

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

**Summary report**

Harry Comber

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National  
Cancer  
Registry  
Ireland



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Published by the National Cancer Registry 2008

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This report should be cited as:

Comber H. & Walsh P.M. (2008) Patterns of care and survival of cancer patients in Ireland 1994 to 2004. Summary report. National Cancer Registry, Cork.

## Key findings

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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

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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](http://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 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](http://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

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### 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<sup>1</sup> 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.

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<sup>1</sup> Health Service Executive, 2005. *Towards better health*.

See [http://www.hse.ie/eng/About\\_the\\_HSE/Map\\_of\\_Hospital\\_Networks\\_and\\_HSE\\_Areas.pdf](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 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 estimates.

## 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 <sup>1</sup>
<b>surgery</b>						
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)	-	-	-	-	-	-*
<b>chemotherapy</b>						
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) <sup>2</sup>	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%
<b>radiation therapy</b>						
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%

<sup>1</sup> ↑=statistically significant increase ↓=statistically significant decrease \* insufficient data

<sup>2</sup> 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% ( $\chi^2=81.1$ ;  $p<0.001$ ), 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** ( $\chi^2=5.1$ ,  $p<0.05$ ) and between 1995-1999 and 2000-2004 for **colorectal cancer** ( $\chi^2=25.8$ ,  $p<0.001$ ), 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** ( $\chi^2=39.8$ ,  $p<0.001$ ), **lung cancer** ( $\chi^2=7.1$ ,  $p=0.008$ ) and **prostate cancer** ( $\chi^2=4.6$ ,  $p=0.031$ ).

*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 <sup>1</sup>	2000-2004	1995-1999	2000-2004
<b>surgery</b>								
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
<b>chemotherapy</b>								
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	--	--
<b>radiation therapy</b>								
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

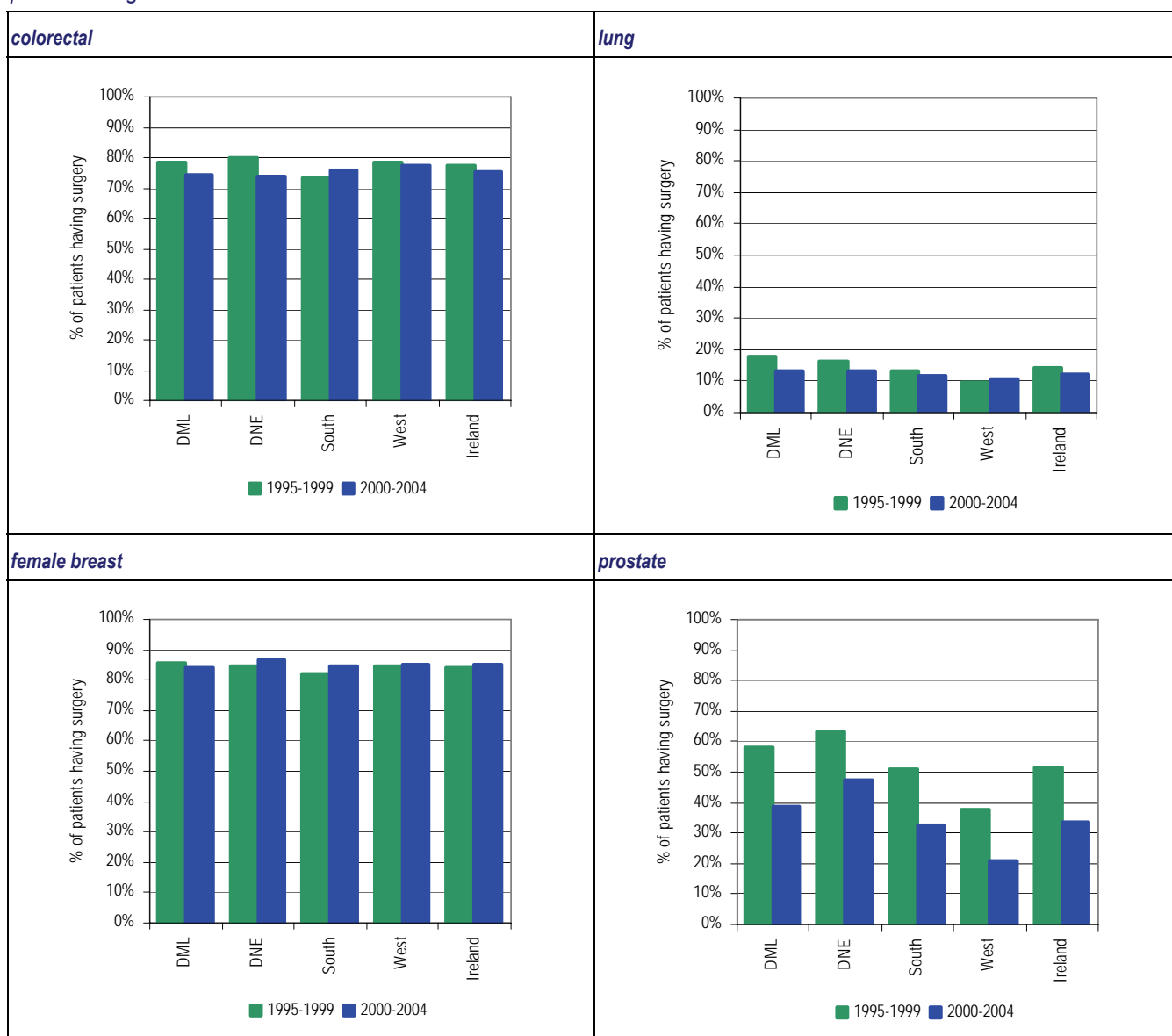
<sup>1</sup> 1996-1999 for chemotherapy

## 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.

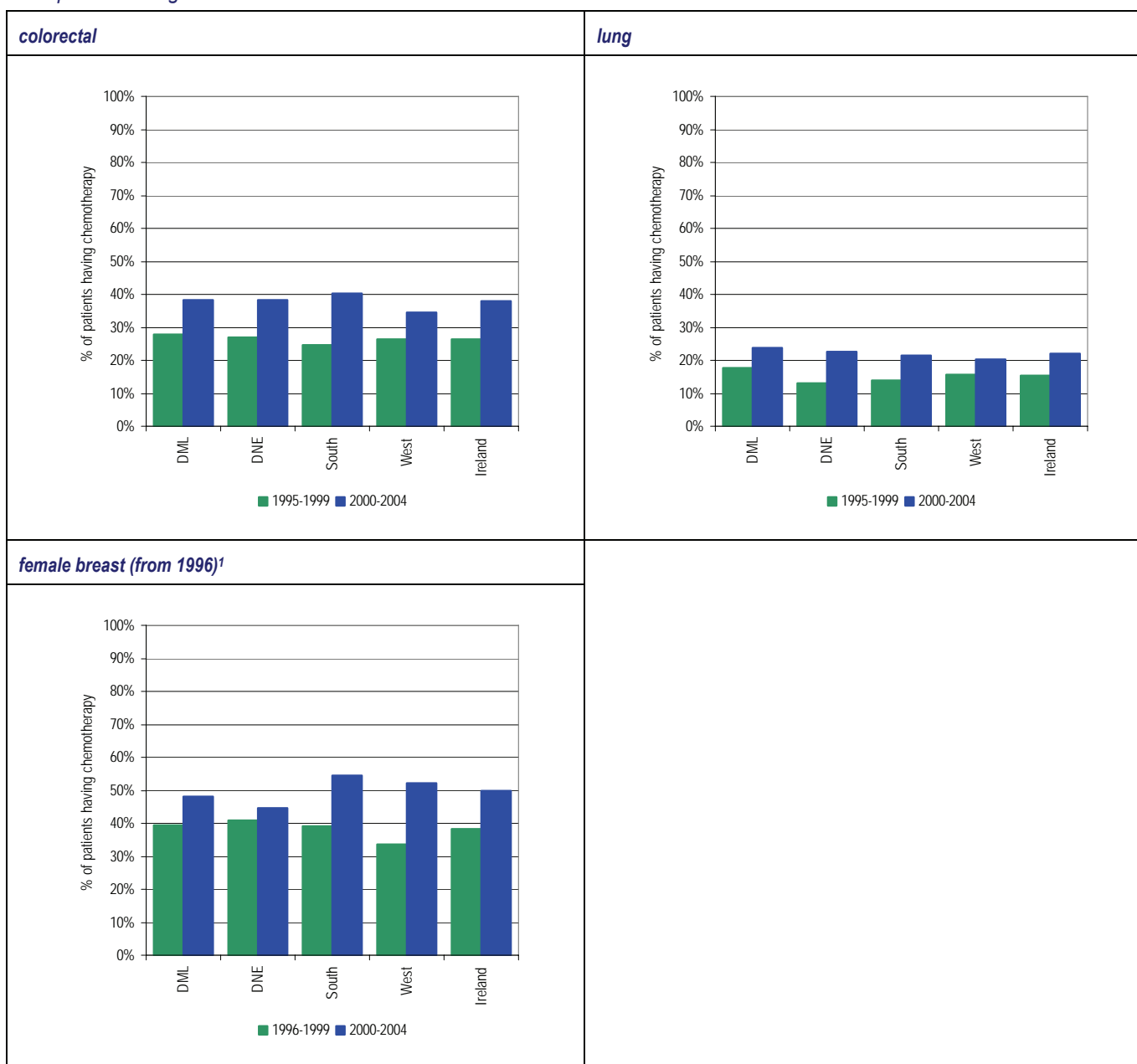
Figure S.1. Percentage of cancers treated by surgery within 6 months of diagnosis—by HSE area of residence and period of diagnosis



## 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<sup>1</sup> 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*

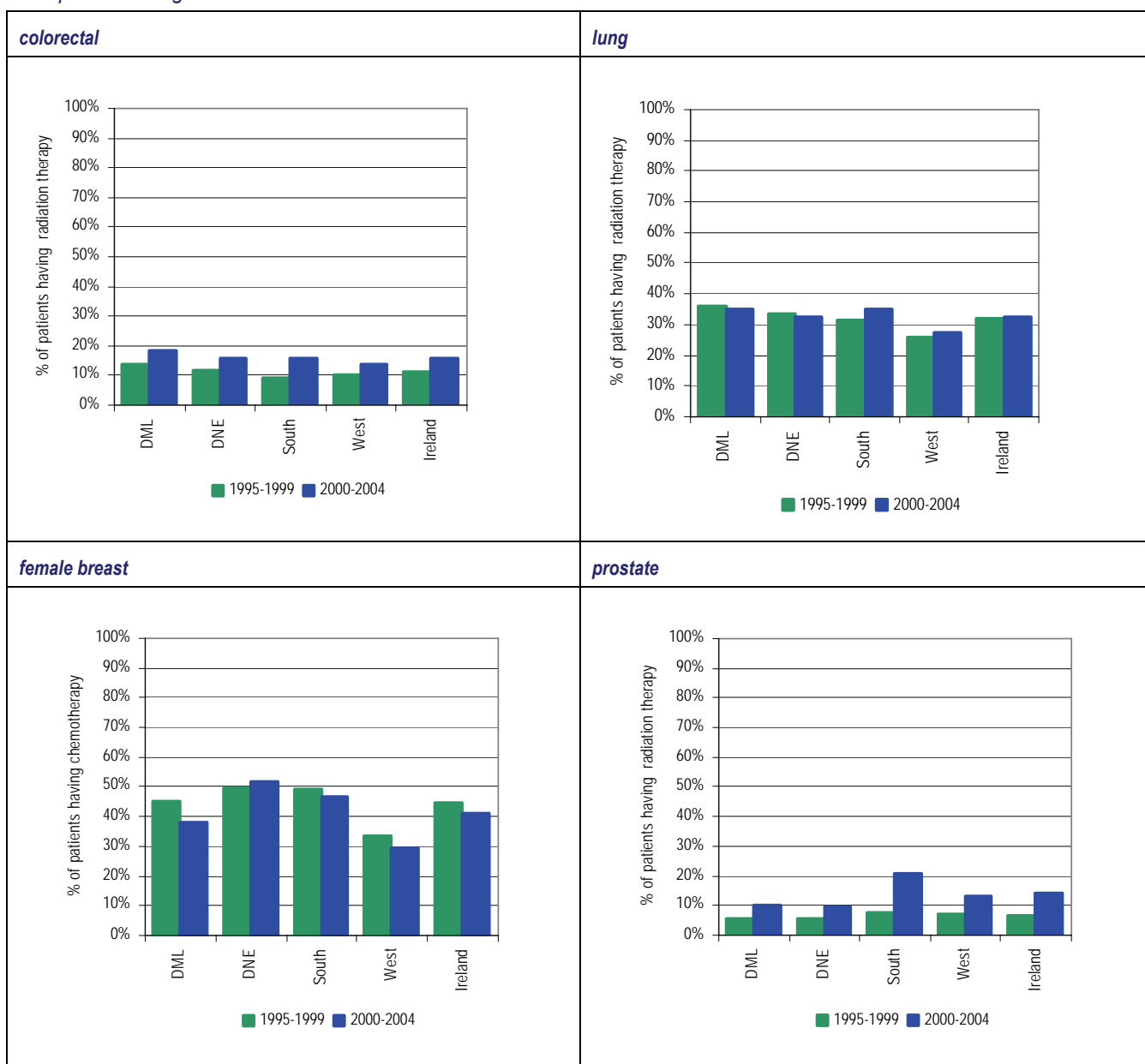


<sup>1</sup> 1995 chemotherapy data excluded for this cancer

### 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*



## 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

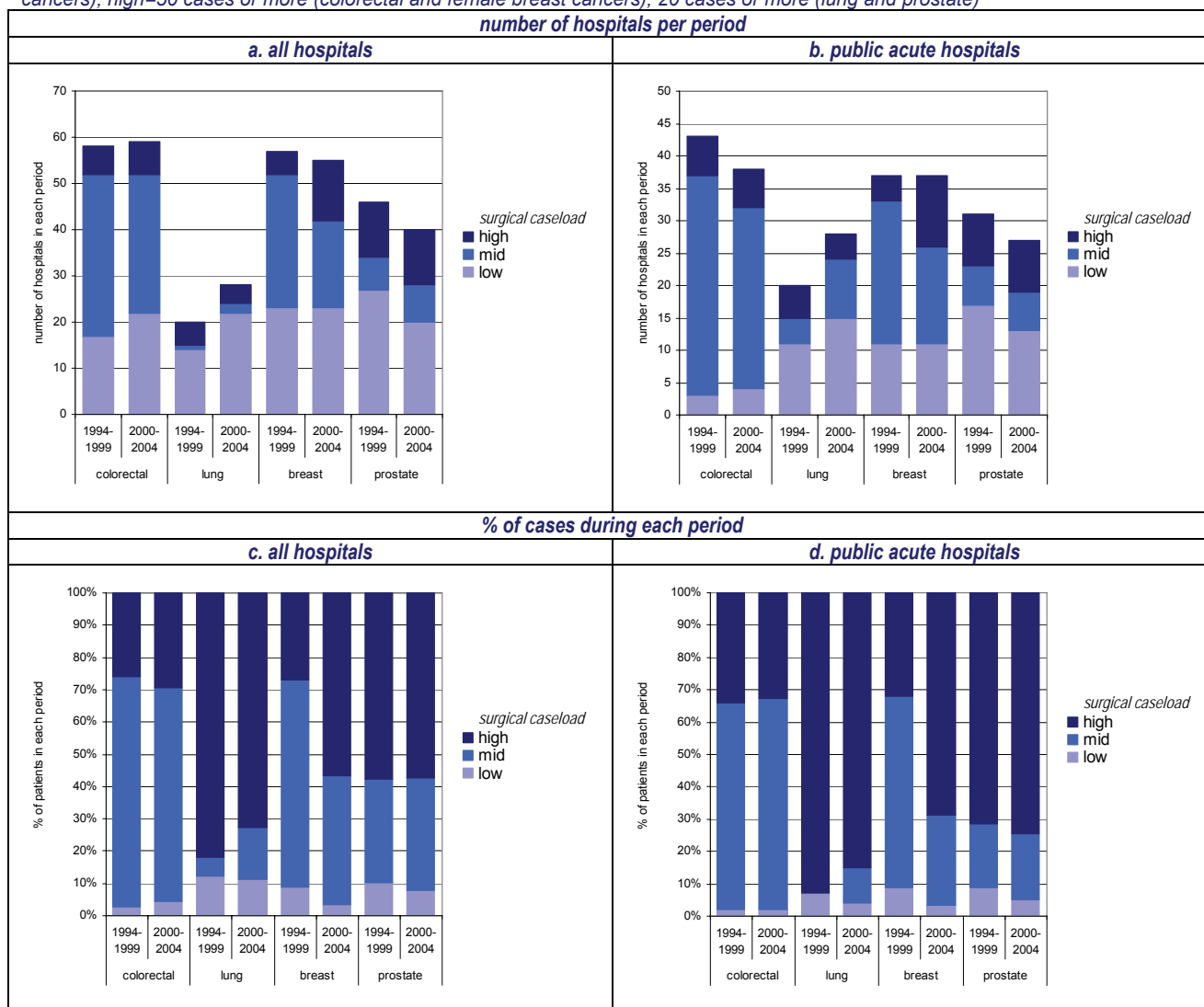
There was little change in the distribution of hospital surgical caseload between 1995-1999 and 2000-2004, although there was some evidence of an unexpected shift to lower caseload hospitals.

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

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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.

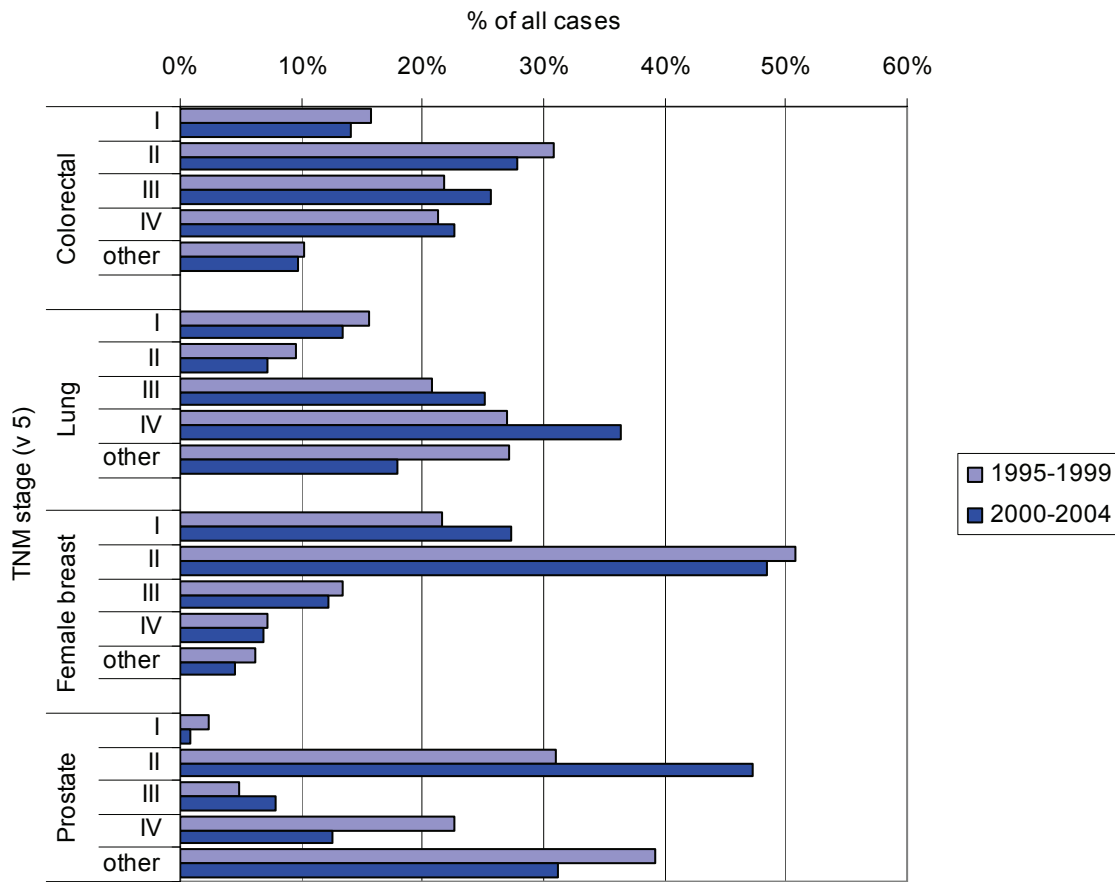
### Female breast cancer

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

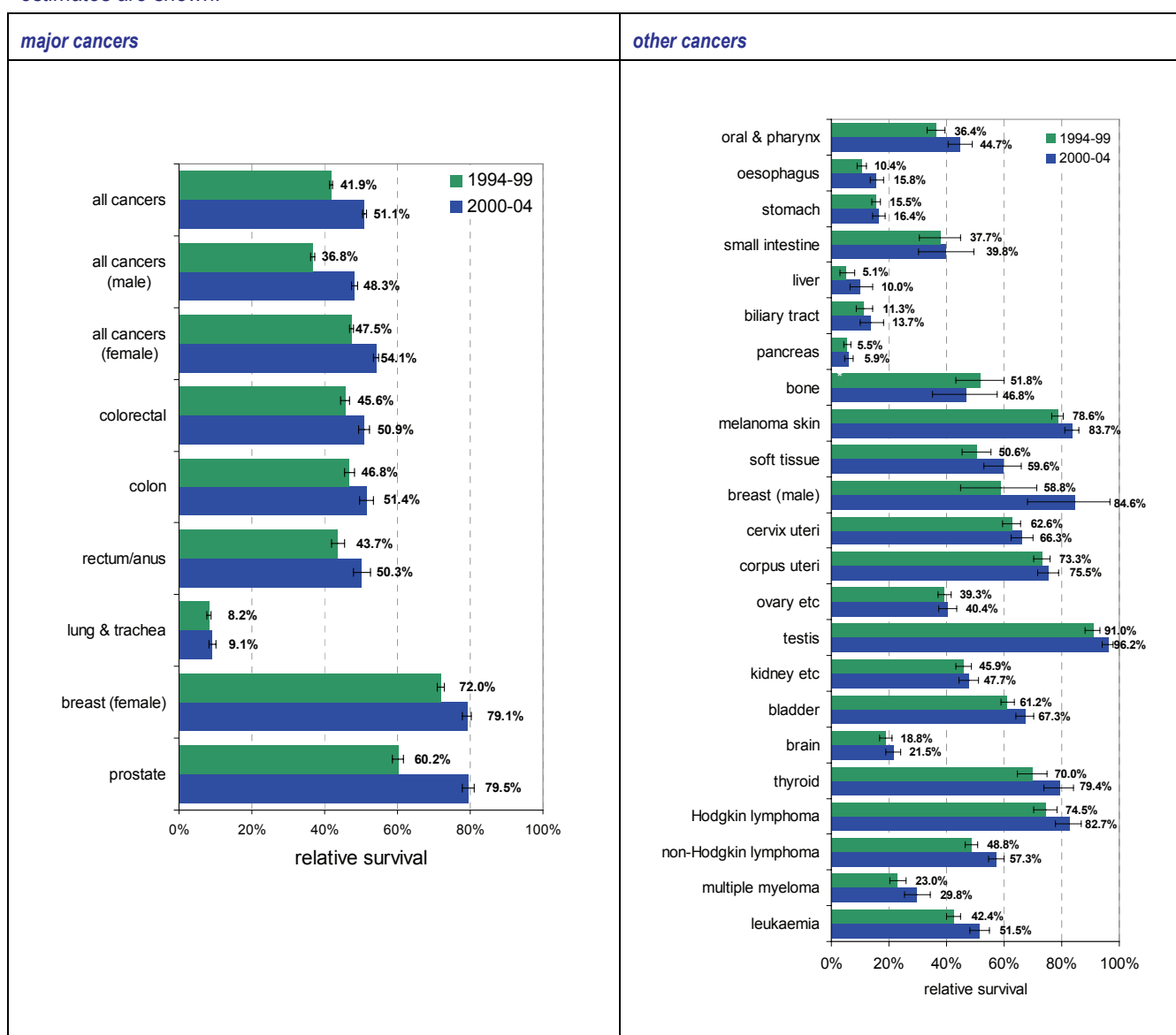


### National estimates of relative survival, including time-trends

Estimates of five-year relative survival are presented below (Figure S.5) 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.5. Five-year relative survival, by year of diagnosis: 1994-1999 v. 2000-2004. 95% confidence intervals of estimates are shown.

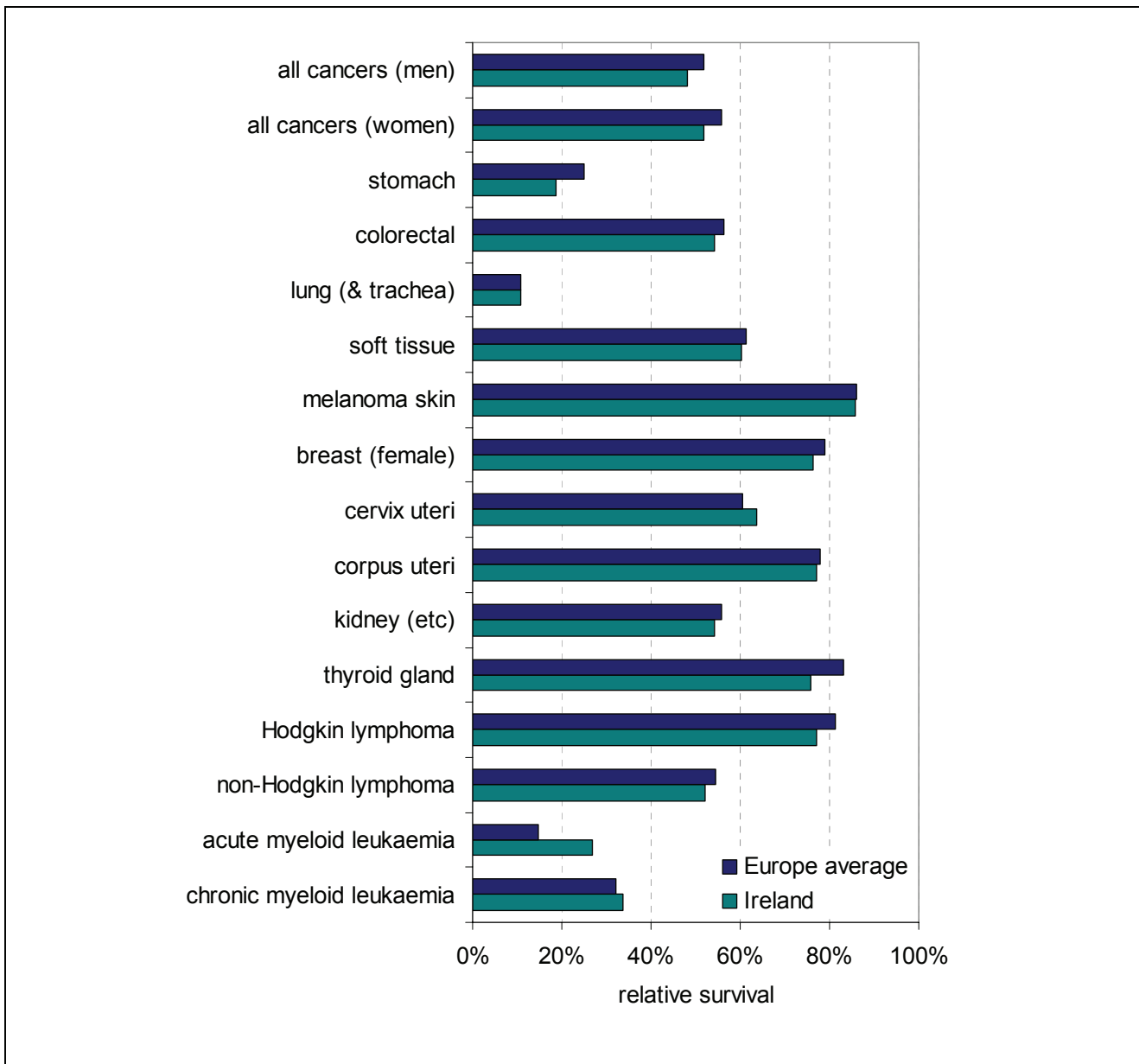


## Comparison of survival between Ireland and other European countries

As part of the collaborative EURO CARE-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**.

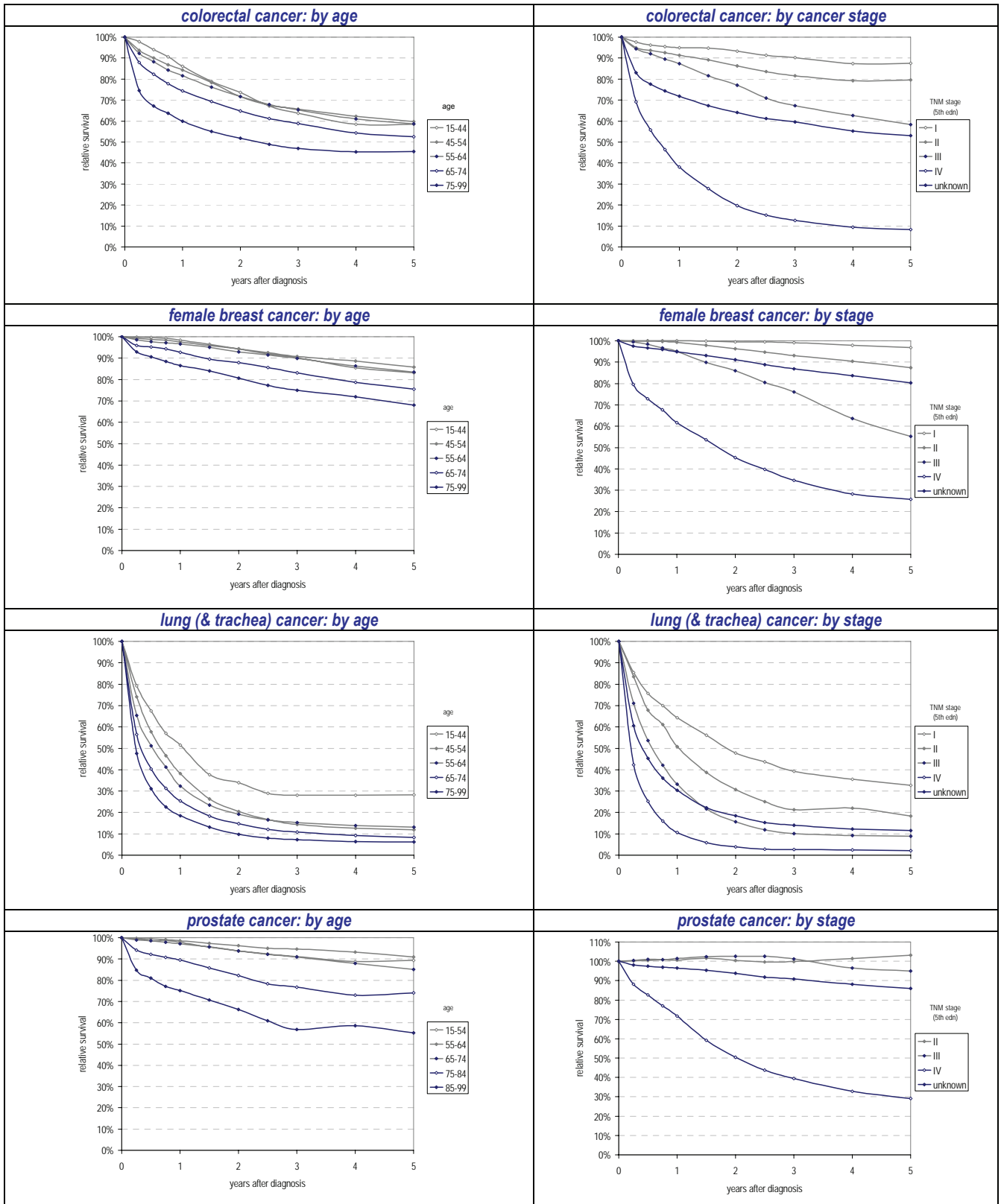
*Figure S.7 Five-year relative survival (age-standardized), 2000-2002: European (average) and Ireland (Verdecchia et al. 2007).*



### 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.

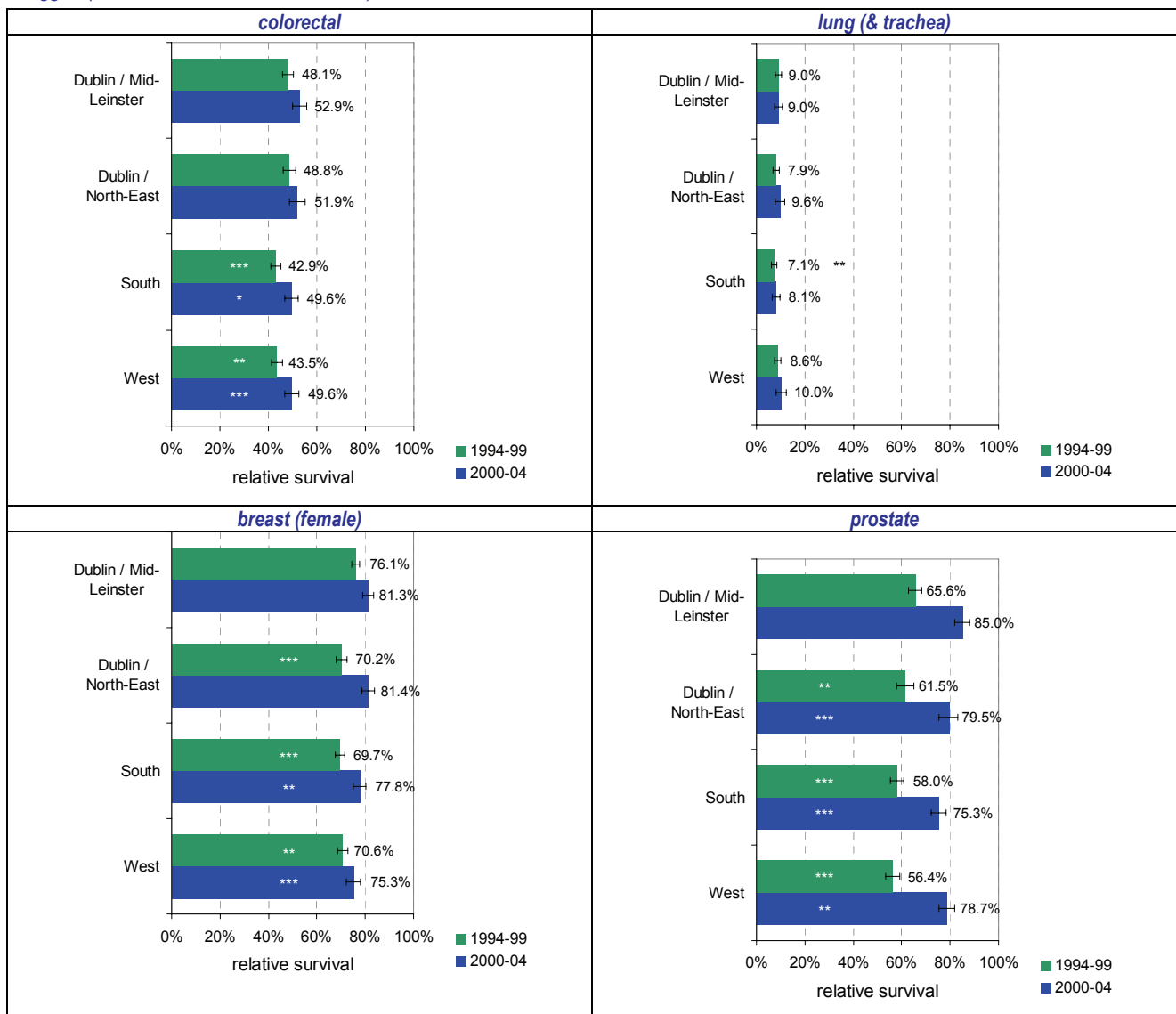


## Variation in survival by area of residence

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 (\*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ ).*

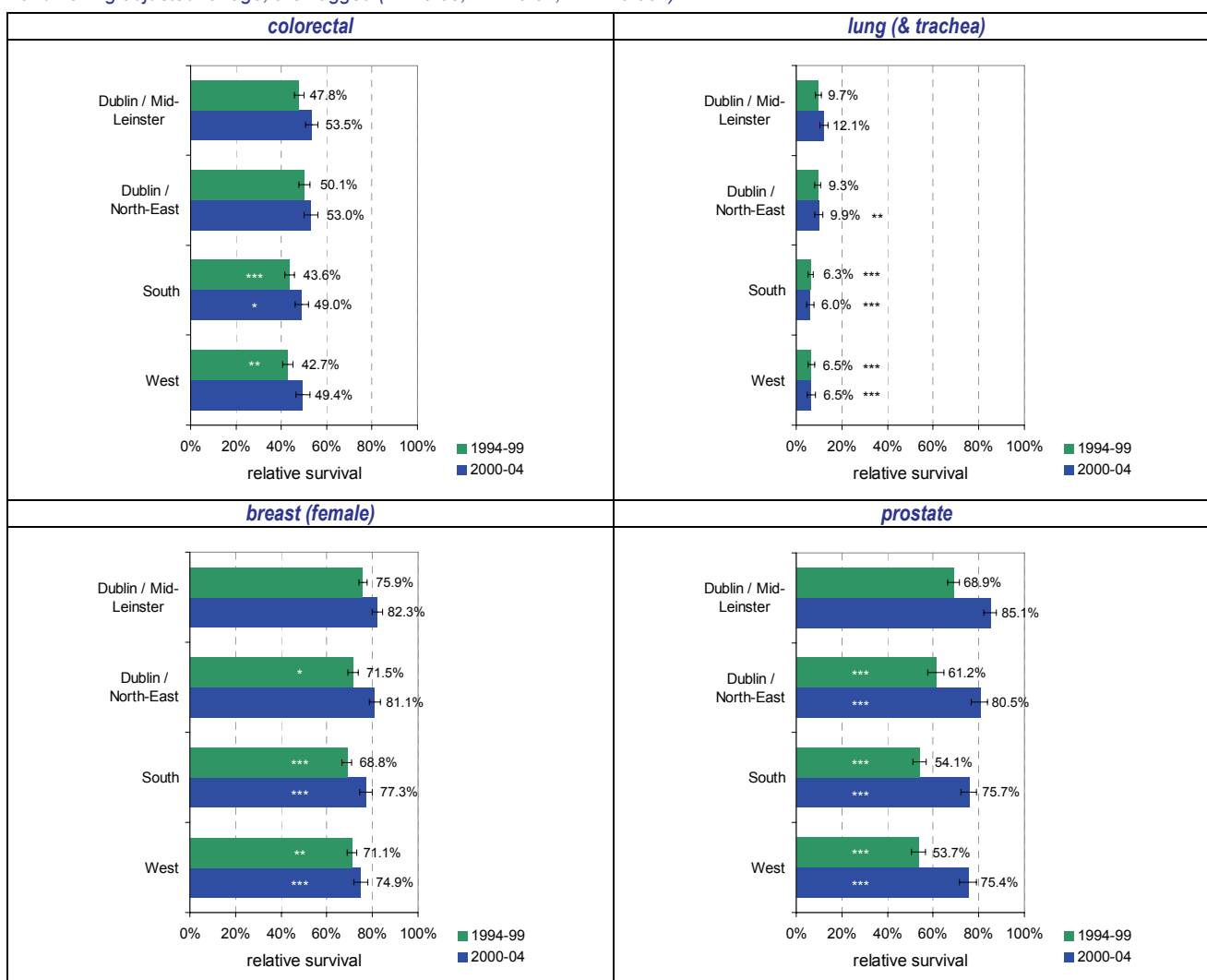


### Variation in survival by area of first treatment

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)

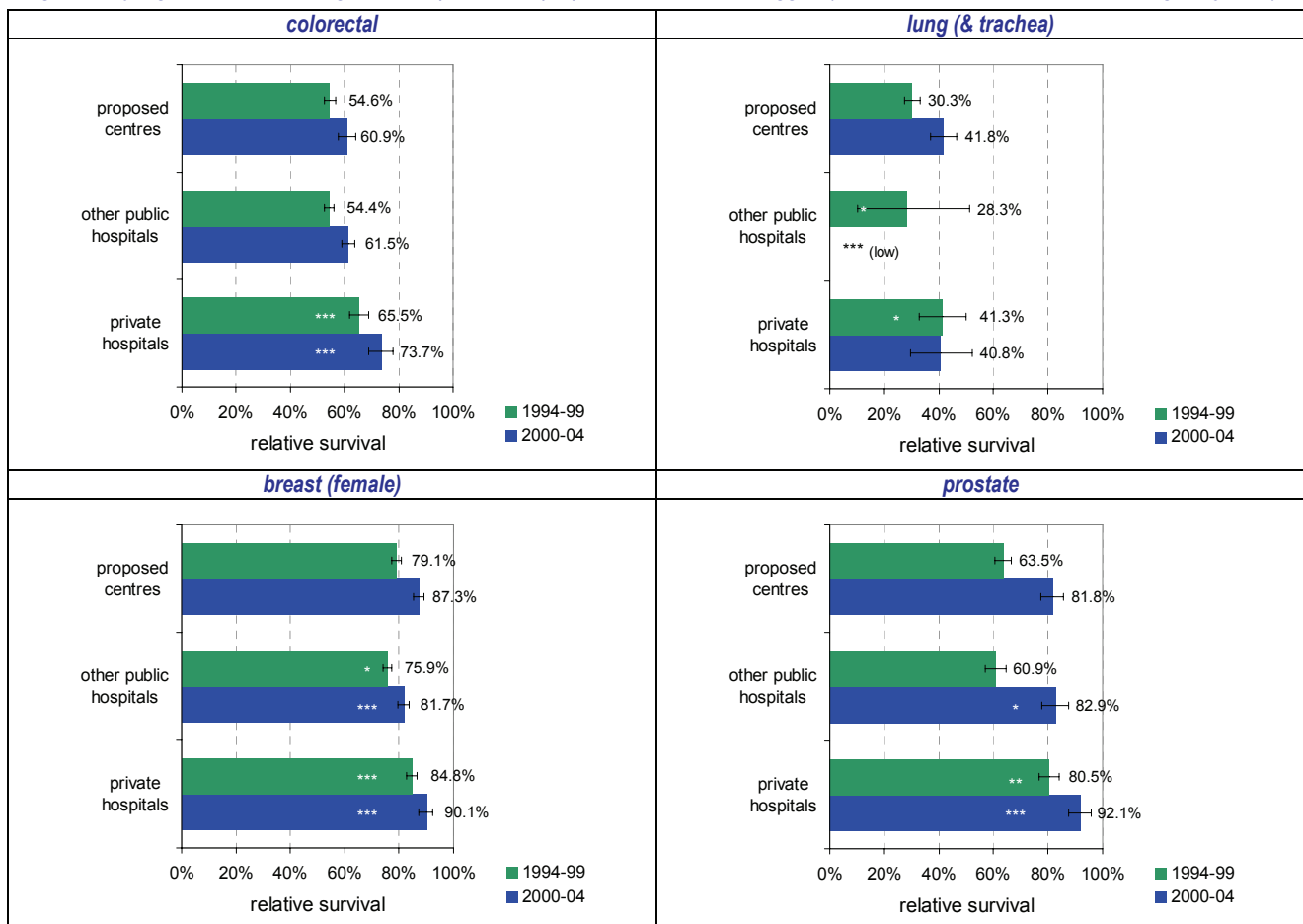
The Health Service Executive plans to transfer of major cancer treatment to eight designated Specialist Cancer Centres – two in each HSE area<sup>1</sup>. The analyses below assign patients to the first hospital in which they had tumour-directed surgery within six months of diagnosis. Five-year relative 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).*



<sup>1</sup> See [http://www.hse.ie/eng/About\\_the\\_HSE/Cancer\\_Services/nccp.html](http://www.hse.ie/eng/About_the_HSE/Cancer_Services/nccp.html) ; last updated 10/11/2008

## Acknowledgments

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We thank:

- the Department of Health and Children, which funded this analysis of treatment and survival data as part of its general funding of the National Cancer Registry;
- the staff of the National Cancer Registry, who collected and quality-assured the data analyzed here and provided administrative support and other assistance;
- the hospitals, clinics and their staff, who provided access to data;
- the Central Statistics Office and General Register Office, which provided death-certificate data.

## References

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- Corazziari I., Quinn M. & Capocaccia R. 2004. Standard cancer patient population for age standardising survival ratios. *Eur J Cancer* 40: 2307-2316.
- Dickman P.W., Sloggett A., Hills M. & Hakulinen T. 2004. Regression models for relative survival. *Statist Med* 23: 51-64.
- Dickman P.W., Coviello E. & Hills M. In press. Estimating and modelling relative survival. *Stata J.*
- National Cancer Forum. 2006. *A strategy for cancer control in Ireland*. Department of Health and Children, Dublin.
- National Cancer Registry. 2006. *Cancer in Ireland 1994-2005: a summary*. National Cancer Registry, Cork.
- NicAmhlaoibh R., Mahmud S. & Comber H. 2006. *Patterns of care and survival from cancer in Ireland 1994 to 1998*. National Cancer Registry, Cork.
- Verdecchia A., Francisci S., Brenner H., Gatta G., Micheli A., Mangione L., Kunkler I. & the EURO CARE-4 Working Group. 2007. Recent cancer survival in Europe: a 2000-02 period analysis of EURO CARE-4 data. *Lancet Oncol* 8: 784-796.
- Walsh P.M. & Comber H. 2006. *Patterns of care and survival of cancer patients in Ireland 1994 to 2001: time-trends and regional variation for breast, colorectal, lung and prostate cancer*. National Cancer Registry, Cork

