a new treatment or intervention is cost-effective across various willingness-to-pay thresholds. It provides information on the probability of cost-effectiveness for different monetary valuations or thresholds, aiding decision-makers in understanding the potential economic value of adopting a new treatment compared to existing options.[15] Keeping all the above aspects in view, the present study was conducted to evaluate and examine the Economic burden of respiratory drugs and to perform pharmacoeconomic analysis by using Cost Benefit Analysis (CBA) and Cost-Effective Analysis (CEA).

MATERIALS AND METHODS

The study was conducted at Vivekananda General Hospital, Hubballi. It was a prospective observational study conducted over the course of six months, from November 2022 to April 2023. The study included all the inpatients with both the gender having either acute or chronic respiratory infections. Patients from the OPD and pediatrics were excluded.

Ethical Consideration

The Institutional Ethical Committee permission was obtained by KLE College of Pharmacy, Hubballi. The study ICE No: KLECOPH/IEC/2022-23/08.

Study Procedures

Participants were chosen based on inclusion criteria. The written informed consent was obtained after the understanding of study protocol and its findings. The following patient's information was gathered like Socio-demographic information (including age, sex, kind of employments and income status using the modified socioeconomic scale B G Prasad). The pharmacoeconomic effects of preventative medications for the respiratory tract were recorded and documented using the cost benefit and cost effectiveness analysis.

Data Collection

The data was collected on regular visit to medicine units for over the period of six months. The list of patients who had been admitted to the wards were reviewed each day. All these patients' medication information were gathered and recorded on the specially designed data collection forms. Patients' socio-demographic information was also included. The medical and the medication history, test results, progress chart and medications consumed were all obtained and recorded.

A cost benefit analysis is calculated using by the following formula

Cost Benefit ratio=Total cost/net benefits.

If C/B ratio is <1 it implies benefits are more than costs.

If C/B ratio is >1 it implies costs are more than benefits.

If C/B ratio is=1 it implies costs is equal to benefits.

Cost effectiveness is calculated by using the formula of Incremental Cost- Effectiveness Ratio (ICER).

ICER= Cost A-Cost B/Effect A-Effect

RESULTS

Out of 120 total study participants, male was highest than female i.e. 61.66% (74) and 38.34% (46) respectively. Most of the study participants belong to the income scale IV i.e. Lower Middle 40.00% (48). The same is displayed in the Table 1. The patients were treated with multiple medications and different combinations. Out of which, Nebulizer Asthalin Brand was the most prescribed drug i.e. 61 patients. The total drugs used in respiratory tract diseases are depicted in Table 2. Cost Benefit Analysis consists of 3 ranges which signify whether the Benefits, Costs are more, less (or) equal. Out of 120 samples 89 had C/B ratio <1 and for 30 sample C/B ratio was found out to be >1 and for 1 sample it was =1. The same is depicted in the Table 3. Drug wise Cost /Benefit distribution among study participants were shown in Table 4. The drugs having range >1 which concludes that Cost is more than Benefit i.e. the treatment is not Cost Benefited is shown in Table 5. The drugs having range <1 which concludes that Benefit is more than Cost i.e. the treatment is Cost Benefited is shown in Table 6. According to Table 7 we conclude that Bronchodilators (0.67), Corticosteroids (0.72), Anti TB Drugs (0.23) have the C/B Ratio <1 which concludes that benefit is more than costs i.e. these classes of drugs are Cost Benefited. Whereas, Oxygen Inhalation (5.65), Anti-Cholinergic drugs (1.14) have the C/B

ratio>1 which concludes that Costs are more than Benefits i.e., these classes of drugs are not cost benefited. Table 8 represents the Cost-Effective Analysis of Bronchodilators: Duolin (Salbutamol Sulphate+Ipratropium Bromide) with Asthalin (Salbutamol). Table 9 represents the Cost-Effective Analysis of Corticosteroids: Hydrocort (Hydrocortisone) with Budecort (Budesonide) and Table 10 represents the Cost-Effective Analysis of Anti TB: AKT4 (Rifampicin, Pyrazinamide, Isoniazid, Ethambutol) with Ethambutol.

DISCUSSION

A 2022 study by Kulkarni N *et al.* included 120 participants 69 were male and 51 were female between the ages of 01 and 60 were enrolled in the study.[16] In our study 120 participants were included in which (74) 38% of the population was female, while 62% were men. Young adults made up 19.16%, seniors 50.82% and geriatrics 29.99% of the population.

According to the modified B G Prasad scale for 2022, income was distributed. Class I was represented by 4.17% of the entire

Table 1: Gender and Age distribution among the study participants.

Sl. No.	Parameters	Number	Percentage
Gender			
1	Male	74	61.66
2	Female	46	38.34
Age Group			
1	18-28	23	19.16
2	29-38	20	16.66
3	39-48	10	8.33
4	49-58	31	25.83
5	59-68	24	20
6	69-78	10	8.33
7	79-88	2	1.66
Income scale 2022			
1	Upper Class	5	4.17
2	Upper Middle	6	5.00
3	Middle Class	38	31.67
4	Lower Middle	48	40.00
5	Lower Class	23	19.17

Table 2: Drugs used in respiratory Tract Diseases.

Sl. No.	Drugs	No. of patients	Percentage
1	Neb Asthalin	61	50.83
2	Neb Budecort	53	44.17
3	Neb Duolin	12	10.00
4	Inj Deriphylline	32	26.67
5	Inj Hydrocort	11	9.17
6	Tab Prednisolone	02	1.67
7	AKT4	28	23.33
8	Inj Ethambutol	10	8.33
9	Inj Pyrazinamide	02	1.67
10	Inj Rifampicin	07	5.83
11	Syp Mucinac	02	1.67
12	O2 Inhalation	28	23.33
13	Inj Isoniazid	01	0.83
14	Tab Oseltamivir	02	1.67

Table 3: Cost Benefit Analysis.

Sl. No.	Criteria	Total Sample
1	>1	89
2	<1	30
3	=1	1

Table 4: Drug wise Cost /Benefit distribution among study participants.

Sl. No.	Respiratory Drugs	Average C/B
1	Acetylcysteine	1.32
2	AKT4	0.56
3	Budesonide	0.23
4	Ethambutol	0.53
5	Hydrocortisone	0.95
6	Ipratropium bromide	0.06
7	Isoniazid	0.00
8	Oseltamivir	1.51
9	Oxygen Inhalation	0.65
10	Prednisonlone	0.01
11	Pyrazinamide	0.01
12	Rifampicin	0.02
13	Salbutamol	1.50
14	Salbutamol+Budecortisone	1.80
15	Theophylline	0.12

Table 5: The C/B ratio of drugs having range <1.

Sl. No.	Drugs	Range
1	AKT4	0.56
2	Budecort	0.23
3	Duolin	0.06
4	Ethambutol	0.53
5	Hydrocort	0.95
6	Isoniazid	0.00
7	Oseltamivir	0.51
8	Prednisolone	0.01
9	Pyrazinamide	0.01
10	Rifampicin	0.02
11	Salbutamol	0.09
12	Theophylline	0.12

population, Class II by 5.0%, Class III by 31.67%, Class IV by 40.0% and Class V by 19.17%. Families were split into two types: nuclear and joint.[17]

The respiratory medication Neb Asthalin was frequently used. The pharmacological classes that were prescribed the most frequently in our study were bronchodilators, corticosteroids

Table 6: The C/B ratio of drugs having range >1.

Sl. No.	Drugs	Range
1	Acetylcysteine	1.32
2	Oxygen Inhalation	5.65
3	Asthalin+Budecort	1.80

Table 7: Class wise representation of average C/B.

Sl. No.	Drug Class	Average C/B
1	AKT4	0.23
2	Anti-cholinergic Drugs	1.14
3	Bronchodilators	0.67
4	Corticosteriods	0.720
5	Oxygen Inhalation	5.65

and Anti-Tubercular Therapy (ATT). The most often given medications were Neb Budecort and Neb Asthalin.

In our study the cost benefit ratio of 120 samples was determined, out of them 30 samples had shown cost benefit ratio less than 1, indicating that the cost outweighed the benefits. The C/B ratio was greater than1 for 89 samples, meaning that the benefits incurred were greater than the costs and it was equal (=) 1 for 01 sample, meaning that benefits were equal to costs. When the cost-benefit ratio is more than 1, advantages outweigh costs. This indicates that they have net advantages.[18]

A 2019 study by Ivanova ZI *et al.* found that the annual cost of asthma varies from $1,000 to $7,500 per patient in the United States; depending on the severity of the condition.[19] We also compared the cost-effectiveness of two treatments using the ICER method. ICER stands for a conclusion or outcome of an economic assessment. The ICER provides a concise indicator of the economic benefit of an intervention in comparison to a control. It gives a comparison between the most expensive therapy and an alternative in terms of the extra cost per unit health effect.[20]

According to a 2020 study by Adhaulia G *et al.*, the Average Cost-Effectiveness Ratio (ACER) and Incremental Cost-Effectiveness Ratio (ICER) were used to determine the monthly cost of treatment/prescription and the improvement in FEV1. The study found that among the single prescription group, steroids and anticholinergics had the highest and lowest percentage cost variances, respectively.[21]

The conclusion of the study is based on the threshold of cost-effectiveness, which refers to figuring out how much one is willing to pay to achieve an objective. The cost of a given treatment will be excessive if the ICER is above the threshold; however, if it is below the threshold, then the treatment may be cost-effective. Comparisons were made between the outcomes of samples that provided bronchodilators and samples that prescribed corticosteroids. The ratio was expressed in terms of QALYs

Table 8: Cost Effective Analysis of Bronchodilators.

CEA of Bronchodilators	Cost of Duolin	Cost of Asthalin	Effect of Duolin	Effect of Asthalin	ICER
Total	783.56	2141.19	41	203	51.69Rs/QALY
Average	65.29	35.1	3.41	3.32	

Table 9: Cost Effective Analysis of Corticosteroids.

CEA of Corticosteroids:	Cost of Hydrocort	Cost of Budecort	Effect of Hydrocort	Effect of Budecort	ICER
Total	1593.72	6597.26	43.5	151	110.55Rs/QALY
Average	144.8836364	124.4766	3.954545455	2.849057	

Table 10: Cost Effective Analysis of Anti TB.

CEA of Anti TB	Cost of Ethambutol	Cost of AKT4	Effect of Ethambutol	Effect of AKT4	ICER
Total	1901.38	3834	27	90	193.89Rs/QALY
Average	237.6725	136.9286	3.375	3.214286	

(Quality Adjusted Life Years). The quantitative non-monetary health units were used to calculate QALY.[22]

We have categorized the willingness to pay in this section based on current state of the income scale for 2022.[23] The 120 participants average BGP I threshold was 333.3 INR and it was 266.6 INR for BGP Class II,133.3 INR for Class III, 83.3 INR for Class IV and 40 INR for BGP V. The average cost of bronchodilators (Neb Duolin is 65.29 and Neb Asthalin is 35.1) was found to be 51.69 INR, which means an additional 51.69 Indian rupees should be spent on Duolin over Asthalin to get cost-effective treatment without disease for one whole year. While the average cost of corticosteroids (InjHydrocort 144.8836364 and Neb Budecort 124.4766) was found to be 110.557738 INR which means an additional 110.557738 Indian rupees should be spent on Hydrocort over Asthalin to get cost-effective treatment without disease for one whole year. In comparison to corticosteroids, which received an average rating of 3.40 out of 5, bronchodilators received a 3.37 out of 5 rating. The ICER of therapy costs (bronchodilators and corticosteroids) split by treatment results was 162.24 INR/QALY. The finding indicates that, depending on their respective threshold costs, classes I through IV of the BGP income scale for 2022 have inexpensive therapies, whereas classes V have expensive therapies. Class V (threshold of 40 INR) of the BGP scale is implied since it will be viewed as being overly expensive for the provided treatment cost/QALY (162.24 INR).[24]

CONCLUSION

The common medications prescribed in our study include bronchodilators (Asthalin, Deriphylline, Duolin), corticosteroids (Hydrocort, Budecort, Prednisolone) and anti-tuberculosis medications (Ethambutal, Isoniazid, Pyrazinamide and Rifampicin). Asthalin has a lower pharmacoeconomic burden than other medications in its class. Asthalin was the most prescribed drug in our study.

In 120 samples, the CBA revealed a cost-benefit ratio; 89 samples had a C/B ratio greater than 1, indicates that the benefits outweigh the expenses. Similarly, for 30 samples C/B ratio was less than 1, indicating that the costs were greater than benefits and for 1 sample C/B ratio was equal to 1, indicating that the benefits and costs were equal.

We used ICER to evaluate CEA. The CEA of bronchodilators, corticosteroids and anti-tuberculosis drugs. The results showed that Asthalin (bronchodilators), Budecort (corticosteroids)and AKT-4 (anti-tuberculosis drugs) are more cost-effective than Duolin (bronchodilators), Hydrocort (corticosteroids) and Ethambutol. The results showed that people in income classes I through IV can access affordable therapies, while those in class V face expensive treatment options. The threshold cost for class V indicates that the treatments were considered overly expensive compared to the benefits they achieve.

ACKNOWLEDGEMENT

The authors are thankful to the Vice-Chancellor, Registrar and Dean of Pharmacy, KLE Academy of Higher Education and Research, Belagavi. We would also like to thank medical and hospital staff of Vivekanand General Hospital, Hubballi for providing necessary support.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

INFORMED CONSENT

The written informed consent was obtained from the study participants prior enrolling into the study.

ABBREVIATIONS

CBA: Cost Benefit Analysis; **CEA:** Cost Effective Analysis; **QALY:** Quality Adjusted Life Years; **ICER:** Incremental Cost Effectiveness Ratio **INB:** Incremental Net Benefit; **DALY:** Disability Adjusted Life Years; **COPD:** Chronic Obstructive Pulmonary Disorder; **RTI:** Respiratory Tract Infections; **ATT:** Anti Tubercular Therapy; **INR:** Indian Rupee.

REFERENCES

1. Van der Pol S, Garcia PR, Postma MJ, Villar FA, van Asselt AD. Economic analyses of respiratory tract infection diagnostics: A systematic review. Pharmacoeconomics. 2021;39(12):1411-27. doi: 10.1007/s40273-021-01054-1, PMID 34263422.
2. Soriano JB, Kendrick PJ, Paulson KR, Gupta V, Abrams EM, Adedoyin RA, *et al.* Prevalence and attributable health burden of chronic respiratory diseases, 1990-2017: a systematic analysis for the Global Burden of Disease Study. Lancet Respir Med. 2017.
3. Mori AT, Robberstad B. Pharmacoeconomics and its implication on priority-setting for essential medicines in Tanzania: a systematic review. BMC Med Inform Decis Mak. 2012;12:110. doi: 10.1186/1472-6947-12-110, PMID 23016739.
4. Shah CH, Reed RM, Wastila L, Onukwugha E, Gopalakrishnan M, Zafari Z. Direct medical costs of COPD in the USA: an analysis of the medical expenditure panel survey 2017-2018. Appl Health Econ Health Policy. 2023;21(6):915-24. doi: 10.1007/s40258-023-00814-8, PMID 37270431.
5. Levine SM, Marciniuk DD. Global impact of respiratory disease: What Can We Do, Together, to Make a Difference? Chest. 2022;161(5):1153-4. doi: 10.1016/j.chest.2022.01.014, PMID 35051424.
6. Vos T, Barber RM, Bell B, Bertozzi-Villa A, Biryukov S, Bolliger I, *et al.* Global, regional and national incidence, prevalence and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. The lancet; 2015 Aug.
7. Khaltaev N, Axelrod S. Chronic respiratory diseases global mortality trends, treatment guidelines, life style modifications and air pollution: preliminary analysis. J Thorac Dis. 2019;11(6):2643-55. doi: 10.21037/jtd.2019.06.08, PMID 31372301.
8. Salvi S, Kumar GA, Dhaliwal RS, Paulson K, Agrawal A, Koul PA, *et al.* The burden of chronic respiratory diseases and their heterogeneity across the states of India: the Global Burden of Disease Study 1990-2016. Lancet Glob Health. 2018;6(12):1363-74. doi: 10.1016/S2214-109X(18)30409-1, PMID 30219316.
9. Soriano JB, Kendrick PJ, Paulson KR, Gupta V, Abrams EM, Adedoyin RA, *et al.* Prevalence and attributable health burden of chronic respiratory diseases, 1990-2017: a systematic analysis for the Global Burden of Disease Study. Lancet Respir Med. 2017.
10. Gross NJ, Barnes PJ. New therapies for asthma and chronic obstructive pulmonary disease. Am J Respir Crit Care Med. 2017;195(2):159-66. doi: 10.1164/rccm.201610-2074PP, PMID 27922751.
11. Robinson R. Economic evaluation and health care. What does it mean? Br Med J.
12. McCabe C, Claxton K, Culyer AJ. The NICE cost-effectiveness threshold: what it is and what that means. Pharmacoeconomics. 2008;26(9):733-44. doi: 10.2165/00019053-200826090-00004, PMID 18767894.
13. Prieto L, Sacristán JA. Problems and solutions in calculating quality-adjusted life years (QALYs). Health Qual Life Outcomes. 2003;1:80. doi: 10.1186/1477-7525-1-80, PMID 14687421.
14. Hoch JS, Dewa CS. A clinician's guide to correct cost-effectiveness analysis: think incremental not average. Can J Psychiatry. 2008;53(4):267-74. doi: 10.1177/070674370805300408.
15. Devangi D, Shashirekha CH, Shruthi SL. Cost analysis study of different brands of commonly used drugs for bronchial asthma available in india-A pharmacoeconomicsstudy. Indian J Pharm Pharmacol.
16. Kulkarni N, Rasi M, Nizar N, David N, N Bali P, I Dalal V. the pharmacoeconomic impact of gastro-protective agents at a tertiary care hospital. Asian J Pharm Clin Res. 2021;15(1):92-6. doi: 10.22159/ajpcr.2022.v15i1.43412.
17. Abu Bashar MD. Modified BG prasad socioeconomic status scale: updated for the year 2022. Indian Pediatr. 2022;59(10):816. doi: 10.1007/s13312-022-2631-1, PMID 36089848.
18. Balicer RD, Huerta M, Davidovitch N, Grotto I. Cost-benefit of stockpiling drugs for influenza pandemic. Emerg Infect Dis. 2005;11(8):1280-2. doi: 10.3201/eid1108.041156, PMID 16102319.
19. Ivanova ZI, Ivanov YY. Pharmacoeconomics of bronchial asthma. Folia Med. 2019;61(2):163-71. doi: 10.2478/folmed-2018-0070, PMID 31301669.
20. Lee KH, Phua J, Lim TK. Evaluating the pharmacoeconomic effect of adding tiotropium bromide to the management of chronic obstructive pulmonary disease patients in Singapore. Respir Med. 2006;100(12):2190-6. doi: 10.1016/j.rmed.2006.03.011, PMID 16635566.
21. Adhaulia G, Singh D, Verma A, Verma A, Singh A, Nath R, *et al.* Study of prescribing pattern of drugs used in the treatment of bronchial asthma at tertiary care hospital of northern India. Int J Basic Clin Pharmacol;9(2). doi: 10.18203/2319-2003.ijbcp20200184.
22. Bleichrodt H, Johannesson M. Standard gamble, time trade-off and rating scale: experimental results on the ranking properties of QALYs. J Health Econ. 1997;16(2):155-75. doi: 10.1016/s0167-6296(96)00509-7, PMID 10169092.
23. Abu Bashar MD. Modified BG prasad socioeconomic status scale: updated for the year 2022. Indian Pediatr. 2022;59(10):816. doi: 10.1007/s13312-022-2631-1, PMID 36089848.
24. Van Boven JF, Tommelein E, Boussery K, Mehuys E, Vegter S, Brusselle GG, *et al.* Improving inhaler adherence in patients with chronic obstructive pulmonary disease: a cost-effectiveness analysis. Respir Res. 2014;15(1):66. doi: 10.1186/1465-9921-15-66, PMID 24929799.

Cite this article: Nyamagoud SB, Swamy AHMV, Umarani TJ, Gummadi SM. Pharmaco-economic Evaluation of Drugs Used in Respiratory Diseases in a Tertiary Care Teaching Hospital. Int. J. Pharm. Investigation. 2024;14(4):1273-8.