

## Chapter 5. LUNG CANCER

### Summary

#### Trends in incidence, mortality and patient/tumour characteristics

Numbers of cases and age-standardized incidence rates showed a significant upward trend in females, while incidence rates fell significantly for males. Numbers of deaths showed no significant trends, while mortality rates among males declined significantly.

Overall, some improvements in completeness of staging were seen, but no tendency towards earlier detection. The proportion of patients aged 65-74 decreased, while the proportion aged 75+ increased. The proportion of stage III and IV cancers increased; those with unknown stage decreased.

#### Survival

##### *1994-2001 average*

Relative survival to five years after diagnosis was estimated as 8.6% (95% CI 8.0-9.2%) overall, 7.9% (7.1-8.5%) for males and 10.0% (8.9-11.0%) for females.

##### *Survival trends*

Five-year relative survival showed some indication of improvement (not statistically significant) from 8.2% (95% CI 7.4-9.0%) for 1994-97 to 9.0% (8.1-9.9%) for 1998-2001. Having adjusted for age, sex and cell-type the change in relative survival was again not significant. Patients aged 55-64 or resident in the North-Eastern region showed a significant reduction in relative survival between 1994-97 and 1998-2001; other regions and age-groups showed no significant change.

The lack of any notable or general improvement in relative survival for this cancer, within the period examined, is not unexpected. Lung cancer is, on average, far more fatal and far less treatable than other cancers considered in this report. The scope for improvements in treatment and survival is also, currently, less, in the absence of effective approaches to population-based screening.

##### *Regional variation in survival*

Taking account of a range of patient and tumour characteristics, three regions (Mid-Western, North-Western and Western) had a significantly low excess risk of death i.e. high survival (compared with the Eastern region) during 1994-2001, and

also during both 1994-97 and 1998-2001. The North-Eastern region also showed a significantly low excess risk, during 1994-97. Only one region (South-Eastern in 1998-2001) showed a significantly high excess risk of death (lower survival) compared with the Eastern region.

Regional variation in risk was less marked than for the other cancers considered in this report and, by contrast, largely involved higher relative survival for patients from a number of regions compared with the Eastern region. However, the low average survival of lung cancer patients should be borne in mind. Statistically significant differences between regions may involve only small absolute differences in survival.

##### *International comparison of survival*

For males, the average five-year relative survival for Irish patients diagnosed with lung cancer during 1994-97 was lower than the European average for patients diagnosed during 1990-94. For female patients, Irish and average European survival figures were similar.

#### Treatment

##### *Proportions of patients treated: main modalities and combinations*

Overall during 1994-2001, 53% of patients had some form of definitive or tumour-directed treatment within six months of diagnosis, 32% had radiotherapy, 15% had chemotherapy and 14% had surgery. For 1998-2001, 54% were treated, 34% had radiotherapy, 16% had chemotherapy and 13% had surgery. For non-small-cell lung cancers, radiotherapy was the main treatment (40% of cases); for small-cell lung cancers, chemotherapy (56%). A substantial proportion of small-cell cancers cases received multimodal treatment, in particular chemotherapy plus radiotherapy (17%).

##### *Region of treatment versus region of residence*

The majority of surgical patients from six of the eight regions had their main surgical treatment in the Eastern region. Only in the Eastern, Southern and Western regions did most have their surgical treatments locally (100%, 97% and 55% of 1994-2001 cases, respectively).

##### *Hospital caseloads*

Lung cancers were surgically treated in a total of

29 hospitals during 1994-2001. In contrast to other major cancers (breast, colorectal and lung), there were indications that the number of hospitals where lung cancer patients had surgical treatment increased, and average surgical caseloads by hospital fell, during this period. About half of the hospitals involved in surgery in any given year treated fewer than 10 surgical cases each, and about two-thirds treated fewer than 20 surgical cases. Apparent declines in average surgical caseloads per hospital were supported by significant increases in the proportion of surgical cases treated in hospitals averaging <20 or <50 surgical cases annually.

#### *Surgical consultant caseloads*

99 individual consultants were coded as responsible for surgical managements of lung cancers diagnosed during 1994-2001. There were more during 1998-2001 (68) than 1994-1997 (51). Most treated fewer than 10 surgical cases, and almost all treated fewer than 20 surgical cases, annually. There was some evidence that average surgical caseloads, by consultant, decreased over time. Reflecting this, significant increases were seen in the proportions of surgical patients treated by 'low volume' consultants treating <10 or, especially, <20 surgical cases annually.

#### *Treatment trends*

The use of surgery fell significantly, by *c.*5.0% annually in relative terms after adjustment for age and stage, between 1996 and 2001. Regional trends were not statistically significant. The trends largely involved surgery of non-small-cell lung cancers.

Radiotherapy use increased significantly by *c.*2.2% annually between 1996 and 2001, although the basic trend was not significant after adjustment for stage. Significant increases were also seen among patients from the Mid-Western and North-Eastern regions.

Chemotherapy use increased significantly, by *c.*6.4% annually (age-adjusted), or *c.*4.6% (age- and stage-adjusted), and also among patients from the Eastern region. These trends largely reflected increased use of chemotherapy for non-small-cell cancers.

#### *Regional variation in treatment*

There was a general tendency for higher proportions of patients from the Eastern region to be treated than those from other regions, overall and based on specific modalities. This tendency was strongest for chemotherapy, especially in the most recent period.

Approximately two-fold regional variation in proportions of patients treated was apparent for surgery (e.g. range 8-16% of regional cases during 1998-2001), radiotherapy (range 20-37%) and chemotherapy (range 10-22%). There was apparently little in common between patterns for different modalities, except that use of all three modalities was high among patients from the Eastern region.

During 1994-2001 as a whole, significantly low use of surgical treatment, after full adjustment for patient and tumour characteristics, was seen in the Mid-Western, North-Western and Western and South-Eastern regions, compared with the Eastern region. This was also seen in the North-Western and Western regions for 1994-97, and the Southern and South-Eastern for 1998-2001. These patterns were essentially the same for non-small-cell cancers as for lung cancers as a whole. Case numbers were too small to examine regional patterns in surgery for small-cell cancers.

Patients from the Mid-Western, South-Eastern and Western regions during 1994-97, but only the Western region during 1998-2001, had significantly low use of radiotherapy compared with the Eastern region. Similar regional patterns were evident for non-small-cell lung cancers.

Regional variation in chemotherapy use was very marked, although there were substantial differences between diagnosis periods. Overall, patients from five regions (Midland, Mid-Western, North-Eastern, North-Western and South-Eastern) were significantly less likely, and patients from the Western region significantly more likely, to receive chemotherapy than those from the Eastern region. However, regional variation (except for the Western region) was largely confined to 1998-2001.

#### *International comparison of treatment*

For both non-small-cell and small-cell lung cancer, Irish patients were significantly less likely to receive treatment, whether overall, radiotherapy, chemotherapy or surgery, than in the USA during 1998-2001. For both cell-types, Irish cases were less likely to have a combination of radiotherapy and chemotherapy and more likely to have radiotherapy only.

## 5.1 Incidence and mortality statistics

On average, there were 1576 cases of and 1497 deaths from invasive lung cancer annually in Ireland during 1994-2001 (*Table 5.1.1*). Over this period, total numbers of cases showed a significant upward trend, but this was confined to females.

Age-standardized incidence rates fell significantly for males but increased for females. Numbers of deaths showed no significant trends, while mortality rates among males (but not females) declined significantly.

**Table 5.1.1** Incidence of and mortality from invasive lung cancer, Republic of Ireland, 1994-2001.

1994-2001	Annual average numbers						age-standardized rate <sup>a</sup>			
	total		male		female		male		female	
Incidence (cases)	1576		1014		562		63.9		28.6	
Incidence trend (per year) <sup>b</sup>	+1.1%	**	+0.1%	ns	+3.1%	***	-1.4%	**	+1.8%	**
Mortality (deaths)	1497		963		534		60.5		26.6	
Mortality trend (per year)	-0.4%	ns	-1.2%	ns	+1.2%	ns	-2.6%	***	-0.4%	ns

<sup>a</sup>European age-standardized rate per 100,000 persons per year.

<sup>b</sup>Estimated annual percentage change (ns not significant, \* P<0.05, \*\*P<0.01, \*\*\*P<0.001).

## 5.2 Cases included for treatment and survival analyses; patient and tumour characteristics

Analyses cover invasive cancers of the bronchus and lung (ICD-10 code C34) diagnosed in 11,663 persons aged 15-99 years during 1994-2001 (*Table 5.2.1*).

**Table 5.2.1** Summary of inclusions and exclusions for lung cancer analyses.

Case definition	total
all registered tumours <sup>a</sup>	12 686
ages 15-99 only	12 682
excluding death-certificate-only & autopsy-only cases	12 045
invasive tumours only	12 002
first tumours only <sup>b</sup>	<b>11 663</b>

<sup>a</sup> Including in situ carcinomas, and tumours of unspecified behaviour, but excluding lymphomas and any other cancer morphologies that are classified separately within ICD-10.

<sup>b</sup> Or most serious tumour diagnosed same date.

A breakdown of basic patient and tumour characteristics is given in *Table 5.2.2*, including comparisons between diagnosis periods 1994-97 and 1998-2001. The variables and category-values shown are those considered, later in this chapter, for inclusion in statistical models aimed at describing and if possible explaining regional variation and time-trends in survival and treatment.

For this cancer, overall numbers of cases increased only slightly between 1994-97 and 1998-2001, thus proportional changes match changes in absolute numbers of cases. Statistically significant changes

between 1994-97 and 1998-2001 in proportions of patients or tumours with particular characteristics were as follows:

- Decrease in male, increase in female patients.
- Decrease in patients aged 65-74, increase in those aged 75+ at diagnosis.
- Increase in stage III and stage IV cancers, decrease in unknown stage.
- Decrease in tumours in T4 category, decrease in T unknown.
- Increase in node-positive cancers, decrease in unknown nodal status.
- Increase in cases with and without metastases, decrease in unknown metastatic status.
- Decrease in grade 2 and grade 3+ tumours, increase in grade unknown.
- Decrease in microscopically verified (MV) cases, increase in non-MV cases.
- Decrease in symptomatic cases, increase in incidental presentation and unknown method of presentation.
- Decrease in patients with marital status unknown.
- Decrease in patients recorded as smokers, increase in patients with unknown smoking status.

Overall, these changes indicate improvements in completeness of staging but no tendency towards earlier detection.

Variation in patient and tumour characteristics by region of residence is summarized in *Table 5.2.3*.

**Table 5.2.2** Summary of patient and tumour characteristics for lung cancer patients included in survival and treatment analyses, 1994-2001.

	diagnosed 1994-2001		diagnosed 1994-1997		diagnosed 1998-2001	
	number	% of cases	number	% of cases	number	% of cases
total	11663		5734		5929	
age 15-44	234	2.0%	104	1.8%	130	2.2%
age 45-54	898	7.7%	422	7.4%	476	8.0%
age 55-64	2235	19.2%	1122	19.6%	1113	18.8%
age 65-74	4494	38.5%	2280	39.8%	2214	*37.3%
age 75+	3802	32.6%	1806	31.5%	1996	*33.7%
male	7508	64.4%	3772	65.8%	3736	*63.0%
female	4155	35.6%	1962	34.2%	2193	*37.0%
non-small-cell	6953	59.6%	3456	60.3%	3497	59.0%
small-cell	1623	13.9%	799	13.9%	824	13.9%
other/NOS	3087	26.5%	1479	25.8%	1608	27.1%
stage I	496	4.3%	258	4.5%	238	4.0%
stage II	192	1.6%	103	1.8%	89	1.5%
stage III	849	7.3%	296	5.2%	553	*9.3%
stage IV	3258	27.9%	1403	24.5%	1855	*31.3%
stage X <sup>a</sup>	6868	58.9%	3674	64.1%	3194	*53.9%
T1	935	8.0%	444	7.7%	491	8.3%
T2	2838	24.3%	1391	24.3%	1447	24.4%
T3	1057	9.1%	508	8.9%	549	9.3%
T4	2067	17.7%	817	14.2%	1250	*21.1%
T X	4766	40.9%	2574	44.9%	2192	*37.0%
N negative	1775	15.2%	838	14.6%	937	15.8%
N positive	3438	29.5%	1463	25.5%	1975	*33.3%
N X	6450	55.3%	3433	59.9%	3017	*50.9%
M negative	2190	18.8%	971	16.9%	1219	*20.6%
M positive <sup>b</sup>	3267	28.0%	1408	24.6%	1859	*31.4%
M X	6206	53.2%	3355	58.5%	2851	*48.1%
grade 1	288	2.5%	156	2.7%	132	2.2%
grade 2	1358	11.6%	750	13.1%	608	*10.3%
grade 3+	3086	26.5%	1663	29.0%	1423	*24.0%
grade X	6931	59.4%	3165	55.2%	3766	*63.5%
MV <sup>c</sup> yes	8709	74.7%	4336	75.6%	4373	*73.8%
MV no	2797	24.0%	1316	23.0%	1481	*25.0%
MV X	157	1.3%	82	1.4%	75	1.3%
symptomatic	10777	92.4%	5371	93.7%	5406	*91.2%
incidental	432	3.7%	174	3.0%	258	*4.4%
screen detected	32	0.3%	13	0.2%	19	0.3%
presentation X	422	3.6%	176	3.1%	246	*4.1%
non-smoker	1056	9.1%	503	8.8%	553	9.3%
ex-smoker	2774	23.8%	1301	22.7%	1473	*24.8%
smoker	6403	54.9%	3237	56.5%	3166	*53.4%
smoking X	1430	12.3%	693	12.1%	737	12.4%
ever married	9239	79.2%	4510	78.7%	4729	79.8%
never married	2039	17.5%	1014	17.7%	1025	17.3%
marital status X	385	3.3%	210	3.7%	175	*3.0%

<sup>a</sup>Unknown values shown as "X" for stage and other variables. <sup>b</sup>Minor discrepancies between stage IV and M positive cases reflect morphologies for which TNM staging is not strictly applicable. <sup>c</sup>MV = microscopic verification (histology or cytology).

\*Significant change in the proportion of cases in this category ( $\chi^2$  test, 1 df,  $P < 0.05$ ); but note that some further changes may be significant if cases in "unknown" categories are excluded.

**Table 5.2.3** Summary of patient and tumour characteristics, by region of residence, for lung cancer patients included in survival and treatment analyses, 1994-2001. Account is taken of the potential confounding affect of these variables in statistical models of regional variation in survival (*section 5.4.4*) and treatment (*section 5.6.3*).

	Eastern	Mid-Western	Midland	North-Eastern	North-Western	Southern	South-Eastern	Western
total cases	4686	587	875	905	753	1678	1189	990
age 15-44	2.3%	3.1%	1.6%	2.4%	1.7%	*1.4%	1.7%	1.6%
age 45-54	8.2%	*4.6%	7.8%	7.8%	7.6%	8.5%	6.9%	6.9%
age 55-64	19.7%	16.2%	*24.0%	19.4%	*16.3%	19.3%	17.8%	17.6%
age 65-74	39.3%	42.8%	37.1%	36.2%	37.8%	*36.1%	41.1%	37.1%
age 75+	30.6%	33.4%	29.5%	*34.0%	*36.5%	*34.7%	32.5%	*36.9%
male	60.7%	*69.2%	*66.3%	*65.5%	*69.1%	*64.7%	*67.0%	*68.7%
female	39.3%	*30.8%	*33.7%	*34.5%	*30.9%	*35.3%	*33.0%	*31.3%
non-small-cell	65.1%	61.3%	*47.8%	*57.8%	*53.4%	*61.0%	*53.5%	*54.4%
small-cell	15.1%	13.5%	*11.1%	13.3%	13.0%	14.9%	*12.8%	*12.0%
other/NOS	19.8%	*25.2%	*41.1%	*29.0%	*33.6%	*24.1%	*33.7%	*33.5%
stage I	5.3%	4.3%	5.4%	*2.8%	*3.1%	*3.2%	*3.6%	*3.3%
stage II	2.0%	0.9%	1.5%	1.2%	2.1%	*0.8%	1.4%	2.0%
stage III	8.3%	8.7%	7.2%	*5.6%	*5.7%	*4.4%	8.4%	8.0%
stage IV	29.7%	*25.0%	*23.9%	*25.0%	*22.8%	29.5%	27.8%	28.9%
stage X	54.7%	*61.2%	*62.1%	*65.4%	*66.3%	*62.2%	*58.8%	57.8%
T1	9.3%	8.2%	*6.4%	*13.4%	*3.7%	*6.7%	*6.2%	*6.3%
T2	24.6%	*28.8%	22.3%	24.6%	21.5%	23.9%	27.2%	*21.3%
T3	7.6%	*14.8%	6.6%	6.4%	*13.0%	*12.8%	*9.8%	6.8%
T4	15.8%	16.4%	17.6%	*9.4%	*20.2%	*21.1%	*22.2%	*22.4%
T X	42.7%	*31.9%	*47.1%	46.2%	41.6%	*35.5%	*34.5%	43.2%
N negative	16.5%	14.8%	16.6%	*11.9%	*10.9%	15.9%	16.7%	*11.7%
N positive	30.2%	31.2%	*25.6%	30.1%	*26.3%	27.7%	32.1%	30.5%
N X	53.4%	54.0%	*57.8%	*58.0%	*62.8%	*56.5%	51.1%	*57.8%
M negative	22.5%	19.9%	21.6%	*15.0%	*15.9%	*11.7%	*17.9%	*16.7%
M positive	29.8%	*25.0%	*24.1%	*25.1%	*22.8%	29.6%	27.9%	29.0%
M X	47.7%	*55.0%	*54.3%	*59.9%	*61.2%	*58.8%	*54.2%	*54.3%
grade 1	2.1%	2.9%	*4.1%	1.8%	1.6%	*3.8%	2.6%	1.2%
grade 2	12.3%	*9.0%	*8.8%	9.9%	13.4%	13.1%	13.5%	*8.4%
grade 3+	29.8%	26.4%	*21.4%	*24.0%	*24.7%	*22.2%	*23.7%	29.2%
grade X	55.8%	*61.7%	*65.7%	*64.3%	*60.3%	*60.9%	*60.2%	*61.2%
MV yes	81.0%	*76.3%	*60.3%	*72.2%	*68.3%	*76.6%	*67.9%	*68.3%
MV no	17.7%	*22.7%	*36.8%	*27.1%	*31.5%	*22.7%	*30.5%	*28.9%
MV X	1.2%	1.0%	*2.9%	0.8%	*0.3%	0.7%	1.6%	*2.8%
symptomatic	90.9%	93.2%	92.5%	*93.1%	*94.6%	*95.4%	*93.5%	90.2%
incidental	4.1%	3.7%	3.1%	3.6%	3.7%	3.3%	*2.6%	4.3%
screen detected	0.4%	0.0%	0.1%	0.1%	0.1%	0.4%	0.1%	0.1%
presentation X	4.6%	3.1%	4.3%	3.1%	*1.6%	*0.8%	3.8%	5.4%
non-smoker	6.8%	8.5%	*10.1%	6.5%	*8.9%	*16.3%	*9.5%	*8.7%
ex-smoker	25.8%	23.2%	*21.9%	26.2%	22.6%	*19.4%	24.3%	*21.8%
smoker	52.8%	*57.8%	*56.6%	52.8%	*62.5%	53.4%	55.5%	*59.8%
smoking status X	14.7%	*10.6%	*11.4%	14.5%	*6.0%	*10.8%	*10.7%	*9.7%
ever married	82.8%	*75.0%	*76.6%	*76.1%	*74.2%	*79.7%	*77.7%	*74.8%
never married	13.6%	*22.0%	*18.9%	*20.4%	*23.8%	*17.8%	*18.8%	*22.5%
marital status X	3.6%	3.1%	4.6%	3.4%	*2.0%	2.5%	3.5%	2.6%

\*Significant difference in proportion of cases, compared with Eastern region ( $\chi^2$  test, 1 df,  $P < 0.05$ )

### 5.3 Relative survival: descriptive analysis

Five-year relative survival estimates for national population, by period of diagnosis, age, sex, cell-type and other patient or tumour characteristics, are shown in *Table 5.3.1*. Survival curves, to five years after diagnosis, are plotted for the same variables in *Figure 5.3.1*. Five-year estimates by treatment status are shown in *Table 5.3.2*; and one-year, three-year and five-year estimates, nationally and regionally by diagnosis period, in *Table 5.3.3*.

Results and comparisons presented in this section are not adjusted for potential confounding variables, thus are potentially open to misinterpretation if taken at face value. More formal (multivariate) comparisons are made in *section 5.4*.

#### 5.3.1 General summary

For lung cancer cases diagnosed in Ireland during 1994-2001 as a whole, relative survival to five years after diagnosis was estimated as 8.6% (95% CI 8.0-9.2%) (*Table 5.3.1*). Equivalent figures for males were 7.9% (7.1-8.5%), for females 10.0% (8.9-11.0%). Relative survival to one year averaged 23.7% (22.9-24.5%), and to three years 10.5% (9.8-11.0%) (*Table 5.3.3*).

#### 5.3.2 Variation by patient and tumour characteristics

relative survival (to five years) was highest for age-groups under 45 years or, for other specific variables, cases that were of non-small-cell carcinoma morphologies; early stage; T category 1; node-negative; non-metastatic; grade 1 or 2; microscopically verified; incidentally detected; or in non-smokers or patients who were ever married (*Table 5.3.1 & Figure 5.3.1*). Survival was lowest in the oldest age-group (75+), and, for other variables, cases that were of small-cell or non-specific morphologies; stage IV; T categories 3-4 or unknown; node-positive or nodal status unknown; metastatic; grade 3+ or unknown; lacking microscopic verification (or with MV status unknown); cases presenting symptomatically; or in smokers, or patients with unknown smoking or marital status. Note however that patients in a given univariate category may differ in other characteristics also - see *section 5.4.1* for multivariate comparisons.

#### 5.3.3 Variation by treatment status

Patients who received any tumour-directed treatment, or surgery, within six months of diagnosis had substantially higher five-year survival than patients who did not receive these treatments: averaging 12% v 4.5% for treatment v

no treatment, and 35% v 4.2% for surgery v no surgery for 1994-2001 as a whole (*Table 5.3.2*). In contrast, survival was lower overall in patients who had radiotherapy or had chemotherapy compared with those did not. However, since patients given or not given particular treatments are likely to have differed, on average, in disease stage, cell-type or other characteristics, these figures do not provide any measure of treatment effectiveness.

#### 5.3.4 National and regional trends

National estimates of five-year survival showed some indication of an improvement, though not statistically significant, from 8.2% (95% CI 7.4-9.0%) for cases diagnosed during 1994-97 to 9.0% (8.1-9.9%) for 1998-2001 (*Table 5.3.1*). Similar apparent improvements were evident for most regions of residence, but again were not clear-cut in terms of statistical significance (*Table 5.3.3*). See *sections 5.4.2-3* for more formal comparisons, adjusted for age or other factors.

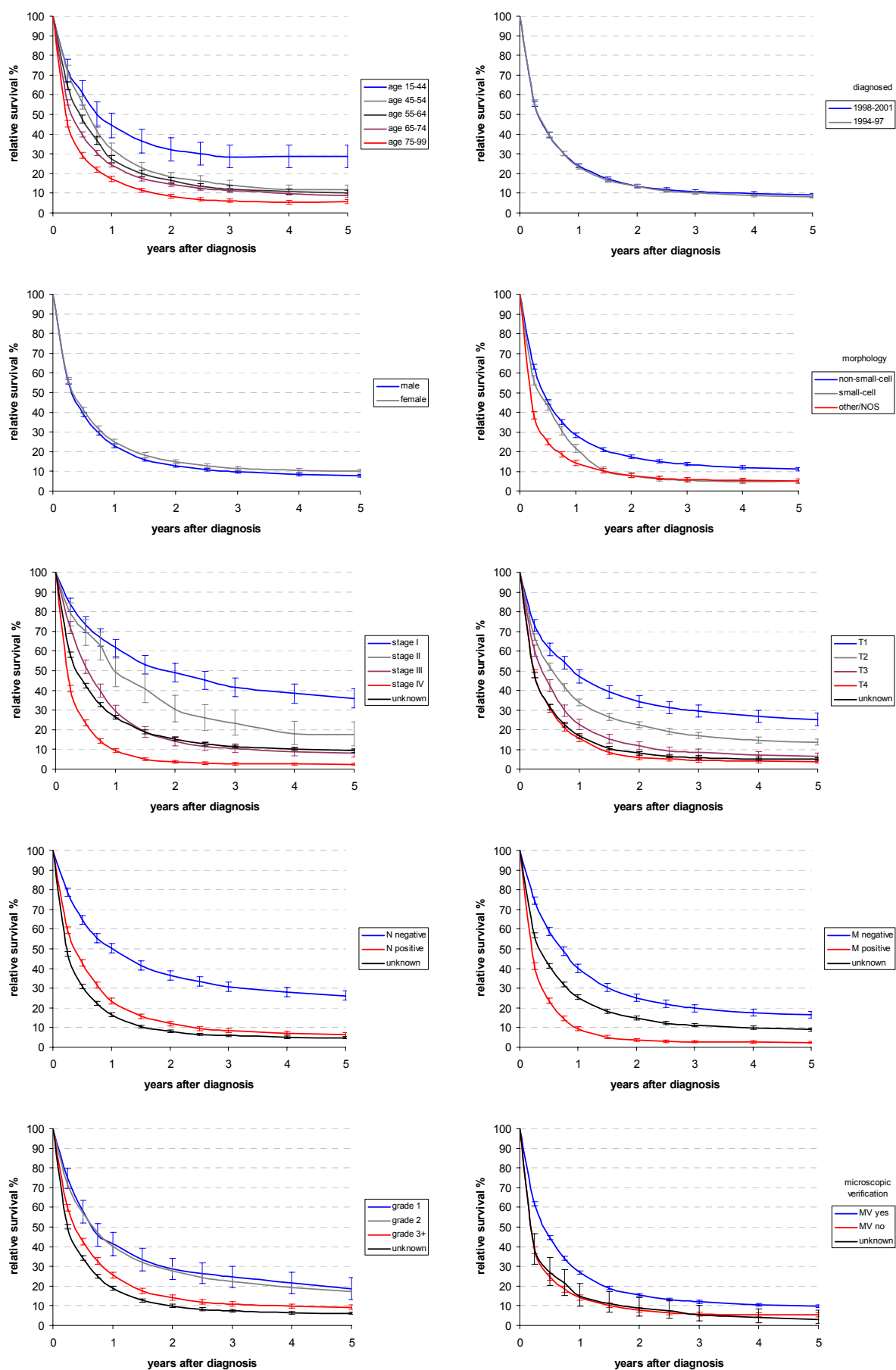
#### 5.3.5 Regional variation

Five-year relative survival estimates during 1994-2001 ranged from 7.3% (95% CI 5.9-8.9%) for patients from the Southern region to 9.9% (7.5-12.5%) for the North-Eastern region (*Table 5.3.3*). However, confidence intervals overlapped markedly between regions, and regional rankings varied between diagnosis periods. See also *section 5.4.4*.

**Table 5.3.1** National five-year relative survival for lung cancer patients, by patient and tumour characteristics, 1994-2001. Relative survival is the survival of cancer patients as a percentage of the expected survival of persons of the same age and sex in the general population.

	1994-2001		1994-1997		1998-2001	
	5-yr survival	(95% CI)	survival	(95% CI)	survival	(95% CI)
total	8.6%	(8.0%-9.2%)	8.2%	(7.4%-9.0%)	9.0%	(8.1%-9.9%)
age 15-44	28.6%	(22.9%-34.5%)	29.1%	(20.6%-38.0%)	28.2%	(20.6%-36.2%)
age 45-54	11.7%	(9.6%-14.0%)	10.5%	(7.7%-13.6%)	13.3%	(10.2%-16.6%)
age 55-64	10.1%	(8.8%-11.5%)	8.4%	(6.8%-10.2%)	12.1%	(10.0%-14.4%)
age 65-74	8.7%	(7.7%-9.6%)	9.0%	(7.7%-10.3%)	8.0%	(6.6%-9.5%)
age 75+	5.6%	(4.6%-6.7%)	5.3%	(4.0%-6.8%)	6.1%	(4.6%-7.7%)
male	7.9%	(7.1%-8.5%)	7.5%	(6.6%-8.5%)	8.2%	(7.1%-9.3%)
female	10.0%	(8.9%-11.0%)	9.6%	(8.2%-11.0%)	10.4%	(8.9%-12.0%)
non-small-cell	11.0%	(10.1%-11.8%)	10.3%	(9.1%-11.4%)	11.9%	(10.5%-13.2%)
small-cell	5.0%	(3.8%-6.2%)	5.6%	(4.0%-7.5%)	4.1%	(2.7%-5.9%)
other/NOS	5.1%	(4.1%-6.1%)	4.9%	(3.7%-6.3%)	5.3%	(3.9%-6.8%)
stage I	35.9%	(30.9%-40.8%)	35.8%	(29.3%-42.4%)	35.2%	(27.3%-43.3%)
stage II	17.6%	(11.9%-24.1%)	14.9%	(8.3%-23.3%)	21.7%	(12.8%-32.1%)
stage III	8.1%	(6.1%-10.5%)	8.4%	(5.3%-12.3%)	7.7%	(4.9%-11.1%)
stage IV	2.4%	(1.8%-3.1%)	2.6%	(1.7%-3.6%)	2.3%	(1.6%-3.3%)
stage X <sup>a</sup>	9.4%	(8.6%-10.2%)	8.3%	(7.3%-9.3%)	*10.7%	(9.4%-12.1%)
T1	25.1%	(21.9%-28.3%)	23.1%	(18.9%-27.5%)	26.7%	(21.9%-31.8%)
T2	13.7%	(12.2%-15.2%)	12.8%	(10.9%-14.8%)	14.8%	(12.6%-17.1%)
T3	6.3%	(4.7%-8.1%)	7.2%	(4.9%-9.9%)	5.2%	(3.2%-7.8%)
T4	3.8%	(2.9%-4.8%)	4.0%	(2.6%-5.6%)	3.5%	(2.3%-5.0%)
T X	5.0%	(4.2%-5.7%)	4.7%	(3.8%-5.7%)	5.3%	(4.1%-6.6%)
N negative	26.2%	(23.8%-28.5%)	25.2%	(22.0%-28.5%)	26.7%	(23.0%-30.3%)
N positive	6.5%	(5.5%-7.4%)	6.4%	(5.1%-7.8%)	6.6%	(5.2%-8.0%)
N X	4.9%	(4.2%-5.5%)	4.8%	(4.0%-5.7%)	5.0%	(4.1%-6.0%)
M negative	16.5%	(14.7%-18.3%)	18.3%	(15.6%-21.0%)	14.8%	(12.4%-17.4%)
M positive <sup>b</sup>	2.5%	(1.9%-3.1%)	2.6%	(1.8%-3.6%)	2.3%	(1.6%-3.3%)
M X	9.1%	(8.2%-9.9%)	7.7%	(6.6%-8.7%)	*10.9%	(9.4%-12.3%)
grade 1	18.4%	(13.2%-24.3%)	10.9%	(6.22%-17.0%)	*30.0%	(20.1%-40.7%)
grade 2	17.3%	(15.0%-19.7%)	16.5%	(13.7%-19.5%)	17.9%	(14.2%-21.9%)
grade 3+	9.2%	(8.1%-10.4%)	8.6%	(7.1%-10.1%)	9.7%	(7.8%-11.7%)
grade X	6.2%	(5.5%-6.9%)	6.0%	(5.0%-6.9%)	6.6%	(5.6%-7.6%)
MV yes	9.8%	(9.1%-10.5%)	9.4%	(8.4%-10.3%)	10.2%	(9.0%-11.3%)
MV no	5.3%	(4.2%-6.3%)	4.9%	(3.6%-6.4%)	5.6%	(4.2%-7.3%)
MV X	3.1%	(0.9%-7.6%)	1.7%	(0.1%-7.9%)	4.9%	(1.2%-12.4%)
symptomatic	8.1%	(7.5%-8.7%)	8.0%	(7.2%-8.8%)	8.2%	(7.3%-9.1%)
incidental	20.0%	(15.6%-24.8%)	18.5%	(12.4%-25.7%)	21.3%	(15.1%-28.2%)
screen detected	-	-	-	-	-	-
presentation X	9.0%	(6.0%-12.7%)	6.5%	(3.1%-11.5%)	12.9%	(8.7%-18.0%)
non-smoker	12.6%	(10.3%-15.0%)	14.2%	(10.9%-17.8%)	10.6%	(7.3%-14.5%)
ex-smoker	9.7%	(8.4%-11.0%)	9.0%	(7.3%-10.8%)	10.5%	(8.6%-12.5%)
smoker	7.8%	(7.1%-8.6%)	7.3%	(6.3%-8.2%)	8.5%	(7.3%-9.7%)
smoking X	7.2%	(5.7%-8.9%)	7.2%	(5.2%-9.5%)	6.9%	(4.7%-9.6%)
ever married	9.1%	(8.4%-9.7%)	8.6%	(7.7%-9.5%)	9.5%	(8.4%-10.5%)
never married	7.3%	(6.0%-8.7%)	7.1%	(5.4%-8.9%)	7.7%	(5.7%-9.9%)
marital status X	4.6%	(2.5%-7.6%)	5.1%	(2.3%-9.3%)	3.5%	(0.9%-8.8%)

<sup>a</sup>Unknown values shown as "X" for stage, T category, N category, M category, grade, microscopic verification (MV), method of presentation, marital status and smoking status. <sup>b</sup>Minor discrepancies between stage IV and M positive cases are because some M positive cases were of morphologies for which TNM staging is not strictly applicable for this site. \*Significant changes (improvements) in survival between diagnosis periods, unadjusted for age, based on non-overlap of 95% CIs; some other changes may also be significant.



**Figure 5.3.1** Relative survival up to five years after diagnosis for lung cancer patients diagnosed during 1994-2001: variation by patient and tumour characteristics. 95% confidence intervals are shown.

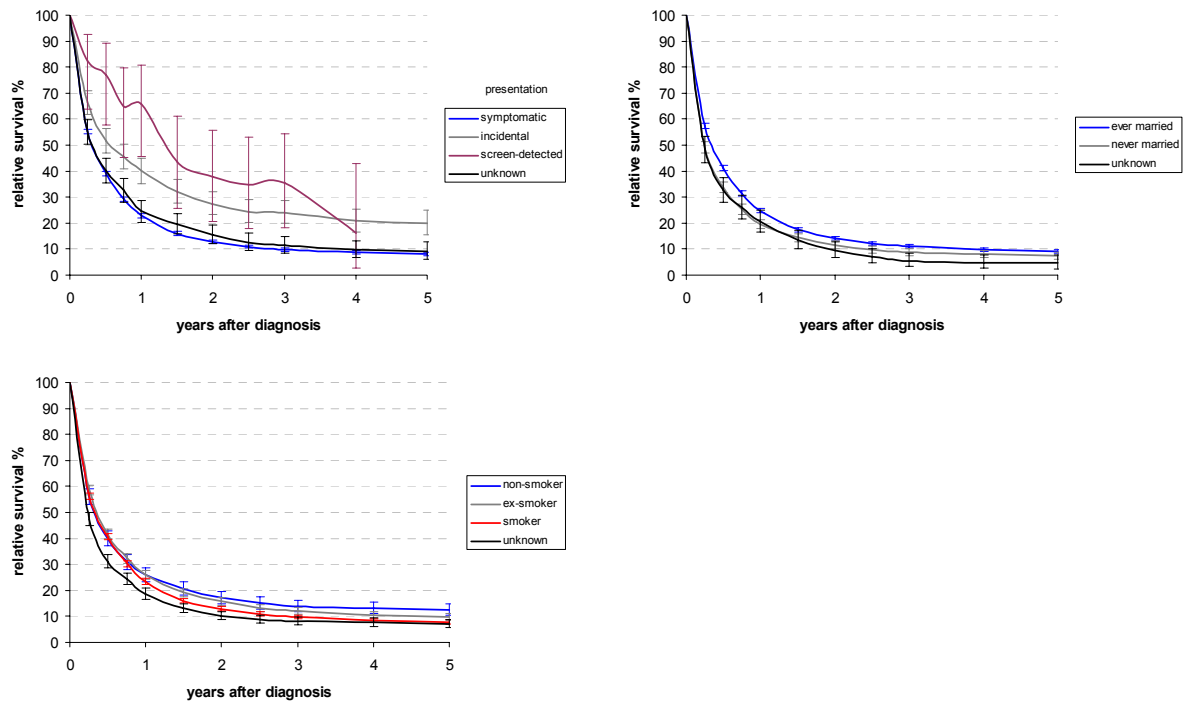


Figure 5.3.1 (continued)

**Table 5.3.2** National five-year relative survival for lung cancer patients, by treatment status (within six months of diagnosis) and period of diagnosis, 1994-2001. Relative survival is the survival of cancer patients as a percentage of the expected survival of persons of the same age and sex in the general population. Patients treated and not treated are likely to differ markedly in disease stage, age, cell-type or other characteristics, thus *differences in survival between treated and untreated patients below should not be interpreted as reflecting the effect of treatment.*

	1994-2001		1994-1997		1998-2001	
	survival	(95% CI)	survival	(95% CI)	survival	(95% CI)
total	8.6%	(8.0%-9.2%)	8.2%	(7.4%-9.0%)	9.0%	(8.1%-9.9%)
treatment	12.3%	(11.3%-13.2%)	12.0%	(10.7%-13.3%)	12.5%	(11.1%-13.9%)
no treatment	4.5%	(3.6%-5.2%)	4.2%	(3.3%-5.1%)	4.9%	(3.8%-6.0%)
surgery	34.7%	(32.0%-37.3%)	30.2%	(26.9%-33.5%)	*40.0%	(35.4%-44.4%)
no surgery	4.2%	(3.7%-4.6%)	4.0%	(3.4%-4.6%)	4.3%	(3.6%-5.0%)
radiotherapy	4.8%	(4.0%-5.6%)	4.6%	(3.5%-5.7%)	5.2%	(4.1%-6.4%)
no radiotherapy	10.4%	(9.6%-11.2%)	9.8%	(8.8%-10.8%)	11.0%	(9.7%-12.2%)
chemotherapy	5.0%	(3.9%-6.2%)	5.1%	(3.6%-6.8%)	4.8%	(3.3%-6.6%)
no chemotherapy	9.3%	(8.6%-10.0%)	8.8%	(7.9%-9.7%)	9.9%	(8.8%-10.9%)

\*Significant changes (improvements) in survival between diagnosis periods, unadjusted for age, based on non-overlap of 95% CIs.

**Table 5.3.3** One-year, three-year and five-year relative survival for lung cancer patients, unadjusted for age, by region of residence and period of diagnosis, 1994-2001. Relative survival is the survival of cancer patients as a percentage of the expected survival of persons of the same age and sex in the general population (from the same region for regional estimates).

Region	1994-2001		1994-1997		1998-2001	
	1-yr survival	(95% CI)	survival	(95% CI)	survival	(95% CI)
total	23.7%	(22.9%-24.5%)	23.4%	(22.3%-24.5%)	24.0%	(22.8%-25.1%)
E	24.7%	(23.4%-26.0%)	24.4%	(22.6%-26.1%)	25.1%	(23.3%-26.9%)
M	24.8%	(21.2%-28.4%)	24.7%	(19.5%-30.1%)	24.8%	(20.0%-29.8%)
MW	24.0%	(21.1%-26.9%)	21.8%	(17.8%-26.1%)	25.8%	(21.8%-29.8%)
NE	21.8%	(19.1%-24.6%)	23.6%	(19.4%-27.8%)	20.3%	(16.8%-24.0%)
NW	23.8%	(20.7%-27.0%)	26.3%	(21.7%-31.0%)	21.5%	(17.4%-25.8%)
S	22.6%	(20.5%-24.6%)	21.2%	(18.4%-24.1%)	23.9%	(21.0%-26.8%)
SE	22.1%	(19.7%-24.6%)	21.3%	(18.0%-24.8%)	23.0%	(19.5%-26.4%)
W	23.7%	(21.0%-26.4%)	23.7%	(19.8%-27.6%)	23.7%	(20.0%-27.5%)

Region	1994-2001		1994-1997		1998-2001	
	3-yr survival	(95% CI)	survival	(95% CI)	survival	(95% CI)
total	10.5%	(9.8%-11.0%)	10.1%	(9.2%-10.9%)	10.8%	(9.9%-11.6%)
E	10.9%	(9.9%-11.8%)	10.3%	(9.0%-11.6%)	11.5%	(10.1%-12.9%)
M	10.8%	(8.2%-13.7%)	10.7%	(7.1%-15.1%)	11.0%	(7.6%-15.0%)
MW	10.4%	(8.3%-12.6%)	9.8%	(7.0%-13.2%)	11.0%	(8.1%-14.2%)
NE	10.2%	(8.2%-12.3%)	10.5%	(7.6%-13.9%)	9.8%	(7.2%-12.8%)
NW	11.8%	(9.4%-14.4%)	13.1%	(9.6%-17.0%)	10.5%	(7.4%-14.2%)
S	9.4%	(7.9%-10.9%)	8.4%	(6.5%-10.5%)	10.4%	(8.3%-12.7%)
SE	10.5%	(8.6%-12.4%)	10.7%	(8.2%-13.5%)	10.1%	(7.7%-12.9%)
W	9.5%	(7.6%-11.6%)	8.7%	(6.2%-11.6%)	10.5%	(7.7%-13.5%)

Region	1994-2001		1994-1997		1998-2001	
	5-yr survival	(95% CI)	survival	(95% CI)	survival	(95% CI)
total	8.6%	(8.0%-9.2%)	8.2%	(7.4%-9.0%)	9.0%	(8.1%-9.9%)
E	9.0%	(8.0%-9.9%)	8.3%	(7.1%-9.5%)	9.6%	(8.1%-11.2%)
M	9.4%	(6.9%-12.4%)	8.9%	(5.5%-13.2%)	10.1%	(6.6%-14.4%)
MW	8.2%	(6.2%-10.5%)	7.8%	(5.1%-11.1%)	8.5%	(5.6%-12.2%)
NE	9.0%	(6.9%-11.2%)	8.6%	(5.8%-11.9%)	9.6%	(6.8%-12.8%)
NW	9.9%	(7.5%-12.5%)	11.3%	(7.9%-15.3%)	7.9%	(4.7%-11.9%)
S	7.3%	(5.9%-8.9%)	6.5%	(4.7%-8.5%)	8.7%	(6.4%-11.2%)
SE	8.7%	(6.9%-10.6%)	9.3%	(6.8%-12.1%)	7.8%	(5.4%-10.7%)
W	8.1%	(6.2%-10.2%)	7.4%	(5.0%-10.3%)	8.8%	(6.0%-12.1%)

## 5.4 Relative survival: modelling

### 5.4.1 Variation by patient and tumour characteristics

For assessment of regional variation in relative survival during 1994-2001, a full relative survival model was run, potentially incorporating and adjusting for available patient and tumour characteristics. These included year of follow-up (years 1 to 5 after diagnosis), age-group, stage-related variables (T, N and M categories), grade, interaction between those variables and year of follow-up, and additional patient and tumour variables without interaction terms (sex, cell-type, microscopic verification status, method of presentation, marital status, smoking status, year of diagnosis). Excluding region and year (covered later), and variables that did not contribute significantly to model-fit, statistically significant excess hazard ratios (EHRs) were recorded as follows:

- During year 1 of follow-up (for variables assessed using an interaction term for follow-up year):
  - Higher EHR (lower relative survival) for age-groups 45-54 years (1.316 [95% CI 1.088-1.592]), 55-64 (1.604 [1.340-1.919]), 65-74 (1.944 [1.629-2.319]) and 75+ (2.392 [2.002-2.859]), compared with age-group 15-44 years.
  - Higher EHR for T categories 2 (1.321 [1.193-1.464]), 3 (1.651 [1.471-1.853]), 4 (1.946 [1.753-2.161]), and unknown or non-applicable (1.709 [1.547-1.887]), compared with T category 1.
  - Higher EHR for N positive (1.689 [1.558-1.832]) and N unknown cases (1.886 [1.739-2.045]), compared with N negative cases.
  - Higher EHR for M positive (2.219 [2.071-2.378]) and M unknown cases (1.239 [1.159-1.324]), compared with M negative cases.
  - Higher EHR for grade 3+ (1.227 [1.064-1.416]) and grade unknown cases (1.207 [1.047-1.391]), compared with grade 1.
- For age, stage-related and grade variables, EHRs varied significantly during subsequent follow-up and cannot readily be summarized beyond year 1.
- Overall (for variables assessed without an interaction term for follow-up year):
  - Lower EHR (higher relative survival) for female patients (0.914 [0.877-0.954]), compared with males.
  - Higher EHR (lower relative survival) for cases of 'other or unspecified' morphology (1.391 [1.316-1.470]), compared with non-small-cell carcinoma.

- Lower EHR for cases that presented incidentally (0.706 [0.630-0.792]), were screen detected (0.330 [0.203-0.536]) or whose method of presentation was unknown (0.831 [0.742-0.930]), compared with cases presenting symptomatically.
- Higher EHR for current smokers (1.148 [1.067-1.235]) and patients of unknown smoking status (1.140 [1.041-1.249]), compared with non-smokers (never-smokers).
- Higher EHR for patients who were never married (1.198 [1.137-1.262]), compared with those who were ever married.
- Microscopic verification status did not significantly improve model fit, after adjustment for other variables, and was excluded from the full model.

These findings are broadly consistent with the variations already noted for unadjusted relative survival (*Table 5.3.1*), for the overall period 1994-2001. A number of further differences were evident from the unadjusted estimates, including significantly low survival for small-cell carcinomas, cases lacking microscopic verification or of unknown MV status, and patients of unknown marital status. However, these differences were either not significant, or the variables did not significantly contribute to model-fit, after adjustment for available patient and tumour characteristics.

### 5.4.2 National and age-specific trends

There was no significant change, overall, in relative survival for lung cancer between diagnosis periods 1994-97 and 1998-2001, having adjusted for age, sex and cell-type (*Table 5.4.1*). In specific age-groups, a significant improvement was only seen for age-group 55-64, equivalent to a 10% reduction in excess risk of death.

### 5.4.3 Regional trends

Patients resident in the North-Eastern region showed a significant reduction in relative survival between 1994-97 and 1998-2001, equivalent to a 17% increase in excess risk of death (*Table 5.4.1*). Other regions showed no significant changes.

**Table 5.4.1** Changes in relative survival between diagnosis-years 1994-97 and 1998-2001, stratified by age and region of residence, for patients diagnosed with lung cancer during 1994-2001. Excess hazard ratios in bold = significant difference from baseline (1994-1997) (EHR <1 = reduction in excess hazard thus improvement in relative survival, EHR >1 = increase in excess hazard thus reduction in relative survival). Only the basic model is shown for individual regions as regional sample sizes are generally too small too allow complex modelling.

	1998-2001 v 1994-97 <sup>a</sup> EHR (95% CI)	P
basic model: age-specific, sex-, celltype-adjusted		
age 15-44	1.053 (0.766-1.449)	0.747
age 45-54	0.918 (0.797-1.057)	0.236
age 55-64	<b>0.899</b> (0.823-0.983)	0.020
age 65-74	1.010 (0.949-1.076)	0.736
age 75+	1.056 (0.986-1.131)	0.115
basic model: sex-, age-, celltype-adjusted <sup>b</sup>		
total	0.996 (0.958-1.036)	0.878
E	0.982 (0.922-1.044)	0.568
M	1.017 (0.853-1.214)	0.845
MW	0.937 (0.812-1.081)	0.377
NE	<b>1.172</b> (1.014-1.353)	0.031
NW	1.091 (0.930-1.280)	0.281
S	0.964 (0.869-1.069)	0.490
SE	1.043 (0.921-1.181)	0.501
W	0.954 (0.832-1.094)	0.505
fuller model: sex-, age-, celltype-, stage-adjusted <sup>b</sup>		
total	0.991 (0.953-1.031)	0.678
final multivariate model <sup>b</sup>		
total	0.999 (0.960-1.040)	0.988

<sup>a</sup> EHR = excess hazard ratio (or "relative excess risk")

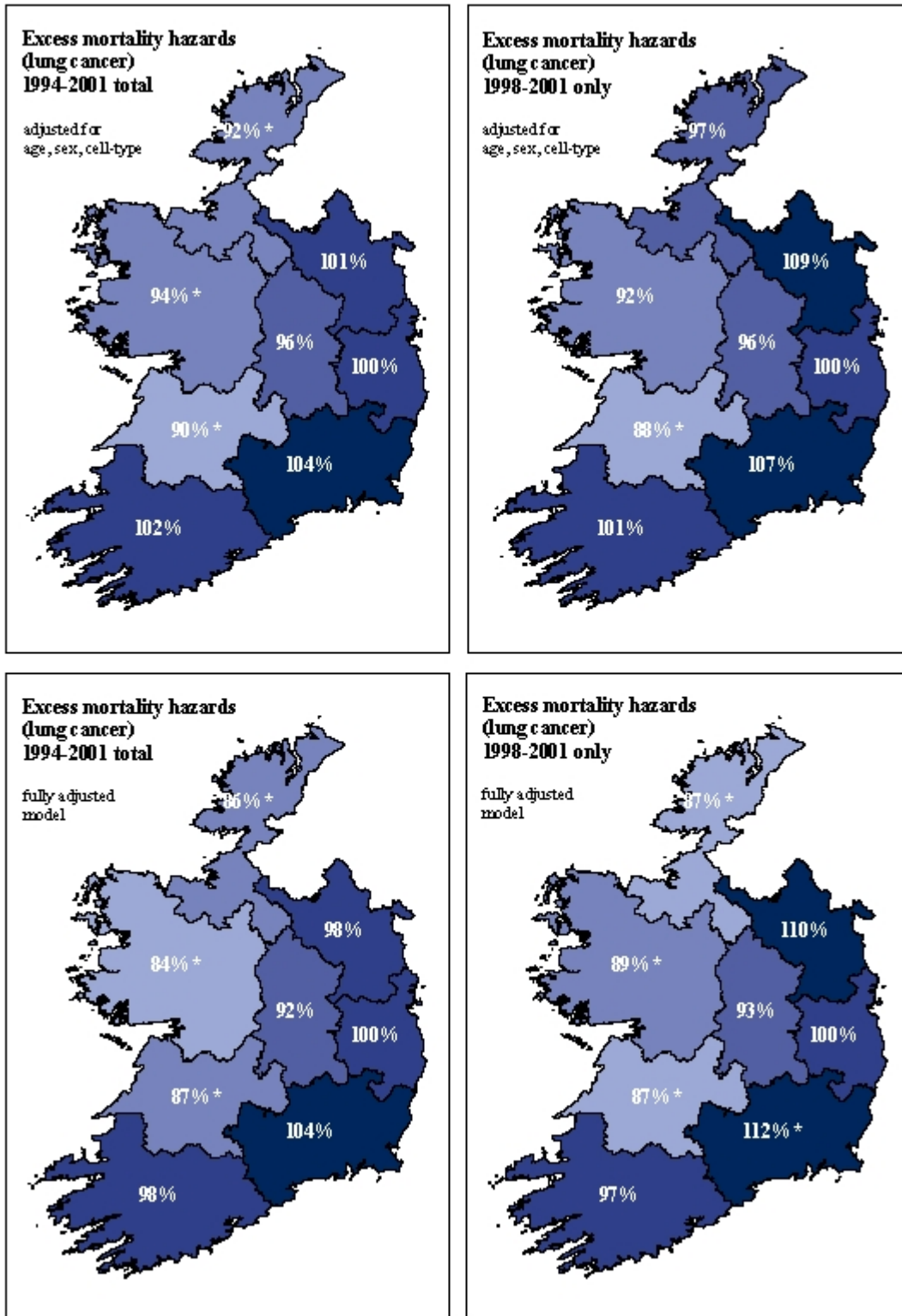
<sup>b</sup> See *Table 5.4.2* but region and diagnosis year excluded here.

### 5.4.4 Regional variation

Moderate regional variation in relative survival (as assessed by modelling of excess hazard ratios) was evident. For the period 1994-2001 as a whole, patients resident in the Mid-Western and North-Western regions had a significantly lower (by 8-10%) excess risk of death - i.e. higher relative survival - compared with patients from the Eastern region, based on comparisons adjusted for age, sex and cell-type (*Figure 5.4.1, Table 5.4.2*). This was significant only for North-Western region in 1994-97 and Mid-Western region in 1998-2001. After further adjustment, for stage-related variables, two further regions had significantly reduced excess risk of death - the Western region overall and in 1994-97, and the North-Eastern region in 1994-97. However, the North-Eastern and South-Eastern regions had significantly higher excess risk (lower survival) than the Eastern region during the most recent period, 1998-2001, after adjustment for stage.

In the fully adjusted model, taking account of a wider range of patient and tumour characteristics, three regions had a significantly low excess risk of death (compared with the Eastern region) during 1994-2001: Mid-Western (13% lower than the Eastern), North-Western (15% lower) and Western (14% lower) (*Figure 5.4.1, Table 5.4.2*). Again, regional variation was higher than in the basic model, and not fully consistent between the two diagnosis periods. However, three regions (Mid-Western, North-Western and Western) showed a significantly low excess risk in both 1994-97 and 1998-2001. Only one region (South-Eastern in 1998-2001) showed a significantly high excess risk of death based on the fully adjusted model (12% higher than for the Eastern region in 1998-2001).

In interpreting these analyses, the low average survival of lung cancer patients should be borne in mind. Statistically significant differences in survival may involve only small absolute gains or losses in survival. In addition to this, the modifying effects of stage-related and other variables on regional comparisons are difficult to interpret, given the particularly high proportions of lung cancer cases lacking specific data for many variables (see *Table 5.2.3*). This may be accentuated by the low survival figures involved and the tendency for survival to be particularly poor in patients lacking specific diagnostic or staging information (*section 5.4.1*).



**Figure 5.4.1** Regional variation in excess mortality hazards (based on relative survival) for lung cancer, expressed in comparison with patients from the Eastern region (100%): 1994-2001 total (left), 1998-2001 (right); basic model adjusted for age, sex & cell-type (top), fully-adjusted model (bottom). See *Table 5.4.2* for further details. \* = significantly high or low excess risk (P<0.05).

**Table 5.4.2** Variation in relative survival, by region of residence, for patients diagnosed with lung cancer during 1994-2001. Analysis is based on survival up to five years from diagnosis. Excess hazard ratios in bold = significant difference from Eastern region (EHR <1 = lower excess hazard thus higher relative survival than in Eastern region, EHR >1 = higher excess hazard thus lower relative survival).

	1994-2001		1994-1997		1998-2001	
	<sup>a</sup> EHR (95% CI)	P	EHR (95% CI)	P	EHR (95% CI)	P
basic model: sex-, age-, celltype-adjusted <sup>b,c,d</sup>						
E	1.000		1.000		1.000	
M	0.957 (0.872-1.050)	0.361	0.945 (0.824-1.083)	0.419	0.964 (0.849-1.095)	0.578
MW	<b>0.896</b> (0.828-0.970)	0.007	0.915 (0.816-1.027)	0.134	<b>0.876</b> (0.786-0.977)	0.017
NE	1.008 (0.933-1.088)	0.837	0.925 (0.827-1.035)	0.179	1.087 (0.978-1.208)	0.121
NW	<b>0.915</b> (0.841-0.995)	0.039	<b>0.867</b> (0.768-0.978)	0.021	0.971 (0.863-1.093)	0.634
S	1.017 (0.958-1.080)	0.562	1.021 (0.938-1.111)	0.627	1.007 (0.925-1.096)	0.866
SE	1.038 (0.969-1.112)	0.279	1.009 (0.915-1.112)	0.855	1.067 (0.968-1.177)	0.186
W	0.939 (0.871-1.011)	0.100	0.961 (0.864-1.068)	0.463	0.915 (0.824-1.017)	0.103
fuller model: sex-, age-, cell-, stage-adjusted <sup>b,c,d,e</sup>						
E	1.000		1.000		1.000	
M	0.954 (0.868-1.047)	0.324	0.905 (0.789-1.039)	0.158	0.982 (0.864-1.116)	0.788
MW	<b>0.891</b> (0.824-0.965)	0.005	<b>0.880</b> (0.784-0.988)	0.030	<b>0.893</b> (0.800-0.996)	0.043
NE	1.001 (0.926-1.081)	0.975	<b>0.870</b> (0.777-0.975)	0.017	<b>1.142</b> (1.027-1.271)	0.014
NW	<b>0.869</b> (0.798-0.946)	0.001	<b>0.837</b> (0.741-0.945)	0.004	0.896 (0.796-1.009)	0.072
S	0.983 (0.925-1.044)	0.582	0.963 (0.883-1.050)	0.395	0.991 (0.909-1.080)	0.843
SE	1.049 (0.979-1.124)	0.173	0.980 (0.888-1.081)	0.690	<b>1.131</b> (1.026-1.247)	0.013
W	<b>0.859</b> (0.797-0.926)	0.000	<b>0.808</b> (0.726-0.899)	0.000	0.909 (0.818-1.011)	0.079
final multivariate model <sup>b,f</sup>						
E	1.000		1.000		1.000	
M	0.924 (0.841-1.015)	0.103	0.903 (0.786-1.037)	0.150	0.931 (0.818-1.059)	0.279
MW	<b>0.871</b> (0.804-0.943)	0.001	<b>0.856</b> (0.762-0.961)	0.009	<b>0.868</b> (0.777-0.969)	0.012
NE	0.976 (0.903-1.055)	0.547	<b>0.857</b> (0.764-0.960)	0.008	1.104 (0.991-1.229)	0.071
NW	<b>0.855</b> (0.785-0.931)	0.000	<b>0.835</b> (0.739-0.944)	0.004	<b>0.872</b> (0.773-0.983)	0.026
S	0.978 (0.919-1.039)	0.478	0.969 (0.888-1.058)	0.486	0.973 (0.892-1.061)	0.538
SE	1.035 (0.966-1.109)	0.324	0.968 (0.877-1.069)	0.530	<b>1.119</b> (1.014-1.235)	0.024
W	<b>0.839</b> (0.779-0.905)	0.000	<b>0.785</b> (0.705-0.875)	0.000	<b>0.894</b> (0.804-0.994)	0.040

<sup>a</sup>EHR = excess hazard ratio (or “relative excess risk”) estimated by a generalized linear model (GLM) with a Poisson error structure, fitted to exact survival times and collapsed observations.

<sup>b</sup>Models included interaction terms between follow-up interval (years 1-5) and age (plus stage-related variables in fuller and final models), equivalent to stratification by these variables, to allow for non-proportional hazards across follow-up time.

<sup>c</sup>Age-categories: EUROCARE age-groups 15-44, 45-54, 55-64, 65-74, 75+.

<sup>d</sup>Cell-type: non-small-cell (NSCLC), small-cell (SCLC) or other/unspecified lung cancer.

<sup>e</sup>Stage-related variables: T categories 1-4 & unknown; N category negative, positive, unknown; M category negative, positive, unknown.

<sup>f</sup>Final (full) multivariate model, also including: grade 1, 2, 3+ or unknown; method of presentation (symptomatic, incidental, screen-detected, unknown); smoking status (non, ex, smoker, unknown); marital status (ever married, never married, unknown). [Microscopic verification status and individual year of observation did not significantly improve model-fit and were excluded.]

## 5.5 Treatment: Descriptive analysis

### 5.5.1 General comment

Analyses here are confined to *treatments administered within six months after diagnosis*. Variations in treatment between patient groups may, to some extent, reflect variations in the timing of treatment, but for this cancer the majority of first-line treatments should be included.

### 5.5.2 General summary of treatment

Of the total 11,683 lung cancer cases included in analyses for the period 1994-2001, 53% had some form of definitive or tumour-directed treatment within six months of diagnosis, 32% had radiotherapy, 15% had chemotherapy and 14% had surgery (*Table 5.5.1*). Equivalent figures for the most recent period, 1998-2001, were 5929 cases, of which 54% were treated, 34% had radiotherapy, 16% had chemotherapy and 13% had surgery (*Table 5.5.1, Figure 5.5.2*). A further breakdown by age is shown in *Table 5.5.1* and *Figure 5.5.1*.

The most frequent treatments or combinations were radiotherapy only (24% of cases 1994-2001), surgery only (12%), and chemotherapy only (8.9%). For the most recent period (1998-2001), equivalent figures were 25%, 10% and 9%,

representing a significant increase in the use of radiotherapy and a significant decrease in surgery compared with 1994-97 (*Table 5.5.1*). Only chemotherapy plus radiotherapy (5.6% 1994-2001) and surgery plus radiotherapy (2.0%) made up more than 1% of treatments, and use of the former combination increased significantly between the periods 1994-97 and 1998-2001.

Equivalent figures by lung cancer cell-type are shown in *Table 5.5.2*. The main treatments for non-small-cell lung cancer (NSCLC) were radiotherapy (40% of 1994-2001 cases), surgery (23%) and to a lesser extent chemotherapy (11.5%); use of radiotherapy and chemotherapy fell significantly, but surgery increased, between 1994-97 and 1998-2001. Most NSCLC cases received a single treatment modality. For small-cell lung cancers (SCLC), chemotherapy was the main treatment (56% of 1994-2001 cases), radiotherapy to a lesser extent (27%); radiotherapy use increased significantly but chemotherapy use fell significantly between 1994-97 and 1998-2001. A substantial proportion of SCLC cases received multimodal treatment, in particular chemotherapy plus radiotherapy (17%).

**Table 5.5.1** Summary of main treatment modalities and combinations (within six months of diagnosis) for lung cancer patients, by age and diagnosis period, 1994-2001. Only treatments or combinations making up at least 1% of cases in any period are listed.

	1994-2001					total	1994-97	1998-2001	
	age 15-44	44-54	55-64	65-74	75+		subtotal	subtotal	
total cases	234	898	2235	4494	3802	11 663	5734	5929	
any treatment	82.5%	76.3%	71.2%	56.5%	30.5%	52.9%	51.5%	54.2%	*
no treatment	17.5%	23.7%	28.8%	43.5%	69.5%	47.1%	48.5%	45.8%	*
any radiotherapy	43.6%	42.0%	41.2%	32.5%	22.3%	31.8%	29.4%	34.0%	*
any chemotherapy <sup>a</sup>	34.2%	32.6%	24.6%	15.4%	4.6%	15.3%	14.3%	16.3%	*
any surgery <sup>b</sup>	32.1%	22.4%	20.4%	16.6%	5.2%	14.4%	15.8%	13.0%	*
radiotherapy only	18.8%	22.8%	27.4%	24.8%	20.4%	23.6%	22.1%	25.0%	*
surgery only	23.5%	16.1%	15.7%	13.8%	4.7%	11.6%	12.8%	10.4%	*
chemotherapy only	14.1%	16.4%	13.4%	9.7%	3.2%	8.9%	8.7%	9.0%	
chemo + radio	17.5%	14.1%	9.6%	5.0%	1.3%	5.6%	4.8%	6.4%	*
surgery + radio	6.0%	4.0%	3.2%	2.2%	0.4%	2.0%	2.2%	1.8%	
others	2.6%	2.8%	1.9%	1.1%	0.6%	1.2%	1.0%	1.5%	*

<sup>a</sup>Chemotherapy and related treatments (excluding hormonal therapy). <sup>b</sup>Surgery and related treatments.

\*Significant difference between diagnosis periods in percentage having this treatment ( $\chi^2$  tests), unadjusted for age or other variables.

**Table 5.5.2** Summary of main treatment modalities and combinations (within six months of diagnosis) for lung cancer patients, by cell-type and diagnosis period, 1994-2001.

	NSCLC <sup>a</sup>			SCLC <sup>b</sup>			other <sup>c</sup>		
	94-01	94-97	98-01	94-01	94-97	98-01	94-01	94-97	98-01
total cases	6953	3456	3497	1623	799	824	3087	1479	1608
any treatment	64.9%	62.6%	*67.2%	67.3%	71.0%	*63.7%	18.2%	15.2%	*21.0%
no treatment	35.1%	37.4%	*32.8%	32.7%	29.0%	*36.3%	81.8%	84.8%	*79.0%
any radiotherapy	39.7%	37.6%	*41.8%	27.3%	23.8%	*30.7%	16.2%	13.4%	*18.8%
any chemotherapy <sup>a</sup>	11.5%	8.7%	*14.2%	55.7%	61.6%	*50.0%	2.8%	2.0%	*3.5%
any surgery <sup>b</sup>	23.1%	25.0%	*21.3%	3.0%	4.0%	2.1%	0.6%	0.7%	0.5%
radiotherapy only	30.8%	29.7%	*31.9%	9.7%	7.1%	*12.1%	14.6%	12.4%	*16.7%
surgery only	18.9%	20.6%	*17.2%	1.5%	1.8%	1.3%	0.4%	0.6%	0.2%
chemotherapy only	5.5%	3.8%	*7.1%	37.5%	43.9%	*31.2%	1.5%	1.1%	1.9%
chemo + radio	4.9%	3.9%	*5.9%	16.9%	15.6%	18.1%	1.3%	0.9%	1.6%
surgery + radio	3.3%	3.6%	3.0%	0.2%	0.3%	0.1%	0.1%	0.1%	0.2%
others	1.6%	1.0%	*2.1%	1.5%	2.3%	0.8%	0.4%	0.1%	0.6%

<sup>a</sup>Non-small-cell lung cancer. <sup>b</sup>Small-cell lung cancer. <sup>c</sup>Other morphologies (non-carcinomas and non-specific cancer).

\*Significant difference between diagnosis periods in percentage having this treatment ( $\chi^2$  tests), unadjusted for age or other variables.

### 5.5.3 Region of surgical treatment v. region of residence

Only a minority of lung cancer patients receive surgical treatment, thus information on region of surgical treatment is of limited value compared with other major cancers. From the information available, however, it is clear the majority of patients, from six of the eight regions, had their main surgical treatment in the Eastern region

(Table 5.5.3). This included all surgical patients from the Eastern regions and over 85% of those from the Midland, North-Eastern and North-Western regions, whether based on 1998-2001 or 1994-2001 data. Only in the Southern and Western regions did most patients have their surgical treatments locally (97% and 55% of 1994-2001 cases, respectively), although in the more recent period (1998-2001) 58% of Western patients had surgery in the Eastern region.

**Table 5.5.3** Breakdown of lung cancer surgery, 1994-2001, by region of residence and region where main surgery was performed, expressed as percentages of surgically-treated cases. Only surgical procedures within 6 months of diagnosis are included.

Region where treated	Region of residence																	
	1994-2001 total									1998-2001 subtotal								
	E	M	MW	NE	NW	S	SE	W	Total	E	M	MW	NE	NW	S	SE	W	Total
Eastern	% 100.0	97.6	53.2	96.8	87.7	2.6	75.3	44.6	77.8	100.0	100.0	54.3	95.6	92.3	4.2	76.5	58.1	80.2
Midland	% 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mid-Western	% 0.0	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	6.5	0.0	0.0	0.0	0.0	0.0	0.4
North-Eastern	% 0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.4
North-Western	% 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Southern	% 0.0	0.0	25.5	0.0	0.0	97.4	20.1	0.0	16.9	0.0	0.0	30.4	0.0	0.0	95.8	19.1	0.0	15.4
South-Eastern	% 0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.4
Western	% 0.0	2.4	8.5	0.0	12.3	0.0	0.0	55.4	3.9	0.0	0.0	8.7	0.0	7.7	0.0	0.0	41.9	3.3

### 5.5.4 Hospital caseloads (surgical cases)

Lung cancer cases were surgically treated (within six months of diagnosis) in a total of 29 hospitals in the Republic of Ireland during 1994-2001 (Table 5.5.4). In contrast to other major cancers (breast,

colorectal and lung), there were indications that the number of hospitals where lung cancer patients had surgical treatment increased, and average surgical caseloads by hospital fell, during the period 1994-

2001. However, only a small proportion of lung cancer patients had surgical treatment, thus surgical caseload estimates may be less meaningful than for breast or colorectal cancer, for example.

About half (2-8 annually) of the hospitals involved in surgery in any given year treated fewer than 10 surgical cases each, accounting for between 44% and 11% of annual totals. About two-thirds (5-12) of the hospitals treated fewer than 20 surgical cases each in a given year (19% to 40% of annual totals), and almost all (8-12) treated fewer than 50 surgical cases (56% to 100% of annual totals).

Apparent declines in average surgical caseloads per hospital were supported by significant increases in the proportion of surgical cases treated in hospitals averaging fewer than 20, or fewer than 50, surgical cases annually.

### 5.5.5 Consultant caseloads (surgical cases)

A total of 99 individual consultants were coded as responsible for surgical managements of lung cancers diagnosed during 1994-2001. Of these, there were more during 1998-2001 (68) than 1994-97 (51), with between 20 and 34 consultants

involved in any given year, though the overall trend was not clear-cut (*Table 5.5.5*).

Most surgical consultants in any given year treated fewer than 10 surgical cases each, accounting for 10%-21% of annual totals. Almost all treated fewer than 20 surgical cases each in a given year (10%-65% of annual totals), and in most years no consultant was responsible for more than 50 surgical cases. However, as noted under hospital caseloads, most lung cancer patients did not have surgical treatment.

There was some evidence that average surgical caseloads, by consultant, decreased over time. Reflecting this, significant increases during 1994-2001 were seen in the proportions of surgical patients treated by 'low volume' consultants, treating fewer than 10 or, especially, fewer than 20 surgical cases annually (*Table 5.5.5*). These trends may in part reflect decreases in the proportions of lung cancer patients having surgery (*section 5.6.2*), along with only a small annual increase (none for males) in total case-numbers annually (*section 5.1.1*).

**Table 5.5.4** Summary of surgical caseloads by year of diagnosis and hospital, based on lung cancer patients having surgical treatment within six months of diagnosis (invasive cancers only). For this table, but not main treatment analyses, patients are counted once (for a given diagnosis year or diagnosis period) for *each* hospital where surgical treatment received, excluding unidentified hospitals and those outside the Republic of Ireland

	1994	1995	1996	1997	1998	1999	2000	2001		94-97	98-01
hospitals (1+ case)	14	12	14	9	15	11	12	15		19	24
case average	19	20	16	22	14	19	15	14		12	8
<10 cases/year <sup>a</sup>	7	6	6	2	8	5	6	8		12	17
% of cases	10.1	9.4	4.3	5.1	8.1	11.2	8.7	7.4		8.0	7.1
<20 cases/year	9	8	9	5	12	7	8	11		14	19
% of cases	20.1	22.6	19.1	30.1	39.2	25.2	26.8	28.9	**	18.5	19.3
<50 cases/year	12	11	13	8	14	10	12	14		18	23
% of cases	55.6	64.7	74.3	66.8	66.0	70.6	100	72.1	***	70.7	71.2
50+ cases/year	2	1	1	1	1	1	0	1		1	1
% of cases	44.4	35.3	25.7	33.2	34.0	29.4	0.0	27.9		29.3	28.8

<sup>a</sup>Surgical caseloads per year (individual years or averaged across four years – latter not equivalent to average of annual caseloads).

\* P<0.05, \*\* P<0.01, \*\*\* P<0.001: significant trend (1994 to 2001, Mantel's trend test, 1 d.f.) or difference (1994-97 v. 1998-01,  $\chi^2$  test, 1 d.f.) in proportion of patients treated in hospitals of a given caseload.

**Table 5.5.5** Summary of surgical caseloads by year of diagnosis and surgical consultant, based on lung cancer patients having surgical treatment within six months of diagnosis (invasive cancers only). For this table, but not main treatment analyses, patients are counted once (for a given diagnosis year or diagnosis period) for *each* surgical consultant involved, excluding unknown consultants and those based outside the Republic of Ireland

	1994	1995	1996	1997	1998	1999	2000	2001		94-97	98-01	
consultants (1+ case)	29	20	20	23	26	22	27	34		51	68	
case average	9	12	12	9	8	10	7	6		5	3	
<10 cases/year <sup>a</sup>	22	14	14	17	20	14	19	26		45	60	
% of cases	12.5	9.8	14.3	16.6	19.4	16.9	13.0	20.9	**	14.6	20.7	***
<20 cases/year	24	14	15	17	23	19	25	31		45	64	
% of cases	23.2	9.8	21.7	16.6	43.6	54.0	65.2	56.8	***	14.6	48.4	***
<50 cases/year	27	20	20	23	25	22	27	34		51	68	
% of cases	61.2	100	100	100	73.5	100	100	100		100	100	
50+ cases/year	2	0	0	0	1	0	0	0		0	0	
% of cases	38.8	0.0	0.0	0.0	26.5	0.0	0.0	0.0		0.0	0.0	

<sup>a</sup>Surgical caseloads per year (individual years or averaged across four years – latter not equivalent to average of annual caseloads).  
 \* P<0.05, \*\* P<0.01, \*\*\* P<0.001: significant trend (1994 to 2001, Mantel’s trend test, 1 d.f.) or difference (1994-97 v. 1998-01,  $\chi^2$  test, 1 d.f.) in proportion of patients treated by surgical consultants of a given caseload.

### 5.5.6 Variation by patient and tumour characteristics

More detailed comparisons are made under the section covering logistic regression analysis (section 5.6.1). Basic tabulations of treatment for each category of patient or tumour are shown in Table 5.5.6. Detailed comments are not provided here, but note that cases in older patients or of unknown cell-type tended to be less likely to receive a given treatment. It should also be noted that these tabulations are based on unadjusted data – i.e. patients or tumours compared under a given variable may also differ in other characteristics, some of which may be more important determinants of treatment.

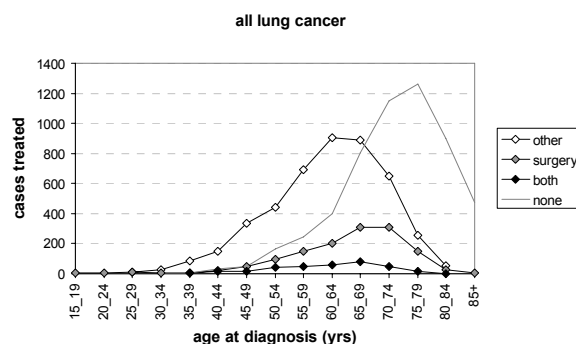
See also Table 5.5.1 and Figure 5.5.1 for further summaries of treatments in relation to age.

### 5.5.7 National trends

See section 5.5.2.

### 5.5.8 Regional variation

Regional variations in treatment, unadjusted for patients or tumour characteristics, are summarized for the period 1998-2001 in Figure 5.5.2 (all lung cancer) and Figure 5.5.3 (for major cell-types). For lung cancer as a whole, approximately two-fold variation between patients from different regions was apparent for surgery (range 8-16% of regional cases), radiotherapy (range 20-37%) and

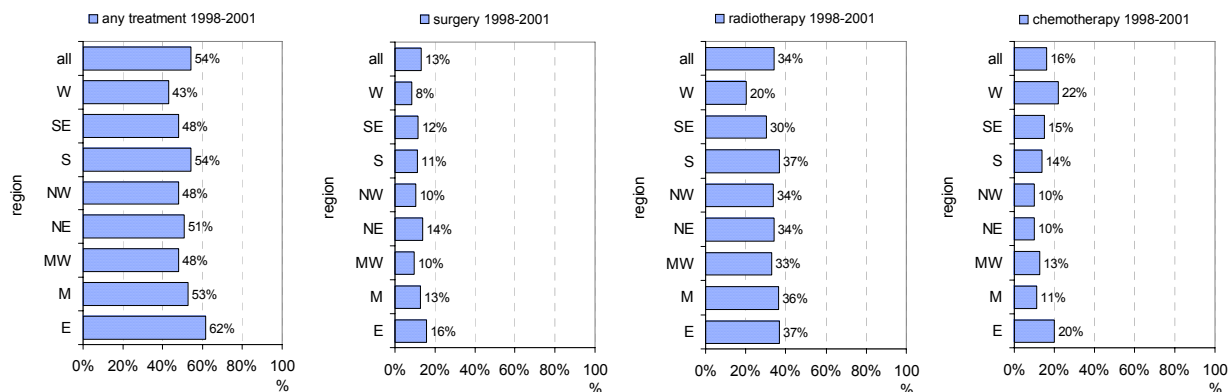


**Figure 5.5.1** Age-profiles for tumour-directed treatments within six months of diagnosis for lung cancer cases diagnosed 1994-2001: numbers of cases having surgery (only), other treatments (radiotherapy, chemotherapy or hormone therapy but not surgery), both surgery and other treatments, or no treatment.

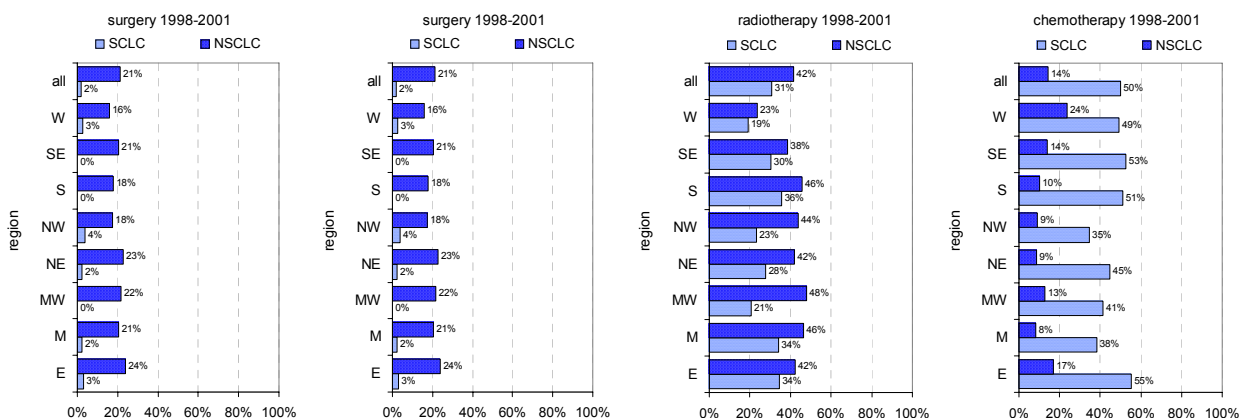
chemotherapy (range 10-22%) (Figure 5.5.2). There was apparently little in common between patterns for different modalities, except that use of all three modalities was high among patients from the Eastern region. Overall treatment varied somewhat less (range 43-62%), but was highest for the Eastern region. Regional variations in treatments for non-small-cell and small-cell lung cancers (Figure 5.5.3) were of broadly similar magnitude to those for lung cancer as a whole. However, overall treatment for both cell-types, surgery for NSCLC and chemotherapy for SCLC appeared to vary less between regions than for lung cancer as a whole. This suggests that some

regional variation may reflect regional differences in the specificity of diagnoses or in treatment of non-specific cancer types. Broadly similar patterns, or extent of regional variation, were also seen during 1994-97 (not presented). More

rigorous comparisons of treatments between regions, taking account of age and where possible other patient and tumour characteristics, are presented under *section 5.6* for both 1994-97 and 1998-2001.



**Figure 5.5.2** Percentage of lung cancer cases having tumour-directed treatment within six months of diagnosis, by region of residence, 1998-2001.



**Figure 5.5.3** Percentage of lung cancer cases having tumour-directed treatment within six months of diagnosis, by region of residence and cell-type, 1998-2001.

**Table 5.5.6** Summary of treatment of lung cancer cases, 1998-2001, by patient and tumour characteristics: unadjusted percentages receiving treatment within six months of diagnosis. See *Table 5.2.2* for sample sizes.

	Overall treatment	Surgery	Radiotherapy	Chemotherapy
total cases	54.2%	13.0%	34.0%	16.3%
age 15-44 <sup>a</sup>	84.6%	33.1%	45.4%	33.8%
age 45-54	78.2%	20.4%	44.5%	34.9%
age 55-64	71.7%	19.8%	42.9%	25.7%
age 65-74	58.0%	14.1%	35.1%	16.9%
age 75+	32.5%	4.8%	24.6%	4.9%
male	55.6%	13.2%	35.3%	16.2%
female	51.8%	12.6%	31.9%	16.5%
non-small-cell	67.2%	21.3%	41.8%	14.2%
small-cell	63.7%	2.1%	30.7%	50.0%
other/NOS	21.0%	0.5%	18.8%	3.5%
stage I	71.4%	46.6%	23.1%	8.4%
stage II	68.5%	52.8%	25.8%	12.4%
stage III	66.5%	9.9%	46.7%	29.1%
stage IV	52.0%	3.6%	37.4%	20.6%
stage X <sup>a</sup>	51.7%	15.3%	30.9%	12.3%
T1	63.7%	34.4%	24.6%	12.2%
T2	62.7%	29.1%	30.3%	14.2%
T3	61.2%	13.3%	43.9%	15.8%
T4	56.9%	4.4%	39.4%	23.3%
T X	43.2%	2.3%	33.0%	14.7%
N negative	71.2%	41.3%	27.1%	11.5%
N positive	62.2%	14.4%	39.3%	22.8%
N X	43.7%	3.2%	32.7%	13.6%
M negative	65.5%	19.6%	38.7%	22.1%
M positive	52.0%	3.7%	37.4%	20.8%
M X	50.8%	16.2%	29.8%	10.9%
grade 1	67.4%	41.7%	22.0%	6.8%
grade 2	77.3%	39.3%	38.2%	10.2%
grade 3+	68.9%	21.7%	38.9%	23.3%
grade X	44.5%	4.4%	31.9%	15.0%
MV yes	66.3%	17.5%	39.5%	21.0%
MV no	20.3%	0.3%	18.6%	3.1%
MV X	21.3%	0.0%	17.3%	4.0%
symptomatic	54.5%	12.2%	35.0%	16.6%
incidental	55.4%	27.9%	24.4%	10.1%
screen detected	36.8%	36.8%	10.5%	0.0%
presentation X	47.2%	13.0%	24.4%	16.7%
non-smoker	48.6%	11.2%	28.4%	15.9%
ex-smoker	58.2%	16.0%	35.1%	15.4%
smoker	56.4%	13.1%	36.1%	17.8%
smoking status X	40.8%	7.7%	27.1%	12.1%
ever married	56.9%	14.1%	35.3%	17.6%
never married	44.9%	9.3%	29.1%	12.0%
marital status X	35.4%	5.1%	27.4%	7.4%

<sup>a</sup>See *Table 5.5.1* for a further breakdown by age, for the overall period 1994-2001.

## 5.6 Treatment: logistic regression analysis

### 5.6.1 Variation by patient and tumour characteristics

Preliminary multivariate logistic regression models were used to assess variation in treatments in relation to patient and tumour characteristics other than region of residence and year of diagnosis (before examining those). Comparisons here are with baseline groups for relevant variables – diagnosis age 15-44, male, non-small-cell morphology, T category 1 (smallest size/local extension), N negative (no nodal involvement), M negative (no distant metastasis), tumour grade 1, microscopically verified (MV), symptomatic method of presentation, non-smoker and ever married – having adjusted for all variables shown in the relevant table (*Tables 5.6.1-4*). The main comparisons are based on data for 1994-2001 as a whole (or 1996-2001 for chemotherapy and hormonal therapy). However, attention is drawn to any significant differences in patterns between the diagnosis periods 1994-97 and 1998-2001.

#### *Overall treatment*

For 1994-2001 as a whole, treatment was significantly less likely, compared with baseline groups, for patients aged 55 or above; tumours of unspecified or non-carcinoma morphology; T category 4 or unknown; N category positive or unknown; M category positive or unknown; grade unknown; cases lacking microscopic verification; and for patients who were never married or whose marital status was unknown (*Table 5.6.1*). Treatment was significantly more likely for small-cell (compared with non-small-cell) carcinomas; tumours of grade 2; and ex-smokers. Patterns were very similar for the diagnosis periods 1994-97 and 1998-2001, and relative risk values showed no significant changes.

#### *Surgery*

Surgical treatment was significantly less likely for age-groups 45 or over; small-cell (compared with non-small-cell) carcinomas; and cases that were T category 2, 3, 4 or unknown; N category positive or unknown; metastatic; grade unknown; lacking microscopic verification; and for smokers and patients who were never married (*Table 5.6.2*). Surgical treatment was more likely for cases of unknown metastatic status or whose method of presentation was incidental, screen-detected or unknown. Patterns were broadly similar between diagnosis periods, and relative risk values differed significantly only for T categories 3 and 4 and M category unknown. However, the magnitude of

variation relative to baseline groups appeared to be greater in the more recent period, 1998-2001.

#### *Radiotherapy*

Radiotherapy use was significantly lower for patients aged 65 or more; for small-cell and unspecified or non-carcinoma morphologies; M category unknown; cases whose method of presentation was incidental, screen-detected or unknown; and patients who were never married (*Table 5.6.3*). Radiotherapy use was higher for cases that were T category 3-4 or unknown; N category positive or unknown; grade 3+ or unknown; and for smokers and ex-smokers. These patterns were broadly similar for 1994-97 and 1998-2001, but the magnitude of variation in radiotherapy use by T category and grade appeared to be higher in the more recent period. Relative risks differed significantly between periods for T category unknown, and grade 2 and unknown.

#### *Chemotherapy*

Chemotherapy was significantly less likely for age-groups 55 or over; M category positive or unknown; and patients who were never married or of unknown marital status (*Table 5.6.4*). Chemotherapy was more likely for small-cell (compare with non-small-cell) carcinomas; T categories 2-4 and unknown; N category positive or unknown; and grade 3+ or unknown. Patterns were broadly similar between diagnosis periods, but relative risk values differed significantly for T categories 2-4 (less marked variation during 1998-2001) and M category unknown.

**Table 5.6.1** Risk ratios for overall treatment of lung cancer patients (within six months of diagnosis), by patient and tumour variables other than year of diagnosis and region of residence, for cases diagnosed 1994-2001: multivariate model.

Variable value <sup>b</sup>	1994-2001		1994-97		1998-2001	
	<sup>a</sup> RR (95% CI)	P	RR (95% CI)	P	RR (95% CI)	P
age 15-44	1.000		1.000		1.000	
age 45-54	0.907 (0.809-0.987)	0.021	0.911 (0.754-1.033)	0.176	<b>0.907</b> (0.809-0.987)	0.021
age 55-64	<b>0.858</b> (0.759-0.943)	0.000	0.896 (0.747-1.016)	0.098	<b>0.858</b> (0.759-0.943)	0.000
age 65-74	<b>0.705</b> (0.597-0.808)	0.000	<b>0.719</b> (0.556-0.870)	0.000	<b>0.705</b> (0.597-0.808)	0.000
age 75+	<b>0.467</b> (0.367-0.576)	0.000	<b>0.473</b> (0.329-0.636)	0.000	<b>0.467</b> (0.367-0.576)	0.000
male	1.000		1.000		1.000	
female	0.970 (0.928-1.012)	0.167	0.983 (0.919-1.047)	0.609	0.970 (0.928-1.012)	0.167
NSCLC	1.000		1.000		1.000	
SCLC	<b>1.108</b> (1.068-1.146)	0.000	<b>1.217</b> (1.160-1.268)	0.000	<b>1.108</b> (1.068-1.146)	0.000
other/NOS	<b>0.639</b> (0.499-0.789)	0.000	<b>0.595</b> (0.411-0.804)	0.000	<b>0.639</b> (0.499-0.789)	0.000
T1	1.000		1.000		1.000	
T2	0.990 (0.924-1.052)	0.768	1.001 (0.908-1.087)	0.967	0.990 (0.924-1.052)	0.768
T3	1.014 (0.937-1.085)	0.710	1.047 (0.940-1.143)	0.369	1.014 (0.937-1.085)	0.710
T4	<b>0.927</b> (0.856-0.995)	0.038	0.907 (0.801-1.006)	0.069	<b>0.927</b> (0.856-0.995)	0.038
T X	<b>0.805</b> (0.737-0.873)	0.000	<b>0.782</b> (0.685-0.879)	0.000	<b>0.805</b> (0.737-0.873)	0.000
N negative	1.000		1.000		1.000	
N positive	<b>0.912</b> (0.866-0.956)	0.000	<b>0.912</b> (0.846-0.974)	0.005	<b>0.912</b> (0.866-0.956)	0.000
N X	<b>0.786</b> (0.736-0.834)	0.000	<b>0.775</b> (0.704-0.844)	0.000	<b>0.786</b> (0.736-0.834)	0.000
M negative	1.000		1.000		1.000	
M positive	<b>0.849</b> (0.800-0.897)	0.000	<b>0.836</b> (0.765-0.904)	0.000	<b>0.849</b> (0.800-0.897)	0.000
M X	<b>0.922</b> (0.879-0.964)	0.000	<b>0.922</b> (0.861-0.978)	0.006	<b>0.922</b> (0.879-0.964)	0.000
grade 1	1.000		1.000		1.000	
grade 2	<b>1.167</b> (1.076-1.245)	0.001	<b>1.176</b> (1.040-1.290)	0.013	<b>1.167</b> (1.076-1.245)	0.001
grade 3+	1.049 (0.952-1.137)	0.310	1.052 (0.910-1.179)	0.455	1.049 (0.952-1.137)	0.310
grade X	0.969 (0.867-1.064)	0.537	0.944 (0.795-1.083)	0.447	0.969 (0.867-1.064)	0.537
MV yes <sup>c</sup>	1.000		1.000		1.000	
MV no	<b>0.755</b> (0.603-0.908)	0.001	<b>0.774</b> (0.562-0.987)	0.037	<b>0.755</b> (0.603-0.908)	0.001
MV X	0.962 (0.741-1.154)	0.723	1.021 (0.700-1.275)	0.887	0.962 (0.741-1.154)	0.723
symptomatic	1.000		1.000		1.000	
incidental	0.951 (0.843-1.058)	0.373	0.846 (0.677-1.023)	0.090	0.951 (0.843-1.058)	0.373
screen detected	0.777 (0.432-1.173)	0.276	0.873 (0.353-1.449)	0.692	0.777 (0.432-1.173)	0.276
presentation X	1.017 (0.899-1.132)	0.772	0.883 (0.693-1.080)	0.247	1.017 (0.899-1.132)	0.772
non-smoker	1.000		1.000		1.000	
ex-smoker	<b>1.136</b> (1.048-1.222)	0.002	<b>1.152</b> (1.019-1.282)	0.025	<b>1.136</b> (1.048-1.222)	0.002
smoker	1.002 (0.921-1.083)	0.961	0.989 (0.869-1.111)	0.866	1.002 (0.921-1.083)	0.961
smoking status X	0.983 (0.881-1.085)	0.745	1.098 (0.942-1.253)	0.218	0.983 (0.881-1.085)	0.745
ever married	1.000		1.000		1.000	
never married	<b>0.751</b> (0.702-0.801)	0.000	<b>0.774</b> (0.701-0.849)	0.000	<b>0.751</b> (0.702-0.801)	0.000
marital status X	<b>0.789</b> (0.673-0.908)	0.001	<b>0.746</b> (0.586-0.918)	0.004	<b>0.789</b> (0.673-0.908)	0.001

<sup>a</sup>Risk ratios derived from adjusted odds ratios using the method of Zhang & Yu (1998).

<sup>b</sup>Unknown values shown as "X" for T category, N category, M category, grade, microscopic verification (MV), method of presentation, marital status and smoking status.

There were no significant differences in RR between diagnosis periods.

**Table 5.6.2** Risk ratios for surgical treatment of lung cancer patients (within six months of diagnosis), by patient and tumour variables other than year of diagnosis and region of residence, for cases diagnosed 1994-2001: multivariate model.

Variable value <sup>b</sup>	1994-2001		1994-97		1998-2001	
	<sup>a</sup> RR (95% CI)	P	RR (95% CI)	P	RR (95% CI)	P
age 15-44	1.000		1.000		1.000	
age 45-54	<b>0.462</b> (0.310-0.670)	0.000	<b>0.556</b> (0.315-0.924)	0.022	<b>0.437</b> (0.249-0.730)	0.001
age 55-64	<b>0.426</b> (0.293-0.608)	0.000	<b>0.533</b> (0.312-0.866)	0.009	<b>0.377</b> (0.221-0.619)	0.000
age 65-74	<b>0.338</b> (0.232-0.485)	0.000	<b>0.475</b> (0.278-0.773)	0.002	<b>0.260</b> (0.151-0.435)	0.000
age 75+	<b>0.131</b> (0.085-0.199)	0.000	<b>0.201</b> (0.109-0.360)	0.000	<b>0.095</b> (0.052-0.172)	0.000
male	1.000		1.000		1.000	
female	1.063 (0.933-1.208)	0.349	1.100 (0.920-1.307)	0.288	1.036 (0.851-1.253)	0.720
NSCLC	1.000		1.000		1.000	
SCLC	<b>0.218</b> (0.161-0.295)	0.000	<b>0.247</b> (0.167-0.362)	0.000	<b>0.174</b> (0.104-0.289)	0.000
other/NOS	1.096 (0.601-1.801)	0.748	1.095 (0.530-1.926)	0.788	1.003 (0.302-2.433)	0.995
T1	1.000		1.000		1.000	
T2	<b>0.846</b> (0.727-0.976)	0.021	0.958 (0.787-1.143)	0.653	<b>0.721</b> (0.565-0.903)	0.004
T3	<b>0.522</b> (0.420-0.642)	0.000	<b>0.751</b> (0.576-0.953)	0.017	<b>0.308</b> (0.212-0.439)	0.000
T4	<b>0.223</b> (0.173-0.286)	0.000	<b>0.325</b> (0.231-0.449)	0.000	<b>0.149</b> (0.101-0.218)	0.000
T X	<b>0.151</b> (0.116-0.196)	0.000	<b>0.173</b> (0.120-0.246)	0.000	<b>0.123</b> (0.083-0.182)	0.000
N negative	1.000		1.000		1.000	
N positive	<b>0.498</b> (0.436-0.565)	0.000	<b>0.540</b> (0.452-0.637)	0.000	<b>0.460</b> (0.374-0.559)	0.000
N X	<b>0.186</b> (0.154-0.225)	0.000	<b>0.179</b> (0.138-0.231)	0.000	<b>0.203</b> (0.151-0.269)	0.000
M negative	1.000		1.000		1.000	
M positive	<b>0.345</b> (0.277-0.426)	0.000	<b>0.317</b> (0.233-0.426)	0.000	<b>0.389</b> (0.284-0.527)	0.000
M X	<b>1.331</b> (1.193-1.475)	0.000	1.111 (0.962-1.267)	0.146	<b>1.648</b> (1.386-1.933)	0.000
grade 1	1.000		1.000		1.000	
grade 2	<b>1.301</b> (1.060-1.549)	0.013	<b>1.518</b> (1.140-1.912)	0.006	1.131 (0.822-1.449)	0.419
grade 3+	0.957 (0.754-1.183)	0.702	1.111 (0.797-1.475)	0.513	0.833 (0.576-1.133)	0.267
grade X	<b>0.409</b> (0.301-0.548)	0.000	<b>0.509</b> (0.332-0.755)	0.000	<b>0.350</b> (0.220-0.539)	0.000
MV yes	1.000		1.000		1.000	
MV no	<b>0.026</b> (0.008-0.079)	0.000	<b>0.019</b> (0.003-0.099)	0.000	<b>0.035</b> (0.006-0.186)	0.000
MV X	-		-		-	
symptomatic	1.000		1.000		1.000	
incidental	<b>1.761</b> (1.364-2.229)	0.000	<b>1.542</b> (1.026-2.211)	0.037	<b>2.009</b> (1.422-2.740)	0.000
screen detected	<b>3.624</b> (1.639-5.591)	0.004	3.248 (0.845-5.590)	0.078	<b>4.241</b> (1.385-6.973)	0.016
presentation X	<b>1.630</b> (1.121-2.282)	0.011	1.380 (0.697-2.446)	0.339	<b>1.969</b> (1.244-2.939)	0.005
non-smoker	1.000		1.000		1.000	
ex-smoker	0.917 (0.718-1.160)	0.479	0.788 (0.562-1.084)	0.148	1.135 (0.785-1.611)	0.492
smoker	<b>0.797</b> (0.632-0.998)	0.049	<b>0.665</b> (0.484-0.901)	0.008	1.044 (0.734-1.462)	0.805
smoking status X	0.982 (0.718-1.321)	0.908	1.084 (0.712-1.587)	0.694	0.932 (0.575-1.470)	0.769
ever married	1.000		1.000		1.000	
never married	<b>0.663</b> (0.553-0.792)	0.000	<b>0.784</b> (0.618-0.987)	0.038	<b>0.553</b> (0.415-0.733)	0.000
marital status X	0.965 (0.606-1.483)	0.877	1.183 (0.657-1.972)	0.559	0.778 (0.349-1.608)	0.517

<sup>a,b</sup>See Table 5.6.1.

\*Significant difference in RR between diagnosis periods.

**Table 5.6.3** Risk ratios for radiotherapy of lung cancer patients (within six months of diagnosis), by patient and tumour variables other than year of diagnosis and region of residence, for cases diagnosed 1994-2001: multivariate model.

Variable value <sup>b</sup>	1994-2001		1994-97		1998-2001	
	<sup>a</sup> RR (95% CI)	P	RR (95% CI)	P	RR (95% CI)	P
age 15-44	1.000		1.000		1.000	
age 45-54	0.928 (0.768-1.098)	0.407	0.910 (0.670-1.177)	0.500	0.927 (0.718-1.149)	0.516
age 55-64	0.924 (0.773-1.083)	0.346	0.935 (0.706-1.187)	0.609	0.909 (0.714-1.117)	0.387
age 65-74	<b>0.765</b> (0.631-0.912)	0.002	<b>0.743</b> (0.547-0.973)	0.030	<b>0.774</b> (0.598-0.970)	0.024
age 75+	<b>0.596</b> (0.480-0.729)	0.000	<b>0.550</b> (0.390-0.753)	0.000	<b>0.620</b> (0.465-0.801)	0.000
male	1.000		1.000		1.000	
female	0.946 (0.890-1.004)	0.069	0.931 (0.846-1.020)	0.128	0.950 (0.876-1.027)	0.205
NSCLC	1.000		1.000		1.000	
SCLC	<b>0.594</b> (0.538-0.653)	0.000	<b>0.545</b> (0.469-0.630)	0.000	<b>0.635</b> (0.558-0.718)	0.000
other/NOS	<b>0.505</b> (0.355-0.698)	0.000	<b>0.451</b> (0.270-0.718)	0.000	<b>0.608</b> (0.372-0.927)	0.018
T1	1.000		1.000		1.000	
T2	1.100 (0.969-1.241)	0.137	1.002 (0.832-1.193)	0.974	<b>1.195</b> (1.001-1.411)	0.049
T3	<b>1.541</b> (1.361-1.728)	0.000	<b>1.350</b> (1.116-1.601)	0.003	<b>1.712</b> (1.443-1.991)	0.000
T4	<b>1.380</b> (1.224-1.544)	0.000	<b>1.209</b> (1.003-1.434)	0.046	<b>1.508</b> (1.281-1.750)	0.000
T X	<b>1.275</b> (1.133-1.427)	0.000	1.103 (0.923-1.302)	0.270	<b>1.464</b> (1.245-1.699)	0.000
N negative	1.000		1.000		1.000	
N positive	<b>1.489</b> (1.366-1.616)	0.000	<b>1.521</b> (1.330-1.722)	0.000	<b>1.435</b> (1.278-1.598)	0.000
N X	<b>1.413</b> (1.289-1.541)	0.000	<b>1.495</b> (1.302-1.698)	0.000	<b>1.353</b> (1.194-1.521)	0.000
M negative	1.000		1.000		1.000	
M positive	0.957 (0.881-1.037)	0.295	1.054 (0.924-1.191)	0.421	<b>0.898</b> (0.805-0.996)	0.042
M X	<b>0.790</b> (0.727-0.857)	0.000	<b>0.858</b> (0.754-0.970)	0.014	<b>0.771</b> (0.689-0.857)	0.000
grade 1	1.000		1.000		1.000	
grade 2	1.216 (0.995-1.458)	0.055	1.031 (0.791-1.301)	0.812	<b>1.543</b> (1.116-2.037)	0.010
grade 3+	<b>1.289</b> (1.070-1.526)	0.008	1.127 (0.885-1.392)	0.317	<b>1.583</b> (1.163-2.062)	0.004
grade X	<b>1.368</b> (1.144-1.608)	0.001	1.113 (0.872-1.378)	0.373	<b>1.755</b> (1.313-2.241)	0.000
MV yes	1.000		1.000		1.000	
MV no	0.859 (0.629-1.129)	0.295	0.872 (0.550-1.278)	0.514	0.771 (0.480-1.140)	0.212
MV X	1.008 (0.655-1.418)	0.967	1.084 (0.571-1.716)	0.779	0.882 (0.461-1.424)	0.657
symptomatic	1.000		1.000		1.000	
incidental	<b>0.760</b> (0.633-0.903)	0.001	<b>0.753</b> (0.555-0.997)	0.048	<b>0.763</b> (0.606-0.944)	0.012
screen detected	<b>0.200</b> (0.049-0.708)	0.009	-		0.326 (0.078-1.056)	0.064
presentation X	<b>0.810</b> (0.667-0.973)	0.023	0.769 (0.547-1.048)	0.100	0.804 (0.631-1.003)	0.054
non-smoker	1.000		1.000		1.000	
ex-smoker	<b>1.194</b> (1.065-1.330)	0.003	<b>1.209</b> (1.017-1.418)	0.032	<b>1.179</b> (1.009-1.362)	0.038
smoker	<b>1.120</b> (1.004-1.242)	0.041	1.058 (0.895-1.239)	0.495	<b>1.176</b> (1.017-1.346)	0.029
smoking status X	1.068 (0.927-1.221)	0.352	1.163 (0.943-1.409)	0.151	1.003 (0.824-1.202)	0.973
ever married	1.000		1.000		1.000	
never married	<b>0.804</b> (0.740-0.872)	0.000	<b>0.809</b> (0.714-0.913)	0.000	<b>0.800</b> (0.714-0.892)	0.000
marital status X	0.837 (0.687-1.005)	0.058	<b>0.731</b> (0.536-0.971)	0.030	0.926 (0.713-1.168)	0.538

<sup>a,b</sup>See Table 5.6.1.<sup>c</sup>The MV variable was dropped from the logistic model for NSCL and SCLC, as cases were all microscopically verified.

\*Significant difference in RR between diagnosis periods.

**Table 5.6.4** Risk ratios for chemotherapy of lung cancer patients (within six months of diagnosis), by patient and tumour variables other than year of diagnosis and region of residence, for cases diagnosed 1994-2001: multivariate model.

Variable value <sup>b</sup>	1994-2001		1994-97		1998-2001	
	<sup>a</sup> RR (95% CI)	P	RR (95% CI)	P	RR (95% CI)	P
age 15-44	1.000		1.000		1.000	
age 45-54	0.897 (0.691-1.132)	0.378	0.912 (0.595-1.302)	0.641	0.884 (0.627-1.193)	0.445
age 55-64	<b>0.671</b> (0.512-0.861)	0.001	<b>0.676</b> (0.435-0.997)	0.048	<b>0.655</b> (0.459-0.904)	0.009
age 65-74	<b>0.420</b> (0.313-0.554)	0.000	<b>0.388</b> (0.240-0.607)	0.000	<b>0.434</b> (0.297-0.618)	0.000
age 75+	<b>0.140</b> (0.098-0.197)	0.000	<b>0.137</b> (0.078-0.238)	0.000	<b>0.140</b> (0.089-0.218)	0.000
male	1.000		1.000		1.000	
female	1.008 (0.904-1.122)	0.876	1.055 (0.886-1.249)	0.541	0.947 (0.820-1.089)	0.451
NSCLC	1.000		1.000		1.000	
SCLC	<b>5.015</b> (4.712-5.312)	0.000	<b>7.441</b> (6.848-7.999)	0.000	<b>3.602</b> (3.268-3.935)	0.000
other/NOS	0.893 (0.513-1.503)	0.681	0.756 (0.305-1.768)	0.532	1.066 (0.522-2.003)	0.853
T1	1.000		1.000		1.000	
T2	<b>1.376</b> (1.079-1.739)	0.010	<b>1.897</b> (1.249-2.809)	0.003 *	1.140 (0.841-1.523)	0.392
T3	<b>1.657</b> (1.268-2.137)	0.000	<b>2.504</b> (1.609-3.751)	0.000 *	1.288 (0.910-1.785)	0.150
T4	<b>2.214</b> (1.768-2.736)	0.000	<b>3.103</b> (2.089-4.431)	0.000 *	<b>1.781</b> (1.347-2.308)	0.000
T X	<b>1.564</b> (1.234-1.962)	0.000	<b>2.206</b> (1.471-3.214)	0.000	1.300 (0.965-1.723)	0.083
N negative	1.000		1.000		1.000	
N positive	<b>1.878</b> (1.588-2.207)	0.000	<b>2.050</b> (1.550-2.668)	0.000	<b>1.726</b> (1.394-2.115)	0.000
N X	<b>1.307</b> (1.082-1.571)	0.006	1.263 (0.924-1.707)	0.141	<b>1.278</b> (1.003-1.611)	0.047
M negative	1.000		1.000		1.000	
M positive	<b>0.723</b> (0.623-0.837)	0.000	<b>0.756</b> (0.582-0.972)	0.029	<b>0.702</b> (0.585-0.838)	0.000
M X	<b>0.658</b> (0.569-0.757)	0.000	0.909 (0.721-1.137)	0.411 *	<b>0.518</b> (0.428-0.625)	0.000
grade 1	1.000		1.000		1.000	
grade 2	1.382 (0.803-2.326)	0.239	1.426 (0.601-3.235)	0.415	1.231 (0.606-2.392)	0.558
grade 3+	<b>2.336</b> (1.422-3.714)	0.001	<b>2.494</b> (1.119-5.204)	0.026	<b>2.084</b> (1.096-3.717)	0.026
grade X	<b>2.258</b> (1.373-3.600)	0.002	<b>2.410</b> (1.076-5.062)	0.033	<b>1.937</b> (1.016-3.480)	0.045
MV yes	1.000		1.000		1.000	
MV no	<b>0.385</b> (0.209-0.686)	0.001	0.434 (0.163-1.065)	0.070	<b>0.319</b> (0.142-0.685)	0.003
MV X	0.769 (0.301-1.704)	0.550	1.234 (0.324-3.135)	0.735	0.523 (0.135-1.628)	0.296
symptomatic	1.000		1.000		1.000	
incidental	0.757 (0.541-1.044)	0.091	0.632 (0.346-1.114)	0.116	0.789 (0.523-1.161)	0.237
screen detected	0.633 (0.141-2.225)	0.517	1.980 (0.354-5.142)	0.397	-	
presentation X	1.294 (0.965-1.701)	0.083	0.871 (0.473-1.525)	0.645	<b>1.453</b> (1.045-1.958)	0.027
non-smoker	1.000		1.000		1.000	
ex-smoker	1.039 (0.841-1.274)	0.716	1.182 (0.831-1.653)	0.346	0.919 (0.701-1.188)	0.527
smoker	0.861 (0.706-1.046)	0.134	1.032 (0.742-1.417)	0.844	<b>0.754</b> (0.584-0.965)	0.025
smoking status X	0.812 (0.622-1.050)	0.115	0.865 (0.553-1.326)	0.514	0.769 (0.550-1.059)	0.110
ever married	1.000		1.000		1.000	
never married	<b>0.574</b> (0.488-0.673)	0.000	<b>0.528</b> (0.407-0.681)	0.000	<b>0.611</b> (0.496-0.750)	0.000
marital status X	<b>0.510</b> (0.326-0.783)	0.002	0.598 (0.311-1.101)	0.102	<b>0.457</b> (0.243-0.831)	0.009

<sup>a,b</sup>See Table 5.6.1.<sup>c</sup>The MV variable was dropped from the logistic model for NSCL and SCLC, as cases were all microscopically verified.

\*Significant difference in RR between diagnosis periods.

### 5.6.2 National and regional trends

#### Overall treatment

Nationally, treatment increased significantly between 1996 and 2001, by *c.*2.5% annually in relative terms, based on analyses adjusted for age, sex and cell-type (Table 5.6.5). Patients from the Eastern region also showed a significant increase,

by *c.*2.2% annually. Further adjustment for stage reduced the magnitude of the national trend slightly. However, there were clear differences in trends between non-small-cell and small-cell lung cancers, with significant increases in treatment seen for NSCLC only (nationally and in three regions).

**Table 5.6.5** Average annual changes in the proportion of lung cancer patients having any tumour-directed treatment (within six months of diagnosis), overall, by region of residence and by cell-type, 1996-2001.

	1996-2001 annual All lung cancers <sup>a</sup> RR (95% CI)	P	1996-2001 annual NSCLC RR (95% CI)	P	1996-2001 annual SCLC RR (95% CI)	P
age-, sex-, celltype-adjusted <sup>b</sup>						
total	<b>1.025</b> (1.011-1.039)	0.000	<b>1.029</b> (1.015-1.042)	0.000 *	0.977 (0.952-1.001)	0.067
E	<b>1.022</b> (1.002-1.041)	0.028	<b>1.029</b> (1.010-1.048)	0.003 *	0.972 (0.939-1.003)	0.085
M	1.060 (0.988-1.132)	0.101	1.043 (0.975-1.108)	0.208	1.004 (0.834-1.164)	0.958
MW	1.062 (0.998-1.127)	0.055	<b>1.092</b> (1.023-1.159)	0.008	1.136 (0.912-1.390)	0.247
NE	1.042 (0.992-1.092)	0.097	1.035 (0.988-1.080)	0.134	0.956 (0.870-1.032)	0.275
NW	0.991 (0.930-1.052)	0.773	0.986 (0.923-1.049)	0.673	0.923 (0.827-1.008)	0.078
S	1.018 (0.982-1.055)	0.314	1.030 (0.995-1.063)	0.088	0.978 (0.916-1.033)	0.461
SE	1.047 (0.988-1.107)	0.113	1.027 (0.979-1.074)	0.262	0.991 (0.889-1.090)	0.874
W	1.006 (0.951-1.063)	0.809	1.010 (0.954-1.066)	0.716	1.000 (0.856-1.143)	0.997

age, sex, celltype-, stage-adjusted <sup>b,c</sup>						
total	<b>1.017</b> (1.002-1.031)	0.023	<b>1.025</b> (1.011-1.039)	0.000 *	<b>0.973</b> (0.948-0.998)	0.041

<sup>a</sup>Risk ratios derived from adjusted odds ratios using the method of Zhang & Yu (1998).

<sup>b</sup>Morphology: non-small-cell (NSCLC), small-cell (SCLC) or other/unspecified lung cancer (for overall category).

<sup>c</sup>T categories 1-4 & unknown; N category negative, positive, unknown; M category negative, positive, unknown.

\*Significant difference in RR between NSCLC and SCLC morphologies, thus “all cancer” trends may not, strictly, be meaningful.

#### Surgery

The use of surgery fell significantly, by *c.*3.4% annually (*c.*5.0% after stage-adjustment) between 1996 and 2001 (Table 5.6.6). Regional trends were

not statistically significant. The trends largely involved surgery of non-small-cell lung cancers, (significant decline after stage-adjustment).

**Table 5.6.6** Average annual changes in the proportion of lung cancer patients having surgical treatment (within six months of diagnosis), overall, by region of residence and by cell-type, 1996-2001.

	1996-2001 annual All lung cancers RR (95% CI)	P	1996-2001 annual NSCLC RR (95% CI)	P
age-, sex-, celltype-adjusted				
total	<b>0.966</b> (0.935-0.998)	0.039	0.975 (0.946-1.004)	0.101
E	0.982 (0.938-1.027)	0.442	0.993 (0.951-1.036)	0.769
M	0.961 (0.830-1.108)	0.591	0.951 (0.830-1.084)	0.464
MW	0.960 (0.831-1.106)	0.583	0.994 (0.867-1.135)	0.936
NE	0.908 (0.813-1.012)	0.085	0.930 (0.845-1.019)	0.122
NW	1.028 (0.880-1.197)	0.721	0.991 (0.857-1.139)	0.907
S	0.952 (0.870-1.041)	0.290	0.958 (0.882-1.038)	0.303
SE	0.937 (0.828-1.058)	0.299	0.961 (0.859-1.070)	0.476
W	0.962 (0.835-1.105)	0.589	0.971 (0.847-1.111)	0.681
age-, sex-, celltype-, stage-adjusted				
total	<b>0.950</b> (0.912-0.989)	0.013	<b>0.962</b> (0.926-0.999)	0.048

**Radiotherapy**

Radiotherapy use increased significantly at national scale, by *c.*2.2% annually between 1996 and 2001, although the basic trend was not significant after further adjustment for stage (Table 5.6.7).

Significant increases were also seen among patients from the Mid-Western and North-Eastern regions, both overall (by 8.7-13% annually) and for non-small-cell morphologies.

**Table 5.6.7** Average annual changes in the proportion of lung cancer patients having radiotherapy (within six months of diagnosis), overall, by region of residence and by cell-type, 1996-2001. Note that some trends differ significantly between morphological subgroups, thus may not strictly be meaningful except as an overall summary of trends.

	1996-2001 annual All lung cancers RR (95% CI)	P	1996-2001 annual NSCLC RR (95% CI)	P	1996-2001 annual SCLC RR (95% CI)	P
age-, sex-, celltype-adjusted						
total	<b>1.022</b> (1.003-1.042)	0.023	1.011 (0.990-1.032)	0.280	1.048 (0.991-1.107)	0.094
E	0.993 (0.965-1.021)	0.655	0.984 (0.954-1.014)	0.314	1.045 (0.966-1.129)	0.264
M	1.083 (0.991-1.181)	0.077	1.039 (0.950-1.129)	0.390	1.400 (0.894-2.193)	0.141
MW	<b>1.087</b> (1.006-1.172)	0.034	<b>1.109</b> (1.012-1.210)	0.026	1.390 (0.944-1.986)	0.093
NE	<b>1.130</b> (1.047-1.217)	0.002	<b>1.101</b> (1.016-1.190)	0.019	1.149 (0.897-1.445)	0.263
NW	1.006 (0.929-1.086)	0.876	0.962 (0.880-1.047)	0.385	1.053 (0.810-1.339)	0.686
S	1.019 (0.970-1.069)	0.439	1.021 (0.969-1.074)	0.420	1.069 (0.932-1.217)	0.329
SE	1.033 (0.964-1.104)	0.345	1.043 (0.968-1.120)	0.257	* 0.835 (0.687-1.000)	0.050
W	1.020 (0.941-1.102)	0.620	0.978 (0.894-1.067)	0.633	* 1.412 (0.990-1.962)	0.056
age-, sex-, celltype-, stage-adjusted						
total	1.016 (0.997-1.036)	0.095	1.008 (0.987-1.030)	0.413	1.048 (0.989-1.108)	0.106

\*Significant difference in RR between NSCLC and SCLC morphologies.

**Chemotherapy**

Significant overall increases in chemotherapy use were seen nationally (by *c.*6.4% annually or *c.*4.6% after stage-adjustment) and among patients from the Eastern region (by *c.*14% annually) (Table

5.6.8). However, these trends largely reflected increased use of chemotherapy for non-small-cell cancers (significant nationally and for three regions). In contrast, chemotherapy use declined for small-cell cancers (by *c.*5% annually at national scale).

**Table 5.6.8** Average annual changes in the proportion of lung cancer patients having chemotherapy (within six months of diagnosis), overall, by region of residence and by cell-type, 1996-2001.

	1996-2001 annual All lung cancers <sup>a</sup> RR (95% CI)	P	1996-2001 annual NSCLC RR (95% CI)	P	1996-2001 annual SCLC RR (95% CI)	P
age-, sex-, celltype-adjusted <sup>b</sup>						
total	<b>1.064</b> (1.029-1.100)	0.000	<b>1.162</b> (1.111-1.215)	0.000	* <b>0.951</b> (0.924-0.978)	0.000
E	<b>1.139</b> (1.084-1.196)	0.000	<b>1.264</b> (1.181-1.351)	0.000	* 0.966 (0.928-1.003)	0.080
M	0.978 (0.803-1.186)	0.823	1.131 (0.860-1.479)	0.373	0.821 (0.641-1.006)	0.059
MW	1.048 (0.912-1.201)	0.501	1.037 (0.869-1.231)	0.680	1.043 (0.793-1.357)	0.755
NE	1.064 (0.929-1.215)	0.363	<b>1.320</b> (1.062-1.633)	0.012	* 0.931 (0.837-1.019)	0.132
NW	0.915 (0.766-1.089)	0.322	1.042 (0.789-1.375)	0.768	<b>0.868</b> (0.764-0.962)	0.005
S	1.057 (0.955-1.169)	0.278	<b>1.278</b> (1.102-1.481)	0.001	* 0.950 (0.889-1.006)	0.083
SE	1.040 (0.927-1.166)	0.494	1.061 (0.917-1.223)	0.423	0.971 (0.872-1.068)	0.571
W	0.958 (0.876-1.045)	0.338	0.979 (0.883-1.081)	0.690	0.951 (0.812-1.091)	0.496
age-, sex-, celltype-, stage-adjusted <sup>b,c</sup>						
total	<b>1.046</b> (1.010-1.082)	0.010	<b>1.143</b> (1.091-1.197)	0.000	* <b>0.945</b> (0.917-0.973)	0.000

\*Significant difference in RR between NSCLC and SCLC morphologies.

### 5.6.3 Regional variation

Regional variations in treatment use (relative risks compared with the Eastern region) are summarized in *Figures 5.6.1-3* for the overall period 1994-2001 and for the most recent diagnosis period, 1998-2001. Results of basic models adjusted for age, sex and cell-type and of fully adjusted models are

presented for overall treatment, surgical treatment, radiotherapy and chemotherapy. More detailed summaries, overall, by cell-type and for periods 1994-97 and 1998-2001, are presented in *Table 5.6.9-12*.

**Overall treatment**

During 1994-2001 as a whole, patients from six regions (Midland, Mid-Western, North-Eastern, North-Western, South-Eastern and Western) were significantly less likely to be treated than those from the Eastern region, after adjustment for age, sex and tumour morphology (Table 5.6.9a). The same pattern was seen for 1994-97, and a similar pattern for 1998-2001 (additionally including lower use of treatment in the Southern region). Relative risk estimates (RRs) differed significantly between diagnosis periods for Southern region only.

Regional patterns changed only slightly after further adjustment for stage-related variables, and

in some instances appeared to be accentuated. (This especially applied to 1998-2001, when adjusted treatment use was significantly low among patients from all regions other than the Eastern region.) Fuller adjustment for patient and tumour variables had little further effect, or slightly moderated, the pattern of variation.

Regional patterns for non-small-cell (Table 5.6.9b) and small-cell lung cancers (Table 5.6.9c), essentially mirrored those for lung cancer as a whole (i.e. generally lower use of treatment outside the Eastern region), albeit with less statistically significant variation especially for SCLC.

**Table 5.6.9a** Risk ratios for overall treatment of lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

	1994-2001		1994-1997		1998-2001	
	<sup>a</sup> RR (95% CI)	P	RR (95% CI)	P	RR (95% CI)	P
basic model: sex-, age-, celltype-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	<b>0.878</b> (0.798-0.958)	0.003	<b>0.850</b> (0.728-0.972)	0.016	<b>0.891</b> (0.785-0.995)	0.041
MW	<b>0.837</b> (0.767-0.908)	0.000	<b>0.768</b> (0.664-0.874)	0.000	<b>0.887</b> (0.793-0.978)	0.015
NE	<b>0.861</b> (0.793-0.928)	0.000	<b>0.824</b> (0.723-0.926)	0.001	<b>0.872</b> (0.781-0.961)	0.005
NW	<b>0.854</b> (0.780-0.928)	0.000	<b>0.887</b> (0.778-0.995)	0.041	<b>0.821</b> (0.720-0.921)	0.000
S	0.959 (0.906-1.010)	0.119	1.013 (0.936-1.088)	0.729	<b>0.903</b> (0.831-0.974)	0.007
SE	<b>0.805</b> (0.744-0.866)	0.000	<b>0.785</b> (0.697-0.875)	0.000	<b>0.819</b> (0.735-0.902)	0.000
W	<b>0.773</b> (0.708-0.839)	0.000	<b>0.795</b> (0.699-0.892)	0.000	<b>0.752</b> (0.664-0.842)	0.000
fuller model: sex-, age-, cell-, stage-adjusted <sup>b,c</sup>						
E	1.000		1.000		1.000	
M	<b>0.844</b> (0.761-0.926)	0.000	<b>0.846</b> (0.719-0.973)	0.018	<b>0.845</b> (0.736-0.953)	0.005
MW	<b>0.829</b> (0.757-0.901)	0.000	<b>0.776</b> (0.668-0.887)	0.000	<b>0.868</b> (0.773-0.962)	0.006
NE	<b>0.867</b> (0.798-0.937)	0.000	<b>0.872</b> (0.766-0.977)	0.017	<b>0.855</b> (0.761-0.947)	0.002
NW	<b>0.852</b> (0.775-0.928)	0.000	0.890 (0.776-1.004)	0.059	<b>0.818</b> (0.714-0.921)	0.000
S	0.951 (0.896-1.004)	0.075	1.007 (0.926-1.086)	0.855	<b>0.897</b> (0.822-0.970)	0.005
SE	<b>0.765</b> (0.703-0.827)	0.000	<b>0.732</b> (0.642-0.826)	0.000	<b>0.788</b> (0.703-0.873)	0.000
W	<b>0.777</b> (0.710-0.844)	0.000	<b>0.855</b> (0.754-0.955)	0.005	<b>0.722</b> (0.634-0.813)	0.000
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	<b>0.867</b> (0.783-0.950)	0.002	0.882 (0.752-1.011)	0.074	<b>0.869</b> (0.759-0.977)	0.018
MW	<b>0.835</b> (0.762-0.908)	0.000	<b>0.785</b> (0.675-0.898)	0.000	<b>0.877</b> (0.781-0.972)	0.011
NE	<b>0.882</b> (0.811-0.952)	0.001	<b>0.886</b> (0.778-0.993)	0.038	<b>0.885</b> (0.790-0.978)	0.016
NW	<b>0.856</b> (0.778-0.934)	0.000	0.915 (0.798-1.030)	0.152	<b>0.808</b> (0.703-0.914)	0.000
S	0.965 (0.910-1.020)	0.219	1.033 (0.950-1.112)	0.429	<b>0.904</b> (0.828-0.979)	0.012
SE	<b>0.762</b> (0.699-0.826)	0.000	<b>0.739</b> (0.647-0.834)	0.000	<b>0.781</b> (0.695-0.868)	0.000
W	<b>0.788</b> (0.720-0.857)	0.000	<b>0.871</b> (0.769-0.973)	0.013	<b>0.732</b> (0.641-0.824)	0.000

<sup>a</sup>Risk ratios derived from adjusted odds ratios using the method of Zhang & Yu (1998).

<sup>b</sup>Age-group 15-44, 45-54, 55-64, 65-74, or 75+; cell-type (non-small-cell, small-cell, other/unknown).

<sup>c</sup>T categories 1-4 & unknown; N category negative, positive, unknown; M category negative, positive, unknown.

<sup>d</sup>Age-group; sex; cell-type; T, N and M categories; grade; microscopic verification status; smoking status; marital status; individual year of diagnosis. [Method of presentation did not significantly improve model-fit and was excluded from the final model.]

\*Significant difference in RR between diagnosis periods.

**Table 5.6.9b** Risk ratios for overall treatment of non-small-cell lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

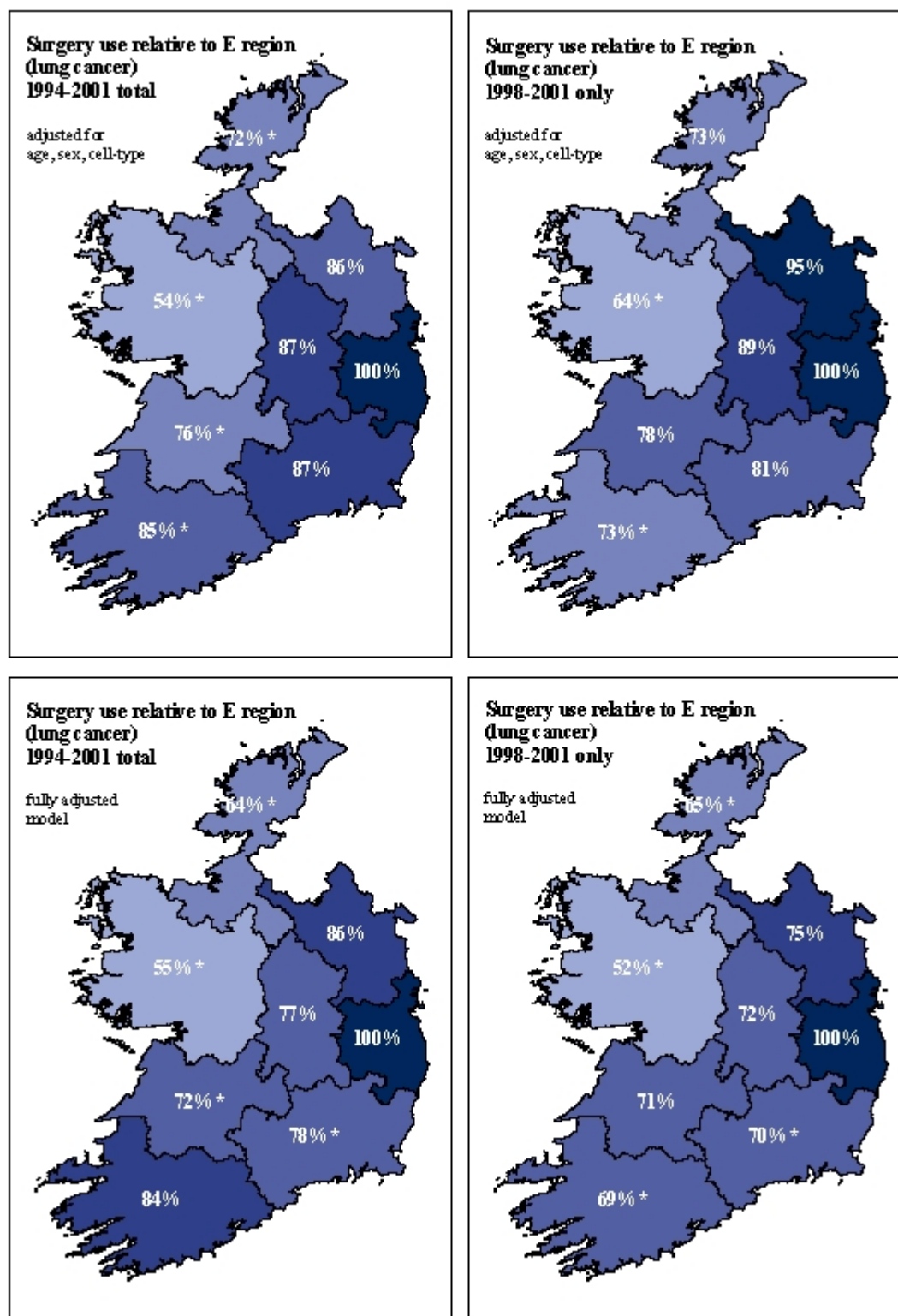
	1994-2001 <sup>a</sup> RR (95% CI)	P	1994-1997 RR (95% CI)	P	1998-2001 RR (95% CI)	P
basic model: sex-, age-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	0.918 (0.837-0.995)	0.037	0.886 (0.761-1.004)	0.061	0.935 (0.827-1.032)	0.202
MW	<b>0.881</b> (0.803-0.955)	0.001	<b>0.795</b> (0.679-0.908)	0.000 *	0.957 (0.853-1.049)	0.384
NE	<b>0.877</b> (0.807-0.944)	0.000	<b>0.849</b> (0.738-0.956)	0.005	<b>0.882</b> (0.791-0.966)	0.005
NW	<b>0.862</b> (0.783-0.937)	0.000	<b>0.877</b> (0.761-0.987)	0.028	<b>0.846</b> (0.737-0.948)	0.002
S	0.968 (0.917-1.017)	0.212	0.997 (0.919-1.069)	0.947	0.936 (0.865-1.001)	0.055
SE	<b>0.884</b> (0.819-0.946)	0.000	<b>0.896</b> (0.799-0.989)	0.028	<b>0.868</b> (0.781-0.950)	0.001
W	<b>0.764</b> (0.694-0.833)	0.000	<b>0.813</b> (0.712-0.912)	0.000	<b>0.713</b> (0.616-0.809)	0.000
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	<b>0.912</b> (0.825-0.993)	0.034	0.909 (0.775-1.034)	0.164	0.932 (0.818-1.033)	0.203
MW	<b>0.896</b> (0.813-0.974)	0.009	<b>0.817</b> (0.691-0.940)	0.003	0.966 (0.858-1.061)	0.516
NE	<b>0.882</b> (0.807-0.953)	0.001	0.915 (0.796-1.027)	0.142	<b>0.871</b> (0.774-0.962)	0.005
NW	<b>0.854</b> (0.769-0.935)	0.000	0.894 (0.768-1.012)	0.081	<b>0.824</b> (0.707-0.934)	0.001
S	0.972 (0.916-1.024)	0.306	1.017 (0.933-1.094)	0.674	0.937 (0.862-1.006)	0.077
SE	<b>0.847</b> (0.778-0.914)	0.000	<b>0.856</b> (0.751-0.958)	0.005	<b>0.840</b> (0.747-0.927)	0.000
W	<b>0.781</b> (0.707-0.855)	0.000	<b>0.895</b> (0.787-0.998)	0.046 *	<b>0.687</b> (0.586-0.789)	0.000

<sup>a,b</sup>See Table 5.6.9a.<sup>d</sup>Age-group; sex; T, N and M categories; grade; smoking status; marital status; individual year of diagnosis. [Method of presentation did not significantly improve model-fit for lung cancers as a whole and was excluded from the final model; microscopic verification was excluded for SCLC and NSCLC as all had MV.]

\*Significant difference in RR between diagnosis periods.

**Table 5.6.9c** Risk ratios for overall treatment of small-cell lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

	1994-2001 <sup>a</sup> RR (95% CI)	P	1994-1997 RR (95% CI)	P	1998-2001 RR (95% CI)	P
basic model: sex-, age-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	0.893 (0.720-1.043)	0.179	0.841 (0.578-1.058)	0.175	0.947 (0.710-1.142)	0.633
MW	<b>0.678</b> (0.523-0.835)	0.000	<b>0.661</b> (0.437-0.888)	0.002	<b>0.700</b> (0.489-0.916)	0.005
NE	0.902 (0.757-1.029)	0.142	0.907 (0.727-1.055)	0.245	0.867 (0.624-1.082)	0.248
NW	0.874 (0.716-1.014)	0.082	0.990 (0.778-1.143)	0.920	<b>0.758</b> (0.533-0.977)	0.029
S	1.047 (0.951-1.128)	0.317	1.101 (0.984-1.186)	0.085	0.975 (0.817-1.111)	0.746
SE	<b>0.804</b> (0.672-0.929)	0.001	<b>0.735</b> (0.557-0.904)	0.001	0.878 (0.680-1.055)	0.190
W	0.897 (0.751-1.026)	0.126	0.900 (0.678-1.077)	0.307	0.905 (0.703-1.082)	0.318
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	0.877 (0.690-1.039)	0.150	0.818 (0.540-1.050)	0.142	0.946 (0.689-1.155)	0.655
MW	<b>0.631</b> (0.471-0.798)	0.000	<b>0.627</b> (0.392-0.873)	0.002	<b>0.631</b> (0.416-0.865)	0.001
NE	0.879 (0.725-1.017)	0.091	0.911 (0.721-1.065)	0.293	0.838 (0.572-1.077)	0.203
NW	0.851 (0.684-1.002)	0.055	0.991 (0.761-1.152)	0.933	<b>0.702</b> (0.472-0.937)	0.012
S	1.019 (0.909-1.112)	0.717	1.091 (0.957-1.186)	0.163	0.922 (0.739-1.082)	0.366
SE	<b>0.748</b> (0.607-0.885)	0.000	<b>0.695</b> (0.507-0.880)	0.001	<b>0.788</b> (0.575-0.991)	0.040
W	0.930 (0.779-1.060)	0.316	0.925 (0.694-1.102)	0.463	0.922 (0.705-1.107)	0.444



**Figure 5.6.1** Regional variation in surgical treatment for lung cancer, expressed as risk ratios compared with patients from the Eastern region (100%): 1994-2001 total (left), 1998-2001 (right); basic model adjusted for age, sex and cell-type (top), fully-adjusted model (bottom). See *Table 5.6.10* for further details. \* = significantly high or low values (P<0.05).

**Surgical treatment**

Patients from four regions (Mid-Western, North-Western, Southern and Western) were significantly less likely to have surgical treatment than patients from the Eastern region during 1994-2001, after adjustment for age, sex and tumour cell-type (Figure 5.6.1, Table 5.6.10a). Use of surgical treatment was significantly low for three of these regions (Mid-Western, North-Western and Western) during 1994-97 and two of the regions (Southern and Western) during 1998-2001.

Regional patterns for 1994-2001 as a whole were accentuated somewhat (significantly low use of surgery in six regions) after further adjustment for stage. But a more complete model adjusting more patient and tumour characteristics indicated significantly low use of surgical treatment in four

regions (Mid-Western, North-Western and Western in common with the basic model, and additionally the South-Eastern region). The full model indicated lower use of surgery in two regions (North-Western and Western) for 1994-97, and four (Southern and South-Eastern) for 1998-2001, compared with the Eastern region. However, there were no differences in relative risk estimates (RRs) between diagnosis periods for any of the regions or models examined.

These patterns were essentially the same for non-small-cell cancers (Table 5.6.10b) as for lung cancers as a whole. Samples sizes were too small to examine regional patterns in surgery for small-cell cancers.

**Table 5.6.10a** Risk ratios for surgical treatment of lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

	1994-2001 <sup>a</sup> RR (95% CI)	P	1994-1997 RR (95% CI)	P	1998-2001 RR (95% CI)	P
basic model: sex-, age-, celltype-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	0.868 (0.694-1.077)	0.203	0.862 (0.630-1.159)	0.336	0.885 (0.639-1.205)	0.447
MW	<b>0.760</b> (0.613-0.935)	0.009	<b>0.743</b> (0.550-0.988)	0.041	0.784 (0.574-1.056)	0.112
NE	0.864 (0.716-1.037)	0.119	0.789 (0.597-1.029)	0.082	0.951 (0.733-1.218)	0.698
NW	<b>0.720</b> (0.573-0.899)	0.003	<b>0.710</b> (0.517-0.962)	0.027	0.731 (0.523-1.007)	0.056
S	<b>0.846</b> (0.733-0.974)	0.020	0.961 (0.796-1.150)	0.673	<b>0.728</b> (0.580-0.908)	0.005
SE	0.865 (0.729-1.021)	0.088	0.920 (0.732-1.145)	0.467	0.805 (0.620-1.035)	0.093
W	<b>0.544</b> (0.433-0.680)	0.000	<b>0.466</b> (0.336-0.640)	0.000	<b>0.643</b> (0.467-0.876)	0.005
fuller model: sex-, age-, cell-, stage-adjusted <sup>b,c</sup>						
E	1.000		1.000		1.000	
M	<b>0.716</b> (0.540-0.940)	0.016	0.788 (0.531-1.138)	0.211	0.708 (0.467-1.049)	0.087
MW	<b>0.701</b> (0.537-0.906)	0.006	0.717 (0.494-1.021)	0.066	0.708 (0.480-1.026)	0.069
NE	0.833 (0.660-1.041)	0.111	1.016 (0.724-1.390)	0.922	<b>0.713</b> (0.513-0.979)	0.036
NW	<b>0.681</b> (0.515-0.892)	0.005	<b>0.660</b> (0.443-0.962)	0.030	0.710 (0.473-1.044)	0.083
S	<b>0.793</b> (0.663-0.944)	0.009	0.906 (0.715-1.135)	0.399	<b>0.687</b> (0.519-0.901)	0.006
SE	<b>0.807</b> (0.655-0.988)	0.038	0.845 (0.638-1.103)	0.222	0.759 (0.550-1.033)	0.081
W	<b>0.570</b> (0.436-0.740)	0.000	<b>0.561</b> (0.382-0.810)	0.002	<b>0.611</b> (0.417-0.881)	0.008
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	0.774 (0.577-1.024)	0.074	0.887 (0.595-1.282)	0.537	0.721 (0.461-1.098)	0.131
MW	<b>0.715</b> (0.543-0.931)	0.012	0.729 (0.495-1.047)	0.089	0.713 (0.477-1.045)	0.084
NE	0.863 (0.676-1.090)	0.221	0.988 (0.691-1.374)	0.946	0.752 (0.532-1.047)	0.093
NW	<b>0.641</b> (0.477-0.851)	0.002	<b>0.631</b> (0.416-0.936)	0.021	<b>0.650</b> (0.424-0.978)	0.038
S	0.840 (0.699-1.005)	0.057	0.998 (0.783-1.254)	0.988	<b>0.690</b> (0.514-0.916)	0.010
SE	<b>0.778</b> (0.625-0.962)	0.020	0.826 (0.617-1.090)	0.182	<b>0.699</b> (0.496-0.972)	0.033
W	<b>0.549</b> (0.415-0.719)	0.000	<b>0.594</b> (0.403-0.860)	0.005	<b>0.516</b> (0.343-0.766)	0.001

<sup>a,b,c</sup>See Table 5.6.9a.

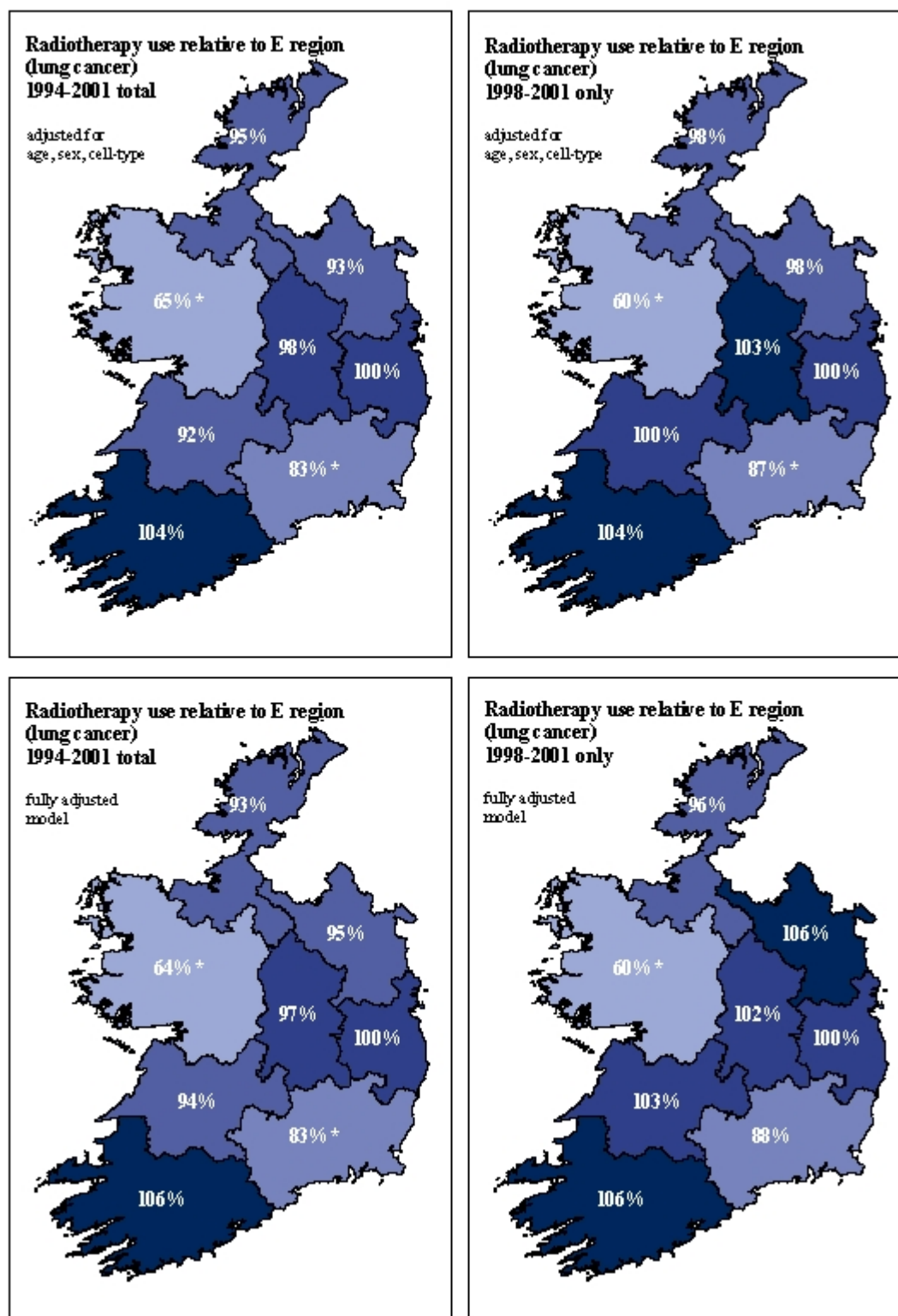
<sup>d</sup>Age-group; cell-type; T, N and M categories; grade; microscopic verification status; method of presentation; marital status. [Sex, smoking status and year of diagnosis did not significantly improve model-fit and were excluded from the final model.]

**Table 5.6.10b** Risk ratios for surgical treatment of non-small-cell lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

	1994-2001 <sup>a</sup> RR (95% CI)	P	1994-1997 RR (95% CI)	P	1998-2001 RR (95% CI)	P
basic model: sex-, age-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	0.891 (0.722-1.085)	0.260	0.907 (0.679-1.182)	0.488	0.884 (0.648-1.178)	0.415
MW	<b>0.794</b> (0.648-0.964)	0.019	<b>0.745</b> (0.557-0.976)	0.032	0.852 (0.636-1.117)	0.255
NE	0.885 (0.741-1.046)	0.157	0.804 (0.615-1.030)	0.087	0.977 (0.768-1.223)	0.847
NW	<b>0.726</b> (0.582-0.897)	0.003	<b>0.748</b> (0.553-0.989)	0.042	<b>0.706</b> (0.506-0.965)	0.028
S	<b>0.848</b> (0.740-0.968)	0.014	0.935 (0.782-1.105)	0.442	<b>0.761</b> (0.613-0.934)	0.009
SE	0.877 (0.746-1.024)	0.099	0.896 (0.719-1.101)	0.307	0.859 (0.673-1.079)	0.198
W	<b>0.572</b> (0.458-0.707)	0.000	<b>0.495</b> (0.360-0.671)	0.000	<b>0.667</b> (0.489-0.894)	0.006
fuller model: sex-, age-, stage-adjusted <sup>b,c</sup>						
E	1.000		1.000		1.000	
M	<b>0.746</b> (0.566-0.966)	0.026	0.838 (0.575-1.176)	0.324	0.712 (0.471-1.041)	0.082
MW	<b>0.744</b> (0.572-0.952)	0.018	<b>0.700</b> (0.482-0.986)	0.041	0.805 (0.552-1.138)	0.231
NE	0.859 (0.686-1.061)	0.164	1.006 (0.722-1.350)	0.967	0.759 (0.551-1.024)	0.073
NW	<b>0.670</b> (0.507-0.871)	0.002	<b>0.695</b> (0.469-0.995)	0.047	<b>0.654</b> (0.433-0.959)	0.029
S	<b>0.804</b> (0.675-0.950)	0.010	0.880 (0.697-1.093)	0.257	<b>0.737</b> (0.561-0.954)	0.020
SE	0.829 (0.676-1.006)	0.058	0.813 (0.614-1.054)	0.122	0.841 (0.618-1.120)	0.246
W	<b>0.599</b> (0.459-0.771)	0.000	<b>0.588</b> (0.403-0.837)	0.002	<b>0.641</b> (0.438-0.915)	0.013
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	0.798 (0.601-1.039)	0.097	0.923 (0.632-1.290)	0.660	0.722 (0.464-1.082)	0.119
MW	<b>0.747</b> (0.571-0.963)	0.024	<b>0.702</b> (0.477-0.998)	0.049	0.807 (0.546-1.153)	0.251
NE	0.885 (0.700-1.103)	0.287	0.995 (0.703-1.351)	0.977	0.788 (0.563-1.075)	0.138
NW	<b>0.629</b> (0.469-0.831)	0.001	<b>0.665</b> (0.440-0.968)	0.033	<b>0.595</b> (0.383-0.896)	0.012
S	<b>0.837</b> (0.700-0.993)	0.042	0.955 (0.755-1.187)	0.695	<b>0.728</b> (0.547-0.953)	0.020
SE	<b>0.794</b> (0.641-0.974)	0.026	0.791 (0.591-1.036)	0.091	0.771 (0.553-1.050)	0.102
W	<b>0.572</b> (0.434-0.744)	0.000	<b>0.612</b> (0.418-0.872)	0.006	<b>0.546</b> (0.362-0.805)	0.002

<sup>a,b,c</sup>See Table 5.6.9a.<sup>d</sup>Age-group; T, N and M categories; grade; method of presentation; marital status. [Sex, smoking status and year of diagnosis did not significantly improve model-fit and were excluded from the final model; microscopic verification was also excluded as all NSCLC cases had MV.]

There were no significant differences in RR between diagnosis periods.



**Figure 5.6.2** Regional variation in radiotherapy for lung cancer, expressed as risk ratios compared with patients from the Eastern region (100%): 1994-2001 total (left), 1998-2001 (right); basic model adjusted for age, sex and cell-type (top), fully-adjusted model (bottom). See *Table 5.6.11* for further details. \* = significantly high or low values ( $P < 0.05$ ).

## Radiotherapy

Regional variation was less marked for radiotherapy use than for surgical treatment. For the overall period (1994-2001), patients from two regions (South-Eastern and Western) were significantly less likely to have radiotherapy than those from the Eastern region (*Figure 5.6.2, Table 5.6.11a*). This applied, in terms of general pattern and magnitude of regional variation, for the three models examined (from basic to fully adjusted). In the basic model, radiotherapy usage was low in patients from the same two regions for both the 1994-97 and 1998-2001 diagnosis periods, and also low for the Mid-Western region for 1994-97. In the final model, patients from the Mid-Western, South-Eastern and Western regions during 1994-97, but only the Western region during 1998-2001, had significantly low use of radiotherapy compared

with the Eastern region. The only significant difference in relative risk values (RRs) between periods was for the Mid-Western region (in the stage-adjusted model).

The regional patterns for non-small-cell lung cancer were similar to those for lung cancers as a whole. The main exception was significantly higher radiotherapy use in NSCLC patients from the Mid-Western region compared with the Eastern region, for 1998-2001 (*Table 5.6.11b*). For small-cell lung cancer, radiotherapy usage was again significantly low among patients from the Western region (as for NSCLC and overall lung cancer); but, in contrast to NSCLC, was also significantly low for the Mid-Western region during 1998-2001 (*Table 5.6.11c*).

**Table 5.6.11a** Risk ratios for radiotherapy of lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

	1994-2001 <sup>a</sup> RR (95% CI)	P	1994-1997 RR (95% CI)	P	1998-2001 RR (95% CI)	P
basic model: sex-, age-, celltype-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	0.975 (0.857-1.099)	0.690	0.883 (0.714-1.073)	0.220	1.030 (0.875-1.194)	0.712
MW	0.920 (0.821-1.026)	0.140	<b>0.798</b> (0.658-0.956)	0.014	1.001 (0.867-1.143)	0.986
NE	0.928 (0.831-1.030)	0.165	0.853 (0.713-1.008)	0.063	0.977 (0.849-1.113)	0.742
NW	0.949 (0.843-1.062)	0.373	0.907 (0.753-1.077)	0.275	0.981 (0.838-1.134)	0.808
S	1.036 (0.958-1.117)	0.363	1.031 (0.916-1.153)	0.598	1.035 (0.930-1.145)	0.509
SE	<b>0.832</b> (0.749-0.921)	0.000	<b>0.792</b> (0.673-0.924)	0.003	<b>0.867</b> (0.753-0.990)	0.035
W	<b>0.649</b> (0.568-0.737)	0.000	<b>0.699</b> (0.578-0.837)	0.000	<b>0.599</b> (0.495-0.717)	0.000
fuller model: sex-, age-, cell-, stage-adjusted <sup>b,c</sup>						
E	1.000		1.000		1.000	
M	0.970 (0.852-1.096)	0.643	0.886 (0.715-1.079)	0.239	1.012 (0.855-1.179)	0.883
MW	0.928 (0.827-1.036)	0.190	<b>0.800</b> (0.658-0.960)	0.016	1.014 (0.877-1.158)	0.843
NE	0.956 (0.857-1.061)	0.415	0.855 (0.713-1.013)	0.071	1.041 (0.906-1.183)	0.557
NW	0.930 (0.823-1.044)	0.226	0.902 (0.747-1.074)	0.257	0.949 (0.806-1.103)	0.512
S	1.038 (0.958-1.121)	0.349	1.026 (0.908-1.151)	0.669	1.040 (0.932-1.152)	0.468
SE	<b>0.827</b> (0.742-0.917)	0.000	<b>0.775</b> (0.656-0.908)	0.001	<b>0.874</b> (0.757-0.998)	0.048
W	<b>0.629</b> (0.549-0.717)	0.000	<b>0.674</b> (0.555-0.810)	0.000	<b>0.584</b> (0.481-0.702)	0.000
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	0.969 (0.850-1.096)	0.632	0.903 (0.729-1.099)	0.324	1.021 (0.862-1.191)	0.795
MW	0.936 (0.833-1.044)	0.244	<b>0.814</b> (0.669-0.976)	0.026	1.026 (0.888-1.173)	0.712
NE	0.950 (0.850-1.055)	0.348	0.858 (0.715-1.017)	0.080	1.056 (0.918-1.201)	0.430
NW	0.934 (0.826-1.049)	0.261	0.924 (0.764-1.100)	0.386	0.955 (0.810-1.112)	0.572
S	1.055 (0.972-1.140)	0.191	1.047 (0.926-1.175)	0.451	1.063 (0.952-1.178)	0.268
SE	<b>0.834</b> (0.749-0.926)	0.001	<b>0.791</b> (0.669-0.926)	0.003	0.879 (0.761-1.005)	0.061
W	<b>0.636</b> (0.555-0.725)	0.000	<b>0.677</b> (0.556-0.815)	0.000	<b>0.599</b> (0.493-0.719)	0.000

<sup>a,b,c</sup>See *Table 5.6.9a*.

<sup>d</sup>Age-group; sex; cell-type; T, N and M categories; grade; method of presentation; smoking status; marital status; individual year of diagnosis. [Microscopic verification status did not significantly improve model-fit and was excluded from the final model.]

\*Significant difference in RR between diagnosis periods.

**Table 5.6.11b** Risk ratios for radiotherapy of non-small-cell lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

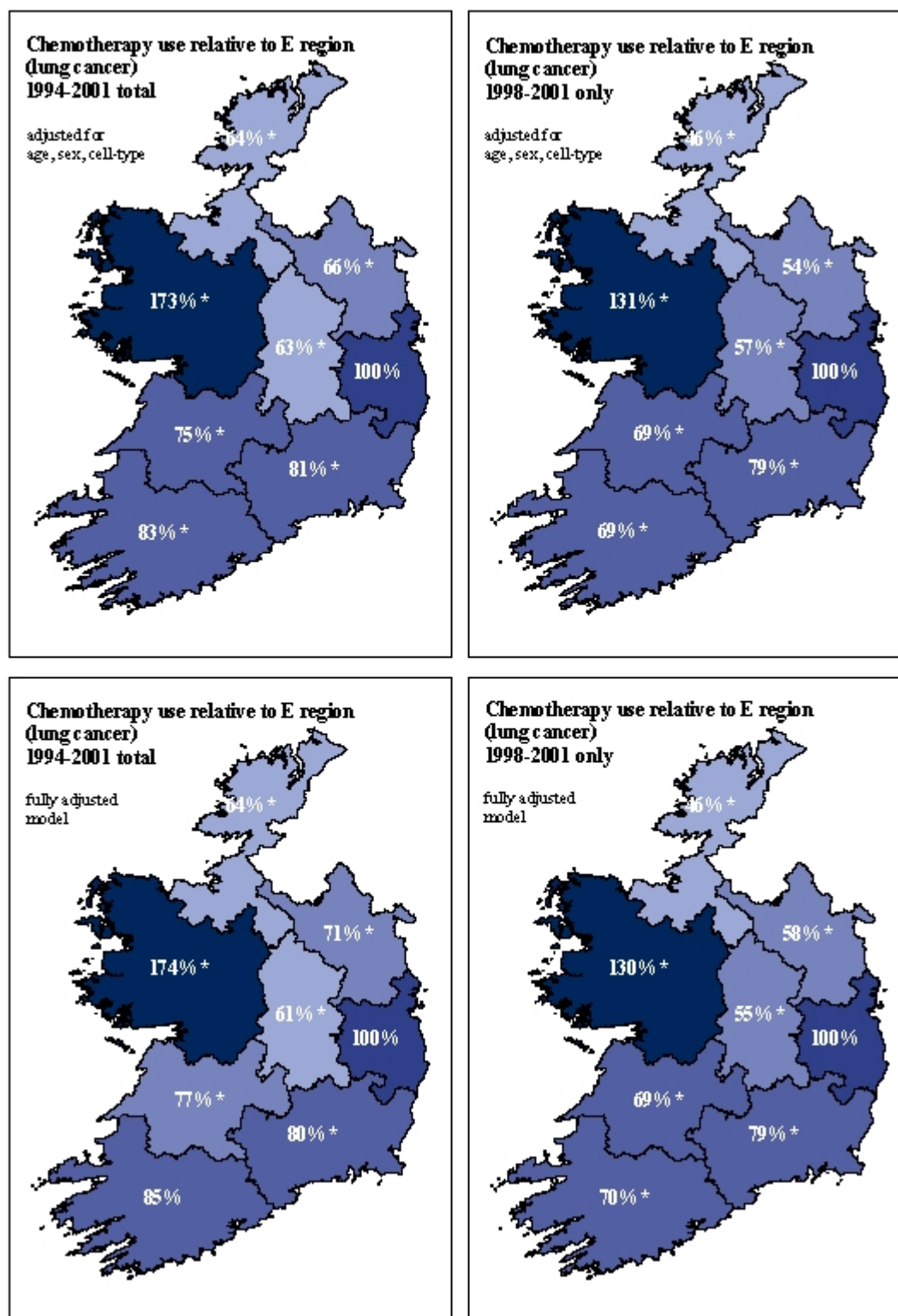
	1994-2001 <sup>a</sup> RR (95% CI)	P	1994-1997 RR (95% CI)	P	1998-2001 RR (95% CI)	P
basic model: sex-, age-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	1.039 (0.909-1.173)	0.559	0.953 (0.766-1.154)	0.640	1.101 (0.925-1.280)	0.264
MW	0.959 (0.840-1.084)	0.520	<b>0.792</b> (0.633-0.970)	0.024 *	1.114 (0.946-1.284)	0.185
NE	0.983 (0.874-1.097)	0.777	0.947 (0.783-1.123)	0.550	0.994 (0.851-1.142)	0.937
NW	0.983 (0.861-1.110)	0.794	0.954 (0.781-1.141)	0.629	1.012 (0.844-1.188)	0.884
S	1.061 (0.976-1.148)	0.157	1.029 (0.905-1.158)	0.646	1.080 (0.964-1.198)	0.178
SE	<b>0.870</b> (0.773-0.972)	0.013	<b>0.827</b> (0.689-0.978)	0.026	0.904 (0.772-1.044)	0.180
W	<b>0.661</b> (0.567-0.764)	0.000	<b>0.773</b> (0.633-0.928)	0.005 *	<b>0.548</b> (0.430-0.687)	0.000
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	1.058 (0.923-1.197)	0.400	0.996 (0.801-1.205)	0.972	1.121 (0.936-1.309)	0.201
MW	0.992 (0.867-1.122)	0.909	<b>0.793</b> (0.630-0.977)	0.029 *	<b>1.183</b> (1.006-1.360)	0.042
NE	0.999 (0.886-1.116)	0.993	0.929 (0.762-1.109)	0.434	1.077 (0.924-1.233)	0.324
NW	0.968 (0.842-1.099)	0.632	0.956 (0.776-1.150)	0.652	0.992 (0.818-1.175)	0.939
S	1.087 (0.997-1.179)	0.057	1.057 (0.926-1.193)	0.396	1.113 (0.989-1.238)	0.073
SE	<b>0.875</b> (0.774-0.980)	0.021	<b>0.824</b> (0.682-0.980)	0.028	0.923 (0.785-1.069)	0.297
W	<b>0.637</b> (0.544-0.741)	0.000	<b>0.723</b> (0.585-0.878)	0.001	<b>0.539</b> (0.420-0.681)	0.000

<sup>a,b</sup>See Table 5.6.9a.<sup>d</sup>Age-group; sex; T, N and M categories; grade; method of presentation; smoking status; marital status; individual year of diagnosis. [Microscopic verification status was excluded from the final model for NSCLC and SCLC cases as all had MV.]

\*Significant difference in RR between diagnosis periods.

**Table 5.6.11c** Risk ratios for radiotherapy of small-cell lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

	1994-2001 <sup>a</sup> RR (95% CI)	P	1994-1997 RR (95% CI)	P	1998-2001 RR (95% CI)	P
basic model: sex-, age-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	0.938 (0.621-1.337)	0.742	0.558 (0.225-1.224)	0.158	1.107 (0.701-1.581)	0.634
MW	0.683 (0.440-1.013)	0.059	0.851 (0.425-1.524)	0.618	<b>0.576</b> (0.320-0.960)	0.033
NE	0.737 (0.502-1.043)	0.088	0.742 (0.423-1.219)	0.254	0.778 (0.448-1.231)	0.312
NW	0.807 (0.539-1.155)	0.256	0.971 (0.535-1.598)	0.917	0.687 (0.387-1.118)	0.142
S	1.134 (0.909-1.384)	0.255	1.191 (0.845-1.606)	0.304	1.098 (0.814-1.414)	0.517
SE	0.981 (0.733-1.273)	0.896	1.151 (0.751-1.658)	0.498	0.839 (0.550-1.203)	0.366
W	<b>0.540</b> (0.342-0.822)	0.003	<b>0.433</b> (0.176-0.970)	0.041	<b>0.556</b> (0.321-0.902)	0.015
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	0.871 (0.564-1.271)	0.499	0.509 (0.199-1.156)	0.114	1.142 (0.710-1.640)	0.552
MW	<b>0.636</b> (0.403-0.960)	0.030	0.937 (0.464-1.666)	0.843	<b>0.559</b> (0.305-0.947)	0.029
NE	0.735 (0.495-1.049)	0.093	0.780 (0.439-1.290)	0.356	0.744 (0.416-1.205)	0.253
NW	0.761 (0.499-1.110)	0.166	0.940 (0.498-1.598)	0.838	0.683 (0.378-1.124)	0.145
S	1.081 (0.846-1.346)	0.517	1.099 (0.744-1.542)	0.619	1.067 (0.766-1.409)	0.682
SE	0.929 (0.684-1.223)	0.620	1.018 (0.637-1.525)	0.935	0.797 (0.509-1.168)	0.265
W	<b>0.522</b> (0.326-0.804)	0.002	0.470 (0.189-1.051)	0.068	<b>0.556</b> (0.318-0.911)	0.018



**Figure 5.6.3** Regional variation in chemotherapy for lung cancer, expressed as risk ratios compared with patients from the Eastern region (100%): 1994-2001 total (left), 1998-2001 (right); basic model adjusted for age, sex and cell-type (top), fully-adjusted model (bottom). See *Table 5.6.12* for further details. \* = significantly high or low values ( $P < 0.05$ ).

### Chemotherapy

Regional variation in chemotherapy use was very marked, although there were substantial differences between diagnosis periods 1994-97 and 1998-2001. For 1994-2001 as a whole, patients from six regions were significantly less likely to receive chemotherapy than those from the Eastern region, after adjustment for age, sex and cell-type (Figure 5.6.3, Table 5.6.12a). However, patients from the Western region were significantly more likely to have chemotherapy, and this also applied in for 1994-97 and 1998-2001 (although the relative risk value was significantly lower in the latter period). For other regions during 1994-97, radiotherapy usage did not differ significantly from the Eastern region. In contrast, six regions during 1998-2001 had significantly low radiotherapy usage compared with the Eastern region. For two of these regions, RR values were significantly lower in the latter period.

Further adjustment for stage-related or other variables had little effect on the pattern and magnitude of regional variations seen. Based on the fullest model (and 1994-2001 data), patients from five regions (Midland, Mid-Western, North-Eastern, North-Western and South-Eastern) were significantly less likely, and patients from the Western region significantly more likely, to receive radiotherapy than those from the Eastern region. As in the basic model, apart from the finding from the Western region, regional variation was largely confined to 1998-2001.

Findings for lung cancer as a whole were largely mirrored by those for non-small-cell cancers (Table 5.6.12b), while chemotherapy use for small-cell cancers was significantly low in several regions (Table 5.6.12c).

**Table 5.6.12a** Risk ratios for chemotherapy of lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

	1994-2001 <sup>a</sup> RR (95% CI)	P	1994-1997 RR (95% CI)	P	1998-2001 RR (95% CI)	P
basic model: sex-, age-, celltype-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	<b>0.626</b> (0.472-0.822)	0.001	0.718 (0.451-1.116)	0.145	<b>0.565</b> (0.394-0.796)	0.001
MW	<b>0.750</b> (0.598-0.934)	0.010	0.856 (0.588-1.221)	0.401	<b>0.686</b> (0.515-0.902)	0.006
NE	<b>0.664</b> (0.530-0.826)	0.000	0.794 (0.564-1.100)	0.170	<b>0.540</b> (0.395-0.730)	0.000
NW	<b>0.641</b> (0.497-0.820)	0.000	0.965 (0.662-1.375)	0.850	<b>0.464</b> (0.325-0.654)	0.000
S	<b>0.834</b> (0.713-0.971)	0.019	1.056 (0.832-1.326)	0.646	<b>0.688</b> (0.555-0.846)	0.000
SE	<b>0.808</b> (0.669-0.971)	0.023	0.825 (0.604-1.112)	0.213	<b>0.786</b> (0.618-0.989)	0.040
W	<b>1.725</b> (1.493-1.976)	0.000	<b>2.523</b> (2.066-3.013)	0.000	<b>1.310</b> (1.066-1.587)	0.011
fuller model: sex-, age-, cell-, stage-adjusted <sup>b,c</sup>						
E	1.000		1.000		1.000	
M	<b>0.605</b> (0.452-0.800)	0.000	0.718 (0.451-1.116)	0.145	<b>0.541</b> (0.374-0.771)	0.000
MW	<b>0.751</b> (0.598-0.937)	0.011	0.856 (0.588-1.221)	0.401	<b>0.693</b> (0.519-0.915)	0.009
NE	<b>0.698</b> (0.556-0.870)	0.001	0.794 (0.564-1.100)	0.170	<b>0.576</b> (0.418-0.784)	0.000
NW	<b>0.616</b> (0.476-0.791)	0.000	0.965 (0.662-1.375)	0.850	<b>0.444</b> (0.309-0.629)	0.000
S	<b>0.836</b> (0.711-0.978)	0.025	1.056 (0.832-1.326)	0.646	<b>0.698</b> (0.561-0.863)	0.001
SE	<b>0.772</b> (0.635-0.932)	0.007	0.825 (0.604-1.112)	0.213	<b>0.774</b> (0.605-0.980)	0.033
W	<b>1.694</b> (1.462-1.946)	0.000	<b>2.523</b> (2.066-3.013)	0.000	<b>1.272</b> (1.030-1.548)	0.026
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	<b>0.606</b> (0.451-0.805)	0.000	0.702 (0.431-1.113)	0.137	<b>0.550</b> (0.378-0.788)	0.001
MW	<b>0.767</b> (0.609-0.959)	0.020	0.938 (0.642-1.340)	0.735	<b>0.692</b> (0.516-0.916)	0.010
NE	<b>0.706</b> (0.561-0.882)	0.002	0.841 (0.593-1.173)	0.316	<b>0.582</b> (0.421-0.794)	0.000
NW	<b>0.640</b> (0.493-0.824)	0.000	1.008 (0.686-1.446)	0.963	<b>0.457</b> (0.317-0.650)	0.000
S	0.854 (0.725-1.001)	0.052	1.076 (0.836-1.367)	0.562	<b>0.695</b> (0.555-0.863)	0.001
SE	<b>0.800</b> (0.658-0.967)	0.021	0.774 (0.559-1.059)	0.112	<b>0.787</b> (0.614-0.998)	0.049
W	<b>1.743</b> (1.503-2.003)	0.000	<b>2.547</b> (2.070-3.061)	0.000	<b>1.303</b> (1.054-1.586)	0.015

<sup>a,b,c</sup>See Table 5.6.9a.

<sup>d</sup>Age-group; sex; cell-type; T, N and M categories; grade; microscopic verification status; smoking status; marital status; individual year of diagnosis. [Method of presentation did not significantly improve model-fit and was excluded from the final model.]

\*Significant difference in RR between diagnosis periods.

**Table 5.6.12b** Risk ratios for chemotherapy of non-small-cell lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

	1994-2001 <sup>a</sup> RR (95% CI)	P	1994-1997 RR (95% CI)	P	1998-2001 RR (95% CI)	P
basic model: sex-, age-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	<b>0.553</b> (0.363-0.830)	0.004	0.685 (0.334-1.364)	0.288	<b>0.474</b> (0.281-0.779)	0.003
MW	0.861 (0.639-1.147)	0.311	1.253 (0.790-1.946)	0.332	<b>0.667</b> (0.449-0.971)	0.034
NE	<b>0.549</b> (0.390-0.766)	0.000	0.596 (0.320-1.089)	0.094	<b>0.488</b> (0.323-0.726)	0.000
NW	<b>0.590</b> (0.405-0.851)	0.004	0.848 (0.458-1.530)	0.593	<b>0.468</b> (0.290-0.743)	0.001
S	<b>0.669</b> (0.529-0.843)	0.001	0.789 (0.529-1.165)	0.237	<b>0.598</b> (0.447-0.794)	0.000
SE	0.969 (0.761-1.225)	0.800	1.286 (0.866-1.878)	0.210	0.810 (0.595-1.086)	0.164
W	<b>2.140</b> (1.788-2.533)	0.000	<b>3.625</b> (2.784-4.607)	0.000	<b>1.460</b> (1.127-1.852)	0.005
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	<b>0.548</b> (0.354-0.836)	0.005	0.780 (0.374-1.571)	0.496	<b>0.455</b> (0.264-0.766)	0.003
MW	0.878 (0.643-1.186)	0.403	1.488 (0.924-2.330)	0.100	<b>0.660</b> (0.436-0.978)	0.038
NE	<b>0.551</b> (0.387-0.778)	0.001	0.650 (0.344-1.202)	0.173	<b>0.511</b> (0.333-0.773)	0.001
NW	<b>0.556</b> (0.375-0.816)	0.002	0.872 (0.458-1.610)	0.670	<b>0.462</b> (0.280-0.745)	0.001
S	<b>0.657</b> (0.513-0.838)	0.001	0.777 (0.509-1.174)	0.235	<b>0.593</b> (0.435-0.799)	0.000
SE	0.972 (0.755-1.241)	0.828	1.270 (0.833-1.902)	0.262	0.826 (0.600-1.118)	0.222
W	<b>2.219</b> (1.838-2.646)	0.000	<b>3.864</b> (2.927-4.955)	0.000	<b>1.434</b> (1.092-1.842)	0.010

<sup>a,b</sup>See Table 5.6.9a.<sup>d</sup>Age-group; sex; T, N and M categories; grade; microscopic verification status; smoking status; marital status; individual year of diagnosis. [Method of presentation did not significantly improve model-fit for either NSCLC and SCLC and was excluded from the final models for these cell-types; microscopic verification was also excluded as all NSCLC and SCLC cases had MV.]

\*Significant difference in RR between diagnosis periods.

**Table 5.6.12c** Risk ratios for chemotherapy of small-cell lung cancer patients (within six months of diagnosis), by region of residence, for cases diagnosed 1994-2001. Relative risks in bold = significant difference from Eastern region (RR <1 = lower use of treatment than in Eastern region, RR >1 = higher use).

	1994-2001 <sup>a</sup> RR (95% CI)	P	1994-1997 RR (95% CI)	P	1998-2001 RR (95% CI)	P
basic model: sex-, age-adjusted <sup>b</sup>						
E	1.000		1.000		1.000	
M	<b>0.778</b> (0.582-0.980)	0.031	0.827 (0.544-1.093)	0.223	0.760 (0.492-1.058)	0.116
MW	<b>0.624</b> (0.460-0.807)	0.000	<b>0.552</b> (0.333-0.815)	0.001	<b>0.700</b> (0.467-0.966)	0.028
NE	0.872 (0.704-1.037)	0.132	0.907 (0.703-1.092)	0.348	0.764 (0.501-1.054)	0.112
NW	<b>0.794</b> (0.615-0.977)	0.027	0.964 (0.716-1.172)	0.761	<b>0.621</b> (0.391-0.901)	0.009
S	1.038 (0.915-1.153)	0.529	1.084 (0.931-1.211)	0.264	0.969 (0.772-1.161)	0.765
SE	<b>0.808</b> (0.658-0.958)	0.012	<b>0.719</b> (0.529-0.915)	0.004	0.914 (0.683-1.145)	0.477
W	0.897 (0.727-1.062)	0.231	0.932 (0.683-1.147)	0.570	0.901 (0.662-1.141)	0.432
final multivariate model <sup>d</sup>						
E	1.000		1.000		1.000	
M	<b>0.743</b> (0.535-0.961)	0.021	0.793 (0.503-1.075)	0.163	0.691 (0.413-1.019)	0.065
MW	<b>0.588</b> (0.422-0.779)	0.000	<b>0.513</b> (0.295-0.789)	0.001	<b>0.607</b> (0.381-0.886)	0.006
NE	0.835 (0.658-1.011)	0.067	0.898 (0.682-1.093)	0.329	0.715 (0.439-1.034)	0.081
NW	<b>0.778</b> (0.590-0.971)	0.024	0.970 (0.706-1.189)	0.815	<b>0.544</b> (0.326-0.826)	0.002
S	1.044 (0.908-1.168)	0.516	1.108 (0.940-1.242)	0.193	0.922 (0.704-1.138)	0.491
SE	<b>0.769</b> (0.613-0.929)	0.005	<b>0.719</b> (0.517-0.927)	0.007	0.822 (0.581-1.077)	0.175
W	0.952 (0.771-1.121)	0.594	0.951 (0.690-1.172)	0.699	0.925 (0.664-1.183)	0.582

\*Significant difference in RR between diagnosis periods.

## 5.7 Discussion: lung cancer

The major findings here are:

- no significant changes in relative survival of patients between the periods 1994-97 and 1998-2001, except for an improvement for age-group 55-64 and a reduction in survival for patients from the North-Eastern region;
- significantly higher relative survival in patients from at least two regions (Mid-Western and North-Western) compared with the Eastern region, and (after fuller adjustment for patient and tumour characteristics) significantly lower survival in those from the South-Eastern region (1998-2001 only);
- significant increases in overall treatment, radiotherapy and chemotherapy use, but decreases in surgery use, nationally and in some regions, between 1996 and 2001;
- significant regional variation in treatments, mainly involving lower use of overall treatment, surgery, chemotherapy and to a lesser extent radiotherapy for patients from outside the Eastern region.

### Survival trends

The lack of any notable or general improvement in relative survival for this cancer, within the period examined, is not unexpected. Lung cancer is, on average, far more fatal and less treatable than other cancers considered in this report. The scope for improvements in treatment and survival is also, currently, less, in the absence of effective

approaches to population-based screening that might lead to substantially earlier detection.

### Regional variation in survival

This was less marked than for the other cancers considered in this report (breast, colorectal and prostate cancers). Also, in contrast to those cancers, the variation seen largely involved higher relative survival for patients from a number of regions compared with the Eastern region. Reflecting the poor survival rates for this cancer, absolute differences between regions were small and the clinical significance of the variation seen is unclear.

### Survival: international context

For males, the average five-year relative survival for Irish patients diagnosed with lung cancer during 1994-97 was lower than the European average for patients diagnosed during 1990-94 (EUROCARE-3 results summarized in *Table 5.7.1*). For female patients, Irish and average European survival figures were similar. More recent Europe-wide figures are not yet available. Note that figures tabulated here are age-standardized to the EUROCARE-3 patient population, thus the Irish figures differ slightly from those tabulated earlier in this chapter.

**Table 5.7.1** Comparison of five-year relative survival for lung cancer patients, Ireland 1994-97 and 1998-2001, and Europe 1990-94, age-adjusted to the EUROCARE-3 standard patient population for this cancer.<sup>a</sup>

	Ireland 1994-97 5-yr survival (95% CI)		Ireland 1998-2001 survival (95% CI)		Europe 1990-94 <sup>b</sup> survival (95% CI) [range] <sup>c</sup>		
male	7.7%	(6.7%-8.7%)	8.4%	(7.3%-9.5%)	9.7%	(9.3%-10.0%)	[6.1%-13.4%]
female	9.8%	(8.4%-11.3%)	11.2%	(9.6%-12.9%)	9.6%	(9.0%-10.2%)	[5.9%-16.2%]

<sup>a</sup>Capocaccia *et al.* (2003) and unpublished. <sup>b</sup>EUROCARE-3: Sant *et al.* (2003), including cancer of the trachea (not included in Irish data).

<sup>c</sup>Range of national figures: highest Austria (male), Switzerland (female).

### Treatment trends

Radiotherapy use, and overall treatment, increased nationally by the equivalent of between 2% and 3% annually in relative terms between 1996 and 2001, while chemotherapy use increased to a greater extent (by *c.*6% annually). Regional trends for these modalities were generally not clear-cut, but were consistent with either stable or increasing use of treatment. There was some evidence that trends differed between small-cell and non-small-cell lung cancers, particularly for chemotherapy (decrease in usage for SCLC compared with an increase for

NSCLC). In contrast to radiotherapy and chemotherapy, the use of surgical treatment fell nationally, and also appeared to fall at regional scale. It is not clear to what extent this reflects (or is compensated for by) increases in use of the other modalities.

### Regional variation in treatment

There was a general tendency for higher proportions of patients from the Eastern region to be treated than those from other regions, overall and based on specific modalities.

This tendency was strongest for chemotherapy, but for this modality regional variation was much more marked in the most recent diagnosis period, 1998-2001, with significantly lower use among patients from six of the eight regions (compared with none during 1994-97). Chemotherapy use was actually highest in the Western region, in both periods, but (relative to the Eastern region) was lower in the more recent period. The change in regional variation for chemotherapy use between diagnosis periods appears to reflect a more substantial annual increase in chemotherapy use among patients from the Eastern region compared with other regions.

Regional variation in surgical treatment was also substantial (significantly low use in up to four regions), but with less clear-cut differences between diagnosis periods. Radiotherapy usage varied least between regions, but was significantly low among patients from the South-Eastern and Western regions (especially the latter during 1998-2001).

In general, the extent of adjustment for patient and tumour characteristics (in addition to age, sex and cell-type included in the basic model) had little effect on the patterns or magnitude of regional variation in treatment. Likewise, these patterns were broadly reflected by analyses confined to the most common cell-type, non-small-cell lung cancer.

#### *Treatment: international context*

Comparisons are made here with first-course treatments reported for cancers in the USA as part of the National Cancer Data Base (<http://web.facs.org/ncdbbmr/ncdbbenchmarks7.cfm>). Data have been extracted from the latter for cases other than stage 0, diagnosed during 1998-2001, to provide nearest-equivalent data on treatments of invasive lung cancers. Possible minor differences between the Irish and US data in the timing of treatment included, or the histological definitions used, should be borne in mind, but the data should be broadly comparable.

For both non-small-cell and small-cell lung cancer, Irish patients were significantly less likely to receive treatment, whether radiotherapy, chemotherapy or surgery, than in the USA (*Table 5.7.2*). A significantly smaller proportion of small-cell lung cancer cases had treatment, whether radiotherapy, chemotherapy or surgery, than in the USA (*Table 5.7.2*). Of specific single or multi-modal treatments, fewer Irish cases had chemotherapy plus radiotherapy, and more had radiotherapy only, for both SCLC and NSCLC. Irish NSCLC cases were less likely to have surgery only, chemotherapy only or surgery plus chemotherapy plus radiotherapy. High proportions of SCLC in both populations had chemotherapy only.

#### *Standard treatment modalities for lung cancer*

Evidence-based summaries of standard treatment options, by stage or other prognostic grouping, are available as part of the US National Cancer Institute's PDQ Cancer Information Summaries: (<http://www.cancer.gov/cancertopics/pdq/cancerdatabase>).

A brief summary is provided below, by broad modality (see also *Appendix 1*).

##### *Small-cell lung cancer*

*Surgery:* Curative intent [or survival-prolonging] in combination with adjuvant chemotherapy or chemotherapy plus radiotherapy for disease of limited stage.

*Radiotherapy:* Adjuvant for limited stage; adjuvant or palliative for extensive stage.

*Chemotherapy:* Curative (as single modality) or adjuvant for limited and extensive stage.

##### *Non-small-cell lung cancer*

*Surgery:* Curative (as single modality or in combination with adjuvant chemotherapy or radiotherapy) for stage I; curative (in combination with adjuvant radiotherapy and chemotherapy) for stages I-IIIa; curative (in combination) for stage IIIB.

*Radiotherapy:* Curative (as single modality) for stages I-II; curative or adjuvant for IIIa-IIIB; palliative for stage IV.

*Chemotherapy:* Adjuvant for stages I-IIIa; curative or adjuvant for stage IIIB; mainly palliative for stage IV.

**Table 5.7.2** Comparison of main treatment modalities and combinations for patients with invasive lung cancer, Ireland and USA, in diagnosis period 1998-2001. US data were not specified in detail for some treatments, and may be based on slightly different definitions of lung cancer cell-type.

	non-small-cell lung cancer		small-cell lung cancer	
	Ireland 1998-2001	USA <sup>a</sup> 1998-2001	Ireland 1998-2001	USA <sup>a</sup> 1998-2001
any treatment	67.2% ***	80.9%	63.7% ***	81.6%
no treatment	32.8% ***	19.1%	36.3% ***	18.4%
any radiotherapy	41.8% ***	≥44.6%	30.7% ***	<sup>c</sup> ≥45.4%
any chemotherapy	14.2% ***	≥32.5%	50.0% ***	≥69.9%
any surgery <sup>b</sup>	21.3% ***	32.5%	2.1% **	≥4.4%
radiotherapy only	31.9% ***	18.6%	12.1% ***	6.1%
surgery only	17.2% ***	23.0%	1.3% -	-
chemotherapy only	7.1% ***	9.9%	31.2% ns	30.7%
chemo + radio	5.9% ***	19.2%	18.1% ***	39.2%
surgery + radio	3.0% ns	3.4%	0.1% -	-
surge + radio + chemo	0.3% ***	3.4%	0.2% -	-
others	1.7% -	3.3%	0.6% -	5.5%

- = data not available or statistical comparison not possible.

<sup>a</sup>Source of US data: National Cancer Data Base of first-course treatments reported by hospitals approved by the American College of Surgeons Commission on Cancer; cases of stage 0 have been excluded but cases of unknown stage have been included and assumed to be invasive; see <http://web.facs.org/ncdbbmr/ncdbbenchmarks7.cfm>.

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<sup>b</sup>US surgical data are for surgery of primary site only.

(P<0.05), \*\* (P<0.01), \*\*\* (P<0.001): significant differences between Ireland and USA in proportion of patients treated ( $\chi^2$  tests, 1.d.f.).

<sup>c</sup>≥ indicates that overall use of these treatments among patients in the USA may be higher than shown, as figures less frequent single modalities or combinations of modalities are not quoted on the NCDB website.

## References

Capocaccia R., Gatta G., Roazzi P. *et al.* & the EUROCARE Working Group. 2003. The EUROCARE-3 database: methodology of data-collection, standardization, quality control and statistical analysis. *Ann Oncol* 14 (Suppl 5): v14-v27.

Sant M., Aareleid T., Berrino F. *et al.* & the EUROCARE Working Group. 2003. EUROCARE-3 database: survival of cancer patients diagnosed 1990-94 – results and commentary. *Ann Oncol* 14 (Suppl 5): v61-v118.

Zhang, J., & Yu, K.F. 1998. What's the relative risk? A method of correcting the odds ratio in cohort studies of common outcomes. *JAMA* 280: 1690-1691.