Healthcare Technology Assessment

WARWICK

Dr Leandro Pecchia – 14/1/2016

Lecture goal

- *Introduce the concept of Market*
- *Discuss why healthcare is not an ideal market (…why we need HTA?)*
- *HTA recall*
- *Early stage HTA*

BME&MP and HTA

- *BMEs are increasingly involved in HTA*, collaborating with economists, medical doctors, nurses, pharmacologists, patients, healthcare managers.

- BMEs contribution to HTA is peculiar because *BMEs are involved <u>also</u> in the design* of health technologies and particularly medical devices

- The *European Economic and Social Affairs Committee's* (EESC) of the *European Commission* stated recently that:
  - *"Biomedical Engineering is not simply a subset of modern medicine. Modern medicine predominantly secures important advances through the use of the products of biomedical engineering"**

* EESC, *Promoting the European single market combining biomedical engineering with the medical and care services industry*, 23rd April 2015, http://www.eesc.europa.eu/?i=portal.en.ccmi-opinions.32831

Definition of health technology

- **Health Technology,** according to WHO definition, refers to any application of organized knowledge and skills in the form of medicines, medical devices, vaccines, procedures and systems developed to solve a health problem and improve quality of life.

- **Health technology assessment (HTA)** refers to the systematic evaluation of properties, effects, and/or impacts of health technology. It is a multidisciplinary process to evaluate the social, economic, organizational and ethical issues of a health intervention or health technology. The main purpose of conducting an assessment is to inform a policy decision making.

- *"the "problem" of the assessments is considered only when the technology is close to its placing on the market and not during R&D process"* (WHO*)

*WHO web site (last access 15.09.2012): http://www.who.int/medical_devices/assessment/en/

Healthcare is not and ideal market

What is it a market?

"human beings have unlimited wants but limited resources with which to meet those wants. Given the limited resources, human beings constantly make decisions that require trade-off."

- **Market:** The term market refers to a situation where buyers (consumers) and sellers (producers) interact (directly or through intermediaries) to trade goods and services.
- **Supply** is the total amount of a product (good or service) that producers (sellers) are willing and able to sell at a specified price.
- **Demand** is the total amount of a good or service that consumers are willing and able to purchase at a given price.
- **Market forces** of supply and demand represent the aggregate influence of self-interested buyers and sellers on prices and quantities of goods and services offered in a market: demand and supply interact to determine prices of goods and services being exchanged.

Healthcare is not and ideal market

What is it a ideal market?

A market is ideal under several conditions (perfect competition):

- Perfect market information
- No participant with market power to set prices
- Non intervention by governments
- No barriers to entry or exit
- Equal access to factors of production
- Profit maximization
- No externalities (other benefits/costs for non choosing a product/service)

According to the general equilibrium theory, on the assumption of Perfect Competition, and some technical assumptions about the shapes of supply and demand curves, *it is possible to prove that a market will reach an equilibrium* (Pareto optimum), in which sellers and consumers are at the best possible level of utility.

Healthcare is not and ideal market

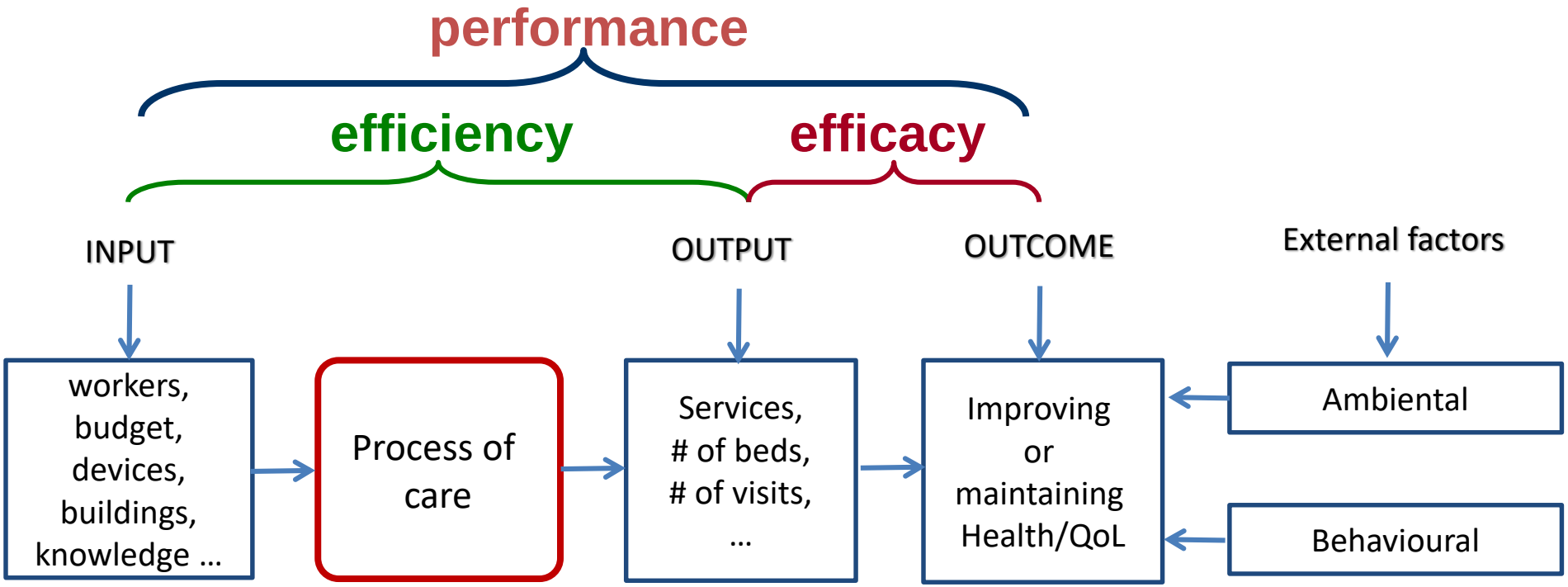
- **Market structure:**
  - number and size of firms
  - Access to market for firms
  - Product differentiation
- **Demand derivation**
  - Not “satisfaction” but “health preservation”
  - The final achievement (health) is not marketable (cannot be passed to other)
  - Low market force (demand does not affect the prices or quantity)

Healthcare is not and ideal market

- **Information asymmetry:**
  - Medical Doctors:
    - Have a deep knowledge of the medical problem, but not of all the patients and not of all the technologies
    - Cannot be 100% sure of results
    - Are the suppliers, but they also act on behalf of the patient…

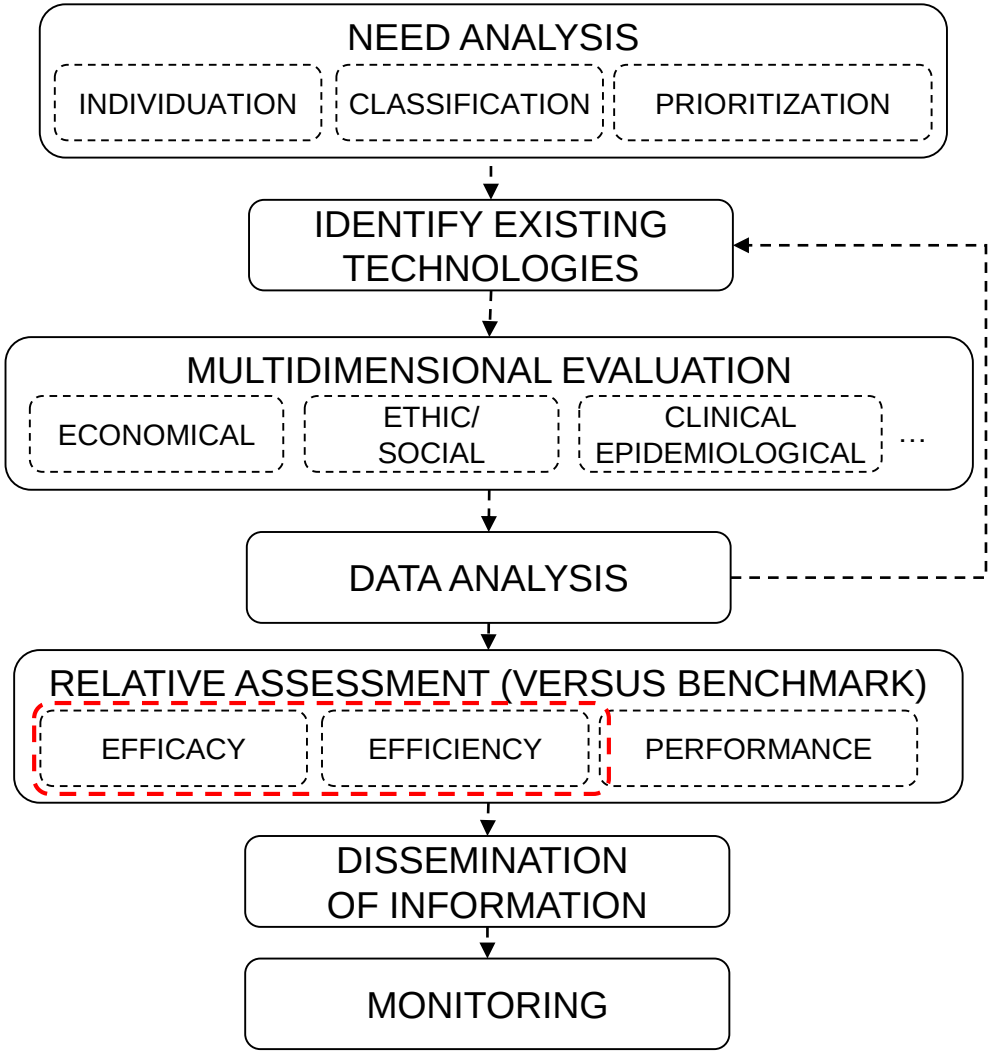
      … demand and supply are jointly determined
  - The patients
    - they lack necessary information about their illness
    - they lack necessary information about the effective healthcare technologies
    - Not completely free of choosing
    - Are not consistent, non stationary, not fully transitive (A>B, B>C, A?C)
    - Final users of the healthcare technology, but not those that directly pay for it
  - Suppliers
    - Not all are profit-oriented (e.g. hospitals)

HTA
Performance, efficiency, efficacy



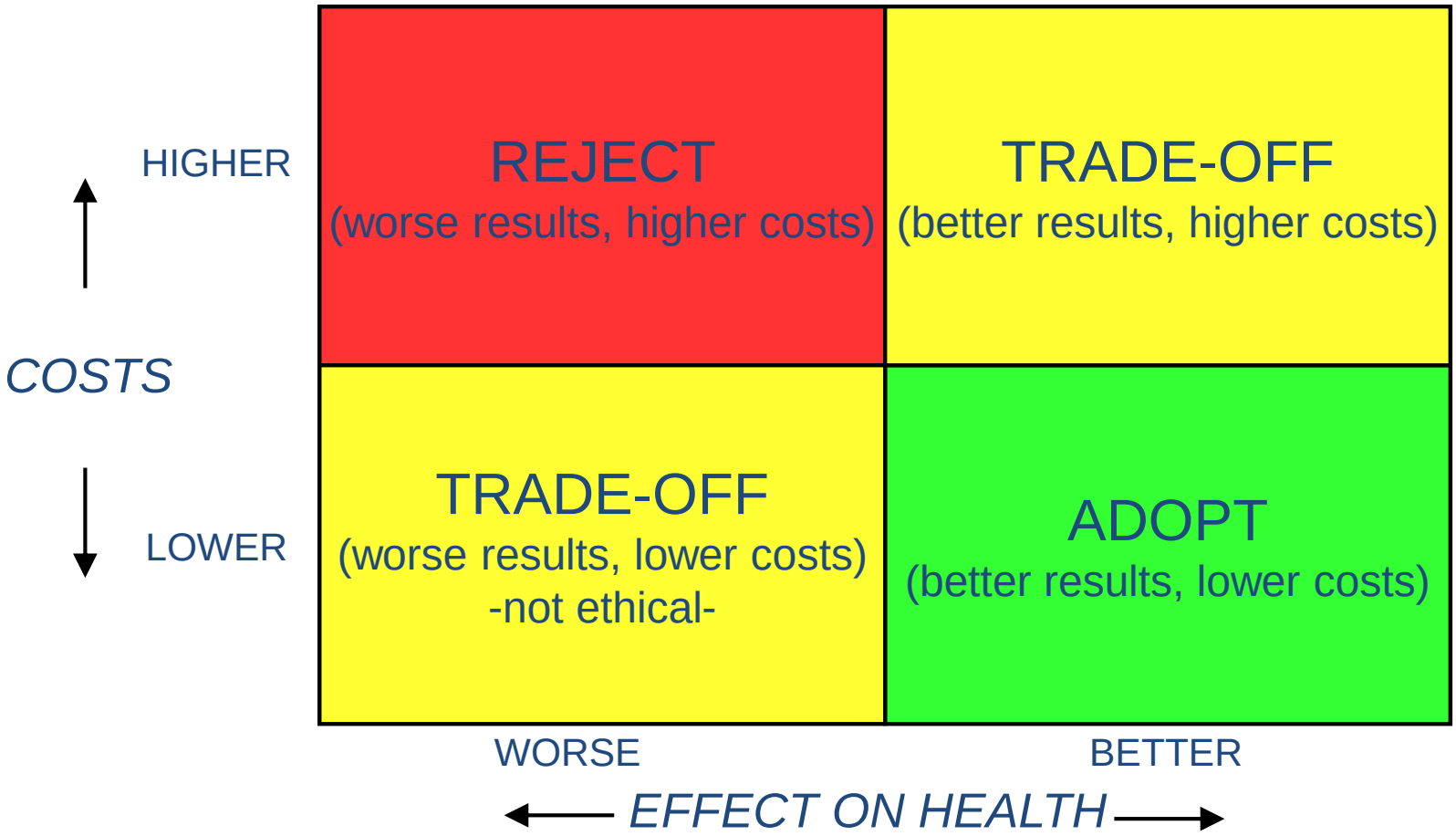
$$Efficiency = \frac{output}{input} \quad Efficacy = \frac{outcome}{output} \quad Performance = \frac{outcome}{input}$$

HTA
standard methods



HTA

Possible results of complete analyses



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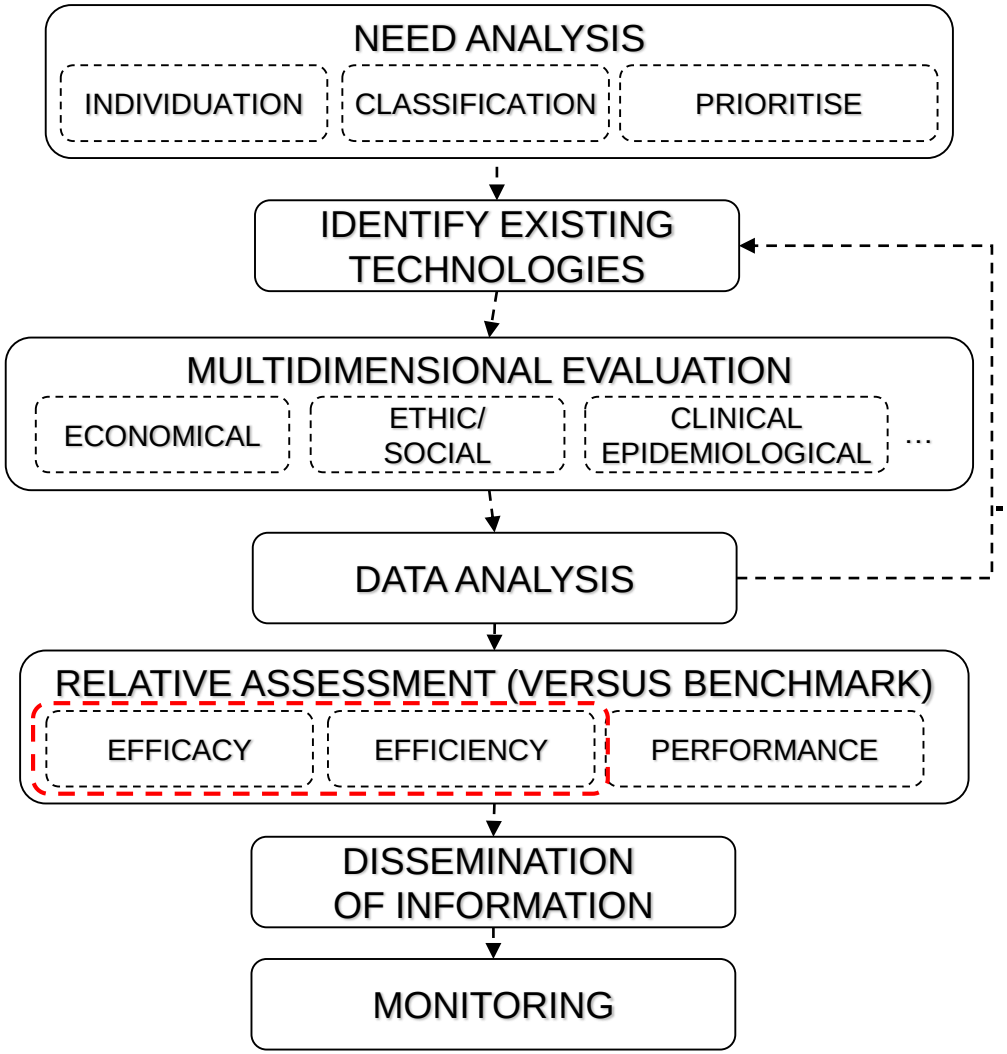
HTA
standard methods



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* NHS NICE willingness-to-pay 'threshold' range of £20,000-£30,000 per QALY.

Example Examples of cost-effectiveness requirements

		COSTS & CONSEQUENCES?		
		NO		YES
2 OR MORE ALTERNATIVES?	NO	PARTIAL ASSESSMENT (ONLY CONSEQUENCES) DESCRIBE RESULTS (outcome)	PARTIAL ASSESSMENT (ONLY COSTS) DESCRIBE THE COSTS OF THE PROBLEM (input)	PARTIAL ASSESSMENT (NO BENCHMARK) ANALYSIS COST-CONSEQUENCES (input-outcomes)
	YES	PARTIAL ASSESSMENT (ONLY CONSEQUENCES) CLINICAL TRIAL (outcomes of 2 or more technologies)	PARTIAL ASSESSMENT (ONLY COSTS) COST ANALYSIS ABC (Activity Based Costing) (input of 2 or more technologies)	VALUTAZIONE COMPLETA COST-EFFICACY COST MINIMIZATION COST-UTILITY COST-BENEFIT (Δoutcomes/ Δinput of 2 or more technologies)

Typologies of complete analyses

Analysis	*Resources (Input)*	*Consequences (outcome)*	*How we measure the outcome?*	*Advantages*	*Limits*
Cost Minim.	£	• 1 result • assumed equally for each alternative	Not needed -ΔC-	• Univocal result • First step for the other analyses	•No effect measured
Cost Eff.	£	• 1 result • 1 technology perform better	Physical units (ages gained, pain) -iCER-	• Can measure univocally clinical results as far as are it is the same for all the technologies	• non heterogeneous effects • efficacy≠effectiveness; • no universal scales can measure the iCER
Cost Util.	£	• >1 results • 1 technology perform better	QALY -iCUR-	• Measure heterogeneous clinical results, by introducing an objective function (i.e. QALY)	• only clinical results • no universal scales to measure the iCUR
Cost Ben.	£	• >1 results not only medical • 1 technology perform better	£ -iCBR-	• Measure heterogeneous results (not only clinical), by converting their impact in £	• difficult to quantify the value of results in £ • less than the 4% of studies

HTA
Typologies of complete analyses

	COST-MINIMIZATION	COST-EFFECTIVENESS	COST-UTILITY	COST-BENEFITS
Costs	•monetary units	•monetary units	•monetary units	•monetary units
Consequences	•equal in both programs	•clinical outcomes	•QALY	•monetary units
Measuring	•differences in costs (ΔC)	•iCER	•iCUR	•iCBR
Advantage	•direct measurement •necessary for the other	•direct measurement •uniform clinical outcomes	•indirect measurements •mixed clinical outcomes •multidimensional analysis	•indirect measurements •mixed outcomes •multidimensional analysis
Limits	•no consequences	•one-dimensional analysis •data table missing in many national health services	•indirect measurement •data table missing in many national health services	•indirect measurement •monetization of value of life •ethical limits

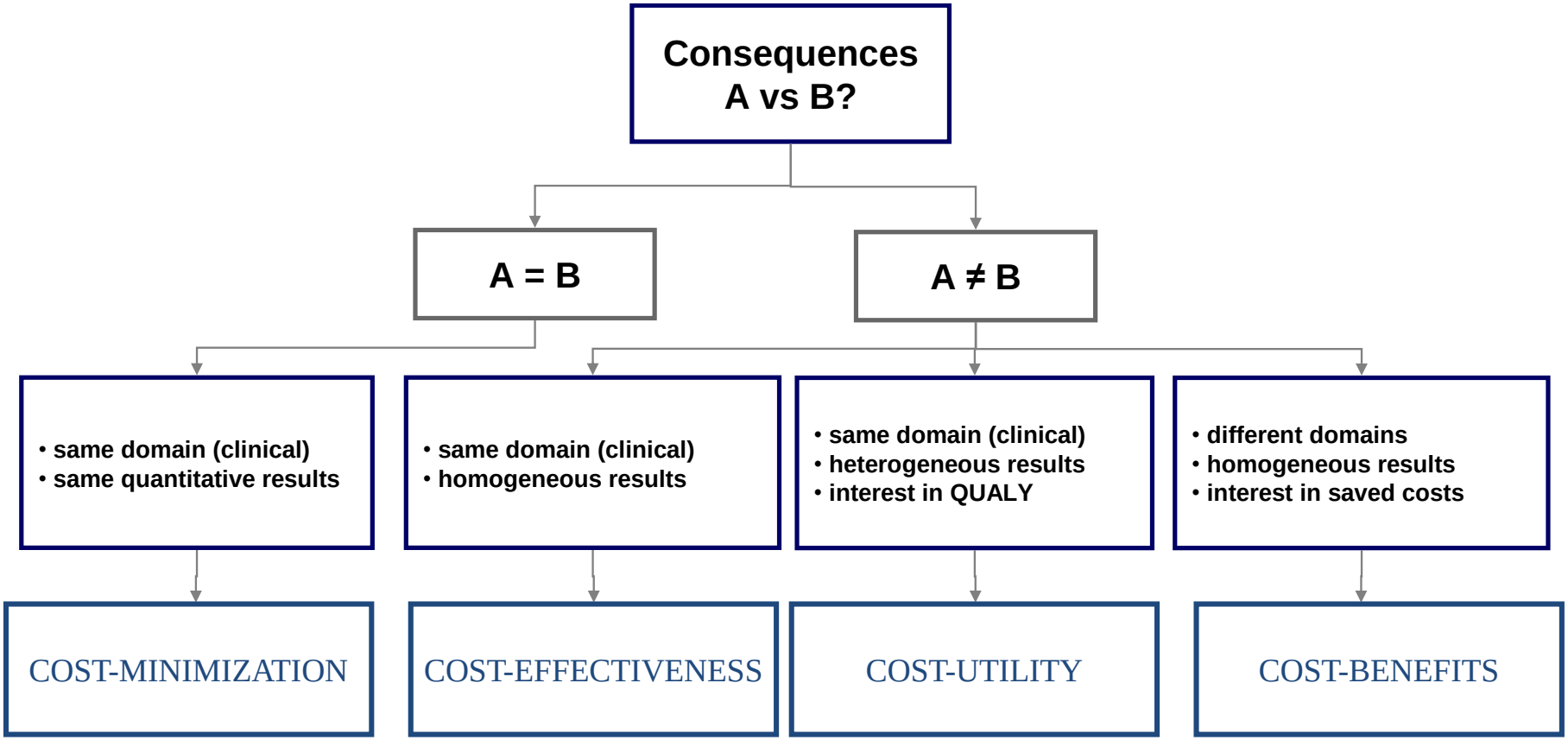
HTA
Quality of Life

- Five attributes (5 dimensions):
  - Mobility
  - Self-care
  - Independency
  - Pain
  - Anxiety depression
- 3 level for each attribute
  - No problem (0)
  - Some problems (1)
  - Significant problems (2)

243 possibile states of health (3^5)
+ 1 for uncontious
+ 1 for death
(total of 245 possible health statuses)

- This tool is standardise by a no-profit group: http://www.euroqol.org/
- Profiles of EuroQol exist for pathology, age, gender…

HTA
How to chose the analysis?



HTA

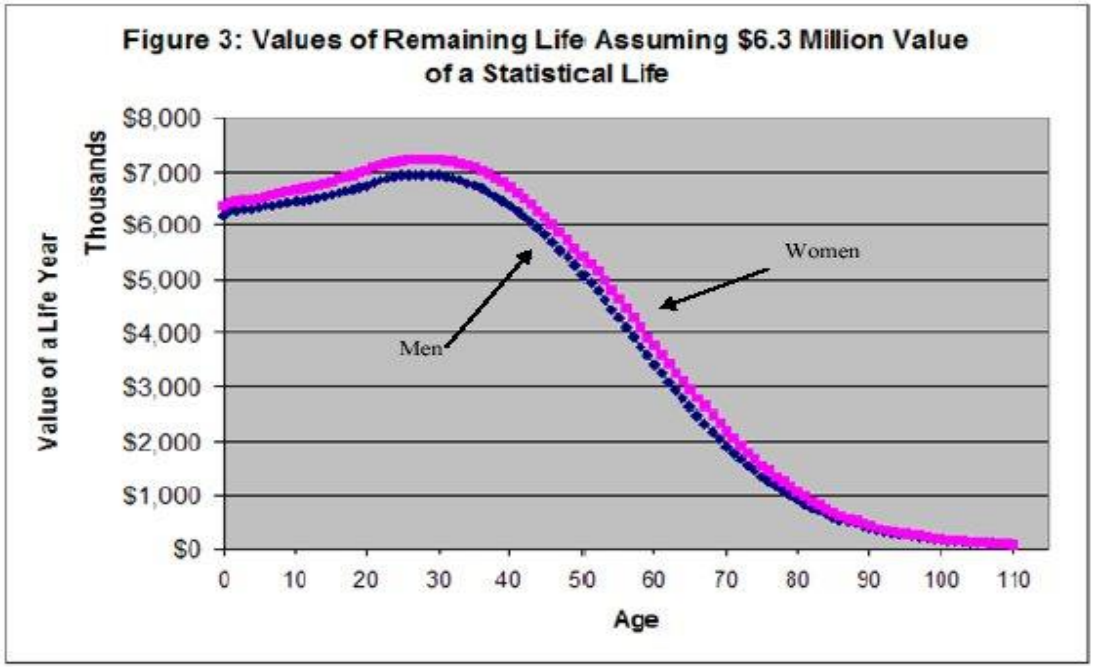
When the incremental analysis is needed?

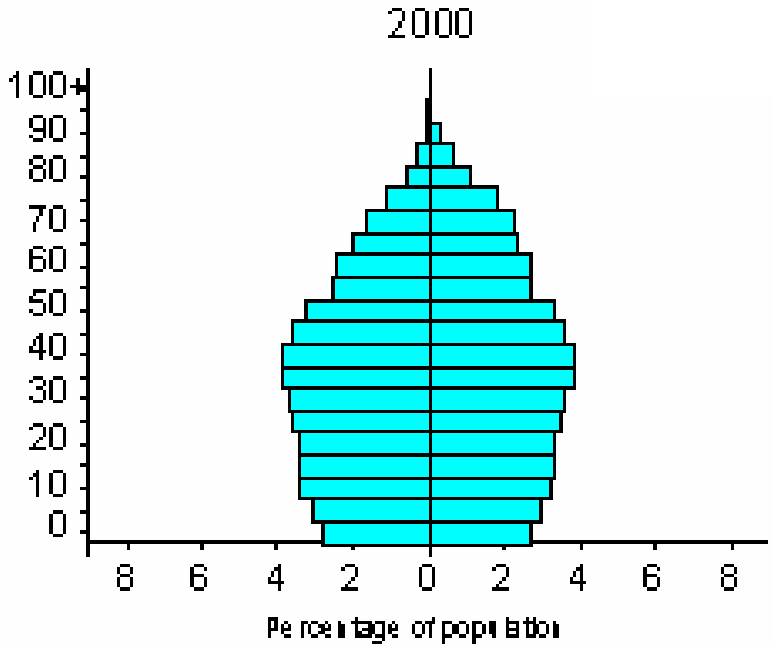
Costs	Consequences	Result
$C_A \geq C_B$	$X_A < X_B$	DOMINANCE. A is more expensive and less effective/utile than B. B continues to be the standard.
$C_A \leq C_B$	$X_A > X_B$	A IS COST-SAVING. A is less expensive and more effective/utile than B. The new technology A is introduced gradually in the NHS.
$C_A \geq C_B$	$X_A > X_B$	INCREMENTAL ANALYST IS REQUIRED. A is more expensive and more effective/utile than B. The new technology A may be introduced gradually in the NHS if the cost for unit of effectiveness/utility is less than the last one introduced into the NHS for the same problem: $iRCX = \frac{C_A - C_B}{X_A - X_B}$ $\quad X = \begin{cases} E \\ U \\ B \end{cases}$

Incremental Ratio in £

Can we convert (quality of) life in £ ?

Value of Life (VoL)





Valore of a QALY (VoQ) = VoL/max(Qaly)

If (RICX > VoQ) => A is accepted

Incremental Ratio in £

Can we convert (quality of) life in £ ?

Table 2. Cost per QALY of healthcare interventions (adapted from references 2–4)

Intervention	£/QALY at 1990 prices
Cholesterol testing and diet therapy (all adults aged 40–69)	220
Neurosurgical intervention for head injury	240
GP advice to stop smoking	270
Neurosurgical intervention for subarachnoid haemorrhage	490
Antihypertensive treatment to prevent stroke (ages 45–64)	940
Pacemaker implantation	1,100
Hip replacement	1,180
Valve replacement for aortic stenosis	1,410
Cholesterol testing and treatment (all adults aged 40–69)	1,480
Docetaxel (as opposed to paclitaxel) in treatment of recurrent metastatic breast cancer	1,890*
CABG (left main-vessel disease, severe angina)	2,090
Kidney transplantation	4,710
Breast cancer screening	5,780
Heart transplantation	7,840
Cholesterol testing and treatment incrementally (all adults aged 25–39)	14,150
Home haemodialysis	17,260
CABG (one-vessel disease, moderate angina)	18,830
Hospital haemodialysis	21,970
Erythropoietin treatment for anaemia in dialysis patients (assuming 10% reduction in mortality)	54,380
Addition of interferon-α2b to conventional treatment in newly diagnosed multiple myeloma	55,060[5]
Neurosurgical intervention for malignant intracranial tumours	107,780
Erythropoietin treatment for anaemia in dialysis patients (assuming no increase in survival)	126,290

The prospective of the HTA

- Prospective:
  - Patient
  - Hospital Trust
  - Local Healthcare services
  - NHS
  - Society
- At what level are we working?
  - **Hospital**: micro-HTA, which device should we buy?
  - **Regional/National**: meso-HTA, should we reimburse this health technology?
  - **National/super-National**: macro-HTA, should Health Ministry invest in prevention or treatment?

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