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Methods for Evaluating Medical Tests and Biomarkers (MEMTAB) Symposium 2016, Birmingham
Introduction

- Motivated by work in US by Black and Welch.
- Increased incidence of cancer attributed to overdiagnosis
- Replicate their method with British data and examine the impact of modern diagnostic practice.
Definitions

• Conventional
  • Detection of cancer by screening that otherwise would go undetected.

• Wider definition:
  • Detection of disease that would not cause symptoms or death within a patient's lifetime
Objectives

• Examine the twenty most common cancers in the UK and assess the risk of overdiagnosis over the last thirty years

• Quantify
  • Excess incidence
  • number of deaths avoided
  • Ratio of excess incidence / deaths avoided
  ) for cancers most likely to be overdiagnosed
Incremental increase in detection of disease

= 

Incremental improvement in disease-specific outcomes.
Method 1

• Downloaded incidence, mortality and 5 year survival statistics from CRUK.

• Calculated for men and women separately
  • % change between 1980-2012
  • Average annual percentage change (AAPC)
  • Ratio of incidence AAPC to mortality AAPC (IMR)

• Potential for overdiagnosis if IMR > 1.5
Example: Liver cancer (men)
IMR = 1.3 (1.2 to 1.4)
Results
Kidney cancer (males)

IMR = 3.6 (3.1 to 4.5)
Melanoma (women)

IMR = 5.9 (4.3 to 9.3)
Non-Hodgkin’s Lymphoma (women)
IMR = 0.5 (0.4 to 0.7)
Results

• Nine cancer sites in men and eight in women had IMR > 1.5

• Kidney, melanoma, myeloma, non-Hodgkin’s lymphoma, oral and thyroid in both sexes

• Prostate, brain and Leukemia in men only

• Lung and uterine in women.

• Notable exceptions: Breast, cervical and bowel.
Method 2

• Defined a pre-diagnostic era: 1950 – 1978
• Post diagnostic era: 1980 – 2012
• Used mortality trends from pre-diagnostic era to predict incidence and mortality trends.
• Excess incidence due to modern diagnostic practice
• Number of deaths avoided
• Odx = excess incidence - deaths avoided.
Example: Breast cancer
<table>
<thead>
<tr>
<th>Site</th>
<th>Excess incidence</th>
<th>Deaths Avoided</th>
<th>Difference</th>
<th>Number of extra cases needed to avoid one death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>1155</td>
<td>432</td>
<td>724</td>
<td>2</td>
</tr>
<tr>
<td>Cervical</td>
<td>1664</td>
<td>67</td>
<td>1597</td>
<td>24</td>
</tr>
<tr>
<td>Lung (women)</td>
<td>16</td>
<td>120</td>
<td>-105</td>
<td>0*</td>
</tr>
<tr>
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Strengths and Limitations

• Method 1 applicable to any cancer/disease with incidence and mortality data
  • specific but not necessarily sensitive?
• Method 2 is simple but relies on historic data
  • estimates sensitive to assumptions
• Early detection may not always prevent death but may reduce morbidity in survivors.
Discussion

- Validation?
- Comparison with US data is informative.
- GB melanoma ≈ US Melanoma incidence/mortality
- Breast cancer mortality now similar to US.
- GB thyroid cancer incidence is 5.3 per 100,000, yet 10 in US and 70 in S. Korea.
Thanks