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Economics of palliative care

An introduction to some key concepts

Peter May, PhD
Research Fellow in Health Economics, Centre for Health Policy & Management, Trinity College Dublin, Ireland

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National Palliative Care Research Center, USA

Learning Objectives

- To provide a basic introduction to economic evaluation
  - What and why
- To review current economic literature on palliative care
  - What does the evidence say (what does it not)?
- To provide an overview of considerations in conducting an economic analysis of a palliative care programme:
  - Variables, statistical considerations, research gaps

Caveat

- This is a whistle-stop tour with some simplification and generalisation, more reading obviously needed

Overview

- Health economic evaluation
- Economic evidence on palliative care
- Practical considerations in conducting a study

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Economic evaluation

What is economic evaluation?

'Full' economic evaluation has two components:

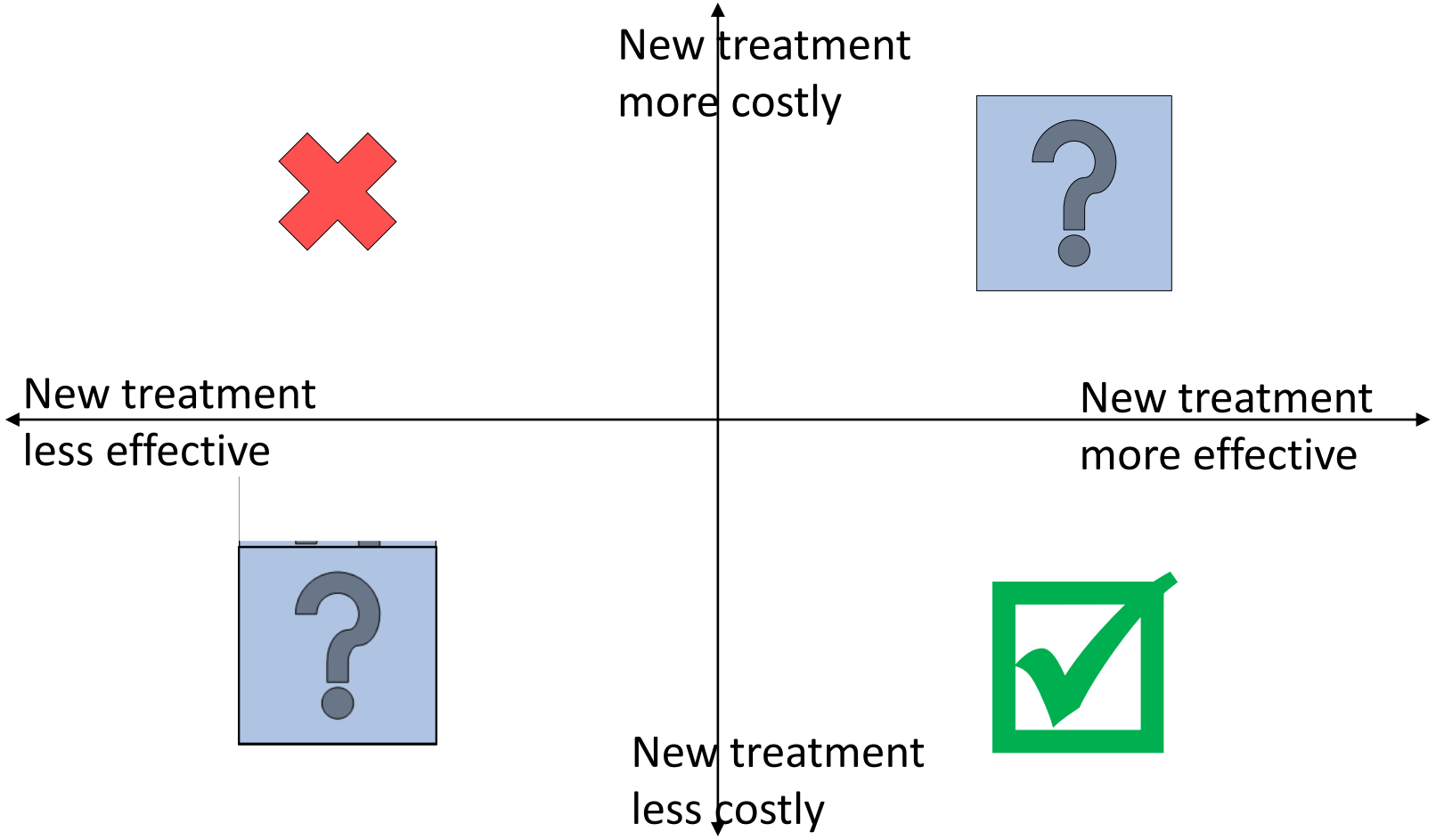
- Measuring treatment effect on costs
  - Formal costs: e.g. hospital, GP, nursing home, out-of-pocket pharma
  - Informal costs: care & help provided by friends, family
- Measuring treatment effect on outcomes
  - Patient outcomes: e.g. survival, HRQoL
  - Family outcomes: e.g. caregiver HRQoL

➢ 'Cost-consequence' analysis

- cost-effectiveness, cost-utility, cost-benefit, etc

Economic evaluation

Cost-consequence analysis



Economic evaluation

Why do we do economic evaluation?

- A tool for managing scarcity
  - Unrelated to overall budget or who pays - a fact of life
  - Cost of health-related demands > available resources
    - ➢ Decisions in allocation: what do we pay for?
    - ➢ Every decision has an "opportunity cost"

- A tool we each use every day
  - Each of us has finite budgets at work and at home
    - ➢ Decisions in allocation and "opportunity cost"

Everyday economic evaluation

Everyday economic evaluation

- Sky subscription was €78 per month…

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= (78 * 12) = €936 per year…

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= (936 * 18) = €16,848

Everyday economic evaluation

- Sky subscription was €78 per month…

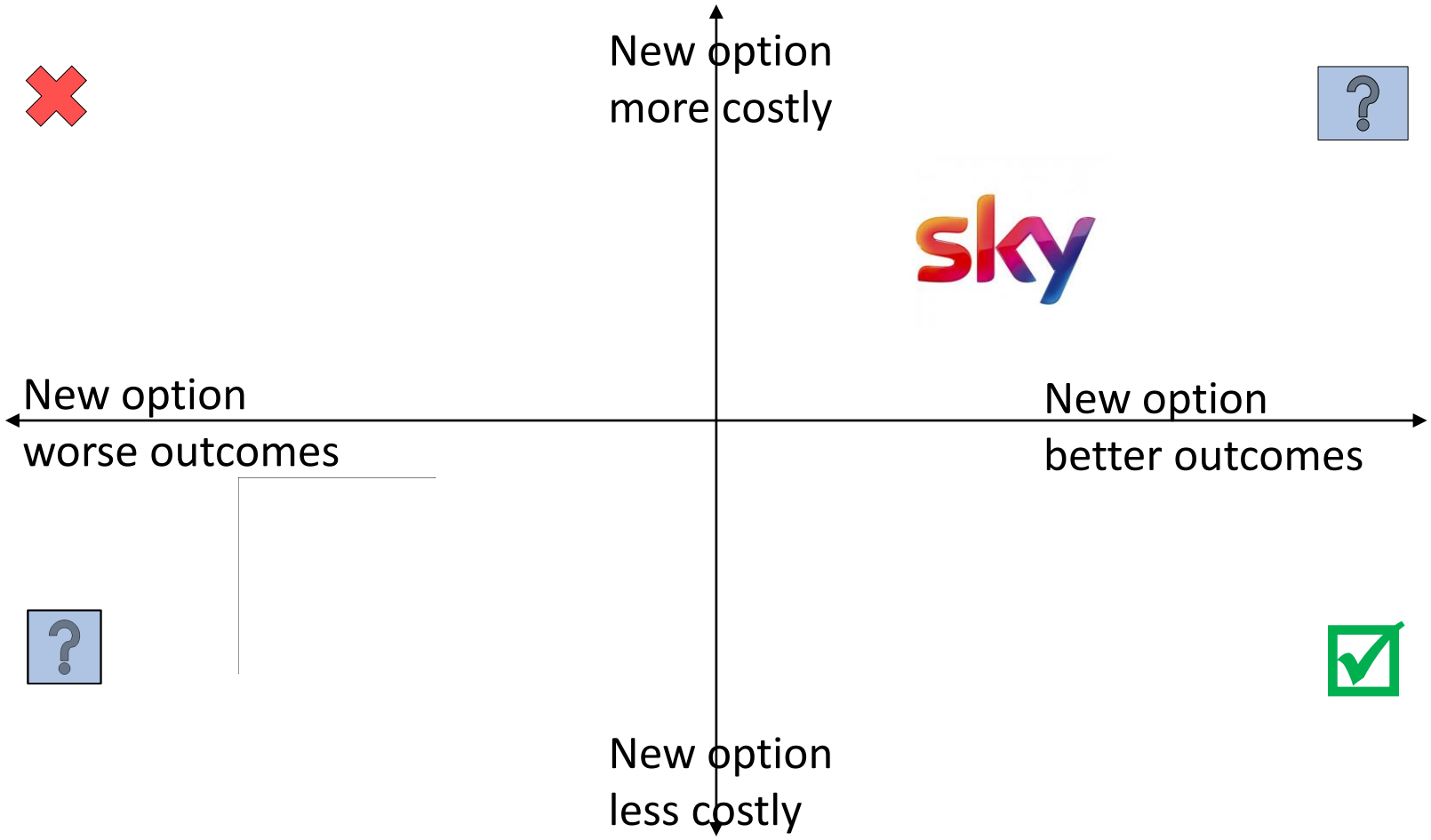
= (78 * 12) = €936 per year…

= (936 * 18) = €16,848

- We can choose to spend €16,848 on Sky over the course of our son's childhood
  - And if benefits>costs then it might be the right decision
  - **BUT** that decision has an opportunity cost - this money could instead go on a college fund, dental care, trumpet lessons…

Everyday economic evaluation

Cost-consequence analysis



Everyday economic evaluation

Cost-consequence analysis

New option
more costly

New option
worse outcomes

New option
better outcomes

New option
less costly

Everyday economic evaluation

Cost-consequence analysis

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Economic evaluation

Summary

- Economic evaluation is a comparison of different options for their effect on costs and on outcomes
- Our aim is to ensure best care for greatest number of people through wise allocation of resources, which will always be scarce and have alternate uses
- While some abstraction is inevitable in practice, the principles are familiar & intuitive
- Timeframe is key because unlike many outcome variables costs add up (€78 versus €16,848)

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Current evidence

Cost of care for serious illness

- 2001-2011: US healthcare spending doubled
- By 2040, projected to be 1/3 of all economic activity in the US
- Similar, less dramatic trends in other HICs and LMICs
- High costs driven those with long-term chronic conditions and functional limitations (Aldridge and Kelley, 2015, Davis et al., 2016)

  - Lowering costs for those with serious and complex medical illness is key to US health system sustainability

Current evidence

Four key systematic literature reviews

Review	Key findings
Smith et al. (2014)	• All settings, study designs; 46 papers • General pattern of cost-saving, heterogeneity of everything
Langton et al. (2014)	• Count-back studies of administrative data; 78 (!) papers • Lower costs for PC, increasing use of 'decedent cohort' design
Gomes et al. (2013)	• High quality studies of homecare; 6 economics papers • ~15-30% cost-saving
May et al. (2014)	• Prospective studies of hospital inpatient PCC; 10 papers • ~15-20% cost-saving (update coming soon)

Current evidence

- Together these reviews establish two points of consensus:
  1. Palliative care is associated with lower health care/system costs
  2. Knowledge gaps re:
     - Everything! Few meta-analyses (so far)
     - But in particular **limited scope of enquiry**:
       i. Analytic framework
       ii. Timeframe
       iii. Perspective

Current evidence

Limitation (i): Analytic framework

Two components to economic evaluation:

- Measuring treatment effect on costs
- Measuring treatment effect on outcomes

Current evidence

Limitation (i): Analytic framework

Two components to economic evaluation:

- **Measuring treatment effect on costs**
- ~~Measuring treatment effect on outcomes~~

In PC studies, ‘consequence’ part typically fudged through ‘non-inferiority’ assumption

Current evidence

Limitation (i): Analytic framework

Two components to economic evaluation:

- **Measuring treatment effect on costs**
- ~~Measuring treatment effect on outcomes~~

In PC studies, 'consequence' part typically fudged through 'non-inferiority' assumption

- i.e. that outcomes for intervention group patients are at least no worse than those for comparison group patients
  - ➢ Cost analysis (or cost-minimisation analysis)

Current evidence

Limitation (ii): Timeframe

- Most evidence is from one of two phases of care:
  - Inpatient hospital stays
  - End of life (decedent count-back studies)

- Both associated with intensive treatment
  - Not representative of full trajectory of serious illness
  - Observational designs (so concerns re: matching)
  - EOL data a concern (Bach et al., 2004; Earle & Ayanian, 2006)

Current evidence

Limitation (ii): Timeframe

- In Temel et al. (2010), Greer et al. (2016) PC patients had
  - Lower hospital utilisation
  - Lower costs in last 30 days
  - …. yet higher mean costs overall?!
    - ➢ Survival effects eclipse lower intensity of care

- **<u>Because costs add up, timeframe will dictate results</u>**

Current evidence

Limitation (iii): Perspective

- Whose costs?
  - Hospital studies focus on hospital costs
  - Charges studies focus on payer (e.g. Medicare) costs
  - Out-of-pocket and informal costs comparatively ignored

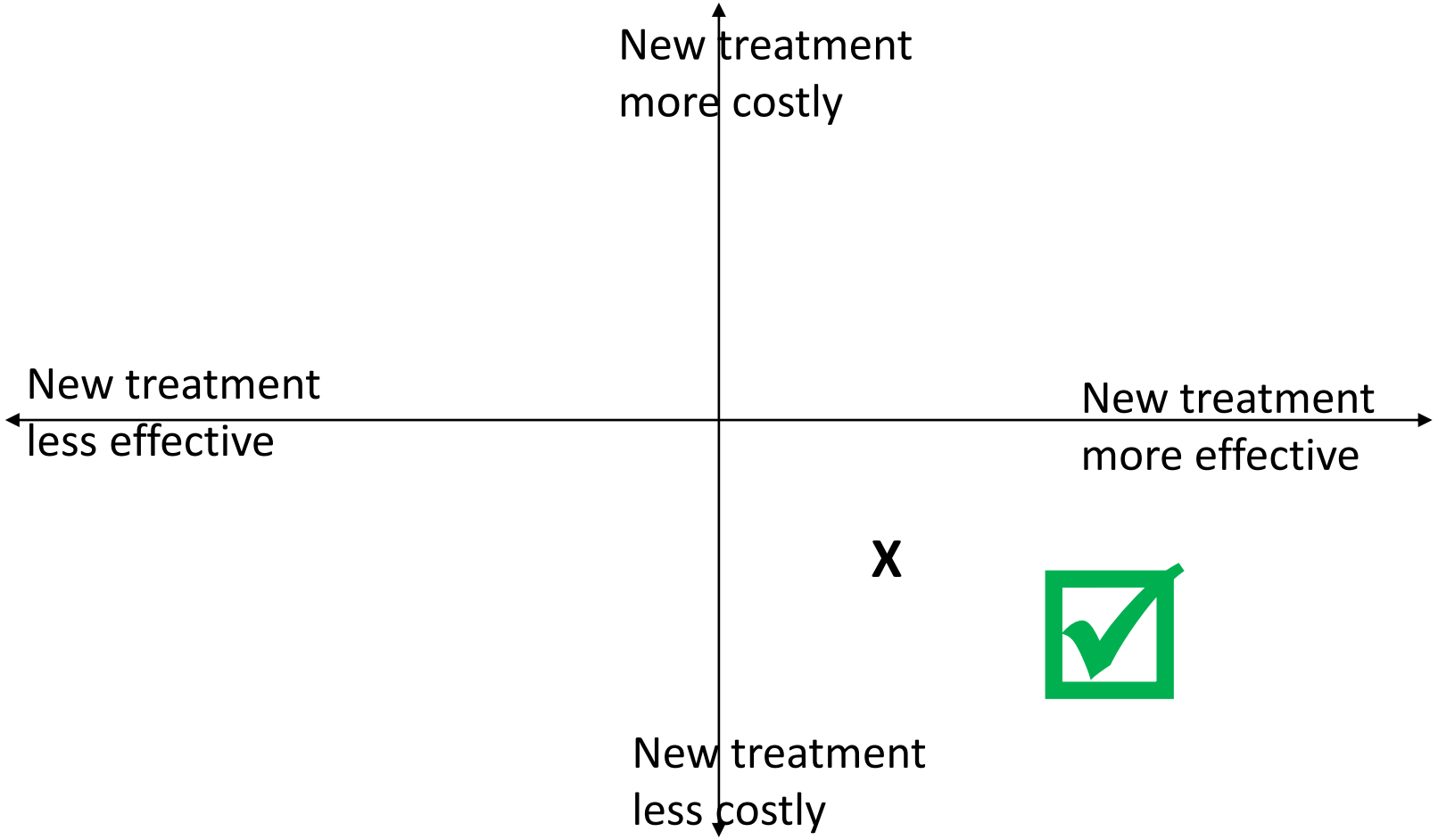
    ➢ Risk that observed cost-savings are passed on to other parts of the system or to patients and families

Summary

- Evidence on **cost** of care for medical complexity is unarguable: costs are high and going higher (particularly in the US)
- Evidence on **PC effect** on these costs sometimes reported as unarguable ("PC saves money") but reality more complicated
- Studies to date have limitations that may lead to overestimation
- Limitations not arbitrary; reflect routine data collection
- Critical for long-term development of policy and services that limits are addressed through expanded scope

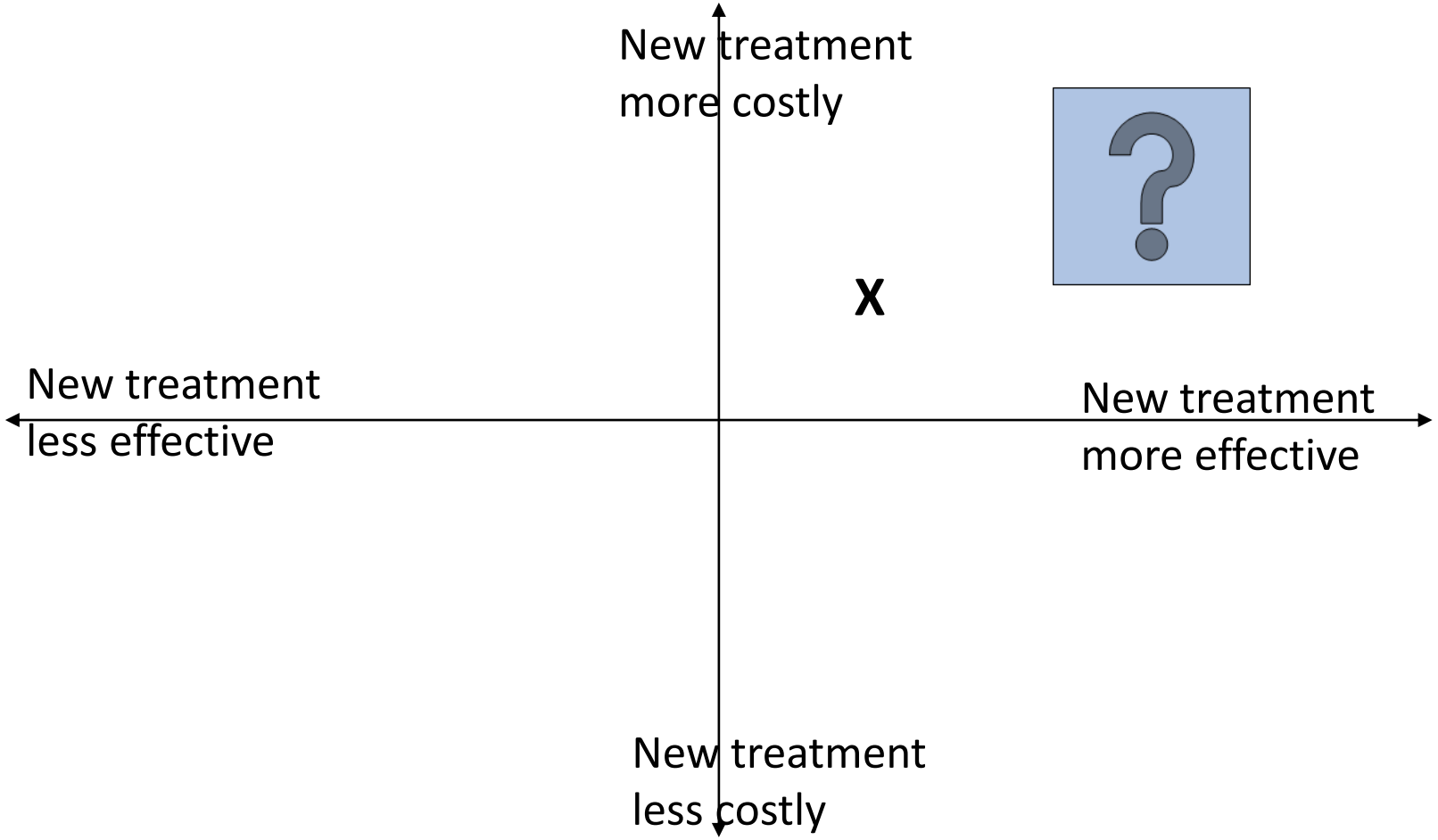
Summary

One interpretation of current literature



Summary

An alternative we should be ready for



Overview

- Health economic evaluation
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- Practical considerations in conducting a study
  - Defining a research question
  - Statistical model

Defining a research question

What, when, for whom?

- An economic research question will compare the costs (and consequences) of two options
- Most in the literature are broad, e.g.
    - What is the effect of palliative care on costs compared to usual care for adults with serious illness?
- Recent evidence recommends more detailed questions:
    - Intervention
    - Outcome
    - Target population

Defining a research question

Advice

- Consider intervention **timing**:
  - Earlier intervention more effective for hospital admissions (May & Normand, 2016) and LYOL (Scibetta et al., 2016)
- Consider outcome **perspective**:
  - PC reduces hospital costs (but CMS costs? Family costs?)
- In both cases, widest view is the best (and the hardest to achieve)

Defining a research question

Advice

- Consider target **population**:
  - What is the effect of palliative care on costs compared to usual care **for adults with serious illness**?
- Early studies assume treatment effect homogeneity but evidence of great heterogeneity (May et al., 2018):
  - PCC cost-effects larger for cancer & for more comorbidities

➢ Research populations who are particularly complex and/or understudied (e.g. dementia, multimorbidity)

Statistical model

Awkwardness of healthcare utilization data

Distributions typically pose problems for statistical analysis:

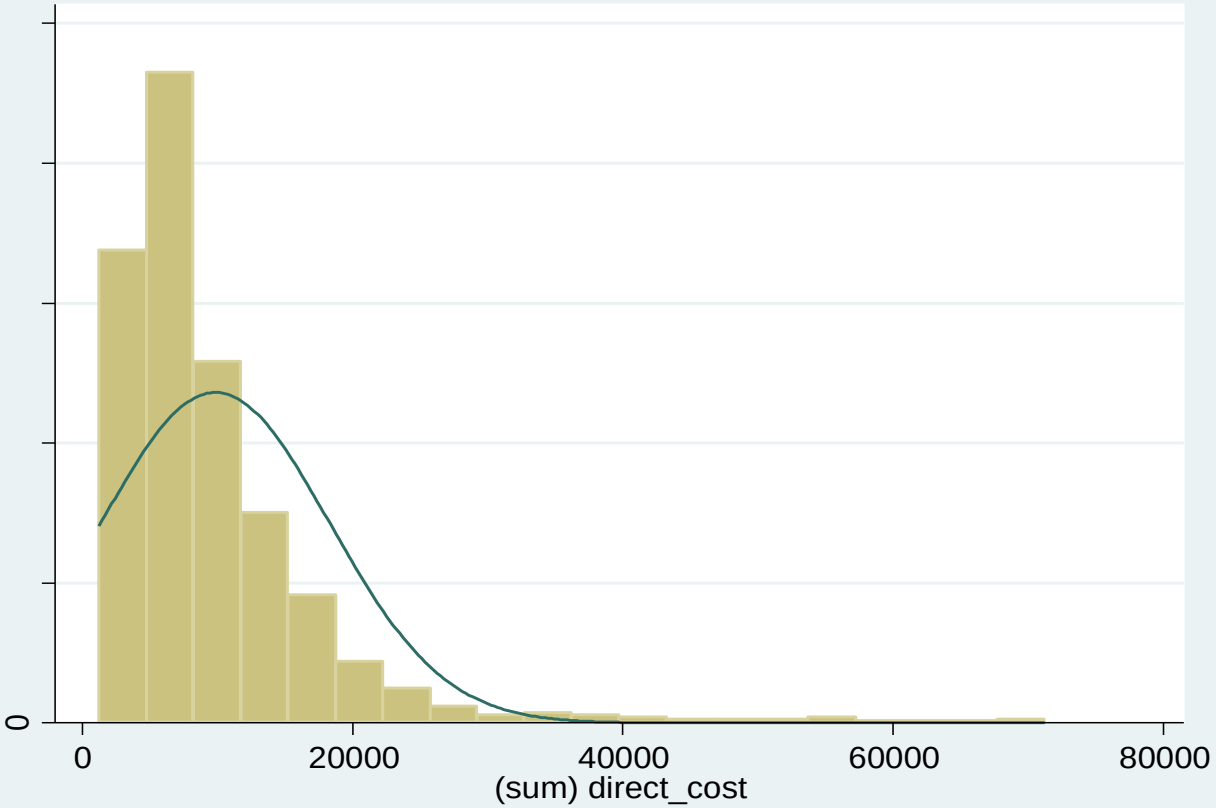
- **Non-negativity:** by definition never less than zero
- **Mass of zero-value observations:** in data drawn from populations, a large number of cost data-points will be zero
- **Positive skew:** a minority of patients incur a disproportionately high level of costs, skewing the distribution right
- **Heteroscedasticity:** variability of costs is unequal across a range of values for important predictors
- **Leptokurtosis:** clustering of cost observations for a large number of patients with similar care trajectories may result in high 'peaked-ness' of distribution

➢ **<u>Linear regression (OLS) is seldom appropriate</u>**

Statistical model

Awkwardness of healthcare utilization data

Total direct cost of hospital admission



Skewness: 3.2

(0 for normal distribution)

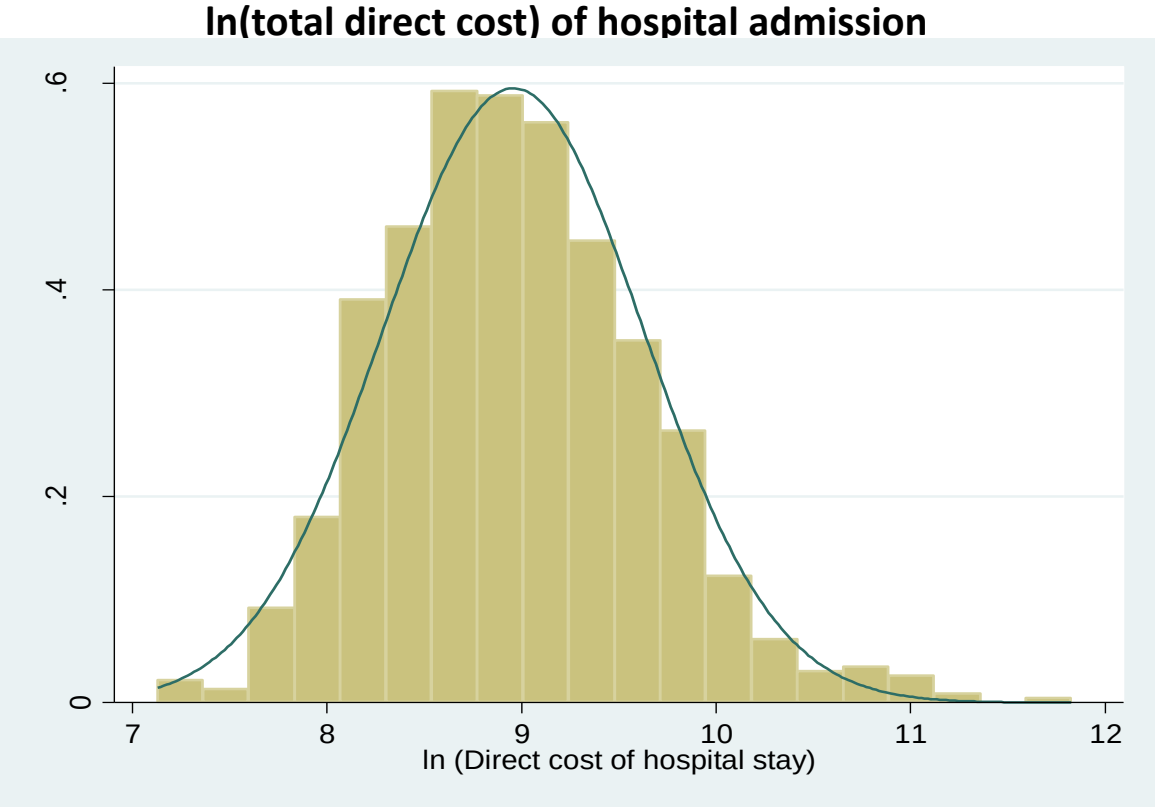
Kurtosis: 17.7

(3 for normal distribution)

Statistical model

Awkwardness of healthcare utilization data

The ‘old’ way to address this was log-transformation, which generally mitigates skew, heteroscedasticity & leptokurtosis



Skewness: 0.4

(0 for normal distribution)

Kurtosis: 3.4

(3 for normal distribution)

Statistical model

Awkwardness of healthcare utilization data

However, beware the 'retransformation problem':

"Although [log-transformed] estimates may be more precise and robust [than estimates using highly skewed distributions of untransformed costs], no one is interested in log model results on the log scale per se*.*

"Congress does not appropriate log dollars. First Bank will not cash a check for log dollars. Instead, the log scale results must be retransformed to the original scale so that one can comment on the average or total response to a covariate x*.*

"There is a very real danger that the log scale results may provide a very misleading, incomplete, and biased estimate of the impact of covariates on the untransformed scale, which is usually the scale of ultimate interest." - Manning (1998)

Statistical model

Awkwardness of healthcare utilization data

Consider instead non-linear alternatives to OLS:

Generalized linear model

Family	Link
Gaussian	Identity
Poisson	Log
Gamma	Power
Inverse Gaussian	

Statistical model

Awkwardness of healthcare utilization data

Consider instead non-linear alternatives to OLS:

Generalized linear model

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Statistical model

Awkwardness of healthcare utilization data

Consider instead non-linear alternatives to OLS:

Generalized linear model

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Exponential conditional mean models

Generalized gamma models

Extended estimation equations

Finite mixture models

Statistical model

Awkwardness of healthcare utilization data

Stata programs available online to evaluate model performance:

- For GLMs only, Stata *glmdiag.do* from UPenn (http://www.uphs.upenn.edu/dgimhsr/stat-cstanal.htm)
- For all models, Stata *AHE_2ed_Ch_3&12.do* from University of York (http://www.york.ac.uk/economics/postgrad/herc/hedg/software/)

- These test the appropriateness of specific models to a given distribution
- No model is dominant
  - Evaluating models prior to analysis is essential to maximize accuracy of estimated effects

Statistical model

Advice

- Consider and describe data carefully prior to analysis
- Avoid use of OLS, OLS ln(y) and ANOVA with healthcare utilization data
- Consider nonlinear alternatives
  - Use available software to understand and evaluate options
  - Report briefly this process in Methods

Further reading:

- ***The York .do file accompanies a book: Jones et al. (2013a)***
- ***For an overview of why model choice matters, see Jones (2010)***
- ***For more technical analyses, see Jones et al. (2013b); Garrido et al. (2012)***
- ***Not my true expertise but I am happy to help if I can (peter.may@tcd.ie)***

Additional considerations

Advice

- Do not remove outliers, e.g. define your sample by length of stay, match by length of stay, or use length of stay as a regression variable (May et al., 2016)
- If your cost data come from more than one year adjust for inflation using Consumer Price Index
- If your cost data come from more than one state adjust for cost of living using Medicare Wage Index

Summary

- Economics of palliative care studies require consideration re:
  - Intervention timing
  - Cost perspective
  - Target population
    - Status quo reflects where data are routinely collected
    - Priority is expanding scope, i.e. well-funded 1ary research or better linking existing data (Maetens et al., 2016)
- Awkward data preclude use of ordinary regression

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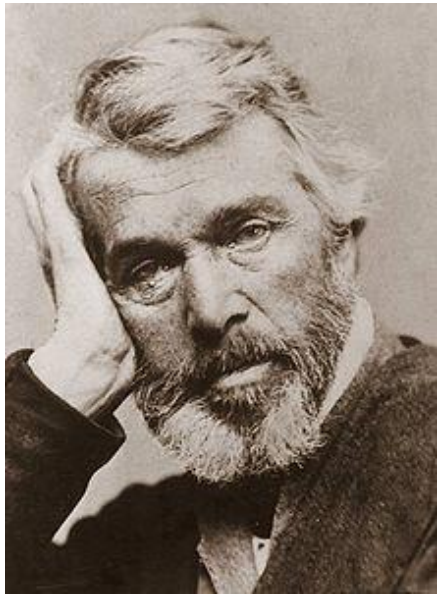
Final thoughts



Thomas Carlyle (1795-1881) called economics ‘the dismal science’

Economists might argue that it is **reality** that is dismal

Rationing inevitable in all health systems; economics merely a decision tool to navigate hard (often unpalatable) choices

Projections of health status and costs make it critical to both improve outcomes and control cost of care to seriously-ill people

- An opportunity to make a difference!

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Thank You

E: peter.may@tcd.ie

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