Cancer in Ireland 1994-2012: Annual Report of the National Cancer Registry

National Cancer Registry Ireland

2014

ABBREVIATIONS

95% CI	95% confidence interval
APC	Annual percentage change
ASR	Age-standardised rate (European standard population)
CNS	Central nervous system
CSO	Central Statistics Office
ECO	European Cancer Observatory
ENCR	European Network of Cancer Registries
IARC	International Agency for Research on Cancer
ICD	International Statistical Classification of Diseases and Related Health Problems
NCR	National Cancer Registry
NMSC	Non-melanoma skin cancer
NOS	Not otherwise specified
RSJ	Recto-sigmoid junction
TNM	Tumour, node, metastasis (staging)

Published by;

National Cancer Registry
Building 6800,
Cork Airport Business Park,
Kinsale Road,
Cork, Ireland.

Telephone: +353 21 4318014
Fax: +353 21 4318016
Email: info@ncri.ie
Website: www.ncri.ie

This report should be cited as:
National Cancer Registry (2014)
Cancer in Ireland 1994-2012: Annual Report of the National Cancer Registry. NCR, Cork, Ireland.

CONTENTS

SUMMARY

Incidence: new cases per year and stage at diagnosis

In the most recent three years for which full data are available (2010-2012), on average about 36,000 newly diagnosed tumours were registered per year. Of these cases, just over 20,000 involved invasive cancers other than the less serious, non-melanoma skin cancers. Over half involved the four most common major malignancies – prostate (3,400 cases per year), breast (2,800), colorectal (2,500) and lung cancer (2,300).

Age-standardised incidence rates of cancer in Ireland in 2012 were estimated to be 10% higher than the European Union average for males, and 16% higher than the EU average for females. This included higher Irish rates of colorectal, female lung, breast and, especially, prostate cancer, although male lung cancer rates were lower in Ireland.

Time-trends in cancer incidence since 1994 have varied substantially depending on the cancer type. Overall, age-standardised incidence rates for invasive cancers have increased by about 1% per year in both males and females (throughout 1994-2012). Many individual cancer types have also shown upward trends in annual rates, for example lymphomas and prostate, melanoma , kidney, thyroid, cervical, uterine and female lung cancer, although the likely factors involved may differ (e.g., screening, lifestyle factors or diagnostic improvements). But some cancers have shown declines in incidence rates, notably stomach cancer and male lung cancer.

For some cancers, there has been a marked shift towards earlier stages at diagnosis – notably for melanoma and for breast, prostate, kidney and thyroid cancers – reflecting improvements in early detection.

Mortality: deaths from cancer

Cancer remains the second most common cause of death in Ireland, after diseases of the circulatory system. Deaths from cancer averaged about 8,800 deaths per year during 2010-2012, representing about 30% of all deaths in that period. Age-standardised rates of cancer mortality were about 37% higher in men than in women. Lung cancer was by far the single most common cause of cancer death during 2010-2012, with approximately 1,800 deaths annually, with deaths from colorectal (990), breast (680), prostate (550) and pancreatic cancer (490) the next most common.

Compared with the EU as a whole, estimated cancer mortality rates in Ireland in 2012 were 14% higher for Irish women but were 9% lower for Irish men. For women, lung cancer mortality for Ireland was substantially (34%) higher than the EU average.

Unlike incidence, time-trends in cancer mortality rates have fallen overall throughout 1994-2012, by about 1.5% per year in men and about 1.1% per year in women. But, like incidence, the trends have varied by cancer type, although many cancer types have shown ongoing reductions in mortality rates since the early 1990s. The exceptions, showing significant increases in rates, include melanoma in both sexes and lung and uterine cancer in women.

Cancer survival

Trends in cancer mortality reflect changes in both cancer incidence and survival. Survival estimates for most cancer types in Ireland have improved over time, although the trend is clearer for some cancers than for others. Some of the more striking improvements have been seen for colorectal, breast, kidney, testicular and prostate cancers and for multiple myeloma, lymphoma and leukaemia. However, across ten major cancer types the recently published CONCORD-2 study indicated that, in general, Ireland remained approximately mid-way in the ranking of survival estimates among European countries.

Cancer prevalence

As average survival improves, as incidence (or diagnosis) of many cancers increases, and the population ages, cancer prevalence - the number of cancer survivors - in Ireland continues to grow. Of all the patients diagnosed with invasive cancer during 1994-2012 (excluding non-melanoma skin cancer), approximately 122,500 were still alive at the end of

2012. Of these, almost 94,000 had survived ten years or more since their diagnosis. The growing population of cancer survivors has implications for health service provision in the decades ahead.

Treatment

The survival improvements seen for some cancers reflect, in part, detection at earlier stages than in earlier years. For the majority of cancers, however, improvements in treatment are probably the major contributor to survival improvements. Most notably, the use of chemotherapy, either on its own or more frequently in combination with other treatment modalities has increased markedly across the majority of relevant cancer types. Radiotherapy use has also increased across many cancer types, and the proportion of patients having surgical treatment has increased for some cancers. These improvements mean that the overall proportion of cancer patients having tumour-directed treatment (as opposed to treatments aimed at symptom relief and palliation) continues to increase. However, the proportion of older patients (≥65 years) having no tumour-directed treatment remains high.

1. INCIDENCE: 2010-2012

An average of approximately 35,800 cancers was registered per year between 2010 and 2012 inclusive, representing an overall age-standardised incidence rate of 747 females cases and 790 males cases per 100,000 per year (Table 1-1). Approximately 18% of these were non-invasive tumours (in-situ tumours, tumours of uncertain behaviour and benign brain and CNS tumours) and 25% were non-melanoma skin cancers (NMSC, 9,102 cases per year). Looking at figures for all invasive cancers only, and excluding NMSC, just over 20,000 cases were registered annually, representing 56% of all registered cases and equivalent to an incidence rate of 385 female cases and 493 male cases per 100,000 per year. Incidence rates for all invasive cancers combined, excluding NMSC, were 28% higher for men than for women (similar to previously published figures), and cumulative lifetime risk remains approximately 1 in 3 for men and 1 in 4 for women.

Further statistics by individual cancer type are summarised below and, for a longer list of sites, in Appendix I.

Table 1-1. Annual average incidence of the main cancers: 2010-2012

	CASES			RATE** (age-standardised) per 100,000		% RISK to age 75 years		% of all invasive cancers		
site	females	males	total	females	males	females	males	females	males	total
C00-C96: All invasive cancers*	**13,378**	**15,788**	**29,166**	**543.9**	**722.1**	**35.04**	**44.22**	**100%**	**100%**	**100%**
C00-C43,C45-C96: All invasive tumours excluding NMSC*	9,312	10,751	20,063	384.5	492.5	26.55	33.63	69.6%	68.1%	68.8%
D00-D48: All non-invasive tumours	5,110	1,497	6,606	203.0	68.0	14.18	5.26			
C00-D48: All registered tumours	18,488	17,284	35,772	746.9	790.1	44.25	47.15			
mouth & pharynx	129	257	386	5.5	11.9	0.45	1.05	1.0%	1.6%	1.3%
oesophagus	139	247	386	5.2	11.4	0.39	0.94	1.0%	1.6%	1.3%
stomach	187	344	530	7.0	15.7	0.48	1.23	1.4%	2.2%	1.8%
colorectal	1,046	1,439	2,486	41.1	65.6	3.11	4.97	7.8%	9.1%	8.5%
liver	74	144	217	2.8	6.5	0.21	0.52	0.6%	0.9%	0.7%
pancreas	228	255	484	8.6	11.7	0.63	0.91	1.7%	1.6%	1.7%
lung	973	1,300	2,273	39.0	59.3	3.18	4.55	7.3%	8.2%	7.8%
melanoma skin	496	392	889	20.5	17.8	1.64	1.42	3.7%	2.5%	3.0%
non-melanoma skin (NMSC)	4,066	5,036	9,102	159.4	229.7	11.55	15.96	30.4%	31.9%	31.2%
breast	2,816	28	2,844	122.7	1.3	9.64	0.10	21.1%	0.2%	9.8%
cervix	306		306	13.0		1.01		2.3%		1.0%
corpus uteri	412		412	17.9		1.61		3.1%		1.4%
ovary	360		360	15.1		1.23		2.7%		1.2%
other gynaecological cancers†	103		103	4.2		0.32		0.8%		0.4%
prostate		3,384	3,384		157.3		13.83		21.4%	11.6%
testis		176	176		7.3		0.52		1.1%	0.6%
kidney	191	351	542	7.9	16.1	0.69	1.31	1.4%	2.2%	1.9%
bladder	129	314	443	4.7	14.3	0.33	1.00	1.0%	2.0%	1.5%
brain & CNS (malignant)	156	197	353	6.6	8.9	0.53	0.73	1.2%	1.2%	1.2%
brain & CNS (benign)	117	49	166	4.9	2.2	0.40	0.19			
brain & CNS (uncertain)	34	29	63	1.4	1.3	0.11	0.10			
all lymphoma	388	472	860	16.1	21.4	1.32	1.67	2.9%	3.0%	2.9%
Hodgkin lymphoma	*64*	*73*	*137*	*2.7*	*3.2*	*0.21*	*0.25*	*0.5%*	*0.5%*	*0.5%*
non-Hodgkin lymphoma	*324*	*399*	*723*	*13.4*	*18.2*	*1.11*	*1.42*	*2.4%*	*2.5%*	*2.5%*
multiple myeloma	103	141	244	3.9	6.5	0.28	0.48	0.8%	0.9%	0.8%
all leukaemia	192	297	489	7.9	13.5	0.60	0.98	1.4%	1.9%	1.7%
other invasive cancers (not listed)‡	958	1,158	2,114					7.2%	7.3%	7.2%

* invasive cancer included all tumours classified as behaviour 3 in ICD-O-3 classification (including some neoplasms previously classified as uncertain behaviour) [1]

**rates are standardised to the European standard population [16][17]

† vulva, vagina, uterus (NOS) and placenta

‡ see Appendix I for more site specific statistics

Figure 1-1. Relative frequency of the main invasive cancers diagnosed during 2010-2012

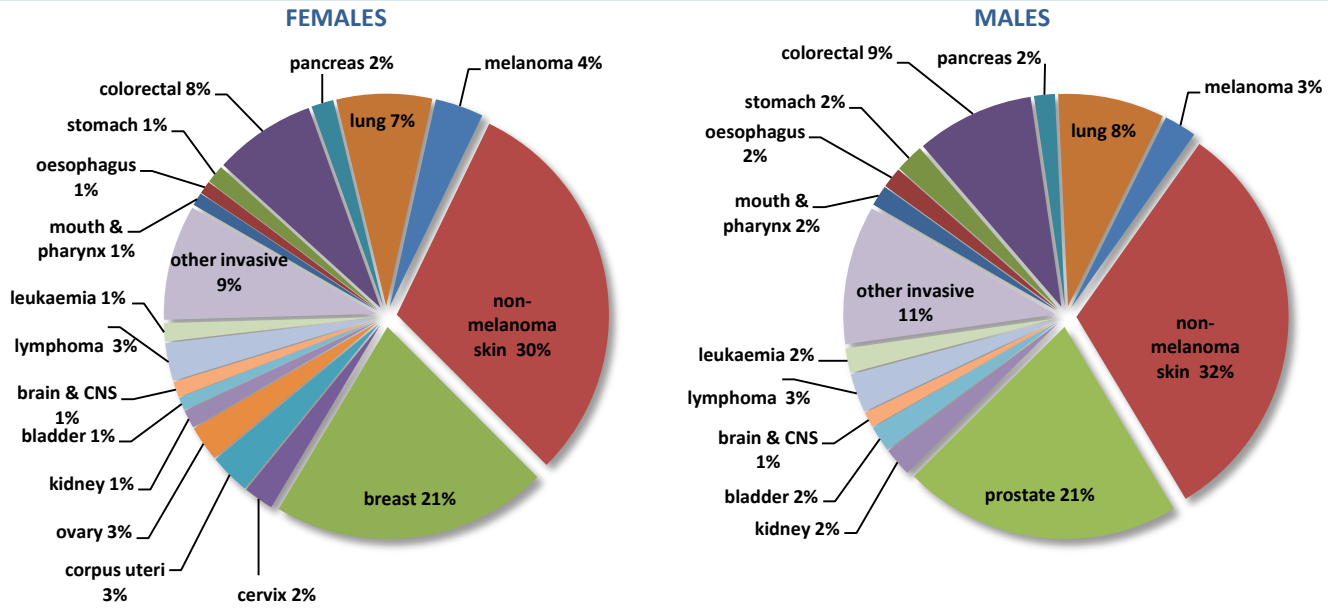


Table 1-2. Ranking of the most commonly diagnosed invasive cancers (excluding NMSC): 2010-2012

	FEMALES		MALES		ALL	
	%	rank	%	rank	%	rank
All invasive cancers, excluding NMSC	100.0%		100.0%		100.0%	
prostate			31.5%	1	16.9%	1
breast	30.2%	1			14.2%	2
colorectal	11.2%	2	13.4%	2	12.4%	3
lung	10.4%	3	12.1%	3	11.3%	4
melanoma skin	5.3%	4	3.6%	5	4.4%	5
lymphoma	4.2%	6	4.4%	4	4.3%	6
kidney	2.1%	11	3.3%	6	2.7%	7
stomach	2.0%	12	3.2%	7	2.6%	8
pancreas	2.5%	9	2.4%	10	2.4%	9
leukaemia	2.1%	10	2.8%	9	2.4%	10
bladder	1.4%	16	2.9%	8	2.2%	11
corpus uteri	4.4%	5			2.1%	12
mouth & pharynx	1.4%	17	2.4%	11	1.9%	13
oesophagus	1.5%	15	2.3%	12	1.9%	14
brain & spinal cord	1.7%	14	1.8%	13	1.8%	15
ovary	3.9%	7			1.8%	16
cervix	3.3%	8			1.5%	17
thyroid	2.0%	13	0.5%	17	1.2%	18
multiple myeloma	1.1%	18	1.3%	16	1.2%	19
liver	0.8%	19	1.3%	15	1.1%	20
testis			1.6%	14	0.9%	21
Other sites not listed	8.5%		9.2%		8.8%	

Of all invasive cancers registered, NMSC was the most common cancer, representing 30% and 32% of all cases in females and males respectively (Figure 1-1). If NMSC was excluded, prostate and female breast cancer were the most commonly diagnosed cancers overall, and each comprised almost one-third of all cancers in women and men respectively (Table 1-2). Colorectal and lung cancer were the 2nd and 3rd most common cancers in both sexes respectively, and for these two sites combined, their relative contribution to all invasive cancers was still less than that for breast or prostate alone. Little change was observed in the relative frequency of individual cancer types from previously reported figures (2009-2011 average) [2].

2. MORTALITY: 2010-2012

Cancer remains the second most common cause of death, after diseases of the circulatory system, and an estimated annual average of 8,762 deaths from cancer occurred during the period 2010-2012. This represented approximately 30% of all deaths for the period and a mortality rate of approximately 155 female and 212 male deaths per 100,000 persons per year (Table 2-1). Almost all cancer deaths were from invasive cancers (97%). All-cancer mortality rates for the period 2010-2012 were approximately 37% higher in men than in women. The lifetime risk (to age 75 year) of dying from cancer during the period 2010-2012 was approximately 1 in 10 for women and 1 in 8 for men. Lung cancer was the single most common cause of cancer death during 2010-2012, with approximately 1,780 deaths annually, just over one-fifth of all cancer deaths.

A breakdown of mortality statistics by cancer site is given below and, in more detail, in Appendix II.

Table 2-1. Average annual number of deaths from cancers: 2010-2012

	DEATHS			RATE* (age-standardised) per 100,000		% RISK to age 75 years		% of all cancer deaths		
site	females	males	total	females	males	females	males	females	males	total
C00-D48: All registered cancer deaths	4,128	4,634	8,762	154.7	211.9	10.49	13.10	100.0%	100.0%	100.0%
C00-C96: All invasive cancer deaths	3,986	4,480	8,466	150.0	204.9	10.30	12.84	96.6%	96.7%	96.6%
D00-D48: All non-invasive cancer deaths	142	154	296	4.7	7.1	0.22	0.29	3.4%	3.3%	3.4%
All cancer invasive deaths, excl. NMSC	3,959	4,428	8,387	149.2	202.4	10.27	12.75	95.9%	95.6%	95.7%
mouth & pharynx	44	99	143	1.7	4.5	0.13	0.39	1.1%	2.1%	1.6%
oesophagus	120	230	350	4.2	10.6	0.27	0.81	2.9%	5.0%	4.0%
stomach	127	199	326	4.5	9.1	0.27	0.64	3.1%	4.3%	3.7%
colorectal	416	576	992	14.8	26.3	0.95	1.78	10.1%	12.4%	11.3%
liver	111	153	265	4.0	7.1	0.29	0.52	2.7%	3.3%	3.0%
pancreas	230	258	488	8.4	11.9	0.55	0.86	5.6%	5.6%	5.6%
lung	743	1,040	1,783	28.8	47.4	2.20	3.57	18.0%	22.4%	20.4%
melanoma skin	66	87	153	2.5	4.0	0.18	0.28	1.6%	1.9%	1.7%
breast	673	9	682	26.4	0.4	2.04	0.03	16.3%	0.2%	7.8%
cervix	94		94	4.0		0.33		2.3%		1.1%
corpus uteri	81		81	3.2		0.26		2.0%		0.9%
ovary	279		279	11.2		0.92		6.8%		3.2%
other gynaecological cancers †	56		56					1.3%		0.6%
prostate		549	549		25.3		1.04		11.9%	6.3%
testis		5	5		0.2		0.01		0.1%	0.1%
kidney	57	140	197	2.1	6.4	0.15	0.45	1.4%	3.0%	2.2%
bladder	78	128	206	2.6	5.8	0.14	0.26	1.9%	2.8%	2.3%
brain & CNS (malignant)	103	149	251	4.2	6.7	0.35	0.56	2.5%	3.2%	2.9%
brain & CNS (benign)	8	4	12	0.2	0.2	0.01	0.00	0.2%	0.1%	0.1%
brain & CNS (uncertain)	10	13	23	0.3	0.6	0.03	0.04	0.2%	0.3%	0.3%
lymphoma	128	151	280	4.7	6.9	0.32	0.42	3.1%	3.3%	3.2%
Hodgkin lymphoma	*11*	*10*	*21*	*0.4*	*0.4*	*0.02*	*0.03*	*0.3%*	*0.2%*	*0.2%*
non-Hodgkin lymphoma	*117*	*141*	*258*	*4.3*	*6.4*	*0.30*	*0.38*	*2.8%*	*3.1%*	*2.9%*
multiple myeloma	76	79	155	2.6	3.6	0.16	0.24	1.8%	1.7%	1.8%
leukaemia	86	133	219	3.0	6.0	0.17	0.38	2.1%	2.9%	2.5%
other cancer deaths ‡	652	785	1,438					15.8%	16.9%	16.4%

*rates are standardised to the European standard population
† vulva, vagina, uterus (NOS), placenta
‡ see Appendix II for site specific data

Figure 2-1. Relative frequency of the main invasive cancer deaths : 2010-2012

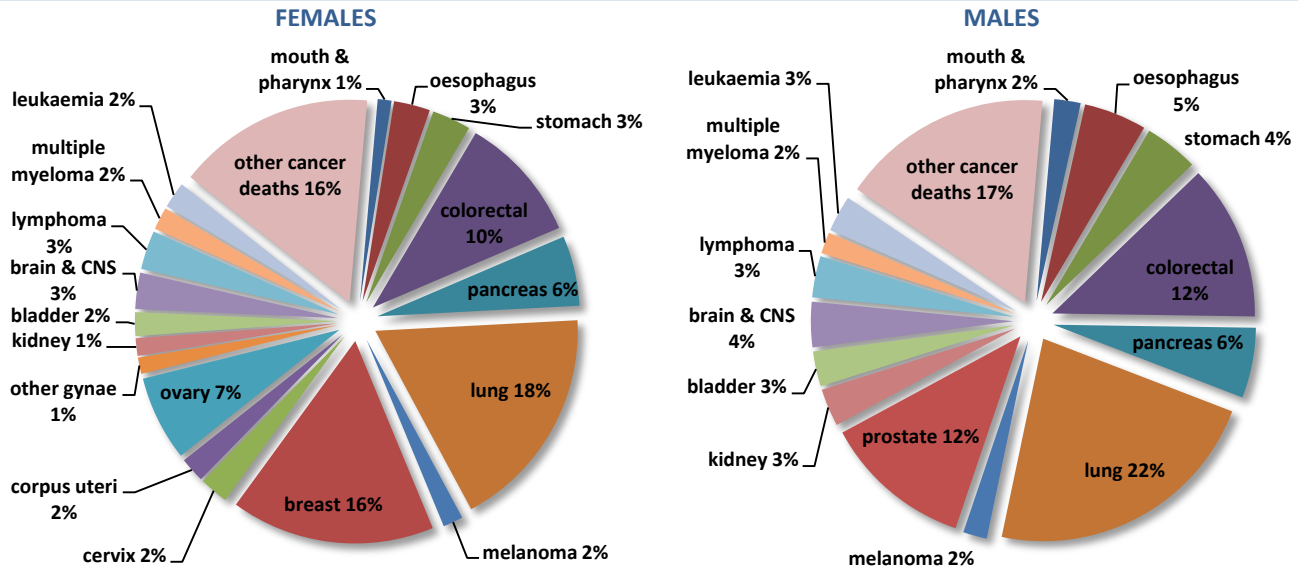


Table 2-2. Ranking of the most common cancer deaths: 2010-2012

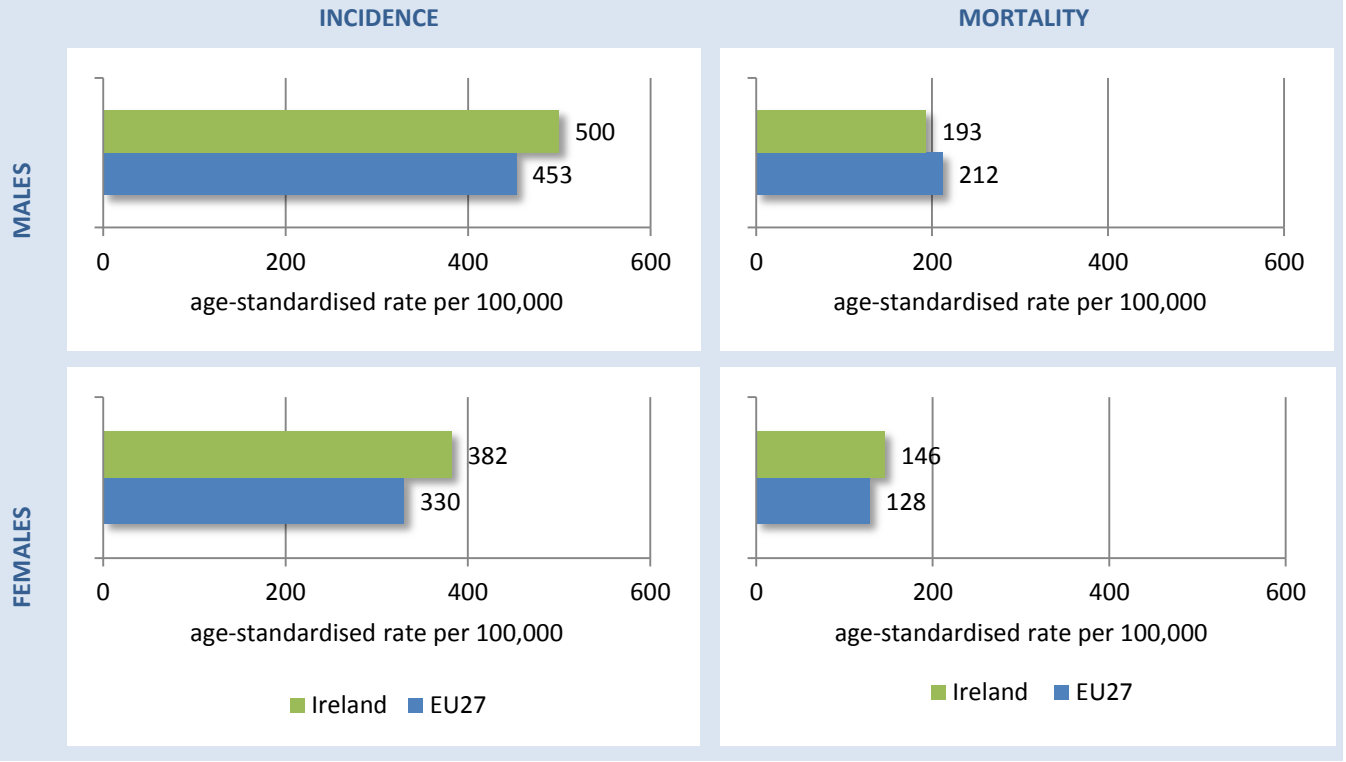
	FEMALES		MALES		ALL	
	%	rank	%	rank	%	rank
lung	18.0%	1	22.4%	1	20.4%	1
colorectal	10.1%	3	12.4%	2	11.3%	2
breast	16.3%	2			7.8%	3
prostate			11.9%	3	6.3%	4
pancreas	5.6%	5	5.6%	4	5.6%	5
oesophagus	2.9%	8	5.0%	5	4.0%	6
stomach	3.1%	6	4.3%	6	3.7%	7
ovary	6.8%	4			3.2%	8
lymphoma	3.1%	7	3.3%	7	3.2%	9
liver	2.7%	9	3.3%	8	3.0%	10
brain & spinal cord	2.5%	10	3.2%	9	2.9%	11
leukaemia	2.1%	12	2.9%	11	2.5%	12
bladder	1.9%	14	2.8%	12	2.3%	13
kidney	1.4%	17	3.0%	10	2.2%	14
multiple myeloma	1.8%	15	1.7%	15	1.8%	15
melanoma skin	1.6%	16	1.9%	14	1.7%	16
mouth & pharynx	1.1%	18	2.1%	13	1.6%	17
cervix	2.3%	11			1.1%	18
corpus uteri	2.0%	13			0.9%	19
other gynaecological	1.1%	19			0.6%	20
other cancer deaths	13.6%		14.2%		13.9%	

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 2010-2012 (Figure 2-1). Deaths from lung, colorectal, breast and prostate cancers combined made up almost half of all deaths from cancer during this period. Deaths from cancers of the ovary and pancreas in females, and from cancers of the pancreas, oesophagus and stomach in males, together made up 12% and 15% respectively of all cancer deaths. These sites respectively ranked as the 4th and 5th most common causes of cancer death in women and the 4th to 6th most common in men (Table 2-2). Comparison with the lower cancer incidence ranking for pancreas and oesophagus in particular (Table 1-2) provides a clear indicator of the high mortality:incidence ratio for these cancers, reflecting their poor prognosis.

3. INCIDENCE AND MORTALITY: IRELAND AND EUROPE

The European Cancer Observatory (ECO) has been developed in collaboration between IARC and 130 ENCR member registries [3][4]. ECO provides a comprehensive window on cancer incidence, mortality, prevalence and survival for Europe as a whole and for individual countries and registries. *Estimates* of cancer incidence and mortality in Ireland are presented for 2012 (Figures 3-1, 3-2). The average pooled estimates for the 27 members of the EU (in 2012) are presented for comparison.

Figure 3-1. Comparison of estimated incidence and mortality rates in Ireland with EU(27) average rates in 2012: all cancer sites, invasive tumours, excluding NMSC: European Cancer Observatory [3][4]



The age-standardised incidence rate in Irish males was 500/100,000, which was substantially higher than the EU average (453/100,000), partly due to increased diagnosis of prostate cancer in Ireland (Figure 3-2). Similarly, the incidence rate in females was 382/100,000, considerably higher than the EU average (330/100,000), mostly reflecting higher incidence of lung, breast and colorectal cancer among Irish females (Figure 3-2).

It cannot be excluded that some of this international variation might reflect differences in completeness of cancer registration. Almost half of the population of Europe falls outside the coverage of cancer registration and some countries may not have recorded all incident cancer cases that occurred within their borders, or incidence may have been estimated from mortality statistics. Some countries have regional registries that do not cover the whole population of the country (e.g. Spain, Italy, Poland, France and Germany) [5]. Ireland has a national cancer registry which covers the whole population (since 1994) and completeness of registration is estimated as 98% [6].

The mortality rate estimate from cancer in males was 193/100,000, which was slightly lower than the EU27 average (212/100,000), partly due to lower than average mortality rates from lung cancer (Figure 3-2). Conversely, the mortality rate in females was higher than the EU27 average: 146 *vs.* 128/100,000 respectively. This was largely due to the higher death rates for lung, breast and ovarian cancer in Irish females relative to the European average (Figure 3-2).

Figure 3-2. Comparison of estimated incidence and mortality rates in Ireland with EU(27) average rates in 2012: invasive tumours, excluding NMSC: European Cancer Observatory [3][4]

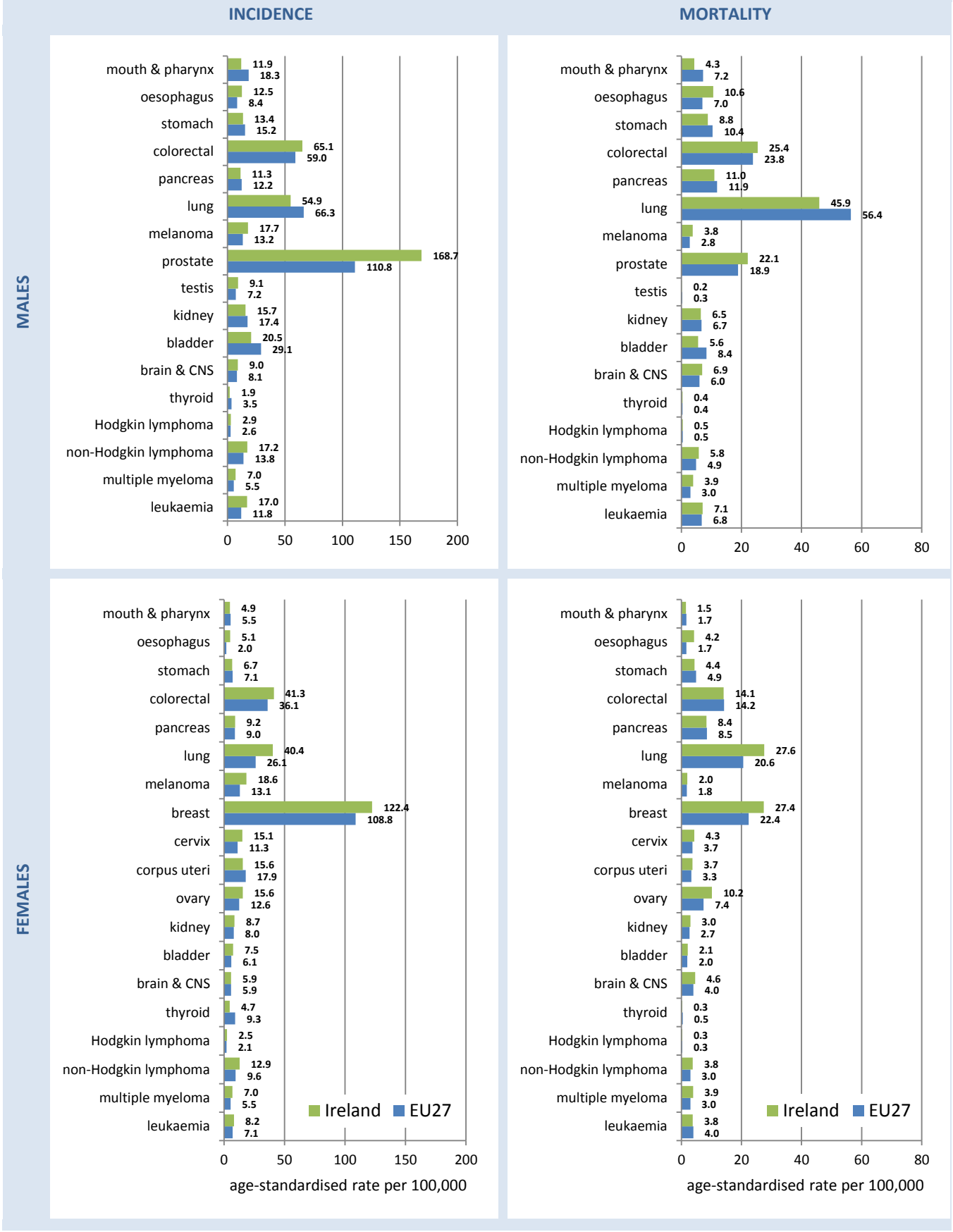
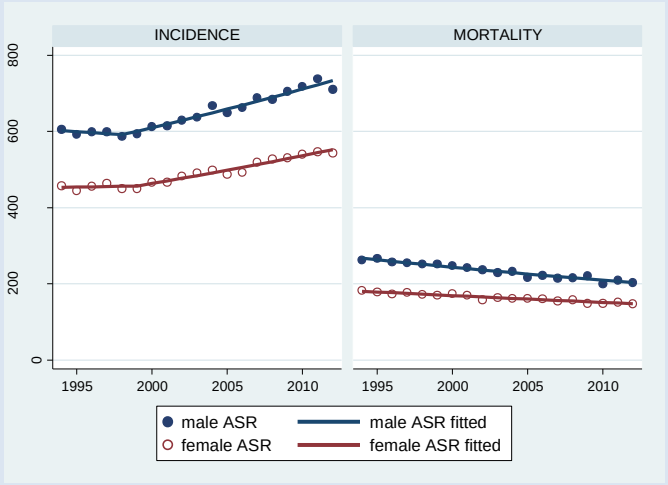


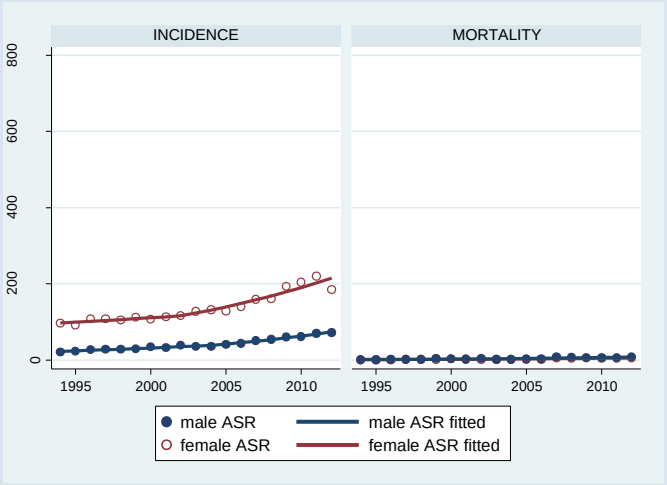
Figure 4-1. a-c: trends in incidence and mortality: 1994-2012

a. C00-C96: All invasive cancers



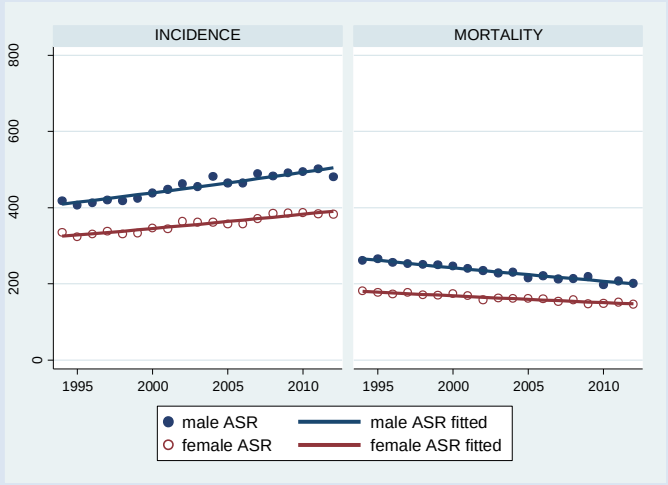
	sex	from	to	APC	95%CI		trend
incidence	female	1994	1999	**0.1**	-1.1	1.4	↔
incidence	female	1999	2012	**1.5**	1.2	1.7	↑
incidence	male	1994	1998	**-0.5**	-2.3	1.4	↔
incidence	male	1998	2012	**1.5**	1.3	1.8	↑
mortality	female	1994	2012	**-1.1**	-1.3	-0.9	↓
mortality	male	1994	2012	**-1.5**	-1.7	-1.3	↓

b. D00-D48: All non-invasive cancers



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2002	**2.2**	-1.1	5.7	↔
incidence	female	2002	2012	**6.4**	4.6	8.2	↑
incidence	male	1994	2004	**5.3**	3.8	6.8	↑
incidence	male	2004	2012	**8.4**	7.1	9.8	↑
mortality	female	1994	2012	**9.0**	6.3	11.7	↑
mortality	male	1994	2012	**10.0**	6.8	13.4	↑

c. C00-C43, C45-C96: all invasive cancers, excluding NMSC



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**1.0**	0.9	1.2	↑
incidence	male	1994	2012	**1.2**	1.0	1.4	↑
mortality	female	1994	2012	**-1.1**	-1.3	-0.9	↓
mortality	male	1994	2012	**-1.5**	-1.7	-1.4	↓

APC: annual percentage change; trend: ↑=significant increase, ↓=significant decrease, ↔=no change, at the 95% level; calculated using Joinpoint regression with 5 years set as minimum constraint for allowance of inflexion point(s)

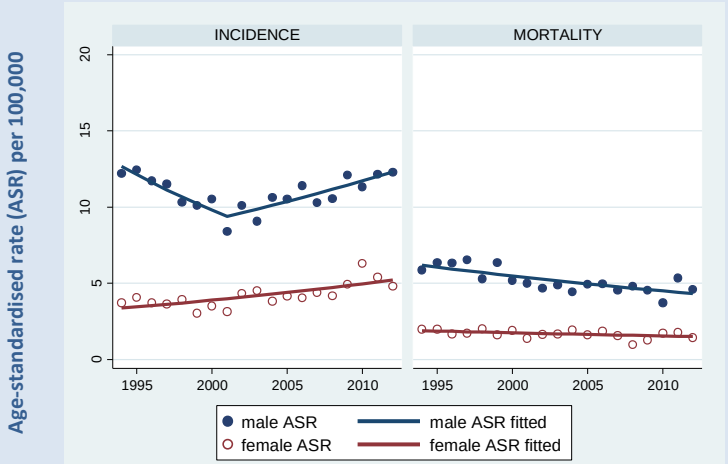
Figure 4-1.c (rightmost) shows trends in incidence and mortality for invasive cancer during the period 1994-2012. During 2010-2012 the incidence rate averaged 385/100,000 and 493/100,000 for females and males respectively. The annual rate of cancer incidence increased significantly and quite steadily at 1.2% in males and 1.0% in females over the period 1994-2012, probably largely due to improved detection (including screening for some cancers).

During 2010-2012 the average mortality rate was 212/100,000 and 155/100,000 for males and females respectively. The annual rate of cancer mortality decreased significantly and steadily at 1.5% for males and 1.1% for females during 1994-2012 largely due to improvements in treatment and earlier diagnosis.

Figure 4-1.b (middle) shows the substantially higher rate of incidence of non-invasive cancers in females compared to males, which was due to *in situ* cervix and breast tumours which together comprise over 50% all non-invasive tumours regardless of sex (2010-2012: Appendix I). The recent increase in the rate of non-invasive cancers in females at 6% annually since 2002 largely reflected the implementation of the national breast and (more recently) cervical screening programmes. The increased rate in males (by 8% annually) since 2004 was due in part to increases in cases presenting with *in situ* skin cancers.

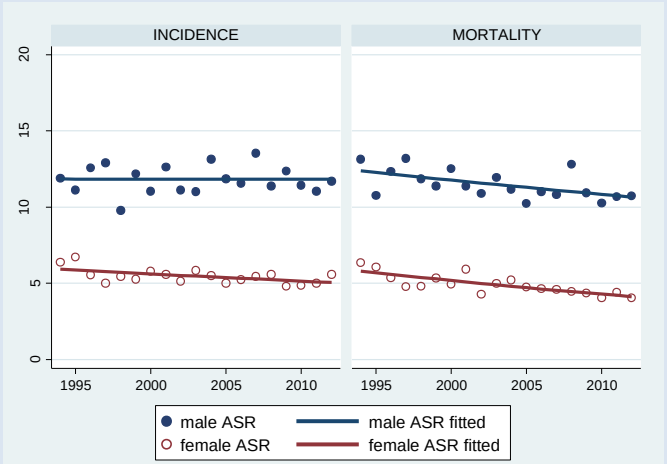
Figure 4-1. d-f: trends in incidence and mortality: 1994-2012

d. C01-C14: mouth & pharynx



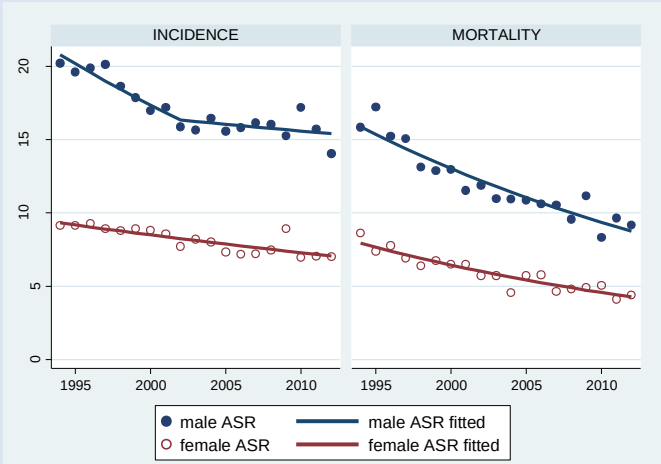
	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**2.4**	1.3	3.6	↑
incidence	male	1994	2001	**-4.2**	-6.2	-2.1	↓
incidence	male	2001	2012	**2.5**	1.5	3.5	↑
mortality	female	1994	2012	**-1.3**	-2.5	0.0	↔
mortality	male	1994	2012	**-2.0**	-2.8	-1.1	↓

e. C15: oesophagus



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**-0.9**	-1.5	-0.2	↓
incidence	male	1994	2012	**0.0**	-0.7	0.7	↔
mortality	female	1994	2012	**-1.9**	-2.6	-1.2	↓
mortality	male	1994	2012	**-0.8**	-1.4	-0.2	↓

f. C16: stomach



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**-1.5**	-2.1	-1.0	↓
incidence	male	1994	2002	**-3.0**	-4.5	-1.4	↓
incidence	male	2002	2012	**-0.6**	-1.7	0.5	↔
mortality	female	1994	2012	**-3.4**	-4.0	-2.8	↓
mortality	male	1994	2012	**-3.3**	-3.8	-2.7	↓

Tobacco and alcohol are established risk factors for the cancers detailed in Figure 4-1.d-f above [7]. *h. pylori* infection is also an established risk factor for stomach cancer [8].

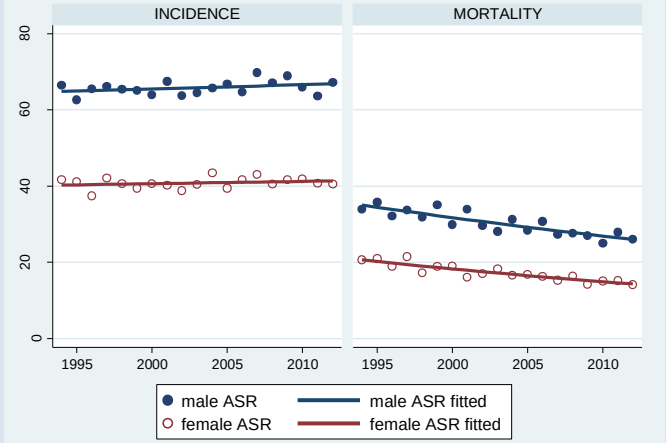
The incidence rate of mouth/pharyngeal cancer has increased by 2.5% annually for males since 2001 and 2.4% annually for women since 1994. There has been no significant change in the mortality rate in females since 1994, whereas mortality has decreased in males by 2% annually since 1994 (Figure 4-1.d).

There was no significant change in the annual incidence rate for oesophageal cancer in males, but the rate in females decreased by almost 1% annually during 1994-2012. The mortality rate decreased by 2% annually in females, and by almost 1% annually in males during the same period (Figure 4-1.e).

The incidence rate of stomach cancer in males decreased significantly by 3% annually up to 2002 – thereafter, the annual rate reduction stalled somewhat throughout 2002-2012 (<1% annual decrease) (Figure 4-1.f). In females, the incidence rate decreased steadily by 1.5% annually during 1994-2012. The mortality rate decreased significantly by >3% annually in both males and females.

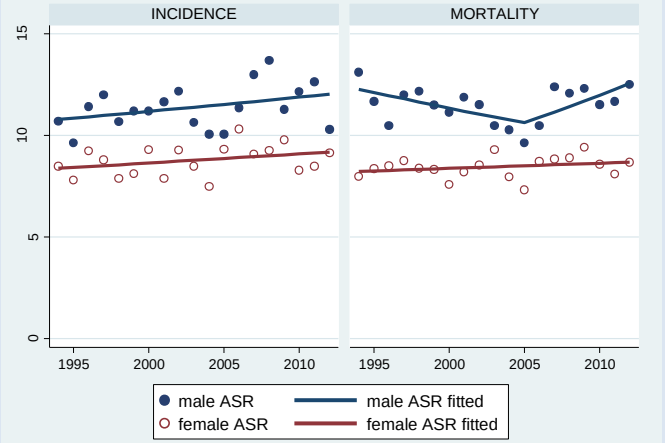
Figure 4-1. g-i: trends in incidence and mortality: 1994-2012

g. C18-C21: colorectal



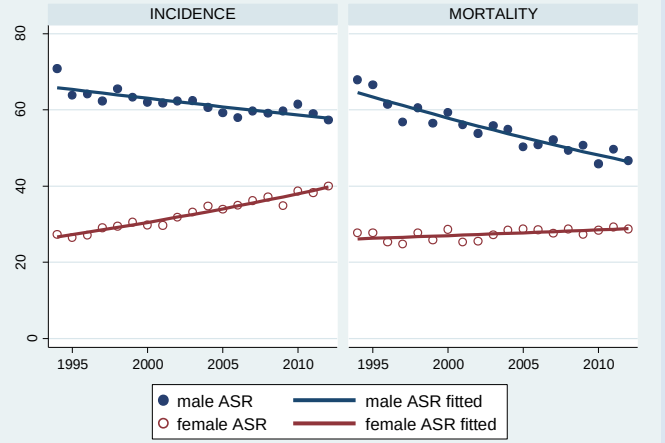
	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**0.1**	-0.2	0.4	↔
incidence	male	1994	2012	**0.2**	-0.1	0.4	↔
mortality	female	1994	2012	**-2.0**	-2.5	-1.5	↓
mortality	male	1994	2012	**-1.6**	-2.1	-1.2	↓

h. C25: pancreas



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**0.5**	-0.2	1.2	↔
incidence	male	1994	2012	**0.6**	-0.2	1.4	↔
mortality	female	1994	2012	**0.3**	-0.2	0.8	↔
mortality	male	1994	2005	**-1.3**	-2.6	0.0	↔
mortality	male	2005	2012	**2.4**	0.2	4.7	↑

i. C34: lung



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**2.2**	2.0	2.5	↑
incidence	male	1994	2012	**-0.7**	-1.0	-0.5	↓
mortality	female	1994	2012	**0.5**	0.2	0.9	↑
mortality	male	1994	2012	**-1.8**	-2.1	-1.5	↓

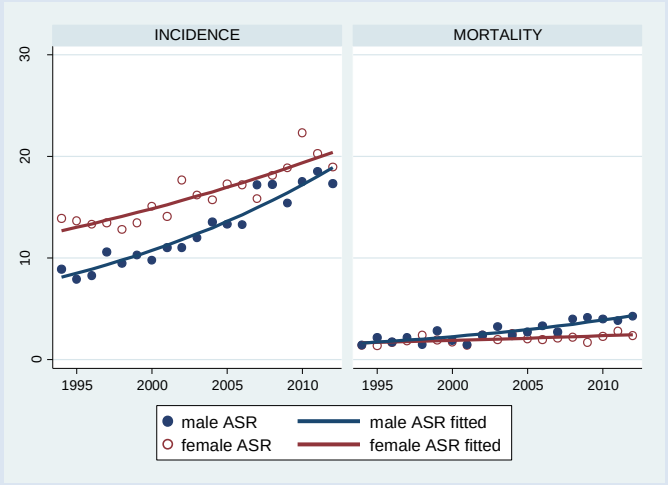
The incidence rate of colorectal cancer in males and females did not change significantly during 1994-2012 (Figure 4-1.g). The mortality rate decreased significantly by 2% annually in females and 1.6% in males over the same period. The reduction in mortality was due in part to advances in treatment strategy over the last two decades.

Pancreatic cancer has a very poor prognosis, with fewer than 1 in 10 patients surviving beyond five years. Incidence has shown a slight but non-significant increase, by <1% annually, in both males and females. The mortality rate increased at 2.4% annually in males during 2005-2012, but this followed an apparent decrease during 1994-2005 so the true trend may be unclear. Mortality remained fairly static in females (possibly a slow increase) during 1994-2012 (Figure 4-1.h).

Lung cancer also has a poor prognosis, with only 1 in 7 surviving beyond five years after diagnosis. The incidence rate of lung cancer declined steadily in males at almost 1% annually during 1994-2012, whereas in females it increased significantly at over 2% annually over the same period (Figure 4-1.i). The same trends in incidence are apparent in other northern and western European countries [5]. The lung cancer mortality rate in Ireland decreased significantly, by almost 2% annually, in males but increased by 0.5% annually in females during 1994-2012. These trends reflect smoking prevalence from decades earlier, but the contrast between males and females is striking.

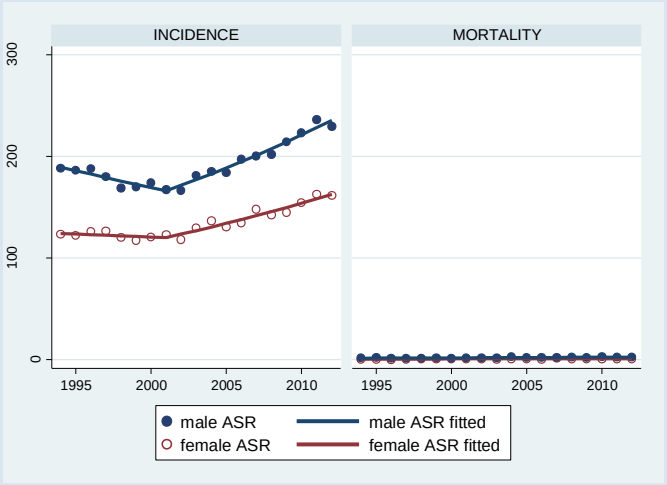
Figure 4-1. j-l: trends in incidence and mortality: 1994-2012

j. C43: melanoma skin



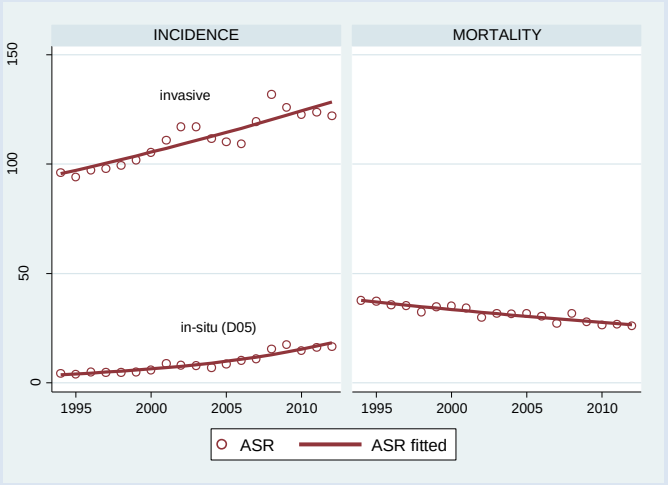
	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**2.7**	2.0	3.4	↑
incidence	male	1994	2012	**4.8**	4.1	5.6	↑
mortality	female	1994	2012	**2.2**	0.6	3.7	↑
mortality	male	1994	2012	**5.6**	4.0	7.3	↑

k. C44: non-melanoma skin (NMSC)



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2001	**-0.5**	-1.9	0.9	↔
incidence	female	2001	2012	**2.8**	2.2	3.4	↑
incidence	male	1994	2001	**-1.9**	-3.0	-0.8	↓
incidence	male	2001	2012	**3.2**	2.7	3.7	↑
mortality	female	1994	2012	**4.0**	1.5	6.5	↑
mortality	male	1994	2012	**3.6**	2.0	5.1	↑

l. C50: breast (female)



invasive	from	to	APC	95%CI		trend
incidence	1994	2012	**1.7**	1.2	2.1	↑
mortality	1994	2012	**-1.9**	-2.3	-1.5	↓

in-situ	from	to	APC	95%CI		trend
incidence	1994	2012	**9.2**	7.7	10.7	↑

For melanoma skin cancer, the rate of incidence in females increased at almost 3% annually during the period 1994-2012, and in males by almost 5% over the same period. The mortality rate increased by 2.2% annually in females, and almost 6% in males (Figure 4-1.j).

For non-melanoma skin cancer (NMSC), the incidence rate has increased by about 3% annually since 2001 in both males and females. Only a very small proportion of all cancer deaths are due to NMSC (<1% during 2010-2012), nevertheless, the annual mortality rate increased at 3-4% annually for both sexes during 1994-2012 (Figure 4-1.k).

The prognosis for breast cancer has improved since the 1990s due to earlier diagnosis and advances in treatment, with >80% net survival at five years in recent years (Figure 9-1). The incidence rate increased by 1.7% annually during the period 1994-2012 (Figure 4-1.l). In large part, the incidence trend for malignant breast cancer reflects the advent of the national breast screening program which was implemented in the eastern half of the country from 2000 and was extended to the rest of the country by 2007. The mortality rate decreased significantly at almost 2% annually during 1994-2012. The effect of the screening program is also evident in the highly significant 9% annual increase the incidence rate of *in situ* breast tumours (Figure 4-1.l).

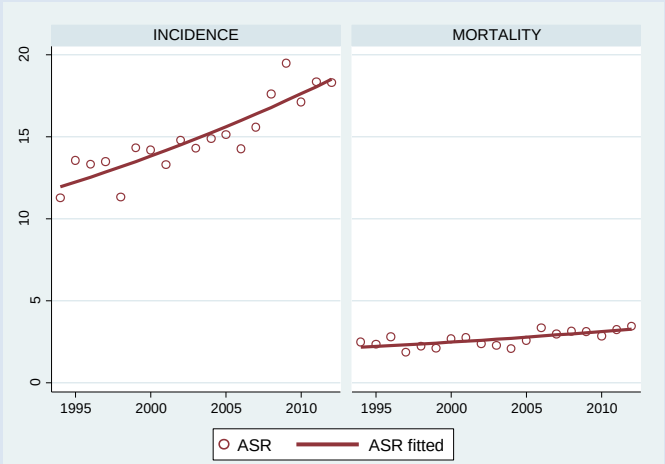
Figure 4-1. m-o: trends in incidence and mortality: 1994-2012

m. C53: cervix

invasive	from	to	APC	95%CI		trend
incidence	1994	2012	**1.8**	0.7	2.9	↑
mortality	1994	2012	**-0.4**	-1.3	0.4	↔

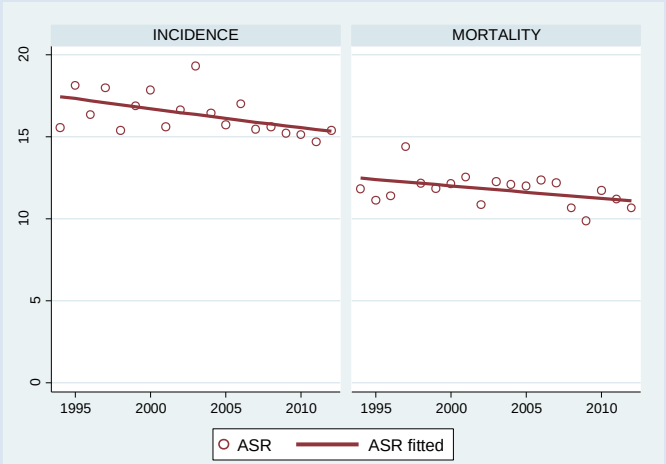
in-situ	from	to	APC	95%CI		trend
incidence	1994	2012	**5.4**	4.1	6.7	↑

n. C54: corpus uteri



	from	to	APC	95%CI		trend
incidence	1994	2012	**2.5**	1.8	3.1	↑
mortality	1994	2012	**2.3**	1.2	3.4	↑

o. C56: ovary



	from	to	APC	95%CI		trend
incidence	1994	2012	**-0.7**	-1.3	-0.1	↓
mortality	1994	2012	**-0.6**	-1.3	0.0	↔

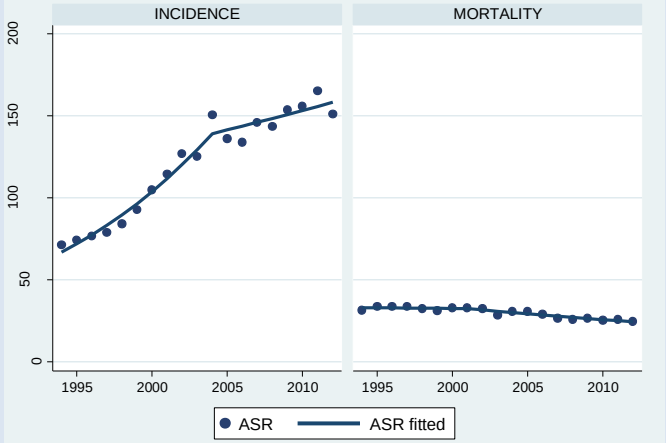
Screening activity has had an impact on cervical cancer incidence. The incidence rate for invasive tumours increased by almost 2% annually during 1994-2012 (Figure 4-1.m). Mortality rates have declined non-significantly by 0.4% annually. The number of *in situ* cervical cancers diagnosed per year increased significantly at 5.4% annually during the same period, mainly due to screening.

Incidence of uterine cancer (corpus uteri) increased significantly at 2.5% annually and mortality at 2.3% annually during 1994-2012 (Figure 4-1.n).

The incidence rate of ovarian cancer decreased significantly by 0.7% annually during 1994-2012, while the mortality rate declined (albeit non-significantly) by about 0.6% per annum during the same period (Figure 4-1.o). Most ovarian cancer patients are diagnosed at late stage and average survival is poor – five-year relative survival in Ireland for the population diagnosed in 2000-2007 was 30% compared to nearly 38% for the European average [9]. For the more recent diagnosis period in Ireland, 2006-2011, five-year net survival was 32% (Figure 9-2).

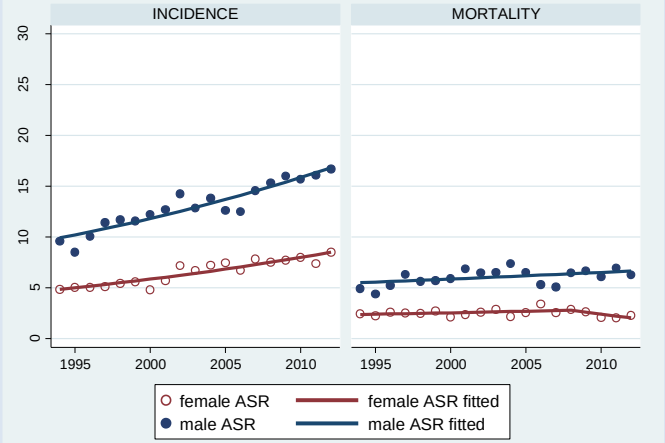
Figure 4-1. p-r: trends in incidence and mortality: 1994-2012

p. C61: prostate



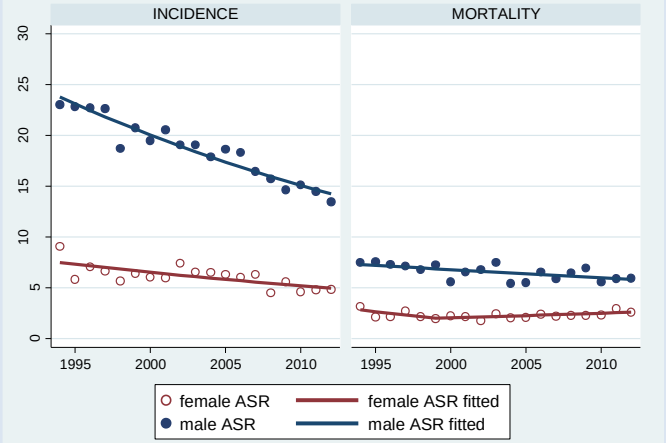
	from	to	APC	95%CI		trend
incidence	1994	2004	**7.6**	6.3	9.0	↑
incidence	2004	2012	**1.6**	0.4	2.9	↑
mortality	1994	2001	**-0.2**	-1.8	1.4	↔
mortality	2001	2012	**-2.6**	-3.3	-1.8	↓

q. C64: kidney



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**3.2**	2.5	3.9	↑
incidence	male	1994	2012	**3.0**	2.4	3.6	↑
mortality	female	1994	2008	**1.2**	-0.5	2.9	↔
mortality	female	2008	2012	**-7.2**	-16.5	3.1	↔
mortality	male	1994	2012	**1.1**	0.0	2.1	↔

r. C67: bladder



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**-2.3**	-3.3	-1.2	↓
incidence	male	1994	2012	**-2.8**	-3.2	-2.4	↓
mortality	female	1994	1999	**-6.6**	-14.1	1.5	↔
mortality	female	1999	2012	**2.0**	0.1	3.9	↑
mortality	male	1994	2012	**-1.2**	-2.0	-0.5	↓

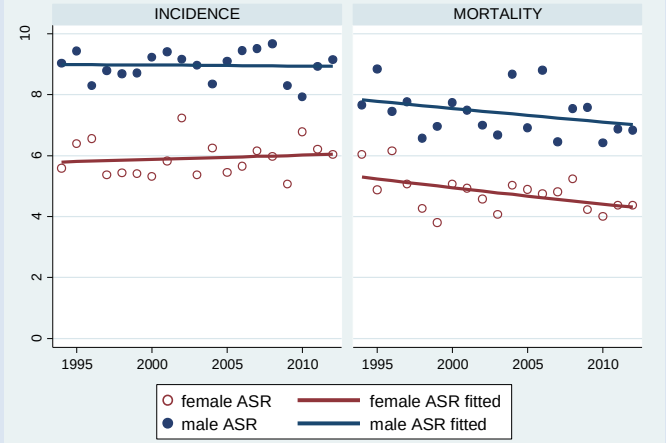
For prostate cancer, the incidence rate increased dramatically, by nearly 8% annually, between 1994 and 2004, and then by 1.6% annually from 2004 to 2012 (Figure 4-1.p). The increased incidence over the last two decades probably largely reflects large-scale PSA testing of asymptomatic men. The number of PSA tests carried out increased five-fold between 1995 and 2004 [10]. The prostate cancer mortality rate decreased significantly at 2.6% annually during 2001-2012.

The incidence rate of kidney cancer has increased by about 3% annually for both females and males since 1994 (Figure 4-1.q). Mortality rates did not change significantly during 1994-2012 in either sex.

The incidence rate of invasive bladder cancers decreased by 2.3% annually in females, and by 2.8% annually in males over the period 1994-2012. However, the magnitude of the downward trend may be exaggerated somewhat by possible changes in coding (a higher proportion may have been coded as non-invasive in more recent years). The mortality rate increased at 2% per annum in females during 1999-2012, and decreased in male at 1.2% annually during 1994-2012 (Figure 4-1.r).

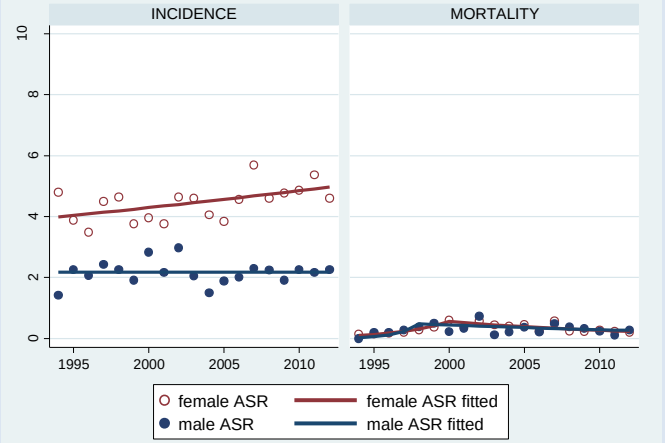
Figure 4-1. s-u: trends in incidence and mortality: 1994-2012

s. C71-C72: brain & CNS



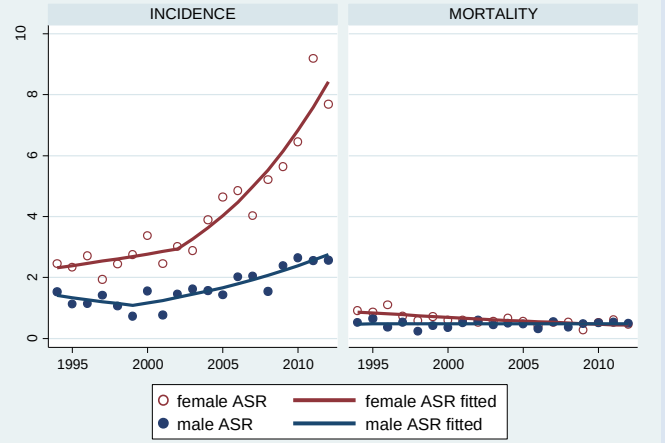
	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**0.2**	-0.6	1.1	↔
incidence	male	1994	2012	**0.0**	-0.5	0.5	↔
mortality	female	1994	2012	**-1.1**	-2.1	-0.2	↓
mortality	male	1994	2012	**-0.6**	-1.5	0.3	↔

t. D32-D33: benign brain & CNS



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**1.2**	0.2	2.2	↑
incidence	male	1994	2012	**0.0**	-1.5	1.5	↔
mortality	female	1994	2000	**33.2**	8.9	62.8	↑
mortality	female	2000	2012	**-7.0**	-11.5	-2.3	↓
mortality	male	1994	1998	**100.3**	-22.8	419.8	↔
mortality	male	1998	2012	**-4.2**	-11.4	3.6	↔

u. C73: thyroid



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2002	**3.0**	-3.6	10.0	↔
incidence	female	2002	2012	**11.1**	7.8	14.5	↑
incidence	male	1994	1999	**-5.1**	-17.5	9.2	↔
incidence	male	1999	2012	**7.4**	4.8	10.2	↑
mortality	female	1994	2012	**-3.7**	-5.3	-2.1	↓
mortality	male	1994	2012	**0.1**	-1.7	2.0	↔

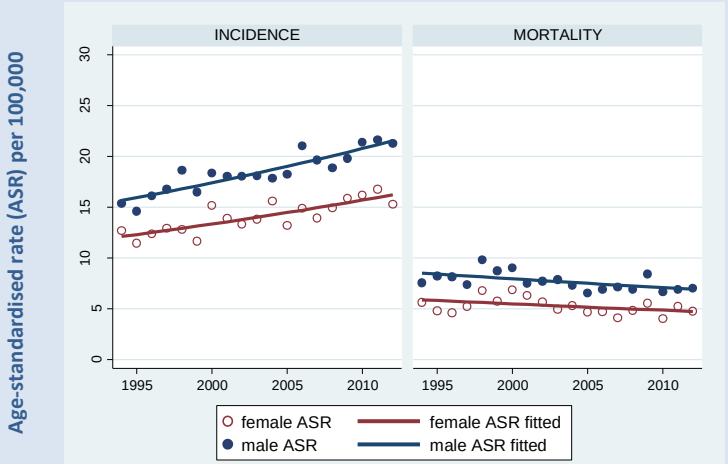
There was no change for males or females in the incidence rate of invasive brain/CNS tumours during the period 1994-2012. The mortality rate for invasive tumours declined significantly in females by 1.1% annually, but not in males (-0.6% annually) (Figure 4-1.s).

For benign brain & CNS tumours, there was a 1.2% annual increase in the incidence rate in females during 1994-2012, and no change in the male incidence rate over the same period. Mortality rates for benign brain & CNS tumours are much lower than for invasive tumours, with only 12 deaths annually during 2010-2012 (Appendix II). The mortality rate has decreased by 7% annually (since 2000) and 4% annually (since 1998) for females and males respectively, but based on very small numbers (Figure 4-1.t).

Thyroid cancers are infrequent, and between 2010 and 2012 they comprised 2% of all female cancers and just 0.5% of male cancers. The female incidence rate increased significantly, by 11% annually during 2002-2012, while the male rate increased by 7.4% annually during 1999-2012 (Figure 4-1. u). These trends are likely to reflect an increase in 'incidental' detection of thyroid cancers during investigations for other conditions. The mortality rate has decreased in females by nearly 4% annually since 1994 but has remained static in males (Figure 4-1.u). Similar increases in thyroid cancer incidence have been seen in other countries [11][12].

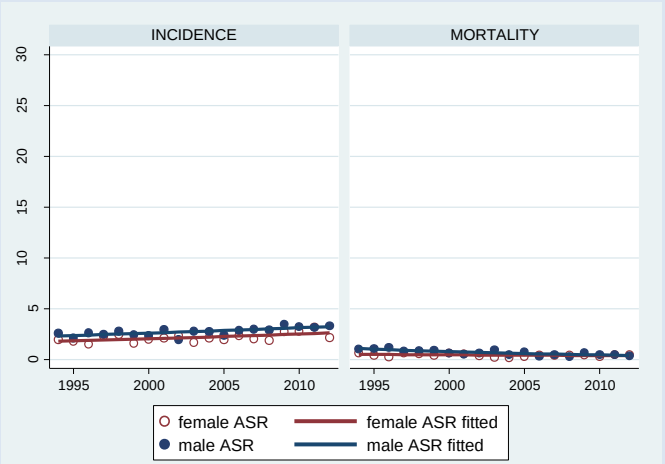
Figure 4-1. v-x: trends in incidence and mortality: 1994-2012

v. C81-C85: lymphoma (all)



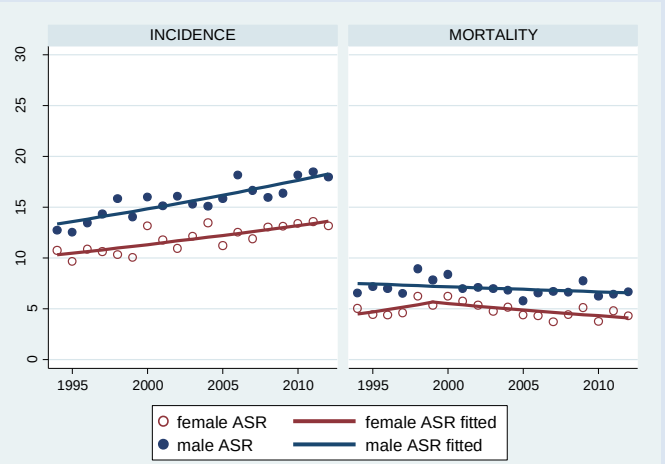
	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**1.6**	1.1	2.2	↑
incidence	male	1994	2012	**1.8**	1.3	2.2	↑
mortality	female	1994	2012	**-1.2**	-2.4	0.0	↔
mortality	male	1994	2012	**-1.1**	-2.0	-0.3	↓

w. C81: Hodgkin lymphoma



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**2.1**	0.6	3.6	↑
incidence	male	1994	2012	**1.9**	1.0	2.8	↑
mortality	female	1994	2012	**-1.6**	-4.2	1.2	↔
mortality	male	1994	2012	**-5.4**	-7.5	-3.2	↓

x. C82-C85: non-Hodgkin lymphoma



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**1.6**	1.0	2.2	↑
incidence	male	1994	2012	**1.8**	1.3	2.3	↑
mortality	female	1994	1999	**4.8**	-3.9	14.3	↔
mortality	female	1999	2012	**-2.5**	-4.3	-0.6	↓
mortality	male	1994	2012	**-0.7**	-1.6	0.2	↔

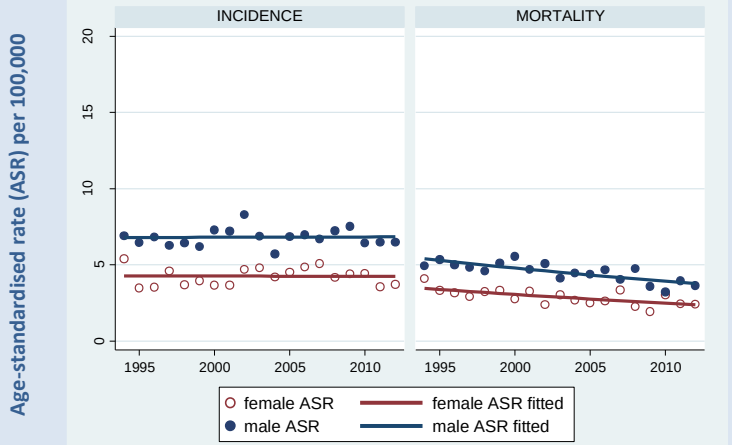
Lymphomas are a heterogeneous group of cancers of the haematopoietic system, classified as two distinct groups based on histological appearance. They comprise just under half of all haematopoietic cancers (along with leukaemia, multiple myeloma and similar malignancies). The incidence rate for lymphomas as a whole increased steadily by 1.6% annually in females, and by 1.8% in males during the period 1994-2012. The mortality rate decreased significantly in males at 1.1% annually, but not significantly in females (-1.2%) (Figure 4-1.v).

The incidence rate for Hodgkin lymphoma increased steadily by 2.1% annually in females, and by 1.9% annually in males during 1994-2012. The mortality rate decreased significantly at 5.4% annually in males, and not significantly (-1.6%) in females over the same period (Figure 4-1.w).

Non-Hodgkin lymphoma cases are diagnosed at approximately five times the frequency of Hodgkin lymphoma The incidence rate for non-Hodgkin lymphoma increased significantly and steadily by 1.6% annually in females and 1.8% in males during the period 1994-2012. The mortality rate decreased significantly by 2.5% annually in females during 1999-2012, but not in males (-0.7% annually during 1994-2012) (Figure 4-1.x).

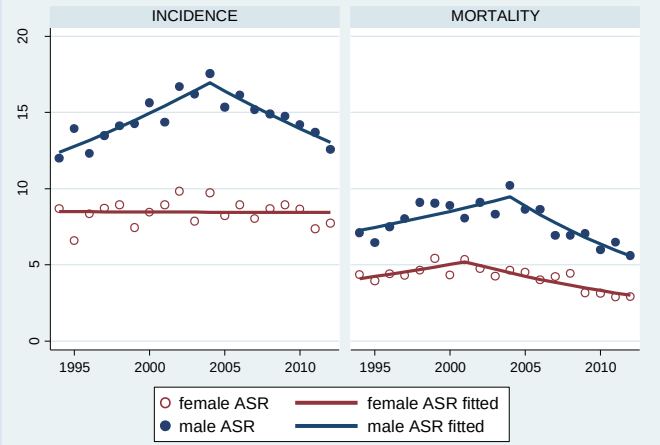
Figure 4-1. y-z: trends in incidence and mortality: 1994-2012

y. C90: multiple myeloma



	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**0.0**	-1.2	1.2	↔
incidence	male	1994	2012	**0.0**	-0.7	0.8	↔
mortality	female	1994	2012	**-2.0**	-3.2	-0.9	↓
mortality	male	1994	2012	**-2.0**	-2.8	-1.2	↓

z. C91-C95: leukaemia (total)



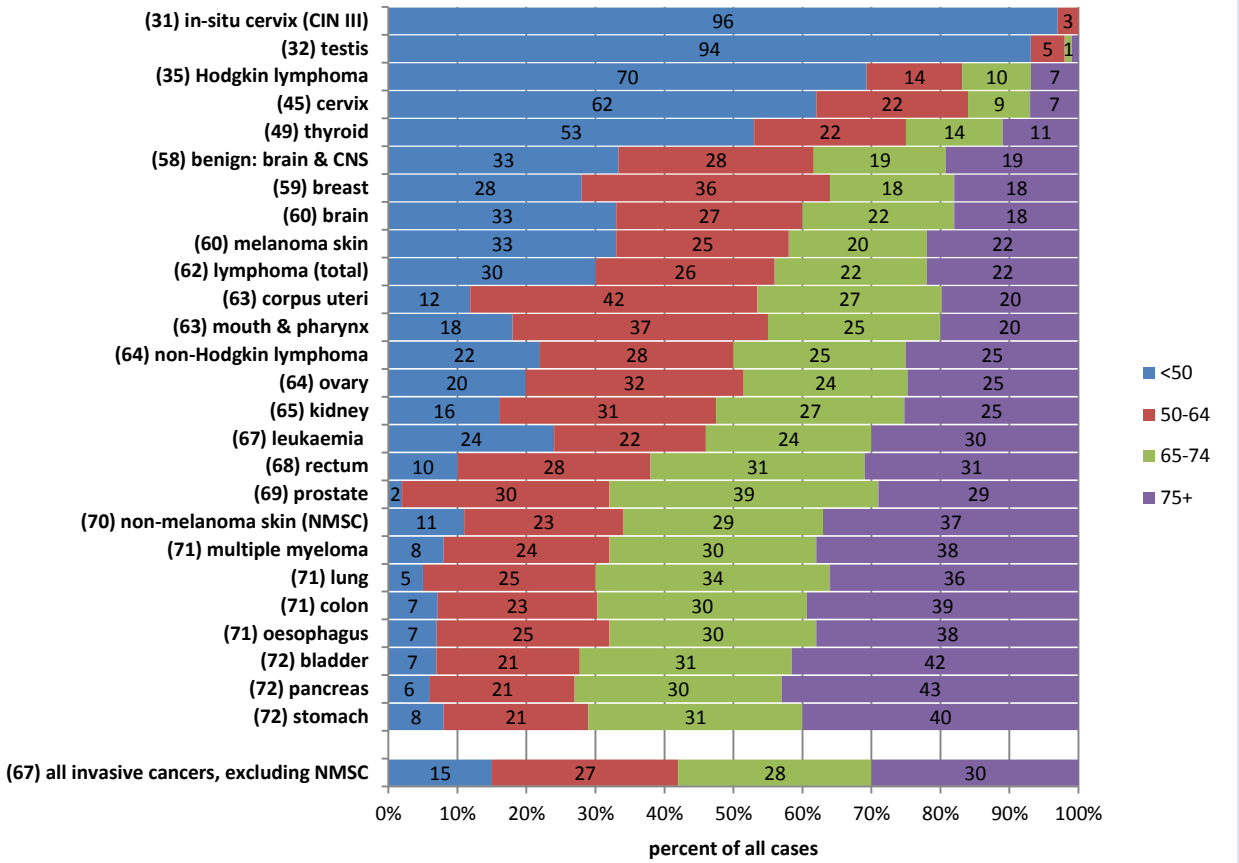
	sex	from	to	APC	95%CI		trend
incidence	female	1994	2012	**0.0**	-0.9	0.8	↔
incidence	male	1994	2004	**3.2**	2.1	4.4	↑
incidence	male	2004	2012	**-3.2**	-4.6	-1.9	↓
mortality	female	1994	2001	**3.5**	-0.6	7.7	↔
mortality	female	2001	2012	**-4.9**	-6.7	-2.9	↓
mortality	male	1994	2004	**2.7**	0.7	4.7	↑
mortality	male	2004	2012	**-6.4**	-8.8	-3.9	↓

Multiple myeloma is a cancer of plasma cells (immunoglobulin-producing B-lymphocytes), where abnormal plasma cells accumulate in the bone marrow and interfere with haematopoiesis. The incidence rate did not change during the period 1994-2012, but the mortality rate decreased by 2% annually in both males and females over the same period (Figure 4-1.y).

Leukaemia comprised about one quarter of all cancers of the haematopoietic system during 2010-2012. The incidence rate in males decreased significantly by 3.2% annually during 2004-2012, following an earlier period of increase; there was no change in incidence among females over the same period. The mortality rate decreased at 4.9% annually in females during 2001-2012, and at 6.4% in males during 2004-2012 (Figure 4-1.z).

5. AGE PROFILE OF PATIENTS AT DIAGNOSIS AND DEATH

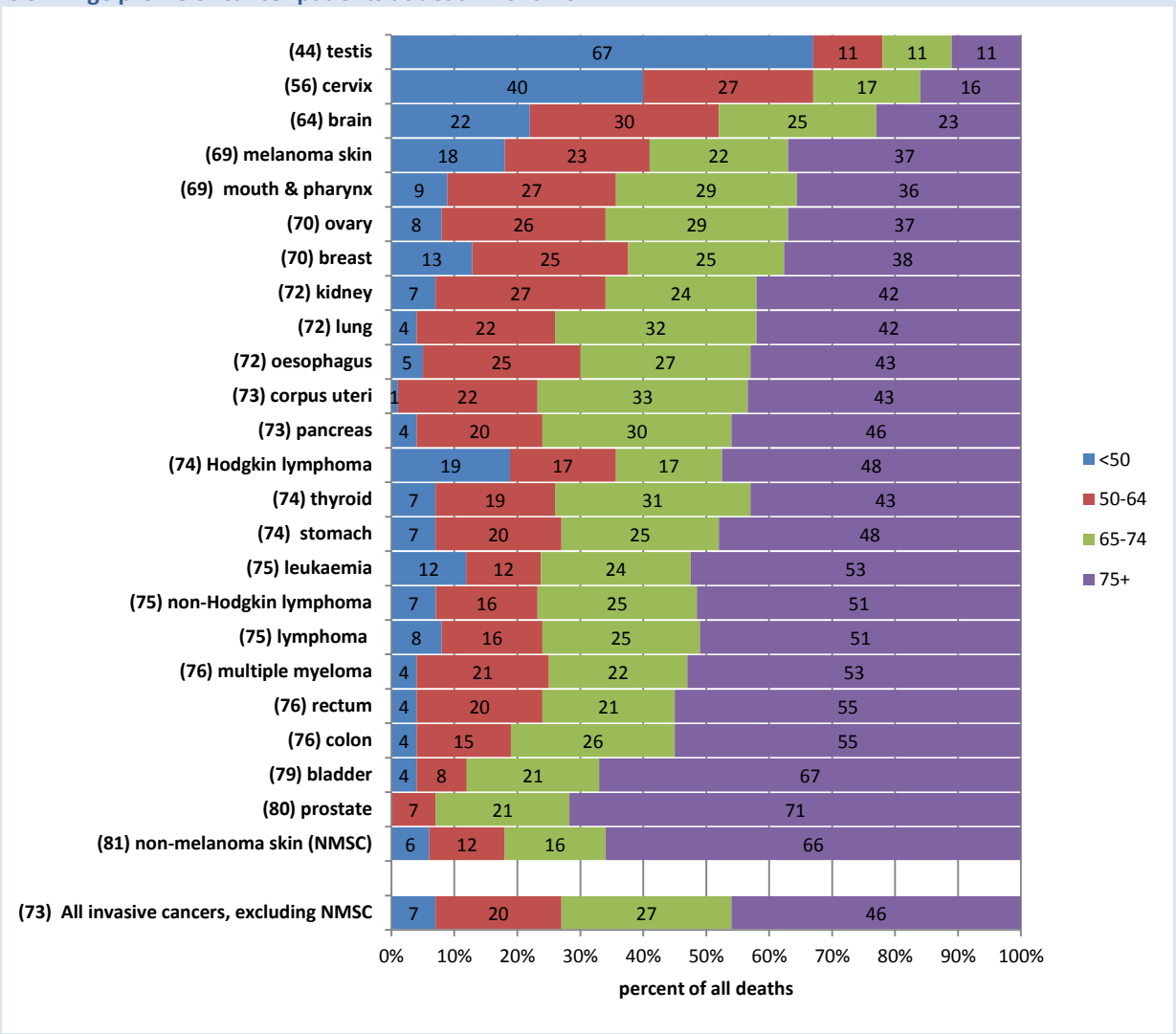
Figure 5-1. Age profile of patients at diagnosis: 2010-2012



numbers in parentheses- median age at diagnosis

Approximately 15% of all patients were under 50 years of age when diagnosed with invasive cancer, excluding NMSC (Figure 5-1). The proportions of all patients aged between 50 and 64, between 65 and 74, and over 75 were fairly similar and the median age overall was 67 years. The age profile of individual cancer types varied considerably however. Over two-thirds of patients with cancers of the stomach, pancreas, bladder, oesophagus, colon, lung and prostate as well as multiple myeloma were diagnosed when aged 65 or over. In contrast patients diagnosed with *in situ* cervical cancer, invasive testicular cancer and Hodgkin lymphoma were very young by comparison, with median ages of 31, 32 and 35 respectively.

Figure 5-2. Age profile of cancer patients at death: 2010-2011



numbers in parentheses- median age at death

The median age at death from cancer during the period 2010-2011 was 73 years, and 46% deaths occurred at ages ≥75 years (Figure 5-2). Median age at death for patients dying from non-melanoma skin cancer (NMSC) was 81 years, representing the oldest group overall, although they comprised just 1% of all cancer deaths (about 80 deaths per annum 2010-2012). Prostate and bladder cancer patients had the next highest median ages at death overall (80 and 79 years respectively) and over two-thirds of these patients were aged 75 or older at death. For the most part, those cancers that were diagnosed at older ages tended to have a similar age profile at death, and patients with stomach, pancreas and lung cancer had very similar median ages at diagnosis and death. The greatest differences between median ages at diagnosis and death were observed for patients with testicular cancer and Hodgkin lymphoma. Over 96% of all testicular cancer patients were under 50 when diagnosed; only 67% of patients were in this age group at death, when the median age was 44 years. Similarly for Hodgkin lymphoma patients, median age was 35 years at diagnosis but 74 years at death, and 48% of patients were aged at least 75 when they died.

6. STAGE AT DIAGNOSIS

Stage is important for assessment of prognosis and selection of an appropriate treatment regimen. The distribution of TNM 5th-edition stage at diagnosis over two diagnostic periods (1995-2003 and 2004-2012) is presented in Figure 6-1. For some cancers, there has been a marked shift towards earlier stage at diagnosis – notably for melanoma and for breast, prostate and thyroid cancers – reflecting a trend towards early detection. Changes in stage distribution are less clear for many other cancers, but in general the proportion of cases lacking adequate stage information has fallen over time, which suggests improvements in diagnostic methods with implications for more targeted treatment (Figure 6-1).

For some cancers, changes in staging criteria over time may also have contributed (artefactually) to apparent trends. In particular, a high proportion of cases staged in the earlier period were staged according to 4th-edition TNM criteria, and translation to 5th-edition TNM (as presented in Figure 6-1) was not always possible. This caveat applies particularly to cancers of the mouth and pharynx, stomach, pancreas, kidney, and bladder, of those presented here.

For invasive cancers as a whole (excluding NMSC), the proportion of unstaged cancers decreased from 36% to 25% between the periods 1995-2003 and 2004-2012. The greatest proportion of unstaged tumours was for oesophageal cancer, 49% and 39% in the earlier and later period, respectively. Breast cancer had the smallest proportion of unstaged tumours, and the proportion decreased from 8% to 6%.

During the earlier period a large proportion of prostate tumours were unstaged (39%); in the later period this proportion fell to 13%, coinciding with a large increase in the proportion of stage II tumours (from 36% to 66%). This was probably driven by an increase in opportunistic screening and diagnostic investigation resulting from increased use of PSA testing.

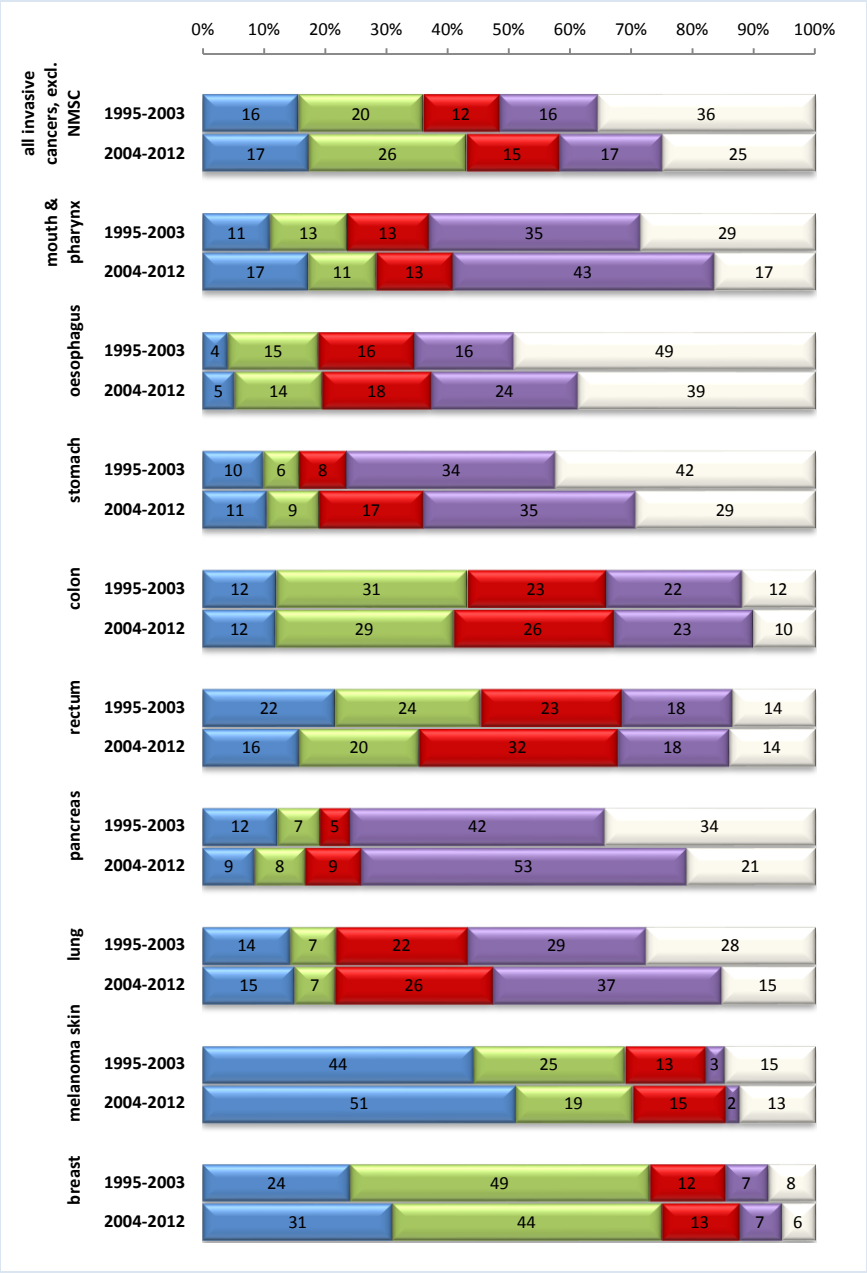
The proportion of unstaged colorectal tumours changed little from the earlier to the later period (10-12% for colon, and 14% for rectum). However, the relative proportion of stage III/IV tumours increased for colon cancer from 45% to 49% and for rectal cancer from 41% to 50%, suggesting more complete investigation of cases that might previously have been assigned a lower stage.

The proportion of unstaged lung cancer cases decreased from 28% to 15%, concomitant with an increase in the proportion of stage III/IV tumours (51% to 63% for the earlier and later period respectively) (Figure 6-1).

There was little change in the stage proportions for cervical cancer and cancer of the corpus uteri. Ovarian cancer was the only cancer where the unstaged proportion actually increased from the earlier to the later period (14% to 17%) (Figure 6-1).

Among less common cancers, kidney cancer showed the biggest relative reduction in unstaged cancers, from 36% to 8% between the two periods examined. However, this reflects (at least in part) the difficulty of converting 4th-edition TNM stage to the 5th-edition equivalent for this cancer. The proportion of stage I thyroid cancer increased substantially from 37% to 52% from the earlier to the later period, which is notable in the light of the increased diagnosis of this infrequent cancer in recent years (Figure 4-1. u) (Figure 6-1).

Figure 6-1. Percentage distribution of TNM 5th-edition stage of disease at diagnosis by cancer site: 1995-2003, 2004-2012



‡bladder: includes tumours that were *in situ,* or uncertain behaviour (other sites were behaviour 3, i.e. 'invasive only')

7. PREVALENCE: 1994-2012

Follow-up of all registered patients (through matching of registrations to death certificates) is currently complete to the end of 2012. From the beginning of 1994 (when national cancer registration began in Ireland) to the end of 2012, a total of 135,043 females and 147,788 males were diagnosed with invasive cancer. Some patients had more than one cancer diagnosis and, for the purposes of Table 7-1, patients were counted once only, choosing either their first invasive cancer or the cancer with the higher fatality rank in cases with synchronous cancers of different types [13]. Total prevalence for this 19 year period shows that 122,452 of these patients were still alive at end 2012, representing 46% of all female and 40% of all male cancer patients, and nearly 3% of the whole Irish population (Table 7-1).

Table 7-1. Prevalence of invasive cancer (excluding NMSC) in Ireland at the end of 2012

	19 year		10 years		5 years		3 years		1 year	
	diagnosed from Jan 1994		diagnosed from Jan 2003		diagnosed from Jan 2008		diagnosed from Jan 2010		diagnosed during 2012	
	alive	% alive†	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	62,739	46	45,731	58	28,690	68	18,944	73	7,218	83
male	59,713	40	47,841	54	30,709	65	20,863	72	7,990	83
‡<65	53,983	57	43,436	70	29,179	79	19,952	84	7,621	92
‡65+	68,469	36	50,136	48	30,220	57	19,855	64	7,587	75
Total	122,452	43	93,572	56	59,399	66	39,807	72	15,208	83

‡ refers to age category of patient at end of 2012
†Figures for '% alive' should not be interpreted or used as survival estimates because length of follow-up is not taken into account

As prevalence takes all patients into account, the majority of those still alive are patients diagnosed in recent years. However prevalence can be a good indicator of cancer burden, particularly when shorter time periods are examined. for example one-year prevalence provides an estimate of the number of patients currently undergoing treatment or just recently completing their treatment (c.15,200), three-year prevalence gives an indication of the number of these patients together with those who may have completed treatment but are still under clinical surveillance or follow-up (c.39,800).

Prevalence for various periods for lung, breast, prostate and colorectal cancers as well as other common cancers is presented in Tables 7-2 to 7-23. Note that, for individual cancer types, each patient is counted only once, based on their earliest diagnosis with that cancer type.

A total of 1,118 patients diagnosed with lung cancer during 2012 were still alive at the end of that year (one-year prevalence) (Table 7-2). This represents 56% of all patients diagnosed who are likely to be still undergoing or just completed treatment. Three-year prevalence for lung cancer indicated that 2,032 patients (34% of all those diagnosed) were likely to be still undergoing treatment or follow-up clinical surveillance for lung cancer at the end of 2010. Lung cancer has very high mortality; of all cases diagnosed in the 19 year period 1994-2012 (over 33,000) only 11% remain alive at the close of 2012.

A total of 14,862 colorectal cancer patients, 27,271 breast cancer patients and 25,358 prostate cancer patients diagnosed since 1994 were still alive at the end of 2012, representing 40%, 67% and 63% of all patients diagnosed during the 19-year period respectively (Tables 7-3, 7-4, 7-5). These cancers all have a better prognosis than lung cancer, and focusing on those patients who are likely to be still under active treatment or clinical follow-up (three-year prevalence) gives totals for colorectal cancer of 4,896 (74% of all patients diagnosed), for breast cancer 7,602 (93% of all patients diagnosed) and 9,004 for prostate cancer (93% of all patients diagnosed).

The majority of patients in the prevalent population in 2012 were those diagnosed with breast, prostate and colorectal cancers. Other cancers with generally good prognoses, such as melanoma, also contributed a large proportion of the total (Table 7-6).

Cancers with generally poor survival, such as pancreatic and oesophageal cancer, represented fairly low numbers in the prevalent population (Table 7-7, 7-8). For example, out of almost 7,100 cases of pancreatic cancer diagnosed between 1994 and 2012, only 7% (496) remain alive at the close of 2012.

In contrast, there were much greater numbers of patients still alive who had been diagnosed with comparatively rarer cancers with good prognoses, such as thyroid cancer where 19-year prevalence to 2012 was 79% (Table 7-9).

Over 70% of living prostate, colorectal and bladder cancer patients were over 65 at the end of 2012, reflecting their generally older age at diagnosis. In contrast, fewer than 15% of patients diagnosed with cancers of the cervix (Table 7-11) and Hodgkin lymphoma (Table 7-12) were over 65, indicative of their much younger age at diagnosis.

Table 7-2. Prevalence of cancer of the lung in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	1,808	14	1,580	21	1,242	30	1,006	39	527	60
male	1,859	10	1,587	15	1,292	24	1,026	31	591	53
‡<65	1,200	14	1,090	21	896	32	732	42	396	68
‡65+	2,467	11	2,077	16	1,638	24	1,300	31	722	52
Total	3,667	11	3,167	17	2,534	26	2,032	34	1,118	56

‡ refers to age category of patient at end of 2012

Table 7-3. Prevalence colorectal cancer in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	6,657	42	4,845	54	3,063	65	2,070	73	806	84
male	8,205	39	6,374	54	4,160	66	2,826	74	1,166	87
‡<65	4,213	49	3,592	64	2,524	76	1,790	83	746	94
‡65+	10,649	38	7,627	50	4,699	61	3,106	69	1,226	82
Total	14,862	40	11,219	54	7,223	66	4,896	74	1,972	86

‡ refers to age category of patient at end of 2012

Table 7-4. Prevalence of breast cancer in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	27,099	67	19,724	81	11,994	89	7,531	93	2,661	97
male	172	58	139	73	98	86	71	92	33	97
‡<65	14,828	76	11,943	88	7,738	95	4,997	97	1,785	99
‡65+	12,443	59	7,920	71	4,354	81	2,605	87	909	94
Total	27,271	67	19,863	81	12,092	89	7,602	93	2,694	97

‡ refers to age category of patient at end of 2012

Table 7-5. Prevalence of prostate cancer in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
‡<65	5,999	87	5,826	93	4,514	97	3,261	98	1,232	100
‡65+	19,359	58	15,977	76	9,173	86	5,743	91	1,846	96
Total	25,358	63	21,803	80	13,687	90	9,004	93	3,078	97

‡ refers to age category of patient at end of 2012

Table 7-6. Prevalence of melanoma of the skin in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	4,738	77	3,277	84	1,995	91	1,313	94	423	97
male	2,842	66	2,188	75	1,383	83	954	91	330	96
‡<65	4,162	84	3,102	89	1,923	93	1,284	96	414	98
‡65+	3,418	62	2,363	72	1,455	80	983	89	339	95
Total	7,580	72	5,465	81	3,378	87	2,267	93	753	97

‡ refers to age category of patient at end of 2012

Table 7-7. Prevalence of cancer of the pancreas in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	269	7	220	11	179	17	150	25	99	46
male	227	6	204	10	176	16	149	22	79	39
‡<65	191	10	173	15	147	24	122	34	66	63
‡65+	305	6	251	8	208	13	177	19	112	36
Total	496	7	424	10	355	16	299	23	178	42

‡ refers to age category of patient at end of 2012

Table 7-8. Prevalence of cancer of oesophagus in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	318	14	256	21	197	32	146	39	84	62
male	552	15	481	23	373	34	296	45	157	69
‡<65	317	19	284	28	224	42	176	55	98	81
‡65+	553	13	453	19	346	30	266	37	143	59
Total	870	15	737	22	570	34	442	43	241	67

‡ refers to age category of patient at end of 2012

Table 7-9. Prevalence of cancer of the thyroid in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	1,295	83	1,016	90	680	93	474	96	162	98
male	360	67	285	77	181	85	126	87	45	98
‡<65	1,316	92	1,057	95	711	97	498	97	170	99
‡65+	339	51	244	63	150	71	102	80	37	93
Total	1,655	79	1,301	87	861	91	600	94	207	98

‡ refers to age category of patient at end of 2012

Table 7-10. Prevalence of cancer of the bladder in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	1,014	42	628	50	319	54	211	60	99	83
male	2,362	41	1,529	53	853	63	587	72	221	86
‡<65	811	62	582	70	330	77	220	81	77	88
‡65+	2,565	37	1,575	48	842	56	578	65	243	84
Total	3,376	41	2,157	52	1,172	61	798	68	320	85

‡ refers to age category of patient at end of 2012

Table 7 11. Prevalence of cancer of the cervix in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
‡<65	2,338	70	1,711	77	1,070	84	679	89	207	91
‡65+	394	43	197	45	114	55	77	65	31	86
Total	2,732	64	1,908	72	1,184	80	756	85	238	90

‡ refers to age category of patient at end of 2012

Table 7-11. Prevalence of Hodgkin lymphoma in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	687	79	442	86	261	88	170	91	44	88
male	806	78	525	84	312	90	197	95	69	97
‡<65	1,320	87	844	92	504	95	322	98	94	99
‡65+	173	45	123	54	69	63	45	69	19	73
Total	1,493	79	967	85	573	90	367	93	113	93

‡ refers to age category of patient at end of 2012

Table 7-12. Prevalence of cancer of mouth and pharynx in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	733	47	573	60	373	69	263	75	88	85
male	1,222	35	960	48	656	60	475	69	198	84
‡<65	1,091	48	930	62	644	73	473	80	188	91
‡65+	864	32	603	42	385	52	265	60	98	74
Total	1,955	39	1,533	52	1,029	63	738	71	286	84

‡ refers to age category of patient at end of 2012

Table 7-13. Prevalence of cancer of stomach in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	565	17	431	25	313	36	234	46	108	64
male	914	17	746	26	542	36	411	45	178	63
‡<65	456	20	392	32	298	44	224	55	93	73
‡65+	1,023	16	785	23	557	33	421	42	193	59
Total	1,479	17	1,177	26	855	36	645	45	286	63

‡ refers to age category of patient at end of 2012

Table 7-14. Prevalence of cancer of the corpus uteri in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
‡<65	1,334	77	1,114	83	783	90	510	93	191	97
‡65+	2,007	60	1,250	69	735	78	468	84	178	90
Total	3,341	66	2,364	75	1,518	84	978	88	369	94

‡ refers to age category of patient at end of 2012

Table 7-15. Prevalence of cancer of the ovary in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
‡<65	1,058	41	811	55	541	69	377	79	156	94
‡65+	795	24	534	30	340	39	249	47	122	67
Total	1,853	32	1,345	41	881	53	626	62	278	80

‡ refers to age category of patient at end of 2012

Table 7-16. Prevalence of cancer of the kidney in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	1,168	50	890	60	572	71	387	78	148	87
male	1,824	45	1,427	56	980	68	665	74	266	85
‡<65	1,427	59	1,165	70	807	78	554	82	238	91
‡65+	1,565	39	1,152	49	745	61	498	69	176	80
Total	2,992	47	2,317	58	1,552	69	1,052	76	414	86

‡ refers to age category of patient at end of 2012

Table 7-17. Prevalence of malignant cancer of the brain in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	477	22	339	28	239	37	183	44	85	65
male	599	20	439	26	314	35	243	46	132	69
‡<65	898	29	648	38	453	50	336	61	158	81
‡65+	178	8	130	11	100	16	90	23	59	47
Total	1,076	21	778	26	553	36	426	45	217	68

‡ refers to age category of patient at end of 2012

Table 7-18. Prevalence of benign cancer of the brain and CNS in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	1,219	76	790	82	466	90	297	93	100	97
male	551	77	329	86	192	92	126	95	41	95
‡<65	1,009	92	669	96	405	99	273	99	89	99
‡65+	761	62	450	69	253	81	150	85	52	93
Total	1,770	76	1,119	83	658	91	423	94	141	97

‡ refers to age category of patient at end of 2012

Table 7-19. Prevalence of lymphoma in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	3,017	57	2,157	67	1,308	75	852	79	297	86
male	3,347	54	2,456	65	1,502	73	1,010	78	378	86
‡<65	3,781	70	2,723	80	1,678	87	1,112	90	400	95
‡65+	2,583	42	1,890	53	1,132	61	750	65	275	76
Total	6,364	55	4,613	66	2,810	74	1,862	78	675	86

‡ refers to age category of patient at end of 2012

Table 7-20. Prevalence of non- Hodgkin lymphoma in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	2,330	52	1,715	64	1,047	72	682	76	253	86
male	2,541	49	1,931	62	1,190	70	813	74	309	84
‡<65	2,461	64	1,879	76	1,174	84	790	88	306	94
‡65+	2,410	42	1,767	53	1,063	60	705	65	256	76
Total	4,871	50	3,646	63	2,237	71	1,495	75	562	85

‡ refers to age category of patient at end of 2012

Table 7-21. Prevalence of multiple myeloma in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	2,330	52	1,715	64	1,047	72	682	76	253	86
male	2,541	49	1,931	62	1,190	70	813	74	309	84
‡<65	2,461	64	1,879	76	1,174	84	790	88	306	94
‡65+	2,410	42	1,767	53	1,063	60	705	65	256	76
Total	4,871	50	3,646	63	2,237	71	1,495	75	562	85

‡ refers to age category of patient at end of 2012

Table 7-22. Prevalence of leukaemia in Ireland at the end of 2012

	19 year diagnosed from Jan 1994		10 years diagnosed from Jan 2003		5 years diagnosed from Jan 2008		3 years diagnosed from Jan 2010		1 year diagnosed during 2012	
	alive	% alive	alive	% alive	alive	% alive	alive	% alive	alive	% alive
female	1,425	44	1,011	56	604	66	378	71	136	79
male	2,023	43	1,525	56	897	67	567	72	201	82
‡<65	1,860	61	1,351	73	821	81	524	83	184	90
‡65+	1,588	32	1,185	44	680	55	421	61	153	71
Total	3,448	43	2,536	56	1,501	67	945	72	337	80

‡ refers to age category of patient at end of 2012

8. TREATMENT

Since the establishment of the National Cancer Registry, cancer treatment has been recorded for each registered patient. Surgery, radiotherapy, chemotherapy (including immunotherapy) and hormone therapy data are presented here in summary format, i.e. did patients receive treatment between one month before and one year after diagnosis, which approximately coincides with the first course of treatment for most cancers. Surgery was defined as 'tumour-directed surgery' if it entailed tumour resection or other physical destruction, regardless of curative intent. Treatments or other procedures purely or mainly aimed at symptom relief were excluded if they did not also involve excision or destruction of tumour tissue.

TREATMENT BY MODALITY, SITE AND DIAGNOSTIC PERIOD

During the period 2004-2012, 48% of all invasive cancers (excluding NMSC) had tumour-directed surgery, 31% chemotherapy, 33% radiotherapy and 24% no tumour-directed treatment during the window of one month before diagnosis, and one year after diagnosis. However the proportion of cases that received each treatment varied considerably by cancer type (Figure 8-1). Equivalent figures for 1995-2003 are also shown in Figure 8-1.

As expected rates of tumour-directed surgery was highest for solid tumours. During 2004-2012, over 70% of colorectal, breast, corpus uterine, testicular, bladder and thyroid cancers and melanoma had surgery either to completely remove or to reduce the tumour (highest 97% for testis). Rates of surgery were low (<25%) for cancers such as pancreas, lung and oesophagus where either the tumour site can prove difficult to operate on or patients frequently present with late-stage cancers.

The highest rates of radiotherapy were found for cancers of the breast, mouth & pharynx, rectum, oesophagus, cervix and brain & CNS.

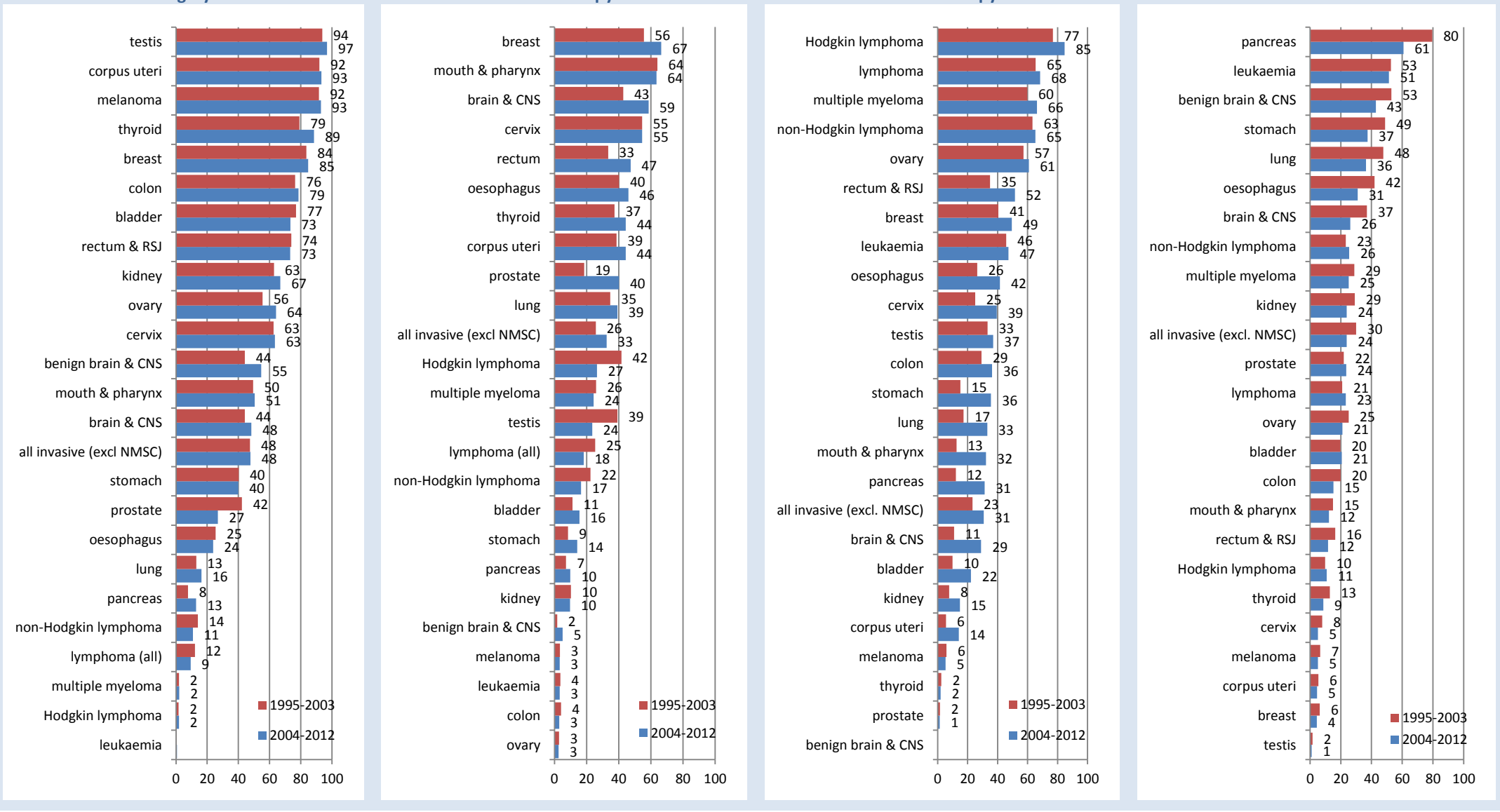
Chemotherapy rates were highest for cancers of the blood and lymphatic systems but also for cancers of the ovary, rectum and breast (all >45%).

Hormonal therapy was administered to substantial numbers of patients with breast and prostate cancer, where at least 53% and 33% were treated during 2004-2012 (Figure 8-2). Note that, because hormonal therapy is sometimes administered on an outpatient basis, or the date on which hormonal therapy began is not always known, the figures presented on hormonal therapy should be regarded as conservative estimates.

A substantial proportion of patients with some cancers had no tumour-directed treatment, although many of these patients had other procedures, such as palliative treatment to relieve symptoms. For example, 36% of lung cancer patients and 61% of pancreatic cancer patients during 2004-2012 had no tumour-directed therapy. *Watchful waiting* for some cancers may result in apparently high percentages of untreated cases, as was the case for leukaemia, where overall 51% were classed as untreated. However, the majority of these cases were chronic lymphocytic subtypes where watchful waiting is a recognized management. Watchful waiting is also a common management for prostate cancers and 24% of these patients were also classified as untreated during 2004-2012.

While overall rates of surgery for all cancers were 48% during both 1995-2003 and in 2004-2012, increases in the rate of surgery were observed for several individual cancer types between the earlier and later periods. Notable increases in the proportions of patients undergoing surgery were observed for lung (13% to 16%) and pancreatic cancer patients (8% to 13%) and ovary (56% to 64%). However, a decline in the rate of surgery was observed for some sites between the two periods, notably a reduction in the proportion of prostate (42% to 27%) and lymphoma (12% to 9%) having surgery.

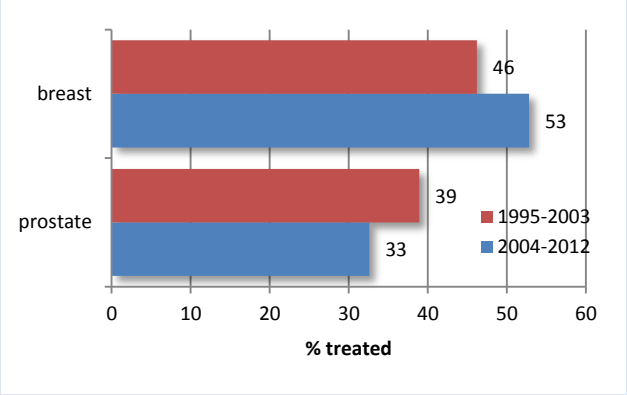
Figure 8-1. percentage of cancer patients that received tumour-directed treatment: 1995-2003, 2004-2012



Rates of radiotherapy showed more substantial increases between the two periods than observed for surgery. Overall rates of radiotherapy increased from 26% to 33% (all cancers combined). However the proportion of patients having radiotherapy declined in the case of testicular cancer (39% to 24%) and Hodgkin lymphoma (42% to 27%) (Figure 8-1). The greatest relative increases in the proportion of patients treated with radiotherapy were observed for cancers of the prostate (19% to 40%), breast (56% to 67%), brain & CNS (43% to 59%), rectum (33% to 47%), stomach (9% to 14%), bladder (11% to 16%) and thyroid (37% to 44%).

Use of chemotherapy increased overall from 23% to 31% of patients between 1995-2003 and 2004-2012 (Figure 8-1). The most substantial increases in relative terms were observed in patients with cancers of the corpus uteri (6% to 14%), kidney (8% to 15%), bladder (10% to 22%), brain/CNS (11% to 29%), pancreas (12% to 31%) , mouth/pharynx (13% to 32%), lung (17% to 33%), stomach (15% to 36%), cervix (25% to 39%), oesophagus (26% to 42%) and rectum (35% to 52%).

Figure 8-2.
Percentage of cancer patients that received hormone therapy as part of treatment regimen: female breast and prostate cancer: 1995-2003 and 2004-2012



The proportion of breast cancer patients known to have had hormone therapy increased from 46% to 53% between the periods 1995-2003 and 2004-2012. In contrast the proportion of prostate cancer patients that had hormone therapy decreased from 39% to 33% (Figure 8-2). However, note the earlier caveat about completeness of hormonal therapy data.

The proportion of patients that had no tumour-directed therapy dropped from 30% to 24% overall between 1995-2003 and 2004-2012 (Figure 8-1). This decline was observed for almost all cancer sites, with notable relative changes observed for colon, rectum, melanoma, thyroid, lung, oesophagus, stomach, pancreas and brain/CNS.

Figure 8-3. Percentage treated by age and sex: all invasive cancer (excluding NMSC): 2007-2011

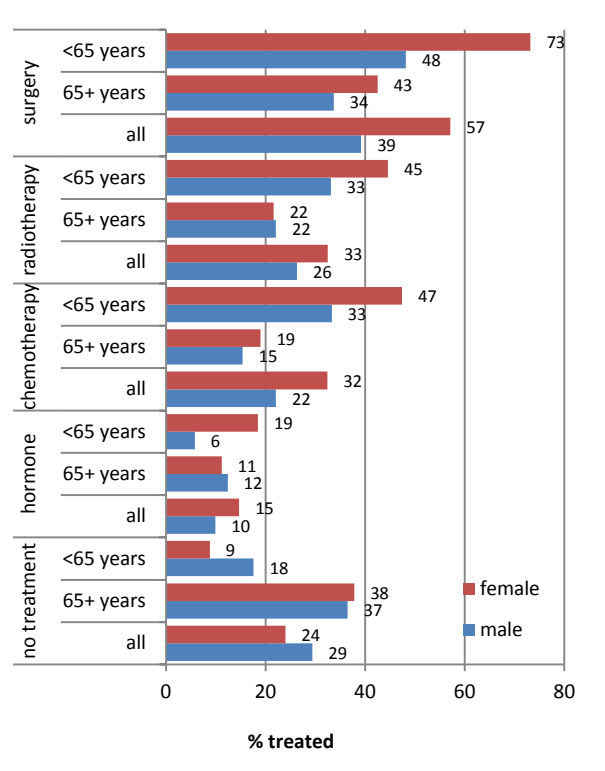
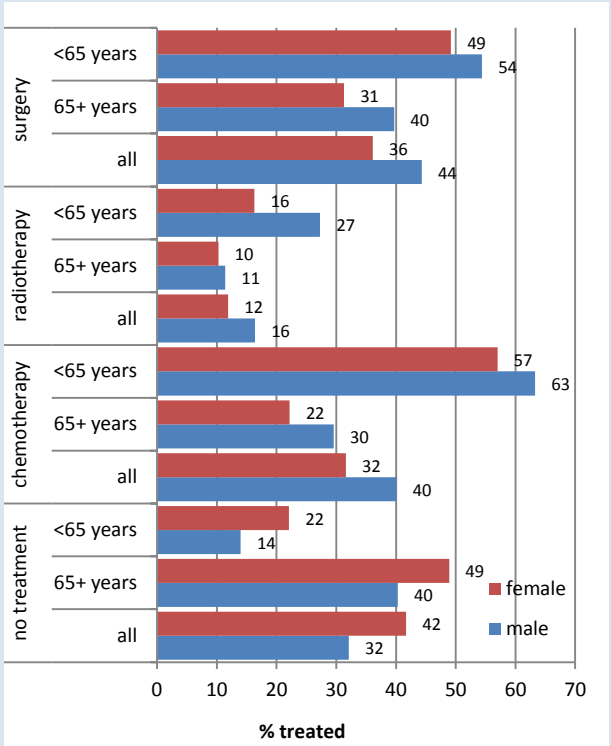


Figure 8-4. Percentage treated by age and sex: mouth and pharynx cancer 2007-2011



Over the five-year period 2007-2011, the effect of age (<65 *vs.* 65+) and sex on the proportion of all cancer patients who had surgery, radiotherapy, chemotherapy, and hormone therapy was explored (Figure 8-3). The same analyses were repeated for each of the main cancer sites individually (Figures 8-2 to 8-28). Note that treatments presented in Figures 8-2 to 8-28 are not mutually exclusive, and many patients had combination treatment (cf. Figures 8.29 to 8.33).

In general, considering all invasive cancers, males were less likely to receive treatment than females (especially among the under-65s), but this reflects differences in the types of cancer involved. Many prostate cancer patients are subject to watchful waiting (c.20-25%), while the vast majority of breast cancer patients had some form of treatment (c.95%). These two cancers alone account for about 30% of male and 30% of female cancers, respectively. Older patients (≥65 years) were less likely to receive treatment (except for hormone therapy) (Figure 8-3); this partly reflects the tolerability of treatments, especially with regard to chemotherapy and surgery, but may also reflect comorbidities or other factors influencing treatment decisions (Figure 8-3). 'No treatment' referred to no tumour-directed treatment; most patients listed under 'no treatment' would have had other forms of treatments aimed at symptom relief / palliation.

For cancer of the *mouth and pharynx*, the proportion of older patients who had chemotherapy, radiotherapy and surgery was substantially lower than that for the younger population (Figure 8-4). The proportion of females who had no tumour-directed treatment was greater than that of males: 42% and 32% respectively.

Figure 8-5. Percentage treated by age and sex: cancer of the oesophagus 2007-2011

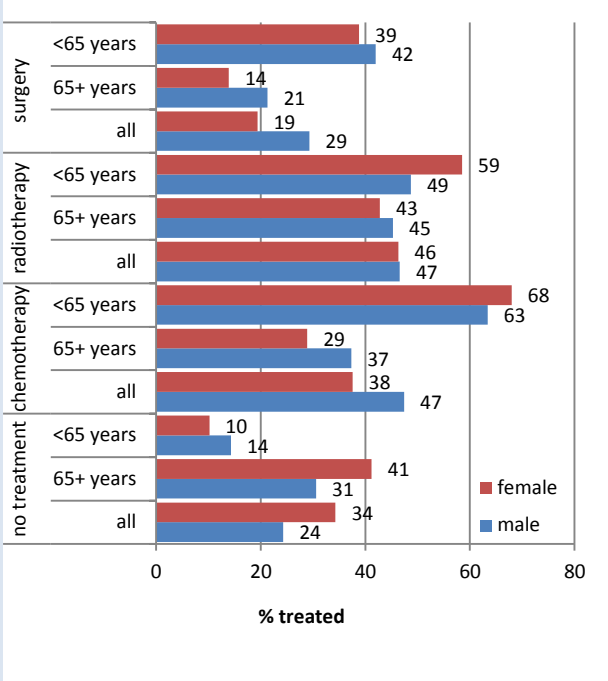
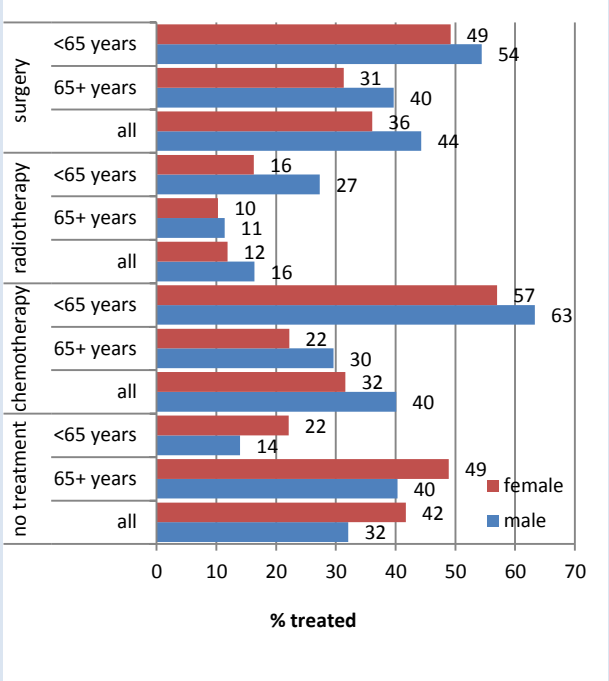


Figure 8-6. Percentage treated by age and sex: cancer of the stomach 2007-2011



Surgery for cancer of the *oesophagus* is very invasive and older patients were less likely to have surgery. Radiotherapy was used as a treatment option regardless of age. Chemotherapy was twice as likely to be given as a treatment if the patient was younger (Figure 8-5). Patients with cancer of the *stomach* had a broadly similar pattern of treatment as those with cancer of the oesophagus, except that radiotherapy was much less frequently used (Figure 8-6).

Figure 8-7. Percentage treated by age and sex: colorectal cancer

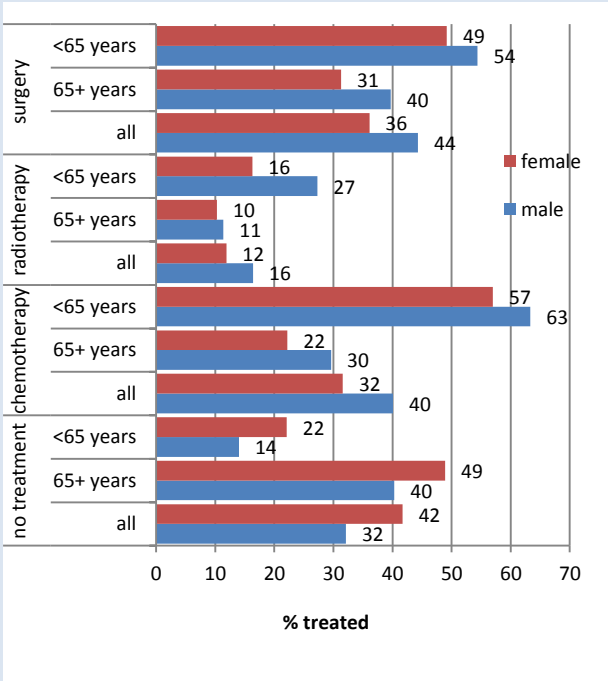
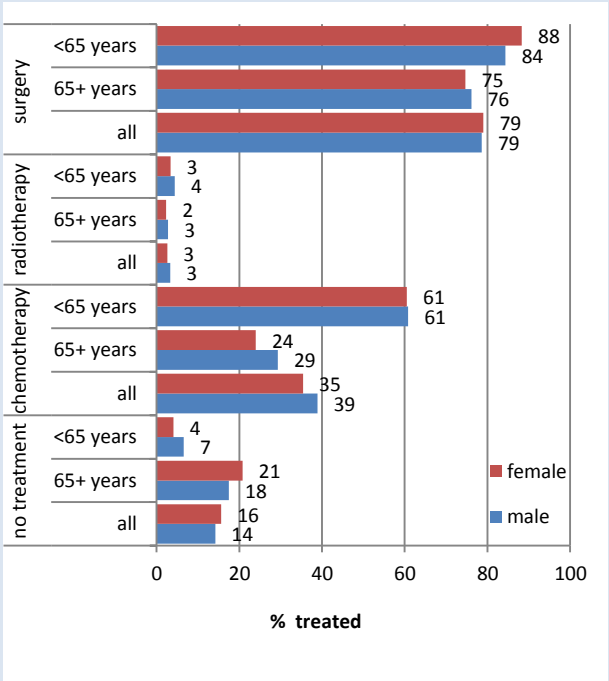


Figure 8-8. Percentage treated by age and sex: cancer of the colon 2007-2011



Colon cancer was generally treated with colectomy or with local excision, and over 75% of patients had such surgery, regardless of age and sex. Chemotherapy was twice as likely to be used if the patient was younger. Approximately 15% of patients receive no tumour-directed treatment (Figure 8-8).

Figure 8-9. Percentage treated by age and sex: cancer of the rectum/rectosigmoid junction 2007-2011

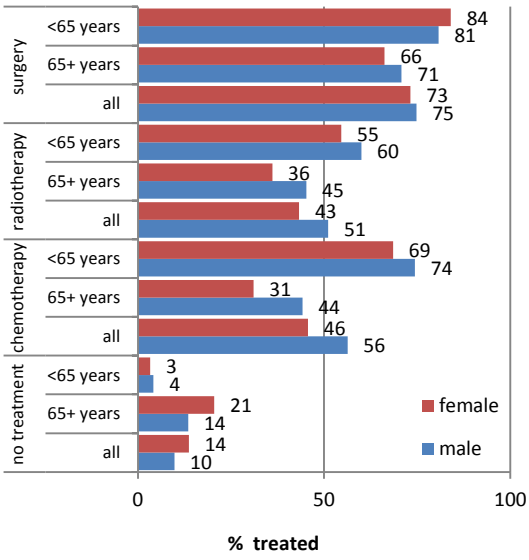
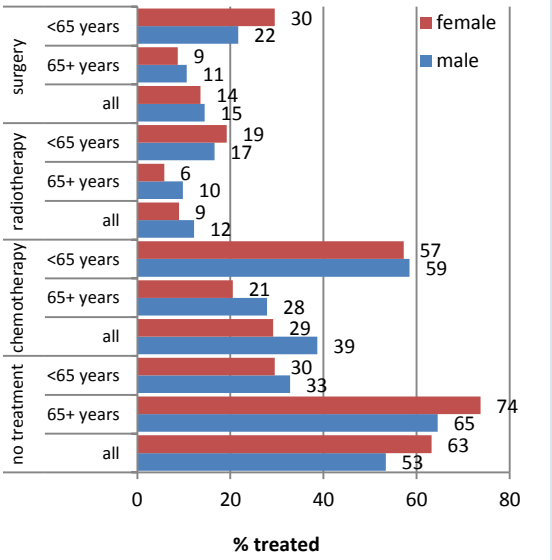


Figure 8-10. Percentage treated by age and sex: cancer of the pancreas 2007-2011



Cancer of the *rectum* was generally treated with mesorectal excision or local excision (>70% of patients). Unlike cancer of the colon, radiotherapy was used in up to 40-50% of patients (more so in males than females). Just over 10% of patients had no tumour-directed treatment; 14% of females and 10% of males (Figure 8-9). Only about 15% of *pancreatic cancer* patients had surgery (up to 30% if they were younger). Chemotherapy was the main treatment modality (about one third of cases, or almost two thirds if younger. 63% of females and 53% of males had no tumour-directed treatment (Figure 8-10).

Figure 8-11. Percentage treated by age and sex: cancer of the lung 2007-2011

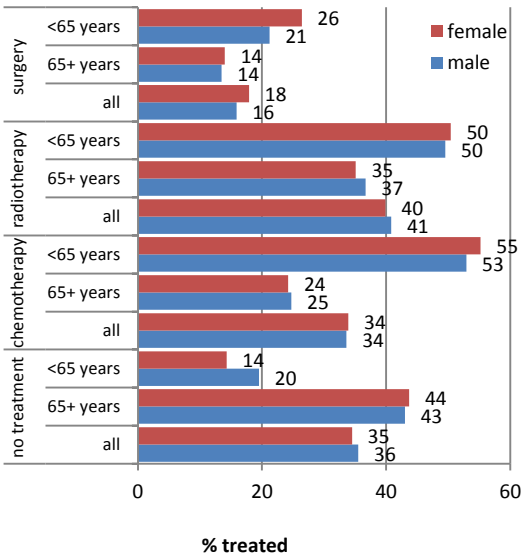
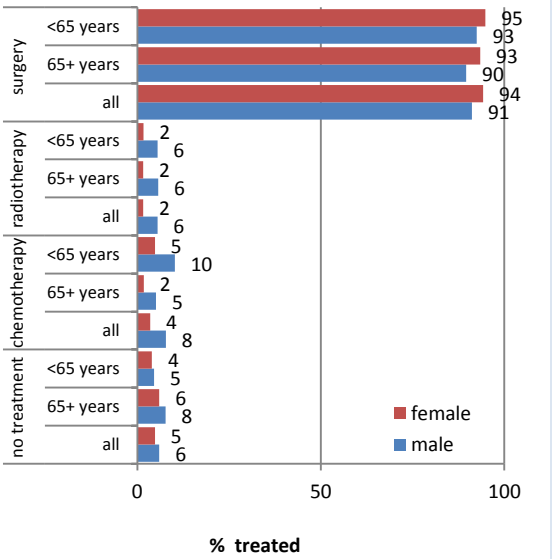


Figure 8-12. Percentage treated by age and sex: melanoma skin cancer: 2007-2011



For *lung cancer*, only 18% of females and 16% of males had surgery, mostly lobectomy or wedge resection for non-small-cell lung cancer (NSCLC). Approximately 40% of patients had radiotherapy and 34% had chemotherapy. 36% of males and 35% of females had no tumour-directed treatment (Figure 8-11). *Melanoma* skin cancer was treated almost exclusively with surgery (excision), with over 90% of patients treated (Figure 8-12). Chemotherapy (targeted immunotherapy) was used only for patients with late-stage melanoma.

Figure 8-13. Percentage treated by age: female breast cancer: 2007-2011

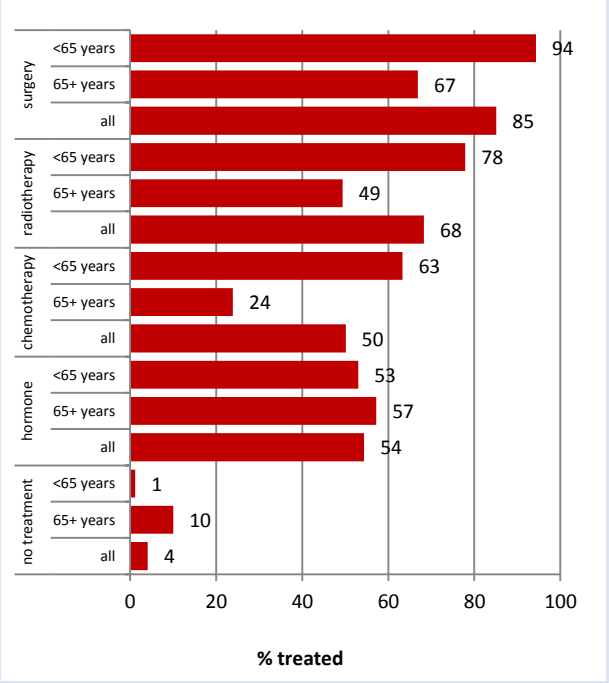
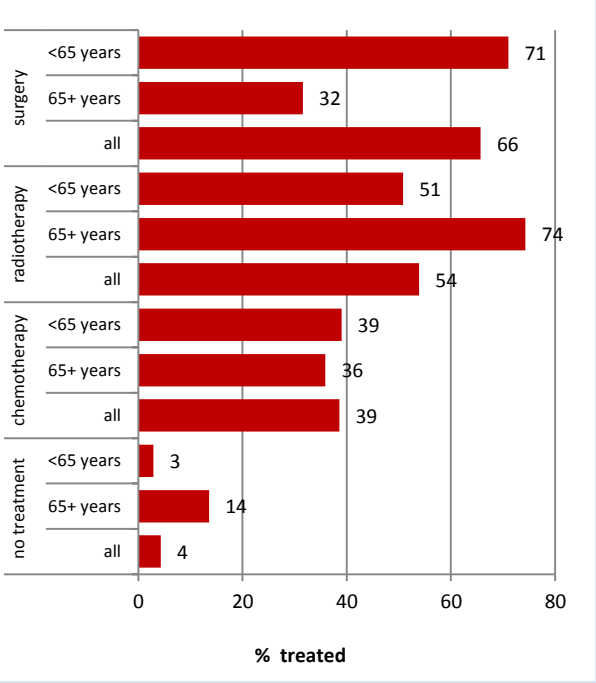


Figure 8-14. Percentage treated by age: cancer of the cervix: 2007-2011



85% of female *breast cancer* patients had surgery (breast-conserving or mastectomy). Almost two thirds of breast cancers were treated with radiotherapy, half had chemotherapy and at least half hormone therapy. Only 4% had no tumour-directed treatment (Figure 8-13). Two thirds of *cervical cancer* patients had surgery and just over half had radiotherapy. Older patients were half as likely to have surgery but more likely to have radiotherapy. Almost 40% of patients had chemotherapy. Only 4% of cervical cancer patients had no tumour-directed treatment (Figure 8-14).

Figure 8-15. Percentage treated by age: cancer of the corpus uteri: 2007-2011

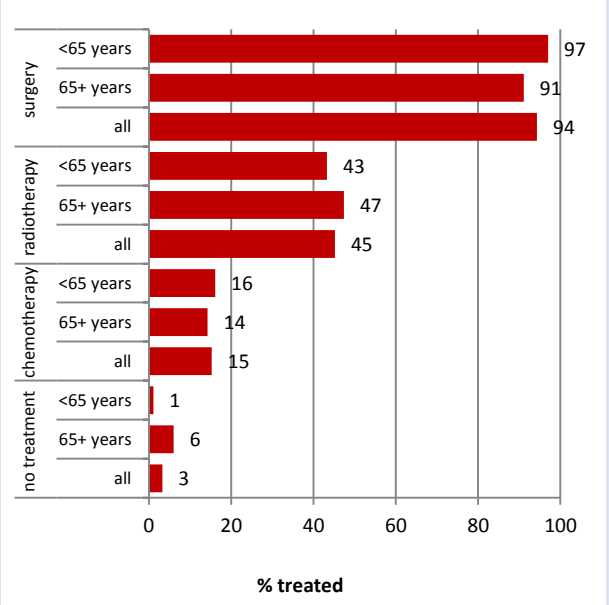
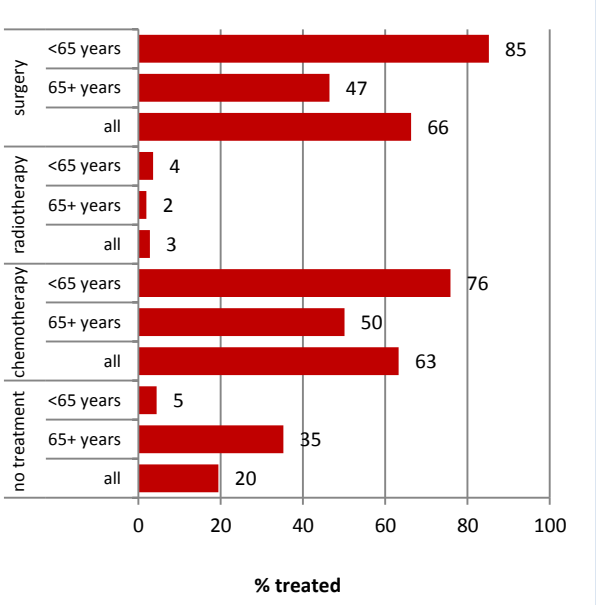


Figure 8-16. Percentage treated by age: cancer of the ovary: 2007-2011



Almost 95% of patients had surgery for cancer of the *uterus* (corpus uteri) and almost 50% had radiotherapy. Chemotherapy was used in 15% of cases. Treatment varied little by age. Only 3% of patients had no tumour-directed treatment (figure 8-15). Two thirds of *ovarian cancer* patients had surgery (85% in <65 and 47% in 65+). Chemotherapy was the other main treatment modality (almost two thirds of patients). Radiotherapy was rarely given (3% only). Approximately 1 in 5 had no tumour-directed treatment, almost all of whom were 65+ years (Figure 8-16).

Figure 8-17. Percentage treated by age: cancer of the testis: 2007-2011

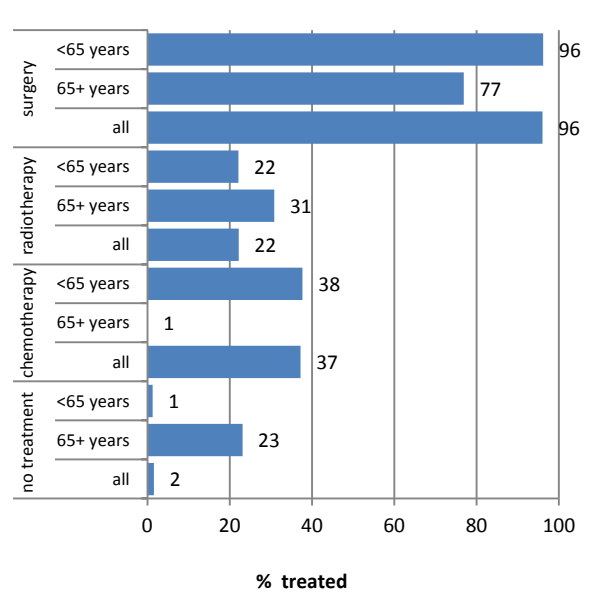
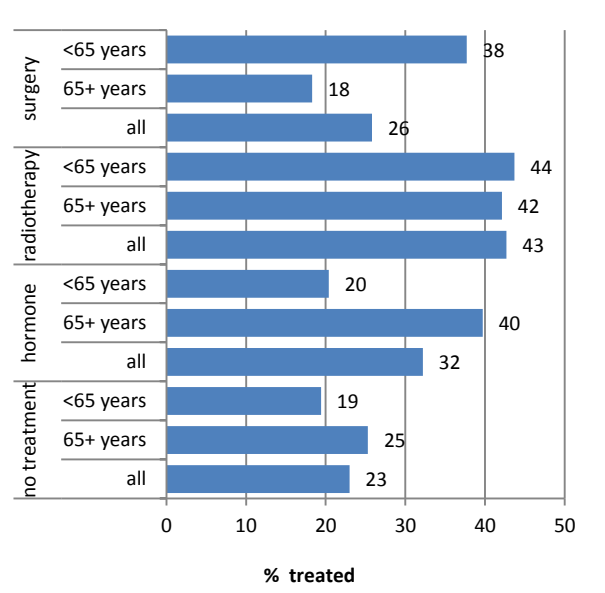


Figure 8-18. Percentage treated by age: cancer of the prostate: 2007-2011



More than 95% of patients with *testicular cancer* had surgery (orchiectomy). Just over 1 in 5 had radiotherapy. Chemotherapy was almost exclusively confined to the younger subset (<65), who comprise the bulk of patients. Only 2% had no tumour-directed treatment (Figure 8-17). One quarter of *prostate cancer* patients had surgery (prostatectomy or TURP). The rate of surgery in older males was approximately half that of younger males (18% and 38% respectively). 40% of patients had radiotherapy regardless of age. Hormone therapy was used in 32% of patients (20% in <65, and 40% in 65+). 23% of patients had no tumour-directed treatment; most of these would have been followed up in watchful waiting (Figure 8-18).

Figure 8-19. Percentage treated by age and sex: cancer of the kidney 2007-2011

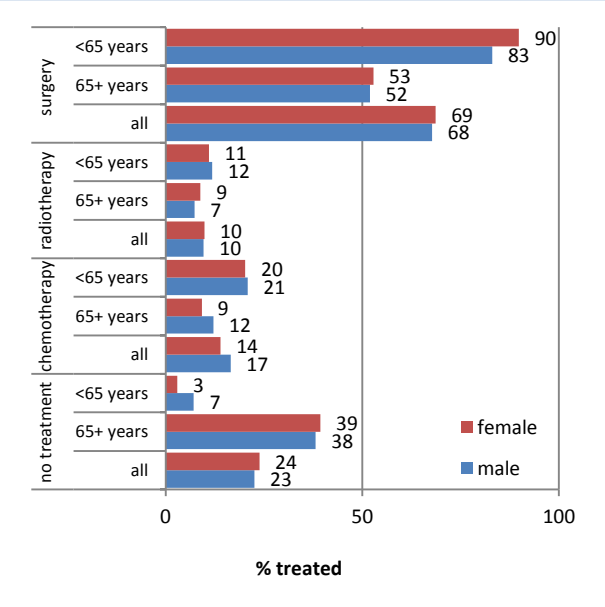
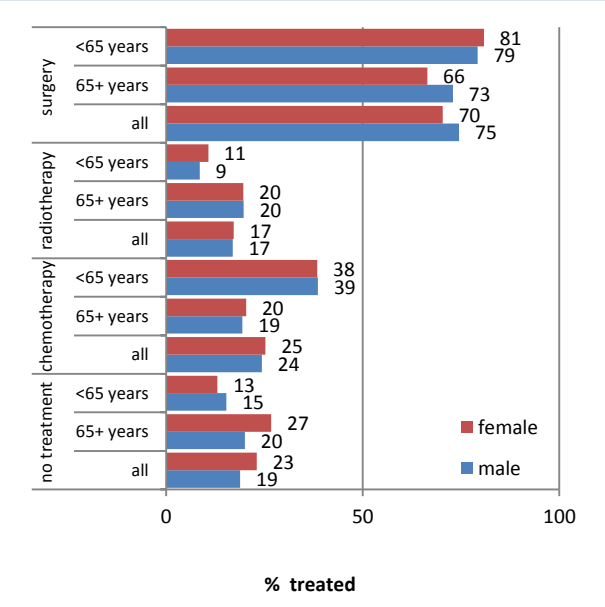


Figure 8-20. Percentage treated by age and sex: cancer of the bladder 2007-2011



Almost 70% of patients with *kidney cancer* had surgery (over 80% of under-65s, and just over 50% in the 65+ age-group). Radiotherapy was used in only 10% of patients, chemotherapy in 14-17% of patients. Approximately one quarter of patients had no tumour-directed treatment (Figure 8-19). Over 70% of patients with cancer of the *bladder* had surgery. Radiotherapy was used in the treatment of 17% of patients. Chemotherapy was used to treat approximately 25% of patients (Figure 8-20).

Figure 8-21. Percentage treated by age and sex: cancer of the brain & CNS 2007-2011

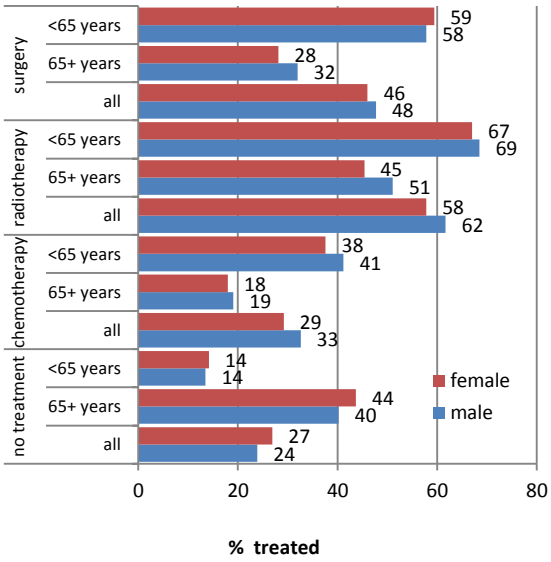
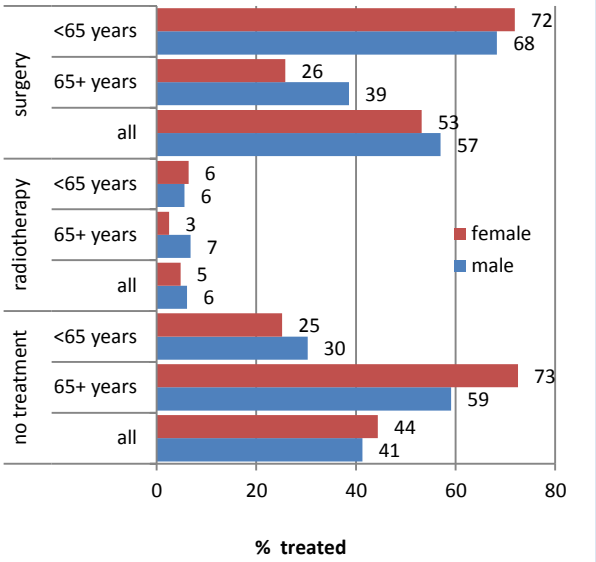


Figure 8-22. Percentage treated by age and sex: benign cancer of the brain & CNS: 2007-2011



Approximately 47% of patients with a *malignant brain tumour* underwent surgery; more so if they were younger (>58%), and less so if they were older (c.30%). Radiotherapy was received by approximately 60%. Chemotherapy was used in approximately 30% of patients (c.40% in <65 and c.20% in 65+) (Figure 8-21). Surgery was a more frequently used treatment for *benign brain tumours* (about 55% of patients). Radiotherapy was used in only 5-6% of patients, and chemotherapy not used at all. 44% of females and 41% of males had no tumour-directed treatment for benign brain tumours (Figure 8-22).

Figure 8-23. Percentage treated by age and sex: cancer of the thyroid: 2007-2011

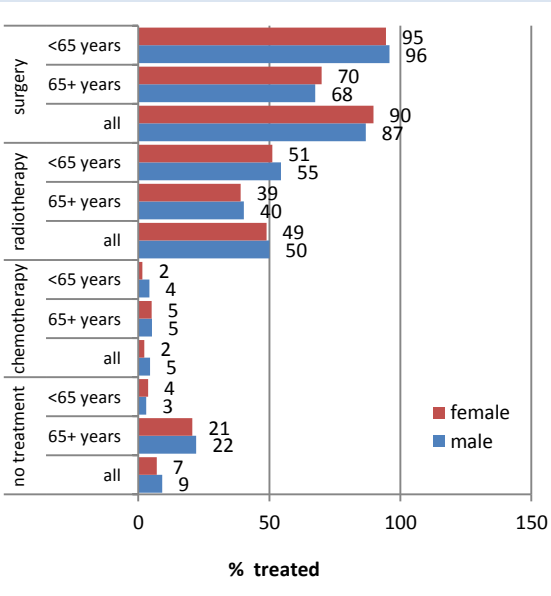
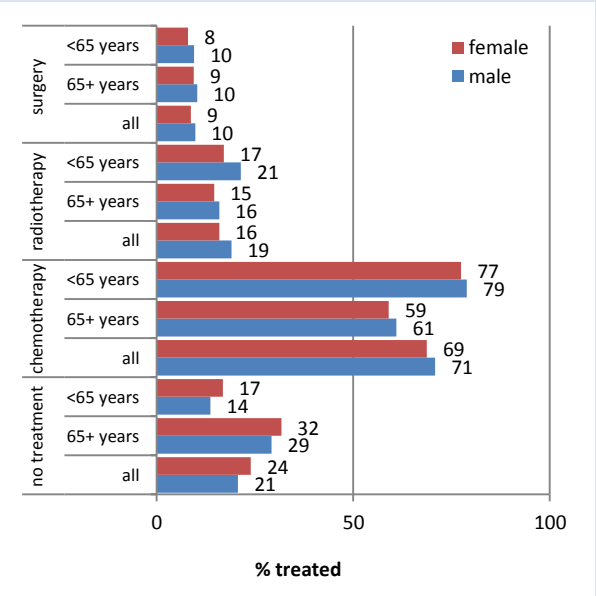


Figure 8-24. Percentage treated by age and sex: lymphoma (all): 2007-2011



Approximately 90% of *thyroid cancer* patients had surgery, and radiotherapy was used in approximately 50% of cases; chemotherapy was used in only 3-4% of cases (Figure 8-23). *Lymphoma* (all types) was rarely treated with surgery (c.10%). Almost 20% of patients had radiotherapy. Chemotherapy was used in approximately 70% of patients. The proportion of patients who had no tumour-directed treatments was 24% of females and 21% of males (Figure 8-24).

Figure 8-25. Percentage treated by age and sex: Hodgkin lymphoma: 2007-2011

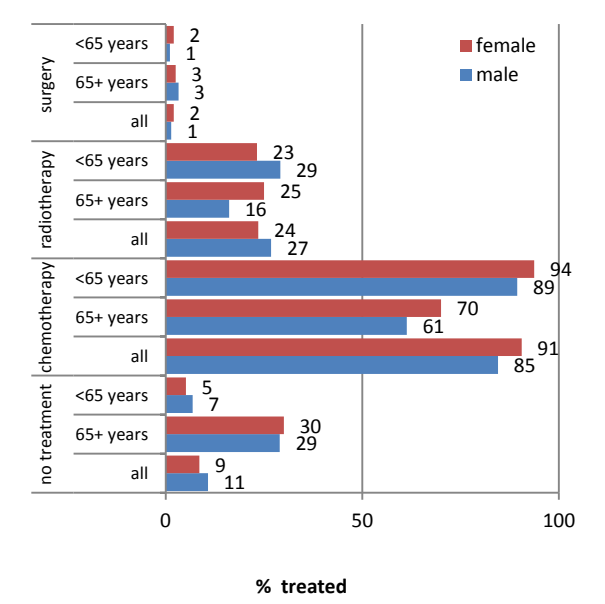
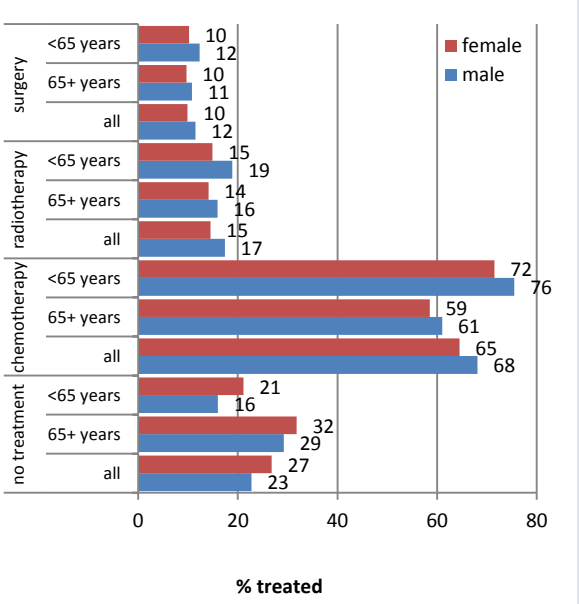


Figure 8-26. Percentage treated by age and sex: non-Hodgkin lymphoma: 2007-2011



The bulk of *Hodgkin lymphoma* cases occur in younger patients (<65). It was treated mostly by chemotherapy (85-91% of patients). Radiotherapy was used in a quarter of patients. Slightly more males had no tumour-directed treatment (11% and 9%, for males and females respectively) (Figure 8-25). *Non-Hodgkin lymphoma* cases were also treated mainly with chemotherapy (65-68%). Radiotherapy was used in 15-17% of cases. Surgery was employed in approximately 10% of patients. 27% of females and 23% of males had no tumour-directed treatment (Figure 8-26).

Figure 8-27. Percentage treated by age and sex: multiple myeloma: 2007-2011

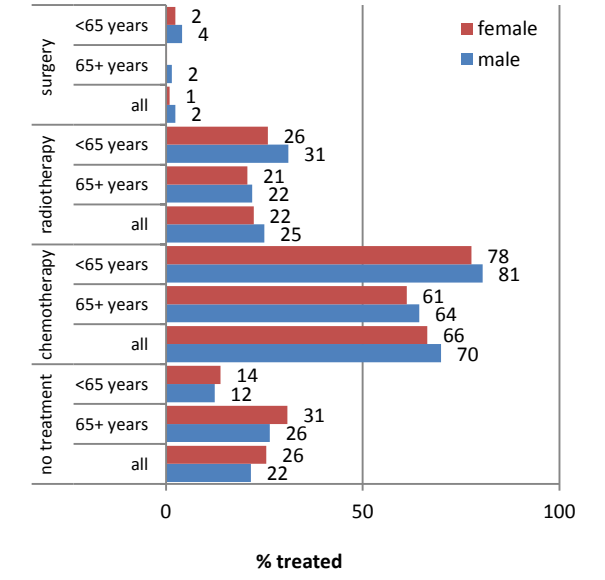
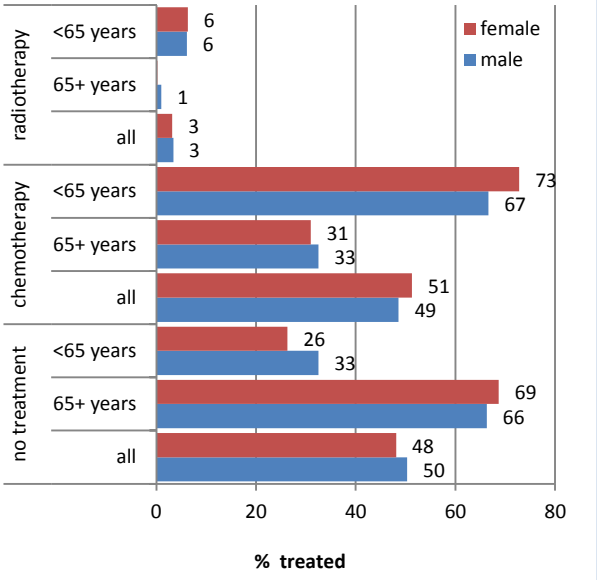


Figure 8-28. Percentage treated by age and sex: leukaemia: 2007-2011



Multiple myeloma was treated mostly with chemotherapy, used in over 65% of all patients (66% in females, 70% in males). Radiotherapy was used in about one quarter of patients. 26% of females and 22% of males had no tumour-directed treatment (Figure 8-27). Approximately half of patients with *leukaemia* were treated with chemotherapy (but c.70% of patients <65 years and c.30% of 65+). Half of patients had no tumour-directed treatment (48% of males and 50% of females) (Figure 8-28).

TREATMENT: COMBINATION REGIMENS BY SELECTED SITES

Most cancer treatments are not administered in isolation; rather they are given as part of a regimen with the aim of achieving therapeutic synergism. In this section, the use of broad treatment modalities (surgery, radiotherapy, chemotherapy and hormone therapy), separately or in various combinations, is summarised for cancers of the breast, prostate, lung, colon and rectum.

Throughout 1996-2011 the proportion of *breast cancer* patients who received treatment regimens with a surgical component remained fairly constant at around 80-85% (Figure 8-29). However, the proportion receiving radiotherapy (either before/after surgery or without surgery) changed substantially, from 46% in 1996 to 70% in 2011. The most commonly administered combination regimens for breast cancer in 2011 were surgery + chemotherapy + radiotherapy (SCR) (18%), SCR with hormone therapy (SCRH) (21%), the same combination bar chemotherapy (SRH) (18%), and surgery + radiotherapy (SR) (10%). Radiotherapy as sole modality was used for only 1% of patients (Figure 8-29).

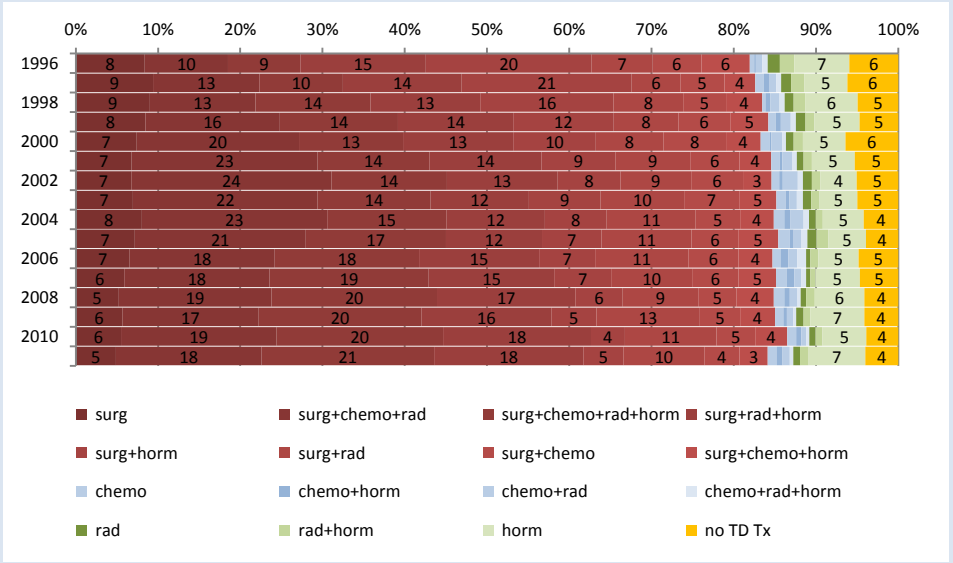
The use of chemotherapy as part of a treatment regimen increased from 33% in 1996 to over 50% from 2002 onwards. In 2011, it was mostly given in combination with surgery + radiotherapy (18%), surgery + radiotherapy + hormone therapy (21%). The use of chemotherapy as sole modality was noted for only 1% of patients (Figure 8-29).

The use of hormone therapy as sole therapy or as part of combination therapy decreased from nearly 60% of patients in 1996 to c.45% in 2003 and then increased again to nearly 60% in 2011. Fewer than 10% of patients received hormone therapy as sole agent. It is mostly recommended as part of a combination regimen, and in general these combinations increased over time - SCRH from 9% of patients in 1996 to 21% in 2011, and SRH from 15% in 1996 to 18% in 2011 - although the combination of surgery + hormone therapy decreased substantially from 20% in 1996 to only 5% in 2011. However, for reasons noted earlier, NCR data may have underestimated the full extent of hormone treatment in breast cancer (Figure 8-29).

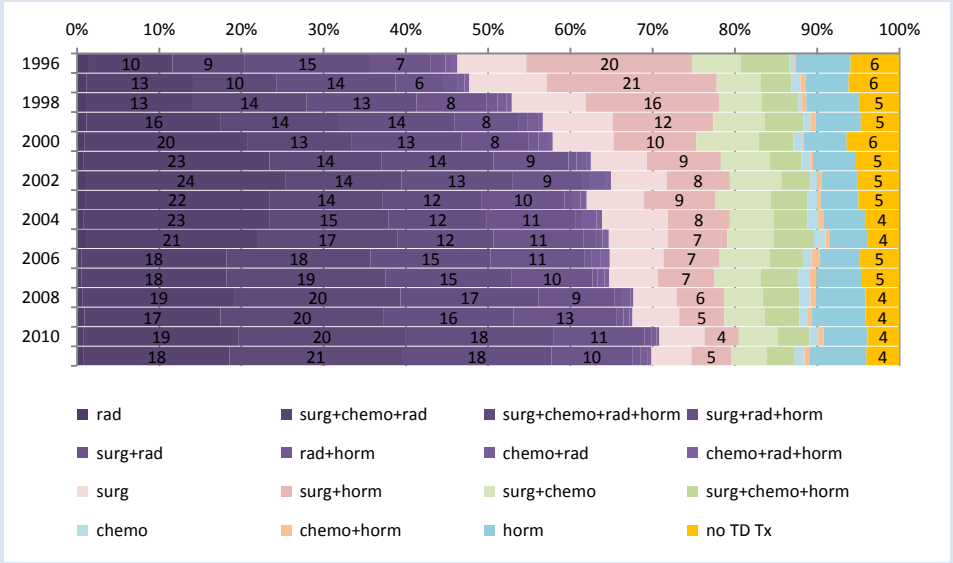
The proportion of breast cancer patients who had no tumour-directed treatment decreased from 6% in 1996 to 4% in 2011.

Figure 8-29. Percentage treated: breast cancer: mutually exclusive combination regimens: years 1996-2011

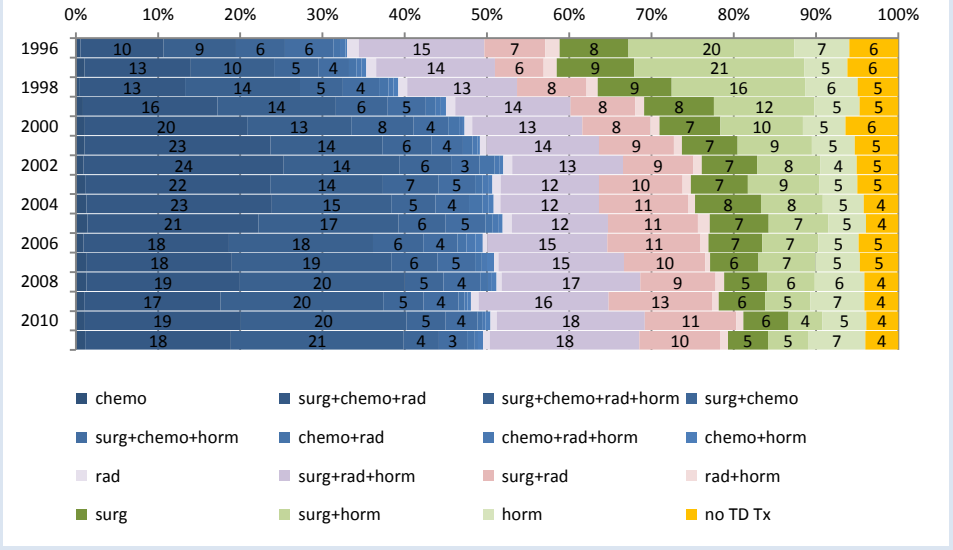
emphasis: surgery (red)



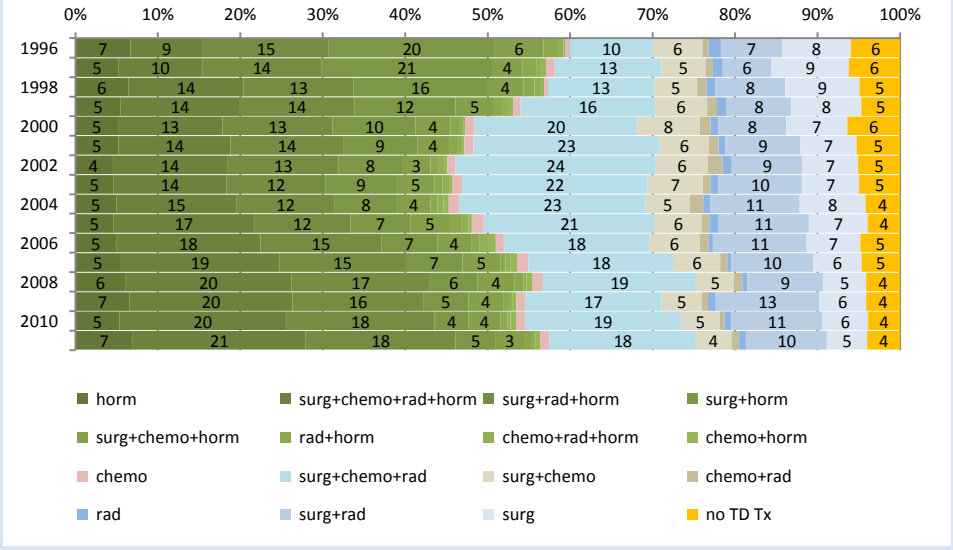
emphasis: radiotherapy (purple)



emphasis: chemotherapy (blue)



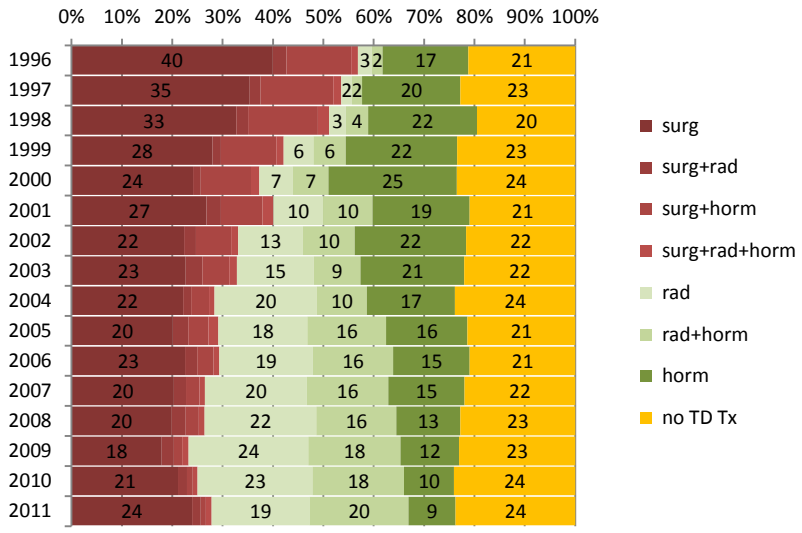
emphasis: hormone therapy (green)



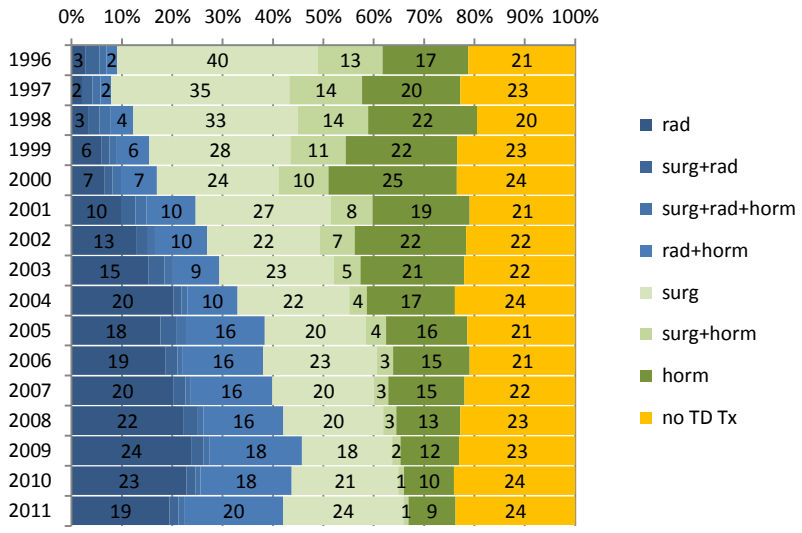
No TD Tx= no tumour-directed treatment

Figure 8-30. Percentage treated: prostate cancer: mutually exclusive combination regimens years 1996-2011

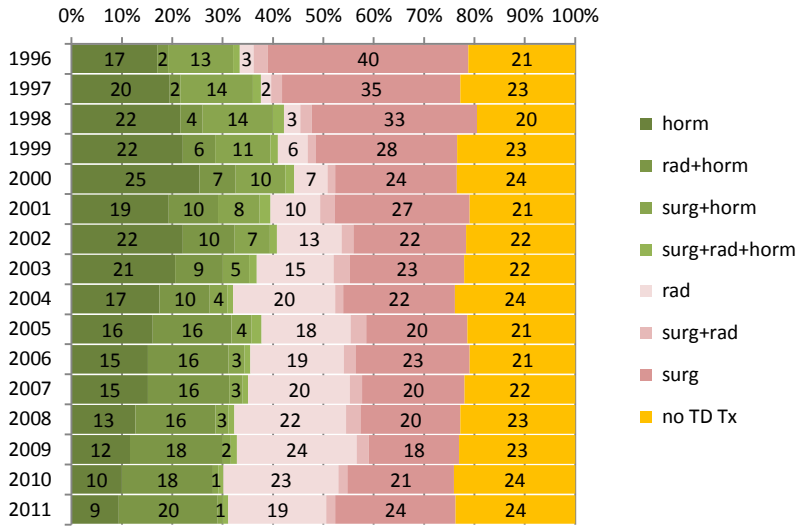
emphasis: surgery (red)



emphasis: radiotherapy (blue)



emphasis: hormone therapy (green)



No TD Tx= no tumour-directed treatment

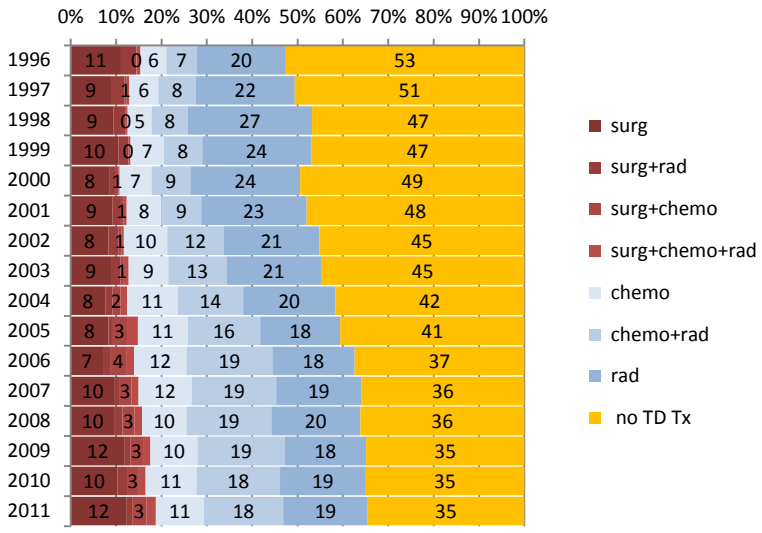
Treatment regimens for *prostate cancer* have changed substantially over the period 1996-2011 (Figure 8-30). Use of surgery as the sole treatment modality decreased from 40% in 1996 to 24% in 2011. Overall use of surgery, including combination regimens, also decreased, from 56% to 28% over the same period. Yet, in 2011 the proportion that had surgery (only) still formed the largest group of patients (excluding those who had no tumour-directed treatment: 24%, most of whom were probably in watchful waiting).

The most notable change has been the adoption of radiotherapy as part of the treatment regimen. In 2011, 43% of patients had radiotherapy, increased from only 9% in 1996. 19% of patients had radiotherapy as their sole treatment in 2011. Otherwise it was given with surgery (2%), or surgery and hormone therapy (1%), or with hormone therapy (20%) (Figure 8-30).

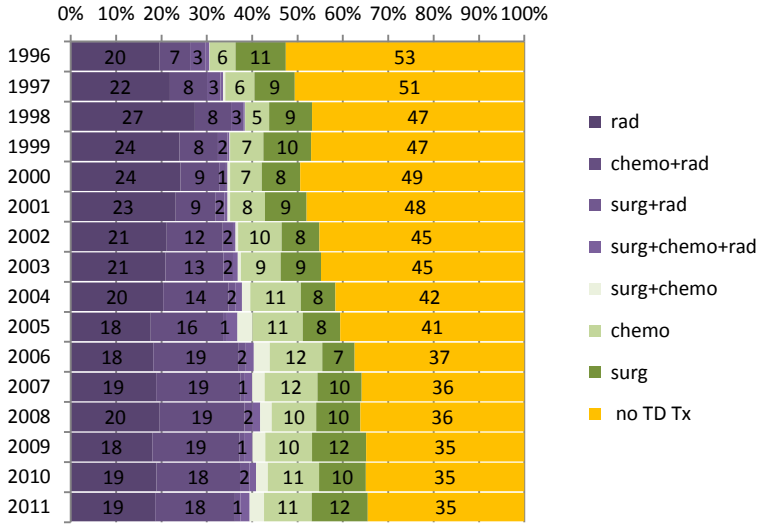
Hormone therapy in the form of androgen deprivation is a cornerstone of prostate cancer treatment. The combination of hormone therapy and radiotherapy has emerged as the main non-surgical treatment regimen, utilised in only 2% of patients in 1996 but 20% in 2011. This mirrors the decline of hormone therapy as sole treatment, from 17% to only 9% over the same period (Figure 8-30).

Figure 8-31. Percentage treated: lung cancer: mutually exclusive combination regimens years 1996-2011

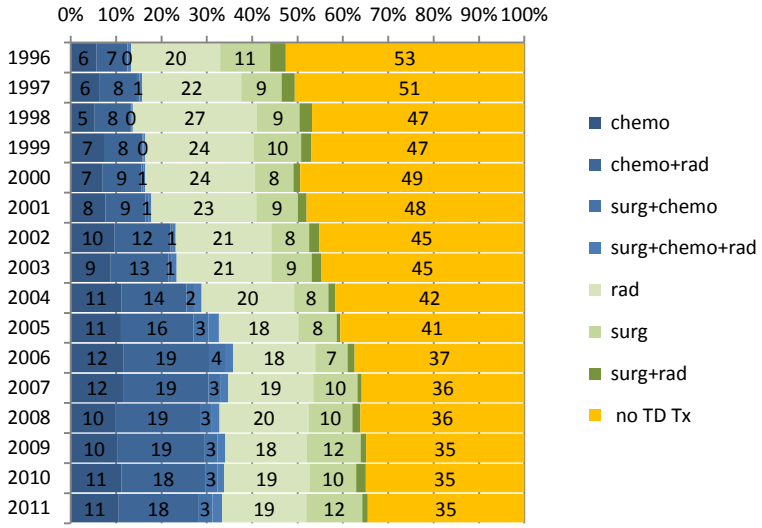
emphasis: surgery (red)



emphasis: radiotherapy (purple)



emphasis: chemotherapy (blue)



No TD Tx= no tumour-directed treatment

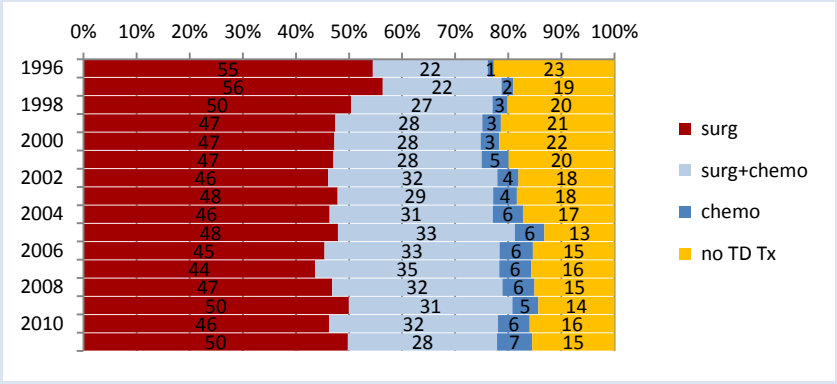
In 2011, surgery-based regimens were used in only 19% of *lung cancer* patients; 12% where surgery was the sole treatment, 1% where it was used with radiotherapy, 3% with chemotherapy and 1% with both chemotherapy and radiotherapy. Surgery is not used in the subset of small-cell lung cancer (SCLC), which make up approximately 15% of lung cancer cases (Figure 8-31).

Radiotherapy is an important treatment modality in lung cancer. Radiotherapy-based regimens increased in use from 31% of cases in 1996 to 39% of cases in 2011. In 2011 radiotherapy was the sole treatment in 19% of cases. Otherwise, it was administered with chemotherapy (18%), or with surgery (1%), or with surgery and chemotherapy (3%) (Figure 8-31).

Chemotherapy-based regimens increased in use from 13% of cases in 1996 to 33% of cases in 2011. In 2011 chemotherapy was the sole treatment in 11% of cases. Otherwise, it was administered with radiotherapy (18%), or surgery (3%), or surgery and radiotherapy (2%) (Figure 8-31).

The proportion of patients who had no tumour-directed treatment decreased from 53% in 1996 to 35% in 2011.

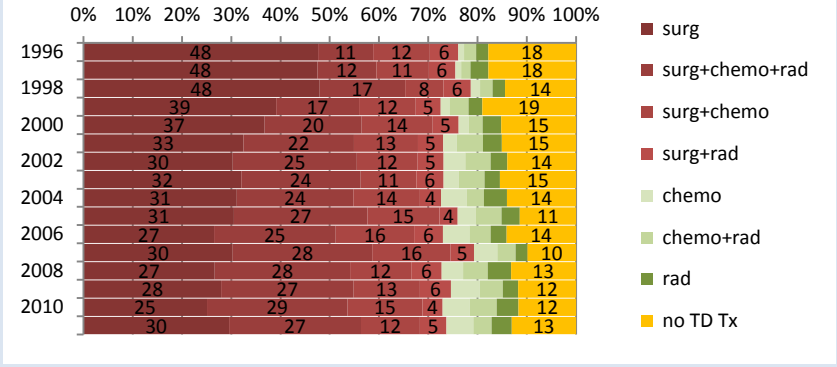
Figure 8-32. Percentage treated: colon cancer: mutually exclusive combination regimens years 1996-2011



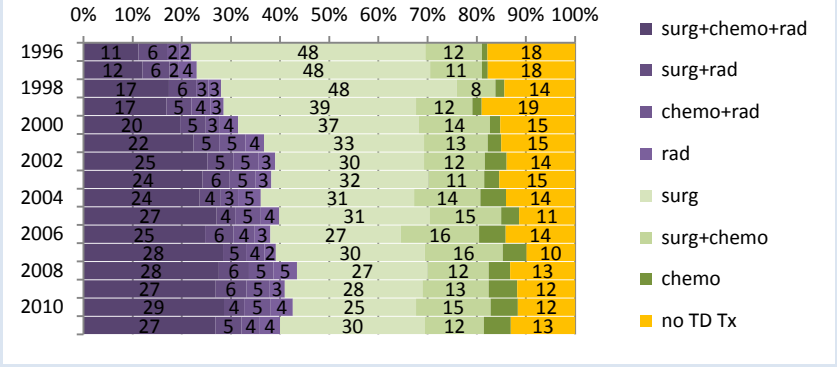
No TD Tx= no tumour-directed treatment

Figure 8-33. Percentage treated: rectum & rectosigmoid junction (RSJ): mutually exclusive combination regimens years 1996-2011

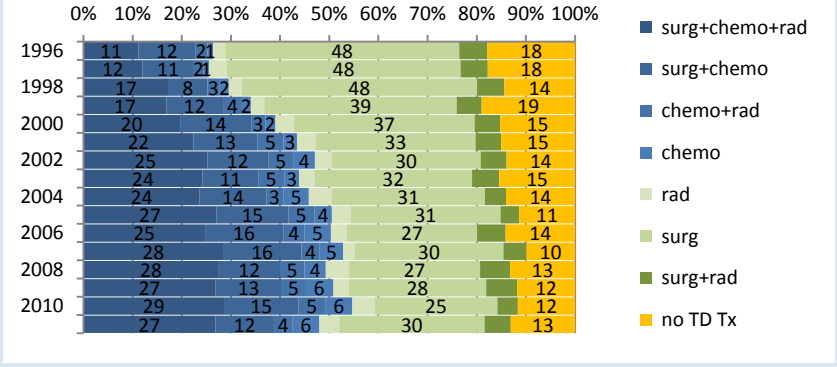
emphasis: surgery (red)



emphasis: radiotherapy (purple)



emphasis: chemotherapy (blue)



No TD Tx= no tumour-directed treatment

Overall, c.77% of patients with *colon cancer* underwent a surgery-based treatment regimen in the period 1996-2011 (Figure 8-3). In 2011, 50% of colon cancer cases had surgery as their sole treatment. Otherwise, surgery was given with chemotherapy (27%). Chemotherapy was the sole treatment in 7% of patients. The proportion of patients who had no tumour-directed treatment of the colon decreased from 23% in 1996 to 15% in 2011.

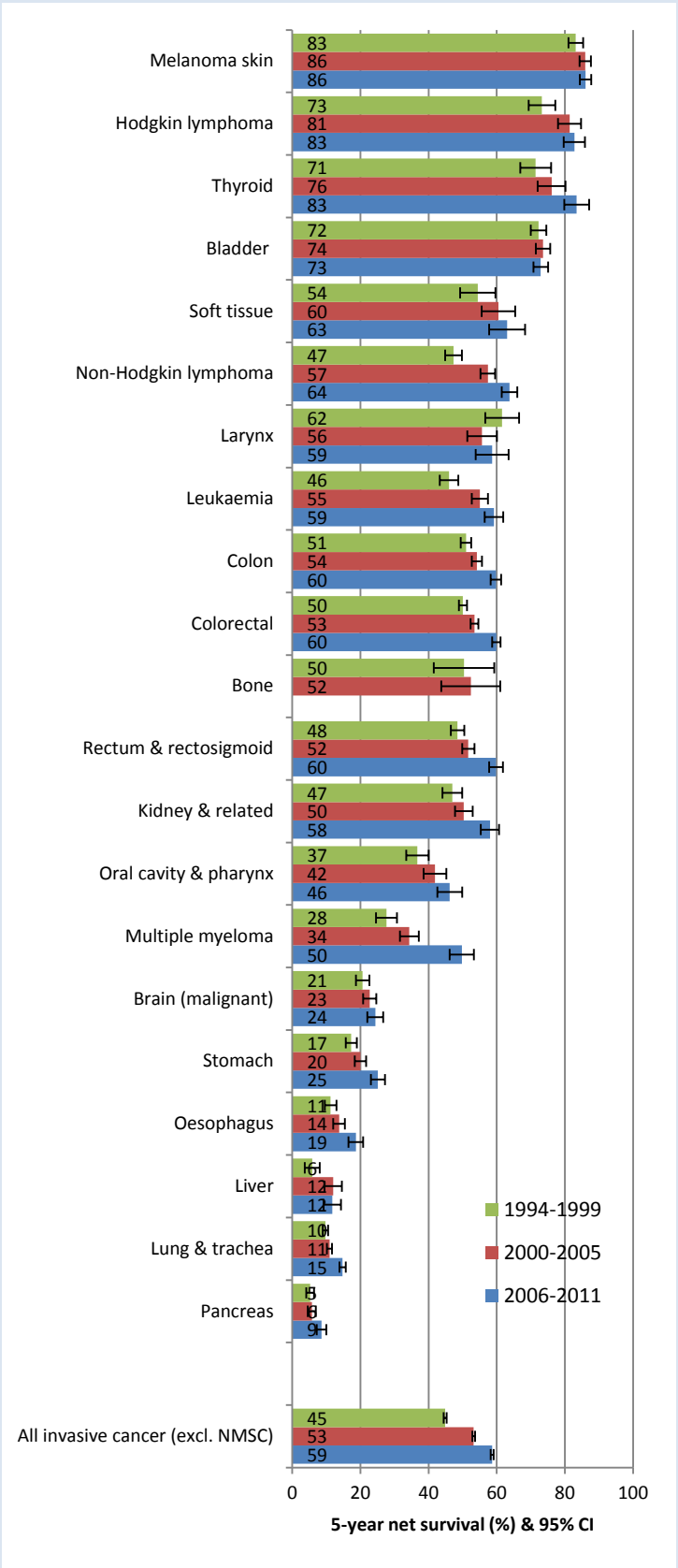
During 1996-2011, c.85% of patients with *rectal/rectosigmoid cancer* received a surgery-based treatment protocol. In 2011, 30% of patients had surgery as their sole treatment. Otherwise, they had surgery with chemotherapy and radiotherapy (27%), or with chemotherapy (12%), or with radiotherapy (Figure 8-33).

Over the same period, the proportion of patients who had a radiotherapy-based regimen increased from 22% to 39%. In 2011, 27% of patients had radiotherapy with surgery and chemotherapy, or with surgery (5%), or with chemotherapy (4%), or they had radiotherapy as their sole treatment (4%) (Figure 8-33).

The proportion of patients who had a chemotherapy-based regimen increased from 27% in 1996 to 48% in 2011. In 2011, 27% of patient had chemotherapy with surgery and radiotherapy, or with surgery (12%), or with radiotherapy (4%), or they had chemotherapy as their sole treatment (6%) (Figure 8-33).

CANCER SURVIVAL IN IRELAND: 1994-2011

Figure 9-1. Net survival at five years for main cancers in Ireland: 1994-2011: males and females combined (age-standardised)



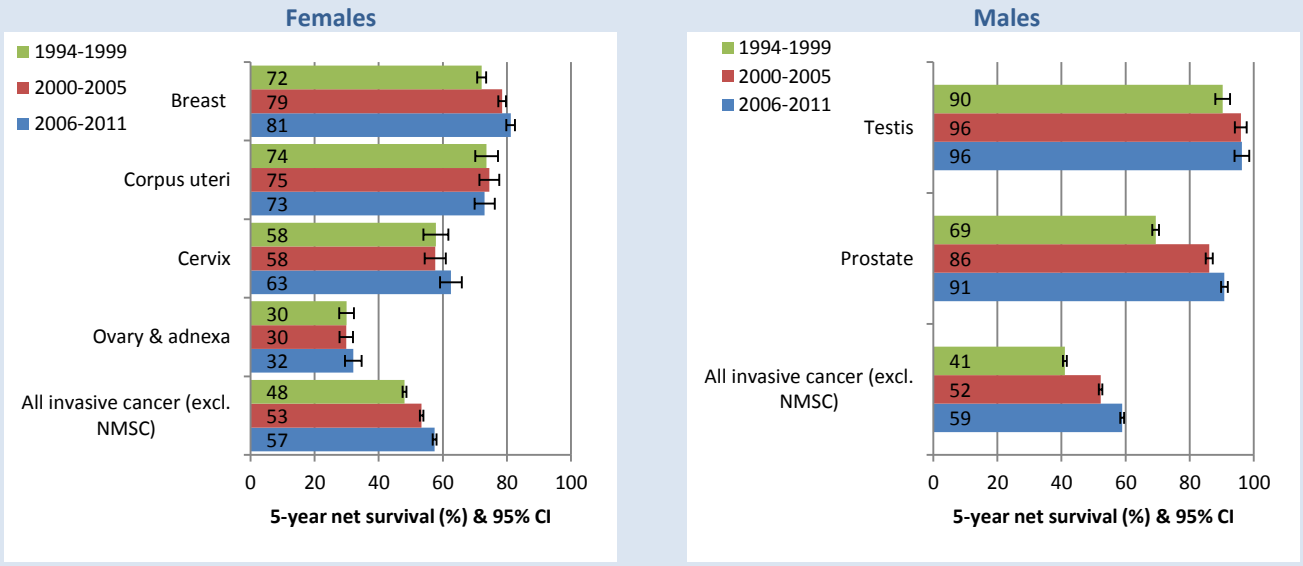
Net survival of cancer patients can be interpreted as the proportion of patients who survive a specified time after diagnosis, after adjusting for other potential causes of death (background mortality). In effect, it estimates the likelihood of survival in the hypothetical situation in which there are no other causes of death (much like the more traditional relative survival).

Considering all invasive cancers (excl. NMSC) together, net survival to five years after diagnosis increased from 45% for Irish patients diagnosed during 1994-1999 to 59% during 2006-2011 (Figure 9-1).

Compared with other invasive cancers occurring in both sexes, net survival at five years was notably high for melanoma skin cancer diagnosed during 2006-2011 (86%). Other cancers with five-year survival >70% included Hodgkin lymphoma (83%), and thyroid (83%) and bladder cancers (73%). In contrast, survival was very low for pancreatic (9%), liver (12%), lung (15%), oesophageal (19%), stomach (25%) and malignant brain cancers (24%).

Most cancers show ongoing improvements in survival. Of the non-sex-specific cancers, relative improvements between 1994-1999 and 2006-2011 were greatest for cancers of the pancreas (6% to 9%), lung (10% to 15%), oesophagus (11% to 19%), stomach (17% to 25%), kidney (47% to 58%), and rectum (48% to 60%), and for multiple myeloma (28% to 50%), leukaemia (46% to 59%) and non-Hodgkin lymphoma (47% to 64%).

Figure 9-2. Net survival at five years for sex specific cancers: 1994-2011



During 2006-2011, for the first time, five-year net survival for all cancers combined in males (59%) exceeded that of females (57%) (Figure 9-2). However, this comparison does not take account of differences between the sexes or changes over time in the relative frequency of different cancer types. In particular, recent survival figures for male cancers as a whole are strongly influenced by prostate cancer, which has shown major increases in both incidence and survival in the last two decades.

For breast cancer, comparing the diagnosis periods 1994-1999 and 2006-2011, five-year net survival increased from 72% to 81%. There was no improvement in survival for uterine cancer (corpus uteri), with estimates of 74% and 73% for the same periods. Survival for cancer of the cervix increased from 58% (1994-1999) to 63% (2006-2011). There was a very small increase in net survival for ovarian cancer, from 30% to 32% for the earlier and later periods respectively (Figure 9.2).

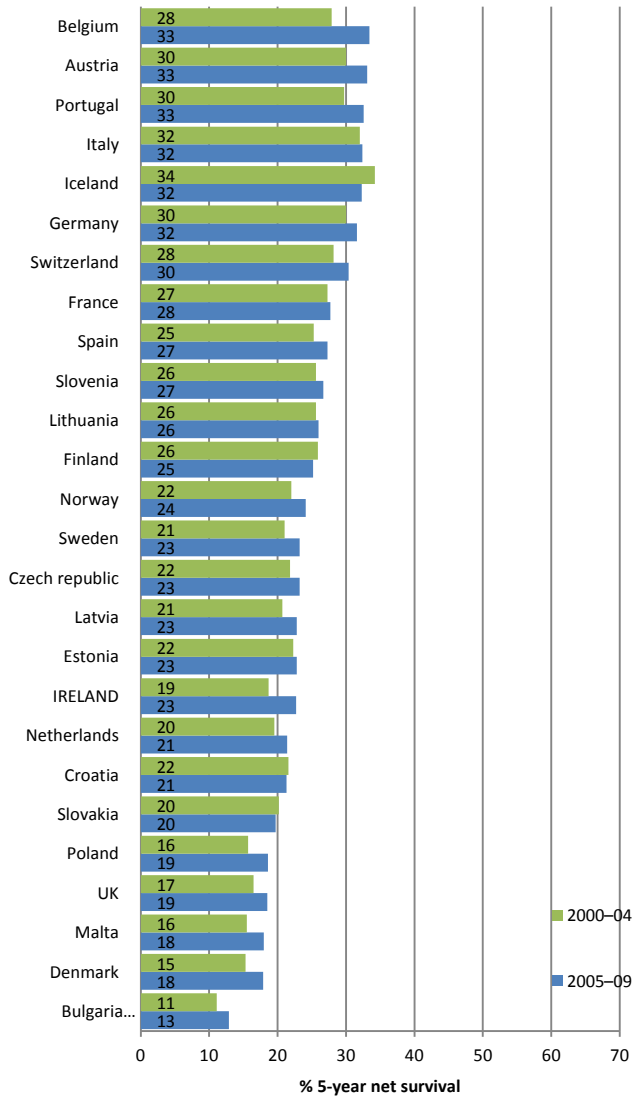
For male-specific cancers, cancer of the testis showed very high net survival, with an increase in five-year survival from 90% to 96% between 1994-1999 and 2006-2011. For prostate cancer, there was a marked increase in five-year survival from 69% to 91% between the same periods (Figure 9.2).

CANCER SURVIVAL: INTERNATIONAL COMPARISON (CONCORD-2 STUDY, 2014)

For the CONCORD-2 study, tumour records were submitted by 279 population-based cancer registries in 67 countries (5 continents) for 25·7 million adults (age 15-99 years) and 75 000 children (age 0-14 years) diagnosed with cancer during 1995-2009 and followed up to Dec 31, 2009. The main results, published in 2014, covered cancers of the stomach, colon, rectum, liver, lung, breast (women), cervix, ovary and prostate in adults, and adult and childhood leukaemia. A summary of five-year net survival estimates is presented below (Figures 9-1 to 9-6), specifically comparing Ireland with other European countries[14]. In general, across the 11 cancer types included in CONCORD-2, survival rates for Ireland fell towards the mid-range of European estimates. But there were some deviations from this, for example adult leukaemia (for which Ireland ranked about 6th of 26 countries) and cervical cancer (23rd of 26 countries). Survival from ovarian cancer in Ireland was the lowest of any European countries, but this might partly reflect coding differences between countries (it is possible that Irish figures included fewer 'borderline' malignancies, which would have better survival).

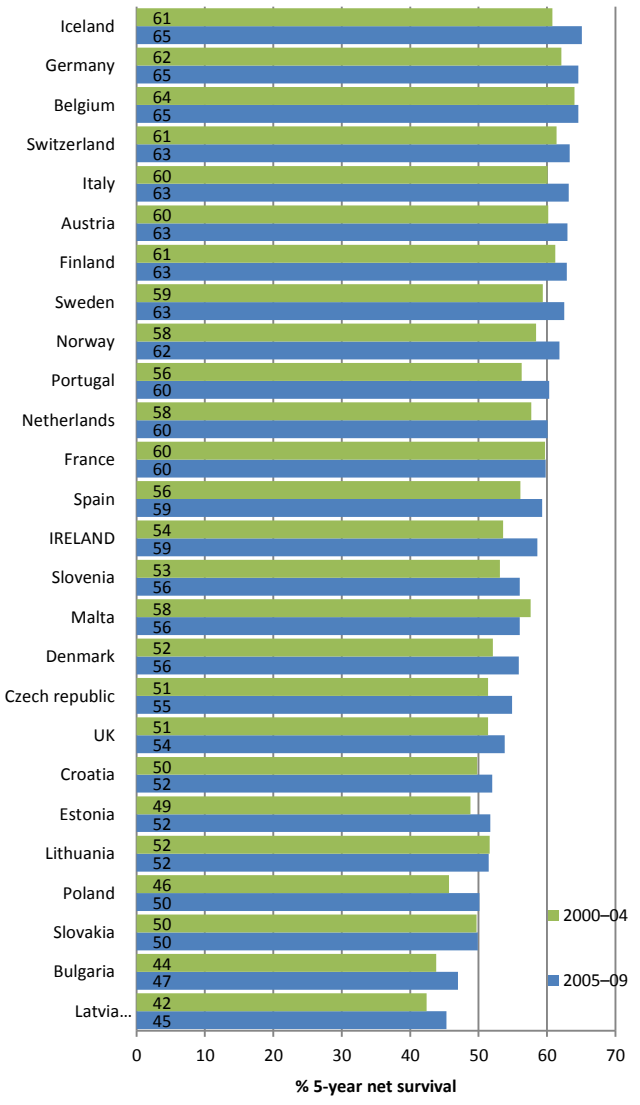
Figure 9-3. Age-standardised net survival at 5 years (%) in Europe - CONCORD-2 [14]

stomach



years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	18	
2005-09	18	4.0%

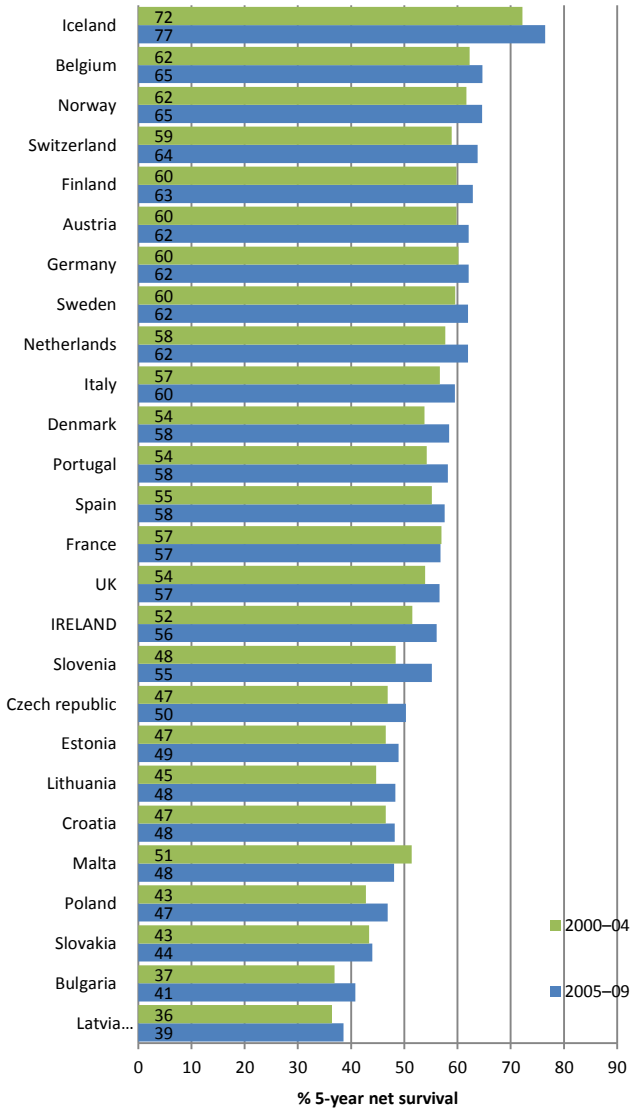
colon & rectosigmoid junction



years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	14	
2005-09	14	5.0%

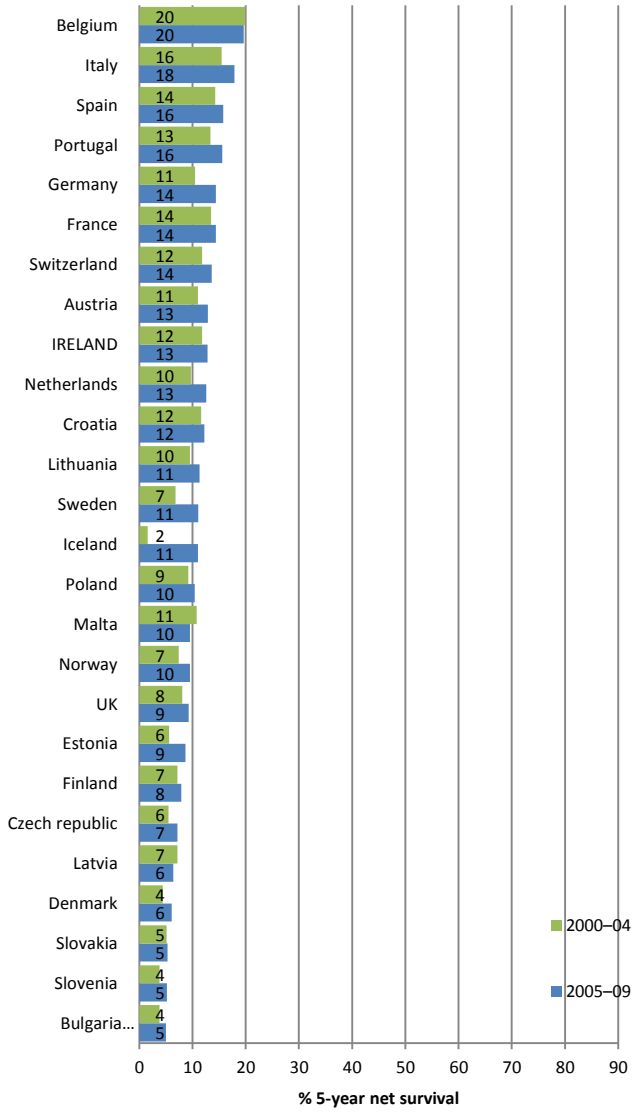
Figure 9-4. Age-standardised net survival at 5 years (%) in Europe - CONCORD-2 [14]

rectum & anus



years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	16	
2005-09	16	4.6%

liver



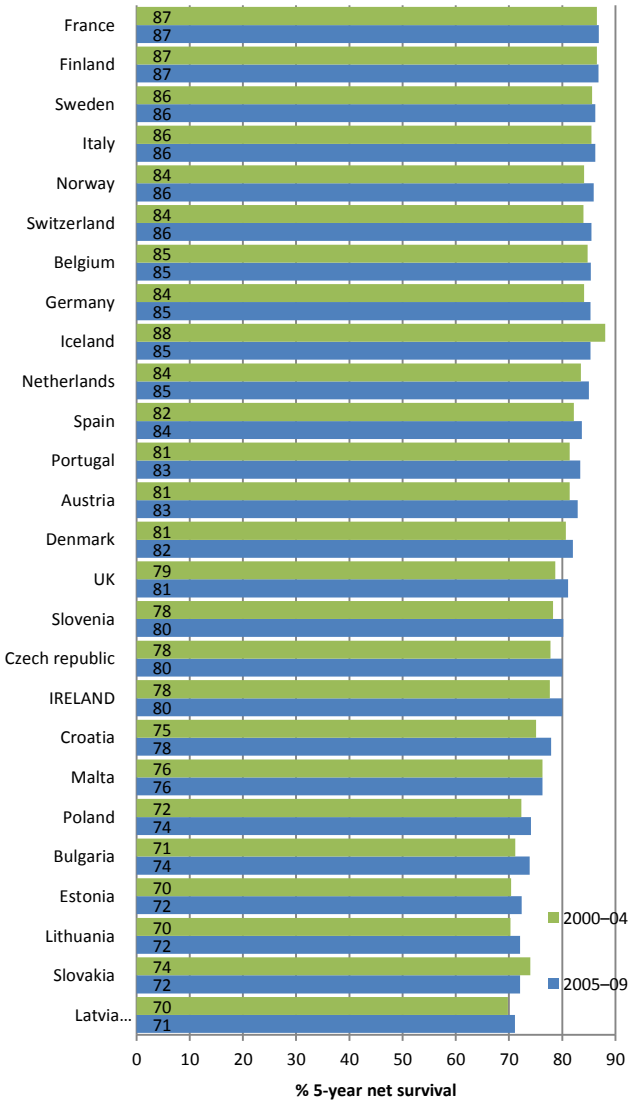
years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	6	
2005-09	9	1.0%

Figure 9-5. Age-standardised net survival at 5 years (%) in Europe, by site - CONCORD-2 [14]

lung

years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	14	
2005-09	14	2.6%

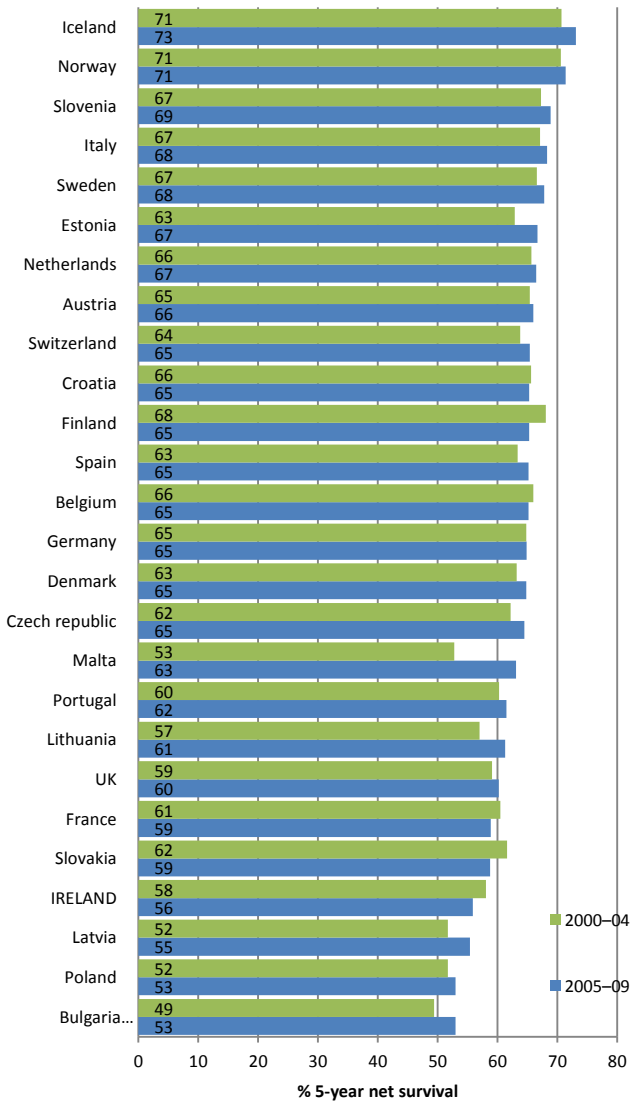
female breast



years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	18	
2005-09	17	2.3%

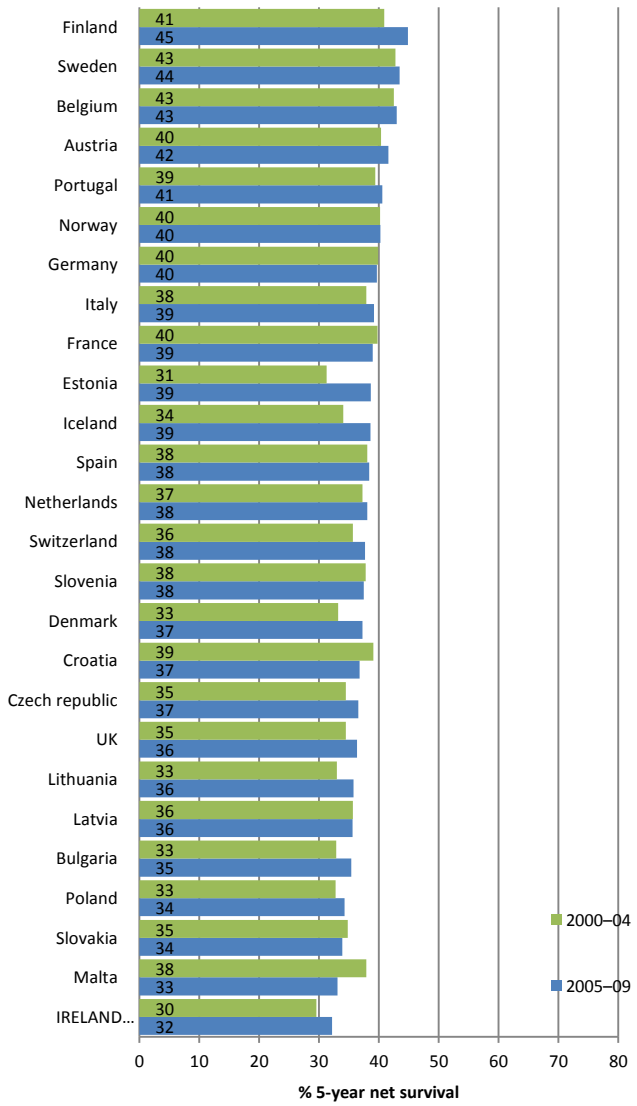
Figure 9-6. Age-standardised net survival at 5 years (%) in Europe - CONCORD-2 [14]

cervix



years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	21	
2005-09	23	-2.2%

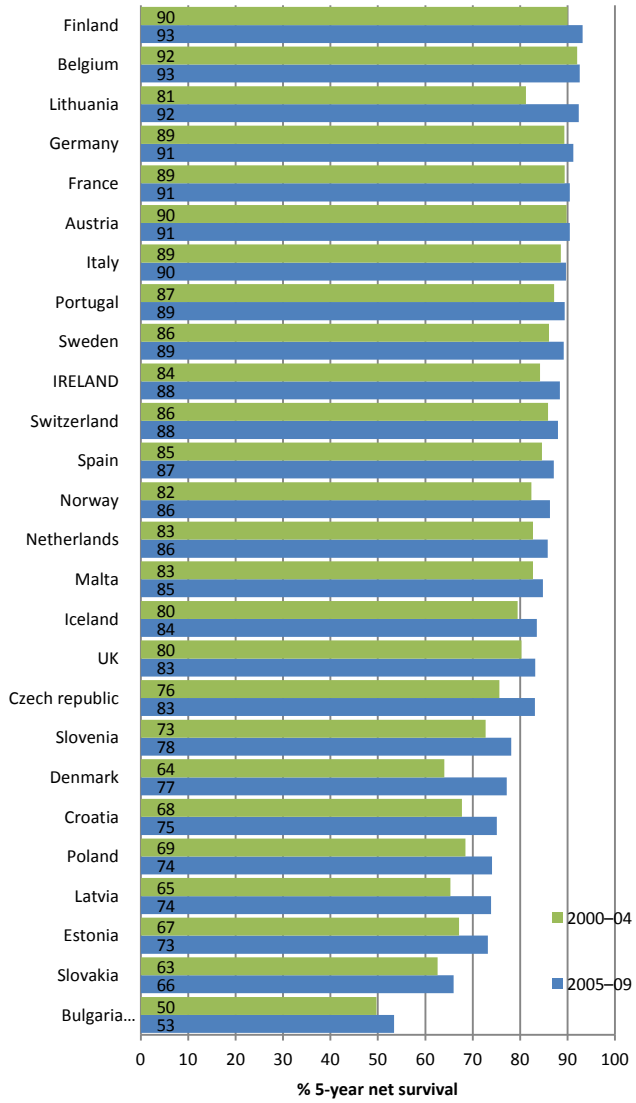
ovary & uterine adnexa



years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	26	
2005-09	26	2.6%

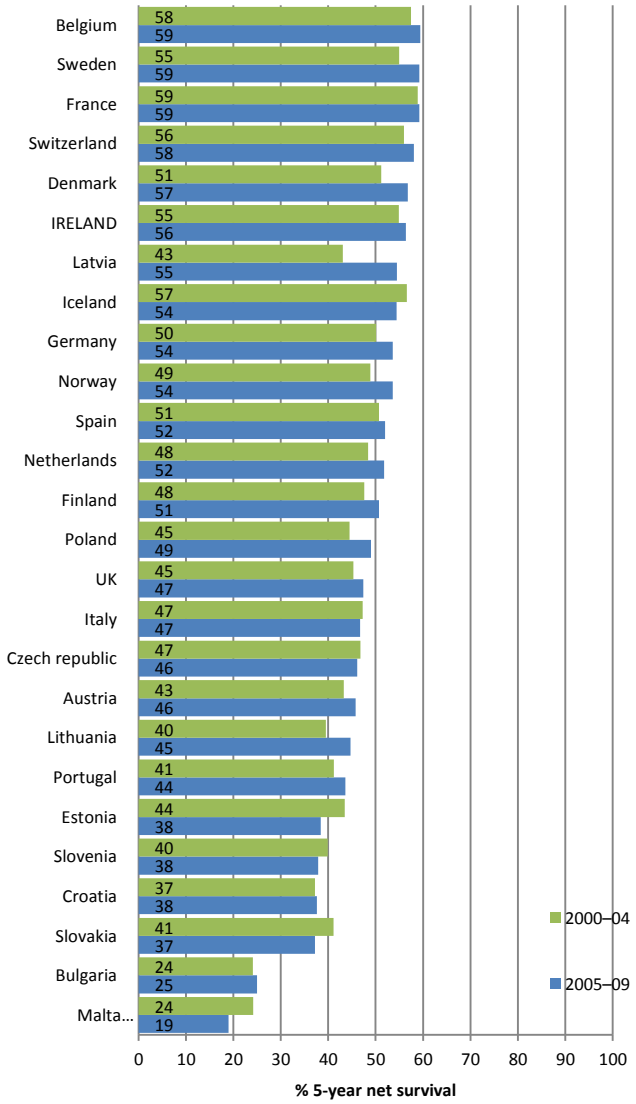
Figure 9-7. Age-standardised net survival at 5 years (%) in Europe - CONCORD-2 [14]

prostate



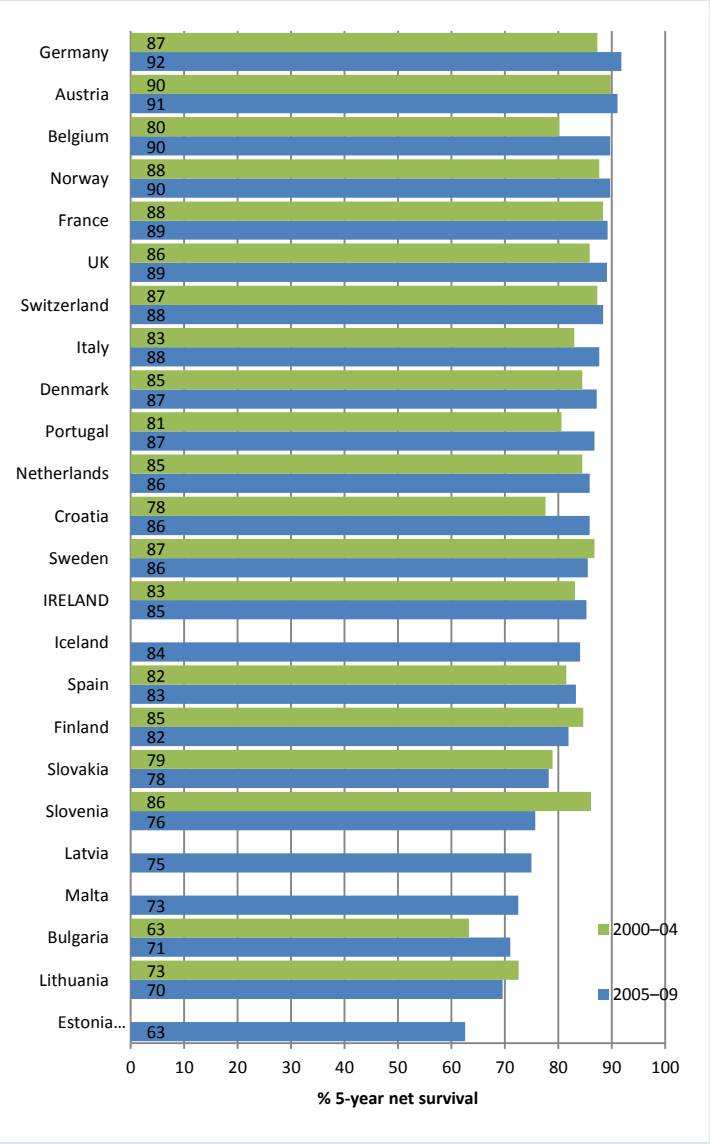
years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	9	
2005-09	10	4.2%

leukaemia (adult)



years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	5	
2005-09	6	1.5%

Figure 9-8.
Age-standardised net survival at 5 years (%) in Europe - CONCORD-2 [14] acute lymphoblastic leukaemia (children)



years of incidence	Rank Ireland	% absolute change 2000-04/2005-09
2000-04	10	
2005-09	14	2.2%

10. METHODS

The National Cancer Registry was established by the Minister for Health in 1991. It has been collecting comprehensive cancer information for the Republic of Ireland since 1994. The information collected is used in research into the causes of cancer, in education and information programmes, and in the planning of cancer services to deliver the best cancer care to the whole population. Completeness of case ascertainment at five years after diagnosis is estimated to be at least 98% [6].

Incidence data are collected and coded by the NCR according to the ICD-O-3 classification (including translation from ICD-O-2 codes for older data). For convenience, cancer types are specified or grouped in this report under ICD10-type codes, but these do not correspond to 'strict' ICD10 codes as some neoplasms classed as non-invasive / non-malignant under ICD10 (e.g. myelodysplastic syndrome, ICD10 D46) are now considered fully malignant under ICDO3. For such cases, the nearest equivalent malignant ICD10 code or subheading is used (thus polycythaemia vera, myelodysplastic syndromes and chronic myeloproliferative diseases have been included under C96, rather than D45-D47).

Mortality data was provided by the Central Statistics Office (CSO) for 1994-2011 [15]. National anonymised datasets for all cancer deaths are provided to the Registry annually by the CSO. At the time of writing this report (December 2014), age-, sex- and cause-specific mortality data were not available for 2012. Therefore, mortality rates by cancer type were estimated for 2012 by extrapolation from mortality data for the preceding 10 years (2002-2011).

The *age-standardised (ASR) rate* is the annual rate of newly diagnosed cases (or of deaths) in a given population (and year), expressed per 100,000 per persons, weighted by the age-structure of a defined 'standard' population, to allow meaningful comparisons geographically and over time. Age-standardised rates for incidence and mortality were weighted by the European standard population [16][17].

Annual percentage changes (APC) of incidence and mortality over time (1994-2012) were estimated with the Joinpoint regression program, using annual age-standardised rates and their standard errors as inputs [18][19].

The *stage* of disease at diagnosis was presented in summary form for each of the main cancer sites according to TNM 5th edition classification [20]. Stage data originally collected using TNM 4th edition criteria (mainly pre-2000) was translated to 5th edition codes as necessary. Where nodal status was coded as 'NX', 'N0' was assumed. Where metastasis status was coded as 'MX', 'M0' was assumed.

Data was downloaded from the European Cancer Observatory (ECO) database to compare incidence and mortality (estimates) between Ireland and other European countries for the most common cancer sites in 2012 [3]. Published survival data from the CONCORD-2 study was extracted to compare 5-year net survival rates in Ireland against other European countries [14].

The NCRI collects information on first course of *treatment* in cancer according to ICD9-CM (in earlier years) and ICD-10AM 6th edition coding (more recently) [21][22]. Tumour-directed surgery (including endoscopic tumour-directed surgery, or other tumour destructive procedure) was counted if undertaken 1 month before, and up to 12 months after diagnosis. A case was deemed to have had chemotherapy or hormone therapy (e.g. tamoxifen) if at least one medical oncology agent (including targeted immunotherapy or other targeted treatment) was administered over the same time frame. Similarly, a case was deemed to have undergone radiotherapy if the case underwent at least one radiotherapy session. Treatments not fitting these criteria (e.g. symptom-relieving surgery and palliative care) were not considered as tumour-directed treatment, i.e. if they did not remove or destroy (or slow growth of) tumour tissue.

Survival figures presented in this report use *net survival,* an 'improved' version of relative survival (which was presented in previous NCR reports) taking better account of competing mortality risks and allowing greater comparability between different populations or age-groups. Net survival represents the cumulative probability of a patient surviving a given time in the hypothetical situation in which the disease of interest is the only possible cause of death, i.e. survival having controlled for other possible cause of death. (This involves comparison of observed survival with the expected survival of

persons of the same age and gender in the general population, as for relative survival.) Net survival was calculated using the '*strs*' command in STATA with an adjustment to obtain the Pohar-Perme estimate [23][24]. All survival estimates were age-standardisation to the International Cancer Survival Standards (ICSS) [25]. Net survival to five years was presented for the most frequently occurring cancers.

11. REFERENCES

[1] A. G. Fritz, *International classification of diseases for oncology: ICD-O*. Geneva: World Health Organization, 2000.

[2] The National Cancer Registry Ireland, "Cancer in Ireland 1994-2011 - annual report of the National Cancer Registry (2014)," Apr. 2014.

[3] "NEW European Cancer Observatory." [Online]. Available: http://eco.iarc.fr/. [Accessed: 21-Nov-2014].

[4] J. Ferlay, E. Steliarova-Foucher, J. Lortet-Tieulent, S. Rosso, J. W. W. Coebergh, H. Comber, D. Forman, and F. Bray, "Cancer incidence and mortality patterns in Europe: estimates for 40 countries in 2012," *Eur. J. Cancer Oxf. Engl. 1990*, vol. 49, no. 6, pp. 1374–1403, Apr. 2013.

[5] J. Lortet-Tieulent, E. Renteria, L. Sharp, E. Weiderpass, H. Comber, P. Baas, F. Bray, J. W. Coebergh, and I. Soerjomataram, "Convergence of decreasing male and increasing female incidence rates in major tobacco-related cancers in Europe in 1988–2010," *Eur. J. Cancer*, Nov. 2013.

[6] K. O'Brien, H. Comber, and L. Sharp, "Completeness of case ascertainment at the Irish National Cancer Registry," *Ir. J. Med. Sci.*, Aug. 2013.

[7] B. Secretan, K. Straif, R. Baan, Y. Grosse, F. El Ghissassi, V. Bouvard, L. Benbrahim-Tallaa, N. Guha, C. Freeman, L. Galichet, V. Cogliano, and WHO International Agency for Research on Cancer Monograph Working Group, "A review of human carcinogens--Part E: tobacco, areca nut, alcohol, coal smoke, and salted fish," *Lancet Oncol.*, vol. 10, no. 11, pp. 1033–1034, Nov. 2009.

[8] L. Fuccio, R. M. Zagari, L. H. Eusebi, L. Laterza, V. Cennamo, L. Ceroni, D. Grilli, and F. Bazzoli, "Meta-analysis: can Helicobacter pylori eradication treatment reduce the risk for gastric cancer?," *Ann. Intern. Med.*, vol. 151, no. 2, pp. 121–128, 2009.

[9] R. De Angelis, M. Sant, M. P. Coleman, S. Francisci, P. Baili, D. Pierannunzio, A. Trama, O. Visser, H. Brenner, E. Ardanaz, M. Bielska-Lasota, G. Engholm, A. Nennecke, S. Siesling, F. Berrino, R. Capocaccia, and EUROCARE-5 Working Group, "Cancer survival in Europe 1999-2007 by country and age: results of EUROCARE--5-a population-based study," *Lancet Oncol.*, vol. 15, no. 1, pp. 23–34, Jan. 2014.

[10] A.-E. Carsin, F. J. Drummond, A. Black, P. J. van Leeuwen, L. Sharp, L. J. Murray, D. Connolly, L. Egevad, M. Boniol, P. Autier, H. Comber, and A. Gavin, "Impact of PSA testing and prostatic biopsy on cancer incidence and mortality: comparative study between the Republic of Ireland and Northern Ireland," *Cancer Causes Control CCC*, vol. 21, no. 9, pp. 1523–1531, Sep. 2010.

[11] R. J. Q. McNally, K. Blakey, P. W. James, B. Gomez Pozo, N. O. Basta, and J. Hale, "Increasing incidence of thyroid cancer in Great Britain, 1976-2005: age-period-cohort analysis," *Eur. J. Epidemiol.*, vol. 27, no. 8, pp. 615–622, Aug. 2012.

[12] L. Dal Maso, M. Lise, P. Zambon, F. Falcini, E. Crocetti, D. Serraino, C. Cirilli, R. Zanetti, M. Vercelli, S. Ferretti, F. Stracci, V. De Lisi, S. Busco, G. Tagliabue, M. Budroni, R. Tumino, A. Giacomin, S. Franceschi, and AIRTUM Working Group, "Incidence of thyroid cancer in Italy, 1991-2005: time trends and age-period-cohort effects," *Ann. Oncol. Off. J. Eur. Soc. Med. Oncol. ESMO*, vol. 22, no. 4, pp. 957–963, Apr. 2011.

[13] "EUROCARE - Survival of cancer patients in Europe." [Online]. Available: http://www.eurocare.it/. [Accessed: 27-Nov-2014].

[14] C. Allemani, H. K. Weir, H. Carreira, R. Harewood, D. Spika, X.-S. Wang, F. Bannon, J. V. Ahn, C. J. Johnson, A. Bonaventure, R. Marcos-Gragera, C. Stiller, G. Azevedo e Silva, W.-Q. Chen, O. J. Ogunbiyi, B. Rachet, M. J. Soeberg, H. You, T. Matsuda, M. Bielska-Lasota, H. Storm, T. C. Tucker, and M. P. Coleman, "Global surveillance of cancer survival 1995–2009: analysis of individual data for 25 676 887 patients from 279 population-based registries in 67 countries (CONCORD-2)," *The Lancet*, Nov. 2014.

[15] I. Central Statistics Office, "Number of Deaths classified by Age and Sex." [Online]. Available: http://www.cso.ie/en/statistics/birthsdeathsandmarriages/numberofdeathsclassifiedbyageandsex/. [Accessed: 03-Dec-2014].

[16] O. M. Jensen, International Agency for Research on Cancer, World Health Organization, and International Association of Cancer Registries, *Cancer registration: principles and methods*. Lyon, France; New York: International Agency for Research on Cancer ; Distributed in the USA by Oxford University Press, 1991.

[17] European Standard Population, "EUCAN | Glossary." [Online]. Available: http://eco.iarc.fr/EUCAN/Glossary.aspx. [Accessed: 19-Nov-2013].

[18] H. J. Kim, M. P. Fay, E. J. Feuer, and D. N. Midthune, "Permutation tests for joinpoint regression with applications to cancer rates," *Stat. Med.*, vol. 19, no. 3, pp. 335–351, Feb. 2000.

[19] SEER, "Joinpoint Regression Program - Surveillance Research Program." [Online]. Available: http://surveillance.cancer.gov/joinpoint/. [Accessed: 19-Nov-2013].

[20] L. H. Sobin and I. D. Fleming, "TNM classification of malignant tumors, fifth edition (1997)," *Cancer*, vol. 80, no. 9, pp. 1803–1804, Nov. 1997.

[21] M. Karaffa, *International classification of diseases*. Los Angeles, California, USA: Practice Management Information Corp., 1992.

[22] "Australian Classification of Health Interventions (ACHI) 6th edition." [Online]. Available: http://meteor.aihw.gov.au/content/index.phtml/itemId/361681. [Accessed: 10-Dec-2014].

[23] P. W. Dickman, A. Sloggett, M. Hills, and T. Hakulinen, "Regression models for relative survival," *Stat. Med.*, vol. 23, no. 1, pp. 51–64, Jan. 2004.

[24] M. P. Perme, R. Henderson, and J. Stare, "An approach to estimation in relative survival regression," *Biostat. Oxf. Engl.*, vol. 10, no. 1, pp. 136–146, Jan. 2009.

[25] I. Corazziari, M. Quinn, and R. Capocaccia, "Standard cancer patient population for age standardising survival ratios," *Eur. J. Cancer Oxf. Engl. 1990*, vol. 40, no. 15, pp. 2307–2316, Oct. 2004.

12. APPENDIX I: SUMMARY TABLE-CANCER INCIDENCE: 2010-2012

ICD10 cancer site (INCIDENCE)	FEMALES					MALES					TOTAL		
ASR†: age-standardised rate, cases per 100,000 (standardised to the European population)	annual average 2010-2012	% all invasive	% all invasive excl. NMSC	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all invasive	% all invasive excl. NMSC	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all invasive	% all invasive excl. NMSC
C00-C96: All invasive cancers*	13,378	100.0%		543.9	35.04	15,788	100.0%		722.1	44.22	29,166	100.0%	
C00-C43, C45-C96: All invasive cancers, excluding NMSC*	9,312	69.6%	100.0%	384.5	26.55	10,751	68.1%	100.0%	492.5	33.63	20,063	68.8%	100.0%
D00-D48: All non-invasive neoplasms**	5,110	-	-	203.0	14.18	1,497	-	-	68.0	5.26	6,606	-	-
C00-D48: All registered neoplasms	18,488	-	-	746.9	44.25	17,284	-	-	790.1	47.15	35,772	-	-
C00: lip	5	<0.1%	0.1%	0.2	0.01	15	0.1%	0.1%	0.7	0.05	20	0.1%	0.1%
C01: base of tongue	8	0.1%	0.1%	0.4	0.04	27	0.2%	0.3%	1.3	0.11	35	0.1%	0.2%
C02: other tongue	26	0.2%	0.3%	1.1	0.09	43	0.3%	0.4%	2.0	0.17	69	0.2%	0.3%
C03: gum	9	0.1%	0.1%	0.4	0.03	8	0.1%	0.1%	0.4	0.04	17	0.1%	0.1%
C04: floor of mouth	7	<0.1%	0.1%	0.3	0.03	21	0.1%	0.2%	1.0	0.10	28	0.1%	0.1%
C05: palate	8	0.1%	0.1%	0.3	0.03	11	0.1%	0.1%	0.5	0.05	19	0.1%	0.1%
C06: other mouth	16	0.1%	0.2%	0.6	0.04	17	0.1%	0.2%	0.8	0.06	33	0.1%	0.2%
C07: parotid	14	0.1%	0.2%	0.6	0.05	15	0.1%	0.1%	0.7	0.05	29	0.1%	0.1%
C08: other salivary	5	<0.1%	0.1%	0.2	0.01	3	<0.1%	<0.1%	0.1	0.01	8	<0.1%	<0.1%
C09: tonsil	12	0.1%	0.1%	0.6	0.05	38	0.2%	0.4%	1.8	0.16	50	0.2%	0.2%
C10: oropharynx	4	<0.1%	<0.1%	0.2	0.02	16	0.1%	0.1%	0.7	0.06	20	0.1%	0.1%
C11: nasopharynx	5	<0.1%	0.1%	0.2	0.02	14	0.1%	0.1%	0.7	0.06	19	0.1%	0.1%
C12: pyriform	4	<0.1%	<0.1%	0.2	0.02	20	0.1%	0.2%	0.9	0.09	24	0.1%	0.1%
C13: hypopharynx	5	<0.1%	0.1%	0.2	0.01	13	0.1%	0.1%	0.6	0.05	18	0.1%	0.1%
C14: other mouth/pharynx	5	<0.1%	0.1%	0.2	0.02	11	0.1%	0.1%	0.5	0.05	17	0.1%	0.1%
C01-C14: mouth & pharynx	129	1.0%	1.4%	5.5	0.45	257	1.6%	2.4%	11.9	1.05	386	1.3%	1.9%
C15: oesophagus	139	1.0%	1.5%	5.2	0.39	247	1.6%	2.3%	11.4	0.94	386	1.3%	1.9%
C16: stomach	187	1.4%	2.0%	7.0	0.48	344	2.2%	3.2%	15.7	1.23	530	1.8%	2.6%
C17: small intestine	29	0.2%	0.3%	1.2	0.09	40	0.3%	0.4%	1.8	0.15	70	0.2%	0.3%
C18: colon	718	5.4%	7.7%	27.6	2.03	861	5.5%	8.0%	39.1	2.89	1,579	5.4%	7.9%
C19: rectosigmoid	65	0.5%	0.7%	2.6	0.22	113	0.7%	1.1%	5.2	0.41	178	0.6%	0.9%
C20: rectum	237	1.8%	2.5%	9.7	0.80	445	2.8%	4.1%	20.4	1.69	682	2.3%	3.4%
C21: anus	26	0.2%	0.3%	1.1	0.08	20	0.1%	0.2%	0.9	0.06	46	0.2%	0.2%
C18-C21: colorectal	1,046	7.8%	11.2%	41.1	3.11	1,439	9.1%	13.4%	65.6	4.97	2,486	8.5%	12.4%
C22: liver	74	0.6%	0.8%	2.8	0.21	144	0.9%	1.3%	6.5	0.52	217	0.7%	1.1%
C23: gallbladder	33	0.2%	0.4%	1.2	0.09	13	0.1%	0.1%	0.6	0.04	46	0.2%	0.2%
C24: other biliary	47	0.4%	0.5%	1.7	0.11	56	0.4%	0.5%	2.5	0.19	103	0.4%	0.5%
C25: pancreas	228	1.7%	2.5%	8.6	0.63	255	1.6%	2.4%	11.7	0.91	484	1.7%	2.4%
C26: other digestive	18	0.1%	0.2%	0.6	0.03	16	0.1%	0.1%	0.7	0.05	33	0.1%	0.2%
C30: nasal cavity/middle ear	6	<0.1%	0.1%	0.3	0.02	8	0.1%	0.1%	0.4	0.03	14	<0.1%	0.1%
C31: sinuses	4	<0.1%	<0.1%	0.1	0.01	7	<0.1%	0.1%	0.3	0.02	10	<0.1%	0.1%
C32: larynx	21	0.2%	0.2%	0.9	0.08	142	0.9%	1.3%	6.7	0.57	164	0.6%	0.8%
C33: trachea	1	<0.1%	<0.1%	0.0	<0.01	1	<0.1%	<0.1%	0.1	<0.01	3	<0.1%	<0.1%
C34: lung	973	7.3%	10.4%	39.0	3.18	1,300	8.2%	12.1%	59.3	4.55	2,273	7.8%	11.3%

ICD10 cancer site (INCIDENCE)	FEMALES					MALES					TOTAL		
ASR†: age-standardised rate, cases per 100,000 (standardised to the European population)	annual average 2010-2012	% all invasive	% all invasive excl. NMSC	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all invasive	% all invasive excl. NMSC	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all invasive	% all invasive excl. NMSC
C37: thymus	4	<0.1%	<0.1%	0.2	0.02	4	<0.1%	<0.1%	0.2	0.02	8	<0.1%	<0.1%
C38: mediastinum	6	<0.1%	0.1%	0.2	0.02	10	0.1%	0.1%	0.4	0.03	16	0.1%	0.1%
C39: other chest		<0.1%	<0.1%	0.0	<0.01		<0.1%	<0.1%	0.0	<0.01	-	<0.1%	<0.1%
C40: bones, joints of limbs	9	0.1%	0.1%	0.4	0.03	13	0.1%	0.1%	0.6	0.05	22	0.1%	0.1%
C41: bones, joints head and trunk	6	<0.1%	0.1%	0.3	0.02	10	0.1%	0.1%	0.4	0.03	16	0.1%	0.1%
C43: melanoma skin	496	3.7%	5.3%	20.5	1.64	392	2.5%	3.6%	17.8	1.42	889	3.0%	4.4%
C44: non-melanoma skin (NMSC)	4,066	30.4%		159.4	11.55	5,036	31.9%		229.7	15.96	9,102	31.2%	
C45: mesothelioma	7	<0.1%	0.1%	0.3	0.03	32	0.2%	0.3%	1.5	0.12	39	0.1%	0.2%
C46: Kaposi's sarcoma	1	<0.1%	<0.1%	0.0	<0.01	8	0.1%	0.1%	0.4	0.03	9	<0.1%	<0.1%
C47: peripheral nerves	3	<0.1%	<0.1%	0.1	0.01	3	<0.1%	<0.1%	0.1	0.01	6	<0.1%	<0.1%
C48: peritoneum	16	0.1%	0.2%	0.7	0.06	5	<0.1%	<0.1%	0.2	0.01	21	0.1%	0.1%
C49: connective tissues	39	0.3%	0.4%	1.6	0.13	56	0.4%	0.5%	2.5	0.17	95	0.3%	0.5%
C50: breast	2,816	21.1%	30.2%	122.7	9.64	28	0.2%	0.3%	1.3	0.10	2,844	9.8%	14.2%
C51: vulva	49	0.4%	0.5%	1.9	0.14						49	0.2%	0.2%
C52: vagina	11	0.1%	0.1%	0.5	0.04						11	<0.1%	0.1%
C53: cervix	306	2.3%	3.3%	13.0	1.01						306	1.0%	1.5%
C54: corpus uteri	412	3.1%	4.4%	17.9	1.61						412	1.4%	2.1%
C55: uterus, NOS	26	0.2%	0.3%	1.1	0.09						26	0.1%	0.1%
C56: ovary	360	2.7%	3.9%	15.1	1.23						360	1.2%	1.8%
C57: other female genital	14	0.1%	0.2%	0.6	0.04						14	<0.1%	0.1%
C58: placenta	3	<0.1%	<0.1%	0.1	0.01						3	<0.1%	<0.1%
C60: penis						30	0.2%	0.3%	1.3	0.09	30	0.1%	0.1%
C61: prostate						3,384	21.4%	31.5%	157.3	13.83	3,384	11.6%	16.9%
C62: testis						176	1.1%	1.6%	7.3	0.52	176	0.6%	0.9%
C63: other male genital						3	<0.1%	<0.1%	0.1	0.01	3	<0.1%	<0.1%
C64: kidney	191	1.4%	2.1%	7.9	0.69	351	2.2%	3.3%	16.1	1.31	542	1.9%	2.7%
C65: renal pelvis	9	0.1%	0.1%	0.4	0.03	13	0.1%	0.1%	0.6	0.05	22	0.1%	0.1%
C66: ureter	7	0.1%	0.1%	0.3	0.02	11	0.1%	0.1%	0.5	0.04	18	0.1%	0.1%
C67: bladder	129	1.0%	1.4%	4.7	0.33	314	2.0%	2.9%	14.3	1.00	443	1.5%	2.2%
C68: other urinary	2	<0.1%	<0.1%	0.1	<0.01	3	<0.1%	<0.1%	0.1	0.01	5	<0.1%	<0.1%
C69: eye	24	0.2%	0.3%	1.0	0.08	28	0.2%	0.3%	1.3	0.12	52	0.2%	0.3%
C70: meninges	8	0.1%	0.1%	0.3	0.02	5	<0.1%	<0.1%	0.2	0.01	13	<0.1%	0.1%
C71: brain	149	1.1%	1.6%	6.3	0.51	193	1.2%	1.8%	8.7	0.71	342	1.2%	1.7%
C72: spinal cord	7	<0.1%	0.1%	0.3	0.02	4	<0.1%	<0.1%	0.2	0.01	11	<0.1%	0.1%
C73: thyroid	182	1.4%	2.0%	7.8	0.63	58	0.4%	0.5%	2.6	0.21	240	0.8%	1.2%
C74: adrenal	8	0.1%	0.1%	0.3	0.02	10	0.1%	0.1%	0.4	0.03	18	0.1%	0.1%
C75: other endocrine	6	<0.1%	0.1%	0.2	0.01	9	0.1%	0.1%	0.4	0.04	15	0.1%	0.1%
C76: ill-defined site	15	0.1%	0.2%	0.5	0.04	9	0.1%	0.1%	0.4	0.04	24	0.1%	0.1%
C77: lymph nodes	2	<0.1%	<0.1%	0.1	<0.01	2	<0.1%	<0.1%	0.1	0.01	4	<0.1%	<0.1%
C80: unknown primary site	250	1.9%	2.7%	8.9	0.56	212	1.3%	2.0%	9.6	0.61	461	1.6%	2.3%
C81: Hodgkin lymphoma	63	0.5%	0.7%	2.7	0.21	73	0.5%	0.7%	3.2	0.25	137	0.5%	0.7%

ICD10 cancer site (INCIDENCE)	FEMALES					MALES					TOTAL		
ASR†: age-standardised rate, cases per 100,000 (standardised to the European population)	annual average 2010-2012	% all invasive	% all invasive excl. NMSC	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all invasive	% all invasive excl. NMSC	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all invasive	% all invasive excl. NMSC
C82: follicular non-Hodgkin lymphoma (NHL)	89	0.7%	1.0%	3.9	0.34	85	0.5%	0.8%	3.9	0.32	173	0.6%	0.9%
C83: diffuse non-Hodgkin lymphoma	140	1.0%	1.5%	5.6	0.46	191	1.2%	1.8%	8.7	0.67	331	1.1%	1.6%
C84: peripheral and cutaneous T cell lymphoma	21	0.2%	0.2%	0.9	0.07	36	0.2%	0.3%	1.7	0.13	57	0.2%	0.3%
C85: other and unspecified NHL	74	0.6%	0.8%	3.0	0.24	87	0.6%	0.8%	3.9	0.30	162	0.6%	0.8%
C82-C85: all non-Hodgkin lymphoma (NHL)	324	2.4%	3.5%	13.4	1.11	399	2.5%	3.7%	18.2	1.42	723	2.5%	3.6%
C81-C85: lymphoma (total)	388	2.9%	4.2%	16.1	1.32	472	3.0%	4.4%	21.4	1.67	860	2.9%	4.3%
C88: malignant immunoproliferative disease	7	0.1%	0.1%	0.3	0.02	12	0.1%	0.1%	0.6	0.05	19	0.1%	0.1%
C90: multiple myeloma	103	0.8%	1.1%	3.9	0.28	141	0.9%	1.3%	6.5	0.48	244	0.8%	1.2%
C91: lymphoid leukaemia	98	0.7%	1.1%	4.1	0.32	171	1.1%	1.6%	7.8	0.60	269	0.9%	1.3%
C92: myeloid leukaemia	79	0.6%	0.8%	3.2	0.25	103	0.7%	1.0%	4.7	0.34	182	0.6%	0.9%
C93: monocytic leukaemia	1	<0.1%	<0.1%	0.1	<0.01	1	<0.1%	<0.1%	0.0	<0.01	2	<0.1%	<0.1%
C94: other specified leukaemia	1	<0.1%	<0.1%	0.1	<0.01	6	<0.1%	0.1%	0.3	0.02	8	<0.1%	<0.1%
C95: unspecified leukaemia	13	0.1%	0.1%	0.4	0.02	16	0.1%	0.1%	0.7	0.03	28	0.1%	0.1%
C91-C95: leukaemia (total)	192	1.4%	2.1%	7.9	0.60	297	1.9%	2.8%	13.5	0.98	489	1.7%	2.4%
C96: other lymphoid and haematopoietic*	113	0.8%	1.2%	4.4	0.33	169	1.1%	1.6%	7.6	0.54	282	1.0%	1.4%
D03: in situ: melanoma	278			11.7	0.99	239			11.0	0.93	518		
D04: in situ: carcinoma of skin	1,019			38.5	2.92	658			29.8	2.30	1,677		
D05: in situ: breast	340			15.8	1.28	1			0.0	<0.01	340		
D06: in situ: cervix	2,903			113.0	7.80						2,903		
D32-D33: benign: brain & CNS	117			4.9	0.40	49			2.2	0.19	166		
D42-D43: uncertain: brain & CNS	34			1.4	0.11	29			1.3	0.10	63		

*Incidence figures for C00-C96 and C96 presentedin this report include polycythaemia vera, myelodysplastic syndromes and chronic myeloproliferative disease, considered malignant in ICDO3 but previously classed as uncertain behaviour (and previously coded under ICD10 codes D45-D47).
** D00-D48 tumours in this report exclude polycythaemia vera, myelodysplastic syndromes and chronic myeloproliferative disease (see note above).

13. APPENDIX II: SUMMARY TABLE-CANCER DEATHS: 2010-2012

ICD10 cancer site (MORTALITY)	FEMALES				MALES				TOTAL	
ASR†: age-standardised rate, cases per 100,000 (standardised to the European population)	annual average 2010-2012	% all cancers	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all cancers	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all cancer deaths
C00-D48: All registered neoplasms	4,128	100.0%	154.7	10.49	4,634	100.0%	211.9	13.10	8,762	100.0%
C00-C96: All invasive cancers	3,986	96.6%	150.0	10.30	4,480	96.7%	204.9	12.84	8,466	96.6%
C00-C43, C45-C96: All invasive cancers, excluding NMSC	3,959	95.9%	149.2	10.27	4,428	95.6%	202.4	12.75	8,387	95.7%
D00-D48: All non-invasive neoplasms	142	3.4%	4.7	0.22	154	3.3%	7.1	0.29	296	3.4%
C00: lip	0	<0.1%	0.0	<0.01	1	<0.1%	0.1	<0.01	1	<0.1%
C01: base of tongue	0	<0.1%	0.0	<0.01	3	0.1%	0.1	0.02	3	<0.1%
C02: other tongue	12	0.3%	0.4	0.03	18	0.4%	0.9	0.08	31	0.4%
C03: gum	2	<0.1%	0.1	0.01	2	<0.1%	0.1	0.01	4	<0.1%
C04: floor of mouth	2	<0.1%	0.1	0.01	4	0.1%	0.2	0.03	6	0.1%
C05: palate	2	<0.1%	0.1	0.01	2	<0.1%	0.1	0.01	4	<0.1%
C06: other mouth	8	0.2%	0.3	0.02	7	0.1%	0.3	0.02	14	0.2%
C07: parotid	3	0.1%	0.1	0.01	9	0.2%	0.4	0.01	12	0.1%
C08: other salivary	3	0.1%	0.1	0.01	2	<0.1%	0.1	<0.01	5	0.1%
C09: tonsil	3	0.1%	0.1	0.01	10	0.2%	0.5	0.04	13	0.1%
C10: oropharynx	1	<0.1%	0.0	<0.01	12	0.3%	0.6	0.05	13	0.1%
C11: nasopharynx	1	<0.1%	0.0	<0.01	9	0.2%	0.4	0.04	10	0.1%
C12: pyriform	1	<0.1%	0.1	0.01	5	0.1%	0.2	0.02	7	0.1%
C13: hypopharynx	2	0.1%	0.1	<0.01	3	0.1%	0.1	0.01	6	0.1%
C14: other mouth/pharynx	4	0.1%	0.2	0.01	12	0.3%	0.5	0.07	16	0.2%
C01-C14: mouth & pharynx	44	1.1%	1.7	0.13	99	2.1%	4.5	0.39	143	1.6%
C15: oesophagus	120	2.9%	4.2	0.27	230	5.0%	10.6	0.81	350	4.0%
C16: stomach	127	3.1%	4.5	0.27	199	4.3%	9.1	0.64	326	3.7%
C17: small intestine	9	0.2%	0.3	0.01	11	0.2%	0.5	0.02	20	0.2%
C18: colon	235	5.7%	8.1	0.51	283	6.1%	12.9	0.85	518	5.9%
C19: rectosigmoid	112	2.7%	4.3	0.29	181	3.9%	8.3	0.63	293	3.3%
C20: rectum	63	1.5%	2.3	0.14	107	2.3%	4.9	0.29	170	1.9%
C21: anus	5	0.1%	0.2	0.01	6	0.1%	0.3	0.01	10	0.1%
C18-C21: colorectal	416	10.1%	14.8	0.95	576	12.4%	26.3	1.78	992	11.3%
C22: liver	111	2.7%	4.0	0.29	153	3.3%	7.1	0.52	265	3.0%
C23: gallbladder	17	0.4%	0.6	0.04	6	0.1%	0.3	0.02	23	0.3%
C24: other biliary	8	0.2%	0.3	0.02	7	0.1%	0.3	0.02	14	0.2%
C25: pancreas	230	5.6%	8.4	0.55	258	5.6%	11.9	0.86	488	5.6%
C26: other digestive	64	1.6%	2.2	0.14	71	1.5%	3.3	0.20	136	1.5%
C30: nasal cavity/middle ear	1	<0.1%	0.0	<0.01	1	<0.1%	0.0	<0.01	2	<0.1%
C31: sinuses	1	<0.1%	0.0	<0.01	3	0.1%	0.2	0.01	4	0.1%
C32: larynx	6	0.2%	0.3	0.02	51	1.1%	2.4	0.18	58	0.7%
C33: trachea	1	<0.1%	0.0	<0.01	1	<0.1%	0.0	<0.01	2	<0.1%
C34: lung	743	18.0%	28.8	2.20	1,040	22.4%	47.4	3.57	1,783	20.4%
C37: thymus	1	<0.1%	0.1	0.01	2	<0.1%	0.1	0.01	3	<0.1%

ICD10 cancer site (MORTALITY)	FEMALES				MALES				TOTAL	
ASR†: age-standardised rate, cases per 100,000 (standardised to the European population)	annual average 2010-2012	% all cancers	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all cancers	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all cancer deaths
C38: mediastinum	3	0.1%	0.1	0.01	1	<0.1%	0.1	0.01	4	<0.1%
C39: other chest	0	<0.1%	0.0	<0.01	1	<0.1%	0.0	<0.01	1	<0.1%
C40: bones, joints of limbs	1	<0.1%	0.0	<0.01	1	<0.1%	0.0	<0.01	2	<0.1%
C41: bones, joints head and trunk	7	0.2%	0.3	0.02	10	0.2%	0.4	0.03	17	0.2%
C43: melanoma skin	66	1.6%	2.5	0.18	87	1.9%	4.0	0.28	153	1.7%
C44: non-melanoma skin (NMSC)	27	0.6%	0.8	0.03	52	1.1%	2.5	0.10	79	0.9%
C45: mesothelioma	6	0.1%	0.2	0.02	30	0.7%	1.4	0.08	36	0.4%
C46: Kaposi's sarcoma	0	<0.1%	0.0	<0.01	0	<0.1%	0.0	<0.01	0	<0.1%
C47: peripheral nerves	1	<0.1%	0.1	<0.01	0	<0.1%	0.0	<0.01	1	<0.1%
C48: peritoneum	11	0.3%	0.4	0.02	2	0.1%	0.1	0.01	13	0.1%
C49: connective tissues	21	0.5%	0.9	0.08	25	0.5%	1.1	0.09	46	0.5%
C50: breast	673	16.3%	26.4	2.04	9	0.2%	0.4	0.03	682	7.8%
C51: vulva	18	0.4%	0.6	0.03					18	0.2%
C52: vagina	5	0.1%	0.2	0.02					5	0.1%
C53: cervix	94	2.3%	4.0	0.33					94	1.1%
C54: corpus uteri	81	2.0%	3.2	0.26					81	0.9%
C55: uterus, NOS	24	0.6%	0.9	0.06					24	0.3%
C56: ovary	279	6.8%	11.2	0.92					279	3.2%
C57: other female genital	8	0.2%	0.3	0.03					8	0.1%
C58: placenta	0	<0.1%	0.0	<0.01					0	<0.1%
C60: penis					6	0.1%	0.3	0.02	6	0.1%
C61: prostate					549	11.9%	25.3	1.04	549	6.3%
C62: testis					5	0.1%	0.2	0.01	5	0.1%
C63: other male genital					1	<0.1%	0.0	<0.01	1	<0.1%
C64: kidney	57	1.4%	2.1	0.15	140	3.0%	6.4	0.45	197	2.2%
C65: renal pelvis	1	<0.1%	0.0	<0.01	2	<0.1%	0.1	<0.01	2	<0.1%
C66: ureter	3	0.1%	0.1	0.01	4	0.1%	0.2	0.01	7	0.1%
C67: bladder	78	1.9%	2.6	0.14	128	2.8%	5.8	0.26	206	2.3%
C68: other urinary	4	0.1%	0.1	<0.01	5	0.1%	0.2	0.02	9	0.1%
C69: eye	3	0.1%	0.1	0.01	2	0.1%	0.1	0.01	5	0.1%
C70: meninges	3	0.1%	0.1	0.01	0	<0.1%	0.0	<0.01	3	<0.1%
C71: brain	102	2.5%	4.2	0.35	149	3.2%	6.7	0.56	250	2.9%
C72: spinal cord	1	<0.1%	0.0	<0.01	0	<0.1%	0.0	<0.01	1	<0.1%
C73: thyroid	15	0.4%	0.5	0.04	11	0.2%	0.5	0.05	26	0.3%
C74: adrenal	5	0.1%	0.2	0.02	3	0.1%	0.1	0.01	8	0.1%
C75: other endocrine	1	<0.1%	0.0	<0.01	3	0.1%	0.1	0.01	4	<0.1%
C76: ill-defined site	11	0.3%	0.4	0.03	13	0.3%	0.6	0.03	25	0.3%
C80: unknown primary site	164	4.0%	5.8	0.40	129	2.8%	5.8	0.40	293	3.3%
C81: Hodgkin disease	11	0.3%	0.4	0.02	10	0.2%	0.4	0.03	21	0.2%
C82: follicular non-Hodgkin lymphoma	5	0.1%	0.2	0.01	7	0.2%	0.3	0.02	12	0.1%
C83: diffuse non-Hodgkin lymphoma	11	0.3%	0.4	0.03	17	0.4%	0.8	0.04	29	0.3%
C84: peripheral and cutaneous T cell lymphoma	7	0.2%	0.3	0.01	12	0.3%	0.6	0.04	20	0.2%

ICD10 cancer site (MORTALITY)	FEMALES				MALES				TOTAL	
ASR†: age-standardised rate, cases per 100,000 (standardised to the European population)	annual average 2010-2012	% all cancers	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all cancers	ASR†	cumulative risk (%) to age 75y	annual average 2010-2012	% all cancer deaths
C85: other and unspecified NHL	93	2.3%	3.3	0.25	104	2.3%	4.7	0.28	198	2.3%
C82-C85: all non-Hodgkin lymphoma	117	2.8%	4.3	0.30	141	3.1%	6.4	0.38	258	2.9%
C81-C85: lymphoma (total)	128	3.1%	4.7	0.32	151	3.3%	6.9	0.42	280	3.2%
C88: malignant immunoproliferative disease	1	<0.1%	0.0	<0.01	3	0.1%	0.1	0.01	4	<0.1%
C90: multiple myeloma	76	1.8%	2.6	0.16	79	1.7%	3.6	0.24	155	1.8%
C91: lymphoid leukaemia	29	0.7%	0.9	0.03	49	1.1%	2.3	0.14	79	0.9%
C92: myeloid leukaemia	51	1.2%	1.9	0.13	78	1.7%	3.6	0.22	129	1.5%
C93: monocytic leukaemia	0	<0.1%	0.0	<0.01	0	<0.1%	0.0	<0.01	1	<0.1%
C94: other specified leukaemia	0	<0.1%	0.0	<0.01	1	<0.1%	0.0	<0.01	1	<0.1%
C95: unspecified leukaemia	6	0.1%	0.2	0.01	6	0.1%	0.3	0.02	12	0.1%
C91-C95: leukaemia (total)	86	2.1%	3.0	0.17	133	2.9%	6.0	0.38	219	2.5%
C96: other lymphoid and haematopoietic	1	<0.1%	0.0	<0.01	0	<0.1%	0.0	<0.01	1	<0.1%
D03: in situ: melanoma	0	<0.1%	0.0	<0.01	0	<0.1%	0.0	<0.01	0	<0.1%
D04: in situ: carcinoma of skin	0	<0.1%	0.0	<0.01		<0.1%			0	<0.1%
D32-D33: benign: brain & CNS	8	0.2%	0.2	0.01	4	0.1%	0.2	<0.01	12	0.1%
D42-D43: uncertain: brain & CNS	10	0.2%	0.3	0.03	13	0.3%	0.6	0.04	23	0.3%