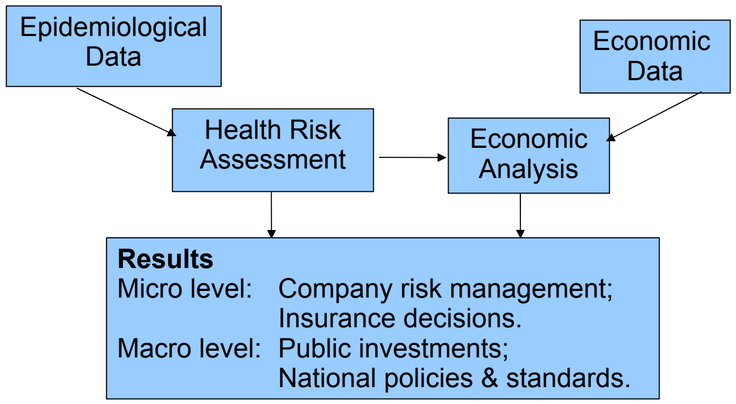
Methods of Economic Evaluation of Health Risks

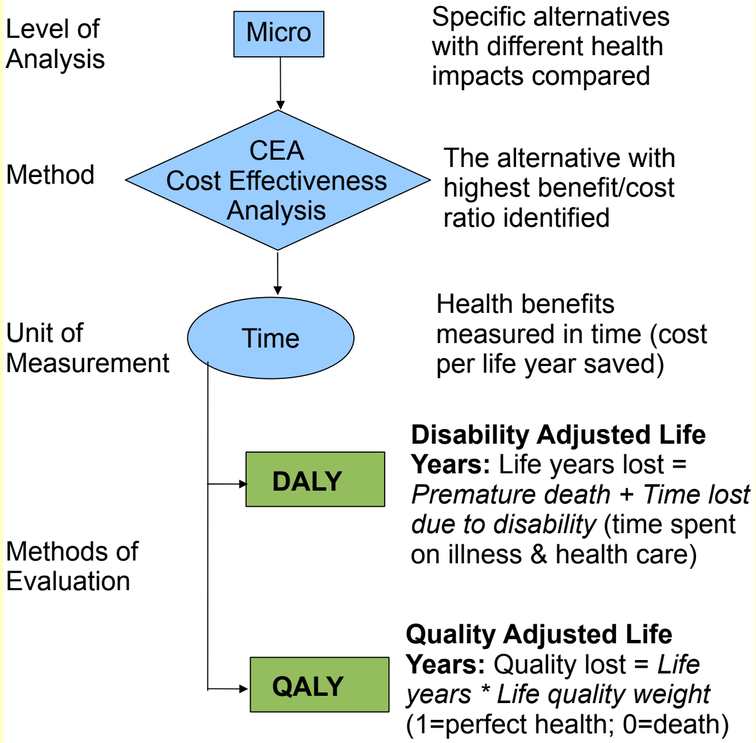
Associated with Nanomaterials

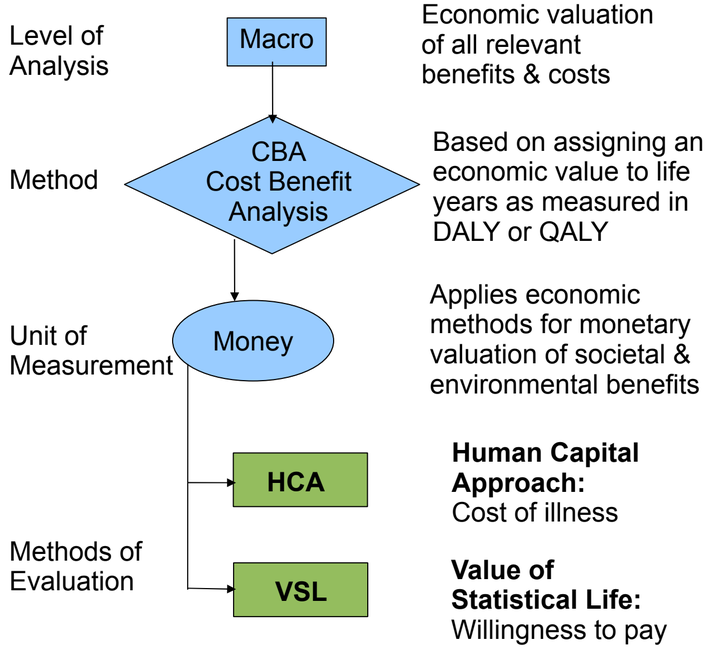
Sarit Shalhevet, Environmental Economics Consultant, SustainEcon, Brookline MA, USA. Email: sarit.shalhevet@gmail.com
Nava Haruvy, Netanya Academic College, Netanya, Israel. Email: navaharu@netvision.net.il

Risk Management Model



Economic Analysis Methods





Human Capital Approach (HCA)

HCA = Cost of treatment + Loss of potential earnings

Treatment costs: Emergency room visits, hospital stay, subsequent treatment, restricted activity days, workday loss.

Earnings = Annual earning + Value of household service

Cost of developmental delays = Probability * Impact on lifetime earnings. Example in figure 1: Fetal exposure or exposure as small child to mercury is related to IQ deficit.

Estimates based on epidemiological data.

Value of Statistical Life (VSL)

Defined as the willingness to pay to avoid a **small change** in risk of dying (value of minor increase- not of saving your life).

Methods of Estimating VSL

Contingent valuation: Surveys asking people what they are willing to pay to avoid a small increase in specific risk.

Averting behaviour: People's investments in preventive measures as an indicator of willingness to pay.

Hedonic valuation: Regression analysis between risk and independent variables. Hedonic wages: observing risk premiums paid for riskier jobs.

Sample of Results (US 2000$)

Human Capital Approach

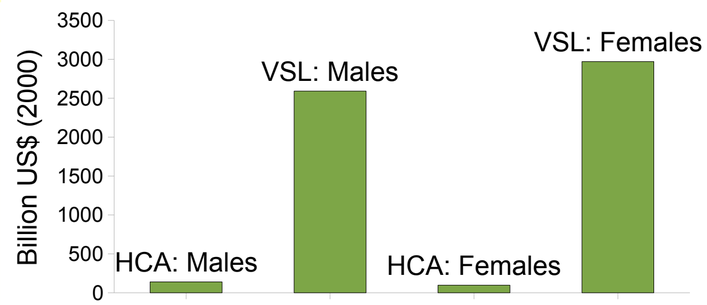
Cost of a lost productive day: $150/day (Grosse, 2003).
Time frame and cost of treatment varies by disease.

Value of Statistical Life

Estimates (independent of age): range of $3 - $9 million.
The EPA uses an estimate of $5.9 million.

In almost all cases VSL > HCL

Figure 1. Valuation of health risks from exposure to mercury in consumers of commercial fish (total for the US)



Based on data from Rice & Hammitt. 2005. Economic valuation of human health benefits of controlling mercury emissions from US coal-fired power plants.

Summary of Current State

- Research suggests that even nanoparticles of harmless substances can be dangerous.
- Exposure to particulate air pollution increases some health risks; exposure to the nanoparticle component increases the risks at lower exposure concentrations.
- Nanomaterials like silver may become “the next asbestos”.
- Needed: policies for public and workplace safety.
- Nanotech companies usually responsible for determining the health risks; many are small companies with limited resources; they mostly rely on data from their suppliers.
- A few life cycle assessments were published (including health risk assessment in DALY's).
- The Environmental Defense Fund and DuPont published a joint framework for responsible development of nanoscale materials (2007; online).