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Review Article

Role of Instruments in Pharmacoeconomics Perspective-An Overview

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Abstract

In health care usually physical scaling is helping in understanding the cure of a disease. In abstract scaling, one has to give his or her own feelings that does not have a fixed scale to compare with, but defined, evaluated and used. Documenting abstract scaling along with physical scaling is gaining its importance to assess a desired outcome achieved or not, which is usually not recorded. In certain circumstances, choice of treatment, therapy is up to the patient. Mathematical equations were established as cost, benefit, utility, effectiveness etc. Policies relating to health care are to increase lifespan of the individual so that losses in productivity or work are minimized. Holistically, in pharmacoeconomics, it is necessary to compile costs and benefits to come to scientific conclusions in selecting a treatment among the choices available and for reimbursements. The current review article illustrates the various approaches, mathematical models and need of abstract scaling for economical effective therapies.

Keywords: Pharmacoeconomics, HRQOL, Instruments, mathematical methods, health policies

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1. Introduction

The fundamental concept of economics is need and want. Where there is a need, there is a want and vice-versa. Relating to pharmaceuticals, various therapies and treatments plays a critical role even though the plan is made rationally. The objective of this review article is to enlighten the various methodologies available to meet pharmacoeconomic rationality in healthcare.

In a hospital different therapies are utilized by the doctors among several rationally available approaches. In pharmacoecomics, one can consider, it is a balance mechanism among the facilitators, the health professionals and the patients. It is commonly observed that any individual does not wish to visit or stay in a hospital. However, as age proceeds or with change in habits a base line, stimulus and outcome are observed leading to visit a hospital. Age and negligence of an ailment is an issue for hospitalization where still patients in several circumstances does not accept the reality.

The current article briefly overviews the various approaches with respect to implementation of health policies, rational treatments and therapies.

2. Cost - Benefit Analysis (CBA) (1)

The method is helpful in decision making of implementation of a health policy. Here, investments and benefits are converted into currency values. Keeping in view of the objective, investments varies and one can consider establishing the premises, providing the facilities which directly are the expenditure. Whereas, benefits are seen in the productivity of the individual as well as with respect to physical scale and abstract scale of recovery of the patient to normal health. The current/past currency value is converted to present/future value by including interest rate as discount rate. The investments and benefits are direct, indirect or intangible. With respect to discount rate calculations, one has to develop a range of rates and should be in a position to select the appropriate based on ailment/ service/intervention/treatment. The cost-benefit analysis can be established as follows:

$$\textbf{Cost Benefit Analysis} = \frac{[B_1 - B_2]}{[(DC_1 + IC_1) - (DC_2 + IC_2)]}$$

Where, B = Benefits

DC = Direct costs

IC = Indirect costs

2.1 Assumptions to be considered for establishing cost-benefit methodologies

Several assumptions such as distinguishing one service from another, providing a choice to the patient among several interventions, estimate the outcomes of a service, able to convert them to currency value, estimate the cost for a service, giving equal importance to both cost and benefits and finally benefits should have high value than costs. The assumptions are found to be helpful developing mathematical equations.

2.2 Various methods of Cost-Benefit analysis (1)

Cost-benefit ratio method (1)

The following equation provides a benefit to cost ratio where the benefits are on the numerator and costs are on the denominator. A better choice of interventions not only alters costs but also benefits. Several times, either one or both have to be reflected in the equations, which is an ambiguity.

$$\textbf{Cost Benefit Ratio} = \frac{\sum \mathbf{n}_{(t=1)} \left[\frac{B_t}{(1+r)^t}\right]}{\sum \mathbf{n}_{(t=1)} \left[\frac{C_t}{(1+r)^t}\right]}$$

Where, B_t = total benefits with respect to a time period (say t)

C_t = total costs for time period (say t)

r = discount rate

n = number of time periods

If B/C is greater or equal or less than one, then the health policy proposed is socially valuable, no-profit no-loss or not socially valuable respectively.

Net present value method (NPV) (1)

In this method, it is the difference among the benefits and costs rather than the ratio. The following equation is used for the purpose.

$$\textbf{Benefit} - \textbf{Costs} = \textbf{NPV} = \sum \mathbf{n}_{(t=1)} \left[\frac{(B_t - C_t)}{(1+r)^t}\right]$$

The results may have to be carefully interpreted in terms of currency value and time involved so as to interpret among programs.

Rate of return method (1)

The method involves with a ratio of net present value to costs i.e., (B-C)/C. The method is found promising for an investment that benefits over time.

Extra yearly benefits method (1)

The method helps in understanding the money that can be saved reflecting to benefits every year that can be saved and can be used to repay the startup loans taken for the project. This can be achieved by increasing distribution systems. The following equation is said to be useful for the purpose.

$$\textbf{Bx} = \textbf{SL}\left[\frac{r}{1-(1+r)^{-t}}\right]$$

Where, Bx = Extra yearly benefits

SL = Start-up loan

t = time

r = interest rate

Cost Effective Analysis (CEA) (1)

In this method the pre-requirements are that there should be at least two or alternative interventions /treatments/services/therapies. The method is not only on cost reduction but also on establishing and standardizing a process. In this method, the costs, benefits, life years extended and cost to effectiveness ratio are compiled to make a final judgment among interventions. Along with the following equation, judging the effectiveness of the treatment may have to be achieved with various physical, abstract and quality of life (QOL) scaling.

$$\textbf{Cost Effective Analysis} = \frac{[(DC_1 + IC_1) - (DC_2 + IC_2)]}{[E_1 - E_2]}$$

Where, E is effectiveness

Cost Utility Analysis (CUA) (1)

In this method, the mortality and quality of life (QOL) is measured to figure out quality adjusted life years (QALY) that tells us the best choice among the interventions. The compilation analysis using the following equation includes cost, utilities such as extra years of life, QOL, QALYs, cost to utility ratio (i.e., cost to QALYs).

$$\textbf{Cost Utility Analysis} = \frac{[(DC_1 + IC_1) - (DC_2 + IC_2)]}{[U_1 - U_2]}$$

Where, U is utility

Cost Minimization Analysis (CMA) (1)

The method helps in making a choice among interventions with respect to cost. In this method, a compilation using the following equation, with respect to costs, outcomes achieved as effectiveness after treatment is made to make a final decision holistically.

$$\textbf{Cost Minimization Analysis} = [(DC_1 + IC_1) - (DC_2 + IC_2)]$$

Decision Analysis (1)

Especially decision analysis method is found to establish or uses logistics. Every ailment/ service/ intervention/treatment has a set of logical steps to achieve the cure of a disease or task. Hence, it is necessary to identify the logical steps, separate them, assess the costs-benefits-outcomes and finally recombine all the logical steps and come to a firm decision among the choices of interventions. Hence, a decision analysis helps in clearing confusions, establishing logical steps and quantifying the attributes both individually and holistically. The method involves with converting excel data attributes to decision tree. In the method, for a treatment one has to establish success, failure outcomes, their corresponding utility scores (U) and probability (P) and later calculate expected utility (as U X P) in order to finally calculate total expected utility by cumulating expected utility for that treatment. Hence, several treatments available for the ailment are calculated for

their respective total expected utility and later ranked. The highest total expected utility is best choice among the treatments.

Establishing a formulary list-Ranking Priorities (1)

A hospital formulary is a booklet or book usually carried by health professionals in a hospital. A hospital formulary comprises of hospital administrative hierarchy, members of pharmacy and therapeutic committee, hospital policies as rules and regulations, inclusion and exclusion criteria of a drug product in the formulary, inclusion of information relating to dosage calculations, inclusion of monographs relating to a drug product etc. The current method helps in best utilization of the budget allotted for an ailment among the several available treatments. The method further helps in filtering and selecting treatments out of all the available treatments for the same ailment. In this method one has to compile all the available treatments for an ailment, later establish the corresponding quality adjusted life years (QALY), cost and finally calculate the cost to utility ratio. The ratios are sorted in increasing order and all the treatments that cover the budget corresponding to cumulative costs are considered as selected treatments among treatments available for the same ailment.

Incremental Analysis (1)

It is yet one another model in comparing and making a best choice among treatments. In this method, both mathematically and graphically, the choice of treatment is established. The method is not for adding one treatment to another but comparison. The various formulae usually used are as follows:

$$\mathbf{CEA} = \frac{(\mathbf{Cost_1} - \mathbf{Cost_2})}{(\mathbf{Effectiveness_1} - \mathbf{Effectiveness_2})}$$

or

$$\mathbf{CUA} = \frac{(\mathbf{Cost_1} - \mathbf{Cost_2})}{(\mathbf{Utility_1} - \mathbf{Utility_2})}$$

For instance, let us consider three treatments i.e., A_1, A_2, A_3 with costs 50,000 with 1 QALY, 100000 with 11 QALYs and 150000 with 15 QALYs respectively. In case of the second, the incremental cost effectiveness ratio is found to be a cost of 9100 per QALY. Depending of the incremental values, one may have to select the best feasible.

Based on this approach one can develop a graphical representation, to easily select the treatment is beneficial or not. Figure 1, illustrates four quadrants with y-axis for cost and x-axis for effectiveness. If more effective and of less cost, then the treatment or intervention can be encouraged, accepted or dominant. If the treatment is less effective and of more cost, then the treatment or intervention can be abandoned, rejected or dominated. The left over quadrants are useful for incremental cost ratios whose therapies lie between set lower and higher costs per QALY.

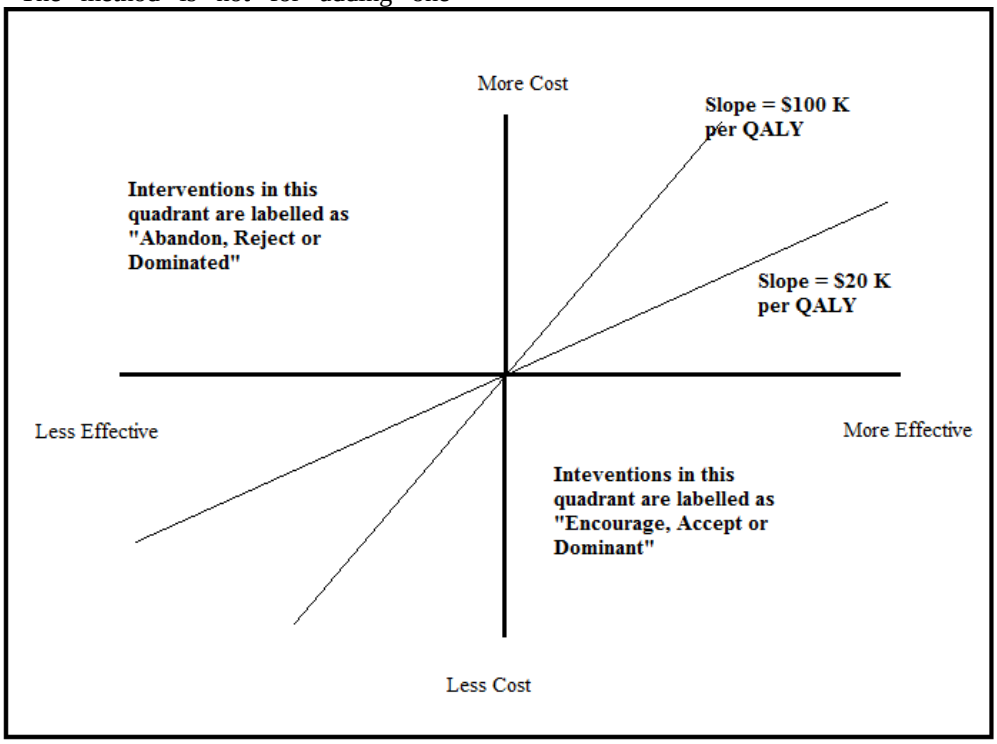

Figure 1. Pharmacoeconomic ratios and Quadrants

3. Role of Instruments (1-4)

Instruments are also called as questionnaires. Such questionnaires are either of generic version or of disease specific. It is always necessary to use already available and globally accepted instruments. Where an instrument is not available for the said purpose, one has to develop and validate. The instrument developed should be reliable, practical, valid and accurate. Instruments are usually meant for abstract scaling and should be developed language specific. Hence, the same question when asked by different languages, the answer may be inappropriate by the same individual.

To develop an instrument (2, 3), one has to develop concept, concept dimensions, indicators and index. In addition to this one has to design the instrument keeping in mind subject orientation, response form, degree of subjectivity, scale properties, number of dimensions. In order to develop indexes one may have to use either or all such as arbitrary, consensus, item analysis, cumulative or factor approaches.

Once an instrument is developed, a test feedbacks to each question and answer among the multiple choice or so have to be recorded for several individuals as sample from a population, checked for its reliability using Cronbach's alpha and should be at least in acceptable range. The internal consistency of an instrument using Cronbach's alpha is as illustrated in Table 1.

Table 1. Validation of Instrument based on Cronbach's alpha values (5)

Cronbach's alpha Value	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

In health care sector, Health related quality of life (HRQOL) instruments are used. Several instruments developed have back end mathematical calculations upon feeding the feedback received from an individual based on the instrument. (4) Hence, feedbacks received are recorded into softwares, and the softwares give final net scores.

Several health related quality of life questionnaires include several questions finally falling under the categories of physical or mental health. Hence, the questionnaire helps in understanding the physical and mental health components of the individual. For instance, SF-36 is an instrument that is used to know the mental and physical health by asking several questions and getting the answer from a multiple choice.

Some of the generic instruments are SIP, Nottingham, QWB, SF-36, EQ-5D etc., and some of the disease specific instruments are pain, arthritis, epilepsy, cancer, COPD, GI etc. One has to understand the role of these instruments to the current context to establish benefits that are to be converted into currency values so as to come up with appropriate mathematical method for developing choices.

4. Conclusion

In health care, cost of illness is given by direct cost plus indirect costs. The main objective is to decrease morbidity and mortality by extending individual life years so that one's productivity is recovered which plays a critical role in individual's economics as well as country's economics. Especially, policies that are more beneficial rather than costs are considered by government, charity oriented sectors, where as those with benefits equal to cost are considered by no-profit-no-loss sectors. Discount rates in the form of current yield rate on long-term government bonds is found practical, riskless long-term alternative for best utilization of funds especially by tax-free institutions. Hence, an abstract attribute feedback from a patient can be converted into a score and later to a currency value for developing a mathematical model for developing choices and picking one among treatments. The role of instruments is no way witnessed in Drugs and Cosmetics Act, 1940 and Rules, 1945 or as amended, to the knowledge.

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Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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