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PHARMACOECONOMICS

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ABSTRACT

Pharmacoeconomics can help to determine the feasibility of a particular method of treatment from all the perspectives including but not limited to the patients, doctors and physicians and insurers. Pharmacoeconomics is a health science that focuses on the determining the economical aspect of a particular drug therapy or treatment. Pharmacoeconomics consists of economic and human health related factors. The techniques used for pharmacoeconomics methods analysis are cost-minimization, cost-benefit ratio, cost-utility ratio, cost-effectiveness ratio. The pharmacoeconomics will not only have a relevant and significant impact on actual patient treatment but also the ongoing field of research and clinical trials and structure and running if pharmacies and various pharmaceutical companies. The execution of the principles of pharmacoeconomics is collective responsibility of all healthcare specialists to obtain safe, effective and affordable medications.

Keywords: Pharmacoeconomics, cost-minimization, cost-benefit ratio, cost-utility ratio, cost-effectiveness ratio

INTRODUCTION

Pharmacoeconomics can be defined as a health science that focuses on the determining the economical aspect of a particular drug therapy or treatment. It tries

to find out the extent of economic burden that the treatment in question will put the individual or the society in. This field further focuses on the identifying, comparing as well as determining the pheasibility of the particular methodology of the treatment. It is a detailed overall analysis of the possible treatment options one may make within a set of economic parameter restrictions **[1]**. The word pharmacoeconomics was derived from the following words. 'Pharmakon' meaning 'drug' and the word 'Oikonomia' means 'managing the household'. The word Oikonomia is further derived from the words 'Oikos' and 'Nomos' meaning 'House' and 'Law' respectively.

HISTORY AND ORIGIN

Pharmaceutical research is a money guzzling business. It needs lots and lots of resources, be it financially or the time needed. Due to this a need was gradually felt to have a comparative analysis of cost benefit ratio.

In 1982, an article was published by Bootman, McGhan and Schondelmeyer regarding economic methods. The importance of this article was seen by the then editors of the journal (DICP) The Annals of Pharmacotherapy. Thereafter a sub section was established in the journal where such articles having information on this cost benefit analysis will be published. After a couple of years a book named Principles of Pharmacoeconomics was published by Harvey Whitney. It is also regarded as the pioneer book in this field. The concept of cost-effectiveness analysis was introduced at University of Minnesota during the year of 1978 **[2, 3]**. Since then the importance of amalgation of the fields of Pharmacy, Economics, and Social Sciences was realized and a course was introduced in the University of Minnesota for the very first time in 1976.

This field has thereafter bloomed into the huge behemoth that we can see today and transformed into a multi-billion dollar field which directs the path of the innovation and treatment to a significant degree.

SIGNIFICANCE OF BRANCH

There are multiple therapies available for various diseases but there are also parallel drugs or treatment methodologies which have an exorbitantly high cost yet are only effective to a certain degree. Sometimes, these high priced therapies do not make sense if we look at it from a cost- benefit perspective as they bring minimal to no benefits to the individual. Pharmaco-economics consists of mainly two components i.e. economic and human health related. The economic component made up of factors like cost benefit, effectiveness, minimization and utility while health-related

quality of life (HrQoL), patients' preference and satisfaction etc. are humanistic components **[2]**. **Figure 1** shown below represents pharmacoeconomics analysis components **[2]**.

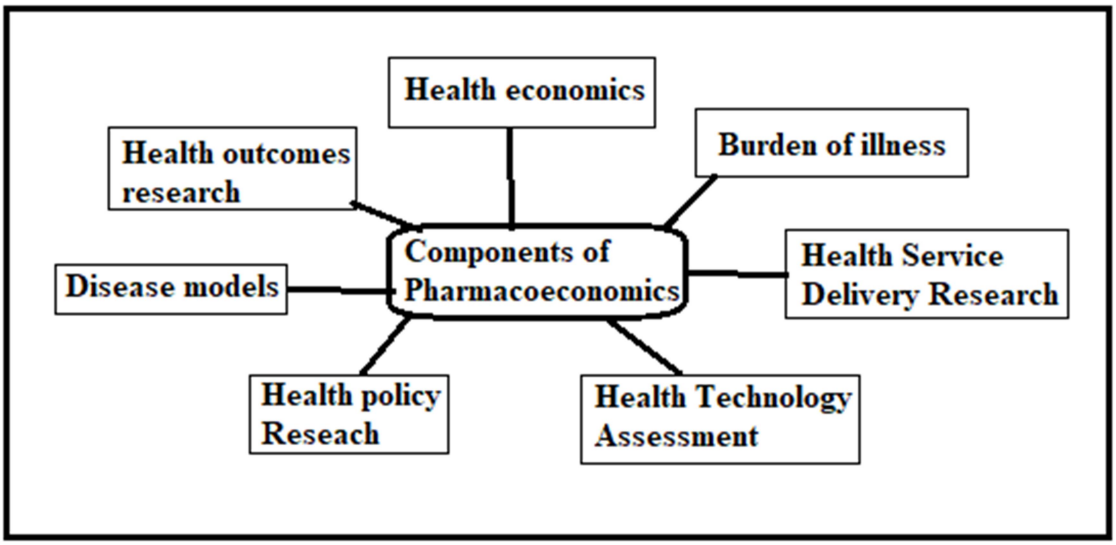

Figure 1: Pharmacoeconomics analysis components

Thus, in such situations a comparison of cost and alternative drug treatment is needed to maximize the possible benefits for the patients as the resources are often limited up to a certain degree. Even in Multi National Companies there is a panel which decides the amount of resources that can be dedicated to a particular research or drug therapy pathway. In these scenarios the Pharmacoeconomic Analysis helps them make a sane decision and make a choice which is comparatively better **[3, 4]**.

- Helps in the evaluation of Drug Therapy
- Determines the exact value of current therapy
- Helps to make a decision regarding the most cost effective drug for hospital formulary
- For the society - It contributes towards reducing the mortality and morbidity.
- For the producer – It helps in setting the cost of a drug, its marketing as well as guaranteeing its efficacy upto a certain extent **[5]**.

EFFECT OF COVID-19

The **Figure 2** shown below is the flowchart of sequential events occurred in pharmaco-economics as an effect of pandemic of COVID-19.

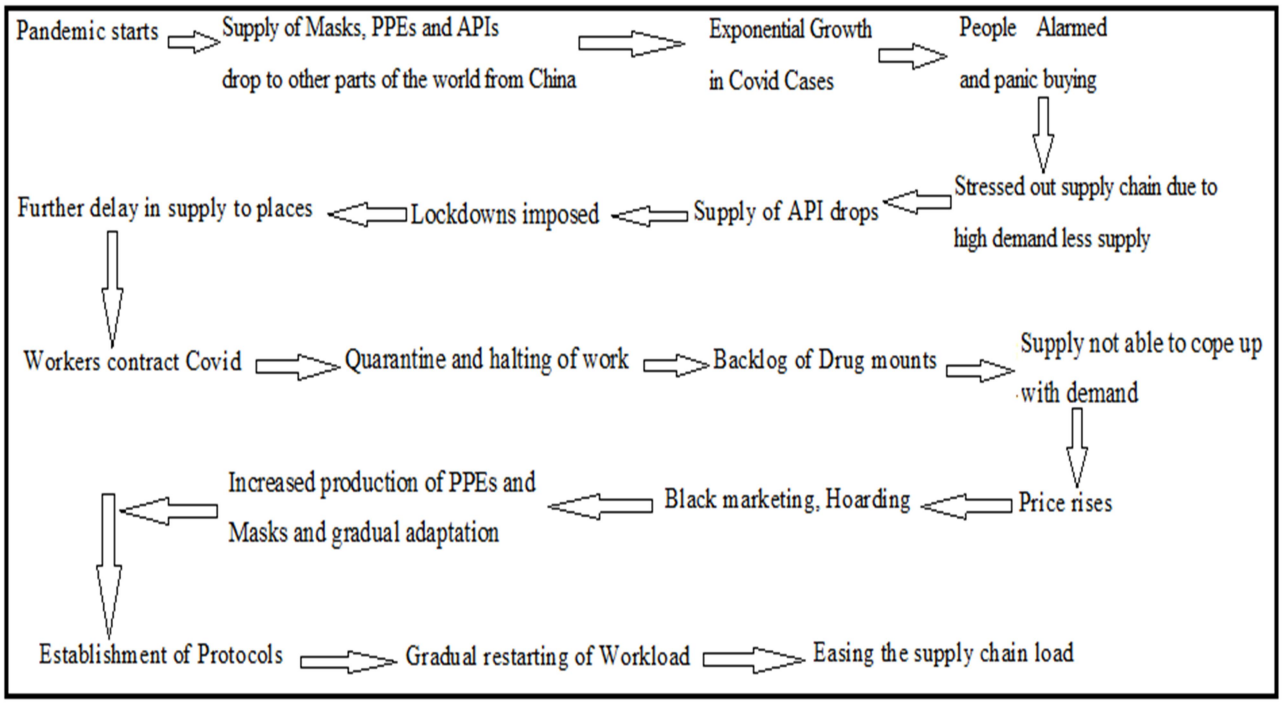

Figure 2: Representation of events in pharmacoeconomics in COVID-19

PHARMACOECONOMIC POINT OF VIEW OF PANDEMIC ON PHARMA INDUSTRY

As the supply of APIs decreased, lockdowns were imposed and the supply chain broke down the costs of drugs and masks and PPEs spiralled out of control. In fact, for many drugs, the cost of manufacturing now exceeded the wholesale or list price due to these constraints.

The increase in cost and decrease in supply had changed business market for a short while. Cost containment has become a top priority in these extraordinary times. Various attempts were made to find out alternative drugs to those existing in low amounts. Cost Benefit analysis was of utmost importance in these times as an individual's earnings decreased due to imposition of lockdown. As the cases grew exponentially, the government was forced to open wards and spend more money on the ill than they would have initially. In fact, during lockdown period, total average hospitalization expenses more than doubled. In spite of these high costs the beds were not able to meet the demand. The damages incurred by pharmaceutical companies were tremendous and the demand for alternative drugs increased as the supply of APIs dropped considerably from China. The companies had to take the workers health into consideration and take certain measures to prevent spread of covid in case one of them tested positive.

During the pre-covidperiod the global stock of APIs was mostly sourced from China, India and Malaysia. The pharmaceutical industry was faced with a very serious issue as they had to increase their budgets for drug production exponentially. In fact, the rise in cost of APIs was so far reaching that it forced various pharmaceutical firms to close down key manufacturing unit still its finances were stabilised **[6, 7]**.

There are four main pillars of pharmacoeconomics acted as the panacea. These techniques are also used for pharmacoeconomics methods evaluation. These fundamental pillars can be enlisted as cost – minimization analysis, cost – benefit ratio analysis, cost – utility ratio analysis, cost – effectiveness ratio analysis. There was intense focus on these points during this time. This led to an overall derivation of solutions according to situation required for the companies as they were able to find out the parts where they were spending more resources than necessary.

1. Cost Minimization Analysis-

This method depends totally upon determining the method which has least possible expenses throughout the whole procedure. The cost determination of these includes all the costs included right from the drug production cost to the service and administration charges if any. When all the costs are derived, we calculate the total cost of each method of treatment and choose the one having lowest expenditure.

This method has a few limitations such as; the methods should have a comparable efficacy or effect at a parallel cost level. Another limitation of this method is that there need to be at least 2 methods of administration or at least 2 different types of drugs if this analysis is to be carried out.

e.g. Rabies vaccine can be given intra-dermal as well as intra-muscular. Yet as the intradermal method of administration requires lower number of vials to be administered there is significant decrease in the cost of treatment **[7, 8]**.

2. Cost-Benefit Ratio Analysis –

This method focuses on calculating the ratio of benefits received by a particular methodology of treatment as comparted to only its cost. This method has an outlook towards better benefits received rather than only looking from an economical aspect. This analysis may be done in various ways. For example if two drugs A and B having similar effect on a particular disease X. Drug 'A' has high cost but low toxicity and Drug 'B' has low cost but comparatively higher toxicity. In this scenario if the cost benefit ratio depends completely on the condition of

the individual. If the patient in question is young and doesn't have any adverse allergies or weaknesses then he can be given the drug B but same cannot be said for a geriatric patient having a feeble body.

The limitation of this method is that it is assumed that there are finite resources for a particular project and Thus, not all methods may be considered as a result if the cost for that treatment is particularly exorbitant **[8, 9]**.

3. Cost Utility Ratio Analysis-

Cost Utility Ratio Analysis compromises of the opinion of the patient in question. This method takes into consideration not only the number of years the treatment will give but also the quality of life that the treatment can provide. This can also be termed as a special part of the Cost effectiveness analysis which takes multiple factors like Quality of Life into the equation with the personal opinions of the patients.

For example if there are two options for a Disease X; Drug A gives life for 1 year but the person is fully mobile and healthy for the period and Drug B which allows the person to live for 10 years but the limitation is that he will only be able to live with the constant help of IV infusions everyday and has restricted mobility **[10, 11]**. In this case the personal choices of the patient compromise a huge part of the equation. The limitation of this method is that it depends too much on preferences of the patient and that a pathway of treatment which is less suitable from a bigger point of view may be chosen.

4- Cost Effectiveness Ratio Analysis-

This method mainly tries to quantify all the data available. It analyses the quantitative things with references of data collected from clinical data.

The disadvantage of this method is its reliance on a single metric system. This method always has a certain amount of assumption involved in it. This makes this method unable to be accurate 100% of the times.

Table 1: Economic evaluation methods with formula and applications [12]

Economic Analysis	Formula	Applications
Cost minimization analysis(CMA)	Cost: X > Y and Benefits: X = Y, then Drug 'Y' is better than 'X'.	Shows cost savings of the treatment programme over another.
Cost effectiveness analysis (CEA)	Cost effectiveness = Net Cost of Intervention/ Net Change in Health Effect	Useful in comparing cost with health outcomes for individual patients.
Cost benefit analysis(CBA)	Net benefit = net benefits – net costs	Used at macro level for policy decision on health care program
Cost utilization analysis(CUA)	Cost/ Quality ratio = COST/ Quality adjusted life years	Compares treatment program with different outcomes and various health programmes.

NEED AND SCOPE OF PHARMACO-ECONOMICS IN HEALTHCARE SYSTEM

In India the main challenge is providing medical facilities to rural areas of country where people face lack of education and financial crises. In less developed regions of the country larger travelling cost, lack of advances technology and multispecialty hospitals are the barriers that restrict people from getting a good quality of healthcare. People here often get poor quality services and unlicensed practioners. The privatization of hospitals has resulted in high cost due to lack of regulation and advancement in treatment quality. As the hospitals and healthcare facilities are becoming more and more sophisticated, the cost of health technologies is increasing day by day. This is as a result of increase life expectancy, better medical facilities, wide spread of medicines, better quality of life and higher living standards **[13]**. Most of this money comes from the higher class society of people which in turn makes it seldom possible for poor people to spend money on healthcare facilities. Therefore, price of the drugs must be such that it can be afforded by all the people regardless of their financial status. Thus, the emergence of pharmacoeconomics becomes crucial in global healthcare market. Before the new drug is launched several factors must be investigated cost of illness related drug, cost of treatment related technology and its impacts and also the quality of life of the patient. This knowledge beforehand can help in drug development and reduce its failure ratios. Also this will help in determining if the drug should be further manufactured and taken for clinical trials. The third stage of clinical trials makes the picture of impacts more clearly on patient outcome. Thus, the applications of these parameters before drug development will certainly ease the decision making process and yield significant results in healthcare sector **[14, 15]**.

USES AND BENEFITS OF PHARMACOECONOMICS FOR CLINICAL PRACTIONERS AND PHARMACY

Pharmacoeconomics plays a vital role in clinical and hospital studies. It aids in analytical pharmaceutical research decision making which comprises of cost, patient and illness related factors **[16]**.

Table 2: Representation of variables used in pharmacoeconomics study

	Input	Output	Aim
Cost minimization	**Cost**	**Therapeutic equivalence**	**Efficiency**
Cost effectiveness	**Cost**	**Health outcome**	**Cost minimization with adequate resources**
Cost benefit	**Cost**	**Cost for health outcome**	**Optimized benefit given limited resources**
Cost utility	**Cost**	**Health outcomes adjusted for HrQoL**	**HrQoL gains**

Pharmacoeconomics help in getting patient the access on drug at the right time and in right place. It presents a comparative study of two drugs having same dynamics and mechanism of action not only does a pharmacoeconomic approach depends on efficacy and safety it has humanistic and economic perspectives which help the clinical and pharmacy practioners to make improvised decisions. Health should be measured in life expectancy and giving the right treatment to the patient however in current times the clinical practioners are dealing more with treating the illness and its ill effects than the actual health and quality of life. Also cost is a issue of high economic sentiment in the current financial market due to lack of rules and proper formulary decision making that has brought the requirement of cost-effectiveness threshold in current healthcare system. Pharmacoeconomics is needed for hospital management, proper allocation of treatment to respective patient taking into account his/her financial affordability. Application of pharmacoeconomics also helps in resource management and distribution in healthcare and clinical sectors. It helps in rejecting certain medicines and contraindicating high-cost treatments. It compares two or more methods of treatment for right decision making. Pharmacoeconomics is a boon for formulary decision making and analysis that helps the experts in diagnosis of disease and cost appropriate treatments. This study helps the hospitals in effective management of product and services, modelling technologies and line of treatment. It influences the research carried out in that specific area and ensures maximum profit per dollar investment. Pharmacoeconomic studies and through analysis report help the patients to achieve best care and treatment quality within their financial affordability. This in turn leads to economic saving and effective cost and resource utilization. This not only improves quality of line but also treatment technology and patients life expectancy in a particular hospital. Within the given cost pharmacoeconomic analysis will yield maximum profit and patients no longer have to compromise with care and treatment

quality. So, pharmacoeconomics now have become globally a integral part of clinical decision making processes that balance the patients cost and treatment ratio **[17, 18]**.

PHARMACOECONOMICS ANALYSIS AND DRUG DEVELOPMENT IN INDIAN HEALTHCARE SYSTEM

CLINICAL TRAILS:

Clinical trials play a important role in drug development. Out of the 10,000 drugs only 10 drugs reach clinical evaluation and only 1 is released in the drug market. This process proceeds as follows-

Phase 1 trials: In this stage the toxicity index of the drug is determined. Further it is decided that whether the drug is to be developed and data about further pharmacoeconomics of drug is collected. This further aids in developing a more improvised model and a patient friendly drug to be launched in market.

Phase 2 trials: In this stage the drug is administered to the patient with respective disease. This will give a deeper insight in cost of treatments, instruments utilities and technologies which makes the cost index clearer. Taking these into consideration changes can be made in the new model.

Phase 3 & 4 trials: Stage 3 determines the drug marketability. In this stage the drug is administered taking in account its pharmacoeconomics, patient and cost illness, distribution and marketing strategies just as when they are marketed. The final stage of clinical trials is called as post-marketing phase. In this the past and future drug events can be analyzed using pharmacoeconomics. Also the drug is tested on patients in real life scenarios which give better accuracy than the artificial settings. After the success of these pharmacoeconomic estimates is the drug is considered ready to be launched for practice **[19, 20]**.

CHALLENGES

The execution of the pharmacoeconomics is a challenging task. The large investments are required in pharmacoeconomics. In healthcare sector and in clinical trials large, reliable and continuous data is necessary for safety, efficacy and pricing of the drug. Also, the budgeting and fund distribution is also challenging part. People will unable to purchase costly medicines in affordable prices as the system is not supported by the pharmacoeconomics. There is no regular curriculum available to technical education for students in healthcare sector on the subject of pharmacoeconomics. Designing and implementation of updated course of pharmacoeconomics course is also a challenge **[19, 20]**. To terminate the academic and healthcare or pharmaceutical

industry gap, the pharmacoeconomics education should be more focused.

FUTURE SCOPE

Pharmacoeconomics analyses need a better intervention in patient related costs and efficacy. A real cost-effectiveness its needs and benefits must be evaluated on a real timeframe rather than hypothetical scenarios. The rise in treatment cost must be estimated in near long term future and cost minimization with hundred percent patient benefits must be ensured based on real data. The ongoing question that rises in the cost of newer interventions in healthcare must be resolved. Despite of this newer intervention fits in the current guidelines and have cost-patient effectiveness ratio. Also the budget improvisations in the current technology to meet up the needs of newer treatment methods must be worked upon. The resource availability per area of distribution and proper allocation of services must be statistically evaluated for lucid management of healthcare systems **[20, 21]**.

CONCLUSION

Pharmacoeconomics can shed some light on the best path possible for the patient in their current situation. It can mark the possible ways one can take in a plenthora of situations. Covid Pandemic led to huge fluctuations in the economic capabilities of common citizen and has marketed, changed the way that an individual looks at healthcare and sanitation system of the country. Considering the steep fall in capital markets of the country pharmacoeconomics plays a major role in determining the future path of Indian healthcare system. It has set a high standard for proper customer care in equivalence to the proportion to finances spent in hospitals. It has also significantly influenced the distribution of commodities and has mainly benefited the lower rungs of the society. Pharmacoeconomics ensures the best treatment to every patient in minimal costs and has also accelerated new clinical research in the country. Although in the past few years pharmacoeconomicshas been at its infancy stage in India, over the past 3 years it has gained significant momentum and has proved to be a boon to the Indian healthcare system.

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