Online Advanced Methods for Cost-Effectiveness Analysis

Presentation 4: Populating Models: Costs and Outcomes
4.4: Costing Methods: Key Principles

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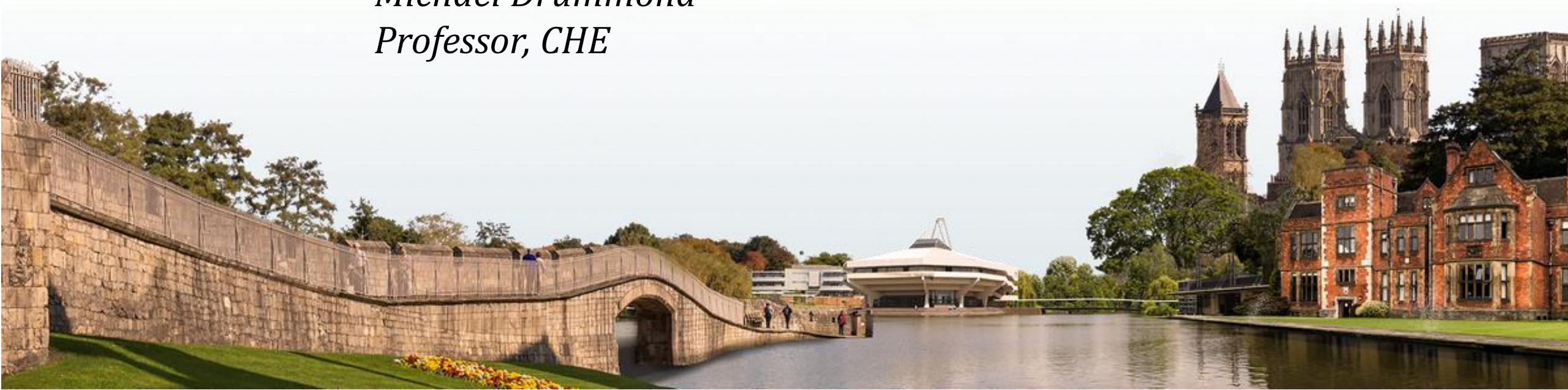


Objectives

- To understand the key principles of costing, including:
  - The importance of the perspective for analysis
  - The alternative sources of cost data
  - The difference between costs and charges
  - The relevance of considering the context when costing
  - The costing of informal care

Background to costing

- A neglected area in economic evaluation
- Depends on the *perspective* for the evaluation (eg payer, society)
- Requires estimates of the quantities of resources (q) and their prices (p); if possible, report these separately
- Costing methods are often heavily constrained by the financial data available in a given setting
- Observed prices (i.e. charges) may not reflect true costs

Importance of costing assumptions: Cost-effectiveness of Dasatinib and Nilotinib in Imatinib-resistant chronic myeloid leukemia (1)

- Independent analysis performed for NICE in the UK
- No head-to-head trials, but an indirect treatment comparison made
- *Survival estimates*

  Nilotinib 13.0 years Dasatinib 13.4 years
- *Costs of treatment*

  Nilotinib £70,000 Dasatinib £161,000
- Incremental cost-effectiveness ratio was £91,500 per QALY
- In an extensive probabilistic sensitivity analysis, Dasatinib was more costly than Nilotinib 'in virtually all simulations'
- Unambiguous result?

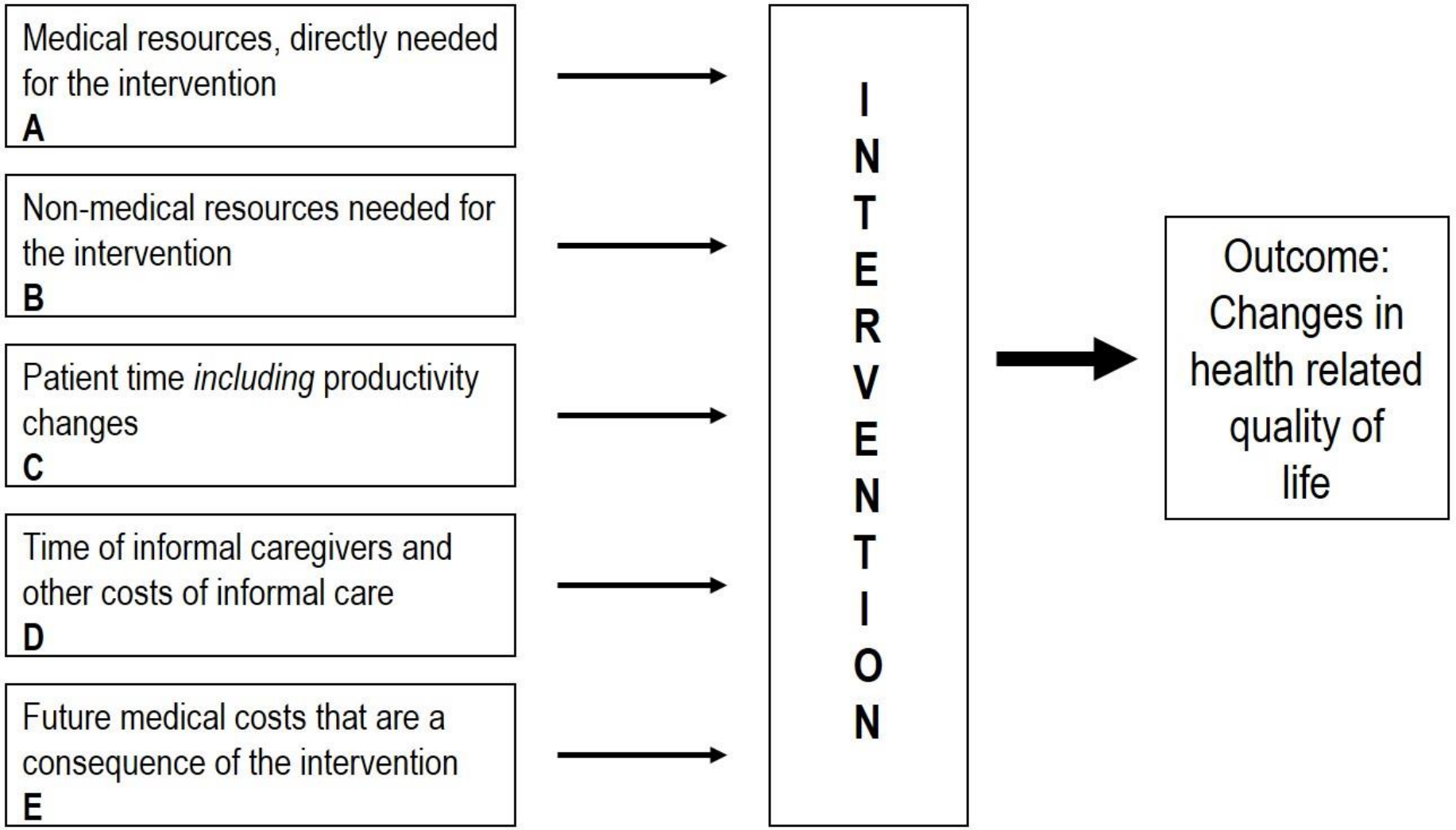
Source: Hoyle *et al. Value in Health* 2011; 14: 1057-1067

Importance of costing assumptions: Cost-effectiveness of Dasatinib and Nilotinib in Imatinib-resistant chronic myeloid leukemia (2)

- Progression-free survival was 0.63 for nilotinib (at 18 months) and 0.77 for dasatinib (at 20 months)
- Monthly drug cost was £1217 for nilotinib and £1169 for dasatinib, so treatment cost difference can only be due to the amount of therapy
- Direct information on treatment duration was not available, but duration of therapy was assumed to be just 2.4 years for nilotinib, but 6.5 years for dasatinib
- The estimate of drug utilisation was an assumption, based on time to progression, which was longer for dasatinib.
- NICE's clinical advisers felt that, in their experience, the duration of therapy was fairly similar for the two drugs

Source: Reed SD. *Value in Health* 2011; 14: 1055-6

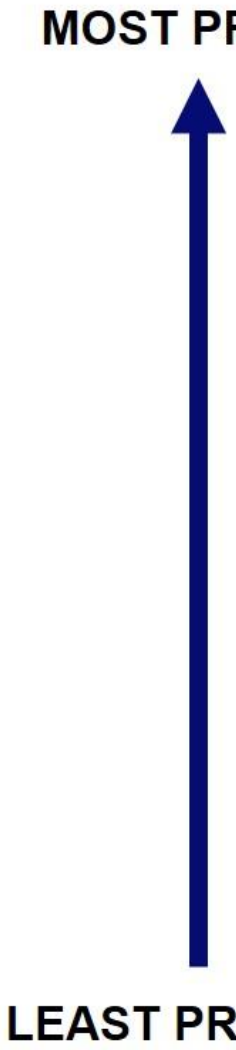
Categories of cost in economic evaluation



Important things to know about cost estimates

- Is it a cost or a charge?
- What elements does it include (e.g. capital costs)?
- Is it average or marginal?
- Is it relevant to the setting of my study?

General approaches to costing (e.g. hospital costs)



Micro-costing
Each component of resource use (e.g. laboratory tests, days of stay by ward, drugs) is estimated and a unit cost derived for each.

Case-mix group
Gives the cost for each category of 'case' or hospital patient. Takes account of length of stay. Precision depends on the level of detail in specifying the types of cases.

Disease-specific per diem (or daily cost)
Gives the average daily cost for treatments in each disease category. These may still be quite broad (e.g. orthopaedic surgery).

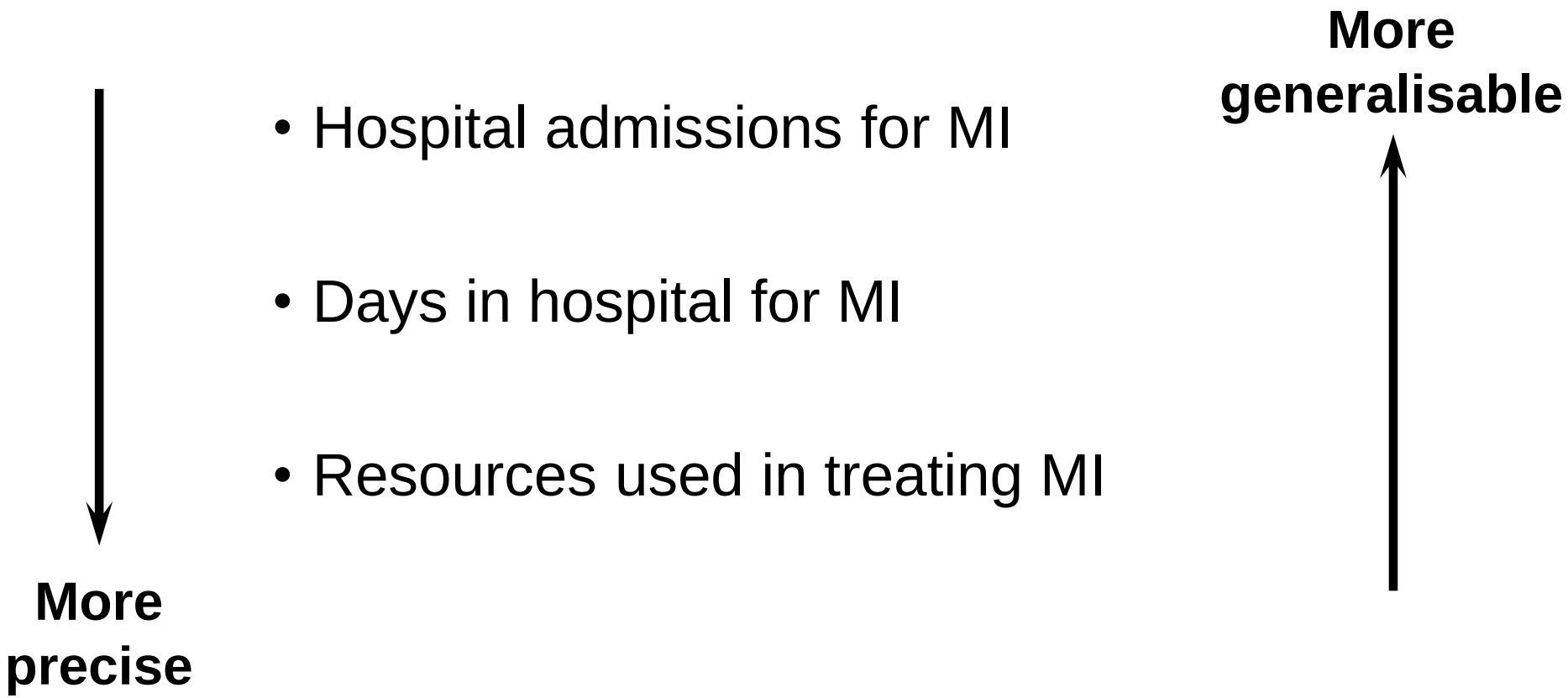
Average per diem (or daily cost)
Averages the per diem over all categories of patient. Available in most health care systems.

Source: Drummond *et al*, 2015

Typical sources of cost data

- Clinical trials with concurrent economic evaluation (e.g. resource use and/or billings)
- Free-standing study (e.g. database study, patient chart review)
- Existing literature
- Routinely available sources

Levels of detail in resource data capture alongside clinical trials



Examples of adjusting charges to costs

- Most experience is from the USA, where hospital bills (i.e. charges) are readily obtainable
- Nigrovic and Chiang. *Arch. Pediatric Adolesc. Med.* 2000; 154: 817-21:
  - costs calculated from charges using a standard cost-to-charge ratio of 0.65
- Zupancic *et al. Paediatrics* 2003; 111: 146-152:
  - itemised billing records converted to costs using Medicare cost-to-charge ratios

Does the method of adjustment matter?

- Taira *et al* (*Am. Heart. J.* 2003; 145: 452-8) compared four methods of estimating costs:
  (i) hospital charges
  (ii) hospital charges converted to costs by use of hospital-level cost-to-charge ratios
  (iii) hospital charges converted to costs by use of departmental cost-to-charge ratios
  (iv) itemised laboratory costs with nonprocedural hospital costs generated from departmental level cost-to-charge ratios

Treatment group level comparison of analytic methods for the Vegas II clinical trial

	Treatment				
	Urokinase (n = 169)		Angiojet (n = 163)		
Analytic model	**Mean**	**Median**	**Mean**	**Median**	**Difference in means**
Hospital charges	$80,753	$50,953	$59,442	$75,617	$21,311
Hospital level cost-to-charge ratios	$37,705	$24,954	$27,571	$35,074	$10,134
Department level cost-to-charge ratios	$19,154	$12,276	$13,950	$18,305	$5204
Itemised procedure costs and department cost-to-charge ratios	$22,529	$15,234	$17,075	$21,261	$5454

Adapted from Taira *et al* (2003)

Does the method of adjustment matter?

- In the study by Taira et al the method used to approximate costs did not affect the main results of the cost comparisons (eg Urokinase always more costly than Angiojet)
- Charges were approximately twice as high as hospital cost estimates
- The magnitude of the cost differences between groups varied considerably by method
- Department-level cost-to-charge ratios represent a reasonable compromise between accuracy and ease of implementation
- However, depending on the perspective of the study, we may be mostly interested in the amount actually paid or received

Cost, Context, and Decisions in Health Economics and Health Technology Assessment

- A really good conceptual paper on the nature of costs, why costs are always associated with a decision and why costs always vary according to the context of that decision
- Considers the distinctions between short and long run costs and between fixed and variable inputs
- Discusses why 'harms' and negative consequences are not, in general, costs and how the consideration of 'clinically unrelated' future costs and benefits depends on context

Culyer AJ. *Int. J of Tech Assess in Health Care* 2018; 34:1-8

Other issues

- Costing in specific contexts
- Learning curves
- Costing informal care

Costing in specific contexts

- For reimbursement submissions national, average, costs may be appropriate
- At the local level, decision-makers may be sceptical about costs (e.g. will the ‘savings’ from the use of a new drug really be achieved?)

Economic evaluation of Propofol/Fentanyl compared with Midazolam/Fentanyl on recovery in the ICU following cardiac surgery

- Propofol shortened times to extubation and discharge from the ICU
- Patient level data reanalysed in terms of nursing shifts
- Savings calculated based on reduction in nurse staffing requirements

Source: Sherry *et al. Anaesthesia* 1996; 51: 312-317

Sugammadex in the reversal of Neuromuscular Blockade (NMB)

- Immediate reversal of NMB can save time in the operating room or recovery room
- The value of the time saved depends greatly on:
  - where it is saved
  - whether the time saved can be put to alternative uses

    (e.g. in caring for other patients or improving workflow)

Source: Chambers *et al. Health Technology Assessment* 2010; 14: 1-211

Learning curves

- Important when studying the cost impact of newly introduced technologies
- Cost data gathered alongside clinical trials may require adjustments
- Examples include:
  - drug dosage and wastage
  - time for surgical techniques
  - monitoring for side effects
- Routinely available costs generally reflect the effects of ‘learning’
- Important issue in the evaluation of medical devices

Cost-effectiveness of spinal cord stimulation versus percutaneous myocardial laser revascularisation in patients with angina

- Outcomes in survival and quality of life for SCS improved over the time of the trial, 'which could be indicative of a learning curve effect'
- 'The ICER was estimated at £230,000 per QALY in 2000/1, whereas for 2002/3 is was £18,000'

Source: Dyer MT *et al. Trials* 2008; 9: 40-51

Costing informal care

- Most important in areas such as care of the elderly, mental illness and end-stage disease
- Very little guidance in the literature
- Estimates of the *quantities* of time should distinguish between actual tasks and general surveillance
- The *valuation* of time should depend on what time is being sacrificed (e.g. paid work, unpaid work, leisure time)
- It may also be relevant to consider the impact on caregivers' wellbeing or quality of life

Useful papers on costing informal care

- Weatherly *et al*: review a number of methods for estimating caregiver burden, in terms of the opportunity cost of time, loss of wellbeing and impact of quality of life

  In: A J Culyer (ed) *Elsevier Online Encyclopaedia of Health Economics* 2014
- Van den Berg *et al*: estimate the value by assessing the compensating valuation necessary to maintain the same level of well-being after providing informal care

  Health Economics 2007; 16: 1227-44
- Koopmanschap *et al*: review several methods, assessing which can be used alongside estimates of health effects in a CEA or CUA

  PharmacoEconomics 2008; 26: 269-80
- Themed issue on measuring family spillover effects of illness

  PharmacoEconomics 2019; 37(4)

Summary

- Costing is a neglected area of economic evaluation
- Whilst theoretical principles exist, the methods used are highly dependent on the data available
- The main estimation issues include adjusting charges to costs, learning curves and costing in context

Further reading

- Drummond MF et al. *Methods for the economic evaluation of health care programmes.* Oxford University Press, 2015, Chapter 7.
- Culyer, AJ Cost, Context, and Decisions in Health Economics and Health Technology Assessment. . *Int. J of Tech Assess in Health Care* 2018; 34:1-8