What is preventability?

- Estimates of the proportion of cases of cancer that could be prevented in a given population.

- We are specifically looking at how much of each cancer could be prevented through changes in diet, physical activity and body fatness.
Previous estimates

• 1981: Richard Doll and Richard Peto
  – Diet possibly responsible for 35% of cancers in the USA (CI: 10 - 70%)
  – Did not include physical activity, body composition, or infant nutrition. Alcohol considered separately.

• 1982: National Academy of Sciences
  – About a third

• 1997 WCRF/AICR report
  – Between 30-40%
Policy Report

- Companion to the Expert Report
- Aim: Produce recommendations that will help achieve the public health goals from the Expert Report.
Policy Report: why were new estimates prepared?

- Updated evidence on which factors related to food, nutrition, physical activity and body fatness are linked to cancer (i.e. the 2007 WCRF/AICR Expert Report).
- Compare different countries
- Diet and physical activity patterns have changed since the 1980s/1990s
  - eg obesity levels have risen in many countries
Who produced the estimates?

- Tim Byers, Larry Kolonel, Walter Willett, Elio Riboli
  - Steering group

- Jos Kleijnen (Cochrane collaboration)
  - SLR of authoritative estimates previously published
  - Initial work to develop method

- Rachel Thompson and Giota Mitrou (WCRF)
  - Produced the actual estimates
  - Input from the Secretariat
The information we need

Good quality information on:

- **Cancer risk** related to food, nutrition, body fatness and physical activity.
- Food, nutrition, body fatness and physical activity for each country.
- **Cancer incidence rates** in different countries.
Information on cancer risk?

• **NEED**: Cancer risk related to food, nutrition, body fatness and physical activity.

• **HAVE**: 2007 WCRF/AICR Expert Report.
Information on diet and lifestyle?

- **NEED**: Good quality information on food, nutrition, body fatness and physical activity for each country.
- **HAVE**: National surveys for some countries, all have limitations.
Can we get good quality information - how common cancer is?

- **NEED**: Information on how common different cancers are in each country.

- **HAVE**: Information on new cases of cancer diagnosed in 2002 for many countries.
  - Most countries don’t have accurate registries for new cases of cancer.
Why we need country specific estimates
Imagine eating 2 slices of bacon a day increases risk of bowel cancer

<table>
<thead>
<tr>
<th></th>
<th>Bacon intake</th>
<th>If everyone stopped eating bacon</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country A</strong></td>
<td>Everyone eats 2 slices of bacon a day</td>
<td>Prevent some bowel cancer</td>
</tr>
<tr>
<td><strong>Country B</strong></td>
<td>No one eats bacon</td>
<td>No bowel cancer would be prevented</td>
</tr>
</tbody>
</table>

Slide 11
Imagine salt increases stomach cancer and alcohol increases breast cancer

<table>
<thead>
<tr>
<th>Country A</th>
<th>Alcohol and salt intake</th>
<th>Change diet</th>
<th>Effect on cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lots of breast cancer and very low stomach cancer</td>
<td>If everyone has 3 glasses of wine a day and a high salt diet</td>
<td>Stop drinking wine.</td>
<td>Some cancer prevented</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Salt same</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduce salt</td>
<td>No cancer prevented</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wine same</td>
<td></td>
</tr>
</tbody>
</table>

Slide 12
Imagine salt increases stomach cancer and alcohol increases breast cancer

<table>
<thead>
<tr>
<th>Country B</th>
<th>Alcohol and salt intake</th>
<th>Change diet</th>
<th>Effect on cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lots of stomach cancer and very low breast cancer</td>
<td>If everyone has 3 glasses of wine a day and a high salt diet</td>
<td>Stop drinking wine. Salt same</td>
<td>No cancer prevented</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wine same Reduce salt</td>
<td>Some cancer prevented</td>
</tr>
</tbody>
</table>
What we did

• Chose 4 countries that represent high, middle and low income countries, which had good quality information on cancer, food, nutrition, physical activity and body fatness.

• Estimated preventability for all cancers where probable or convincing and a recommendation was made.

• Estimated preventability for individual cancers and combined.

• Estimated preventability from body fatness.
How did we choose the countries?

NEEDED

• Information on how common different types of cancer are.
• Information on food, nutrition, physical activity and body fatness.
  – High income - UK and USA
  – Middle income - Brazil
  – Low income - China
### Panel judgements for bowel cancer

#### FOOD, NUTRITION, PHYSICAL ACTIVITY, AND CANCERS OF THE COLON AND THE RECTUM

In the judgement of the Panel, the factors listed below modify the risk of cancers of the colon and the rectum. Judgements are graded according to the strength of the evidence.

<table>
<thead>
<tr>
<th></th>
<th>DECREASES RISK</th>
<th>INCREASES RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Convincing</strong></td>
<td><strong>Physical activity</strong>&lt;sup&gt;1&lt;/sup&gt;&lt;sup&gt;2&lt;/sup&gt;</td>
<td><strong>Red meat</strong>&lt;sup&gt;3&lt;/sup&gt;&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Processed meat</strong>&lt;sup&gt;4&lt;/sup&gt;&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Alcoholic drinks (men)</strong>&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Body fatness</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Abdominal fatness</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Adult attained height</strong>&lt;sup&gt;7&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Probable</strong></td>
<td><strong>Foods containing dietary fibre</strong>&lt;sup&gt;8&lt;/sup&gt;</td>
<td><strong>Alcoholic drinks (women)</strong>&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td><strong>Garlic</strong>&lt;sup&gt;9&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Milk</strong>&lt;sup&gt;10&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Calcium</strong>&lt;sup&gt;12&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Limited — suggestive</strong></td>
<td><strong>Non-starchy vegetables</strong>&lt;sup&gt;9&lt;/sup&gt;</td>
<td><strong>Foods containing iron</strong>&lt;sup&gt;4&lt;/sup&gt;&lt;sup&gt;8&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td><strong>Fruits</strong>&lt;sup&gt;9&lt;/sup&gt;</td>
<td><strong>Cheese</strong>&lt;sup&gt;10&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td><strong>Foods containing folate</strong>&lt;sup&gt;8&lt;/sup&gt;</td>
<td><strong>Foods containing animal fats</strong>&lt;sup&gt;9&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td><strong>Foods containing selenium</strong>&lt;sup&gt;8&lt;/sup&gt;</td>
<td><strong>Foods containing sugars</strong>&lt;sup&gt;15&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td><strong>Fish</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Foods containing vitamin D</strong>&lt;sup&gt;8&lt;/sup&gt;&lt;sup&gt;13&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Selenium</strong>&lt;sup&gt;14&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>
### Summary of ‘convincing’ and ‘probable’ judgements

| Convincing decreased risk | Probable decreased risk | Probable increased risk | Convincing increased risk | 1 Includes evidence on foods containing carotenoids for mouth, pharynx, larynx; foods containing beta-carotene for oesophagus; foods containing vitamin C for oesophagus | 2 Includes evidence on foods containing carotenoids for mouth, pharynx, larynx and lung; foods containing beta-carotene for oesophagus; foods containing vitamin C for oesophagus | 3 Includes evidence from supplements for prostate | 4 Includes ‘fast foods’ | 5 Convincing harm for men and probable harm for women for colorectum | 6 The evidence is derived from studies using supplements for lung | 7 Includes evidence on television viewing | 8 Judgement for physical activity applies to colon and not rectum |

**KEY**

- Convincing decreased risk
- Probable decreased risk
- Probable increased risk
- Convincing increased risk

1 Includes evidence on foods containing carotenoids for mouth, pharynx, larynx; foods containing beta-carotene for oesophagus; foods containing vitamin C for oesophagus
2 Includes evidence on foods containing carotenoids for mouth, pharynx, larynx and lung; foods containing beta-carotene for oesophagus; foods containing vitamin C for oesophagus
3 Includes evidence from supplements for prostate
4 Evidence is from milk and studies using supplements for colorectum
5 Includes ‘fast foods’
6 Convincing harm for men and probable harm for women for colorectum
7 The evidence is derived from studies using supplements for lung
8 Includes evidence on television viewing
9 Judgement for physical activity applies to colon and not rectum
Which factors were **not** included (1)

- Dairy foods, adult attained height
  - No Panel Recommendation
- Dietary supplements
- Aflatoxins, Cantonese style salted fish
  - Missing dietary information
- Having been breast fed
  - Lack of data, different type of risk factor
Which factors were **not** included (2)

- Abdominal fatness or weight gain
  - Insufficient data
- Foods containing selenium
  - Recent trial found no effect of selenium on prostate cancer.
**What did we do with the study?**

Divided risk factors (e.g. processed meat intake) into three levels.

<table>
<thead>
<tr>
<th>Low (target)</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eaten less than once a week</td>
<td>Eaten once a week or more but not daily</td>
<td>Eaten every day</td>
</tr>
</tbody>
</table>
Processed meat and bowel cancer

Cancer risk

Intake of processed meat

- low risk
- medium risk
- high risk

World Cancer Research Fund
American Institute for Cancer Research
Preventability estimates for bowel cancer - USA (appendix)

<table>
<thead>
<tr>
<th>Factors</th>
<th>%</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foods containing fibre</td>
<td>11</td>
<td>≥30g/day</td>
</tr>
<tr>
<td>Red meat</td>
<td>5</td>
<td>&lt; once a week</td>
</tr>
<tr>
<td>Processed meat</td>
<td>12</td>
<td>&lt; once a week</td>
</tr>
<tr>
<td>Alcoholic drinks</td>
<td>5</td>
<td>Non-drinker</td>
</tr>
<tr>
<td>Physical activity</td>
<td>15</td>
<td>≥21 mins/day</td>
</tr>
<tr>
<td>Body fatness</td>
<td>9</td>
<td>BMI &lt;25</td>
</tr>
</tbody>
</table>
What does 12% mean?

- We calculated what would happen if everyone ate processed meat less than once a week, then the number of new cases of bowel cancer diagnosed would be reduced by 12% in USA.
### Preventability estimates for bowel cancer - USA (appendix)

<table>
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<td>BMI &lt;25</td>
</tr>
<tr>
<td><strong>Total estimate</strong></td>
<td></td>
<td><strong>57</strong></td>
</tr>
</tbody>
</table>
## Preventability estimates for bowel cancer - USA (appendix)

<table>
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<tr>
<td>Body fatness</td>
<td>9</td>
<td>BMI &lt;25</td>
</tr>
<tr>
<td><strong>Total estimate</strong></td>
<td><strong>57</strong></td>
<td></td>
</tr>
</tbody>
</table>
Why cannot add factors to obtain total estimate?

• No individual case of cancer can be prevented more than once

• Multiple exposures
e.g. a person eats a high fibre diet and if in addition avoids processed meat...two protective effects adds up.
## Preventability estimates for bowel cancer - USA (appendix)

<table>
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</tr>
<tr>
<td>Body fatness</td>
<td>9</td>
<td>BMI &lt;25</td>
</tr>
<tr>
<td><strong>Total estimate</strong></td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>
Is it exactly 45%?

- No!
- Computed range (see appendix).
- Method gives a very wide range (0-73%).
- In chapter 2 we use the term ‘about’ to show the figures are estimates and are not precise figures.
- Best estimate.
Preventability for all cancers combined

• Totals for the 12 cancer sites combined
  – Using information on how common each cancer is
  – These account for 2/3 to 3/4 of all cancers.

• Total for all types of cancers
  – also includes:
    – Ovary, cervix, bladder, skin, nasopharynx (SLRs)
    – Leukaemia, testis, brain, thyroid (narrative reviews)
    – Assumed these cancers are not preventable by food, nutrition, body fatness and physical activity, but this is likely not to be true.
Separate preventability estimates for obesity

- Of 12 cancer sites - body fatness was an important factor for 7 cancers.
- Estimated preventability separately for men and women.
What are the results?
&
What do they mean?
Preventability Results for 4 countries

- Preventability estimates for food, nutrition, physical activity and body fatness
  - By cancer type for 12 cancers
  - Total estimates for 12 cancers combined
  - Total estimates for all cancers

- Preventability estimates for body fatness
  - For obesity related cancers for men and women separately
  - Total estimate of preventability for obesity related cancers combined
Preventability estimates for bottom 6 cancers through food, nutrition & physical activity & body fatness.

- Oesophagus
- Mouth, pharynx, larynx
- Endometrium
- Stomach
- Colorectum
- Breast
- Pancreas
- Lung
- Prostate
- Kidney
- Liver
- Gallbladder

Graph comparing preventability estimates across USA, UK, Brazil, and China.
Preventability estimates for specific risk factors—Example: Breast cancer in USA

- **Alcoholic Drinks**: 11%
- **Physical activity**: 17%
- **Body fatness**: 17%

**USA Total Estimate: 38%**
Preventability estimates of breast cancer for specific risk factors across countries

USA

- Alcoholic Drinks: 11%
- Physical activity: 17%
- Body fatness: 17%

Brazil

- Alcoholic Drinks: 5%
- Physical activity: 11%
- Body fatness: 14%

UK

- Alcoholic Drinks: 22%
- Physical activity: 12%
- Body fatness: 16%

China

- Alcoholic Drinks: 1%
- Physical activity: 8%
- Body fatness: 12%
Preventability estimates of breast cancer for specific risk factors across countries

USA

- Alcoholic Drinks: 11%
- Physical activity: 17%
- Body fatness: 17%

Brazil

- Alcoholic Drinks: 5%
- Physical activity: 11%
- Body fatness: 14%

UK

- Alcoholic Drinks: 22%
- Physical activity: 12%
- Body fatness: 16%

China

- Alcoholic Drinks: 1%
- Physical activity: 8%
- Body fatness: 12%
Why are there differences in preventability estimates of breast cancer across countries for specific risk factors?

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>High risk group</th>
<th>USA</th>
<th>UK</th>
<th>Brazil</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcoholic drinks</td>
<td>≥15g/d</td>
<td>13</td>
<td>24</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Physical activity</td>
<td>0 hr/week</td>
<td>30</td>
<td>16</td>
<td>50</td>
<td>12</td>
</tr>
<tr>
<td>Body fatness</td>
<td>≥25kg/m²</td>
<td>61</td>
<td>53</td>
<td>39</td>
<td>28</td>
</tr>
</tbody>
</table>
Why are there differences in preventability estimates of breast cancer across countries for specific risk factors?

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>% of population at high risk group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High risk group</td>
</tr>
<tr>
<td>Alcoholic drinks</td>
<td>≥15g/d</td>
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<tr>
<td>Physical activity</td>
<td>0 hr/week</td>
</tr>
<tr>
<td>Body fatness</td>
<td>≥25kg/m²</td>
</tr>
</tbody>
</table>
Total estimates for food, nutrition, physical activity, body fatness & cancer

- USA: 34% (12 cancers), 24% (All cancers)
- UK: 39% (12 cancers), 26% (All cancers)
- Brazil: 30% (12 cancers), 19% (All cancers)
- China: 27% (12 cancers), 20% (All cancers)
Preventability estimates for body fatness for obesity related cancers in men

- Pancreas
- Oesophagus
- Kidney
- Colorectum
- Gallbladder

USA
UK
Brazil
China
Preventability estimates for body fatness for obesity related cancers in women

- Endometrium
- Oesophagus
- Gallbladder
- Kidney
- Pancreas
- Breast
- Colorectum
Total estimates for body fatness for obesity related cancers combined

- **USA**: Men 20%, Women 19%
- **UK**: Men 18%, Women 16%
- **Brazil**: Men 13%, Women 13%
- **China**: Men 11%, Women 12%
Summary of estimates for food, nutrition, physical activity & body fatness

• A large number of cases of the 12 cancer types examined can be prevented by improving patterns of food, nutrition, physical activity and body fatness.

• Other cancers may well be prevented by these factors, hence the true figures for all cancers are likely to be higher than the current estimates.
Summary of estimates for body fatness for obesity related cancers

- A large number of cases caused by food, nutrition, physical activity and body fatness could be prevented by *avoiding overweight and obesity alone*.
- This was particularly true for high income countries.
- Obesity related cancers are less common in lower income countries but as the number of overweight and obese individuals increase, the preventability estimates for body fatness will also increase with the numbers of preventable cancers!!!
CONCLUSIONS

• A broad preventability estimate of about:

  1/3 in high-income countries and

  1/4 in lower income countries

seems reasonable based on current data