Health Technology Assessment: A Policy-Maker Starter Kit

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What is Health Care Technology?

Technology is the practical application of knowledge.

Three ways to describe health technology include:

- **Physical nature**
- **Clinical purpose**
- **Stage of diffusion**

Technology: Physical Nature

- **Drugs: e.g., aspirin, antibiotics, chemotherapy for cancer**
- **Biologics: e.g., vaccines, blood products, biotechnology-derived substances**
- **Devices, equipment, supplies: e.g., cardiac pacemaker, MRI scanner, mosquito netting**
- **Medical and surgical procedures: e.g., acupuncture, cancer chemotherapy, cesarean section**
- **Support systems: e.g., clinical laboratory, drug formulary, patient record system**
- **Organizational, delivery, managerial systems: e.g., vaccination program, health care payment system**

Technology: Clinical Purpose

- **Prevention**
- **Screening**
- **Diagnosis**
- **Treatment**
- **Rehabilitation**
- **Palliation**

Technology: Stage of Diffusion

- **Future**
- **Experimental (laboratory or animal testing)**
- **Investigational (clinical studies)**
- **Established (standard approach)**
- **Obsolete**

Technologies Determined to be Ineffective or Harmful After Diffusion (some/all uses)

- **ABMT-HDC for breast cancer**
- **COX-2 inhibitors**
- **Drug-eluting coronary artery stents(?)**
- **Electronic fetal monitoring during labor without access to fetal scalp sampling**
- **Episiotomy (routine or liberal) for birth**
- **Extracranial-intracranial bypass to reduce risk of stroke**
- **Erythropoiesis-stimulating agents for anemia(?)**
- **Gastric bubble for morbid obesity**
- **Gastric freezing for peptic ulcer disease**
- **Hormone replacement therapy for healthy menopausal women(?)**
- **Intermittent positive pressure breathing**
- **Prefrontal lobotomy for mental disturbances**
- **Radiation therapy for acne**
- **Thalidomide for sedation in pregnant women**

Underused Cost-Effective Technologies

- ACE inhibitors for treatment of heart failure
- Antibiotics for gastrointestinal ulcers
- Cochlear implants for severe-to-profound deafness
- Colorectal cancer screening
- HbA1c testing every 6 months in diabetic patients
- Hypertension management
- ICDs for survivors of cardiac arrest
- Inhaled corticosteroids in adults with asthma
- Mammography (esp. age 50+)
- Organ transplantation
- Pap smears
- Pneumococcal vaccine for high risk patients
- Smoking cessation interventions
- Warfarin to prevent strokes due to atrial fibrillation

What Is Health Technology Assessment? (1)

- **HTA is the systematic evaluation of properties, effects, or other impacts of health care technology.**
- **The main purpose of HTA is to inform policy making for technology in health care.**
- **HTA may address the direct and intended consequences of technologies, as well as the indirect and unintended consequences of technologies.**
- **HTA is conducted by interdisciplinary groups.**
- **HTA uses explicit analytical frameworks and a variety of methods.**

Source: Goodman C. HTA 101. Introduction to Health Technology Assessment. 2004. NICHSR, NLM. http://www.nlm.nih.gov/nichsr/hta101/ta101_c1.html

Properties and Impacts Assessed

Main categories:

- **Technical properties**
- **Safety**
- **Efficacy and effectiveness**
- **Cost and other economic attributes**
- **Social, legal, ethical, or political impacts**

Related Concepts and Inception Timeline

- **HTA – 1970s**[1]
- **Outcomes research – 1986**[2]
- **Effectiveness research – 1988**[3]
- **Pharmacoeconomics – approx. 1989**[4]
- **Evidence-based medicine – 1990**[5]
- **Comparative effectiveness research – early 2000s**[6]

[1] Origin of TA in 1965: US Congressman Daddario; first "experimental" HTA by National Academy of Engineering in 1969 (multiphasic screening); first HTA by Office of Technology Assessment in 1974

[2] Patient Outcomes Assessment Research Program (later, PORTs) initiated by NCHSR (later AHCPR; now AHRQ) in 1986 ("promote research with respect to patient outcomes of selected medical treatments and surgical procedures for the purpose of assessing their appropriateness, necessity and effectiveness ")

[3] HCFA Effectiveness Initiative: 1988

[4] Early published appearance of "pharmacoeconomics": Bootman et al. 1989

[5] "Evidence-based": Eddy 1990; "Evidence-based medicine": Guyatt et al. 1992

[6] Medicare Prescription Drug, Improvement, and Modernization Act of 2003 (MMA) specifies AHRQ role in "comparative clinical effectiveness"

Comparative Effectiveness Research

Multiple, emerging definitions, for example:

- **A type of health care research that compares the results of one approach for managing a disease to the results of other approaches. Comparative effectiveness usually compares two or more types of treatment, such as different drugs, for the same disease. Comparative effectiveness also can compare types of surgery or other kinds of medical procedures and tests. The results are often summarized in a systematic review.**

Source: Agency for Healthcare Research and Quality
http://effectivehealthcare.ahrq.gov/tools.cfm?tooltype=glossary&report=full

HTA Performed by Different Organizations to Inform Health Care Policies or Decisions

- **Advise a regulatory agency about allowing the marketing / use of a technology**
- **Advise payers (health authorities, health plans, etc.) about technology reimbursement: coverage (whether or not to pay), coding, and payment amount**
- **Advise clinicians and patients about appropriate use of a technology**
- **Help managers of hospitals and other health care organizations make decisions about acquiring a technology**
- **Support decisions by health technology companies about technology development and marketing**
- **Support decisions by financial groups about investing in new technology companies**

Three Main Groups Of Methods

- **Primary data collection**

  Collect original new data, for example, using experiments

- **Secondary / integrative analyses**

  Combine (synthesize or integrate) data from existing sources

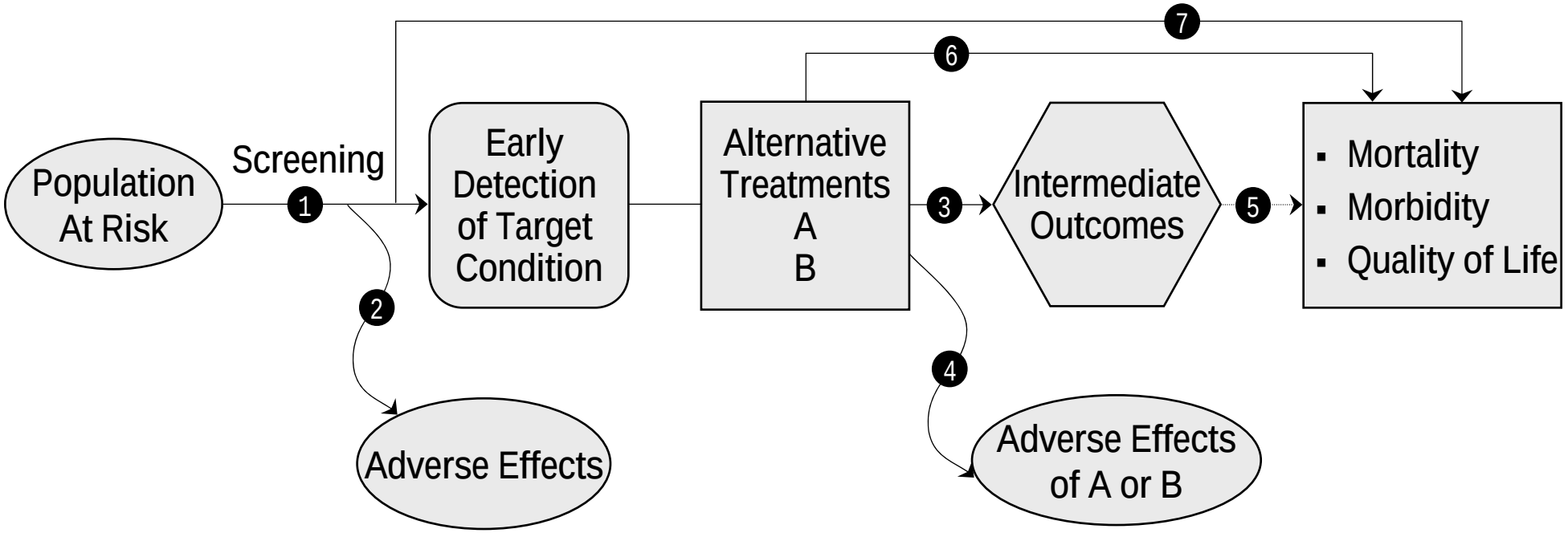
- **Economic analyses**

  Weighing costs and benefits (outcomes or other results)

Primary Data Methods

- **Large randomized controlled trial**
- **Small randomized controlled trial**
- **Nonrandomized trial w/ contemporaneous controls**
- **Nonrandomized trial w/ historical controls**
- **Cohort study (prospective)**
- **Case-control study (retrospective)**
- **Cross-sectional study**
- **Surveillance (e.g., w/ databases or registries)**
- **Series of consecutive cases**
- **Single case report (anecdote)**

Causal Pathways: Beyond One Step



1. **Is screening test accurate for target condition?**
2. **Does screening result in adverse effects?**
3. **Do treatments change intermediate outcomes?**
4. **Do treatments result in adverse effects?**
5. **Are changes in intermediate outcomes associated with changes in health outcomes?**
6. **Does treatment improve health outcomes?**
7. **Is there direct evidence that screening improves health outcomes?**

Source: Adapted from Harris, Helfand, Woolf, et al. 2001

Types of Cost Studies

	Valuation of costs		Valuation of outcomes
Cost of Illness	**$**	**vs.**	**None**
Cost Minimization	**$**	**vs.**	**Assume same**
Cost Effectiveness	**$**	**÷**	**Natural units**
• **Cost Conseq.**	**$ (disaggr.)**	**vs.**	**Natural units (disaggr.)**
• **Cost Utility**	**$**	**÷**	**Utiles (e.g., QALYs)**
Cost Benefit	**$**	÷ or -	**$**
Budget Impact	**$ (fixed)**	**vs.**	**Any**

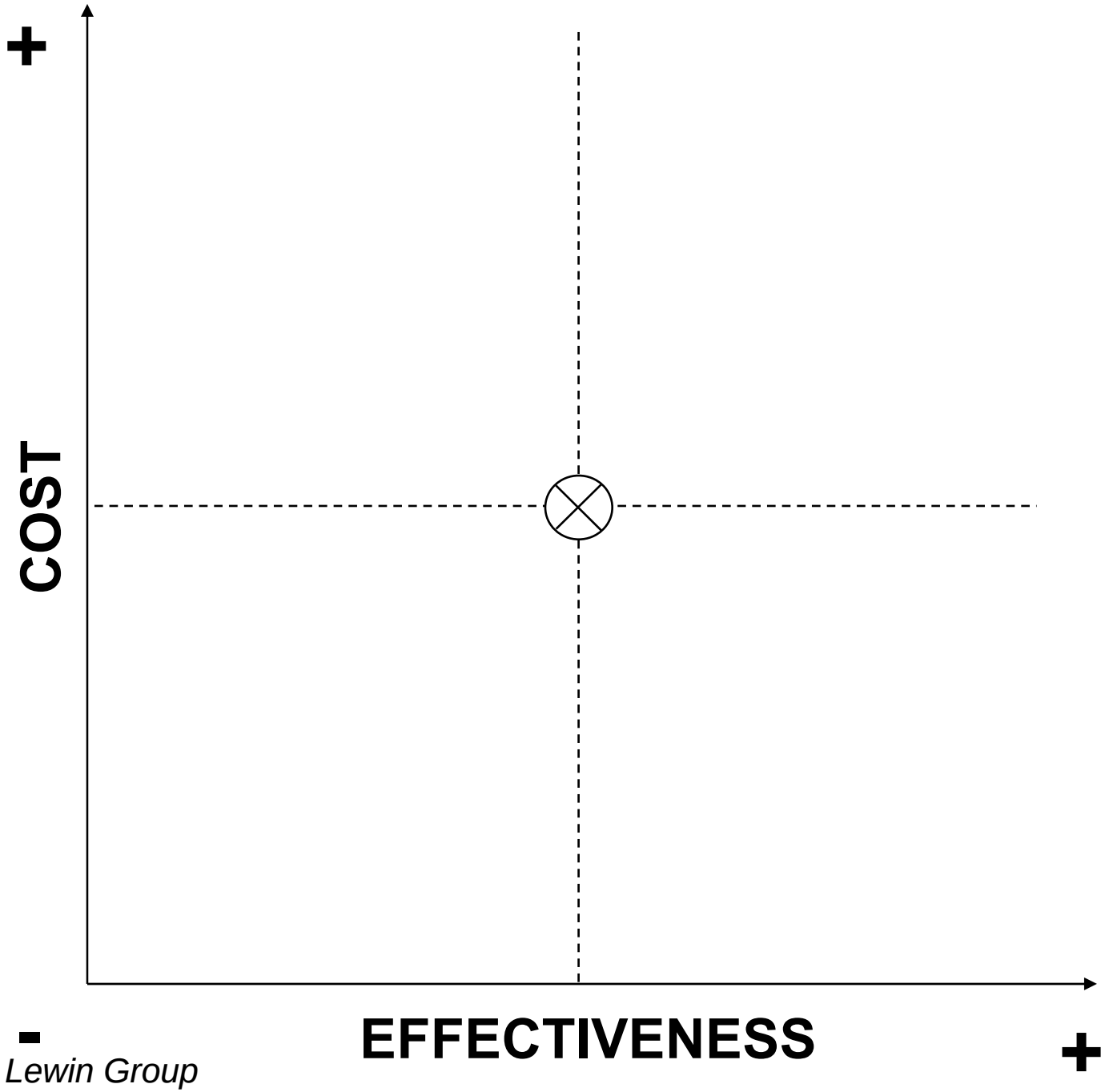
Incremental Cost-Effectiveness Ratio

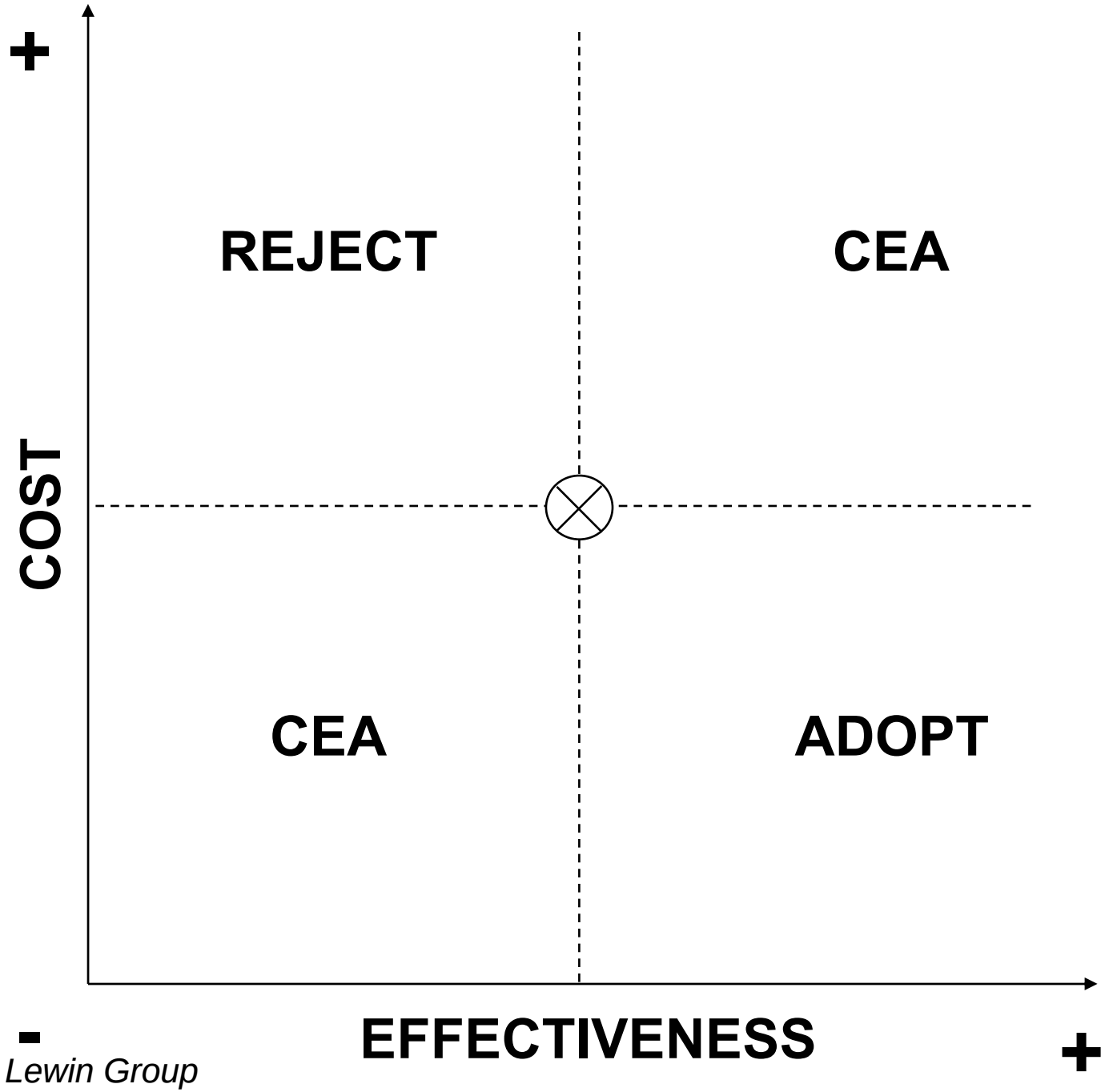
$$ICER = \frac{€Cost_{Int} - €Cost_{Comp}}{Effect_{Int} - Effect_{Comp}}$$

For example:

- **"€45,000 per life-year saved"**
- **"€10,000 per myocardial infarction averted"**

Int: Intervention
Comp: Comparator


+
COST
-
EFFECTIVENESS
+


+
REJECT
CEA
COST
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ADOPT
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EFFECTIVENESS
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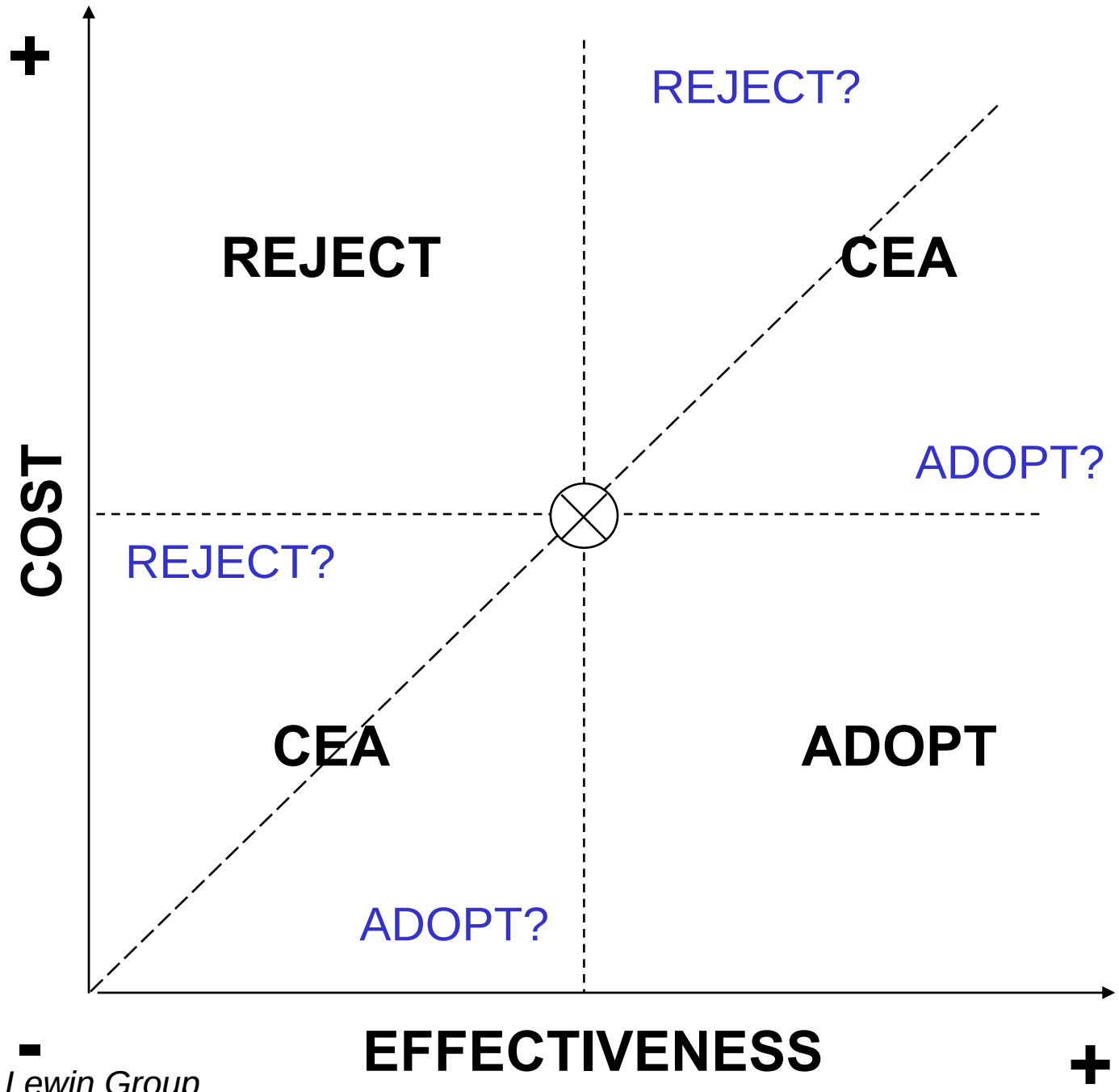
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REJECT?
REJECT
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COST
REJECT?
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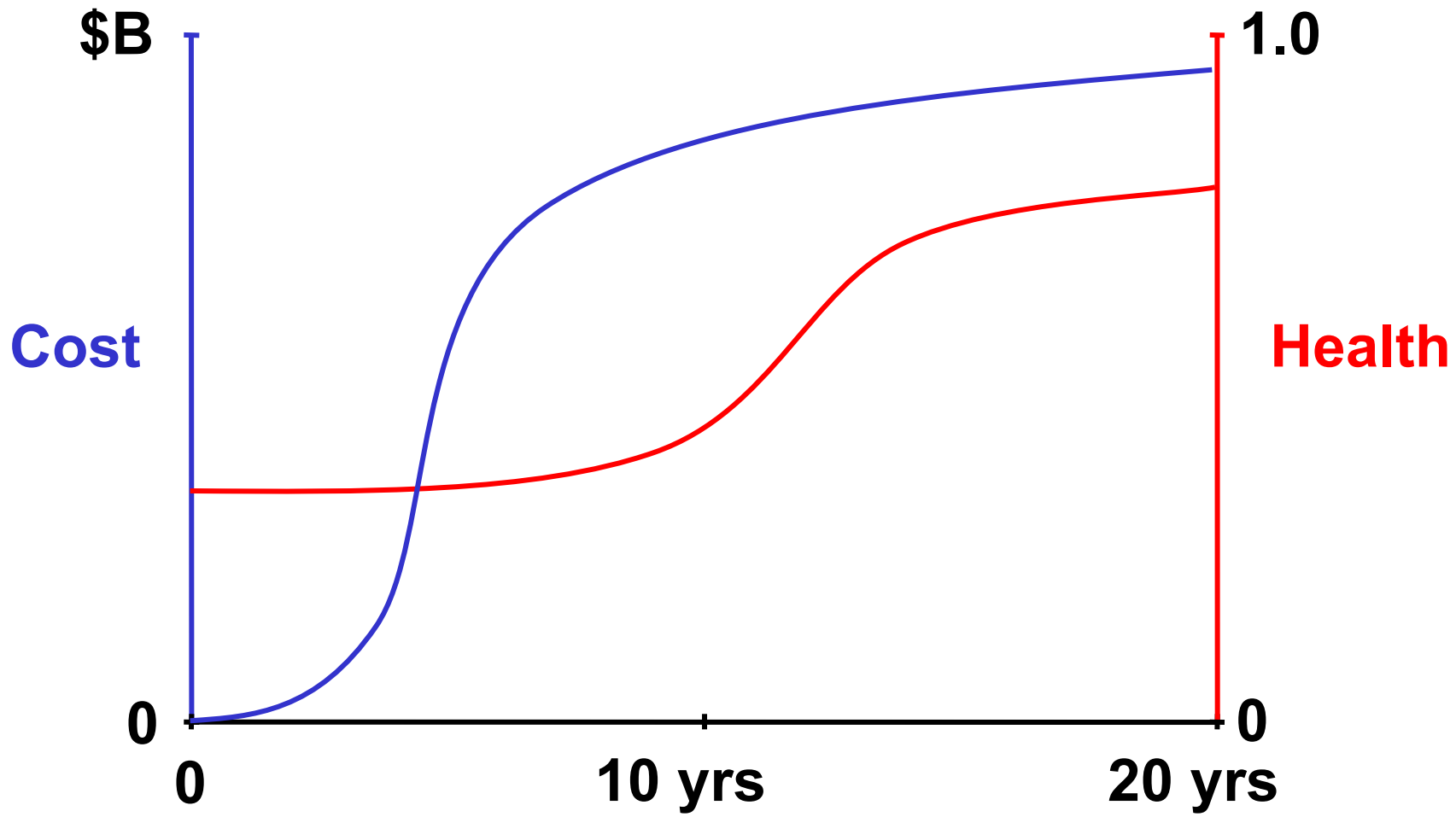
ADOPT?
-
EFFECTIVENESS
+

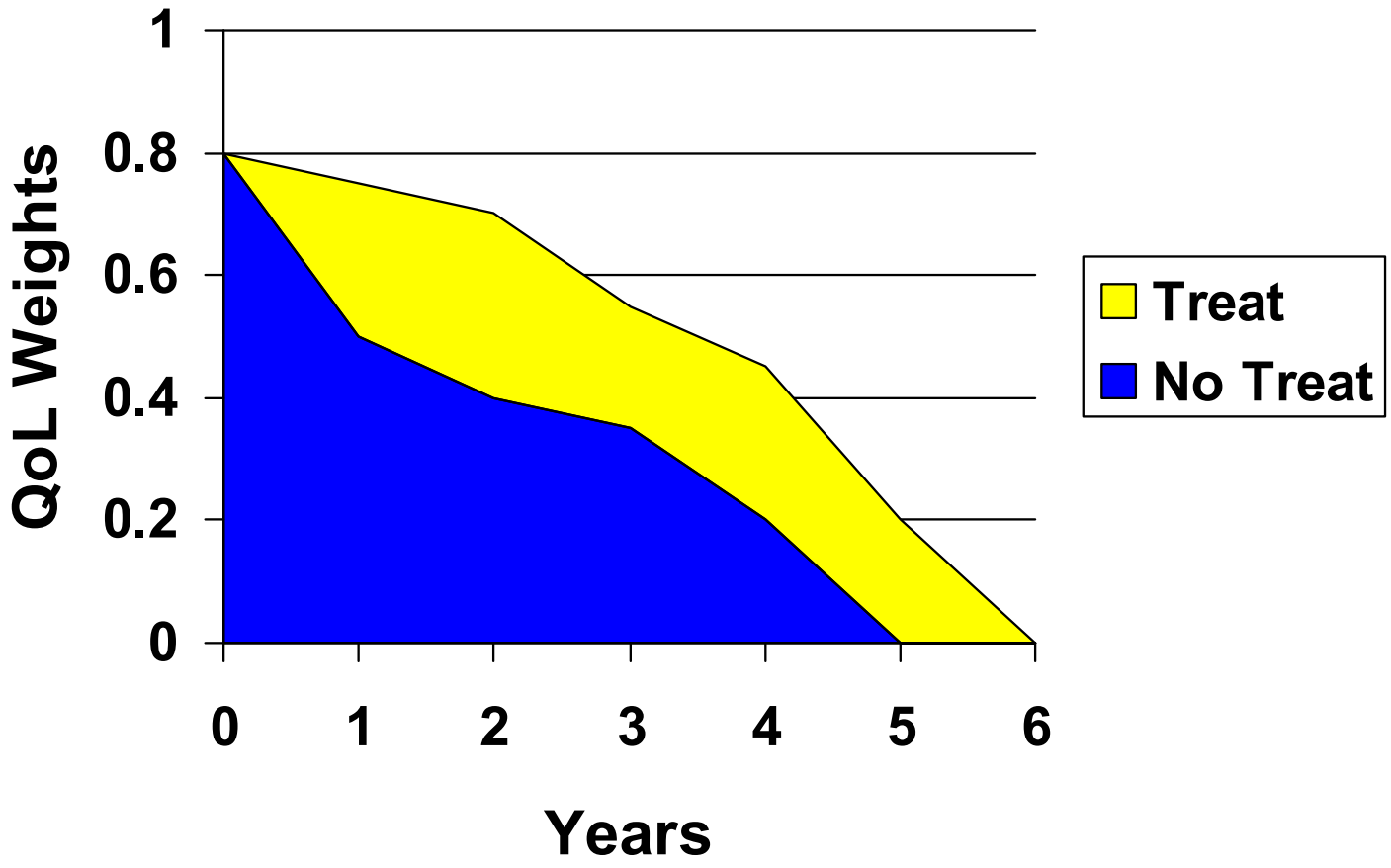
Time Horizon of Analysis

- **Long enough to capture streams of health and economic outcomes (intended and unintended)**
- **Could be a disease episode, patient life, or multiple generations**
- **Consider: emergency appendectomy vs. cholesterol lowering in high-risk adults vs. smoking cessation in teenagers**
- **Modeling may be needed to capture outcomes beyond available data**
- **The higher the discount rate, the less important are far-future outcomes**

Time Horizon:
Health Benefits Lagging Costs



QALY = Length of Life X Quality Weight



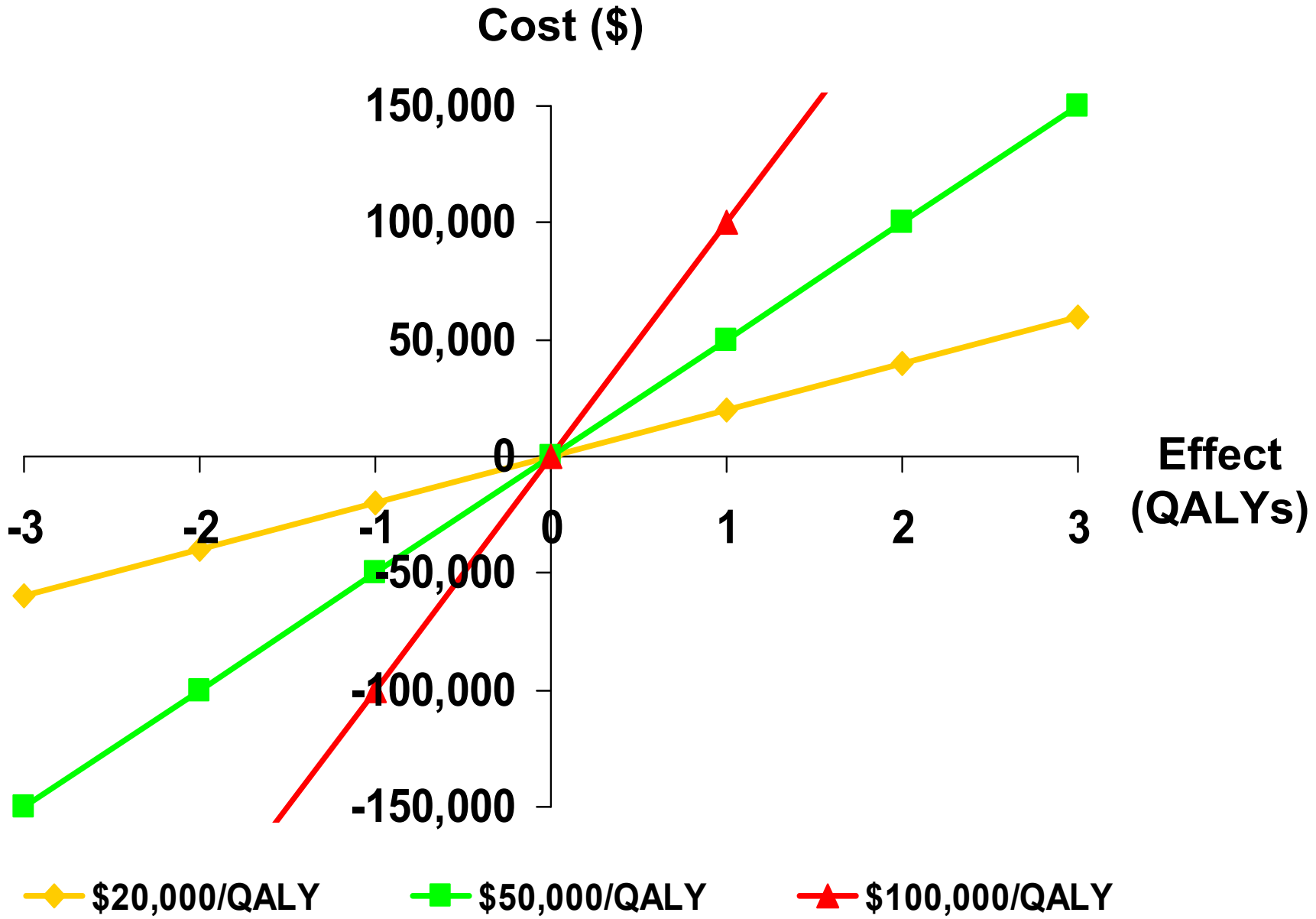
Use to capture changes in length of life (mortality) and quality of life (e.g., utility for state of health)

League Table - Estimated Cost/QALY Gained by Investing in Different Treatments

	Cost per QALY (£ 1990)
Cholesterol testing and diet therapy (all 40-69 yrs)	220
Neurosurgery for head injury	240
General practitioner advice to stop smoking	270
Neurosurgery for subarachnoid hemorrhage	490
Antihypertensive therapy to prevent stroke (45-64 yrs)	940
Pacemaker implantation	1,100
Hip replacement	1,180
Valve replacement for aortic stenosis	1,140
Cholesterol testing and treatment	1,480
CABG (left main disease, severe angina)	2,090
Kidney transplant	4,710
Breast cancer screening	5,780
Heart transplantation	7,840
Cholesterol testing and treatment (incremental) (all 25-39 yrs)	14,150
Home hemodialysis	17,260
CABG (one-vessel disease, moderate angina)	18,830
Continuous ambulatory peritoneal dialysis	19,870
Hospital hemodialysis	21,970
EPO for dialysis anemia (with 10% reduction in mortality)	54,380
Neurosurgery for malignant intracranial tumors	107,780
EPO for dialysis anemia (with no increase in survival)	126,290

Source: Maynard A. The Economic Journal 1991;101:1277-86.

Cost-Effectiveness Threshold?



Source: Laupacis A, et al. CMAJ 1992;146:473-81.

Current Trends in HTA (1)

1. **Greater demand for HTA to support health service policies, practice guidelines, patient care decisions, payment, purchasing**
2. **Increase in government and private sector HTA agencies/organizations/functions**
3. **More transparent, systematic, consultative HTA processes**
4. **Higher standards of evidence and use of evidence grading hierarchies**
5. **More interest in evidence from real-world practice (registries, surveillance, practical clinical trials) and comparative effectiveness research (especially "head-to-head" trials), not just RCTs for efficacy**

Current Trends in HTA (2)

6. Greater emphasis on cost-effectiveness and related economic impacts, and on improving and standardizing these
7. Greater use of systematic reviews, meta-analysis, decision analysis, and other synthesis methods
8. More interest in tailoring evidence requirements, methods to particular types of technology, contexts (e.g., biomarkers, adaptive trial design)
9. Close evidence gaps by linking payment to new evidence generation (conditional reimbursement, coverage with evidence development)
10. More specificity in HTA findings, e.g., by patient subgroup, practice setting, provider experience

Current Trends in HTA (3)

11. Greater international collaboration in HTA methods, expertise, reports, reporting standards
12. Instant, low-cost, international access to published evidence, most completed HTA reports, awareness of ongoing HTAs
13. More horizon scanning and systematic priority-setting
14. More interest in rapid assessments, i.e., focused or condensed systematic reviews
15. More efforts to coordinate/align/harmonize evidence requirements to support market approval and payment
16. Industry more aware of and interested in HTA than simply opposing it

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