



- **Lec n. :** Subject 10

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♥ وَقُلْ رَبِّ زِدْنِي عِلْمًا ♥





# Economic Evaluation



Dr. Omnia Elmahdy

## \* Functions of health Economists

- 1- Economic Evaluation
- 2- Comparison between costs and benefits  
يقارن بين Cost And Benefits ويبحثون  
Efficiency And Effectiveness
- 3- Decision Making

Two plans

Two Treatments  
Two programs

دور 4 يستخدم Health Economist حتى يتأبين

يبنى يستخدمها في Decision Making

كلم مستخدمين في Cost ..... Analysis



### \* Cost minimization Analysis (CMA)

\* I have two programs/two drugs/two intervention (Any 2 things I want to compare) but have the same outcome (same side effects), I will compare the cost "ONLY" (It is the most simple measure)  
(we use it to choose between substitutes)

→ we have two things "similar to each other"

### \* cost-effectiveness Analysis (CEA)

→ Medical Field في مستخدم

### Cost-benefit Analysis

→ we will compare between 2 different programs (compare between "Cost And Output")

وحدود البرنامجين يقفوا same Goal، الامتلاف في outcome

### Cost-Utility Analysis

الجدول: قديش من Cost  
حقت جدول للتعريف

→ يستخدم (DALY And QALY) two measures

بما انه تعدت حسب Economic point of View "cost يكون داخلها"

مثلاً: قد يكون هناك برنامج له Benefits كثيرة لكن Cost لا يتناسب مع Benefits

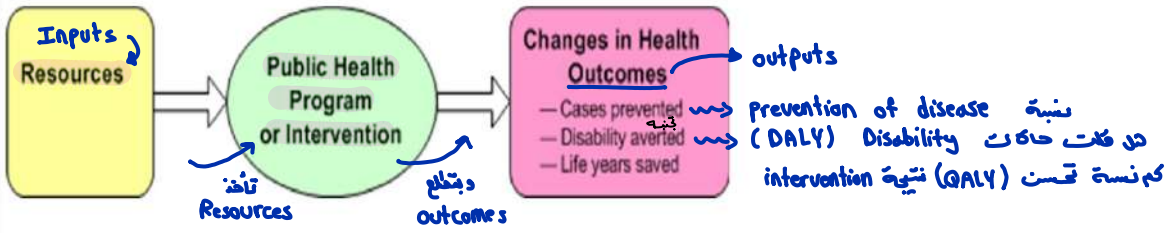
← في حالة ولمة تقار الأراض: إذا كان مع يعطيني The same Outcome

لكن في كل البرامج العيية، مستحيل آلا في حالة إنه في برنامجين يقفوا نفس outcome، بل يك آ

تقار الأراض (دلائل نصل مقارنة بين Benefit And cost)

**Economic evaluation** is the process of systematic identification, measurement and valuation of the inputs and outcomes of two alternative activities, and the subsequent comparative analysis of these, in order to assist policy decisions.

\* Economic evaluation is NOT "choosing the cheapest"  
❖ "The search of efficient practice is not merely about reducing costs."  
only



Public health programs and interventions can be thought of as a production process that transforms inputs (resources) into outputs (changes in health outcomes)

البرامج الصحية Programs

وذا يساعد Health Economist في عملية Decision making (عن طريق دراسة cost, benefit or output)

### Importance of Economic Evaluations

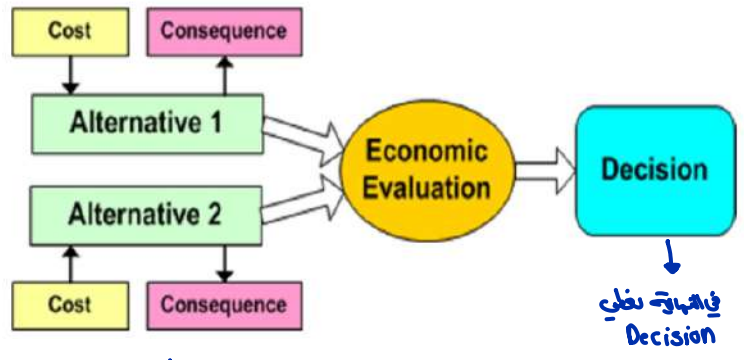
- At present, **resources are being limited** while on the other hand, **costs of programs are rising** in addition with more innovative and technological advancements. Thus, **economic evaluation** has become a **necessary need**.
- Economic evaluation also helps to **prioritize the programs** and make the best decision for **optimal resource allocation**.
- Economic evaluations are important tools for **assessing economic feasibility and efficiency** of health interventions.

لتحسين البرامج الصحية فيما بعد

Economic Evaluation يتطلع بالذکر أرقام هذه الأرقام تساعد في عمل

Economic evaluation has **2 characteristics**

- Inputs and outputs (costs and consequences)**
- Choice between at least 2 alternatives**



Alternative كس بنوف (Consequence And cost) لا



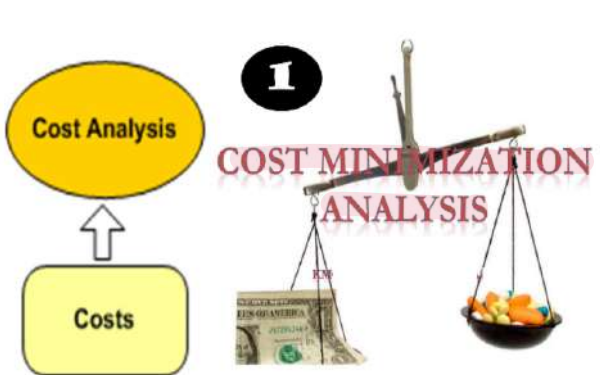
# ECONOMIC EVALUATION

(4 measures of economic Evaluation) "مبين"

Economists usually distinguish several types of economic evaluation, differing in **how consequences are measured**:

1. **Cost-minimization analysis (CMA).**
2. **Cost-effectiveness analysis (CEA).**
3. **Cost-benefit analysis (CBA)**
4. **Cost-utility analysis (CUA).**

الأكثر استعمالاً  
مما يجب اقتصادات



تكنولوجيا استخدام (CMA)

- It is a tool used in **Pharmacoeconomics** and is applied when **comparing multiple drugs** which their **efficacy and tolerability**, and adverse reactions, must be proven to be **equivalent**.
- It is used to compare **costs of alternative therapies** that have **identical clinical effectiveness**, **BUT Different Costs**.

يعني مثلاً  
Hibberty or Renal Patient  
يقد يتكلمم....

- It compares **two or more options** that achieve the same effect (**similar outcome**).

تحليل تقليل التكلفة

Choose the **least cost alternative** among **equivalent or equally effective alternatives**

Cost Analysis Measure : دون بين نعمل

تكنولوجيا استخدام له في Comparing multiple drugs

because we have the same outcome ؟ outcome

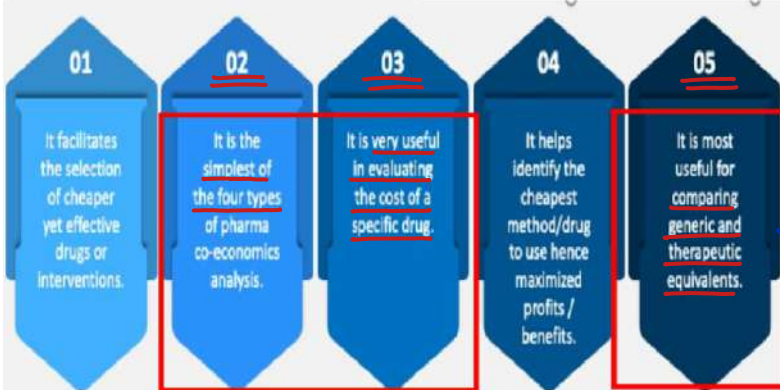
two Health problems outcome نفس (بالذات)

يساعد في المقارنة بين التي و Substitutes

## COST MINIMIZATION ANALYSIS

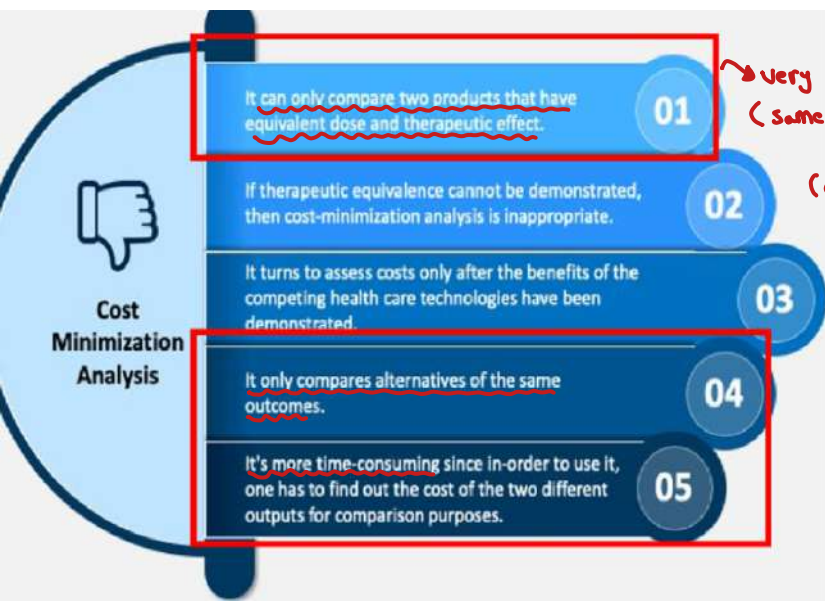
### Advantages

بعد ان يعلم  
أخصر



Generic And therapeutic Equivalents  
Substitutes

Limitations  
لن تستخدم إلا في Situations معينة



very limited  
(لن يعمل إلا إذا توفرت المكافئة: بوجود same outcome  
ينوزلك كما نستعمله  
في Medical Health (معجب جيداً استعملنا CMA)

فقط في الأحمر

"ليه يأخذ وقت أطول؟" (It is more time-consuming) why  
لأنه تم عمل دراسات كثيرة أثبتت أن two drugs لهم نفس outcome...

### Summary (CMA) =>

Only cost Analysis between two or more options "with same outcome"

\* Pharmacoeconomics (comparing multiple drugs)

choose the least cost alternative among equivalent alternatives

Advantages (simplest/ very useful in evaluating the cost of specific drug / most useful for comparing generic and therapeutic equivalents)

limitations ( more time-consuming / only compares alternatives of the same outcomes / very limited)

Cost against Benefit (It is important for decision making)

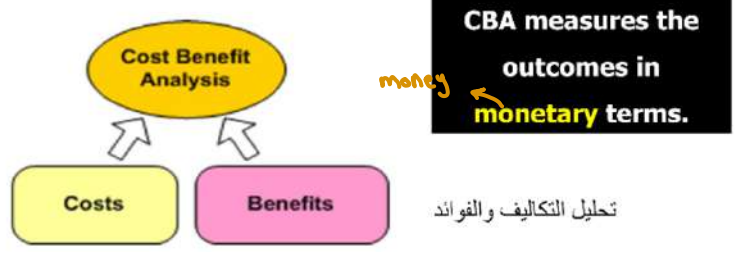
It is a systematic process for calculating and comparing benefits and costs of an action.

It involves comparing the total expected cost of each option against the total expected benefits, to see whether the benefits <sup>تتفوق</sup> outweigh the costs, and by how much.

← مع نشوف Cost And Benefit ووزم الاثنين يكونوا Numbers (prices)

يعني حت outcome رح نقيسه بـ (Numbers)

(In Money Terms)



تحليل التكاليف والفوائد

In CBA, benefits and costs are expressed in money terms, and are adjusted for the time value of money, so that all flows of benefits and flows of costs over time are expressed on a common basis in terms

of their "net present value"  
 القيمة في فترة محددة  
 CBA يسبها

عذوموده، Policy makers  
 يستعملوا CEA And CBA

Example, when deciding how to allocate the limited funding, policy makers might have to choose between implementing program with great benefits.

Advantage: Allows comparison of programs of entirely different outcomes

بين ربحية فدية زمينة معينة، ويسبوا costs (Direct/Indirect...)

ويسبوا Benefits (كلاسي In Numbers)

مثلا: برنا نشوف عدد حاكات CANCER الي قلت نتيجة Vaccine

سوف نسب اياه خلال سنة ... طبقت برامج Vaccination

cost للاضطرابات استعملت خلال هذه السنة ~ فوق  
 (الي جعلت خلال هذه السنة) Percentage of improvement  
 مرت مرت  
 (CBA)

\* ايزن يستعمل CBA ؟ من فدي Program هو الاحق (priorities)

مثلا: في برنامج طبيته cost ↓ Benefit ↑

وفي برنامج آخر استعملت نفس fund حققت Benefit ↓ ار

غلب عدد قليل من الكسب.

\* One outcome Identical "CMA"

\* Two programs with (different or some outcome) "CBA"

هل يستحق البليغ الذي سينفق عليه ام لا ؟ يستحق اذا B < C

The question that a CBA is trying to answer is relatively straightforward: Is the health program worth it? The answer is also simple enough: The program is worth doing if the costs are smaller than the benefits.

It is a particularly helpful tool for the following purposes:

**A. Deciding Whether To Implement a Specific Program:**

For example, research indicates that a vaccine protects against human papillomavirus. (HPV is the virus that is responsible for the majority of cervical cancer cases.)

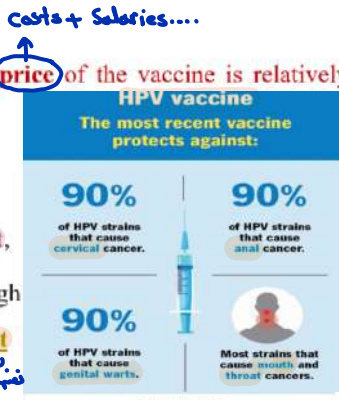
← كون كايوجد مقارنته بين برنامجين ، لو برامج جديد بي امونو هل يستحق

التطبيق ام لا ؟ (الالة الوميدة الي فيها تقيم برنامج واحد)

فانه معنى C كبير جدا لكن B (protection) قليل

A CBA might indicate that, even if the price of the vaccine is relatively high, the savings from:

- The avoided HPV infection,
- The resulting cervical cancer treatment,
- The avoided productivity losses outweigh the costs of vaccination and generate a net gain in community welfare.



Net present value

This provides an additional argument for public decision makers to support an HPV vaccination program that can prevent thousands of deaths.

CBA ⇒  $\frac{\text{Costs (Salaries/costs ...)}}{\text{Savings}}$

يفي ربحية كل (Savings + cost) بربح اطلع قيمته Net Gain

ومن قيمته Net Gain سوف دل B < C ام لا ؟

← لو وجدت ان Benefit كبير بالنسبة لـ cost (worth) يستحق

يفي تنفيذ

\* كلما كانت Net Gain كبيرة ، معنى ذلك ان B < C

It is a particularly helpful tool for the following purposes: نفس outcome

### B. Choosing Among Competing Options

Health policy makers might have to choose between :

1. Funding a program of **free Pap smear testing** for women at high risk of infection and,
2. **HPV vaccination** program.

The results of a CBA might indicate that the **net gain** in community welfare equals :

•\$521 million for Pap smear testing and

•\$987 million for HPV vaccination programs.

The evident **preferable** alternative would be the **HPV vaccination program.**

لذو Savings (Gain)  
"ماتم توفيره"

مهم جدا للاختبار

Comparing between Drugs (CMA)

Comparing between programs / policy (CB)

حفظوا الأسماء منيح ، درج يجب Situation مبني على الفهم

مثلا : لو الطعوم غاي ، فبدل ما اعطت

Pap smear Females (كافرة مينة) بندا نعمل

Cervix (عنق الرحم) يلاونا ويغن Cancer

pre-cancer state (يفي قبل ما يدخل في Cancer) "يفي بداية تغير

حالة الرزة

Vaccin افضل ام Pap smear ؟ كازم يعرفوا اللغتين وشر

الفرق بينهم

واتبهوا : كلامي Free (لناس) ذبح يدفوا عليهم كثير

كل ما كانت Net Gain كبيرة. اذا B < C

It is a particularly helpful tool for the following purposes:

### C. Choosing and Setting Priorities from a Group of Potential Programs with different goals

The **benefit maximization** rule can also guide decisions on **allocating resources** among a group of potential programs.

The combination of programs that has the **largest net gain** in community benefit is the **preferred choice.**

كل ما كانت Net Gain كبيرة ، اذا لنا Priority افضل من غيره

Summary => (CBA)

A. Deciding Whether To Implement a Specific Program:

B. Choosing Among Competing Options (Some outcome)

C. Choosing and Setting Priorities from a Group of Potential Programs

لكن كايوا نفس Result  
(Some Result) : CMA



# What are benefits?

هذا فيها حساب كذا مثل cost

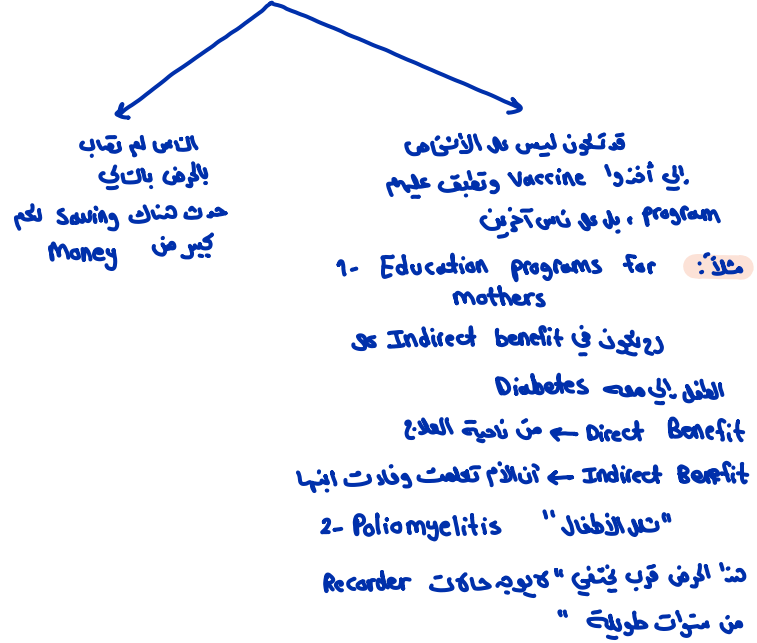
Benefits are the economic values of desirable consequences of economic policies and decisions.

- 1. **Direct benefits** are the values of desirable **health and non-health outcomes** directly related to the implementation of proposed interventions that can be estimated **from data**.
- 2. **Indirect benefits** are the **averted costs** التكاليف التي تم تجنبها and **savings** resulting from the interventions but **not related directly to them**.
- 3. **Indescribable benefits** include the values of positive outcomes (e.g., reductions in pain, and suffering), which **cannot be estimated from data**.

Direct Benefits = Health Outcomes

E x: implementation of the programs, Estimation for any saving

Indirect benefits (في التكاليف التي تم تجنبها)



1- Education programs for mothers

or Indirect benefit

الظن في معه Diabetes

Direct Benefit ← من ناحية العلاج

Indirect Benefit ← أنالام تكلمت وفلات ابنها

2- Poliomyelitis "شلل الأطفال"

تنا المرض قرب يتني "كايو حاكات Recorder من سترات طويلة"

وعدوا اية الأطفال الذين يأخذوا Vaccine Oral (عن طريق الفم)

تنا يعطي Immunity (ممانته) لبقية الناس كيف ؟

كيف Group يأخذ Vaccine و Benefit تكون له بقية

؟ population

مثل COVID 19 فانه الشباب هم الي يتعلموا منهم بروحوا ويحبوا (ينتقلوا)

وتيك بعملوا حماية لبقية الناس الأخرى

Health Immunity تعتبر Indirect benefit لأنها قانظله ناس أخرى ما استخدمت

تنا program

يعني أنت حسيت صرت أفضل " Suffering / pain قل قل الوعيدة الي كا نستطيع التبيير عنها بأرقام (فاني كلام وكا تيب كرقم)





**\* Polio Vaccination ⇒**

A **vaccination program** against an infectious disease protects the vaccinated from catching the infection and provides additional "herd immunity" for the population, including unvaccinated persons.

What are the program benefits: classified?



**POLIO WILL BE THE 2ND HUMAN DISEASE IN HISTORY TO BE ERADICATED.**

**\* Direct Benefit ⇒**

لن يظل حالات مثل أطفال "وتأصل عليه الأطفال إلى أخذوا vaccine"

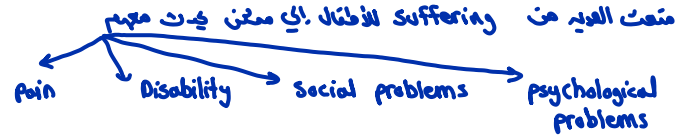
**\* Indirect Benefits ⇒**

Among population ← Cases سوف يقل عدد  
↓  
Health Immunity لن يحصل vaccin إلى ما أخذوا population

**\* Indescribed Benefits ⇒**

1- satisfaction (Health program تجاه)

2-

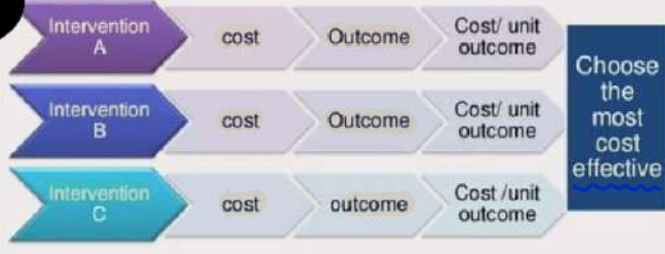


**These are the program benefits:**

1. The savings associated with **prevented illness cases** among those actually vaccinated would be classified as a **direct benefit**.
2. The savings resulting **from lower morbidity among unvaccinated persons** due to herd immunity would be an **indirect benefit**.
3. The **reduced risks of catching the infection** for those vaccinated and the **peace of mind** resulting from that risk reduction would be **indescribable benefits**.

Intangible Cost And Indescribed benefits من ركزوا على الفرق بين

**3 Cost-Effectiveness Analysis**



Medical practise أكثر من يستخدم في

Cost- Effectiveness

Efficiency نوع من أنواع

← معناه: إما مرادف نقص في Input لكن يري

إحافظ على نفس Output

عن طريق نفس Inputs سيتم تحسين

outcome

نوع من أنواع  
Cost-effectiveness analysis (CEA) is a method of economic evaluation where the value of the resources spent on an intervention is compared with the quantity of health gained as a result.

Not Quantity of money

أي قبل كانوا أرقام (Money) سواء Savings  
لكن هنا منشون مدى تحسين Health

Total cost  
أي شيء دون يعبر عن مدى التحسين بالوقت

سيتم حساب



تكونان يكون In money like  
 نسبة CE Ratio  
 In measure like  
 قسبة بأرقام أيضاً لكن measurement (قياسية)  
 اسمها يطالع بالآخر

Typically, the CEA is expressed in terms of a **ratio** where the **denominator** is a **gain in health from a measure** (years of life, premature births averted, sight-years gained) and the **numerator** is the **cost associated with the health gain**.

Family planning ⇒ Outcome (Birth Rate)  
 نوال يمكن استزاده ك (Birth Rate)

**Why Is CEA Important?**  
**Resources** are **scarce**; therefore, they must be **allocated wisely**.  
 CEA is used to identify the **most cost-effective strategies from a set of options** that have **similar results**.



\* Numerator (البسط) → Cost  
 \* Denominator (القام) → outcome  
 مثلاً: نتيجة البرامج اي لعرض العي  
 لم يعل اسم : العيب العري (Affection on Optic Nerve)

Dominant & Excluded > Common Goal يعني نفس وما قدرت آخر قرار من البداية (م ليسوا) ذبثون من يستحق (which is worth)

For example, the government might have to allocate scarce resources

الكومة بدينا تقال Infections وقول Allocation of Resources

- Provide a new facility to assist in the development of vaccines, or
- Enhance the current public health vaccine delivery.

خيارين

- These options have a **common health outcome**: the **number of cases of a disease prevented by the vaccine**.
- CEA can be used to identify the option that **prevents the most cases at the least cost**.

من ميسغ عدد حركات أكثر لكن في cost أقل  
 ونادي العلاجة  
 نسبة \* معنى يطالع  
 $cost A < cost B$  لكن Benefit A < Benefit B  
 تخرج خيار B  
 \* أو يطالع  $cost A > cost B$  لكن Benefit B > Benefit A  
 فهو ان يتم اختيار B

مقارنتين

# The most commonly CERs used are:

نستخدم ACER في حالات:

## 1. Average cost-effectiveness ratio (ACER)

No comparisons between interventions

$$ACER = \frac{\text{Cost } B}{\text{Effectiveness } B}$$

New vaccine or

The average cost effectiveness ratio is the appropriate measure when there are **no comparisons between interventions**

\* ACER لا يستخدم كثيرًا (لأنه يفتقر بشفرة وحدة)

وذلك ليس مفيد ، المفيد أنه ليس في مقارنته

الذي يستخدم أكثر في Cost-Effectiveness هو المقارنته

## • CEA for immunization program for poliomyelitis:

\* المقارنته

لوسائل الذكورة عن أي شغلنا

$$CEA = \frac{\text{cost}}{\text{number of cases of a disease prevented by the vaccine}}$$

حيث Measurement قست فيها عدد الكائنات

Cost-Effectiveness

ومثلت عن Demominator قد يكون

Total population decreased

Total cases decreased

Number of cases declined

Birth Rate  
Accidents ↓

أي شغلنا قد يكون Measurement

لوفي مقارنته

## 2. Incremental Cost-Effectiveness Ratio (ICER)

$$ICER = \frac{(C_1 - C_0)}{(E_1 - E_0)}$$

الجدد  
القديم  
الجدد  
القديم

New treatment/policy/program

C<sub>1</sub> = cost in intervention group

C<sub>0</sub> = cost in control group

E<sub>1</sub> = effect in intervention group

E<sub>0</sub> = effect in control group

Existing (الوجود الآن)

• ICER used in the situation where **two or more interventions are being compared.**

on hepatitis  
↑ therapy

$$ICER = \frac{(C_n - C_0)}{(QALY_n - QALY_0)}$$

شو معنى اضع بالمقام ؟

- $C_n$  = cost of new hepatitis C therapy
- $C_0$  = cost of old hepatitis C therapy
- $QALY_n$  = quality adjusted life years with new hepatitis C therapy
- $QALY_0$  = quality adjusted life years with old hepatitis C therapy

- 1- Quality Adjusted life years
- 2- Number of treated Cases
- 3- الفرق بعد الحركات الي اجابا cancer بسبب الفيروس C

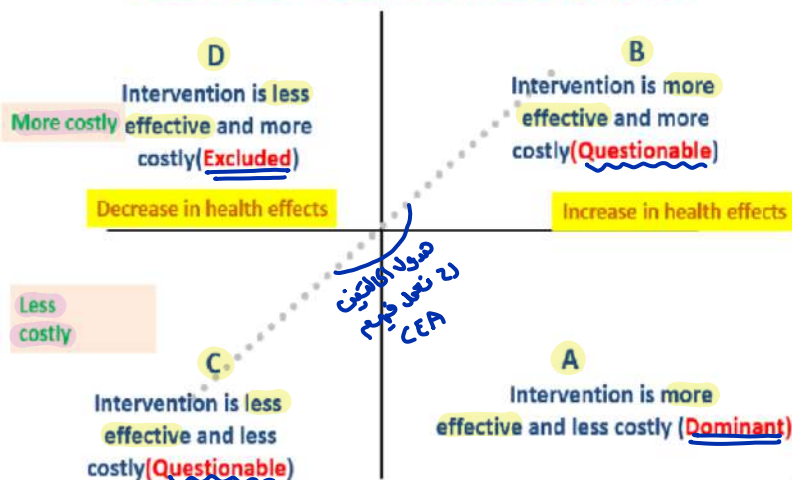
▪ The next question is : Is the intervention "cost-effective"?

\* المعادلتين كثير مبهين :)

Decision صحت من غير  
في راج تأقده

### Cost-effectiveness plane

\* مرفه ؟



D And C ⇒ Decrease in health effects  
↓  
(Less Effective)

B And A ⇒ Increase in health effects  
↓  
(More effective)

D And B ⇒ More costly (كنوا اكلز)

C And A ⇒ less costly (كنوا اقل)

D (Excluded) "ماز افقي فيه"

↑ cost ↓ Effective فيه

A (Dominant) "يعني راج اختاره ✓"

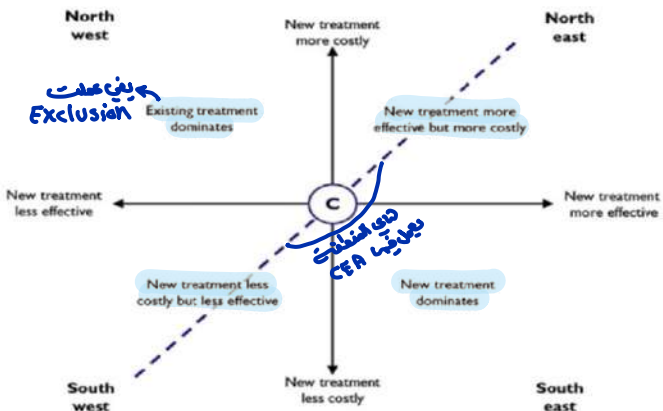
↓ cost ↑ Effective

B ( ↑ Effective ↑ cost )

C ( ↓ Effective ↓ cost )

Questionable

يعني راج نعمل عليهم معادلتين  
CEA



CEA differs from cost-benefit analysis CBA and cost-utility analysis CUA in that:

ما عرفت لها

• **CEA expresses outcomes in natural units** (e.g., "cases prevented" or "number of lives saved"), whereas:

• **CBA assigns dollar values to the outcomes attributable** to the program, and

• **CUA includes a quality-of-life component** associated with morbidity using common health indices such as quality-adjusted life years (QALYs) and disability-adjusted life years (DALYs).

• The **limitation** of this analysis is that it is **difficult to compare the interventions with differing natural effects**. E.g.: interventions which are focused on looking at **life years saved** cannot be compared with others which are focusing on **improving the physical functioning**.

**Examples of the public health activities that are highly cost-effective:**

Immunization : in the first year of life

School-based health services

Family planning and nutrition.

Primary health care is cost effective than building five star hospital.

ما عرفت لها

## 4 Cost Utility Analysis

ما عرفت لها

- A unique form of economic evaluation that compares **costs in monetary units** with **outcomes in terms of the quantity and quality of life**

e.g., in QALYs, DALYs

- Utility represents a **person's preference** (or utility) for a preferred **outcome** (or health state).

## • VALUING OUTCOMES

ماكلت بايا

1: a year of full health

0: death (extremely bad health)

- Health states that lie somewhere between these two anchor points will have a utility value that lies somewhere between zero and one.

Type of evaluation	Costs considered	Health considerations	Strengths	Important issues
Cost-minimization	All present and future health-care costs relevant to the patient and the disease state are compared for each therapeutic strategy	No difference in health status attributable to disease or treatment strategies is assumed	Requires minimal data (on costs only) Enables assessment of the technical efficiency of each strategy	Assumption of identical outcomes of disease and the treatments compared should be robust
Cost-effectiveness	All present and future health-care costs relevant to the patient and the disease state are compared for each therapeutic strategy	Uses commonly evaluated health outcomes, including clinical or surrogate outcomes, such as blood pressure, renal function (eGFR), and serum LDL levels	Relates costs of treatment with therapeutic effectiveness based on health outcomes that are readily available from clinical trials	The 'cost per unit of health' values obtained in cost-effectiveness analyses can be difficult to interpret; comparisons between populations and diseases are not possible
Cost-utility	All present and future health-care costs relevant to the patient and the disease state are compared for each therapeutic strategy	Health status is transformed into a quality-adjusted life-year score anchored between 0 (death) and 1 (perfect health) All aspects of disease and its treatment are captured in one metric	The metric comprehensively measures health, enabling benchmarking and comparisons of outcomes among disparate populations and diseases	Cost-utility analyses require the greatest amount of data of all these types of economic evaluation Assumptions might be required when estimating health-related quality of life

وتيك تم، إنما، تفريغ الحياة كاملة ن

فالكم A+، تذكروني يدعوة ن

ان نوالف يكون معكم بتعاريف اخرى

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## Types/Methods of Economic Evaluation

There are major 4 different types of economic evaluation methods. Each of this analysis involves systematic identification and measurement of the costs and consequences of the interventions

### 1. Cost Benefit Analysis (CBA)

- In this method of evaluation, cost of the intervention is compared with the benefit incurred from the intervention
- **Both** costs and benefit is measured in terms of monetary units
- The net benefit is measured as: **Net benefit= Benefit – Costs**
- Therefore, if the benefit exceeds the cost incurred during the intervention, the intervention should be continued

### 2. Cost Minimization Analysis (CMA)

- In this method of analysis, costs of two or more interventions achieving identical outcome are measured. The intervention incurring the lowest cost is then chosen
- It should be strictly noted that the intervention can only be conducted when the outcomes of the comparing interventions are same

### 3. Cost Effective Analysis (CEA)

- In this method of analysis, cost is measured against the effectiveness of the intervention (effectiveness is the final consequence)
- The consequences of the comparing interventions may vary here (different than cost minimization analysis where the outcomes of interventions were identical). However, these consequences can be expressed



in **common natural units** like life years gained, saved years of life etc or improvement in functional status (units of cholesterol, blood pressure etc.)

- The limitation of this analysis is that it is difficult to compare the interventions with differing natural effects. Eg: interventions which are focused on looking at life years saved cannot be compared with other interventions which are focusing on improving the physical functioning

#### 4. Cost Utility Analysis (CUA)

- In this method of analysis, cost incurred in the intervention is measured against the “utility” related to health
- Utility refers to (**QALY**) and (**DALY**)
- This method is specially used when there are multiple objectives of the program and when both quality of life and quantity of life are important to know