249

Economic Evaluation Method:

The basic task of the economic evaluation is to identify, measure, value, and compare the costs and consequences of the alternatives being considered the two distinguishing characteristic of economic evaluation are as following:

1. Is there a comparison of two or more alternatives?
2. Are both costs and consequences of the alternatives examined?

- Full economic evaluation encompasses both characteristics, whereas a partial economic evaluation addresses only one.
- Partial economic evaluations may include simple descriptive tabulations of outcomes or resources consumed and thus require a minimum of time and effort. Another partial evaluation is cost analysis that compares the cost of two or more alternatives without regard to outcome.
- Full economic evaluation includes: cost minimization, cost benefit, cost effectiveness and cost utility analyses.

Cost Minimization Analysis

• Although a full economic evaluation generally provides higher quality and more useful information, the time the resources, the effort employed are also great.

• Application of an economic evaluation method to health care products and services especially pharmaceuticals, may increase their acceptance by health care professionals and society.

□ Cost Minimization Analysis:

• CMA involves determination of the least costly alternatives when comparing two or more treatment alternatives.

• With CMA the alternatives must have been assumed or demonstrated equivalency in safety and efficacy (which means two alternatives must be equivalent therapeutically). Once the equivalency has been confirmed the cost can be identified, measured and compared in monetary units.

• Cost-minimization is a tool used in pharmacoeconomics to compare the cost per course of treatment when alternative therapies have demonstrably ↗ equivalent clinical effectiveness.

- CMA is a relatively straight forward and simple method of comparing and competing programs or treatment alternatives as long as the therapeutics equivalence of the alternatives being compared.
- The cost should extend beyond the comparison of the drug acquisition costs and include the cost of the drug preparation (pharmacist and technician time), administration (nursing time) and the storage when appropriate, other costs to be evaluated may be the cost of physician, visits, numbers of hospital days and pharmacokinetic consultation. The least expensive agent, considering all these costs should be preferred.

CMA Process:

- Obtain acquisition price for each medicine and calculate the price for the course of treatment to be compared dose per day, number of days of treatment.
- Calculate pharmacy, nursing and physician cost,

associated with the use of each medicine.
- Calculate equipment cost with its association with each medicine.
- Calculate laboratory cost associated with each medicine.
- Calculate cost of any other significant factors.
- Calculate and compare total medicine cost for each medicine.

☐ Applications of CMA:

- Cost saving of one program over another.
- Applied in the formulary decision making when often the available evidence for a new product appears to be not better than the existing one. Ex: Ciprofloxacin tablets 500mg manufactured and marketed by different manufacturers can be subjected to CMA if the selected items were reported to have same benefits or outcomes for a specific infection.
- Similarly if two or more brands of ciprofloxacin

tablet 500mg are having same outputs for a specific reason, we can do CMA for those branded items.

- If the hospital decides to introduce compulsory prescribing of generic names of drugs instead of their brand name, the CMA can be selected as the best pharmacoeconomic evaluation method as it will take into consideration only such items which are having same clinical outcomes.

Case Study:

- In one study, carboplatin was compared with cisplatin for treating ovarian cancer. It was found that, though carbaplatin was expensive per dose as compared to cisplatin, it was cheaper when the total cost was taken in to consideration, as lower toxicity was encountered with the use of carbaplatin. The treatment with cisplatin always requires a hospital admission because of the need for intensive hydration before and after the procedure.

You are an aztra Zeneca pharmaceuticals representative and you are giving a presentation to the pharmacy and therapeutic committee of large hospital in India, many of the committee members are attending physicians. Currently, Prevacid is on the formulary for the treatment of acid reflux. Your presentation today convinces the committee members that the hospital adapt prilosec, a less efficacy is similar for both the drugs.

a. The two alternatives are prevacid (lansaprazole) and prilosec (omeprazole)

b. Here hospital perspective should be adapted.

C. Here only costs should be considered as the efficacy and safety profiles are similar.

d. Here CMA should be used as healthcare evaluation technique.

3. EXAMPLE:

Cost categories	Ampicilin 500mg	Ceftriaxone 1g	Gentamicin 80mg
Acquisition price for one vial	USD 1.00	USD 8.0	USD 2.00
DOSES PER DAY	4	1	3
PRICE PER DAY	USD 4.00	USD 8.00	USD 6.00
NURSING SALARY PER INJ	USD3	USD 0.75	USD 2.25
EQUIP	1	1	1
SYRINGE	2	----	1.50
LAB TESTS	2	2	4

Cost of Illness:

- Cost of illness evaluation also known as Burden of disease.It is an economic evaluation method used to identify and estimate the overall cost of a particular disease for a defined population.It involves measuring the direct and indirect costs attributable to a specific disease.
- COI is often termed as burden of illness.
- COI evaluation is not used to compare competing treatment programs or treatment alternatives.
- It is used to provide an estimation of the financial burden of a disease.
- Cost of illness studies measure the economic load of an illness or a disease.
- It estimates the maximum amount that could potentially be saved or gained if a disease or a group of diseases were to be eradicated.
- COI studies help to understand which diseases have a serious effect on their costs.
- All cost of illness studies provide important information for pharmacoeconomic studies like cost effectiveness analysis (CEA) though they can provide only one part of cost analysis.
- Cost of illness studies can provide framework for the cost estimation in CEA and CBA analyses.

Applications of COI studies

- The cost of illness studies are frequently used by policy makers and other government organizations.
- In some countries the published cost of illness reports are used in law suits to recover medical insurance claims.
- They are also used to estimate the costs of fatal occupational injuries by various countries.

limitations of COI studies

- Cost of illness studies can demonstrate which diseases may require increased allocation of resources for prevention or treatment.However they are limited in determining how resources are to be allocated because they do not measure benefits.

Costs in COI

- A comprehensive cost of illness study includes both direct and indirect costs.
- Direct costs measure the opportunity cost of resources used for treating a particular illness.
- Indirect costs measure the value of resources lost due to a particular illness.

Indirect cost:

- There are three primary approaches to estimate indirect cost:
- The human capital method
- The friction cost method

- The willingness to pay method

Human capital method

- For practically the human capital method is generally recommended.
- The human capital method measures the lost production in terms of lost earning,of a patient or caregiver.
- For mortality or permanent disability costs,the approach multiplies the earnings lost at each age by the probability of living to that age.

Friction cost method

- A related method,the friction cost method,measures only the production losses during the time it takes to replace a worker.
- This approach assumes that short –term work losses can be made up by an employee and the loss of employee only result in costs in the time it takes a new employee to be hired and trained,known as the friction period.

Willingness to pay method

- The willingness to pay approach measures the amount an individual would pay to reduce the probability of illness or mortality.
- There are various methods of determining an individuals willingness to pay,including surveys,examining the demand for products that lead to greater health or saftey,and other related methods.

Direct costs

- Direct costs can be estimated using one of three approaches:
- The top-down approach
- Bottom – up approach
- The econometric approach

Top-down approach

- The top – down approach also known as the epidemiological or attributable risk approach.
- Measures the proportion of a disease that is due to exposure to the disease or risk factor.
- The approach uses aggregated data along with a population – attributable fraction to calculate the attributable costs.
- In this the proportion of medical care for disease B attributable to disease A is measured as follows:
- PAF=p(RR -1)/[p(RR-1)+1]
- Where P is the prevalence rate of disease A and
- RR is the unadjusted relative risk of disease B
- For people with disease A,compared with those without disease A.

Bottom-Up approach

- While the top-down approach is a valid approach,to avoid the need to calculate PAFs and the potentially more cumbersome methods needed to prevent a bias in the estimate,the bottom up or econometric approach can be used.
- The bottom – up approach estimates costs by calculating the average cost of treatment of illness and multiplying it by the prevalence of the illness.
- The bottom up approach often multiplies the unit cost of a particular treatment by the average amount of utilization of the treatment to get an average cost estimate of the treatment.

Econometric approach

- The econometric or incremental approach estimates the difference in costs between a cohort of the population with the disease and a cohort of the population without the disease.
- The two cohorts are matched,usually via regression analysis by various demographic characteristics (e.g. sex ,age,race) and the presence of other chronic condition.
- The econometric approach measures the incremental difference between persons who have the disease and those who do not,it often only requires one dataset.

SEVERAL APPROACHES OF COI STUDIES

1: Prevalence- vs. incidence-based approaches

- The COI studies can be described as prevalence-based or incidence-based approaches based on the way in which the epidemiological data are used.
- Being most commonly used, the former approach estimates the economic burden of a condition over a specific period, usually a year, while the latter approach estimates the lifetime costs of a condition from its onset until its disappearance (usually by cure or death), which refers to the new number of cases arising in a predefined time period.
- Prevalence-based studies estimate the number of cases of death and hospitalizations attributable to diseases in a given year and then estimate the costs that flow from those deaths or hospitalizations (plus other costs such as prevention, research and law enforcement costs).
- Incidence-based studies estimate the number of new cases of death or hospitalization in a given year and apply a lifetime cost estimate to these new cases.
- With the nature of long-lasting conditions such as a long duration that requires considerably lengthy follow-up periods, the prevalence-based approach is the only practicable way to measure the long-term conditions. But it may not quantify the long-term consequences of the conditions.
- Thus, the prevalence- based approach generally measures the COI in the present and the past in a given year, while incidence-based

studies generally estimate the present and future COI in a given year.

II: Prospective vs. retrospective approaches

- The COI studies can be performed either in prospective or retrospective way depending on the relationship between the study kick-off and the data collection.
- In a retrospective approach, all the relevant events have already happened when the study starts, in which we just collect the data that are previously recorded.
- Conversely, in a prospective approach the relevant events have not already occurred at the beginning of the study, which means that the data collection needs to be done by following-up the patients over time.
- The prevalence- and incidence-based COI studies can be both performed either in prospective or retrospective way.

The major advantage of retrospective approach is that they are less costly and time consuming than its counterpart because all relevant events have already occurred so that they can be measured and recorded in a dataset.

PERSPECTIVES OF COI STUDIES

- The COI studies may be carried out from a variety of perspectives, each of which then includes slightly different cost items to eventually lead to different and wide range of results for the same illness.

- These perspectives may measure costs to a society, health care system, third-party payers, business sectors, the government, and the participants and their families.
- However, each perspective provides useful information about the costs to the particular group. In general, the broader societal واستخدم إجتماع perspective is preferred, because the impact of a condition is not solely on the individuals or organizations that are directly involved.
- Through the societal perspective, we can detect 'cost shifting' between sectors and account for alternative resources used outside the health care sector.
- The societal perspective is the most comprehensive because it includes all direct medical costs and indirect costs for all members in a given society where they are involved, and it is often preferred because it allows a complete analysis of all of the opportunity costs attributable to a disease and is recommended for possible cost analyses such as CBA, CEA, and CUA.

PRESENT VALUE WITH DISCOUNTING AND SENSITIVITY ANALYSIS

- Discounting is an economic method that captures an individual's preference for income or payment today rather than that in the future.
- This time preference is often explained by the opportunity cost of interest, but it varies with individuals' attitudes toward future , so that its value can also be endogenously determined. Income earned now can bear interest through investment so people want to get

partially or fully compensated when they rather choose to have money later to feel indifferent between these two portfolio options, having money now or having more money later.

- Discounting allows us to calculate the present value (PV) of income or payments that occur in the future. The PV of a specific amount received in the future after n-year of maturity when the discount rate (which is closely related to the real interest rate) is r is given by the formula of:

- PV=payment/(1-r)n

- Discounting is relevant for direct and indirect costs that accrue past the first year.

CONCLUSION

- The COI studies are considered to be an important and essential measurement technique in health and medical sciences.

  By measuring and comparing the economic BOD to society, health care decision makers can benefit in setting up and prioritizing health care policies and interventions that they are supposed to implement.

- And by discussing the epidemiological and economic grounds of COI studies, it aims to further achieve the knowledge on several evaluation techniques at more advanced level such as CBA, CEA, and CUA.

- The COI studies are a descriptive study that can provide information to support the political process as well as the management functions of a various levels of health care providers and organization.

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Cost Benefit Analysis

Definition:

. Cost benefit analysis compares the total cost of each alternative to resultant consequences or benefits of the intervention measured in monetary units. This reflects the value of health status improvement and not cost of health care.

Or

. It is a method that allows for the identification, measurement and comparison of the benefits and costs of a program or treatment alternatives. The --- cost and benefits are measured in the same units like rupees or dollars.

It is easy to do the cost analysis of CBA. However, it is difficult and often controversial task to convert the benefits or outcomes interms of money value. In CBA, the benefits are converted into the equivalent money units in the year in which they occur.

CBA type of pharmacoeconomic analysis is preferred by economists. However the employment or use

of CBA in health care is always a problem. It is not an easy task to give monetary values to the clinical outcomes like relief of pain or improvement of quality of life.

CBA compares the total cost of each alternative to the outcomes Future cost and outcomes are discounted or reduced to their current value. In programs and treatment alternatives where cost and benefits are not occuring simultaneously, CBA can be used.

It can also be used while comparing programs with different objectives as all benefits are converted into moniey value. It may also discriminate against the unproductive population or the depended population.

□ Measurement of benefits:

Cost and benefits are considered to be either po-

Silive or negative. A cost can be incurred or avoided. A benefit can be gained or lost. Various approaches are suggested for the measurement of benefits in CBA. Benefits are measured using contingent valuation also commonly referred to as willingness to pay method (WTP)

In WTP, a representative population of the patients are told about the probability of success of a treatment and asked how much each one of them is willing to pay as insurance premium to avail the service, if needed. Alternatively, they can be asked to state how much they would be prepared to pay to avoid a particular event or symptom or difficulty like pain, nausea.

WTP measures an individual's desirability or utility for a program by determining how much money he or she willing to lose in order to

purchase access to improved health.

• Willing to accept (WTA) is another method of contingent valuation. It is based on the minimum amount a patient or group of patients would accept or receive in order to be prepared to lose or avoid a service. None of the existing methods for measurement of benefits are perfect or ideal.

□ Steps in conducting a CBA:

Step 1: to identify clearly the intervention, program, or therapeutic regimen to be evaluated.

Step 2: to identify and value all of the resources consumed or costs of providing each intervention, program or regimen. Different types of resources should be recognised.

Step 3: benefits are identified.

Step 4: To sum the value of all the cost and then sum all the benefits of program, intervention or regimen. Total cost then may be subtracted (كاستن) from total benefits to determine net benefit.

Net: صافي

Net benefit = total benefit - total cost

Cost benefit ratio = total benefit / total cost

- If the B/C ratio is >1, then benefit exceed cost and program is socially valuable.
- If B/C ratio is =1, the benefits equal the cost
- If the B/C ratio is <1, the program or the treatment alternative is not economically beneficial

A program or treatment alternative with the highest net benefit or greatest benefit to cost ratio is considered as the best choice for positive clinical outcome.

Eg 1

COST OF THERAPIES

	Drug A	Drug B
Costs		
Acquisition costs	300	400
Administration costs	50	0
Monitoring	50	0
Adverse effects	100	0
= Sub total	500	400
Benefits		
Days at work[$]	1000	1000
Extra months of life[$]	2000	3000
Subtotal	3000	4000
Benefit to cost ratio	3000/500=6:1	4000/400=10:1
Net benefit	2500	3600

Eg 2

- **Problem:** comparison of two medication regimen for resolving an infection by means of CBA.

- **Outcome measurement :**
  - to compare the cost benefit of two antibacterial in resolving an infection in an 30 bed hospital.
  - one regimen uses parenteral antibacterials only. Other uses a combined regimen of parenteral and oral antibacterial.

Assumptions :

- This was in hospital with 30 beds in a unit fully used for each regimen.
- Total hospital costs per bed/day were :$700 for combination therapy and $720 for parenteral therapy.
- The combination therapy resulted in an average hospital stay for 8 days, and parenteral therapy resulted in an average hospital stay of 12 days.

- Combination regimen was found to produce cure rate of 88%, failure rate of 5 %,and partial resolution of 7%.
- The parenteral had a cure rate of 90%, failure rate of 7 % and partial resolution of 3%.

Calculation:

- Benefits of the two regimen were so close that , for the purpose of our discussion, we consider them equal without going into statistical consideration.
- Cost benefit ratio of combination therapy= 8 days* 30beds* $700 / bed-day = $168000/ benefit
- Cost benefit ratio of parenteral therapy= 12 days* 30 beds* $720 / bad-day = $ 259200/ benefit.
- CBA of two regimen combination : parenteral = 168000: 259200

Outcome measurement-

- Our CBA shows that combination therapy compares favourbly to parenteral therapy in the ratio of 168,000: 259,200 or 0.648: 1.00.

Eg 3

- Comparison of new anti depressant moclobemide, with tricyclic antidepressants which have equivalent efficacy but a higher incidence of adverse effects.
- In study respondents -- patients with a history of mild to moderate depression- were asked to rank from most to least bothersome, a list of seven common side effects associated with use of
- TCA's.Next they were asked to assume they had two choices: they would continue taking their TCA with specified probability of side effects or new drug with lower side effects
- New drug was more expensive. Respondents were asked what was the maximum they were willing to pay for the extra benefits of the new drug per month.
- They were also informed that access to the newer agent would require them to pay out of pocket.

Cost, benefit and net benefit switch from TCA to moclobemide

DRUG	DRUG COST PER MONTH	NET COST FOR SWITCH(a)	WTP(U) (b)	WTP(L) (c)	CBA RATIO a-b/a-c
MOCLOBEMIDE	61.5				
AMITRYPTYLINE	9.9	51.6	117.6	36.2	Indeterminant
IMIPRAMINE	10.8	50.7	117.6	36.2	Indeterminant
DESIPRAMINE	75.6	-14.1	117.6	36.2	< 0
CLOMIPRAMINE	76.8	-15.3	117.6	36.2	<0

- CB ratio of less than zero supports the conversion of TCA to moclobemide.
- Indeterminant ratio means that depending on whether upper or lower bound of WTP range was used the CB ratio will be greator or equal to zero, therefore data is too broad to support a decision regarding conversion.

-Applications:

- CBA can be employed at macro level for policy decisions on health care program. Expenditure for public projects should be able to produce benefits for the society in large.
- CBA is useful and helping tool for the judicious allocation of funds or resources for public investments

in health care. It consists of identifying all the public or social benefits that will result from the program and convert them into money value in which they occur.

- The cost of two alternative treatments and the consequences in terms of productivity or sickness benefits may be compared.

- Nation wide immunization programs like the oral polio vaccine can be subjected to CBA. Such programs can be valued against the reduced mortality or morbidity that can occur as a result of them

- In programs and treatment alternatives where cost and benefits are not occuring simultaneously, CBA can be used. It can also be used while comparing programs with different objectives as all benefits are converted to money values.

- CBA is best suited method to justify and document the value of an existing health care service or feasibility of a new one.
- CBA is useful in examining the values of services like hospital pharmacy prepared IV additives and ward preparations by nurses

It will help to demonsirate the value of pharmacy services. The staffing cost and equipment cost can offset against the benefits of reduced morbidity and mortality

- It can also be used to evaluate health care programs like TDM, drug information services, patient counseling centers, pharmacokinetic services in a hospital set up.
- It may allow comparisons to be made b/w totally different areas and not just medical. Eg. cost benefits of expanding university

education (with benefits of improved education and hence producitivity) can be compared to back pain clinics (with benefits of making people able to work and enhance productivity).

Cost Effectiveness Analysis

Introduction:

- Cost-effectiveness analysis (CEA) is a way of summarizing the health benefits and resources used by competing healthcare programs so that policymakers can choose among them
- CEA involves comparing programs or treatment alternatives with different safety and efficacy profiles.
- Cost is measured in dollar or rupees, and outcomes are measured in terms of obtaining a specific therapeutic outcome.
- These outcomes are often expressed in physical units, natural units or non rupee units (lives saved, Cases cured, life expectancy, or drop in blood pressure).
- It can also be measured in terms of change in an intermediate clinical outcome like cost per night free of pain, night free of wheezing or per cent change in blood cholesterol level.

• The results of a CEA are expressed as cost/outcome for both therapies.

• Thus, to compare the cost effectiveness of an H_2 receptor blocker and a proton pump inhibitor, the cost per ulcer healed by each of the two drugs may be calculated and compared.

• The results of CEA are also expressed as a ratio either as an average cost effectiveness ratio (ACER) or as an incremental cost-effectiveness ratio (ICER)

□ Average cost effectiveness ratio:

• An ACER represents the total cost of a program or treatment alternative divided by its clinical outcome to yield a ratio representing the rupee cost per specific clinical outcome gained, independent of comparators. The ACER can be summarised

as follows:

$$ACER = \frac{\text{Health care costs (monetary)}}{\text{Clinical outcome (not monetary)}}$$

°Average cost effectiveness ratio:

- This allows the costs and outcomes to be reduced to a single value to allow for comparison.
- Using this ratio, the clinician would choose the alternative with the least cost per outcome gained.
- The most cost effective alternative is not always the least costly alternative for obtaining a specific therapeutic objective.
- In this regard, cost-effectiveness need not be cost reduction but rather cost optimization.

Incremental cost effectiveness ratio (ICER):

- Often clinical effectiveness is gained at an increased cost.

- Is the increased benefit worth the increased cost?
- Incremental CEA can be used to determine the additional cost and effectiveness gained when one treatment alternative is compared with the next best treatment alternative.
- Thus, instead of comparing the ACERs of each treatment alternative, the additional cost that a treatment alternative imposes over another treatment is compared with the additional effect, benefit, or outcome it provides.

$$ICER = \frac{\text{Cost A (monetary)} - \text{Cost B (monetary)}}{\text{effect A (\%)} - \text{effect B (\%)}}$$

- This formula yields the additional cost required to obtain the additional effect gained by switching from drug A to drug B.

Calculation of ICER using a theoretical model of treatment of hypertention

Alternatives	C (cost)	DC (Difference in cost)	E (Effect)	DE (Difference in effect)	ICER=DC/DE
Diet	50	-	48	-	-
Drug - A	80	30	5.3	0.5	30/0.5=60
Drug - B	98	18	6.4	1.1	18/1.1=16.3
Drug - C	120	22	6.7	0.3	22/0.3=73.3

- Handling of results in CEA:

Consider the four possible results of CEA-:

- The new treatment is more effective and less expensive. The costs are lowest and the benefits are highest. Here the choice is clear without any ambiguity. It is the choice of preference recommended to be selected.

- The new treatment is less effective and more expensive. The costs are high and benefits less. Not to be recommended.

- The new treatment is more effective and more expensive that is the cost is high and the benefits are more. Here the ICER should be calculated. A judgement has to be made whether the additional benefits are worth the extra costs of the new drug.

- The new treatment is less effective and less expensive. Here we have to answer one question whether the extra benefits provided by the standard treatment justifies the additional costs of retaining it as a preferred treatment when the option of a new, cheaper but less effective drug exists.

• Definition:

A form of economic study design in which interventions which produce different consequences, in terms of both quantity and quality of life, are expressed as 'Utilities'. These are measure which comprise both length of life and subjective levels of well being. The best known utility measure is the 'quality adjusted life year' or QALY.

QALY:

Quality-adjusted life years (QALYs) measure health as a combination of the duration of life and the health related quality of life (HRQoL).

HRQoL is measured on a preference scale anchored at 1 (perfect or best imaginable health) and 0 (a quality of life [QoL] as bad as dead).

• Figure illustrates how QALYs can capture improvements in both life expectancy and QoL.

• It is this facility that allows decision-makers, in principle, to use QALYs to compare the value of interventions across the full range of healthcare activities.

CUA: When is CUA appropriate?

Drummond et al. enumerated several circumstances where CUA may be the most appropriate analytic approach.

• When quality of life is the important outcome.

• When the intervention affects both morbidity and mortality and a combined unit of outcome is desired.

• When the interventions being compared have a wide range of potential outcomes and there is a need to have a common unit of outcome for comparison.

- When the objective is to compare an intervention with others that have already been evaluated in terms of cost per QALY (or equivalent) gained.

Need for Health State Utility Assessment:

- Healthcare has different objectives.

Examples:

- A diabetologist's objective might be reduction in diabetic complications.
- Oncologist's objective might be to keep their patients alive and may be satisfied with a short increase in survival time.
- Primary care providers' objective is often focus on shortening the cycle of acute illnesses for which mortality is not an immediate concern.
- When mortality is studied, those who are

alive are statistically coded as 1.0 and those who are dead are statistically coded as 0.0.

- Incremental cost utility ratio:

- It is also known as cost per QALY.

- This is calculated as the difference in the expected cost of two intervention, divided by the differences in the expected QALYs produced by the two interventions

Strategy	Treatment	Effectiveness	Utility
Treatment A	40000 $	3.5 years	0.9
Treatment B	55000	4.5 years	0.8

- If treatment A provides on average an increase of 3.5 years life expectancy but that is valued at the utility of 0.9, then the health gain for this intervention is $0.9 \times 3.5 = 3.15$ QALY

• Similarly, if treatment B provides on average an increase of 4.5 yrs life expectancy but that is valued at a utility of 0.8, then the health gain for this intervention is .8 x 4.5 = 3.6 QALY

$$ICUR = \frac{C_A - C_B}{QALY_A - QALY_B}$$

QALY = Utility X Effectiveness

An incremental CUA can be undertaken as follows.

• ICUR: 55,000 - 40,000 / 3.6 - 3.15 = 33,333 per life QALY gained.

• The outcomes of any health intervention can be calculated as the product of the increase in utility that it may cause and the time in years over.

□ Methods:

•There are four common methods for deriving utility-like measures of health status or QALYs.

1. Health rating method: This derives health ratings from questionnaires with health experts, potential subjects of treatment, or members of society in general. Individuals are asked to assign values b/w 0 and 1 to various (well-described) health states.

2. Time trade-off method:

Respondents asked to compare different combinations of length and quality of life. The trade offs in the responses provide a basis for ranking various states (in quality and years)

3. Standard gamble method:

Respondents are presented with a decision

tree with two alternatives like the following: one alternative is impaired health for t years; the other is normal health for x years with probability p or immediate death with probability 1-p. The p at which an individual is indifferent can be interpreted as the respondent's utility of the former alternative.

4. Health index method:

Health status is assessed in terms of a health index with various dimensions of well-being, such as mobility, absence from pain, etc. For example, the Short Form Health Survey (SF-36) provides eight dimensions of assessment. With several levels of well being on each dimension, the index can distinguish among thousands of health status

Researchers use the standard gamble or time trade-off method to elicit respondent's utilities for a subset of the statuses and then statistically estimate weights that can be used to assign utilities to any of the statuses

Cost Utility Analysis: Problem

- Assess the net benefit of drug "Wonder X", in utility unit, rather than dollars
  - Quality-adjusted life years will be the utility unit
- Illustrative Example:
  - Let us assume that based on expert meta-analysis, our drug can extend patients' lives by 8 years. However, this drug is so toxic that it produces a great deal of serious side effects that are miserable to the patient. So the question of the quality of life in using the drug is of real concern to the patient, in terms of how worthwhile it is to live with the drug and its side effects. QALYs is a meaningful unit for us to use in this situation. This value is subjective (based on the patient's response):
  - QALYs produced by the drug = the unadjusted life years saved by the drug + the morbidity reduced by the drug the side effects caused by the drug
- *Outcome measurement desired:* To find the mean QALYs saved by our Drug, Wonder X, in treating our patients

Assumptions

- We take life years as our utility unit
- We collect our patients' subjective responses, based on their experience with taking Wonder X. Let us assume we did this with 500 patients over a 5-year period

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- Let us assume that the mean values found from the responses were as follows:
- Patients are willing to forego 1 year of their lives for every 4 years if *they do not have to suffer from the morbidity caused by the cancer*
- Assumption 3 (cont'd):
- Patients are willing to forego 1 year of their lives for every 2 years if, they do not have to suffer from the severe side effects of Wonder X.

Calculations:

- Unadjusted life years saved = 8
- Morbidity in life years = 8 years/(4 years/life year = 2 life years
- Side effect adjusted life years = 8 years/(2 years/life year) = 4 life years
- Outcome measurements

QALYs saved = 8 + 2- 4 = 6

Advantages and Benefits

- Cost-utility analysis was developed to address the problem of conventional cost effectiveness analysis, which did not allow decision-makers to compare the value of interventions for different health problems. The need for such a comparison persists and, as healthcare costs continue to increase, it is likely to become more rather than less pressing. Unlike cost-benefit analysis, the conventional technique for evaluating different uses of public funding, cost-utility analysis facilitates these comparisons without recourse to placing monetary values on different health states and indeed life itself, with all the technical and ethical challenges associated with this.

- Cost-utility analysis can capture the value

of improvements in morbidity and mortality. The utilities can now be obtained from standardized and validated health status instruments, making the evidence required to inform cost utility analysis relatively straightforward and cheap to acquire certainly when compared with the cost of acquiring evidence on clinical effectiveness, and indeed the cost of many of the treatments being reviewed.

- Cost-utility analysis makes it clear what value is attached to specific health states, and this transparency then allows discussion among the stakeholders involved in decision-making (for example, patients, doctors, budget holders) about the accuracy and robustness of these utilities. Cost-utility analysis thus increasingly facilitates

the transparency of resource allocation processes.

□ [redacted]

- With many healthcare interventions, there are significant concerns about the ability of cost-utility analysis to capture all the valued characteristics. It is undoubtedly true that QALYs do not capture differences in the process characteristics of interventions, and there is substantial evidence that patients do attach value to these.

- There is also concern that the descriptive instruments and the utilities they generate are insufficiently sensitive to differences in treatments for milder conditions. For chronic conditions, the assumption that the utility of a health state is independent

of the time spent in that health state is consi
problematic.

Similarly, that the preceding and subsequent health states do not affect the utility of a specific health state is a strong assumption in the conte of chronic conditions, especially conditions where disability accumulates over time.

- In addition, there is evidence that the utility that society attaches to health is not independent of the characteristics of the person experiencing that health. Health gain for individuals in a severe health state may be valued more highly than health gain for individuals with milder health problems. Equally, it has been suggested that society would not want to penalise those with a limited capacity to

benefit from healthcare when allocating resources. The current formulation of cost-utility analysis does not reflect such preferences.