CANCER IN IRELAND 1994-2016 with estimates for 2016-2018: ANNUAL REPORT OF THE NATIONAL CANCER REGISTRY

2018

National Cancer Registry Ireland

ABBREVIATIONS	
95% CI	95% confidence interval
APC	Annual percentage change
ASR	Age-standardised rate (European standard population)
CIN	Cervical intraepithelial neoplasia
CLL	Chronic lymphocytic leukaemia
CNS	Central nervous system
CSO	Central Statistics Office
ESP	European Standard Population
HD	Hakulinen-Dyba (projection models)
HSE	Health Service Executive
IARC	International Agency for Research on Cancer
ICBP	International Cancer Benchmarking Partnership
ICD	International Statistical Classification of Diseases and Related Health Problems
LOLE	Loss of life expectation
NCCP	National Cancer Control Programme
NCRI	National Cancer Registry, Ireland
NMSC	Non-melanoma skin cancer
NOS	Not otherwise specified
RS	Relative survival
TNM	Tumour, node, metastasis (staging)
WHO	World Health Organisation

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FOREWORD

The National Cancer Registry reached a major milestone in its history this year, as 2018 was its 25th year of data-collection. Over this time the registry has observed an increasing cancer incidence and prevalence and significant improvements in survival. This year's report summarises these patterns, but we also look to the next quarter century, providing updated projections of numbers of cancer cases expected up to 2045.

Overall, the message of this year's report is that population growth (and ageing) will continue to generate a major increase in numbers of cancer cases diagnosed annually – potentially a doubling of numbers between 2015 and 2045 if current cancer rates continue to apply - and this in turn, combined with survival improvements, will greatly increase the numbers of cancer survivors. As noted in last year's report, planning for the long-term support and follow-up needs of cancer survivors is an important health priority, as recognised by the recently published National Cancer Strategy 2017-2026. With improving outcomes, we must go beyond our current capabilities of reporting of incidence, initial treatments and survival to better understand the patient experience, including quality of life, disease progression and recurrence and long term treatments.

The report estimates that numbers of invasive cancers (excluding non-melanoma skin cancer) have risen to about 22,640 cases diagnosed annually during 2016-2018 (12,080 males and 10,560 females), or 33,460 cases including all invasive cancers. This represents almost a doubling of case-numbers since the registry's early years (1994-1996), in substantial part reflecting the growth of our population, which increased by over one million between 1996 and 2016. Moreover, the proportion of the population most likely to be diagnosed with cancer (65+ years) has expanded by over 50% over the same period. In combination with ongoing improvements in survival for most cancer types, this has resulted in a growing numbers of cancer survivors in the general population. Currently we estimate that about 173,000 cancer survivors previously diagnosed with an invasive cancer were alive at the end of 2016, equivalent to almost 4% of the Irish population, excluding non-melanoma skin cancers (NMSC).

Based on demographic changes alone (population growth and ageing without change in per-population rates or cancer risk), numbers of cancers (excluding NMSC) are projected to increase to 24,160 in men (approximately a 110% increase in case-numbers compared with 2015) and to 18,840 in women (approximately an 85% increase) by 2045 – or 43,000 total, a doubling of numbers overall. However, an overview of projections based on different sets of assumptions suggests that the overall increase by 2045 could be more modest (approximately a 50% increase across both sexes) if recent trends in some cancers (for example, declines in male lung and prostate cancer rates) continue. Nevertheless, this is likely to require a sustained and expanded focus on prevention of cancer, through appropriate interventions and education.

Following the publication of the current report, reports planned by NCRI for the early months of 2019 will summarise cancer incidence projections for a fuller list of cancers, survival ‘cure’ statistics for selected cancers, and patterns of centralisation of cancer services in Ireland. These form part of an expanded programme of NCRI reports and an increased focus on disseminating information of relevance to health policy and planning.

Professor Kerri Clough-Gorr
Director
National Cancer Registry

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Who are we, and what do we do?

The National Cancer Registry of Ireland (NCRI) works on behalf of the Department of Health and collects information from all hospitals in Ireland on the number of persons diagnosed with cancer and the types of cancer they have. NCRI also follows up the numbers dying from their cancer or from other causes. All the patient's personal and private details are removed before summaries of this information are made available to the public and health professionals through our annual cancer report and other reports on our website.

How are the numbers reported?

The process of collecting and checking all of this information is done largely by hand and hence is time-consuming, even with increasing use of electronic data sources. Our staff collect cancer diagnosis information and then use an agreed system of coding (The International Classification of Diseases) to group the cancers into different types. After a process of collating diverse information from Irish hospitals and carefully assigning it to the correct person, it may take up to two years before the annual cancer report can be finalised. For new diagnoses we have recently adopted a new way of estimating these numbers (based on predictable population changes) which we feel better reflects the number of people being diagnosed around the time the report is generated. Hence, the average numbers of new cancer diagnoses are reported for the most recent three-year period (2016-2018 at November 2018) – the average for three years, rather than a single year, to allow more reliable estimates.

Cancer is not a single disease and there are a number of different ways to report cancer case numbers (and numbers of related tumours), reflecting the likely impact on the people receiving a diagnosis. Some people are diagnosed with tumour types which are not likely to spread and hence pose little risk to health after they are removed. These are termed *non-invasive tumours*, including "benign" tumours and a range of "pre-cancers". Other people are diagnosed with what are termed *non-melanoma skin cancers*, which typically don't spread but are included within *invasive cancers*. However, other invasive cancers, including melanoma (the most worrying form of skin cancer), have started to spread by the time they are diagnosed, or are likely to do so if not treated. These cancers are particularly important as they directly threaten life and most patients will need much more extensive treatment to combat their disease.

In common with cancer registries (organisations that measure numbers of cancer cases) in other countries, the NCRI reports the numbers of cancers and related tumours in three ways:

1) Total registered tumours – the total number of invasive cancers (including non-melanoma skin cancers) plus other non-invasive tumours.
2) Total invasive cancers – the number of all invasive cancers (including invasive non-melanoma skin cancers).
3) Total invasive cancers *excluding* NMSC - the number of invasive cancers minus the non-melanoma skin cancers. This is the most common international statistic used to compare cancer numbers.

What have we found?

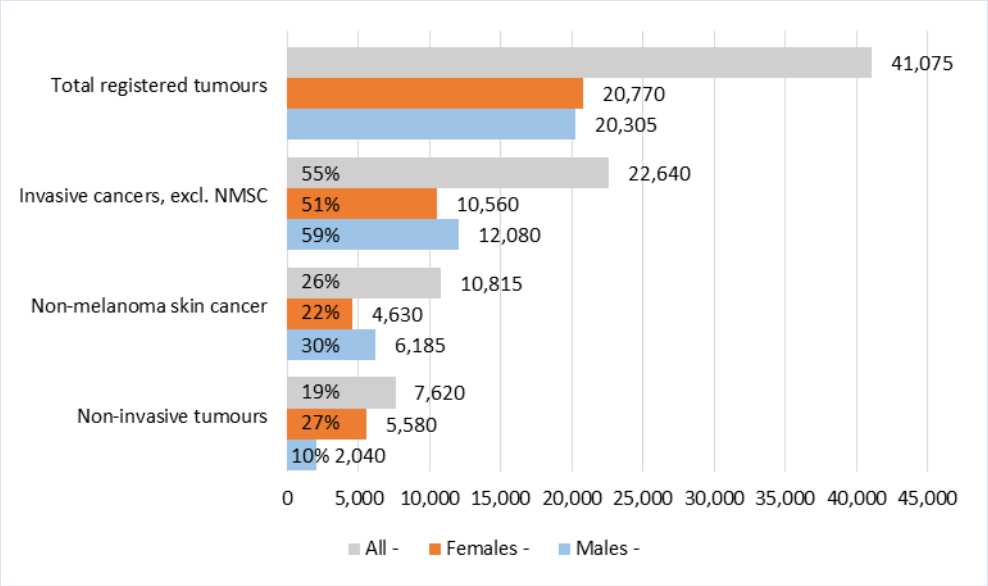
Numbers of cancers diagnosed

Over the years 2016-2018 the average number of new cases of invasive and non-invasive tumours in males and females is estimated to total just over 41,000 per year. One in five of these are non-invasive tumours while a further one quarter are non-melanoma skin cancers. To put this another way, about 41,075 new cancer cases were diagnosed each year on average in the Republic of Ireland over this recent period. This is made up of about 22,640 invasive cancers other than non-melanoma skin cancers; 10,815 non-melanoma skin cancers; and 7,620 non-invasive tumours. This equates to an average of 112 people being diagnosed each and every day; in practice cancers are usually diagnosed during the working week so the daily number on any given weekday is substantially higher.

These numbers show a continuing increase on previous years. However, cancers are more commonly diagnosed the older we get, and this continued increase in cancer numbers is largely related to the increased numbers of our population who are living longer. Taking age and population size into account, the overall risk of cancer at an individual level appears not to be increasing in recent years, although there are some exceptions for specific cancers.

These numbers are summarised in the figure below.

Cancer cases: annual average 2016-2018, by cancer type and sex

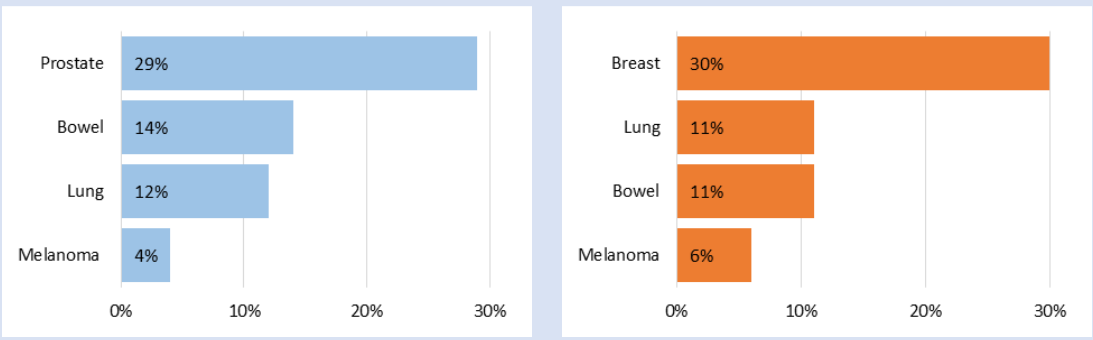


Percentages represent the proportion of 'total registered tumours' e.g. non-melanoma skin cancer (NMSC) made up 30% of all registered cancers in males, 22% in females, or 26% overall

What were the most common invasive cancers diagnosed?

If we exclude NMSC and non-invasive tumours, the four most common cancers diagnosed in men and women in Ireland are summarised in the figure below.

Top four most common incident cancers: 2016-2018

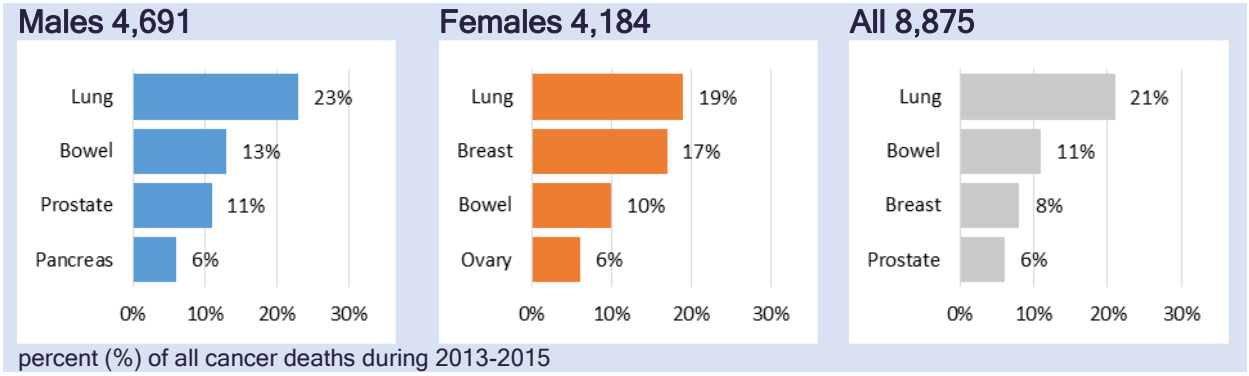


Percent (%) of all invasive cancers, excluding non-melanoma skin cancer

Deaths from cancer

Over the years 2013-2015 an average of 8,875 people lost their life due to invasive cancer (or 9,084 due to any tumour), or about one person dying from cancer every hour of the day.

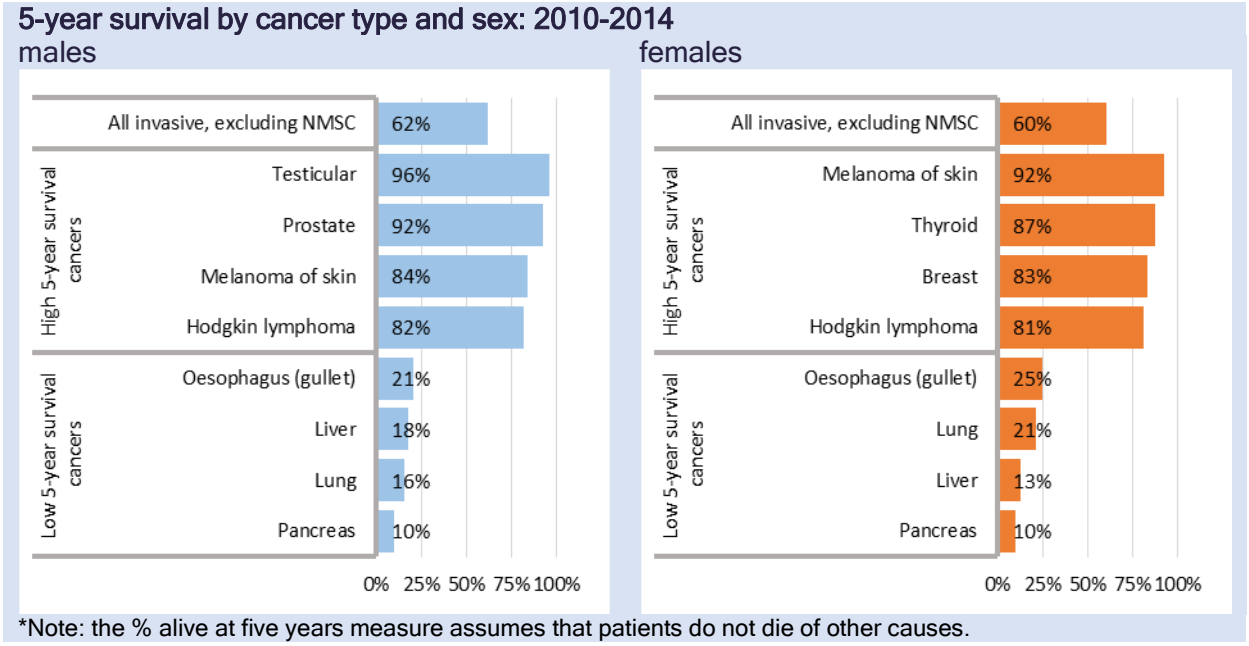
The breakdown of these deaths by sex is shown in the figure below along with the top four most common types of cancer causing death.



What percentage of people can expect to survive a cancer diagnosis?

Due to significant improvements in cancer treatment, and earlier detection, for example through national screening programmes, the likelihood of surviving many forms of cancer continues to increase. Interpretation of cancer survival data is complex as patients can die of many causes besides cancer, but survival to five years after diagnosis is a common measure. Cancer registries typically calculate this as relative survival, by comparison with expected survival in the general population (for the same age and sex).

Based on the period 2010-2014 (the latest period with a full set of survival calculations), survival has continued to improve compared with earlier years for many cancers. Since non-invasive and NMSC types are usually not life threatening, survival statistics are generally presented for invasive cancers excluding NMSC. Due to differences in biology, including sensitivity to treatment and likelihood of early diagnosis, the likelihood of surviving varies dramatically across different cancers. The figure below outlines the percentage of adults diagnosed with cancer who survived five years without succumbing to cancer death, and shows the top and bottom ranked cancers in terms of survival prospects.

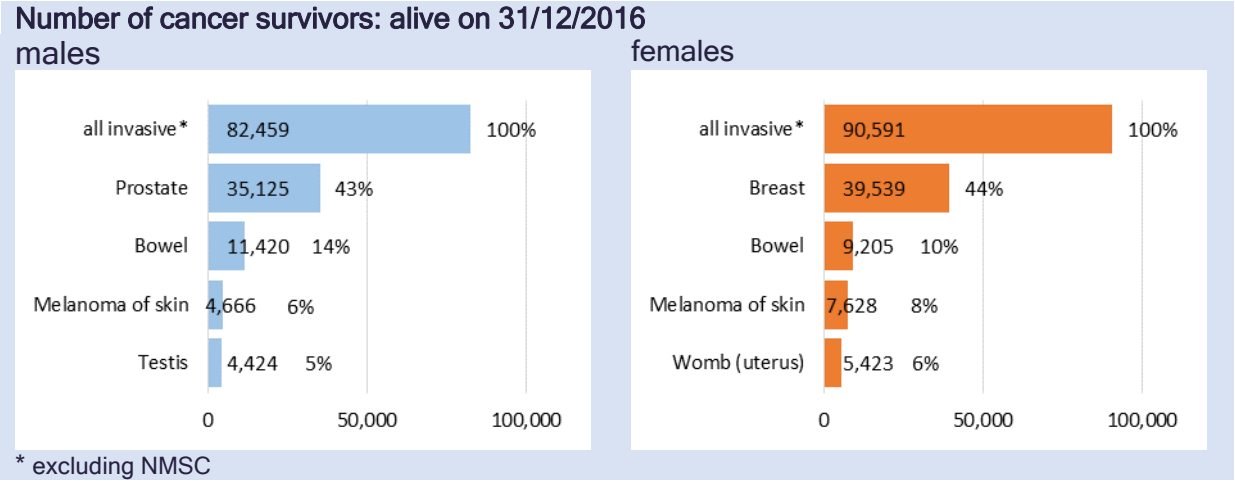


*Note: the % alive at five years measure assumes that patients do not die of other causes.

How many people in Ireland are living with cancer?

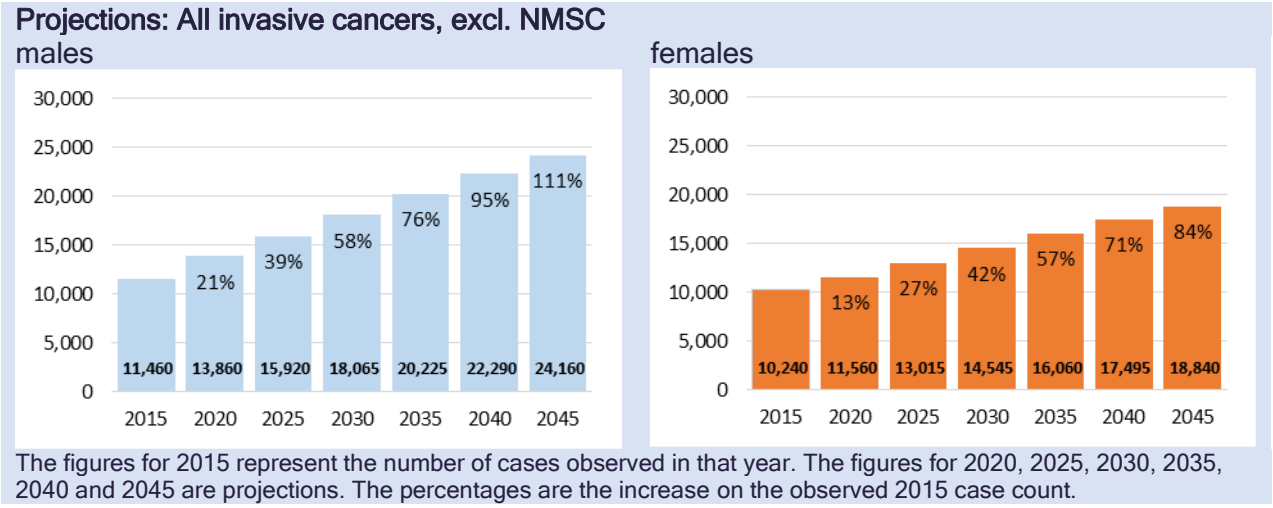
The total number of people who remain alive after some form of invasive cancer is growing significantly all the time. The NCRI only began its work collating cancer figures in 1994 but we have estimated the numbers from before this time to produce estimates of the total number of cancer survivors who were still alive at the end of 2016. This number was over 173,000 (a 'snap-shot' on 31/12/2016), representing almost one in 25 of the total population of Ireland, based on invasive cancers excluding non-melanoma skin cancer. One in seven of these cancer survivors was under 50 years of age at the end of 2016.

A summary of the largest groups of cancer survivors by sex is provided in the figure below.



What will the cancer figures look like in the decades ahead?

The population of Ireland increased by over one million between 1996 and 2016. Moreover, the proportion of the population most likely to be diagnosed with cancer (age 65+ years) expanded by over 50% over the same period. Because the population is likely to continue to increase, it is likely that the numbers of cancer cases (and survivors) will continue to increase over the next three decades. If average rates of cancer (at each age) during 2011-2015 are applied to population estimates up to 2045, estimated (projected) numbers of invasive cancer (excluding NMSC) are summarised in the following figure.



The figures for 2015 represent the number of cases observed in that year. The figures for 2020, 2025, 2030, 2035, 2040 and 2045 are projections. The percentages are the increase on the observed 2015 case count.

What these figures mean is that, if future populations have the same risk of being diagnosed with cancer as currently, numbers of cancers (excluding NMSC) would be expected to increase by more than double in men and to almost double in women by 2045 – to 43,000 cases in total, a doubling of numbers overall. However, a word of caution is required here. It is very difficult to anticipate cancer case numbers three decades into the future. Indeed, an overview of projections based on different sets of assumptions suggests that the overall increase by 2045 could be a more modest 50% increase in both sexes if recent trends, including declines, in some cancers continue.

1. TECHNICAL SUMMARY

Cancer in Ireland 1994-2016 with estimates for 2016-2018: Annual report of the National Cancer Registry

Estimated incidence 2016-2018

- An average of 41,080 cancers or other (non-invasive) tumours diagnosed annually was estimated for the period 2016-2018. Approximately 19% of these were non-invasive tumours (in situ carcinomas, tumours of uncertain behaviour and benign brain and CNS tumours) and 26% were invasive non-melanoma skin cancers.
- Invasive cancers (incl. NMSC) were estimated to average 33,460 cases per year during 2016-2018.
- For all invasive cancers excluding NMSC, the figures most often quoted in international comparisons, an estimated 22,640 cases (12,080 male and 10,560 female) were diagnosed annually during 2016-2018, or 68% of all invasive cases.
- Annual numbers of invasive cancers excluding NMSC during 2016-2018 were 85% higher than the average during 1994-1996 (12,270 cases per year - 6,350 male and 5,920 female).
- If NMSC cases were excluded, prostate and female breast cancer were the most commonly diagnosed invasive cancers overall, and each comprised almost one-third of all invasive cancers in men and women respectively during the period 2016-2018.
- Colorectal cancer, lung cancer, melanoma of skin and NHL were the 2nd, 3rd, 4th and 5th most common cancers in males, respectively.
- Lung cancer, colorectal cancer, melanoma of skin, and uterine cancer (corpus uteri) were the 2nd, 3rd, 4th and 5th most common cancers in females respectively.

Mortality 2013-2015

- Of deaths occurring in 2016, 73.6% were attributed to 3 main chapters in the ICD-10 classification: IX (I00-I99) diseases of the circulatory system (30.1%), II (C00-D48) cancer and other neoplasms (30.7%), and X (J00-J99) diseases of the respiratory system (12.8%) [1].
- On average there were 8,875 deaths per year from invasive cancer (4,691 in males, 4,184 in females) during the period 2013-2015, or 9,084 deaths per year from any neoplasm.
- The cumulative lifetime risk (to age 75 year) of dying from invasive cancer was approximately 1 in 10 for women and 1 in 8 for men.

Cancer incidence projections

- Using demography-based projections, based on population projections alone and assuming that average cancer age-specific rates during 2011-2015 remain unchanged, it was estimated that the numbers of invasive cancers (excl. NMSC) in males will increase from 11,460 in 2015

to 24,160 in 2045 (111% increase); and from 10,240 to 18,840 in 2045 (85% increase) in females.

- Of the 11 major cancer types for which projections are summarized here, demographic projections for most also suggested a doubling of numbers by 2045; however, for breast cancer, head and neck cancers and melanoma of skin, numbers were projected to increase by about two-thirds (reflecting a younger age-profile of cases for these cancers).
- Alternative estimates based on statistical models with different assumptions (including continuation of long-term or recent trends in rates) are also presented, overall and for a range of major cancers.
- For the majority of major cancers, the median of all models examined also suggested substantial increases in case numbers by 2045 – to a greater extent than demographic projections would suggest for head and neck, colon, lung (especially female lung), kidney and non-melanoma skin cancer, melanoma of skin and non-Hodgkin lymphoma, but to a lesser extent for stomach, rectal and breast cancers and 'all excluding NMSC'.
- A fuller report on incidence projections, including additional cancer types, will be published in early 2019.

Cancer prevalence: number of cancer survivors

- At the end of 2016 it was estimated that there were 173,050 persons (M 82,460; F 90,590) living with a cancer diagnosis which comprise c.3.7% of the Irish population in 2016.
- Overall, the top most common cancers in the prevalent cancer population (excluding non-melanoma skin) were: breast cancer (23% of all cancer survivors), prostate cancer (20%), colorectal cancer (12%) and skin melanoma (7%).

Cancer survival

- Net survival is the expected survival in the hypothetical situation in which cancer is the only cause of death, scaled against the life expectancy of the general population.
- Five-year net survival has improved markedly for cancers as a whole and for the most common cancer types since the mid-1990s.
- For invasive cancers (excluding generally less serious NMSC), overall five-year net survival increased from 40% for males during 1994-1998 to 62% during 2010-2014; in females, five-year net survival increased from 48% during 1994-1998 to 60% during 2010-2014.
- Over the same 20-year period, five-year survival for colorectal cancer increased from 48% to 62% in males and from 52% to 63% in females; for lung cancer, from 8% to 16% in males, and from 9% to 21% in females; for female breast cancer, from 72% to 83%; for prostate cancer from 66% to 92%; and for melanoma of the skin, from 73% to 84% in males and from 88% to 92% in females.

Emergency presentation

- Emergency presentation with cancer can result from lack of awareness of symptoms in patients and is generally associated with more advanced stage, limited treatment options and poorer survival outcomes. Overall during 2014-2016, 14% of cancer cases (excluding non-melanoma skin cancers) presented as emergencies at the time of diagnosis, based on data collected by NCRI, excluding cases where the mode of presentation was unknown.
- From 2005 to 2009 the incident proportion of invasive cancers presenting emergently decreased significantly from c.19% in 2005 to c.14% in 2009, but with little further change to 2016 (c.14%).
- Of the 24 individual cancer types examined, those with the highest proportions (>20%) of emergency presentation during 2014-2016 were cancers of the pancreas (36%), liver (34%), brain & CNS (31%), lung (25%), ovary (24%), leukaemia (23%), stomach (21%) and colon (20%).
- Cancers with the lowest proportions (<10%) of emergency presentation were: melanoma of skin (0.9%), and breast (1.4%), prostate (2.4%), thyroid (3.7%), uterine (4.7%), cervical (5.9%), oral / pharyngeal (8.0%), laryngeal (8.7%) and rectal cancer (8.8%).
- Intermediate levels of emergency presentation were seen for multiple myeloma (19%), non-Hodgkin lymphoma (18%), kidney cancer (17%), oesophageal (16%), bladder cancers (15%), Hodgkin lymphoma (14%), and testicular cancers (12%).

2. CANCER INCIDENCE 2016-2018

Table 2-1
Estimated annual average incidence, rate and cumulative risk of the most common cancers: 2016-2018‡

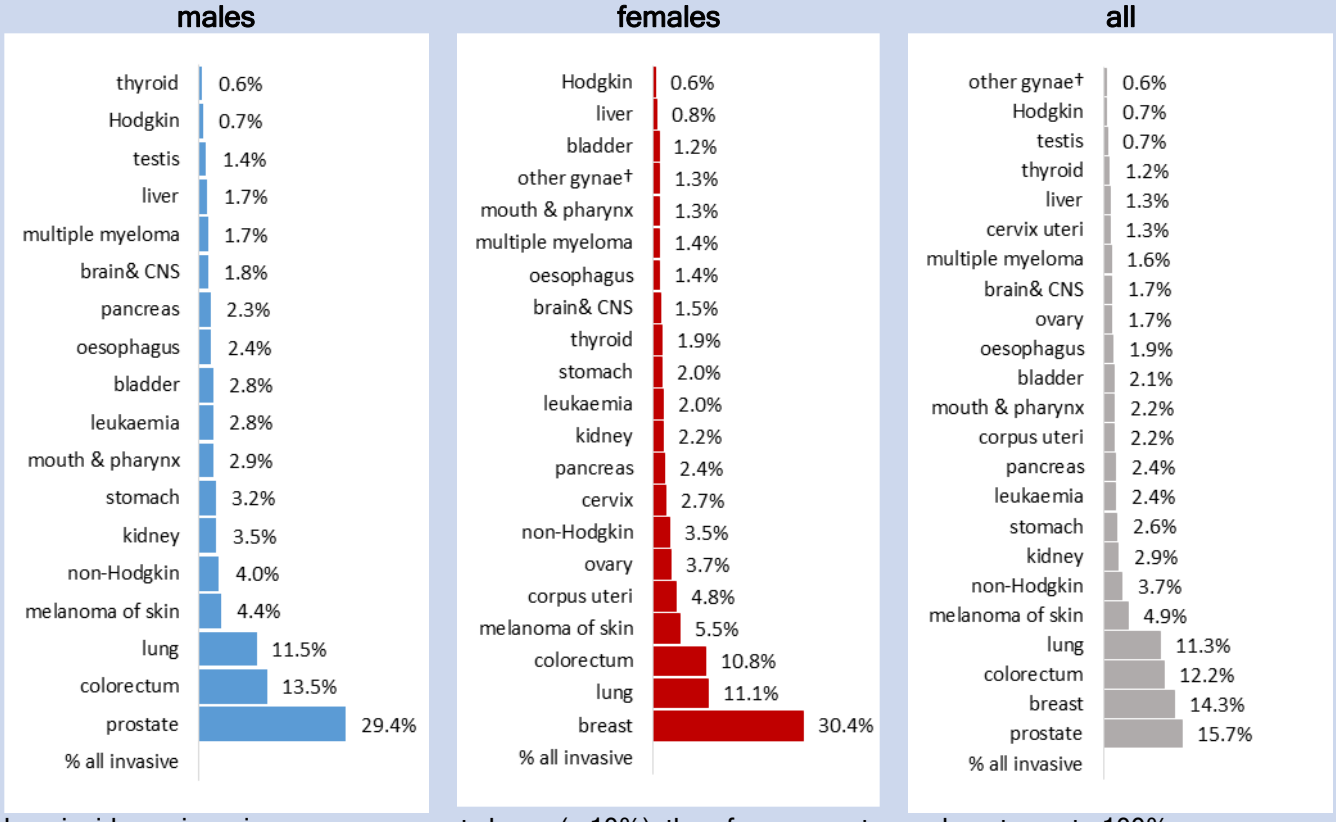
	case count			rate*/100,000		risk # to age 75 1 in:	
ICD cancer site **	male	female	all	male	female	male	female
C00-96 all invasive	18,265	15,192	33,457	700.1	539.0	2	3
all invasive, excl. NMSC	12,081	10,560	22,641	467.0	382.1	3	4
C00-D48 all registered	20,306	20,771	41,077	778.0	756.3	2	2
D00-48 all non-invasive	2,041	5,579	7,620	77.9	217.3	17	7
mouth & pharynx	351	140	491	14.0	5.2	87	234
oesophagus	290	149	439	11.1	4.8	111	277
stomach	391	206	597	14.8	6.8	91	192
colorectum & anus	1,631	1,136	2,767	62.2	38.9	21	34
liver	200	86	285	7.6	2.9	161	457
pancreas	281	259	540	10.7	8.5	126	158
lung	1,391	1,170	2,561	52.5	40.2	24	30
melanoma of skin	529	581	1,110	20.6	21.4	65	59
C44 NMSC	6,184	4,632	10,816	233.1	156.9	6	9
breast	29	3,215	3,244	1.1	122.5	1,099	11
cervix		287	287		11.2		118
corpus uteri		506	506		19.0		59
ovary		392	392		14.2		87
other gynae†		136	136		4.7		286
prostate	3,550		3,550	138.9		8	
testis	168		168	7.1		193	
kidney	418	235	653	16.4	8.5	73	144
bladder	337	130	467	12.5	4.1	119	372
all brain & CNS	316	352	668	12.6	13.2	96	99
malignant brain & CNS	220	157	377	8.8	5.9	137	214
benign brain & CNS	60	159	219	2.4	5.8	494	223
uncertain brain & CNS	36	36	72	1.5	1.5	895	997
thyroid	73	198	271	2.9	7.8	409	158
Hodgkin lymphoma	87	63	150	3.6	2.6	353	495
non-Hodgkin	478	369	847	18.6	13.1	70	92
multiple myeloma	209	143	352	8.0	4.8	159	262
leukaemia	340	215	554	13.2	7.8	101	167
other invasive cancers	1,108	787	1,895				

‡ Average age-standardised rates for 2012-2016 period were projected onto populations in 2017 & 2018.
Estimated average annual case counts and rates for 2016-2018 are presented in the table.
* Rates are standardised to the 1976 European standard population;
see Appendix II for rates standardised to the 2013 ESP.
** Invasive cancer included all tumours classified as behaviour 3 in ICD-O-3 classification
(including some neoplasms previously classified as uncertain behaviour, e.g. polycythaemia vera).
Cumulative risk of developing a type of cancer before age 75 expressed as a proportion, e.g. 1 in 3
† Vulva, vagina, uterus (NOS) and placenta

- Taking known cancer incidence rates during 2012-2016, and applying these rates to population estimates for 2017-2018, an average of 41,077 cancers or other (non-invasive) tumours diagnosed annually was estimated for the period 2016-2018, representing an age-standardised incidence rate of 756 female cases and 778 male cases per 100,000 per year (Table 2-1).
- Approximately 19% of these were non-invasive tumours (in situ carcinomas, tumours of uncertain behaviour and benign brain and CNS tumours) and 26% were invasive non-melanoma skin cancers (NMSC, estimated 10,816 cases per year).
- Invasive cancers (incl. NMSC) were estimated to average 33,457 cases per year during 2016-2018, or an age-standardised rate of 539 female and 700 male cases per 100,000 per year.

- For all invasive cancers excluding NMSC, the figures most often quoted in international comparisons, an estimated 22,641 cases (12,081 male and 10,560 female) were diagnosed annually during 2016-2018, or 68% of all invasive cases.
- This is equivalent to an incidence rate of 382 cases per 100,000 females and 467 cases per 100,000 males per year – 22% higher for men than for women.
- The annual average number of invasive cancers excluding NMSC during 2016-2018 was 85% higher than the average during 1994-1996 (12,270 - 6,350 male and 5,920 female).
- The cumulative lifetime risk (to age 75 years) of being diagnosed with an invasive cancer other than NMSC was approximately 1 in 3 for men and 1 in 4 for women.
- These figures assume that average annual cancer incidence rates did not change between the periods 2012-2016 and 2017-2018, and that the Irish population estimates or projections available for 2017-2018 at the time of writing prove to be accurate.

Figure 2-1
Estimated percentages and rank of the most commonly diagnosed invasive cancer (excluding NMSC): annual average 2016-2018



Low-incidence invasive cancers are not shown (c.10%), therefore percentages do not sum to 100%
†Other gynaecological cancers: vulva, vagina, uterus (NOS) and placenta

- If NMSC cases are excluded, prostate and female breast cancer were the most commonly diagnosed invasive cancers overall, each comprising almost one-third of all invasive cancers in men and women respectively, during the period 2016-2018 (Figure 2-1).
- Colorectal cancer, lung cancer, melanoma of skin and NHL were the 2nd, 3rd, 4th and 5th most common cancers in males respectively.

- Lung cancer, colorectal cancer, melanoma of skin, and uterine cancer (corpus uteri) were the 2nd, 3rd, 4th and 5th most common cancers in females respectively.

A more detailed breakdown of incidence statistics by cancer site is given in Appendix I & II.

Incidence trends are not presented in this year's report, but trends for selected cancers are shown as background to the chapter on cancer incidence projections.

3. CANCER MORTALITY

- Of deaths occurring in 2016, 73.6% were attributed to 3 main chapters in the ICD-10 classification: IX (I00-I99) diseases of the circulatory system (30.1%), II (C00-D48) cancers and other neoplasms (30.7%), and X (J00-J99) diseases of the respiratory system (12.8%) [1].
- An annual average of 8,875 deaths from invasive cancer (4,691 in males, 4,184 in females) occurred during the period 2013-2015, or 9,084 deaths from any neoplasm (Table 3-1).
- This represents an estimated age-standardised mortality rate of 146 invasive cancer deaths per 100,000 females and 196 deaths per 100,000 males per year (Table 3-1) – 34% higher for men than for women. The estimated lifetime risk (to age 75 year) of dying from invasive cancer was approximately 1 in 10 for women and 1 in 8 for men.

Table 3-1
Annual average mortality attributable to cancer: 2013-2015

	DEATHS			rate*/100,000		risk‡ to age 75y 1 in:	
	male	female	all	male	female	male	female
all neoplasms	4,805	4,279	9,084	200.5	149.3	8	10
C00-96 all invasive	4,691	4,184	8,875	195.6	146.3	8	10
mouth & pharynx	124	48	172	5.3	1.7	235	794
oesophagus	267	120	387	11.3	4.0	116	380
stomach	199	133	332	8.3	4.4	179	392
colorectum	587	423	1,010	24.6	14.0	63	115
liver	188	121	309	7.8	4.1	175	364
pancreas	269	249	518	11.2	8.4	121	168
lung	1,060	805	1,865	44.1	28.8	31	45
melanoma of skin	86	72	158	3.6	2.5	411	648
breast	5	706	711	0.2	26.0	8,951	52
cervix		86	86		3.5		358
corpus uteri		97	97		3.4		371
ovary		269	269		10.0		126
prostate	522		522	21.6		123	
testis	4		4	0.2		7,627	
kidney	151	85	236	6.3	2.9	227	489
bladder	158	75	233	6.5	2.3	353	819
brain & CNS	169	123	291	7.1	4.8	166	238
thyroid	12	19	31	0.5	0.6	2,384	3,231
Hodgkin	14	10	24	0.6	0.3	1,945	3,353
non-Hodgkin	147	128	275	6.1	4.3	259	359
multiple myeloma	95	80	175	4.0	2.6	416	668
leukaemia	151	100	251	6.2	3.3	250	421
other cancers	477	432	909	20.0	14.0		

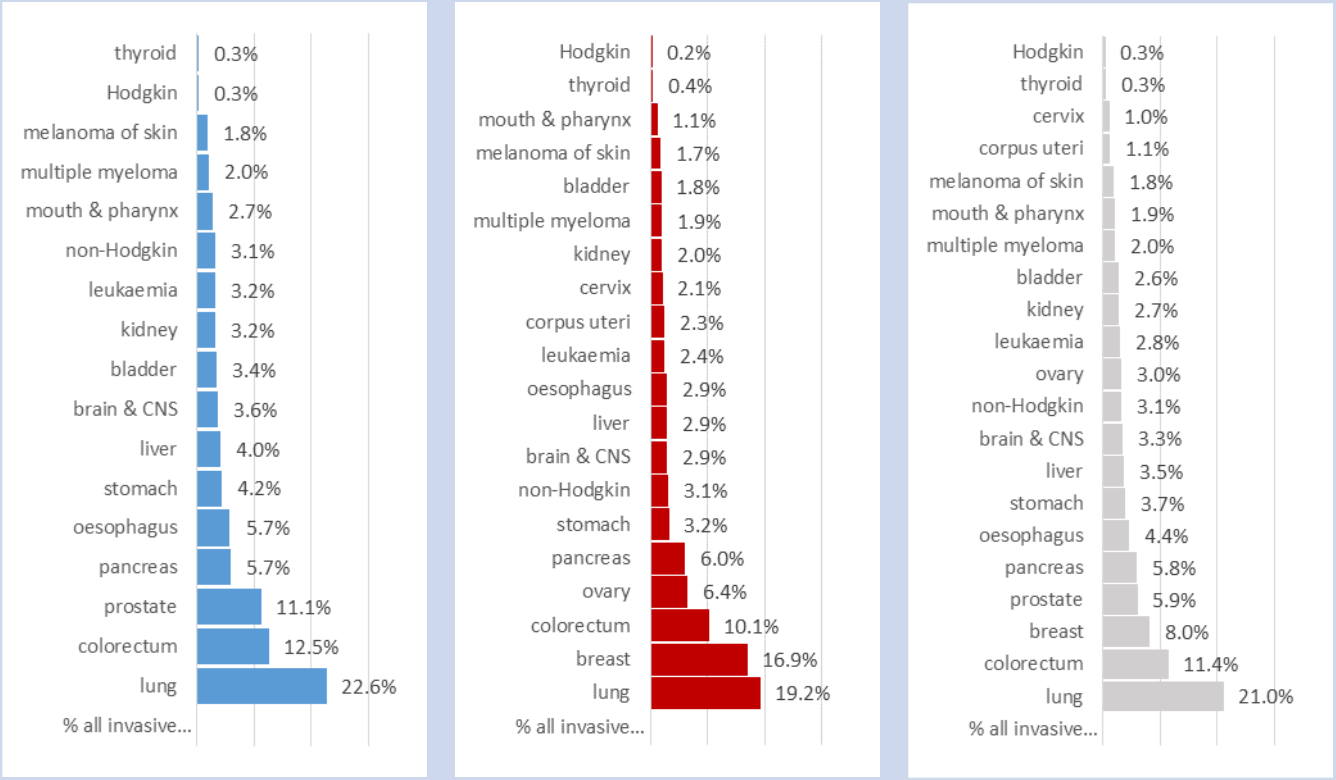
source of data: Central Statistics Office, Ireland
*Rates are standardised to the 1976 European standard population.
‡ Cumulative risk of dying of a cancer before age 75 expressed as a proportion, e.g. 1 in 10;
see Appendix III for other cancers

- Lung cancer was the leading cause of cancer death in both sexes, with an estimated average of 1,865 deaths per year or 19% of cancer deaths in women and 23% of cancer deaths in men during the period 2013-2015 (Table 3-1, Figure 3-1).
- Colorectal cancer was the next most common cause of cancer death in both sexes, with an estimated average of 1,010 deaths per year or 13% of cancer deaths in males and 10% of cancer

deaths in females. Deaths from lung, colorectal, breast and prostate cancers combined made up almost half (46%) of all deaths from cancer during this period.

- Deaths from cancers of the pancreas, oesophagus, and stomach in males ranked 4th, 5th and 6th respectively, and comprised 16% of all cancer deaths in males. Mortality rankings for these high-fatality cancers ranked were much higher than their incidence rankings (Figure 3-1).
- Deaths from cancers of the ovary and pancreas ranked 4th and 5th respectively in females and comprised almost 12% of cancer deaths in women, again much higher than the incidences ranking for these high-fatality cancers (Figure 3-1). A more detailed breakdown of mortality statistics by cancer site is given in Appendix III.

Figure 3-1
Estimated percentages and rank of the most common cancer deaths: annual average 2013-2015



Cancers accounting for smaller precentages of cancer deaths (c.10% in total) are not shown, therefore percentages do not sum to 100%. Mortality data was provided by the central statistics office (CSO)

4. CANCER INCIDENCE PROJECTIONS

Cancer incidence data from the National Cancer Registry from 1994 to 2015 and population projections from the Central Statistics Office (CSO) have been combined to estimate the number of new cancer cases expected in the years 2020, 2025, 2030, 2035, 2040 and 2045 based on a number of assumptions about changes in population and age-specific cancer rates. A fuller report will be published by NCR in early 2019, but a preliminary summary of findings for cancers as a whole, and for major cancer types/groups, is presented here.

A number of different estimation methods were used (see Section 8, methods):

1) Demographic projection, which applies average annual age-specific cancer incidence rates during 2011-2015 to the future projected populations provided by the CSO (www.cso.ie). These assume that there are no changes in the underlying incidence rates over time and therefore make the fewest assumptions.
2) The Nordpred method, which uses a special version of the age-period-cohort model [2,3] with a power link, and uses cancer rate trends from 1996-2015.
3) Age-period methods, as described by Hakulinen and Dyba [4-6], which apply linear, non-linear and log-linear models to historical data but, where significant recent changes in cancer rates have occurred, may use a shorter baseline (minimum 2011-2015) for estimation and projection of trends.

Table 4-1
Cancer sites and groups of cancer for which projections are presented

cancer site	ICD10 code
All invasive cancers, excl. NMSC	C00-43, C45-96
head and neck	C01-C14, C30, C31, C32
stomach	C16
colon	C18
rectum and anus	C19-21
lung	C33-34
melanoma of skin	C43
non melanoma of skin	C44
female breast	C50
prostate	C61
kidney and renal pelvis	C64-65
Non-Hodgkin lymphoma	C82-85

The advantages and limitations of cancer projections have been described in previous NCRI reports [7-10].

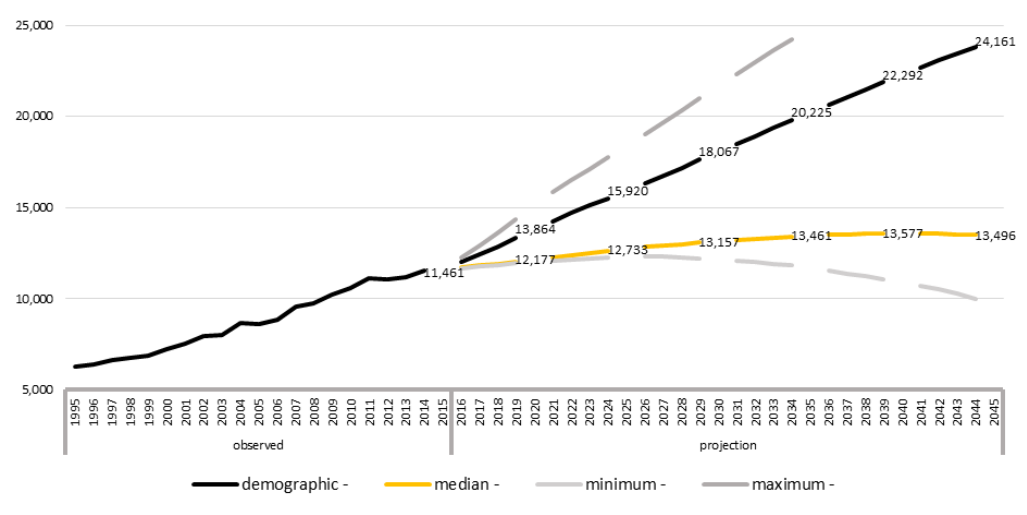
It is important to note that this report gives projections of current data into the future, and not predictions as such. To make predictions, would ideally require knowledge of underlying exposure to risk factors (and trends in such exposure). In the absence of appropriate risk-factor data (and methodologies to account for them), the projections made here assume that available cancer-rate data reflect exposure to relevant risk factors, and that either recent trends continue or current rates prevail in future years. The graphs below emphasise projections based on demographic changes (solid black line) and the median of all projections generated (orange line), with the full range of available projections shown in grey (highlighting the variability of projections that reflect different model assumptions).

Figure 4-1
Projections: All invasive cancers, excl. NMSC C00-43, C45-96

MALES
% projected increase: represents the increase on the observed 2015 case count – based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate (5+1)

	demographic projection	model median estimate projection
2020	21%	6%
2025	39%	11%
2030	58%	15%
2035	76%	17%
2040	95%	18%
2045	111%	18%

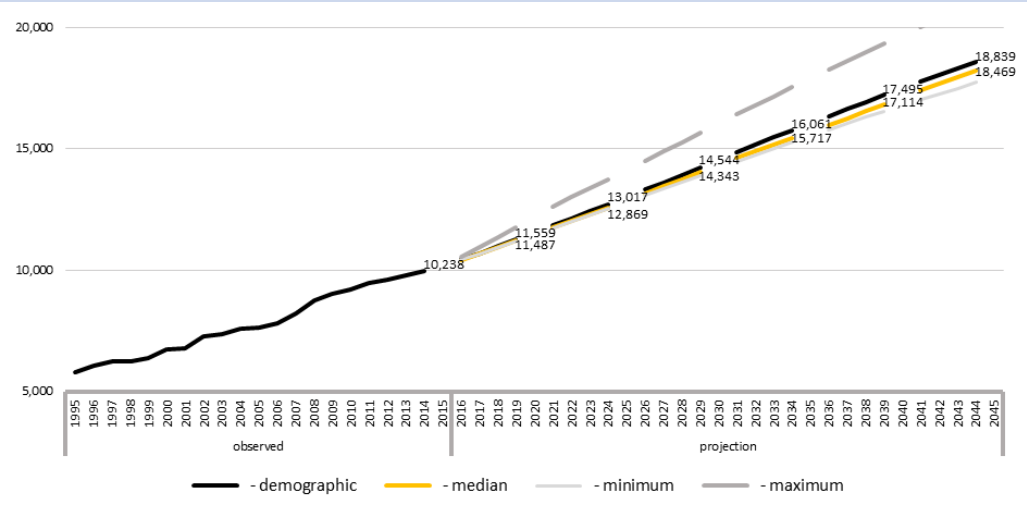
projected numbers of cases are shown in the graph on the right



FEMALES
% projected increase: represents the increase on the observed 2015 case count – based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate (5+1)

	demographic projection	model median estimate projection
2020	13%	12%
2025	27%	26%
2030	42%	40%
2035	57%	54%
2040	71%	67%
2045	84%	80%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

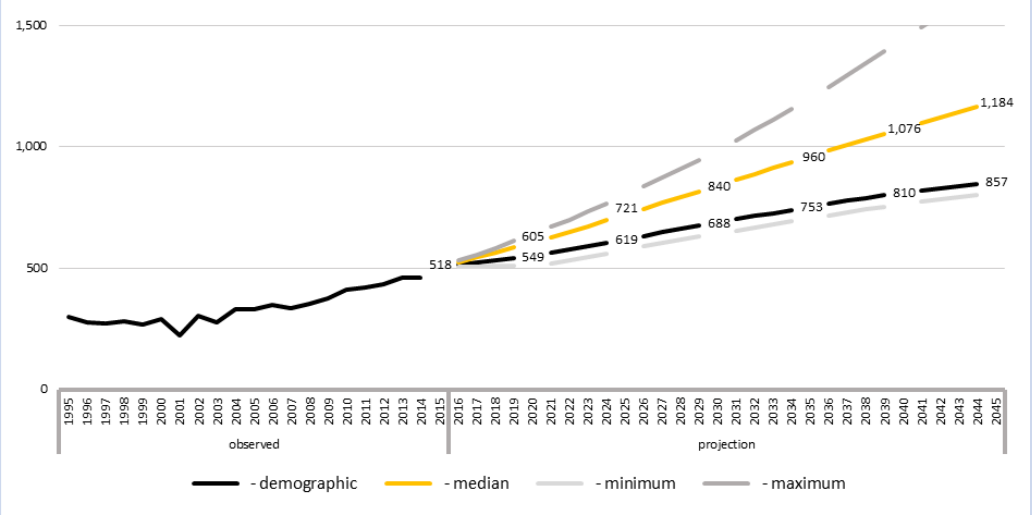
- Assuming that average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of all cancers combined (excluding NMSC) are projected to increase in males from 11,460 in 2015 to 24,160 in 2045 (+111%) and in females from 10,240 in 2015 to 18,840 in 2045 (+84%) – a doubling of numbers overall (+98%)
- The median of all projections suggests an increase for females, to 18,470 cases in 2015 (+80% from 2015), very similar to the demographic projection, but a much more modest increase for males, to 13,500 in 2045 (+18% from 2015), or a 47% increase for both sexes combined.
- However, the full range of projections is very wide, especially for males, and implies substantial uncertainty regarding the male projections in particular; this reflects evidence of a recent downturn in male rates, less marked in females, which not all models may capture.

Figure 4-2
Projections: head and neck cancers C01-14, C30-32

MALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	6%	17%
2025	19%	39%
2030	33%	62%
2035	45%	85%
2040	56%	108%
2045	65%	129%

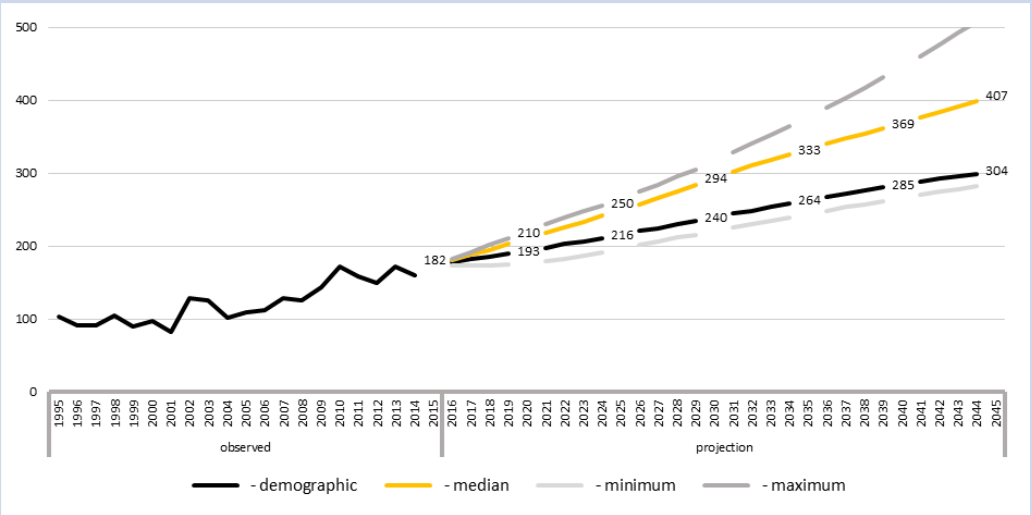
projected numbers of cases are shown in the graph on the right



FEMALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	6%	15%
2025	19%	37%
2030	32%	62%
2035	45%	83%
2040	57%	103%
2045	67%	124%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

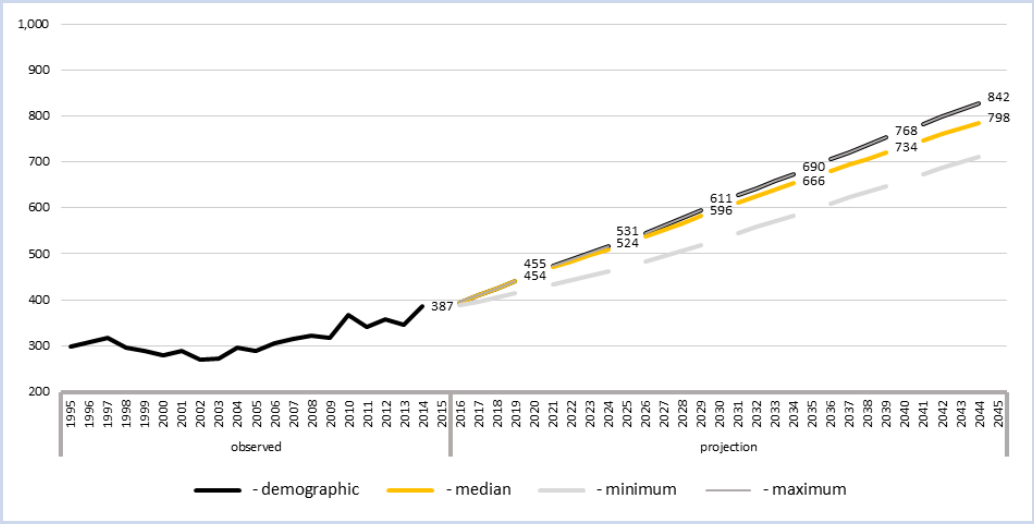
- Based on demographic changes alone, annual numbers of cases of head and neck cancer are projected to increase in males from 518 in 2015 to 857 in 2045 (+65%) and in females from 182 in 2015 to 304 in 2045 (+67%) – an increase by about two-thirds (+66%) for males and females combined.
- The median of all model projections suggests an increase for males, to 1,184 cases in 2045 (+129% from 2015), and to 407 in females (+124%) – or more than a doubling overall (+127%).
- All models examined project ongoing increases in numbers of cases up to 2045.

Figure 4-3
Projections: stomach cancer C16

MALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	18%	17%
2025	37%	35%
2030	58%	54%
2035	78%	72%
2040	98%	90%
2045	118%	106%

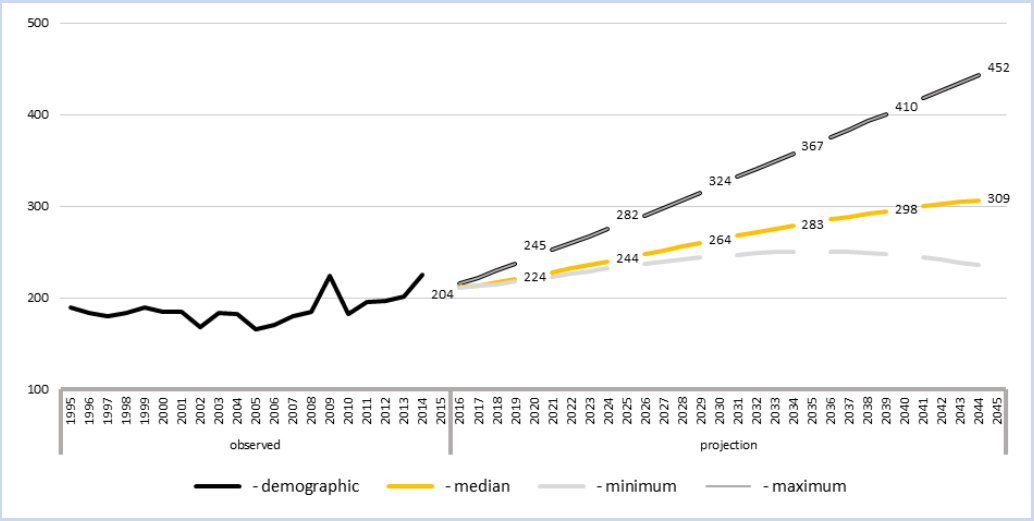
projected numbers of cases are shown in the graph on the right



FEMALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	20%	10%
2025	38%	20%
2030	59%	29%
2035	80%	39%
2040	101%	46%
2045	122%	51%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

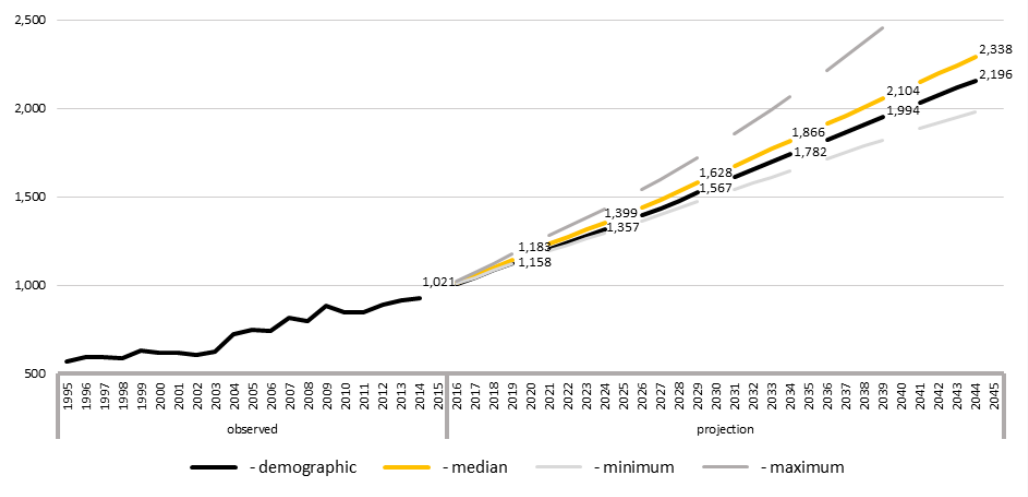
- Based on demographic changes alone, annual numbers of cases of stomach cancer are projected to increase in males from 387 in 2015 to 842 in 2045 (+118%) and in females from 204 in 2015 to 452 in 2045 (+122%) – or more than doubling (+119%) for males and females combined.
- The median of all model projections suggests a broadly similar increase for males, to 798 cases in 2045 (+106% from 2015), but a more modest increase to 309 in females (+51%) – still almost a doubling of numbers (+87%) for males and females combined.
- All models examined project increases in numbers of cases up to 2045 although some models suggest some stabilization or downturn after 2035.

Figure 4-4
Projections: colon cancer C18

MALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	13%	16%
2025	33%	37%
2030	53%	59%
2035	75%	83%
2040	95%	106%
2045	115%	129%

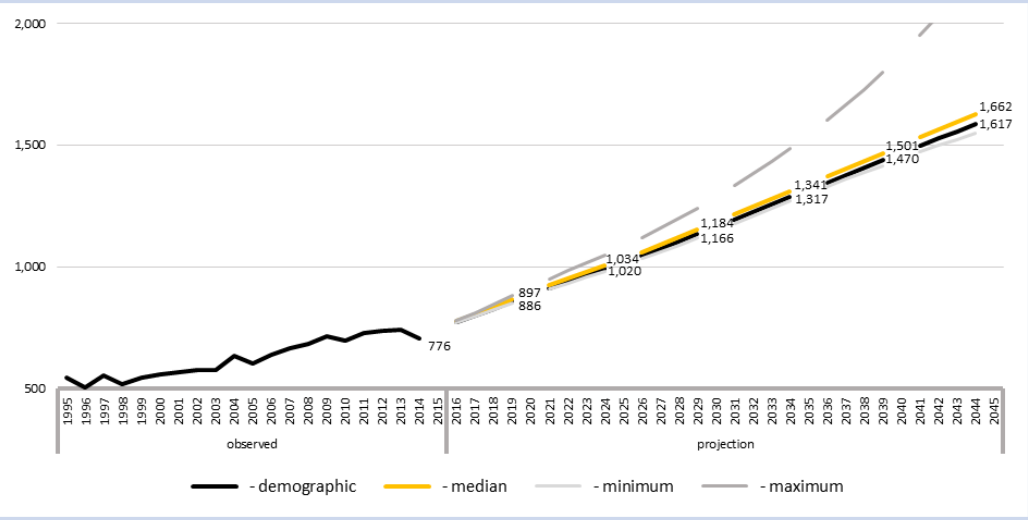
projected numbers of cases are shown in the graph on the right



FEMALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	13%	12%
2025	27%	26%
2030	42%	40%
2035	57%	54%
2040	71%	67%
2045	84%	80%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

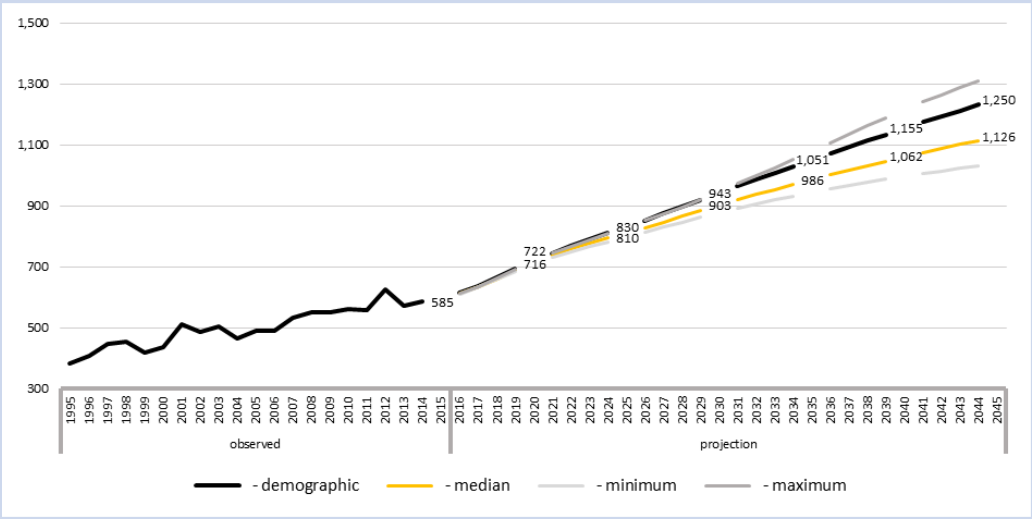
- Based on demographic changes alone, annual numbers of cases of colon cancer are projected to increase in males from 1,021 in 2015 to 2,196 in 2045 (+115%) and in females from 776 in 2015 to 1,617 in 2045 (+84%) – or an approximate doubling of numbers (+112%) for males and females combined.
- The median of all model projections was similar to the demographic projections for both sexes, and suggests increases in males to 2,338 cases in 2045 (+129% from 2015) and in females, to 1,662 cases (+80%) – again, about a doubling of numbers overall (+125%).
- All models examined project substantial increases in numbers of cases up to 2045, to varying degrees.

Figure 4-5
Projections: rectal and anal cancer C19-21

MALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	23%	22%
2025	42%	38%
2030	61%	54%
2035	80%	69%
2040	97%	82%
2045	114%	92%

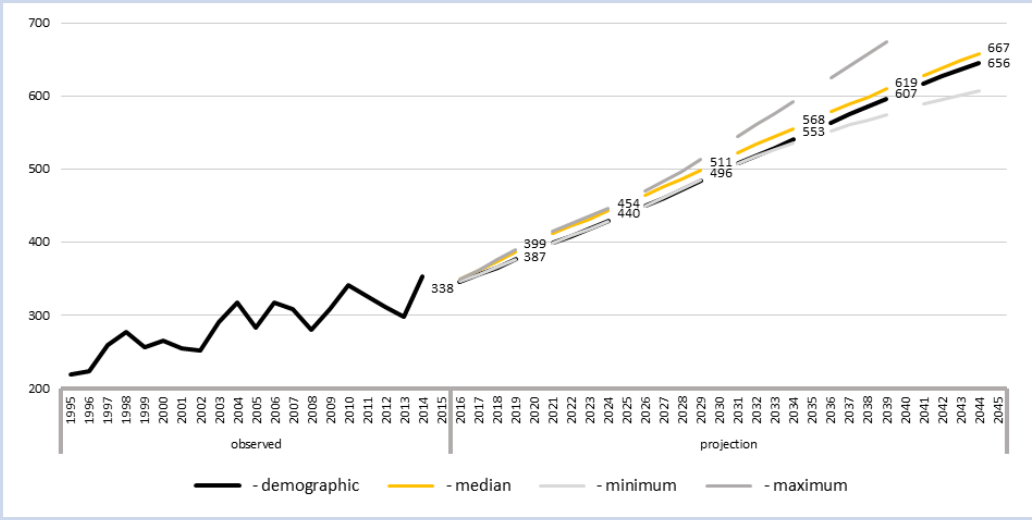
projected numbers of cases are shown in the graph on the right



FEMALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	14%	18%
2025	30%	34%
2030	47%	51%
2035	64%	68%
2040	80%	83%
2045	94%	97%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

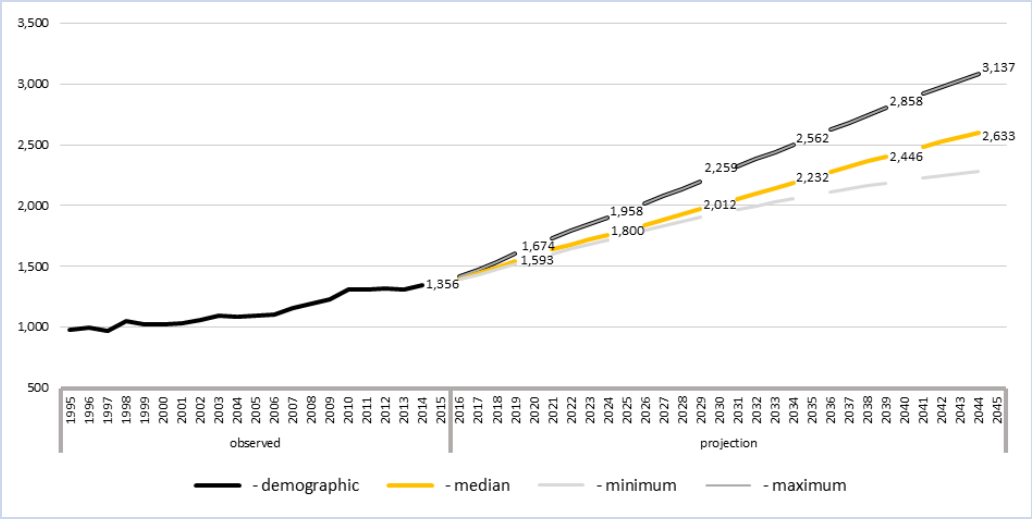
- Based on demographic changes alone, annual numbers of cases of rectal cancer are projected to increase in males from 585 in 2015 to 1,250 in 2045 (+114%) and in females from 338 in 2015 to 656 in 2045 (+94%) – or about a doubling (+107%) for males and females combined.
- The median of all model projections also suggests about a doubling of numbers for both males, to 1,126 cases in 2045 (+92% from 2015), and females, to 667 (+97%), or +94% overall for males and females combined.
- All models examined project substantial increases in numbers of cases up to 2045, to varying degrees.

Figure 4-6
Projections: lung cancer C33-34

MALES
% projected increase: represents the increase on the observed 2015 case count – based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	23%	17%
2025	44%	33%
2030	67%	48%
2035	89%	65%
2040	111%	80%
2045	131%	94%

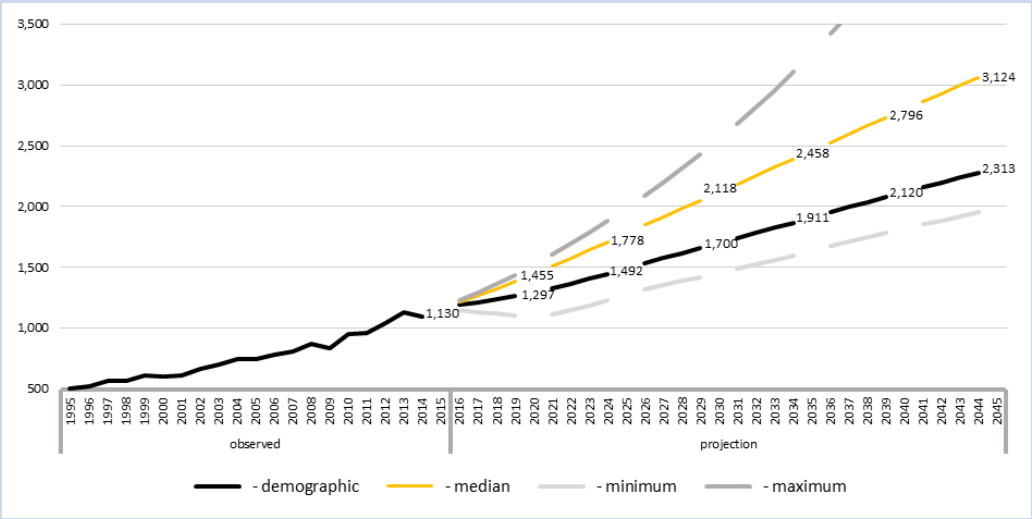
projected numbers of cases are shown in the graph on the right



FEMALES
% projected increase: represents the increase on the observed 2015 case count – based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	15%	29%
2025	32%	57%
2030	50%	87%
2035	69%	118%
2040	88%	147%
2045	105%	176%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

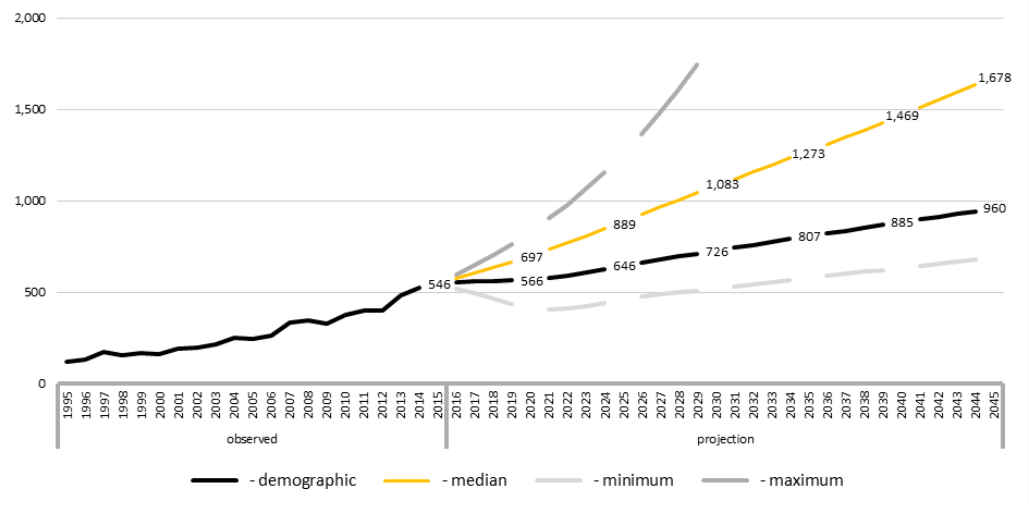
- Based on demographic changes alone, annual numbers of cases of lung cancer are projected to increase in males from 1,356 in 2015 to 3,137 in 2045 (+131%) and in females from 1,130 in 2015 to 2,313 in 2045 (+105%) – or approximately a doubling (+119%) for males and females combined.
- The median of all model projections suggests (compared with demographic projections) a slightly more modest increase for males, to 2,633 cases in 2045 (+94% from 2015), but a more substantial increase for females, to 3,124 (+176%), +130% overall (thus, balancing male against female projections, only slightly higher than demographic projections would suggest).
- The demographic projection is the least conservative of all models examined for male lung cancer, but is one of the most conservative models for female lung cancer – this reflects the fact that demographic projection takes no account of the ongoing decrease seen in male lung cancer rates up to 2015 and the contrasting increase seen in female rates over the same period.
- Nevertheless, all models examined suggest substantial increase in case numbers by 2045.

Figure 4-7
Projections: invasive melanoma of skin C43

MALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	4%	28%
2025	18%	63%
2030	33%	98%
2035	48%	133%
2040	62%	169%
2045	76%	207%

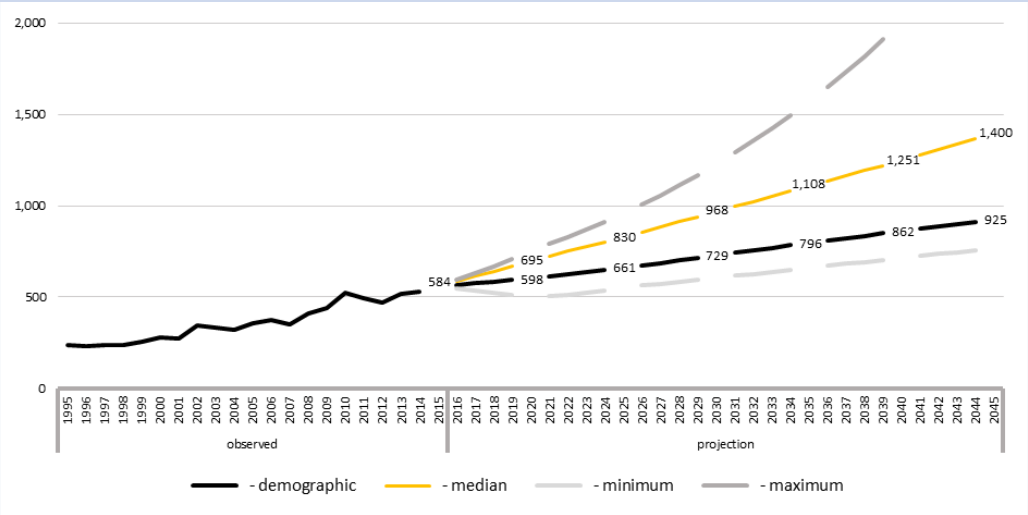
projected numbers of cases are shown in the graph on the right



FEMALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	2%	19%
2025	13%	42%
2030	25%	66%
2035	36%	90%
2040	48%	114%
2045	58%	140%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

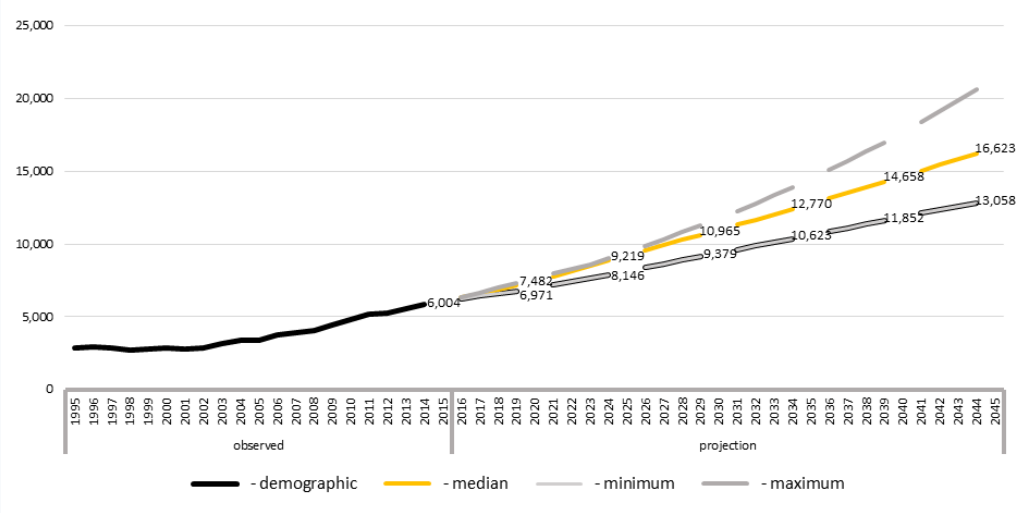
- Based on demographic changes alone, annual numbers of cases of melanoma skin cancer are projected to increase in males from 546 in 2015 to 960 in 2045 (+76%) and in females from 584 in 2015 to 925 in 2045 (+58%) – or about a two-thirds increase (+67%) for males and females combined.
- In contrast, the median of all model projections suggests a trebling of case numbers for males, to 1,678 cases in 2045 (+207% from 2015), and more than a doubling for females, to 1,400 cases (+140%), or +170% overall.
- All models examined suggest increases in case numbers by 2015, but to varying degrees. The demographic model is one of the most conservative for melanoma, as it assumes that ongoing increases in melanoma rates in both sexes do not continue.

Figure 4-8
Projections: non-melanoma skin cancer C44

MALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	16%	25%
2025	36%	54%
2030	56%	83%
2035	77%	113%
2040	97%	144%
2045	117%	177%

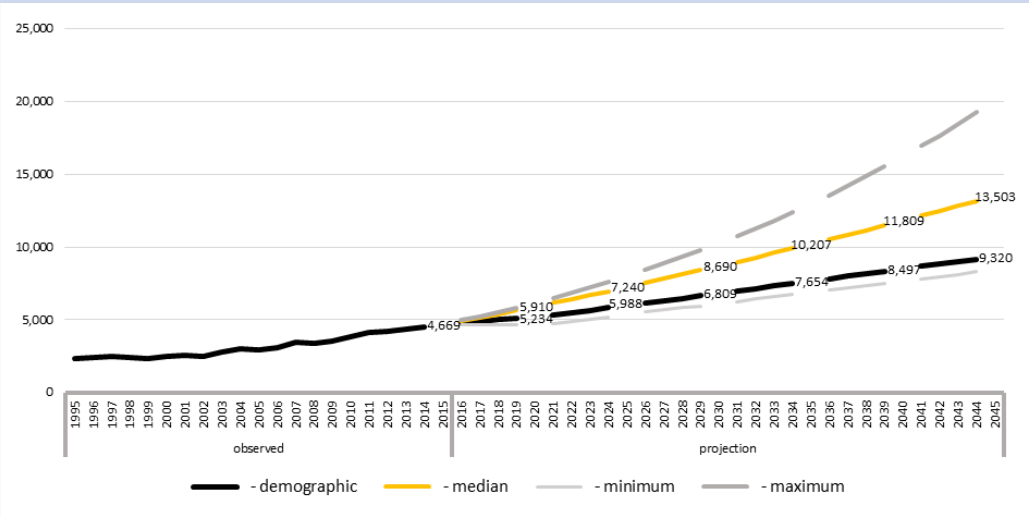
projected numbers of cases are shown in the graph on the right



FEMALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	12%	27%
2025	28%	55%
2030	46%	86%
2035	64%	119%
2040	82%	153%
2045	100%	189%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

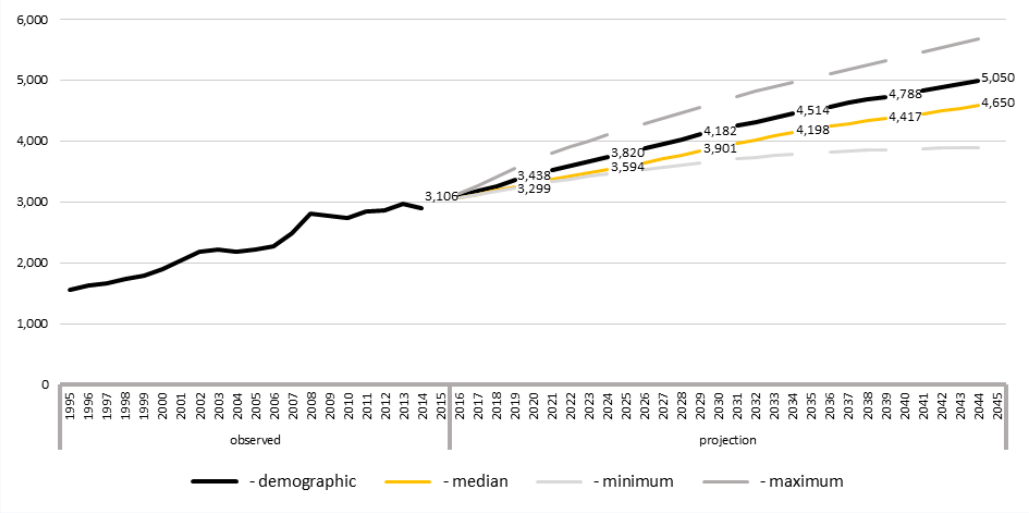
- Based on demographic changes alone, annual numbers of cases of non-melanoma skin cancer (NMSC) are projected to increase in males from 6,004 in 2015 to 13,058 in 2045 (+117%) and in females from 4,669 in 2015 to 9,320 in 2045 (+100%) - about a doubling (+110%) overall.
- The median of all model projections suggests more marked increases - to 16,623 male cases in 2045 (+177% from 2015) and 13,503 female cases (+189%) - almost a trebling overall (+182%).
- The full range of models examined all suggest substantial increases in case numbers by 2015, but to varying degrees. The demographic model is the most conservative for males, and one of the most conservative for females, as it assumes that ongoing increases in NMSC rates do not continue.

Figure 4-9 Projections: female breast cancer C50

% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	11%	6%
2025	23%	16%
2030	35%	26%
2035	45%	35%
2040	54%	42%
2045	63%	50%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

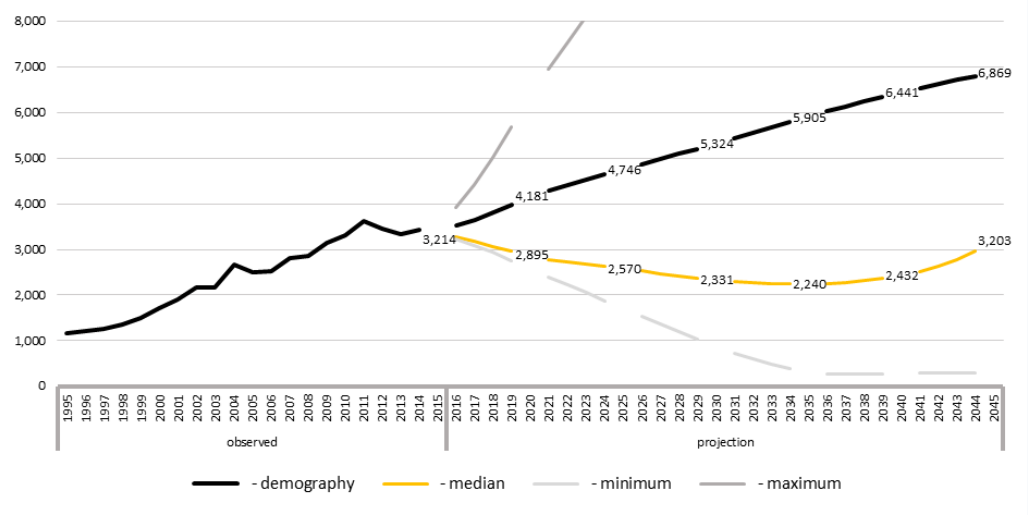
- Based on demographic changes alone, annual numbers of cases of breast cancer in females are projected to increase from 3,106 in 2015 to 5,050 in 2045 (+63%).
- The median of all model projections suggest a slightly more modest increase, to 4,650 cases in 2045 (+50% from 2015).
- All models suggest an ongoing increase in case numbers above the 2015 baseline, but some suggest a degree of slowing down in later years.

Figure 4-10 Projections: prostate cancer C61

% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	30%	-10%
2025	48%	-20%
2030	66%	-27%
2035	84%	-30%
2040	100%	-24%
2045	114%	0%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

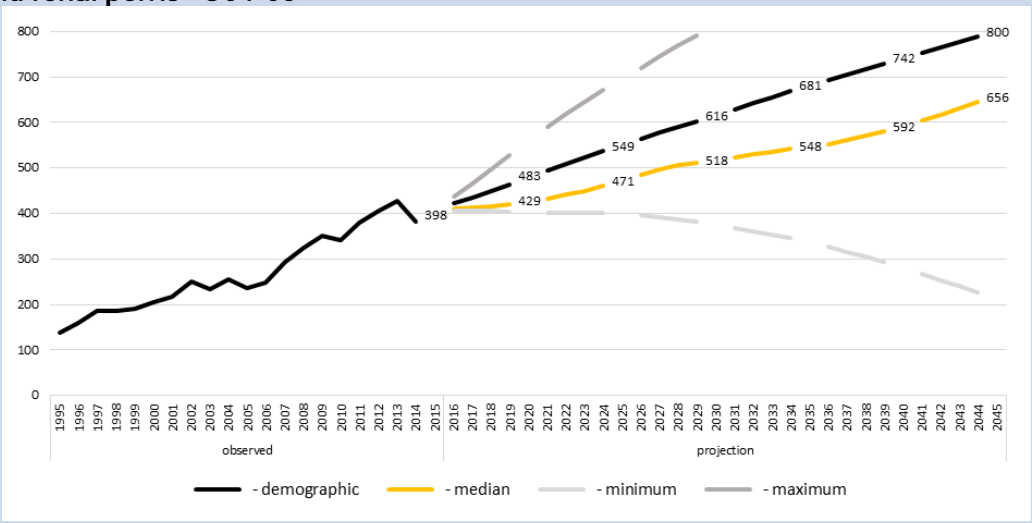
- Based on demographic changes alone, annual numbers of cases of prostate cancer are projected to approximately double from 3,214 in 2015 to 6,869 in 2045 (+114%).
- In contrast, the median of all models examined suggests little net change by 2045, but with a dip in numbers diagnosed during intermediate years. The full range of projections derived from all models is extremely wide - the widest of any cancer presented here.
- The trend in prostate cancer incidence has been affected by large-scale opportunistic screening of asymptomatic men (PSA testing) since 1995 [11]. This, in combination with age-specific variation in testing and with differing assumptions or constraints of different models, makes the HD and Nordpred models difficult to interpret and contributes to the large differences between the minimum and maximum model estimates, and to the U-shaped curve for the median model estimates.

Figure 4-11
Projections: kidney and renal pelvis C64-65

MALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	21%	8%
2025	38%	18%
2030	55%	30%
2035	71%	38%
2040	86%	49%
2045	101%	65%

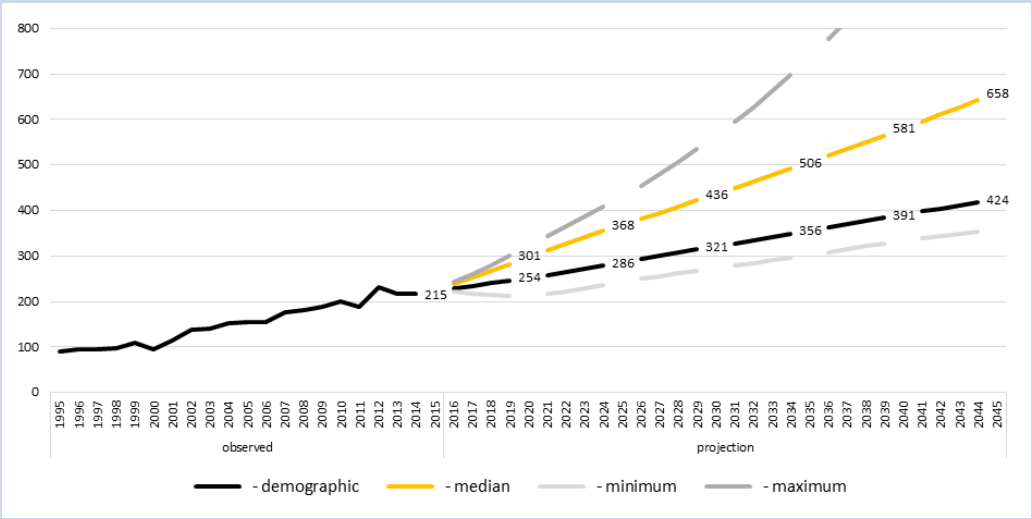
projected numbers of cases are shown in the graph on the right



FEMALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	18%	40%
2025	33%	71%
2030	49%	103%
2035	66%	135%
2040	82%	170%
2045	97%	206%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

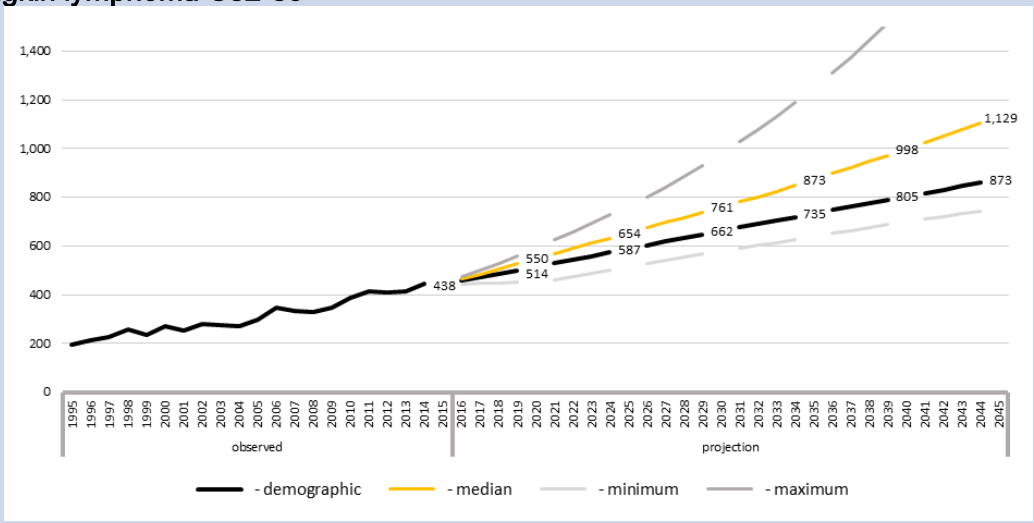
- Based on demographic changes alone, annual numbers of cases of kidney and renal pelvis cancer are projected to increase in males from 398 in 2015 to 800 in 2045 (+101%) and in females from 215 in 2015 to 424 in 2045 (+97%) – an overall doubling (+100%) for males and females combined.
- The median of all model projections suggests for males a more modest increase, to 656 cases in 2045 (+65% from 2015), but a more marked increase to 658 in females (+206%) – but, again, an approximate doubling overall (+115%) when the sexes are combined.
- For females, all models suggest substantial increases in case numbers by 2045, to varying degrees, but the range of possible projections is much wider for males, with some models suggesting a decrease in case numbers by 2045.

Figure 4-12
Projections: Non-Hodgkin lymphoma C82-85

MALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	17%	26%
2025	34%	49%
2030	51%	74%
2035	68%	99%
2040	84%	128%
2045	99%	158%

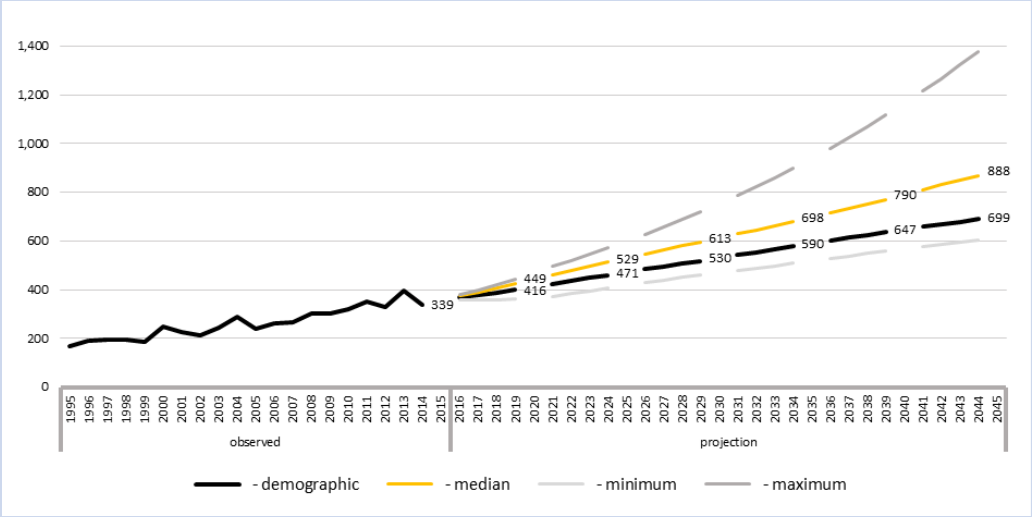
projected numbers of cases are shown in the graph on the right



FEMALES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 5 model projection estimates *and* the demographic estimate

	demographic projection	model median estimate projection
2020	23%	32%
2025	39%	56%
2030	56%	81%
2035	74%	106%
2040	91%	133%
2045	106%	162%

projected numbers of cases are shown in the graph on the right



Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Based on demographic changes alone, annual numbers of cases of non-Hodgkin lymphoma are projected to double in both sexes - in males from 438 in 2015 to 873 in 2045 (+99%) and in females from 339 in 2015 to 699 in 2045 (+106%), or +102% for males and females combined.
- The median of all model projections suggest more marked increases, to 1,129 males cases in 2045 (+158% from 2015), and 888 female cases (+162%).
- All models suggest substantial increases in case numbers for both sexes, to varying degrees.

5. PREVALENCE: NUMBER OF CANCER SURVIVORS

Complete cancer prevalence is defined as the number of persons surviving with, or following a diagnosis of, cancer in a given population at a particular point in time, the index date. For a cancer registry, *fixed-duration prevalence* is the number of cancer survivors calculated directly from observed data collected by the cancer registry since it was established. The NCRI began national collation of cancer registration in 1994 and it currently holds 23 years of complete or near-complete incidence and follow-up information on cancer cases, up to the end of 2016. However, there remains a subset of cancer patients alive at the end of 2016 who are not included in NCRI data because they were diagnosed before 1994. The size of this hidden subset was estimated using methods described in chapter 9. The sum of the fixed-duration cancer survivor population (1994-2016) and estimated numbers of survivors from the hidden cancer subset (pre-1994) gives an estimate of complete prevalence, presented below.

Table 5-1
Fixed and estimated complete prevalence by sex and age: number of cancer survivors* at end of 2016

sex	age‡	fixed duration (1994-2016)	%	%	complete prevalence	%	%
all		**156,469**	**100.0%**	**100.0%**	**173,051**	**100.0%**	**100.0%**
	<50	22,629	14.5%		23,314	13.5%	
	50+	133,840	85.5%		149,736	86.5%	
males		**76,958**	**100.0%**	**49.2%**	**82,459**	**100.0%**	**47.7%**
	<50	8,825	11.5%		9,120	11.1%	
	50+	68,133	88.5%		73,340	88.9%	
females		**79,511**	**100.0%**	**50.8%**	**90,591**	**100.0%**	**52.3%**
	<50	13,804	17.4%		14,194	15.7%	
	50+	65,707	82.6%		76,397	84.3%	

*Survivors of any invasive cancer, other than non-melanoma skin cancer (ICDO-3 C00-43, C45-96), counting only the first invasive cancer per patient and ignoring any subsequent cancers in other body sites
‡age category on 31/12/2016

- The figure reported for complete cancer prevalence (up to 31/12/2015) in last year's annual report was 167,715 [12]. For this report (up to 31/12/2016) the same figure was estimated at 173,051 (Table 5-1) which comprised c.3.7% of the Irish population in 2016.
- These figures include patients still undergoing active treatment or palliative treatment at the end of 2016, in addition to longer-term survivors (either cured or potentially at risk of recurrence or relapse).

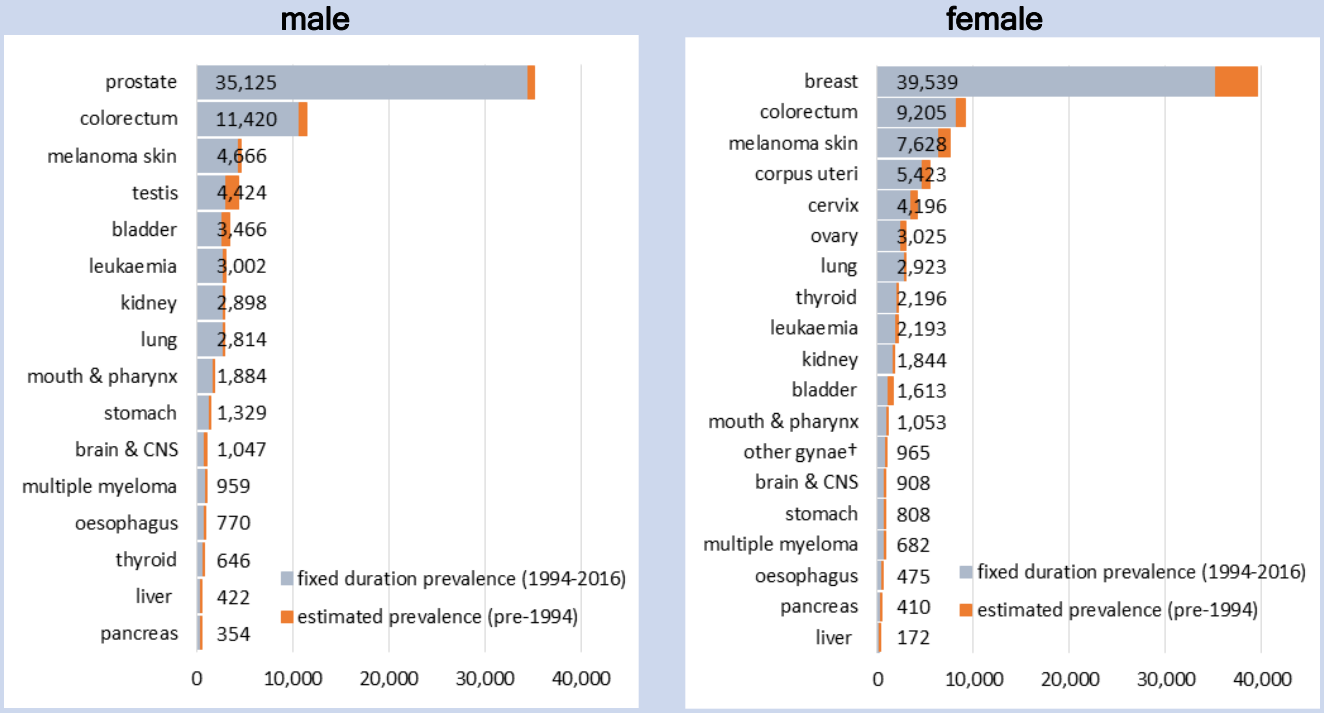
Table 5-2
Fixed-duration and estimated complete prevalence, by sex and cancer type: number of cancer survivors at the end of 2016

	males		females		all
	fixed duration (1994-2016)	complete to end of 2016	fixed duration (1994-2016)	complete to end of 2016	complete to end of 2016
breast	216	226	35,217	39,539	39,765
prostate	34,571	35,125			35,125
colorectum	10,639	11,420	8,242	9,205	20,625
melanoma of skin	4,340	4,666	6,456	7,628	12,294
non-Hodgkin lymphoma	3,551	3,900	3,148	3,505	7,404
lung	2,721	2,814	2,861	2,923	5,738
corpus uteri			4,730	5,423	5,423
leukaemia	2,749	3,030	1,894	2,193	5,223
bladder	2,654	3,466	1,091	1,613	5,079
kidney	2,751	2,898	1,692	1,844	4,742
testis	3,069	4,424			4,424
cervix uteri			3,449	4,196	4,196
ovary			2,389	3,025	3,025
mouth & pharynx	1,787	1,884	983	1,053	2,937
thyroid	615	646	2,076	2,196	2,842
Hodgkin lymphoma	1,056	1,461	903	1,201	2,661
stomach	1,271	1,329	742	808	2,137
brain and	778	1,047	670	908	1,954
multiple myeloma	946	959	671	682	1,640
oesophagus	753	770	441	475	1,245
other gynae†			868	965	965
pancreas	348	354	372	410	764
liver	418	422	163	172	594

†Other gynaecological malignancies: vulva, vagina, uterus (NOS) and placenta

- The number of survivors of a given cancer type is related to its incidence rate, median age at diagnosis and survival prospects. Rare, high-fatality cancers diagnosed in elderly patients comprise only a small proportion of cancer survivors. Conversely, common cancers with good survival prospects diagnosed in younger persons will tend to predominate in the prevalent cancer population.
- Overall, the top most common cancers in the prevalent cancer population were: breast cancer (23% of all cancer survivors), prostate cancer (20%), colorectal cancer (12%) and skin melanoma (7%) (Table 5-2). These percentages are not mutually exclusive (i.e. add up to >100%), as some cancer survivors had been diagnosed with more than one type of cancer.
- Lung cancer (a common but high-fatality) cancer accounted for only 3% of survivors, and less common, high-fatality cancers such as liver, pancreatic, oesophageal and stomach cancers and multiple myeloma together comprise <3% of the cancer survivors.

Figure 5-1.
Number of cancer survivors: fixed-duration and estimated complete prevalence by cancer type and sex

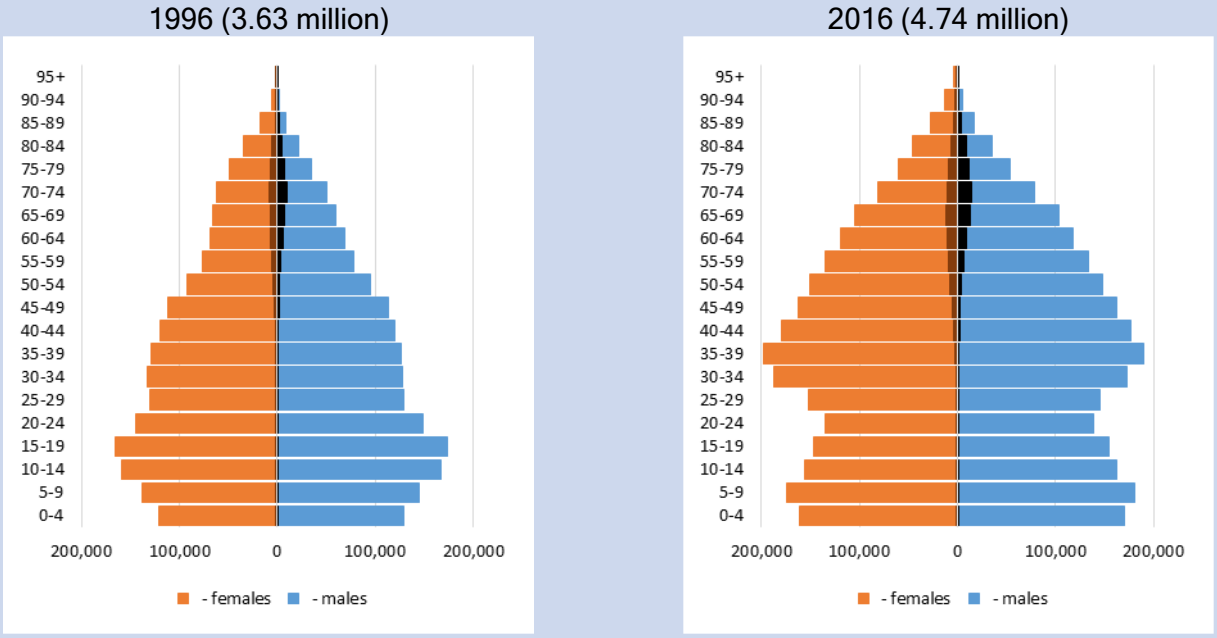


Only the most common cancers are shown. The numbers reflect to the combined height of the stacked bars (complete prevalence), i.e. the number surviving with a particular cancer on 31/12/2016
† Other gynae: vulva, vagina, uterus (NOS) and placenta

- The top five most common prevalent cancers in males were prostate cancer (43% of all male cancer survivors), colorectal cancer (14%), skin melanoma (6%), testicular cancer (5%), and non-Hodgkin lymphoma (5%).
- The top five most common prevalent cancers in females were: breast cancer (44% of all female cancer survivors), colorectal cancer (10%), skin melanoma (8%), uterine (6%) and cervical cancer (5%).
- Certain cancers with good survival prospects, often diagnosed in younger patients, tended to predominate in the estimated prevalence for the period prior to 1994 (orange sections of bars). This was most apparent for cancer of the testis. Conversely, for cancers with very poor survival, it was estimated that there were hardly any survivors still alive who had been diagnosed before 1994 (e.g. cancers of the pancreas and liver).
- Detailed figures are not presented here, but just over 100,000 persons who had been diagnosed with non-melanoma skin cancer (NMSC) during 1994-2016 were also alive at 31/12/2016. Relative survival from these cancers closely approaches 100%.

The numbers of cancers diagnosed increased annually due to growth of our population which increased by over 1 million between 1996 and 2016 (Figure 5-2). Moreover, the proportion of the population most likely to be diagnosed with cancer (65+ years) expanded by over 50% over the same 20-year period. In combination with ongoing improvements in survival for most cancer types, this has resulted in a growing numbers of cancer survivors in the general population.

Figure 5-2
Population age structure and cancer prevalence‡ in Ireland: 1996 *vs.* 2016

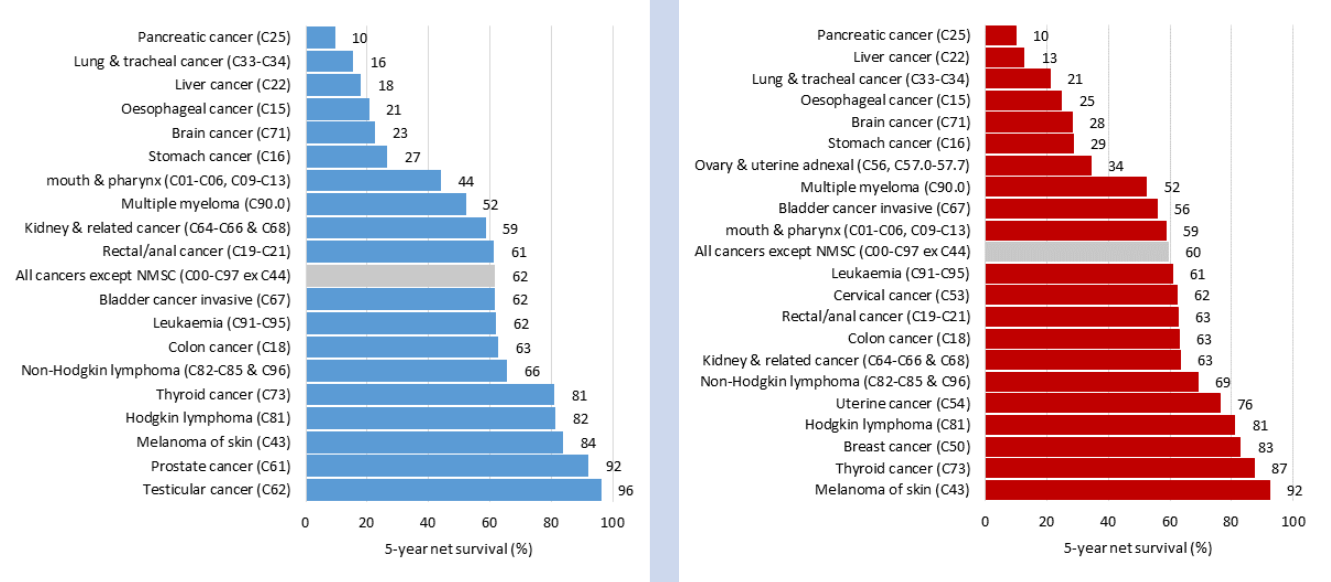


- The smaller, dark overlay bars represent the prevalent (living) cancer population in 1996 and 2016.
- Cancer prevalence in 1996 is not known for certain. The prevalence estimates for 1996 assume that proportions of survivors among the general population, within each age-group, were the same in 1996 as in 2016, i.e. representation of changes in prevalent cancer case numbers over the 20-year interval is scaled against population and age structure rather than any changes in risk factors and survival time. But survival has improved significantly since 1996, so the proportion of cancer survivors shown for 1996 (left-most graph) is an overestimate.
- At the end of 2016, it was estimated that 3.7% of the Irish population were cancer survivors.
  Population figures: Central Statistics Office (CSO, www.cso.ie) [13]
  ‡ all invasive cancer excl. NMSC

6. SURVIVAL

This section presents a summary of previously-published survival estimates for Irish cancer patients, using figures available on net (relative) survival on the NCRI website and also published in last year's annual report [12].

Figure 6-1
Ranked 5-year average net survival of Irish cancer patients (age 15-99): 2010-2014*



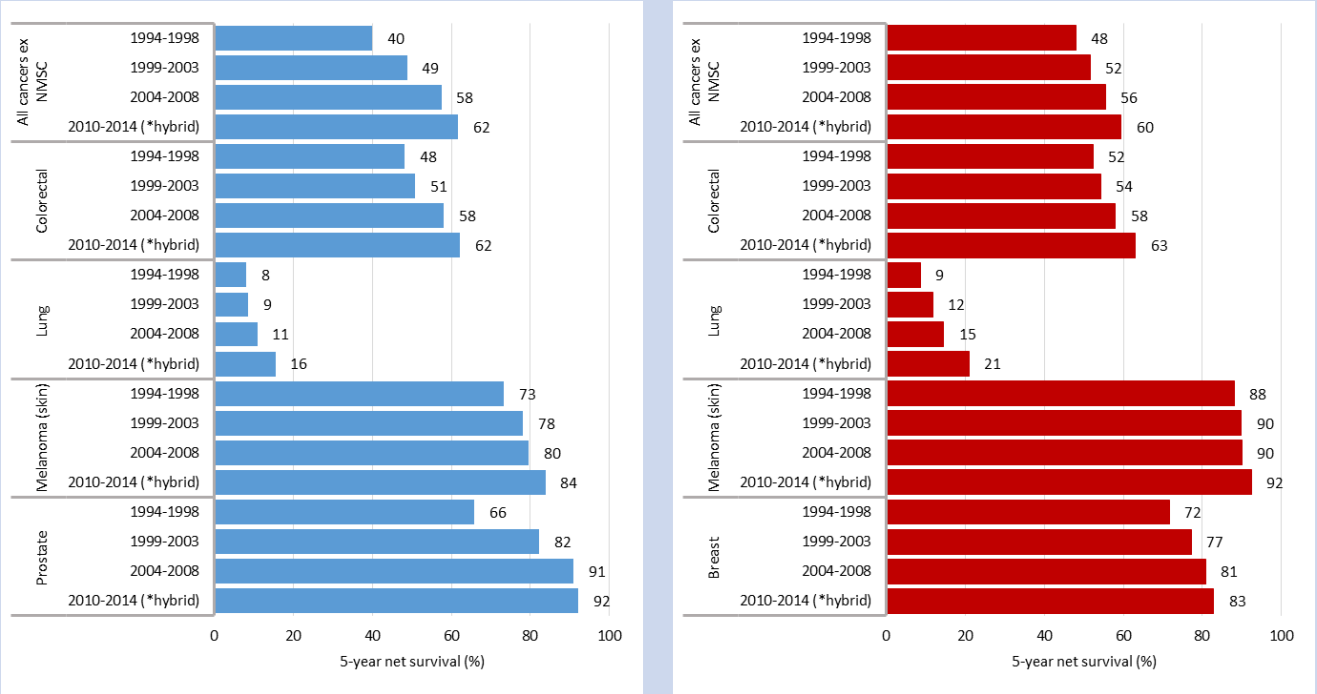
Interpretation, e.g. *83% of women diagnosed with invasive breast cancer during 2010-2014 had avoided cancer death by the five year mark after diagnosis.*
All estimates were age-standardised i.e. survival for all ages 15-99 (15-64 for testicular cancer) was standardised to recommended population age weights [14]; the age groups used differ for prostate cancer, and greater weighting is given to younger patients for some cancers (melanoma, cervix, testis, brain and thyroid), reflecting difference in typical age at diagnosis for these cancers.
*2010-2014: net survival hybrid method: i.e. all patients alive at some point 2010-2013, or diagnosed in 2009 were followed up to 31/12/2014; Source: https://www.ncri.ie/data/survival-statistics

Figure 6-1 summarises the most recent NCRI estimates of *net survival* of Irish patients. Net survival is the expected survival in the hypothetical situation in which cancer is the only cause of death, thus it will be close to actual survival in younger patients but higher than actual survival in older patients. Net survival is a particular type of *relative survival*.

- In males, age-standardised five-year net survival averaged 96% for testicular cancer, 92% for prostate cancer and 84% for melanoma of the skin during the 2010-2014 follow-up period.
- In females, five-year net survival averaged 92% for melanoma skin cancer, 87% for thyroid cancer and 83% for breast cancer.
- At the other end of the spectrum, five-year net survival for cancers of the pancreas (M: F; 10%, 10%), liver (18%, 13%), lung (16%, 21%), oesophagus (21%, 25%), stomach (27%, 29%) and ovary (34%) remain very poor.

- Cancers of the colon (five-year net survival 63% in both sexes) and rectum (61%, 63%) fell within the mid-range for survival.
- For all invasive cancers combined (excluding NMSC), five-year net survival averaged 62% in males and 60% of females.

Figure 6-2
Trends in five-year net survival for the 4 most common cancers in males and females: 1994-1998, 1999-2003, 2004-2008, and cross-sectional period 2010-2014



All estimates are age-standardised i.e. survival for all ages 15-99 is standardised to the standard populations recommended by Corazziari et al, [14].
*Hybrid: by year of follow-up (all patients alive at some point 2010-2013, or diagnosed in 2009, followed up to 31/12/2014)

- Five-year net survival has improved markedly for cancers as a whole and for the most common cancer types since the mid-1990s (Figure 6-2).
- For invasive cancers (excluding generally less serious NMSC), overall five-year net survival increased from 40% for males during 1994-1998 to 62% during 2010-2014; in females, five-year net survival increased from 48% during 1994-1998 to 60% during 2010-2014.
- Over the same 20-year period, five-year survival for colorectal cancer increased from 48% to 62% in males and from 52% to 63% in females; for lung cancer, from 8% to 16% in males, and from 9% to 21% in females; for female breast cancer, from 72% to 83%; for prostate cancer from 66% to 92%; and for melanoma of the skin, from 73% to 84% in males and from 88% to 92% in females.

7. EMERGENCY PRESENTATION OF CANCER

Emergency presentation with cancer can result from lack of awareness of symptoms in patients and is generally associated with more advanced stage, limited treatment options and poorer survival outcomes. This section of the report assesses the proportion of cancers diagnosed in Ireland which first presented through emergency admissions, using data collected by the National Cancer Registry of Ireland (NCRI). Figures presented in this section provide a brief interim update to a more recent diagnosis period (2014-2016), following a comprehensive report (covering years up to 2014) commissioned by the Irish Cancer Society and published jointly with the NCRI earlier in 2018 [15].

The number and proportion of cancer patients presenting emergently (i.e. first diagnosed as an emergency presentation) in a hospital was calculated using National Cancer Registry data for the period 2002-2016 inclusive, with the main focus on the more recent period 2014-2016. To this end, the sequential diagnosis/management/treatment schedule for each cancer case was abstracted within the date limits from 4 weeks before to 1 year after the formal diagnosis date. The first record ('1st presentation') within these date limits was categorised for each case by cancer type and presentation (emergency/ elective/ unknown).

The definition of "emergency" included all cancers first diagnosed during an admission through a hospital emergency department, as well as any further cases described in clinical notes as having been diagnosed emergently during (other) in-patient or out-patient hospital visits (but not including General Practitioner visits). At the level of the individual patient this approach might appear somewhat arbitrary, and there is still some question about distinctions between 'true' emergency-department admissions and planned/referred admissions via emergency departments (since these may act as the entry point for most hospital admissions to public hospitals in Ireland). However, at the population level it provides a useful way of looking at trends and ranking of different cancers for emergency presentation. Comparisons of previous NCRI analyses with UK data suggested that Irish figures compiled in this way matched UK data quite closely when the latter were restricted to hospital-based emergency presentations [15]

The list of common invasive cancers selected is shown in Table 7-1, including a group for all invasive cancers combined (excl. non-melanoma skin (NMSC)).

Table 7-1
ICD10 codes and list of selected cancers (malignant neoplasms only)

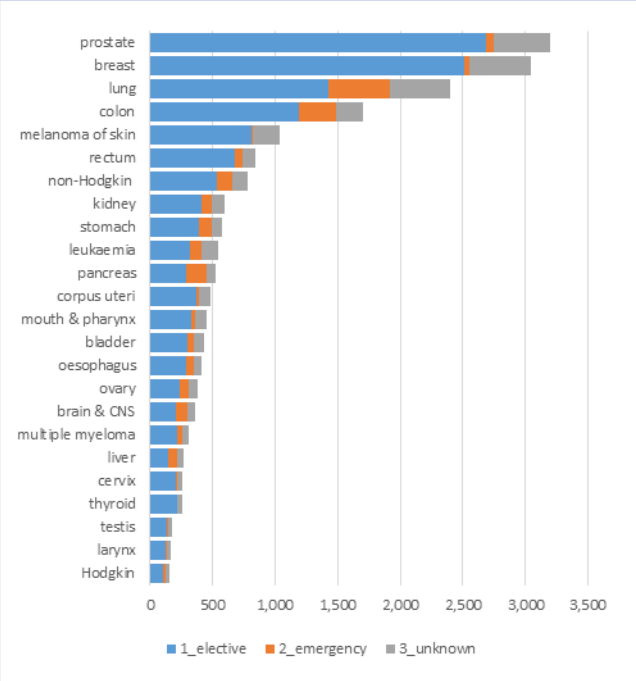
C00-43 C45-96 all invasive cancers excluding NMSC
C00-14 lip, oral cavity and pharynx (mouth and pharynx)
C15 oesophagus
C16 stomach
C18 colon
C19-20 rectum
C22 liver and intrahepatic bile ducts
C25 pancreas
C32 larynx
C33-34 lung and trachea
C43 melanoma of skin
C50 breast
C53 cervix uteri
C54 corpus uteri
C56 ovary
C61 prostate
C62 testis
C64 kidney
C67 bladder
C70-72 meninges, brain and spinal cord (brain & CNS)
C73 thyroid gland
C81 Hodgkin lymphoma
C82-85 non-Hodgkin lymphoma
C90 multiple myeloma
C91-95 leukaemia

The NCRI began registration of cancer cases from 1994. Registration completeness has been estimated to be 98% within 5 years of diagnosis [16]. From 1994 to 2001, the 'presentation status' information was incompletely recorded or was not available. Analysis was thus confined to the diagnosis period 2002-2016 (15 years). Over this period, a small proportion of patients was diagnosed with more than one distinct primary cancer. For the analysis in this section all 'reportable' invasive cancers (i.e. cancers of sufficiently different site, morphology or both) [17] were counted for each patient. This applied both for the 'all invasive cancer' group (mainly with cancer at another body site), and for the individual types (with another de-novo cancer of a sufficiently different morphological type or subsite), excluding recurrences or progressions. This approach of considering some patients more than once, i.e. 'case count vs. patient count', better reflects the scale of the burden of hospital presentation, and is consistent with how NCRI reports cancer incidence for wider purposes.

Annual percentage changes (APC) for mode of presentation over time (2002-2016) were estimated with the Joinpoint regression program [18], based on the proportion presenting electively and emergently, including and excluding unknown mode of presentation. The default constraints specified with Joinpoint were that a maximum of two trend break points (indicating any significant changes in trend) were allowed over the 15-year period 2002-2016, and that all break points had to be at least four years (inclusive) from other break points or from either end of the 15-year range.

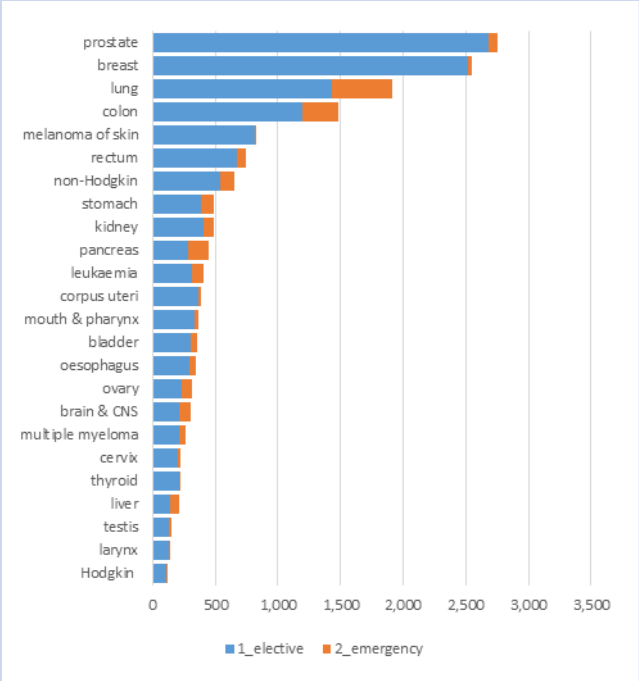
Figure 7-1
Type of presentation, by cancer type during 2014-2016†

including 'unknown' presentation status



graph sorted on total cases per year

excluding 'unknown' presentation status



graph sorted on total cases per year

	annual average cases†	elective	emergency‡	unknown
pancreas	526	54.8%	30.4%↑	14.8%
liver	262	53.1%	27.5%↑	19.5%
brain & CNS	361	57.6%	25.8%↑	16.6%
lung	2,399	59.6%	20.1%↑	20.3%
ovary	380	62.1%	19.5%↑	18.4%
stomach	571	68.1%	17.7%↑	14.2%
colon	1,699	70.0%	17.5%↑	12.5%
leukaemia	540	58.1%	17.0%↑	24.8%
multiple myeloma	303	70.0%	16.2%↑	13.9%
non-Hodgkin	784	68.6%	14.5%↑	16.8%
kidney	591	69.0%	13.9%↑	17.1%
oesophagus	409	70.9%	13.7%↑	15.4%
bladder	427	70.3%	12.2%↑	17.6%
all invasive*	**21,124**	**71.3%**	**11.7%**	**17.0%**
Hodgkin	152	69.7%	11.2%↓	19.1%
testis	175	73.7%	10.3%↓	16.0%
rectum	842	80.4%	7.7%↓	11.9%
larynx	163	77.3%	7.4%↓	15.3%
mouth & pharynx	452	73.7%	6.4%↓	19.9%
cervix	260	79.2%	5.0%↓	15.8%
corpus uteri	479	77.0%	3.8%↓	19.2%
thyroid	259	81.5%	3.1%↓	15.4%
prostate	3,197	83.9%	2.0%↓	14.0%
breast	3,042	82.6%	1.2%↓	16.2%
melanoma	1,040	78.2%	0.7%↓	21.2%

*Excluding NMSC;
‡Table sorted in order of % presenting emergently
↑/↓ Greater/less than all invasive cancer figure

	annual average cases†	elective	emergency‡
pancreas	448	64.3%	35.7%↑
liver	211	65.9%	34.1%↑
brain & CNS	301	69.1%	30.9%↑
lung	1,913	74.8%	25.2%↑
ovary	310	76.1%	23.9%↑
leukaemia	406	77.3%	22.7%↑
stomach	490	79.4%	20.6%↑
colon	1,487	80.0%	20.0%↑
multiple myeloma	261	81.2%	18.8%↑
non-Hodgkin	652	82.5%	17.5%↑
kidney	490	83.3%	16.7%↑
oesophagus	346	83.8%	16.2%↑
bladder	352	85.2%	14.8%↑
all invasive*	**17,529**	**85.9%**	**14.1%**
Hodgkin	123	86.2%	13.8%↓
testis	147	87.8%	12.2%↓
rectum	742	91.2%	8.8%↓
larynx	138	91.3%	8.7%↓
mouth & pharynx	362	92.0%	8.0%↓
cervix	219	94.1%	5.9%↓
corpus uteri	387	95.3%	4.7%↓
thyroid	219	96.3%	3.7%↓
prostate	2,748	97.6%	2.4%↓
breast	2,549	98.6%	1.4%↓
melanoma	820	99.1%	0.9%↓

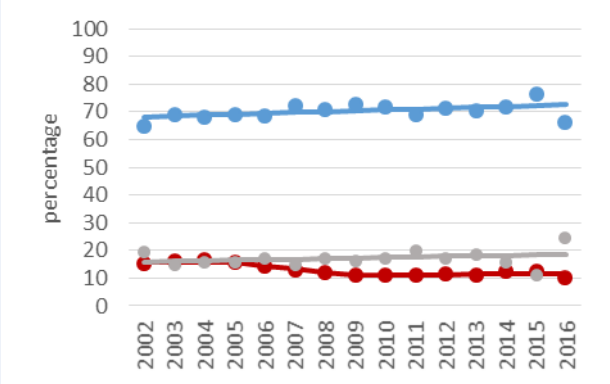
*Excluding NMSC;
‡Table sorted in order of % presenting emergently
↑/↓ Greater/less than all invasive cancer figure

- Overall during 2014-2016, 14% of cancer cases (excluding non-melanoma skin cancers) presented as emergencies at the time of diagnosis, excluding cases where the mode of presentation was unknown (Figure 7-1).

- Of the 24 individual cancer types examined, those with the highest proportions (>20%) of emergency presentation during 2014-2016 were cancers of the pancreas (36%), liver (34%), brain & CNS (31%), lung (25%), ovary (24%), leukaemia (23%), stomach (21%) and colon (20%).
- Cancers with the lowest proportions (<10%) of emergency presentation were: melanoma of skin (0.9%), and breast (1.4%), prostate (2.4%), thyroid (3.7%), uterine (4.7%), cervical (5.9%), mouth / pharynx (8.0%), laryngeal (8.7%) and rectal cancer (8.8%).
- Intermediate levels of emergency presentation were seen for multiple myeloma (19%), non-Hodgkin lymphoma (18%), kidney cancer (17%), oesophageal (16%) and bladder cancers (15%), Hodgkin lymphoma (14%) and testicular cancer (12%).

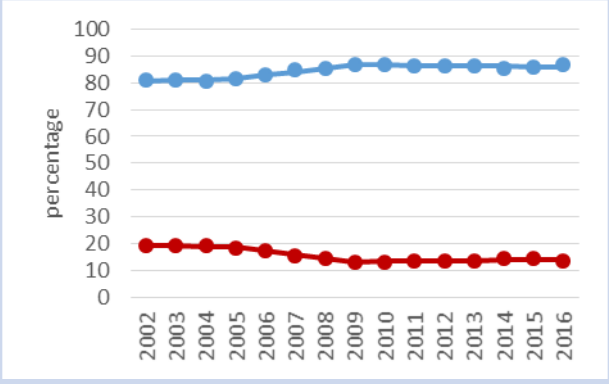
Figure 7-2
Trend in mode of presentation 2002-2016: all invasive cancers (excl. NMSC)

including unknown presentation status



	from	to	APC	95%CI	trend
elective	2002	2016	0.4	[-0.1, 0.9]	↔
emergency	2002	2005	-0.1	[-11.1, 12.4]	↔
	2005	2009	-8.7	[-19.4, 3.3]	↔
	2009	2016	0.9	[-2.5, 4.3]	↔
unknown	2002	2016	1.1	[-1.2, 3.5]	↔

excluding unknown presentation status



	from	to	APC	95%CI	trend
elective	2002	2005	0.4	[-1.0, 1.7]	↔
	2005	2009	1.6	[0.4, 2.7]	↑
	2009	2016	-0.2	[-0.4, 0.1]	↔
emergency	2002	2005	-1.2	[-6.5, 4.4]	↔
	2005	2009	-8.2	[-13.4, -2.7]	↓
	2009	2016	0.9	[-0.7, 2.5]	↔

● elective; ● emergency; ● unknown.
APC= annual percentage change, with 95%CI=95% confidence intervals
↑ significant increase; ↓ significant decrease; ↔ no significant change at the 95% level

From 2005 to 2009 the incident proportion of invasive cancers presenting emergently decreased significantly from c.19% in 2005 to c.14% in 2009, with little change to 2016 (c.14%). This followed an earlier period of non-significant decline from 2002 (c.20%) to 2005 (c.19%); more recently (2009 to 2016) the trend has been stable (right-most graph, Figure 7-2). The pattern of change matched that reported previously based on 2002-2015 data [15].

The possible influence of variation over time in the breakdown of cases by age, sex and cancer-type (defined by either ICD-10 3-digit code or quartile of average emergency %) was tested using a Poisson model equivalent to the Joinpoint model, but produced very similar results. This indicates that the reduction in overall emergency percentage between 2005 and 2009 was not simply a reflection of changes in the proportion of younger patients or of less-fatal cancers. However, it cannot be excluded

that some of the decline may involve changes in stage breakdown over time (within individual sites), or possible artefacts in assignment or coding of cases to emergency v. elective status.

Table 7-1
Trend in mode of emergency presentation (as a proportion of known mode of presentation): most recent trend

	from	to	APC	[95%CI]	trend
stomach	2002	2016	-1.9	[-3.3, -0.5]	↓
colon	2002	2016	-2.3	[-3.2, -1.4]	↓
breast	2002	2016	-6.2	[-8.8, -3.5]	↓
kidney	2002	2016	-3.7	[-5.3, -2.0]	↓
thyroid	2002	2016	-7.1	[-12.0, -1.9]	↓
multiple myeloma	2002	2016	-2.6	[-5.0, -0.1]	↓
brain & CNS	2009	2016	4.5	[1.6, 7.4]	↑
non-Hodgkin	2009	2016	3.6	[0.3, 7.0]	↑
all invasive	**2009**	**2016**	**0.9**	**[-0.7, 2.5]**	↔
mouth & pharynx	2013	2016	17.1	[-11.5, 55.0]	↔
rectum	2009	2016	-2.1	[-7.1, 3.1]	↔
pancreas	2013	2016	9.3	[-3.0, 23.2]	↔
larynx	2013	2016	26.1	[-9.1, 74.9]	↔
lung	2012	2016	1.7	[-3.2, 6.8]	↔
cervix	2007	2016	6.5	[-0.9, 14.4]	↔
prostate	2011	2016	0.8	[-6.0, 8.1]	↔
oesophagus	2002	2016	-0.5	[-2.4, 1.5]	↔
liver	2002	2016	-0.8	[-2.1, 0.5]	↔
melanoma of skin	2002	2016	-4.8	[-9.8, 0.4]	↔
corpus uteri	2002	2016	-1.4	[-4.4, 1.8]	↔
ovary	2002	2016	-1.8	[-3.7, 0.2]	↔
testis	2002	2016	1.7	[-2.5, 6.1]	↔
bladder	2002	2016	0.2	[-1.7, 2.0]	↔
Hodgkin	2002	2016	-0.6	[-3.2, 2.0]	↔
leukaemia	2002	2016	-1.6	[-3.3, 0.1]	↔

APC= annual percentage change, with 95%CI
↑ significant increase; ↓ significant decrease;
↔ no significant change at the 95% level

For further details of trends 2002 onwards for specific cancers, see the Irish Cancer Society / NCRI report on 2002-2014 cases published earlier in 2018 [15].

Of the cancer types examined:

- Six (stomach, colon, breast, kidney, thyroid, and multiple myeloma) showed significant declines in the proportion of cases presenting emergently over the whole period 2002-2016 (Table 7-1).
- Nine (oesophageal, liver, melanoma of skin, uterine, ovarian, testicular, bladder, Hodgkin lymphoma and leukaemia) showed no significant trends across the whole period 2002-2016.
- Seven (mouth/pharynx, rectum, pancreas, laryngeal, lung, cervical and prostate cancers) showed no significant recent trend.
- Only cancers of the brain/ CNS and non-Hodgkin lymphoma showed a significant recent increase (during 2009-2016) in emergency presentation proportions.
- Adjustment for possible changes in age or sex breakdown of cases over time had no little or no appreciable effect on these trends, except for prostate cancer (where adjustment for age resulted in a moderate reduction in the APC).

8. METHODS

The registry

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 was estimated to be at least 98% [16].

Incidence data are collected and coded by the NCR according to the ICDO3 classification (including translation from ICDO2 codes for older data) [17]. 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, myelodysplastic syndromes and chronic myeloproliferative diseases have been included under C96, rather than D45-47).

Mortality data

Age-, sex- and cause-specific deaths attributable to cancer by year of death (1994-2015) were obtained from the Central Statistics Office (CSO).

Calculation of rates and trends

The age-standardised (ASR) rate is the annual rate of newly diagnosed cases (or deaths) in a given population (and year), expressed per 100,000 persons (usually males and females separately), weighted by the age-structure of a defined 'standard' population, to allow meaningful comparisons between different countries over time [19]. By convention for European cancer registries, age-standardised rates for incidence and mortality were weighted by the European standard population (ESP) as defined in 1976 [20]. However, this report also presents incidence rates weighted by the 2013 ESP proposed by EUROSTAT to more accurately reflect the demographic age shift in the European population since 1976 [21]. The 2013 ESP is a better reflection of the current population structure than the ESP of 1976. The 2013 ESP gives older ages a greater weight than the 1976 ESP and also, while the 1976 ESP has only one upper age band of 85+ years, the 2013 ESP contains age bands of 85-89, 90-94 and 95+. Like most cancer registries, by convention the NCR pools case-counts and population weights for age categories '<1 year' and '01-04 years' (Table 8-1).

Table 8-1.
Comparison of the 1976 ESP and the 2013 ESP population structures

1976 ESP		2013 ESP	
age band	weight per 100,000	age band	weight per 100,000
<1	1600	<1	1000
01-04	6400	01-04	4000
05-09	7000	05-09	5500
10-14	7000	10-14	5500
15-19	7000	15-19	5500
20-24	7000	20-24	6000
25-29	7000	25-29	6000
30-34	7000	30-34	6500
35-39	7000	35-39	7000
40-44	7000	40-44	7000
45-49	7000	45-49	7000
50-54	7000	50-54	7000
55-59	6000	55-59	6500
60-64	5000	60-64	6000
65-69	4000	65-69	5500
70-74	3000	70-74	5000
75-79	2000	75-79	4000
80-84	1000	80-84	2500
85+	1000	85-89	1500
		90-94	800
		95+	200
Total	100,000	Total	100,000

Source: EUROSTAT [21]

Annual percentage changes (APC) of incidence/mortality over time (incidence 1994-2016/mortality 1994-2015, were estimated with the Joinpoint regression program, using annual age-standardised rates and their standard errors as inputs [18][22]. The same break point constraints for trend were applied to rates calculated using the 1976 ESP and 2013 ESP. Default constraints were used with Joinpoint; a maximum of three trend break points were allowed over the 23 year period from 1994-2016, and only after four consecutive years inclusive, and four years from either end of the year range (inclusive).

Projections of cancer incidence

The cancer case projections are based on the population projections of the Irish Central Statistics Office (CSO) based on different assumptions regarding mortality, migration (M) and fertility (F). These give expected population numbers for each year 2015-2045, by five year age group and sex.

Mortality rates are assumed to decrease, which will result in gains in life expectancy at birth from:

- 77.9 years in 2010 to 85.1 years in 2046 for males
- 82.7 years in 2010 to 88.5 years in 2046 for females.

Two fertility assumptions were considered:

- F1: Total fertility rate to remain at the 2016 level of 1.8 for the lifetime of the projections
- F2: Total fertility rate to decrease from 1.8 to 1.6 by 2031 and to remain constant thereafter to 2051.

Three migration assumptions were considered:

- M1: Net migration +30,000 per annum to 2051
- M2: Net migration +20,000 per annum to 2051
- M3: Net migration +10,000 per annum to 2051

The fertility assumptions, which will affect only the population aged under 30 years by 2045, will have a minimal impact on numbers of cancer cases over the period studied, since cancer is predominantly a disease of the elderly.

The projections presented in this report are based on the **M2:F1** assumptions, i.e. assuming fertility rate to remain at the 2016 level of 1.8 for the lifetime of the projections, and net migration set at +20,000 per annum to 2051.

Historic incidence rates

Projections are based on the assumption that current trends in incidence will continue into the future. The precision of a model is greatest if a long prior period of observation can be used. Where possible, all years of data from the National Cancer Registry, beginning from 1994, were used. For the Hakulinen and Dyba (HD) models, trends in age-standardised incidence rate for each cancer were tested for linearity over the period 1994-2015, using Joinpoint software [18]. Joinpoint constraints were applied with no more than 3 inflexion points allowed, with at least 4 years between each inflexion point and 5 years from either end of the range of years (1994-2015). For cancers with a linear trend in incidence rate over the full period 1994-2015, cancer rates over this period were used to construct the model. For other cancers, the most recent linear trend in the historic incidence rate data (the base of projection) for each cancer site was fitted using four different HD models, for each sex separately, where relevant. For Nordpred, aggregated incidence data for four five-year periods were used: 1996-2000, 2001-2005, 2006-2010, 2011-2015.

Demographic projections were based on the average annual age-specific incidence rates in the period 2011-2015 inclusive applied to the future population. Only the most common invasive cancers are considered in this report (Table 8-2), as trends in non-invasive cancers (predominantly in situ cancers) are largely dependent on screening activity rather than underlying risk, and so cannot be convincingly modelled.

Model fitting:

Demographic projections

Demographic projections were produced by applying the population projections to the average age-specific incidence rates for each age group (0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-85 and 85+) for the years 2011-2015 and applying these rates to the estimated population up to 2045.

Hakulinen-Dyba (HD) age-period methods

Hakulinen and Dyba propose four age-period models to fit and project incidence [4-6]. These are:

Model HD 1. $n_{i,t} = p_{i,t} \times (\alpha_i + \beta_i t)$

Model HD 2. $n_{i,t} = p_{i,t} \times (\alpha_i \times (1 + \beta t))$

Model HD 3. $n_{i,t} = p_{i,t} \times e^{(\alpha_i + \beta t)}$

Model HD 4. $n_{i,t} = p_{i,t} \times e^{(\alpha_i + \beta_i t)}$

where:
N= number of cases
P=population at risk
i=age group
t=time period
α = intercept
β =slope

These models use single year of incidence data and calculate projected numbers of cases, age-standardised incidence rates and 95% confidence limits for both. Hakulinen/Dyba (HD) **model 1** is a linear model, which assumes that the cancer incidence rate increases by a fixed amount (β) annually. It estimates a different slope (β) for each age-group i, which can give a better fit to the data when there are opposing trends for different age groups e.g. an increasing trend for older, but a falling trend for the younger, patients.

Model 2 is a non-linear model. This model tends to be the most conservative of the four HD models, giving projections which are often significantly lower than the other HD models and when incidence rates are increasing this model gives estimates which are closest to the assumption of no change in underlying trend (i.e. demographic change only).

Models 3 and 4 are log-linear models, which assume that the incidence rate increases by a fixed proportion (β) annually. Model 4 allows for a different slope (β) for each age-group i, whereas model 3 does not. These models provide larger estimates of future increase and smaller estimates of decrease than the linear model.

The median model estimates (with maximum and minimum) were presented for the years 2020, 2025, 2030, 2035, 2040 and 2045 (Figure 4-1 to 4-12) for defined cancer sites (Table 8-2).

Nordpred

The Nordpred software provides projections for a maximum of five future five-year periods. It fits a power age-period-cohort model, with a power coefficient of 0.2, to the historic trends, using a different slope parameter for each age group. The Nordpred software gives aggregate case numbers for the five five-year periods 2016-2020, 2021-2025, 2026-2030, 2031-2035, 2036-2040. Projected numbers for the years 2020, 2025, 2030, 2035, 2040 and 2045 were derived from these estimates by linear interpolation and extrapolation.

The application of the four HD models, Nordpred and the demographic projections to the incidence rate of all cancers combined (excl. NMSC, ICD10 C00-43, C45-96) from 2015 to 2045 is shown.

Table 8-2
Range of years with most recent stable trends; base level of HD projections

	Males Period		Females Period	
All Invasive Cancers excl. NMSC	2011	2015	2010	2015
Head and Neck	2001	2015	1994	2015
Stomach	2003	2015	1994	2015
Colon	1994	2015	1994	2015
Rectal	1994	2015	1994	2015
Lung	1994	2015	1994	2015
Melanoma	1994	2015	1994	2015
NMSC	2011	2015	2000	2015
Breast			2008	2015
Prostate	2011	2015		
Kidney	2011	2015	1994	2015
NHL	1994		1994	2015
Joinpoint constraints: maximum of 3 Joinpoint Minimum of 5 observations from a Joinpoint to either end Minimum of 4 observations between two Joinpoint [22]				

Case projections are presented graphically (Figure 4-1 to 4-12) where the demographic projections are presented up to 2045, along with the median of all projection estimates (from 1 demographic, 4 HD models and 1 Nordpred model), as well as the upper and lower estimates of these models.

Prevalence

Table 8-3 Cancer types and complete prevalence

C00-43, C45-96 all invasive cancers excl. NMSC
C01-14 mouth & pharynx
C15 oesophagus
C16 stomach
C18-20 colorectum
C22 liver and intrahepatic bile duct
C25 pancreas
C33-34 lung and trachea
C43 melanoma of skin
C50 neoplasm of breast
C51-52, C55, C57, C58 other malignant gynaecological
C53 neoplasm of cervix
C54 corpus uteri (uterine cancer)
C56 ovary
C61 prostate
C62 testis
C64 kidney, except renal pelvis
C67 bladder
C71-72 brain and spinal cord
C73 thyroid
C81 Hodgkin's disease
C82-85 non-Hodgkin lymphoma
C90 multiple myeloma
C91-95 leukaemia

Complete prevalence is defined as the number of persons surviving with cancer at a given population at a particular point in time, the index date. For a cancer registry, *limited duration prevalence* is the number of cancer survivors from observed data collected by the cancer registry since it was established (1994 for the NCRI, or 22-23 years of data; 1994-2016). It was estimated that a cancer registry must be in existence for about 50 years before *limited duration prevalence* approximates to *complete prevalence* [23]. Complete prevalence can be estimated in various ways [23,24]. We have adapted a method to extend limited duration prevalence to estimate complete prevalence [25]. This is considered a pragmatic approach which considers prevalence as an isolated statistic. However, prevalence is not an isolated measure, but depends on the dynamic interactions between historic incidence and survival data.

With the index date set at 31st December, 2016, the available cancer registry data provided 23 years of prevalence data for Ireland. The number of cancer patients alive on the index date (31/12/2016) was stratified by cancer site, sex and single year of age at the year the patient was diagnosed. To extend the limited duration prevalence for complete prevalence estimate, negative binomial regression

models were constructed for all cancers combined (C00-43, C45-96, excl. NMSC) and selected common cancers, taking the first incident cancer for each person.

For each strata (gender & year of age), the prevalence count (number alive) on the index date was the model response variable, and the predictor variable was number of years since diagnosis in those patients alive on 31/12/2016 (0-1, 1-2, 2-3…, 103-104 years). The models provided estimates for the period not covered by the registry (1993 back to 1911, where 1911 was the earliest year that any patient in our dataset could meet the inclusion criteria, i.e. cases with attained age of >104 on the index date (31/12/2016) were suppressed from the prevalence prediction, e.g. Infants <1 year at diagnosis in 1911 with attained age of 104 in 31/12/2016 just met the inclusion criteria, whereas predictions for infants of age 1 year in the distant past (1911) were suppressed as their attained age was >104 years on 31/12/2016).

Inclusion criteria: complete prevalence calculation

1. Age at diagnosis 0-99 years
2. *All invasive cancers, excluding NMSC:* Only *first* invasive tumour was considered for each person
3. *Specific cancer sites:* Only *first* invasive cancer of the given type (Table 8-2) was considered for each person.
4. Behaviour 3 (ICDO3)

Exclusion criteria: complete prevalence calculation

1. Persons with missing data on age, sex or date of diagnosis
2. Persons that died before the index date (31/12/2016)

The method used was similar to that outlined in Maddams *et al.* [25] and a recent SOP from the UKIACR [26], except that instead of stratification by broad age categories at diagnosis (i.e. 0-39, 40-69, 70+), stratification was by single year of age (0-99 at diagnosis). Unlike the UK registries which have been collating cancer incidence since 1971 (England and Scotland), 1985 (Wales) and 1993 (N.Ireland), the registry in Ireland did not begin until 1994. Therefore, the aim was to estimate the number of people who were diagnosed before 1994 and who were still alive at the end of 2016. This number was then added to the known *fixed duration prevalence* (1994-2016) to give the estimated *complete prevalence*.

A negative binomial regression model was used on each strata of cancer type, sex and single year of age (at diagnosis) to estimate the number of cancers diagnosed before 1994.

- Included a log link
- Dependent variable: number alive on index date (or censor date, 31/12/2016)

- Independent variable - years survived (0 min, 104 max, where number surviving from years 0-23 was known and numbers for years 24-104 were predicted from the regression coefficients
- Covariates: year of age at diagnosis and sex, entered in the model as a composite variable [age]*[sex].
- Offset- log: Ireland population by single year of age for each year 1924-2016 interpolating for years between censuses [27]; population for years 1911-1923 were uncertain and were set at the value for 1924.
- In keeping with the Maddams method [25], persons diagnosed during the years 2012-2016 (survived <5 years) were excluded from the modelling process, but these cases were added to the final count.

Survival analyses

Survival figures presented in this report use net survival, an 'improved' version of relative survival 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 [28]. (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. All survival estimates were age-standardised to the International Cancer Survival Standards (ICSS) [14] .

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- This work uses data provided by patients and collected by the health service as part of their care and support.

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APPENDIX I: INCIDENT CANCER CASES

Three year annual average 2013-2015 and estimates for 2016-2018	2013-2015			2016-2018 (estimate)‡			cumulative risk # to age75 (2016-2018), 1 in:	
cancer	male	female	all	male	female	all	male	female
C00-96 all invasive cancers *	17,190	14,512	31,702	18,265	15,192	33,457	2	3
C00-43 C45-96 all invasive cancers excl. NMSC	11,393	10,004	21,397	12,081	10,560	22,641	3	4
C00-D48 all registered cancers	19,017	19,869	38,886	20,306	20,771	41,077	2	2
D00-48 all non-invasive cancers **	1,827	5,357	7,185	2,041	5,579	7,620	17	7
C00 lip	20	4	23	20	4	23	2,050	>10,000
C01 base of tongue	30	10	40	35	10	45	773	2,625
C02 other and unspecified parts of tongue	50	29	80	53	31	83	526	1,018
C03 gum	13	8	22	10	11	21	2,766	4,178
C04 floor of mouth	34	6	39	32	9	41	850	2,939
C05 palate	14	8	21	16	7	22	1,966	4,415
C06 other and unspecified parts of mouth	17	15	31	16	15	32	1,953	2,430
C07 parotid gland	29	13	42	27	10	37	1,713	4,150
C08 other and unspecified salivary glands	7	3	9	5	2	7	5,119	>10,000
C09 tonsil	50	18	68	53	18	71	511	1,560
C10 oropharynx ***	20	5	25	22	5	27	1,233	6,680
C11 nasopharynx	13	5	18	14	6	20	2,165	4,883
C12 pyriform sinus	24	3	28	23	4	28	1,105	6,669
C13 hypopharynx	15	4	18	17	4	21	1,711	6,735
C14 other and ill-defined: oral cavity and pharynx	9	2	11	8	4	12	3,516	>10,000
C01-14 mouth & pharynx	324	128	452	331	136	468	87	234
C00-14 lip oral cavity and pharynx	344	132	476	351	140	491	84	231
C15 oesophagus	258	140	398	290	149	439	111	277
C16 stomach	373	210	583	391	206	597	91	192
C17 small intestine	53	39	92	49	42	92	611	777
C18 colon	956	742	1,698	1,006	808	1,814	36	50
C19 rectosigmoid junction	112	71	183	113	66	179	267	527
C20 rectum	445	227	672	490	228	717	62	156
C21 anus and anal canal	23	31	55	23	34	57	1,534	1,040
C19-20 rectosigmoid junction & rectum	557	298	855	603	294	897	51	120
C19-21 rectum and anus	580	330	910	625	328	953	49	108
C18-20 colorectum	1,512	1,041	2,553	1,608	1,102	2,710	21	35
C18-21 colorectum and anus	1,536	1,072	2,608	1,631	1,136	2,767	21	34
C17-21 intestine	1,589	1,111	2,700	1,681	1,178	2,859	20	33
C22 liver and intrahepatic bile ducts	196	75	270	200	86	285	161	457
C23 gallbladder	17	47	64	21	48	69	2,235	929
C24 other and unspecified parts of biliary tract	70	61	131	78	65	143	475	653
C23-24 gallbladder and biliary tract	87	108	196	99	113	212	392	384
C22-24 liver and biliary passages	283	183	466	299	199	498	114	209
C25 pancreas	294	255	549	281	259	540	126	158
C26 other and ill-defined digestive organs	19	20	39	25	24	49	1,327	1,831
C30 nasal cavity and middle ear	8	7	15	5	7	12	6,035	4,370
C31 accessory sinuses	9	6	15	9	6	16	2,853	4,075
C32 larynx	139	30	169	151	27	178	196	1,101
C00-14 C30-32 all head and neck	499	175	674	516	181	697	57	175
C00-15 C32 oral, pharynx, larynx & oesophagus	740	303	1,043	792	317	1,108	39	114
C33 trachea	<2	<2	<4	<2	<2	<4	>10,000	>10,000
C34 bronchus and lung	1,337	1,119	2,456	1,390	1,169	2,559	24	30
C37 thymus	3	6	9	5	4	9	5,386	6,775
C38 heart, mediastinum and pleura	6	3	10	11	8	19	4,078	5,011
C40 bone and articular cartilage of limbs	11	9	19	12	13	26	2,300	2,318
C41 bone and articular cartilage NOS	9	8	16	11	9	20	3,246	4,011
C40-41 bone and articular	11	9	19	12	13	26	2,300	2,318
C43 melanoma of skin	518	543	1,061	529	581	1,110	65	59
C44 other neoplasms of skin	5,797	4,508	10,304	6,184	4,632	10,816	6	9
C45 mesothelioma	40	5	46	44	10	54	774	3,290
C46 Kaposi sarcoma	7	<2	<9	8	<2	<10	5,470	>10,000
C47 peripheral nerves and autonomic	4	<2	<6	3	2	5	>10,000	>10,000
C48 retroperitoneum and peritoneum	7	20	28	9	19	29	4,043	1,639
C49 other connective and soft tissue	75	54	129	93	56	149	448	615
C50 breast	26	2,999	3,025	29	3,215	3,244	1,099	11
C51 vulva		54	54		58	58		684
C52 vagina		14	14		12	12		3,483
C53 cervix uteri		269	269		287	287		118
C54 corpus uteri		469	469		506	506		59
C55 uterus, part unspecified		20	20		30	30		1,184
C56 ovary		394	394		392	392		87
C57 other and unspecified female genital		22	22		34	34		1,113
C58 placenta		2	2		2	2		>10,000
C51-52, C55 C57, C58 other gynaecological		113	113		136	136		282
C60 penis	37		37	39		39	831	
C61 prostate	3,325		3,325	3,550		3,550	8	
C62 testis	174		174	168		168	193	
C63 other and unspecified male genital	4		4	4		4	>10,000	
C64 kidney, except renal pelvis	387	209	596	418	235	653	73	144
C65 renal pelvis	16	8	24	14	8	23	3,643	3,699

Three year annual average 2013-2015 and estimates for 2016-2018	2013-2015			2016-2018 (estimate)‡			cumulative risk # to age75 (2016-2018), 1 in:	
cancer	**male**	**female**	**all**	**male**	**female**	**all**	**male**	**female**
C66 ureter	16	9	25	18	8	27	2,013	4,713
C64-66 kidney incl. renal pelvis and ureter	419	226	645	451	251	702	69	134
C67 bladder	315	128	443	337	130	467	119	372
C68 other and unspecified urinary organs	3	2	5	4	3	8	>10,000	8,444
C69 eye and adnexa	34	27	60	37	28	65	791	1,133
C70 meninges	3	6	10	4	7	11	8,847	6,415
C71 brain	203	153	356	210	144	354	143	231
C72 spinal cord, cranial nerves & CNS	5	7	12	6	6	12	5,745	5,539
C71-72 brain and spinal cord	208	160	368	216	150	366	139	222
C70-72 malignant meninges, brain and CNS	211	167	378	220	157	377	137	214
C70-72 D32-33 D42-43 all meninges, brain & CNS	309	348	657	316	352	668	96	99
C73 thyroid gland	77	211	288	73	198	271	409	158
C74 adrenal gland	8	11	19	10	10	20	3,105	3,106
C75 other endocrine glands and related	7	7	14	7	8	15	4,754	4,584
C76 other and ill-defined sites	6	16	23	12	21	33	2,914	2,004
C80 neoplasm without specification of site	193	196	389	208	207	415	197	239
C81 Hodgkin lymphoma	82	66	148	87	63	150	353	495
C82 follicular nodular non-Hodgkin lymphoma	91	112	203	103	112	214	306	285
C83 diffuse non-Hodgkin lymphoma	217	151	368	229	156	385	151	230
C84 peripheral and cutaneous T-cell lymphoma	40	25	65	40	25	65	731	1,263
C85 other and unspecified non-Hodgkin lymphoma	84	69	153	106	77	183	333	456
C82-85 all non-Hodgkin lymphoma	432	357	789	478	369	847	70	92
C81-85 lymphoma (total)	514	423	937	565	432	997	59	78
C88 immunoproliferative diseases	10	6	16	11	4	15	3,039	>10,000
C90 multiple myeloma and plasma cell neoplasms	171	121	293	198	139	337	167	268
C88,C90 multiple myeloma and immunoproliferative	181	128	309	209	143	352	159	262
C91 lymphoid leukaemia	182	110	292	203	112	315	160	324
C911 leukaemia CLL	133	68	201	151	75	226	215	515
C92 myeloid leukaemia	96	74	171	107	85	192	322	403
C93 monocytic leukaemia	4	<2	<6	3	<2	<5	9,773	>10,000
C94 other leukaemias of specified cell type	7	3	10	7	2	8	4,256	>10,000
C95 leukaemia of unspecified cell type	19	16	35	20	15	34	4,186	3,237
C91-95 leukaemia	309	204	513	340	215	554	101	167
C91-95 leukaemia excl. C911 leukaemia CLL	176	136	312	189	139	328	189	250
C96 other and unspecified: haematopoietic	218	151	369	218	151	369	175	256
D00 in situ of oral cavity, oesophagus and stomach	13	9	22	18	13	31	1,520	2,378
D01 in situ of other and unspecified digestive	14	12	26	13	12	25	2,539	2,923
D02 in situ of middle ear and respiratory system	20	10	29	18	10	28	1,600	2,879
D03 melanoma in situ	286	318	605	307	332	639	105	100
D04 carcinoma in situ of skin	789	1,093	1,882	926	1,181	2,107	38	35
D05 carcinoma in situ of breast	<2	359	<361	<2	397	<399	>10,000	74
D06 carcinoma in situ of cervix uteri		2,914	2,914		2,949	2,949		12
D07 in situ of other and unspecified genital	93	50	144	107	63	170	237	495
D09 carcinoma in situ of other and unspecified	54	13	67	75	23	98	451	1,318
D18 Haemangioma and lymphangioma, any site	2	3	5	2	3	5	>10,000	9,566
D32 benign meninges	43	125	168	42	136	178	714	266
D33 benign brain and other parts of CNS	22	24	46	18	23	41	1,600	1,365
D32-33 benign meninges, brain & CNS	65	149	214	60	159	219	494	223
D35 benign other and unspecified endocrine glands	56	51	107	56	48	104	550	626
D37 uncertain or unknown behaviour of oral /digestive	31	36	67	37	41	78	825	786
D38 uncertain or unknown behaviour of middle ear	6	5	10	8	4	13	4,166	9,408
D39 uncertain/ unknown behaviour of female genital		93	93		95	95		325
D40 uncertain/ unknown behaviour of male genital	2		2	3		3	>10,000	
D41 uncertain or unknown behaviour of urinary	208	80	287	217	74	291	154	435
D42 uncertain or unknown behaviour of meninges	9	6	15	10	11	21	3,545	3,563
D43 uncertain/ unknown behaviour of brain & CNS	25	26	51	26	25	51	1,196	1,383
D42-43 uncertain meninges, brain & CNS	33	33	66	36	36	72	895	997
D44 uncertain or unknown behaviour of endocrine	11	14	25	9	12	21	3,457	2,647
D47 other uncertain/ unknown of haematopoietic	74	66	140	78	66	143	505	547
D48 uncertain or unknown of other and unspecified	67	47	114	66	59	125	603	590
HAEMACARE classification of tumours of lymphatic and haematopoietic tissue								
H01 Lymphoma NOS	14	11	25	33	25	58	1,192	1,310
H02 NH lymphoma NOS	69	58	127	72	50	122	472	690
H04 Hodgkin lymphoma nodular predominance	6	4	10	6	4	10	4,952	7,443
H05 Classical HL	76	62	138	81	59	141	380	530
H06 Chronic lymphocytic leukaemia/small lymphocytic	149	78	227	167	85	251	195	460
H07 Immunoproliferative diseases	16	10	26	17	9	25	1,993	5,069
H08 Mantle cell/centrocytic lymphoma	25	12	37	30	8	38	1,291	4,849
H09 Follicular B lymphoma	77	88	165	86	86	173	352	352
H10 Diffuse B lymphoma	152	120	271	163	127	290	208	276
H11 Burkitt lymphoma	12	4	16	13	4	16	2,457	9,566
H12 Marginal zone lymphoma	16	25	41	18	27	46	1,987	1,348
H13 T lymphoma cutaneous	15	8	24	14	11	25	2,336	3,297
H14 Other T cell lymphomas	29	22	51	29	18	47	951	1,566
H15 Lymphoblastic/Acute (precursor cell) lymphoma	37	36	72	37	29	67	912	1,140
H16 Plasma cell neoplasms	174	121	295	199	139	338	166	267
H18 Mature B cell leukaemia hairy cell	10	2	11	11	3	14	2,788	>10,000
H19 Lymphatic leukaemia NOS	<2	<2	<4	<2	2	<4	>10,000	>10,000
H20 Leukaemia NOS	19	16	35	20	15	34	4,186	3,237

Three year annual average 2013-2015 and estimates for 2016-2018	2013-2015			2016-2018 (estimate)‡			cumulative risk # to age75 (2016-2018), 1 in:	
cancer	male	female	all	male	female	all	male	female
H21 Myeloid leukaemia NOS	2	3	5	2	<2	<24	>10,000	>10,000
H22 Acute myeloid leukaemia	72	57	129	81	62	143	409	564
H23 Myeloproliferative neoplasms	111	86	197	121	100	222	279	333
H24 Myelodysplastic syndrome	115	71	186	107	65	172	406	732
H25 Myelodysplastic neoplasm NOS	18	9	27	20	9	29	1,925	3,743

*Incidence figures for C00-C96 where C96 presented in 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).
*** The ICD-10 definition C10 “Malignant neoplasm of oropharynx” is not equivalent to (and is narrower than) the definition of “oropharyngeal” used to categorise sites/subsites for purposes of identifying cancers where HPV-associated cancers may be involved. The broader, HPV-relevant definition includes the whole of C01 (base of tongue), C09 (tonsil) and C10 (oropharynx *sensu stricto*) and selected subsites within C02 (other/unspecified parts of tongue), C05 (palate) and C14 (other/ill-defined sites of lip, oral cavity & pharynx), further characterized by cell-type (squamous cell carcinoma).
‡ Average age-specific rates for 2012-2016 were calculated and applied to population estimates for 2017 and 2018, to allow estimation of average annual counts for 2016-2018 presented in the table.
Average annual counts for males and females, and M+F (all) are subject to rounding.
Cumulative risk of developing a type of cancer before age 75, expressed as 1 in […], e.g. 1 in 3

APPENDIX II: INCIDENT CANCER RATES

Age-standardised rate (ASR, per 100,000): annual average 2013-2015 with estimates for 2016-2018. Average age-specific rates for 2012-2016 were applied to population estimates for 2017 and 2018, to allow estimation of average annual age-standardised rates for 2016-2018 presented in the table.

INCIDENT CANCER RATES (annual average over 3 year intervals)	2013-2015 ASR				2016-2018 ASR (estimates)			
	MALE		FEMALE		MALE		FEMALE	
	ESP 1976	ESP 2013	ESP 1976	ESP 2013	ESP 1976	ESP 2013	ESP 1976	ESP 2013
C00-96 all invasive cancers	722.7	1,129.3	551.6	801.4	700.1	1,087.4	539.0	778.2
C00-43 C45-96 all invasive cancers excl. NMSC	481.7	731.8	387.1	545.0	467.0	704.0	382.1	534.5
C00-D48 all registered cancers	799.1	1,247.8	764.1	1,045.3	778.0	1,209.3	756.3	1,026.8
D00-48 all non-invasive cancers	76.4	118.5	212.5	243.9	77.9	121.8	217.3	248.6
C00 lip	0.8	1.3	0.1	0.2	0.7	1.2	0.1	0.2
C01 base of tongue	1.3	1.7	0.4	0.5	1.4	1.8	0.4	0.5
C02 other and unspecified parts of tongue	2.2	3.0	1.1	1.6	2.1	2.8	1.1	1.5
C03 gum	0.6	0.8	0.3	0.5	0.4	0.6	0.4	0.6
C04 floor of mouth	1.5	2.0	0.2	0.3	1.3	1.7	0.3	0.5
C05 palate	0.6	0.8	0.3	0.4	0.6	0.8	0.3	0.3
C06 other and unspecified parts of mouth	0.7	1.1	0.6	0.8	0.6	1.0	0.6	0.8
C07 parotid gland	1.2	2.1	0.5	0.7	1.0	1.9	0.4	0.5
C08 other and unspecified salivary glands	0.3	0.4	0.1	0.1	0.2	0.2	0.1	0.1
C09 tonsil	2.2	2.7	0.8	0.9	2.2	2.7	0.7	0.8
C10 oropharynx [see footnote *** to Appendix I]	0.9	1.2	0.2	0.3	0.9	1.2	0.2	0.2
C11 nasopharynx	0.6	0.7	0.2	0.2	0.6	0.7	0.2	0.3
C12 pyriform sinus	1.0	1.5	0.1	0.2	0.9	1.3	0.2	0.2
C13 hypopharynx	0.6	0.9	0.1	0.2	0.7	0.9	0.2	0.2
C14 other/ ill-defined: oropharynx	0.4	0.6	0.1	0.1	0.3	0.4	0.1	0.2
C01-14 mouth & pharynx	14.1	19.3	5.1	6.9	13.3	18.1	5.1	6.8
C00-14 lip oral cavity and pharynx	14.9	20.6	5.2	7.1	14.0	19.3	5.2	7.0
C15 oesophagus	10.9	17.1	4.9	8.3	11.1	17.5	4.8	8.1
C16 stomach	15.5	25.2	7.5	12.0	14.8	24.0	6.8	11.0
C17 small intestine	2.3	3.5	1.5	2.2	1.9	2.9	1.5	2.2
C18 colon	39.9	65.7	27.0	42.5	38.0	62.1	27.2	42.7
C19 rectosigmoid junction	4.7	7.2	2.6	4.0	4.4	6.6	2.3	3.5
C20 rectum	18.8	28.8	8.7	12.7	18.9	28.4	8.1	11.7
C21 anus and anal canal	1.0	1.5	1.2	1.8	0.9	1.4	1.3	1.7
C19-20 rectosigmoid junction & rectum	23.5	35.9	11.3	16.7	23.3	35.1	10.4	15.2
C19-21 rectum and anus	24.5	37.4	12.6	18.4	24.2	36.4	11.7	16.9
C18-20 colorectum	63.4	101.6	38.3	59.2	61.3	97.2	37.6	57.9
C18-21 colorectum and anus	64.3	103.1	39.6	60.9	62.2	98.5	38.9	59.6
C17-21 intestine	66.6	106.5	41.1	63.1	64.1	101.4	40.4	61.8
C22 liver and intrahepatic bile ducts	8.2	12.8	2.7	4.3	7.6	12.0	2.9	4.6
C23 gallbladder	0.7	1.4	1.7	2.8	0.8	1.4	1.6	2.7
C24 other and unspecified parts of biliary	2.9	4.9	2.1	3.6	2.9	4.9	2.1	3.5
C23-24 gallbladder and biliary tract	3.6	6.3	3.7	6.5	3.7	6.3	3.7	6.2
C22-24 liver and biliary passages	11.8	19.1	6.4	10.7	11.3	18.3	6.6	10.8
C25 pancreas	12.3	20.2	8.9	15.0	10.7	17.7	8.5	14.0
C26 other and ill-defined digestive organs	0.8	1.4	0.7	1.2	1.0	1.7	0.8	1.3
C30 nasal cavity and middle ear	0.3	0.5	0.3	0.4	0.2	0.3	0.3	0.4
C31 accessory sinuses	0.4	0.6	0.2	0.3	0.4	0.5	0.2	0.3
C32 larynx	5.9	8.7	1.2	1.7	5.9	8.4	1.0	1.4
C00-14 C30-32 all head and neck	21.5	30.4	6.9	9.5	20.5	28.6	6.7	9.1
C00-15 C32 oropharynx, larynx & oesophagus	31.7	46.5	11.3	17.0	31.0	45.3	11.1	16.5
C33 trachea	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0
C34 bronchus and lung	55.7	91.6	41.7	65.4	52.4	85.3	40.2	63.0
C33-34 lung and trachea	55.8	91.7	41.7	65.4	52.5	85.3	40.2	63.1
C37 thymus	0.1	0.2	0.3	0.3	0.2	0.3	0.2	0.2
C38 heart, mediastinum and pleura	0.3	0.5	0.1	0.2	0.4	0.7	0.3	0.4
C40 bone and articular cartilage of limbs	0.5	0.5	0.4	0.4	0.5	0.5	0.6	0.5
C41 bone and articular cartilage NOS	0.4	0.5	0.3	0.4	0.4	0.6	0.3	0.4
C40-41 bone and articular	0.5	0.5	0.4	0.4	0.5	0.5	0.6	0.5
C43 melanoma of skin	21.9	32.4	21.2	28.1	20.6	30.3	21.4	28.4
C44 other neoplasms of skin	241.0	397.5	164.5	256.5	233.1	383.5	156.9	243.7
C45 mesothelioma	1.6	2.8	0.2	0.3	1.6	2.8	0.4	0.5
C46 Kaposi sarcoma	0.3	0.3	-	-	0.3	0.4	0.0	0.0
C47 peripheral nerves and autonomic	0.2	0.2	0.1	0.0	0.1	0.1	0.1	0.1
C48 retroperitoneum and peritoneum	0.3	0.4	0.8	1.2	0.4	0.5	0.7	1.0
C49 other connective and soft tissue	3.2	4.7	2.1	2.8	3.6	5.6	2.1	2.7
C50 breast	1.1	1.8	122.1	157.2	1.1	1.7	122.5	156.8
C51 vulva			2.1	3.0			2.0	2.9
C52 vagina			0.5	0.8			0.4	0.6
C53 cervix uteri			11.0	12.3			11.2	12.3
C54 corpus uteri			19.1	26.0			19.0	26.1
C55 uterus, part unspecified			0.8	1.1			1.1	1.5
C56 ovary			15.4	21.6			14.2	19.9
C57 other and unspecified female genital			0.9	1.2			1.2	1.8
C58 placenta			0.1	0.1			0.1	0.1
C51-52, C55 C57, C58 other gynaecological			4.3	6.3			4.7	7.0
C60 penis	1.5	2.4			1.5	2.3		
C61 prostate	142.4	206.0			138.9	200.1		
C62 testis	7.4	7.1			7.1	6.8		
C63 other and unspecified male genital	0.2	0.2			0.1	0.2		
C64 kidney, except renal pelvis	16.4	23.6	8.1	11.6	16.4	22.9	8.5	12.0

INCIDENT CANCER RATES (annual average over 3 year intervals)	2013-2015 ASR				2016-2018 ASR (estimates)			
	MALE		FEMALE		MALE		FEMALE	
	ESP 1976	ESP 2013	ESP 1976	ESP 2013	ESP 1976	ESP 2013	ESP 1976	ESP 2013
C65 renal pelvis	0.7	1.2	0.3	0.4	0.5	0.9	0.3	0.5
C66 ureter	0.7	1.1	0.3	0.6	0.7	1.2	0.3	0.5
C64-66 kidney incl. renal pelvis and ureter	17.8	25.9	8.7	12.6	17.7	25.1	9.1	12.9
C67 bladder	13.0	23.5	4.3	7.6	12.5	22.1	4.1	7.1
C68 other and unspecified urinary organs	0.1	0.2	0.1	0.1	0.2	0.3	0.1	0.2
C69 eye and adnexa	1.5	2.0	1.1	1.4	1.5	2.0	1.1	1.4
C70 meninges	0.1	0.2	0.2	0.3	0.2	0.2	0.2	0.4
C71 brain	8.7	11.4	6.1	7.8	8.4	11.0	5.4	6.9
C72 spinal cord, cranial nerves & CNS	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.2
C71-72 brain and spinal cord	8.9	11.7	6.4	8.1	8.6	11.3	5.7	7.2
C70-72 malignant meninges, brain and CNS	9.0	11.8	6.6	8.5	8.8	11.5	5.9	7.5
C70-72 D32-33 D42-43 all brain & CNS	13.2	17.3	13.8	17.7	12.6	16.3	13.2	16.9
C73 thyroid gland	3.3	4.1	8.7	9.8	2.9	3.6	7.8	8.8
C74 adrenal gland	0.3	0.3	0.5	0.5	0.4	0.5	0.4	0.5
C75 other endocrine glands and related	0.3	0.4	0.3	0.3	0.3	0.4	0.3	0.3
C76 other and ill-defined sites	0.3	0.5	0.6	0.9	0.4	0.7	0.7	1.1
C80 neoplasm without specification of site	8.1	14.4	6.4	11.5	7.8	13.6	6.4	11.3
C81 Hodgkin lymphoma	3.6	3.9	2.8	3.0	3.6	4.1	2.6	2.7
C82 follicular nodular non-Hodgkin lymphoma	3.9	5.3	4.5	6.1	4.1	5.5	4.1	5.7
C83 diffuse non-Hodgkin lymphoma	9.1	13.5	5.7	8.5	8.8	13.3	5.4	8.2
C84 peripheral and cutaneous T-cell lymphoma	1.7	2.2	1.0	1.3	1.6	2.1	0.9	1.2
C85 other and unspecified non-Hodgkin lymphoma	3.5	5.7	2.5	4.0	4.1	6.5	2.6	4.1
C82-85 all non-Hodgkin lymphoma	18.3	26.7	13.7	19.9	18.6	27.5	13.1	19.2
C81-85 lymphoma	21.9	30.6	16.5	22.9	22.2	31.6	15.7	21.9
C88 immunoproliferative diseases	0.4	0.7	0.2	0.4	0.4	0.7	0.1	0.2
C90 multiple myeloma	7.2	11.4	4.5	7.0	7.6	11.8	4.7	7.5
C88,90 multiple myeloma & immunoproliferative	7.6	12.1	4.7	7.3	8.0	12.5	4.8	7.7
C91 lymphoid leukaemia	7.7	10.9	4.3	5.6	8.0	11.3	4.1	5.5
C911 leukaemia CLL	5.6	8.8	2.5	3.9	5.8	9.1	2.5	4.0
C92 myeloid leukaemia	4.0	6.1	2.9	4.0	4.1	6.1	3.1	4.1
C93 monocytic leukaemia	0.2	0.2	0.0	0.0	0.1	0.2	0.1	0.1
C94 other leukaemias of specified cell type	0.3	0.4	0.1	0.2	0.2	0.4	0.1	0.1
C95 leukaemia of unspecified cell type	0.8	1.6	0.5	0.9	0.7	1.5	0.4	0.8
C91-95 leukaemia	13.0	19.3	7.8	10.8	13.2	19.5	7.8	10.6
C91-95 leukaemia excl. C911 leukaemia CLL	7.4	10.5	5.3	6.8	7.4	10.4	5.2	6.5
C96 other and unspecified: haematopoietic	9.1	15.0	5.6	8.5	8.2	13.3	5.1	7.9
D00 in situ of oral cavity, oesophagus and stomach	0.6	0.8	0.3	0.5	0.7	1.0	0.5	0.7
D01 in situ of other and unspecified digestive	0.6	0.8	0.5	0.6	0.5	0.7	0.4	0.6
D02 in situ of middle ear and respiratory system	0.8	1.2	0.4	0.5	0.7	1.0	0.4	0.5
D03 melanoma in situ	12.0	18.1	12.5	17.2	11.8	17.6	12.1	16.6
D04 carcinoma in situ of skin	32.8	53.7	38.6	65.1	34.8	58.1	38.3	64.9
D05 carcinoma in situ of breast	0.0	0.0	15.8	18.0	0.1	0.1	16.3	18.7
D06 carcinoma in situ of cervix uteri			118.6	109.3			123.5	113.8
D07 in situ of other and unspecified genital	4.0	5.2	2.1	2.4	4.3	5.6	2.5	2.9
D09 carcinoma in situ of other and unspecified	2.2	3.7	0.5	0.7	2.8	4.6	0.8	1.2
D18 Haemangioma and lymphangioma	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
D32 benign meninges	1.8	2.8	4.8	6.7	1.6	2.4	4.9	6.7
D33 benign brain and other parts of CNS	1.0	1.1	1.0	1.2	0.7	0.8	0.9	1.1
D32-33 benign meninges, brain & CNS	2.7	3.9	5.8	7.8	2.4	3.2	5.8	7.8
D35 benign other and unspecified endocrine glands	2.4	3.0	2.1	2.4	2.2	2.9	1.9	2.2
D37 uncertain/ unknown behaviour of oral /digestive	1.3	1.9	1.5	1.9	1.5	2.1	1.5	2.0
D38 uncertain/ unknown behaviour of middle ear	0.3	0.3	0.2	0.2	0.3	0.4	0.2	0.2
D39 uncertain/unknown behaviour of female genital			3.9	4.4	0.0	0.0	3.8	4.3
D40 uncertain unknown behaviour of male genital	0.1	0.1			0.1	0.1		
D41 uncertain or unknown behaviour of urinary	8.7	13.5	3.1	4.5	8.3	13.1	2.7	3.9
D42 uncertain or unknown behaviour of meninges	0.4	0.4	0.3	0.3	0.4	0.5	0.4	0.5
D43 uncertain/ unknown behaviour of brain & CNS	1.0	1.1	1.1	1.1	1.1	1.1	1.0	1.0
D42-43 uncertain meninges, brain & CNS	1.4	1.5	1.4	1.4	1.5	1.6	1.5	1.5
D44 uncertain or unknown behaviour of endocrine	0.5	0.5	0.6	0.7	0.4	0.4	0.5	0.5
D47 other uncertain/ unknown of haematopoietic	3.1	5.3	2.5	3.8	2.9	4.9	2.3	3.5
D48 uncertain or unknown of other and unspecified	2.8	4.6	2.0	2.2	2.5	4.1	2.3	2.7
HAEMACARE classification of tumours of haematopoietic tissue								
H01 Lymphoma NOS	0.6	1.1	0.4	0.6	1.3	2.1	0.9	1.4
H02 NH lymphoma NOS	2.9	4.6	2.1	3.4	2.8	4.3	1.7	2.7
H04 Hodgkin lymphoma nodular predominance	0.3	0.3	0.2	0.2	0.2	0.3	0.1	0.2
H05 Classical HL	3.3	3.6	2.6	2.8	3.4	3.9	2.5	2.6
H06 Chronic lymphocytic leukaemia/small lymphocytic	6.3	9.8	2.9	4.5	6.4	10.0	2.9	4.5
H07 Immunoproliferative diseases	0.7	1.1	0.4	0.6	0.6	1.0	0.3	0.5
H08 Mantle cell/centrocytic lymphoma	1.1	1.6	0.4	0.7	1.1	1.9	0.3	0.4
H09 Follicular B lymphoma	3.3	4.4	3.5	4.8	3.4	4.5	3.2	4.4
H10 Diffuse B lymphoma	6.3	9.6	4.5	6.7	6.3	9.4	4.4	6.7
H11 Burkitt lymphoma	0.5	0.5	0.2	0.2	0.5	0.6	0.1	0.2
H12 Marginal zone lymphoma	0.7	1.0	1.0	1.4	0.7	1.1	1.0	1.4
H13 T lymphoma cutaneous	0.6	0.9	0.3	0.5	0.6	0.8	0.4	0.5
H14 Other T cell lymphomas	1.3	1.6	0.9	1.1	1.1	1.5	0.7	0.9
H15 Lymphoblastic/Acute(precursor cell) lymphoma	1.6	1.4	1.6	1.3	1.6	1.4	1.3	1.1
H16 Plasma cell neoplasms	7.3	11.6	4.5	7.0	7.7	11.9	4.7	7.5
H18 Mature B cell leukaemia hairy cell	0.4	0.5	0.1	0.1	0.4	0.6	0.1	0.1
H19 Lymphatic leukaemia NOS	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1
H20 Leukaemia NOS	0.8	1.6	0.5	0.9	0.7	1.5	0.4	0.8
H21 Myeloid leukaemia NOS	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
H22 Acute myeloid leukaemia	3.0	4.6	2.2	3.1	3.1	4.7	2.2	3.0
H23 Myeloproliferative neoplasms	4.7	6.7	3.4	4.6	4.7	6.8	3.6	5.0
H24 Myelodysplastic syndrome	4.7	8.8	2.5	4.2	3.9	7.1	2.0	3.5
H25 Myelodysplastic neoplasm NOS	0.7	1.3	0.3	0.5	0.7	1.3	0.3	0.4

APPENDIX III: MORTALITY

Annual average 2013-2015

MORTALITY (annual average over 3 years)	DEATHS			RATE/100,000				cumulative risk of death to age 75 # 1 in:	
	males	females	all	males		females		males	females
ICD10 cancer sites				ESP 1976	ESP 2013	ESP 1976	ESP 2013		
C00-C96, D00-D48 all neoplasms	4,805	4,279	9,084	200.5	358.1	149.3	248.8	8	10
C00-96 all invasive cancers	4,691	4,184	8,875	195.7	348.4	146.4	243.1	8	10
C00-96 all invasive cancers excl. lung	3,581	3,353	6,934	149.5	268.5	116.9	194.2	11	13
C00-14 lip, oral cavity and pharynx	124	48	172	5.3	8.2	1.7	2.7	235	794
C00-14, C30-32 all head and neck	184	57	241	7.8	12.3	2.0	3.2	163	638
C00-15, C32 oral cavity, pharynx, larynx & oesophagus	445	176	621	18.8	30.3	6.0	10.2	69	241
C15 oesophagus	267	120	387	11.3	18.4	4.0	7.0	116	380
C16 stomach	199	133	332	8.3	14.3	4.4	7.7	179	392
C17 small intestine	13	14	27	0.5	0.9	0.5	0.8	2,648	2,592
C18 colon	279	223	502	11.7	22.0	7.1	13.3	143	247
C19-21 rectum and anus	308	200	509	12.9	22.4	6.9	11.7	113	214
C18-21 colorectum and anus	587	423	1,011	24.6	44.5	14.0	25.0	63	115
C17-21 intestine	600	437	1,038	25.2	45.4	14.5	25.8	62	110
C22 liver and intrahepatic bile ducts	188	121	309	7.8	13.3	4.1	7.3	175	364
C23-24 gallbladder and biliary tract	19	36	55	0.8	1.5	1.2	2.1	2,330	1,407
C22-24 liver and biliary passages	207	157	364	8.6	14.7	5.3	9.4	162	289
C25 pancreas	269	249	519	11.2	19.4	8.4	14.8	121	168
C32 larynx	53	8	61	2.3	3.7	0.3	0.4	583	3,869
C33-34 lung and trachea	1,060	805	1,864	44.1	75.3	28.8	47.3	31	45
C43 melanoma of skin	86	72	158	3.6	6.2	2.5	4.1	411	648
C45 mesothelioma	30	3	33	1.2	2.1	0.1	0.2	1,022	9,981
C50 breast	5	706	711	0.2	0.4	26.0	39.8	8,951	52
C53 cervix uteri		86	86			3.5	4.4		358
C54 corpus uteri		97	97			3.4	5.8		371
C56 ovary		269	269			10.0	15.5		126
C61 prostate	522		522	21.6	47.3			123	
C62 testis	4		4	0.2	0.2			7,627	
C64 kidney	151	85	236	6.3	10.4	2.9	5.1	227	489
C67 bladder	158	75	233	6.5	13.2	2.3	4.6	353	819
C70-72 malignant meninges, brain & CNS	169	123	291	7.2	10.0	4.8	6.5	166	238
D32-33 benign meninges, brain & CNS	10	12	23	0.4	0.8	0.4	0.7	4,026	5,133
D42-43 uncertain meninges, brain & CNS	10	9	18	0.4	0.7	0.3	0.5	3,141	6,098
C70-72, D32-33, D42-43 all meninges, brain & CNS	189	144	332	8.0	11.5	5.5	7.8	152	219
C73 thyroid gland	12	19	31	0.5	0.9	0.6	1.1	2,384	3,231
C81 Hodgkin lymphoma	14	10	24	0.6	0.9	0.3	0.6	1,945	3,353
C82-85 non-Hodgkin lymphoma	147	128	275	6.1	10.6	4.3	7.5	259	359
C88, C90 multiple myeloma	95	80	175	4.0	7.5	2.6	4.8	416	668
C91-95 leukaemia	151	100	251	6.2	11.3	3.4	5.9	250	421

source of data: Central Statistics Office, Ireland
*Rates are standardised to the 1976 European standard population
cumulative risk to age 75 of dying of cancer, expressed as 1 in [...], e.g. 1 in 10

APPENDIX IV: PREVALENCE ESTIMATION

Complete prevalence by cancer type, gender and age: number of cancer survivors on 31/12/2016

	AGE‡	FEMALES	%	MALES	%	All	%
mouth & pharynx	<50	186	17.7%	246	13.0%	432	14.7%
	50+	867	82.3%	1,638	87.0%	2,505	85.3%
total		1,053		1,884		2,937	
oesophagus	<50	19	4.0%	32	4.2%	51	4.1%
	50+	456	96.0%	738	95.8%	1,194	95.9%
total		475		770		1,245	
stomach	<50	74	9.1%	85	6.4%	159	7.4%
	50+	734	90.9%	1,244	93.6%	1,978	92.6%
total		808		1,329		2,137	
colorectum	<50	583	6.3%	493	4.3%	1,075	5.2%
	50+	8,623	93.7%	10,927	95.7%	19,550	94.8%
total		9,205		11,420		20,625	
liver	<50	33	19.3%	69	16.3%	102	17.2%
	50+	139	80.7%	353	83.7%	492	82.8%
total		172		422		594	
pancreas	<50	36	8.7%	26	7.4%	62	8.1%
	50+	374	91.3%	328	92.6%	702	91.9%
total		410		354		764	
lung	<50	148	5.1%	121	4.3%	269	4.7%
	50+	2,776	94.9%	2,693	95.7%	5,469	95.3%
total		2,923		2,814		5,738	
melanoma of skin	<50	1,743	22.8%	863	18.5%	2,605	21.2%
	50+	5,885	77.2%	3,803	81.5%	9,688	78.8%
total		7,628		4,666		12,294	
breast	<50	4,400	11.1%	14	6.2%	4,414	11.1%
	50+	35,139	88.9%	212	93.8%	35,351	88.9%
total		39,539		226		39,765	
other gynae	<50	145	15.0%			145	15.0%
	50+	820	85.0%			820	85.0%
total		965				965	
cervix	<50	1,607	38.3%			1,607	38.3%
	50+	2,590	61.7%			2,590	61.7%
total		4,196				4,196	
corpus uteri	<50	206	3.8%			206	3.8%
	50+	5,217	96.2%			5,217	96.2%
total		5,423				5,423	
ovary	<50	457	15.1%			457	15.1%
	50+	2,568	84.9%			2,568	84.9%
total		3,025				3,025	
prostate	<50			275	0.8%	275	0.8%
	50+			34,850	99.2%	34,850	99.2%
total				35,125		35,125	
testis	<50			2,371	53.6%	2,371	53.6%
	50+			2,054	46.4%	2,054	46.4%
total				4,424		4,424	
kidney	<50	298	16.1%	406	14.0%	704	14.8%
	50+	1,547	83.9%	2,492	86.0%	4,039	85.2%
total		1,844		2,898		4,742	
bladder	<50	38	2.3%	81	2.4%	119	2.3%
	50+	1,576	97.7%	3,385	97.6%	4,960	97.7%
total		1,613		3,466		5,079	
brain & CNS	<50	497	54.8%	545	52.0%	1,042	53.3%
	50+	411	45.2%	502	48.0%	913	46.7%
total		908		1,047		1,954	
thyroid	<50	1,026	46.7%	226	35.0%	1,252	44.1%
	50+	1,169	53.3%	420	65.0%	1,589	55.9%
total		2,196		646		2,842	
Hodgkin lymphoma	<50	701	58.4%	738	50.6%	1,440	54.1%
	50+	500	41.6%	722	49.4%	1,222	45.9%
total		1,201		1,461		2,661	
non-Hodgkin	<50	484	13.8%	720	18.5%	1,204	16.3%
	50+	3,021	86.2%	3,179	81.5%	6,200	83.7%
total		3,505		3,900	2.4%	7,404	
multiple myeloma	<50	35	5.1%	59	6.2%	94	5.7%
	50+	647	94.9%	900	93.8%	1,546	94.3%
total		682		959		1,640	
leukaemia	<50	759	34.6%	818	27.3%	1,577	30.4%
	50+	1,434	65.4%	2,184	72.7%	3,618	69.6%
		2,193		3,002		5,195	

†other gynae: other gynaecological malignancies: vulva, vagina, uterus (NOS) and placenta; ‡ age on 31/12/2016