Strengths and Weaknesses of Opportunistic and Program - based CRC Screening

Roland Valori
Gastroenterologist
April 2018
Timeline of colorectal cancer
Timeline of colorectal cancer diagnosis

- Pre-cancer starts
- Cancer starts
- Symptom
- Action
- GP
- OP
- Test
- Test

Screen diagnosis
Symptomatic diagnosis
What does CRC screening achieve?

- Lower mortality
- Reduced incidence
- (fewer emergency admissions)
# Routes to diagnosis for CRC

<table>
<thead>
<tr>
<th>Hospital</th>
<th>GP referral</th>
<th>TWW</th>
<th>Emergency</th>
<th>Other outpatient</th>
<th>Screening</th>
<th>Inpatient</th>
<th>DCO</th>
<th>Unknown</th>
<th>No route information</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLOUCESTERSHIRE HOSPITALS NHS FOUNDATION TRUST</td>
<td>184 19.6</td>
<td>312</td>
<td>202 21.5</td>
<td>78 8.3</td>
<td>97 10.3</td>
<td>36 3.8</td>
<td>0.0</td>
<td>28 3.0</td>
<td>1 0.1</td>
<td>938</td>
</tr>
<tr>
<td>GREAT WESTERN HOSPITALS NHS FOUNDATION TRUST</td>
<td>166 35.7</td>
<td>105</td>
<td>95 20.4</td>
<td>36 7.7</td>
<td>30 6.5</td>
<td>17 3.7</td>
<td>0.0</td>
<td>14 3.0</td>
<td>2 0.4</td>
<td>465</td>
</tr>
<tr>
<td>NORTH BRISTOL NHS TRUST</td>
<td>83 14.2</td>
<td>229</td>
<td>138 23.7</td>
<td>58 9.9</td>
<td>40 6.9</td>
<td>247 42.4</td>
<td>1.0</td>
<td>8 1.4</td>
<td>2 0.3</td>
<td>583</td>
</tr>
<tr>
<td>OXFORD UNIVERSITY HOSPITALS NHS FOUNDATION TRUST</td>
<td>210 23.7</td>
<td>201</td>
<td>214 24.1</td>
<td>61 6.9</td>
<td>78 8.8</td>
<td>87 9.8</td>
<td>1.0</td>
<td>34 3.8</td>
<td>1 0.1</td>
<td>887</td>
</tr>
<tr>
<td>ROYAL UNITED HOSPITALS BATH NHS FOUNDATION TRUST</td>
<td>169 26.9</td>
<td>164</td>
<td>160 25.5</td>
<td>28 4.5</td>
<td>61 9.7</td>
<td>28 4.5</td>
<td>2.0</td>
<td>9 1.4</td>
<td>7 1.1</td>
<td>628</td>
</tr>
<tr>
<td>UNIVERSITY HOSPITALS BRISTOL NHS FOUNDATION TRUST</td>
<td>69 19.2</td>
<td>124</td>
<td>72 20.1</td>
<td>15 4.2</td>
<td>40 11.1</td>
<td>19 5.3</td>
<td>1.0</td>
<td>18 5.0</td>
<td>1 0.3</td>
<td>359</td>
</tr>
<tr>
<td>WORCESTERSHIRE ACUTE HOSPITALS NHS TRUST</td>
<td>158 18.5</td>
<td>288</td>
<td>197 23.0</td>
<td>66 7.7</td>
<td>88 10.3</td>
<td>37 4.3</td>
<td>1.0</td>
<td>19 2.2</td>
<td>2 0.2</td>
<td>856</td>
</tr>
</tbody>
</table>

Definitions: British Journal of Cancer (2012) 107, 1220–1226
Emergency diagnosis rates for CRC – national data

Definitions: British Journal of Cancer (2012) 107, 1220–1226
Age standardised incidence of CRC - England
Danish CRC screening programme

- FIT @ 100ug/L
- 61% participation
- 7% +ve
- 90% of these have colonoscopy or CTC

New cases of CRC/year

Terminology

• Opportunistic
• Programme based
• Organised
• Planned
What does ‘organised’ involve?

- Defining target population
- Distributing invitations
- Managing all communications
- Organising follow up tests
- Ensuring quality of further testing
- Monitoring quality
- Dealing with poor performance
- Comprehensive IT system to support all of the above
Extent of organisation of CRC screening programmes

No organisation

Highly organised
Features of program and non program based screening

Non programme based
• Can get started straight away
• No start up costs
• No organisational costs
BUT
• No control of quality
• No measures of effectiveness
• Possible excess (low value) screening

Programme based
• Well defined target population
• Tight quality control
• Measures of effectiveness
BUT
• May take a long time to get started
• Extra start up costs
• Ongoing organisational costs
The challenge: implementation lags behind change and expectations

“economics will trump politics”
output = net benefit

willingness to pay

lower cost

higher cost
Benefits of high and low quality screening

Benefits of high quality screening

Benefits of low quality screening

‘missed lesions’
Impact of adenoma detection on interval cancer

B. Risk of Advanced-Stage CRC

<table>
<thead>
<tr>
<th>Quintile</th>
<th>Adjusted Hazard Ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00</td>
<td>(reference)</td>
</tr>
<tr>
<td>2</td>
<td>0.80</td>
<td>0.55–1.16</td>
</tr>
<tr>
<td>3</td>
<td>0.68</td>
<td>0.45–1.00</td>
</tr>
<tr>
<td>4</td>
<td>0.48</td>
<td>0.33–0.71</td>
</tr>
<tr>
<td>5</td>
<td>0.43</td>
<td>0.29–0.64</td>
</tr>
</tbody>
</table>

No. of CRCs:
- Quintile 1: 79
- Quintile 2: 53
- Quintile 3: 47
- Quintile 4: 49
- Quintile 5: 27

C. Risk of Fatal CRC

<table>
<thead>
<tr>
<th>Quintile</th>
<th>Adjusted Hazard Ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00</td>
<td>(reference)</td>
</tr>
<tr>
<td>2</td>
<td>1.02</td>
<td>0.65–1.61</td>
</tr>
<tr>
<td>3</td>
<td>0.80</td>
<td>0.55–1.17</td>
</tr>
<tr>
<td>4</td>
<td>0.51</td>
<td>0.33–0.81</td>
</tr>
<tr>
<td>5</td>
<td>0.38</td>
<td>0.22–0.65</td>
</tr>
</tbody>
</table>

No. of Deaths:
- Quintile 1: 43
- Quintile 2: 35
- Quintile 3: 29
- Quintile 4: 28
- Quintile 5: 12
### Relationship of Adenoma Detection Rate (ADR) to cancer

<table>
<thead>
<tr>
<th>Quintiles: ADR range</th>
<th>Interval cancers</th>
<th>Hazard ratio for interval cancer</th>
<th>Unadjusted risk of cancer no. of cases/10,000 person-years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: 7.35–19.05%</td>
<td>186</td>
<td>1.00 (reference)</td>
<td>9.8</td>
</tr>
<tr>
<td>2: 19.06–23.85%</td>
<td>144</td>
<td>0.93 (0.70–1.23)</td>
<td>8.6</td>
</tr>
<tr>
<td>3: 23.86–28.40%</td>
<td>139</td>
<td>0.85 (0.68–1.06)</td>
<td>8.0</td>
</tr>
<tr>
<td>4: 28.41–33.50%</td>
<td>167</td>
<td>0.70 (0.54–0.91)</td>
<td>7.0</td>
</tr>
<tr>
<td>5: 33.51–52.51%</td>
<td>76</td>
<td>0.52 (0.39–0.69)</td>
<td>4.8</td>
</tr>
</tbody>
</table>

1% increase in ADR is associated with a 3% decreased risk of cancer

## Relationship of ADR to cancer and death from cancer

<table>
<thead>
<tr>
<th>Quintiles: ADR range</th>
<th>Interval cancers</th>
<th>Hazard ratio for interval cancer</th>
<th>Unadjusted risk of cancer no. of cases/10,000 person-years</th>
<th>Hazard ratio for death from cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: 7.35–19.05%</td>
<td>186</td>
<td>1.00 (reference)</td>
<td>9.8</td>
<td>1.00 (reference)</td>
</tr>
<tr>
<td>2: 19.06–23.85%</td>
<td>144</td>
<td>0.93 (0.70–1.23)</td>
<td>8.6</td>
<td>0.80 (0.55–1.16)</td>
</tr>
<tr>
<td>3: 23.86–28.40%</td>
<td>139</td>
<td>0.85 (0.68–1.06)</td>
<td>8.0</td>
<td>0.68 (0.45–1.00)</td>
</tr>
<tr>
<td>4: 28.41–33.50%</td>
<td>167</td>
<td>0.70 (0.54–0.91)</td>
<td>7.0</td>
<td>0.51 (0.33–0.81)</td>
</tr>
<tr>
<td>5: 33.51–52.51%</td>
<td>76</td>
<td>0.52 (0.39–0.69)</td>
<td>4.8</td>
<td>0.38 (0.22–0.65)</td>
</tr>
</tbody>
</table>

Colonoscopies undertaken in the English NHS followed by a diagnosis of cancer within 36 months

3 year Post Colonoscopy CRC (PCCRC) - 140 English NHS hospitals (2009 - 2012)

PCCRC % = 1 - sensitivity

For colonoscopies done from 2009-2012

Individual NHS Hospitals

False negative colonoscopy rate (%)

= 1100 patients/year
Risks of high and low quality screening

Adverse effects of low quality screening:
- perforation
- bleeding
- death

Adverse effects of high quality screening:
- minimal or no adverse effects
AVOIDABLE HARM

- Pain
- Sedation risks
- Perforation
- Bleeding
- Splenic rupture
- Death

- If none of these measures is captured there is no:
  - benchmark
  - idea of variation


Unplanned admissions within 8 days of a colonoscopy – Gloucestershire 1/4/14 - 31/12/14

<table>
<thead>
<tr>
<th>9 months n = 4648 colonoscopies</th>
<th>Related to procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Bleeding</td>
<td>6*</td>
</tr>
<tr>
<td>Pain</td>
<td>1</td>
</tr>
<tr>
<td>palpitations</td>
<td>1</td>
</tr>
<tr>
<td>ACS</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
</tr>
</tbody>
</table>

Rate of admission related to procedure = 7/4648 = 0.15% = 1:670

All patients well on discharge: *one patient had 2 unit transfusion; another repeat colonoscopy + clips
FOBT +ve colonoscopy complications
Admission for colonoscopy complications - Scotland
Benefits and risks of high and low quality screening

Benefits of high quality screening

Adverse effects of high quality screening

Harm exceeds benefit

Benefits of low quality screening

Adverse effects of low quality screening

Adverse effects of high quality screening
Benefits and risks of high and low quality screening

- Benefits of high quality screening
- Benefits of low quality screening
- Adverse effects of low quality screening
- Adverse effects of high quality screening

Harm exceeds benefit
Trend in adenoma detection rates in Scottish and English screening programmes

Adenoma Detection Rate

2007 2008 2009 2010 2011 2012 2013 2014

Men
Women

49%
37%
What did we do differently in England?

- Quality assured before we started:
  - units
  - colonoscopists

- Measured and fed back performance data:
  - units
  - colonoscopists

- Acted on poor performance:
  - units
  - colonoscopists
Impact of screening on colonoscopy services - has been enormous
Thank you