‘Addiction to technology adoption’: Using economic evaluation to support a broader search for efficiency in the management of health technology

Graham Scotland, PhD
Stirling Bryan, PhD
At a time of intense pressure on health care budgets, the technology management challenge is for disinvestment in low-value technologies and reinvestment in higher value alternatives. The aim of this article is to explore ways in which health economists might begin to redress the observed imbalance between the evaluation of new and existing in-use technologies. The argument is not against evaluating new technologies but in favor of the “search for efficiency,” where the ultimate objective is to identify reallocations that improve population health in the face of resource scarcity. We explore why in-use technologies may be of low value and consider how economic evaluation analysis might embrace a broader efficiency lens, first through “technology management” (a process of analysis and evidence-informed decision making throughout a technology’s life cycle) and progressing through “pathway management” (the search for efficiency gains across entire clinical care pathways). A number of model-based examples are used to illustrate the approaches. Key words: health economics methods; decision analysis; economic evaluation; cost-effectiveness analysis. (Med Decis Making XXXX;XX:xx–xx)
Premise

“Practitioners of economic evaluation have largely focused narrowly on new technologies, with less emphasis on broader efficiency questions relating to technologies already in widespread use.”

“This ‘adoption addiction’ has contributed to the unabated rise in health care expenditures over recent years in all developed countries.”

Scotland & Bryan (2016) Medical Decision Making
Economic evaluation for adoption decision making

• What is differences in expected costs and effects with new technology (B) versus current practice (A)

• Incremental cost-effectiveness ratio (ICER)

  \[ \text{ICER} = \frac{(\text{Cost}_B - \text{Cost}_A)}{(\text{Effect}_B - \text{Effect}_A)} = \text{ICER} \]

• Additional cost per addition unit of effect gained (B versus A)
### Incremental cost-effectiveness ratio

\[
\frac{(\text{Cost}_B - \text{Cost}_A)}{(\text{Effect}_B - \text{Effect}_A)}
\]

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean cost with new technology (B)</td>
<td>£10,000</td>
</tr>
<tr>
<td>Mean cost with current practice (A)</td>
<td>£6,000</td>
</tr>
<tr>
<td>Incremental cost</td>
<td>+£4,000</td>
</tr>
<tr>
<td>Mean QALYs with new technology (B)</td>
<td>3.8</td>
</tr>
<tr>
<td>Mean QALYs with current practice (A)</td>
<td>3.6</td>
</tr>
<tr>
<td>Incremental effect (QALYs)</td>
<td>+0.2</td>
</tr>
<tr>
<td>ICER</td>
<td>£20,000 per QALY gained</td>
</tr>
</tbody>
</table>
Incremental cost-effectiveness plane

- New treatment more costly
- New treatment less costly
- New treatment more effective
- New treatment less effective

Ceiling ratio; e.g. £20-£30,000 per QALY gained

QALY gained
Technology and cost growth

• Technological change
  – Large contributor to cost growth
  – Efforts to address cost growth cannot ignore ‘technology’

• UK has long Health Technology Assessment (HTA) traditions

• But... the HTA ‘industry’ has...
  – become obsessed by technology adoption questions
  – largely ignored technology management issues

• Need to scrutinise in-use as well as new
Why would we have low value in-use technologies?

- Adoption before rigorous standards of evidence and value
- Indication creep (overuse?)
- Unexpected poor technology performance
- Emergence of other new technologies
- Changing demographics / risk profiles of clinical populations
Addressing overdiagnosis and overtreatment in cancer: a prescription for change

Laura J Esserman, Ian M Thompson, Brian Reid, Peter Nelson, David F Ransohoff, H Gilbert Welch, Shelley Hwang, Donald A Berry, Kenneth W Kirzler, William C Black, Mina Bissell, Howard Parnes, Sudhie Srivastava

Imaging overutilisation: Is enough being done globally?

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Department of Radiology, University of Cincinnati

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Is there overutilisation of cataract surgery in England?

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See Editorial, p 1

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2 Clinical Effectiveness Unit

Abstract

Objectives: Following a 3.7-fold increase in the rate of cataract surgery in the UK between 1989 and 2004, concern has been raised as to whether this has been accompanied by an excessive decline in the threshold privately funded surgery. During the 1990s, the increase was due to the advent of day surgery, the introduction of phacoemulsification and the shift from general to local anaesthesia. Despite the rate having increased 2.5-fold in England by 2000.

From Efficacy to Effectiveness in the Face of Uncertainty

Indication Creep and Prevention Creep

Benjamin Djulbegovic, MD, PhD

Ash Paul, MBBS, MPP, FFPH(UK)

of the most important sources of clinical use of inductive inferences (such as rely framework) can help reduce some unc
REALISTIC MEDICINE
CAN WE:

- Change our style to shared decision-making?
- Build a personalised approach to care?
- Reduce harm and waste?
- Reduce unnecessary variation in practice and outcomes?
- Manage risk better?
- Become improvers and innovators?

Opportunity to:

1. Use decision modelling to identify low value (potential improvements) in the delivery of in-use technologies

2. Take a broader frame to assess the value of care pathways as a whole, and identify efficient reconfigurations of pathways
Re-focusing on in-use technologies

1. Does the technology, as currently used, deliver value?
   - Yes: Ensure targeting patients in whom use represents value
   - No: Can more cost-effective utilisation of the technology be achieved?
      - Yes: Changes to clinical protocols
      - No: Technology withdrawal
Example

Modelling the cost-effectiveness of adopting risk stratified screening intervals within the national diabetic retinopathy screening programme in Scotland

Graham Scotland (University of Aberdeen); Paul McKeigue (University of Edinburgh); Sam Philip (NHS Grampian); Helen Looker; Helen Colhoun (University of Dundee); Graham Leese (NHS Tayside); John Olson (NHS Grampian).

Background

- Diabetic retinopathy / maculopathy – a leading cause of visual loss and blindness
  - proliferative retinopathy
  - macular oedema
- Early signs can be identified on retinal photographs
- Early identification and treatment can reduce the risk of visual loss
The Scottish diabetic retinopathy screening programme

- Established in 2006, annual screening using digital retinal photography
- In 2014/2015*
  - 298,101 people over 12 living with diabetes in Scotland
  - Eligible screening population: 255,928
  - Number screened 201,299
  - 3.5% of patients referable in one annual round of screening
- Prevalence of diabetes growing by 4% annually

Aim

Model the clinical and cost-effectiveness of adopting extended intervals for groups of patients defined by selected clinical and demographic variables routinely available to screening programmes.
Extended screening intervals for diabetic retinopathy

Screening cohort
Non-referable participants (age, sex, type of diabetes, duration of diabetes, current / previous grade)

Risk of visual loss
Progression risks by current/prior grade (Type 2 diabetes)

<table>
<thead>
<tr>
<th>Current / prior grade</th>
<th>Percentage of screening cohort</th>
<th>Risk of developing referable disease within one year*</th>
</tr>
</thead>
<tbody>
<tr>
<td>No DR</td>
<td>69%</td>
<td>0.14-0.38%</td>
</tr>
<tr>
<td>No DR / -</td>
<td>15%</td>
<td>0.14-0.38%</td>
</tr>
<tr>
<td>No DR / No DR</td>
<td>47%</td>
<td>0.07-0.24%</td>
</tr>
<tr>
<td>No DR / Mild DR</td>
<td>6.4%</td>
<td>0.32-1.84%</td>
</tr>
<tr>
<td>No DR / Obs DR</td>
<td>0.1%</td>
<td>0.5-3.8%</td>
</tr>
</tbody>
</table>

Annual versus biennial screening by current / prior screened grade

Current practice:
- Annual for all
- Biennial if no DR and no history of DR; otherwise
- No DR, biennial screen; otherwise annual
- ICER >£200,000 per QALY
Summary of findings

• Individuals with a no retinopathy on two consecutive screening episodes (~50% of the cohort) face a very low risk of developing referable disease within one year (<0.5%)
• Can safely extend the screening interval in these patients to two years
• Economic cost savings could equate to ~£16 million over the life time of the current Scottish screening cohort
Technology adoption

Technology management

Pathway management
Broader frame for economic evaluation?

• Conventional CEA is piecewise
  – e.g., the cost-effectiveness of drug A for first line treatment of patients with disease X

• Criticism of this approach
  – May not promote higher levels of allocative efficiency

• Broader approaches
  – Simultaneous consideration of investments and disinvestments
  – Analysis of technologies at different points in a clinical pathway

References
Example: Prostate cancer pathway considerations

• Pathway considerations explore both adoption and management questions

• Adoption question:
  – Should an enhanced MRI sequence (T2, contrast-enhanced...) be used to direct biopsies?

• Technology management question:
  – Should we be making more use of active surveillance for low-risk cancer?
Simplified model schematic

Mowatt et al. Health Technol Assess. 2013 May;17(20)
Benefits of diagnosis and referral

• Men with low-risk disease may not require immediate radical treatment\(^1\)
  – Same survival benefit can be achieved in with active surveillance
  – Similar or improved quality of life through avoidance of unpleasant side effects
• Observational data: ~50% of low risk group receive radical therapy
• Scope to reduce overtreatment through shared decision making?

Pathway changes

1. Adoption of an enhanced MRI sequence (T2, diffusion weighted) to direct biopsies
2. Increased use of active surveillance for low-risk cancer
3. Combination of 1 and 2 above
Cost-effectiveness plane

ICER = £14,412

1. Systematic TRUS
2. Enhanced-MRI
3. Systematic TRUS + increased AS
4. Enhanced-MRI + increased AS

ICER = £14,150

Cost

QALYs
Challenges and future directions

- Pathway reconfirmation modelling feasible
- Limited breadth and depth
  - More detail = greater flexibility for examining pathway reconfigurations
- Whole disease/pathway reference models?¹
  - More comprehensive way to operationalise pathway management / reallocation decisions
  - Long term goal of iterative model development?

¹. Tappenden P et al., Value in Health 2012, 15(8): 1127-36
Pathway management and ‘resource stewardship’

• ‘Resource stewardship’
  – A culture where resource scarcity is openly acknowledged and recognized as a shared responsibility

• Pathway model development should be a collaborative effort
  – Active engagement of, and ownership by, key stakeholders, including clinical leaders, policy makers, patients and analysts

• Guide investment and disinvestment decisions within clinical areas
Stewardship facilitated through pathway modelling

- Clinical leaders and care teams
- HTA analysts
- Policy makers and managers
- Agreed pathway model
- Patients and carers
- Industry
In conclusion

• We encourage the health economics/HTA community to:
  
  – Adopt the role of efficiency searchers rather than technology evaluators
  – Use modelling to help identify/highlight inefficiencies in current care pathways
  – Adopt a broader analytic perspective to inform the efficient reconfiguration of clinical pathways

• This broadening the analytic scope offers the possibility of fundamentally changing the nature of the contribution health economists and their HTA colleagues can make