Pharmacoeconomics – Evaluating the Cost of Pharmaceuticals

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Health economics is about making resource allocation decisions under condition of scarcity (Resource is always limited in developing countries like India). Economics provides methods for evaluating choices in terms of their costs and benefit. Although resource allocation can be a highly political process, the tool of economic analysis encourages better decision making by providing information.

Key Definitions:

Pharmacoeconomics : The description and analysis of the cost of drug therapy to the health care systems and society.

Cost : The total resources consumed in providing a good or service

Price : The amount of money required to purchase an item.

Drug Effectiveness : The effects of a drug when used in real life situation.

Drug Efficacy : The effects of drug under clinical trial condition

Pharmacoeconomics provides a set of analytical tools that can help identify which of several alternatives offers the greatest benefits compared with its cost.

1. Cost minimization analysis – Calculating the cost of two or more alternatives that have the same outcome to identify the lowest cost option.
2. Cost - effectiveness analysis - measuring both costs and benefits of alternatives to find the strategy with the best ratio of benefits, measured in therapeutic or programme effects, per money unit.
3. Cost – Utility analysis - same as cost effectiveness analysis except that benefits are measured in utility units (which are often controversial).
4. Cost benefit analysis – Comparison of cost and benefits of any intervention by translating the health benefits into a money value, so that both costs and benefits are measured in same units.

Cost minimization analysis:

The benefits have to be measured in the same units and all the alternatives considered need to produce the same quantity of benefits – Identify the lowest cost alternative, - needs only calculation of costs.

(If two drugs have the same therapeutic benefit, have the same safety profile and are of equivalent quality, the drug with lower cost would be selected).

Cost Effective Analysis:

Unit of output of the alternatives is the same, but the quantities of output or effectiveness of the strategy, can differ. - Identify the option with the lowest cost of benefit.

Ex: Different vaccination strategies: - (Fixed Point, Outreach, Campaign) may reach different numbers of children and have different levels of effectiveness. The cost effective analysis will help identify the one that has the lowest cost per fully immunized child. Output/benefits can be measured as intermediate outputs (cost per child vaccinated, cost per course of therapy).

Cost Utility Analysis:

Simple cost effective analysis conducted with programme outcome measured in utility units. The common utility measure is the quality adjusted life year (QALY). The years are weighed by the 'quality' of those years where they are lived in less than perfect health. Not much useful because quality of life scales are not perfect measures.

Cost benefit analysis is rarely under taken in health section because of difficulty of assigning a monetary value to live years saved. However, it allows the comparisons of programs with different outcomes.
Ex: Investment in Health Vs Investment in Education.

Pharmacoeconomic analysis helps addressing the questions such as:

- What drugs should be included on the formulary?
- What are the patient outcomes of various treatment modalities?
- How do two options for providing pharmacy services compare?

A Comparative Study of various Methods

Type of Analysis	**Drug Therapy Choice (Antibiotics A Vs antibiotic B for treating childhood pneumonia)**
Cost Minimization:	At the two drugs with equal effectiveness, which is the least expensive.
Cost Effectiveness:	Two drugs have different degree of effectiveness: what is the cost per child cured and for antibiotics A Vs antibiotic B.
Cost Utility:	What is the cost per QALY saved of treating childhood pneumonia with drug A Vs treating tuberculosis with a short course of chemotherapy (method is controversial)

Cost benefit:	What is the cost – benefit ratio (value of costs per value of life saved) for treating childhood pneumonia Vs the cost benefit ratio for saving lives through improved road lighting (not used for comparing drug therapy).

Cost Effective Evaluation:

Six Steps:

Step I: Define the objective:

For Example in terms of program output:

- Which drug regimen should be the therapy of choice for the treatment of childhood pneumonia?

Step II: Enumerate the different ways to achieve the objective.

Short course chemotherapy with more expensive drugs (Option 1) Vs traditional long course chemotherapy with cheaper drugs (option 2).

Step III: Identify and measure the cost of each option.

All the inputs required for each option should be identified and costs determined.

<u>Different types of costs:</u>

Recurrent Costs – The Costs of goods that are consumed or used over the course of a year. Ex: Staff, Fuel.

Capital Cost: The costs of goods that are intended to last for longer than a year (buildings, vehicles).

Annualised Capital Cost – Capital Cost per year of useful life for a building, vehicle etc.,

Fixed Cost: Cost that does not change with the level of output (building, equipment, salary).

Variable Cost: Cost that changes depending on the amount of services delivered (Drugs, Supply).
Total cost: The sum of recurrent costs and annualised capital costs

Average cost per unit: Total cost divided by the number of units produced (cost per patient treated, per immunization given, per cure dispensed)

Marginal cost: The cost of providing one additional unit.

Step IV: Identity and measure the benefits of each option:

In the drug choice example, benefits could be measured in DALY. Measures of drug effectiveness will be needed as well as epidemiological information on the course of illness without treatment.

Step V: Calculate and interpret the cost effectives of each option.

The cost effectiveness ratio is total cost divided by total number of units of output.
Better over all efficiency is indicated by a lower cost per unit of output.

Step VI: Perform sensitivity analysis on the conclusions:

Sensitivity analysis measures how different assumptions made in the course of estimating costs and outputs affect the conclusions. Sensitivity analysis deals with uncertainty in assumptions. It identifies the value/assumptions about which there is uncertainty, determines their likely range or values and recalculates study results based on a combination of the best guess, most conservatives. (The question of interest is whether the conclusions of analysis would be changed with these extreme values).

Case Studies:
Pharmacoeconomics in formulary decisions in Australia: In Australia, the federal government subsidizes the use of pharmaceuticals through the maintenance of a positive formulary, called Pharmaceutical Benefits Schedule (PBS). Recommendations to list new drugs on PBS are made by a Pharmaceutical Benefits Advisory Committee (PBAC) to the health minister.

In making recommendation, it considers,

1. Importance of the drug, 2. Need for it in the community 3. Cost effectiveness, and
4. Financial implications of adding it to the formulary.

The PBAC generally does not consider testing new drug unless the request is accompanied by economic analysis. Relative clinical performances and cost of both the potential new drug and comparable drugs listed in PBS are presented (cost not only acquisition costs - but also savings in other area - lower use of other drugs, fewer consultations, hospital admission).

Ex: Cost of achieving a bacterial use.
Cost of achieving a 50% reduction in seizure frequency for anticonvulsants.

Cost – Utility Analysis

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Cost – Utility Analysis (CUA) is a pharmacoeconomic tool in which drugs / interventions with different outcomes can be compared. CUA is similar to cost – effective analysis except that outcomes are adjusted for patient preference or utility. CUA provides opportunities to compare two or more alternative choices in terms of both their costs and their outcomes while measuring the outcomes in units of utility or preference. The most commonly used unit of utility is "Quality Adjusted Life year (QALY)". The comparison is made in terms of clinically meaningful outcomes and cost between the products. *CUA is considered as 'GOLD STANDARD' methodology for evaluating the cost effectiveness of healthcare choices.*

Cost – Utility Analysis Vs Cost – Effectiveness Analysis:

- Different types of health outcomes and diseases with multiple outcomes can be compared using a common unit, QALY. On the other hand, cost – effective analysis does not compare different outcomes.
- In cost-effective analysis, the comparison is done among alternatives: cost per infection cured; cost per cancer detected. The outcome measurement is not complete but is an intermediate outcome. It does not compare: survival period and quality of life. The quality of life is important in addition to life saved.

Utility and Quality Adjusted Life Year:

A utility is a quantitative expression of an individual's preference or desirability of a particular state of health under conditions of uncertainty. We call it as Health Utility. Health Utility is also can be described as health outcomes. When health outcome is saving life, then effectiveness of therapy or intervention is measured in terms of 'life year saved'. But the number of years lived after the intervention does not tell everything. It is silent about the quality of life during survival period. It is logical to think of including the quality of life, health related quality of life, to measure the outcomes. Thus, it is necessary to measure the outcomes combining the mortality (life year) and morbidity (illness and disability / compromised life). The use of single value index which reflects all aspects of health including morbidity and mortality would be very helpful in performing economic analysis of various outcomes.

Besides, the healthcare interventions are also concerned for improving the quality of life not just extending the length. Yes, it is difficult to measure the quality of life of an individual but there must be a method of quality of life measurement which would be acceptable for economic analysis even though it may not be perfect.

While we consider the outcomes of an intervention in terms of extending the patient's life and improving the quality of life as well, it is easy to measure whether the intervention extends life but the measurement of improvement of quality of life is very complicated. It is

very difficult to directly compare the value of a treatment that primarily extends life to the value of a treatment that primarily improves quality of life. QALYs are an attempt to get around this difficulty. The QALY is a single index which combines the effects of treatment on quality of life and quantity of life. It lowers the value of year of treatment by the degree to which an illness or disability is perceived to harm the person's quality of life during that year.

The utility values are based on previous studies where the members of the general public valued a sample of possible health status. This is preferred compared to using 'patient preference'.

Quality Adjusted Life Year (QALY) is the most acceptable unit of health outcome measurement. QALY is the unit of outcomes as it allows comparability across all CUA studies. It is a universal measure which can be applied to all patients and all disease.

Calculation of QALYs: The QALYs can be calculated by multiplication of quality of life (QoL) and number of years gained.

$$QALY = QoL \times number\ of\ years\ \ gained$$

Person's health related quality of life ranges between 0 and 1. The '0' indicates death and '1' indicates full health. Utility measurement is on interval scale. A change in health state from 0.2 to 0.5 is equivalent to change from 0.6 to 0.9. Health state worse than death is also accounted and the value goes below '0' (negative).

The score of 0.5 is equivalent to living in full health 50 % of the time.

Usefulness of QALYs: It is necessary to determine by 'how much not being in perfect health impacts a person's quality of life.it is the most acceptable unit of utility for economic analysis. QALYs are used to compare the impact of multiple treatment for unrelated conditions to one another.

QALY, determined through questionnaires, is used in countries like, USA, UK, Iran and China.

Limitation of QALY: Utilities measured as QALY by different researchers vary considerably for the same severity of the same .disease. It is independent of age.

Cost – Benefit Analysis and Frame work that uses patient preference to determine the value of healthcare treatment are viewed as alternative to QALYs.

Interpretation of CUA: It is expressed in terms of a ratio of the incremental costs of two alternatives / treatments over the incremental quality adjusted life years of the two alternatives.

Incremental cost effective ratio [ICER], difference between cost effectiveness of the new treatment compared to another treatment, is the deciding factor for choosing the treatment. The comparator is either another possible treatment for the same illness, placebo or standard therapy. ICER is also known as 'cost per QALY'.

$$\text{Cost per QALY} = \frac{[C1-C0]}{[E1-E0]}$$

Where: C_1 = Treatment cost which gives outcomes of E_1

C_0 = Treatment cost which gives outcomes of E_0

E_1 = Number of QALYs gained with cost of C_1

E_0 = Number of QALYs gained with cost of C_0

- The cost of saving one QALY (Cost ÷QALY) is the basis for choice. The lower cost per QALY, the most cost effective the treatment is.
- Utility ratio is the incremental gain in QALYs comparing one programme to another.
- In general QALYs are calculated before and after treatment to determine the degree to which a treatment improves the number of QALYs gained by the patients.

Application of Cost – Utility Analysis:

- Medical Insurance providers have been using CUA to determine the cost – effectiveness of medications and treatment as an attempt to reduce healthcare cost. Cost – effective treatment is generally considered to be a treatment for which, from the perspective of the payer, the cost of treatment does not outweigh the health improvements it provides.
- Useful in comparing treatments and outcomes that are very different [Ex: treatment of heart disease with prenatal care].
- It considers quality of life is a concern while performing economic analysis of two alternative treatments.

CUA in Practice: Australia has Pharmaceutical Benefit Scheme under which the citizens are provided subsidized medicines and the scheme assumes responsibilities towards the cost of medicines in community setting. The Pharmaceutical Benefit Advisory Committee makes funding recommendations based on cost minimization and cost utility analysis. It quantifies the comparative costs and benefits of funding decisions. The CUA is used to estimate an incremental cost effectiveness ratio for new medicines with superior efficacy.

CUA analysis using QALY as a measure of utility is used in USA for payment through medical insurance. In UK, CUA is used for NHS. There are threshold value for 'Cost per QALY' for using a new treatment.

Other Utility Measurement Units:

Utility scores can be assigned by direct measurement using techniques like standard gamble and the time trade off. The scores can be assigned indirectly by using utility weighted index: EuroQoL, Health Utlities Index, and Quality of well-being scale.

In utility measurement, a hypothetical situation is given to the person and asked to respond the questions about the hypothetical situations:

Time Trade Off: The people are given two alternatives –

- Alternative 1: Living certain period of time with the disease state and then death.
- Alternative 2: Living healthy for a time period (less than the time period given under alternative 1)

The people are asked to determine: how many years of living with a particular disability Vs shorter number of years in perfect health.

Standard Gamble: The people are given two alternatives –

- Alternative 1: has two possible outcomes – Either to return to normal health or immediate death (a surgery with risk of death).
- Alternative 2: Living for life with the disease state.

The people are asked to imagine having a disability and asked whether they would undergo a procedure that involves a risk like chances of coming back to normal health and at the same time risk of death too in the intervention. Gambling is: to accept alternative 1 (taking risk) or live with disease condition.

The calculation of Utility Score is not easy for Time Trade Off and Standard Gamble Method. The further discussion is beyond the scope of this text.

Bottom Line

- Cost – Utility Analysis is a type of economic analysis which measures the benefits in utility –weighted life years (QALYs) and that computes a cost per utility – measure for comparison between programmes.
- The number of QALYs gained from a treatment is a measure of “Health Outcome” or over all benefits of the treatment.
- “Cost per QALY” can be obtained for simple treatment and multiple treatment as well.
- Lower the Cost per QALY: more cost effective is the treatment.

Cost Effective Analysis

1. **Comparison of two lipid lowering agents:**

   Atorvastatin versus Rosuvastatin

	Atorvastatin	Rosuvastatin
Dose (minimum)	10 mg once daily	10 mg once daily
Price in Rupees per Tablet	2.45	6.5
Effectiveness [% reduction in LDL]	40%	50%
Cost for 12 months	894	2372
Cost effectiveness [for 1% reduction in LDL]	22.35	47.44

Though atorvastatin seems to be less effective comparative to rosuvastatin, it is more cost effective.

2. **Comparison of Antihypertensives:**

   You are asked to evaluate a new alpha-antagonist for the treatment of hypertension. Its dose is once daily. It has been proved that it lowers the blood pressure to a similar extent as enalapril and losartan.

   The approximate cost for a month's supply: prazosin – USD 18, enalapril – USD 28 and losartan – USD 38. Beta blockers and thiazide diuretics are also in hospital's subsidy list at a cost of about USD 8 for month's supply. No trial data of the new agent is available against these drugs.

   What would be your approach?

   Answers: The goal of treating hypertension in terms of health outcomes is to prolong life by preventing cardiovascular events and target organ damage. This is achieved by lowering blood pressure to a range where absolute cardiovascular risk is essentially reduced to the population level. The reduction of blood pressure is a surrogate outcome measure, but is accepted by regulatory authorities for registration. All the drug groups lower blood pressure to approximately the same extent. Outcome studies are available fr diuretics, beta blockers and ACE inhibitors, but for alpha-antagonists. In terms of subsidy listing, a principle should be that, to achieve a price premium, a new drug should have demonstrated an increased benefit in terms of health outcomes.

   It has been argued that this is a new innovative treatment that has been shown to be equivalent to losartan and the price accordingly equivalent to the alpha 2 anatgonists.

   Answer: This is just another alpha antagonist and therefore be compared with prazosin.

   It has been stated that new agent is not compared with prazosin but comparative data with ACE inhibitors and alpha 2 antagonist are available.

   Answer: Lack of data comparing the new agent with prazosin is the problem and higher price can be considered if there is demonstrable health outcome benefit over prazosin. [This is also a concern why prazosin has higher price over diuretics and beta blockers].

   It is now further argued that the new agent has a longer half life than prazosin so it can be administered once a day compared to twice day for prazosin. It would, therefore, improve compliance, a very important consideration in treating hypertension.

   Answer: There is no evidence that once-daily dose leads to improved compliance or health outcomes. A small premium may be considered for the extra convenience of the patients who are taking a life-long treatment when they are essentially without symptoms.

   The product is not made available in the market.

3. **Antibiotic Ear Drops:**

Otic Ear drop is available at a cost of Rs. 6.50 per treatment and is effective in approximately 80% of treatment courses. Another Ear drop Cortispor has a cost of Rs. 7.90 for each treatment and has been reported to be 90% effective. The drug would be used approximately for 1000 patients each year.

Answer the following questions:

a. Evaluate the cost of these medications.
b. Which of these medications is preferable for the drug list in a public hospital?

Answers:

a.

	Otic	Cortispor
Cost per treatment in Rupees	6.5	7.9
Effectiveness	80%	90%
Cost for 100 cases	650	790
Cost effectiveness [Cost per case]	650/80=8.125	790/90=8.7

The Otic Ear drop is more cost effective compared to Cortispor.

b. The Otic Ear drop is preferable for the public hospital. However, there may be further consideration on compliance, ADR rate, and ease of use. In a year it can save 7900-6500 = 1400/-.

4. **Cost Effective Choice in Thrombolytics for Acute Myocardial Infarction:**

The data on two thrombolytics is available from a large randomized trial in which the primary outcome of mortality was measured 30 days after randomization. The average survival time following non-fatal myocardial infarction is 8 years.

Outcomes in 100 patients	
No treatment	15 deaths
Thrombase	10 deaths
Klotgon	7 deaths
Medicine Cost per patient	
Thrombase	USD 200
Klotgon	USD 1000

The following questions are required to answer and present the finding in a large group of experts:

a. If hospital budget are unlimited, if 1000 patients were to be treated, how many lives could be saved if patients were treated with Thrombase, compared to no treatment? How many could be saved with Klotgon, compared with no treatment?
b. If the hospital's budget for purchasing thrombolytics were USD 200,000, how many patients could be treated, and how many lives could be saved with each of drugs, compared with no treatment at all?
c. What is the incremental cost per life saved, for each of thrombolytic agents, compared with no active treatment?
d. What are the incremental cost effectiveness ratio (ICERs), expressed as the incremental cost per life year gained, for each of thrombolytic agents, compared with no active treatment?
e. What is the ICER for Klotgon compared to Thrombase?
f. What would be your recommendations?

Answers:

a. Of 1000 patients treated with a placebo, 150 will die.
Of 1000 patients treated with Thrombase, 100 will die. Therefore, 50 lives would be saved.
Of 1000 patients treated with Klotgon, 70 will die. Therefore, 80 lives would be saved.

b. Treatment with Thrombase

If the budget is USD 200,000 and the cost of treatment is USD 200 per patient; then 1000 (200,000/200) patients can be treated and 50 live saved.

Treatment with Klotgon

If the budget USD 200,000 and the cost of treatment USD 1000 per patient; then 200 (200,000/1,000) patients can be treated and 80/1000X200 = 16 lives saved.

c. If 1000 patients are treated with thrombase, 50 lives are saved.
ICER (thrombase versus placebo for 1000 patients) = $\frac{(1000 \times USD\ 200 - 1000 \times USD\ 0)}{50\ lives\ saved}$

= $\frac{USD\ 200{,}000}{50\ lives\ saved}$ = USD 4000 per life saved

If 1000 patients are treated with Klotgon, 80 lives are saved.
ICER (klotgon versus placebo for 1000 patients) = $\frac{(1000 \times USD\ 1000 - 1000 \times USD\ 0)}{80\ lives\ saved}$
= $\frac{USD\ 1000\ 000}{80\ lives\ saved}$ = USD 12,500 per life saved

d. If 1000 patients are treated with Thrombase, 50 lives are saved. Assuming an increase in survival time of 8 years per patient, 50X8 = 400 life years gained.
ICER (thrombase versus placebos for 1000 patients) = $\frac{(1000 \times USD\ 200 - 1000 \times USD\ 0)}{400\ life\ years}$
= $\frac{(USD\ 200\ 000}{400\ life\ years}$ = USD 500 per life year gained.

If 1000 patients are treated with Klotgon, 80 lives are saved. Assuming an increase in survival time of 8 years per patient, 80X8 = 640 life years gained.
ICER (Klotgon versus placebos for 1000 patients) = $\frac{(1000 \times USD\ 1000 - 1000 \times USD\ 0)}{640\ life\ years}$ = $\frac{USD\ 1000\ 000}{640\ life\ years}$ = USD 1562.50 per life year gained.

If 1000 patients are treated with Thrombase, 50 lives are saved; if 1000 patients are treated with Klotgon, 80 lives are saved; therefore 30 lives are saved by treatment with Klotgon rather than Thrombase.
Assuming an increase in survival time of 8 years per patient, 30X8 = 240 life years gained.
ICER (Klotgon versus thrombase for 1000 patients) = $\frac{(1000 \times USD\ 1000 - 1000 \times USD\ 200)}{240\ life\ years}$
= $\frac{USD\ 800\ 000}{400\ life\ years}$ = USD 3 333 per life year gained.

5. Un-fractionated heparin versus low molecular weight heparin:

There has been a request for replacement of un-fractionated heparin with low molecular weight heparin in the management of patients with unstable coronary artery disease. A summary of data was provided from a clinical trial published in reputed medical journal. The outcomes were reported 30 days after randomization.

Outcome	Low molecular weight heparin	Un-fractionated heparin	P-value
Combined risk of death due to acute myocardial infarction or unstable angina	318/1607 (19.8%)	364/1564 (23.3%)	0.016
Percutaneous revascularization (USD 1390 per procedure)	236/1607 (14.7%)	293/1564 (18.7%)	0.002
Major bleeds	102/1569 (6.5%)	107/1564 (7.0%)	0.57
Minor bleeds	188/1580 (11.9%)	110/1528 (7.2%)	<0.001

On investigation the followings are noted:

Item	Low molecular weight heparin	Un-fractionated heparin
Monthly drug cost in USD	72.50	27.09
Monthly cost monitoring	None	5 tests/patient of
Anticoagulant effect		12.40 USD per test

Answer the following and defend your decision in a expert group meeting.

a. Calculate the relative risk of the combined (triple) end point in patients who received low molecular weight heparin compared with those who received un-fractionated heparin.
b. Calculate the risk difference and the number of patients who need to be treated to prevent a single event with low molecular weight heparin compared with un-fractionated heparin.
c. Calculate the ICER for the main clinical outcome with low molecular weight heparin, compared with un-fractionated heparin using drug cost only.

d. Re-calculate the ICER for the main clinical outcome with low molecular weight heparin, compared with un-fractionated heparin including the cost of monitoring treatment with heparin.

Answers: Un-fractionated heparin versus low molecular weight heparin

a. **Relative risk** = event rate in the treatment group / event rate in the control group = 19.8%/23.3% = 0.85.
b. Risk difference (also called **absolute risk reduction**) = 23.3% - 19.8% = 3.5%
   Number of patients who needed to be treated = 1/absolute rate reduction = 1/0.035 = 29 patients.
c. **ICER (for 1000 patients)** = $\frac{(1000 \times USD\ 72.20) - (1000 \times USD\ 27.09)}{3.5\% \times 1000} = \frac{USD\ 45\ 110}{35} = USD\ 1\ 288.86\ per\ event\ avaoided.$
d. **ICER (for 1000 patients)** = $\frac{(1000 \times USD\ 72.20) - [1000 \times (USD\ 27.09 + 5 \times USD\ 12.40)]}{(1000 \times 23.3\%) - (1000 \times 19.8\%)} = \frac{-USD\ 16890}{35}$

   Low molecular weight heparin is dominant. It is both cheaper and more effective than un-fractionated heparin when monitoring costs are included.
   When a drug is dominant, it is not appropriate to calculate ICER, as this can produce spurious result.

6. Celecoxib versus diclofenac:

It has been proposed by the Head of Rheumatology Department to add celecoxib, a COX 2 inhibitor, to the hospital formulary in place of NSAIDs. He argues that the hospital will have lot of savings by avoiding complications associated with NSAIDs such as peptic ulcer.

On investigation, following result of a clinical trial has been found to have reported in a prestigious medical journal:

Mean (SD) arthritis assessment results at week 24				
Primary assessments	Celecoxib		Diclofenac	
	Base Line	Week 24	Base Line	Week 24
Physician's assessment [grading from 1 (very good: symptom free with no limitation of normal activities) to 5 (very poor: very severe symptoms that are intolerable, and inability to carry out all normal activities)]	2.9 (0.7)	2.6 (0.8)	3.0 (0.8)	2.6 (0.8)
Patient's assessment [grading from 1 (very good: symptom free with no limitation of normal activities) to 5 (very poor: very severe symptoms that are intolerable, and inability to carry out all normal activities)]	3.0 (0.8)	2.7 (0.9)	3.1 (0.8)	2.8 (0.9)
Number of tender / painful joints	20.3 (14.4)	14.5 (14.1)	21.7 (14.4)	16.4 (14.7)
No. of swollen joints	14.9 (10.2)	10.7 (10.1)	14.3 (9.9)	10.4 (10.0)

The following adverse events data were also reported:

Frequency of peptic ulceration and related complications			
	Celecoxib (n =212)	Diclofenac (n=218)	P – value
Patients on whom erosion, ulcer or both were detected			
Gastric Duodenal	38 (18%) 11 (5%)	74 (34%) 23 (11%)	<0.001 <0.009
Ulcer incidence by *Helicobacter pylori* status			
Positive serological test Negative serological test	7/93 (8%) 1/97 (1%)	19/87 (22%) 10/100 (10%)	Not Significant both cases
Ulcer frequency by concomitant corticosteroid use			
Corticosteroid use No corticosteroid use	2/80 (3%) 6/132 (5%)	12/102 (12%) 21/116 (18%)	Not Significant both cases

Further literature review gives the following additional information:

- One percent of patients with endoscopic damage are hospitalized with gastrointestinal bleeding.
- The cost of hospitalization for gastrointestinal bleeding is USD 1434/Patient.
- Ten percent of patients admitted with gastrointestinal bleeding die.
- The cost of celecoxib for 60X100 mg tablets is USD 50.
- The usual dose of celecoxib is 200 mg twice daily.
- The cost of diclofenac is USD 11.60 for 50X50 mg tablets. And USD 14.35 for 100X25 mg tablets.

Answer the following questions for presenting before the expert group of DTC:

a. Calculate the relative risk for peptic (gastric or duodenal) ulcers in the patients who received celecoxib compared with those who received the NSAID diclofenac.
b. Calculate the risk difference and the number of patients who have to be treated tp prevent a single event with celecoxib, as compared with NSAID.
c. Calculate the ICER for the main clinical outcome with celecoxib, compared with NSAID, using drug cost only.
d. Re-calculate the ICER for the mail clinical outcome with celecoxib, compared with NSAID, including the cost of treatment of gastrointestinal bleeding.

Answers:

a. **Relative risk** = $\frac{[(38+11)\div 212]}{[(74+23)\div 218]} = \frac{23\%}{44\%} = 0.52$
b. **Risk difference** = 23% - 44% = -21%
   Number patients who have to be treated to prevent a single event = 1/0.21 = 5 patients
c. Dose of celecoxib = 400 mg/day. One pack contains sufficient drugs for 15 days of treatment. The duration of treatment is 24 weeks = 168 days. Therefore, 168/15 = 11.2 packs are required at the cost of 11.2 X USD 50 = USD 560 per patient.

   Dose of diclofenac = 100-150 mg/day. Assume conservative dose of 100 mg/day.
   One pack contains sufficient drugs for 25 days of treatment. The duration of treatment is 168 days. Therefore, 168/25 = 6.72 packs are required at a cost of 6.72 X USD 11.60 = USD 77.95 per patient.
   ICER (for 1000 patients) = $\frac{(1000 \times USD\ 560 - 1000 \times USD\ 77.95)}{4440-230} = \frac{USD\ 482\ 050}{210}$ = USD 2 295.48 per ulcer avoided.
d. ***Incremental cost per ulcer or erosion avoided***

ICER (for 1000 patients) =

$$\frac{[(1000 \times USD\ 560) + (1000 \times 23\% \times 1\% \times USD\ 1434)] - [(1000 \times USD\ 77.95) + (1000 \times 44\% \times 1\% \times USD\ 1434)]}{(1000 \times 0.44) - (1000 \times 0.23)} =$$

$$\frac{USD\ 479038.60}{210}$$ = USD 2281.14 per ulcer or erosion avoided.

Incremental cost per hospitalization avoided

ICER (for 1000 patients) =

$$\frac{[(1000 \times USD\ 560) + (1000 \times 23\% \times 1\% \times USD\ 1434)] - [(1000 \times USD\ 77.95) + (1000 \times 44\% \times 1\% \times USD\ 1434)]}{(1000 \times 0.44 \times 0.01) - (1000 \times 0.23 \times 0.01)} =$$

$$\frac{USD\ 479038.60}{2.1}$$ = USD 228113.20 per hospitalization avoided.

Incremental cost per death avoided

ICER (for 1000 patients) =

$$\frac{[(1000 \times USD\ 560) + (1000 \times 23\% \times 1\% \times USD\ 1434)] - [(1000 \times USD\ 77.95) + (1000 \times 44\% \times 1\% \times USD\ 1434)]}{(1000 \times 0.44 \times 0.01 \times 0.1) - (1000 \times 0.23 \times 0.01 \times 0.1)} =$$

$$\frac{USD\ 479038.60}{0.21}$$ = USD 2281136.20 per death avoided.

7. Oral montelukast versus an inhaled steroid:

A pharmaceutical company donated the 10 cartoons of montelukast urging it is more effective and much easier to use than the usual puffers. As the product is new and not in the hospital's essential medicine list, you have been asked to do a comparative cost effectiveness study for presentation in DTC meeting.

On literature search the following are obtained:

End point	**Placebo**	**Beclomethasone**	**Montelukast**
Percent change (FEV)	0.7 [-2.3, 3.7]	13.1 [10.1, 16.2]	7.4 [4.6, 10.1]
Change in daytime asthma symptom score	-0.17 [-0.3, -0.05]	-0.62 [-0.75, 0.49]	-0.41 [-5.3, -0.29]
Percentage change in total daily beta agonist use	0.0 [-8.3, 8.3]	-40.0 [-48.5, - 31.5]	-23.9 [-31.4,-16.5]
Change in morning PEFR [l/min]	0.8 9-7.1, 8.6]	39.1 [31.0, 47.1]	23.8 [16.6, 30.9]
Change in evening PEFR [l/min]	0.3 [-7.3, 8.0]	32.1 [24.2, 39.9]	20.8 [13.8, 27.8]
Change in nocturnal awakening [nights per week]	-0.5 [-0.9, -0.1]	-2.4 [-2.8, -2.0]	-1.7 [-2.07, 1.3]
Change in eosinophil count [cells X $10^3/\mu l$]	-0.02 [-0.07, 0.03]	-0.07 [-0.12, -0.02]	-0.08 [-0.12,-0.03]
Percentage of patients with asthma attacks	27.3	10.1	15.6

Note: Values are mean [95% CI], FEV – Forced expiratory volume in second, FEPR – Peak expiratory flow rate.

The costs of the two drugs are:

- Beclomethasone : Australian Dollar 26 for 28 days of treatment,
- Montelukast : Australian Dollar for 28 days of treatment.

Answer the following questions for presentation before the hospital formulary committee:

a. Which outcome(s) will you use for comparison while comparing montelukast with beclomethasone? Why?
b. Calculate the ICER for the main clinical outcome.
c. Which is the better drug? Why?

Answers:

a. There is no right answer.
b. There is no right answer.
c. C. Beclomethasone is both cheaper and more effective than montelukast. Therefore, Beclomethasone is dominant.

8. Two thrombolytics in acute myocardial infarction:

The study showed the cost of treatment (in Australian Dollar) and mortality rates of streptokinase (SK) and plasminogen activator (TPA) as follows:

Treatment	Cost in AUS Dollar	Outcome
Usual care of myocardial infarction (MI)	3.5 million / 1000 cases	120 die
Usual care of MI + Streptokinase (SK)	3.7 million / 1000 cases	90 die
Usual care of MI + Plasminogen Activator (TPA)	5.5 million / 1000 cases	80 die

Question: Perform pharmacoeconomic analysis and draw your conclusion. If the hospital has limited budget of AUS Dollar 500,000 for thrombolytics, which one should be sued?

Answer:

Cost Effectiveness of SK compared to usual care:

Cost of treatment = (AUD 3.7 –AUD 3.5) million / 1000 cases = AUD 200 / case

Number of deaths that will be prevented = 120 – 90 = 30 deaths / 1000 cases treated

Cost effectiveness of SK = AUD 0.2 million / 30 lives = AUD 6700 per life saved.

Cost Effectiveness of TPA compared to usual care:

Cost of treatment = (AUD 5.5 – AUD 3.5) million / 1000 cases = AUD 2000 / case

Number of deaths that will be prevented = 120-80 = 40 deaths / 1000 cases treated

Cost effectiveness of TPA = AUD 2000 / 40 lives = AUD 50, 000 per life saved.

Difference in cost of treatment between TPA and SK:

Cost of treatment = (AUD 5.5 – AUD 3.7) million / 1000 cases = AUD 1800 / case

Number of deaths that would be avoided = 90-80 = 10 deaths / 1000 cases treated

Marginal cost of TPA over SK = AUD 1.8 million / 10 lives = AUD 180,000 per life saved.

With limited budget of AUD 500,000 for thrombolytics:

For SK:

Number of cases can be treated = AUD 500,000/200 = 2500

Number of lives that can be saved = (30/1000) X 2500 = 75

For TPA:

Number of cases can be treated = AUD 500,000/2000 = 250

Number of lives that can be saved = (40/1000) X 250 = 10

Conclusion: Although TPA is slightly more efficacious and marginally saved more lives, when cost was taken into account, more patients could be treated and more lives saved using SK. In other words, the extra cost of TPA over SK was so high (AUD 180,000 per life saved) that with limited budget available fewer people could be treated and lives saved, using TPA as compared to SK.

9. **Drug Treatment of type – II diabetes:**

The preliminary costing of Drug A and Drug B intended for type – II diabetes shows:

Cost Type	Cost of Drug A in USD per Month	Cost of Drug B in USD per Month
Acquisition Cost	20.00	10.00
Administrative Cost	2.00	2.00
Lab Cost	8.00	16.00
ADR Cost	4.00	8.00
Physician Visits	10.00	20.00
Total Cost	44.00	56.00

The cost comparison at this point shows that Drug A is less costly than Drug B by 22 percent. This lower cost is despite the high acquisition price USD 20.00/month, twice that of Drug B. The cost savings comes from Drug A's lower ADR rate and subsequent lower and physician costs.

The clinical study reported that on average Drug A lowers glycosylated haemoglobin by 1.5% and Drug B by an average of 0.8%.

Cost Effective Analysis:

Drug A:

Cost of Drug A = USD 44.00

Effectiveness measure = Reduction in glycosylated haemoglobin

Cost Effective Ration = Cost required to cause reduction of 1% glycosylated haemoglobin

= USD 44.00/1.5 = USD 29.33

Drug B:

Cost of Drug B = USD 56.00

Effectiveness measure = Reduction in glycosylated haemoglobin

Cost Effective Ration = Cost required to cause reduction of 1% glycosylated haemoglobin

= USD 56.00/0.8 = USD 70.00

Conclusion: The Drug A is more effective clinically even though it has a substantially higher acquisition price.

COST – MINIMIZATION ANALYSIS

1. **Three antimicrobials to treat uncomplicated urinary tract infection:**
   Three oral antimicrobials are available for uncomplicated urinary tract infection: Trimethoprim, Amoxycillin and Norfloxacin

Cost categories	Trimethoprim 200 mg Tab	Amoxycillin 500 mg Cap	Norfloxacin 400 mg Tab
Recommended treatment regimen for uncomplicated UTI	200 mg twice daily for 5 days	3 g twice daily for one day	400 mg twice daily for 3 days
Number of tabs/caps per course treatment	10	12	6
Acquisition price for 1 loose tab/cap in UK pound	0.048	0.088	0.365
Price for course of treatment in UK pound	0.48	1.06	2.19
Cost to treat 10,000 patients per year in UK pound	4,800	10,600	21,900

The cheapest medicine is trimethoprim. It is assumed that all the three antimicrobials are effective and are therapeutically equivalent. The cost of side effects is not taken into consideration.

2. Three injectable narcotics:

Cost categories	Diamorphine 5 mg vial		Pethidine 50 mg vial	Pentazocine 30 mg vial
Recommended treatment regimen for severe pain requiring injectable analgesia	5 mg 4 hourly IV	5 mg 4 hourly IM or SC	50 mg 4 hourly IM or SC	30 mg 4 hourly IM or SC
Acquisition price for one vial in USD	1.84	1.84	0.83	2.61
Number doses needed per day	6 doses per day	6 doses per day	6 doses per day	6 doses / day
Price for one day's treatment in USD	11.04	11.04	4.98	15.66
Nursing staff's salary @ USD 2.00 per IM or SC injection	----------	12.00	12.00	12.00
Specialist nursing salary @USD 4.00 per slow IV injection	24.00	----------	----------	----------
Equipment: syringe + needle @USD 2.00 per set	12.00	12.00	12.00	12.00
Total drug costs per day (USD)	47.04	35.04	28.98	39.66
Anticipated no. days treatment per year	3000 days	3000 days	3000 days	3000 days
Total drug costs for 3000 days treatment in USD	141,120	105,120	86,940	118,980

The analysis shows that pethidine intramascular (IM) or subcutaneous (SC) injection is the cheapest option. Diamorphine given by slow intravenous (IV) injection is the most expensive option.

3. **Two injectable antibiotics:**

Costs in USD	Drug A	Drug B
Acquisition Price	8.00	15.00
Pharmacist's salary	2.50	1.50
Nursing Salary	2.50	2.00
Supplies	9.00	2.25
Laboratory Services	4.00	1.00
Total	26.00	21.75

The cost analysis shows that Drug B costs less. If we just look at the acquisition price, the drug A is cheaper. The analysis shows that the real costs of two drugs are significantly different from acquisition price and that drug B has a lower overall cost.

4. Antibiotics for meningitis in children:
   Cephalosporacillin is an established drug but not in the hospital's drug list because of high cost. The antibiotic appears to be at least as effective as other antibiotics listed in the drugs' list (ceftriaxone and ampicillin)for the treatment of meningitis in children. One member of the DTC feels that Cephalosporacillin is much safer. You need to answer the following questions and give a presentation before the DTC:
   a. Determine the cost of each treatment course using the different regimen.

   Answers: Further research gives the following information –

	Cephalosporacillin injection	Ampicillin injection	Ceftriaxone injection
Dose	1 g IV every 24 hour	1 g every 4 hour	1 g every 12 hour
Procurement Price [USD]	22.50/dose	0.50 / dose	6.00/dose
Treatment course	7 days	7 days	7 days

Other administration costs [USD]:

- IV Set = 1.00
- Nursing salary to prepare and administer one dose of antibiotic = 1.00
- Pharmacist's salary to prepare one dose of antibiotic:
  - Cephalosporacillin – 1.50
  - Ampicillin – 1.00
  - Ceftriaxone – 1.50
- One course of treatment = 7 days

The total costs involved for each of these medications:

	Cephalosporacillin injection	Ampicillin injection	Ceftriaxone injection
Dose	1 g IV every 24 hour	1 g every 4 hour	1 g every 12 hour
Total number of doses for whole course	1 dose X 7 days = 7	6 doses X 7 days = 42	2 doses X 7 = 14
Procurement Price for whole course [USD]	22.50/dose X 7 = 157.50	0.50 / dose X 42 = 21.00	6.00/dose X 14 = 84.00
IV Set [USD]	1.00 X 7 = 7.00	1.00 X 42 =42.00	[can be adjusted with Ampicillin]
Nursing salary [USD]	1.00 /dose X 7 = 7.00	1.00X42 = 42.00	1.00 X 14 = 14.00
Pharmacist salary [USD]	1.50 /dose X 7 =10.50	1.00X42 = 42.00	1.50 X 14 = 21.00
Total Course Cost [USD]	182.50	147	119
Total Course Cost [USD]	**182.50**	**147 + 119 = 238**	

In Indian hospitals, where the staff are paid fixed salary and assuming that there are enough staff, the nursing and pharmacist salary may be ignored in the calculation. In such case, the earlier regimen looks better as it costs USD 147 against the new drug's cost USD 182.50.

5. Three antimicrobials for Uncomplicated Urinary Tract Infection

Assumption: All three regimens are therapeutically equivalent and effective.

Cost categories	Trimethoprim 160 mg + sulfamethoxazole 800 mg tablet	Ciprofloxacin 250 mg tablet	Cefalexin 500mg capsules
Recommended treatment regimen for uncomplicated UTI	Twice daily for three days	250 mg twice daily x 3 days	500mg twice a day x 7 days
No. of tablets/caps per course of treatment	6	6	14
Price for 1 loose tab/cap in Rupees	0.898	2.545	1.3831
Price for course of treatment in Rupees	5.388	15.27	19.3634
Cost to treat 10,000 patients per year in rupees	53,880	1,52,700	1,93,634

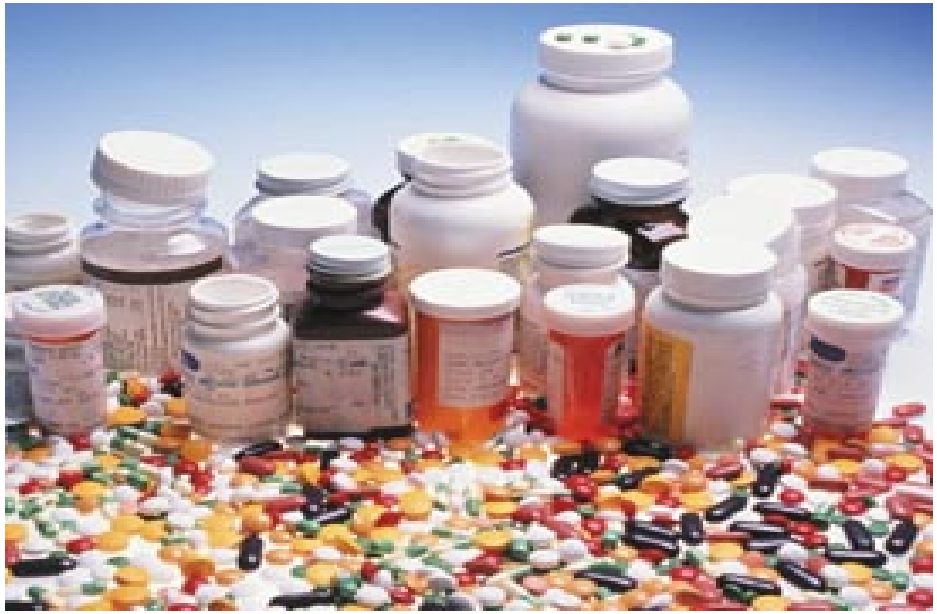
COST – BENEFIT Analysis

Cost Parameter	Cost in USD
Patient Cost	
Drug Cost	50.00
Laboratory Monitoring	20.00
Supplies to Administer	15.00
Personnel Cost	7.00
Hospital Cost	150.00
Total Patient Cost	242.00
Patient Benefits	
Work productivity	250.00
Patient satisfaction	100.00
Reduced Hospitalization Days	75.00
Total Benefit of the Drug	425.00
Net benefit of the drug	425-242 = 183

The benefit to cost ratio would be 1.8 to 1. This can then be used to calculate a ratio for other drugs to make a final comparison when deciding on a specific drug or service for the drug list.

Because of the difficulty in obtaining valid estimates of benefits and the value of those benefits, this type of cost comparison may prove to be problematic.

Pharmacoeconomics – an Emerging Area



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Professor,
Department of Pharmacy,
Annamalai University,
Annamalai Nagar – 608 002

WHO PAYS FOR MEDICINE ?

"The one who pays does not decide and one who decides does not pay"

"The one who decides is often paid"

EXAMPLE

Brand Name	Company	MRP of 10 Tab of 500 mg (In Rupees)
Crocin	GSK	11.97
Calpol	GSK	9.49
Metacin	Themis Pharma	6.50
Pacimol	IPCA	9.20
Fepanil	Citadel	6.30
Dolo	Micro Labs	15.50 (for 15 Tabs)
Ultragin	Wyeth	8.80

MEDICINE SCENARIO

- Medicines cost between 10-20% of the total health expenditure: high-income countries.
- While in low income countries like India, it is around 10% of total health are budget. 2% in Punjab to 17% in Kerala.
- Three – fourth of total out of pocket health expenditure is spent on medicines.
- Over 5% of the total household consumption goes on health spending.
- More than 60,000 drug formulations in the market

Medicine Scenario

- Proportion of spending on OOP health expenditure is high in lesser developed states like Orissa, Bihar etc. compared to developed states like Maharastra, Tamil Nadu, Gujarat etc.

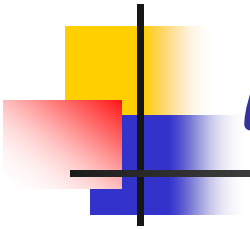
- Only 74 drugs are under DPCO.

Market Price of Drugs

- The variation between the price of most expensive brand and the cheapest brand of the same drug can be up to 1000%.
- Often the top selling brand for a particular drug is the most expensive brand.
- The price difference between retail price and the tender price for supply to institutions range from around 100% to 5600%.
- Same company sells the same drug at two different rates.

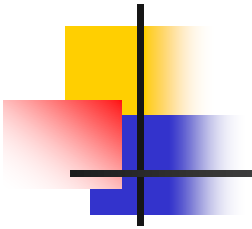
Ciprofloxacin Pricing

Brand/ Company	Price to Retailer	MRP	% Profit
Ciplox (Cipla)	65.94	85.73	30 +(7+3) Scheme
Ciprobid (Cadila)	56.36	65.87	17+ (4+1) Scheme
Gercip (German Remedies)	11.50	60.10	422
Cipdose (Plethico)	11.10	59.50	436
Ciprodac (Cadila)	14.00	64.00	357



Medicine Selection

- Efficacy
- Safety
- Quality
- Cost



DEFINITION

The discipline that describes and analyses the cost and benefits of pharmaceutical and alternative therapies to the health care system, the different stake holders, and the society as a whole.

A sub field of health economics

WHY PHARMACOECONOMICS ?

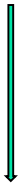
- Developed countries have insurance system.
- Developing and least developed countries: Health care mostly through public health system.
- Consumers pay from their pockets.

PHARMACOECONOMICS: Genesis

- The First Book on Health Economics in 1973.
- The Term Pharmacoeconomics was introduced in the literature in 1982 .
- A Journal on Pharmacoeconomics Started in 1992.
- International Society for Pharmacoeconomics and Outcome research (ISPOR)

PHARMACOECONOMICS: Transformation

- Analysis of the Costs of Drug Therapy to Healthcare systems and Society.



- Included the Outcome of the Investment.

PHARMACOECONOMICS ?

A set of analytical tools:

- Cost minimization analysis.
- Cost effective analysis.
- Cost utility analysis.
- Cost benefit analysis.

It provides better decision making by providing Information: which several alternatives offer greatest benefits compared with cost.

TOOLS in Brief: Cost Minimization

- Least information required and straight forward approach.
- Outcomes or benefits of alternatives must be in same unit and equivalent.
- Cost not necessarily restricted to price but include cost of preparation and delivery of treatment, of monitoring their use, and the cost of treating and ADR.

Brand Selection is an example

TOOLS in Brief: Cost Effectiveness

Examples of cost effectiveness measurement

- Acute illness:cost per course of treatment or cost per cure.
- Chronic illness: cost per month of satisfactory control.
- Disease prevention: cost per case prevented.
- Health promotion: cost per month of desired outcome.

Incremental cost effectiveness

EXAMPLE OF MEASURABLE OUTCOMES

- Pneumania – Cured of Infection.
- Hypertension – Reduction in Blood Pressure.
- Diabetes – Glycosylated haemoglobin, Blood glucose level.
- Coronary Heart Disease – No. of Angina Attacks.
- UTI –Cured of Infection.
- HIV/AIDS – CD_4 Counts

TOOLS in Brief: Cost Effectiveness

- With different effectiveness.
- Accurate information on cost of drug therapy.
- Total cost ÷Total no. of units of outputs.

Lower cost per unit of output is the choice

TOOLS in Brief: Cost Utility Analysis

- Overcomes the the problem of multiple and different outcomes.
- Different outcomes are combined: Gain of Quality Adjusted Life Years (QALY) – the basic unit is life year.
- Two treatment may extend life, but if these extra years are filled with pain in one case and pain free in the other, the value of treatment is different.

TOOLS in Brief: Cost Utility Analysis

- Simple cost effective analysis but outcome in QALYs; Full healthy life is taken as 1.0. (Scale is from 0 to 1). 0 indicates death while 1 indicates perfect health.
- DALY(disability adjusted life year) also used.
- Not much useful as quality of life scales are not perfect measures.

Examples: Evaluation of treatments in arthritis

TOOLS in Brief: Cost Benefit Analysis

- Cost and benefits are measured / expressed in monetary terms.
- Net savings calculation: negative costs with positive benefits.
- Highest net savings give the best economic value.

TOOLS in Brief:
Cost Benefit Analysis

- Comparison of dissimilar outcomes.
- Difficult to assign monetary value.
- Not much useful.

Example: Cost benefit ratio of saving life by treating childhood pneumonia Vs life saved by road lighting.

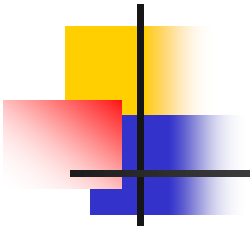
B/C is greater than 1 indicates Good.

B/C is less than 1 indicates not beneficial.

B/C is equal to 1 indicates same

Cost Minimization Analysis (Three Antimicrobials to treat UTI)

	Trimethoprim 200 mg tablets	Amoxycillin 500mg Capsule	Norfloxacin 400 mg tablets
Recommended treatment regimen	200 mg twice daily for 5 days	3 g twice daily for 1 day	400 mg twice daily for 3 days
No of tabs/caps per treatment course	10	12	6
Acquisition Price for each tab/cap	0.048	0.088	0.365
Price per course	0.48	1.06	2.19



COST EFFECTIVE ANALYSIS

- Single Measurable Dimension of Alternatives.
- With Different Effectiveness.
- Accurate Information on Drug Cost is Necessary.

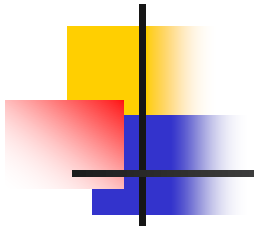
TREATMENT OF DIABETES - II

Parameter	Drug A (Cost/month)	Drug B (Cost/month)
Acquisition Price	20.00	10.00
Administration Cost	2.00	2.00
Lab. Cost	8.00	16.00
ADR Cost	4.00	8.00
Physician's visit	10.00	20.00
Total Cost	44.00	56.00

Drug A is less costly by 22%.

Savings from ADR, Lab. and Physician Cost.

CALCULATION OF COST EFFECTIVE RATIO



- Clinical Study Report: Drug A lowers Glycosylated Hb. by 0.8%. Drug B by 1.5%

Drug – A: Cost – 44.00

Cost Effective Ratio:

44÷0.8 = 55 for 1% decrease.

Drug – B: Cost – 56.00

Cost Effective Ratio:

56 ÷ 1.5 = 37.33 for 1% decrease.

Drug B is more cost effective

Uses of Pharmacoeconomics

Tools for analysis

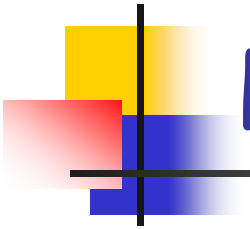
- the social cost of drug therapy.
- identify savings potential.
- Identify drugs for formulary.
- Promotes rational use of medicines.
- Helps pharma industries to develop right drug and market at right price.

Uses of Pharmacoeconomics

- Identification and Choice among the alternatives.
- Assessment of Costs and Consequences.
- Decision Making within the limited/fixed or available budget.

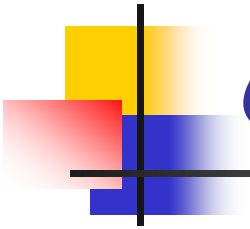
Pharmaceutical consumption per capita in selected countries (EDM/PAR/2000.2)

Country	1975	1990	2000
Australia	60.1	87.6	291.4
France	108.8	223.3	486.9
UK	53.5	97.4	239.5 (1997)
USA	90.4	190.6	540.3
India	1.6	3.3	NA
China	6.4	7.1	NA
Philippines	9.8	11.4	NA
Iran	24.8	37.2	NA



Pharmacoeconomics in Practice

In Australia, the federal government subsidizes the use of pharmaceuticals through maintenance of a positive formulary called Pharmaceutical Benefit Scheme. While Recommending, Pharmaceutical Benefits Advisory Committee considers: importance of the drug, Need for in the community, cost effectiveness and financial implications of adding it to formulary list.



Collaborative Approach

- Young (1982), multi-disciplinary and multi-functional.
- Clinical pharmacists and clinical pharmacologists.
- Research to practice: interpreting published studies, conducting pharmacoeconomic studies.


Clinical Guidelines
Drug Use Evaluation
Hospital Formulary

Some Initiatives

- WHO organizes two weeks programme on Pharmacoeconomics.
- Pharmacoeconomics is a main component of DTC training programme of WHO.
- Bombay College of Pharmacy started a PG Diploma Programme.
- Pharmacoeconomics Training Programme at Al-Ameen College of Pharmacy 2007.
- Amrita School of Pharmacy – 2009 – National Seminar

If in the recent past you

haven't DISCARDED one of your favorites ideas or

ACCEPTED a new one

CHECK YOUR PULSE;

YOU MIGHT BE DEAD

Useful Websites

- <www.chepa.org> Centre for health economics and policy analysis.
- <www.ispor.org>International Society of Pharmaceconomics and Outcomes Research.
- <www.isoqol.org> International Society of Quality of life

I hear, and I forget,
I see, and I remember,
I do, and I understand.

Exercise -I

- Ear drop A costs 6.50 and has been found to be 80% effective; Ear drop B costs 7.90 and has been found to be 90% effective.
- Find out which of the two antibiotic drops is preferable for public hospital use?
- What is the incremental cost effectiveness?

Solution to Exercise - I

	Ear Drop A	Ear Drop B
Cost per product	6.50	7.90
Costs for 100 patients	650	790
Amount needed to treat one case successfully	650/80=8.125	790/90=8.778
To benefit 10 extra cases	Amount required = 790-650 = 140	
Incremental cost effectiveness	140/10=14 additional amount required for benefiting one extra person	

Conflict of Interest

- Medicine Price.
- Clinical Pharmacy Service.
- Acquisition of Indian Pharma by Multinationals.
- Indian Patent Act.


THANK YOU