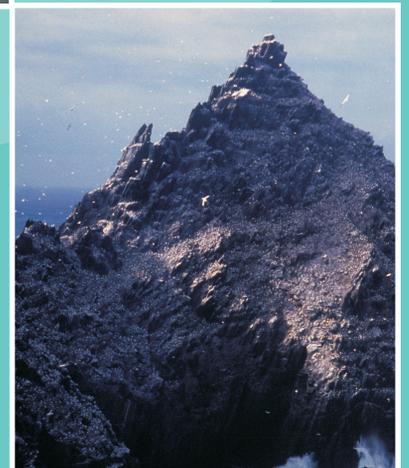


Cancer in Ireland 1994-2007

Annual report of the National Cancer Registry



Cancer incidence 2005-2007

In 2005-2007, the National Cancer Registry registered an annual average of 27023 new cases (Table 1).¹ The commonest invasive cancers overall (apart from non-melanoma skin cancer, NMSC) were prostate (2462 cases), breast (2335 cases; 2315 in females), colorectal (2156 cases) and lung cancer (1810 cases). The risk of developing invasive cancer over the period 2005-2007 was roughly 570 cases per 100,000 persons per year (420 per 100,000 excluding NMSC).

Breast cancer was, apart from NMSC, the commonest diagnosis in women, making up 30% of all invasive cancers (excluding NMSC), while colorectal cancer accounted for 12% and lung cancer for 10%. In men, prostate cancer was the commonest diagnosis, accounting for 29% of cases, followed by colorectal cancer at 15% and lung cancer at 13%. No other cancer, in either men or women, accounted for more than 5% of cases. The next most common cancer in women was melanoma of skin (4.8%) and in men was lymphoma (4.3%).

The number of *in situ* cancers has increased considerably in the past few years, to become almost as common in females as non-melanoma skin cancer. Although most *in situ* cancers in females are in the cervix, the recent increase has been largely due to *in situ* breast cancer, as a result of breast screening. Increased diagnoses of *in situ* melanoma and carcinoma of the cervix have also contributed to the increase.

Cancer mortality 2006²

Lung cancer was the most frequent cause of cancer death overall in 2006 (Table 2), with over 1600 deaths registered, and was also the commonest cause of death from cancer in men (964 deaths; 22% of the total) and the second commonest cause in women (659 deaths, 17% of the total). Breast cancer was the commonest cause of cancer death in women (678 deaths, 17.5% of the total). Colorectal cancer was the second commonest cause of death overall (1004 deaths in total or 12% of all cancer deaths).

¹ As well as invasive/malignant cancer, this includes cancers of *in situ*, uncertain or benign (intracranial and intraspinal only) behaviour.

² All information on cancer mortality in this report is taken from the Report on Vital Statistics, 2006 by the Central Statistics Office (Stationery Office, Dublin 2009).

Table 1. Number of cancers registered and incidence rates³, 2005-2007

| | 2005 | | 2006 | | 2007 | | average number 2005-2007 | | incidence rate ³ 2005-2007 | |
|--|--------|-------|--------|-------|--------|-------|-----------------------------|-------|--|--------|
| | female | male | female | male | female | male | female | male | female | male |
| all cancers¹ | 13356 | 12658 | 13896 | 13230 | 14561 | 13369 | 13938 | 13086 | 626.97 | 688.01 |
| Invasive cancers | | | | | | | | | | |
| all invasive cancers except non-melanoma skin | 7459 | 8309 | 7686 | 8515 | 7625 | 8577 | 7590 | 8467 | 350.34 | 445.14 |
| non-melanoma skin | 2919 | 3411 | 3046 | 3721 | 3346 | 3730 | 3104 | 3621 | 135.81 | 190.78 |
| prostate | — | 2428 | — | 2422 | — | 2536 | — | 2462 | — | 131.64 |
| breast | 2203 | 22 | 2278 | 23 | 2463 | 16 | 2315 | 20 | 112.67 | 1.09 |
| colorectal | 884 | 1227 | 957 | 1226 | 897 | 1277 | 913 | 1243 | 40.27 | 65.58 |
| lung | 741 | 1104 | 769 | 1074 | 717 | 1025 | 742 | 1068 | 33.41 | 56.30 |
| lymphoma | 277 | 339 | 304 | 395 | 279 | 367 | 287 | 367 | 13.31 | 18.71 |
| melanoma skin | 362 | 247 | 367 | 259 | 354 | 313 | 361 | 273 | 16.47 | 14.04 |
| unknown primary site | 274 | 223 | 244 | 241 | 253 | 287 | 257 | 250 | 10.51 | 13.20 |
| bladder | 144 | 335 | 140 | 350 | 149 | 329 | 144 | 338 | 6.29 | 17.86 |
| stomach | 166 | 287 | 170 | 301 | 162 | 293 | 166 | 294 | 7.01 | 15.39 |
| pancreas | 210 | 178 | 240 | 212 | 182 | 190 | 211 | 193 | 8.84 | 10.34 |
| leukaemia | 158 | 249 | 169 | 259 | 120 | 212 | 149 | 240 | 6.72 | 12.44 |
| kidney | 148 | 228 | 141 | 228 | 153 | 240 | 147 | 232 | 6.98 | 12.24 |
| oesophagus | 121 | 215 | 129 | 220 | 139 | 263 | 130 | 233 | 5.31 | 12.32 |
| ovary | 361 | — | 388 | — | 322 | — | 357 | — | 17.04 | — |
| brain and CNS | 117 | 187 | 141 | 195 | 143 | 179 | 134 | 187 | 6.29 | 9.54 |
| corpus uteri | 302 | — | 288 | — | 299 | — | 296 | — | 14.67 | — |
| head and neck | 83 | 192 | 83 | 213 | 93 | 198 | 86 | 201 | 4.08 | 10.64 |
| cervix | 259 | — | 232 | — | 286 | — | 259 | — | 12.25 | — |
| Non-invasive cancers | | | | | | | | | | |
| in situ | 2607 | 560 | 2803 | 609 | 3254 | 755 | 2888 | 641 | 124.64 | 33.86 |
| of uncertain behaviour | 274 | 313 | 249 | 317 | 222 | 249 | 248 | 293 | 11.08 | 14.97 |
| benign intracranial and intraspinal | 97 | 65 | 112 | 68 | 114 | 58 | 108 | 64 | 5.10 | 3.25 |

Table 2. Number of cancer deaths and mortality rates⁴, 2006

| | number of deaths | | mortality rate ⁴ | | % of all cancer deaths | |
|----------------------|------------------|------|-----------------------------|-------|------------------------|-------|
| | female | male | female | male | female | male |
| all cancers | 3869 | 4303 | 163.3 | 226.2 | — | — |
| lung | 659 | 964 | 28.6 | 50.9 | 17.0% | 22.4% |
| breast | 678 | 9 | 30.4 | 0.1 | 17.5% | — |
| prostate | — | 543 | — | 29.1 | — | 12.6% |
| colorectal | 419 | 585 | 16.3 | 30.9 | 10.8% | 13.6% |
| pancreas | 214 | 196 | 8.7 | 10.5 | 5.5% | 4.6% |
| stomach | 145 | 204 | 5.9 | 10.6 | 3.7% | 4.7% |
| unknown primary site | 181 | 175 | 7.1 | 9.2 | 4.7% | 4.1% |
| oesophagus | 119 | 208 | 4.7 | 11.0 | 3.1% | 4.8% |
| brain and other CNS | 105 | 173 | 4.8 | 8.9 | 2.7% | 4.0% |
| leukaemia | 105 | 168 | 4.0 | 8.7 | 2.7% | 3.9% |
| ovary | 275 | — | 12.4 | — | 7.1% | — |
| lymphoma | 110 | 136 | 4.7 | 7.0 | 2.8% | 3.2% |
| kidney | 83 | 110 | 3.5 | 5.8 | 2.1% | 2.6% |
| liver | 91 | 101 | 3.7 | 5.3 | 2.4% | 2.3% |
| bladder | 64 | 124 | 2.4 | 6.6 | 1.7% | 2.9% |
| multiple myeloma | 65 | 87 | 2.6 | 4.6 | 1.7% | 2.0% |
| head and neck | 44 | 96 | 1.9 | 5.2 | 1.1% | 2.2% |
| other digestive | 57 | 63 | 2.2 | 3.2 | 1.5% | 1.5% |
| melanoma of skin | 46 | 64 | 1.9 | 3.3 | 1.2% | 1.5% |
| cervix | 83 | — | 4.2 | — | 2.1% | — |

³ cases per 100,000 persons per year; age-standardised to European standard population.

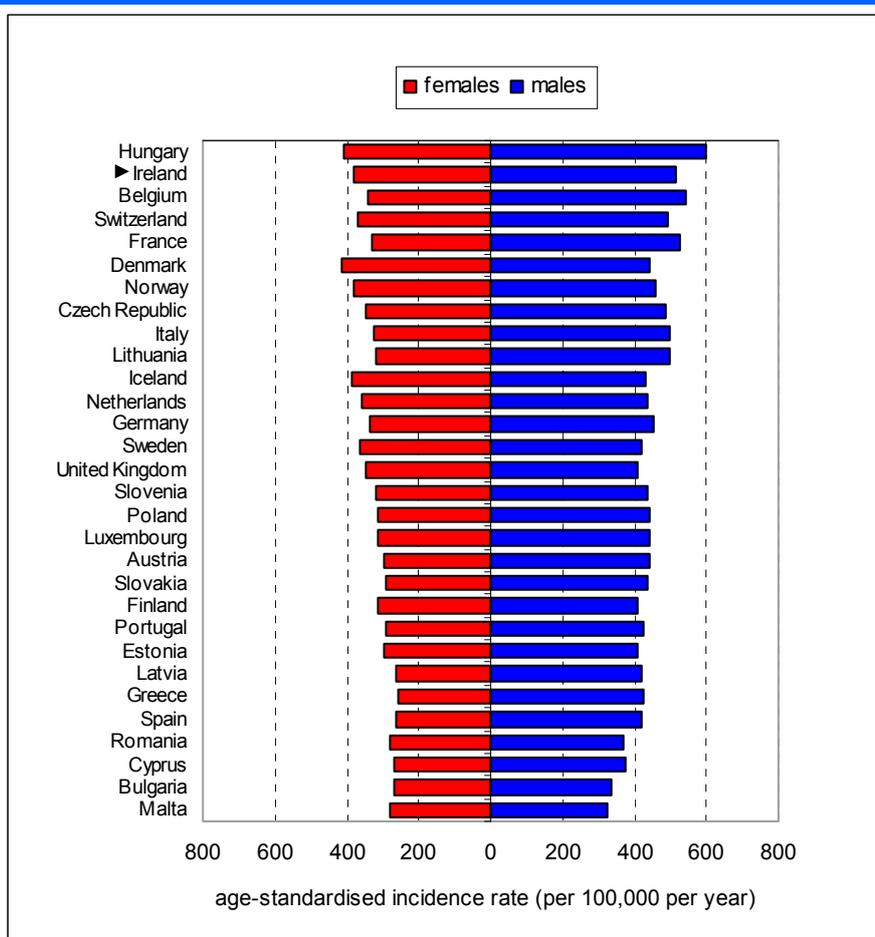
⁴ deaths per 100,000 persons per year; age-standardised to European standard population.

International variation in cancer incidence 2006

Figure 1 shows estimated cancer incidence rates for Europe in 2006, for all invasive cancers excluding non-melanoma skin.⁵ Irish rates (males and females combined) were the 2nd highest of all 30 countries shown.

Incidence rates for individual cancer sites varied between countries (data not shown). Incidence rates in Irish women were high compared to other European countries for melanoma, leukaemia and cancers of the breast and oesophagus (all ranked 2nd) as well as for lung cancer (ranked 5th). Comparatively low incidence rates were found for cervical and endometrial cancers; for stomach and head & neck cancers the rates for Irish women were among the lowest in Europe. In men the incidence of prostate cancer and leukaemia were high in Ireland compared to other European countries and were ranked 1st and 2nd overall respectively. Unlike women, lung cancer in men in Ireland ranked as one of the 10 lowest incidence rates in Europe (21st of 30 countries).

Figure 1. Estimated cancer incidence in Europe for all invasive cancers excluding non-melanoma skin, 2006



⁵ Ferlay J, Autier P, Boniol M, Heanue M, Colombet M, Boyle P. *Estimates of the cancer incidence and mortality in Europe in 2006*. Ann Oncol 2007;18:581-92.

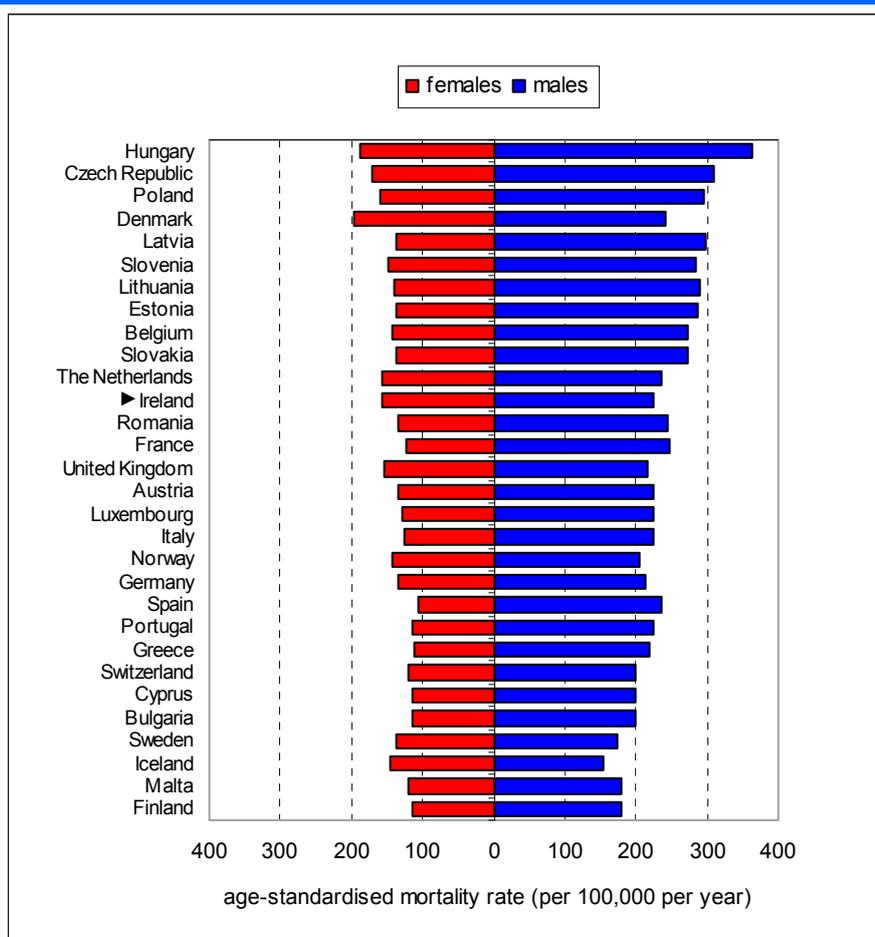
See also: ECO/OEC. European Cancer Observatory, International Agency for Research on Cancer, Lyon, 2009 (<http://eu-cancer.iarc.fr>, last accessed on 4/8/09)

International variation in cancer mortality

Cancer mortality rates in Ireland for 2006 were fairly close to the European average and overall ranked 12th of the 30 countries examined (Figure 2 shows mortality rates for all invasive cancers excluding non-melanoma skin).⁶ However, mortality rates in females were the 5th highest overall compared to the other European counties.

As for incidence, mortality rates for individual cancers varied between countries (data not shown). Comparatively high death rates were found in women in Ireland for breast cancer (ranked 5th) and oesophageal cancer (2nd) as well as melanoma (4th) and non-Hodgkin's lymphoma (1st). Lung cancer deaths in women in Ireland ranked 6th highest in Europe, while mortality rates for lung cancer in men were ranked amongst the lowest in Europe (24th of 30). Death rates from oesophageal cancer and non-Hodgkin's lymphoma in Irish men were also comparatively high and ranked 5th and 2nd highest in Europe respectively. Deaths from bladder and liver cancer as well as lung cancer in men in Ireland were all ranked amongst the lowest of the 30 countries shown.

Figure 2. Estimated cancer mortality in Europe, 2006



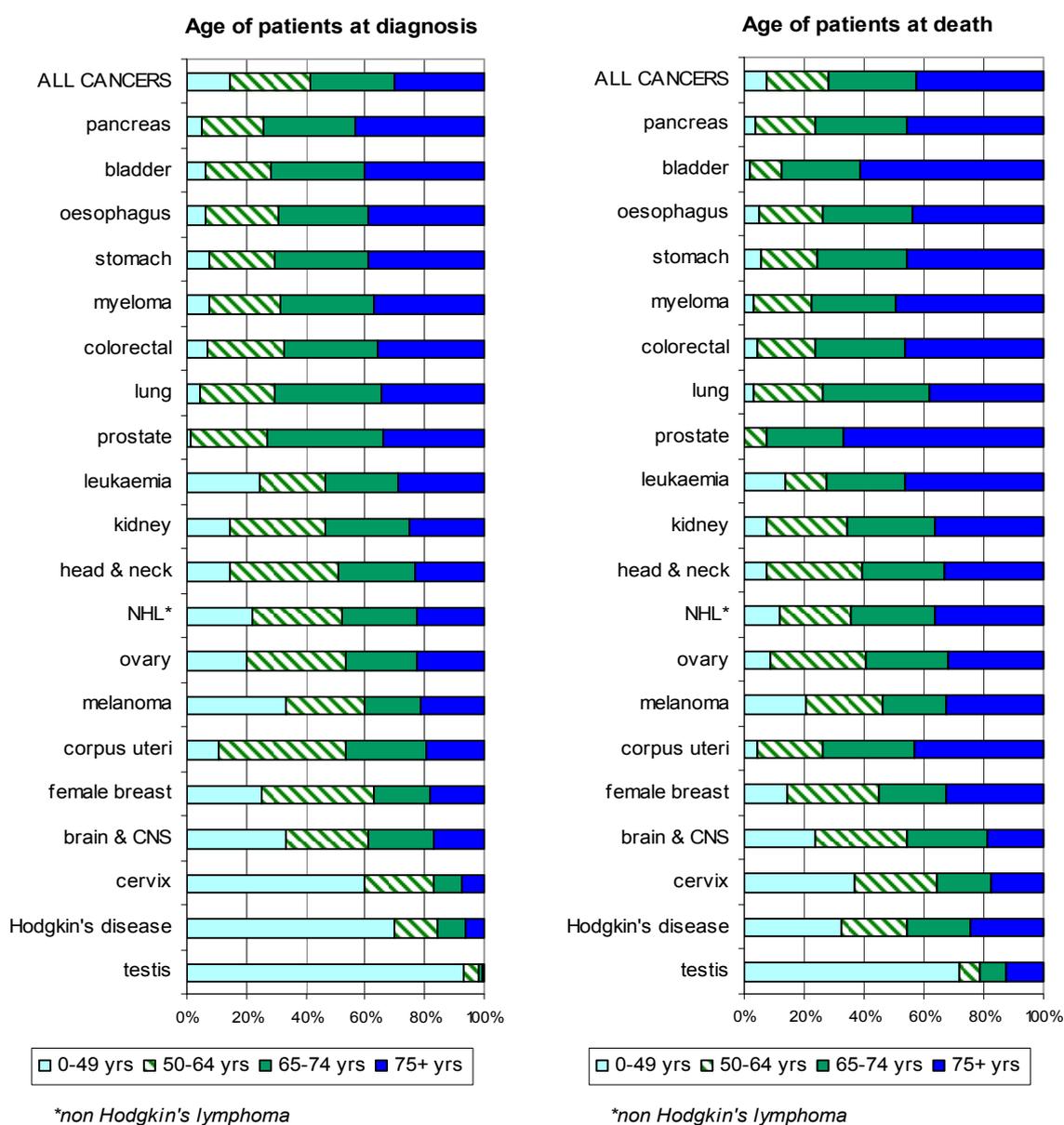
⁶ Ferlay J, Autier P, Boniol M, Heanue Ferlay J, Autier P, Boniol M, Heanue M, Colombet M, Boyle P. *Estimates of the cancer incidence and mortality in Europe in 2006*. Ann Oncol 2007;18:581-92 (World age standardised rates). See also: ECO/OEC. European Cancer Observatory, International Agency for Research on Cancer, Lyon, 2009 (<http://eu-cancer.iarc.fr>, last accessed on 4/8/09)

Age profile of patients at diagnosis and death

The majority of patients were over 65 years of age when first diagnosed with most cancers (Figure 3). Over two-thirds of patients diagnosed with cancers of the digestive system, bladder, lung, prostate or multiple myeloma were at least 65 years at diagnosis. On the other hand, over 60% of patients diagnosed with cancers of the testis, cervix or with Hodgkin's lymphoma were aged under 50 years at diagnosis.

The age distribution of patients at death was broadly similar to that for incident cases but the greater proportion of older patients at death in the case of testicular cancer and Hodgkin's lymphoma indicates the long survival times for these cancers. Although one-quarter of patients diagnosed with prostate cancer were under 65 years at diagnosis, only 8% of all patients who died from the disease were in this age group.

Figure 3. Age composition of patients at diagnosis and death for the main cancer sites; 1994-2007 (cases) and 1994-2006 (deaths)



Time trends

Table 3. Invasive cancer cases (including non-melanoma skin cancer) 1994-2007

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | APC ⁷ |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------------------|
| number of cases | | | | | | | | | | | | | | | |
| female | 8152 | 8051 | 8373 | 8599 | 8550 | 8624 | 9087 | 9260 | 9663 | 10091 | 10419 | 10378 | 10732 | 10971 | 2.5% |
| male | 9068 | 8995 | 9212 | 9360 | 9313 | 9497 | 9973 | 10208 | 10679 | 10979 | 11835 | 11720 | 12235 | 12307 | 2.8% |
| both sexes | 17220 | 17046 | 17585 | 17959 | 17863 | 18121 | 19060 | 19468 | 20342 | 21070 | 22254 | 22098 | 22967 | 23278 | 2.6% |
| incidence rate (cases per 100,000 persons per year, standardized to European standard population) | | | | | | | | | | | | | | | |
| female | 453 | 442 | 453 | 460 | 446 | 446 | 463 | 464 | 478 | 486 | 491 | 479 | 486 | 493 | 0.8% |
| male | 599 | 586 | 595 | 594 | 581 | 587 | 606 | 607 | 621 | 624 | 656 | 632 | 641 | 634 | 0.8% |

The number of new cases of invasive cancer increased from 17220 in 1994 to 23278 in 2007, an annual increase of 2.5% in women and 2.8% in men, but incidence rates increased much less, 0.8% annually for both sexes (Table 3). Table 4 shows time trends—estimated annual percentage change (APC) in rate—for individual cancers as fitted to the data using the Joinpoint program.⁸ There was considerable variation in the overall 1994-2006⁹ time trends between cancer sites, ranging, for women, from an annual increase of 3.7% in kidney cancer incidence to a 2.0% fall in stomach cancer, and for men, from a 4.3% annual increase in melanoma incidence rate to a 2.5% decrease in stomach cancer (Table 4).

Table 4. Time trends (annual percentage change) in cancer incidence rates 1994-2006⁹

| cancer site | females | | males | |
|--------------------|-------------------|------------------|-------------------|------------------|
| | year of diagnosis | APC ⁷ | year of diagnosis | APC ⁷ |
| head and neck* | 1994-2006 | 0.9% | 1994-2000 | -4.6% |
| | | | 2001-2006 | 3.8% |
| oesophagus | 1994-2006 | -1.3% | 1994-2006 | 0.0% |
| stomach | 1994-2006 | -2.0% | 1994-2006 | -2.5% |
| colorectal | 1994-2006 | 0.1% | 1994-2006 | 0.0% |
| pancreas | 1994-2006 | 0.6% | 1994-2006 | -0.1% |
| lung | 1994-2006 | 2.3% | 1994-2006 | -1.1% |
| melanoma | 1994-2006 | 2.3% | 1994-2006 | 4.3% |
| non-melanoma skin* | 1994-2006 | 0.7% | 1994-2000 | -1.8% |
| | | | 2001-2006 | 3.1% |
| breast* | 1994-1998 | 1.3% | 1994-2006 | 2.3% |
| | 1999-2001 | 5.1% | | |
| | 2002-2006 | -1.9% | | |
| cervix | 1994-2006 | 0.6% | | |
| uterus | 1994-2006 | 1.6% | | |
| ovary | 1994-2006 | 0.1% | | |
| prostate* | | | 1994-2003 | 7.9% |
| | | | 2004-2006 | -4.7% |
| kidney* | 1994-2006 | 3.7% | 1994-2001 | 5.5% |
| | | | 2002-2006 | -3.1% |
| bladder | 1994-2006 | -1.4% | 1994-2006 | -2.1% |
| brain and CNS | 1994-2006 | 0.4% | 1994-2006 | 0.1% |
| lymphoma | 1994-2006 | 1.6% | 1994-2006 | 1.9% |
| myeloma | 1994-2006 | 0.4% | 1994-2006 | 0.3% |
| leukaemia* | 1994-2006 | -0.0% | 1994-2003 | 2.8% |
| | | | 2004-2006 | -9.8% |

⁷ APC: (estimated) annual percentage change.

⁸ Joinpoint Regression Program, Version 3.3 - April 2008; Statistical Research and Applications Branch, National Cancer Institute (APC: annual percentage change derived from fitted Joinpoint lines; positive values indicate an increase, negative values a fall, in rate. Trends for the cancers indicated by * were not consistent over the full 13 year period).

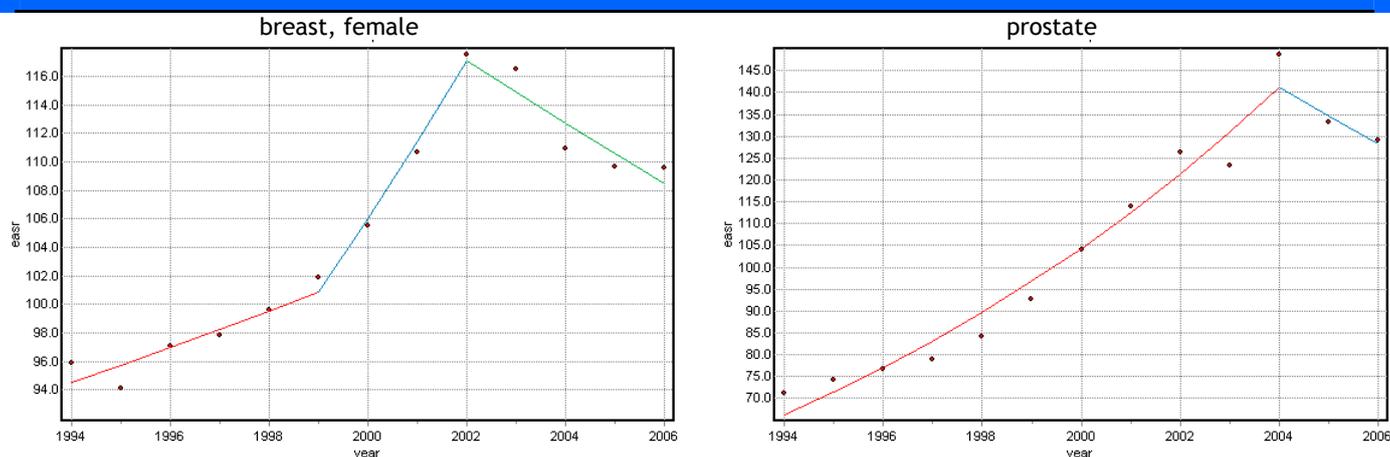
⁹ As 2007 data was not finalised at the time of analysis, it was excluded from these time trend calculations.

For the majority of cancers the relationship between incidence rate and year followed a simple linear trend between 1994 and 2006, but for a small number (marked * in Table 4) the trend changed significantly during this period. For female breast cancer and prostate cancer (Table 4, Figure 4) the effects of screening—organised for breast and opportunistic for prostate—can be seen.

Breast cancer seems to show the expected increase in 2000 following the introduction of BreastCheck, and a decline from 2002, following the end of the first round of screening. This is likely to be reversed as the programme is extended to the rest of the country. For prostate cancer, the downward trend (which has been observed so far for two years only, and may not be sustained) may reflect the fact that most prostate cancers which were detectable by PSA testing have now been picked up.

For the other cancers for which there were changes in trend, the reasons for the change in trend are less clear and may be artefactual. Head and neck cancer is a heterogeneous group of diseases and examination of the various subsites within this group is necessary to understand the trend. The incidence of non-melanoma skin cancer, kidney cancer and leukaemia can be affected by changes in diagnostic practice; the fact that the change in trend was seen for males only suggests that this may be the case.

Figure 4. Time trends (annual percentage change) in incidence per 100,000 persons per year, 1994-2006 (standardised to European standard population) (EASR)¹⁰



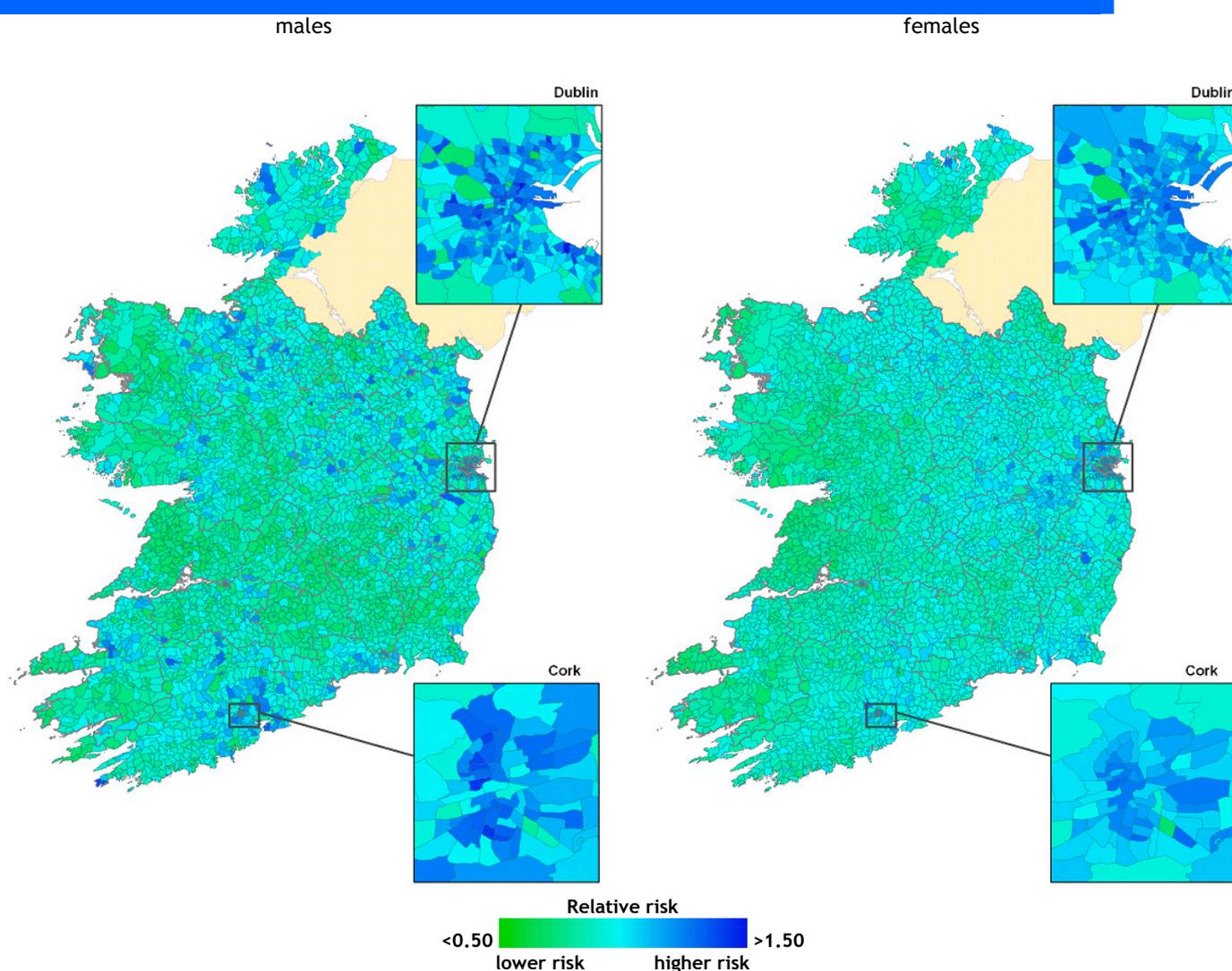
¹⁰ The dots in each graph are the observed incidence rates for each year and the lines the fitted Joinpoint regression lines.

Geographical trends

1. Small area variation

The incidence rate for all invasive cancers combined varied across the country (Figure 5), with the highest incidence rate around the major cities, in the east midlands, northeast and to a lesser extent the northwest. The maps show smoothed incidence data. This means that the risk shown on the map for each electoral district is not the actual incidence for the area, but an estimate based on the observed incidence and that in neighbouring areas. A series of maps and other data on small area variation in common cancers will be contained in an atlas of cancer incidence in Ireland which will be published shortly by the Registry.

Figure 5. Cancer incidence (smoothed relative risk) 1994-2003 by electoral district of residence—all invasive cancers

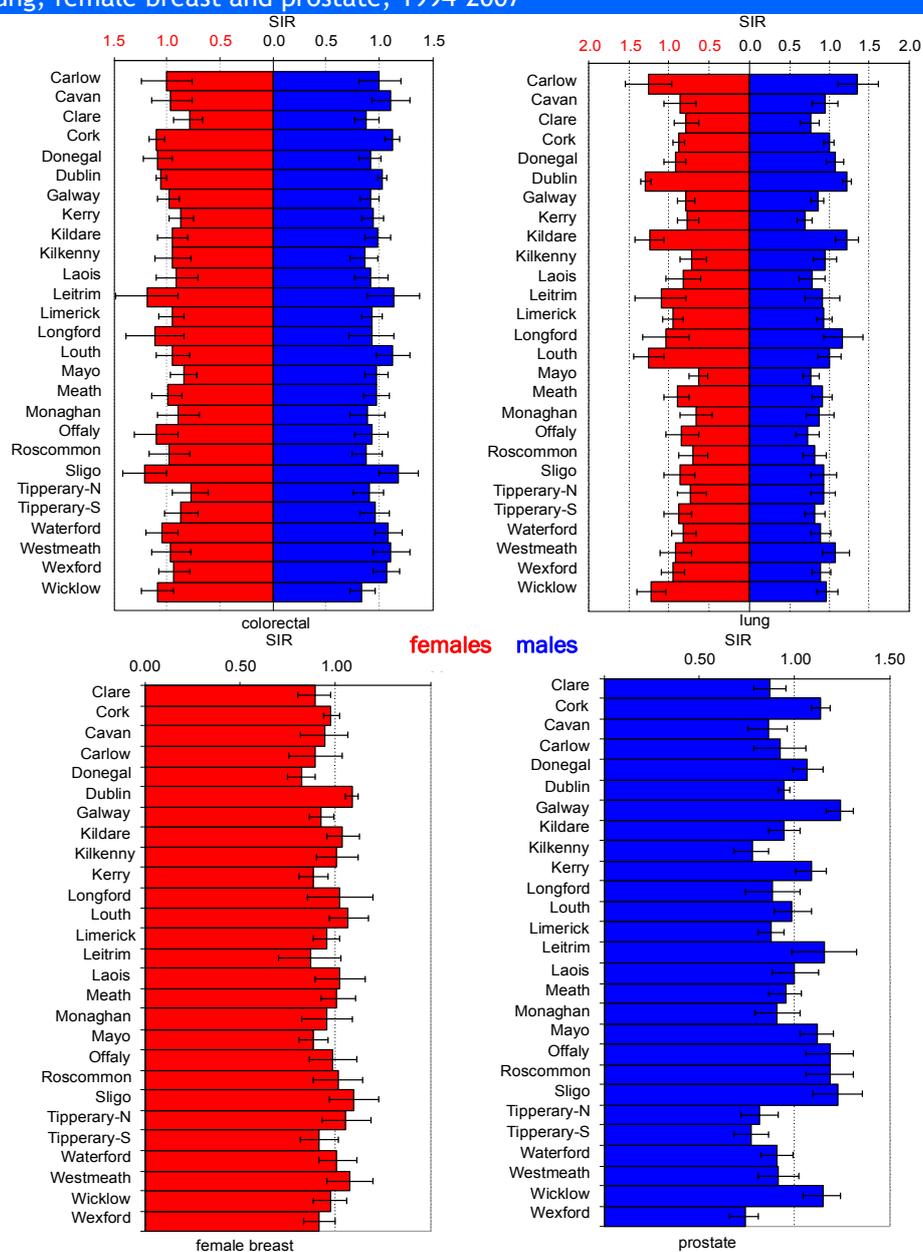


2. Variation by county

Some variation in the incidence of the four main cancer sites—colorectal, lung, female breast and prostate—was observed between counties (Figure 6). Colorectal cancer incidence was statistically significantly higher than the national average in Cork for both males and females, as well as for females in Dublin and Sligo. Statistically low incidence rates were found for females in

Kilkenny and Wicklow as well as for males in Clare, Kerry, Mayo and Tipperary North. Lung cancer incidence was significantly high in Dublin and Kildare for both sexes as well as in Louth and Wicklow for females and in Carlow for males. Statistically significantly low incidence rates were found in both sexes in Clare, Galway, Kerry, Mayo and Roscommon as well as in Laois, Offaly and Tipperary South for men and in Cork, Kilkenny, Monaghan, Tipperary North and Waterford for women. Female breast cancer incidence was significantly higher in Dublin compared to the national average. Counties Clare, Donegal, Galway, Kerry and Mayo had significantly lower than average rates. There was greater variability in incidence between counties for prostate cancer than for the other 3 main cancer sites: statistically significantly high incidence rates were recorded in 8 counties (Cork, Galway, Kerry, Mayo, Offaly, Roscommon, Sligo and Wicklow) and significantly low rates were found in 9 counties (Clare, Cavan, Dublin, Kilkenny, Limerick, Tipperary North and South, Waterford and Wexford).

Figure 6. Standardised Incidence Ratio (SIR) by county of residence for the four main cancers: colorectal, lung, female breast and prostate; 1994-2007



Tumour stage

For each of the four main cancers there was a fall in the relative proportion of late stage or “distant” disease during 2000-2005 compared to 1994-1999 (Figure 7). This was accompanied by an increase in the proportion of earlier stage tumours, particularly in breast and prostate cancer, probably reflecting the increase in screening—organised for breast and opportunistic for prostate—for these cancers. While localised tumours remain infrequent in colorectal cancer, the ratio of regional to distant disease has increased. For lung cancer, the number of cancers which have already spread to distant sites at the time of diagnosis remains high, despite some decrease in recent years. A relatively high number of cancers still do not have full staging information recorded at the time of diagnosis, although this proportion is falling. However, where patients have neo-adjuvant treatment (that is, chemotherapy and/or radiotherapy prior to surgery) cancer staging at the time of surgery is not comparable with the conventional staging described here. Cancers in patients having neo-adjuvant therapy are therefore shown here as “unstaged”.

Figure 7. Extent of disease at diagnosis for colorectal, lung, female breast and prostate cancers; 1994-1999 and 2000-2005

For local, regional and distant tumours, the percentage shown is that of all staged tumours, while for unstaged tumours the percentage given is that of all tumours.

