Patterns of care and survival of cancer patients in Ireland 1994 to 2004

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Summary

Key findings

This report shows marked improvements in treatment and survival of Irish cancer patients over the period 1994-2004. However, geographic disparities in treatment and survival (at the level of HSE administrative area) are still evident, although reduced to some degree. These findings highlight the need to improve access to consistent levels of care for Irish cancer patients, a major aim of the National Cancer Control Programme and the ongoing reorganization of cancer treatment services.

Treatment and stage: key findings

For the major cancers, the percentage of cancer patients treated surgically did not change markedly between 1995-1999 and 2000-2004, the main exception being a 35% relative reduction in surgery for prostate cancer. However, the use of chemotherapy increased considerably for a range of cancers. Radiation therapy became more frequent for some sites (e.g. **colorectal**) but became less used for others (e.g. a slight reduction for **breast**).

A strong dependence of treatment on age persists. The percentage of patients over 80 having surgery remains low and has decreased for **breast cancer** (from 46% to 43%) and for **prostate cancer** (from 43% to 27%). Use of chemotherapy and radiation therapy, although still relatively low, has increased in the over 80s.

Variations in treatment uptake by HSE area are of a similar magnitude as noted previously for the former health board areas. Although treatment tended to be more frequent in the two Dublin areas, this was not consistent either by cancer site or period. Apart from a general increase in the use of chemotherapy, there was little evidence of common time trends in treatment for the most common cancers, or of increased consistency of treatment of patients in different geographical areas.

There was evidence of a reduction in the number of centres performing surgery for five or fewer cases per year of the four most common cancers. There was less evidence of any movement of caseload to larger centres (>20 cases per year), with the exception of breast cancer.

There was only limited evidence of a shift to earlier stage disease between the periods 1995-99 and 2000-2004, mainly involving a significant shift to stage II **prostate cancers** in all regions and to stage I **breast cancers** in women living in the Dublin/Mid-Leinster and Dublin/North-East areas.

Survival: key findings

Relative survival of patients diagnosed with almost all types of cancer showed improvement between the diagnosis periods 1994-1999 and 2000-2004. Statistically significant improvements (age-adjusted) were seen for **all cancers** combined, **colorectal cancers**, cancers of the **lung**, **female breast**, **prostate**, **oesophagus**, **stomach**, **liver**, **gallbladder**, **pancreas**, **testis**, **brain** and **adrenal gland melanoma of skin**, **Hodgkin lymphoma**, **non-Hodgkin lymphoma**, **multiple myeloma** and **leukaemia**. For **breast** and **prostate cancer**, it cannot be ruled out that some of the apparent improvement in survival is an artefact of increases in screening. However, for the most common cancers, improvements in survival were seen across most tumour-stage categories, suggesting improvements in appropriateness or availability of treatment.

Some marked differences in survival were seen during 2000-2004 between different areas of residence or of first treatment, with a range of cancers having significantly lower survival in the Dublin/North-East or (especially) Southern or Western areas compared with Dublin/Mid-Leinster. For **colorectal**, **breast** and **prostate cancers**, area disparities, though still evident, appeared to be reduced compared with the period 1994-1999, reflecting improvements in survival at area scale.

During 2000-2004, **colorectal**, **lung** and female **breast cancer** patients surgically treated in the eight hospitals recently proposed as 'specialist cancer centres' had significantly higher survival compared with other public acute general hospitals, after adjustment for age and stage. Even more markedly, **colorectal**, **prostate** and female **breast cancer** patients in private hospitals had significantly higher survival than those treated in the proposed centres, although interpretation of this finding is difficult because of the possible involvement of socioeconomic factors.

Introduction

Previous reports from the National Cancer Registry (NicAmhlaoibh *et al*. 2004; Walsh & Comber 2006) have identified inequalities in cancer treatment and outcome across Ireland. The 2002 National Cancer Strategy and the 2006 National Cancer Control Strategy (National Cancer Forum 2006) have identified these inequalities as one of the major targets of national health policy.

This report describes the situation with regard to cancer treatment and outcomes in Ireland up to the end of 2004 (including 2005 follow-up). Other recent reports (National Cancer Registry 2006; www.ncri.ie/data) ave described cancer incidence to the end of 2005 and a forthcoming report will update this information to the end of 2006.

The report is based on 138349 malignant cancers diagnosed in the Republic of Ireland over an 11 year period. Treatment and survival of patients diagnosed during 1994-2004 are described, including follow-up to the end of 2005. Particular emphasis is given to changes over time and to geographic variation. As well as variation between areas of residence, comprehensive survival comparisons are, for the first time, made between treatment areas and different categories of hospital. Findings presented here will help assess the effects of the first National Cancer Strategy for Ireland (published in 2002) and provide context for the ongoing reorganization of cancer treatment services in Ireland under the 2006 National Cancer Control Strategy (National Cancer Forum 2006).

A fuller version of this report, including more detailed results for a wider range of cancers, is available online at www.ncri.ie/pubs/pubs.shtml. The full report will not be published in printed form; however, duplicated laser-printed copies can be provided for individuals with no internet access.

Methods

Data preparation and exclusions

Analyses in this report are based on fully malignant cancers among patients aged 15-99 years at diagnosis. Non-melanoma skin cancers (generally non-fatal), cancers identified from only from death certificates or from autopsies, and any second or subsequent cancers in the same patient are excluded from the treatment and survival analyses. Matching of patients to death certificates was used to identify deaths, up to a common follow-up date of 31 December 2005. Each patient was assigned to a HSE (Health Service Executive) administrative area[1] of main residence and, on the basis of dates and types of treatment, to a HSE area of first treatment or other hospital encounter and (where relevant) to a hospital of first surgical treatment.

Stage

Summary data on the completeness and composition of stage data are presented, based on 5th edition AJCC cancer staging rules.

Treatment

Treatment data are presented for the years 1995-2004, based on any *tumour-directed treatment* received *within six months of diagnosis*. No distinction is made between 'curative' and 'palliative' treatment, in part because the distinction is not always clear and the 'purpose' of treatment is often undocumented in hospital notes. However, we have attempted to exclude purely diagnostic procedures (including biopsies), and any non-destructive procedures (e.g. exploratory surgery, or insertion of stents). A six-month window is used to maximise consistency of analyses across years, as treatments received later than six months after diagnosis may be incomplete for earlier years, in particular; also, later treatments may also in some cases involve treatment for recurrences, not always readily separable. For the majority of the cancer and treatment types examined, almost all relevant initial treatment is received within the first six months, although for some cancers (notably prostate cancer) some relevant treatments may be missed by the use of a six-month window. Throughout this report, 'treatment' should be understood to refer to treatment within six months, unless otherwise noted. Regardless of how fully this captures the 'full' treatment of a patient, it does at least provide a common measure that can be compared across years, areas, hospitals and cancers.

[1] Health Service Executive, 2005. *Towards better health.*
See http://www.hse.ie/eng/About_the_HSE/Map_of_Hospital_Networks_and_HSE_Areas.pdf for a map and list of hospitals in each administrative area

Relative survival

Relative survival is defined as the ratio of the survival observed among a group of patients to that expected among the general population of the same age and sex. For cancer patients, it provides a measure of the effect of the *excess mortality* associated with a cancer diagnosis, and provides an indirect alternative to estimation of cause-specific survival. Unlike the latter, however, relative survival does not require knowledge about the cause of death, which may not always be available reliably (e.g. because of errors in the death-certification process). Most commonly, *five-year relative survival* estimates are presented. For example, if average five-year relative survival for patients a with a particular cancer type is 80%, on average 20 out of 100 patients die within five years who would *not otherwise have died*, based on our knowledge of 'background' mortality rates among populations of the same age and sex.

Five-year relative survival estimates are presented for different categories of cancer patients – by *year of diagnosis* (1994-1999 or 2000-2004), *age and cancer stage at diagnosis*, *area of usual residence*, *area in which a patient was first treated*, and *hospital type in which surgical patients first had surgery*. The main estimates presented here are not age-standardized, i.e. differences could relate partly to differences in the age-composition of different patient populations. However, formal statistical comparison between categories is based on *relative survival models* adjusted for age, within the first five years after diagnosis (Dickman *et al*. 2004, 2006). These provide a more solid assessment of differences than simple comparisons of five-year survival estimatess.

Trends in treatment

Surgery

The percentage of patients having surgery increased significantly for 7 cancer sites (14%), including **breast** (slightly), and decreased for 11 (22%), including **colorectal**, **lung** and **prostate** *(see Table S.1* for selected sites*)*. These changes ranged from a 98% relative increase for cancer of the **liver** to a 53% decrease for **mesothelioma**. For 31 (63%) of the cancer sites examined in the full report, there was no significant change in the percentage of patients having surgery. It should be noted that for some cancer types (e.g. haematological malignancies) surgery would rarely be a treatment option.

Chemotherapy

The percentage of patients having chemotherapy increased significantly for 19 cancer sites (39%) and decreased for none. The changes, where statistically significant, ranged from a 26% relative increase for **mesothelioma** to a 3% increase for cancers of the kidney. For 30 (61%) of the cancer sites there was no significant change in the percentage of patients having chemotherapy.

Radiation therapy

The percentage of patients having radiation therapy increased for 7 cancer sites (14%), including **colorectal** and **prostate cancer**, and decreased for 5 (10%), including **breast cancer**. The changes, where statistically significant, ranged from a 47% relative increase for cancers of the **oesophagus** to an 11% fall for cancers of **connective tissue**. For 37 (76%) of the cancer sites examined (including **lung cancer**) there was no significant change in the percentage of patients having radiation therapy.

Table S.1. Changes in percentages of patients treated within 6 months of diagnosis, 1994-1999 to 2000-2004

	1995-1999		2000-2004		change in % treated		
	all cases	% treated	all cases	% treated	absolute	relative	trend[1]
surgery							
stomach (C16)	2254	44%	2108	39%	-5%	-10.5%	↓
colorectal (C18-C21)	8448	77%	9109	75%	-2%	-2.4%	↓
lung (C34)	7218	14%	7786	12%	-2%	-15.2%	↓
melanoma of skin (C43)	1880	94%	2440	91%	-3%	-3.5%	↓
female breast (C50)	8134	84%	10164	85%	1%	1.5%	↑
female genital (C51-C58)	3759	67%	4219	74%	6%	9.5%	↑
prostate (C61)	6080	51%	9800	33%	-18%	-35.1%	↓
bladder (C67)	2146	79%	2118	76%	-2%	-2.6%	
non-Hodgkin lymphoma (C82-C85)	1938	20%	2365	17%	-2%	-11.6%	↓
leukaemia (C91-C95)	-	-	-	-	-	-	*
chemotherapy							
stomach (C16)	2254	10%	2108	25%	15%	160.2%	↑
colorectal (C18-C21)	8448	27%	9109	38%	11%	43.0%	↑
lung (C34)	7218	16%	7786	23%	7%	47.8%	↑
melanoma of skin (C43)	1880	5%	2440	4%	-1%	-18.4%	
female breast (C50) [2]	6610	38%	10164	50%	12%	30.2%	↑
female genital (C51-C58)	3759	26%	4219	35%	8%	32.2%	↑
prostate (C61)	6080	1%	9800	1%	0%	19.7%	
bladder (C67)	2146	6%	2118	13%	7%	108.0%	↑
non-Hodgkin lymphoma (C82-C85)	1938	63%	2365	64%	1%	1.8%	
leukaemia (C91-C95)	1579	41%	1843	43%	1%	3.5%	
radiation therapy							
stomach (C16)	2254	5%	2108	12%	6%	113.0%	↑
colorectal (C18-C21)	8448	11%	9109	16%	5%	43.1%	↑
lung (C34)	7218	32%	7786	33%	1%	1.8%	
melanoma of skin (C43)	1880	2%	2440	2%	-1%	-21.3%	
female breast (C50)	8134	43%	10164	41%	-2%	-5.7%	↓
female genital (C51-C58)	3759	24%	4219	26%	1%	6.1%	
prostate (C61)	6080	7%	9800	14%	8%	115.7%	↑
bladder (C67)	2146	9%	2118	9%	0%	-2.7%	
non-Hodgkin lymphoma (C82-C85)	1938	19%	2365	15%	-4%	-20.9%	↓
leukaemia (C91-C95)	1579	2%	1843	2%	0%	3.7%	

1. ↑=statistically significant increase ↓=statistically significant increase * insufficient data

2. 1996-2004 for breast cancer chemotherapy

Treatment, age and period of diagnosis

Surgery

The percentage of patients having surgery decreased with age for the four commonest cancers *(Table S.2)*. The largest decrease with age was for **lung cancer**, where the percentage of patients of 80 years and over having surgery was only one-tenth of the percentage aged under 50. There were no significant changes in the percentage of patients of 80 and older having surgery between 1995-1999 and 2000-2004, with the exception of **prostate cancer**, for which the percentage having surgery fell from 43% to 27% (χ^2=81.1; p<0.001), while remaining unchanged for younger patients.

Chemotherapy

The percentage of patients having chemotherapy decreased with age more markedly than did the percentage having surgery, for the three commonest cancers. **Prostate cancer** is omitted, as the overall percentage having chemotherapy was only 1%. The decrease with age was similar for the other three major cancers, with the percentage of patients of 80 years and over having chemotherapy being less than one-tenth of the percentage aged under 50. There were significant increases in the percentage of patients of 80 and older having chemotherapy between 1996-1999 and 2000-2004 for **breast cancer** (χ^2=5.1, p<0.05) and between 1995-1999 and 2000-2004 for **colorectal cancer** (χ^2=25.8, p<0.001), but the largest increases were for patients in their 60s.

Radiation therapy

Radiation therapy use decreased much less with age than did surgery or chemotherapy. The largest decrease with age was for **prostate cancer**, and the smallest for **lung cancer**. There were significant increases in the percentage of patients of 80 and older having radiation therapy between 1995-1999 and 2000-2004 for **colorectal cancer** (χ^2=39.8, p<0.001), **lung cancer** (χ^2=7.1, p=0.008) and **prostate cancer** (χ^2=4.6, p=0.031).

Table S.2. Percentage of cancers treated surgically within 6 months of diagnosis, by patient age and period of diagnosis

	colorectal		lung		breast (female)		prostate	
	1995-1999	2000-2004	1995-1999	2000-2004	1995-1999[1]	2000-2004	1995-1999	2000-2004
surgery								
patients under 50	84%	81%	23%	19%	92%	93%	64%	50%
patients 80 and over	61%	61%	2%	2%	46%	43%	43%	27%
ratio of rate in 80+ patients to that in under 50s	0.72	0.75	0.09	0.11	0.50	0.47	0.67	0.54
chemotherapy								
patients under 50	51%	63%	31%	42%	60%	68%	--	--
patients 80 and over	2%	5%	2%	4%	2%	4%	--	--
ratio of rate in 80+ patients to that in under 50s	0.04	0.08	0.07	0.09	0.04	0.06	--	--
radiation therapy								
patients under 50	19%	23%	43%	41%	51%	43%	16%	18%
patients 80 and over	3%	7%	16%	20%	16%	15%	2%	3%
ratio of rate in 80+ patients to that in under 50s	0.14	0.31	0.36	0.48	0.31	0.35	0.10	0.15

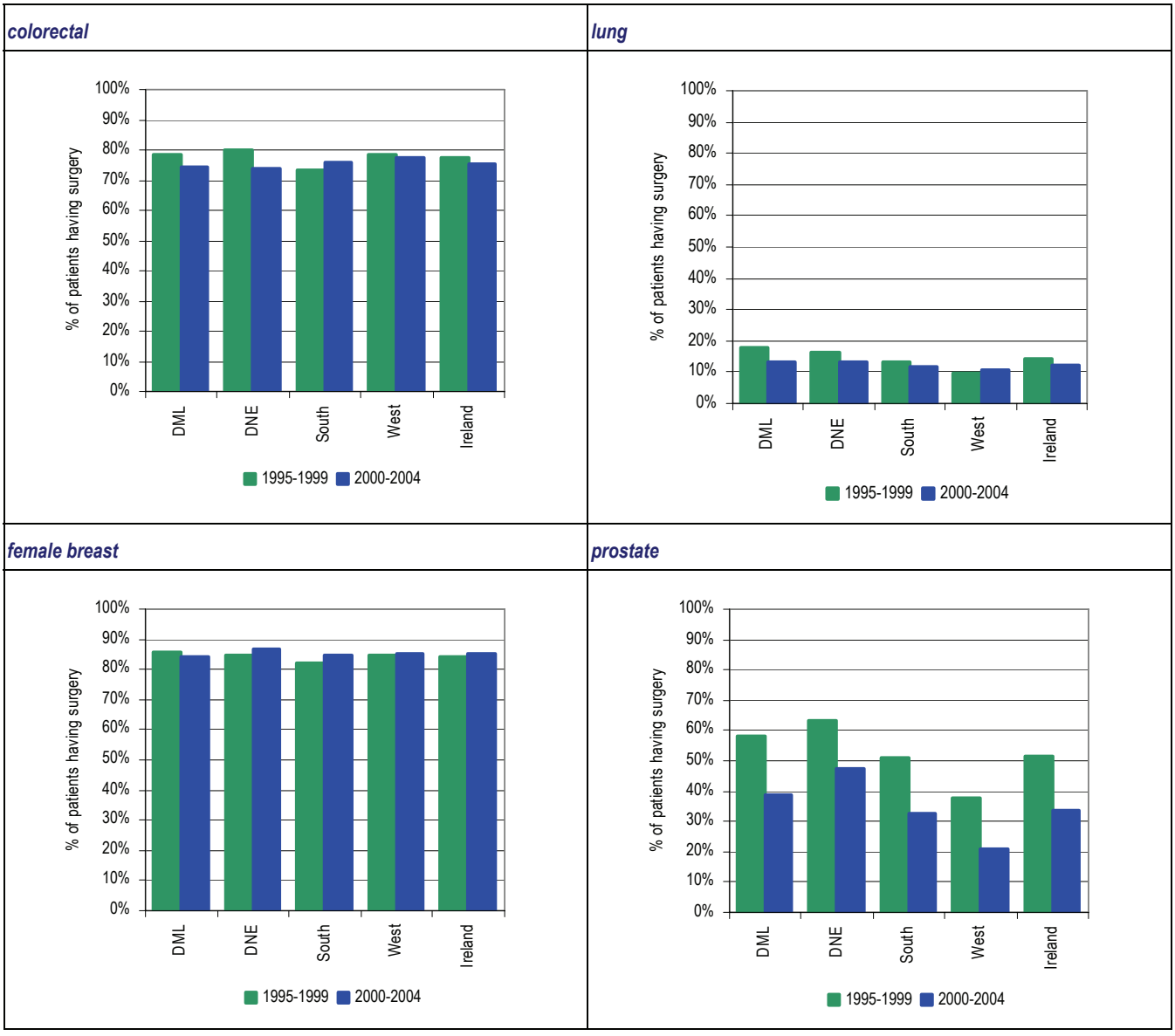
[1] 1996-1999 for chemotherapy

Treatment, HSE area of residence and period of diagnosis

Surgery

The percentage of patients having surgery for **colorectal cancer** in 1995-99 was highest in the Dublin/North-East area and in the West in 2000-2004 *(Figure S.1)*. There was a fall in the percentage treated in all areas but the Southern between 1995-1999 and 2000-2004. The percentage treated was quite similar in all areas in 2000-2004, ranging from 74.1% in Dublin/North-East to 75.8% in the South. Far fewer patients had surgery for **lung cancer**; the lowest percentage in both periods was in the West. While the overall percentage fell between 1995-1999 and 2000-2004, it increased in the South and West, so that in 2000-2004 the differences between areas were less than in 1995-1999. There was little difference between areas in the percentage of patients having surgery for **breast cancer**, which ranged from 82.3% in the South to 86.1% in Dublin/Mid-Leinster in 1995-1999 and from 84.1% in Dublin/Mid-Leinster to 86.9% in Dublin/North-East in 2000-2004. As with other cancers, the differences between areas became smaller in the later period. The percentage of patients having surgery for **prostate cancer** fell in all areas between 1995-1999 and 2000-2004. The highest percentage in both periods was in Dublin/North-East and the lowest was in the West. Unlike the other major cancers, the relative differences between areas increased between 1995-1999 and 2000-2004.

Figure S.1. Percentage of cancers treated by surgery within 6 months of diagnosis—by HSE area of residence and period of diagnosis

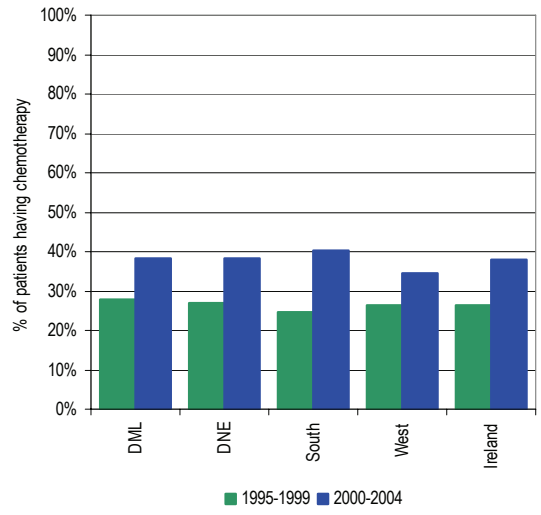


Chemotherapy

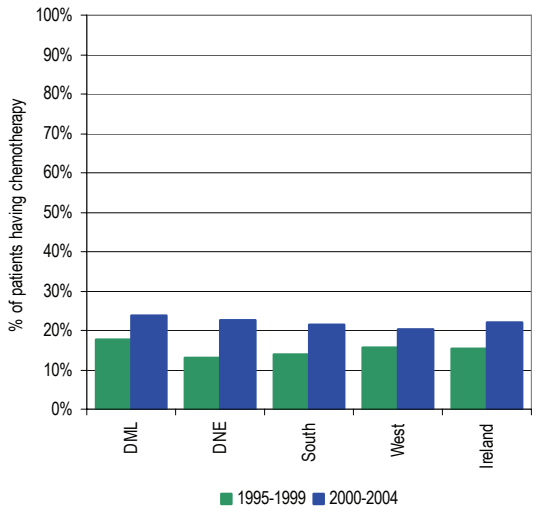
The percentage of patients having chemotherapy for **colorectal cancer** increased considerably between 1995-1999 and 2000-2004 (*Figure S.2*). The increase was least in the West, which had the lowest level of chemotherapy in 2000-2004, and greatest in the South. The percentage of patients having chemotherapy for **lung cancer** also increased between 1995-1999 and 2000-2004. The largest increase was in Dublin/North-East and the smallest in the West, and the differences between areas were much smaller in 2000-2004. As with colorectal and lung cancer, the percentage of patients having chemotherapy for **breast cancer** increased in all areas between 1996-1999[1] and 2000-2004. The increases were greater in the South and West areas, with the percentage treated in the West increasing from 34% to 52%. Only 1.2% of **prostate cancer** patients in 1995-1999 and 1.4% in 2000-2004 had chemotherapy, so examination of area or temporal patterns was not informative.

Figure S.2. Percentage of cancers treated by chemotherapy within 6 months of diagnosis —by HSE area of residence and period of diagnosis

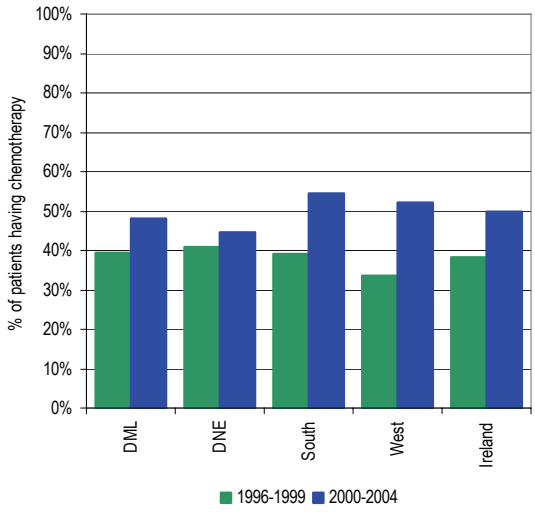
colorectal



lung



female breast (from 1996)[1]



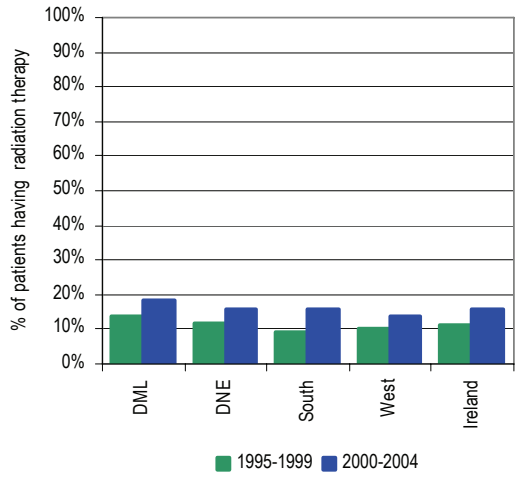
[1] 1995 chemotherapy data excluded for this cancer

Radiation therapy

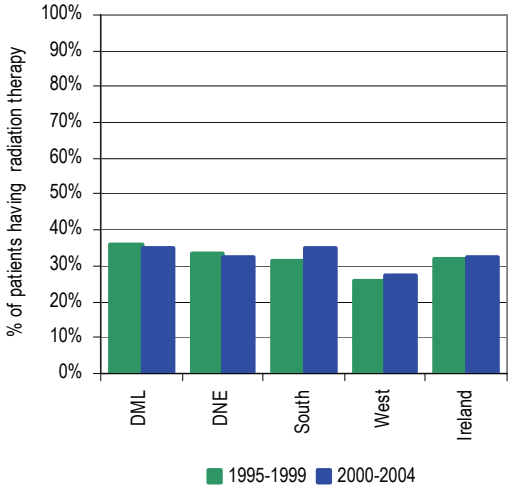
Radiation therapy was relatively uncommon for **colorectal cancer**, but increased in frequency in all areas between 1995-1999 and 2000-2004. The lowest level in 1995-1999 was in the South and in 2000-2004 in the Western area (*Figure S.3*). Apart from the increase in the Southern area, the differences between areas persisted. A far smaller percentage of patients had radiation therapy for **lung cancer** in the West than in other areas, in both periods. The use of this therapy increased in the Southern and Western areas between 1995-1999 and 2000-2004 but fell slightly in Dublin/Mid-Leinster and Dublin/North-East. The variation between areas in radiation therapy was largest for **breast cancer**. The lowest level of treatment in both periods was in the West. The overall percentage treated fell between 1995-1999 and 2000-2004 in all areas but Dublin/North-East. Radiation therapy was infrequent for **prostate cancer**, and was much most common in the South, particularly in 2000-2004, where the level of treatment was 50% above the national average and more than twice that in Dublin/Mid-Leinster and Dublin/North-East.

Figure S.3. Percentage of cancers treated by radiation therapy within 6 months of diagnosis —by HSE area of residence and period of diagnosis

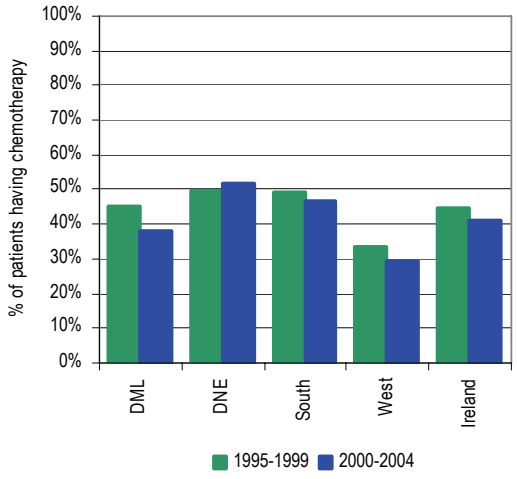
colorectal



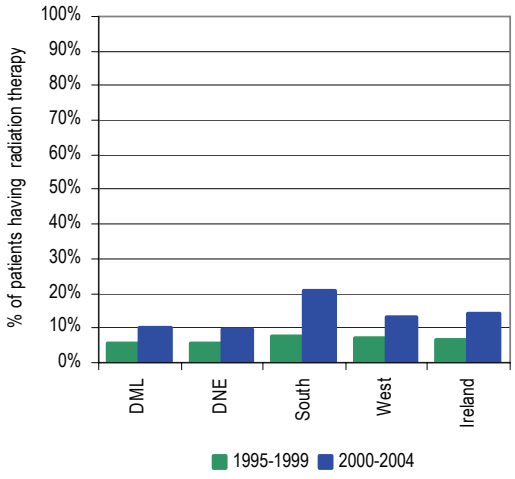
lung



female breast



prostate



Hospitals providing cancer surgery within six months of diagnosis

The total number of hospitals in which **colorectal cancer** surgery was carried out fell over the period studied *(Table S.3)* from 52 in 1995 to 48 in 2003, but rose to 53 in 2004. Public acute hospitals accounted for a consistent 37-38 of these hospitals. The total number of hospitals in which **lung cancer** surgery was carried out varied over the period studied, with no perceptible time trend. This was also true of public hospitals considered separately. The total number of hospitals in which **breast cancer** surgery was carried out fell from 53 in 1995 to 42 in 2004, almost all of this fall being since 2001. The number of public acute hospitals providing breast surgery also fell, from 37 in 1994 to 31 in 2004, accounting for more than 50% of the total fall in hospital numbers. There was some year-to-year variation in the total number of hospitals in which **prostate cancer** surgery was carried out, and a slight downward trend. Most of this fall was due to a decrease in the number of public acute hospitals providing prostate cancer surgery, from 27 in 1994 to 24 in 2004.

Table S.3. Number of hospitals in which surgery was performed—by HSE area of residence and period of diagnosis

year of diagnosis	all hospitals				public acute hospitals			
	colorectal	lung	breast (female)	prostate	colorectal	lung	breast (female)	prostate
1995	52	12	53	39	37	9	37	27
1996	49	13	53	40	37	9	37	27
1997	52	9	55	39	37	7	37	27
1998	48	15	54	39	37	12	37	28
1999	49	11	54	36	37	8	37	25
2000	50	12	50	34	37	8	37	23
2001	49	15	51	35	37	9	37	24
2002	51	14	49	34	38	10	35	23
2003	48	12	47	33	37	10	34	23
2004	53	14	42	35	38	9	31	24

Hospital surgical caseload

Colorectal cancer

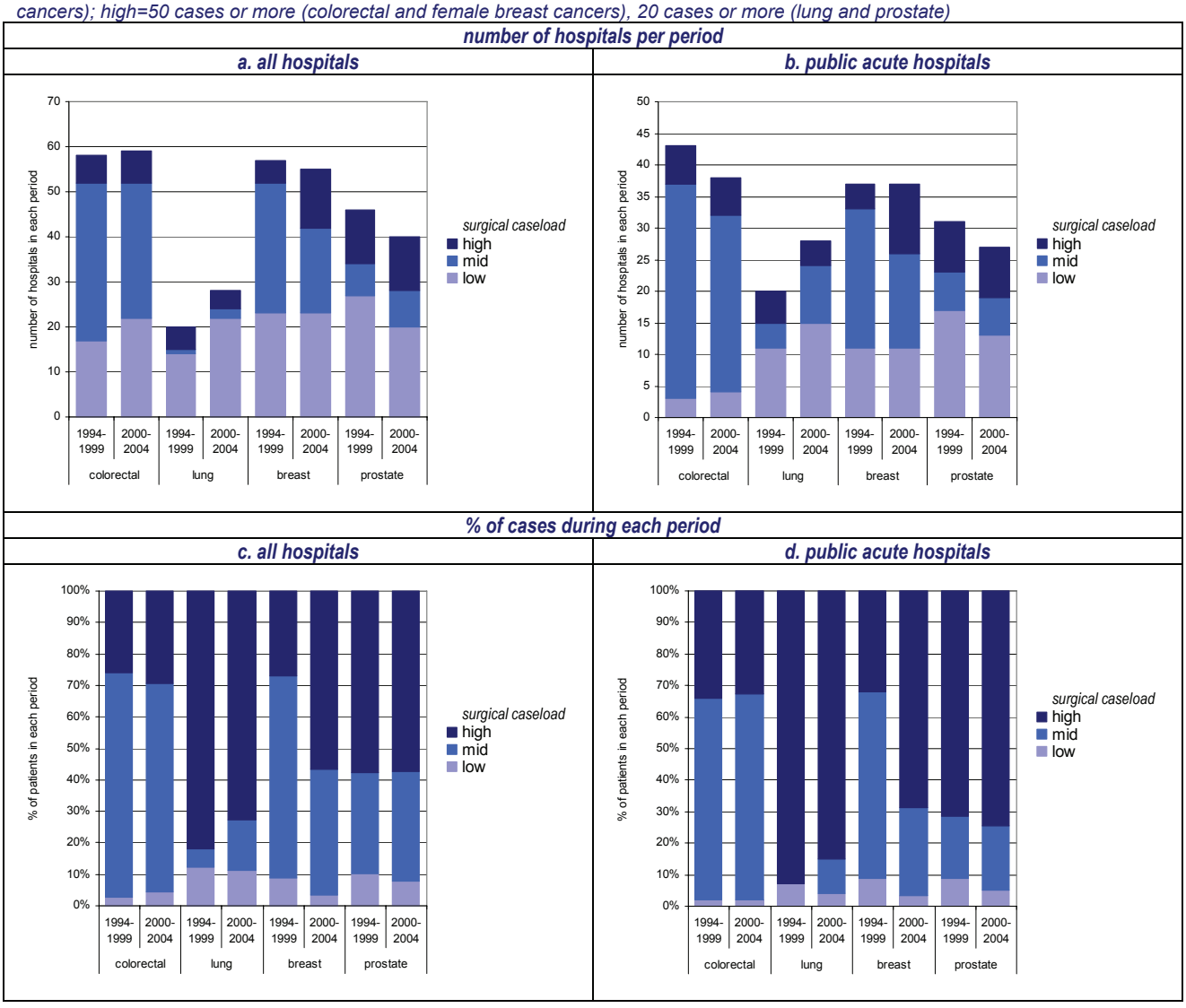
There was little change in the distribution of hospital surgical caseload between 1995-1999 and 2000-2004, although there was some evidence of an unexpected shift to lower caseload hospitals.

There were six 'high' surgical caseload hospitals (50 or more cases per year) in 1995-1999, and seven in 2000-2004 (*Figure S.4a)*. The percentage of patients treated at these hospitals increased slightly, from 26% to 29%, between 1995-1999 and 2000-2004 *(Figure S.4c)*. The number of 'low' surgical caseload hospitals (fewer than 10 cases annually) increased from 17 to 22, and the percentage of patients treated in these hospitals increased slightly, from 3% to 4%. The number of hospitals with caseloads in the mid-range (10-49 surgical cases per year) fell from 35 to 30.

All but one of the 'high' surgical caseload hospitals was a public hospital (*Figure S.4b).* The percentage of patients treated in 'high' caseload public hospitals fell very slightly, from 34% to 33%, but this concealed differences between areas—an increase from 27% to 45% in the Dublin/Mid-Leinster area and a fall from 37% to 21% in the West (data not shown; see full report). These changes were balanced by changes in the numbers treated in 'mid-range' hospitals. The percentage of patients treated in 'low' surgical caseload public hospitals remained low, and unchanged, at 2% overall *(Figure S.4d)*.

Figure S.4. Hospitals where surgery was performed—numbers of hospitals and patients treated, by period of diagnosis and surgical caseload

***Surgical caseload**: low=0-9 cases/year; mid=10-49 cases per year (colorectal and female breast cancers); 10-19 (lung and prostate cancers); high=50 cases or more (colorectal and female breast cancers), 20 cases or more (lung and prostate)*



Lung cancer

There was little change in the distribution of hospital surgical caseload between 1995-1999 and 2000-2004, although there was some evidence of a shift to lower surgical caseload hospitals.

There were five 'high' surgical caseload hospitals (20 or more cases per year) in 1995-1999, and 4 in 2000-2004 (*Figure S.4a)*. The percentage of patients treated at these hospitals fell from 82% to 73%, between 1995-1999 and 2000-2004 *(Figure S.4c)*. The percentage of patients treated at hospitals with a caseload of 50 or more cases per year also fell, from 31% to 29% (data not shown).The number of 'low' surgical caseload hospitals (fewer than 10 cases annually) increased from 14 to 22, while the percentage of patients treated in these hospitals fell slightly, from 12% to 11%. However it should be noted that 7 hospitals in 1995-1999 and 13 in 2000-2004 were registered as treating only one patient surgically during that period, which would account for most of the increase. The number of hospitals with caseloads in the mid-range (10-19 surgical cases per year) increased from 1 to 2, and the number of patients increased from 6% to 16% of the total.

All of the 'high' surgical caseload hospitals were public (*Figure S.4b).*The percentage of patients treated in 'high' caseload public hospitals fell from 93% to 85%. The percentage of patients treated who were seen at hospitals with a caseload of 50 or more cases per year also fell, from 36% to 34% (data not shown). The percentage of patients treated in 'low' surgical caseload hospitals increased from 4% to 7% *(Figure S.4d)*. The number of 'low' caseload public hospitals increased from 11 to 15, but if those treating only a single case during the period are excluded, the number was 5 in 1994-1999 and 4 in 2000-2004.

Female breast cancer

There was evidence of a significant shift of surgical management of breast cancer from hospitals with a surgical caseload under 50 annually to those with higher caseloads between 1995-1999 and 2000-2004, particularly in public hospitals.

There were five 'high' surgical caseload hospitals (50 or more cases per year) in 1995-1999, and 13 in 2000-2004 (*Figure S.4a)*. The percentage of patients treated at these hospitals increased considerably, from 27% to 57%, between 1995-1999 and 2000-2004 *(Figure S.4c)*. The number of 'low' surgical caseload hospitals (fewer than 10 cases annually) remained at 23, while the percentage of patients treated in these hospitals fell from 9% to 4%. The number of hospitals with caseloads in the mid-range (10-49 surgical cases per year) fell from 29 to 19, and the number of patients fell from 64% to 40% of the total.

Most of the 'high' surgical caseload hospitals were public (*Figure S.4b)*, 4 of 5 in 1994-1999 and 11 of 13 in 2000-2004.The percentage of patients treated in 'high' caseload public hospitals increased from 32% to 69%. The percentage of patients treated in 'low' surgical caseload hospitals fell from 9% to 3% *(Figure S.4d)*. The number of 'low' caseload public hospitals remained at 11 in both periods. The number of 'mid-range' caseload hospitals fell from 22 to 25 and the percentage of patients treated fell from 59% to 28%.

Prostate cancer

There was little overall change in the distribution of surgical caseload for prostate cancer over the period studied.

There were twelve 'high' surgical caseload hospitals (20 or more cases per year) in both periods (*Figure S.4a)*. The percentage of patients treated at these hospitals fell very slightly, from 58% to 57%, between 1995-1999 and 2000-2004 *(Figure S.4c)*.The number of 'low' surgical caseload hospitals (fewer than 10 cases annually) fell from 27 to 20, while the percentage of patients treated in these hospitals fell from 10% to 8%. The number of hospitals with caseloads in the mid-range (10-19 surgical cases per year) increased from 7 to 8, and the number of patients increased from 32% to 35% of the total.

Eight public hospitals were in the 'high' surgical caseload category in both periods (Figure S.4b). The percentage of patients treated in these hospitals increased slightly, from 71% to 74%, while the percentage treated in 'low' surgical caseload hospitals fell from 9% to 5% *(Figure S.4d)*. The number of 'mid-range' caseload hospitals remained at 6 throughout the two periods described, and the percentage of patients treated was also unchanged, at 20%.

Stage at diagnosis

Cancers are staged by the Registry using the TNM system. Sometimes a stage (clinical or pathological) is explicitly given in the medical record, but in most cases the stage is derived by our registration officers from information in the record, mainly pathology, operation and imaging reports. Cancers described in this section as 'unstaged' were those for which a stage could not be assigned, due to lack of information in the record. The use of the term 'unstaged' does not necessarily imply that the cancer stage was unknown to the treating clinicians(s), but only that the information could not be retrieved by chart review. Because of the uneven recording of distant metastasis (and to a lesser extent of regional-nodal metastasis), the stage data in this section is based on the assumption that if the medical record had no information on these, they had not occurred. This is quite an optimistic interpretation of the situation and leads to an over-reporting of early stage cancer. However, this seemed the most consistent method of allowing for differences in the completeness of staging over time and between hospitals. A more rigorous approach has been adopted in the sections on survival. The 'unstaged' category also contains a small number of cancers (generally non-epithelial) for which staging was inappropriate due to their histological type.

Colorectal cancer

There was a significant increase in the proportion of Stage III **colorectal** cancer cases between 1995-1999 and 2000-2004, and a smaller increase in Stage IV cases with matching, but not significant, falls in Stage I and Stage II disease. The latter was statistically significant if non-staged cancers were excluded. The percentage of cancers for which stage was not available did not change significantly between periods *(Figure S.5)*.

Lung cancer

For **lung** cancer the proportion of Stage I and II cases fell (although the former was only statistically significant if unstaged cases were excluded) while the proportion of Stage III and IV cases increased. Some of this stage shift may be due to the availability of more complete stage data on late stage cancers, rather than real changes in stage at presentation. There was a significant fall in the percentage of unstaged cases.

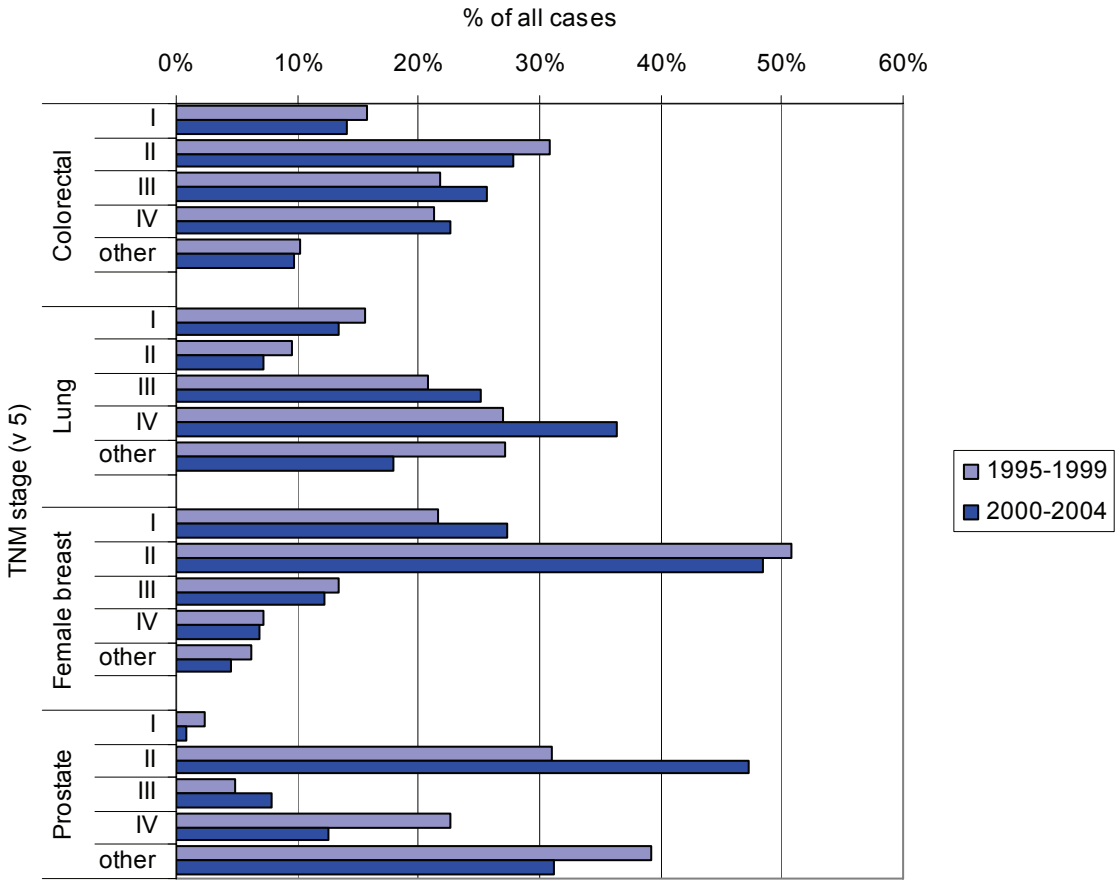
Female breast cancer

There was an increase in the proportion of Stage I **female breast** cancer cases and a fall in Stage II cases, but no significant decrease in late stage cancers. The proportion of unstaged cases, which was already low, fell significantly between 1995-1999 and 2000-2004.

Prostate

There was a large and statistically significant increase in Stage II **prostate** cancer cases and a smaller but also significant increase in Stage III cancer, with a fall in Stage IV disease. The proportion of unstaged cases was high, but fell significantly between 1995-1999 and 2000-2004.

Figure S.5. Stage for the four commonest cancers, by period of diagnosis



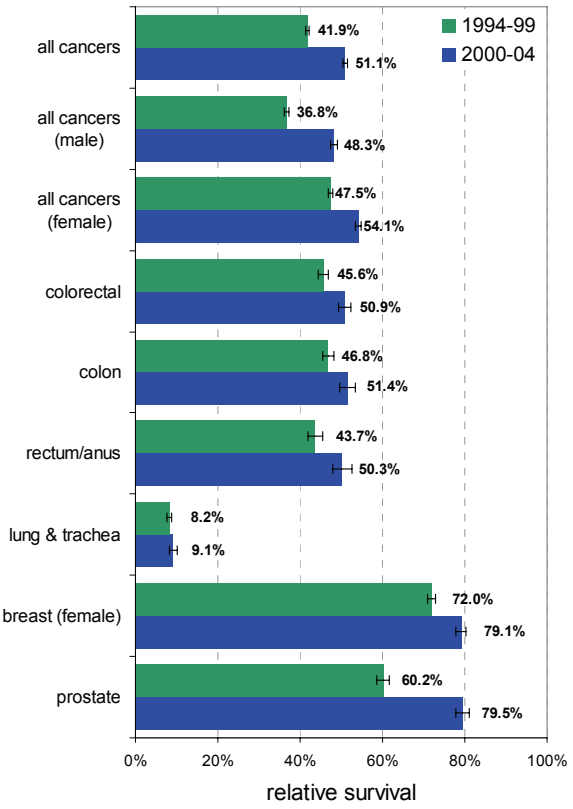
National estimates of relative survival, including time-trends

Estimates of five-year relative survival are presented below (*Figure S.6*) for a range of cancers in patient aged 15-99 years, for the diagnosis periods 1994-1999 and 2000-2004 (with follow-up to 31 December 2005). For cancers as a whole (excluding the usually non-fatal non-melanoma skin cancers), five-year survival averaged 51% for patients diagnosed in the most recent period, although figures for specific cancers varied markedly – e.g. average five-year survival of 6% for **pancreatic cancer** but 96% for **testicular cancer**.

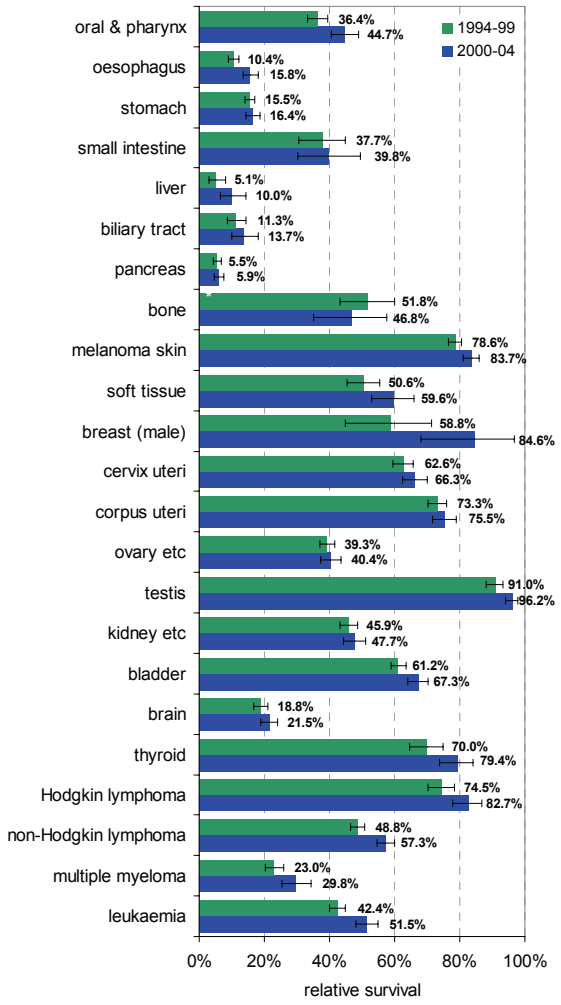
Statistically significant improvements in survival were seen for cancers as a whole and for the four most important cancers in healthcare terms— **colorectal**, **lung**, **prostate** and female **breast cancer**. However, absolute improvements in survival were only minor for **lung cancer**, for which survival remains very low. Most other cancers also showed evidence of improvements in survival, and these were statistically significant for cancers of the **mouth and pharynx**, **oesophagus**, **stomach**, **liver**, **biliary tract** (also **gallbladder** specifically), **pancreas**, and **accessory sinuses**, **melanoma of skin**, cancers of the **testis**, **brain**, and **adrenal gland**, **Hodgkin lymphoma**, **non-Hodgkin lymphoma**, **multiple myeloma**, and **leukaemia**.

Figure S.6. Five-year relative survival, by year of diagnosis: 1994-1999 v. 2000-2004. 95% confidence intervals of estimates are shown.

major cancers



other cancers

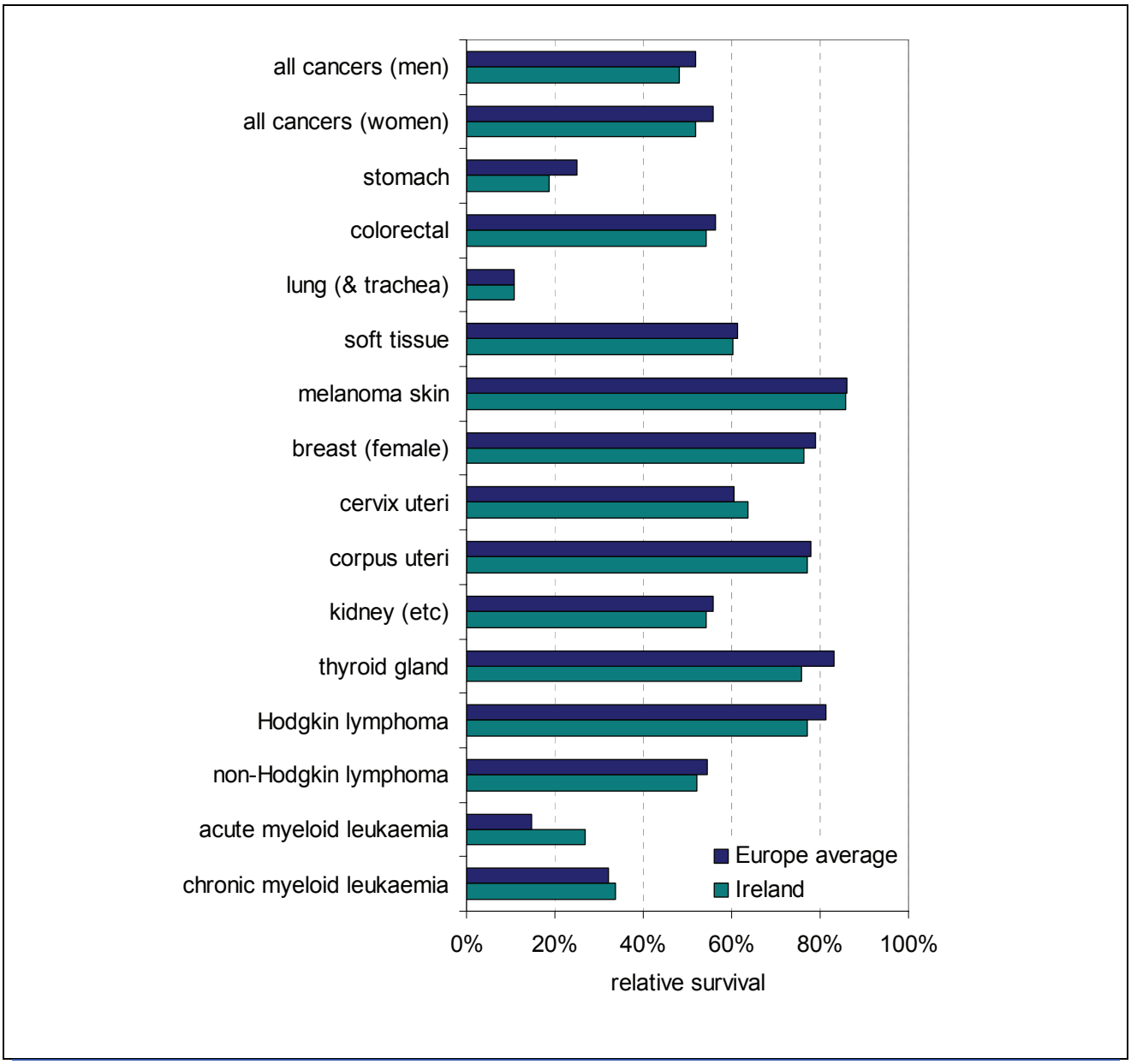


Comparison of survival between Ireland and other European countries

As part of the collaborative EUROCARE-4 study, to which Ireland contributed data, national comparisons of five-year relative survival were made by Verdecchia *et al.* (2007) for the years 2000-02. This was a 'period analysis', based on patients diagnosed during 2000-02, with follow-up to the end of 2003, supplemented by follow-up during 2000-03 of any patients surviving into that period from earlier diagnosis years. (More up-to-date figures for Ireland are provided elsewhere in the present report.)

Results from that study were published for 16 cancer types in up to 21 countries, and for male and female cancers as a whole, but survival estimates were not published for Irish patients with **prostate** and **testicular cancers** because of sparse data in the youngest and oldest age-groups, respectively. For the other cancers included, a summary is provided below *(Figure S.7)*. For most cancers (the exceptions being **lung cancer**, **cervical cancer** and **myeloid leukaemias**), survival estimates for Irish patients were slightly lower than the European average. Within Europe as a whole, survival figures varied markedly, and were generally lowest in former Eastern Bloc countries, the UK countries and Ireland. Ireland was in the top four or five countries for only two of the cancers included – **acute myeloid leukaemia** (for which Ireland had the highest recorded survival) and **chronic myeloid leukaemia**.

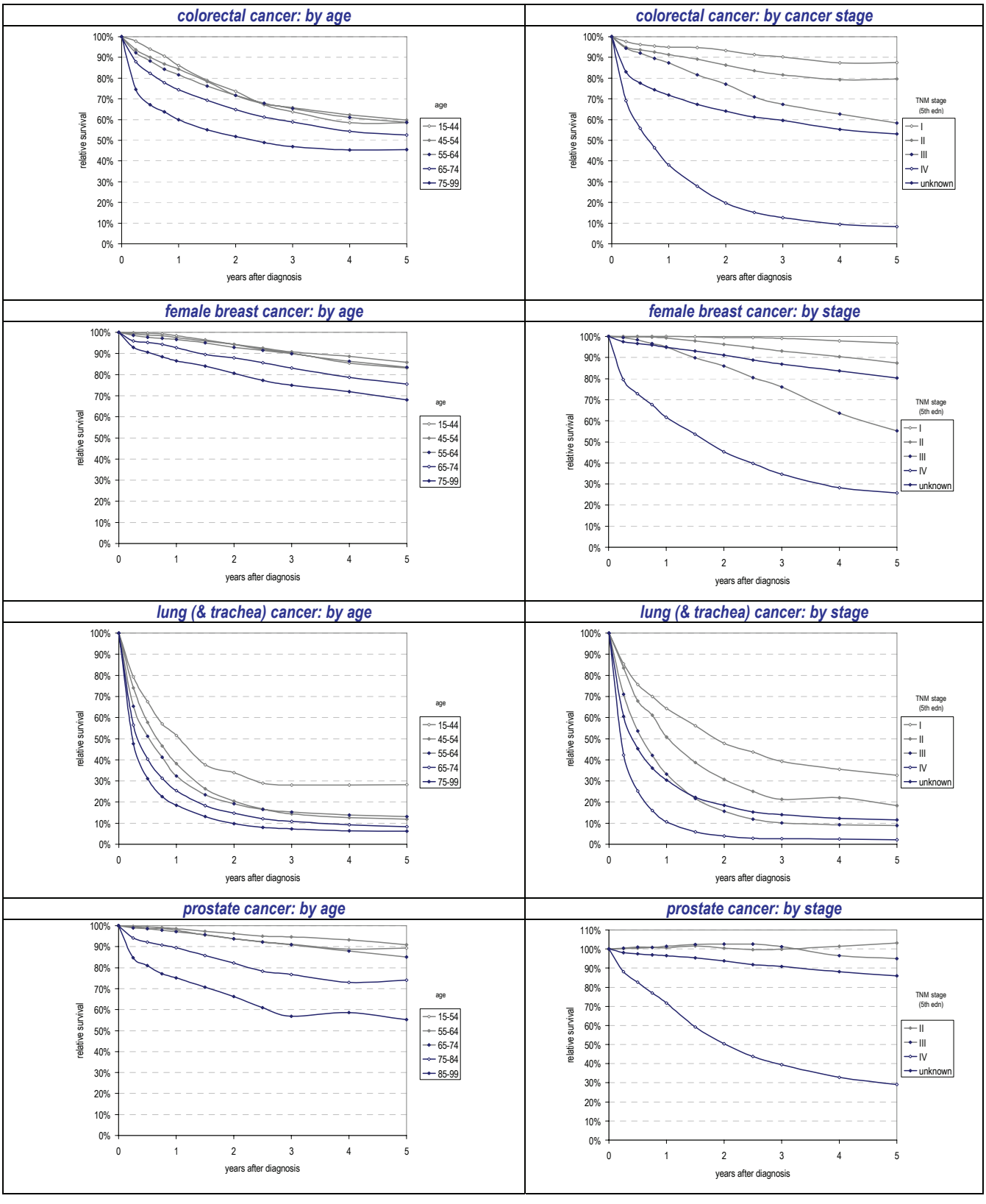
Figure S.7. Five-year relative survival (age-standardized), 2000-2002: European (average) and Ireland (Verdecchia et al. 2007).



Variation in survival by age and stage at diagnosis

Relative survival curves by age and stage are shown for the four major cancers below *(Figure S.8)*.

Figure S.8. Relative survival of Irish cancer patients diagnosed during 2000-2004: by age (EUROCARE age-groups) and cancer stage (TNM 5th edition) at diagnosis.

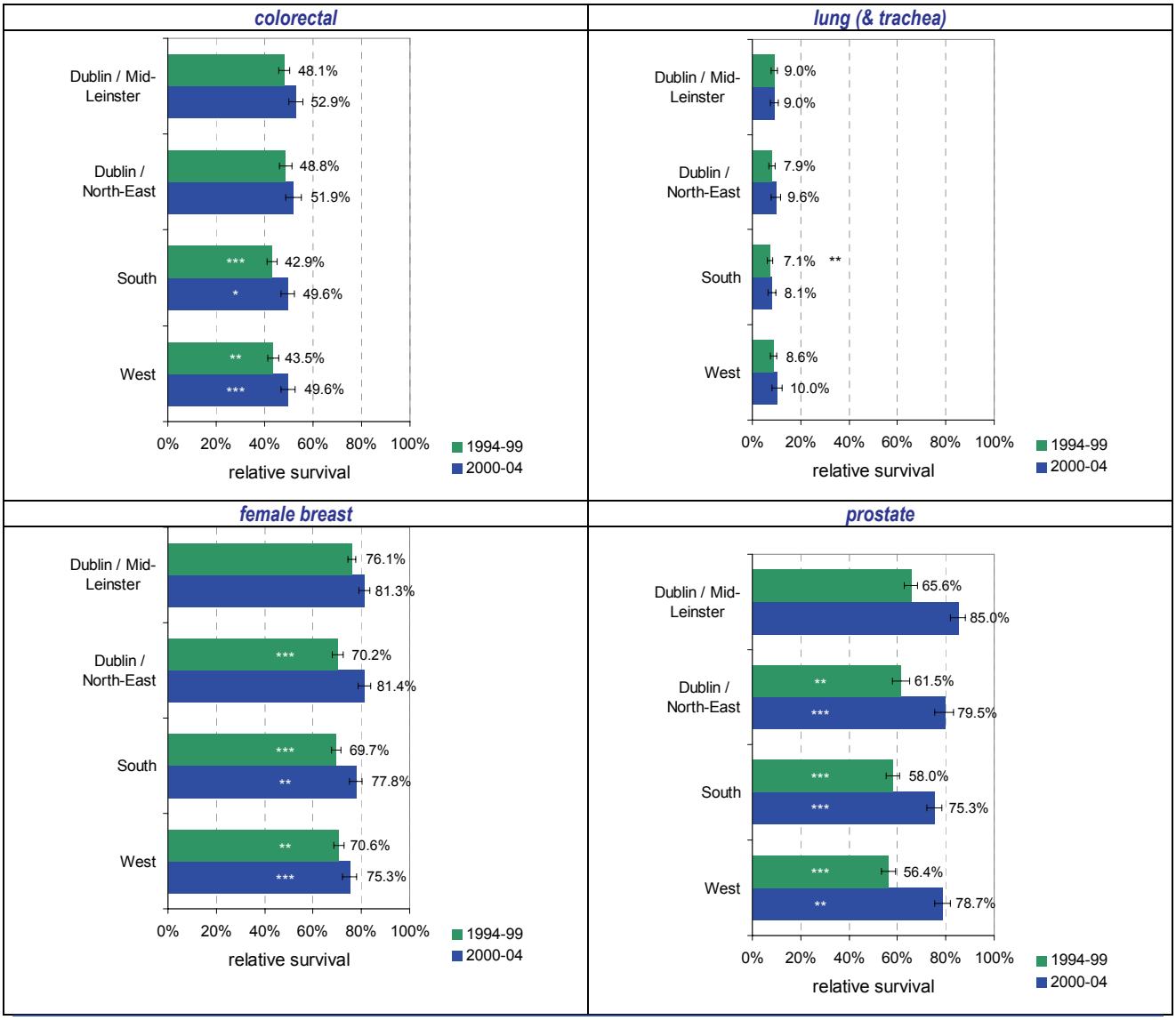


Variation in survival by area of residence

For the diagnosis period 2000-2004, five-year relative survival was statistically significantly lower, after age-adjustment, among **colorectal cancer** patients resident in the HSE South area, female **breast cancer** patients from the South and West, and **prostate cancer** patients from Dublin/North-East, the South and West, compared with Dublin/Mid-Leinster *(Figure S.9)*. Fuller adjustment, for both age and stage-related variables, modified these findings slightly – survival from **prostate cancer** in the West was no longer significantly low, but survival from **colorectal cancer** in the West and **breast cancer** in Dublin/North-East were now significantly low. Similar patterns of geographic variation were also evident for these major cancers in the period 1994-1999 for the four major cancers. However, area disparities in survival appear to have reduced somewhat in more recent years. All areas, but perhaps especially those other than Dublin/Mid-Leinster, showed substantial improvements in survival between 1994-1999 and 2000-2004.

Among less common cancers, significantly low age-adjusted survival (compared with patients resident in Dublin/Mid-Leinster area) were recorded during 2000-2004 for **oral/pharyngeal**, **rectal**, **pancreatic**, **laryngeal** and **cervical cancers**, **non-Hodgkin lymphoma**, **multiple myeloma**, and **leukaemia** in the South; **pancreatic** and **laryngeal cancer** in the West; and **laryngeal cancer**, **multiple myeloma**, and **leukaemia** in Dublin/North-East.

Figure S.9. Five-year relative survival, by HSE area of residence: patients diagnosed 1994-1999 and 2000-2004. Survival figures that are significantly low or high, compared with Dublin/Mid-Leinster area for the same years and having adjusted for age, are flagged (P<0.05, ** P<0.01, *** P<0.001).*

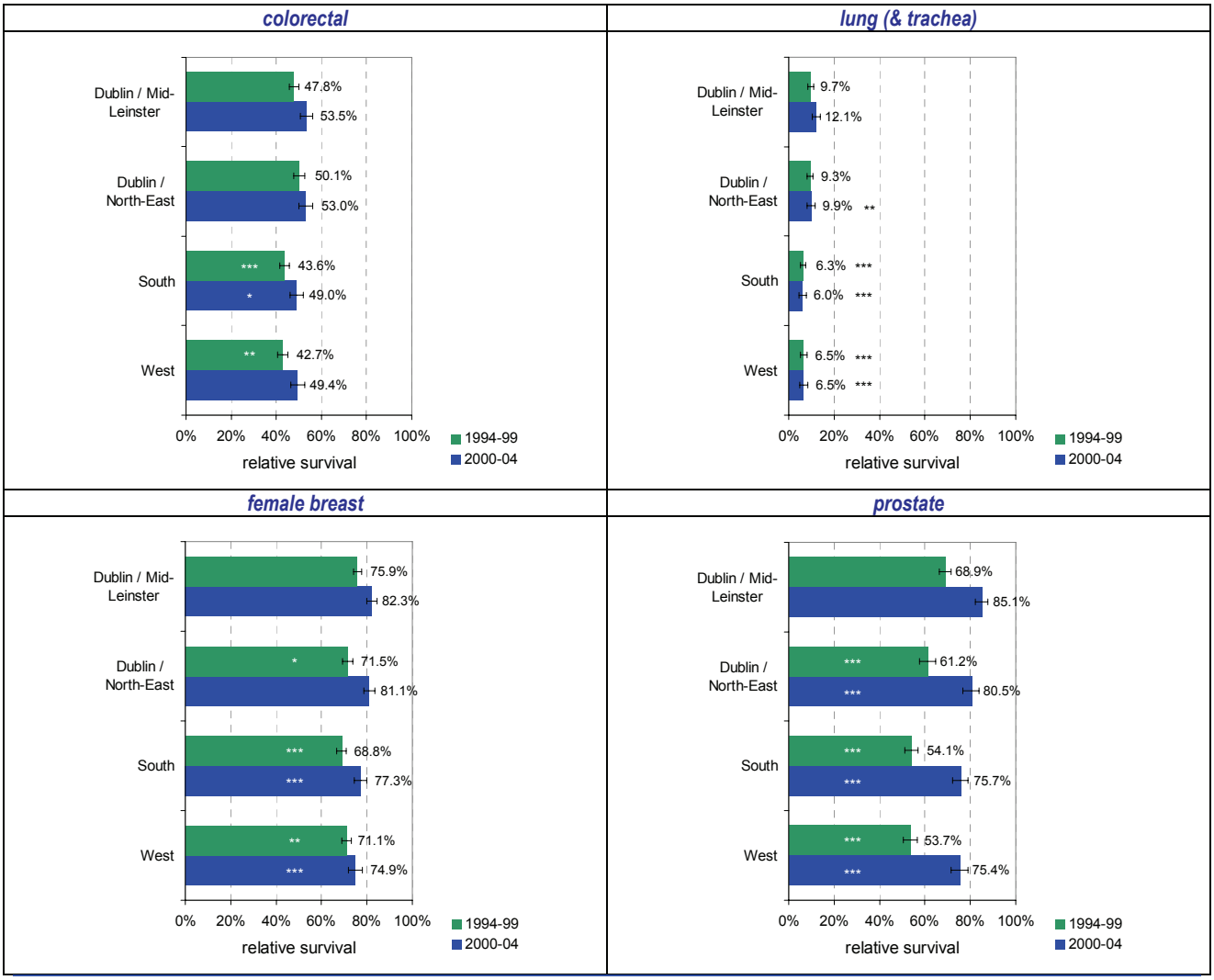


Variation in survival by area of first treatment

Analyses below assign each patient to a 'main' HSE area of treatment, based, in order of priority, on their first tumour-directed surgery, biopsy, or other hospital treatment *(Figure S.10)*. For the diagnosis period 2000-2004, relative survival within five years of diagnosis was significantly lower, after age-adjustment, for **colorectal cancer** patients treated in the HSE South area, **lung cancer** patients in Dublin/North-East, the South and West, female **breast cancer** patients in the South and West, and **prostate cancer** patients in Dublin/North-East, the South and West, compared with Dublin/Mid-Leinster. After adjustment for cancer stage, survival of **colorectal cancer** patients treated in the West and **breast cancer** patients treated in Dublin/North-East were also significantly low compared with Dublin/Mid-Leinster. For **prostate cancer**, adjustment for stage and grade substantially 'explained' area disparities, entirely in the case of the West area, although cautious interpretation is needed because of high proportions of incompletely staged cases. Similar patterns were evident for patients diagnosed during 1994-9, but disparities in survival between areas appear to have widened for **lung cancer** and reduced for **colorectal**, **breast** and **prostate cancers** in recent years.

Among other cancers diagnosed during 2000-2004, survival was significantly poorer (after adjusting for age) compared with HSE Dublin/Mid-Leinster area for patients with **hypopharyngeal**, **pancreatic** and **cervical cancers** treated in the HSE South area; **liver**, **pancreatic**, and **biliary tract cancers** in the West; **laryngeal cancer**, **non-Hodgkin lymphoma**, **multiple myeloma** and **leukaemia** in both Dublin/North-East and the South; and **kidney cancer** in Dublin/North-East.

Figure S.10. Five-year relative survival, by HSE area in which patient had their first treatment: patients diagnosed 1994-1999 and 2000-2004. Survival figures that are significantly low or high, compared with Dublin/Mid-Leinster area for the same years and having adjusted for age, are flagged (P<0.05, ** P<0.01, *** P<0.001).*



Variation in survival by hospital type (surgical patients)

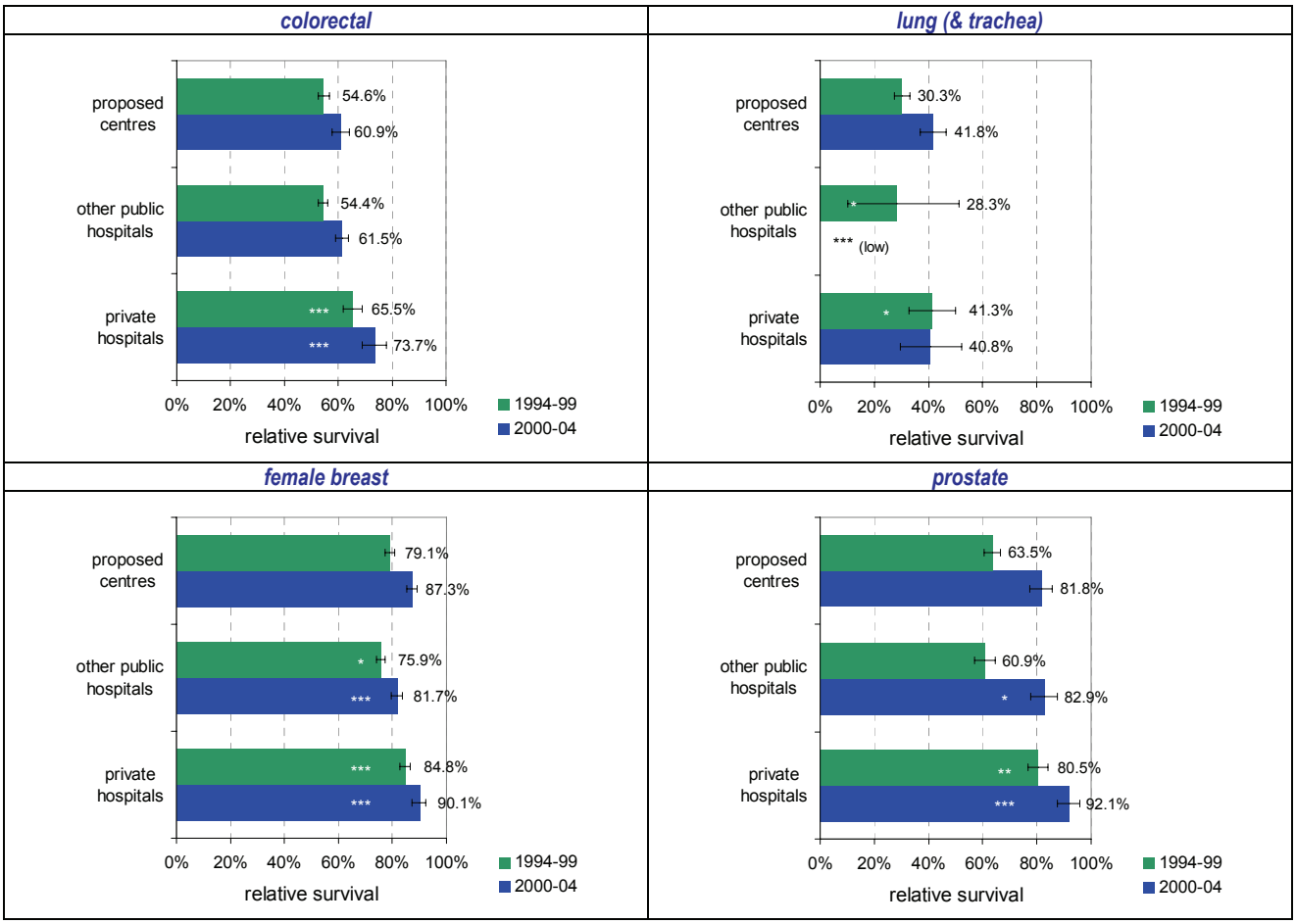
The Health Service Executive plans to transfer major cancer treatment to eight designated Specialist Cancer Centres – two in each HSE area[1]. The analyses below assign patients to the first hospital in which they had tumour-directed surgery within six months of diagnosis. Five-year relative survival estimates are presented for three main hospital categories, and formal comparisons are based on statistical models adjusted for age and cancer stage.

In the most recent diagnosis period (2000-2004), **lung** and female **breast cancer** patients surgically treated in other public acute general hospitals had significantly lower survival compared with the proposed centres *(Figure S.11)*. For **colorectal cancer**, age-adjusted survival was similar in these two categories, but the full age/stage model indicated significantly lower survival for other public hospitals. For **prostate cancer**, age-adjusted survival was significantly higher in the other public hospitals, but this difference was not significant after adjustment for stage (including grade). **Colorectal**, **prostate** and female **breast cancer** patients in private hospitals had significantly higher survival than those treated in the proposed centres. Similar patterns were apparent for these four cancers for the period 1994-1999, with significantly higher survival for **lung cancer** patients in private hospitals also noted.

Findings for other cancers are presented in the main report.

One important caution to note is that, because of the way relative survival is estimated (comparison of observed survival with that expected for the 'average' person of the same age and sex), relative survival of patients treated in private hospitals may be over-estimated to an unknown degree. This is because patients in private hospitals are likely to be healthier than the average cancer patient, even after allowing for age and cancer stage.

Figure S.11. Five-year relative survival, by hospital category in which first surgical treatment received.
Significantly high or low survival figures, compared with proposed centres, are flagged (P<0.05, ** P<0.01, *** P<0.001, age-adjusted).*



[1] See http://www.hse.ie/eng/About_the_HSE/Cancer_Services/nccp.html ; last updated 10/11/2008

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Chapter 1. Introduction

Previous reports

Previous reports from the National Cancer Registry (NicAmhlaoibh *et al*. 2004; Walsh & Comber 2006) have identified inequalities in cancer treatment and outcome across Ireland. The 2002 National Cancer Strategy and the 2006 National Cancer Control Strategy (National Cancer Forum 2006) have identified these inequalities as one of the major targets of national health policy.

This report describes the situation with regard to cancer treatment and outcomes in Ireland up to the end of 2004 (including 2005 follow-up). Other recent reports (National Cancer Registry 2006; www.ncri.ie/data) have described cancer incidence to the end of 2005 and a forthcoming report will update this information to the end of 2006.The National Cancer Control Strategy, in an analysis of the situation in 2004 concluded:

> *"There is inequity in the availability of, access to, and performance of cancer services throughout the country. This must be addressed as part of the expansion and development of services. It should not, however, lead to small-scale developments that do not meet the requirements of evidence and best international practice and, as a result, cannot be sustainable…One of the most significant strategic issues facing cancer services is the variation in survival rates within Ireland and our relatively poor survival rates for many common cancers… In part, this can be attributed to the fragmentation of cancer services, which leads to too many hospitals and too many consultants being involved in the provision of treatment for cancer sufferers….the continuation of current arrangements cannot be recommended."*

One of the primary objectives of this report is to examine the possible impact of the first National Cancer Strategy, which began implementation in 2000, on treatment and survival and to investigate if the patterns of inequity in services and survival, and fragmentation of services, persists. A plan for the geographical rationalisation of cancer services has recently been published[1] and this process has begun with regard to breast cancer. However, the data in this report pre-date this rationalisation, though we hope they will help inform the process.

The National Cancer Registry

The National Cancer Registry was established in 1991 as a statutory body under the Department of Health and Children. Its formal functions are:

> *(a) to identify, collect, classify, record, store and analyse information relating to the incidence and prevalence of cancer and related tumours in Ireland;*
> *(b) to collect, classify, record and store information in relation to each newly diagnosed individual cancer patient and in relation to each tumour which occurs;*
> *(c) to promote and facilitate the use of the data thus collected in approved research projects and in the planning and management of services;*
> *(d) to publish an annual report based on the activities of the Registry;*
> *(e) to furnish advice, information and assistance in relation to any aspect of such service to the Minister.*

Initially, the functions of the Registry were primarily in the area of epidemiology and public health, but in recent years the requirement for data for needs assessment, monitoring and evaluation of health services has become increasingly dominant, and the Registry has moved to providing an increasing volume of timely and detailed information on treatment and survival data. However, the ultimate goal of providing this data close to the time of diagnosis is incompatible with the traditional role of a registry as a retrospective data collector, and the National Cancer Control Strategy has recommended a national system of cancer surveillance, based on the National Cancer Registry. A surveillance system will be based on somewhat different principles, with once-only data collection in the course of clinical practice taking the place of data abstraction from notes. The introduction of such a system has implications for both ICT policy and clinical practice.

[1] See http://www.hse.ie/eng/About_the_HSE/Cancer_Services/; last updated 18/04/08

Chapter 2. Methods

Sources of data

The process of registration

Cancer registration in Ireland relies largely on what is known as 'active' data collection. Registry staff, based in hospitals around the country, access a range of data sources to first ascertain new cancer cases and secondly to abstract information from the medical record on patient and cancer characteristics and treatment. Information on the date and cause of death is added from death certificates, but no active follow-up is performed.

Incidence data

The main source of ascertainment of cancers is from pathology reports, which provide about 85% of all new cases and are made available to the Registry almost immediately after diagnosis. Information on non-microscopically diagnosed cases may come from the Hospital Inpatient Enquiry (HIPE), from records kept by oncology departments or a variety of other sources. This information may not reach the Registry for months, or sometimes years, after diagnosis. Around 3% of cases first become known to the Registry from death certificates, at least a year from the time of death.

Consequently, the great majority of cancers are known to the Registry quite soon after diagnosis, but a substantial minority can take much longer. In the provision of authoritative national statistics, the Registry is constrained by the need to wait for reports from all possible sources of ascertainment before definitive statistics can be published. This will normally be 18-24 months following the end of the year of diagnosis.

For the period covered in this report, incident cases were coded to the second edition of the International Classification of Diseases for Oncology (ICD-O-2: Percy *et al*. 1990). Before analysis, they were recoded to the equivalent ICD10 classification, and results are presented for either single 'main' ICD10 codes or for combinations of those codes. However, for comparability with the international EUROCARE survival studies (Berrino *et al*. 2007, Verdecchia *et al*. 2007), slightly different 'site' definitions have in some cases been used for survival analyses.

Staging and treatment data

Some limited information on staging and surgery can be inferred from pathology reports, but definitive staging and treatment data can be added only after the medical record has been abstracted. To allow capture of all primary treatment data, the Registry does not carry out this abstraction until at least 6 months from the date of diagnosis, but this period is more commonly 12 months or more due to the unavailability of medical records whilst the patient is on active treatment. Over this period, treatment may be given for recurrence of the cancer, and this is not always possible to distinguish from delayed primary treatment. The Registry initially attempted to classify treatment by intent—e.g. curative, palliative—but we discovered that this information was quite unreliable and no longer attempt to classify treatment in this way. For the purposes of this report, the main focus is on treatment within 6 months of diagnosis (which is more likely to be complete for cancers from earlier years).

Treatment is coded according to the International Classification of Disease, 9th edition (Clinical Modification) (ICD9-CM). This provides a comprehensive classification of surgical procedures, but very limited information on chemotherapy, so while the Registry has detailed information on surgical procedures, we can record only the fact and date of chemotherapy or hormone therapy.

For the purposes of this report, treatment episodes have been grouped into four categories of tumour-directed treatment (any treatment that removes or destroys significant amounts of tissue, or directly reduces tumour growth):

- tumour-directed surgery (including related destructive treatments),
- chemotherapy and related treatments (e.g. biological response modifiers),
- radiation therapy
- hormone therapy.

For cases diagnosed during 1994 or 1995, hormone therapy was not generally distinguished from, and was usually coded as, chemotherapy, thus numbers of patients receiving chemotherapy would be over-estimated, relative to hormonal therapy, for those years. For the main treatment analyses, 1994-diagnosed cases have been excluded. For **breast cancer**, analyses of chemotherapy, hormone therapy and combined therapies also exclude 1995. For **prostate cancer** 'chemotherapy' given to 1995-diagnosed cases has been assumed to be hormone therapy. For all other cancers, 1995 chemotherapy data have been analysed at face value.

Data quality

Case and treatment ascertainment

The completeness of case ascertainment has been checked by a number of methods, and is in the area of 97-98%. No comprehensive independent check has been carried out on the completeness of ascertainment of treatment episodes. However, as surgical episodes come to our attention through three separate routes—from pathology reports, HIPE (in public hospitals) and from the case notes—few episodes of surgery are likely to be missed. All courses of radiation therapy administered in Ireland are matched against the registration database, so radiation therapy is also very unlikely to be missed. Chemotherapy episodes may be missed if not explicitly recorded in the case notes or HIPE, but we routinely visit oncology clinics so we believe that we have a record of chemotherapy in almost all cases. However, this is difficult to verify. For hormonal therapy, a higher proportion of treatments may be missed, for similar reasons.

Microscopic verification of diagnosis

Microscopic verification is the 'gold standard' of diagnosis, but not always feasible or justifiable. The percentage of cancers verified by microscopic examination was quite high and increased from 86% in 1995-1999 to 89% in 2000-2004 *(Table 1).* The lowest level of verification (40-48%) was for cancers of the **pancreas**, so more than half of these cancers were diagnosed by clinical examination or imaging only, and the diagnosis may not have been correct in all cases.

Table 1. Percentage of microscopically verified cancers

	1995-1999	2000-2004
all invasive cancers	86%	89%
breast	97%	99%
prostate	86%	91%
lung	76%	77%
colon	91%	92%
rectum	95%	96%
stomach	92%	95%
melanoma of skin	100%	100%
bladder	95%	94%
ovary	92%	91%
pancreas	40%	48%
oesophagus	90%	94%
kidney	77%	77%
brain	70%	72%
corpus uteri	99%	98%
cervix	99%	99%

Completeness of staging

Most cancers had a tumour extent (T category; either clinical or pathological) recorded *(Table 2)*. This varied from 92-94% for **breast** cancer to 42-45% for cancer of the **oesophagus**. For most cancers, the completeness of recording of T category improved between periods, notably for **lung** and **prostate cancer**. Nodal status (N category) was much less complete, 57-61% overall, with the lowest levels in **prostate cancer**. All major sites had an improvement in the recording of N category. Recording of metastatic status (M category) was similar in completeness to nodal status overall and improved for all sites but **melanoma** and **prostate**.

Table 2. Percentage of cancers with recorded TNM categories

	no T category given (TX)		no N category given (NX)		no M category given (MX)	
	1995-1999	2000-2004	1995-1999	2000-2004	1995-1999	2000-2004
all invasive cancers	20%	23%	43%	39%	44%	39%
oesophagus	55%	58%	59%	45%	57%	39%
stomach	39%	41%	51%	44%	43%	35%
colon	15%	16%	25%	23%	38%	30%
rectosigmoid	15%	15%	28%	20%	33%	29%
rectum	18%	18%	33%	26%	38%	32%
pancreas	43%	39%	77%	66%	51%	38%
lung	41%	31%	58%	41%	55%	38%
melanoma	12%	10%	70%	66%	73%	75%
breast	8%	6%	17%	12%	48%	40%
ovary	12%	13%	71%	67%	45%	42%
prostate	51%	37%	89%	83%	56%	57%
kidney	15%	9%	57%	55%	37%	29%
bladder	29%	33%	77%	74%	68%	65%

Although full staging investigations are not always justified, particularly in early cancers, *Table 3* shows that, using female breast cancer as an example, M category staging information was missing for a consistently high proportion of cases, regardless of T or N category. For the earliest stage cancers (T0 N0), 44% of patients had no M category recorded, while for late stage cancer (T4 N1), the percentage was 40%, suggesting that the problem was more likely to have been non-recording of staging data rather than failure to carry out staging investigations. There is some indication that staging of patients with more advanced cancers is becoming more complete. The percentage of 'late' cancers (T4 N1-4) with no M category recorded fell from 40% in 1995-1999 to 25% in 2000-2004, while the percentage with unknown M category for 'early' (T1 N0) **breast cancers** increased very slightly, from 44% to 45%.

Table 3. Percentage of breast cancers recorded as MX (unknown)

	1995-1999		2000-2004	
	N0	N1+	N0	N1+
T1	44%	44%	45%	34%
T2	45%	44%	38%	33%
T3	46%	44%	39%	32%
T4	42%	40%	33%	25%

There were also clear differences between HSE areas in the completeness of staging *(Table 4)*. For the Western area, for instance, the percentage of M0 female **breast cancer** cases increased from 40% to 67% between 1995-1999 and 2000-2004, while the percentage of MX cancers fell from 52% to 25%. However, the percentage of cases recorded as being metastatic (M1) remained at 8%, suggesting that a large part of the shift to earlier stage cancer was due to more complete recording of information rather than earlier diagnosis.

Table 4. Completeness of staging for the commonest cancers, by period and HSE area of residence

	M0		M1		MX	
HSE area of residence	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**
breast cancer (female)						
Dublin/Mid-Leinster	48%	44%	7%	7%	45%	49%
Dublin/North-East	45%	52%	6%	6%	49%	42%
South	43%	52%	7%	7%	49%	41%
West	40%	67%	8%	8%	52%	25%
colorectal						
Dublin/Mid-Leinster	44%	46%	19%	24%	37%	30%
Dublin/North-East	40%	37%	24%	28%	36%	35%
South	38%	43%	24%	24%	38%	33%
West	38%	55%	22%	24%	40%	21%
lung						
Dublin/Mid-Leinster	18%	26%	28%	35%	54%	40%
Dublin/North-East	24%	26%	28%	38%	48%	36%
South	12%	22%	29%	37%	59%	41%
West	16%	28%	23%	36%	61%	36%
prostate						
Dublin/Mid-Leinster	26%	31%	19%	11%	55%	59%
Dublin/North-East	31%	33%	19%	11%	49%	56%
South	26%	33%	20%	11%	54%	56%
West	17%	33%	20%	10%	63%	58%

For the other major cancer sites—**colon**, **lung** and **prostate**—it can similarly be seen that the percentage of metastatic cancers varies very little with area of residence, by comparison with the percentages of M0 and MX cases. For **lung cancer** there has been an apparent increase in both M0 and M1 cases, with a considerable fall in MX disease, while for prostate the percentage of M1 cancer has fallen by about 50%. Clearly, given the high percentage of missing data, and the variation in this between areas and over time, the use of 'stage' (however defined) to explain variations in treatment or survival must be treated with caution.

Exclusions

The National Cancer Registry records all cases of cancer, broadly defined, including those defined as in situ and of 'uncertain behaviour' cancers. Benign intracranial and intraspinal cancers are also registered. To ensure comparability with previous reports, and with international publications such as EUROCARE 4 (Verdecchia *et al.* 2007, Berrino *et al.* 2007) in situ and 'uncertain' cancers, and a small number of malignant cases have also been excluded from the survival analysis *(Table 5)*. The most important exclusion is that of second or synchronous cancers; only once cancer per person (excluding non-melanoma skin cancer) is included here. This has the effect of reducing the total number of cancers by about 4% compared to the incidence reports produced by the Registry, and the report is based on 138349 cancers diagnosed over the 11 year period 1994-2004.

Table 5 Summary of inclusions and exclusions for cancers included in this report.
Numbers dropped at each step are shown in grey.

case definition	**total**
malignant	216 972
non-melanoma skin cancers	67 189
malignant, excluding non-melanoma skin cancers	149 783
diagnosis under 15 or over 99 year of age	1 322
diagnosis ages 15-99 only	148 461
death certificate only or autopsy cases	4 545
excluding death-certificate-only (DCO) cases	143 916
second or synchronous tumour	5 567
first or most-serious-synchronous tumours[a]	138 349

[a]For a given cancer site, a patient was only counted if the cancer was the first 'serious' malignancy in that patient (ignoring neoplasms not fully invasive or malignant, and also ignoring non-melanoma skin cancers); for a patient with more than one cancer diagnosed on the same date, the more serious cancer was counted (typically lung > colorectal > breast/prostate), based on average survival for the cancer types involved (by reference to EUROCARE-3 data: Sant *et al*., 2003).

Methods of analysis

Assessment of time-trends and geographic variation

For treatment, changes in the percentage of cancer patients treated within six months of diagnosis are based on comparisons of the diagnosis periods 1995-99 [1996-99 for **breast cancer** chemotherapy] and 2000-2004, including treatments received up to mid-2005, if within the six-month 'window'. As 1994 was the first year of national cancer registration in Ireland, it was felt that treatment data might be less complete, thus 1994 has been excluded from treatment comparisons.

For survival, comparisons are based on the diagnosis periods 1994-1999 and 2000-2004, with follow-up to the end of 2005.

The statistical significance of changes or differences in treatment (for **colorectal**, **lung**, **breast** and **prostate cancers**) and survival (all cancers) has been assessed by statistical modelling (adjusted for age) – logistic regression for treatment, generalized linear models with Poisson assumption for relative survival (Dickman *et al*. 2004). Such modelling allows for the possibility of changes or differences being more apparent than real (especially for the less common cancers) and for possible changes in the age-profile of patients. Logistic regression output (odds ratios) for treatment has been converted to risk ratios or 'relative probabilities' (Zhang & Yu 1998). For less common cancers, comparisons of proportions treated are based on unadjusted proportions (equivalent statistically to logistic regression unadjusted for age).

For modelling of variation in survival of **colorectal**, **lung**, **breast** and **prostate cancer** patients between areas and hospital categories, further adjustment has been made for tumour stage (T, N and M categories, and also grade for **prostate cancer**) – see further details under the next heading.

Areas of residence have been defined as the HSE administrative areas[1] (Dublin/Mid-Leinster, Dublin/North-East, South and West), based on the address given at the time of diagnosis. These addresses have been matched to electoral division (ED) by the Registry, and each ED assigned to a HSE area. In a small number of cases the HSE area boundaries were not identical to those of the EDs and these addresses were assigned by inspection. HSE areas of 'first treatment' (surgery, biopsy, chemotherapy, hormonal treatment, other hospital encounter, or radiation therapy in that order) have also been identified, for the majority of patients.

Hospitals of treatment have been allocated to HSE area based on either information from the HSE, or, for private hospitals, geographical location within the area. Surgery has been allocated to area on the basis of the first hospital in which 'major' surgery was carried out (i.e. excluding biopsy), and chemotherapy and radiation therapy on the first hospital in which the treatment was given for the specified cancer. These definitions were also used in determining hospital caseload.

Relative and cause specific survival

In assessing survival from cancer, we need to separate mortality from other causes from that which is, directly or indirectly, attributable to the cancer. Two recognised methods exist for this—relative survival and cause-specific survival. Relative survival computes the ratio between the survival of cancer patients and that of a group matched by age (and sometimes other characteristics) in the general population. It can therefore give the excess mortality due to a cancer diagnosis. The advantage of this approach is that in giving a direct measure of the impact of the cancer on survival, it is independent of the quality of death certification. The main disadvantage is that a reference population has to be chosen which is, ideally, matched on all factors other than those which have no influence on survival and those we wish to study. Life tables have to be available for this reference population.

Strictly, area life tables should be used for area comparisons of relative survival. Such tables can be constructed for each HSE area of residence using population and mortality data provided by the Central Statistics Office, but the available mortality data do not distinguish fully between the parts of Dublin city included in the Dublin/Mid-Leinster and Dublin/North-East HSE areas, thus some approximations are involved. Also, in practice, relative survival estimates at HSE area scale showed little difference between those based on national life tables and those based on area life tables. For these reasons, national life tables have been used for all (area and national) survival analyses in this report.

[1] Heath Service Executive. Towards better health care, 2005; page 3.

Cause-specific survival relies on the cause of death as recorded on the death certificate to distinguish, for cancer patients, death from the cancer from those due to other causes. This attribution of cause is subject to a numbers of errors—the certifier may not be aware of the existence of a cancer, or may be mistaken as to the type; a known cancer may be mistakenly given as the cause of death when death was due to other factors; and the coding of the cause of death may be incorrect. The advantage of the cause-specific survival method is that, assuming accuracy of certification, it is independent of the death rate in any reference population and so can be more readily applied to defined sub-populations for whom no life tables exist.

Relative survival methods are now almost universally employed in international comparisons of cancer survival as they are independent of national death certification practice. Pan-European estimates of survival have recently been published (EUROCARE, 2007, 2008). To ensure comparability with these and similar estimates, and for the reasons given above, we have employed the relative survival approach in this report. All survival calculations have been made using the *strs* command (with the 'Hakulinen' option) (Dickman *et al*. 2006) in Stata version 9.0, using fine follow-up intervals initially (three-monthly for the first year of follow-up, then six-monthly for the second and third years, and annual for the fourth and fifth years).

Survival modelling

The use of survival models, rather than a single proportional measure of survival to a pre-defined point (typically 5 years), takes fuller account of the survival experience during follow-up and allows adjustment for more than one variable at a time (e.g. age, or age and stage-related variables). Even for age-adjustment, comparisons based on modelling can be particularly useful when data are too sparse to allow derivation or useful comparison of age-standardized survival estimates.

Modelling allows comparison of relative survival (or rather its inverse, excess mortality) with that shown by a reference or baseline population (e.g. a area or a diagnosis period). The model output (as excess hazard ratios) is expressed in comparison with this baseline population, although the output is not always straightforward for the general reader to interpret. The meaning of hazard ratios and, for relative survival modelling, excess hazard ratios may sometimes be difficult to grasp for readers accustomed to survival information expressed in simpler terms The choice of variables to incorporate in models may not be straightforward; the 'explanatory' power of particular variables may be compromised by their incompleteness (missing data pose particular difficulties, with no easy solution). Also, for practical purposes and to avoid over-complex models, assumptions may be made that may not be fully justified (e.g. that stage has been defined similarly in different areas or in different periods).

The survival models used also adjusted for time since follow-up (follow-up interval), within the first five years of follow-up, and, where possible, for interactions between age and follow-up interval (and stage and follow-up). Where point estimates are presented, the width of 95% confidence intervals (if presented) will also provide some indication of the reliability of the estimates. Fuller adjustment for patient and tumour characteristics (e.g. stage variables and method of presentation) can, in theory, improve the validity of comparisons further, or help 'explain' changes seen. However, this may be complicated by changes or differences in the completeness (and possibly interpretation) of a variable (see Walsh & Comber 2006). With this proviso, previous analyses, covering Irish data up to 2001 (Walsh & Comber 2006), found that patient or tumour characteristics partly accounted for time-trends or geographic differences in survival from **colorectal**, **lung**, **breast** and **prostate cancer**, but their influence on geographic variation in treatment was less apparent.

Age-standardized survival estimates and the Hakulinen method

For strict comparisons of survival percentages between diagnosis periods or geographic populations, adjustment for possible changes or differences in the age-profile of patients should be made. This is generally most straightforward when done as part of statistical modelling (as described above). For presentation of survival estimates to fixed points (e.g. 5 years), age-standardized estimates are also often calculated, if there are sufficient cases in each age-group considered. In general, such age-standardization involves applying age-specific survival estimates to the age-breakdown shown by a defined standard population, either an 'internal' one (e.g. all cancer patients in Ireland) or an external one. The choice of an appropriate standard has been the subject of much international debate, but the broad 'site-specific' standards proposed by Corazziari *et al.* (2004) – covering four main categories of cancer – have been adopted for the internationally-recognized EUROCARE-4 project (Verdecchia *et al.* 2007, Berrino *et al.* 2007), to which Ireland contributes. Thus, for any age-standardized survival estimates in this report (*Table 38* and *Appendix 1*), the same standards have been adopted. Broadly, this involves assuming, for most cancer types, an age-profile heavily biased towards older patients; for **cervical cancer**, **melanoma**, **brain cancer** and some others, a more even spread of cases across age-groups; and, for

testicular cancer and **Hodgkin lymphoma** (of the cancers presented in this report), an age-profile biased towards young adults. Ages are grouped as 15-44, 45-54, 55-64, 65-74 and 75-99 (or 15-54,…85-99 for **prostate cancer**). We have also used these age-groups for statistical modelling of treatment or survival data, rather than finer, often sparsely-populated age-groups.

A further potential complication for relative survival is the age-related bias inherent in the widely-used 'Ederer II' method. This method compares observed with expected survival within successive follow-up intervals, as a group of patients is followed over time, then estimates cumulative relative survival up to any defined point (e.g. five years after diagnosis) as the product of interval-specific relative survival estimates. It has been shown that, when older patients are involved, over longer periods of follow-up the relative survival estimates become increasingly biased towards better-surviving (typically younger) patients – thus estimates of relative survival derived by the Ederer II method may be too low or (as seen for Irish data) too high. Although these differences are typically small during medium-term follow-up, and for five-year relative survival are virtually absent if patients older than 75 years are excluded, they are nevertheless detectable for many cancers if all ages are combined, even if traditional age-standardization is applied (which reduces but does not remove this particular bias).

The EUROCARE-4 project has recently published, for European countries, Hakulinen estimates of relative survival, further age-standardized following Corazziari *et al*. (2004). We have also adopted this methodology in this report, given the ease with which the Hakulinen method can now be applied as an option of the *strs* command (Dickman *et al*. 2006) within the computer program Stata. Figures computed in this way will tend to be slightly lower than, and not directly comparable with, those previously published by NCRI (e.g. Walsh & Comber 2006), which were unstandardized Ederer II estimates. However, because of ongoing minor changes to the cancer case database of NCRI, and status updates as death-certificate information for further years becomes available, we would stress that comparisons of NCRI cancer data between years should always be based only on its most recent reports (or online data). Methodological refinements will also be taken account of, where relevant, to ensure that estimates provided are the most accurate (i.e. correct) available, in addition to international comparability.

For convenience, it may be appropriate to think of Hakulinen estimates, if also age-standardized by the traditional methods described above, as 'fully age-adjusted' estimates of relative survival, compared with age-standardized Ederer II estimates.

Chapter 3. Treatment

This report is based on 138349 cancers diagnosed over the 11 year period 1994-2004 *(Table 6)*, having made the exclusions described in *Chapter 2* (Methods). However, for treatment analyses, cancers diagnosed in 1994 have generally been excluded, both to allow for direct comparisons between the two five-year periods 1995-1999 and 2000-2004 and also because treatment data for 1994 might not have been complete. As noted in *Chapter 2*, chemotherapy and hormonal therapy for breast cancers diagnosed in 1995 have also been excluded, because these modalities were not separately recorded in Registry data before 1996.

Table 6. Number of cancers included in treatment analyses by year, 1994-2004

year of diagnosis	female	male	all
1994	5995	5628	11623
1995	5793	5456	11249
1996	5929	5636	11565
1997	6051	5747	11798
1998	6229	5832	12061
1999	6167	5862	12029
2000	6508	6183	12691
2001	6782	6281	13063
2002	7151	6691	13842
2003	7126	6776	13902
2004	7676	6850	14526
1994-2004	71407	66942	138349

The following tables give the numbers and percentages of patients treated by surgery, chemotherapy and radiation therapy in the periods 1995-1999 and 2000-2004. The difference in the percentages treated between these two periods has been expressed as an absolute difference (by subtraction) and as a relative difference (by division). Statistically significant (relative) differences between the periods ($p<0.05$) have been indicated by arrows (↑and ↓); except where specified (in *Tables 18, 20 & 23*), these comparisons have not been adjusted for age.

Treatment trends: all cancer sites*

Surgery

The percentage of patients having surgery increased significantly for 5 cancer sites (14%), including **breast**, and decreased for 11 (22%), including **colorectal**, **lung** and **prostate** (*Table 7*). These changes ranged from a 19% absolute increase for cancer of the **peritoneum** to an 18% decrease for cancer of the **prostate**. For 31 (63%) of the cancer sites shown there was no significant change in the percentage of patients having surgery.

Table 7. Number of cancers treated surgically, by period of diagnosis

	1995-1999		2000-2004		change in %		
	all cases	% having surgery	all cases	% having surgery	absolute change	relative change	trend[1]
head and neck (C01-C14)	1332	54%	1214	57%	3%	5.2%	
oesophagus (C15)	1424	28%	1524	21%	-7%	-24.3%	↓
stomach (C16)	2254	44%	2108	39%	-5%	-10.5%	↓
small intestine (C17)	163	63%	204	58%	-5%	-8.5%	
colorectal (C18-C21)	8448	77%	9109	75%	-2%	-2.4%	↓
liver (C22)	294	6%	500	13%	6%	98.1%	↑
gallbladder (C23)	199	44%	204	36%	-8%	-19.1%	
other biliary (C24)	328	20%	372	27%	6%	30.3%	↑
pancreas (C25)	1564	8%	1663	8%	0%	-3.8%	
other digestive (C26)	141	11%	122	5%	-6%	-56.7%	↓
nasal cavity/middle ear (C30)	49	67%	31	68%	0%	0.6%	
sinuses (C31)	57	46%	68	54%	9%	19.3%	
larynx (C32)	533	25%	606	29%	4%	14.0%	
trachea (C33)	21	5%	12	0%	-5%	-100.0%	
lung (C34)	7218	14%	7786	12%	-2%	-15.2%	↓
thymus (C37)	20	55%	24	63%	8%	13.6%	
mediastinum (C38)	56	5%	65	3%	-2%	-42.6%	
bones and joints (C40-C41)	123	59%	134	56%	-3%	-4.4%	
melanoma of skin (C43)	1880	94%	2440	91%	-3%	-3.5%	↓
mesothelioma (C45)	83	19%	121	9%	-10%	-52.8%	↓
Kaposi sarcoma (C46)	22	18%	17	24%	5%	29.4%	
peripheral nerves (C47)	20	70%	25	60%	-10%	-14.3%	
peritoneum (C48)	50	40%	68	59%	19%	47.1%	↑
connective tissues (C49)	363	75%	379	70%	-5%	-6.7%	
breast (C50)	8192	84%	10227	85%	1%	1.4%	↑
breast (C50, female only)	8134	84%	10164	85%	1%	1.5%	↑
female genital (C51-C58)	3759	67%	4219	74%	6%	9.5%	↑
penis (C60)	102	91%	101	77%	-14%	-15.3%	↓
prostate (C61)	6080	51%	9800	33%	-18%	-35.1%	↓
testis (C62)	479	94%	632	94%	0%	-0.1%	
other male genital (C63)	12	25%	12	67%	42%	166.7%	
kidney (C64)	1149	65%	1499	65%	-1%	-1.3%	
renal pelvis (C65)	44	77%	42	74%	-3%	-4.5%	
ureter (C66)	44	89%	56	80%	-8%	-9.3%	
bladder (C67)	2146	79%	2118	76%	-2%	-2.6%	
other urinary (C68)	30	73%	12	50%	-23%	-31.8%	
eye (C69)	190	65%	168	60%	-5%	-7.1%	
brain and other CNS (C70-C72)	1153	35%	1342	18%	-17%	-47.7%	↓
thyroid (C73)	287	80%	399	83%	4%	4.6%	
adrenal (C74)	40	55%	40	60%	5%	9.1%	
other endocrine (C75)	41	39%	41	29%	-10%	-25.0%	
ill-defined site (C76)	192	14%	144	15%	2%	12.8%	
unknown primary site (C80)	3335	4%	2713	5%	0%	9.6%	
Hodgkin lymphoma (C81)	380	8%	426	11%	3%	32.4%	
non-Hodgkin lymphoma (C82-C85)	1938	20%	2365	17%	-2%	-11.6%	↓

[1]. ↑=statistically significant relative increase ↓=statistically significant relative decrease * insufficient data

* The sites 'other chest' (C39), 'malignant immunoproliferative disease' (C88), 'multiple myeloma' (C90). 'leukaemia' (C91-C95), and 'other lymphoid and haematopoetic' (C96) have been excluded due to insufficient data.

Chemotherapy

The percentage of patients having chemotherapy increased for 19 cancer sites (39%) and decreased for none *(Table 8).* The changes, where statistically significant, ranged from a 26% absolute increase for **mesothelioma** to a 3% increase for cancers of the **kidney**. For 30 (61%) of the cancer sites shown there was no significant change in the percentage of patients having chemotherapy.

Table 8. Number of cancers treated by chemotherapy, period of diagnosis

	1995-1999		2000-2004		change in %		
	all cases	% having chemotherapy	all cases	% having chemotherapy	absolute change	relative change	trend[1]
head and neck (C01-C14)	1332	5%	1214	18%	13%	251.7%	↑
oesophagus (C15)	1424	20%	1524	36%	17%	85.2%	↑
stomach (C16)	2254	10%	2108	25%	15%	160.2%	↑
small intestine (C17)	163	17%	204	25%	7%	42.7%	
colorectal (C18-C21)	8448	27%	9109	38%	11%	43.0%	↑
liver (C22)	294	5%	500	12%	6%	116.8%	↑
gallbladder (C23)	199	5%	204	11%	6%	124.4%	↑
other biliary (C24)	328	3%	372	8%	5%	193.9%	↑
pancreas (C25)	1564	8%	1663	20%	12%	146.5%	↑
other digestive (C26)	141	13%	122	20%	7%	52.1%	
nasal cavity/middle ear (C30)	49	2%	31	6%	4%	216.1%	
sinuses (C31)	57	12%	68	12%	-1%	-4.2%	
larynx (C32)	533	2%	606	12%	10%	542.1%	↑
trachea (C33)	21	14%	12	8%	-6%	-41.7%	
lung (C34)	7218	16%	7786	23%	7%	47.8%	↑
thymus (C37)	20	30%	24	42%	12%	38.9%	
mediastinum (C38)	56	20%	65	26%	7%	33.1%	
other chest (C39)	-	-	-	-	-	-	*
bones and joints (C40-C41)	123	40%	134	46%	6%	14.3%	
melanoma of skin (C43)	1880	5%	2440	4%	-1%	-18.4%	
mesothelioma (C45)	83	11%	121	36%	26%	235.4%	↑
Kaposi sarcoma (C46)	22	23%	17	24%	1%	3.5%	
peripheral nerves (C47)	20	10%	25	16%	6%	60.0%	
peritoneum (C48)	50	22%	68	38%	16%	73.8%	↑
connective tissues (C49)	363	12%	379	13%	1%	11.0%	
breast (C50)[2]	6661	38%	10227	50%	12%	30.5%	↑
breast (C50, female only)[2]	6610	38%	10164	50%	12%	30.2%	↑
female genital (C51-C58)	3759	26%	4219	35%	8%	32.2%	↑
penis (C60)	102	5%	101	5%	0%	1.0%	
prostate (C61)[3]	6080	1%	9800	1%	0%	19.7%	
testis (C62)	479	32%	632	30%	-1%	-3.6%	
other male genital (C63)	12	0%	12	8%	8%	-	
kidney (C64)	1149	5%	1499	8%	3%	60.4%	↑
renal pelvis (C65)	44	5%	42	17%	12%	266.7%	
ureter (C66)	44	5%	56	11%	6%	135.7%	
bladder (C67)	2146	6%	2118	13%	7%	108.0%	↑
other urinary (C68)	-	-	-	-	-	-	*
eye (C69)	190	4%	168	2%	-2%	-51.5%	
brain and other CNS (C70-C72)	1153	9%	1342	14%	5%	58.5%	↑
thyroid (C73)	287	1%	399	2%	0%	7.9%	
adrenal (C74)	40	5%	40	10%	5%	100.0%	
other endocrine (C75)	41	7%	41	20%	12%	166.7%	
ill-defined site (C76)	192	10%	144	13%	3%	26.7%	
unknown primary site (C80)	3335	10%	2713	15%	5%	56.6%	↑
Hodgkin lymphoma (C81)	380	73%	426	81%	9%	12.1%	↑
non-Hodgkin lymphoma (C82-C85)	1938	63%	2365	64%	1%	1.8%	
malignant immunoproliferative disease (C88)	40	45%	47	40%	-5%	-10.2%	
multiple myeloma (C90)	840	61%	975	64%	3%	4.9%	
leukaemia (C91-C95)	1579	41%	1843	43%	1%	3.5%	
other lymphoid and haematopoetic (C96)	5	20%	4	50%	30%	150.0%	

1. ↑=statistically significant relative increase ↓=statistically significant relative decrease * insufficient data

2. 1996-2004

3. 'chemotherapy' 1994-1995 for prostate cancer has been recoded as hormone therapy

Radiation therapy

The percentage of patients having radiation therapy increased for 7 cancer sites (14%), including **colorectal** and **prostate cancer**, and decreased for 5 (10%), including **breast cancer** *(Table 9)*. The changes, where statistically significant, ranged from a 15% increase for cancers of the **oesophagus** to an 11% fall for cancers of **connective tissue**. For 37 (76%) of the cancer sites shown (including **lung cancer**) there was no significant change in the percentage of patients having radiation therapy.

Table 9. Number of cancers treated by radiation therapy, by period of diagnosis

	1995-1999		2000-2004		change in %		
	all cases	% having radiation therapy	all cases	% having radiation therapy	absolute change	relative change	trend[1]
head and neck (C01-C14)	1332	55%	1214	59%	4%	7.3%	
oesophagus (C15)	1424	32%	1524	48%	15%	47.2%	↑
stomach (C16)	2254	5%	2108	12%	6%	113.0%	↑
small intestine (C17)	163	2%	204	4%	2%	113.1%	
colorectal (C18-C21)	8448	11%	9109	16%	5%	43.1%	↑
liver (C22)	294	2%	500	5%	3%	110.0%	
gallbladder (C23)	199	4%	204	5%	1%	39.4%	
other biliary (C24)	328	3%	372	7%	4%	116.4%	↑
pancreas (C25)	1564	6%	1663	9%	3%	55.7%	↑
other digestive (C26)	141	7%	122	1%	-6%	-88.4%	↓
nasal cavity/middle ear (C30)	49	45%	31	39%	-6%	-13.8%	
sinuses (C31)	57	60%	68	56%	-4%	-6.3%	
larynx (C32)	533	76%	606	71%	-5%	-6.2%	↓
trachea (C33)	21	38%	12	58%	20%	53.1%	
lung (C34)	7218	32%	7786	33%	1%	1.8%	
thymus (C37)	20	50%	24	38%	-13%	-25.0%	
mediastinum (C38)	56	23%	65	31%	8%	32.5%	
other chest (C39)	3	33%	3	0%	-33%	-100.0%	
bones and joints (C40-C41)	123	17%	134	16%	-1%	-8.2%	
melanoma of skin (C43)	1880	2%	2440	2%	-1%	-21.3%	
mesothelioma (C45)	83	10%	121	12%	3%	28.6%	
Kaposi sarcoma (C46)	22	18%	17	0%	-18%	-100.0%	
peripheral nerves (C47)	20	20%	25	36%	16%	80.0%	
peritoneum (C48)	50	10%	68	4%	-6%	-55.9%	
connective tissues (C49)	363	37%	379	26%	-11%	-29.4%	↓
breast (C50)	8192	43%	10227	41%	-2%	-5.0%	↓
breast (C50, female only)	8134	44%	10164	41%	-2%	-5.7%	↓
female genital (C51-C58)	3759	24%	4219	26%	1%	6.1%	
penis (C60)	102	19%	101	13%	-6%	-30.9%	
prostate (C61)	6080	7%	9800	14%	8%	115.7%	↑
testis (C62)	479	36%	632	37%	1%	1.9%	
other male genital (C63)	-	-	-	-	-	-	*
kidney (C64)	1149	8%	1499	10%	2%	21.5%	
renal pelvis (C65)	44	5%	42	14%	10%	214.3%	
ureter (C66)	44	5%	56	2%	-3%	-60.7%	
bladder (C67)	2146	9%	2118	9%	0%	-2.7%	
other urinary (C68)	30	10%	12	25%	15%	150.0%	
eye (C69)	190	12%	168	11%	-1%	-6.6%	
brain and other CNS (C70-C72)	1153	38%	1342	48%	10%	27.0%	↑
thyroid (C73)	287	30%	399	27%	-3%	-10.3%	
adrenal (C74)	40	8%	40	8%	0%	0.0%	
other endocrine (C75)	41	34%	41	24%	-10%	-28.6%	
ill-defined site (C76)	192	7%	144	8%	0%	4.8%	
unknown primary site (C80)	3335	13%	2713	14%	1%	8.1%	
Hodgkin lymphoma (C81)	380	23%	426	20%	-3%	-12.9%	
non-Hodgkin lymphoma (C82-C85)	1938	19%	2365	15%	-4%	-20.9%	↓
malignant immunoproliferative disease (C88)	-	-	-	-	-	-	*
multiple myeloma (C90)	840	24%	975	26%	2%	7.3%	
leukaemia (C91-C95)	1579	2%	1843	2%	0%	3.7%	
other lymphoid and haematopoetic (C96)	5	20%	4	25%	5%	25.0%	

[1] ↑=statistically significant relative increase ↓=statistically significant relative decrease * insufficient data

Treatment combinations: major cancer sites

Colorectal cance

For colorectal cancer, there was a significant decrease in the use of surgery between 1995-1999 and 2000-2004, both as a single modality of treatment and overall *(Table 10)*. The use of chemotherapy and radiation therapy increased, in particular the use of surgery in combination with chemotherapy or with both chemotherapy and radiation therapy.

Table 10. Colorectal cancer treatment combinations, by period of diagnosis

	1995-1999		2000-2004		% change		
.	cases treated	% having treatment	cases treated	% having treatment	absolute change	relative change	trend[1]
all surgery	6537	77%	6877	75%	-1.9%	-2.4%	↓
all chemotherapy	2244	27%	3460	38%	11.4%	43.0%	↑
all radiation therapy	941	11%	1452	16%	4.8%	43.1%	↑
no tumour-directed treatment	1498	18%	1422	16%	-2.1%	-12.0%	
surgery only	4361	52%	3820	42%	-9.7%	-18.8%	↓
surgery and chemotherapy	1463	17%	2031	22%	5.0%	28.8%	↑
surgery, chemotherapy and radiation therapy	486	6%	810	9%	3.1%	54.6%	↑
surgery and radiation therapy	227	3%	216	2%	-0.3%	-11.8%	
chemotherapy only	185	2%	384	4%	2.0%	92.5%	
radiation therapy only	118	1%	191	2%	0.7%	50.1%	
other	110	1%	235	3%	1.3%	98.1%	

[1] ↑=statistically significant relative increase ↓=statistically significant relative decrease

Female breast cancer

The overall use of surgery did not change significantly for breast cancer between 1996-1999 and 2000-2004, but there was a (non-significant) 5% relative fall in the use of surgery as a single modality. Single-modality treatment was uncommon in breast cancer. The use of chemotherapy, almost always in combination, increased considerably, while the use of hormone therapy fell reciprocally *(Table 11)*. The combination of surgery and hormone therapy was the most common treatment combination in 1996-1999 (18% of cases), but was exceeded by surgery and chemotherapy (25% of cases) in 2000-2004.

Table 11. Female breast cancer treatment combinations, by period of diagnosis (1995 excluded for this cancer)

	1996-1999[2]		2000-2004		% change		
.	cases treated	% having treatment	cases treated	% having treatment	absolute change	relative change	trend[1]
all surgery	5573	84%	8642	85%	0.7%	0.8%	
all chemotherapy	2530	38%	5064	50%	11.5%	30.2%	↑
all hormone therapy	3481	53%	3485	34%	-18.4%	-34.9%	↓
all radiotherapy	2939	44%	4201	41%	-3.1%	-7.0%	↓
no tumour-directed treatment	254	4%	471	5%	0.8%	20.6%	
surgery and hormone therapy	1187	18%	924	9%	-8.9%	-49.4%	↓
surgery, hormone therapy and radiotherapy	928	14%	1148	11%	-2.7%	-19.5%	↓
surgery, chemotherapy and radiotherapy	798	12%	1442	14%	2.1%	17.5%	
surgery and chemotherapy	723	11%	2506	25%	13.7%	125.4%	↑
surgery only	637	10%	930	9%	-0.5%	-5.1%	
surgery and radiotherapy	499	8%	943	9%	1.7%	22.9%	
other	1584	24%	1800	18%	-6.3%	-26.1%	↓

[1] ↑=statistically significant relative increase ↓=statistically significant relative decrease.

[2] 1995 data are excluded for breast cancer, as chemotherapy and hormonal therapy not fully separable in pre-1996 data.

Lung cancer

Radiation therapy was by far the most common treatment modality for lung cancer in both periods, either alone or in combination with surgery or chemotherapy. There was a significant fall in the use of surgery for lung cancer between 1995-1999 and 2000-2004, with a significant increase in the use of chemotherapy, both as a single modality and in combination with radiation therapy *(Table 12)*. The percentage of patients not recorded as having any tumour-directed treatment fell slightly, but significantly, from 47% in 1995-1999 to 44% in 2000-2004.

Table 12. Lung cancer treatment combinations, by period of diagnosis

	1995-1999		2000-2004		% change		
	cases treated	% having treatment	cases treated	% having treatment	absolute change	relative change	trend[1]
all surgery	1041	14%	952	12%	-2.2%	-15.2%	
all chemotherapy	1125	16%	1793	23%	7.4%	47.8%	↑
all radiation therapy	2317	32%	2544	33%	0.6%	1.8%	
no tumour-directed treatment	3394	47%	3454	44%	-2.7%	-5.7%	↓
radiation therapy only	1710	24%	1703	22%	-1.8%	-7.7%	
surgery only	837	12%	730	9%	-2.2%	-19.1%	
chemotherapy only	642	9%	981	13%	3.7%	41.7%	↑
chemotherapy and radiation therapy	431	6%	696	9%	3.0%	49.7%	
surgery and radiation therapy	152	2%	106	1%	-0.7%	-35.4%	
surgery and chemotherapy	28	0%	77	1%	0.6%	154.9%	
other	24	0%	39	1%	0.2%	50.6%	

[1] ↑=statistically significant relative increase ↓=statistically significant relative decrease

Prostate cancer

Surgery was the most common treatment modality for prostate cancer in 1995-1999, but hormone therapy was the most common in 2000-2004 *(Table 13).* Although the proportion of patients having surgery fell significantly, the number increased slightly, due to the major increase in prostate cancer numbers over the period described. The percentage of patients not recorded as having any tumour-directed treatment (within six months of diagnosis) increased significantly, from 21% in 1995-1999 to 28% in 2000-2004, while the number of these patients more than doubled.

Table 13. Prostate cancer treatment combinations, by period of diagnosis

	1995-1999		2000-2004		% change		
	cases treated	% having treatment	cases treated	% having treatment	absolute change	relative change	trend[1]
all surgery	3130	51%	3276	33%	-18.1%	-35.1%	↓
all chemotherapy	71	1%	137	1%	0.2%	19.7%	
all hormone therapy	2302	38%	3632	37%	-0.8%	-2.1%	
all radiation therapy	396	7%	1377	14%	7.5%	115.7%	↑
no tumour-directed treatment	1302	21%	2723	28%	6.4%	29.8%	↑
surgery only	2178	36%	2426	25%	-11.1%	-30.9%	↓
hormone therapy only	1334	22%	2493	25%	3.5%	15.9%	↑
surgery and hormone therapy	803	13%	671	7%	-6.4%	-48.2%	↓
radiation therapy only	169	3%	860	9%	6.0%	215.7%	↑
hormone therapy and radiation therapy	97	2%	335	3%	1.8%	114.3%	
surgery and radiation therapy	89	1%	110	1%	-0.3%	-23.3%	
other	108	2%	182	2%	0.1%	4.6%	

[1] ↑=statistically significant relative increase ↓=statistically significant relative decrease

Relationship of treatment to age and period of diagnosis

Surgery

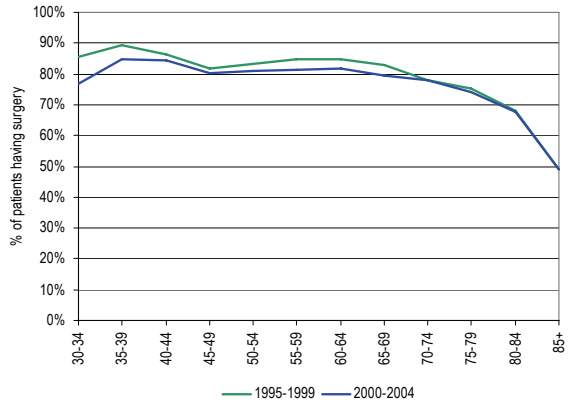
The percentage of patients having surgery decreased with age for the four commonest cancers *(Table 14, Figure 1)*. The largest decrease with age was in **lung cancer**, where the percentage of patients of 80 years and over having surgery was one-tenth of the percentage aged under 50. There were no significant changes in the percentage of patients of 80 and older having surgery between 1995-1999 and 2000-2004, with the exception of **prostate cancer**, for which the percentage having surgery fell from 43% to 27% (χ^2=81.1; p<0.001), while remaining unchanged for younger patients.

Table 14. Percentage of cancers treated surgically within 6 months of diagnosis, by patient age and period of diagnosis

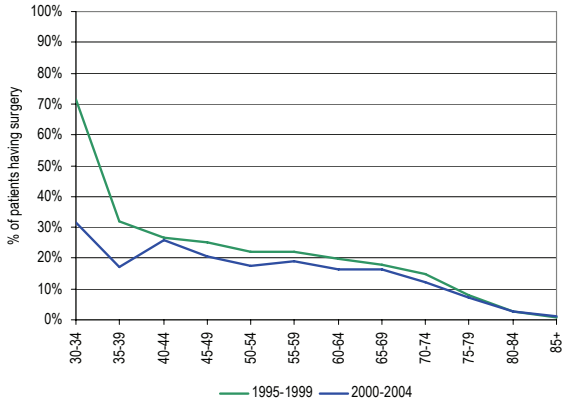
	colorectal		lung		breast (female)		prostate	
	1995-1999	2000-2004	1995-1999	2000-2004	1995-1999	2000-2004	1995-1999	2000-2004
patients under 50	84%	81%	23%	19%	92%	93%	64%	50%
patients 80 and over	61%	61%	2%	2%	46%	43%	43%	27%
ratio of rate in 80+ patients to that in under 50s	0.72	0.75	0.09	0.11	0.50	0.47	0.67	0.54

Figure 1. Percentage of cancers treated surgically within 6 months of diagnosis, by patient age and period of diagnosis

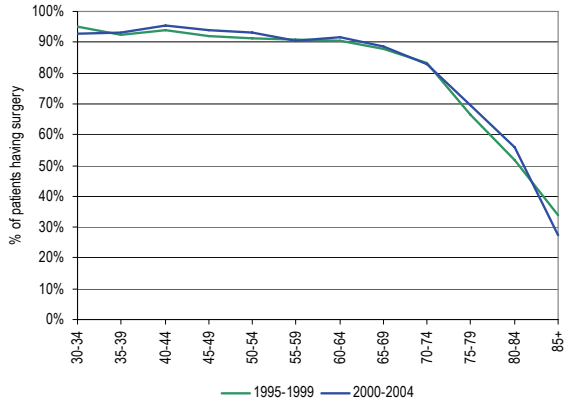
colorectal



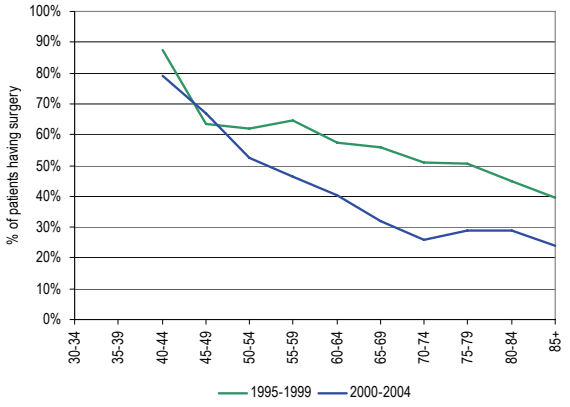
lung



female breast



prostate



Chemotherapy

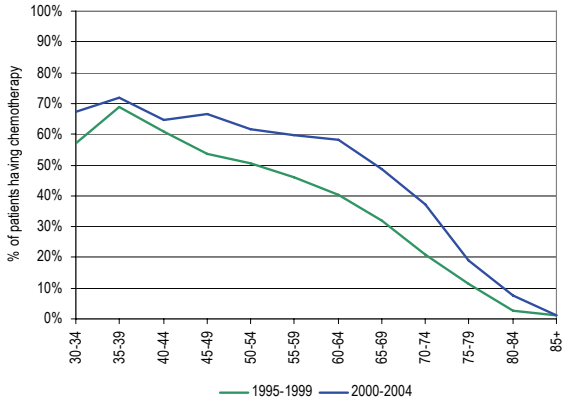
The percentage of patients having chemotherapy decreased with age more markedly than did the percentage having surgery, for the three commonest cancers *(Table 15, Figure 2)*. **Prostate cancer** is omitted, as the overall percentage having chemotherapy was only 1%. The decrease with age was similar for the other three cancers, with the percentage of patients of 80 years and over having chemotherapy ranging less than one-tenth of the percentage aged under 50. There were significant increases in the percentage of patients of 80 and older having chemotherapy between the earlier and later periods for **breast cancer** (χ^2=5.1, p<0.05) and **colorectal cancer** (χ^2=25.8, p<.001), but the largest increases were for patients in their 60s.

Table 15. Percentage of cancers treated with chemotherapy within 6 months of diagnosis, by patient age and period of diagnosis

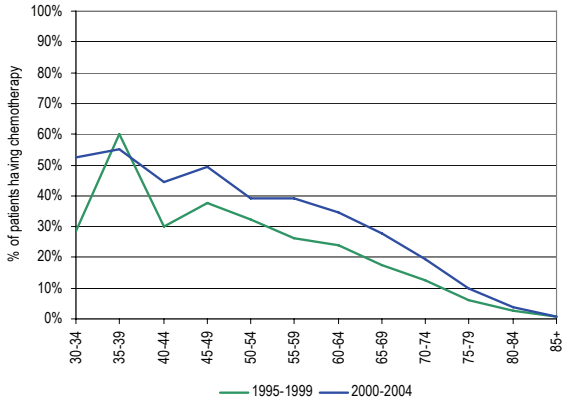
	colorectal		lung		breast (female)	
	1995-1999	2000-2004	1995-1999	2000-2004	1996-1999	2000-2004
patients under 50	51%	63%	31%	42%	60%	68%
patients 80 and over	2%	5%	2%	4%	2%	4%
ratio of rate in 80+ patients to that in under 50s	0.04	0.08	0.07	0.09	0.04	0.06

Figure 2. Percentage of cancers treated by chemotherapy within 6 months of diagnosis, by patient age and period of diagnosis

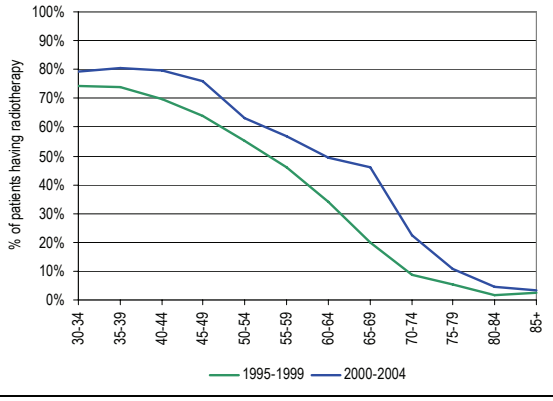
colorectal



lung



female breast (excluding 1995)



Radiation therapy

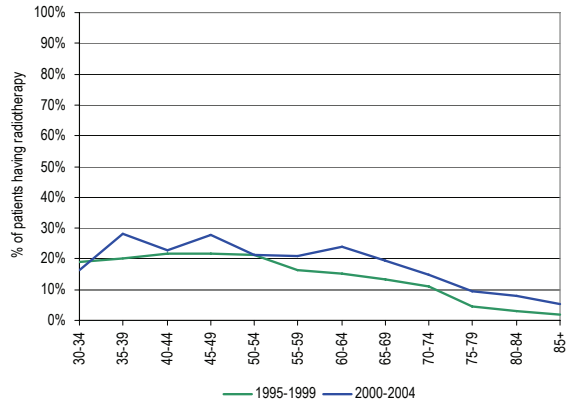
Radiation therapy use decreased much less with age than did surgery or chemotherapy *(Table 16, Figure 3)*. The largest decrease with age was for **prostate cancer**, and the smallest for **lung cancer**. There were significant increases in the percentage of patients of 80 and older having radiation therapy between 1995-1999 and 2000-2004 for **colorectal cancer** (χ^2=39.8, p<0.001), **lung cancer** (χ^2=7.1, p=0.008) and **prostate cancer** (χ^2=4.6, p=0.031).

Table 16. Percentage of cancers treated with radiation therapy within 6 months of diagnosis, by patient age and period of diagnosis

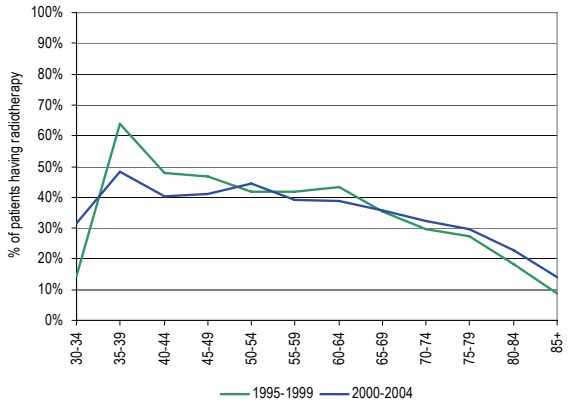
	colorectal		lung		breast (female)		prostate	
	1995-1999	2000-2004	1995-1999	1995-1999	2000-2004	2000-2004	1995-1999	2000-2004
patients under 50	19%	23%	43%	41%	51%	43%	16%	18%
patients 80 and over	3%	7%	16%	20%	16%	15%	2%	3%
ratio of rate in 80+ patients to that in under 50s	0.14	0.31	0.36	0.48	0.31	0.35	0.10	0.15

Figure 3. Percentage of cancers treated by radiation therapy within 6 months of diagnosis, by patient age and period of diagnosis

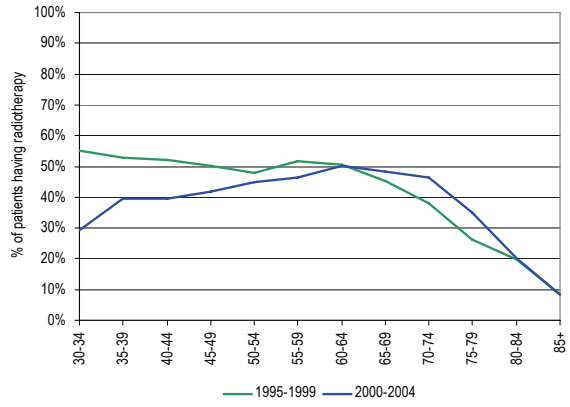
colorectal



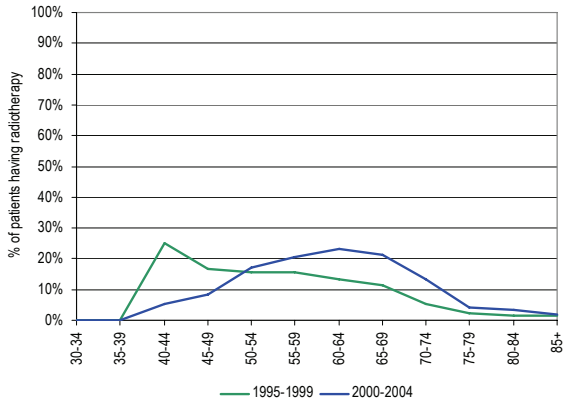
lung



female breast



prostate



Relationship of treatment to HSE area of residence

Surgery: regional variation in treatment, 1994-1999 and 2000-2004

For the commoner cancers, there was a decrease in the proportion of patients resident in Dublin/Mid-Leinster treated surgically for cancer of the **oesophagus**, **colon/rectum**, **lung**, **melanoma of skin** , cancer of the **prostate**, **bladder**, and **brain/other CNS**; for those in the Dublin/North-East for cancer of the **stomach**, **colon/rectum**, **lung**, **prostate**, and **brain/CNS**; for the Southern area for cancer of the **oesophagus**, **melanoma of skin**, cancers of **penis**, **prostate** and **brain/CNS**; and for those in the Western area for cancer of **pancreas**, **mesothelioma**, cancers of **prostate** and **brain/CNS,** and for **non-Hodgkin lymphoma** *(Table 17).* Figures in bold indicate a statistically significant increase or decrease in the proportion treated.

Increases in the proportion of common cancers treated by surgery were less frequent than decreases: for residents of all areas in cancers of the **female genital organs**, and in addition residents of Dublin/Mid-Leinster for **thyroid cancer**; Dublin/North-East for **breast cancer**; the Southern area for cancers of **head and neck**, **larynx** and **breast**; and the Western area for **liver cancer**.

Table 17. Percentage of cancers treated by surgery—by HSE area of residence and period of diagnosis

surgery	Dublin/Mid-Leinster		Dublin/North-East		South		West	
cancer site	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**
head and neck	56.3%	57.9%	55.1%	56.7%	45.0%	**56.1%**	59.3%	58.0%
oesophagus	30.1%	**21.9%**	29.5%	23.1%	27.7%	**17.9%**	24.7%	23.5%
stomach	42.6%	40.0%	46.8%	**39.8%**	40.7%	35.2%	45.9%	42.1%
small intestine	61.7%	60.3%	63.3%	47.5%	64.9%	73.6%	63.9%	44.2%
colorectal	78.4%	**74.4%**	80.3%	**74.1%**	73.4%	75.8%	78.4%	77.4%
liver	6.0%	9.8%	6.3%	14.6%	8.0%	12.8%	5.1%	**15.5%**
gallbladder	42.0%	40.0%	39.4%	18.8%	45.3%	36.5%	48.1%	40.0%
other biliary	25.0%	29.4%	16.2%	30.2%	15.0%	26.5%	24.0%	21.4%
pancreas	10.6%	11.2%	5.9%	9.5%	6.8%	6.4%	9.3%	**5.8%**
other digestive	19.4%	7.1%	18.8%	5.3%	4.8%	2.0%	11.1%	8.0%
nasal cavity/middle ear	73.7%	75.0%	63.6%	55.6%	50.0%	50.0%	72.7%	83.3%
sinuses	30.0%	56.3%	54.5%	56.3%	56.3%	46.7%	40.0%	57.1%
larynx	30.4%	32.5%	38.5%	32.9%	15.2%	**30.0%**	18.6%	19.3%
lung	17.7%	**13.4%**	16.2%	**13.1%**	13.1%	11.6%	9.6%	10.5%
mediastinum	13.3%	4.0%	0.0%	0.0%	9.1%	0.0%	0.0%	8.3%
bones and joints	62.5%	55.9%	54.5%	53.6%	61.8%	51.4%	51.9%	62.2%
melanoma of skin	92.8%	**88.0%**	94.2%	92.1%	95.9%	**90.8%**	94.3%	93.9%
mesothelioma	10.0%	14.6%	16.7%	4.0%	23.5%	9.4%	33.3%	**4.3%**
Kaposi sarcoma	-	-	-	-	-	-	-	-
peripheral nerves	60.0%	42.9%	66.7%	66.7%	66.7%	75.0%	100.0%	62.5%
peritoneum	64.3%	54.2%	40.0%	75.0%	41.7%	78.6%	14.3%	38.9%
connective tissues	76.8%	75.7%	69.7%	69.0%	81.0%	70.3%	70.0%	65.3%
breast	85.2%	84.1%	84.2%	**86.9%**	81.6%	**84.5%**	84.3%	85.1%
female genital	68.9%	**74.9%**	67.2%	**75.2%**	67.2%	**72.7%**	65.6%	**72.1%**
prostate	58.0%	**38.9%**	63.1%	**47.2%**	50.8%	**32.5%**	37.9%	**20.9%**
testis	90.3%	94.2%	94.3%	94.9%	96.5%	93.6%	94.8%	91.7%
kidney	63.1%	64.6%	65.7%	64.5%	67.2%	65.8%	65.7%	63.0%
renal pelvis	75.0%	76.9%	100.0%	88.9%	75.0%	57.1%	69.2%	83.3%
ureter	84.6%	73.7%	90.0%	86.7%	100.0%	100.0%	84.6%	73.3%
bladder	74.9%	**63.1%**	84.9%	81.9%	75.8%	79.3%	80.2%	82.5%
other urinary	91.7%	57.1%	25.0%	0.0%	85.7%	50.0%	57.1%	0.0%
eye	50.0%	57.7%	69.0%	52.8%	68.2%	68.8%	68.2%	59.4%
brain and other CNS	40.4%	**15.8%**	35.9%	**12.6%**	30.8%	**24.1%**	32.7%	**18.8%**
thyroid	76.3%	**88.8%**	86.2%	86.7%	80.5%	81.5%	77.5%	73.5%
adrenal	52.9%	55.6%	25.0%	55.6%	75.0%	62.5%	71.4%	66.7%
other endocrine	30.0%	20.0%	33.3%	33.3%	40.0%	33.3%	46.7%	37.5%
ill-defined site	22.4%	22.2%	15.2%	10.5%	12.5%	15.4%	5.6%	10.8%
unknown primary site	4.7%	4.3%	5.4%	6.2%	2.7%	**5.0%**	5.0%	4.4%
Hodgkin lymphoma	6.0%	13.1%	7.8%	14.8%	11.5%	8.0%	7.7%	7.4%
non-Hodgkin lymphoma	14.3%	14.1%	22.2%	20.4%	20.4%	18.8%	23.1%	**17.3%**

Surgery: detailed results for major cancer sites

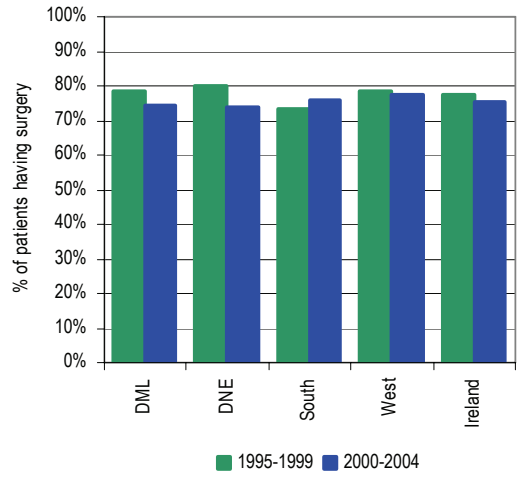
Table 18. Percentage of cancers treated by surgery within 6 months of diagnosis —by HSE area of residence and period of diagnosis

period of diagnosis	area of residence	colorectal		lung		breast (female)		prostate	
		number treated	% treated	number treated	% treated	number treated	% treated	number treated	% treated
1995-1999	Dublin/Mid-Leinster	1724	78.4%	386	17.7%	1756	85.5%	968	58.0%
	Dublin/North-East	1398	80.3%	279	16.2%	1123	84.6%	668	63.1%
	South	1733	73.4%	223	13.1%	1431	82.4%	880	50.8%
	West	1682	78.4%	153	9.6%	1308	84.8%	614	37.9%
	Ireland	6537	77.4%	1041	14.4%	5618	84.3%	3130	51.5%
2000-2004	Dublin/Mid-Leinster	1802	74.4%	303	13.4%	2694	84.1%	1000	38.9%
	Dublin/North-East	1383	74.1%	239	13.1%	1942	86.9%	783	47.2%
	South	1883	75.8%	224	11.6%	2140	84.5%	922	32.5%
	West	1808	77.4%	186	10.5%	1921	85.1%	571	20.9%
	Ireland	6876	75.5%	952	12.2%	8697	85.0%	3276	33.4%

The percentage of patients having surgery for **colorectal cancer** in 1995-1999 was highest in the Dublin/North-East area and in 2000-2004 in the West *(Table 18, Figure 4).* There was a fall in the percentage treated between 1995-1999 and 2000-2004 in all areas but the South. The percentage treated was quite similar in all areas in 2000-2004, ranging from 74.1% in Dublin/North-East to 75.8% in the South. When adjusted for differences in age and sex between HSE areas *(Table 18),* the relative probability (relative risk) of having surgery in 1995-1999 for patients resident in the HSE South area was significantly lower (by 6%) than for those in Dublin/Mid-Leinster. However in 2000-2004, no area had a significantly lower probability of surgery, while the relative probability of having surgery in the HSE West area was 5% higher than in Dublin Mid-Leinster.

Figure 4. Percentage of cancers treated by surgery within 6 months of diagnosis—by HSE area of residence and period of diagnosis

colorectal



lung

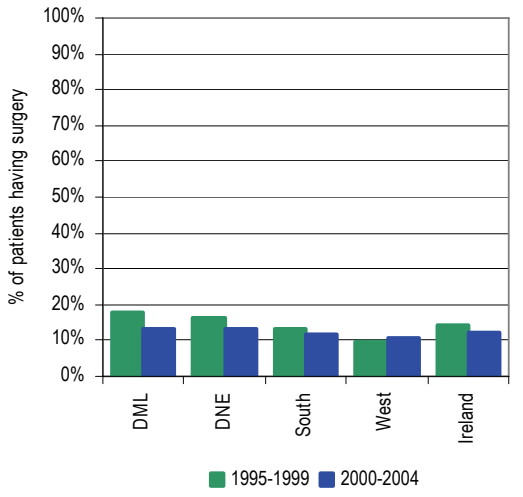
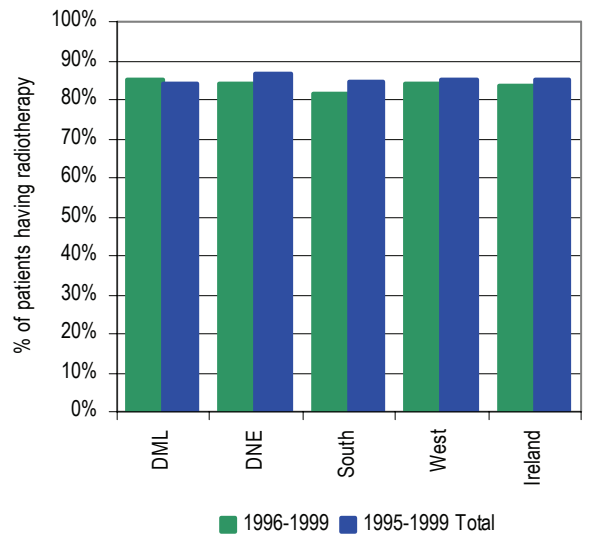
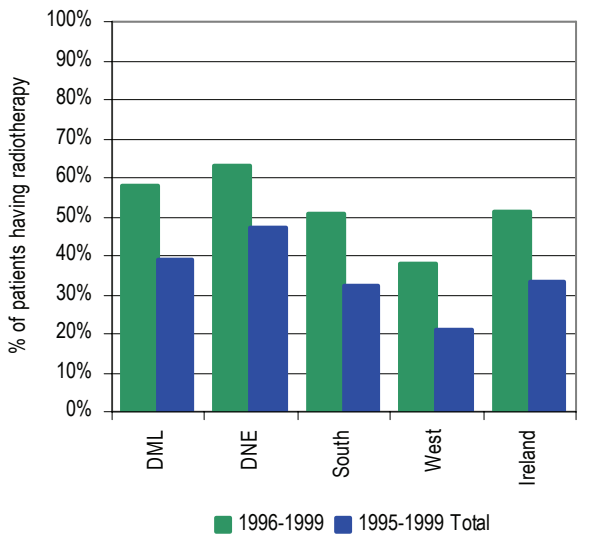


Figure 4 (contd.). Percentage of cancers treated by surgery within 6 months of diagnosis—by HSE area of residence and period of diagnosis

female breast



prostate



Far fewer patients had surgery for **lung cancer**; the lowest percentage in both periods was in the West. While the overall percentage fell between 1995-1999 and 2000-2004, it increased in the South and West, so that in 2000-2004 the difference between areas were less than in 1995-1999 *(Table 18, Figure 4)*. When adjusted for age and sex, the probability of having surgery for lung cancer was significantly lower in the South and West than in Dublin/Mid-Leinster in 1995-1999 and also lower in the West in 2000-2004 than all other areas; as with the unadjusted percentage treated, the gap between areas narrowed in the recent period *(Table 19)*.

There was very little difference between areas in the percentage of patients having surgery for **breast cancer**, which ranged from 82.3% in the South to 86.1% in Dublin/Mid-Leinster in 1995-1999 and from 84.1% in Dublin/Mid-Leinster to 86.9% in Dublin/North-East in 2000-2004 *(Table 18, Figure 4)*. As with other cancers, the differences between areas became smaller in the later period. When adjusted for age and sex patients resident in the Southern area had a significantly lower probability of having surgery for breast cancer than those in Dublin/Mid-Leinster in 1995-1999, but not in 2000-2004, when the rate of surgery was higher in all areas than in Dublin/Mid-Leinster *(Table 19)*.

The percentage of patients having surgery for **prostate cancer** fell in all areas between 1995-1999 and 2000-2004 *(Table 18, Figure 4)*. The highest percentage in both periods was in Dublin/North-East and the lowest was in the West. Unlike the other major cancers, the relative differences between areas increased between 1995-1999 and 2000-2004. When adjusted for age and sex, these differences were even larger--the probability of having surgery for prostate cancer for residents of the Western area area was just over half of that in Dublin/Mid-Leinster, and the rate in Dublin/North-East was higher again that Dublin/Mid-Leinster *(Table 19)*.

Table 19. Relative probability of having surgery, by period and HSE area of residence (adjusted for age and sex)

1995-1999	**colorectal**	**lung**	**breast (female)**	**prostate**
Dublin/Mid-Leinster	1.00	1.00	1.00	1.00
Dublin/North-East	1.03 (1.00, 1.06)	0.89 (0.76, 1.04)	0.99 (0.96, 1.02)	1.11 (1.03, 1.19)
South	0.94 (0.91, 0.98)	0.73 (0.62, 0.86)	0.97 (0.94, 1.00)	0.86 (0.79, 0.93)
West	1.02 (0.98, 1.05)	0.54 (0.44, 0.65)	1.00 (0.97, 1.03)	0.62 (0.56, 0.68)
2000-2004				
Dublin/Mid-Leinster	1.00	1.00	1.00	1.00
Dublin/North-East	0.98 (0.94, 1.01)	1.02 (0.86, 1.20)	1.04 (1.01, 1.06)	1.26 (1.16, 1.35)
South	1.03 (1.00, 1.06)	0.88 (0.74, 1.05)	1.02 (1.00, 1.04)	0.83 (0.77, 0.91)
West	1.05 (1.02, 1.08)	0.80 (0.67, 0.96)	1.03 (1.01, 1.05)	0.53 (0.48, 0.59)

Chemotherapy: regional variation in treatment, 1994-1999 and 2000-2004

Chemotherapy use increased significantly for almost all common cancers in all areas *(Table 20)*. The only exceptions to this were a fall in chemotherapy for **prostate cancer** in the South and for **melanoma of skin** in the West. Substantial increases were seen in chemotherapy for cancers of **oesophagus**, **stomach** and **pancreas** in all areas and smaller but statistically significant increases for cancers of **lung**, **bladder** and **female genital tract**.

Table 20. Percentage of cancers treated by chemotherapy —by HSE area of residence and period of diagnosis

chemotherapy	Dublin/Mid-Leinster		Dublin/North-East		South		West	
cancer site	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**
head and neck	5%	**19%**	6%	**18%**	5%	**17%**	5%	**18%**
oesophagus	21%	**35%**	24%	**38%**	16%	**40%**	18%	**32%**
stomach	9%	**25%**	10%	**24%**	12%	**30%**	7%	**22%**
small intestine	15%	28%	13%	20%	22%	26%	19%	21%
colorectal	28%	**38%**	27%	**38%**	25%	**40%**	27%	**35%**
liver	4%	**14%**	5%	9%	7%	11%	7%	12%
gallbladder	10%	22%	6%	13%	2%	6%	4%	4%
other biliary	1%	**14%**	0%	**8%**	4%	6%	5%	4%
pancreas	11%	**27%**	8%	**23%**	7%	**16%**	6%	**16%**
other digestive	22%	36%	25%	26%	6%	6%	11%	28%
nasal cavity/middle ear	5%	8%	0%	11%	0%	0%	0%	0%
sinuses	20%	13%	0%	13%	31%	7%	0%	14%
larynx	2%	**17%**	3%	**14%**	1%	**6%**	2%	**11%**
trachea	0%	0%	20%	25%	20%	0%	20%	0%
lung	18%	**25%**	14%	**23%**	14%	**23%**	16%	**22%**
thymus	29%	33%	43%	50%	20%	43%	0%	40%
mediastinum	27%	28%	15%	18%	18%	35%	18%	17%
other chest	0%	0%	0%	0%	0%	100%	0%	0%
bones and joints	38%	44%	36%	50%	47%	46%	37%	43%
melanoma of skin	7%	6%	4%	6%	5%	3%	5%	**2%**
mesothelioma	7%	**37%**	6%	**32%**	18%	44%	17%	30%
Kaposi sarcoma	57%	43%	0%	20%	0%	0%	0%	0%
peripheral nerves	0%	0%	0%	17%	33%	50%	0%	13%
peritoneum	21%	33%	30%	67%	17%	36%	21%	28%
connective tissues	14%	18%	12%	17%	13%	12%	8%	7%
breast	196%	48%	186%	45%	206%	54%	206%	52%
female genital	28%	**35%**	23%	**36%**	26%	**36%**	27%	**32%**
penis	5%	10%	0%	4%	8%	3%	6%	4%
prostate	1%	1%	1%	**1%**	1%	**1%**	2%	2%
testis	34%	27%	25%	28%	32%	31%	32%	36%
other male genital	0%	0%	0%	0%	0%	0%	0%	33%
kidney	6%	**11%**	3%	**7%**	6%	6%	3%	7%
renal pelvis	6%	8%	14%	11%	0%	29%	0%	17%
ureter	0%	16%	0%	7%	0%	14%	15%	7%
bladder	4%	**8%**	4%	**10%**	7%	**16%**	9%	**17%**
other urinary	0%	14%	0%	0%	0%	0%	0%	0%
eye	8%	2%	0%	0%	5%	2%	2%	3%
brain and other CNS	11%	15%	9%	7%	9%	**18%**	7%	**15%**
thyroid	4%	2%	2%	1%	0%	1%	0%	1%
adrenal	6%	11%	0%	0%	13%	19%	0%	0%
other endocrine	10%	13%	0%	**50%**	0%	17%	13%	13%
ill-defined site	10%	19%	15%	11%	9%	13%	9%	8%
unknown primary site	13%	**16%**	10%	**18%**	8%	**15%**	8%	**12%**
Hodgkin lymphoma	78%	82%	74%	85%	71%	74%	64%	**86%**
non-Hodgkin lymphoma	63%	64%	64%	61%	65%	64%	61%	**68%**
malignant immunoproliferative disease	33%	46%	50%	80%	47%	33%	45%	29%
multiple myeloma	62%	61%	56%	57%	66%	71%	59%	65%
leukaemia	45%	40%	40%	46%	45%	51%	36%	36%
other lymphoid and hematopoietic	50%	0%	0%	50%	0%	50%	0%	0%

Chemotherapy: major cancer sites

Table 21. Percentage of cancers treated by chemotherapy within 6 months of diagnosis—by HSE area of residence and period of diagnosis

period of diagnosis	area of residence	colorectal		lung		female breast (1995 excluded)		prostate	
		number treated	% treated	number treated	% treated	number treated	% treated	number treated	% treated
1995-1999	Dublin/Mid-Leinster	617	28.1%	394	18.0%	802	39.4%	15	0.9%
	Dublin/North-East	472	27.1%	236	13.7%	540	40.9%	6	0.6%
	South	583	24.7%	239	14.0%	675	39.1%	21	1.2%
	West	572	26.7%	256	16.0%	513	33.6%	29	1.8%
	Ireland	2244	26.6%	1125	15.6%	2530	38.3%	71	1.2%
2000-2004	Dublin/Mid-Leinster	931	38.5%	555	24.6%	1531	48.1%	36	1.4%
	Dublin/North-East	716	38.4%	421	23.0%	995	44.7%	23	1.4%
	South	1002	40.3%	434	22.5%	1367	54.4%	18	0.6%
	West	810	34.7%	383	21.6%	1171	52.3%	60	2.2%
	Ireland	3459	38.0%	1793	23.0%	5064	49.8%	137	1.4%

The percentage of patients having chemotherapy for **colorectal cancer** increased considerably between 1995-1999 and 2000-2005 in the Western area and in the South in 2000-2004 *(Table 21, Figure 5)*. The increase was least in the West, which had the lowest level of chemotherapy in 2000-2004, and greatest in the South. When adjusted for differences in age and sex between HSE areas *(Table 22)*, only the lower rates of chemotherapy in the South (in 1995-99) and the West (in 2000-2004) were statistically significant.

The percentage of patients having chemotherapy for **lung cancer** also increased between 1995-1999 and 2000-2004 *(Table 21, Figure 5)*. The largest increase was in Dublin/North-East and the smallest in the West, and the differences between areas were much smaller in 2000-2004. When adjusted for age and sex, the probability of having chemotherapy for lung cancer was significantly lower in Dublin/North-East and the South, than in Dublin/Mid-Leinster, in 1995-1999, and in the West, in 2000-2004; as with the percentage treated, the gap between areas narrowed *(Table 22)*.

Figure 5. Percentage of cancers treated by chemotherapy—by HSE area of residence and period of diagnosis

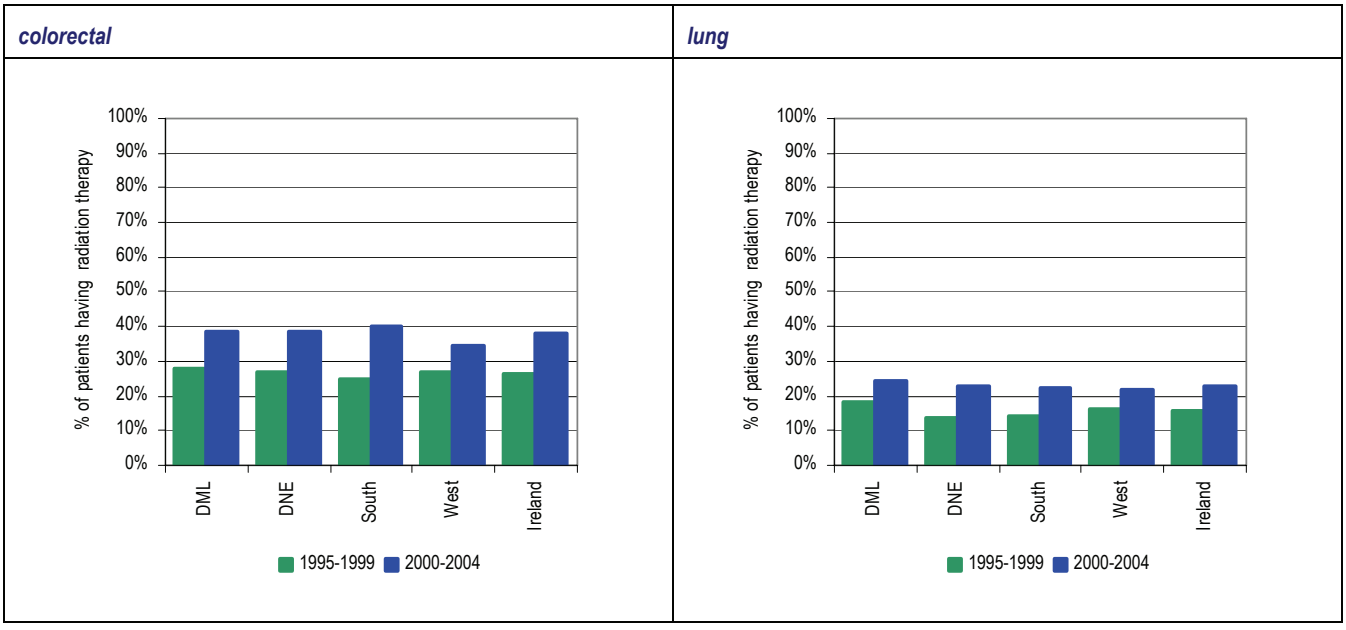
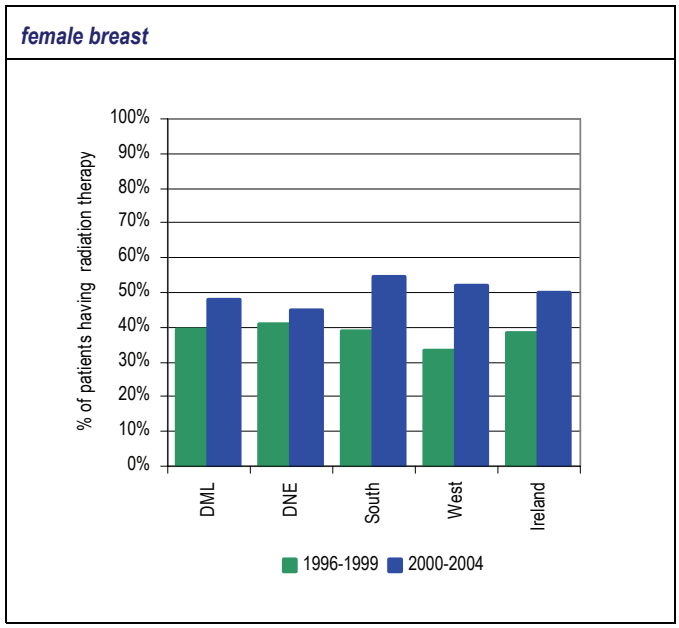


Figure 5 (contd.). Percentage of cancers treated by chemotherapy—by HSE area of residence and period of diagnosis



As with colorectal and lung cancer, the percentage of patients having chemotherapy for **breast cancer** increased in all areas between 1996-1999 and 2000-2004 [1995 chemotherapy data excluded for this cancer] *(Table 21, Figure 5).* The increases were greater in the South and West areas, with the percentage treated in the West increasing from 34% to 52%. When adjusted for age and sex, patients resident in the West in 1996-1999 and in Dublin/North-East in 2000-2004 had a significantly lower probability of having chemotherapy for breast cancer than those in Dublin/Mid-Leinster *(Table 22)*.

Only 1.2% of **prostate cancer** patients in 1996-1999 and 1.4% in 2000-2004 had chemotherapy, so examination of area or temporal patterns was not informative.

Table 22. Relative probability of having chemotherapy, by period and HSE area of residence, adjusted for age and sex

	colorectal	lung	female breast (1995 excluded)
1995-1999			
Dublin/Mid-Leinster	1.00	1.00	1.00
Dublin/North-East	0.94 (0.84, 1.06)	0.70 (0.59, 0.83)	1.09 (0.98, 1.19)
South	0.87 (0.78, 0.97)	0.80 (0.68, 0.94)	1.10 (1.01, 1.20)
West	0.98 (0.88, 1.09)	0.95 (0.81, 1.10)	0.88 (0.79, 0.98)
2000-2004			
Dublin/Mid-Leinster	1.00	1.00	1.00
Dublin/North-East	0.95 (0.87, 1.04)	0.94 (0.83, 1.06)	0.93 (0.87, 0.99)
South	1.05 (0.97, 1.13)	0.90 (0.79, 1.02)	1.21 (1.16, 1.27)
West	0.89 (0.82, 0.97)	0.83 (0.72, 0.94)	1.16 (1.10, 1.21)

Hormone therapy: prostate and female breast cancer

Table 23. Percentage of cancers treated by hormone therapy within 6 months of diagnosis —by HSE area of residence and period of diagnosis

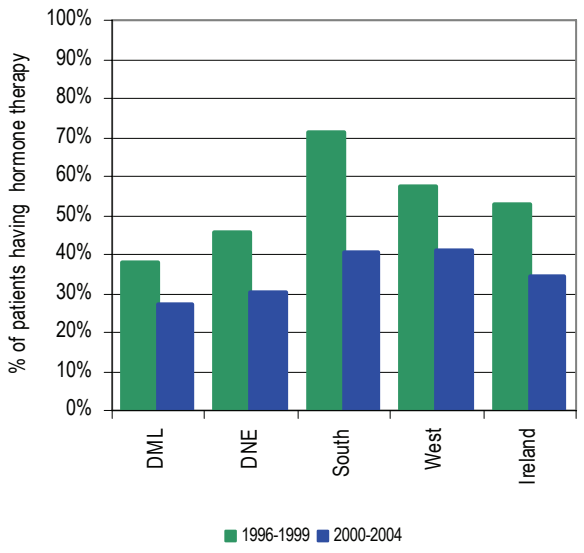
period of diagnosis	area of residence	female breast (1995 excluded)		prostate	
		number treated	% treated	number treated	% treated
1995-1999	Dublin/Mid-Leinster	769	37.8%	493	29.5%
	Dublin/North-East	604	45.7%	281	26.6%
	South	1234	71.5%	665	38.4%
	West	874	57.2%	862	53.2%
	Ireland	3481	52.7%	2301	37.9%
2000-2004	Dublin/Mid-Leinster	869	27.3%	752	29.3%
	Dublin/North-East	674	30.3%	414	25.0%
	South	1023	40.7%	1178	41.6%
	West	919	41.0%	1288	47.0%
	Ireland	3485	34.3%	3632	37.1%

In 1996-1999, the percentage of patients with **breast cancer** treated by hormone therapy varied considerable between areas, being far higher in the Southern area (71.5% of patients) than elsewhere *(Table 23, Figure 6)*. In 2000-2004 the overall level of hormone therapy had fallen and the differences between areas were much less. In both periods, the percentage receiving hormone therapy was lowest in Dublin/Mid-Leinster.

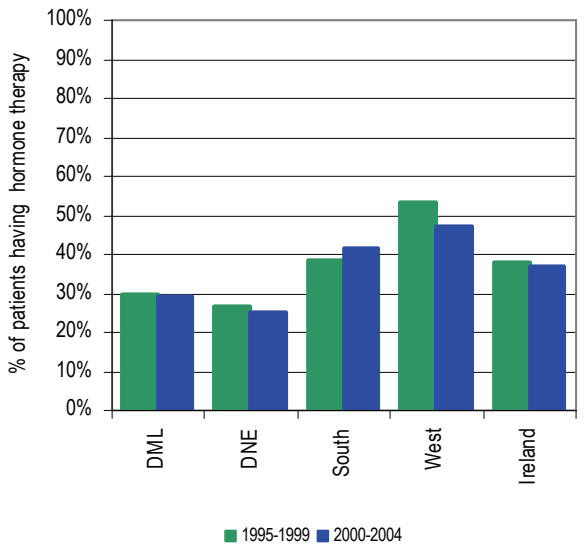
There was little overall change in hormone therapy for **prostate cancer**, and the variation between areas was almost as large in 2000-2004 as it was in 1995-1999 *(Table 23, Figure 6)*. This treatment was most common in the West and least common in Dublin/North-East in both periods.

Figure 6. Percentage of cancers treated by hormone therapy—by HSE area of residence and period of diagnosis

female breast (1996-2004)



prostate



Radiation therapy: regional variation in treatment, 1994-1999 and 2000-2004

There was a significant increase in the use of radiation therapy for **colorectal cancer** in all areas *(Table 24, Table 29)* and for cancers of **oesophagus** and **stomach** in almost all. The largest relative increase across the areas was in radiation therapy for **prostate cancer**. The majority of other significant changes involved increases in radiation therapy use.

Table 24. Percentage of cancers treated by radiation therapy—by HSE area of residence and period of diagnosis

radiation therapy	Dublin/Mid-Leinster		Dublin/North-East		South		West	
ICD10 code	1995-1999	2000-2004	1995-1999	2000-2004	1995-1999	2000-2004	1995-1999	2000-2004
head and neck	54%	60%	59%	59%	62%	60%	48%	**56%**
oesophagus	34%	**49%**	42%	48%	24%	**45%**	32%	**50%**
stomach	7%	10%	6%	**12%**	2%	**10%**	5%	**14%**
small intestine	3%	0%	0%	8%	0%	4%	3%	7%
colorectal	14%	**18%**	12%	**16%**	9%	**16%**	10%	**14%**
liver	2%	5%	3%	3%	3%	3%	0%	**9%**
gallbladder	6%	5%	3%	6%	0%	4%	6%	5%
other biliary	4%	11%	1%	5%	1%	4%	6%	8%
pancreas	10%	9%	6%	**12%**	3%	**8%**	4%	**9%**
other digestive	8%	0%	19%	5%	5%	0%	4%	0%
nasal cavity/middle ear	47%	42%	45%	33%	50%	25%	36%	50%
sinuses	80%	75%	27%	56%	69%	**33%**	60%	57%
larynx	71%	73%	78%	69%	82%	**71%**	74%	72%
trachea	0%	**67%**	40%	50%	80%	100%	40%	33%
lung	36%	35%	34%	32%	31%	**35%**	26%	28%
thymus	57%	50%	71%	**0%**	20%	43%	0%	60%
mediastinum	13%	36%	38%	27%	36%	41%	12%	8%
other chest	0%	0%	0%	0%	0%	0%	100%	0%
bones and joints	25%	15%	18%	7%	9%	23%	15%	16%
melanoma of skin	3%	2%	2%	3%	2%	2%	2%	**0%**
mesothelioma	10%	10%	6%	20%	6%	13%	17%	9%
Kaposi sarcoma	0%	0%	25%	0%	100%	**0%**	0%	0%
peripheral nerves	20%	29%	17%	17%	33%	75%	0%	38%
peritoneum	14%	4%	10%	8%	0%	0%	14%	6%
connective tissues	44%	31%	45%	**21%**	29%	26%	30%	24%
breast	44%	**38%**	48%	**52%**	48%	47%	34%	**29%**
female genital	21%	**27%**	26%	26%	27%	27%	24%	23%
penis	9%	14%	4%	11%	38%	24%	21%	**0%**
prostate	5%	**10%**	6%	**10%**	7%	**21%**	7%	**13%**
testis	37%	34%	52%	46%	28%	36%	33%	33%
other male genital	0%	0%	0%	0%	0%	0%	0%	33%
kidney	9%	8%	7%	10%	9%	10%	7%	11%
renal pelvis	6%	8%	0%	22%	0%	7%	8%	33%
ureter	0%	0%	10%	7%	13%	0%	0%	0%
bladder	9%	11%	6%	6%	14%	11%	7%	8%
other urinary	8%	0%	50%	0%	0%	**50%**	0%	**100%**
eye	3%	8%	7%	3%	21%	23%	11%	9%
brain and other CNS	45%	**55%**	41%	48%	34%	**47%**	29%	**41%**
thyroid	39%	28%	22%	20%	26%	30%	30%	27%
adrenal	12%	11%	0%	0%	0%	13%	14%	0%
other endocrine	10%	20%	50%	17%	50%	25%	33%	38%
ill-defined site	6%	17%	18%	**0%**	4%	10%	6%	0%
unknown primary site	17%	17%	13%	13%	13%	14%	9%	**12%**
Hodgkin lymphoma	17%	22%	20%	14%	29%	24%	26%	17%
non-Hodgkin lymphoma	20%	**11%**	15%	15%	25%	**20%**	16%	15%
malignant immunoproliferative disease	0%	8%	0%	0%	0%	0%	0%	0%
multiple myeloma	23%	22%	30%	25%	25%	**33%**	18%	21%
leukaemia	3%	2%	3%	2%	2%	3%	2%	3%
other lymphoid and hematopoietic	0%	0%	0%	50%	0%	0%	50%	0%

Radiation therapy: major cancer sites

Table 25. Percentage of cancers treated by radiation therapy within 6 months of diagnosis —by HSE area of residence and period of diagnosis

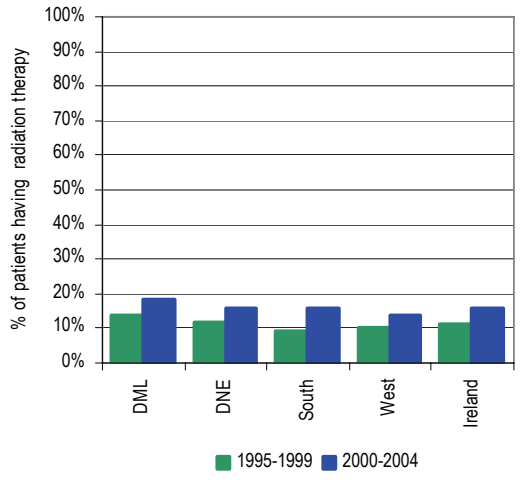
period of diagnosis	area of residence	colorectal		lung		breast (female)		prostate	
		number treated	% treated	number treated	% treated	number treated	% treated	number treated	% treated
1995-1999	Dublin/Mid-Leinster	307	14.0%	792	36.2%	922	44.9%	91	5.5%
	Dublin/North-East	207	11.9%	581	33.7%	658	49.6%	60	5.7%
	South	211	8.9%	534	31.3%	857	49.3%	129	7.4%
	West	216	10.1%	410	25.6%	519	33.7%	116	7.2%
	Ireland	941	11.1%	2317	32.1%	2956	44.4%	396	6.5%
2000-2004	Dublin/Mid-Leinster	440	18.2%	788	34.9%	1220	38.1%	258	10.0%
	Dublin/North-East	297	15.9%	592	32.4%	1156	51.7%	159	9.6%
	South	394	15.9%	676	35.1%	1178	46.5%	592	20.9%
	West	321	13.7%	488	27.5%	664	29.4%	368	13.4%
	Ireland	1452	15.9%	2544	32.7%	4218	41.2%	1377	14.1%

Radiation therapy was relatively uncommon for **colorectal cancer** (mainly used for rectal cancer), but increased in frequency in all areas between 1995-1999 and 2000-2004. The lowest level in 1995-1999 was in the South and in 2000-2004 in the Western area *(Table 25, Figure 7)*. Apart from the increase in the Southern area, the differences between areas persisted. When adjusted for differences in age and sex between HSE areas, the probability of having radiation therapy was significantly less in all areas than in Dublin/Mid-Leinster in both periods, but the differences between areas were less in 2000-2004 *(Table 26)*

A far smaller percentage of patients had radiation therapy for **lung cancer** in the West than in other areas in both periods *(Table 25, Figure 7)*. The use of this therapy increased in the Southern and Western areas between 1995-1999 and 2000-2004 but fell in Dublin/Mid-Leinster and Dublin/North-East. When adjusted for differences in age and sex between HSE areas, the probability of having radiation therapy was significantly less in all areas than in Dublin/Mid-Leinster in 1995-1999, and in Dublin/North-East and the West in 2000-2004 *(Table 26)*.

Figure 7. Percentage of cancers treated by radiation therapy—by HSE area of residence and period of diagnosis

colorectal



lung

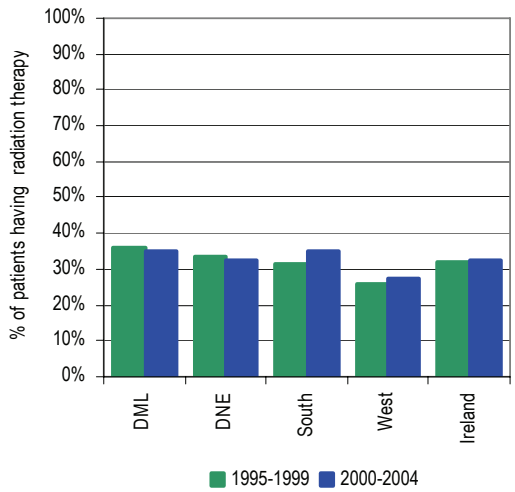
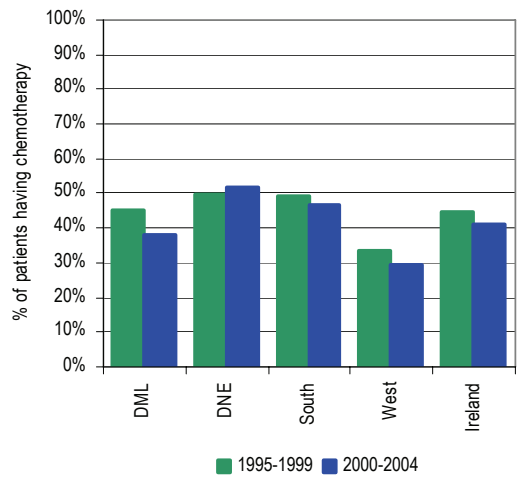
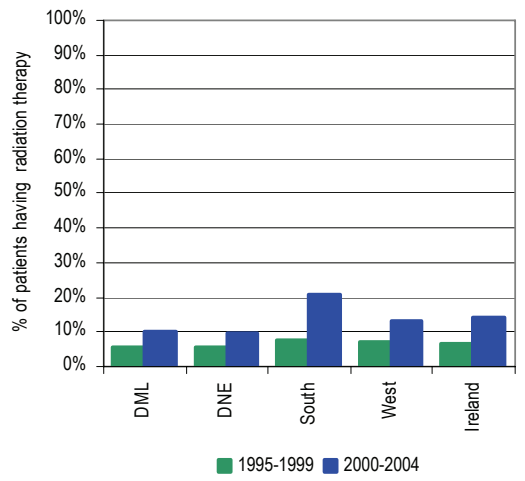


Figure 7 (contd). Percentage of cancers treated by radiation therapy—by HSE area of residence and period of diagnosis

female breast



prostate



The variation between areas in radiation therapy was largest for **breast cancer** *(Table 25, Figure 7)*. The lowest level of treatment in both periods was in the West. While the overall percentage fell between 1995-1999 and 2000-2004, and in all areas but Dublin/North-East. When adjusted for age and sex, the probability of having radiation therapy for female breast cancer was significantly higher in Dublin/North-East and the South, and lower in the West, than in Dublin/Mid-Leinster in both 1995-1999 and 2000-2004 *(Table 26)*.

Radiation therapy was infrequent for **prostate cancer**, and was most common in the South, particularly in 2000-2004, when the level of treatment was 50% over the national average and more than twice that in Dublin/Mid-Leinster and Dublin/North-East *(Table 25, Figure 7)*. These differences persisted after adjustment for age and sex *(Table 26)*.

Table 26. Relative probability of having radiation therapy, by period and HSE area of residence, adjusted for age and sex

	colorectal	lung	breast (female)	prostate
1995-1999				
Dublin/Mid-Leinster	1.00	1.00	1.00	1.00
Dublin/North-East	0.82 (0.69, 0.98)	0.91 (0.83, 1.00)	1.19 (1.03 ,1.18)	1.05 (0.76, 1.44)
South	0.62 (0.52, 0.74)	0.86 (0.77, 0.95)	1.12 (1.05 ,1.19)	1.46 (1.12, 1.88)
West	0.71 (0.60, 0.85)	0.70 (0.62, 0.78)	0.77 (0.70 ,0.83)	1.49 (1.14, 1.93)
2000-2004				
Dublin/Mid-Leinster	1.00	1.00	1.00	1.00
Dublin/North-East	0.84 (0.73, 0.97)	0.92 (0.83, 1.00)	1.36 (1.29 ,1.44)	0.96 (0.80, 1.14)
South	0.85 (0.74, 0.97)	1.00 (0.92, 1.09)	1.23 (1.17 ,1.30)	2.09 (1.86, 2.23)
West	0.74 (0.64, 0.85)	0.77 (0.70, 0.85)	0.78 (0.71 ,0.84)	1.47 (1.28, 1.68)

Hospitals providing cancer surgery within six months of diagnosis

Colorectal cancer

The total number of hospitals in which colorectal cancer surgery was carried out fell over the period studied *(Table 27)* from 52 in 1995 to 48 in 2003, but rose to 53 in 2004. Public acute hospitals accounted for a consistent 37-38 of these hospitals, and their distribution between HSE areas did not change appreciably.

Table 27. Number of hospitals in which surgery was performed for colorectal cancer—by HSE area of hospital and period of diagnosis

year of diagnosis	all hospitals					public acute hospitals				
	Dublin/Mid-Leinster	Dublin/North-East	South	West	all	Dublin/Mid-Leinster	Dublin/North-East	South	West	all
1995	14	12	14	12	52	9	8	10	10	37
1996	13	10	13	13	49	9	8	10	10	37
1997	14	11	13	14	52	9	8	10	10	37
1998	13	11	13	11	48	9	8	10	10	37
1999	13	12	13	11	49	9	8	10	10	37
2000	12	11	13	14	50	9	8	10	10	37
2001	12	10	14	13	49	9	8	10	10	37
2002	12	12	13	14	51	9	8	10	11	38
2003	13	10	13	12	48	9	8	10	10	37
2004	12	12	13	16	53	9	8	10	11	38

Lung cancer

The total number of hospitals in which lung cancer surgery was carried out varied over the period studied *(Table 28)*. There was no clear trend from 1995 to 2004. Public acute hospitals accounted for most of the hospitals, of which the majority were in the Dublin area.

Table 28. Number of hospitals in which surgery was performed for lung cancer—by HSE area of residence and period of diagnosis

year of diagnosis	all hospitals					public acute hospitals				
	Dublin/Mid-Leinster	Dublin/North-East	South	West	all	Dublin/Mid-Leinster	Dublin/North-East	South	West	all
1995	4	5	1	2	12	2	4	1	2	9
1996	4	5	1	3	13	2	3	1	3	9
1997	3	4	1	1	9	2	3	1	1	7
1998	5	4	4	2	15	3	3	4	2	12
1999	4	3	2	2	11	2	2	2	2	8
2000	5	3	2	2	12	2	2	2	2	8
2001	5	6	3	1	15	3	4	1	1	9
2002	5	4	2	3	14	3	3	1	3	10
2003	3	5	1	3	12	2	4	1	3	10
2004	4	4	3	3	14	2	3	2	2	9

Female breast cancer

The total number of hospitals in which breast cancer surgery was carried out fell from 53 in 1995 to 42 in 2004, almost all of this fall being since 2001 *(Table 29)*. The number of hospitals fell most in Dublin/Mid-Leinster and in the Southern area and the number of hospitals providing breast cancer surgery was quite similar in all areas by 2004. The number of public acute hospitals providing breast surgery also fell, from 37 in 1994 to 31 in 2004, accounting for over 50% of the total fall in hospital numbers. The public hospitals were evenly spread between HSE areas.

Table 29. Number of hospitals in which surgery was performed for female breast cancer—by HSE area of residence and period of diagnosis

year of diagnosis	all hospitals					public acute hospitals				
	Dublin/Mid-Leinster	Dublin/North-East	South	West	all	Dublin/Mid-Leinster	Dublin/North-East	South	West	all
1995	15	11	14	13	53	9	8	10	10	37
1996	14	11	15	13	53	9	8	10	10	37
1997	16	11	14	14	55	9	8	10	10	37
1998	15	11	14	14	54	9	8	10	10	37
1999	15	11	14	14	54	9	8	10	10	37
2000	13	11	14	12	50	9	8	10	10	37
2001	14	10	13	14	51	9	8	10	10	37
2002	12	9	14	14	49	8	7	10	10	35
2003	12	8	14	13	47	8	6	10	10	34
2004	11	9	11	11	42	7	7	8	9	31

Prostate cancer

There was some year-to-year variation in the total number of hospitals in which prostate cancer surgery was carried out, and a slight downward trend *(Table 30)*. Most of this fall was due to a decrease in the number of public acute hospitals providing prostate cancer surgery, which fell from 27 in 1994 to 24 in 2004. The public hospitals were evenly spread between HSE areas.

Table 30. Number of hospitals in which surgery was performed for prostate cancer—by HSE area of residence and period of diagnosis

year of diagnosis	all hospitals					public acute hospitals				
	Dublin/Mid-Leinster	Dublin/North-East	South	West	all	Dublin/Mid-Leinster	Dublin/North-East	South	West	all
1995	10	10	10	9	39	6	7	8	6	27
1996	11	7	13	9	40	6	5	9	7	27
1997	11	8	12	8	39	6	5	9	7	27
1998	11	9	11	8	39	7	7	8	6	28
1999	10	7	11	8	36	6	4	8	7	25
2000	9	8	10	7	34	5	5	7	6	23
2001	9	8	10	8	35	5	5	7	7	24
2002	9	8	10	7	34	5	5	7	6	23
2003	10	5	11	7	33	6	3	8	6	23
2004	10	7	9	9	35	6	5	6	7	24

Hospital surgical caseload

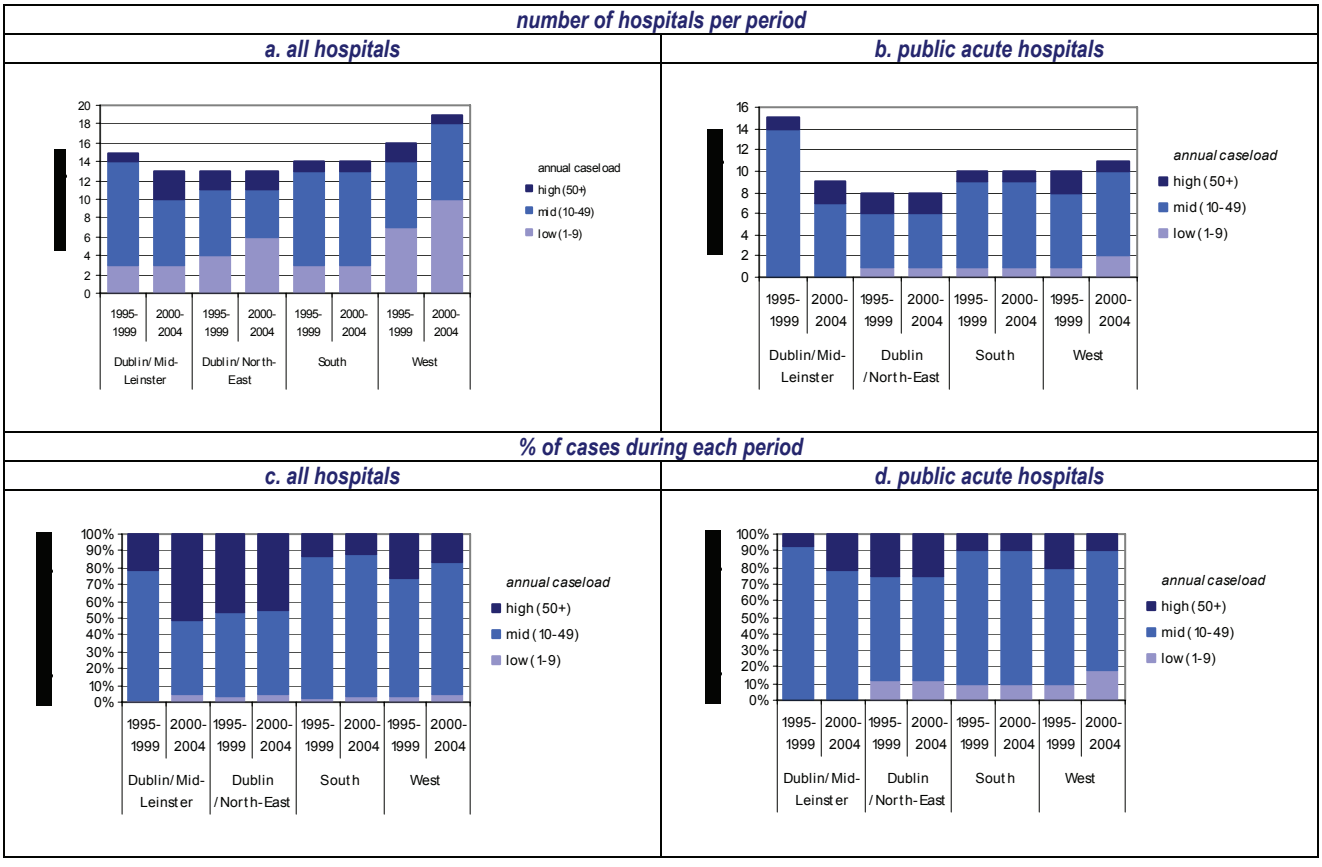
Colorectal cancer

There was little change in the distribution of hospital surgical caseload between 1995-1999 and 2000-2004, although there was some evidence of a shift to lower caseload hospitals.

There were six 'high' surgical caseload hospitals (50 or more cases per year) in 1995-1999, and seven in 2000-2004 (*Figure 8a)*. The percentage of patients treated at these hospitals increased slightly, from 26% to 29%, between 1995-1999 and 2000-2004 *(Figure 8c)*. The number of 'low' surgical caseload hospitals (fewer than 10 cases annually) increased from 17 to 22, and the percentage of patients treated in these hospitals increased slightly, from 3% to 4%. The number of hospitals with caseloads in the mid-range (10-49 surgical cases per year) fell from 35 to 30, most of this fall being in the Dublin area.

All but one of the 'high' surgical caseload hospitals were public (*Figure 8b).*The percentage of patients treated in 'high' caseload public hospitals fell very slightly, from 34% to 33%, but this concealed differences between areas--an increase from 27% to 45% in the Dublin/Mid-Leinster area and a fall from 37% to 21% in the West. These changes were balanced by changes in the numbers treated in "mid-range" hospitals. The percentage of patients treated in 'low' surgical caseload hospitals remained low, and unchanged, at 2% overall. *(Figure 8d)*.

Figure 8. Hospitals where surgery was performed for colorectal cancer—numbers of hospitals and patients treated, by HSE area of treatment, period of diagnosis and surgical caseload



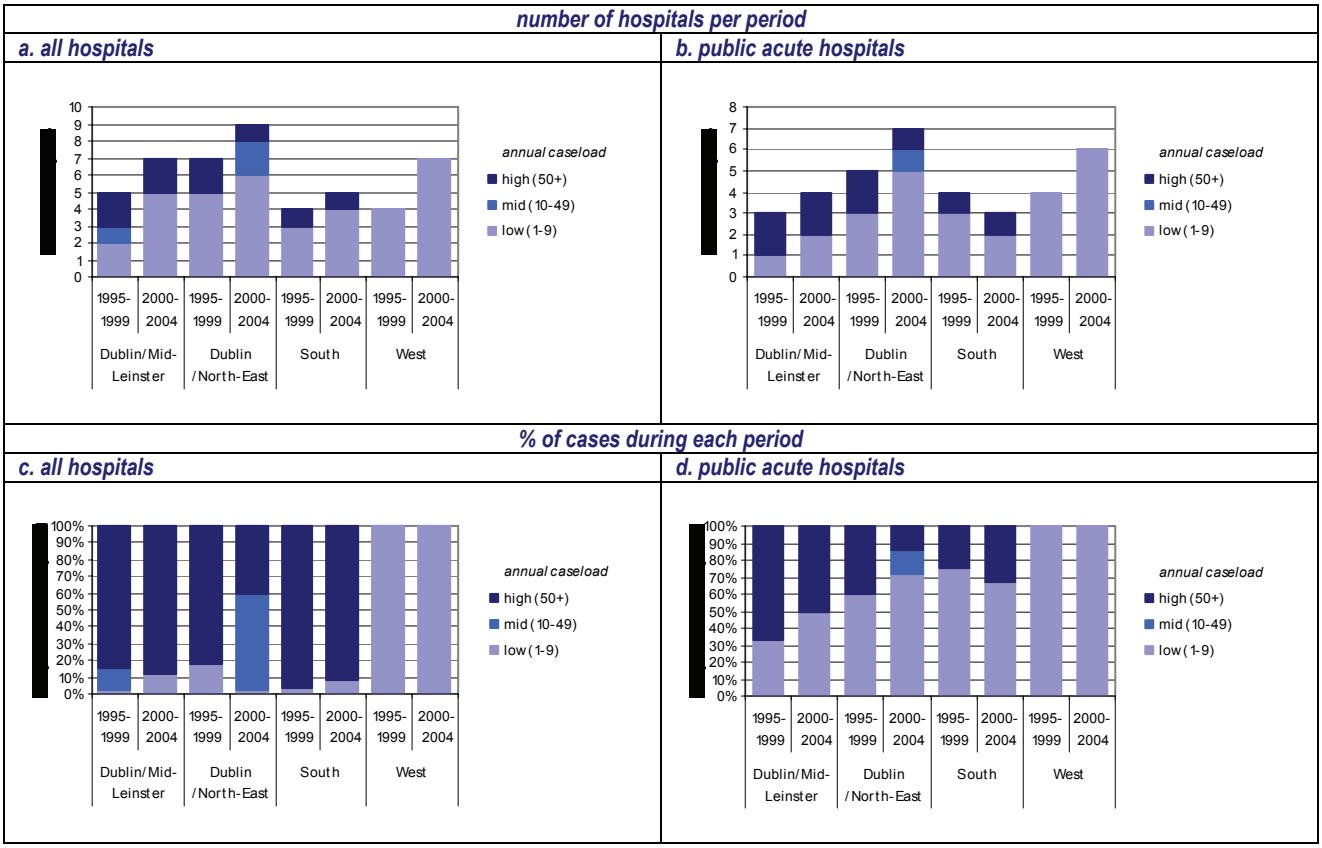
Lung cancer

There was little change in the distribution of hospital surgical caseload between 1995-1999 and 2000-2004, although there was some evidence of a shift to lower surgical caseload hospitals.

There were five 'high' surgical caseload hospitals (20 or more cases per year) in 1995-1999, and 4 in 2000-2004 (*Figure 9a)*. The percentage of patients treated at these hospitals fell slightly, from 82% to 73%, between 1995-1999 and 2000-2004 *(Figure 9c)*. The percentage of patients treated who were seen at hospitals with a caseload of 50 or more cases per year also fell, from 31% to 29% (data not shown).The number of 'low' surgical caseload hospitals (fewer than 10 cases annually) increased from 14 to 22, while the percentage of patients treated in these hospitals fell slightly, from 12% to 11%. However it should be noted that 7 hospitals in 1995-1999 and 13 in 2000-2004 were registered as treating only one patient surgically during that period, which would account for most of the increase. The number of hospitals with caseloads in the mid-range (10-19 surgical cases per year) increased from 1 to 2, and the number of patients increased from 6% to 16% of the total.

All of the 'high' surgical caseload hospitals were public (*Figure 9b).*The percentage of patients treated in 'high' caseload public hospitals fell from 93% to 85%. The percentage of patients treated who were seen at hospitals with a caseload of 50 or more cases per year also fell, from 36% to 34% (data not shown). The percentage of patients treated in 'low' surgical caseload hospitals fell from 4% to 7% *(Figure 9d)*. The number of 'low' caseload public hospitals increased from 11 to 15, but if those treating only a single case during the period are excluded, the number was 5 in 1994-1999 and 4 in 2000-2004.

Figure 9. Hospitals where surgery was performed for lung cancer—numbers of hospitals and patients treated, by HSE area of treatment, period of diagnosis and surgical caseload



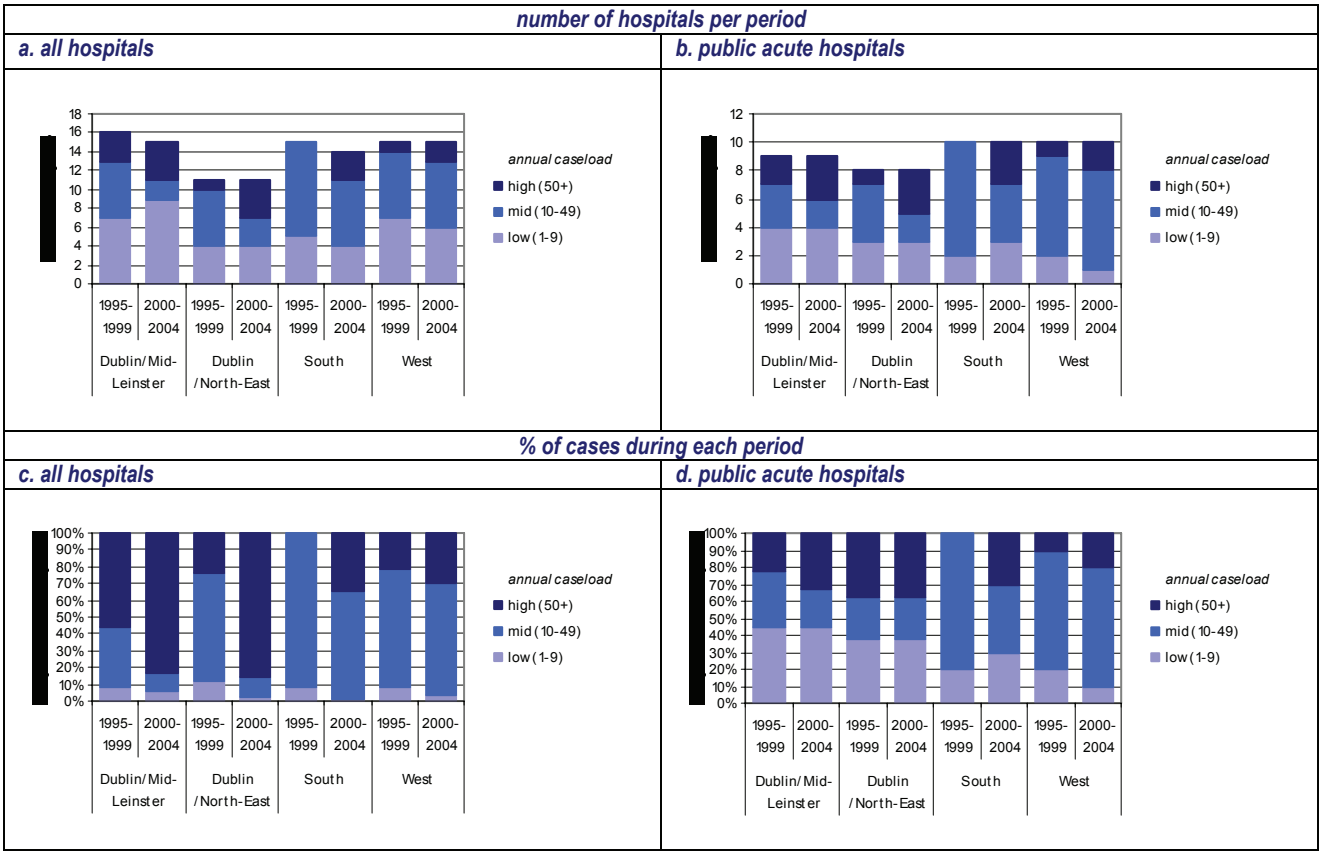
Female breast cancer

There was evidence of a significant shift of surgical management of breast cancer from hospitals with a surgical caseload under 50 annually to those with higher caseloads between 1995-1999 and 2000-2004, particularly in public hospitals.

There were five 'high' surgical caseload hospitals (50 or more cases per year) in 1995-1999, and 13 in 2000-2004 (*Figure 10a)*. The percentage of patients treated at these hospitals increased considerably, from 27% to 57%, between 1995-1999 and 2000-2004 *(Figure 10c)*.The number of 'low' surgical caseload hospitals (fewer than 10 cases annually) remained at 23, while the percentage of patients treated in these hospitals fell from 9% to 4%. The number of hospitals with caseloads in the mid-range (10-49 surgical cases per year) fell from 29 to 19, and the number of patients fell from 64% to 40% of the total.

Most of the 'high' surgical caseload hospitals were public (*Figure 10b)*, 4 of 5 in 1994-1999 and 11 of 13 in 2000-2004.The percentage of patients treated in 'high' caseload public hospitals increased from 32% to 69%. The percentage of patients treated in 'low' surgical caseload hospitals fell from 9% to 3% *(Figure 10d)*. The number of 'low' caseload public hospitals remained at 11 in both periods. The number of 'mid-range' caseload hospitals fell from 22 to 25 and the percentage of patients treated fell from 59% to 28%.

Figure 10. Hospitals where surgery was performed for female breast cancer—numbers of hospitals and patients treated, by HSE area of treatment, period of diagnosis and surgical caseload



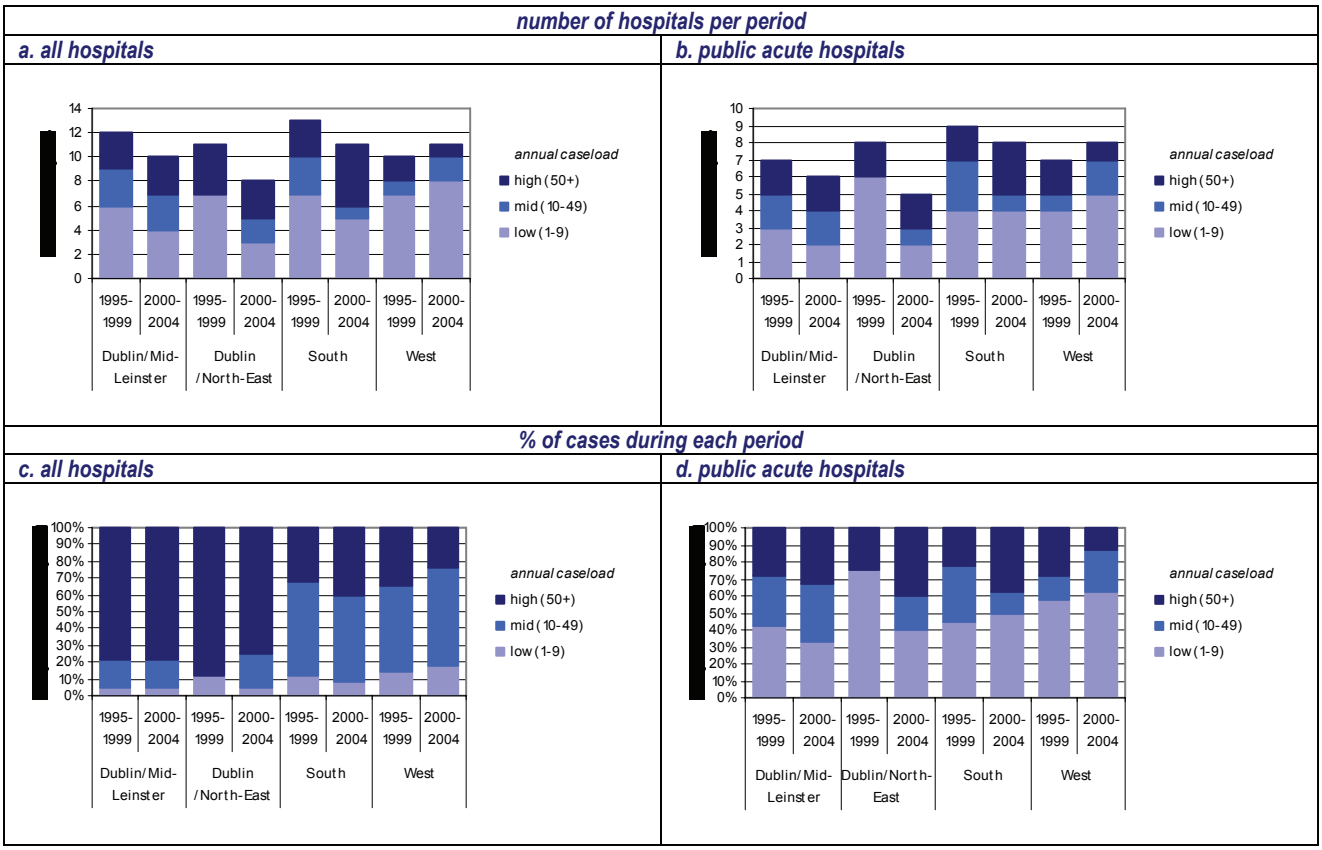
Prostate cancer

There was little overall change in the distribution of surgical caseload for prostate cancer over the period studied.

There were twelve 'high' surgical caseload hospitals (20 or more cases per year) in both periods (*Figure 11a)*. The percentage of patients treated at these hospitals fell very slightly, from 58% to 57%, between 1995-1999 and 2000-2004 *(Figure 11c)*. The number of 'low' surgical caseload hospitals (fewer than 10 cases annually) fell from 27 to 20, while the percentage of patients treated in these hospitals fell from 10% to 8% The number of hospitals with caseloads in the mid-range (10-19 surgical cases per year) increased from 7 to 8, and the number of patients increased from 32% to 35% of the total.

Eight public hospitals were in the 'high' surgical caseload category in both periods (*Figure 11b).* The percentage of patients treated in these hospitals increased slightly, from 71% to 74%, while the percentage treated in 'low' surgical caseload hospitals fell from 9% to 5% *(Figure 11d)*. The number of 'mid-range' caseload hospitals remained at 6 throughout the two periods described, and the percentage of patients treated was also unchanged, at 20%

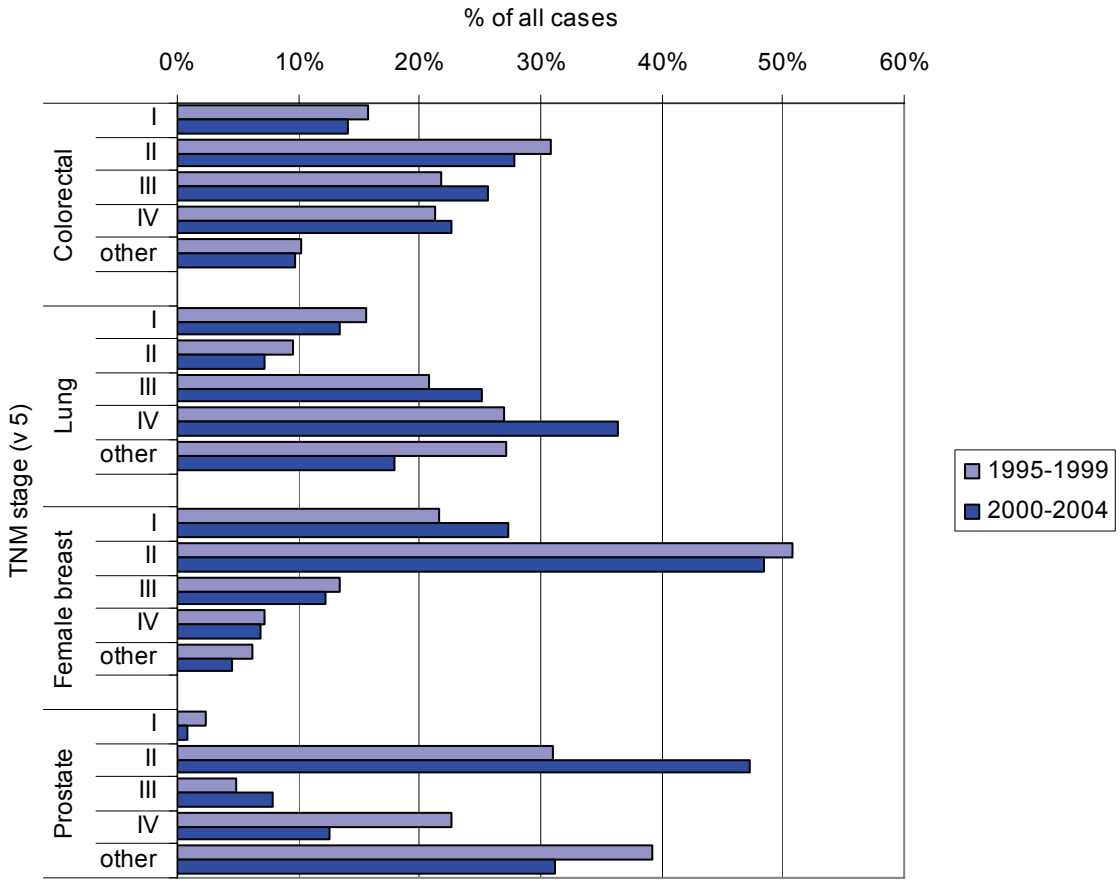
Figure 11. Hospitals where surgery was performed for prostate cancer—numbers of hospitals and patients treated, by HSE area of treatment, period of diagnosis and surgical caseload



Chapter 4. Stage at diagnosis

Cancers are staged by the Registry using the TNM system. Sometimes a stage (clinical or pathological) is explicitly given in the medical record, but in most cases the stage is derived by our registration officers from information in the record, mainly pathology, operation and imaging reports. Cancers described in this section as 'unstaged' were those for which a stage could not be assigned, due to lack of information in the record. The use of the term 'unstaged' does not necessarily imply that the cancer stage was unknown to the treating clinicians(s), but only that the information could not be retrieved by chart review. Because of the uneven recording of metastasis (and to a lesser extent of nodal status), the stage data in this section is based on the assumption that if the medical record had no information on these, they had not occurred. This is quite an optimistic interpretation of the situation and leads to an over-reporting of early stage cancer. However, this seemed the most consistent method of allowing for differences in the completeness of staging over time and between hospitals. A more rigorous approach has been adopted in the sections on survival. The 'unstaged' category also contains a small number of cancers (generally non-epithelial) for which staging was inappropriate due to their histological type.

Figure 12. Stage for the four commonest cancers, by period of diagnosis



Colorectal cancer

There was a significant increase in the proportion of Stage III colorectal cancer cases between 1995-1999 and 2000-2004, and a smaller increase in Stage IV cases with matching, but not significant, falls in Stage I and Stage II disease *(Table 31, Figure 12)*. The latter was statistically significant if non-staged cancers were excluded. The percentage of cancers for which stage was not available did not change significantly between periods. The percentage of colorectal cancers for which stage was not available did not change significantly between periods.

Lung cancer

For lung cancer the proportion of Stage I and II cases fell (although the former was only statistically significant if unstaged cases were excluded) while the proportion of Stage III and IV cases increased (*Table 31, Figure 12)*. Some of this stage shift may be due to the availability of more complete stage data on late stage cancers, rather than real changes in stage at presentation. There was a significant fall in the percentage of unstaged cases.

Female breast cancer

There was an increase in the proportion of Stage I female breast cancer cases and a fall in Stage II cases, but no significant decrease in late stage cancers *(Table 31, Figure 12).* The proportion of unstaged cases, which was already low, fell significantly between 1995-1999 and 2000-2004.

Prostate

There was a large and statistically significant increase in Stage II prostate cancer cases and a smaller but also significant increase in Stage III cancer, with a fall in Stage IV disease *(Table 31, Figure 12).* The proportion of unstaged cases was high, but fell significantly between 1995-1999 and 2000-2004.

Table 31. Stage (TNM 5th edition) for the commonest cancers, by period of diagnosis (figures in bold indicate a significant change between 1995-1999 and 2000-2004).

colorectal	**average number of cases**		**% of all cases**		**% of staged cases**	
	1995-1999	**2000-2004**	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**
I	267	258	16%	14%	18%	16%
II	520	507	31%	28%	34%	**31%**
III	369	468	22%	**26%**	24%	**28%**
IV	361	413	21%	23%	24%	25%
unknown	173	177	10%	10%		
lung	**average number of cases**		**% of all cases**		**% of staged cases**	
	1995-1999	**2000-2004**	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**
I	225	209	16%	13%	21%	**16%**
II	137	112	10%	**7%**	13%	**9%**
III	301	391	21%	**25%**	29%	31%
IV	389	566	27%	**36%**	37%	**44%**
unknown	392	278	27%	**18%**		
female breast	**average number of cases**		**% of all cases**		**% of staged cases**	
	1995-1999	**2000-2004**	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**
I	355	559	22%	**27%**	23%	**29%**
II	831	990	51%	49%	55%	**51%**
III	219	252	13%	12%	14%	13%
IV	119	142	7%	7%	8%	7%
unknown	103	91	6%	**4%**		
prostate	**average number of cases**		**% of all cases**		**% of staged cases**	
	1995-1999	**2000-2004**	**1995-1999**	**2000-2004**	**1995-1999**	**2000-2004**
I	28	17	2%	**1%**	4%	**1%**
II	377	927	31%	**47%**	51%	**69%**
III	59	155	5%	**8%**	8%	**11%**
IV	274	248	23%	**13%**	37%	**18%**
unknown	478	613	39%	**31%**		

Relationship of HSE area of residence to stage at diagnosis

Colorectal cancer

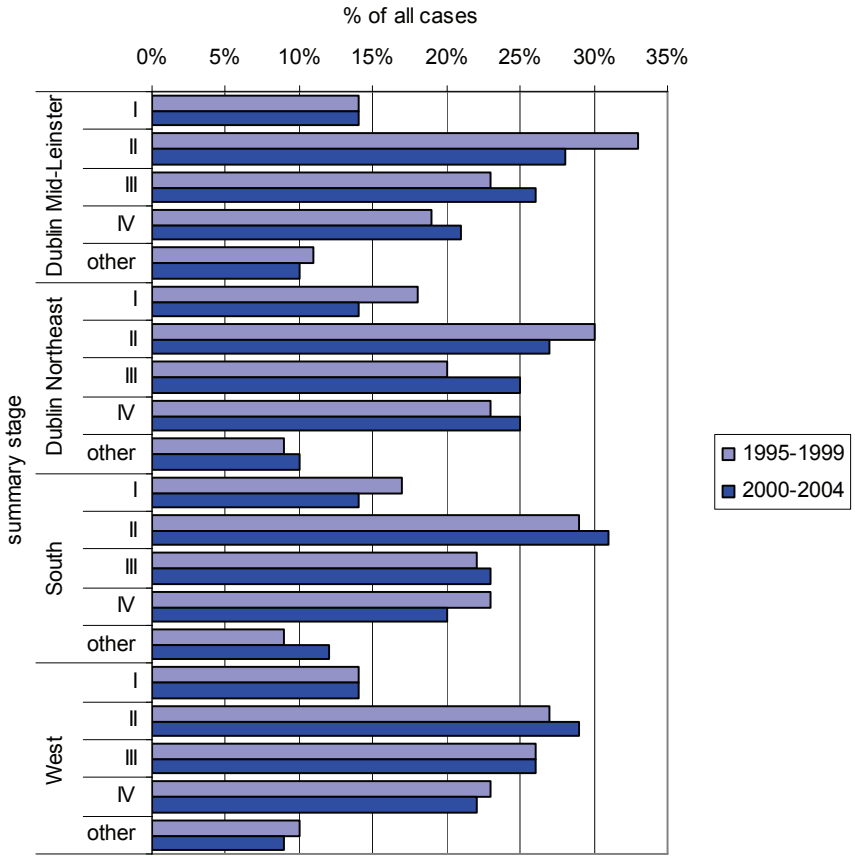
Table 32. Colorectal cancer stage, by area of residence and period
(figures in bold indicate a significant change between 1995-1999 and 2000-2004).

	Ireland		Dublin/Mid-Leinster		Dublin/North-East		South		West	
	cases	% of total	cases	% of total	cases	% of total	cases	% of total	cases	% of total
1995-1999										
I	267	16%	63	14%	63	18%	80	17%	61	14%
II	520	31%	145	33%	105	30%	135	29%	134	31%
III	369	22%	100	23%	69	20%	103	22%	97	23%
IV	361	21%	85	19%	79	23%	110	23%	87	20%
not applicable/unknown	173	10%	46	11%	32	9%	44	9%	50	12%
2000-2004										
I	258	14%	68	14%	54	**14%**	70	**14%**	65	14%
II	507	28%	134	**28%**	99	**27%**	136	**27%**	137	29%
III	468	**26%**	128	**26%**	92	**25%**	128	**26%**	120	**26%**
IV	413	23%	104	21%	92	25%	113	23%	103	22%
not applicable/unknown	177	10%	50	10%	36	10%	49	10%	42	**9%**

There was little variation in the stage of **colorectal cancer** between areas *(Table 32, Figure 13)*. The increase in stage III disease seen nationally was also observed in all areas. There was a significant fall in stage II disease in the Dublin/Mid-Leinster, Dublin/North-East, and South areas.

The proportion of unstaged cases was highest in the West in 1995-1999, but fell significantly in that area to slightly below the national average in 2000-2004.

Figure 13. Colorectal cancer stage, by area of residence and period



Lung cancer

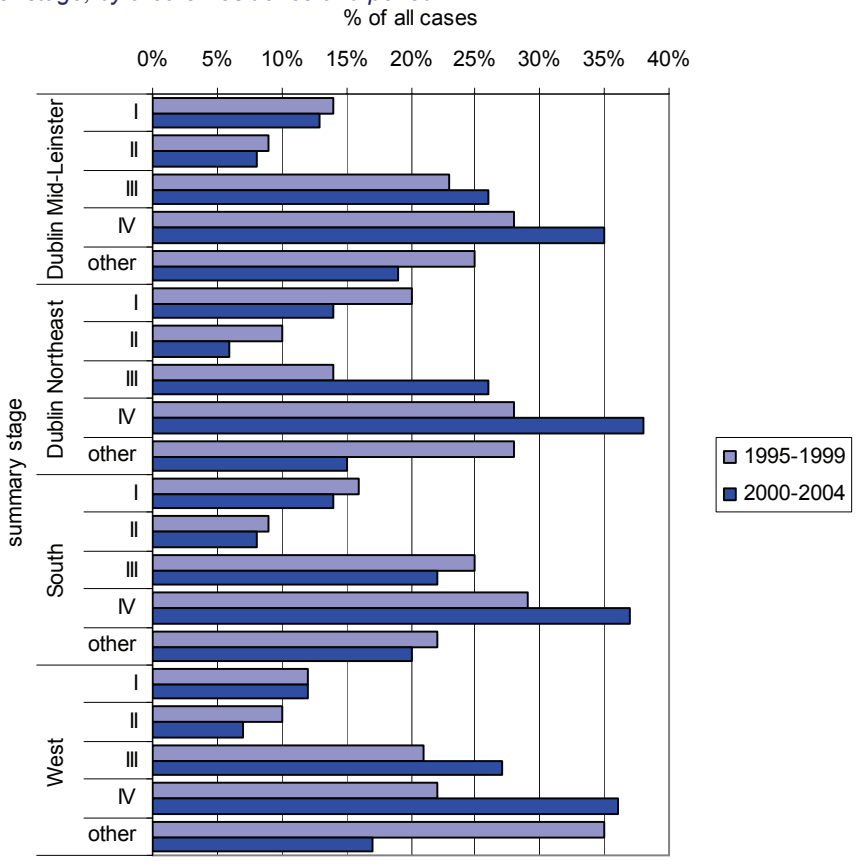
Table 33. Lung cancer stage, by area of residence and period
(figures in bold indicate a significant change between 1995-1999 and 2000-2004).

	Ireland		Dublin/Mid-Leinster		Dublin/North-East		South		West	
	cases	% of total	cases	% of total	cases	% of total	cases	% of total	cases	% of total
1995-1999										
I	225	16%	62	14%	70	20%	54	16%	39	12%
II	137	10%	41	9%	35	10%	31	9%	31	10%
III	301	21%	101	23%	48	14%	84	25%	67	21%
IV	389	27%	122	28%	97	28%	98	29%	72	22%
not applicable/unknown	392	27%	110	25%	95	28%	75	22%	112	35%
2000-2004										
I	209	13%	61	13%	52	**14%**	53	14%	44	12%
II	112	**7%**	34	**8%**	21	**6%**	31	8%	26	7%
III	391	**25%**	116	26%	96	**26%**	85	22%	95	**27%**
IV	566	**36%**	157	**35%**	140	**38%**	141	**37%**	128	**36%**
not applicable/unknown	278	**18%**	84	**19%**	56	**15%**	76	20%	62	**17%**

The percentage of unstaged **lung cancer** cases ranged from 22% in the South area to 35% in the West in 1995-1999 *(Table 33, Figure 14).* This percentage fell significantly in all areas other than the south between 1995-1999 and 2000-2004, the largest fall being in Dublin/North-East and the West. With such a large proportion of unstaged cancers, it is difficult to interpret changes in the distribution of stage. However, as at national level, there was a general fall in the proportion of stage I and II cancers and an increase in stage III and/or stage IV cancers. The increase in stage III disease seen nationally was also observed in all areas. There was a significant fall in stage II disease in the Dublin/Mid-Leinster, Dublin/North-East and South areas.

The proportion of unstaged cases was highest in the West in 1995-1999, but fell significantly in that area to slightly below the national average in 2000-2004.

Figure 14. Lung cancer stage, by area of residence and period



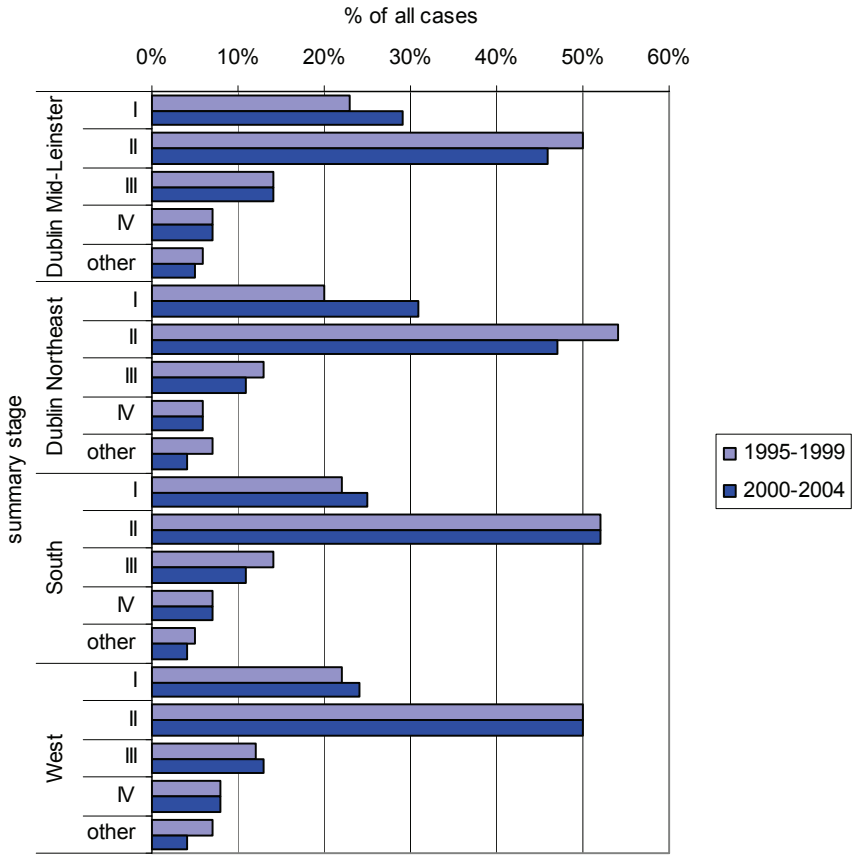
Female breast cancer

Table 34. Female breast cancer stage, by area of residence and period
(figures in bold indicate a significant change between 1995-1999 and 2000-2004).

	Ireland		Dublin/Mid-Leinster		Dublin/North-East		South		West	
	cases	% of total	cases	% of total	cases	% of total	cases	% of total	cases	% of total
1995-1999										
I	355	22%	113	23%	63	20%	93	22%	85	22%
II	831	51%	247	50%	171	54%	222	52%	191	50%
III	219	13%	70	14%	41	13%	61	14%	47	12%
IV	119	7%	37	7%	21	6%	32	7%	30	8%
not applicable/unknown	103	6%	31	6%	23	7%	21	5%	28	7%
2000-2004										
I	559	**27%**	183	**29%**	140	**31%**	127	**25%**	109	24%
II	990	49%	291	**46%**	210	**47%**	263	52%	226	50%
III	252	12%	86	14%	50	11%	56	**11%**	59	13%
IV	142	7%	44	7%	25	6%	37	7%	35	8%
not applicable/unknown	91	**4%**	32	5%	20	**4%**	19	4%	20	**4%**

There was little variation between areas in the stage of **female breast cancer** at diagnosis in 1995-1999 *(Table 34, Figure 15).* In 2000-2004 there was a significant increase in the proportion of stage I cancers in Dublin/Mid-Leinster, Dublin/North-East and the South, and a fall in stage II cancers in Dublin/Mid-Leinster and Dublin/North-East. These changes are probably largely attributable to the start of breast screening in the latter two areas in 2000]; however similar but smaller stage shifts were also noted in the Southern area]. There was a general decrease in the proportion of unstaged cancers

Figure 15. Female breast cancer stage, by area of residence and period



Prostate cancer

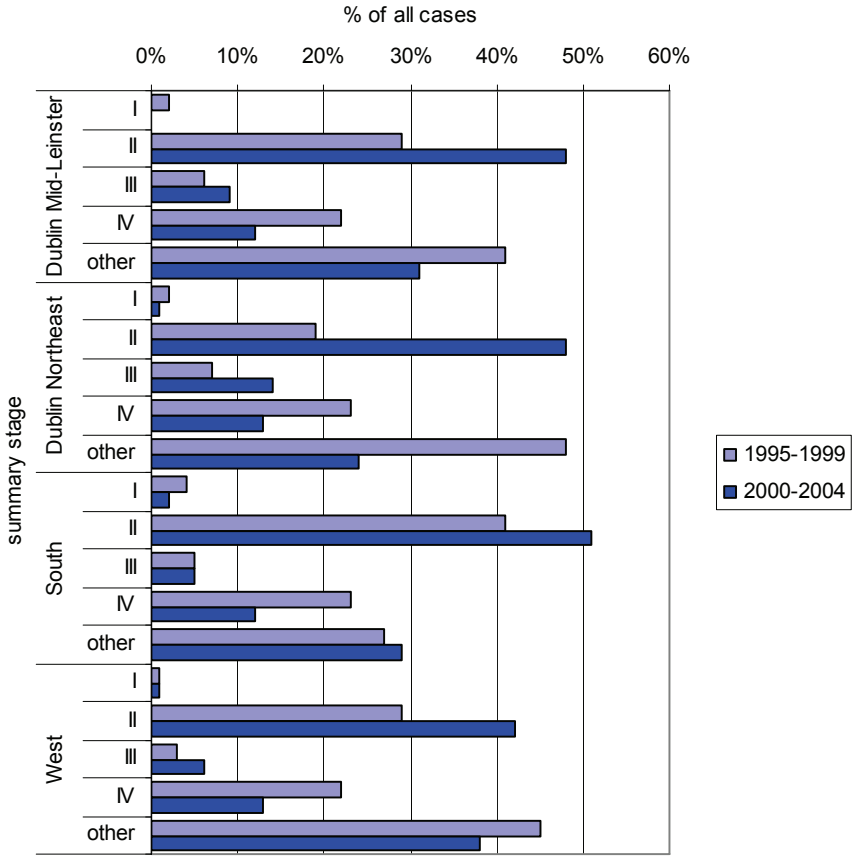
Table 35. Prostate cancer stage, by area of residence and period
(figures in bold indicate a significant change between 1995-1999 and 2000-2004).

	Ireland		Dublin/Mid-Leinster		Dublin/North-East		South		West	
	cases	% of total	cases	% of total	cases	% of total	cases	% of total	cases	% of total
1995-1999										
I	28	2%	6	2%	3	2%	15	4%	3	1%
II	377	31%	98	29%	41	19%	144	41%	94	29%
III	59	5%	19	6%	16	7%	16	5%	9	3%
IV	274	23%	74	22%	49	23%	79	23%	72	22%
not applicable/unknown	478	39%	137	41%	102	48%	93	27%	145	45%
2000-2004										
I	17	**1%**	1	**0%**	2	**1%**	10	**2%**	4	1%
II	927	**47%**	246	**48%**	158	**48%**	291	**51%**	232	**42%**
III	155	**8%**	46	**9%**	46	**14%**	28	5%	35	**6%**
IV	248	**13%**	63	**12%**	44	**13%**	71	**12%**	70	**13%**
not applicable/unknown	613	**31%**	159	**31%**	81	**24%**	167	29%	206	**38%**

The major variation between areas in the staging of **prostate cancer** in 1995-1999 was the much lower percentage of unstaged cases in the Southern area (27% compared to the national average of 39%) *(Table 35, Figure 16).*

All areas experienced an increase in the proportion of stage II cancers, the largest being in Dublin/North-East, with an increase from 29% to 41%. There was a significant fall in the proportion of unstaged cancers in all areas other than the Southern, and in the percentage of stage IV cancers. As with lung cancer, changes in stage distribution are difficult to interpret with such a high proportion of unstaged cancers, but there has been a major increase in the number, as well as the proportion, of stage II cancers between 1995-1999 and 2000-2004, almost certainly due to screening.

Figure 16. Prostate cancer stage, by area of residence and period



Chapter 5. Relative survival

National estimates of relative survival, including time-trends

National estimates of five-year relative survival are presented below *(Table 36)* for a range of cancers in patient aged 15-99 years, for the diagnosis periods 1994-1999 and 2000-2004 (with follow-up to 31 December 2005). For cancers as a whole (excluding the usually non-fatal non-melanoma skin cancers), five-year survival averaged 51% for patients diagnosed inn the most recent period. Estimates varied markedly between cancer type—from as low as 3% for **pleural cancers** (mainly **mesothelioma**) and 6% for **pancreatic cancer** to 83% for **Hodgkin lymphoma** and 96% for **testicular cancer**.

Table 36. Five-year relative survival for major cancer types, by year of diagnosis. 95% confidence intervals are shown, and the statistical significance of change in survival is further assessed by relative survival modeling, adjusted for age[1].

Cancer type	ICD10 code	Five-year relative survival by diagnosis cohort 1994-1999	2000-2004	Statistical significance of change, age-adjusted
colorectal	C18-C21	45.6% (44.5%-46.7%)	50.9% (49.4%-50.0%)	*** (P<0.001) [a] EHR 0.896 (0.855-0.938)
colorectal (male)	C18-C21	44.6% (43.0%-46.0%)	49.1% (47.0%-51.1%)	*** (P<0.001) EHR 0.881 (0.827-0.936)
colorectal (female)	C18-C21	47.2% (45.5%-48.8%)	53.3% (51.1%-55.4%)	* (P=0.018) EHR 0.919 (0.857-0.985)
colon	C18	46.8% (45.3%-48.2%)	51.4% (49.5%-53.3%)	* (P=0.010) EHR 0.926 (0.873-0.981)
rectum (incl. rectosigmoid junction & anus)	C19-21	43.7% (41.8%-45.4%)	50.3% (47.8%-52.6%)	*** (P<0.001) EHR 0.851 (0.789-0.917)
lung (& trachea)	C33-34	8.2% (7.6%-8.8%)	9.1% (8.3%-10.0%)	** (P=0.008) EHR 0.956 (0.924-0.988)
lung (& trachea) (male)	C33-34	7.6% (6.9%-8.4%)	7.7% (6.6%-8.7%)	ns (P=0.783) EHR 0.994 (0.953-1.036)
lung (& trachea) (female)	C33-34	9.3% (8.2%-10.4%)	11.5% (10.0%-13.0%)	*** (P<0.001) EHR 0.907 (0.858-0.957)
breast (female)	C50	72.0% (70.9%-72.9%)	79.1% (77.8%-80.3%)	*** (P<0.001) EHR 0.701 (0.648-0.756)
prostate	C61	60.2% (58.7%-61.6%)	79.5% (77.8%-81.1%)	*** (P<0.001) EHR 0.498 (0.449-0.551)

* = significant improvement in survival between diagnosis periods, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference.

[a]EHR = excess hazard ratio (with 95% confidence intervals) comparing 2000-2004 with 1994-1999, adjusted for age and for length of follow-up (including interaction between age and follow-up where possible): <1.000 indicates reduction in excess (cancer-associated) mortality rate, i.e. improved relative survival; >1.000 indicates increased excess mortality i.e. reduced relative survival. For example, female breast cancer patients diagnosed during 2000-2004 (EHR 0.701) had a cancer-associated mortality rate about 29% lower (95% CI 24-35% lower) than that of patients diagnosed during 1994-1999, thus higher relative survival, having allowed for possible changes in the age-profile of patients and for the shorter average follow-up available for most recently diagnosed patients.

Relative survival can be difficult to interpret, but can be illustrated as follows: if five-year relative survival for a specific cancer is 80%, for every 100 patients diagnosed with that cancer, on average 20 patients die within five years who would *not otherwise have died*, based on our knowledge of 'background' mortality rates among populations of the same age and sex. It is also useful to think in

[1] See *Appendix Table 1.1* for age-standardized estimates

terms of case-fatality (the inverse of survival) when making comparisons – for example, relative survival of 80% represents a cancer-related case-fatality percentage twice as high as that which applies if relative survival is 90%.

The statistical significance of changes in survival between diagnosis periods was assessed by relative survival modelling of case-fatality within the first five-years of follow-up, adjusting for age-related variations in survival, possible changes in the age-profile of patients, and the length of follow-up. This provides a fuller assessment of changes in survival than simple comparison of the five-year endpoints, although the same trends will generally be apparent.

Significant improvements were seen in five-year relative survival of patients with **colorectal**, **lung**, **prostate** and female **breast cancer** (*Table 36, Figure 17*). These improvements were also evident for **colon** and **rectal cancers** when analysed separately. However, absolute improvements in survival were only minor for **lung cancer**, for which five-year survival remains very low.

Most other cancers also showed evidence of improvements in relative survival, and these were statistically significant for cancers of the **oesophagus**, **stomach**, **liver**, **biliary tract** (also **gallbladder** specifically), **pancreas**, and **accessory sinuses**, **melanoma of skin**, cancers of the **testis**, **brain**, and **adrenal gland**, **Hodgkin lymphoma**, **non-Hodgkin lymphoma**, **multiple myeloma**, and **leukaemia** (*Table 37*).

Survival for Irish cancer patients as a whole also improved significantly, although this could in part reflect changes in case-mix—for example, through increased diagnosis of less-fatal cancers like those of the **breast** and **prostate**.

Figure 17. Relative survival of Irish cancer patients diagnosed during 1994-2004 —by period of diagnosis. 95% confidence intervals are shown.

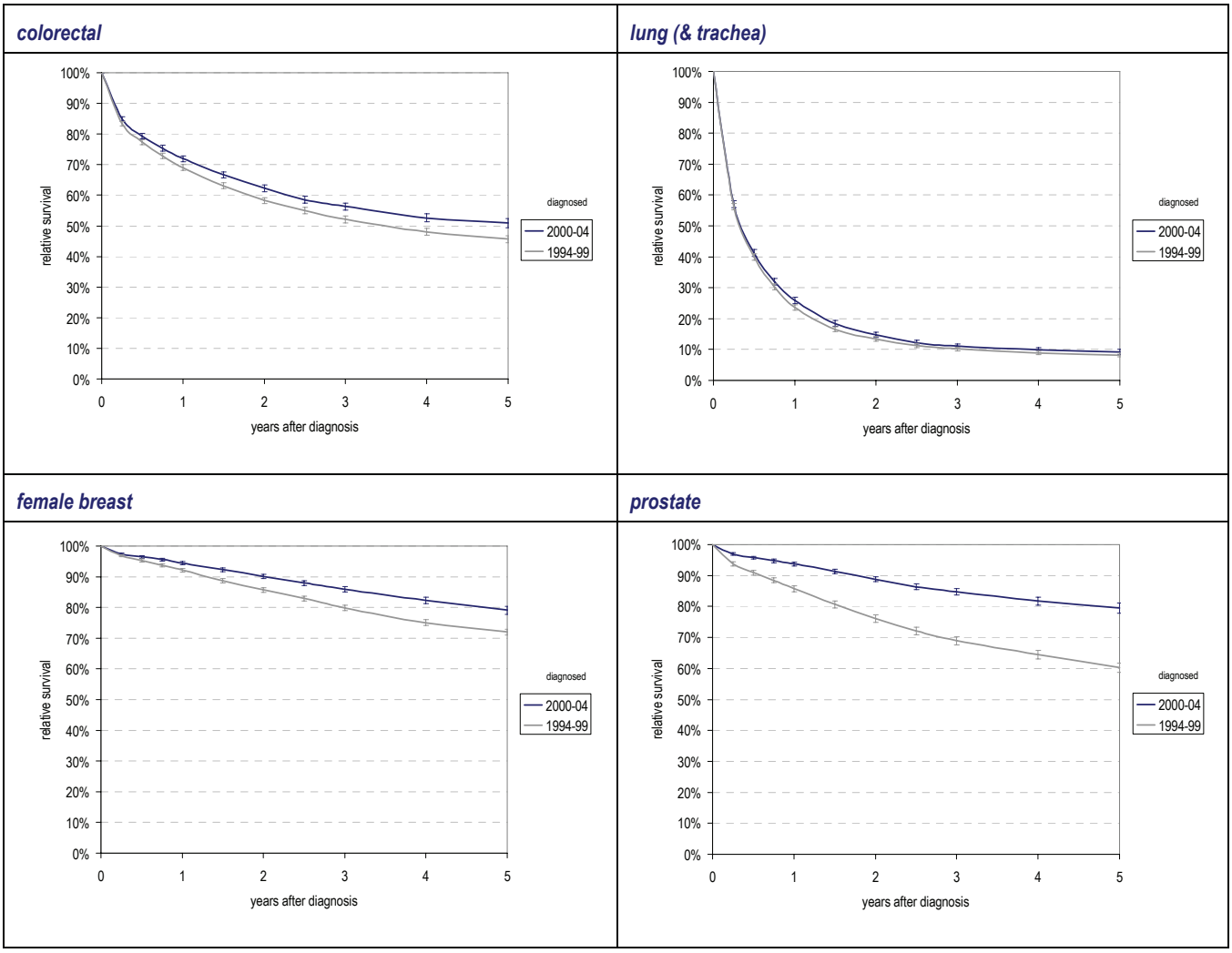


Table 37. Five-year relative survival for other cancer types, by year of diagnosis. For each cancer type (or group), survival is also compared by relative survival modeling, adjusted for age, to assess statistical significance. See Appendix Table 1.2 *for age-standardized estimates.*

Note: Estimates with particularly wide 95% confidence intervals (lower limit less than half of upper limit) are shown in grey.

Cancer type	ICD10 code	Five-year relative survival by diagnosis cohort (95% CI)		Statistical significance of change, age-adjusted
		1994-1999	2000-2004	
all cancers [d] except non-melanoma skin	C00-C96 excl C44	41.9% (41.4%-42.2%)	51.1% (50.5%-51.5%)	*** (P<0.001) EHR 0.804 (0.790-0.817)
all cancers [d] (male) except non-melanoma skin	C00-C96 excl C44	36.8% (36.2%-37.3%)	48.3% (47.5%-49.0%)	*** (P<0.001) EHR 0.761 (0.744-0.778)
all cancers [d] (female) except non-melanoma skin	C00-C96 excl C44	47.5% (46.9%-48.0%)	54.1% (53.4%-54.8%)	*** (P<0.001) EHR 0.851 (0.830-0.871)
lip, oral, pharynx [c]	C00-C14	44.6% (41.8%-47.4%)	45.1% (41.2%-48.9%)	ns (P=0.900) EHR 0.993 (0.884-1.113)
head & neck (mouth/pharynx)	C01-06, C09-13	36.4% (33.3%-39.4%)	44.7% (40.4%-48.8%)	* (P=0.013) EHR 0.852 (0.750-0.966)
lip	C00	80.7% (73.1%-87.4%)	76.3% (59.2%-89.8%)	ns (P=0.120) EHR 1.883 (0.847-4.187)
tongue	C01-02	39.2% (33.3%-45.0%)	51.1% (43.4%-58.4%)	ns (P=0.075) EHR 0.803 (0.630-1.022)
oral cavity	C03-06	42.9% (37.3%-48.4%)	47.5% (39.8%-54.9%)	ns (P=0.493) EHR 0.920 (0.724-1.167)
salivary glands	C07-08	54.1% (45.3%-62.4%)	46.0% (34.4%-57.0%)	ns (P=0.081) EHR 1.413 (0.958-2.082)
oropharynx	C09-10	35.7% (27.9%-43.6%)	46.6% (37.4%-55.3%)	ns (P=0.234) EHR 0.825 (0.600-1.132)
nasopharynx	C11	38.7% (27.2%-49.9%)	58.1% (39.3%-73.4%)	ns (P=0.153) EHR 0.658 (0.370-1.167)
hypopharynx	C12-13	20.6% (15.2%-26.7%)	15.2% (6.9%-26.6%)	ns (P=0.793) EHR 0.965 (0.737-1.261)
oesophagus	C15	10.4% (8.9%-12.0%)	15.8% (13.5%-18.1%)	*** (P<0.001) EHR 0.798 (0.737-0.862)
stomach	C16	15.5% (14.0%-17.0%)	16.4% (14.3%-18.5%)	** (P=0.009) EHR 0.915 (0.856-0.977)
small intestine	C17	37.7% (30.6%-44.9%)	39.8% (30.3%-49.3%)	ns (P=0.085) EHR 0.781 (0.590-1.034)
rectosigmoid junction [c]	C19	42.1% (38.1%-45.9%)	49.9% (44.6%-55.0%)	* (P=0.016) EHR 0.818 (0.693-0.963)
rectum [c]	C20	44.6% (42.5%-46.6%)	50.6% (47.7%-53.3%)	*** (P<0.001) EHR 0.855 (0.782-0.933)
anus [c]	C21	33.0% (24.7%-41.6%)	45.9% (36.0%-55.4%)	ns (P=0.470) EHR 0.879 (0.619-1.247)
liver	C22	5.1% (3.0%-8.0%)	10.0% (6.5%-14.2%)	*** (P<0.001) EHR 0.756 (0.652-0.876)
biliary tract	C23-24	11.3% (8.7%-14.2%)	13.7% (9.9%-18%)	* (P=0.042) EHR 0.874 (0.766-0.995)
gallbladder [c]	C23	6.9% (3.8%-11.2%)	14.8% (9.7%-21.0%)	* (P=0.042) EHR 0.803 (0.649-0.991)
pancreas	C25	5.5% (4.4%-6.7%)	5.9% (4.4%-7.4%)	* (P=0.020) EHR 0.920 (0.858-0.986)

Cancer type	ICD10 code	Five-year relative survival by diagnosis cohort (95% CI)		Statistical significance of change, age-adjusted
		1994-1999	2000-2004	
nasal cavity, middle ear & accessory sinuses	C30-31	36.0% (26.8%-45.5%)	35.9% (21.1%-51.6%)	ns (P=0.342) EHR 0.8258 (0.556-1.225)
nasal cavity & middle ear [c]	C30	49.2% (34.2%-63.4%)	65.9% (43.8%-83.3%)	ns (P=0.840) EHR 0.923 (0.424-2.008)
accessory sinuses [c]	C31	24.3% (14.1%-36.2%)	26.9% (12.1%-44.8%)	* (P=0.016) EHR 0.557 (0.346-0.896)
larynx	C32	57.1% (52.6%-61.4%)	58.6% (53.2%-63.6%)	ns (P=0.230) EHR 1.130 (0.925-1.378)
pleura	C38.4, C45.0	6.5% (2.8%-12.2%)	3.2% (0.5%-10.4%)	ns (P=0.136) EHR 0.8155 (0.623-1.066)
bone	C40-41	51.8% (43.1%-59.9%)	46.8% (35.1%-57.6%)	ns (P=0.718) EHR 0.935 (0.651-1.343)
melanoma skin	C43	78.6% (76.5%-80.6%)	83.7% (81.0%-86.0%)	** (P=0.009) EHR 0.768 (0.630-0.936)
mesothelioma [c]	C45	8.2% (3.6%-15.2%)	5.5% (1.3%-14.5%)	ns (P=0.214) EHR 0.827 (0.613-1.115)
Kaposi sarcoma [c]	C46	45.7% (27.0%-62.7%)	68.8% (40.1%-87.5%)	ns (P=0.455) EHR 0.681 (0.248-1.865)
soft tissue (incl. peripheral nerves / ANS)	C47, C49	50.6% (45.5%-55.5%)	59.6% (52.9%-65.8%)	ns (P=0.334) EHR 0.892 (0.706-1.125)
breast (male)	C50	58.8% (44.8%-71.3%)	84.6% (68.1%-96.6%)	ns (P=0.129) EHR 0.521 (0.224-1.209)
vagina & vulva (incl. other female genital organs)	C51-52, C57.8-.9	53.5% (46.3%-60.3%)	53.6% (44.4%-62.3%)	ns (P=0.953) EHR 1.009 (0.741-1.373)
vulva [c]	C51	58.3% (49.8%-66.2%)	63.2% (52.7%-72.4%)	ns (P=0.520) EHR 0.876 (0.584-1.312)
vagina [c]	C52	45.2% (30.4%-59.4%)	15.1% (2.9%-36.9%)	ns (P=0.115) EHR 1.60 (0.892-2.853)
cervix uteri	C53	62.6% (59.4%-65.6%)	66.3% (62.4%-69.8%)	ns (P=0.116) EHR 0.878 (0.746-1.032)
corpus uteri [d]	C54	73.3% (70.4%-76.0%)	75.5% (71.6%-78.9%)	ns (P=0.251) EHR 0.888 (0.725-1.087)
ovary (& other uterine adnexa)	C56, C57.0-.7	39.3% (37.0%-41.6%)	40.4% (37.2%-43.4%)	ns (P=0.242) EHR 0.947 (0.863-1.037)
ovary (& uterine adnexa) excluding borderlines[e]	C56, C57.0-.7	37.7% (35.4%-40.0%)	38.5% (35.3%-41.6%)	ns (P=0.308) EHR 0.953 (0.863-1.037)
ovary [d]	C56	39.2% (36.8%-41.4%)	40.4% (37.2%-43.4%)	ns (P=0.212) EHR 0.943 (0.860-1.034)
penis (& other/unspecified male genital organs)	C60, C63	66.4% (56.2%-75.4%)	64.7% (49.6%-77.7%)	ns (P=0.837) EHR 1.059 (0.612-1.832)
penis [c]	C60	64.0% (53.1%-73.6%)	63.1% (46.8%-77.2%)	ns (P=0.912) EHR 0.970 (0.559-1.680)
testis	C62	91.0% (88.1%-93.2%)	96.2% (93.9%-97.7%)	** (p=0.003) EHR 0.460 (0.273-0.774)
kidney (& other / unspecified urinary organs)	C64-66, C68	45.9% (43.1%-48.6%)	47.7% (44.2%-51.1%)	ns (P=0.345) EHR 0.948 (0.848-1.058)
kidney [c]	C64	45.2% (42.2%-48.0%)	47.8% (44.2%-51.3%)	ns (P=0.091) EHR 0.906 (0.807-1.015)

Cancer type	ICD10 code	Five-year relative survival by diagnosis cohort (95% CI)		Statistical significance of change, age-adjusted
		1994-1999	2000-2004	
renal pelvis [c]	C65	40.3% (26.4%-54.6%)	46.6% (27.6%-64.5%)	ns (P=0.807) EHR 0.927 (0.502-1.708)
ureter [c]	C66	63.1% (47.9%-75.9%)	48.0% (31.5%-63.4%)	* (P=0.023) EHR 2.597 (1.144-5.895)
bladder [d]	C67	61.2% (58.9%-63.4%)	67.3% (64.1%-70.3%)	ns (P=0.589) EHR 0.966 (0.853-1.094)
eye & adnexa [c]	C69	74.0% (66.8%-80.1%)	84.5% (72.6%-93.3%)	ns (P=0.088) EHR 0.519 (0.244-1.103)
choroid (melanoma)	C69.3	70.8% (59.5%-80.0%)	78.5% (59.4%-91.7%)	-
meninges [c]	C70	58.4% (35.3%-77.0%)	69.0% (40.6%-91.2%)	ns (P=0.905) EHR 0.948 (0.396-2.268)
brain [d]	C71	18.8% (16.7%-21.0%)	21.5% (18.9%-24.1%)	*** (P<0.001) EHR 0.818 (0.747-0.893)
other central nervous system [c]	C72	56.5% (37.6%-72.1%)	55.3% (33.4%-73.0%)	ns (P=0.361) EHR 0.703 (0.330-1.497)
thyroid gland	C73	70.0% (64.6%-74.7%)	79.4% (73.7%-84.0%)	ns (P=0.471) EHR 0.887 (0.639-1.229)
adrenal gland [c]	C74	34.2% (20.2%-48.9%)	53.8% (36.5%-68.6%)	* (P=0.040) EHR 0.5194 (0.278-0.969)
other endocrine [c]	C75	65.2% (48.6%-78.1%)	71.4% (52.4%-84.6%)	ns (P=0.775) EHR 0.890 (0.398-1.985)
Hodgkin lymphoma	C81	74.5% (70.1%-78.3%)	82.7% (77.8%-86.7%)	* (P=0.029) EHR 0.690 (0.495-0.962)
follicular [c] non-Hodgkin lymphoma	C82	72.9% (67.0%-77.9%)	75.2% (67.4%-81.7%)	ns (P=0.370) EHR 0.832 (0.556-1.243)
diffuse [c] non-Hodgkin lymphoma	C83	45.5% (41.8%-49.0%)	54.2% (49.6%-58.5%)	* (P=0.019) EHR 0.837 (0.721-0.971)
T-cell [c] lymphoma	C84	73.5% (63.2%-81.8%)	75.3% (65.7%-83.1%)	ns (P=0.487) EHR 1.235 (0.681-2.233)
other/unspecified non-Hodgkin lymphoma [c]	C85	41.5% (38.2%-44.7%)	51.4% (47.4%-55.2%)	** (P=0.001) EHR 0.793 (0.695-0.904)
non-Hodgkin lymphoma	C82-C85	48.7% (46.5%-50.8%)	57.3% (54.6%-59.8%)	*** (P<0.001) EHR 0.809 (0.736-0.888)
non-Hodgkin lymphoma (& related neoplasms)	C82-C85, C96	48.8% (46.5%-50.9%)	57.3% (54.6%-59.9%)	*** (P<0.001) EHR 0.811 (0.737-0.890)
malignant immunoproliferative disease [c]	C88	51.8% (35.7%-67.0%)	70.0% (45.3%-90.3%)	ns (P=0.147) EHR 0.461 (0.161-1.313)
multiple myeloma etc	C90	23.0% (20.2%-25.8%)	29.8% (25.4%-34.3%)	*** (P<0.001) EHR 0.801 (0.711-0.901)
leukaemia	C91-C95	42.4% (39.9%-44.8%)	51.5% (48.1%-54.7%)	*** (P=0.001) EHR 0.837 (0.754-0.927)
lymphoid [c] leukaemia	C91	57.9% (54.2%-61.4%)	67.8% (63.0%-72.3%)	ns (P=0.189) EHR 0.877 (0.720-1.066)
acute lymphoblastic leukaemia	C91.0	28.0% (20.3%-36.2%)	27.3% (15.5%-40.5%)	ns (P=0.220) EHR 0.808 (0.575-1.135)
chronic lymphocytic leukaemia	C91.1	61.7% (57.5%-65.7%)	72.2% (66.9%-77.1%)	ns (P=0.614) EHR 0.937 (0.727-1.206)

Cancer type	ICD10 code	Five-year relative survival by diagnosis cohort (95% CI)		Statistical significance of change, age-adjusted
		1994-1999	2000-2004	
myeloid leukaemia [c]	C92	27.0% (23.4%-30.6%)	31.4% (26.6%-36.3%)	*** (P<0.001) EHR 0.768 (0.664-0.886)
acute myeloid leukaemia	C92.0	21.9% (17.7%-26.4%)	21.1% (15.9%-26.8%)	** (P=0.004) EHR 0.778 (0.656-0.923)
chronic myeloid leukaemia	C92.1	38.1% (30.2%-45.9%)	57.9% (46.1%-68.4%)	** (P=0.009) EHR 0.589 (0.394-0.877)
monocytic leukaemia [c]	C93	9.2% (1.5%-25.2%)	-	ns (P=0.095) EHR 0.498 (0.219-1.129)
other specific leukaemia [c]	C94	30.6% (19.5%-42.6%)	37.4% (19.7%-55.9%)	ns (P=0.143) EHR 0.647 (0.360-1.158)
leukaemia, unspecified [c]	C95	26.5% (20.4%-33.0%)	26.7% (17.5%-37.1%)	ns (P=0.093) EHR 1.265 (0.961-1.663)

* = significant improvement in survival between diagnosis periods, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference.

[c] Site-definition additional to EUROCARE-4 definitions.

[d] ICD-O-2 definitions of malignancy used here (ICD-O-3 used by EC-4), or (for bladder cancer) in situ and uncertain behaviour excluded (included by EC-4).

[e] Excluding borderline malignancies of the ovary, i.e. tumours considered fully malignant in ICD-O-2 but of uncertain behaviour in ICD-O-3.

- Insufficient data to allow estimation of five-year survival (or statistical model failed to converge).

Comparison of relative survival between Ireland and other European countries

The EUROCARE-4 study has examined relative survival of cancer patients across Europe, and a summary of the 'period' analyses published by Verdecchia *et al*. 2007 is given below *(Table 38)*. This is based on patients diagnosed during 2000-02 with follow-up to the end of 2003, supplemented by follow-up during 2000-03 of any patients surviving into that period from earlier diagnosis years. For further comparison, slightly more recent results from the present report (age-standardized figures from *Appendix Tables 1.1 and 1.2*) are also shown.

Results from were published for 16 cancer types in up to 21 countries, and for male and female cancers as a whole, but survival estimates were not available for Irish patients with **prostate** and **testicular cancers** because of sparse data in the youngest and oldest age-groups, respectively.

For most cancers (the exceptions being **lung cancer**, **cervical cancer** and **myeloid leukaemias**), survival estimates for Irish patients were slightly lower than the European average. Within Europe as a whole, survival figures varied markedly, and were generally lowest in former Eastern Bloc countries, the UK countries and Ireland. Ireland was in the top four or five countries for only two of the cancers included – **acute myeloid leukaemia** (for which Ireland had the highest recorded five-year survival) and **chronic myeloid leukaemia**.

All estimates shown in *Table 38* (with the exception of **testicular cancer** survival for Ireland) are age-standardized to the standard patient populations proposed by Corazziari *et al*. (2004). Depending on the age-profile of the cancer concerned, this can either reduce or increase the overall estimate, compared with non-standardized estimates. Otherwise, the exclusions and cancer-types defined for EUROCARE-4 match those used in this report, with the following main exceptions:

- **Bladder cancers** included in EUROCARE-4 include tumours coded as in situ carcinomas (ICD-O behaviour 2) or as tumours of uncertain behaviour (behaviour 1) – this is because different registries or countries may have coded tumour behaviour differently for this site. In this report, only tumours coded by NCRI as behaviour 3 have been included.
- Cancers of the **corpus uteri** in EC-4 include low-grade endometrial stromal sarcoma (ICD-O-3 morphology 8931/3) as a full malignancy; this was coded as uncertain behaviour (8931/1) in ICD-O-2, and is excluded from this report.
- **Brain cancers** in EC-4 exclude pilocytic astrocytomas (ICD-O-3 9421/1), but include papillary ependymoma (9393/3). Pilocytic astrocytomas were considered full malignancies in ICD-O-2 (and ICD-10) are included in this report, but papillary ependymomas are excluded.
- **Myelodysplastic syndromes** (9980-9989/3) and **chronic myelodysplastic disorders** (ICD-O-3 9950/3, 9960-9964.3) are included as fully malignancies in EC-4. In this report, they are excluded as they are coded as uncertain behaviour (1) in ICD-O-2 (and ICD-10).
- **Ovarian cancers** in EC-4 exclude so-called 'borderline' malignancies, considered fully malignant (behaviour 3) in ICD-O-2 but of uncertain behaviour (1) in ICD-O-3. Elsewhere in this report, ovarian cancer survival is presented for both definitions (including and excluding borderline malignancies).

Table 38. Period estimates of five-year relative survival from EUROCARE-4, 2000-02 (Verdecchia et al. 2007). These are based on patients diagnosed during 2000-02, or alive at some point during 2000-2004; slightly more recent 'complete' estimates for Ireland (also age-standardized) are presented for further comparison.

Cancer type	ICD10 code [b]	Five-year relative survival (95% CI), age-standardized[a]			
		'period' estimates			'complete' estimate
		Ireland 2000-02	Europe average 2000-02	Europe highest 2000-02	Ireland 2000-2004
all malignancies (men)		48.1% (47.2%-49.9%)	51.9% (51.0%-52.8%)	Sweden, Iceland, Austria, Switzerland	49.8% (48.1%-51.4%)
all malignancies (women)		51.9% (51.0%-52.8%)	55.8% (55.3%-56.2%)	Iceland, Sweden, Belgium, Finland	52.6% (51.0%-54.1%)
stomach	C16	18.8% (16.5%-21.5%)	24.9% (23.7%-26.2%)	Italy, Belgium, Spain, Germany	18.1% (13.5%-23.2%)
colorectal	C18-21	54.3% (52.6%-56.0%)	56.2% (55.3%-57.2%)	Switzerland, Spain, Germany, Belgium	53.2% (49.7%-56.4%)
lung (& trachea)	C33-34	10.9% (9.8%-12.2%)	10.9% (10.5%-11.4%)	Iceland, Belgium, Switzerland, Germany	10.6% (8.4%-13.0%)
soft tissue	C47 & C49	60.2% (52.4%-69.3%)	61.2% (`58.3%-64.2%)	Switzerland, Belgium, Slovenia, Sweden	62.2% (47.2%-75.2%)
melanoma of skin	C43	85.9% (83.1%-88.8%)	86.1% (84.3%-88.0%)	Malta, N. Ireland, Scotland, Sweden	85.7% (79.6%-90.6%)
breast (female)	C50	76.2% (74.3%-78.2%)	79.0% (78.1%-80.0%)	Iceland, Sweden, Finland, Switzerland	76.9% (73.5%-80.1%)
cervix uteri	C53	63.8% (58.8%-69.3%)	60.4% (57.7%-63.2%)	Iceland, Netherlands. Norway, Italy	61.2% (51.4%-70.2%)
corpus uteri	C54	77.0% (72.3%-81.9%)	78.0% (76.2%-79.9%)	Norway, Sweden, Germany, Czech Rep	74.3% (65.2%-81.8%)
prostate	C61	-	77.5% (76.5%-78.6%)	Austria, Germany, Italy, Iceland	82.9% (78.9%-86.6%)
testis	C62	-	97.3% (96.4%-98.2%)	Scotland, Sweden, Norway	[c]*96.2% (93.9%-97.7%)*
kidney (etc)	C64-66,C68	54.1% (47.8%-61.2%)	55.7% (53.6%-58.0%)	Spain, Austria, Italy, Switzerland	46.9% (39.2%-54.4%)
thyroid gland	C73	75.8% (69.3%-82.9%)	83.2% (80.9%-85.6%)	Iceland, Slovenia, Poland, Italy	74.4% (60.3%-85.9%)
Hodgkin lymphoma	C81	77.2% (72.0%-82.7%)	81.4% (78.9%-84.1%)	Spain, Norway, Switzerland, Finland	80.0% (67.9%-89.4%)
non-Hodgkin lymphomas	C82-C85	52.0% (47.5%-56.9%)	54.6% (52.7%-56.6%)	Switzerland, Germany Spain, Czech Rep.	55.2% (49.1%-61.0%)
acute myeloid leukaemia	C92.0	26.9% (18.7%-38.8%)	14.8% (13.4%-16.4%)	Ireland, Sweden	16.8% (8.5%-30.1%)
chronic myeloid leukaemia	C92.1	33.8% (25.3%-45.3%)	32.2% (29.0%-35.7%)	Italy, Netherlands, Switzerland, Sweden	54.0% (27.7%-76.5%)

[a] Age-standardized = expressed in terms of standard patient populations proposed by Corazziari *et al*. (2004)

[b] For the individual cancer types shown, the ICD-10 (ICD-O-2) definition of full malignancy matches the ICD-O-3 definition; but for 'all malignancies', EUROCARE-4 results include or exclude some neoplasms, depending on how they are coded ICD-O-3. (EC-4 also includes bladder tumours coded as in situ or as uncertain behaviour.)

[c] Not age-standardized.

- Insufficient data to allow estimation of five-year survival (age-specific Irish data for prostate and testicular cancers were too sparse for some analyses).

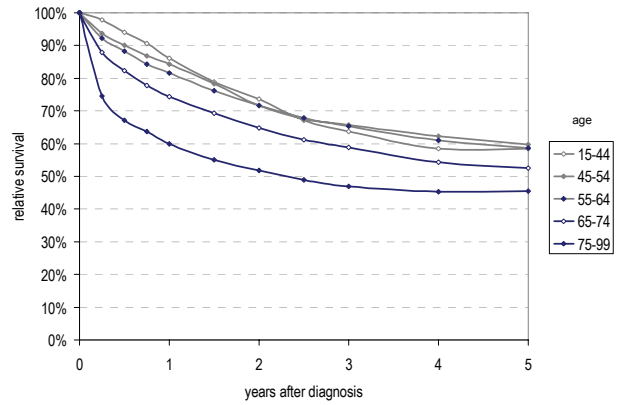
Variation in survival by age at diagnosis

Although estimation of relative survival allows for (and excludes) 'background' or all-cause mortality, which increases with age, the excess mortality associated with a cancer diagnosis also tends (for most cancers) to increase with age (*Tables 39, 40; Figure 18*). As a result, relative survival of cancer patients (i.e. survival compared with the general population) tends to decline with age, although the extent and pattern of this varies between cancer types.

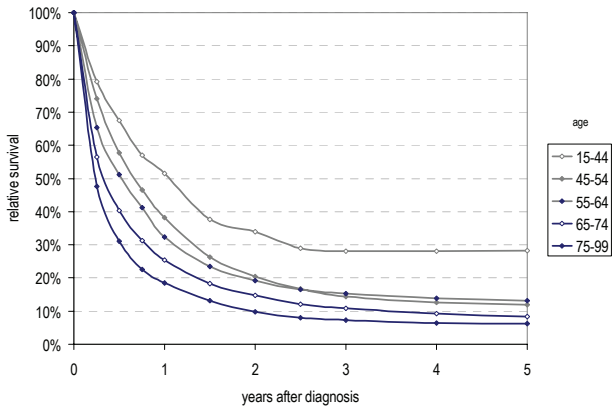
Several possible factors may be involved in the association between relative survival and age of cancer patients. These include more advanced cancer stage (on average) with increasing age at diagnosis, or in younger age-groups for some cancers; interactions between cancer-fatality and age (if older, weaker patients are at higher risk of succumbing); and possible reductions in treatment rates (reflecting patient condition or, more controversially, age-biases in treatment).

Figure 18. Relative survival of Irish cancer patients diagnosed during 2000-2004 —by age at diagnosis (EUROCARE age-groups)

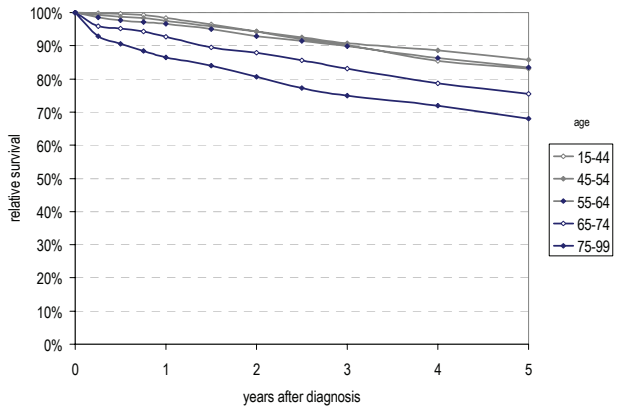
colorectal



lung (& trachea)



female breast



prostate

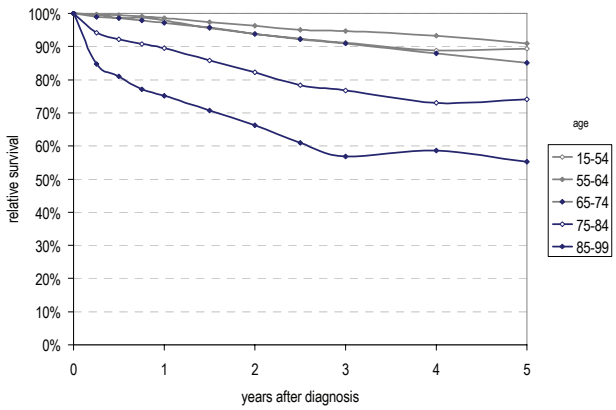


Table 39. Age-specific five-year relative survival of cancer patients diagnosed during 2000-2004: major cancers.

Cancer type	ICD10	Five-year relative survival (95% CI) by age at diagnosis				
		age15-44	45-54	55-64	65-74	75-99
colorectal	C18-21	58.6% (51.8%-64.6%)	59.7% (55.5%-63.6%)	58.7% (55.6%-61.6%)	**52.4% (49.7%-55.1%)	***45.5% (42.3%-48.7%)
colon	C18	54.6% (45.4%-62.8%)	60.9% (55.4%-65.9%)	55.3% (51.2%-59.1%)	53.6% (50.2%-56.9%)	***49.1% (45.2%-53.0%)
rectum/anus/ rectosigmoid	C19-21	63.3% (53.2%-71.8%)	58.4% (52.0%-64.2%)	63.1% (58.3%-67.4%)	**50.7% (46.1%-55.0%)	***38.2% (33.0%-43.5%)
lung (& trachea)	C33-34	28.2% (21.0%-35.6%)	**12.0% (8.7%-15.6%)	***13.1% (11.0%-15.2%)	***8.3% (6.8%-9.7%)	***6.3% (4.8%-7.9%)
breast (female)	C50	83.1% (80.1%-85.7%)	85.8% (83.6%-87.6%)	83.5% (81.2%-85.5%)	***75.4% (71.9%-78.5%)	***68.1% (63.2%-72.7%)
		15-54	**55-64**	**65-74**	**75-84**	**85-99**
prostate	C61	89.3% (84.8%-92.7%)	*90.9% (88.3%-93.1%)	85.1% (82.5%-87.5%)	***74.1% (69.7%-78.3%)	***55.3% (42.0%-70.0%)

* = significantly higher or lower relative survival, adjusted for length of follow-up, compared with youngest age-group (* P<0.05, ** P<0.01, *** P<0.001).

Table 40. Age-specific five-year relative survival of cancer patients diagnosed during 2000-2004: other cancers/groups.

Cancer type	ICD10	Five-year relative survival (95% CI) by age at diagnosis				
		age15-44	45-54	55-64	65-74	75-99
all cancers except non-melanoma skin	C00-C96 excl C44	76.3% (74.9%-77.5%)	***64.9% (63.5%-66.1%)	***58.4% (57.3%-59.4%)	***48.4% (47.3%-49.4%)	***37.7% (36.4%-38.8%)
all (male) except non-melanoma skin	C00-C96 excl C44	72.7% (70.5%-74.7%)	***52.5% (50.3%-54.5%)	***55.0% (53.4%-56.4%)	***49.4% (48.0%-50.8%)	***39.5% (37.6%-41.3%)
all (female) except non-melanoma skin	C00-C96 excl C44	78.4% (76.7%-79.9%)	***72.6% (70.9%-74.1%)	***62.4% (60.8%-63.8%)	***47.0% (45.4%-48.4%)	***36.0% (34.3%-37.6%)
head & neck (mouth/pharynx)	C01-06, C09-13	72.7% (60.7%-81.6%)	***49.2% (39.5%-58.1%)	***49.1% (41.8%-56.0%)	***38.5% (29.0%-48.0%)	***28.0% (16.2%-42.4%)
lip	C00	-	102.4%	78.0% (40.3%-96.2%)	93.8% (66.0%-108%)	60.2% (21.6%-103%)
tongue	C01-02	71.8% (52.2%-84.5%)	55.3% (38.9%-69.1%)	53.9% (40.9%-65.5%)	56.8% (38.6%-72.7%)	***28.3% (9.7%-54.9%)
oral cavity	C03-06	66.8% (43.9%-82.1%)	48.2% (30.9%-63.6%)	55.7% (41.3%-68.2%)	41.7% (27.2%-56.2%)	*40.6% (19.6%-65.9%)
salivary glands	C07-08	95.5% (69.8%-99.8%)	65.6% (33.0%-85.7%)	*51.8% (28.4%-71.5%)	**25.4% (5.9%-53.7%)	**22.2% (2.5%-64.7%)
oropharynx	C09-10	-	58.3% (42.1%-71.6%)	45.6% (30.7%-59.5%)	41.3% (18.0%-64.8%)	*(low)
nasopharynx	C11	83.8% (46.4%-96.3%)	58.4% (7.7%-90.5%)	47.8% (13.1%-77.8%)	*49.8% (14.3%-85.0%)	*(low)
hypopharynx	C12-13	67.4% (5.4%-95.6%)	10.9% (0.1%-47.8%)	29.9% (15.0%-46.7%)	-	*(low)
oesophagus	C15	30.5% (17.4%-44.6%)	27.6% (19.9%-35.7%)	19.7% (14.3%-25.8%)	**12.9% (9.3%-16.9%)	***12.8% (9.0%-17.3%)
stomach	C16	24.8% (16.7%-33.6%)	29.7% (22.1%-37.5%)	22.9% (17.9%-28.3%)	**15.1% (11.6%-18.9%)	***10.9% (7.6%-14.9%)
small intestine	C17	80.5% (47.0%-94.1%)	59.7% (31.2%-80.0%)	*26.9% (10.8%-46.3%)	*50.1% (30.6%-68.5%)	***18.2% (5.8%-38.5%)
liver	C22	34.0% (14.1%-55.3%)	16.7% (5.8%-32.4%)	16.5% (8.8%-26.3%)	**5.6% (1.2%-15.3%)	**2.1% (0.1%-13.2%)
biliary tract	C23-24	40.3% (12.3%-67.4%)	22.8% (9.2%-39.9%)	26.2% (15.1%-38.8%)	18.2% (10.7%-27.3%)	***6.6% (3.0%-12.2%)
pancreas	C25	22.3% (11.9%-34.6%)	6.4% (2.1%-14.0%)	*5.9% (3.0%-10.1%)	***4.6% (2.6%-7.4%)	***5.1% (2.9%-8.31%)
nasal cavity, middle ear & accessory sinuses	C30-31	65.1% (25.4%-87.6%)	56.6% (17.4%-83.9%)	51.8% (25.1%-73.8%)	23.2% (2.1%-60.6%)	27.3% (5.8%-62.6%)

Cancer type	ICD10	Five-year relative survival (95% CI) by age at diagnosis				
		15-44	45-54	55-64	65-74	75-99
larynx	C32	70.7% (38.6%-88.4%)	57.3% (43.2%-69.3%)	67.1% (58.5%-74.5%)	61.1% (50.9%-70.4%)	*48.4% (33.2%-64.5%)
		20-44	**45-54**	**55-64**	**65-74**	**75-99**
bone	C40-41	48.7% (21.9%-71.1%)	39.1% (16.0%-62.0%)	34.2% (9.5%-62.3%)	56.1% (24.1%-82.2%)	**30.4% (4.2%-76.1%)
		15-44	**45-54**	**55-64**	**65-74**	**75-99**
melanoma skin	C43	90.7% (87.2%-93.3%)	*85.3% (79.7%-89.5%)	*85.6% (80.1%-89.9%)	**82.8% (75.6%-88.7%)	80.2% (69.5%-90.3%)
soft tissue (incl.peripheral nerves / ANS)	C47, C49	74.6% (63.4%-82.8%)	59.5% (42.8%-73.0%)	*58.1% (43.8%-70.3%)	***55.6% (41.7%-68.4%)	**55.9% (33.3%-79.5%)
breast (male)	C50	100% (no deaths)	>100% (no deaths)	74.1% (34.7%-94.4%)	81.5% (51.4%-99.2%)	97.8% (49.7%-135%)
vagina & vulva (incl. other female genital organs)	C51-52, C57.8-.9	81.7% (57.6%-93.0%)	59.9% (35.2%-77.9%)	61.7% (43.1%-76.2%)	73.3% (55.4%-86.5%)	**31.9% (15.4%-52.5%)
cervix uteri	C53	76.8% (71.4%-81.3%)	**65.7% (57.3%-72.8%)	***57.0% (46.3%-66.4%)	***57.0% (43.7%-68.7%)	***36.7% (22.5%-52.4%)
corpus uteri	C54	87.3% (75.5%-93.7%)	84.2% (76.7%-89.5%)	78.0% (70.2%-84.2%)	73.9% (65.6%-81.0%)	**64.5% (53.6%-74.8%)
ovary (& other uterine adnexa)	C56, C57.0-.7	77.8% (70.9%-83.3%)	***52.4% (44.6%-59.6%)	***33.3% (26.6%-40.2%)	***34.3% (28.0%-40.7%)	***19.1% (13.7%-25.3%)
ovary (& uterine adnexa) excluding borderlines[a]	C56, C57.0-.7	75.5% (67.9%-81.5%)	***51.1% (43.2%-58.4%)	***32.4% (25.6%-39.4%)	***32.5% (26.2%-38.9%)	***17.7% (12.4%-24.0%)
penis (& other/unspec. male genital organs)	C60, C63	86.5% (33.7%-98.7%)	90.7% (62.9%-99.3%)	50.7% (14.6%-80.4%)	67.4% (40.6%-88.4%)	57.3% (24.2%-92.7%)
testis	C62	96.1% (93.6%-97.6%)	98.0% (86.2%-101%)	100.8% (72.4%-105%)	80.7% (25.0%-107%)	-
kidney (& other /unspec. urinary organs)	C64-66, C68	70.6% (58.6%-79.8%)	63.7% (56.3%-70.1%)	**52.1% (44.8%-58.8%)	***45.7% (39.1%-52.1%)	***31.5% (23.2%-40.5%)
bladder	C67	88.4% (77.4%-94.4%)	79.4% (69.6%-86.4%)	79.4% (73.3%-84.4%)	*68.8% (63.3%-73.8%)	***62.2% (55.5%-68.9%)
choroid (melanoma)	C69.3	50.4% (0.6%-91.6%)	-	80.0% (49.4%-95.0%)	74.4% (43.0%-94.6%)	91.0% (48.6%-117%)
brain	C71	58.9% (51.4%-65.6%)	***24.7% (18.3%-31.6%)	***10.1% (6.3%-14.8%)	***4.7% (2.3%-8.2%)	***5.7% (2.4%-11.1%)
thyroid gland	C73	98.7% (95.1%-99.8%)	**83.6% (66.8%-92.7%)	***75.9% (58.0%-87.6%)	***60.7% (43.9%-75.0%)	***32.0% (9.3%-62.8%)
Hodgkin lymphoma	C81	94.3% (88.7%-97.2%)	***75.9% (59.4%-86.7%)	***66.3% (46.1%-81.0%)	***47.2% (21.5%-71.3%)	***44.5% (19.9%-71.8%)
non-Hodgkin lymphoma (& related neoplasms)	C82-C85, C96	76.0% (70.3%-80.7%)	69.4% (62.9%-74.9%)	***68.2% (62.7%-73.1%)	***54.3% (48.3%-59.9%)	***35.1% (28.5%-42.0%)
multiple myeloma etc	C90	74.2% (49.9%-88.1%)	63.4% (50.9%-73.6%)	*42.1% (31.4%-52.4%)	**24.7% (16.7%-33.6%)	***14.2% (8.4%-21.6%)
leukaemias	C91-C95	63.8% (55.0%-71.3%)	70.5% (62.4%-77.2%)	60.5% (52.5%-67.6%)	**46.4% (39.6%-52.9%)	***44.8% (37.4%-52.5%)
acute lymphoblastic leukaemia	C91.0	40.1% (22.1%-57.5%)	38.1% (10.7%-66.1%)	70.1% (29.6%-92.3%)	**(low)_	***(low)_
chronic lymphocytic leukaemia	C91.1	94.8% (65.5%-99.8%)	94.6% (85.7%-98.8%)	77.2% (66.0%-85.6%)	71.6% (61.2%-80.6%)	70.1% (57.5%-82.3%)
acute myeloid leukaemia	C92.0	49.2% (32.6%-63.7%)	36.9% (20.1%-53.8%)	***4.7% (0.1%-25.0%)	***14.1% (6.8%-24.0%)	***13.0% (6.4%-22.5%)
chronic myeloid leukaemia	C92.1	87.1% (60.0%-96.6%)	78.3% (42.6%-94.3%)	67.0% (38.5%-85.7%)	**35.9% (14.1%-60.1%)	***43.7% (18.8%-73.4%)

* = significantly higher or lower relative survival, adjusted for length of follow-up, compared with youngest age-group (* P<0.05, ** P<0.01, *** P<0.001).

- Insufficient data.

[a] Excluding borderline malignancies of the ovary, i.e. tumours considered fully malignant in ICD-O-2 but of uncertain behaviour in ICD-O-3.

Variation in survival by tumour stage at diagnosis, and stage-specific time-trends in survival

Survival of cancer patients is heavily dependent on tumour stage at diagnosis. For the four most common serious cancers, stage-specific five-year relative survival is summarized in Table 44 for the diagnosis periods 1994-1999 and 2000-2004 (*Table 41, Figure 19*). In general, stage-specific survival improved significantly between these periods, confirmed by relative survival modelling adjusted for age and length of follow-up. However, changes were not statistically significant for **lung cancer** (except unknown stage), **colorectal cancer** stage I, or **breast cancer** stage III, and either could not be assessed or were not significant for **prostate cancer** stages I-III.

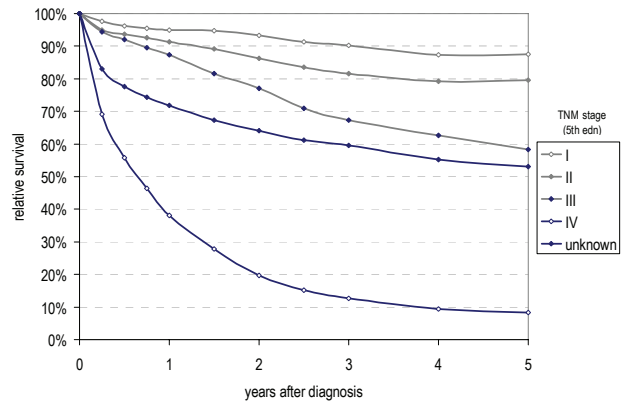
Improvements in stage-specific survival are likely to reflect improvements in the quality or appropriateness of treatment, but could also (in some categories) reflect a degree of stage-shift, not captured by the broad stage-categories shown. For example, stage I **breast cancers** might include, on average, smaller tumours in more recent years, in part reflecting increased population-based screening. Another possibility is that 'stage-migration' (essentially a change in the quality of coding) may have occurred – e.g. cancers coded as early-stage in recent years may be less likely to include cases with undetected area or distant metastasis.

As noted earlier in this report, a high proportion of cases could not be fully (strictly) staged, generally because nodal (N category) or metastatic status (M category) were not explicitly coded in hospital or pathology notes. We have therefore also examined survival patterns by stage when less stringent coding criteria have been applied – assuming that 'NX' and 'MX' cases are 'N0' or 'M0'. The patterns and survival estimates are broadly similar (*Appendix 2*), although stage-specific survival tends to be slightly lower than if 'strict' stage-coding is applied – in part, perhaps, because the completeness of staging information tends to be less for older patients.

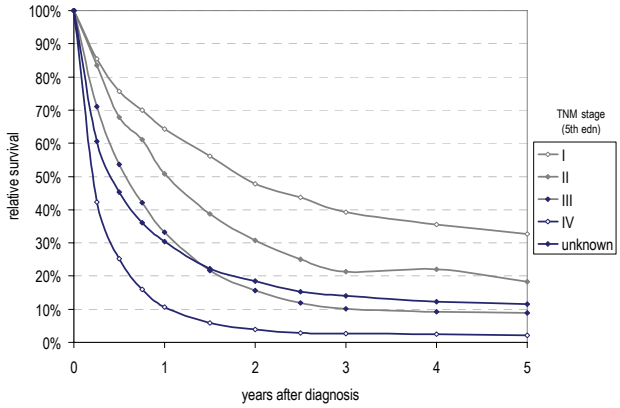
Note also that T, N and M categories of stage were originally coded to either the 4th or the 5th edition of TNM stage, but codes (and stage-groups) have been translated to TNM 5th edition for the analyses here.

Figure 19. Relative survival of Irish cancer patients diagnosed during 2000-2004 —by TNM stage (5th edition)

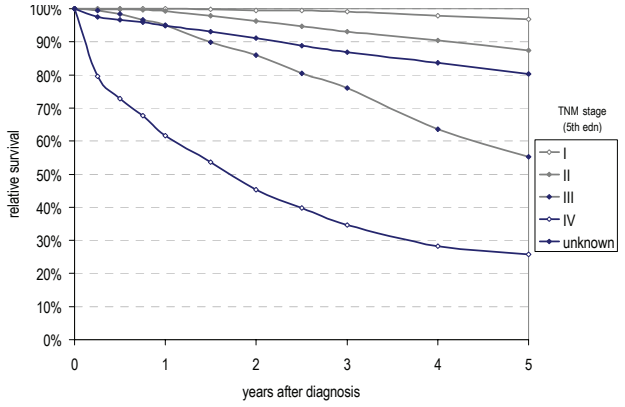
colorectal



lung (& trachea)



female breast



prostate

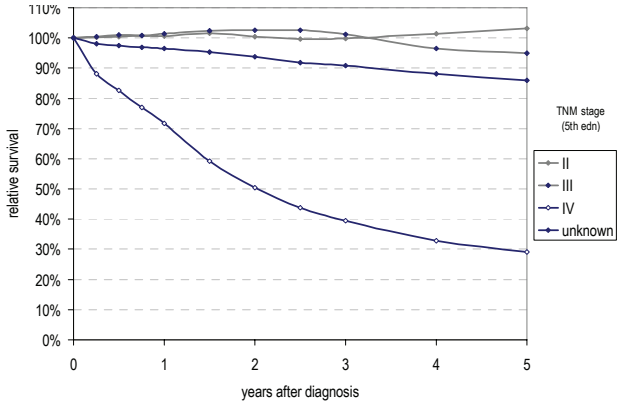


Table 41. Five-year relative survival for major cancer types, by full/strict TNM stage (5th edition) and year of diagnosis. The statistical significance of change in survival is assessed by relative survival modeling, adjusted for age and length of follow-up.

Cancer type	ICD10 code	TNM stage (5th edn)	Five-year relative survival (95% CI) 1994-1999	2000-2004	Statistical significance of change, age-adjusted
colorectal	C18-C21	stage I	82.6% (78.9%-85.9%)	87.6% (82.4%-92.0%)	ns (P=0.922) EHR 0.975 (0.592-1.604)
		stage II	68.9% (66.0%-71.6%)	79.7% (75.9%-83.1%)	** (P=0.010) EHR 0.779 (0.644-0.941)
		stage III	46.5% (43.3%-49.5%)	58.4% (54.3%-62.2%)	*** (P<0.001) EHR 0.7021 (0.612-0.804)
		stage IV	7.6% (6.3%-8.8%)	8.4% (6.7%-10.2%)	** (P=0.001) EHR 0.8901 (0.832-0.951)
		unknown	47.8% (46.0%-49.5%)	53.1% (50.6%-55.5%)	** (P=0.003) EHR 0.8897 (0.822-0.962)
lung (& trachea)	C33-34	stage I	34.7% (29.4%-40.0%)	32.7% (26.1%-39.5%)	ns (P=0.080) EHR 0.836 (0.683-1.021)
		stage II	17.7% (12.4%-23.6%)	18.3% (9.7%-29.1%)	ns (P=0.772) EHR 0.966 (0.762-1.223)
		stage III	6.4% (4.3%-9.0%)	8.9% (6.5%-11.6%)	ns (P=0.081) EHR 0.900 (0.799-1.012)
		stage IV	2.7% (2.0%-3.5%)	2.1% (1.3%-3.1%)	ns (P=0.272) EHR 0.969 (0.914-1.025)
		unknown	8.5% (7.7%-9.3%)	11.6% (10.2%-13.0%)	*** (P<0.001) EHR 0.893 (0.851-0.935)
breast (female)	C50	stage I	93.1% (90.8%-95.0%)	96.8% (94.1%-98.8%)	** (P=0.005) EHR 0.324 (0.148-0.708)
		stage II	80.3% (78.4%-81.9%)	87.4% (85.2%-89.4%)	*** (P<0.001) EHR 0.607 (0.500-0.735)
		stage IIA	84.8% (82.4%-86.8%)	92.2% (89.5%-94.5%)	*** (P<0.001) EHR 0.532 (0.381-0.741)
		stage IIB	74.4% (71.4%-77.1%)	81.5% (77.8%-84.7%)	*** (P<0.001) EHR 0.649 (0.513-0.820)
		stage III	60.9% (56.5%-64.9%	55.3% (48.8%-61.4%)	ns (P=0.832) EHR 0.977 (0.787-1.211)
		stage IIIA	64.4% (58.7%-69.6%)	60.3% (51.2%-68.3%)	ns (P=0.906) EHR 1.019 (0.749-1.385)
		stage IIIB	56.6% (49.7%-62.9%)	50.9% (41.6%-59.5%)	ns (P=0.626) EHR 0.926 (0.683-1.257)
		stage IV	19.6% (16.6%-22.8%)	25.8% (21.4%-30.4%)	** (P-0.008) EHR 0.838 (0.735-0.954)
		unknown	72.3% (70.8%-73.7%)	80.3% (78.3%-82.1%)	*** (P<0.001) EHR 0.645 (0.567-0.733)
prostate [b]	C61	stage II	77.1% (71.0%-82.5%)	103.1% (98.7%-106%)	-
		stage III	97.2% (85.2%-104%)	95.0% (81.3%-102%)	ns (P=0.494) EHR 2.767 (0.149-51.19)
		stage IV	24.3% (21.7%-26.8%)	29.2% (25.2%-33.2%)	** (P=0.006) EHR 0.862 (0.775-0.957)
		unknown	70.2% (68.4%-71.9%)	86.0% (84.1%-87.7%)	*** (P<0.001) EHR 0.491 (0.407-0.592)

* = significant improvement in survival between diagnosis periods, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference., - = not computable.

[a]EHR = excess hazard ratio (with 95% confidence intervals) comparing 2000-2004 with 1994-1999, adjusted for age and for length of follow-up (including interaction between age and follow-up where possible): <1.000 indicates reduction in excess (cancer-associated) mortality rate, i.e. improved relative survival; >1.000 increased excess mortality i.e. reduced relative survival.

[b]Survival estimates at not presented for prostate cancer stage I (equivalent to stage 0 in TNM 4th edition), as very few cases involved (26 1994-1999, 14 2000-2004).

Variation in survival by age and tumour stage at diagnosis

For the four most common cancers (other than non-melanoma skin cancer), stage-specific five-year relative survival is tabulated below *(Table 42)* for each of the standard EUROCARE age-groups.

For a given cancer type, patterns of five-year relative survival by stage were broadly similar in different age-groups, but there was a tendency for survival probabilities to decline more markedly with age for the more advanced stages. Note, however, that 95% confidence intervals are wide for many age/stage combinations, reflecting low number of cases involved, thus the specific figures quoted should be interpreted with caution. Also, the figures tabulated here for stages I-IV are based on fully (explicitly) staged cases, but a high proportion of cases lack explicit coding of the N or M category of stage. Typically, survival of 'unknown stage' cases was equivalent to that of Stage II or Stage III cases.

Table 42. Five-year relative survival for major cancer types diagnosed during 2000-2004, by full/strict TNM stage (5th edition) and age at diagnosis..

Cancer type	ICD10 code	TNM stage (5th edn)	Stage-specific five year relative survival (95% CI) by age at diagnosis				
			15-44	45-54	55-64	65-74	75-99
colorectal	C18-21	I	93.3% (82.6%-97.7%)	99.0% (94.6%-100%)	96.9% (92.4%-99.5%)	101.5% (92.8%-105%)	91.5% (72.0%-106%)
		II	84.5% (67.6%-93.2%)	82.8% (71.4%-90.3%)	83.9% (77.1%-89.2%)	77.6% (70.9%-83.4%)	85.7% (76.6%-94.1%)
		III	65.4% (48.5%-77.9%)	71.2% (60.4%-79.7%)	66.0% (57.7%-73.3%)	58.4% (51.4%-64.9%)	49.2% (40.0%-58.5%)
		IV	-	9.9% (5.5%-15.9%)	7.4% (4.2%-11.7%)	9.3% (6.4%-12.8%)	9.0% (6.0%-12.6%)
		unknown	74.3% (63.1%-82.6%)	74.1% (67.2%-79.7%)	66.7% (61.2%-71.6%)	57.8% (53.0%-62.3%)	41.8% (37.1%-46.6%)
lung (& trachea)	C33-34	I	-	69.2% (41.6%-86.3%)	53.2% (40.2%-64.7%)	35.9% (24.5%-47.8%)	11.4% (3.4%-25.8%)
		II	-	8.3% (0.1%-40.5%)	45.1% (28.5%-60.7%)	17.3% (7.9%-29.8%)	11.8% (3.5%-26.9%)
		III	-	13.7% (5.9%-24.7%)	13.8% (8.9%-19.8%)	6.2% (3.1%-10.6%)	7.5% (3.5%-13.8%)
		IV	-	2.0% (0.5%-5.2%)	2.0% (0.8%-3.9%)	1.3% (0.3%-3.5%)	3.5% (1.5%-6.7%)
		unknown	47.5% (35.5%-58.5%)	18.7% (12.2%-26.3%)	17.9% (14.3%-21.7%)	10.9% (8.6%-13.4%)	6.9% (5.0%-9.1%)

Cancer type	ICD10 code	TNM stage (5th edn)	age at diagnosis				
			15-44	45-54	55-64	65-74	75-99
breast (female)	C50	I	93.3% (82.6%-97.7%)	99.0% (94.6%-100%)	96.9% (92.4%-99.5%)	101.5% (92.8%-105%)	91.5% (72.0%-106%)
		II	89.1% (84.3%-92.4%)	90.7% (87.2%-93.2%)	87.5% (83.3%-90.8%)	85.7% (78.8%-91.1%)	82.3% (69.3%-93.5%)
		IIA	91.4% (84.7%-95.3%)	96.0% (92.5%-98.1%)	91.4% (86.2%-95.0%)	89.0% (79.4%-95.8%)	96.2% (78.0%-110%)
		IIB	86.3% (78.4%-91.5%)	84.2% (77.8%-89.0%)	82.2% (74.8%-87.8%)	81.9% (71.4%-89.9%)	67.0% (48.8%-83.3%)
		III	60.1% (47.0%-70.9%)	54.9% (40.6%-67.2%)	65.2% (54.5%-74.2%)	43.6% (27.8%-58.9%)	53.8% (35.0%-72.6%)
		IIIA	68.0% (53.7%-78.7%)	53.0% (34.2%-68.7%)	60.8% (44.0%-74.2%)	58.0% (30.0%-80.3%)	67.7% (32.7%-95.1%)
		IIIB	44.6% (21.6%-65.3%)	57.9% (35.0%-75.5%)	69.0% (54.4%-80.1%)	33.8% (16.4%-52.7%)	48.4% (26.7%-71.6%)
		IV	52.5% (39.0%-64.4%)	28.2% (18.4%-38.7%)	26.3% (17.7%-35.7%)	15.6% (8.4%-24.8%)	23.4% (14.1%-34.5%)
		unknown	83.6% (78.5%-87.5%)	88.6% (85.3%-91.2%)	86.6% (83.0%-89.5%)	80.2% (75.1%-84.6%)	70.3% (64.0%-76.4%)
			15-54	**55-64**	**65-74**	**75-84**	**85-99**
prostate[a]	C61	II	>100% (no deaths)	104.1% (100%-105%)	110.1% (104%-113%)	82.0% (42.9%-111%)	93.1% (4.9%-288%)
		III	79.9% (17.0%-99.1%)	92.1% (70.0%-101%)	100.7% (77.8%-110%)	-	-
		IV	41.8% (26.2%-56.8%)	41.2% (31.2%-51.0%)	31.0% (24.4%-37.9%)	29.0% (22.1%-36.5%)	4.9% (0.1%-34.3%)
		unknown	95.9% (91.2%-98.6%)	94.4% (91.5%-96.7%)	90.8% (87.9%-93.4%)	85.0% (80.0%-89.8%)	66.3% (50.5%-83.4%)

[a] Insufficient Stage I cases of prostate cancer to allow estimation

Variation in survival by area of residence

For the diagnosis period 2000-2004 (with follow-up to 2005), relative survival within five years of diagnosis was (statistically) significantly lower, after age-adjustment, among **colorectal cancer** patients resident in the HSE South area, female **breast cancer** patients from the South and West areas, and **prostate cancer** patients from the Dublin/North-East, South and West areas, compared with Dublin/Mid-Leinster area (*Table 43; Figure 20*). Comparisons were based on age-adjusted modelling. Fuller adjustment, for both age and stage-related variables, modified these findings slightly – survival from **prostate cancer** in the West was no longer significantly low, but stage-adjusted survival from **colorectal cancer** in the West and breast cancer in Dublin/North-East were significantly low compared with Dublin/Mid-Leinster.

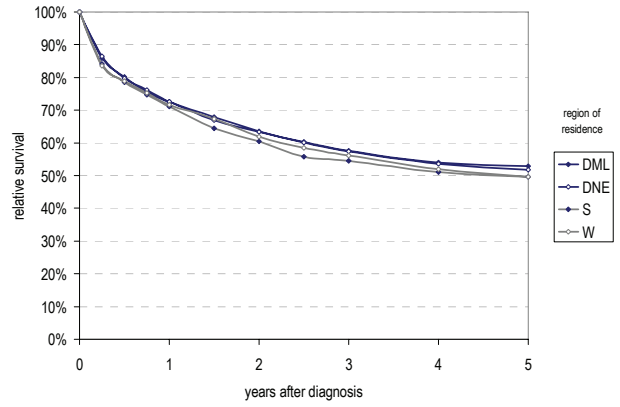
Similar, or more marked, patterns of geographic variation were also evident for these major cancers in the period 1994-1999 (*Table 43; Figure 20*). Figures presented here suggest that, for the major cancers, area disparities in survival have reduced somewhat in more recent years. All areas showed substantial improvements in survival between 1994-1999 and 2000-2004, with some indications that improvements were highest in areas other than Dublin/Mid-Leinster (**colorectal cancer** in the South and West, **lung cancer** in Dublin/North-East, the South and West, **breast cancer** in Dublin/North-East and the South, and **prostate cancer** in the West).

In the more recent period, the significantly lower survival seen for **breast cancer** in the South and West areas could reflect, in part, the absence of population-based mammographic screening in those areas (even if initial survival benefits are more apparent than real, i.e. average survival simply inflated by earlier knowledge of the cancer's presence). But, as the breast screening programme (BreastCheck) has only been in place in eastern counties since 2000/2001, and survival differences between areas were also evident pre-2000, area variation in the quality or effectiveness of treatment seem more likely to be involved. This is supported by the results of stage-adjusted models, which actually suggest wider area discrepancies than those shown by basic age-adjusted models.

Prostate cancer survival figures are even more prone to artificial influences of screening, in this case involving measurement of the prostate-specific antigen (PSA) in blood. Large-scale but unorganized screening for prostate cancer is, in effect, already underway throughout Ireland. This may account for much of the apparent improvements in survival seen for this cancer recently (see also *Table 43*). In addition, possible differences between areas in the extent of PSA and follow-up tests may be contributing to apparent area differences in survival. This is supported to some extent by statistical modelling, which indicates less substantial area variation after adjustment for tumour stage (including grade).

Figure 20. Relative survival of Irish cancer patients diagnosed during 2000-2004 —by HSE area of residence [Dublin/Mid-Leinster, Dublin/North-East, Southern or Western].

colorectal



lung (& trachea)

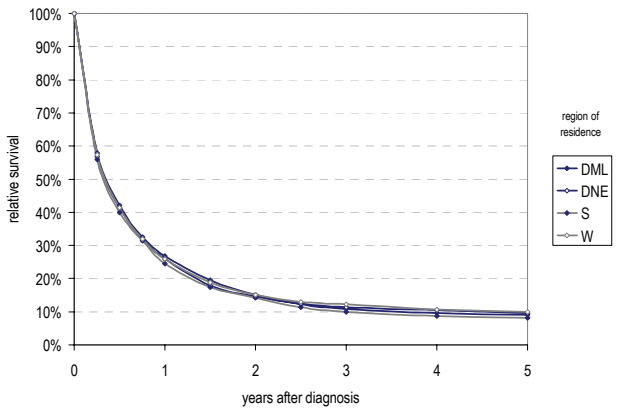
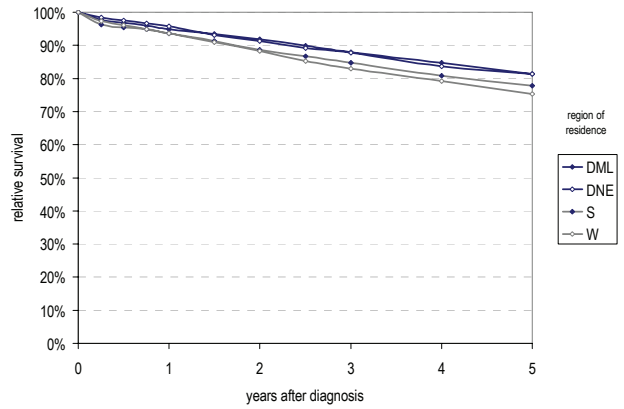


Figure 20 (continued).

female breast



prostate

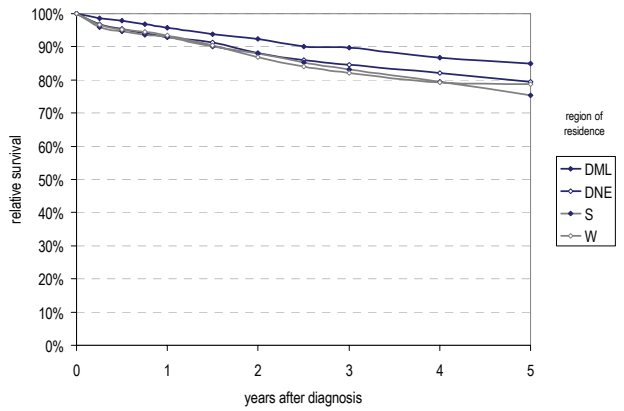


Table 43. Five-year relative survival (cases diagnosed 1994-1999 and 2000-2004) for major cancer types, by HSE area of residence. Baseline category used for comparison is HSE Dublin/Mid-Leinster; statistically significant lower or higher survival of patients resident in other areas is flagged on the basis of relative survival modeling adjusted for age. See Appendix Table 1.3 *for age-standardized estimates.*

Cancer type / ICD10 code	Years	Five-year relative survival (95% CI) by HSE area of residence					
		Dublin/Mid-Leinster	Dublin/North-East		South		West	
colorectal C18-21	2000-2004	52.9% (50.0%-55.8%)	51.9% (48.5%-55.0%)	ns	49.6% (46.7%-52.4%)	* P=0.022	49.6% (46.6%-52.5%)	ns*
	1994-1999	48.1% (45.9%-50.2%)	48.8% (46.2%-51.2%)	ns	42.9% (40.8%-45.0%)	*** P<0.001	43.5% (41.3%-45.6%)	** P=0.001
colon C18	2000-2004	52.1% (48.3%-55.8%)	51.4% (47.1%-55.4%)	ns	50.6% (46.8%-54.2%)	ns	51.7% (47.9%-55.4%)	ns
rectum/anus C19-21	2000-2004	54.5% (49.8%-58.9%)	52.6% (47.2%-57.8%)	ns	48.4% (43.8%-52.7%)	ns	46.6% (41.7%-51.4%)	ns
lung (& trachea) C33-34	2000-2004	9.0% (7.5%-10.7%)	9.6% (7.9%-11.5%)	ns	8.1% (6.5%-9.8%)	ns	10.0% (8.1%-12.1%)	ns
	1994-1999	9.0% (7.8%-10.2%)	8.0% (6.7%-9.2%)	ns	7.1% (5.9%-8.3%)	** P=0.004	8.7% (7.3%-10.1%)	ns
breast (female) C50	2000-2004	81.3% (78.9%-83.3%)	81.4% (78.7%-83.7%)	ns*(low)	77.8% (75.1%-80.3%)	** P=0.002	75.3% (72.2%-77.9%)	*** P<0.001
	1994-1999	76.1% (74.2%-77.7%)	70.2% (67.8%-72.3%)	*** P<0.001	69.7% (67.6%-71.6%)	*** P<0.001	70.6% (68.5%-72.6%)	** P=0.001
prostate C61	2000-2004	85.0% (81.8%-87.9%)	79.5% (75.5%-83.2%)	*** P<0.001	75.3% (72.0%-78.4%)	*** P<0.001	78.7% (75.4%-81.7%)	** P=0.005
	1994-1999	65.6% (62.7%-68.3%)	61.5% (57.9%-64.9%)	** P=0.004	58.0% (55.2%-60.6%)	*** P<0.001	56.4% (53.5%-59.2%)	***ns P<0.001

* = significantly higher or lower survival, adjusted for age, compared with patients resident in Dublin/Mid-Leinster area (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference;

ns* = no significant difference age-adjusted, but significant age-&-stage-adjusted; *ns = significant difference age-adjusted but not age-&-stage-adjusted.

Among less common cancers, significantly low age-adjusted survival (compared with patients resident in Dublin/Mid-Leinster area) were recorded during 2000-2004 for **oral/pharyngeal**, **rectal**, **pancreatic**, **laryngeal** and **cervical cancers**, **non-Hodgkin lymphoma**, **multiple myeloma**, and **leukaemia** in the South; **pancreatic** and **laryngeal cancer** in the West; and **laryngeal cancer**, **multiple myeloma**, and **leukaemia** in Dublin/North-East (*Table 44*). Some other apparent differences could not be confirmed statistically because of small numbers of patients arealy.

None of the cancers examined had significantly higher survival for patients resident in the Dublin/North-East, South or West areas compared with Dublin/Mid-Leinster.

Table 44. Five-year relative survival (cases diagnosed 2000-2004) for other cancer types, by HSE area of residence.
Baseline category used for comparison is HSE Dublin/Mid-Leinster; statistically significant lower or higher survival of patients resident in other areas is flagged on the basis of relative survival modeling adjusted for age. See Appendix Table 1.4 *for age-standardized estimates.*

Cancer type	ICD10	Five-year relative survival (95% CI) by HSE area of residence							
		Dublin/Mid-Leinster	Dublin/North-East		South		West		
head & neck (mouth/pharynx)	C01-06, C09-13	45.5% (37.2%-53.4%)	44.7% (36.2%-52.8%)	ns	46.5% (38.4%-54.3%)	ns	42.7% (34.3%-50.9%)	ns	
lip	C00	81.7% (45.9%-102%)	>100% (no deaths)	ns	30.3% (3.6%-69.0%)	ns	79.0% (54.7%-96.6%)	ns	
tongue	C01-02	45.3% (30.4%-59.3%)	47.6% (32.4%-61.9%)	ns	63.8% (49.1%-75.7%)	ns	51.9% (38.3%-64.5%)	ns	
oral cavity	C03-06	55.2% (40.9%-68.0%)	45.9% (30.2%-60.9%)	ns	48.8% (33.6%-63.2%)	ns	40.4% (26.0%-54.8%)	ns	
salivary glands	C07-08	52.1% (32.9%-69.1%)	63.5% (39.8%-82.3%)	ns	38.5% (19.3%-58.4%)	ns	33.8% (13.5%-56.0%)	ns	
oropharynx	C09-10	48.6% (31.0%-64.5%)	44.3% (23.7%-63.3%)	ns	39.2% (23.3%-55.0%)	ns	52.8% (33.5%-69.2%)	ns	
nasopharynx	C11	56.3% (13.6%-85.6%)	62.7% (32.6%-83.7%)	ns	58.6% (21.2%-87.5%)	ns	57.9% (22.4%-82.6%)	Ns	
hypopharynx	C12-13	18.4% (4.4%-40.2%)	27.0% (10.2%-47.6%)	ns	17.2% (4.4%-37.3%)	* P=0.031	-	ns	
oesophagus	C15	14.6% (10.7%-18.9%)	16.4% (11.1%-22.5%)	ns	16.8% (12.7%-21.4%)	ns	15.9% (11.6%-20.7%)	ns	
stomach	C16	17.7% (13.8%-21.8%)	17.7% (13.5%-22.4%)	ns	12.3% (8.6%-16.6%)	ns	17.2% (13.2%-21.6%)	ns	
small intestine	C17	48.6% (32.1%-63.8%)	26.7% (10.7%-46.9%)	ns	54.5% (37.7%-69.0%)	ns	26.5% (10.5%-46.2%)	ns	
liver	C22	8.3% (3.7%-15.1%)	10.5% (3.9%-20.8%)	ns	12.7% (5.3%-23.4%)	ns	10.0% (4.5%-17.9%)	ns	
biliary tract	C23-24	15.3% (8.8%-23.5%)	15.7% (7.6%-26.6%)	ns	16.8% (9.6%-25.8%)	ns	8.2% (3.3%-16.2%)	** P=0.007	
pancreas	C25	7.0% (4.3%-10.6%)	4.8% (2.1%-8.9%)	ns	5.7% (3.3%-8.9%)	* P=0.026	5.8% (3.5%-8.8%)	** P=0.009	
nasal, ear & sinuses	C30-31	39.6% (15.2%-65.2%)	29.2% (2.2%-70.6%)	ns	37.6% (8.8%-72.0%)	ns	31.5% (9.1%-59.3%)	ns	
larynx	C32	72.6% (62.3%-81.2%)	56.5% (45.7%-66.4%)	* P=0.037	51.9% (41.6%-61.5%)	* P=0.016	54.4% (43.1%-64.8%)	* P=0.019	
bone	C40-41	43.5% (20.6%-65.7%)	49.8% (28.5%-68.1%)	ns	34.5% (9.0%-63.4%)	ns	54.2% (33.4%-71.1%)	ns	
melanoma skin	C43	83.0% (77.6%-87.5%)	84.3% (78.7%-88.8%)	ns	84.3% (79.5%-88.3%)	ns	83.2% (77.1%-88.3%)	ns	
soft tissue	C47, C49	71.4% (60.3%-80.3%)	56.6% (41.1%-70.3%)	* P=0.048	50.9% (36.2%-64.4%)	ns	57.8% (44.4%-70.0%)	ns	

Cancer type	ICD10	Five-year relative survival (95% CI) by HSE area of residence					
		Dublin/Mid-Leinster	Dublin/North-East		South		West	
breast (male)	C50	83.4% (47.6%-102%)	96.2% (49.1%-113%)	ns	91.3% (60.1%-108%)	ns	60.8% (22.7%-90.7%)	ns
vagina & vulva	C51-52, C57.8-.9	58.3% (39.0%-74.5%)	62.9% (42.3%-78.8%)	ns	52.8% (34.9%-69.3%)	ns	43.4% (28.3%-58.7%)	* P=0.019
cervix uteri	C53	73.2% (66.9%-78.6%)	71.5% (64.1%-77.6%)	ns	54.7% (46.1%-62.4%)	** P=0.002	64.2% (54.9%-72.2%)	ns
corpus uteri	C54	77.3% (69.7%-83.5%)	70.4% (59.4%-79.4%)	ns	74.9% (67.5%-81.1%)	ns	77.5% (70.5%-83.4%)	ns
ovary (& other uterine adnexa)	C56, C57.0-.7	42.6% (36.9%-48.2%)	44.8% (37.7%-51.7%)	ns	35.0% (28.8%-41.2%)	ns	40.0% (33.8%-46.1%)	ns
ovary (& adnexa) excl. borderlines[b]	C56, C57.0-.7	40.0% (33.9%-45.9%)	43.3% (36.0%-50.3%)	ns	33.8% (27.6%-39.9%)	ns	38.1% (31.9%-44.4%)	ns
penis (& other male genital)	C60, C63	53.7% (21.5%-81.1%)	61.8% (36.5%-82.0%)	ns	82.9% (57.4%-101%)	ns	66.8% (35.5%-89.2%)	ns
testis	C62	96.2% (90.7%-98.7%)	98.1% (93.1%-99.9%)	ns	95.4% (90.4%-98.1%)	ns	95.4% (89.3%-98.3%)	ns
kidney (& other urinary)	C64-66, C68	48.3% (41.8%-54.6%)	40.4% (32.5%-48.1%)	ns	52.7% (46.2%-58.8%)	ns	47.8% (40.8%-54.6%)	ns
bladder [a]	C67	66.6% (60.3%-72.5%)	70.3% (63.1%-76.9%)	ns	64.9% (59.0%-70.4%)	ns	68.2% (61.6%-74.4%)	ns
choroid (melanoma)	C69.3	73.4% (48.1%-90.1%)	82.6% (23.4%-107%)	ns	76.5% (37.1%-100%)	ns	84.3% (21.4%-102%)	ns
brain [a]	C71	23.2% (18.4%-28.3%)	22.9% (17.0%-29.3%)	ns	19.8% (15.2%-24.8%)	ns	20.6% (15.7%-25.8%)	ns
thyroid gland	C73	85.7% (75.1%-92.4%)	84.7% (73.4%-92.1%)	ns	76.2% (65.4%-84.2%)	ns	67.2% (51.0%-79.5%)	ns
Hodgkin lymphoma	C81	84.7% (76.7%-90.2%)	86.2% (74.1%-93.3%)	ns	78.2% (66.8%-86.2%)	ns	82.6% (69.8%-90.7%)	ns
non-Hodgkin lymphoma	C82-85, C96	61.7% (56.8%-66.2%)	58.1% (52.4%-63.5%)	ns	52.5% (47.1%-57.5%)	** P=0.009	56.9% (51.2%-62.1%)	ns
multiple myeloma etc	C90	34.0% (24.6%-43.8%)	33.5% (24.6%-42.8%)	* P=0.044	29.9% (22.3%-37.8%)	* P=0.033	24.7% (17.0%-33.3%)	ns
leukaemia	C91-95	57.0% (50.8%-62.7%)	54.8% (47.0%-62.1%)	* P=0.023	40.1% (33.7%-46.5%)	*** P<0.001	53.9% (47.0%-60.4%)	ns
acute lymphoblastic leukaemia	C91.0	28.6% (8.4%-53.2%)	39.1% (17.3%-60.7%)	ns	-	* (low) P=0.013	47.4% (22.7%-69.0%)	ns
chronic lymphoblastic leukaemia	C91.1	74.7% (65.1%-83.0%)	74.6% (60.0%-86.3%)	ns	60.6% (49.1%-71.0%)	* P=0.021	76.7% (66.8%-85.1%)	ns
acute myeloid leukaemia	C92.0	29.7% (20.7%-39.2%)	30.4% (17.9%-44.1%)	ns	13.2% (5.7%-23.8%)	ns	17.6% (7.6%-31.2%)	ns
chronic myeloid leukaemia	C92.1	58.4% (37.0%-75.3%)	65.7% (42.6%-82.9%)	ns	63.8% (44.0%-79.6%)	ns	40.6% (14.6%-67.0%)	ns

* = significantly higher or lower relative survival, adjusted for age, compared with patients resident in Dublin/Mid-Leinster area (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference.

- Insufficient data to allow estimation.

[a] ICD-O-2 definitions of malignancy used here (ICD-O-3 used by EUROCARE-4), or (for bladder cancer) in situ and uncertain behaviour excluded (included by EC-4).

[b] Excluding borderline malignancies of the ovary, i.e. tumours considered fully malignant in ICD-O-2 but of uncertain behaviour in ICD-O-3.

Variation in survival by area of first treatment

Analyses below are based on the HSE area where patients had their first tumour-directed surgery, or (in decreasing order of priority), their first biopsy, chemotherapy, hormone therapy, other surgery, other procedure, other non-radiation therapy hospital episode, or radiation therapy, within six months of diagnosis. This attempts to assign each patient to a 'main' HSE area, although for a small proportion of patients this was not possible. Some patients who had initial surgery (or biopsy for non-surgical cases) in one area may have gone on to be treated in another area, but this should result, if anything, in any differences in survival, by area of treatment, being under-estimated (rather than exaggerated) by these analyses.

For the diagnosis period 2000-2004 (follow-up to 2005), relative survival within five years of diagnosis was (statistically) significantly lower, after age-adjustment, among **colorectal cancer** patients treated in the HSE South area, **lung cancer** patients in Dublin/North-East, the South and West, female **breast cancer** patients in the South and West, and **prostate cancer** patients in Dublin/North-East, the South and West, compared with Dublin/Mid-Leinster *(Table 45, Figure 21)*. Further adjustment, for cancer stage, appeared to accentuate these disparities for **colorectal cancer** (with survival of patients treated in the West now also significantly low) but to reduce them somewhat for **lung cancer** (though all still significant). For **breast cancer**, stage-adjustment accentuated area differences for patients treated in the South and Dublin/North-East (latter now significantly low compared with Dublin/Mid-Leinster) but reduced the difference slightly for the West. For **prostate cancer**, adjustment for stage variables (including grade for this cancer) substantially reduced area disparities, entirely in the case of the West area. Nevertheless, cautious interpretation of the apparent 'explanatory; power of stage is needed, because of the high proportion of cases lacking explicitly-coded N (area nodal) or M (metastatic) categories.

Similar patterns were evident for patients diagnosed during 1994-1999 (*Table 52)*. However, the figures presented here suggest that disparities in survival between areas of treatment may have widened for **lung cancer** but reduced for **colorectal**, **breast** and **prostate cancers** in recent years. For **lung cancer**, this reflects an apparently greater improvement in survival for patients treated in the Dublin/Mid-Leinster area. For the other major cancers, one or more areas outside Dublin/Mid-Leinster appeared to show greater improvements than the latter.

Compared with analyses based on area of residence, disparities in **lung cancer** survival by area of first treatment appeared more marked. This presumably reflects a substantial proportion of cases from other areas being seen or treated in Dublin/Mid-Leinster hospitals, which would tend to even-out comparisons based on area of residence. This suggests that there was some degree of differential referral (either by general practitioners originally, or by hospitals of diagnosis) of better-prognosis patients to Dublin centres.

Figure 21. Relative survival of Irish cancer patients diagnosed during 2000-2004 —by HSE area of first treatment.

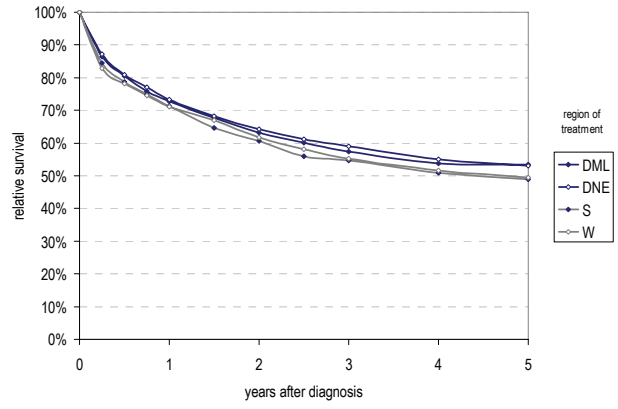
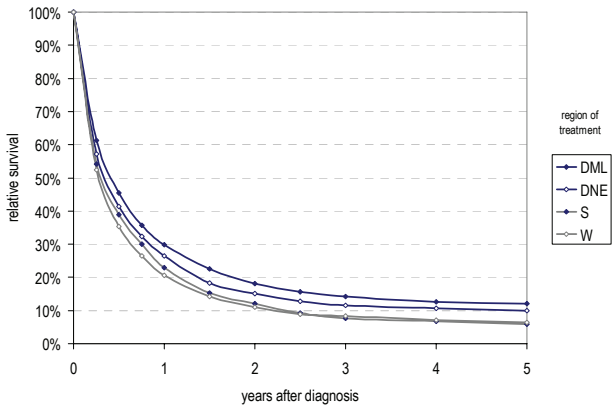
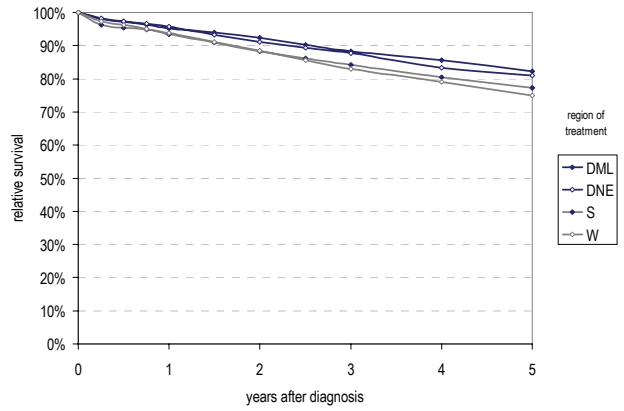
colorectal	***lung (& trachea)***
	

Figure 21 (continued).

female breast



prostate

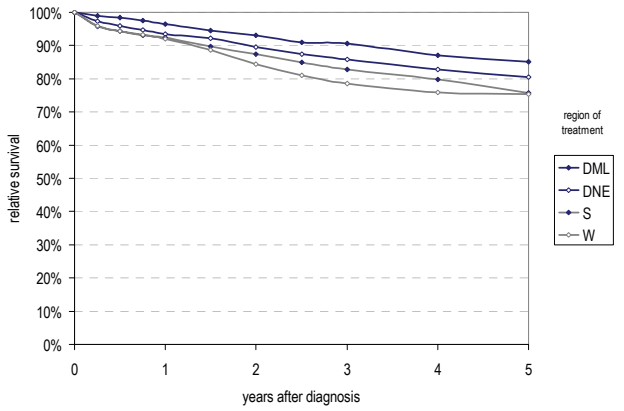


Table 45. Five-year relative survival (cases diagnosed 1994-1999 and 2000-2004) for major cancer types, by HSE area in which patient had their first treatment. Baseline category used for comparison is HSE Dublin/Mid-Leinster; statistically significant lower or higher survival of patients treated in other areas is flagged on the basis of relative survival modeling adjusted for age. See Appendix Table 1.5 *for age-standardized estimates.*

Cancer type / ICD10 code	Years	Five-year relative survival (95% CI) by HSE area of first treatment					
		Dublin/Mid-Leinster	Dublin/North-East		South		West	
colorectal C18-21	2000-2004	53.5% (50.5%-56.3%)	53.0% (49.8%-56.1%)	ns	49.0% (46.1%-51.8%)	* P=0.035	49.4% (46.2%-52.4%)	ns**
	1994-1999	47.8% (45.6%-49.9%)	50.1% (47.6%-52.4%)	ns	43.6% (41.4%-45.7%)	*** P<0.001	42.7% (40.4%-44.9%)	** P=0.001
colon C18	2000-2004	53.5% (49.7%-57.1%)	51.9% (47.8%-56.0%)	ns	49.9% (46.1%-53.6%)	ns**	51.4% (47.4%-55.2%)	ns**
rectum/anus C19-21	2000-2004	53.6% (48.8%-58.1%)	54.6% (49.6%-59.3%)	ns	47.8% (43.2%-52.2%)	ns*	46.2% (41.0%-51.2%)	ns
lung (& trachea) C33-34	2000-2004	12.1% (10.4%-13.8%)	9.9% (8.2%-11.7%)	** P=0.001	6.0% (4.5%-7.6%)	*** P<0.001	6.5% (4.8%-8.4%)	*** P<0.001
	1994-1999	9.7% (8.5%-10.8%)	9.3% (8.1%-10.6%)	ns	6.3% (5.1%-7.5%)	*** P<0.001	6.5% (5.1%-7.9%)	***ns P<0.001
breast (female) C50	2000-2004	82.3% (80.0%-84.3%)	81.1% (78.5%-83.4%)	ns**	77.3% (74.5%-79.8%)	*** P<0.001	74.9% (71.7%-77.8%)	*** P<0.001
	1994-1999	75.9% (74.1%-77.5%)	71.5% (69.2%-73.6%)	* P=0.012	68.8% (66.6%-70.8%)	*** P<0.001	71.1% (68.8%-73.2%)	** P=0.005
prostate C61	2000-2004	85.1% (82.2%-87.8%)	80.5% (76.8%-83.9%)	*** P<0.001	75.7% (72.1%-79.0%)	*** P<0.001	75.4% (71.6%-78.9%)	***ns P<0.001
	1994-1999	68.9% (66.3%-71.3%)	61.2% (57.7%-64.6%)	*** P<0.001	54.1% (51.0%-57.0%)	*** P<0.001	53.7% (50.5%-56.7%)	*** P<0.001

= significantly higher or lower survival compared with patients treated in Dublin/Mid-Leinster area, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (P<0.05 ** P<0.01, *** P<0.001), ns = no significant difference;

ns* = no significant difference age-adjusted, but significant age-&-stage-adjusted; *ns = significant difference age-adjusted but not age-&-stage-adjusted.

Among other cancers diagnosed during 2000-2004, survival was significantly poorer (after adjusting for age) compared with HSE Dublin/Mid-Leinster area for patients with **hypopharyngeal** and **cervical cancers** treated in the HSE South area; **liver** and **biliary tract cancers** in the West; **pancreatic cancer** in the South and West; **laryngeal cancer**, **non-Hodgkin lymphoma**, **multiple myeloma** and **leukaemia** (including **acute lymphoblastic leukaemia** specifically) in Dublin/North-East and the South; and **kidney cancer** in Dublin/North-East *(Table 46).*

Fuller adjustment, for both age and cancer stage, modified these findings somewha: survival was now, in addition, significantly lower than expected for **oral cavity**, **salivary gland**, **laryngeal**, **ovarian** and **bladder cancers** treated in the South; no longer significantly low for **laryngeal** and **kidney cancers** in Dublin/North-East; but significantly higher for **bone cancer** in Dublin/North-East.

With the sole exception of **bone cancer**, none of the cancers examined had significantly higher survival for patients treated in the Dublin/North-East, South or West areas compared with Dublin/Mid-Leinster area.

Table 46. Five-year relative survival (cases diagnosed 2000-2004) for other cancer types, by HSE area in which patient had their first treatment. Baseline category is HSE Dublin/Mid-Leinster; statistically significant lower or higher survival of patients treated in other areas is flagged on the basis of relative survival modeling adjusted for age. See Appendix Table 1.6 *for age-standardized estimates.*

Cancer type	ICD10 code	Five-year relative survival (95% CI) by HSE area of first treatment							
		Dublin/Mid-Leinster	Dublin/North-East		South		West		
head & neck (mouth/pharynx)	C01-06 C09-13	46.7% (39.0%-53.9%)	43.5% (35.5%-51.3%)	ns	42.9% (34.1%-51.6%)	ns	45.4% (35.5%-54.9%)	ns	
lip	C00	75.9% (42.4%-97.5%)	97.0% (31.7%-113%)	ns	26.6% (2.9%-64.6%)	ns	83.8% (57.9%-101%)	ns	
tongue	C01-02	51.5% (38.4%-63.4%)	36.0% (22.1%-50.4%)	ns	64.1% (47.0%-77.6%)	ns	64.0% (47.0%-78.1%)	ns	
oral cavity	C03-06	50.3% (35.9%-63.5%)	50.0% (37.1%-61.9%)	ns	47.9% (31.4%-63.7%)	ns*	40.8% (23.1%-58.8%)	ns	
salivary glands	C07-08	53.1% (36.0%-68.5%)	62.3% (36.6%-82.5%)	ns	32.0% (11.8%-55.7%)	ns*	37.9% (17.7%-58.4%)	ns	
oropharynx	C09-10	48.1% (32.8%-62.1%)	56.2% (31.9%-75.3%)	ns	36.5% (20.4%-53.2%)	ns	49.7% (29.4%-67.3%)	ns	
nasopharynx	C11	70.4% (35.7%-89.7%)	53.0% (22.1%-78.0%)	ns	52.9% (11.9%-90.1%)	ns	51.6% (12.2%-81.8%)	ns	
hypopharynx	C12-13	17.1% (4.1%-37.7%)	30.6% (13.1%-50.8%)	ns	9.9% (1.0%-31.0%)	** P=0.006	-	ns	
oesophagus	C15	16.5% (12.9%-20.5%)	18.2% (13.0%-24.1%)	ns	14.5% (10.3%-19.3%)	ns	12.0% (7.6%-17.3%)	ns	
stomach	C16	17.3% (13.5%-21.5%)	18.5% (14.3%-23.0%)	ns	11.8% (8.2%-16.1%)	ns	17.6% (13.3%-22.3%)	ns	
small intestine	C17	47.5% (31.6%-62.4%)	35.4% (18.7%-53.3%)	ns	51.3% (34.6%-66.1%)	ns	31.0% (12.2%-52.8%)	ns	
liver	C22	13.2% (8.0%-19.8%)	8.1% (2.3%-18.8%)	ns	11.4% (3.5%-25.1%)	ns	-	** P=0.001	
biliary tract	C23-24	12.4% (6.9%-19.4%)	25.5% (17.1%-34.8%)	ns	11.1% (5.2%-19.7%)	ns	10.0% (3.7%-20.2%)	** P=0.002	
pancreas	C25	7.0% (4.4%-10.2%)	5.8% (3.3%-9.1%)	ns	5.9% (3.6%-9.1%)	*** P<0.001	4.8% (2.2%-8.7%)	*** P<0.001	
nasal, ear & sinuses	C30-31	37.6% (13.8%-63.4%)	39.6% (14.4%-65.7%)	ns	38.7% (5.7%-81.5%)	ns	21.3% (3.0%-53.6%)	ns	

Cancer type	ICD10 code	Five-year relative survival by HSE area of first treatment			
		Dublin/Mid-Leinster	Dublin/North-East	South	West
larynx	C32	68.0% (58.8%-76.1%)	54.9% *ns P=0.040	51.6% ** P=0.007	57.0% ns* (45.0%-68.0%)
bone	C40-41	35.8% (8.9%-66.6%)	55.4% ns** (38.6%-69.5%)	41.5% ns (19.5%-62.6%)	46.0% ns (18.7%-70.0%)
melanoma skin	C43	80.9% (75.4%-85.6%)	85.5% ns (79.9%-90.1%)	84.8% ns (79.9%-88.9%)	83.2% ns (76.9%-88.6%)
soft tissue	C47 C49	65.4% (54.7%-74.5%)	62.0% ns (47.4%-74.5%)	49.4% ns (33.4%-64.2%)	61.1% ns (47.5%-73.3%)
breast (male)	C50	91.2% (56.3%-106%)	96.2% ns (49.1%-113%)	91.2% ns (58.4%-109%)	57.8% ns (23.5%-85.9%)
vagina & vulva	C51-52 C57.8-.9	56.7% (38.7%-72.2%)	52.8% ns (32.8%-69.9%)	55.2% ns (37.5%-71.2%)	45.7% ns (28.0%-63.4%)
cervix uteri	C53	71.9% (66.2%-76.9%)	69.9% ns (61.3%-77.0%)	52.2% ** P=0.001	64.1% ns (54.1%-72.5%)
corpus uteri	C54	77.7% (70.1%-84.0%)	70.9% ns (60.5%-79.5%)	76.1% ns (68.8%-82.2%)	76.7% ns (69.2%-83.0%)
ovary (& other uterine adnexa)	C56 C57.0-.7	42.6% (36.9%-48.0%)	43.1% ns (36.5%-49.6%)	36.3% ns*** (29.9%-42.6%)	40.1% ns (33.4%-46.6%)
ovary (& adnexa) excl. borderlines[b]	C56, C57.0-.7	40.6% (34.8%-46.3%)	40.8% ns (34.0%-47.4%)	34.8% ns*** (28.5%-41.2%)	38.2% ns (31.4%-44.8%)
penis (& other male genital)	C60 C63	57.0% (20.0%-88.5%)	56.9% ns (35.3%-74.6%)	80.9% ns (55.3%-99.0%)	72.7% ns (32.0%-100%)
testis	C62	96.4% (91.8%-98.7%)	96.3% ns (90.8%-98.8%)	94.4% ns (88.5%-97.5%)	97.5% ns (91.7%-99.7%)
kidney (& other urinary)	C64-66 C68	50.8% (44.5%-56.8%)	43.3% *ns P=0.038 (36.3%-50.2%)	50.6% ns (43.3%-57.4%)	45.0% ns (37.3%-52.4%)
bladder [a]	C67	66.4% (60.5%-71.8%)	70.0% ns (62.9%-76.5%)	62.8% ns** (56.4%-68.7%)	70.4% ns (63.6%-76.6%)
choroid (melanoma)	C69.3	79.6% (56.1%-94.0%)	77.3% ns (18.5%-106%)	89.1% ns (44.0%-109%)	89.2% ns (32.1%-102%)
brain [a]	C71	15.1% (7.8%-24.7%)	23.8% ns (20.1%-27.6%)	22.5% ns (17.9%-27.2%)	9.8% ns (4.0%-18.8%)
thyroid gland	C73	79.7% (68.9%-87.4%)	85.4% ns (75.4%-92.0%)	73.7% ns (61.5%-82.8%)	72.7% ns (51.6%-86.6%)
Hodgkin lymphoma	C81	83.0% (75.3%-88.5%)	83.9% ns (71.9%-91.5%)	82.4% ns (70.1%-90.3%)	80.6% ns (65.9%-89.9%)
non-Hodgkin lymphoma	C82-85 C96	62.5% (57.6%-67.0%)	58.0% ** P=0.002 (53.1%-62.7%)	51.1% ** P=0.001 (45.4%-56.5%)	56.0% ns (49.9%-61.8%)
multiple myeloma etc	C90	36.5% (27.5%-45.6%)	31.3% * P=0.013 (22.5%-40.7%)	28.5% * P=0.010 (20.7%-36.8%)	23.3% ns (15.3%-32.5%)
leukaemia	C91-95	60.0% (54.3%-65.3%)	48.1% ** P=0.004 (40.3%-55.7%)	38.7% *** P<0.001 (32.2%-45.1%)	55.0% ns (47.8%-62.0%)
acute lymphoblastic leukaemia	C91.0	30.2% (8.8%-55.5%)	28.3% ** P=0.041 (10.2%-49.7%)	- ** P=0.015	49.8% ns (25.0%-70.8%)

Cancer type	ICD10 code	Five-year relative survival by HSE area of first treatment							
		Dublin/Mid-Leinster		Dublin/North-East		South		West	
chronic lymphoblastic leukaemia	C91.1	78.3% (69.3%-85.8%)		67.7% (52.8%-80.3%)	-	59.8% (47.9%-70.6%)	-	76.8% (66.5%-85.6%)	-
acute myeloid leukaemia	C92.0	28.7% (20.4%-37.5%)		24.6% (11.9%-40.0%)	ns	13.9% (6.1%-24.9%)	ns	17.3% (6.5%-32.7%)	ns
chronic myeloid leukaemia	C92.1	64.1% (43.7%-79.7%)		61.7% (36.2%-81.3%)	ns	58.5% (39.0%-74.7%)	ns	44.6% (15.5%-72.4%)	ns

* = significantly higher or lower survival compared with patients treated in Dublin/Mid-Leinster area, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference;
ns* = no significant difference age-adjusted, but significant age-&-stage-adjusted; *ns = significant difference age-adjusted but not age-&-stage-adjusted.

- Insufficient data to allow estimation.

[a] ICD-O-2 definitions of malignancy used here (ICD-O-3 used by EUROCARE-4), or (for bladder cancer) in situ and uncertain behaviour excluded (included by EC-4).

[b] Excluding borderline malignancies of the ovary, i.e. tumours considered fully malignant in ICD-O-2 but of uncertain behaviour in ICD-O-3.

Variation in survival by hospital type (surgical patients)

The Health Service Executive eight public hospitals as 'cancer centres' – two in each of the four HSE areas[1]. For the analyses below (figures pre-dating formal designation of these hospitals/centres), surgical patients have been 'assigned' to the first hospital in which they had tumour-directed surgery within six months of diagnosis, and these hospitals grouped in five categories. 'Surgery' here is broadly defined as any excision, resection, physical destructive technique, or other tissue removal, other than a biopsy, that removes or destroys tissue. Survival estimates are presented for the main three categories (with sufficient cases to allow useful analysis) below – cancer centres, other public acute general hospitals, and private hospitals. Patients whose first surgical treatment was in a maternity hospital, a 'non-general' public hospital or a hospital in Northern Ireland or Britain are not included in these analyses, but the numbers of cases involved are small.

In the most recent diagnosis period (2000-2004), **lung** and female **breast cancer** patients surgically treated in other public acute general hospitals had significantly lower relative survival, after adjusting for age (and also after further adjustment, for stage and lung cancer cell-type) , compared with the public hospitals proposed as cancer centres (*Table 47; Figure 22)*. For **colorectal cancer**, age-adjusted survival was similar in these two categories, but adjustment for both age and tumour stage indicated significantly lower survival for other public acute general hospitals. For **prostate cancer**, age-adjusted survival was significantly better in the other acute general hospitals, but this difference was not significant if tumour stage (including grade for prostate cancer) was also adjusted for.

Colorectal, female **breast**, and **prostate** cancer patients surgically treated in private hospitals had significantly higher survival (age-adjusted and age/stage-adjusted) than those treated in the proposed centres. (For **colon cancer** specifically, the difference was not significant based on the age/stage-adjusted model.)

Similar patterns were apparent for these four cancers for the earlier diagnosis period (1994-1999), the main additional finding for those years being significantly higher survival for **lung cancer** patients treated in private hospitals, compared with the proposed centres (*Table 47; Figure 22*).

For two of the major cancers shown, only small proportions of cases were surgically treated within six months of diagnosis (12% for **lung cancer**, 33% for **prostate cancer**). Results here are more meaningful for **colorectal** and **breast cancers**, for which 75% and 85% of 2000-2004 cases, respectively, had surgery within six months.

For less common cancers, differences between hospital categories were less conclusive, in part reflecting smaller numbers of cases and analyses were confined to the diagnosis period 2000-2004. The only comparisons for which differences were statistically significant for both age-adjusted and age/stage-adjusted models involved higher survival of patients with **soft tissue** and **bladder cancers**, and **melanoma of skin**, who were surgically treated in private hospitals, compared with the public hospitals proposed as cancer centres *(Table 48).* Age-adjusted (but not stage-adjusted) survival also differed significantly between hospital categories for cancers of **kidney** (significantly higher in private hospitals), **soft tissue** (higher in other public hospitals and in private hospitals), **bone** (significantly lower in other public hospitals), and **corpus uteri** (higher in private hospitals).

One caution to note is that cancer patients treated in private hospitals can be expected, on average, to be healthier than the average cancer patient, reflecting lifestyle factors such as lower smoking rates. As well as possible influences on the likelihood of receiving appropriate treatment and on response to treatment, the 'background' (non-cancer) mortality expected among patients in private hospitals will also tend to be lower than for patients treated in other hospitals, i.e. their expected survival will tend to be higher than average. However, relative survival is based on comparison of observed survival with 'average' expected survival among the general population of the same age and sex. Relative survival may thus be over-estimated, to some degree, for patients treated in private hospitals, thus the 'true' disparities in outcomes between private and public hospitals may be exaggerated somewhat by comparisons based on relative survival. Unfortunately, because life tables (giving expected survival) are not available for different socioeconomic strata in Ireland, there is no straightforward way of allowing for this bias. Further comparisons based on cause-specific survival (i.e. using death-certificate data on deaths directly attributed to cancer) may provide some check on the extent of the bias, assuming that the cause of death is equally accurate for patients treated in different categories of hospital.

[1] See http://www.hse.ie/eng/About_the_HSE/Cancer_Services/; last updated 18/04/08

Table 47. Five-year relative survival (cases diagnosed 1994-1999 and 2000-2004) for major cancer types, by hospital category in which first surgical treatment received. Baseline category used for comparison comprises the proposed 'cancer centres'; statistically significant lower or higher survival of patients treated in other hospital categories are flagged on the basis of relative survival modeling adjusted for age. See Appendix Table 1.7 *for age-standardized estimates.*

Cancer type / ICD10 code	Years	Five-year relative survival (95% CI) by surgical hospital category				
		[a]Proposed centres (8 hospitals)	[b]Other public acute general hospitals		Private hospitals	
colorectal C18-21	2000-2004	60.9% (57.7%-64.0%)	61.5% (59.0%-63.8%)	ns*(low)	73.7% (68.9%-78.0%)	*** P<0.001
	1994-1999	54.6% (52.4%-56.8%)	54.4% (52.5%-56.1%)	ns	65.5% (61.9%-68.9%)	*** P<0.001
colon C18	2000-2004	60.0% (55.9%-64.0%)	61.4% (58.4%-64.3%)	ns	72.6% (66.3%-78.3%)	***ns P<0.001
rectum/anus C19-21	2000-2004	62.4% (57.2%-67.2%)	61.6% (57.4%-65.6%)	ns	75.4% (67.9%-81.7%)	** P=0.003
lung (& trachea) [c] C33-34	2000-2004	41.8% (37.0%-46.5%)	-	*** (low) P<0.001	40.8% (29.5%-52.0%)	ns
	1994-1999	30.3% (27.5%-33.2%)	28.3% (10.2%-51.1%)	*ns P=0.028	41.3% (32.7%-49.9%)	* P=0.026
breast (female) C60	2000-2004	87.3% (85.3%-89.1%)	81.7% (79.4%-83.8%)	*** P<0.001	90.1% (87.3%-92.3%)	*** P=0.002
	1994-1999	79.1% (77.3%-80.7%)	75.9% (74.2%-77.4%)	* P=0.031	84.8% (82.6%-86.7%)	*** P<0.001
prostate [c] C61	2000-2004	81.8% (77.4%-85.7%)	82.9% (77.7%-87.6%)	*ns P=0.045	92.1% (87.5%-95.8%)	** P=0.001
	1994-1999	63.5% (60.3%-66.6%)	60.9% (57.1%-64.6%)	ns*	80.5% (76.6%-84.0%)	*** P<0.001

* = significantly higher or lower survival compared with patients treated in hospitals now proposed as cancer centres, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference;
ns* = no significant difference age-adjusted, but significant age-&-stage-adjusted; *ns = significant difference age-adjusted but not age-&-stage-adjusted.

[a] Eight hospitals initially proposed for inclusion in designated centres (2008 onwards i.e. not designated as such during 2000-2004): Beaumont Hospital and Mater Misericordiae Hospital (Dublin/North-East HSE area), St James's Hospital and St Vincent's Hospital (Dublin/Mid-Leinster area), Cork University Hospital and Waterford Area Hospital (Southern area), University College Hospital Galway and Limerick Area Hospital (Western area).

[b] Public hospitals other than area general hospitals are excluded from this category, and in general treat too few cancer patients to allow summary as a separate category.

[c] Note that fewer than 50% of cases of these cancers were surgically treated within six months of diagnosis.

- Insufficient data to allow estimation.

Table 48. Five-year relative survival (cases diagnosed 2000-2004) for other cancer types, by hospital category in which first surgical treatment received. Baseline category used for comparison comprises the proposed 'cancer centres'; statistically significant lower or higher survival of patients treated in other hospital categories are flagged on the basis of relative survival modeling adjusted for age. See Appendix Table 1.8 *for age-standardized estimates.*

Cancer type	ICD10 code	Five-year relative survival (95% CI) by surgical hospital category		
		[a]Proposed centres (8 hospitals)	[b]Other public acute general hospitals	Private hospitals
head & neck (mouth/pharynx)	C01-06, C09-13	51.9% (44.7%-58.7%)	66.2% ns (53.2%-77.0%)	93.2% ns (56.0%-109%)
oesophagus [c]	C15	35.3% (27.4%-43.3%)	34.3% ns (21.5%-47.7%)	47.5% ns (24.0%-69.6%)
stomach [c]	C16	31.6% (25.1%-38.3%)	31.4% ns (25.3%-37.7%)	25.1% ns (12.4%-40.7%)
small intestine	C17	71.4% (47.7%-88.4%)	54.8% ns (34.6%-72.1%)	63.1% ns (27.7%-85.4%)
biliary tract	C23-24	41.9% (29.0%-54.5%)	27.7% ns (14.1%-43.6%)	24.7% ns (5.2%-52.6%)
pancreas [c]	C25	24.7% (15.1%-35.7%)	- ns	24.6% ns (6.3%-50.0%)
nasal, ear & sinuses	C30-31	67.9% (48.0%-82.8%)	16.9% * (0.7%-52.3%) P=0.043	80.3% ns (6.5%-113%)
larynx [c]	C32	53.4% (39.1%-66.4%)	71.3% ns (50.8%-86.6%)	- ns
bone	C40-41	66.4%	30.1% *ns	94.5% ns
melanoma skin	C43	79.4% (74.0%-84.0%)	83.6% ns (78.8%-87.7%)	94.1% *** (89.7%-97.4%) P<0.001
soft tissue	C47, C49	61.9% (48.9%-73.1%)	83.8% **ns (68.0%-94.9%) P=0.008	92.9% *ns (75.9%-101%) P=0.021
breast (male)	C50	71.7% (37.5%-93.2%)	87.8% ns (63.9%-102%)	>100% ns (no deaths)
vagina & vulva	C51-52, C57.8-.9	58.3% (43.1%-71.7%)	82.9% ns (59.2%-97.1%)	39.7% ns (6.14%-75.9%)
cervix uteri	C53	76.6% (68.9%-82.7%)	69.4% ns (56.0%-79.7%)	96.6% ns (65.9%-101%)
corpus uteri	C54	71.0% (63.2%-77.7%)	81.5% ns (75.8%-86.3%)	78.5% *ns (64.7%-88.5%) P=0.023
ovary (& other uterine adnexa)	C56, C57.0-.7	50.3% (44.3%-56.0%)	57.1% ns (49.0%-64.3%)	52.1% ns (39.0%-63.9%)
ovary (& adnexa) excl. borderlines[d]	C56, C57.0-.7	47.8% (41.6%-53.8%)	54.9% ns (46.7%-62.5%)	52.4% ns (39.2%-64.2%)
penis (& other male genital)	C60, C63	76.7% (56.9%-91.4%)	82.2% ns (51.4%-101%)	48.5% ns (15.8%-79.0%)
testis	C62	98.1% (94.7%-99.7%)	98.0% ns (94.7%-99.5%)	95.8% ns (85.6%-99.3%)
kidney (& other urinary)	C64-66, C68	63.9% (58.0%-69.2%)	63.5% ns (53.4%-72.3%)	77.3% *ns (66.0%-86.2%) P=0.019
bladder	C67	70.3% (64.7%-75.5%)	64.5% ns (58.3%-70.3%)	87.1% ** (78.3%-94.2%) P=0.001
brain[d]	C71	26.5% (20.5%-32.8%)	- -	26.0% ns (2.7%-60.5%)
thyroid gland	C73	81.8% (68.9%-90.3%)	92.5% ns (83.8%-97.1%)	95.1% ns (84.7%-99.2%)

Table 48 (footnotes)

* = significantly higher or lower survival compared with patients treated in hospitals now proposed as cancer centres, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference;
ns* = no significant difference age-adjusted, but significant age-&-stage-adjusted; *ns = significant difference age-adjusted but not age-&-stage-adjusted.

[a] Eight hospitals initially proposed for inclusion in designated centres (2008 onwards i.e. not designated as such during 2000-2004): Beaumont Hospital and Mater Misericordiae Hospital (Dublin/North-East HSE area), St James's Hospital and St Vincent's Hospital (Dublin/Mid-Leinster area), Cork University Hospital and Waterford Area Hospital (Southern area), University College Hospital Galway and Limerick Area Hospital (Western area).

[b] Public hospitals other than area general hospitals are excluded from this category, and in general treat too few cancer patients to allow summary as a separate category.

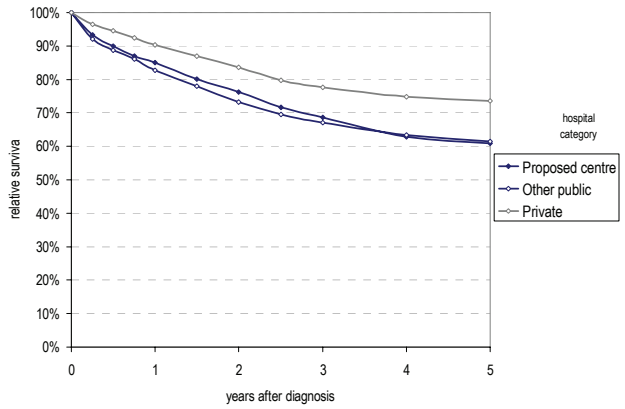
[c] Note that fewer than 50% of cases of these cancers were surgically treated within six months of diagnosis.

[d] Excluding borderline malignancies of the ovary, i.e. tumours considered fully malignant in ICD-O-2 but of uncertain behaviour in ICD-O-3.

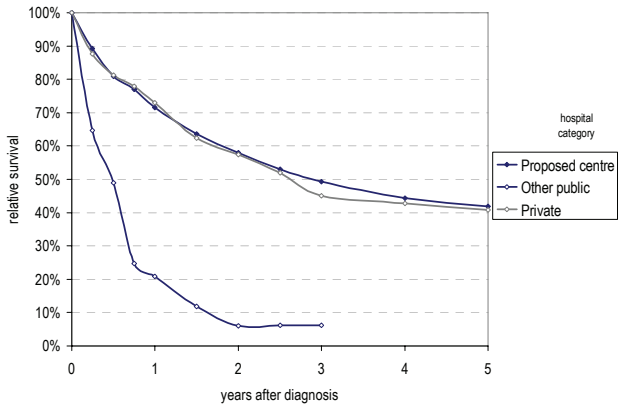
- Insufficient data to allow estimation..

Figure 22. Relative survival of Irish cancer patients diagnosed during 2000-2004 —by hospital-type of first surgical treatment (surgical patients who received surgery within 6 months of diagnosis): proposed centre; other public, area general hospital; or private hospital.

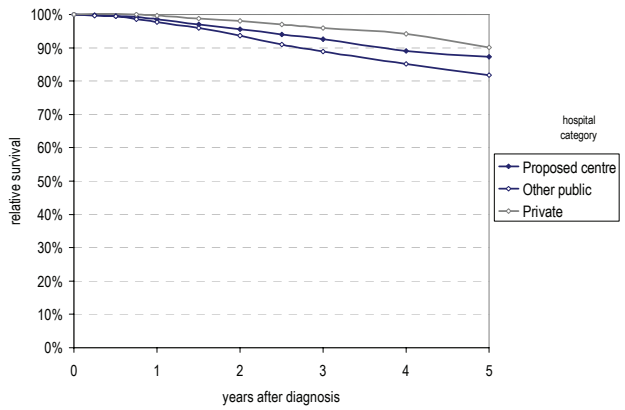
colorectal



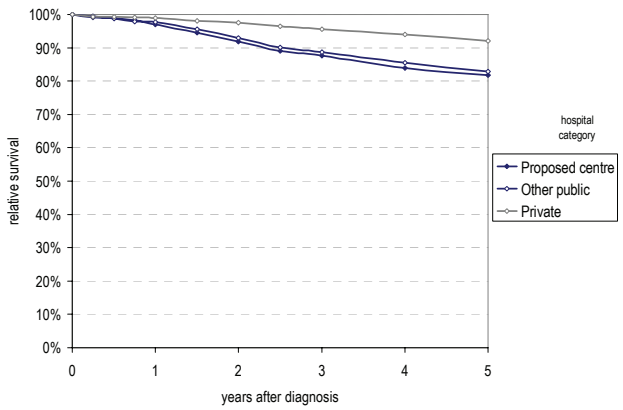
lung (& trachea)*



female breast



prostate



*For lung cancer, insufficient data to allow estimation of 5-year survival for other public, area general hospitals.

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Appendix 1. Age-standardized relative survival estimates

95% confidence intervals are shown for all estimates.

Appendix Table 1.1. Age-standardized[a] five-year relative survival for major cancer types, by year of diagnosis. The statistical significance of change in survival is assessed by relative survival modelling, adjusted for age.

Cancer type	ICD10 code	Five-year relative survival by diagnosis cohort		Statistical significance of change (age-adjusted)
		1994-1999	2000-2004	
colorectal	C18-C21	48.4% (45.8%-50.8%)	53.2% (49.7%-56.4%)	*** (P<0.001) [b]EHR 0.896 (0.855-0.938)
colorectal (male)	C18-C21	47.1% (43.6%-50.5%)	50.8% (46.0%-55.4%)	*** (P<0.001) EHR 0.881 (0.827-0.936)
colorectal (female)	C18-C21	50.7% (46.9%-54.3%)	56.0% (51.2%-60.5%)	* (P=0.018) EHR 0.919 (0.857-0.985)
lung (& trachea)	C33-34	9.7% (8.0%-11.4%)	10.6% (8.4%-13.0%)	** (P=0.008) EHR 0.956 (0.924-0.988)
lung (& trachea) (male)	C33-34	9.0% (7.0%-11.3%)	9.0% (6.4%-12.0%)	ns (P=0.783) EHR 0.994 (0.953-1.036)
lung (& trachea) (female)	C33-34	10.9% (8.1%-13.9%)	13.4% (9.8%-17.4%)	*** (P<0.001) EHR 0.907 (0.858-0.957)
lung [c]	C34	9.7% (8.0%-11.5%)	10.6% (8.4%-13.0%)	** (P=0.009) EHR 0.957 (0.925-0.989)
breast (female)	C50	71.4% (68.8%-73.9%)	76.9% (73.5%-80.1%)	*** (P<0.001) EHR 0.701 (0.648-0.756)
prostate	C61	68.1% (64.0%-71.8%)	82.9% (78.9%-86.6%)	*** (P<0.001) EHR 0.498 (0.449-0.551)

* = significant improvement in survival between diagnosis periods, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference.

[a] Age-standardized = expressed in terms of standard patient populations proposed by Corazziari et al. (2004), as used by the EUROCARE-4 study (but insufficient data for some categories).

[b] EHR = excess hazard ratio (with 95% confidence intervals) comparing 2000-2004 with 1994-1999, adjusted for age and for length of follow-up (including interaction between age and follow-up where possible): <1.000 indicates reduction in excess (cancer-associated) mortality rate, i.e. improved relative survival; >1.000 indicates increased excess mortality i.e. reduced relative survival. For example, female breast cancer patients diagnosed during 2000-2004 (EHR 0.701) had a cancer-associated mortality rate about 29% lower (95% CI 24-35% lower) than that of patients diagnosed during 1994-1999, thus higher relative survival, having allowed for possible changes in the age-profile of patients and for the shorter average follow-up available for most recently diagnosed patients.

[c] More restricted definition than the EUROCARE-4 definition for this site.

Appendix Table 1.2. Age-standardized[a] five-year relative survival for other cancer types, by year of diagnosis. For each cancer type (or group), survival is also compared by relative survival modeling, adjusted for age, to assess statistical significance.

Cancer type	ICD10 code	Five-year relative survival by diagnosis cohort		Statistical significance of change, age-adjusted
		1994-1999	2000-2004	
all cancers [d] except non-melanoma skin	C00-C96 excl C44	43.6% (42.7%-44.4%)	51.5% (50.3%-52.6%)	*** (P<0.001) EHR 0.804 (0.790-0.817)
all cancers [d] (male) except non-melanoma skin	C00-C96 excl C44	39.7% (38.4%-41.0%)	49.8% (48.1%-51.4%)	*** (P<0.001) EHR 0.761 (0.744-0.778)
all cancers [d] (female) except non-melanoma skin	C00-C96 excl C44	47.3% (46.0%-48.5%)	52.6% (51.0%-54.1%)	*** (P<0.001) EHR 0.851 (0.830-0.871)
lip, oral, pharynx [c]	C00-C14	46.8% (40.3%-53.1%)	43.4% (34.4%-52.5%)	ns (P=0.900) EHR 0.993 (0.884-1.113)
head & neck (mouth/pharynx)	C01-06, C09-13	36.3% (29.5%-43.3%)	41.5% (31.7%-51.8%)	* (P=0.013) EHR 0.852 (0.750-0.966)
lip	C00	85.5% (66.5%-97.9%)	-	ns (P=0.120) EHR 1.883 (0.847-4.187)
tongue	C01-02	38.9% (26.0%-52.4%)	48.7% (31.7%-66.3%)	ns (P=0.075) EHR 0.803 (0.630-1.022)
oral cavity	C03-06	45.5% (32.5%-57.6%)	47.1% (29.9%-64.5%)	ns (P=0.493) EHR 0.920 (0.724-1.167)
salivary glands	C07-08	58.4% (37.7%-75.6%)	40.3% (17.8%-68.1%)	ns (P=0.081) EHR 1.413 (0.958-2.082)
oropharynx	C09-10	31.4% (16.0%-51.7%)	-	ns (P=0.234) EHR 0.825 (0.600-1.132)
oesophagus	C15	12.1% (8.44%-16.3%)	17.4% (12.2%-23.3%)	*** (P<0.001) EHR 0.798 (0.737-0.862)
stomach	C16	17.4% (13.9%-21.2%)	18.1% (13.5%-23.2%)	EHR 0.915 (0.856-0.977)
small intestine	C17	38.3% (23.0%-53.9%)	38.8% (20.1%-57.9%)	ns (P=0.085) EHR 0.781 (0.590-1.034)
colon	C18	49.8% (46.5%-52.9%)	53.6% (49.2%-57.8%)	* (P=0.010) EHR 0.926 (0.873-0.981)
rectum (incl. rectosigmoid junction & anus)	C19-21	46.0% (41.8%-50.0%)	51.7% (46.3%-56.8%)	*** (P<0.001) EHR 0.851 (0.789-0.917)
rectosigmoid junction [c]	C19	43.9% (35.0%-52.5%)	52.5% (40.9%-63.0%)	* (P=0.016) EHR 0.818 (0.693-0.963)
rectum [c]	C20	46.8% (42.0%-51.5%)	51.9% (45.5%-57.9%)	*** (P<0.001) EHR 0.855 (0.782-0.933)
anus [c]	C21	36.0% (18.6%-53.6%)	49.7% (25.1%-74.2%)	ns (P=0.470) EHR 0.879 (0.619-1.247)
liver	C22	5.4% (1.6%-13.1%)	10.4% (4.1%-22.1%)	*** (P<0.001) EHR 0.756 (0.652-0.876)
biliary tract	C23-24	14.1% (7.4%-22.5%)	18.8% (9.4%-29.9%)	* (P=0.042) EHR 0.874 (0.766-0.995)
pancreas	C25	6.5% (3.8%-10.1%)	6.5% (3.4%-11.0%)	* (P=0.020) EHR 0.920 (0.858-0.986)

Cancer type	ICD10 code	Five-year relative survival by diagnosis cohort		Statistical significance of change, age-adjusted
		1994-1999	2000-2004	
nasal cavity, middle ear & accessory sinuses	C30-31	36.9% (17.7%-58.5%)	37.9% (11.9%-68.9%)	ns (P=0.342) EHR 0.8258 (0.556-1.225)
larynx	C32	59.2% (48.3%-68.5%)	59.0% (45.7%-70.7%)	ns (P=0.230) EHR 1.130 (0.925-1.378)
bone (age 20-99 only)	C40-41	52.5% (30.4%-72.6%)	42.9% (16.3%-70.6%)	ns (P=0.978) EHR 1.006 (0.673-1.501)
melanoma skin	C43	82.4% (77.6%-86.5%)	85.7% (79.6%-90.6%)	** (P=0.009) EHR 0.768 (0.630-0.936)
soft tissue (incl. peripheral nerves / ANS)	C47, C49	53.8% (41.9%-64.6%)	62.2% (47.2%-75.2%)	ns (P=0.334) EHR 0.892 (0.706-1.125)
breast (male)	C50	61.2% (28.6%-85.5%)	88.4% (56.6%-109.%)	ns (P=0.129) EHR 0.521 (0.224-1.209)
vagina & vulva (incl. other female genital organs)	C51-52, C57.8-.9	57.3% (41.0%-71.3%)	57.6% (38.7%-73.7%)	ns (P=0.953) EHR 1.009 (0.741-1.373)
vulva [c]	C51	61.7% (41.8%-77.7%)	67.4% (44.5%-84.3%)	ns (P=0.520) EHR 0.876 (0.584-1.312)
vagina [c]	C52	53.2% (18.3%-79.5%)	-	ns (P=0.115) EHR 1.60 (0.892-2.853)
cervix uteri	C53	57.7% (49.1%-65.8%)	61.2% (51.4%-70.2%)	ns (P=0.116) EHR 0.878 (0.746-1.032)
corpus uteri [d]	C54	72.9% (65.8%-78.8%)	74.3% (65.2%-81.8%)	ns (P=0.251) EHR 0.888 (0.725-1.087)
ovary (& other uterine adnexa)	C56, C57.0-.7	34.5% (29.6%-39.5%)	34.9% (28.5%-41.4%)	ns (P=0.242) EHR 0.947 (0.863-1.037)
ovary (& adnexa) excl. borderlines[e]	C56, C57.0-.7	33.4% (28.5%-38.4%)	33.4% (27.0%-40.0%)	ns (P=0.308) EHR 0.953 (0.863-1.037)
ovary [d]	C56	34.2% (29.3%-39.2%)	34.8% (28.5%-41.3%)	ns (P=0.212) EHR 0.943 (0.860-1.034)
penis (& other/unspec. male genital organs)	C60, C63	71.1% (45.9%-91.0%)	64.7% (32.1%-89.8%)	ns (P=0.837) EHR 1.059 (0.612-1.832)
penis [c]	C60	67.9% (41.4%-89.3%)	63.2% (32.7%-90.1%)	ns (P=0.912) EHR 0.970 (0.559-1.680)
kidney (& other / unspec. urinary organs)	C64-66, C68	45.9% (39.9%-51.6%)	46.9% (39.2%-54.4%)	ns (P=0.345) EHR 0.948 (0.848-1.058)
kidney [c]	C64	44.5% (38.3%-50.5%)	46.7% (38.7%-54.6%)	ns (P=0.091) EHR 0.906 (0.807-1.015)
renal pelvis [c]	C65	45.8% (19.0%-71.7%)	-	ns (P=0.807) EHR 0.927 (0.502-1.708)
ureter [c]	C66	68.2% (36.1%-91.7%)	48.0% (31.5%-63.4%)	* (P=0.023) EHR 2.597 (1.144-5.895)
bladder [d]	C67	68.6% (63.6%-72.9%)	71.9% (65.1%-77.8%)	ns (P=0.589) EHR 0.966 (0.853-1.094)

Cancer type	ICD10 code	Five-year relative survival by diagnosis cohort		Statistical significance of change, age-adjusted
		1994-1999	2000-2004	
eye & adnexa [c]	C69	77.0% (59.9%-89.6%)	88.0% (62.0%-102%)	ns (P=0.088) EHR 0.519 (0.244-1.103)
choroid (melanoma)	C69.3	68.8% (43.1%-87.2%)	-	-
meninges [c]	C70	69.3% (44.6%-91.3%)	74.5% (43.5%-101%)	ns (P=0.905) EHR 0.948 (0.396-2.268)
brain [d]	C71	20.4% (16.4%-25.1%)	24.6% (19.6%-30.0%)	*** (P<0.001) EHR 0.818 (0.747-0.893)
thyroid gland	C73	71.1% (61.3%-79.6%)	74.4% (60.3%-85.9%)	ns (P=0.471) EHR 0.887 (0.639-1.229)
Hodgkin lymphoma	C81	72.4% (63.6%-80.4%)	80.0% (67.9%-89.4%)	* (P=0.029) EHR 0.690 (0.495-0.962)
follicular [c] non-Hodgkin lymphoma	C82	68.1% (51.9%-82.2%)	67.2% (47.9%-84.5%)	ns (P=0.370) EHR 0.832 (0.556-1.243)
diffuse [c] non-Hodgkin lymphoma	C83	44.9% (36.9%-52.6%)	53.1% (42.6%-63.1%)	* (P=0.019) EHR 0.837 (0.721-0.971)
T-cell [c] lymphoma	C84	74.9% (46.4%-96.2%)	75.6% (50.5%-94.1%)	ns (P=0.487) EHR 1.235 (0.681-2.233)
other/unspecified [c] non-Hodgkin lymphoma	C85	39.9% (32.7%-47.2%)	50.5% (41.8%-58.7%)	** (P=0.001) EHR 0.793 (0.695-0.904)
non-Hodgkin lymphoma	C82-C85	46.7% (41.7%-51.6%)	55.2% (49.1%-61.0%)	*** (P<0.001) EHR 0.809 (0.736-0.888)
non-Hodgkin lymphoma (& related neoplasms)	C82-C85, C96	46.7% (41.7%-51.6%)	55.2% (49.1%-61.0%)	*** (P<0.001) EHR 0.811 (0.737-0.890)
multiple myeloma etc	C90	26.6% (19.9%-33.3%)	33.8% (24.1%-43.1%)	*** (P<0.001) EHR 0.801 (0.711-0.901)
leukaemia	C91-C95	44.3% (38.7%-49.8%)	53.3% (45.7%-60.3%)	*** (P=0.001) EHR 0.837 (0.754-0.927)
lymphoid [c] leukaemia	C91	61.5% (53.1%-69.0%)	70.9% (60.2%-80.1%)	ns (P=0.189) EHR 0.877 (0.720-1.066)
acute lymphoblastic leukaemia	C91.0	33.9% (22.0%-50.2%)	-	ns (P=0.220) EHR 0.808 (0.575-1.135)
chronic lymphocytic leukaemia	C91.1	66.6% (56.4%-74.7%)	76.8% (64.5%-85.8%)	ns (P=0.614) EHR 0.937 (0.727-1.206)
myeloid [c] leukaemia	C92	20.7% (13.8%-29.0%)	26.7% (16.9%-37.8%)	*** (P<0.001) EHR 0.768 (0.664-0.886)
acute myeloid leukaemia	C92.0	14.6% (7.8%-25.2%)	16.8% (8.5%-30.1%)	** (P=0.004) EHR 0.778 (0.656-0.923)
chronic myeloid leukaemia	C92.1	34.1% (17.9%-51.9%)	54.0% (27.7%-76.5%)	** (P=0.009) EHR 0.589 (0.394-0.877)
leukaemia, unspecified [c]	C95	34.2% (18.5%-49.7%)	-	ns (P=0.093) EHR 1.265 (0.961-1.663)

* = significant improvement in survival between diagnosis periods, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference. - Insufficient data to allow estimation.

[a] Age-standardized = expressed in terms of standard patient populations proposed by Corazziari et al. (2004), as used by the EUROCARE-4 study.

[c] Different site-definition than the EUROCARE-4 definition for this site

[d] ICD-O-2 definitions of malignancy used here (ICD-O-3 used by EC-4), or (for bladder cancer) in situ and uncertain behaviour excluded (included by EC-4).

[e] Excluding borderline malignancies of the ovary, i.e. tumours considered fully malignant in ICD-O-2 but of uncertain behaviour in ICD-O-3.

Appendix Table 1.3. Age-standardized[a] five-year relative survival (cases diagnosed 2000-2004) for major cancer types, by HSE area of residence. Baseline category used for comparison is HSE Dublin/Mid-Leinster; statistically significant lower or higher survival of patients resident in other areas are flagged on the basis of relative survival modeling adjusted for age.

Cancer type	ICD10 code	Five-year relative survival by HSE area of residence			
		Dublin/Mid-Leinster	Dublin/North-East	South	West
colorectal	C18-21	54.5% (47.9%-60.7%)	54.0% ns (46.5%-60.9%)	51.9% * P=0.022 (45.4%-57.9%)	52.2% ns* (45.3%-58.7%)
colon	C18	53.4% (45.0%-61.2%)	53.8% ns (44.1%-62.6%)	53.0% ns (44.5%-60.9%)	54.4% ns (45.6%-62.5%)
rectum/anus/ rectosigmoid	C19-21	54.6% (44.0%-64.5%)	53.3% ns (41.1%-64.3%)	50.0% ns (40.2%-59.2%)	49.2% ns (38.0%-59.5%)
lung (& trachea)	C33-34	10.0% (6.4%-14.4%)	11.8% ns (7.4%-17.0%)	9.8% ns (6.0%-14.5%)	11.2% ns (6.9%-16.8%)
breast (female)	C50	78.2% (71.9%-83.7%)	79.0% ns*(low) (71.5%-85.4%)	76.2% ** P=0.002 (69.3%-82.2%)	74.0% *** P<0.001 (66.3%-80.7%)
prostate	C61	86.1% (78.0%-93.4%)	81.3% *** P<0.001 (71.3%-90.1%)	80.9% *** P<0.001 (73.2%-87.6%)	83.6% ** P=0.005 (76.1%-90.0%)

* = significantly higher or lower survival, adjusted for age compared with patients resident in Dublin/Mid-Leinster area (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference;

ns* = no significant difference age-adjusted, but significant age-&-stage-adjusted; *ns = significant difference age-adjusted but not age-&-stage-adjusted.

[a] Age-standardized = expressed in terms of standard patient populations proposed by Corazziari *et al*. (2004), as used by the EUROCARE-4 study..

Appendix Table 1.4. Age-standardized[a] five-year relative survival (cases diagnosed 2000-2004) for other cancer types, by HSE area of residence. Baseline category used for comparison is HSE Dublin/Mid-Leinster; statistically significant lower or higher survival of patients resident in other areas are flagged on the basis of relative survival modeling adjusted for age. Some cancers (not shown) had insufficient data to allow estimation of five-year survival in two or more areas.

Cancer type	ICD10 code	Five-year relative survival by HSE area of residence					
		Dublin/Mid-Leinster	Dublin/North-East		South		West	
head & neck (mouth/pharynx)	C01-06, C09-13	40.2% (24.3%-59.9%)	-	ns	-	ns	39.3% (22.4%-57.1%)	ns
oral cavity	C03-06	56.2% (29.4%-82.7%)	-	ns	-	ns	37.6% (12.3%-67.1%)	ns
oesophagus	C15	16.7% (9.1%-27.3%)	-	ns	-	ns	18.4% (8.1%-30.6%)	ns
larynx	C32	74.2% (47.6%-93.2%)	-	* low P=0.037	50.1% (31.1%-69.9%)	* P=0.016	-	* low P=0.019
melanoma skin	C43	84.3% (71.7%-93.4%)	85.5% (72.2%-94.7%)	ns	86.9% (75.9%-94.8%)	ns	87.1% (72.9%-96.1%)	ns
soft tissue	C47, C49	71.0% (47.8%-88.1%)	-	* P=0.048	54.7% (28.4%-79.5%)	ns	60.3% (28.6%-83.9%)	ns
cervix uteri	C53	64.4% (46.7%-79.4%)	-	ns	53.6% (34.0%-72.9%)	** P=0.002	59.0% (36.5%-78.1%)	ns
corpus uteri	C54	75.4% (56.2%-88.8%)	70.8% (44.2%-88.9%)	ns	75.8% (58.5%-88.4%)	ns	75.6% (58.5%-87.4%)	ns
ovary (& other uterine adnexa)	C56, C57.0-.7	38.1% (27.1%-49.4%)	39.5% (24.5%-55.5%)	ns	30.5% (18.7%-43.3%)	ns	34.9% (22.5%-47.8%)	ns
ovary (& adnexa) excl. borderlines[c]	C56, C57.0-.7	36.6% (25.4%-48.3%)	38.0% (22.9%-54.3%)	ns	29.7% (18.1%-42.4%)	ns	33.2% (20.8%-46.3%)	ns
kidney (& other urinary)	C64-66, C68	47.7% (33.4%-61.1%)	40.3% (25.2%-56.4%)	ns	52.6% (38.5%-65.4%)	ns	46.4% (31.6%-61.5%)	ns
bladder [b]	C67	70.9% (56.5%-81.9%)	72.6% (55.1%-85.5%)	ns	70.2% (56.7%-80.2%)	ns	74.3% (59.8%-84.2%)	ns
brain [b]	C71	25.0% (16.1%-36.6%)	-	ns	23.8% (15.1%-34.9%)	ns	-	ns
non-Hodgkin lymphoma	C82-85, C96	59.9% (48.7%-70.2%)	56.4% (43.6%-67.9%)	ns	49.4% (37.6%-60.7%)	** P=0.009	49.4% (37.6%-60.7%)	ns
multiple myeloma etc	C90	36.4% (16.8%-55.8%)	38.6% (17.4%-57.6%)	* low P=0.044	32.0% (16.3%-47.6%)	* P=0.033	29.4% (12.7%-48.4%)	ns
leukaemia	C91-95	58.9% (45.4%-70.5%)	55.7% (38.0%-72.1%)	* P=0.023	41.9% (27.4%-56.4%)	*** P<0.001	56.3% (41.2%-69.8%)	ns
chronic lymphoblastic leukaemia	C91.1	-	81.2% (51.1%-101%)	ns	64.2% (39.4%-84.3%)	* P=0.021	81.9% (64.9%-95.3%)	ns

* = significantly higher or lower relative survival compared with patients resident in Dublin/Mid-Leinster area (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference.

- Insufficient data to allow estimation.

[a] Age-standardized = expressed in terms of standard patient populations proposed by Corazziari *et al*. (2004), as used by the EUROCARE-4 study (but insufficient data for some categories).

[b] ICD-O-2 definitions of malignancy used here (ICD-O-3 used by EUROCARE-4), or (for bladder cancer) in situ and uncertain behaviour excluded (included by EC-4).

[c] Excluding borderline malignancies of the ovary, i.e. tumours considered fully malignant in ICD-O-2 but of uncertain behaviour in ICD-O-3.

Appendix Table 1.5. Age-standardized[a] five-year relative survival (cases diagnosed 2000-2004) for major cancer types, by HSE area in which patient had their first treatment. Baseline category used for comparison is HSE Dublin/Mid-Leinster; statistically significant lower or higher survival of patients treated in other areas are flagged on the basis of relative survival modeling adjusted for age.

Cancer type	ICD10 code	Five-year relative survival by HSE area of first treatment					
		Dublin/Mid-Leinster	Dublin/North-East		South	West	
colorectal	C18-21	55.0% (48.4%-61.3%)	54.5% (47.3%-61.2%)	ns	51.3% (44.8%-57.5%)	* P=0.035	52.0% (44.7%-58.8%)	ns**
colon	C18	54.8% (46.4%-62.6%)	53.8% (44.3%-62.5%)	ns	52.4% (43.8%-60.4%)	ns**	53.8% (44.8%-62.1%)	ns**
rectum/anus/ rectosigmoid	C19-21	53.6% (42.8%-63.7%)	54.9% (43.5%-65.2%)	ns	49.5% (39.7%-58.8%)	ns*	49.3% (37.2%-60.2%)	ns
lung (& trachea)	C33-34	13.2% (9.4%-17.6%)	11.7% (7.6%-16.6%)	** P=0.001	7.5% (3.9%-12.3%)	*** P<0.001	-	*** P<0.001
breast (female)	C50	79.4% (73.1%-84.9%)	77.9% (70.6%-84.3%)	ns**	76.0% (69.0%-82.1%)	*** P<0.001	73.8% (65.8%-80.9%)	*** P<0.001
prostate	C61	87.5% (74.6%-94.1%)	-	*** (low) P<0.001	[b]90.1% (84.2%-94.0%)	*** (low) P<0.001	-	***(low)ns P<0.001

= significantly higher or lower survival compared with patients treated in Dublin/Mid-Leinster area, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (P<0.05 ** P<0.01, *** P<0.001), ns = no significant difference;
ns* = no significant difference age-adjusted, but significant age-&-stage-adjusted; *ns = significant difference age-adjusted but not age-&-stage-adjusted.

[a] Age-standardized = expressed in terms of standard patient populations proposed by Corazziari *et al*. (2004), as used by the EUROCARE-4 study (but insufficient data for some categories).

[b] Although the estimate of five-year relative survival for prostate cancer patients treated in the South, adjusted to the Corazziari age-standard for this cancer, was higher than the estimate for Dublin/Mid-Leinster, fuller modelling of survival, adjusted for age (but in a different manner) indicated significantly lower survival in the South. This reflects, in part, a potential problem with the use of age-standardized estimates, as the choice of a comparison population can influence the apparent differences between study populations; it also reflects the fact that comparisons based on a five-year endpoint may not necessarily match those based on fuller modelling of case-fatality through the follow-up period leading to that endpoint.

Appendix Table 1.6 Age-standardized[a] five-year relative survival (cases diagnosed 2000-2004) for other cancer types, by HSE area in which patient had their first treatment. Baseline category used for comparison is HSE Dublin/Mid-Leinster; statistically significant lower or higher survival of patients treated in other areas are flagged on the basis of relative survival modeling adjusted for age. Some cancers (not shown) had insufficient data to allow estimation of five-year survival in two or more areas.

Cancer type	ICD10 code	Five-year relative survival by HSE area of first treatment			
		Dublin/Mid-Leinster	Dublin/North-East	South	West
head & neck (mouth/pharynx)	C01-06 C09-13	42.5% (24.8%-61.9%)	- ns	- ns	43.1% ns (23.0%-62.2%)
oral cavity	C03-06	55.1% (23.0%-85.1%)	- ns	- ns*	42.9% ns (15.2%-75.7%)
oesophagus	C15	18.2% (10.4%-28.0%)	19.3% ns (8.3%-33.5%)	- ns	- ns
stomach	C16	18.5% (10.5%-28.1%)	20.2% ns (11.1%-31.1%)	12.4% ns (5.8%-23.9%)	- ns
larynx	C32	67.8% (44.7%-86.6%)	- *(low)ns P=0.040	50.9% ** (31.3%-70.7%) P=0.007	- ns*(low)
melanoma skin	C43	82.7% (70.1%-92.0%)	86.3% ns (71.8%-96.1%)	87.4% ns (76.1%-95.6%)	87.4% ns (72.5%-96.4%)
soft tissue	C47 C49	66.0% (42.5%-84.8%)	64.5% ns (34.5%-87.2%)	52.8% ns (23.0%-80.1%)	68.6% ns (30.7%-89.7%)
cervix uteri	C53	64.1% (48.2%-77.8%)	- ns	51.9% ** (30.4%-72.8%) P=0.001	60.3% ns (37.9%-78.9%)
corpus uteri	C54	76.2% (56.6%-90.2%)	69.5% ns (47.4%-86.5%)	76.8% ns (59.4%-89.5%)	75.3% ns (56.6%-87.6%)
ovary (& other uterine adnexa)	C56 C57.0-.7	38.3% (27.3%-49.6%)	35.7% ns (22.4%-50.4%)	32.3% ns*** (20.0%-45.2%)	34.6% ns (21.4%-48.3%)
ovary (& adnexa) excl. borderlines[c]	C56 C57.0-.7	36.9% (25.7%-48.5%)	33.3% ns (20.2%-48.4%)	31.4% ns (19.2%-44.2%)	33.2% ns (19.9%-47.2%)
kidney (& other urinary)	C64-66 C68	50.6% (36.6%-63.4%)	42.9% *ns (28.6%-57.7%) P=0.038	51.1% ns (35.7%-65.2%)	44.3% ns (28.4%-59.5%)
bladder [a]	C67	71.0% (57.4%-81.2%)	72.3% ns (54.6%-85.3%)	68.2% ns** (53.2%-79.0%)	75.9% ns (60.7%-86.2%)
thyroid gland	C73	74.1% (54.6%-89.0%)	82.0% ns (56.0%-98.9%)	- ns	- ns
non-Hodgkin lymphoma	C82-85 C96	60.5% (49.3%-70.7%)	55.7% ** (44.5%-66.1%) P=0.002	48.8% ** (36.5%-60.5%) P=0.001	54.9% ns (41.2%-67.4%)
multiple myeloma etc	C90	38.3% (19.8%-56.5%)	33.6% * (15.4%-53.6%) P=0.013	31.9% * (19.1%-47.6%) P=0.010	- ns
leukaemia	C91-95	60.7% (48.2%-71.8%)	49.0% ** (31.7%-65.9%) P=0.004	40.8% *** (26.2%-55.7%) P<0.001	57.5% ns (41.3%-71.5%)
chronic myeloid leukaemia	C92.1	81.3% (60.1%-94.8%)	- ns	64.0% ns (37.8%-84.5%)	81.5% ns (63.8%-95.4%)

= significantly higher or lower survival compared with patients treated in Dublin/Mid-Leinster area, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (P<0.05 ** P<0.01, *** P<0.001), ns = no significant difference;

ns* = no significant difference age-adjusted, but significant age-&-stage-adjusted; *ns = significant difference age-adjusted but not age-&-stage-adjusted.

[a] Age-standardized = expressed in terms of standard patient populations proposed by Corazziari *et al*. (2004), as used by the EUROCARE-4 study (but insufficient data for some categories).

[b] Excluding borderline malignancies of the ovary, i.e. tumours considered fully malignant in ICD-O-2 but of uncertain behaviour in ICD-O-3.

Table 1.7. Age-standardized[a] five -year relative survival (cases diagnosed 2000-2004) for major cancer types, by hospital category in which first surgical treatment received. Baseline category used for comparison comprises the proposed 'cancer centres'; statistically significant lower or higher survival of patients treated in other hospital categories are flagged on the basis of relative survival modeling adjusted for age.

Cancer type	ICD10 code	Five-year relative survival by surgical hospital category				
		[b]Proposed centres (8 hospitals)	[c]Other public acute general hospitals		Private hospitals	
colorectal	C18-21	62.6% (55.3%-69.2%)	63.3% (57.8%-68.4%)	ns*(low)	72.9% (61.2%-82.9%)	*** P<0.001
colon	C18	61.4% (52.1%-69.9%)	63.3% (56.4%-69.5%)	ns	73.2% (57.8%-85.7%)	***ns P<0.001
rectum/anus/ rectosigmoid	C19-21	63.5% (51.9%-73.7%)	62.6% (53.0%-71.2%)	ns	70.4% (51.8%-86.6%)	** P=0.003
lung (& trachea) [c]	C33-34	41.4% (30.6%-52.0%)	-	*** (low) P<0.001	40.0% (16.9%-65.0%)	ns
breast (female)	C50	89.1% (82.8%-94.3%)	82.1% (75.7%-87.6%)	*** P<0.001	91.4% (81.1%-98.9%)	*** P=0.002
prostate [c]	C61	85.2% (66.6%-93.8%)	89.4% (70.0%-97.0%)	* P=0.045	-	** (high) P=0.001

***** = significantly higher or lower survival compared with patients treated in the proposed centres, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference;
ns* = no significant difference age-adjusted, but significant age-&-stage-adjusted; *ns = significant difference age-adjusted but not age-&-stage-adjusted.

[a] Age-standardized = expressed in terms of standard patient populations proposed by Corazziari *et al*. (2004), as used by the EUROCARE-4 study (but insufficient data for some categories).

[b] Eight hospitals initially proposed for inclusion in designated centres (2008 onwards i.e. not designated as such during 2000-2004): Beaumont Hospital and Mater Misericordiae Hospital (Dublin/North-East HSE area), St James's Hospital and St Vincent's Hospital (Dublin/Mid-Leinster area), Cork University Hospital and Waterford Area Hospital (Southern area), University College Hospital Galway and Limerick Area Hospital (Western area).

[c] Public hospitals other than area general hospitals are excluded from this category, and in general treat too few cancer patients to allow summary as a separate category.

[d] Note that fewer than 50% of cases of these cancers were surgically treated within six months of diagnosis.

- Insufficient data to allow estimation.

Appendix Table 1.8. Age-standardized[a] five -year relative survival (cases diagnosed 2000-2004) for other surgically-treatable cancer types, by hospital category in which first surgical treatment received. Baseline category used for comparison comprises the proposed 'cancer centres'; statistically significant lower or higher survival of patients treated in other hospital categories are flagged on the basis of relative survival modeling adjusted for age. Some cancers (not shown) had insufficient data to allow estimation of five-year survival for two or more hospital categories.

Cancer type	ICD10 code	Five-year relative survival by surgical hospital category		
		[b]Proposed centres (8 hospitals)	[c]Other public acute general hospitals	Private hospitals
stomach [d]	C16	31.8% (18.5%-46.5%)	30.9% ns (18.8%-44.7%)	- ns
melanoma skin	C43	81.7% (68.9%-90.9%)	85.9% ns (74.6%-94.0%)	95.0% *** (81.3%-103%) P<0.001
soft tissue	C47, C49	62.9% (33.7%-85.7%)	87.0% **ns (50.2%-104%) P=0.008	97.9% *ns (56.4%-110%) P=0.021
vagina & vulva	C51-52, C57.8-.9	59.3% (29.1%-84.6%)	87.0% ns (42.2%-107%)	- ns
corpus uteri	C54	70.8% (52.3%-84.4%)	82.5% ns (68.2%-92.5%)	78.9% *ns (48.5%-96.4%) P=0.023
ovary (& other uterine adnexa)	C56, C57.0-.7	46.8% (33.3%-59.9%)	48.7% ns (29.5%-68.0%)	- ns
ovary (& adnexa) excl. borderlines[e]	C56, C57.0-.7	43.5% (29.7%-57.4%)	46.9% ns (27.8%-66.4%)	- ns
kidney (& other urinary)	C64-66, C68	61.2% (45.9%-75.6%)	62.2% ns (39.4%-80.9%)	79.4% *ns (49.9%-98.6%) P=0.019
bladder	C67	74.1% (61.8%-83.5%)	69.4% ns (55.4%-79.4%)	91.0% ** (69.5%-103%) P=0.001

* = significantly higher or lower survival compared with patients treated in the proposed centres, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference;
ns* = no significant difference age-adjusted, but significant age-&-stage-adjusted; *ns = significant difference age-adjusted but not age-&-stage-adjusted.

[a] Age-standardized = expressed in terms of standard patient populations proposed by Corazziari *et al*. (2004), as used by the EUROCARE-4 study (but insufficient data for some categories).

[b] Eight hospitals initially proposed for inclusion in designated centres (2008 onwards i.e. not designated as such during 2000-2004): Beaumont Hospital and Mater Misericordiae Hospital (Dublin/North-East HSE area), St James's Hospital and St Vincent's Hospital (Dublin/Mid-Leinster area), Cork University Hospital and Waterford Area Hospital (Southern area), University College Hospital Galway and Limerick Area Hospital (Western area).

[c] Public hospitals other than area general hospitals are excluded from this category, and in general treat too few cancer patients to allow summary as a separate category.

[d] Note that fewer than 50% of stomach cancers were surgically treated within six months of diagnosis.

[e] Excluding borderline malignancies of the ovary, i.e. tumours considered fully malignant in ICD-O-2 but of uncertain behaviour in ICD-O-3.

- Insufficient data to allow estimation.

Appendix 2. Relative survival estimates by 'minimum' stage at diagnosis

Appendix Table 2.1. Five-year relative survival for major cancer types, by 'minimum' TNM stage (5th edition) and year of diagnosis. 95% confidence intervals are shown, and the statistical significance of change in survival is further assessed by relative survival modeling, adjusted for age. For this analysis, patients with N and M categories of stage not explicitly coded (i.e. coded as NX or MX in NCRI data) are assumed to be N0 and M0.[a]

Cancer type	ICD10 code	TNM stage (5th edn)	Five-year relative survival (95% CI) 1994-1999	2000-2004	Statistical significance of change, age-adjusted
colorectal	C18-C21	stage I/I+	79.2% (76.5%-81.7%)	84.8% (80.8%-88.3%)	ns (P=0.100) [b]EHR 0.770 (0.564-1.051)
		stage II/II+	61.4% (59.3%-63.4%)	70.0% (67.1%-72.8%)	** (P=0.003) EHR 0.8414 (0.749-0.944)
		stage III/III+	43.5% (41.1%-45.8%)	54.5% (51.2%-57.5%)	*** (P<0.001) EHR 0.736 (0.665-0.815)
		stage IV	7.6% (6.3%-8.8%)	8.4% (6.7%-10.2%)	** (P=0.001) EHR 0.8901 (0.832-0.951)
		unknown	28.6% (25.6%-31.6%)	35.6% (31.4%-39.9%)	ns (P=0.066) EHR 0.892 (0.789-1.007)
lung (& trachea)	C33-34	stage I/I+	21.4% (19.0%-23.7%)	28.8% (25.1%-32.5%)	*** (P<0.001) EHR 0.736 (0.663-0.816)
		stage II/II+	10.7% (8.6%-13.1%)	11.1% (7.3%-15.6%)	* (P=0.010) EHR 0.852 (0.754-0.962)
		stage III/III+	5.3% (4.2%-6.5%)	7.2% (5.6%-8.8%)	*** (P<0.001) EHR 0.873 (0.814-0.935)
		stage IV	2.7% (2.0%-3.5%)	2.1% (1.3%-3.1%)	ns (P=0.272) EHR 0.969 (0.914-1.025)
		unknown	7.1% (6.0%-8.2%)	10.2% (8.2%-12.2%)	* (P=0.043) EHR 0.929 (0.865-0.997)
breast (female)		stage I/I+	91.4% (89.7%-92.9%)	95.4% (93.4%-97.0%)	** (P=0.001) EHR 0.450 (0.276-0.733)
		stage II/II+	77.1% (75.7%-78.3%)	85.7% (83.9%-87.2%)	*** (P<0.001) EHR 0.589 (0.513-0.676)
		stage III/III+	52.7% (49.7%-55.5%)	53.4% (48.6%-57.9%)	* (P=0.020) EHR 0.841 (0.726-0.973)
		stage IV	19.6% (16.6%-22.8%)	25.8% (21.4%-30.4%)	** (P-0.008) EHR 0.838 (0.735-0.954)
		unknown	67.1% (62.7%-71.2%)	57.8% (50.5%-64.5%)	* (P=0.022) EHR 1.373 (1.045-1.803)
prostate[c]		stage II/II+	77.2% (74.6%-79.6%)	93.0% (90.5%-95.1%)	*** (P<0.001) EHR 0.189 (0.083-0.427)
		stage III/III+	81.0% (74.9%-86.3%)	88.3% (82.7%-93.0%)	- -
		stage IV	24.3% (21.7%-26.8%)	29.2% (25.2%-33.2%)	** (P=0.006) EHR 0.862 (0.775-0.957)
		unknown	64.1% (61.6%-66.5%)	79.8% (76.8%-82.5%)	*** (P<0.001) EHR 0.625 (0.516-0.755)

* = significant improvement in survival between diagnosis periods, based on results of age-adjusted modelling of excess mortality hazard up to five years after diagnosis (* P<0.05, ** P<0.01, *** P<0.001), ns = no significant difference., - = not computable.

[a] e.g. T1NXMX is assumed to be T1N0M0, T2NIMX is assumed to be T2N1M0, thus stageable, but TXN0M0 is left as 'unknown stage'.

[b] EHR = excess hazard ratio (with 95% confidence intervals) comparing 2000-2004 with 1994-1999, adjusted for age and for length of follow-up (including interaction between age and follow-up where possible): <1.000 indicates reduction in excess (cancer-associated) mortality rate, i.e. improved relative survival; >1.000 increased excess mortality i.e. reduced relative survival.

[c] Survival estimates at not presented for prostate cancer stage I (equivalent to stage 0 in TNM 4th edition), as very few cases involved (26 1994099, 14 2000-2004).