



- **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
بتارن بين Cost And Benefits وبتوف
Efficiency And Effectiveness
- 3- Decision Making



Two plans
Two Treatments
Two programs

دور 4 يستخدم Health Economist حتى يتارن Health Economist

بني يستخدمها في Decision Making

كلم مستوكنين 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 يقترأ 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 "وكانم يكون داخلها Cost"

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

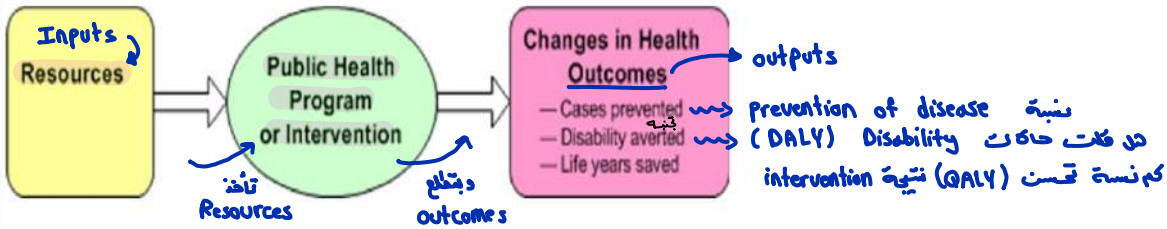
← في حالة ولمة تقار الأراض: إذا كان ربح يعطيني The same Outcome

لكن في كل البرامج العيية، مستحيل آلا في حالة إته في برنامجين يقترأ نفس outcome، بل يك آ

تقار الأراض (وكانم 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 ^{أهميته}

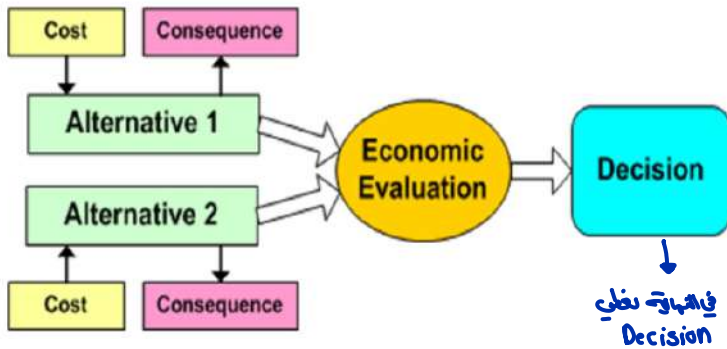
- At present, **resources are being limited** ^{Scarce} while on the other hand, **costs of programs are rising** in addition with more innovative and technological advancements. Thus, **economic evaluation** has become a **necessary need** كانه ما ليس أدرى فقط من ناحية الفائدة (cost And benefit)
- Economic 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** ^{تقييم} of health interventions جودى

لتحسين البرامج الصحية فيما بعد

Economic Evaluation يتعلم بالذکر أرقام هذه الأرقام تساعدني في عمل

Economic evaluation has **2 characteristics**

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



Alternative كى بنوف (Consequence And cost)
 ↓
 ١٥



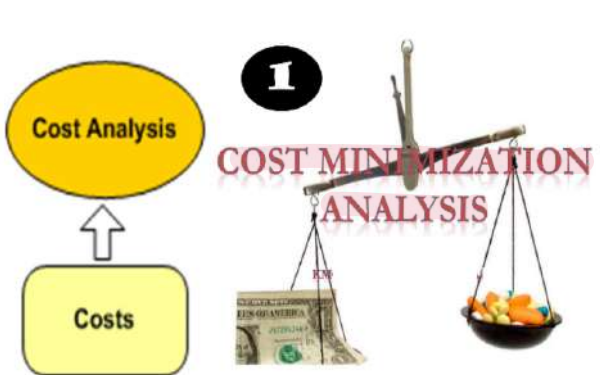
ECONOMIC EVALUATION

(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



يعني مثلاً
Hibitery or
Renal Patient
... يقد يتحتم

تكونتة تستخدم (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**.

- 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

تكون استعماله في Comparing multiple drugs فيه صعب جداً وجود

because we have the same outcome ؟ outcome كاتنكون

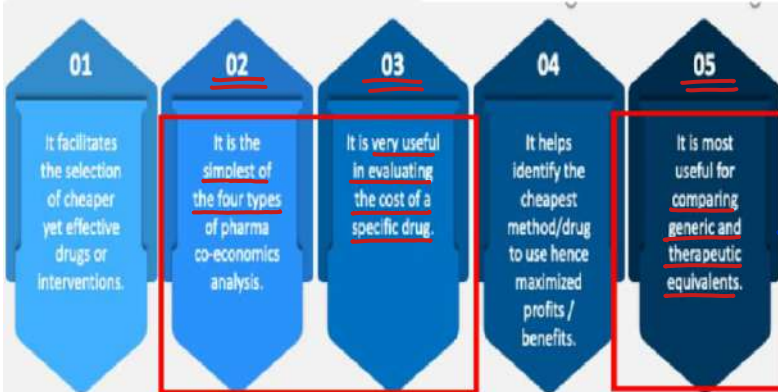
two Health problems outcome نفس (بالذات)

* يعدي في المتاركة بين التي، و Substitutes له

COST MINIMIZATION ANALYSIS

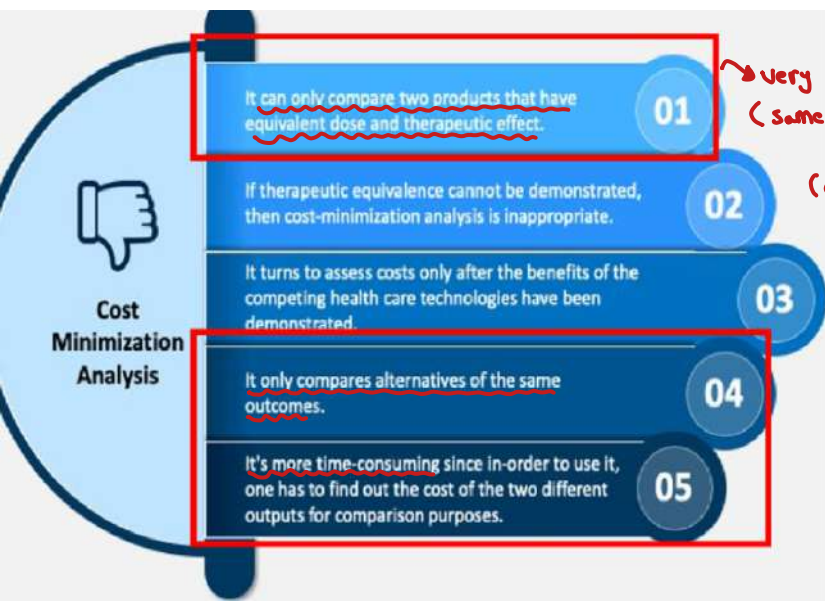
Advantages

بعد ان يلزم
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 استعمل 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)

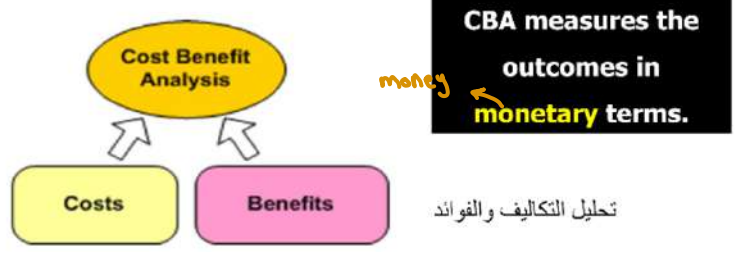
It is a systematic process for calculating and comparing benefits and costs of an action.

It involves comparing the total expected cost of each option against the total expected benefits, to see whether the benefits ^{تتفوق} 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"

المقدرة في فترة محددة
CBA يسبها

عذوموده، عذوموده
CEA And CBA يستعملوا

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

موق نسب اياته خلال سنة ... طبقت برامج Vaccination

cost للاضطفاة استخزمت خلال هذه السنة ~ فوق
الاي حطت خلاقات السنة (percentage of improvement) مرت
(CBA)

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

مثلا: في برنامج طبقت cost ↓ Benefit ↑

وفي برنامج آخر استخزمت له نفس fund حطت Benefit ↓ ار

غطي عدد قليل من الكس.

* One outcome Identical "CMA"

* Two programs with (different or same outcome) "CBA"

لا يستعمل الذي سينفق عليه ام ك ؟ يستعمل 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، كو برامج جديد بي امون دل يستعمل

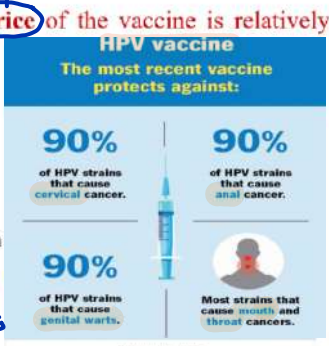
التطبيقات ام ك ؟ (الالة الوميدة الي فيها تقيم برنامج واحد)

فانه معنى C كبير جدا لكن B (protection) قليل

Costs + Salaries....

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.

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

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

ومن قيمته Net Gain نفوق دل B < C ام ك ؟

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

يفتم تنفيذ

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

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

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

بروح لا Females (كفرقة مينة) بنيا نعمل Pap smear

ياخذوا عينت من Cervix (عنق الرحم) يلاونا ويغن Cancer

مت في precancer state (يفي قبل ما يدخل في Cancer) "يفي بداية تغير حالة الرزة"

صل Vaccin افضل ام Pap smear ؟ كازم يعرفوا اللتين وشر الفرق بينهم

واتبهوا : كلاما 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

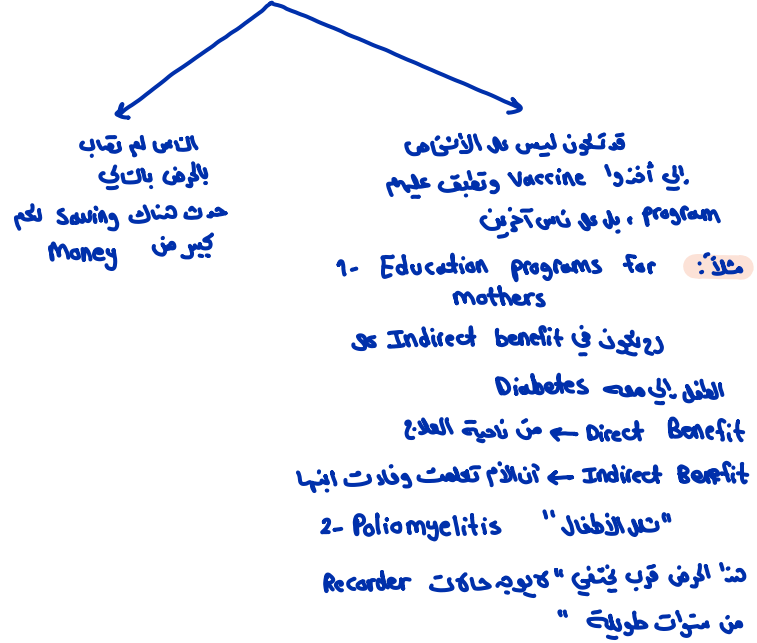
Benefits are the **economic values** of **desirable consequences** of economic policies and decisions.

- 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

الطفل في معه Diabetes

Direct Benefit ← من ناحية العلاج

Indirect Benefit ← أنالام تكلمت وفلات ابنها

2- Poliomyelitis "شلل الأطفال"

نتا المرض قرب يتني "كايو حركات Recorder من سترات طويلة"

وعدودا ابته الأطفال الذين يأخذوا vaccine Oral (عن طريق الفم)

نتا يعطي Immunity (ممانته) لبقية الناس كيف ؟

كيف Group يأخذ vaccine و Benefit تكون له بقية

؟ population

مثل COVID 19 فتاة الشباب هم الي يتعلموا كاهم بروحوا وييجوا (ينتقلوا)

ونيك بعلوا حماية لبقية الناس الأخرى

Health Immunity تعتبر Indirect benefit كانه قانطه ناس أخرى ما استخدمت

نتا program

يعني أنت حسيت مررت أفضل " Suffering / pain / قل
لذه الوعيدة الي كا نستطيع التبيس عنها بأرقام (فالي 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 "ونما حصل عليهم الأطفال إلى أخذوا vaccine"

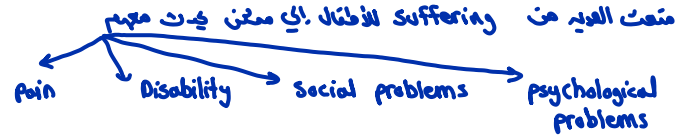
*** Indirect Benefits ⇒**

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

*** Indescribed Benefits ⇒**

1- satisfaction (Health program تجاه)

2-

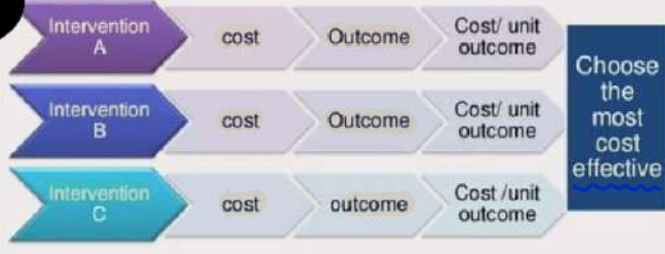


These are the program benefits:

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 هم ركزوا على الفرق بين

3 Cost-Effectiveness Analysis



Medical practise أكثر شيء يستخدم في

Cost- Effectiveness

Efficiency نوع من أنواع

← مضاف: إما مراعى نقص في Input لن يبري

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 يكون يعبر عن مدى التحسين بالشيء)

سيتم حساب

* ملاحظة: لو عملت Vaccine (من الصيام ان يكون Savings) انما الناس لم يثبت لها productivity loss (....)

(,, ,, سجون ان عدد الاكالات قلت)

CEA انكزحي، مستخدم في Medical Field عن Health status ليس مجرد رقم (لا حسبها بالانموال)

Decision rule

Two programs A (comparator) and B.

• If Outcome B = Outcome A

..compare..costs..(CMA)

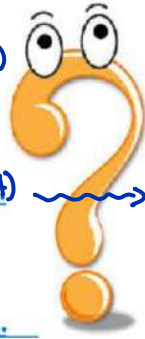
• If Outcome B > Outcome A and Cost B < Cost A,.....

..(B..is..a..dominant)

• If Outcome B > Outcome A and Cost B > Cost A,

make..a..decision..

Decision And Analysis ← نتائج
لتحديد كم مقدار الفائدة و Cost
ذكي وادق منم ← (perfect)



Dominant :

يفتح من نتائج العمل
Additional status
Comparisons و
سيتم اعتبار نتائج
Intervention
كطول
(بين تم قدرتها)

Cost-effectiveness analysis

ما علفت عليها

• It is a form of economic analysis that compares the relative costs and outcomes (effects) of two or more courses of action.

• Cost-effectiveness analysis is distinct from cost-benefit analysis, which assigns a financial value to the measure of effect.

يستخدم Financial Value

• Cost-effectiveness analysis is often used in the field of health services, where it may be inappropriate to monetize health effect.

صعبا ماسيه بال Money Health Effect

تحليل فعالية التكلفة

تكونان يكون In money In measure like
 نسبة CEA
 CE Ratio Ratio
 اسمها يطلع 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
 مثلا: تقيية البرامج الي لمرض العصب البصري (Affection on Optic Nerve)
 لم يعل اسم : العصب البصري

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 بيدنا 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 اكثر لكن في cost اقل
 وناي العلاجة
 نسبة
 * معني يطلع cost A < cost B
 لكن Benefit A < Benefit B
 تخرج خيار B
 * اذ يطلع 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 مفيدًا ، المفيد لأنه ليس في مقارنته

الذي يستخدم أكثر في Cost-Effectiveness هو المقارنته

• CEA for immunization program for poliomyelitis:

* المقارنته

لوسائل التكنولوجيا عن أي شغلنا

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

حيث Measurement قمت 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 تقلد 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

C₁ = cost in intervention group

C₀ = cost in control group

E₁ = effect in intervention group

E₀ = effect in control group

Existing (الوجود الآن)

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

on hepatitis
↑ therapy

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

شئ 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

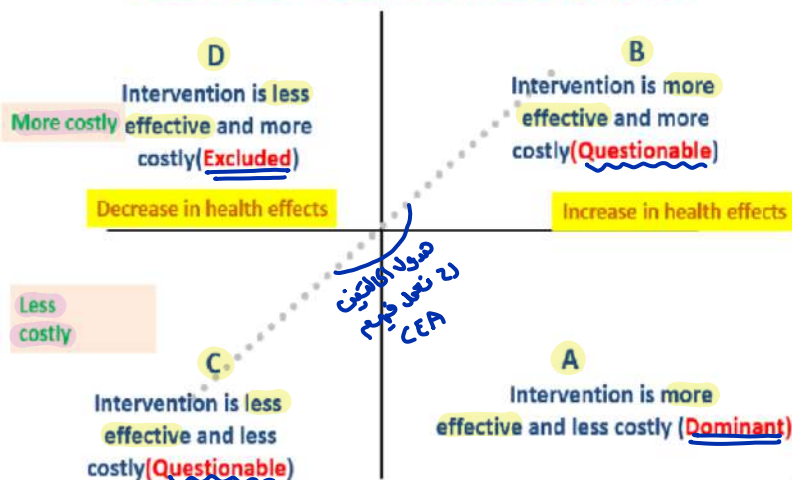
▪ The next question is : Is the intervention "cost-effective"?

* المعادلتين كثير مبهين

Decision حين تأخذ
في راج تأخذ
مهم جداً

Cost-effectiveness plane

* مريض



- D And C ⇒ Decrease in health effects (Less Effective)
- B And A ⇒ Increase in health effects (More effective)
- D And B ⇒ More costly (كنوا اكثر)
- C And A ⇒ less costly (كنوا اقل)
- D (Excluded) "ماز افدي فيه"

↑ cost ↓ Effective

A (Dominant) "يعني راج اختاره ✓"

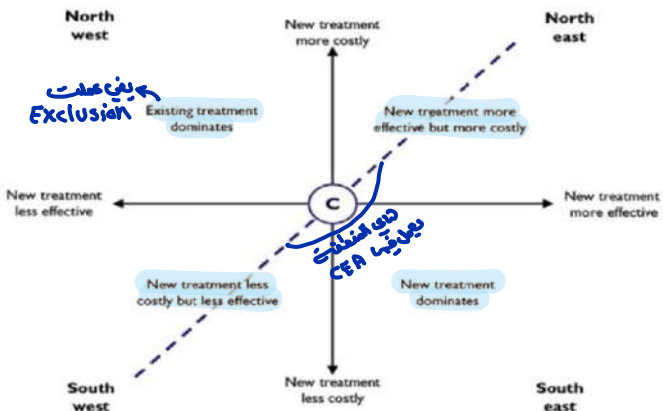
↓ cost ↑ Effective

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

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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