



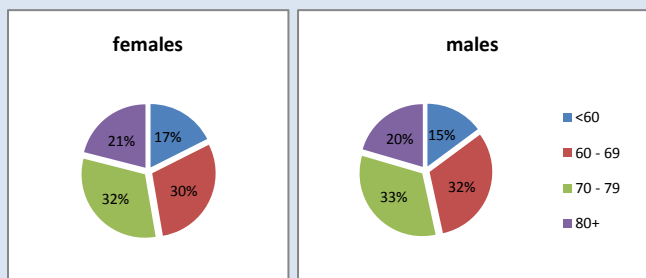
**Incidence**

In the period 2011-2013, cancer of the lung (ICD10: C34) accounted for approximately 11% of all invasive cancers excluding non-melanoma skin cancer (NMSC) and was the fourth most common in Ireland after prostate, breast and colorectal cancers (or fifth most common if NMSC included). An annual average of 2,279 lung cancer cases was diagnosed in the period 2011-2013, 1,005 (44%) cases in females and 1,274 (56%) in males. Annual incidence rates during 1994-2013 (European age-standardised rates) ranged from 54 to 71 cases per 100,000 for males and 26 to 41 per 100,000 for females (see *Time trends*).

**Age profile**

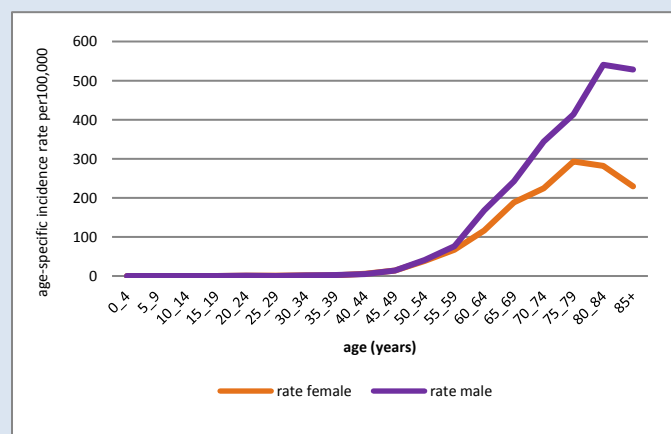
The age profile of women and men was similar, with 17% of females and 15% of males diagnosed aged under 60 years when diagnosed (Figure 1). However median age at diagnosis for females has declined slightly over time, from 72.0 years for patients diagnosed between 1994 and 1998 to 70.8 years for patients diagnosed between 2011 and 2013. For men, there was a slight rise from a median of 70.2 years in the period 1994-1998 to 70.9 years in the period 2011-2013.

**Figure 1. Age at diagnosis: lung cancer 2011-2013**



Males had a higher incidence rate than females for all ages (Figure 2). In both sexes, rates per 100,000 were highest in the older age groups (65-79) and although rates in females declined after age 80, rates per 100,000 peaked in men aged 80-84.

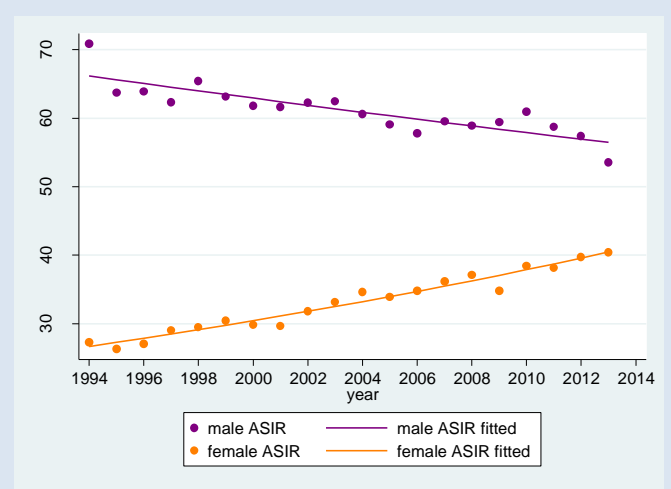
**Figure 2. Age-specific incidence rates 2011-2013**



**Time trends in incidence**

There were opposing trends in the incidence rates of lung cancer for men and women (Figure 3). Joinpoint regression was used to plot and calculate trends over time [1]. The incidence rate of lung cancer declined progressively in men with an annual percentage change (APC) of -0.8% (95%CI [-1.1%, -0.6%]) in the period 1994-2013, whereas in women it increased significantly at 2.2% (95%CI [+2.0%, 2.4%]) annually over the same period. These trends in incidence are comparable to other northern and western European countries [2].

**Figure 3. Fitted age standardised rates, lung cancer, 1994-2013**

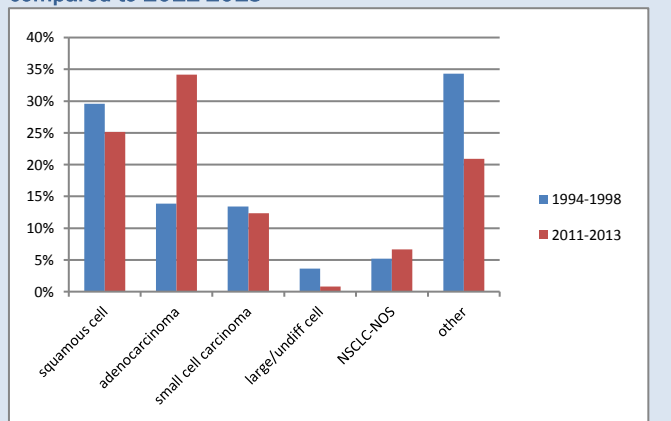


**Incidence by morphology type**

Microscopic verification of cancer type has improved over time, from an average of 73% of all cases microscopically confirmed during the 1990's to 84% in 2011-2013.

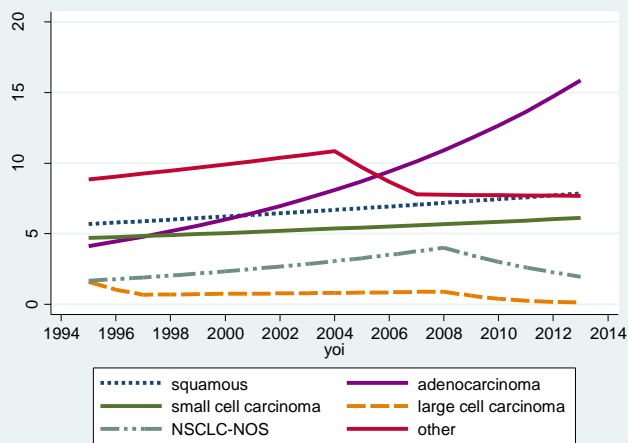
In the period 2011 - 2013, adenocarcinoma was the most common morphological type, comprising 34% of cases while squamous cell carcinoma was the second most common, comprising 25% of cases (Figure 4).

**Figure 4. Morphological type by period, lung cancer 1994-1998 compared to 2011-2013**



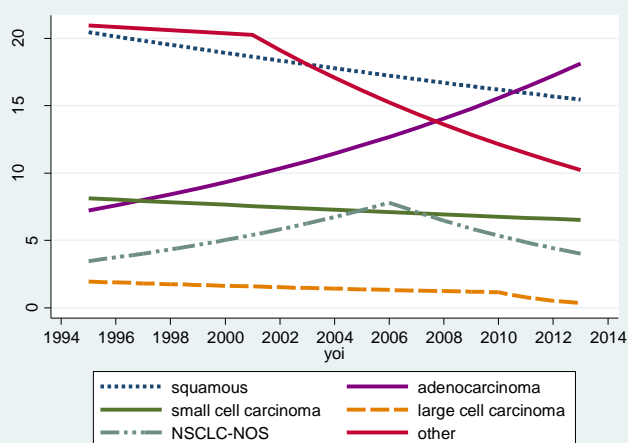
The age-standardised incidence rates of adenocarcinoma have been rising steadily for both women and men, with annual percentage changes (APCs) of 7.8% (95%CI 6.8, 8.7) and 5.2% (4.3, 6.2) respectively (Figures 5 and 6). For women, squamous and small cell lung cancers increased over the period with APCs 1.8% (1.0, 2.7) and 1.5% (0.4, 2.6), whereas for men the rates for these two morphology types decreased over the period with squamous cell carcinoma having an APC of -1.5% (-2.3, -0.8) and small cell lung cancer an APC of -1.2% (-2.0, -0.4).

Figure 5. Incidence rates by morphology type - females



\*data from 1994 omitted in the modelled rates

Figure 6. Incidence rates by morphology type - males

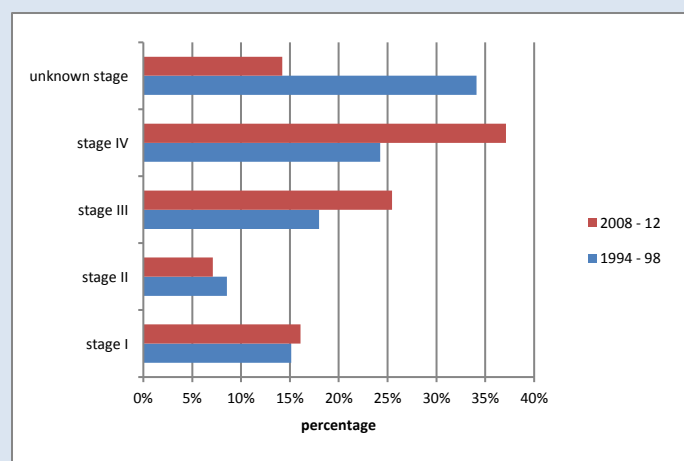


\*data from 1994 omitted in the modelled rates

Stage at diagnosis

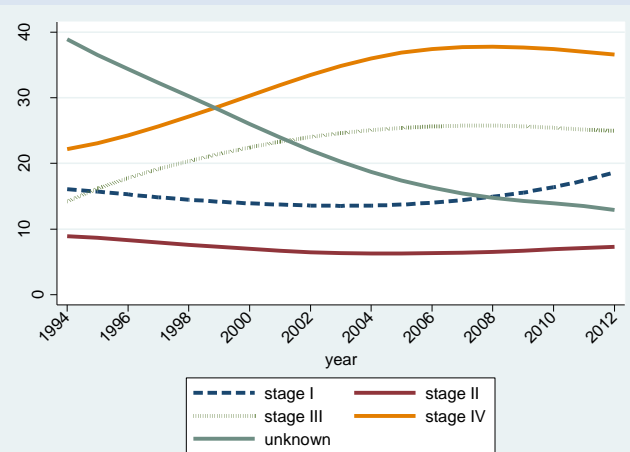
During the 1990s over one-third of all lung cancers were unstaged. Improvements in diagnostic techniques in recent years have reduced the proportion of unstaged tumours to 14%. However the majority of patients are still diagnosed at late stage. We compared the earliest period 1994-1998 with the most recent period. For stage information, the data was complete up to 2012, and thus the most recent five-year period presented is 2008-2012. The combined proportion of stage III and IV was 63% during 2008-12, up from 42% in 1994-1998 (Figure 7).

Figure 7. Percentage of cases by diagnostic stage, lung cancer 1994-1998 compared to 2011-2013



The proportion of unstaged lung cancers decreased steadily over time, and this trend appears to be continuing, albeit at a slower rate in more recent years (Figure 8). This has resulted in an increase in the distribution of those with stage III and stage IV diagnoses with comparatively little change in the proportions of the early stage (I and II) cases until 2008, after which the proportion of stage I cases began to increase.

Figure 8. Proportion of cases by stage over time\*

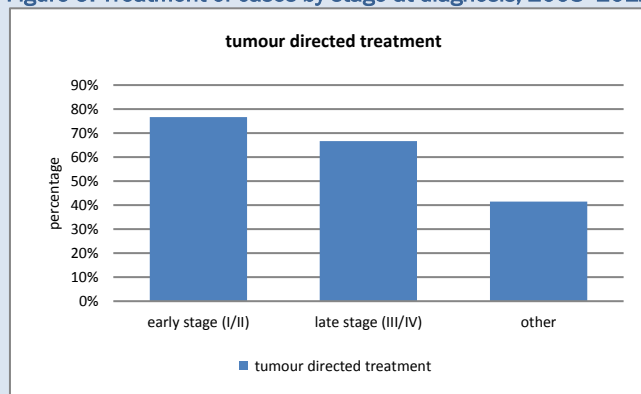


\*smoothed using lowest curves

Treatment

For treatment information, the data was complete up to 2012, and thus the most recent five-year period presented is 2008-2012. A large minority (35%) of patients did not receive tumour-directed treatment in the period 2008-2012. This may be partly due to many presenting with late stage lung cancer as described above. However, it should be noted that patients who did not receive tumour directed treatment (within 1 year), received other type of symptom relieving treatment, either within a year or longer after diagnosis. Of those with early stage lung cancer, 75% received tumour-directed treatment compared with 67% of those with late stage and 41% of those with unstaged disease (Figure 9).

Figure 9. Treatment of cases by stage at diagnosis, 2008 -2012



Whether a patient received tumour-directed treatment was influenced heavily by their age at diagnosis. During 2008-2012, 85% of those aged under 60 years received treatment within one year, compared to only one-third of those over 80 years (Table 1).

**Table 1. Treatment by age group, 2008-2012**

age category	surgery	chemotherapy	Radiotherapy	no tumour directed treatment
<60	26%	58%	50%	15%
60-69	22%	46%	47%	22%
70-79	17%	27%	39%	36%
80+	4%	6%	26%	67%

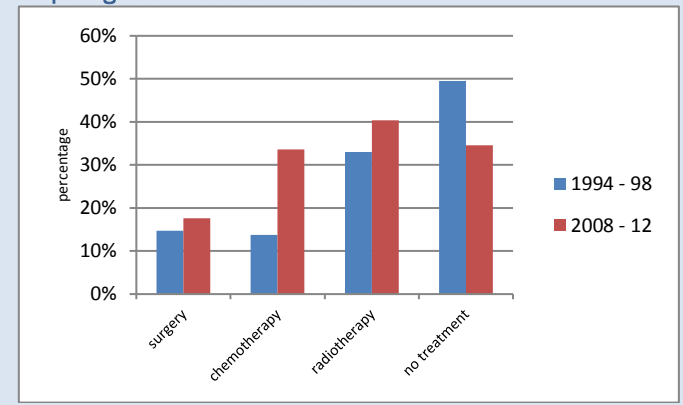
Overall 17% of patients had surgery, though this varied considerably by morphology type, ranging from 2% for small cell lung cancer to 39% for large/undifferentiated cell lung cancer (Table 2). Large/undifferentiated cell types also had the highest proportion with tumour-directed treatment at 82%. Chemotherapy and radiotherapy were the main treatment modalities for small cell lung cancer at 64% and 56% respectively.

**Table 2. Treatment by morphological type, 2008-2012**

morphology type	surgery	chemo	radiotherapy	no tumour directed treatment
squamous	24%	31%	49%	24%
adenocarcinoma	27%	40%	39%	22%
small cell	2%	64%	56%	25%
large/undiff cell	39%	40%	50%	18%
NSCLC-NOS	8%	38%	54%	30%
other	9%	8%	17%	72%

There were increases in the proportion of patients who received surgery and radiotherapy when comparing the late 1990s to 2008-2012, but the biggest increase occurred in chemotherapy which was administered to 14% of patients in the late 1990s compared to 34% of patients in the most recent period (Figure 10).

**Figure 10. Variation in treatment of lung cancer by time period, comparing 1994-1998 to 2008-2012.**

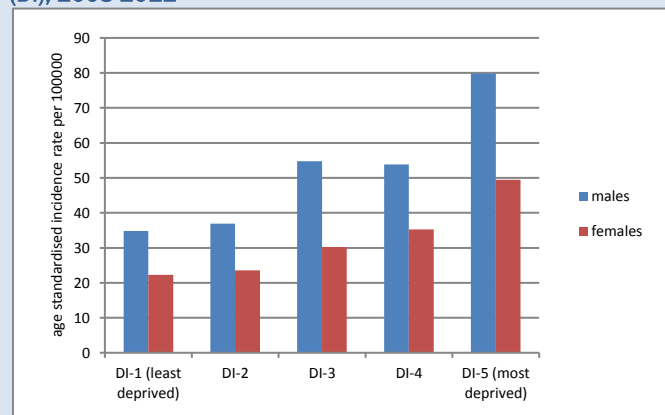


**Social class and incidence rates**

Lung cancer is known to have a strong association with socio-economic status [3]. Patients with a lung cancer diagnosis were assigned to a deprivation category based on an area-based deprivation index derived from 2006 census variables [4].

The age-standardised incidence rate for males in the most deprived group was almost 80 per 100,000, more than double the rate (35 per 100,000) in the least deprived group (Figure 11). Similarly for women, the rate in the most deprived group at almost 50 per 100,000 was more than double that in the least deprived group at 22 per 100,000.

**Figure 11. Age standardised incidence rates by deprivation index (DI), 2008-2011**



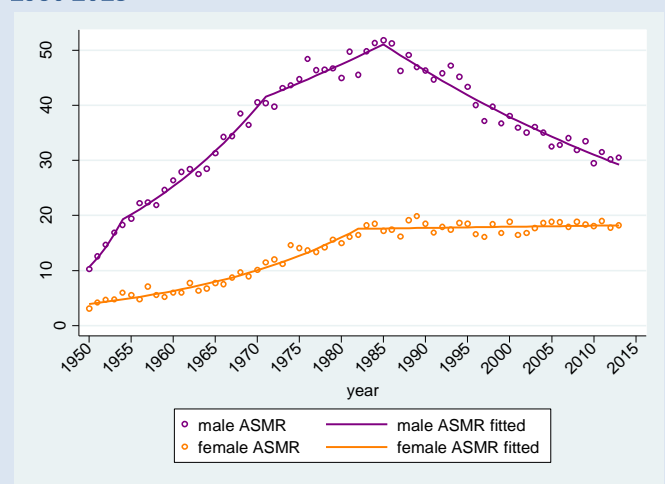
**Trends in Irish mortality rates**

Lung cancer was the leading cause of cancer death in both sexes, comprising 18% of cancer deaths in women and 22% of cancer deaths in men during the period 2010-2013 (mortality from the Central Statistics Office [5] and European Cancer Observatory [2]).

Age-standardised mortality rates for men increased from 1950 to the mid/late 1980s, after which rates declined: APC -2.0% (95%CI -2.2, -1.8), 1985-2013, (Figure 12). Current mortality rates in men are similar to those reported in the 1960s.

For women, while the increase in mortality rates tailed off in the early 1980s, rates have remained fairly constant since then with an APC of +0.1% (95%CI -0.2, 0.5), 1983-2013. Mortality rates in women are lower than in men but, reflecting the lack of any decrease in female mortality since early 1980s, the difference between the sexes has reduced considerably.

**Figure 12. Fitted age standardised mortality rate in Ireland: 1950-2013**



**International variation in mortality**

Comparing our mortality rates with other European countries in 2012, for men Ireland along with the UK, Portugal, Austria and Scandinavia had some of the lowest mortality rates due to lung cancer (Figure 13a) – for Ireland, the 8<sup>th</sup> lowest rate in the European Union (EU-28).

The converse applies to women, with Denmark, Hungary and Netherlands UK and Ireland showing the highest mortality rates. In particular, Ireland had the 5<sup>th</sup> highest female mortality rate in the EU-28 (Figure 13b).

Figure 13. Estimated mortality (European age-standardised) from lung cancer, 2012, in (a) men and (b) women

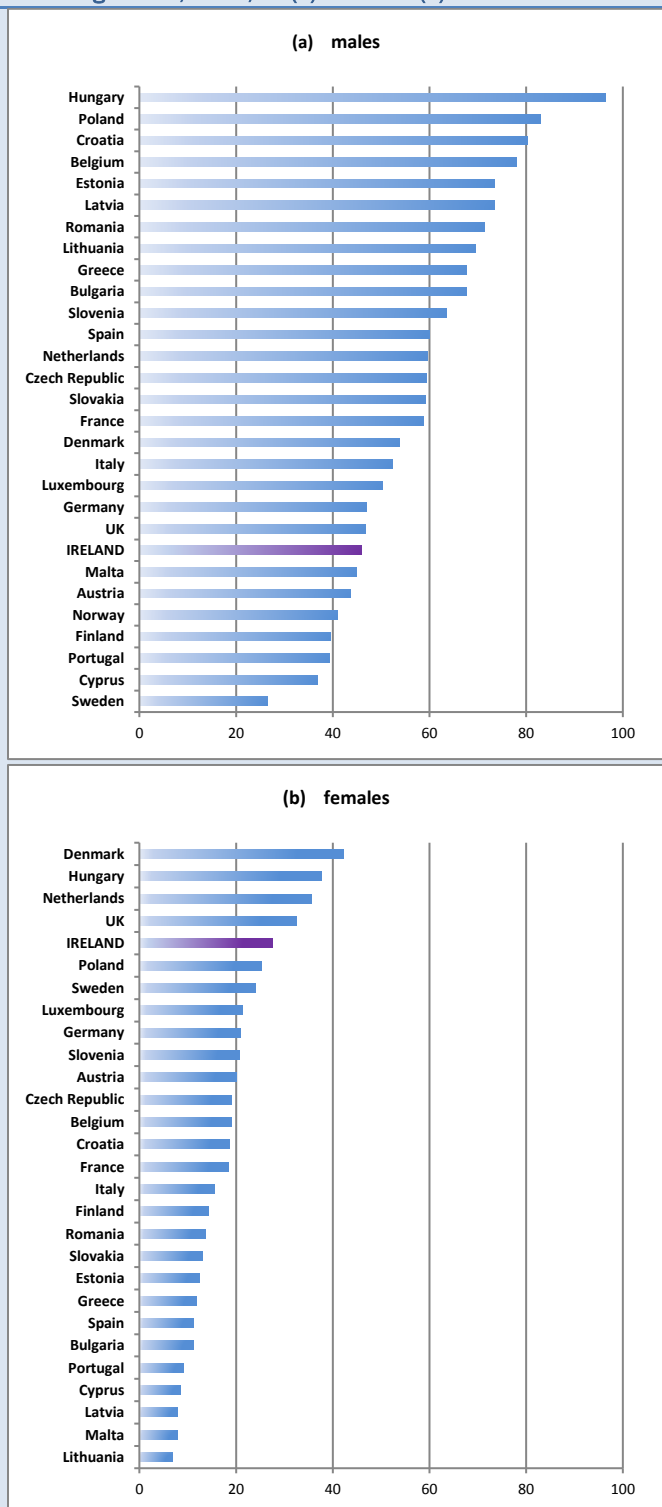
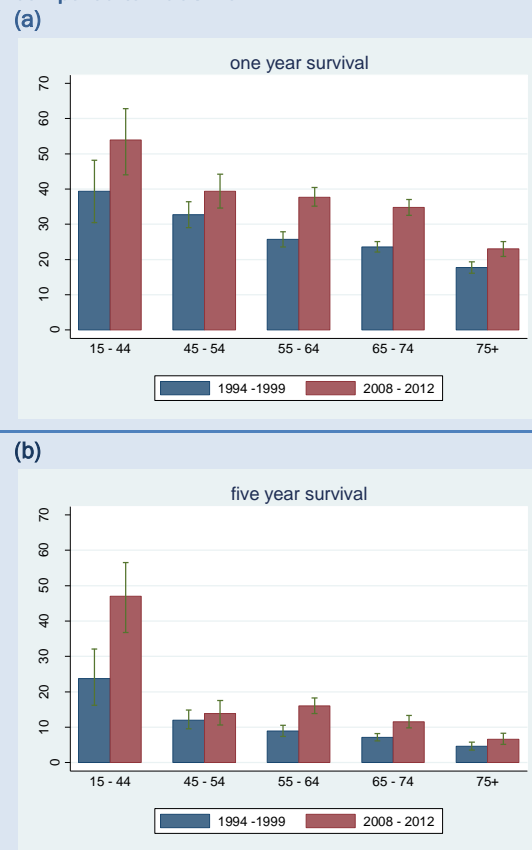
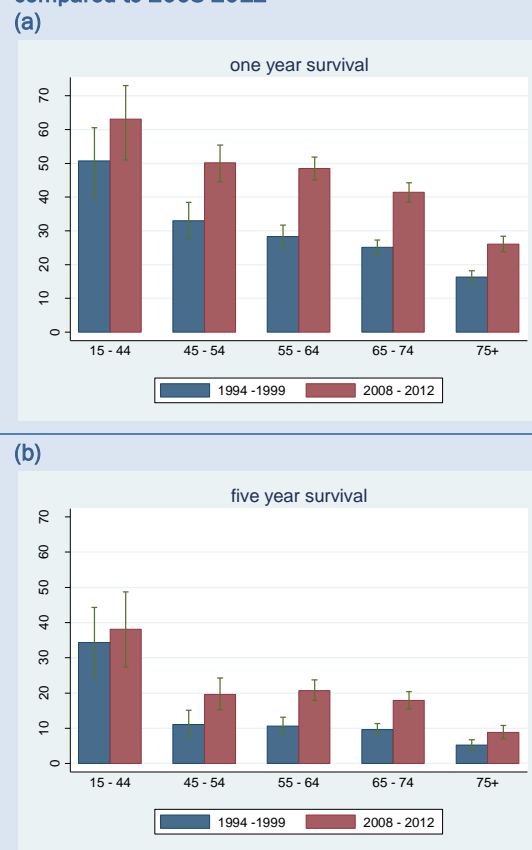


Figure 14. Net survival - males: lung cancer 1994-1999 compared to 2008-2012



There was an improvement for both sexes in all age-groups in both one-year and the five-year survival when comparing 1994-99 and 2008-12. This may be due to advances in treatment regimens and also may be influenced by the higher proportion of adenocarcinomas in the case-mix which confer better survival over other morphology types.

Figure 15. Net survival - females: lung cancer 1994-1999 compared to 2008-2012



**Survival in Ireland**

Net survival due to lung cancer is the ratio of observed survival for lung cancer patients to the expected survival of individuals of the same age, sex and country [6].

Net survival rates for lung cancer are very poor in comparison with many other cancers, with an age-standardised 1-year survival of 37% and a 5-year survival of 15.3% in the period 2008-2012. Women had better 5-year survival than men overall, 17.5% compared to 13.9% respectively in 2008-12. However younger men had higher 5-year survival than women (under-45 age-group), 47% v 38.1% (Figure 14b and 15b).

**REFERENCES**

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