Cost-equality analysis of health care programmes – a methodological case study of the UK Bowel Cancer Screening Programme

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Discussant: Christopher Sampson
• Outline
• Clarifications
• Discussion points
Outline: Background

• Equality matters
  – Health inequality
  – Fairness

• Bowel Cancer Screening
  – Effective intervention
  – Inequality in uptake
    • Sex(F↑), age(↑), ethnic diversity (↓), deprivation(↓)
Outline: Cost-effectiveness analysis

- Model-based approach
  - Pre-existing model
- 3 strategies:
  - Standard screening
  - Screening + targeted reminder
    - Most deprived 40%
    - Highest proportion of Indian subcontinent
  - Screening + universal reminder
Outline: Cost-effectiveness analysis

• Table 1 (edited)

<table>
<thead>
<tr>
<th>Results based on a lifetime model for a cohort comprising of one million 30 year olds(^a)</th>
<th>Incremental Bowel Cancer Related Cost (£) compared to no screening (^b)</th>
<th>Incremental QALYs compared to no screening</th>
<th>Cost per QALY gained (£/QALY) compared to no screening</th>
<th>Incremental NHB @£20k per QALY (QALYs) compared to no screening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>population per person</td>
<td>population per person</td>
<td>population per person</td>
<td>population per person</td>
</tr>
<tr>
<td>1. Standard screening</td>
<td>44,013,836 (44)</td>
<td>50,324 (0.0503)</td>
<td>875</td>
<td>48,123 (0.0481)</td>
</tr>
<tr>
<td>2. Screening + targeted reminder</td>
<td>75,604,844 (76)</td>
<td>54,566 (0.0546)</td>
<td>1,386</td>
<td>50,785 (0.0508)</td>
</tr>
<tr>
<td>3. Screening + universal reminder</td>
<td>75,886,777 (76)</td>
<td>54,919 (0.0549)</td>
<td>1,382</td>
<td>51,124 (0.0511)</td>
</tr>
</tbody>
</table>
Outline: Cost-equality analysis

- Firstly assumes all variation in health unfair
- Estimate distribution of health in population
- Estimate distribution of uptake for each intervention
- Estimate effect of interventions on distribution of health
Outline: Cost-equality analysis

Figure 1: Baseline health distribution

<table>
<thead>
<tr>
<th>Health Quintile</th>
<th>Average Quality Adjusted Life Expectancy at Birth (QALYs)</th>
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<tbody>
<tr>
<td>1</td>
<td>62.37</td>
</tr>
<tr>
<td>2</td>
<td>67.88</td>
</tr>
<tr>
<td>3</td>
<td>69.44</td>
</tr>
<tr>
<td>4</td>
<td>71.25</td>
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<tr>
<td>5</td>
<td>73.01</td>
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Outline: Cost-equality analysis

Figure 2: gFOBT uptake distribution

- Standard
- Targeted
- Universal
Outline: Cost-equality analysis

Figure 3: Health compared to no screening (per million of population invited for screened)

- standard
- targeted
- universal

Figure 4: Health compared to standard screening (per million of population invited for screening)
Outline: Cost-equality analysis

• Inequality indices used to highlight preferred options in terms of equality
  – Screening + targeted reminder is the preferred option
  – Screening + universal reminder is least preferred option
Outline: Cost-equality analysis

- Also uses social welfare indices
  - Maximum health and inequality aversion
    - Measured by level of equal health necessary for indifference with inequality
  - Screening alone always least preferred

<table>
<thead>
<tr>
<th>Social Welfare Indices</th>
<th>standard gFOBT</th>
<th>gFOBT + targeted</th>
<th>gFOBT + universal</th>
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</thead>
<tbody>
<tr>
<td>Mean Health</td>
<td>68.83853</td>
<td>68.84119</td>
<td>68.84153</td>
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<tr>
<td>Atkinson EDE (ε = 1)</td>
<td>68.72511</td>
<td>68.72787</td>
<td>68.72806</td>
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<tr>
<td>Atkinson EDE (ε = 5)</td>
<td>68.22774</td>
<td>68.23091</td>
<td>68.23047</td>
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<tr>
<td>Kolm EDE (α = 0.025)</td>
<td>68.64509</td>
<td>68.6479</td>
<td>68.64799</td>
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<tr>
<td>Kolm EDE (α = 0.125)</td>
<td>67.76671</td>
<td>67.77018</td>
<td>67.76918</td>
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</table>
Outline: Cost-equality analysis

- Secondly, allows for some variation in health to be deemed fair
  - In terms of IMD, ethnic diversity, sex

<table>
<thead>
<tr>
<th>IMD</th>
<th>Ethnic Diversity</th>
<th>Sex</th>
<th>Atkinson EDE (ε= 1 )</th>
<th>Atkinson EDE (ε= 5 )</th>
<th>Kolm EDE (α= 0.025)</th>
<th>Kolm EDE (α= 0.125)</th>
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Outline: Discussion

• Screening increases inequality

• Results suggest BCSP should be augmented with reminder
  – Targeted if inequality aversion high
  – Universal if inequality aversion low

• Limitations
  – Assuming CRC incidence constant across groups
Clarifications

• What are ‘population health interventions’?
• Could not find source of 12% increase in uptake for targeted group
• Why one million 30 year olds?
• Data to derive distribution of health appear to be from general population
  – Those eligible for BCSP are not general population
Clarifications

• Figures (3,4,7,8) show incremental QALYs (compared with no screening).
  – Does not seem to take into account cost of intervention
  – Incremental net health benefit?
  – Negative incremental QALYs (fig 8) doesn’t seem to make sense
Discussion points

• Framework lacks clarity
  – Not clear how social welfare indices are estimated
  – Better explanation needed
    • Formulas if necessary

• How does this framework account for uncertainty?
  – Especially important for this analysis where health benefits are tiny
Discussion points

• Incremental cost/benefit
  – Paper inconsistent, sometimes comparing with no screening, sometimes with standard screening.
  – Actually compares 4 interventions, not 3
Discussion points

• ‘Cost-equality analysis’ misleading
  – Implies trade-off between expenditure and equality, not efficiency and equality

• Equality or Equity?
  – Accounting for ‘fairness’ suggests cost-equity analysis
Discussion points

• Incremental equality
  – Are we interested in equality of benefit or equality of outcome?
    • Does incremental equality matter?

• Equality of what?
  – Are we actually interested in equality of QALYs/QALE?
    • Whether incremental gain or absolute level
  – Or equality of attendance?
  – Or equality of positive screen rate?
Discussion points

• Combination of character-specific and population data
  – Would unbiased results require separate cost and effectiveness information for subgroups
    • Sex/age/IMD/etc
Discussion points

• Different uptake rates may be a good thing
  – Characteristics of treatment may vary by age/sex/IMD
    • Effectiveness of treatment
    • Capacity to benefit
    • Disutility of screening
      – Model does not seem to account for this

• Can’t assume marginal benefit of additional attendees is constant
  – There’s a reason they don’t attend!
Discussion points

• Must this methodology be limited to ‘population health interventions’
  – If we know the characteristics of the treatment group, can apply to any intervention?