
International Agency for Research on Cancer
Lyon, France

Jacques Ferlay
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Ispra, 22 January 2014
M:I Ratio
Jacques → Isabelle
Background

- (Up-to-date) Cancer statistics → Research and Cancer control programmes
- (Often) Delays → Event (I or D) – registration – report
- Variation on existence of (good quality) national cancer registry
History
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THE GEOGRAPHICAL DISTRIBUTION OF CANCER

R. DOLL

From the Medical Research Council's Statistical Research Unit, University College Hospital Medical School, 115 Gower Street, London, W.C.1

Received for publication October 7, 1968.

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Table I.—Multiplying Factors Used to Estimate Incidence of Different Types of Cancer in Persons Aged 35 to 64 Years from Mortality Rates (Male Rates Except for Breast-Cancer)

<table>
<thead>
<tr>
<th>Site of primary cancer (international list number)</th>
<th>Oesophagus (150)</th>
<th>Stomach (151)</th>
<th>Colon (153)</th>
<th>Rectum (154)</th>
<th>Pancreas (157)</th>
<th>Lung (162-3)</th>
<th>Breast ? (170)</th>
<th>Prostate (177)</th>
<th>Bladder (181)</th>
<th>Thyroid (194)</th>
<th>Leukemia (204)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor to convert mortality at ages 35-64 years to incidence at ages 35-64 years</td>
<td>1.19</td>
<td>1.12</td>
<td>1.67</td>
<td>2.08</td>
<td>1.13</td>
<td>1.20</td>
<td>2.26</td>
<td>2.18</td>
<td>2.01</td>
<td>2.43</td>
<td>1.20</td>
</tr>
<tr>
<td>Factor to convert mortality at ages 30-54 years to mortality at ages 35-64 years</td>
<td>1.91</td>
<td>1.77</td>
<td>1.74</td>
<td>1.87</td>
<td>1.70</td>
<td>2.30</td>
<td>2.99</td>
<td>1.37</td>
<td>1.37</td>
<td>1.37</td>
<td>1.37</td>
</tr>
</tbody>
</table>
Cancer in the European Community and its Member States

O. Møller Jensen, J. Estève, H. Møller and H. Renard

The European Community (EC) mounted the “Europe Against Cancer” programme in 1987 to control cancer. Information on mortality rates is available for all member countries and the incident number of cancers was estimated for each site, for each country and for the EC as a whole. In 1980 there were 730,000 deaths from cancer and an estimated 1,186,000 new cases (excluding non-melanoma skin cancers). Among men, cancer of the lung is the leading cancer site with some 135,000 cases per year followed by prostate, colon and bladder cancer. Breast cancer is the leading site in women, with 135,000 cases per year, followed by colon, stomach and genital cancer. Among men, melanoma of the skin, and lung, pancreas and rectum cancer are more frequent in the north in contrast to larynx, oesophagus, buccal cavity and liver cancer, which are more frequent in the south. There are additional contrasts between Southern European countries. The contrasts are less striking for women. This study provides an estimate of the true number of cases only. The establishment of a network of European cancer registries should eventually lead to more comprehensive incidence information from the EC.


12 EC countries
National Registry data: Denmark, Scotland

Regional data: Ireland, Spain, the Netherlands, France, Italy, FRG, UK

No data: Greece, Portugal, Luxembourg, Belgium

“Equation areas”: Denmark, Finland, Norway, Sweden, Scotland, Calvados, Doubs, Isere, Bas-Rhin

National incidence estimated by \( I_N = I_R / M_R \times M_N \)
Cancer Incidence and Mortality in the European Union:
Cancer Registry Data and Estimates of National Incidence for 1990

R.J. Black, F. Bray, J. Ferlay and D.M. Parkin

15 EU countries

Table 1. Registry data used in the prediction models for countries in Western and Southern Europe and all EU models

<table>
<thead>
<tr>
<th>Western Europe</th>
<th>W</th>
<th>Southern Europe</th>
<th>S</th>
<th>All EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calvados (France)</td>
<td></td>
<td>Florence (Italy)</td>
<td></td>
<td>W. Europe data</td>
</tr>
<tr>
<td>Doubs (France)</td>
<td></td>
<td>Vicenza (Italy)</td>
<td></td>
<td>S. Europe data</td>
</tr>
<tr>
<td>Haut-Rhin (France)</td>
<td></td>
<td>Romagna (Italy)</td>
<td></td>
<td>Denmark</td>
</tr>
<tr>
<td>Herault (France)</td>
<td></td>
<td>1 urin (Italy)</td>
<td></td>
<td>Finland</td>
</tr>
<tr>
<td>Isère (France)</td>
<td></td>
<td>Genoa (Italy)</td>
<td></td>
<td>Netherlands</td>
</tr>
<tr>
<td>Tarn (France)</td>
<td></td>
<td>Asurias (Spain)</td>
<td></td>
<td>Sweden</td>
</tr>
<tr>
<td>Hamburg (Germany)</td>
<td></td>
<td>Granada (Spain)</td>
<td></td>
<td>U.K.</td>
</tr>
<tr>
<td>North Netherlands</td>
<td></td>
<td>Navarra (Spain)</td>
<td></td>
<td>Austria</td>
</tr>
<tr>
<td>South Netherlands</td>
<td></td>
<td>Coimbra (Portugal)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyrol (Austria)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Estimates of cancer incidence and mortality in Europe in 1995

F. Bray*, R. Sankila, J. Ferlay, D.M. Parkin

Unit of Descriptive Epidemiology, International Agency for Research on Cancer, 150 cours Albert Thomas, 69.

Received 10 April 2001; received in revised form 29 June 2001; accepted 1 July 2001

38 European countries
Estimates of cancer incidence and mortality in Europe in 2008

J. Ferlay a,*, D.M. Parkin b, E. Steliarova-Foucher a

a International Agency for Research on Cancer, 150 Cours Albert Thomas, 69372 Lyon Cedex 08, France

Cancer incidence and mortality patterns in Europe: Estimates for 40 countries in 2012

J. Ferlay a,*, E. Steliarova-Foucher a, J. Lortet-Tieulent a, S. Rosso b, J.W.W. Coebergh c, d, H. Comber e, D. Forman a, F. Bray a
Data (Europe) in 2012

No national incidence, but national mortality is available (12 countries in 2012).

Other data/methods for 28 countries

<table>
<thead>
<tr>
<th>Local model</th>
<th>Regional model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>Portugal</td>
</tr>
<tr>
<td>Poland</td>
<td>Romania</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>Serbia</td>
</tr>
</tbody>
</table>

Country-specific (local data) model or based on data from neighbouring countries (regional data).
Methods of estimation

National incidence ($I_N$) estimates are calculated by:

$$I_N = I_R / M_R \times M_N$$

The $I_R / M_R$ are obtained using sets of log-linear models, specific for site, sex, and age, based on the most recent selected cancer registry data (incidence plus mortality).
Incidence: Mortality ratio by age and sex in Spain, Leukaemia

![Graph showing the incidence and mortality ratio of Leukaemia by age and sex in Spain.](image)
Incidence: Mortality ratio by age and sex in Poland, Stomach
Incidence: Mortality ratio by age and sex in Switzerland, Pancreas
Illustration of the production of the predicted incidence rate for breast cancer in 2008.

(B) Predicted national incidence rate (2008) based on the projection of local incidence rates.
(C) Predicted incidence rate (2008) based on predicted incidence rate (2000) and projection to 2008 using trends observed in local cancer registries.
Known problems

1. Sparse number of cancer deaths in age strata

\[ I_N = \frac{I_R}{M_R} \times M_N \]
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2. Assume local survival ~ national survival

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If higher survival in local region(s) or neighboring countries
→ high modeled \( I_R/M_R \) → overestimation in estimated
national incidence

- E.g. higher survival: (a) real difference (b) difference in
cancer registration system e.g. incl. non-invasive or
borderline tumors

If lower survival: exclusion of DCO in local incidence →
underestimate national estimate
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3. Uterus NOS in mortality data and the re-allocation to cervix and corpus categories → to be done in both $M_R$ and $M_N$

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4. In region-based model (no local incidence data):

   Local mortality ($M_R$) and national mortality ($M_N$) data are not from the same source.

   - If national mortality ($M_N$) quality is low e.g. overestimation due to inclusion of metastatic cancers → overestimation in estimated national incidence
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Known problems

5. M:I ratios computed using regional data for an earlier period and applied to a more recent (estimated?) year (or period).
   - If current ratio changed e.g. screening: breast, prostate (underestimation)
Suggestions for improvement

1. Use alternative method(s) depending on cancer sites (such as screen detectable cancers). Trends from local cancer registries, most recent rates from local registries, mortality and survival (MIAMOD)

2. Use additional variable(s) such as HDI for area model

3. Use different age bands depending on the cancer site (leukaemia and prostate cancer)
For Discussion

• Validity of M:I ratio by country/region, cancer and sex:
  – Age-specific comparisons of 1 - ( M / I ) and (period) survival

• Validity of national incidence estimates
  – Comparisons of MIAMOD and EUCAN
  – Comparison of regional incidence vs. regional survival

• Testing ground:
  – ECO, EUROCARE, NORDCAN

• Can 1-M:I (survival) be predicted by HDI, GDP etc.?
The validity of the mortality to incidence ratio as a proxy for site-specific cancer survival


**Figure 1** Regression line of 5-year relative survival on 1 – (M/I) ratio using data from the Netherlands cancer registry, 2002–06
Figure 3: Mortality:Incidence ratio (2000-2004) vs. 1-survival (diagnoses 1996-2000), Norwegian Cancer Registry

M:I ratio is a satisfactory proxy for survival probability