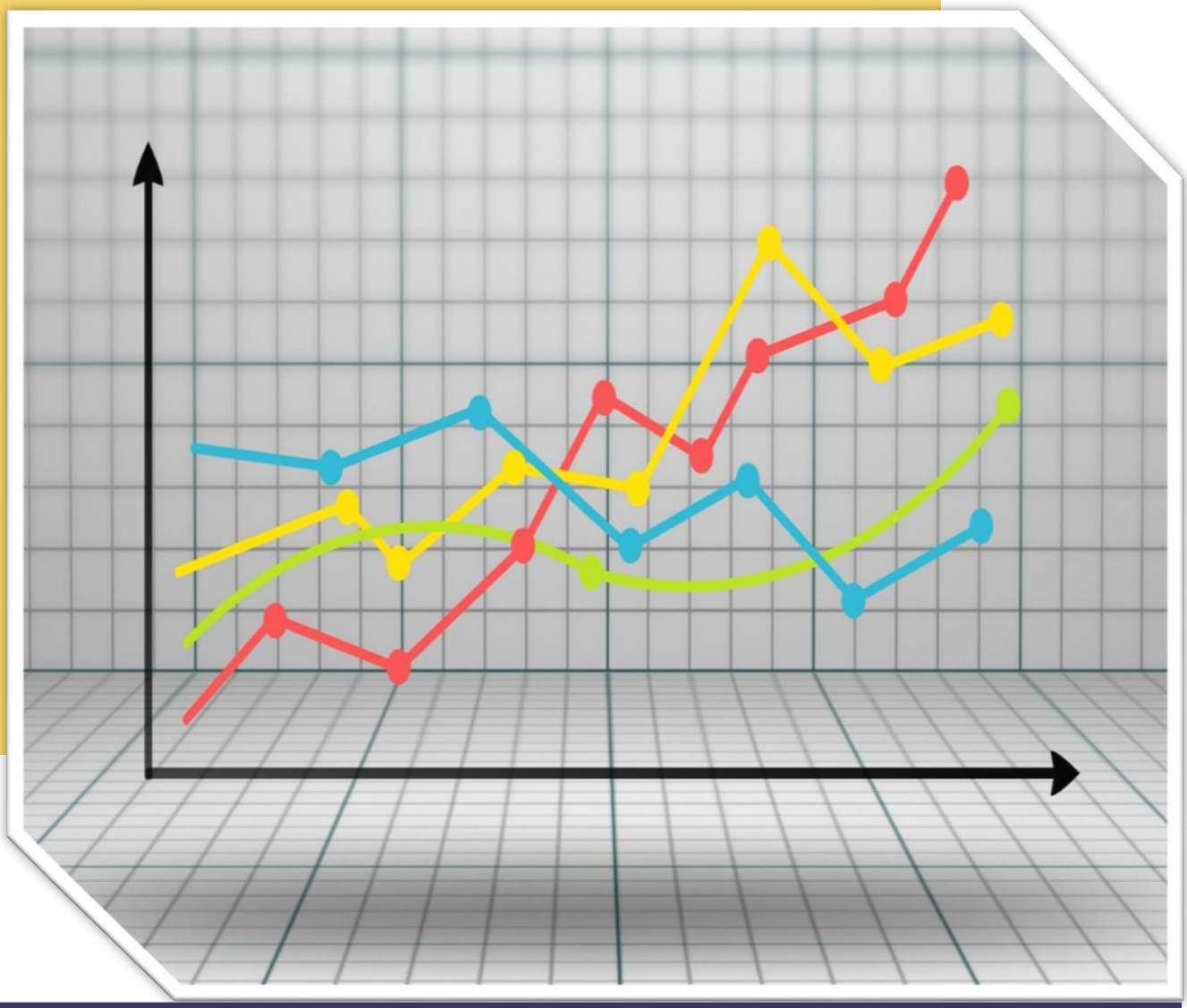

CANCER INCIDENCE PROJECTIONS FOR IRELAND 2020-2045

2019

National Cancer Registry Ireland

GLOSSARY	
95% CI	95% confidence interval
ASR	Age-standardised rate (European standard population)
CNS	Central nervous system
CSO	Central Statistics Office
ESP	European Standard Population
HD	Hakulinen-Dyba (projection models)
IARC	International Agency for Research on Cancer
ICD	International Statistical Classification of Diseases and Related Health Problems
NCRI	National Cancer Registry, Ireland
NMSC	Non-melanoma skin cancer

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FOREWORD

The most recent annual statistical report of the National Cancer Registry, published in November 2018, provided a summary of projected changes in the cancer incidence burden in Ireland over the coming decades, up to 2045. Fuller details are provided in this report, covering a wider range of cancers, updating the last detailed report, published in 2014, which projected cancer incidence to 2040.

There is no doubt that population growth and ageing will result in substantial increases in numbers of cancers diagnosed in Ireland over the coming decades, with resultant increases in the demands on cancer healthcare services. Potentially, between 2015 and 2045, we could see a doubling of the number of cases diagnosed annually if current cancer rates continue to apply.

Nevertheless, there are some grounds for optimism. Recent trends in age-standardised cancer incidence rates, which reflect the risk of an individual being diagnosed with cancer, appear to show a levelling-off or even a decline for a range of cancers. If these recent trends continue, increases in numbers of cancers diagnosed may prove to be substantially smaller, but they are still likely to amount to at least a 50% increase by 2045. But even that more limited increase in projected numbers of cancers will depend on sustained and where possible expanded public health and cancer prevention interventions aimed at reducing the risk of cancer diagnosis at the individual and population level.

Following the publication of this report, the NCRI plans to produce a report in late 2019 focusing on the contribution of various risk factors to the cancer incidence burden in Ireland. That report will also consider how changes in the exposure to these risk factors could impact on future incidence of cancer. A further report will examine treatment projections in more detail and consider the economic implications.

Professor Kerri Clough-Gorr
Director
National Cancer Registry

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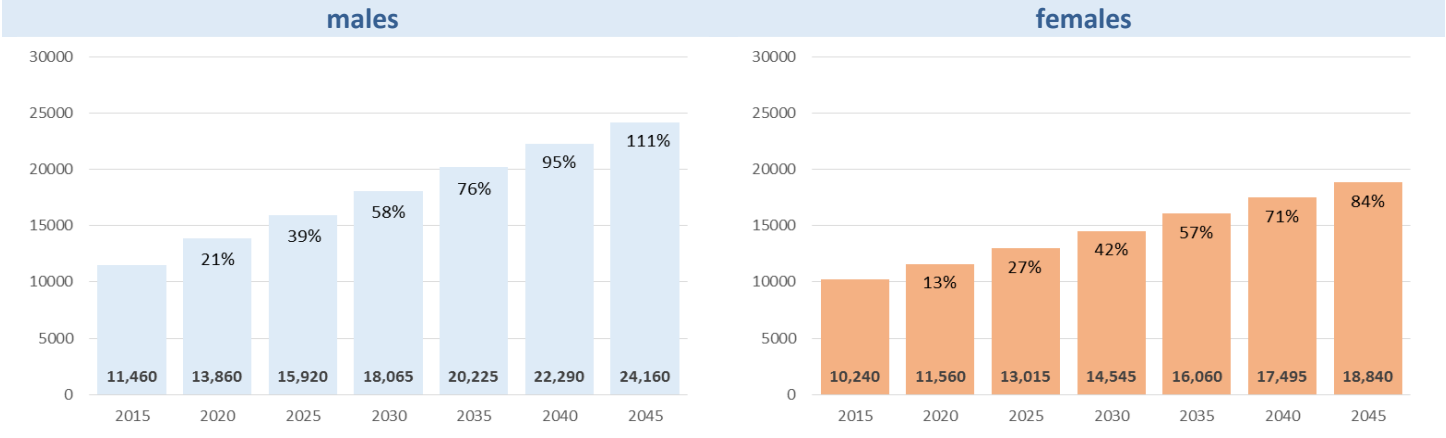
Who are we, and what do we do?

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.

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. As the population is expected to continue to increase, it is likely that the numbers of cancer cases 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 non-melanoma skin cancer (NMSC), are summarised in the following figure.

Projections: All invasive cancers, excluding NMSC



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 overall if recent trends, including declines, in some cancers continue.

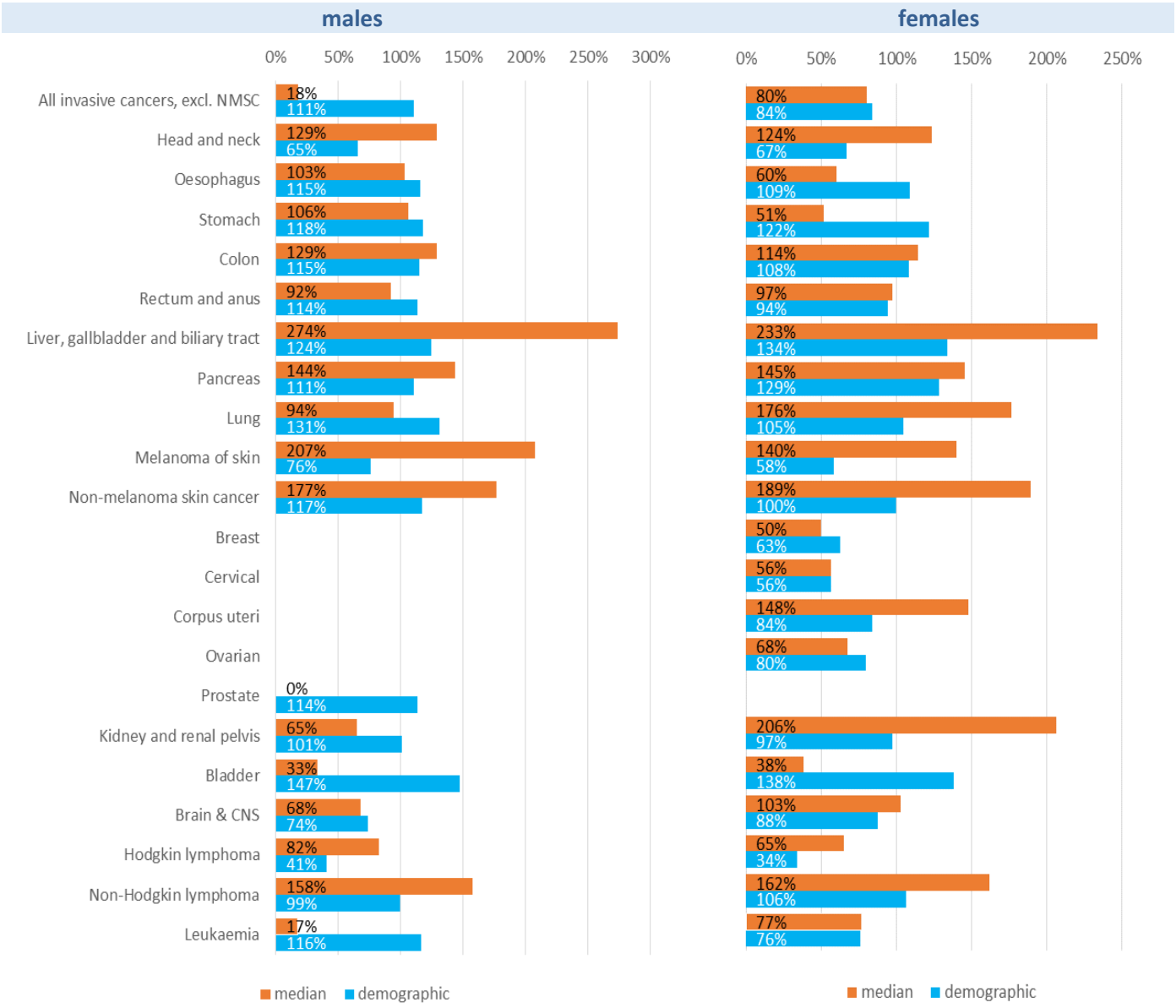
The number of projected cases can vary widely depending on the assumptions used. In this report, six different projection models were used, and the resulting projected total cases increased by between 27% and 143%.

The picture varies even more widely when looking at individual cancer sites. The figure on the next page shows the projected percentage increase in the number of cancer cases between 2015 and 2045, by cancer site and sex. The percentage increases are presented for two models, the demographic model which assumes risk of cancer is the same in the future as it is now, and the median of all projections. The median projection gives an estimate of the middle point of all the projection models and takes into account the range of alternative projections, depending on to what extent recent or longer-term trends in cancer rates (or individual risk of being diagnosed with cancer) carry on into the future.

Longer-term projections for individual cancer sites can have additional uncertainty when screening programmes are in place, as these can lead to initial increases followed by later decreases in cancer rates. Recent downward trends in breast and cervical cancer incidence rates are likely to be in part the result of the national screening programmes, BreastCheck and CervicalCheck. A recent decline in prostate cancer incidence rates may reflect high levels of PSA testing from the mid-1990s on (in effect, a form of unorganised screening). It is not clear if these declining trends are likely to continue into the future, and changes in trends in the years to come make it less likely that the projections presented in this report will accurately reflect future case counts. Changes in the trend in incidence rates for colon or rectal cancers may also occur, following the recent introduction of the BowelScreen programme.

Potential changes in trends in risk factors, such as rates of smoking, alcohol consumption, obesity rates and exposure to UV radiation could also impact on incidence rates for specific cancer sites, causing incidence to decrease (e.g. due to lower rates of smoking) or increase (e.g. due to higher rates of obesity) in the future. The contribution of these risk factors to incidence rates and trends is not examined in this report, but will be looked at in detail in a report due to be released in November 2019.

Summary Figure: Projected percentage increase in number of cancer cases 2015-2045, by cancer site and sex



For individual cancer types in males, the increases in case numbers ranged from 41% (Hodgkin lymphoma) to 147% (bladder) using demographic projections, or from 0% (prostate) to 274% (liver, gallbladder and biliary tract) using the median projection.

For females, the increases in case numbers ranged from 34% (Hodgkin lymphoma) to 138% (bladder) using demographic projections, or from 38% (bladder) to 233% (liver, gallbladder and biliary tract) using the median projection.

This illustrates the wide variation in projections when different assumptions are used. But, overall, these projections indicate that at least a 50% increase, and potentially a doubling, in annual cancer case numbers, for all invasive cancers excluding NMSC, is likely to be seen between 2015 and 2045.

1. TECHNICAL SUMMARY

General methodology

Cancer incidence data from the National Cancer Registry from 1994 to 2015 and population projections from the Irish 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.

Cancer sites

Projections for the 21 major cancer groups listed in Table 1.1, as well as all cancers combined excluding non-melanoma skin cancer, are presented in this report.

Table 1.1. Cancer sites and groups of cancer for which projections are presented in this report

Cancer site	ICD10 codes
All invasive cancers, excl. NMSC	C00-43,C45-96
Head and neck	C01-C14, C30-32
Oesophagus	C15
Stomach	C16
Colon	C18
Rectum and anus	C19-21
Liver, gallbladder and biliary tract	C22-24
Pancreas	C25
Lung	C34
Melanoma of skin	C43
Non-melanoma skin cancer	C44
Female breast	C50
Cervix uteri	C53
Corpus uteri	C54
Ovary	C56
Prostate	C61
Kidney and renal pelvis	C64-65
Bladder	C67
Brain & central nervous system (CNS)	C70-72
Hodgkin lymphoma	C81
Non-Hodgkin lymphoma	C82-85
Leukaemia	C91-95

Projection methods

A number of different estimation methods were used:

1) Demographic projections, which apply the average annual age-specific incidence rates for 2011-2015 to the future projected populations provided by the CSO. These assume that there are no changes in the underlying incidence rates over time and therefore make the fewest assumptions.

2) Age-period methods, as described by Hakulinen and Dyba (HD) [1-3], which apply linear, non-linear and log-linear models to historical data.
3) The Nordpred method [4,5], which uses a special version of the age-period-cohort model with a power link.

The advantages and limitations of cancer projections have been described in previous reports [6-9]. 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 figures in this report highlight projections based on demographic changes and the median of all projections generated, with the full range of available projections also shown (highlighting the variability of projections, reflecting different model assumptions).

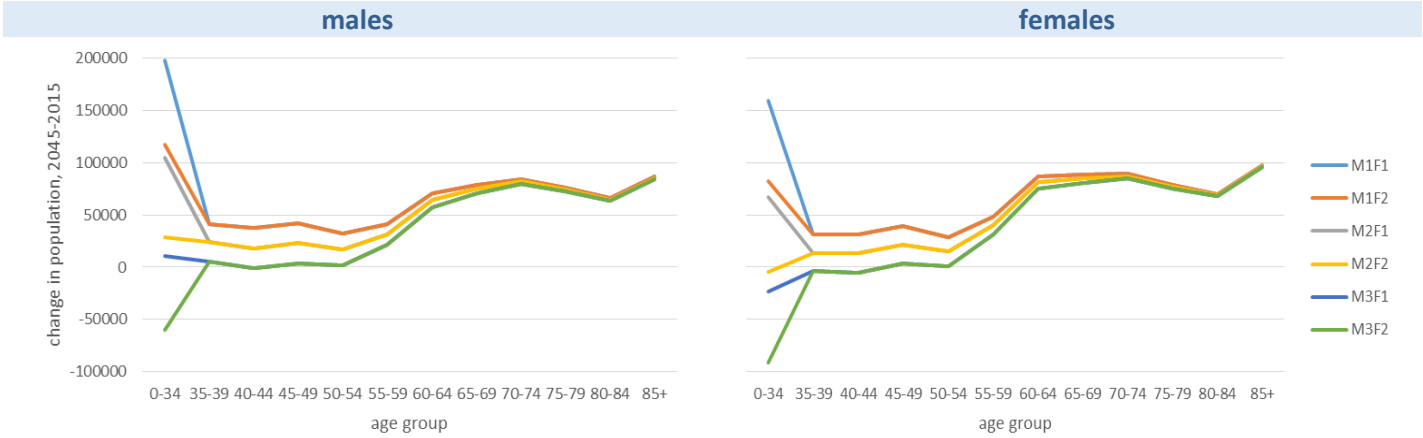
Projected population changes 2020-2045

The cancer case projections in this report are based on the population projections of the CSO. The CSO population projections [10], are themselves based on different assumptions regarding mortality, migration (M) and fertility (F). These give expected population numbers for each year 2020-2045, by five year age group and sex.

Six different population projections, based on combinations of the above assumptions, have been published by the CSO (M1F1-M3F2). Three migration assumptions and two fertility assumptions are used. The mortality assumptions are the same for all population projections.

Figure 1.1 shows the differences between the 2015 population and the projected 2045 populations for the different assumptions. The youngest age groups have the widest variation in population projections. For most ages over 50 the projections suggest a population increase of between 50,000 and 100,000 in each five-year age group.

Figure 1.1. Projected population increase 2015 to 2045, by age group and population growth model

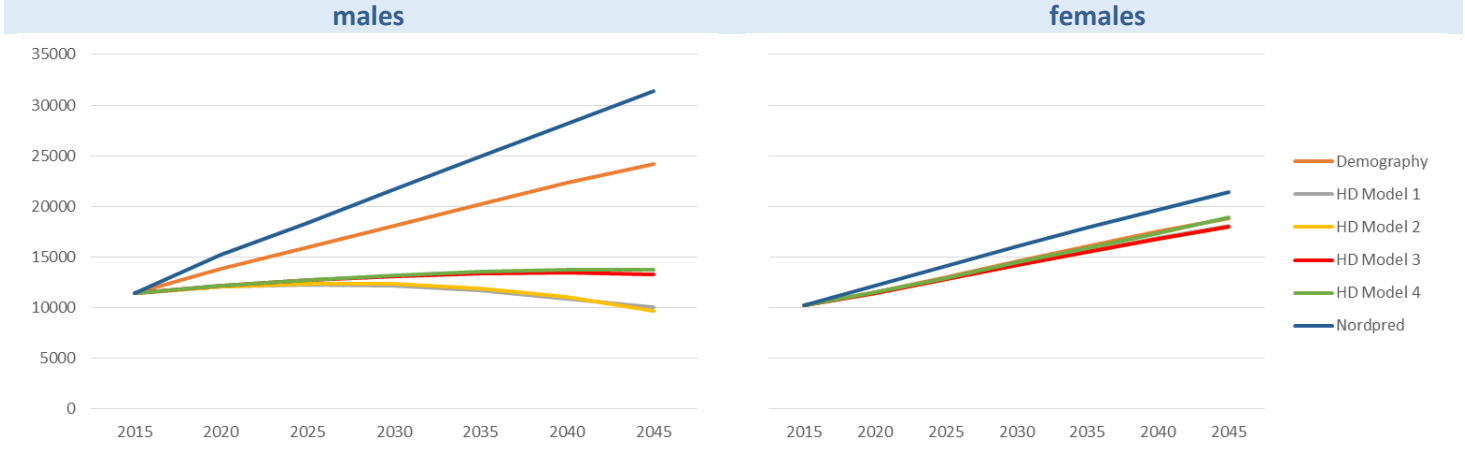


As most of the difference between the models is in the population under 60, who have a low cancer incidence, the impact of using different population projections is relatively small, with a 5-6% difference between the smallest and largest incidence projection by 2045.

The different fertility assumptions made almost no difference to the incidence projections. The M1 migration assumption gives the highest incidence projections, and the M3 assumption gives the lowest. For this report, the M2F1 population projections have been used as they produce projected case numbers which are approximately midway between the lowest and highest estimates.

Projections of overall numbers of cancers from 2020 to 2045, based on the four HD models, Nordpred and the demographic approach, are shown in Figure 1.2. For females, the projections made by the six models are broadly similar, reflecting the fact that trends in age-standardised rates for females have been quite stable over time. For males, on the other hand, the projections are very different, based on the different models used, as a recent decline in the age-standardised rates is factored in to the HD models but is not reflected in the Nordpred projection (which is based on longer-term rate trends) or the demographic projection (which assumes no rate trend).

Figure 1.2. Projections of cancer cases based on HD models 1-4, Nordpred and demographic models, using M2F1 population; all invasive cancers excluding NMSC

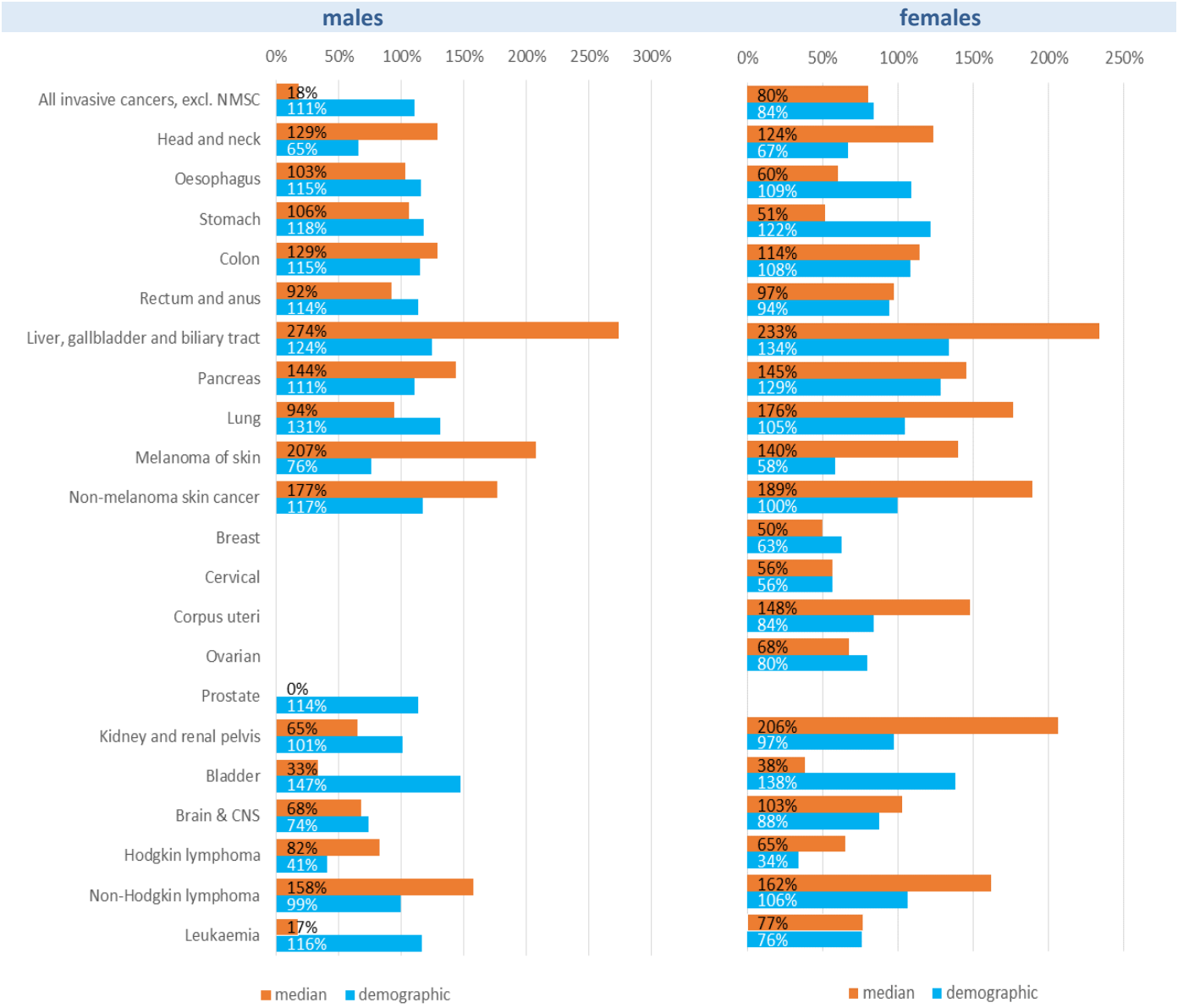


Incidence projections 2020-2045

Figure 1.3 below shows the projected percentage increase in the number of cancer cases between 2015 and 2045, by cancer site and sex.

For all cancers combined, excluding non-melanoma skin cancer, the demographic model projected an increase of 111% increase for males and an 80% increase for females – a doubling of numbers overall. The median model projections showed a similar picture for females with an 84% increase in incidence, whereas for males the position was very different, showing a much more modest projected increase of only 18% - about a 50% increase overall for males and females combined.

Figure 1.3. Projected percentage increase in number of cancer cases 2015-2045, by cancer site and sex



Longer-term projections for individual cancer sites can have additional uncertainty when screening programmes are in place, as these can lead to initial increases followed by later decreases in cancer rates. Recent downward trends in breast and cervical cancer incidence rates are likely to be in part the result of the national screening programmes, BreastCheck and CervicalCheck. A recent decline in prostate cancer incidence rates may reflect high levels of PSA testing from the mid-1990s on (in effect, a form of unorganised screening). It is not clear if these declining trends are likely to continue into the future, and changes in trends in the years to come make it less likely that the projections presented in this report will accurately reflect future case counts. Changes in the trend in incidence rates for colon or rectal cancers may also occur, following the recent introduction of the BowelScreen programme.

Potential changes in trends in risk factors, such as rates of smoking, alcohol consumption, obesity rates and exposure to UV radiation could also impact on incidence rates for specific cancer sites, causing incidence to decrease (e.g. due to lower rates of smoking) or increase (e.g. due to higher rates of obesity) in the future. The contribution of these risk factors to incidence rates and trends is not examined in this report, but will be looked at in detail in a report due to be released in November 2019.

Across individual cancer types, for males, the increases in case numbers ranged from 41% (Hodgkin lymphoma) to 147% (bladder) using demographic projections, and from 0% (prostate) to 274% (liver, gallbladder and biliary tract) using the median projection.

For females, the increases in case numbers ranged from 34% (Hodgkin lymphoma) to 138% (bladder) using demographic projections, and from 38% (bladder) to 233% (liver, gallbladder and biliary tract) using the median projection.

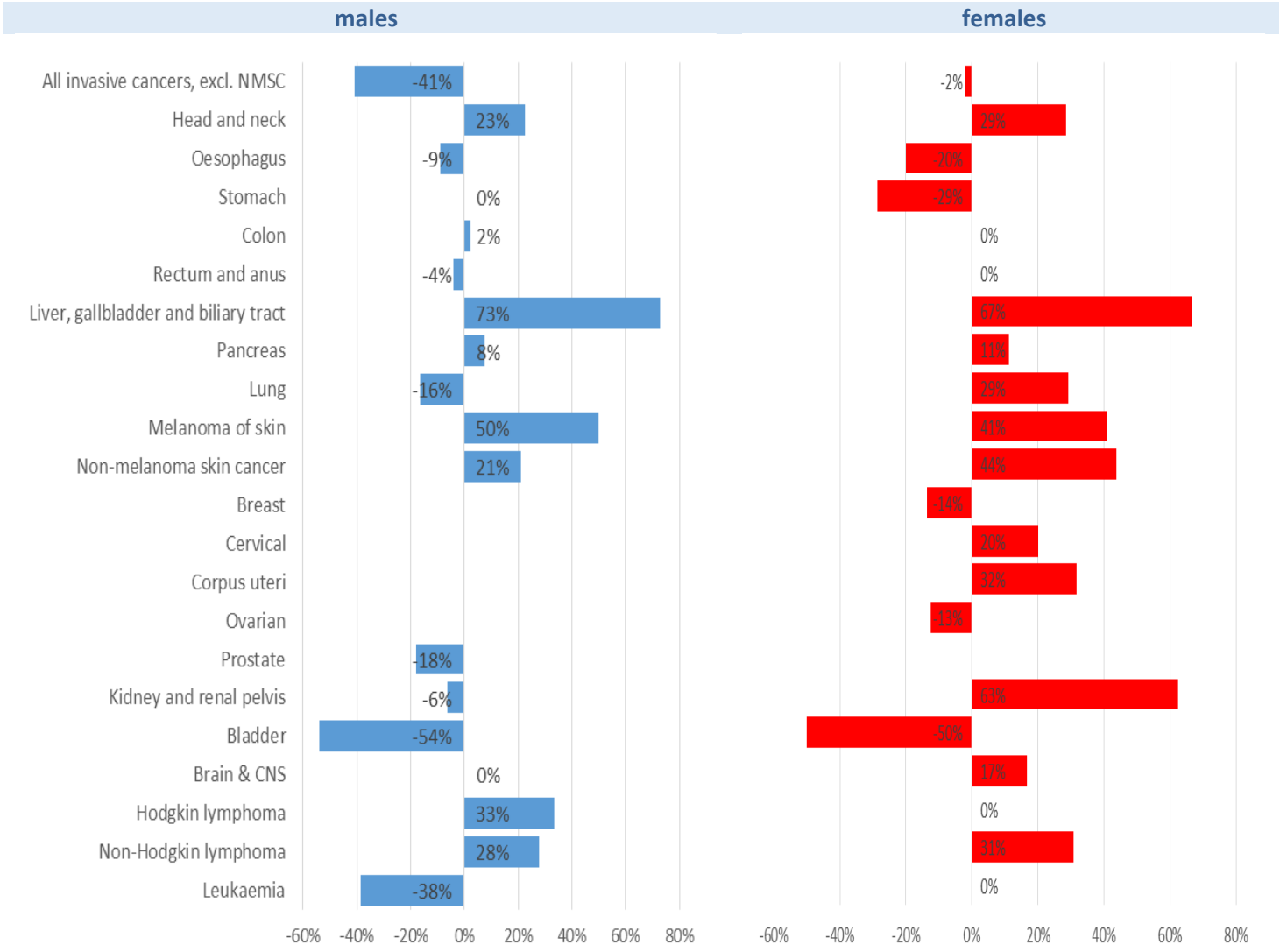
This illustrates the wide variation in projections based on different methodologies, where the site with the largest increase using the demographic method, has the smallest increase using the median projection.

Cancers most strongly associated with advanced age tend to see the biggest increase in the demographic projection, as the elderly population is expected to increase substantially between now and 2045. This is reflected in large increases in cases of bladder (147% for men and 138% for women), lung (131% for men and 105% for women) and prostate cancer (114%).

Sites with smaller projected increases using demographic projections, such as melanoma of skin, Hodgkin lymphoma, and cervical cancer, are more likely to be cancers that affect younger age groups.

Changes in age-standardised rates 2015-2045

Figure 1.4. Median projected percentage increase in age-standardised rates 2015-2045, by cancer site and sex



While the demographic method assumes that the age-standardised rates remain steady from 2015 to 2045, the HD and Nordpred methods assume that recent trends in age-standardised rates will continue into the future. As a result, the age-standardised rate of the median of the projected models, in most cases, will change over time.

Figure 1.4, above, shows the percentage change in age-standardised rates between 2015 and 2045, based on the median of all six models used. For all cancers combined, excluding non-melanoma skin cancer, the median projection showed a decrease of 41% for males and a much more modest 2% decrease for females.

For individual sites, for males, the median projected change in age-standardised rates ranged from a 54% decrease (bladder cancer) to a 73% increase (liver, gallbladder and biliary tract). For females,

the median projected change in age-standardised rates ranged from a 50% decrease (bladder cancer) to a 67% increase (liver, gallbladder and biliary tract).

For both males and females, bladder cancer had the biggest fall in the age-standardised rate in the median of the projections models, while liver, gallbladder and biliary tract cancer had the biggest increase.

2. INTRODUCTION

In order to plan for the needs of future cancer patients, and to ensure that sufficient cancer services are available, the number of cases of cancer in the years to come need to be estimated. Adequate health service planning, especially with regard to staff training and recruitment, and the development of long-term capital projects, requires estimates of the likely future burden of cancer.

This is the fourth set of projections of future cancer cases produced by the National Cancer Registry Ireland (NCRI), following on from reports in 2006, 2008 and 2014 [6-8]. The NCRI will continue to produce projections reports on a five yearly basis, to ensure that up to date estimates are available to allow for future planning of health services.

The projections methods [1-5] used in this report are broadly in line with those used in the previous reports, with some modifications.

This report presents

1. Trends in cancer incidence rates over the period 1994 to 2015.
2. Estimates of the future number of cancer cases and incidence rates, at five year intervals, from 2020 to 2045.

These estimates are presented for all cancer types combined, excluding non-melanoma skin cancers, and for 21 individual cancers or cancer groups. For each cancer site, estimates of future cases are calculated using six models (including a “demography only” model), with the median of these estimates also calculated.

The median projections are presented for each cancer or cancer group, as well as the demographic projections. The latter are calculated assuming the risk of cancer stays the same as in the period 2011-2015, and the changes in projected number of cases are down solely to changes in the population. The highest and lowest projections figures are also presented.

Estimates of the future number of cancer directed treatments (surgery, radiotherapy and chemotherapy) that patients will undergo are also presented up to 2045, based on treatment rates in the period 2011-2015, applied to the demographic projection case numbers.

3. PROJECTIONS BY CANCER SITE

Incidence trends from 1994 to 2015, and projections of incidence (case numbers and age-standardised rates) to 2045, are presented in detail below for each cancer site or grouping of sites. Trends and projections are shown separately by sex, but for each site a textual summary is given of overall projected changes in case numbers between 2015 and 2045.

The figures showing projections highlight *projections based on demographic changes* (blue line) and the *median of all six projections* (yellow line), with the full range of available projections in grey (highlighting the variability of projections, reflecting different model assumptions).

Further details (projected case numbers for all six models for each cancer site) are tabulated in Appendices 1-4 of this report. This allows assessment of which specific models give the lowest and highest projections of case numbers.

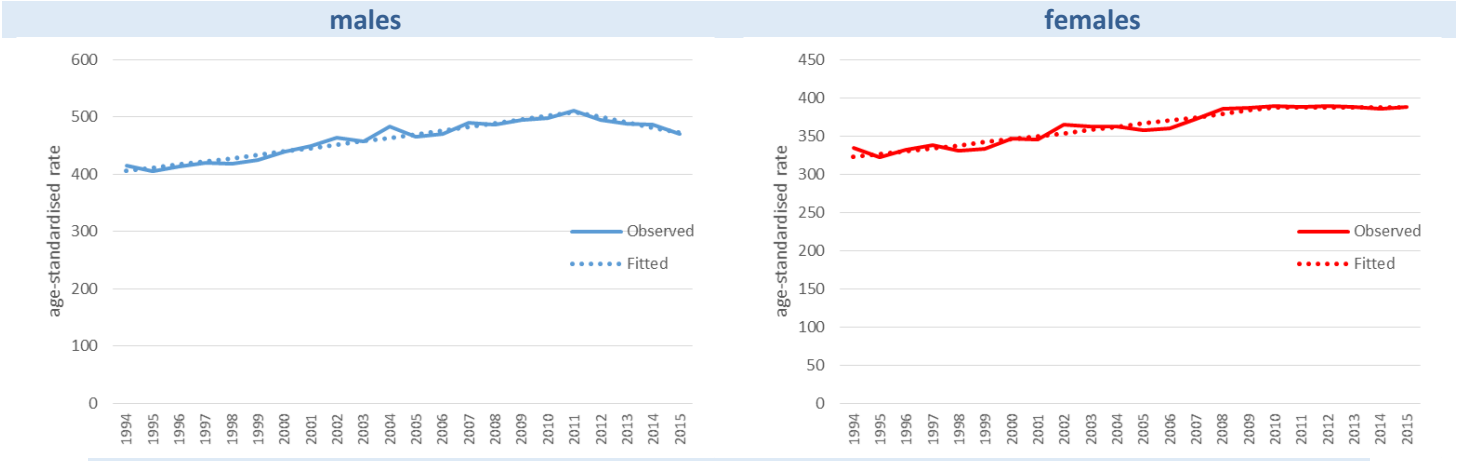
Patterns of variation that may result from different trends in age-standardised rates (up to 2015) include:

- For cancers where age-standardised rates have been relatively stable in recent years, the median projection of case numbers will generally be quite similar to the demographic projection, as the median projection is heavily influenced by the four HD models, which reflect the most recent trend in rates (if this differs significantly from the longer-term trend).
- Where rates show a recent trend of decline, the demographic model will tend to give a higher projection of case numbers than the median projection, because the demographic model applies average (rather than declining) 2011-2015 rates to future populations.
- Conversely, where rates show a recent trend of increase, the demographic model will tend to give a lower projection of case numbers than the median projection.
- Where rates have shown an overall increase between 1994 and 2015, but with a recent slowing down in rate of increase, the Nordpred model will generally give the highest projection of case numbers, as it does not take short-term changes in trend into account.
- Where rates show both long-term and recent increases in trend, the demographic model will generally give the lowest projection of case numbers, potentially underestimating future case numbers.
- Where rates show both long-term and recent decreases in trend, the demographic model will generally give the highest projection of case numbers, potentially overestimating future case numbers.

All invasive cancers combined, excluding non-melanoma skin cancer

Trends in incidence rates 1994-2015

Figure 3.1. All invasive cancers combined, excluding NMSC; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2011	**1.3**	**(1.2, 1.5)**	**1994-2010**	**1.2**	**(0.9, 1.4)**
2011-2015	**-1.8**	**(-3.2, -0.5)**	2010-2015	0.0	(-1.0, 1.0)

- Between 1994 and 2011, age-standardised rates for all cancers combined (excluding NMSC) increased significantly for males by, on average, 1.3% per year, followed by a significant decline of 1.8% per year between 2011 and 2015. For females the pattern was similar, though less marked, with the rates increasing significantly from 1994 to 2010, by 1.2% on average per year, before flattening out, with no change in the age-standardised rates in from 2010 to 2015.

Summary of incidence projections to 2045 (Figures 3.2a-3.2b)

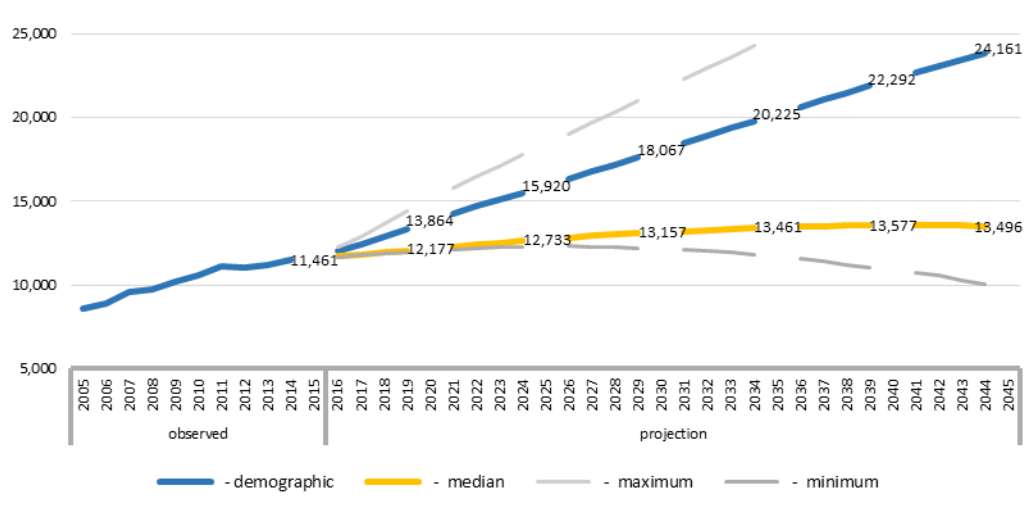
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of all cancers combined (excluding NMSC) are projected to increase in males from 11,460 in 2015 to 24,160 in 2045 (+111%) and in females from 10,240 in 2015 to 18,840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

Figure 3.2a.
Projections: All invasive cancers, excluding NMSC C00-43, C45-96

MALES - CASES
% 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%

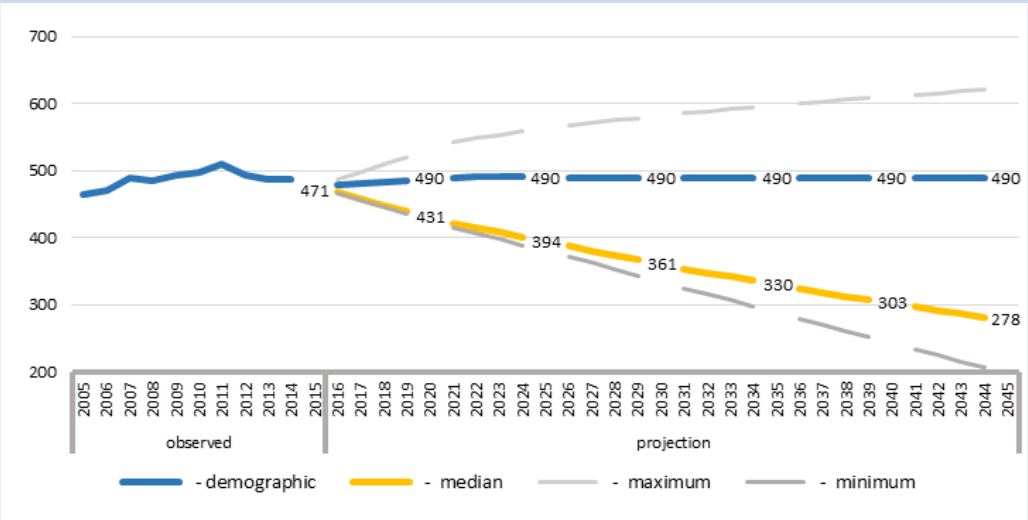
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-8%
2025	-16%
2030	-23%
2035	-30%
2040	-36%
2045	-41%

projected age-standardised rates 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

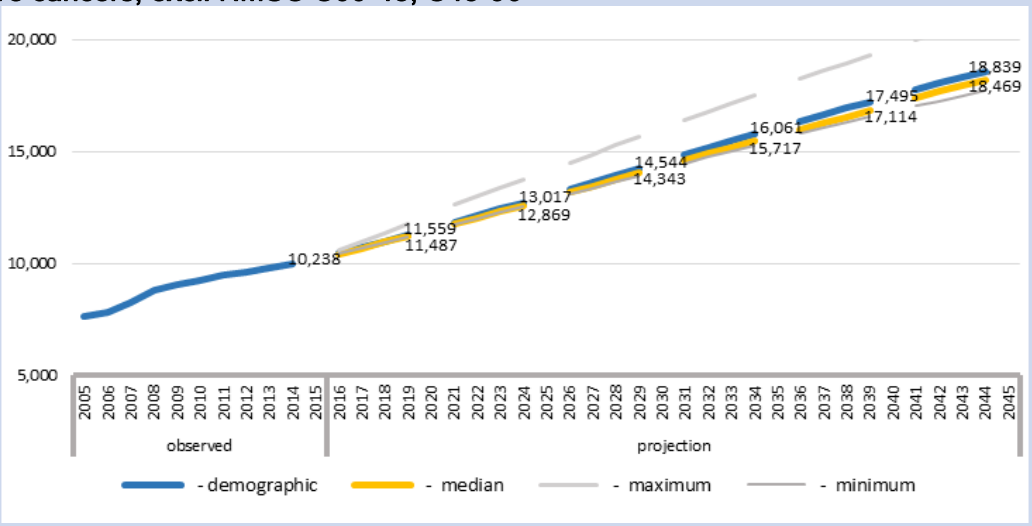
- Age-standardised rates have declined for males since 2011 for all cancers combined (excluding NMSC). As a result the median projection of case numbers is lower than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (490 cases per 100,000).
- The median age-standardised rate, on the other hand, is projected to decrease by 41% by 2045, giving a rate of 278 per 100,000.

Figure 3.2b.
Projections: All invasive cancers, excl. NMSC C00-43, C45-96

FEMALES - CASES
% 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%

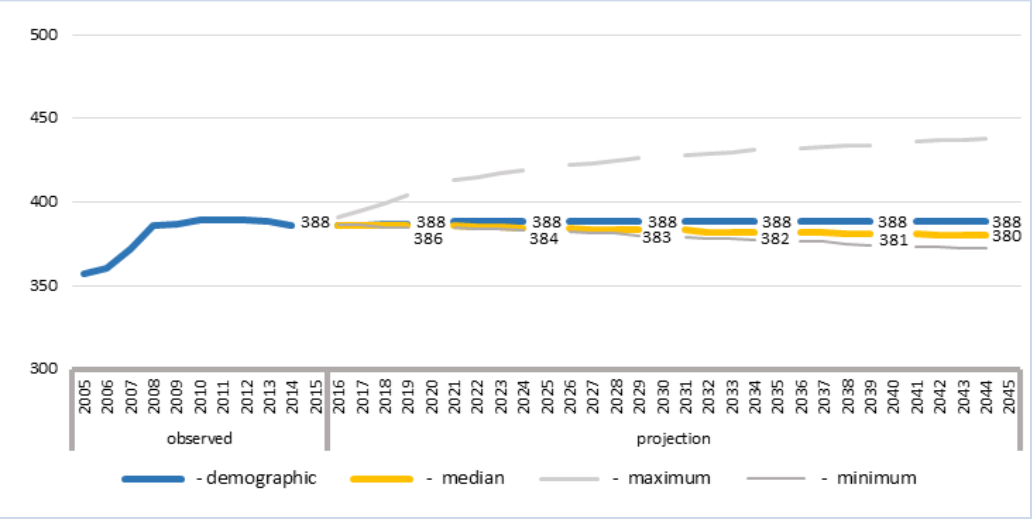
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-1%
2025	-1%
2030	-1%
2035	-2%
2040	-2%
2045	-2%

projected age-standardised rates are shown in the graph on the right



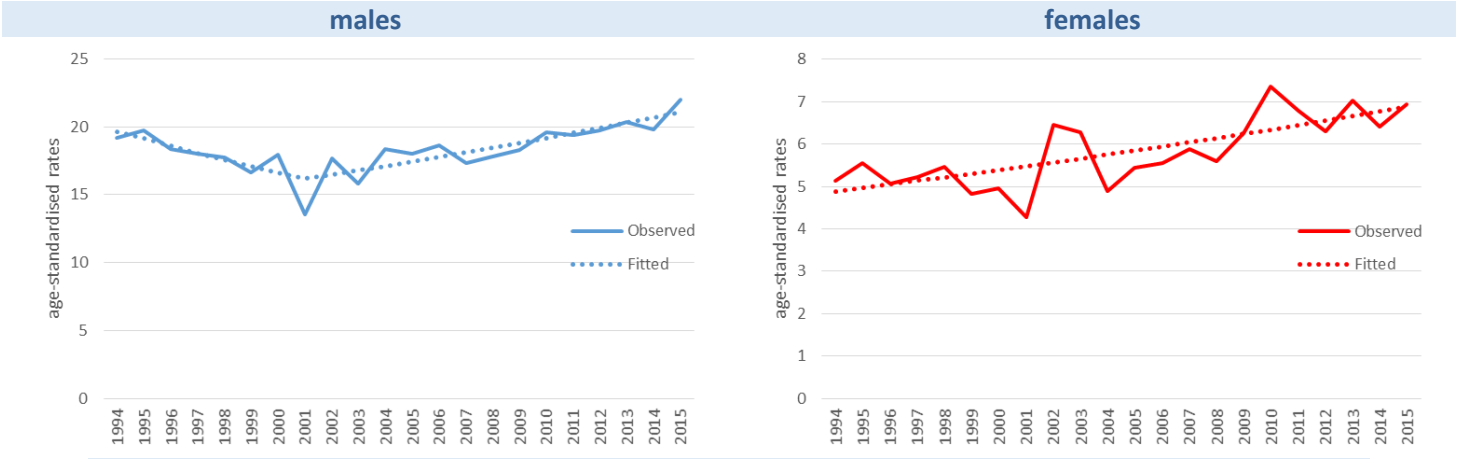
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates have stayed approximately the same for females since 2010 for all cancers combined (excluding NMSC). As a result the median projection of case numbers is almost identical to the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (388 cases per 100,000).
- The median age-standardised rate is projected to decrease by 2% by 2045, giving a rate of 380 per 100,000.

Cancer of the head and neck

Trends in incidence rates 1994-2015

Figure 3.3. Cancer of the head and neck; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2001	-2.8	(-4.5, -1.0)	1994-2015	1.6	(1.0, 2.3)
2001-2015	1.9	(1.4, 2.5)			

- Between 1994 and 2001, age-standardised rates of head and neck cancer declined significantly for males by, on average, 2.8% per year, followed by a significant increase of 1.9% per year between 2001 and 2015. For females the age-standardised rates increased significantly from 1994 to 2015 by, on average, 1.6% per year.

Summary of incidence projections to 2045

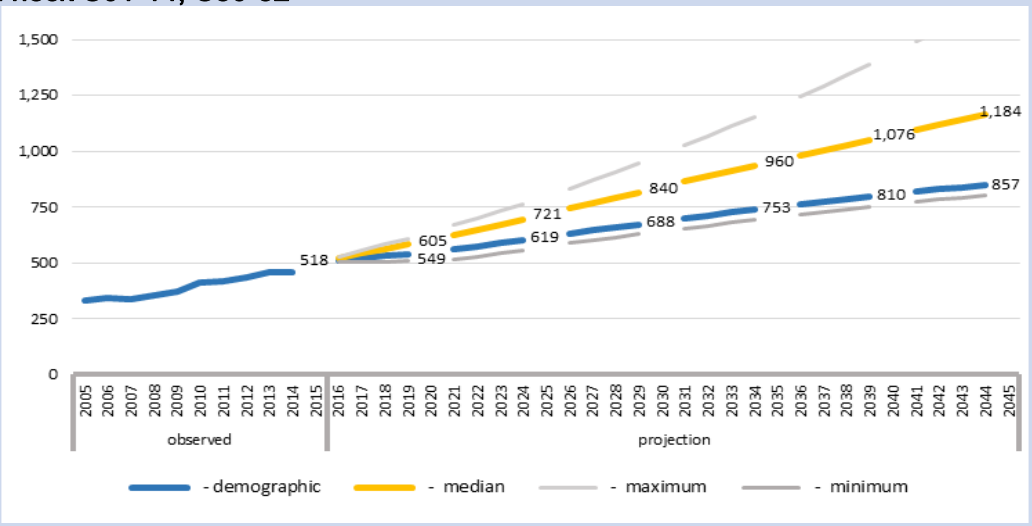
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of head and neck cancer are projected to increase in males from 518 in 2015 to 857 in 2045 (+65%) and in females from 182 in 2015 to 304 in 2045 (+67%) – an increase to 1,161 overall (+66%).
- The median of all projections suggest a much greater increase than the demographic projection for both males and females. For males, cases are projected to increase to 1,184 in 2045 (+129%), and for females cases are projected to increase to 407 (+124%) - a 127% increase (to 1,591 cases) for both sexes combined.

Figure 3.4a.
Projections: Head and neck C01-14, C30-32

MALES - CASES
% 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	6%	17%
2025	19%	39%
2030	33%	62%
2035	45%	85%
2040	56%	108%
2045	65%	129%

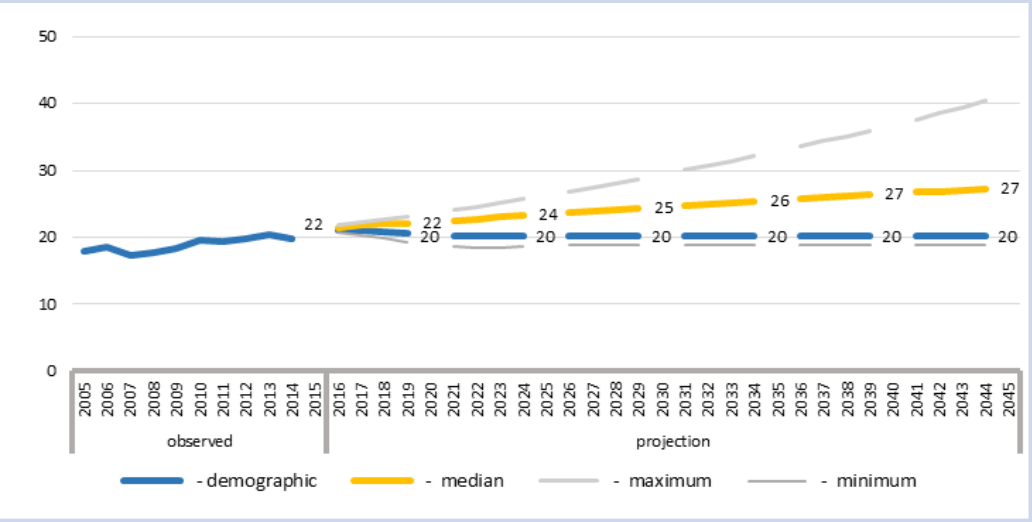
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	1%
2025	7%
2030	12%
2035	17%
2040	21%
2045	25%

projected age-standardised rates 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

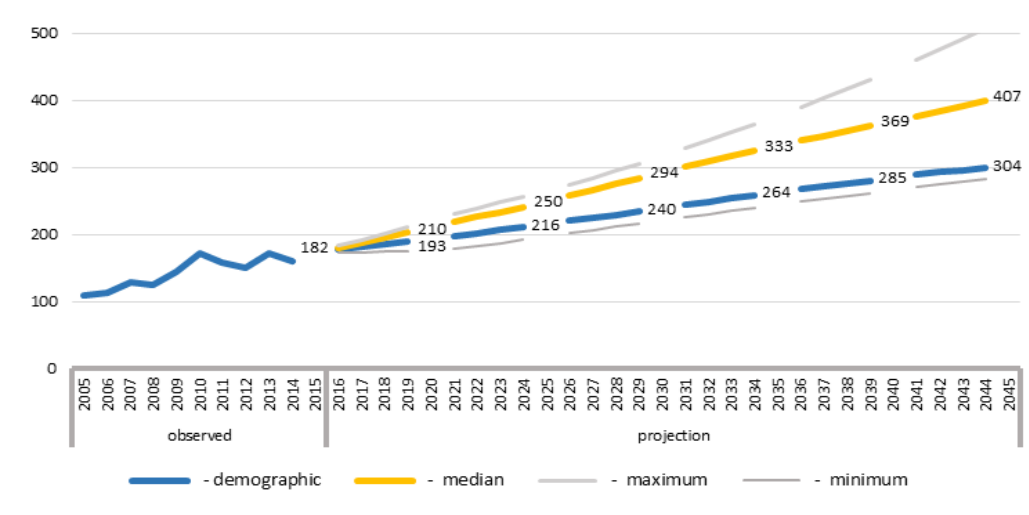
- Age-standardised rates increased steadily for males since 2001 for head and neck cancer. As a result the median projection of case numbers is higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (20 cases per 100,000).
- The median age-standardised rates, on the other hand, are projected to increase by 25% by 2045, giving a rate of 27 per 100,000.

Figure 3.4b.
Projections: Head and neck C01-14, C30-32

FEMALES - CASES
% 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	6%	16%
2025	19%	37%
2030	32%	61%
2035	45%	83%
2040	57%	103%
2045	67%	124%

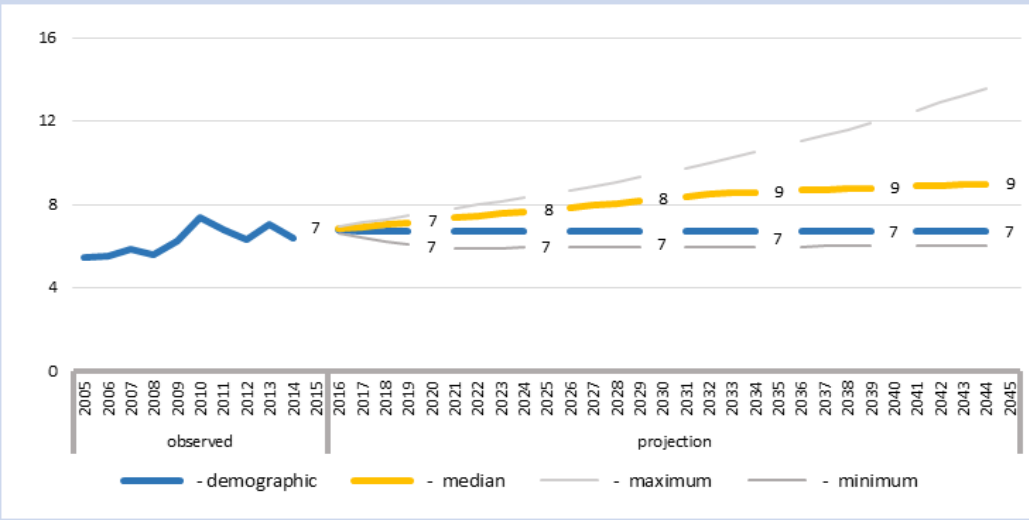
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	5%
2025	12%
2030	19%
2035	25%
2040	27%
2045	30%

projected age-standardised rates are shown in the graph on the right



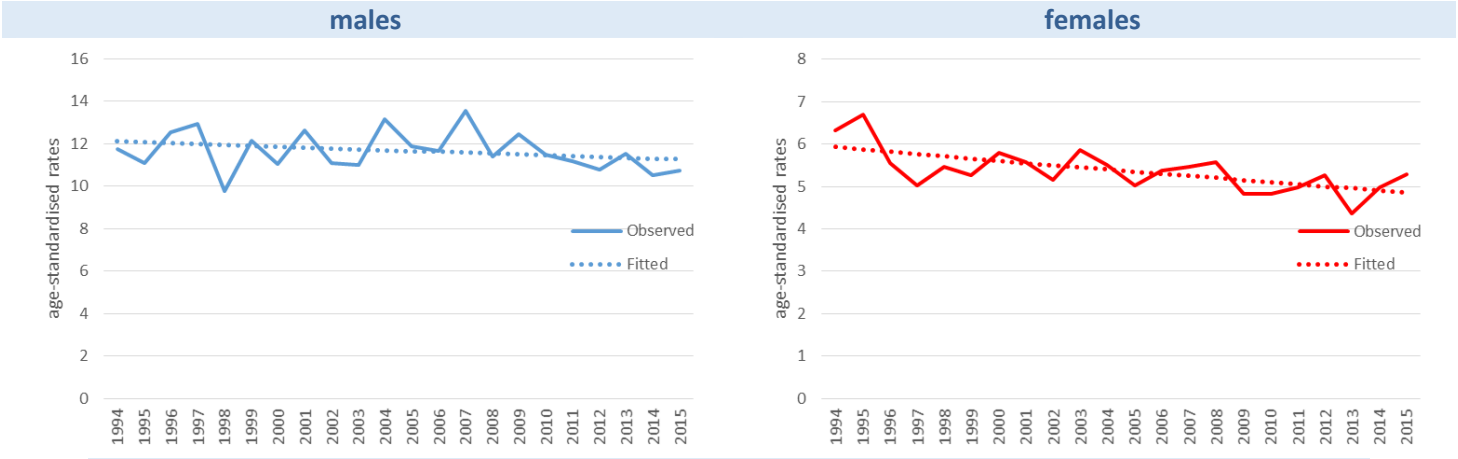
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates increased for females between 1994 and 2015 for head and neck cancer. As a result the median projection is higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (7 cases per 100,000).
- The median age-standardised rates, on the other hand, are projected to increase by 30% by 2045, giving a rate of 9 per 100,000.

Cancer of the oesophagus

Trends in incidence rates 1994-2015

Figure 3.5. Cancer of the oesophagus; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2015	-0.3	(-0.9, 0.2)	**1994-2015**	**-0.9**	**(-1.4, -0.4)**

- Between 1994 and 2005, age-standardised rates of oesophageal cancer declined, non-significantly, for males by, on average, 0.3% per year. For females the age-standardised rates decreased marginally, but significantly, from 1994 to 2015 by0.9% on average per year.

Summary of incidence projections to 2045

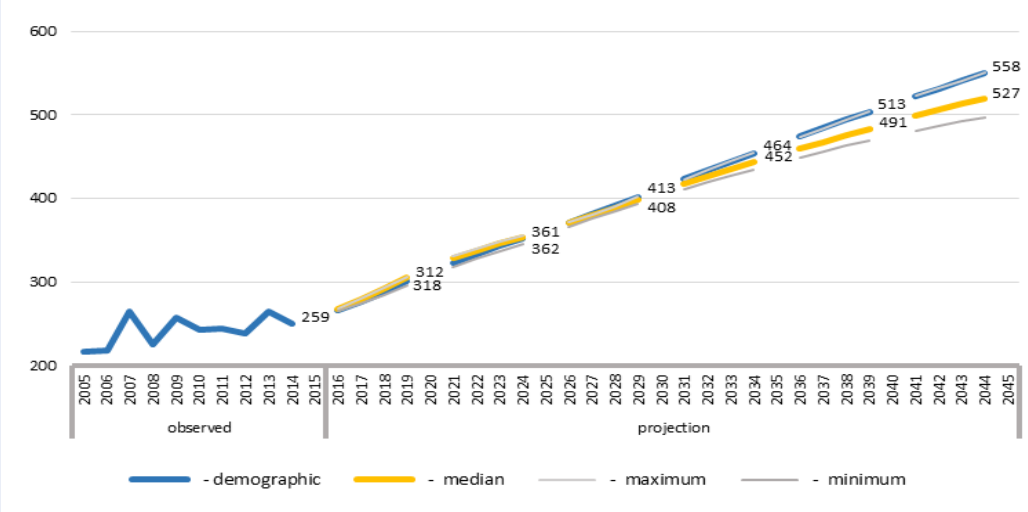
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of oesophageal cancer are projected to increase in males from 259 in 2015 to 558 in 2045 (+115%) and in females from 157 in 2015 to 328 in 2045 (+109%) – an increase to 886 overall (+113%).
- Compared to the demographic projection, the median projection suggests a similar increase for males, but a more modest increase for females. For males, cases are projected to increase to 527 in 2045 (+103%), and for females cases are projected to increase to 251 (+60%) - an 87% increase (to 778 cases) for both sexes combined.

Figure 3.6a.
Projections: Oesophagus C15

MALES - CASES
% 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%	23%
2025	39%	40%
2030	59%	57%
2035	79%	74%
2040	98%	90%
2045	116%	103%

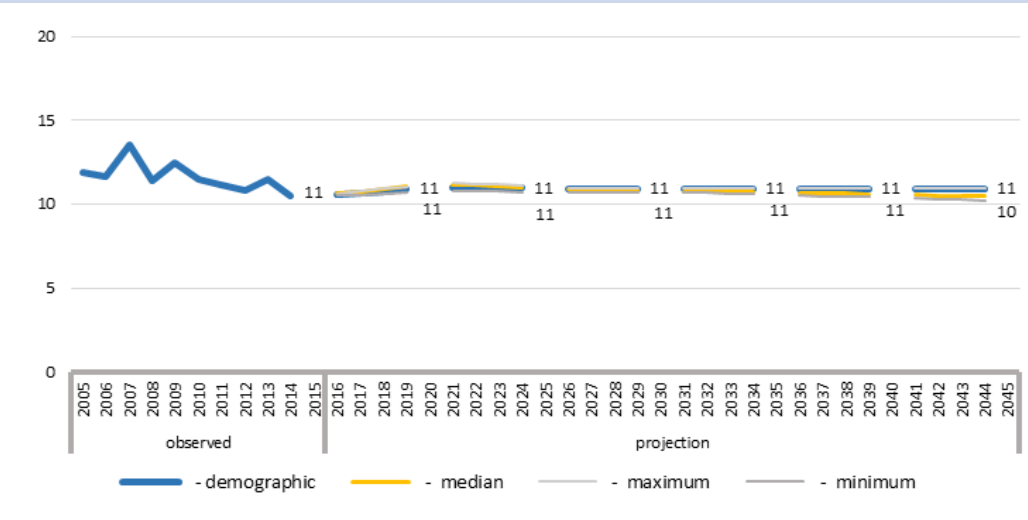
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	4%
2025	2%
2030	1%
2035	0%
2040	-1%
2045	-3%

projected age-standardised rates 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

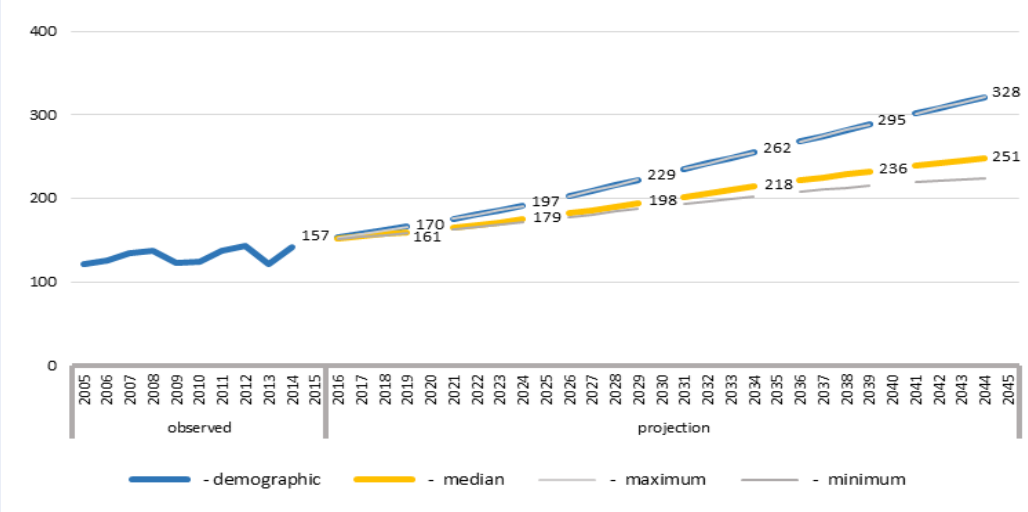
- Age-standardised rates have decreased steadily for males since 1994 for oesophageal cancer. As a result the median projection is lower than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (11 cases per 100,000).
- The median age-standardised rates, on the other hand, are projected to decrease by 3% by 2045, giving a rate of 10 per 100,000.

Figure 3.6b.
Projections: Oesophagus C15

FEMALES - CASES
% 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	8%	3%
2025	26%	14%
2030	46%	26%
2035	67%	39%
2040	88%	50%
2045	109%	60%

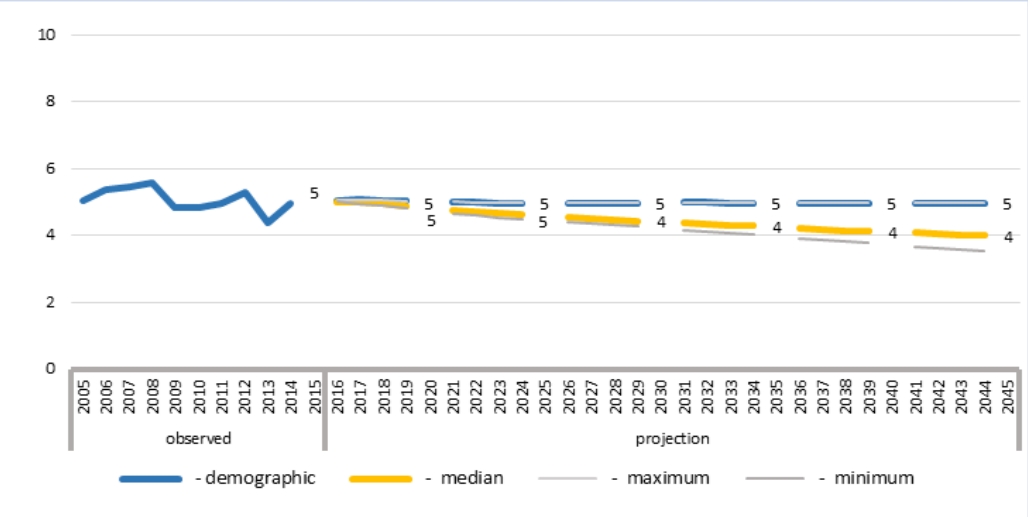
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-10%
2025	-13%
2030	-17%
2035	-20%
2040	-23%
2045	-25%

projected age-standardised rates are shown in the graph on the right



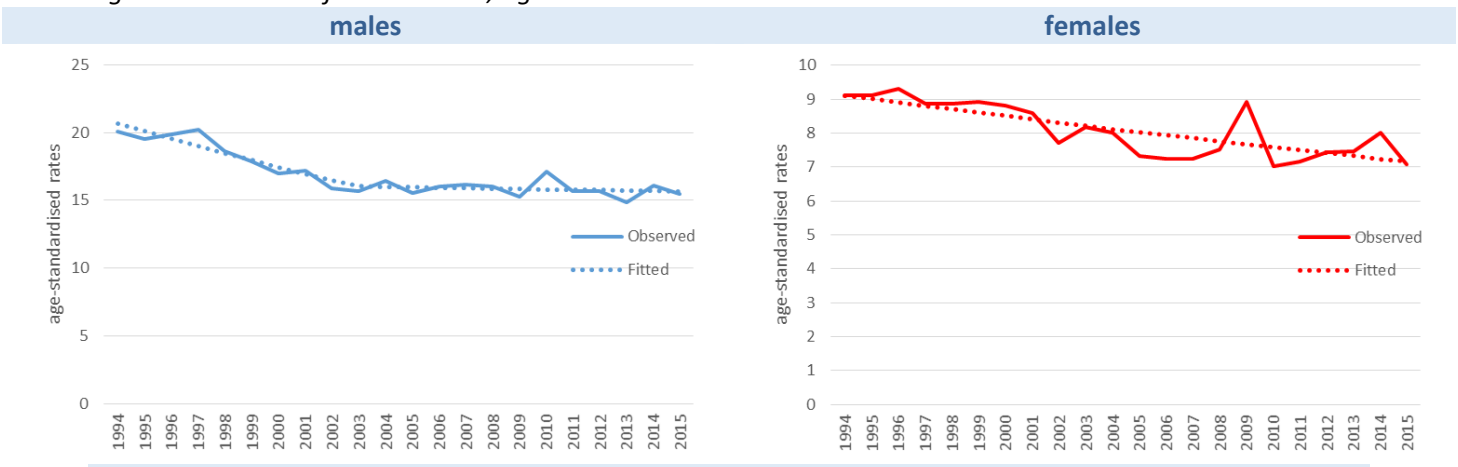
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates have decreased steadily for females since 1994 for oesophageal cancer. As a result the median projection is lower than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (5 cases per 100,000).
- The median age-standardised rates, on the other hand, are projected to decrease by 25% by 2045, giving a rate of 4 per 100,000.

Cancer of the stomach

Trends in incidence rates 1994-2015

Figure 3.7. Cancer of the stomach; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2003	**-2.8**	**(-3.8, -1.8)**	**1994-2015**	**-1.1**	**(-1.6, -0.7)**
2003-2015	-0.2	(-0.8, 0.4)			

- Between 1994 and 2003, age-standardised rates of stomach cancer declined significantly for males by, on average, 2.8% per year. Since 2003, rates have been almost unchanged, declining non-significantly by 0.2% on average per year. For females the age-standardised rates decreased steadily and significantly from 1994 to 2015, by 1.1% on average per year.

Summary of incidence projections to 2045

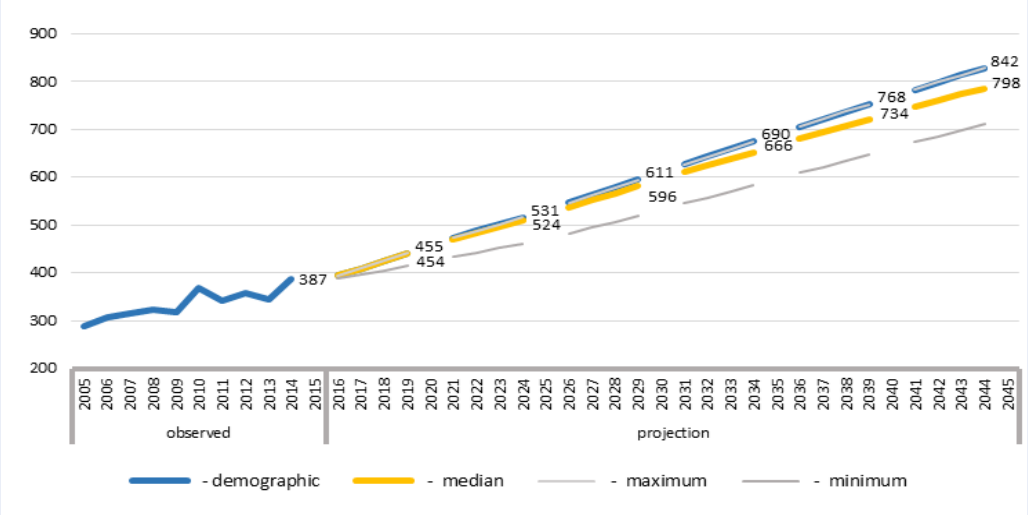
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of stomach cancer are projected to increase in males from 387 in 2015 to 842 in 2045 (+118%) and in females from 204 in 2015 to 452 in 2045 (+122%) – an increase to 1,294 overall (+119%).
- Compared to the demographic projection, the median projection suggests a similar increase for males, but a more modest increase for females. For males, cases are projected to increase to 798 in 2045 (+106%), and for females, cases are projected to increase to 309 (+51%) - an 87% increase (to 1,107 cases) for both sexes combined.

Figure 3.8a.
Projections: Stomach C16

MALES - CASES
% 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	18%	17%
2025	37%	35%
2030	58%	54%
2035	78%	72%
2040	98%	90%
2045	118%	106%

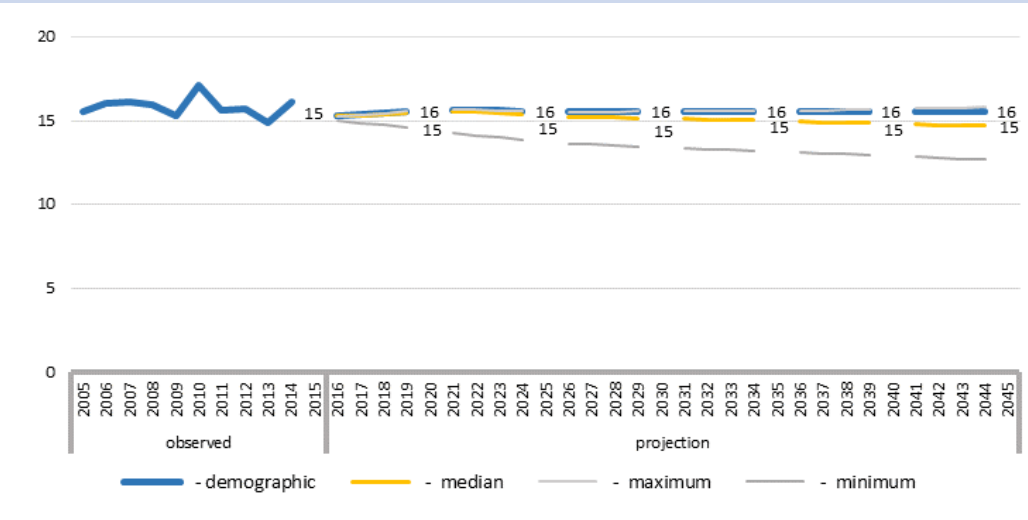
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	0%
2025	-1%
2030	-2%
2035	-3%
2040	-4%
2045	-5%

projected age-standardised rates 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

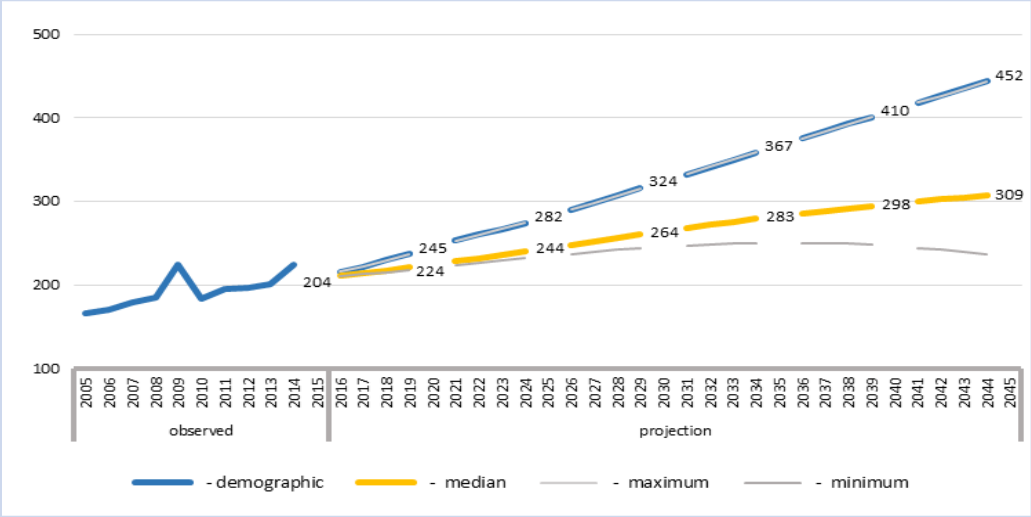
- Age-standardised rates of stomach cancer in males have decreased significantly between 1994 and 2003. Since 2003 rates have decreased marginally. As a result the median projection is slightly lower than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (16 cases per 100,000).
- The median age-standardised rates, on the other hand, are projected to decrease by 5% by 2045, giving a rate of 15 per 100,000.

Figure 3.8b.
Projections: Stomach C16

FEMALES - CASES
% 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	20%	10%
2025	38%	20%
2030	59%	30%
2035	80%	39%
2040	101%	46%
2045	122%	52%

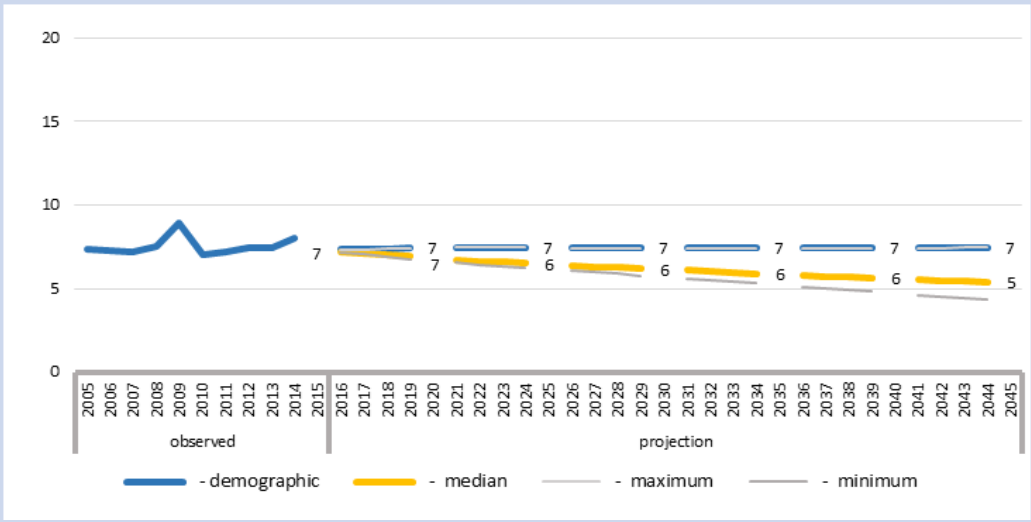
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-4%
2025	-9%
2030	-13%
2035	-17%
2040	-21%
2045	-24%

projected age-standardised rates are shown in the graph on the right



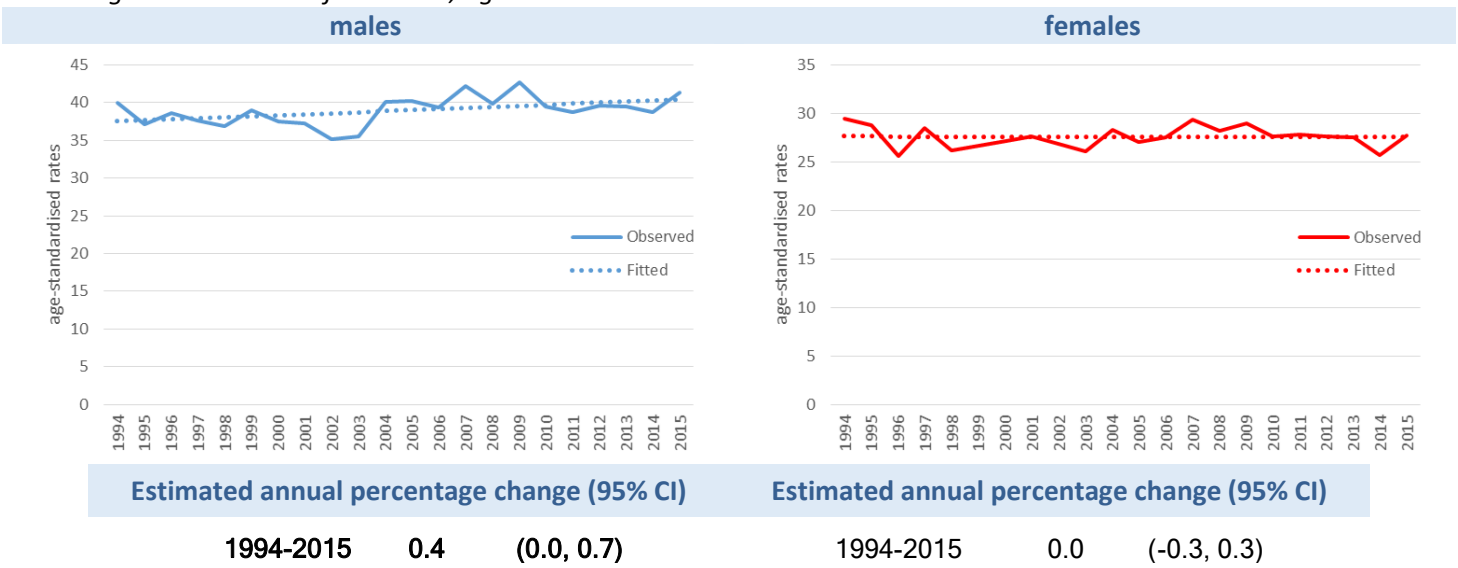
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of stomach cancer in females have decreased significantly since 1994. As a result the median projection is substantially lower than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (7 cases per 100,000).
- The median age-standardised rates, on the other hand, are projected to decrease by 24% by 2045, giving a rate of 5 per 100,000.

Cancer of the colon

Trends in incidence rates 1994-2015

Figure 3.9. Cancer of the colon; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2015	**0.4**	**(0.0, 0.7)**	1994-2015	0.0	(-0.3, 0.3)

- Between 1994 and 2015, age-standardised rates of colon cancer increased marginally, but significantly, for males by, on average, 0.4% per year. For females average age-standardised rates showed no significant change between 1994 and 2015.
- The BowelScreen programme, to screen for colorectal cancer in the Irish population aged 55-74, was launched in October 2012. An initial increase in cancer incidence rates, followed by a decline, is generally expected when a new screening programme is introduced. This expected change in incidence has not occurred to date, and there were no changes in trends over the period 1994 to 2015 for either males or females.

Summary of incidence projections to 2045

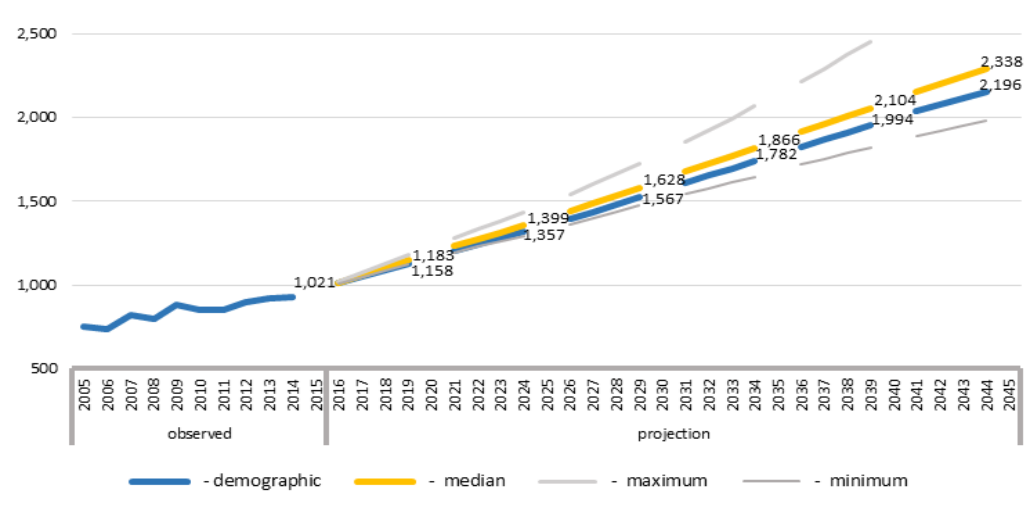
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of colon cancer are projected to increase in males from 1,021 in 2015 to 2,196 in 2045 (+115%) and in females from 776 in 2015 to 1,617 in 2045 (+108%) – an increase to 3,813 overall (+112%).
- Compared to the demographic projection, the median projection suggests a similar increase for both males and females. For males, cases are projected to increase to 2,338 in 2045 (+129%), and for females, cases are projected to increase to 1,662 (+114%) - a 123% increase (to 4,000 cases) for both sexes combined.

Figure 3.10a.
Projections: Colon C18

MALES - CASES
% 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%	16%
2025	33%	37%
2030	53%	59%
2035	75%	83%
2040	95%	106%
2045	115%	129%

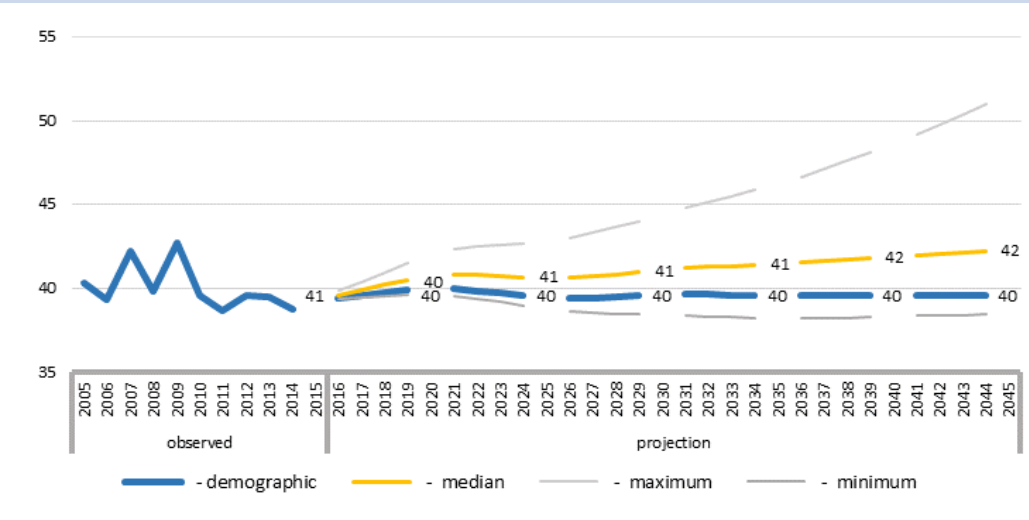
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-2%
2025	-2%
2030	-2%
2035	0%
2040	1%
2045	2%

projected age-standardised rates 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

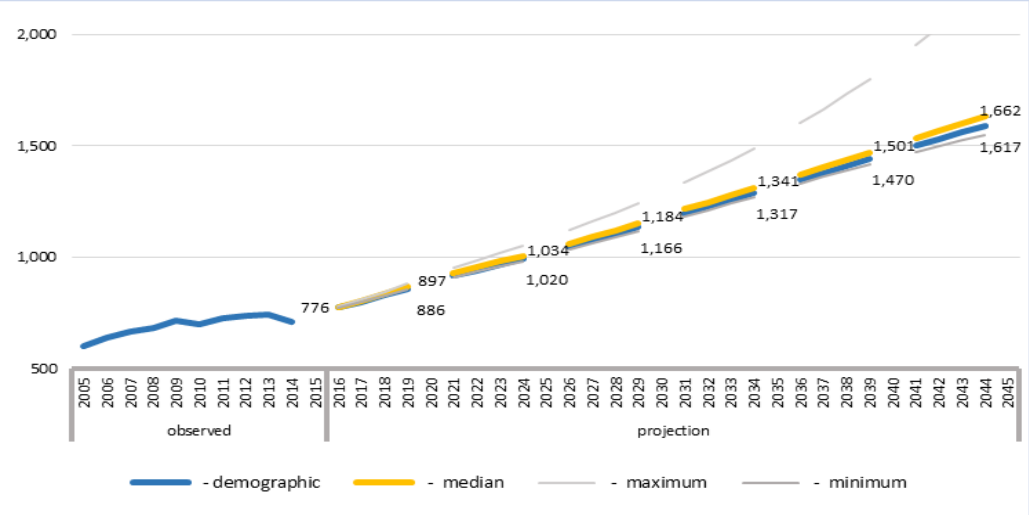
- Age-standardised rates of colon cancer in males have increased steadily since 1994. As a result the median projection is slightly higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (40 cases per 100,000).
- The median age-standardised rates are projected to increase by 5% by 2045, giving a rate of 42 per 100,000.

Figure 3.10b.
Projections: Colon C18

FEMALES - CASES
% 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	14%	16%
2025	31%	33%
2030	50%	53%
2035	70%	73%
2040	89%	93%
2045	108%	114%

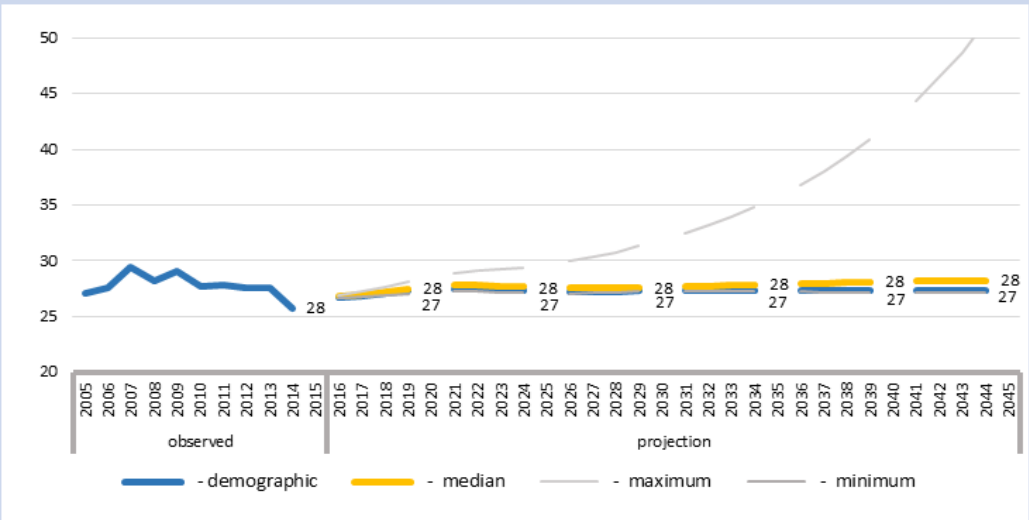
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-1%
2025	-1%
2030	-1%
2035	0%
2040	1%
2045	2%

projected age-standardised rates are shown in the graph on the right



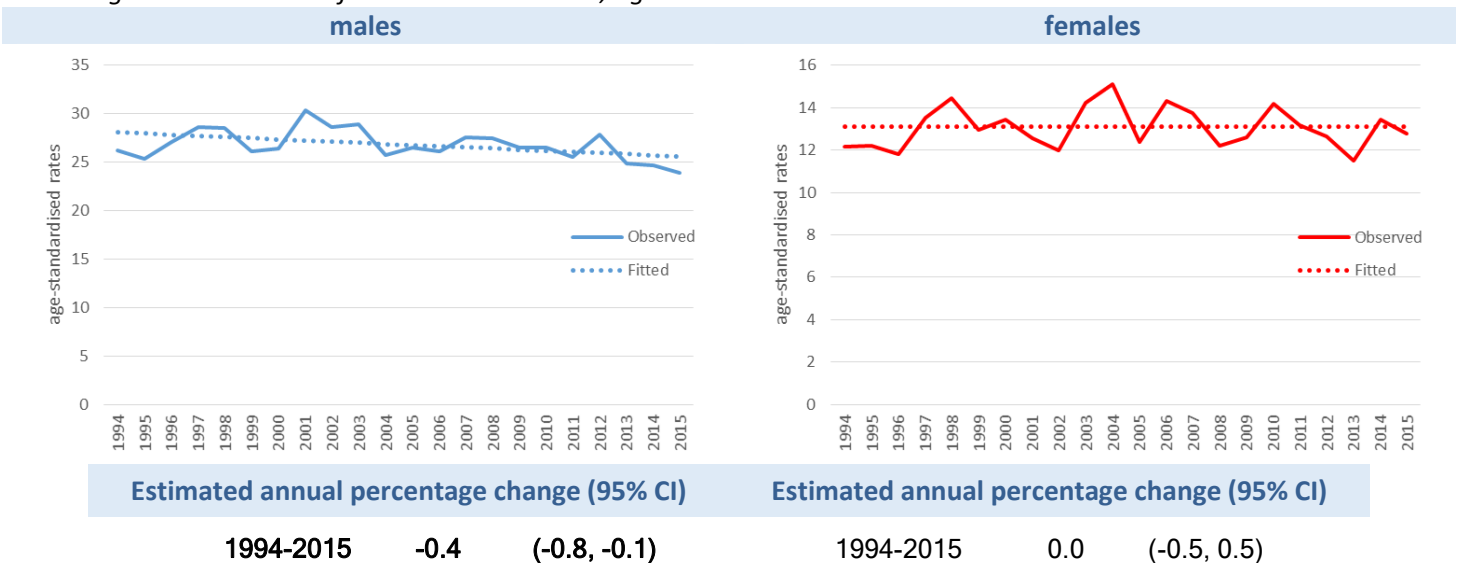
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of colon cancer in females have not changed significantly since 1994. As a result the median projection is almost identical to the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (27 cases per 100,000).
- The median age-standardised rates are projected to increase by 2% by 2045, giving a rate of 28 per 100,000.

Cancer of the rectum and anus

Trends in incidence rates 1994-2015

Figure 3.11. Cancer of the rectum and anus; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2015	**-0.4**	**(-0.8, -0.1)**	1994-2015	0.0	(-0.5, 0.5)

- Between 1994 and 2015, age-standardised rates of cancer of the rectum and anus decreased marginally but significantly for males by, on average, 0.4% per year. For females the age-standardised rates showed no trend from 1994 to 2015.
- The BowelScreen programme, to screen for colorectal cancer in the Irish population aged 55-74, was launched in October 2012. An initial increase in cancer incidence rates, followed by a decline, is generally expected when a new screening programme is introduced. This expected change in incidence has not occurred to date, and there were no changes in trends over the period 1994 to 2015 for either males or females.

Summary of incidence projections to 2045

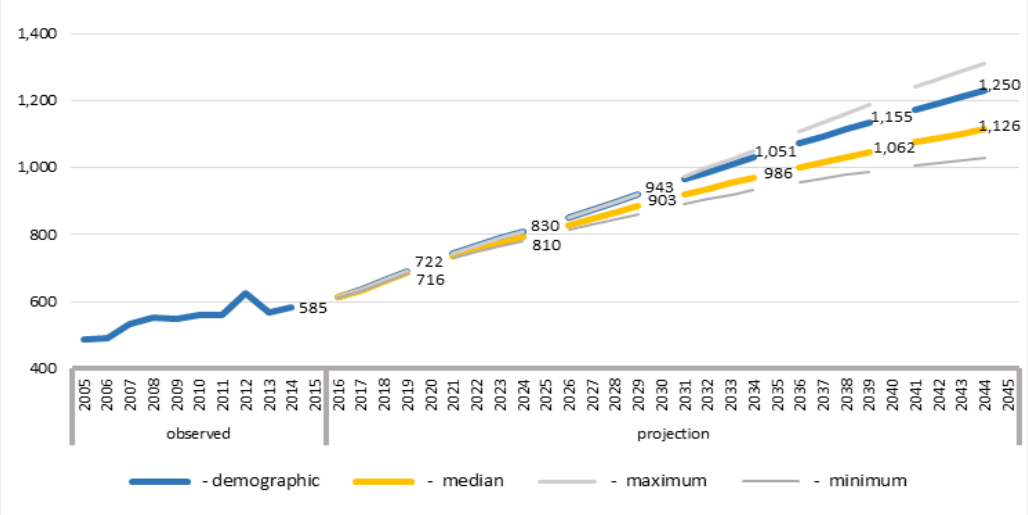
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of cancer of the rectum and anus are projected to increase in males from 585 in 2015 to 1,250 in 2045 (+114%) and in females from 338 in 2015 to 656 in 2045 (+94%) - an increase to 1,906 for males and females combined (+107%).
- Compared to the demographic projection, the median projection suggests a similar increase for females, and a smaller increase for males. For males, cases are projected to increase to 1,126 in 2045 (+92%), and for females, cases are projected to increase to 667 (+97%) - a 94% increase (to 1,793 cases) for both sexes combined.

Figure 3.12a.
Projections: Rectum and anus C19-C21

MALES - CASES
% 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	23%	22%
2025	42%	39%
2030	61%	54%
2035	80%	69%
2040	97%	81%
2045	114%	93%

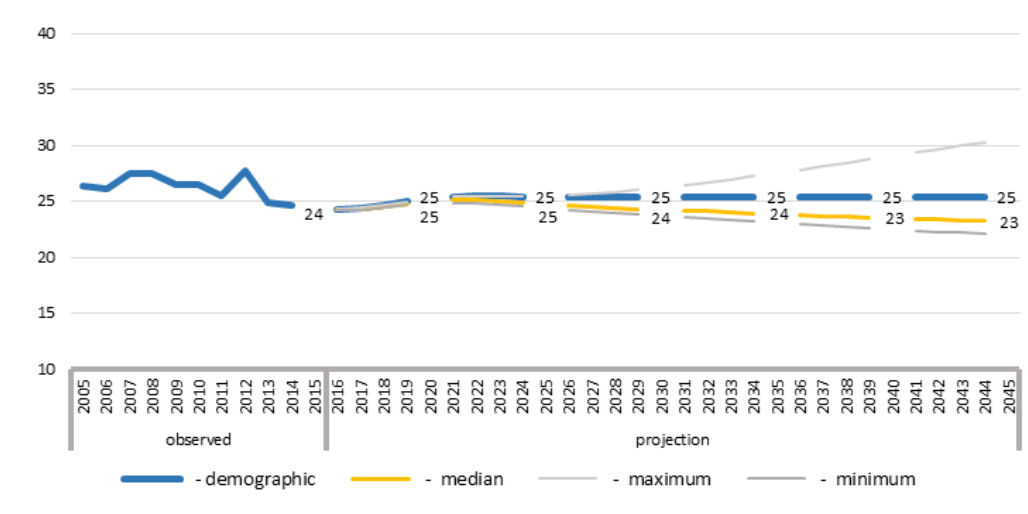
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	5%
2025	3%
2030	1%
2035	0%
2040	-2%
2045	-3%

projected age-standardised rates 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

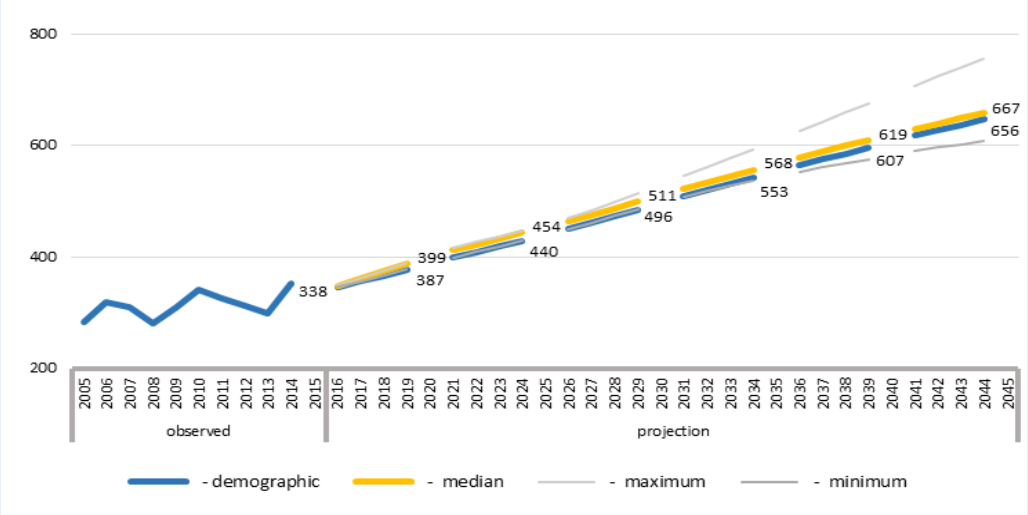
- Age-standardised rates of cancer of the rectum and anus in males have decreased steadily since 1994. As a result the median projection is slightly lower than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (25 cases per 100,000).
- The median age-standardised rates are projected to decrease by 3% by 2045, giving a rate of 23 per 100,000.

Figure 3.12b.
Projections: Rectum and anus C19-C21

FEMALES - CASES
% 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	15%	18%
2025	30%	34%
2030	47%	51%
2035	64%	68%
2040	80%	83%
2045	94%	97%

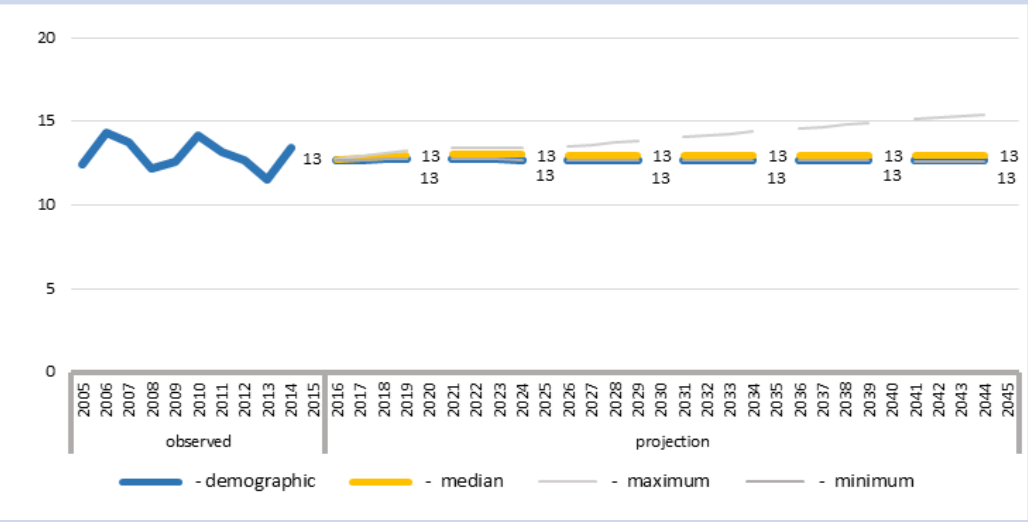
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	2%
2025	2%
2030	2%
2035	1%
2040	1%
2045	1%

projected age-standardised rates are shown in the graph on the right



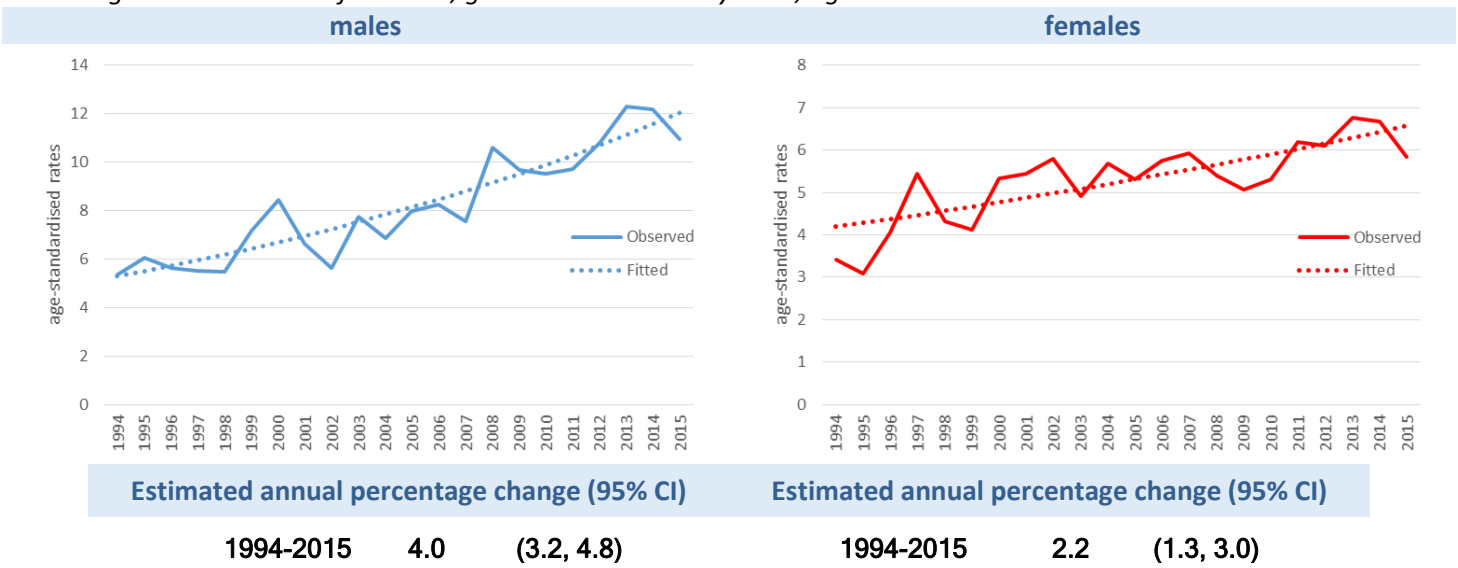
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of cancer of the rectum and anus in females have not changed since 1994. As a result the median projection is almost identical to the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (13 cases per 100,000).
- The median age-standardised rates are projected to decrease by 1% by 2045, also giving a rate of 13 per 100,000.

Cancer of the liver, gallbladder and biliary tract

Trends in incidence rates 1994-2015

Figure 3.13. Cancer of the liver, gallbladder and biliary tract; age-standardised incidence rates 1994-2015



- Between 1994 and 2015, age-standardised rates of cancer of the liver, gallbladder and biliary tract increased significantly for males by, on average, 4.0% per year. For females the age-standardised rates also increased significantly, by 2.2% on average from 1994 to 2015.

Summary of incidence projections to 2045

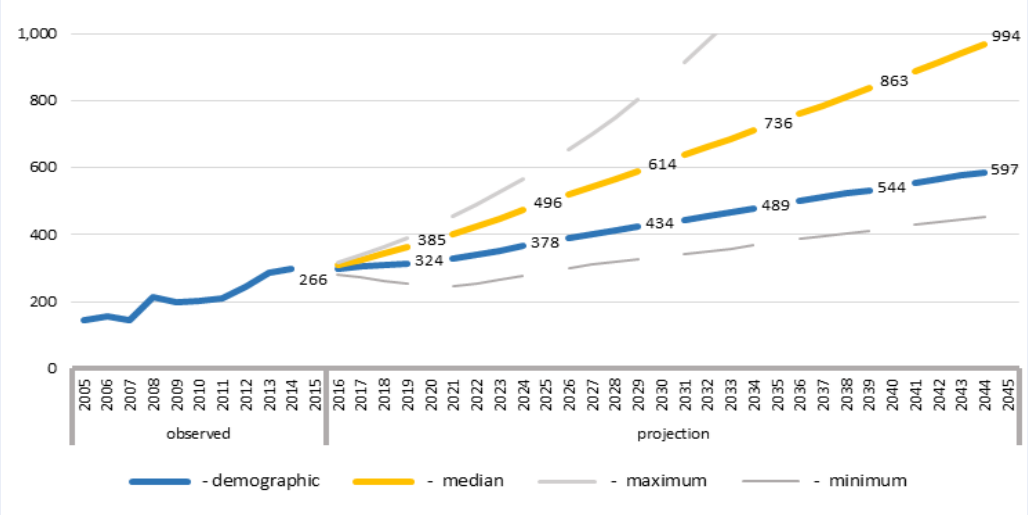
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of cancer of the liver, gallbladder and biliary tract are projected to increase in males from 266 in 2015 to 597 in 2045 (+124%) and in females from 174 in 2015 to 407 in 2045 (+134%) - an increase to 1,004 for males and females combined (+128%).
- Compared to the demographic projection, the median projection suggests a much greater increase for males and females. For males, cases are projected to increase to 994 in 2045 (+274%), and for females, cases are projected to increase to 580 (+233%) - overall a 258% increase (to 1,574 cases) for both sexes combined.

Figure 3.14a.
Projections: Liver, gallbladder and biliary tract C22-C24

MALES - CASES
% 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	22%	45%
2025	42%	86%
2030	63%	131%
2035	84%	177%
2040	105%	224%
2045	124%	274%

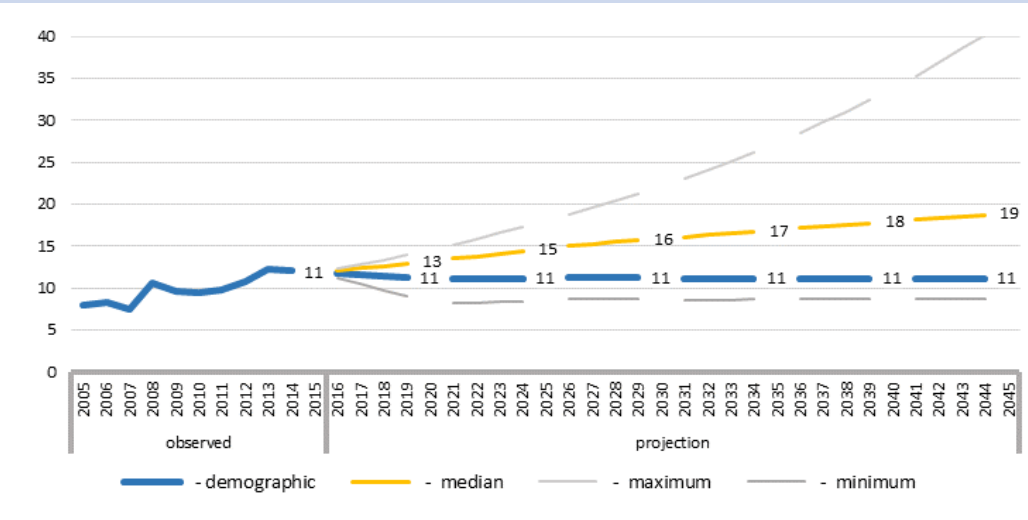
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	22%
2025	35%
2030	45%
2035	55%
2040	64%
2045	73%

projected age-standardised rates 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

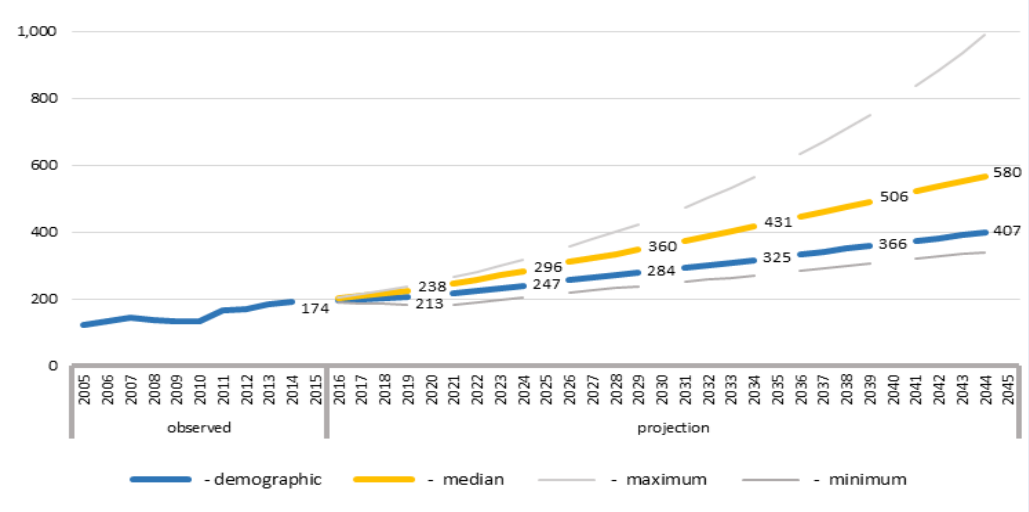
- Age-standardised rates of cancer of the liver, gallbladder and biliary tract in males have increased significantly since 1994. This leads to most models projecting higher incidence than the demographic model. The median projection is considerably higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (11 cases per 100,000).
- The median age-standardised rates are projected to increase by 73% by 2045, giving a rate of 19 per 100,000.

Figure 3.14b.
Projections: Liver, gallbladder and biliary tract C22-C24

FEMALES - CASES
% 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	22%	37%
2025	42%	70%
2030	63%	107%
2035	87%	148%
2040	110%	191%
2045	134%	233%

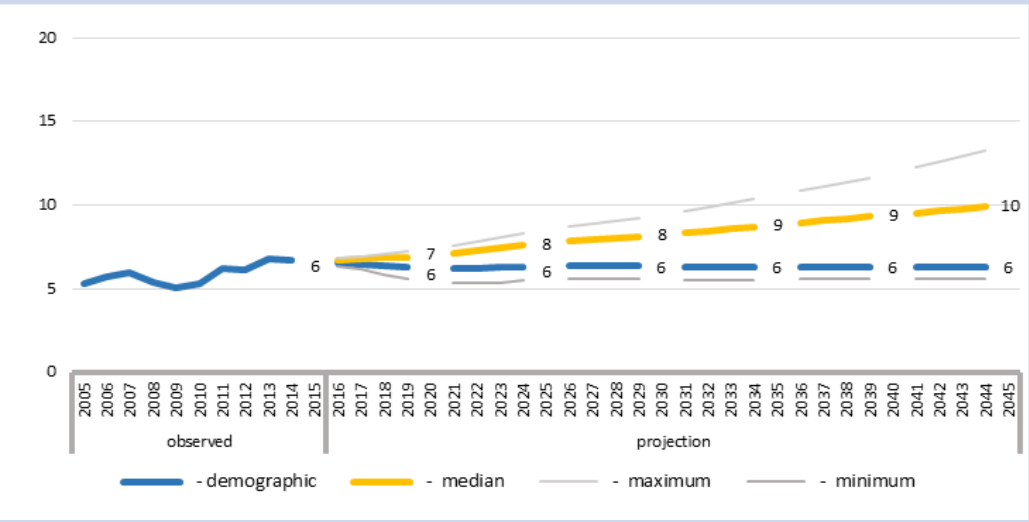
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	22%
2025	32%
2030	41%
2035	51%
2040	61%
2045	71%

projected age-standardised rates are shown in the graph on the right



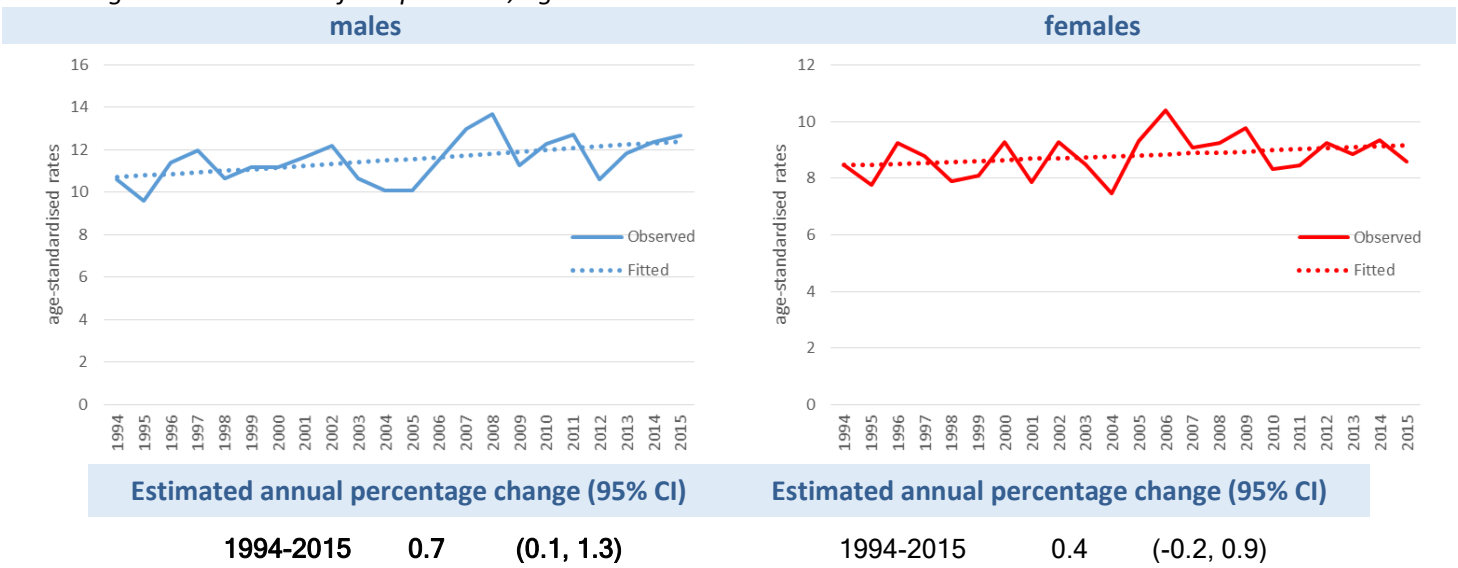
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of cancer of the liver, gallbladder and biliary tract in females have increased significantly since 1994. This leads to most models projecting higher incidence than the demographic model. The median projection is considerably higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (6 cases per 100,000).
- The median age-standardised rates are projected to increase by 71% by 2045, giving a rate of 10 per 100,000.

Cancer of the pancreas

Trends in incidence rates 1994-2015

Figure 3.15. Cancer of the pancreas; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2015	**0.7**	**(0.1, 1.3)**	1994-2015	0.4	(-0.2, 0.9)

- Between 1994 and 2015, age-standardised rates of pancreatic cancer increased significantly for males by, on average, 0.7% per year. For females the average age-standardised rates increased non-significantly, by 0.4% from 1994-2015.

Summary of incidence projections to 2045

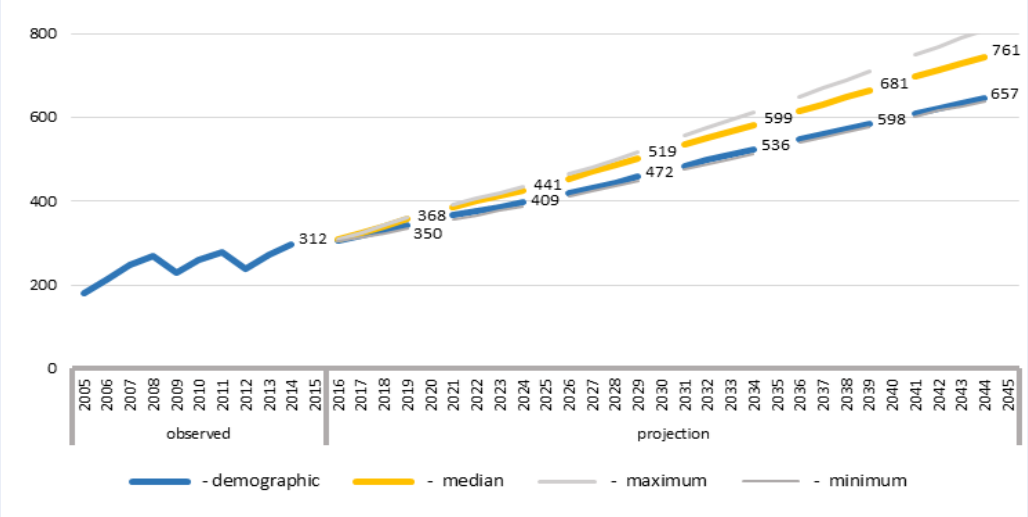
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of pancreatic cancer are projected to increase in males from 312 in 2015 to 657 in 2045 (+111%) and in females from 252 in 2015 to 576 in 2045 (+129%) – an increase to 1,233 for males and females combined (+119%).
- Compared to the demographic projection, the median projection suggests a greater increase for males and females. For males, cases are projected to increase to 761 in 2045 (+144%), and for females, cases are projected to increase to 618 (+145%) - overall a 145% increase (to 1,379 cases) for both sexes combined.

Figure 3.16a.
Projections: Pancreas C25

MALES - CASES
% 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	12%	18%
2025	31%	41%
2030	51%	66%
2035	72%	92%
2040	92%	118%
2045	111%	144%

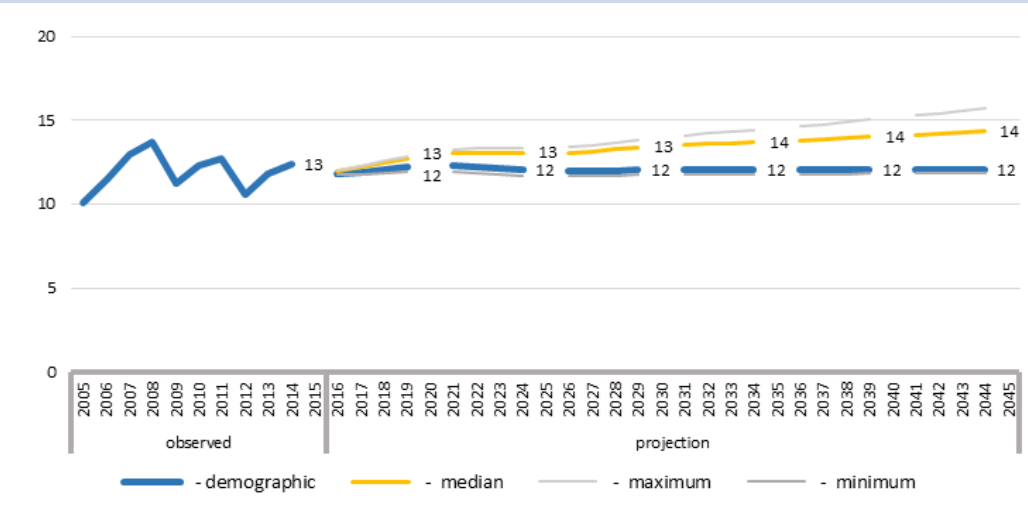
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	0%
2025	3%
2030	6%
2035	8%
2040	11%
2045	14%

projected age-standardised rates 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

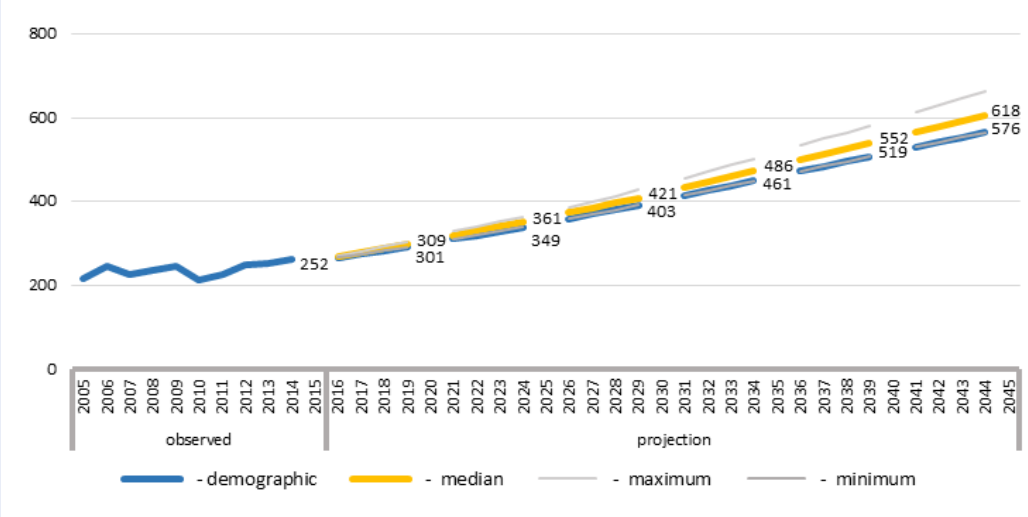
- Age-standardised rates of male pancreatic cancer have increased steadily since 1994. This leads to most models projecting higher incidence than the demographic model. The median projection is higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (12 cases per 100,000).
- The median age-standardised rates are projected to increase by 14% by 2045, giving a rate of 14 per 100,000.

Figure 3.16b.
Projections: Pancreas C25

FEMALES - CASES
% 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	19%	23%
2025	38%	43%
2030	60%	67%
2035	83%	93%
2040	106%	119%
2045	129%	145%

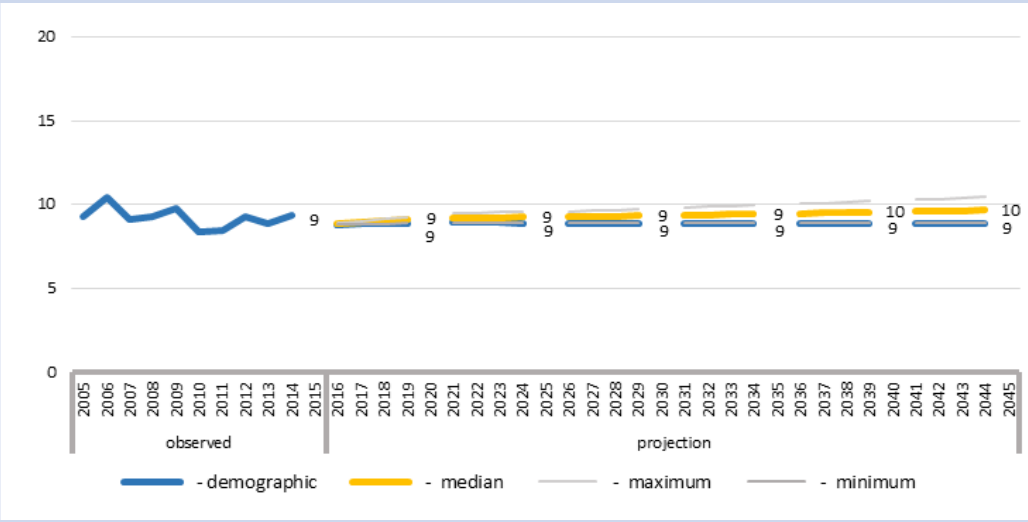
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	6%
2025	8%
2030	9%
2035	10%
2040	11%
2045	13%

projected age-standardised rates are shown in the graph on the right



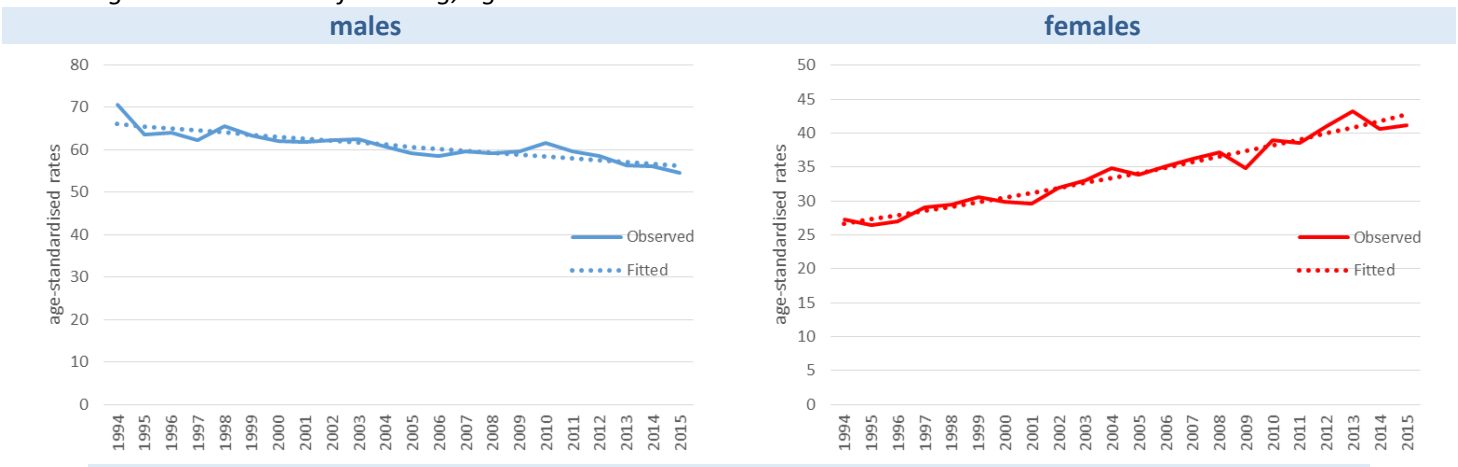
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of female pancreatic cancer have increased slightly since 1994. The median projection is higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (9 cases per 100,000).
- The median age-standardised rates are projected to increase by 13% by 2045, giving a rate of 10 per 100,000.

Cancer of the lung

Trends in incidence rates 1994-2015

Figure 3.17. Cancer of the lung; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2015	-0.8	(-0.9, -0.6)	1994-2015	2.3	(2.0, 2.5)

- Between 1994 and 2015, age-standardised rates of lung cancer decreased significantly for males by, on average, 0.8% per year. In contrast, for females the average age-standardised rates increased significantly by 2.3% in the same period.

Summary of incidence projections to 2045

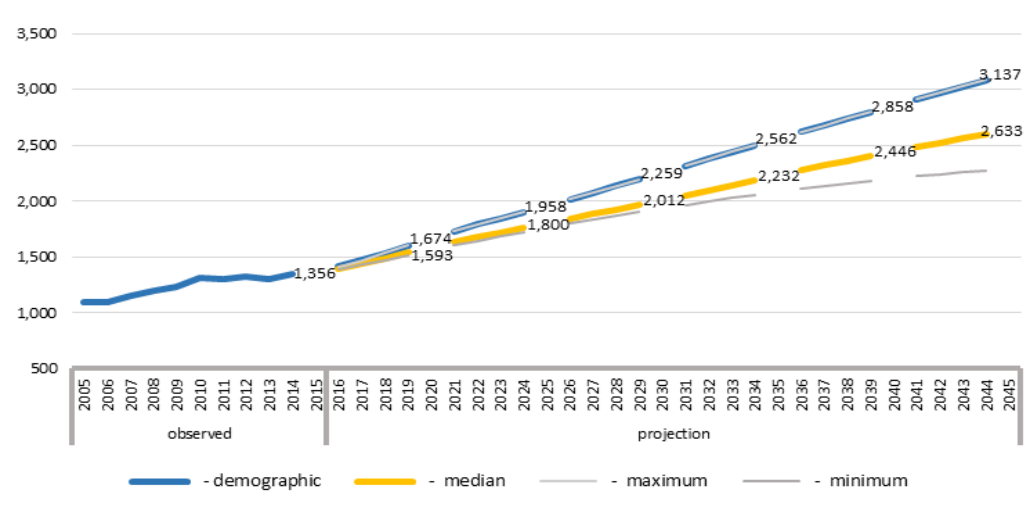
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of lung cancer are projected to increase in males from 1,356 in 2015 to 3,137 in 2045 (+131%) and in females from 1,130 in 2015 to 2,313 in 2045 (+105%) – an increase to 5,450 for males and females combined (+119%).
- Compared to the demographic projection, the median projection suggests a much smaller increase for males and a much larger increase for females. For males, cases are projected to increase to 2,633 in 2045 (+94%), and for females, cases are projected to increase to 3,124 (+176%). Overall this would amount to a 132% increase (to 5,757 cases) for both sexes combined – slightly higher than the overall demographic projection, but with a much higher preponderance of female cases than in the latter.

Figure 3.18a.
Projections: Lung C34

MALES - CASES
% 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	23%	18%
2025	44%	33%
2030	67%	48%
2035	89%	65%
2040	111%	80%
2045	131%	94%

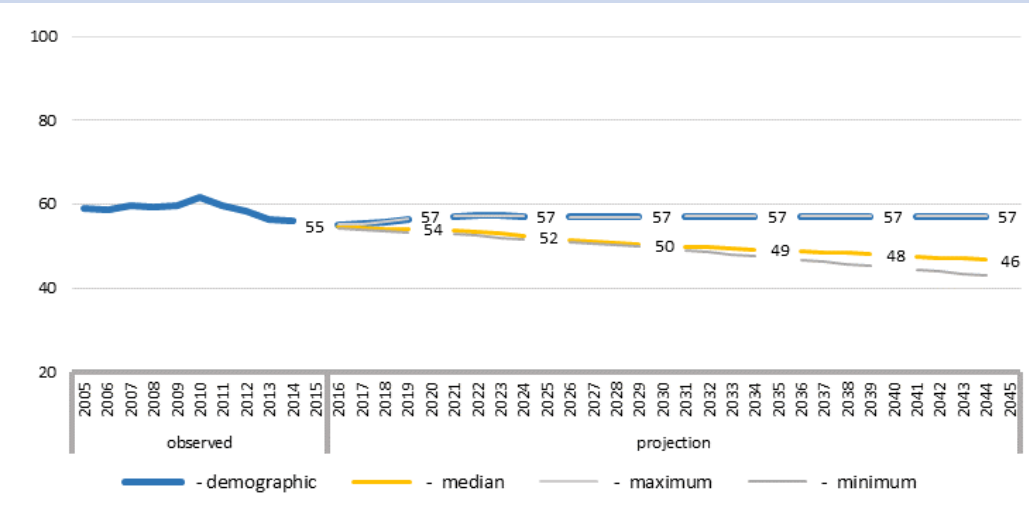
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-1%
2025	-5%
2030	-8%
2035	-10%
2040	-12%
2045	-15%

projected age-standardised rates 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

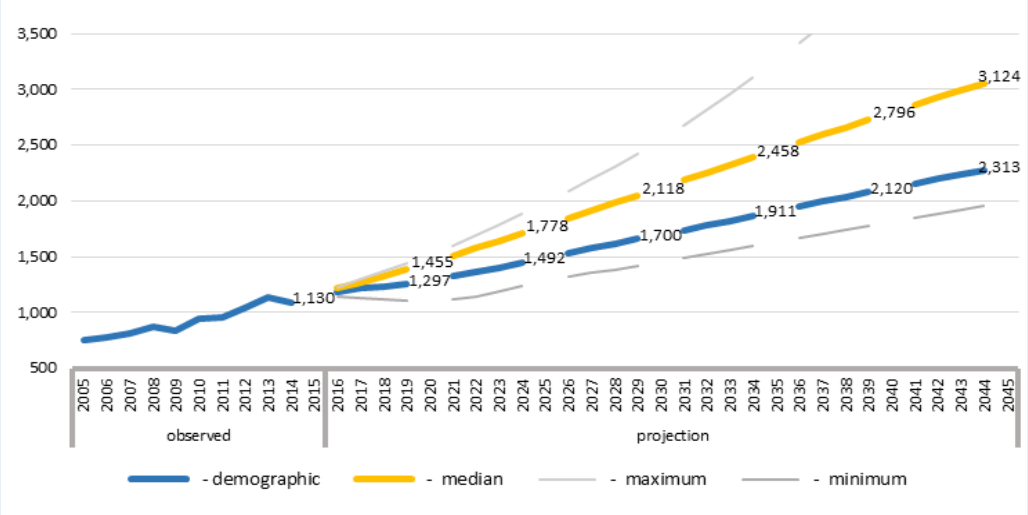
- Age-standardised rates of male lung cancer have decreased significantly since 1994. As a result, the median projection is lower than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (57 cases per 100,000).
- The median age-standardised rates are projected to decrease by 15% by 2045, giving a rate of 46 per 100,000.

Figure 3.18b.
Projections: Lung C34

FEMALES - CASES
% 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	15%	29%
2025	32%	57%
2030	50%	87%
2035	69%	118%
2040	88%	147%
2045	105%	176%

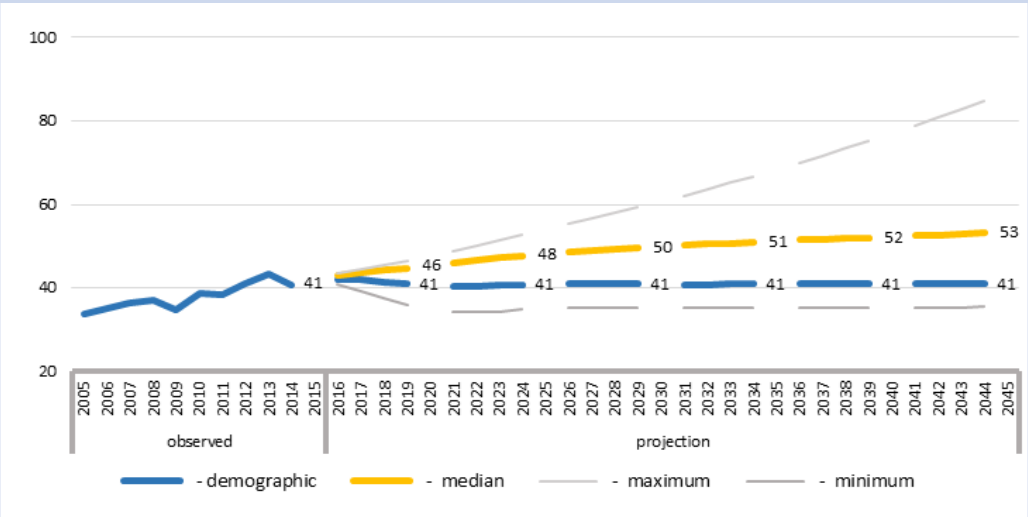
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	11%
2025	17%
2030	21%
2035	24%
2040	27%
2045	30%

projected age-standardised rates are shown in the graph on the right



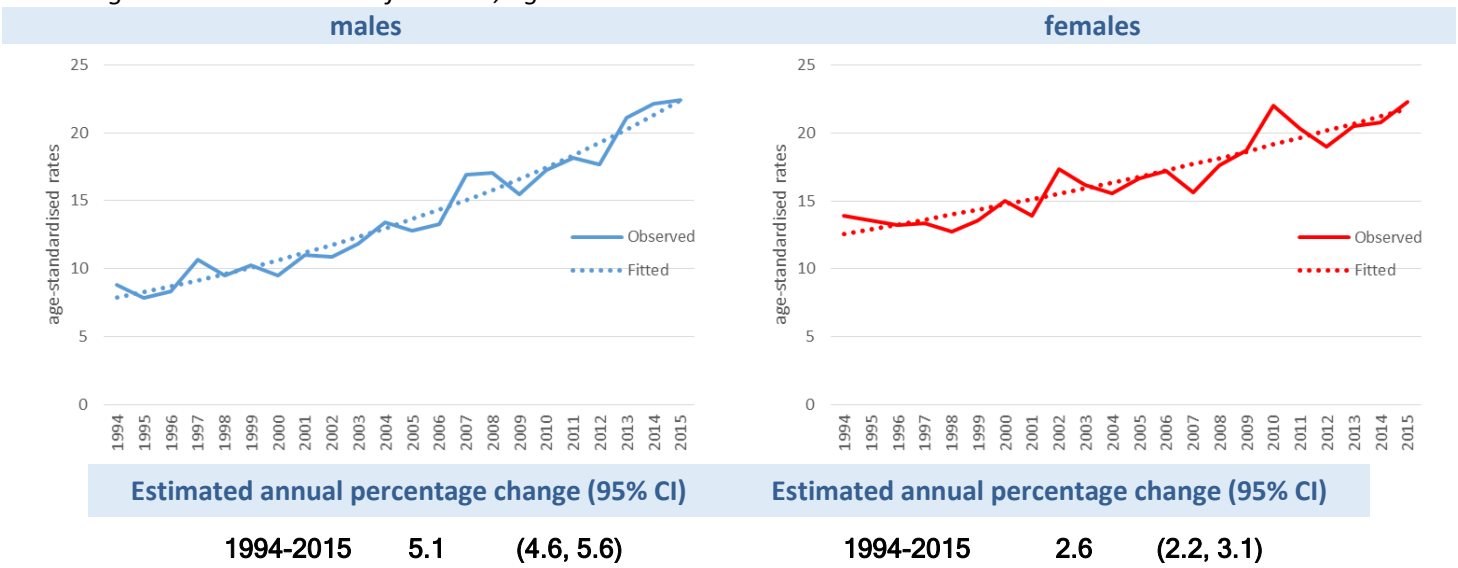
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Unlike for males, age-standardised rates of female lung cancer have increased substantially and significantly since 1994.
- For females, the median projection is higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (41 cases per 100,000).
- The median age-standardised rates are projected to increase by 30% by 2045, giving a rate of 53 per 100,000.

Melanoma of the skin

Trends in incidence rates 1994-2015

Figure 3.19. Melanoma of the skin; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2015	5.1	(4.6, 5.6)	1994-2015	2.6	(2.2, 3.1)

- Between 1994 and 2015, age-standardised rates of melanoma of the skin increased significantly for males by, on average, 5.1% per year. For females, the average age-standardised rates also increased significantly, by 2.6% from 1994-2015.

Summary of incidence projections to 2045

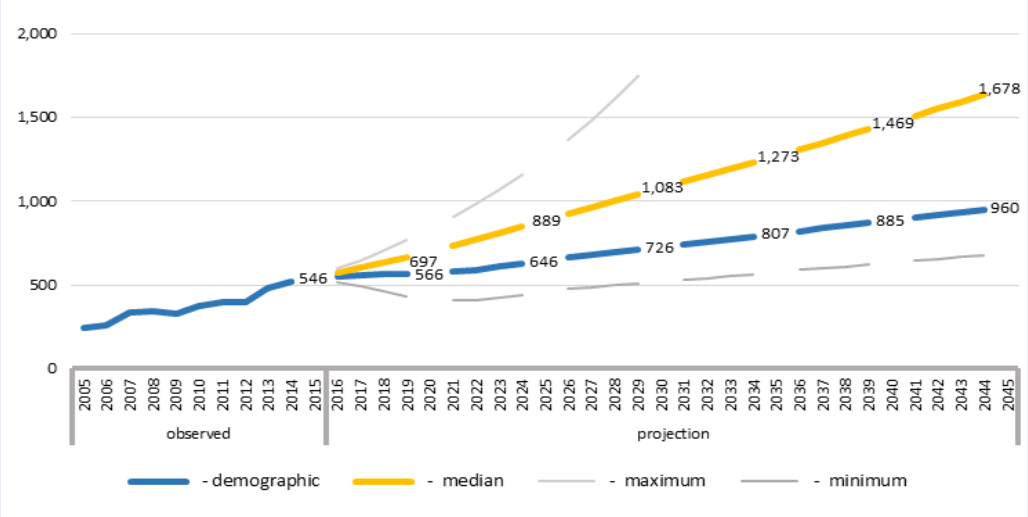
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of melanoma of the skin are projected to increase in males from 546 in 2015 to 960 in 2045 (+76%) and in females from 584 in 2015 to 925 in 2045 (+58%) – an increase to 1,885 for males and females combined (+67%).
- Compared to the demographic projection, the median projection suggests a much greater increase for males and females. For males, cases are projected to increase to 1,678 in 2045 (+207%), and for females, cases are projected to increase to 1,400 (+140%) - a 172% increase (to 3,078 cases) for both sexes combined.

Figure 3.20a.
Projections: Melanoma of skin C43

MALES - CASES
% 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	4%	28%
2025	18%	63%
2030	33%	98%
2035	48%	133%
2040	62%	169%
2045	76%	207%

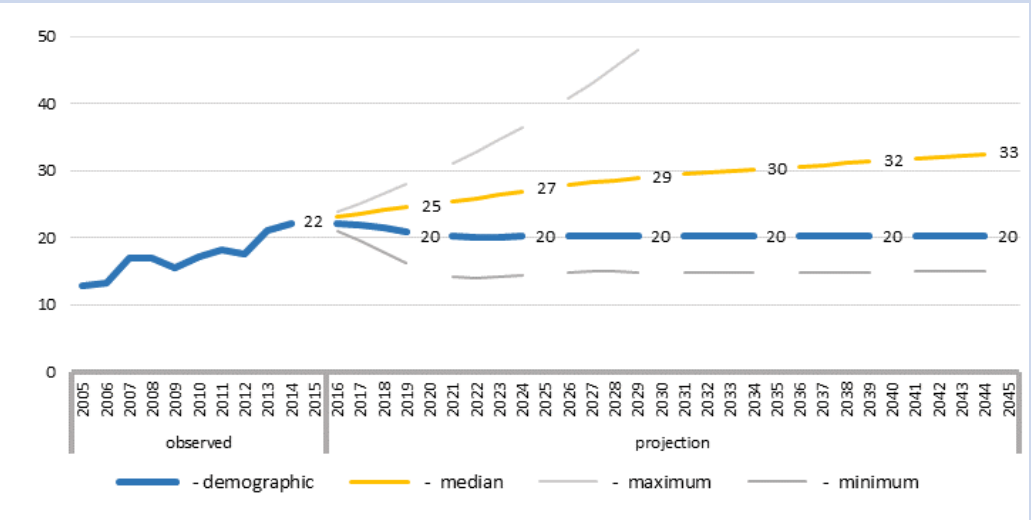
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	11%
2025	22%
2030	30%
2035	36%
2040	41%
2045	46%

projected age-standardised rates 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

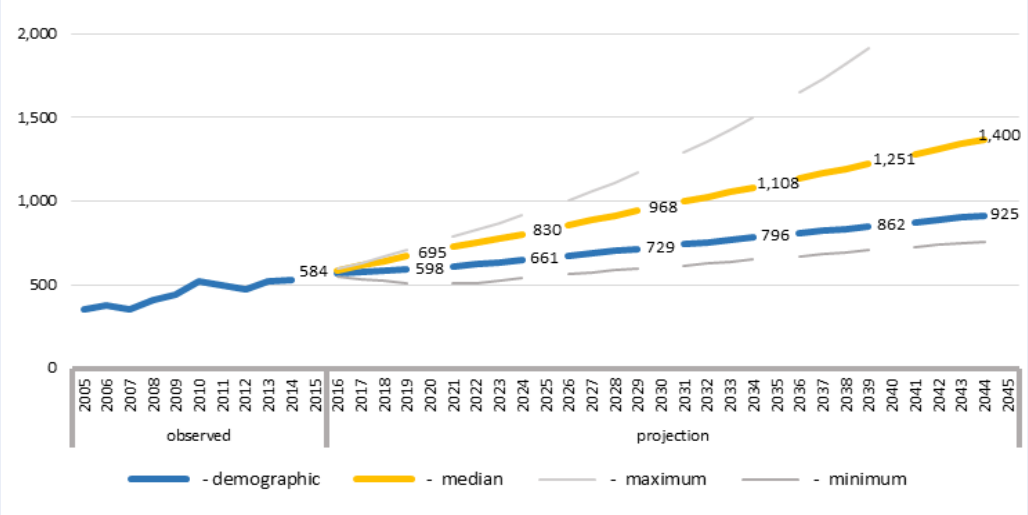
- Age-standardised rates of male melanoma of the skin have increased very substantially since 1994. As a result, the median projection is much higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (20 cases per 100,000).
- The median age-standardised rates are projected to increase by 46% by 2045, giving a rate of 33 per 100,000.

Figure 3.20b.
Projections: Melanoma of skin C43

FEMALES - CASES
% 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	2%	19%
2025	13%	42%
2030	25%	66%
2035	36%	90%
2040	48%	114%
2045	58%	140%

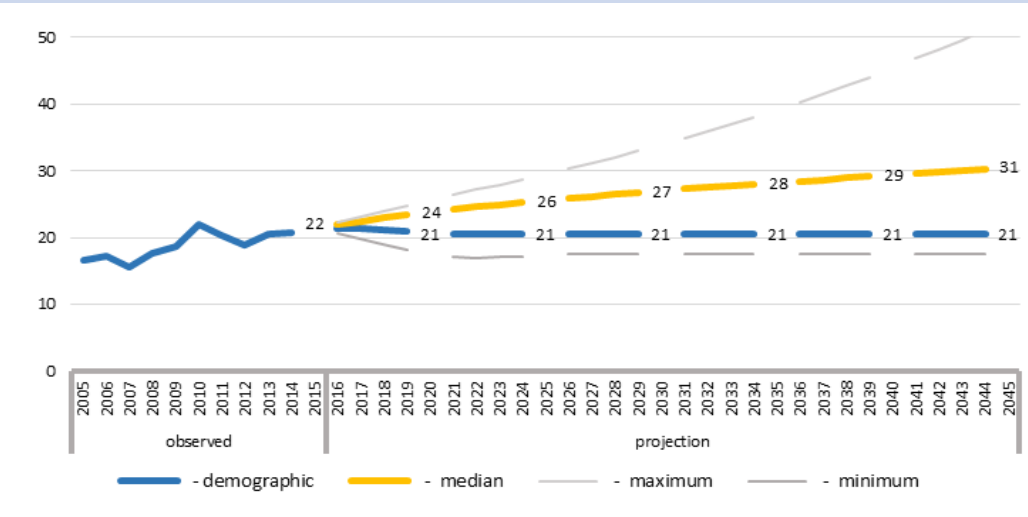
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	7%
2025	15%
2030	21%
2035	27%
2040	32%
2045	37%

projected age-standardised rates are shown in the graph on the right



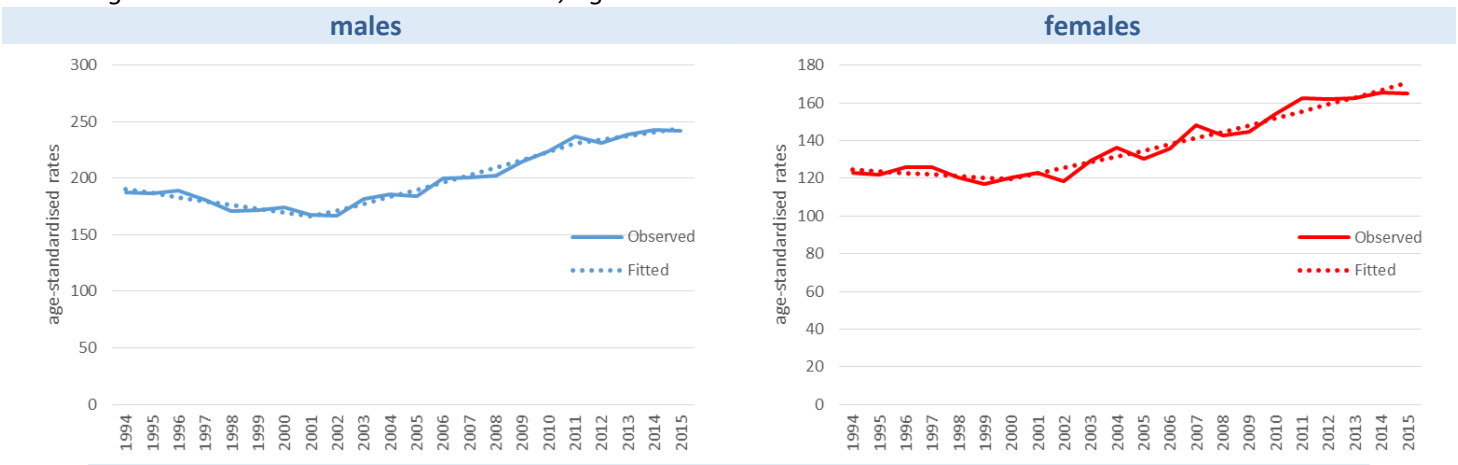
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of female melanoma of the skin have increased substantially since 1994. As a result, the median projection is higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (21 cases per 100,000).
- The median age-standardised rates are projected to increase by 37% by 2045, giving a rate of 31 per 100,000.

Non-melanoma skin cancer

Trends in incidence rates 1994-2015

Figure 3.21. Non-melanoma skin cancer; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2001	**-1.9**	**(-2.9, -1.0)**	1994-2000	-0.7	(-2.4, 1.1)
2001-2011	**3.3**	**(2.7, 4.0)**	**2000-2015**	**2.4**	**(2.0, 2.8)**
2011-2015	1.4	(-0.3, 3.0)			

- Between 1994 and 2001, average age-standardised rates of non-melanoma skin cancer decreased significantly for males, before increasing significantly between 2001 and 2011. Since 2011, the average rates have increased non-significantly, by 1.4% per year. For females, the average age-standardised rates decreased non-significantly between 1994 and 2000 before increasing significantly by an average of 2.4% per year between 2000 and 2015.

Summary of incidence projections to 2045

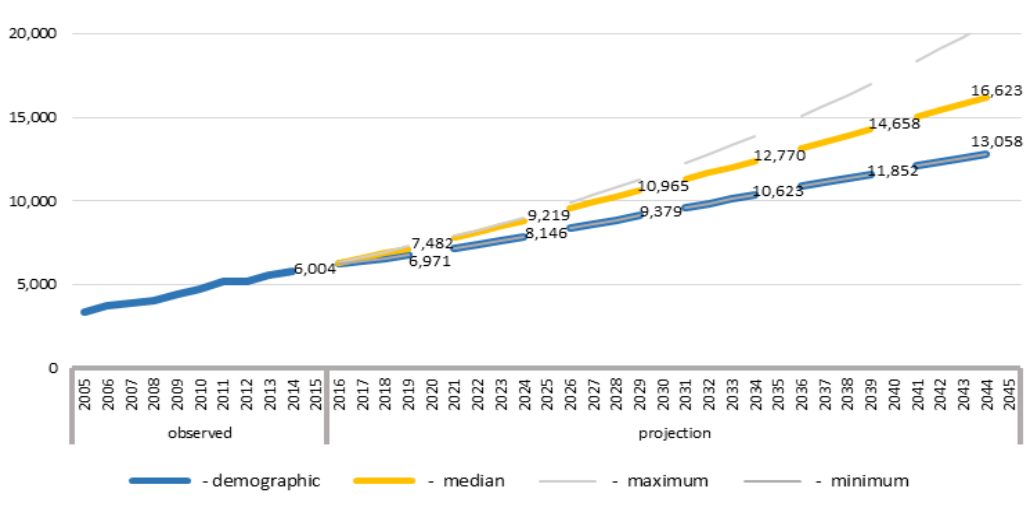
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of non-melanoma skin cancer are projected to increase in males from 6,004 in 2015 to 13,058 in 2045 (+117%) and in females from 4,669 in 2015 to 9,320 in 2045 (+100%) – an increase to 22,378 for males and females combined (+110%).
- Compared to the demographic projection, the median projection suggests a much greater increase for males and females. For males, cases are projected to increase to 16,623 in 2045 (+177%), and for females, cases are projected to increase to 13,503 (+189%) – an increase to 30,126 cases (+182%) for both sexes combined.

Figure 3.22a.
Projections: Non-melanoma skin cancer C44

MALES - CASES
% 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	16%	25%
2025	36%	54%
2030	56%	83%
2035	77%	113%
2040	97%	144%
2045	117%	177%

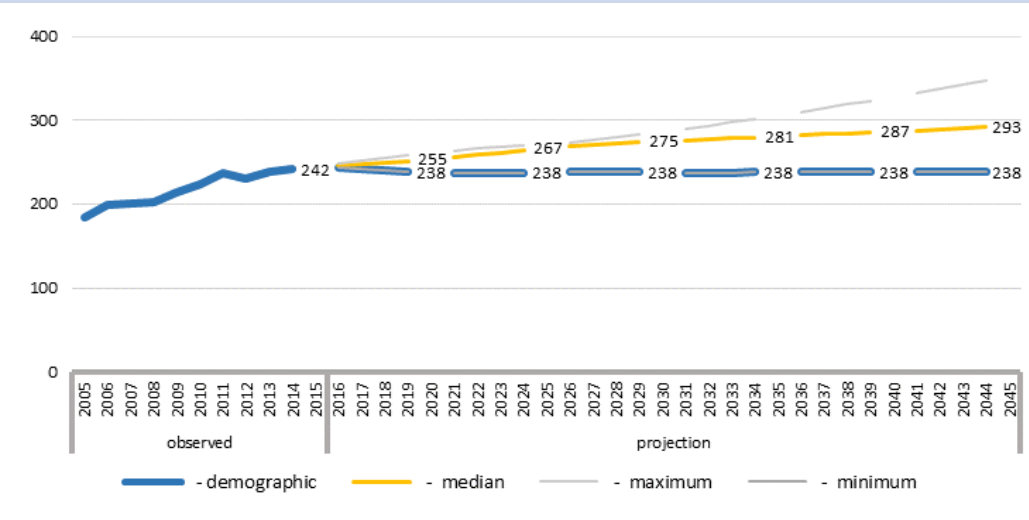
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	5%
2025	10%
2030	14%
2035	16%
2040	19%
2045	21%

projected age-standardised rates 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

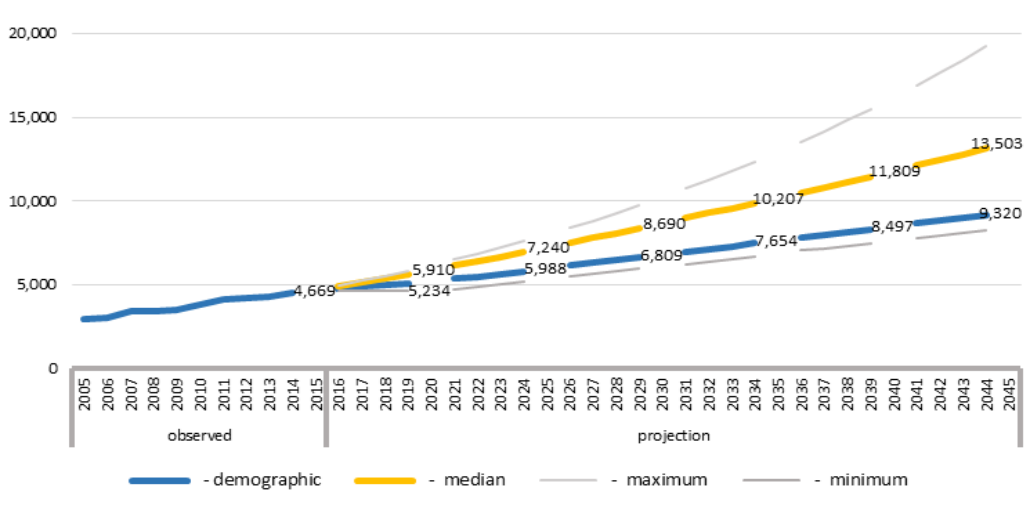
- Age-standardised rates of male non-melanoma skin cancer have increased, non-significantly, since 2011. As a result, the median projection is higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (238 cases per 100,000).
- The median age-standardised rates are projected to increase by 21% by 2045, giving a rate of 293 per 100,000.

Figure 3.22b.
Projections: Non-melanoma skin cancer C44

FEMALES - CASES
% 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	12%	27%
2025	28%	55%
2030	46%	86%
2035	64%	119%
2040	82%	153%
2045	100%	189%

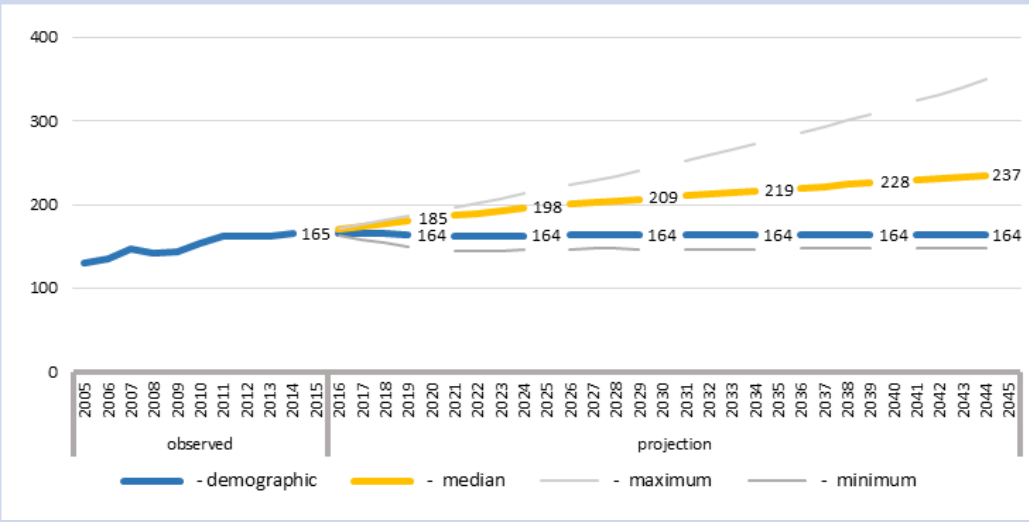
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	12%
2025	20%
2030	27%
2035	32%
2040	38%
2045	44%

projected age-standardised rates are shown in the graph on the right



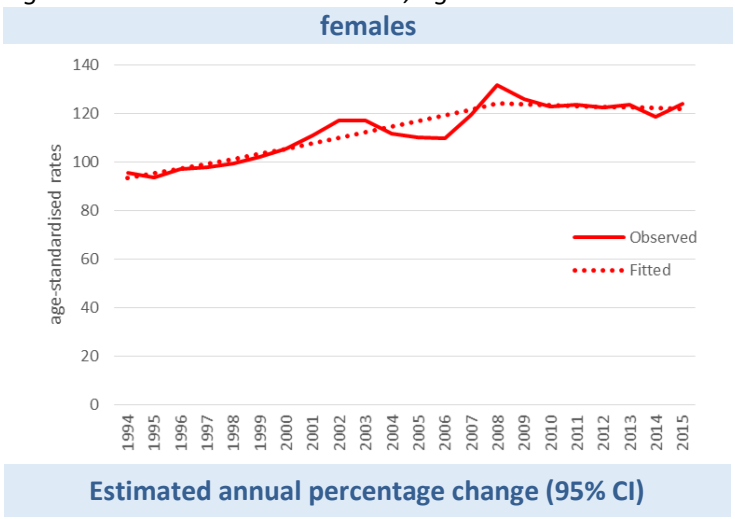
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of female non-melanoma skin cancer have increased significantly since 2000. As a result, the median projection is higher than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (164 cases per 100,000).
- The median age-standardised rates are projected to increase by 44% by 2045, giving a rate of 237 per 100,000.

Female breast cancer

Trends in incidence rates 1994-2015

Figure 3.23. Female breast cancer; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)		
1994-2008	**2.1**	**(1.5, 2.6)**
2008-2015	-0.3	(-1.4, 0.9)

- Between 1994 and 2008, age-standardised rates of female breast cancer increased significantly, on average, by 2.1% per year, before decreasing marginally (and non-significantly) by 0.3% per year between 2008 and 2015.
- The breast screening programme, BreastCheck, commenced screening in the North Eastern and Midland areas in 2000, and began screening nationally in 2007. These two time points coincide with observed increases in incidence rates, followed by declines in rates. This pattern is generally observed when screening is introduced.

Summary of incidence projections to 2045

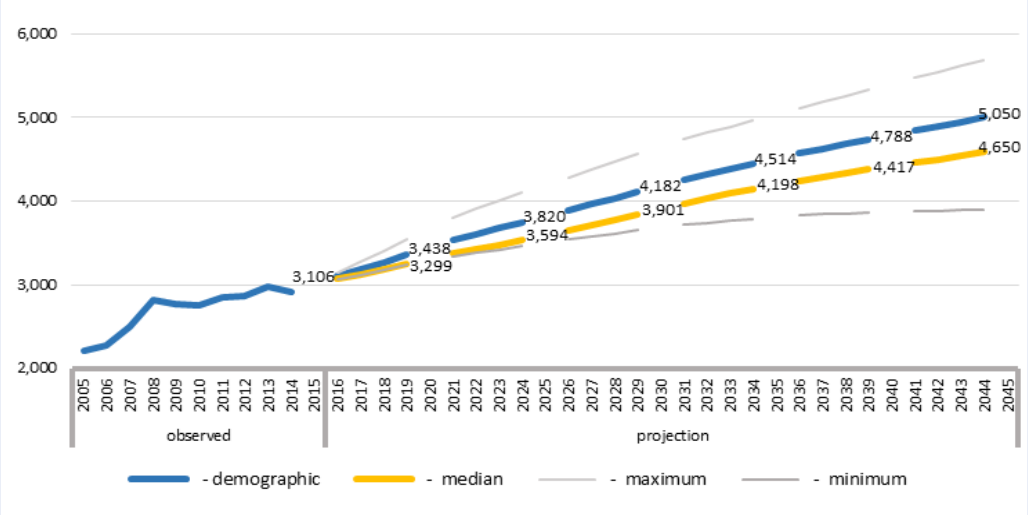
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of female breast cancer are projected to increase from 3,106 in 2015 to 5,050 in 2045 (+63%).
- Compared to the demographic projection, the median projection suggests a smaller increase. Cases are projected to increase to 4,650 in 2045 (+50%).

Figure 3.24.
Projections: Breast cancer C50

FEMALES - CASES
% 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	11%	6%
2025	23%	16%
2030	35%	26%
2035	45%	35%
2040	54%	42%
2045	63%	50%

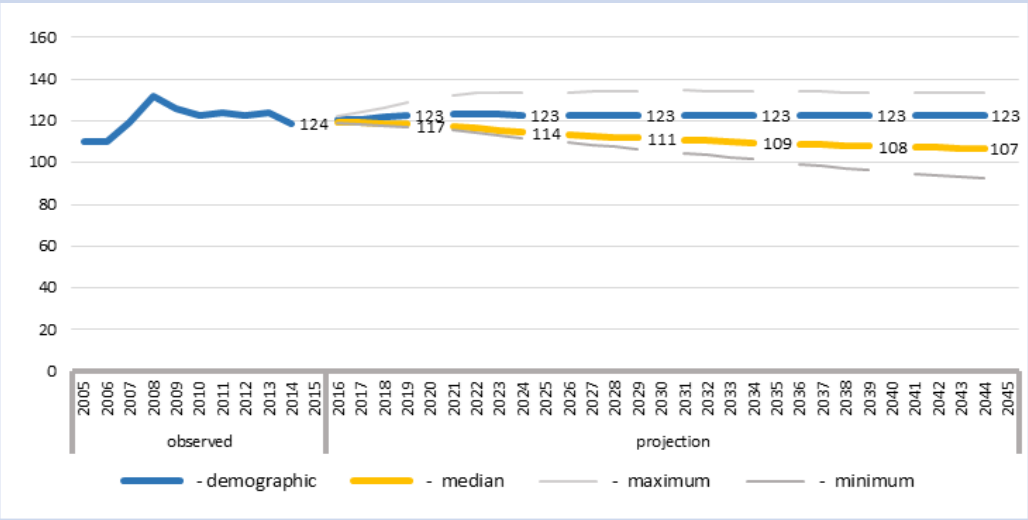
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-5%
2025	-8%
2030	-10%
2035	-12%
2040	-13%
2045	-14%

projected age-standardised rates are shown in the graph on the right



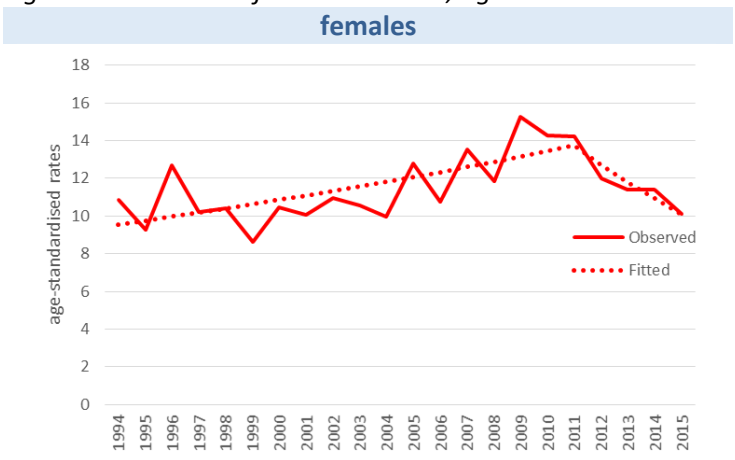
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of female breast cancer increased significantly between 1994 and 2008. Since then rates have begun to decline. The median projection is lower than the demographic projection which assumes the average 2011-2015 age-standardised rates apply into the future (123 cases per 100,000).
- The median age-standardised rates are projected to decrease by 14% by 2045, giving a rate of 107 per 100,000.

Cancer of the cervix uteri

Trends in incidence rates 1994-2015

Figure 3.25. Cancer of the cervix uteri; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)		
1994-2011	**2.2**	**(1.0, 3.4)**
2011-2015	-7.4	(-16.1, 2.2)

- Between 1994 and 2011, age-standardised rates of cervical cancer increased significantly, on average, by 2.2% per year, before decreasing sharply, though non-significantly, by 7.4% per year between 2011 and 2015.
- The decline in rates since 2011 is likely to be in part the result of the population-based screening programme, CervicalCheck, which was launched in 2008. The incidence rate of cervical cancer increased sharply in 2009 and has declined since then, with a steep drop beginning in 2011. HPV testing and vaccination may also lead to significant changes in incidence rates in the future.

Summary of incidence projections to 2045

- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of cervical cancer are projected to increase from 251 in 2015 to 392 in 2045 (+56%).
- The median projection suggests the same increase to 392 cases in 2045 (+56%).

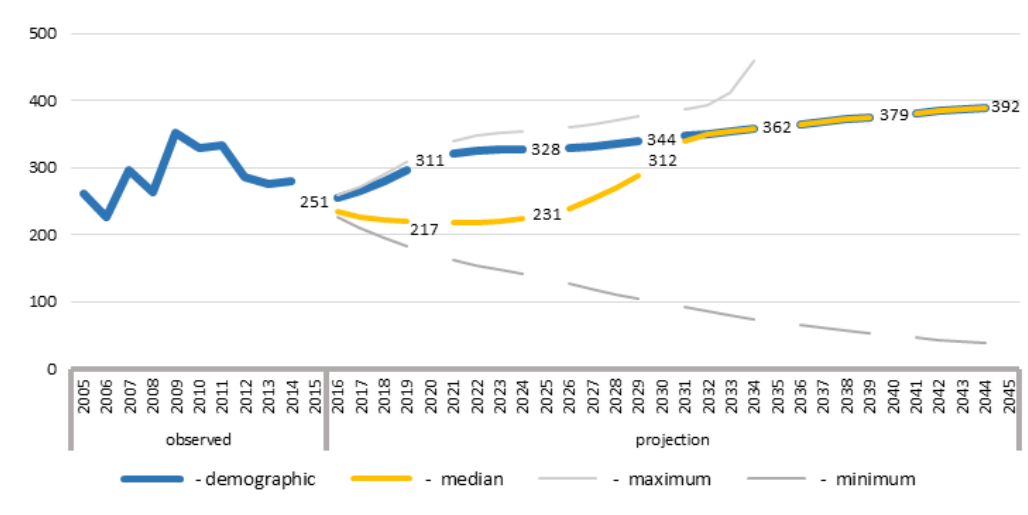
Figure 3.26.
Projections: Cervical cancer C53

FEMALES - CASES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 4 model projection estimates *and* the demographic estimate (4+1)*

	demographic projection	model median estimate projection
2020	24%	-13%
2025	30%	-8%
2030	37%	24%
2035	44%	44%
2040	51%	51%
2045	56%	56%

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

* The HD2 model was excluded from this analysis

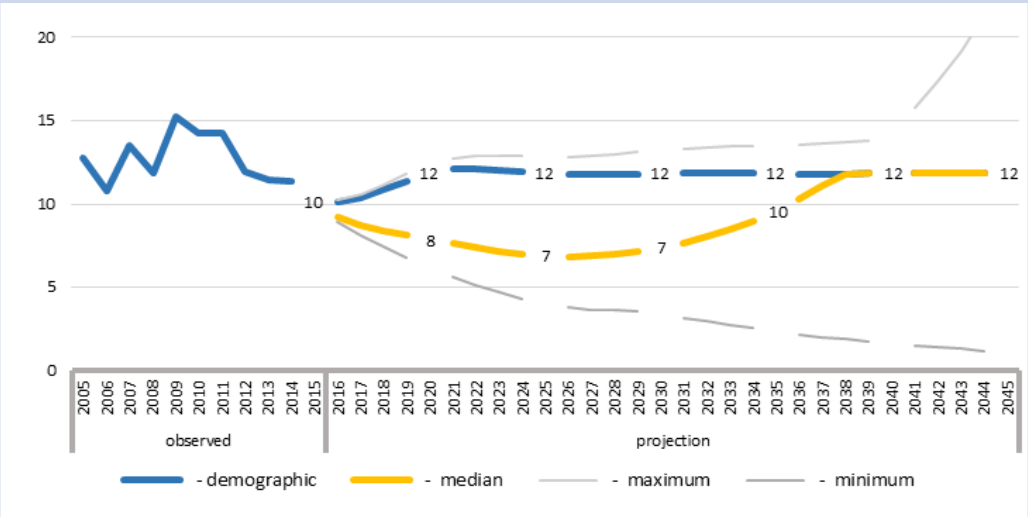


FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 4 model projection estimates *and* the demographic estimate (4+1)*

	model median estimate projection
2020	-23%
2025	-32%
2030	-27%
2035	-5%
2040	17%
2045	17%

projected age-standardised rates are shown in the graph on the right

* The HD2 model was excluded from this analysis



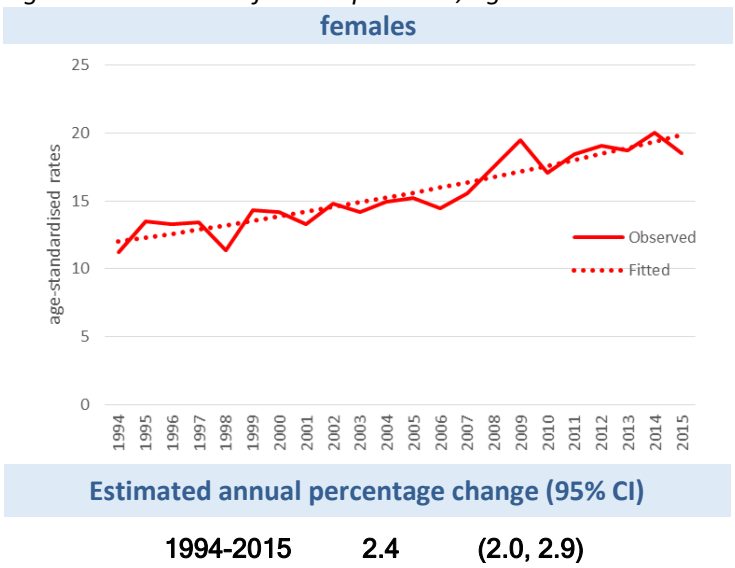
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- The median of all model projections of cervical cancer starts out lower than the demographic projection, before increasing and mirroring the demographic projection from around 2030. The different models produce very different projections of future incidence. HD model 2 was excluded from this analysis as it projected that incidence of cervical cancer would become negative by 2030.
- Although the demographic projection suggests a rise in age-standardised rate between 2015 and 2020, this is because it uses the average rate for 2011-2015 (higher than the 2015 figure because rates declined from 2011 onwards.
- The median age-standardised rates are likewise projected to increase to 12 per 100,000 by 2045, but this would represent no change compared with the 2011-2015 average rate.

Cancer of the corpus uteri

Trends in incidence rates 1994-2015

Figure 3.27. Cancer of the corpus uteri; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)		
1994-2015	2.4	(2.0, 2.9)

- Between 1994 and 2015, age-standardised rates of cancer of the corpus uteri increased significantly, on average, by 2.4% per year.

Summary of incidence projections to 2045

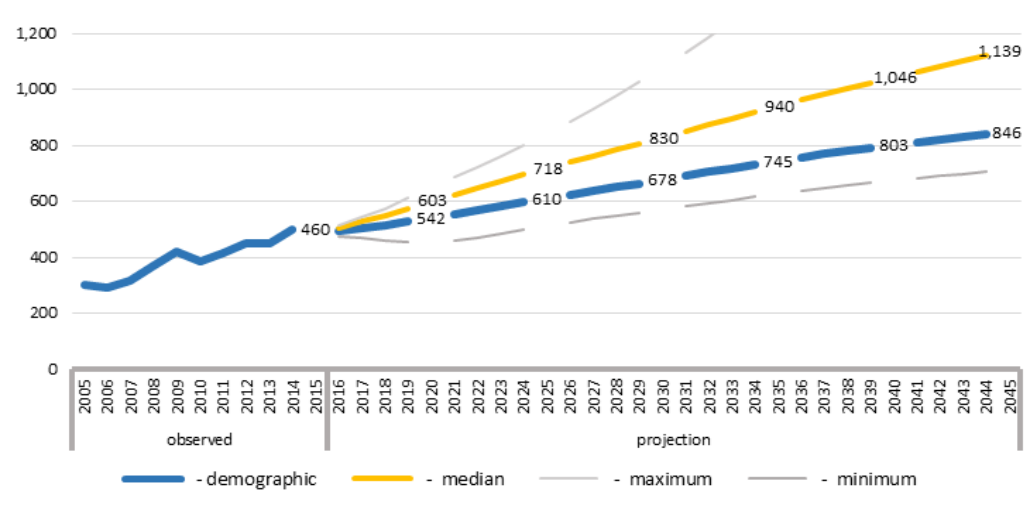
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of cancer of the corpus uteri are projected to increase from 460 in 2015 to 846 in 2045 (+84%).
- The median projection suggests a greater increase to 1,139 cases in 2045 (+148%).

Figure 3.28.
Projections: Cancer of the corpus uteri C54

FEMALES - CASES
% 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	18%	31%
2025	33%	56%
2030	47%	80%
2035	62%	104%
2040	75%	127%
2045	84%	148%

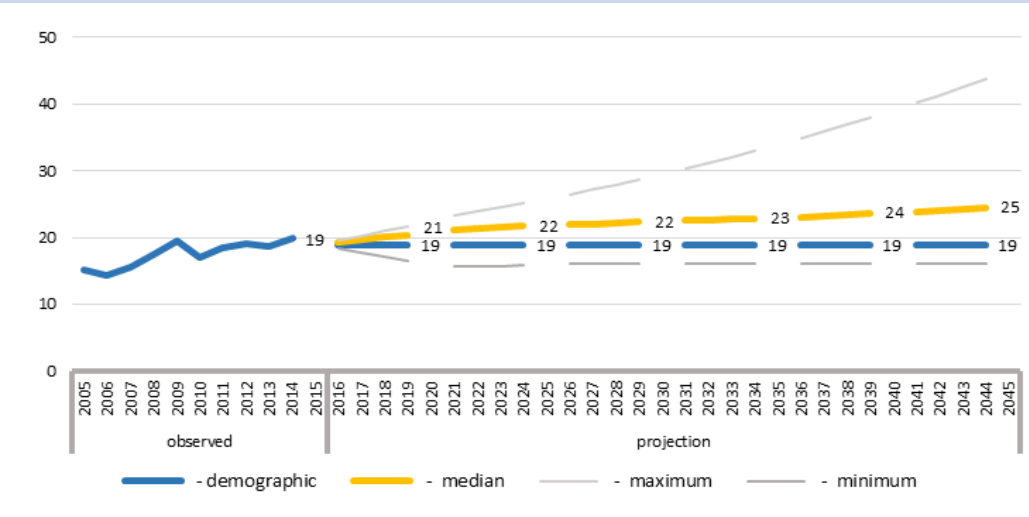
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	13%
2025	18%
2030	21%
2035	24%
2040	28%
2045	33%

projected age-standardised rates are shown in the graph on the right



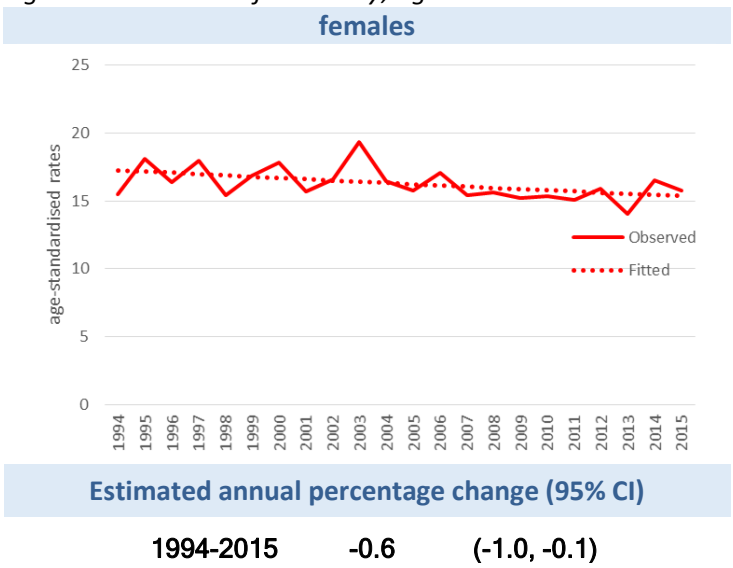
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of cancer of the corpus uteri have increased significantly since 1994. The median projection is higher than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (19 cases per 100,000).
- The median age-standardised rates are projected to increase by 33% by 2045, giving a rate of 25 per 100,000.

Cancer of the ovary

Trends in incidence rates 1994-2015

Figure 3.29. Cancer of the ovary; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)		
1994-2015	-0.6	(-1.0, -0.1)

- Between 1994 and 2015, age-standardised rates of cancer of the ovary decreased significantly, on average, by 0.6% per year.

Summary of incidence projections to 2045

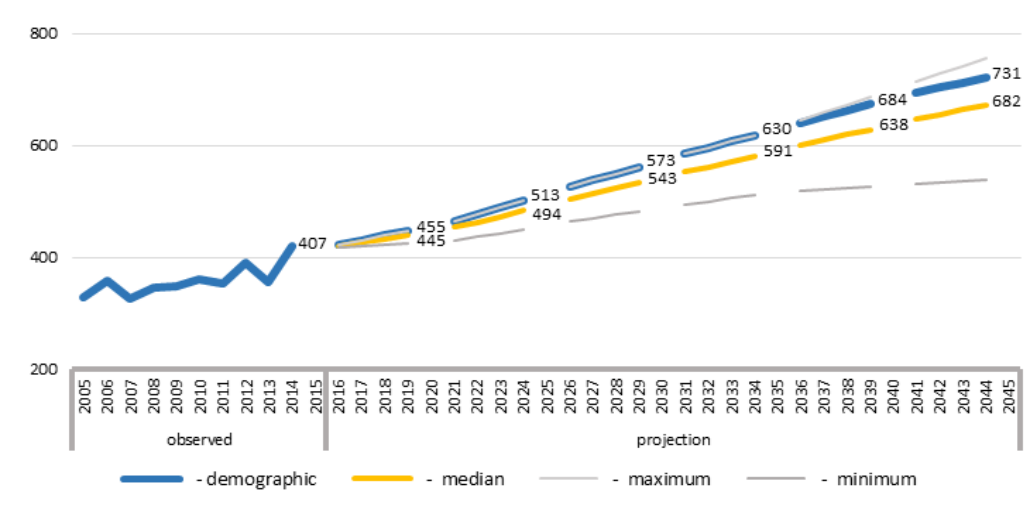
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of cancer of the ovary are projected to increase from 407 in 2015 to 731 in 2045 (+80%).
- The median projection suggests a smaller increase to 682 cases in 2045 (+68%).

Figure 3.30.
Projections: Ovarian cancer C56

FEMALES - CASES
% 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	12%	9%
2025	26%	21%
2030	41%	33%
2035	55%	45%
2040	68%	57%
2045	80%	67%

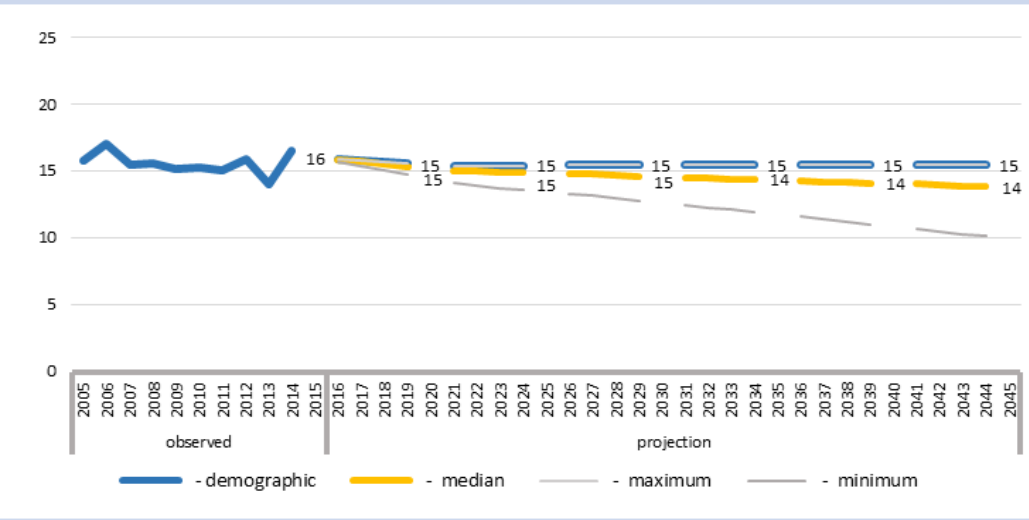
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-4%
2025	-6%
2030	-7%
2035	-9%
2040	-11%
2045	-12%

projected age-standardised rates are shown in the graph on the right



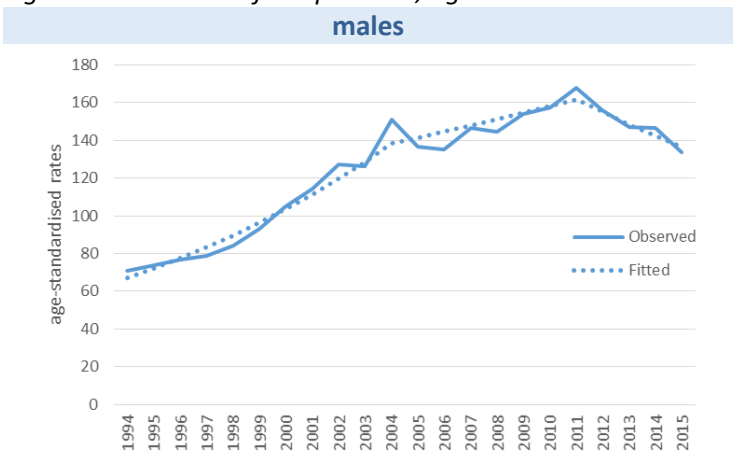
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of ovarian cancer have declined steadily since 1994. As a result, the median projection is lower than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (15 cases per 100,000).
- The median age-standardised rates are projected to decrease by 12% by 2045, giving a rate of 14 per 100,000.

Cancer of the prostate

Trends in incidence rates 1994-2015

Figure 3.31. Cancer of the prostate; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)		
1994-2004	7.5	(6.5, 8.6)
2004-2011	2.3	(0.7, 3.8)
2011-2015	-4.2	(-6.6, -1.7)

- Between 1994 and 2004, age-standardised rates of prostate cancer increased sharply and significantly, on average, by 7.5% per year. Between 2004 and 2011 the average rates continued to increase significantly, but at a slower rate, by 2.3% per year. Since 2011 rates have declined significantly by an average of 4.2% per year.
- The trends in incidence of prostate cancer seen have been affected by major increases in PSA testing of asymptomatic men (in effect, opportunistic screening) since the mid-1990s [11]. The initial increase in rates, and recent decline, are probably in line with what might be expected.

Summary of incidence projections to 2045

- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of prostate cancer are projected to increase from 3,214 in 2015 to 6,869 in 2045 (+114%).
- The median projection on the other hand suggests there will be almost no change in the number of cases, with a projection of 3,203 cases by 2045.

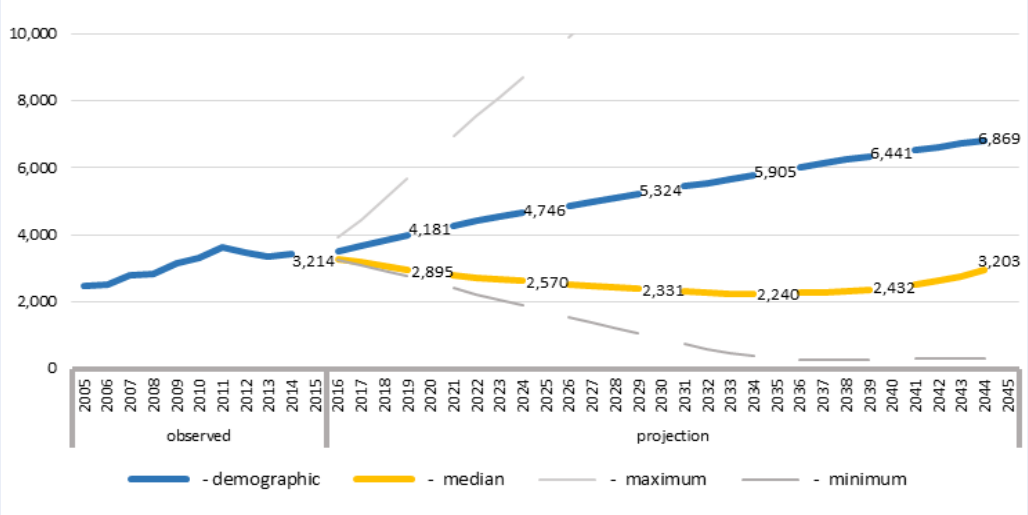
Figure 3.32.
Projections: Prostate cancer C61

MALES - CASES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 4 model projection estimates *and* the demographic estimate (4+1)*

	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

* The HD2 model was excluded from this analysis

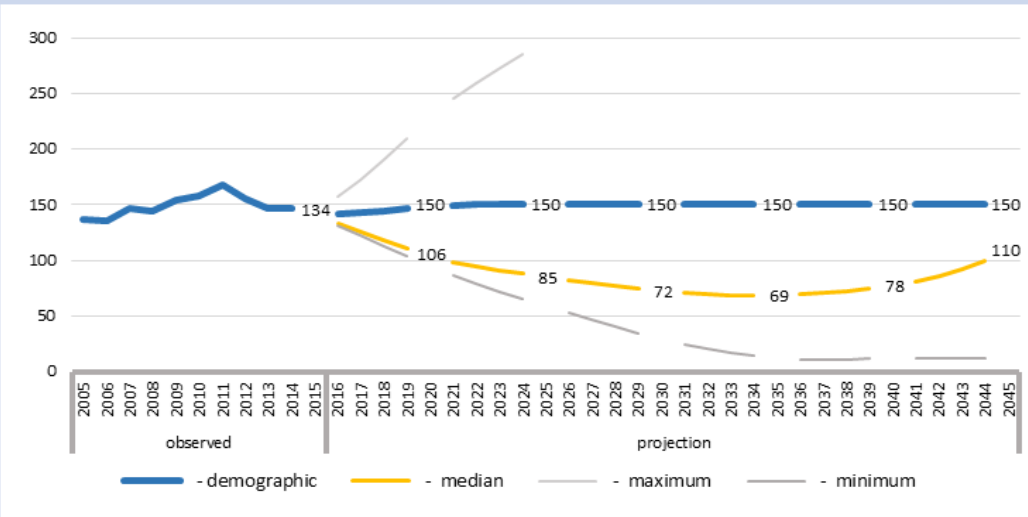


MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 4 model projection estimates *and* the demographic estimate (4+1)*

	model median estimate projection
2020	-21%
2025	-36%
2030	-46%
2035	-49%
2040	-42%
2045	-18%

projected age-standardised rates are shown in the graph on the right

* The HD2 model was excluded from this analysis



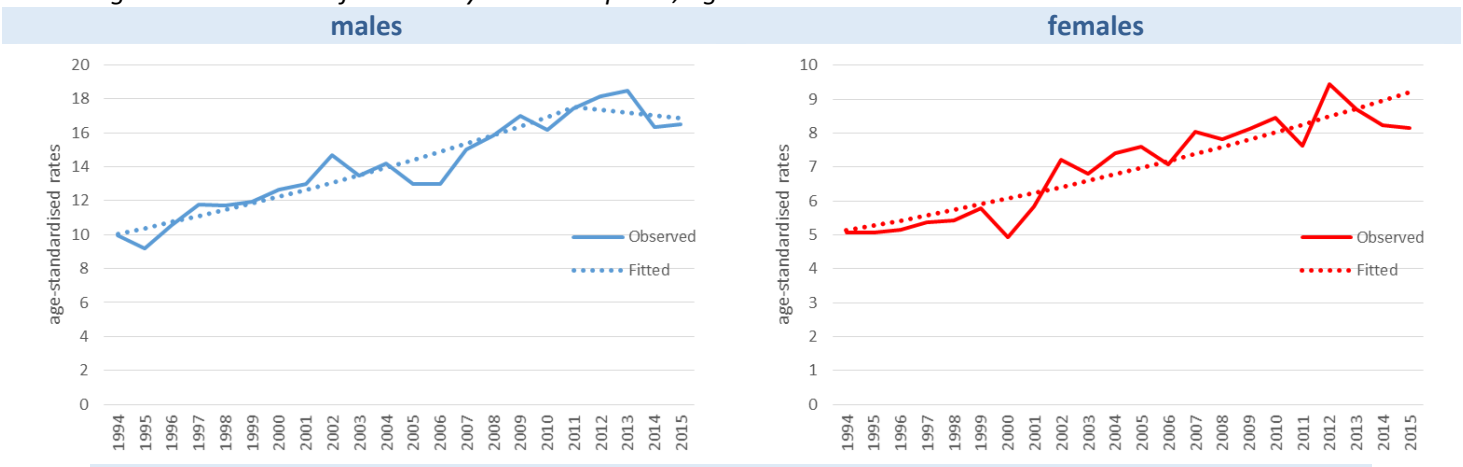
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- The full range of projections derived from all models is extremely wide - the widest of any cancer presented here. HD model 2 was excluded from this analysis as it projected that incidence of prostate cancer would become negative by 2035.
- Changes in trends, reflecting PSA testing, in combination with age-specific variation, and 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.

Cancer of the kidney and renal pelvis

Trends in incidence rates 1994-2015

Figure 3.33. Cancer of the kidney and renal pelvis; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)		
1994-2011	**3.3**	**(2.6, 4.0)**
2011-2015	-0.9	(-5.4, 3.7)

Estimated annual percentage change (95% CI)		
1994-2015	**2.8**	**(2.2, 3.5)**

- Between 1994 and 2011, age-standardised rates of cancer of the kidney and renal pelvis increased significantly for males by, on average, 3.3% per year, before declining non-significantly by an average of 0.9% per year between 2011 and 2015. For females, the average age-standardised rates increased significantly by 2.8% from 1994-2015.

Summary of incidence projections to 2045

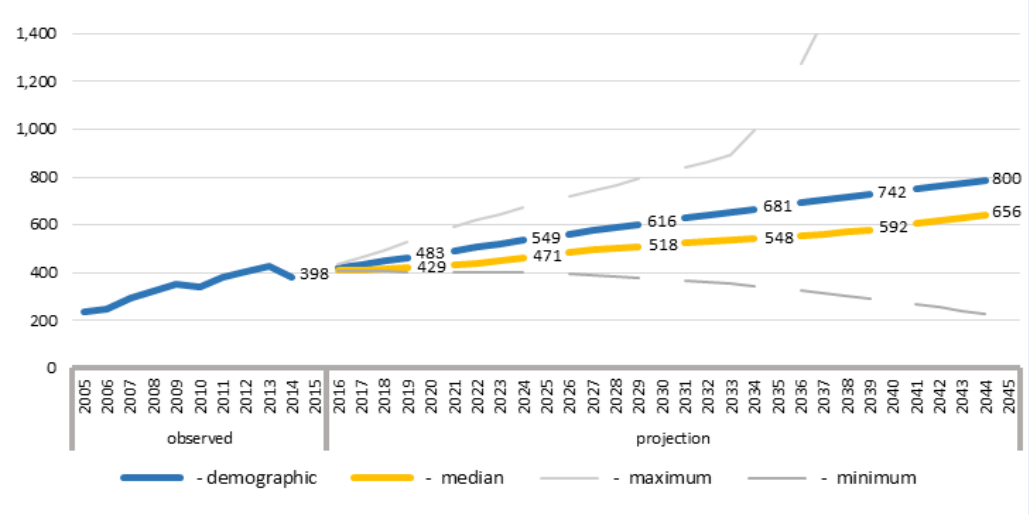
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of kidney and renal pelvis cancer are projected to increase in males from 398 in 2015 to 800 in 2045 (+101%) and in females from 215 in 2015 to 424 in 2045 (+97%) – an increase to 1,224 for males and females combined (+100%).
- Compared to the demographic projection, the median projection suggests a more modest increase for males, and much greater increase for females. For males, cases are projected to increase to 656 in 2045 (+65%), and for females, cases are projected to increase to 658 (+206%) – a 114% increase for both sexes combined.

Figure 3.34a.
Projections: Kidney and renal pelvis cancer C64-C65

MALES - CASES
% 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%	8%
2025	38%	18%
2030	55%	30%
2035	71%	38%
2040	87%	49%
2045	101%	65%

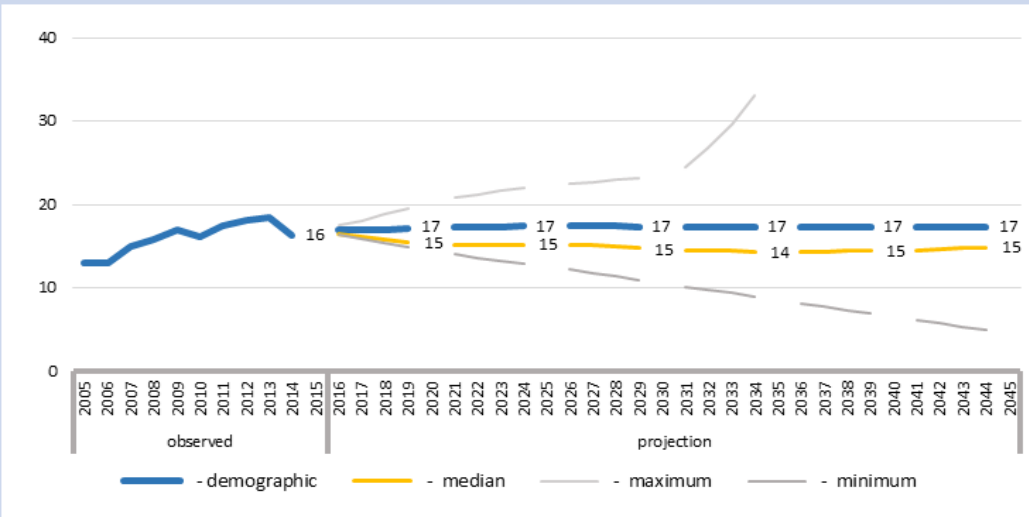
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-6%
2025	-7%
2030	-11%
2035	-13%
2040	-12%
2045	-9%

projected age-standardised rates 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

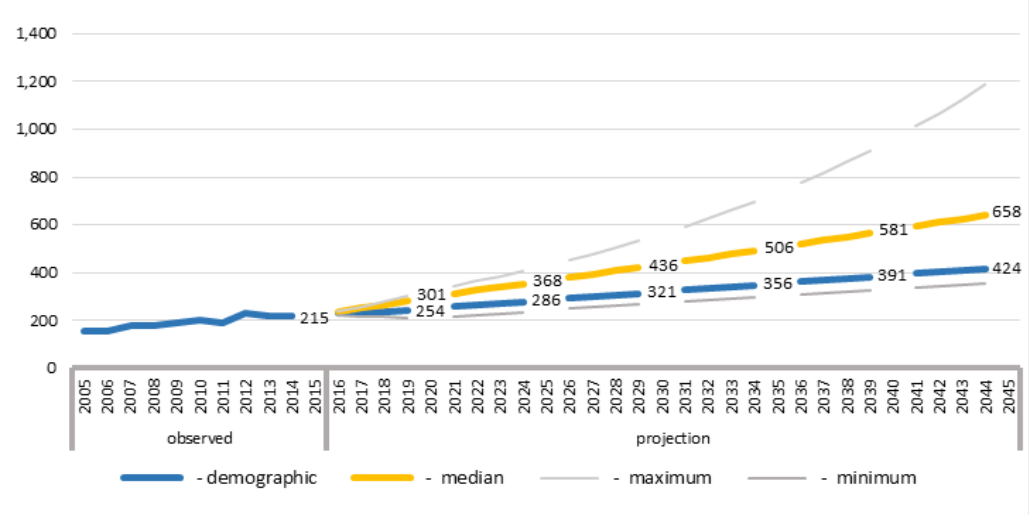
- Age-standardised rates of cancer of the kidney and renal pelvis in males increased significantly between 1994 and 2011. Since 2011 rates have declined slightly. As a result, the median projection is slightly lower than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (17 cases per 100,000).
- The median age-standardised rates are projected to decrease by 9% by 2045, giving a rate of 15 per 100,000.

Figure 3.34b.
Projections: Kidney and renal pelvis cancer C64-C65

FEMALES - CASES
% 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	18%	40%
2025	33%	71%
2030	49%	103%
2035	66%	135%
2040	82%	170%
2045	97%	206%

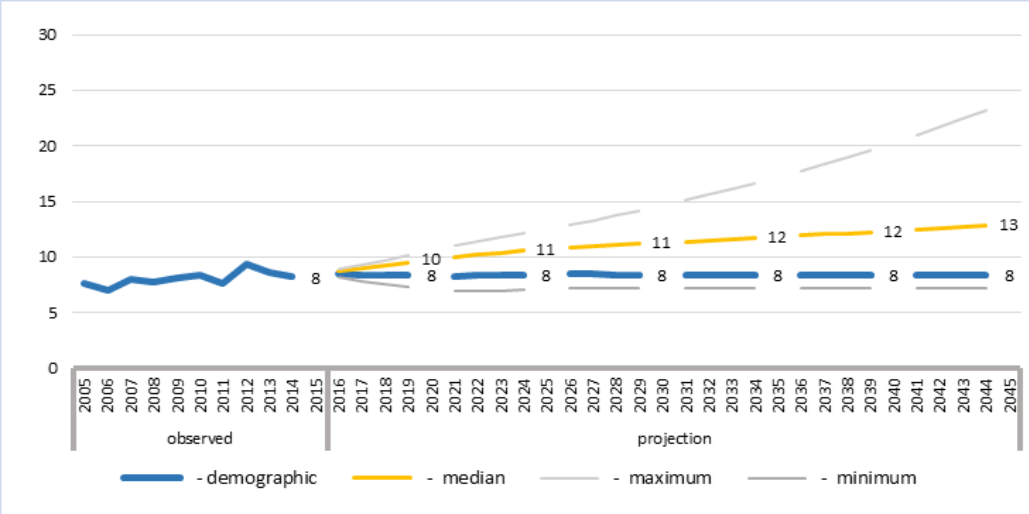
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	21%
2025	31%
2030	39%
2035	45%
2040	52%
2045	59%

projected age-standardised rates are shown in the graph on the right



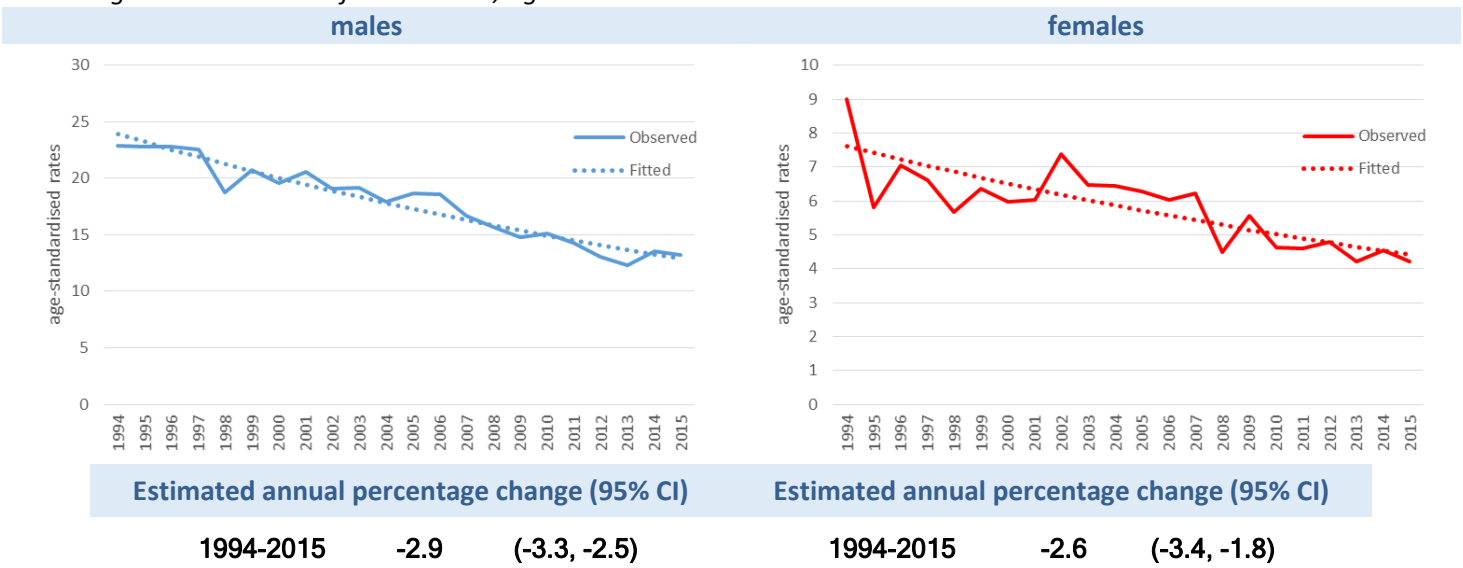
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of cancer of the kidney and renal pelvis in females increased significantly since 1994. As a result, the median projection is much higher than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (8 cases per 100,000).
- The median age-standardised rates are projected to increase by 59% by 2045, giving a rate of 13 per 100,000.

Cancer of the bladder

Trends in incidence rates 1994-2015

Figure 3.35. Cancer of the bladder; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2015	-2.9	(-3.3, -2.5)	1994-2015	-2.6	(-3.4, -1.8)

- Between 1994 and 2015, age-standardised rates of bladder cancer decreased significantly for males and females by, on average, 2.9% per year and 2.6% per year, respectively.
- However, because of coding inconsistencies over time, these decreases are over-estimated, as some cases registered as invasive bladder cancer in earlier years would not be registrable as invasive cases based on more recent registration criteria. This has implications for projections and therefore results quoted should be treated with some caution.

Summary of incidence projections to 2045

- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of bladder cancer are projected to increase in males from 329 in 2015 to 814 in 2045 (+147%) and in females from 128 in 2015 to 305 in 2045 (+138%) – an increase to 1,119 for males and females combined (+145%).
- Compared to the demographic projection, the median projection suggests a much more modest increase for males and females. For males, cases are projected to increase to 438 in 2045 (+33%), and for females, cases are projected to increase to 177 (+38%) - a 35% increase (to 615 cases) for both sexes combined. However, because the long-term (1994-2015) decline in bladder cancer rates is exaggerated by coding issues, median and non-demographic projections of case numbers are likely to be too low for this site.

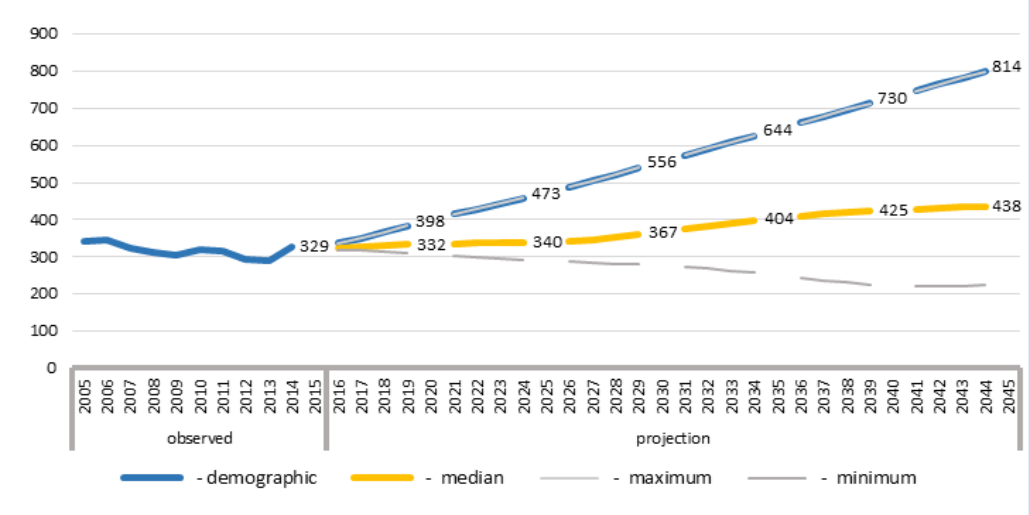
Figure 3.36a.
Projections: Bladder cancer C67

MALES - CASES
% projected increase: represents the increase on the observed 2015 case count - based on demographic population increase alone, **or** the median of 4 model projection estimates *and* the demographic estimate (4+1)*

	demographic projection	model median estimate projection
2020	21%	1%
2025	44%	3%
2030	69%	12%
2035	96%	23%
2040	122%	29%
2045	147%	33%

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

* The HD2 model was excluded from this analysis

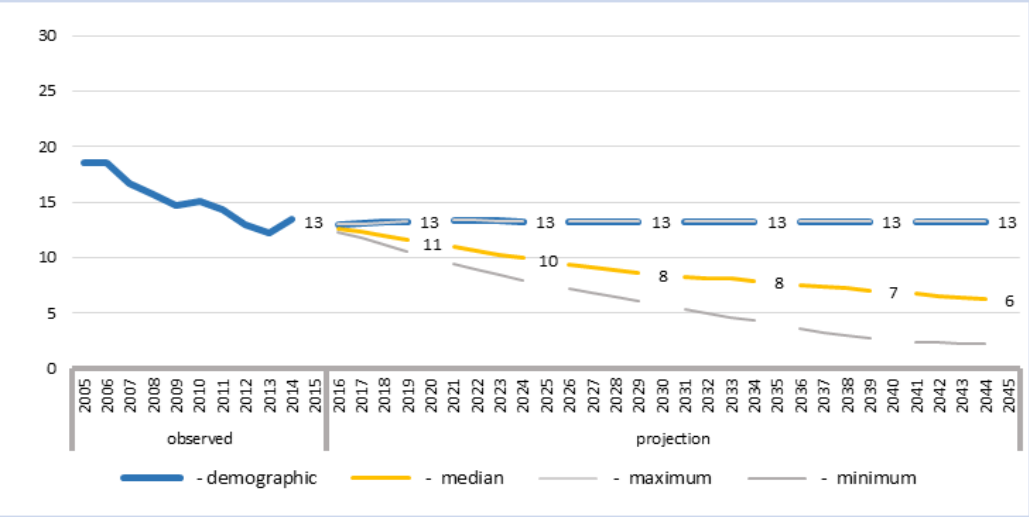


MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 4 model projection estimates *and* the demographic estimate (4+1)*

	model median estimate projection
2020	-15%
2025	-27%
2030	-36%
2035	-41%
2040	-48%
2045	-54%

projected age-standardised rates are shown in the graph on the right

* The HD2 model was excluded from this analysis



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

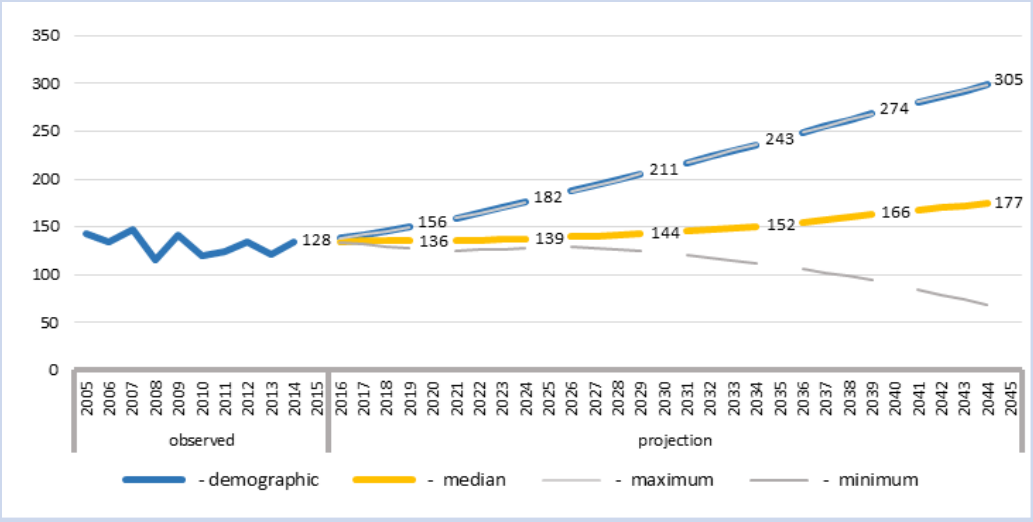
- Age-standardised rates of male bladder cancer have declined significantly since 1994. As a result, the median projection is considerably lower than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (13 cases per 100,000).
- HD model 2 was excluded from this analysis as it projected that incidence of bladder cancer would become negative by 2040.
- The median age-standardised rates are projected to decrease by 54% by 2045, giving a rate of 6 per 100,000.
- As noted earlier, the extent of the decline in bladder cancer rates between 1994 and 2015 has been over-estimated because of coding issues, thus the non-demographic projections (and median projection) are likely to underestimate future case numbers.

Figure 3.36b.
Projections: Bladder cancer C67

FEMALES - CASES
% 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	22%	7%
2025	42%	8%
2030	65%	12%
2035	90%	19%
2040	114%	29%
2045	138%	38%

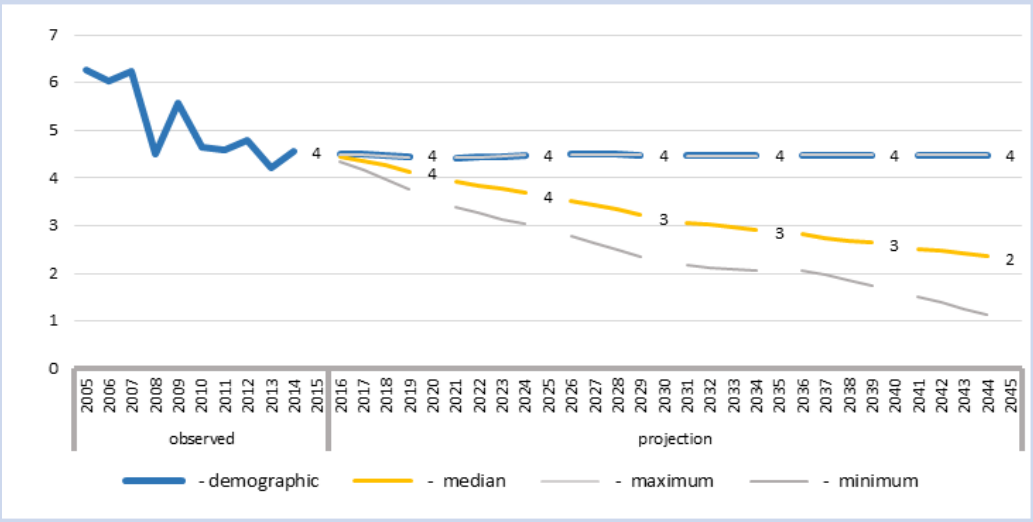
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-3%
2025	-15%
2030	-26%
2035	-32%
2040	-39%
2045	-45%

projected age-standardised rates are shown in the graph on the right



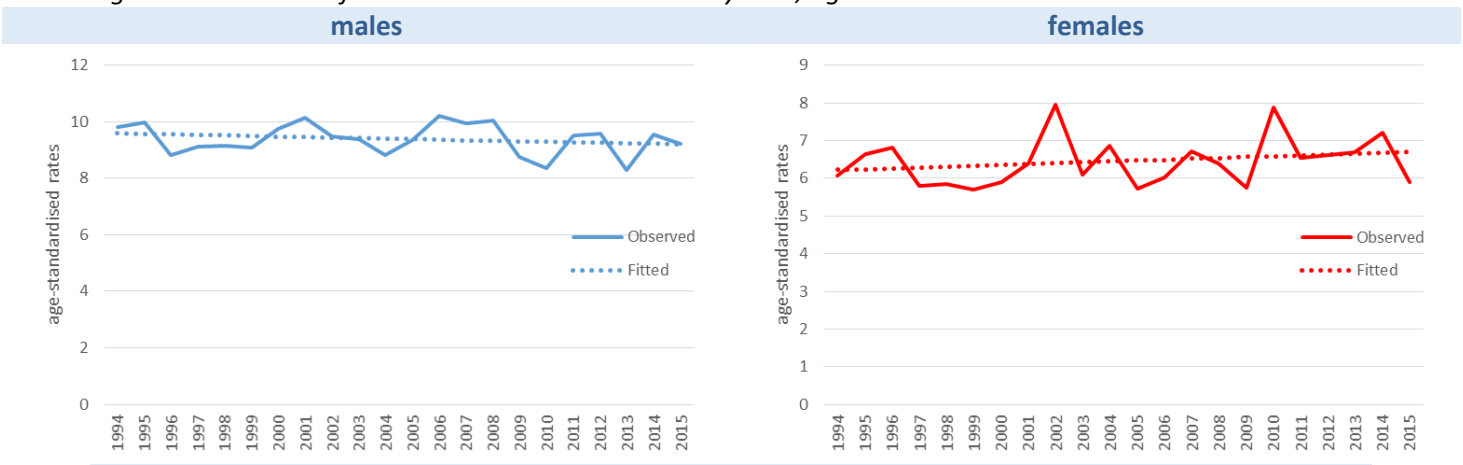
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of female bladder cancer have declined significantly since 1994. As a result, the median projection is considerably lower than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (4 cases per 100,000).
- The median age-standardised rates are projected to decrease by 45% by 2045, giving a rate of 2 per 100,000.
- As for males, over-estimation of the decline in bladder cancer rates between 1994 and 2015 because of coding issues makes it likely that the non-demographic projections (and median projection) of future case numbers are underestimates.

Cancer of the brain and central nervous system

Trends in incidence rates 1994-2015

Figure 3.37. Cancer of the brain and central nervous system; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2015	-0.2	(-0.6, 0.2)	1994-2015	0.4	(-0.3, 1.1)

- Between 1994 and 2015, age-standardised rates of cancer of the brain and central nervous system did not change significantly for males or females. Rates decreased by, on average, 0.2% per year for males, and rates increased by 0.4% per year, for females.

Summary of incidence projections to 2045

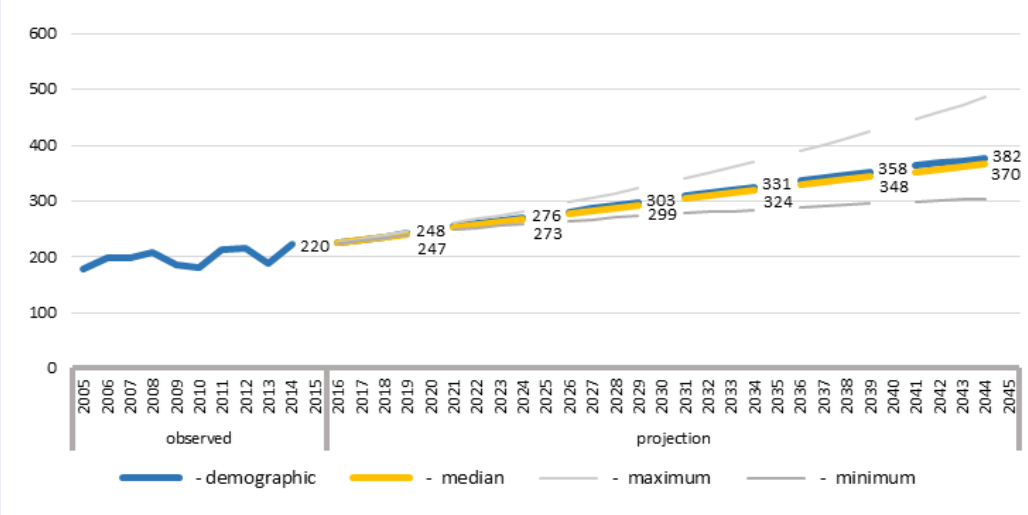
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of cancer of the brain and central nervous system are projected to increase in males from 220 in 2015 to 382 in 2045 (+74%) and in females from 152 in 2015 to 285 in 2045 (+88%) - an increase to 667 for males and females combined (+79%).
- As the rates have not changes significantly since 1994, the median projections are very similar to the demographic projections. For males, cases are projected to increase to 370 in 2045 (+68%), and for females, cases are projected to increase to 308 (+103%) - an 82% increase (to 678 cases) for both sexes combined.

Figure 3.38a.
Projections: Cancers of the brain & central nervous system C70-72

MALES - CASES
% 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	25%	24%
2030	38%	36%
2035	50%	47%
2040	63%	58%
2045	74%	68%

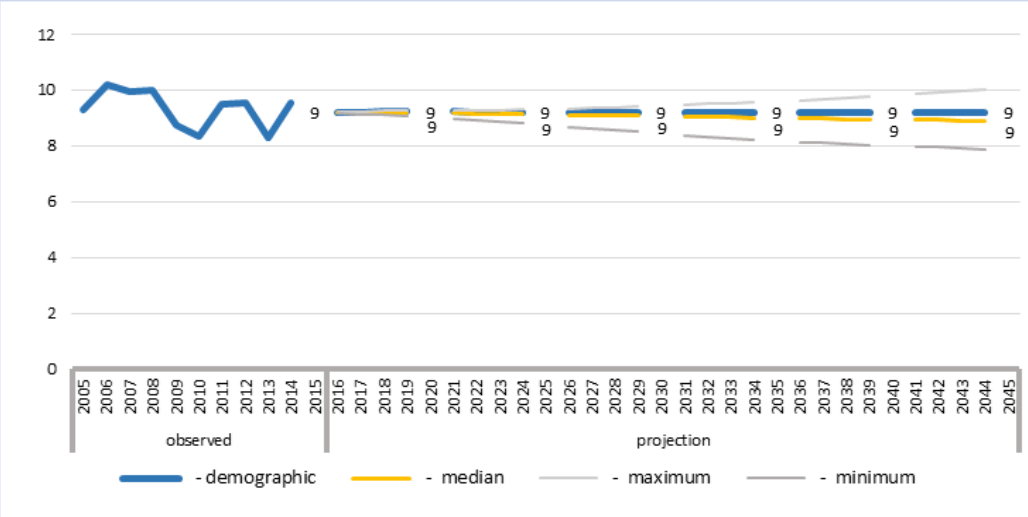
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	0%
2025	-1%
2030	-1%
2035	-2%
2040	-3%
2045	-3%

projected age-standardised rates 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

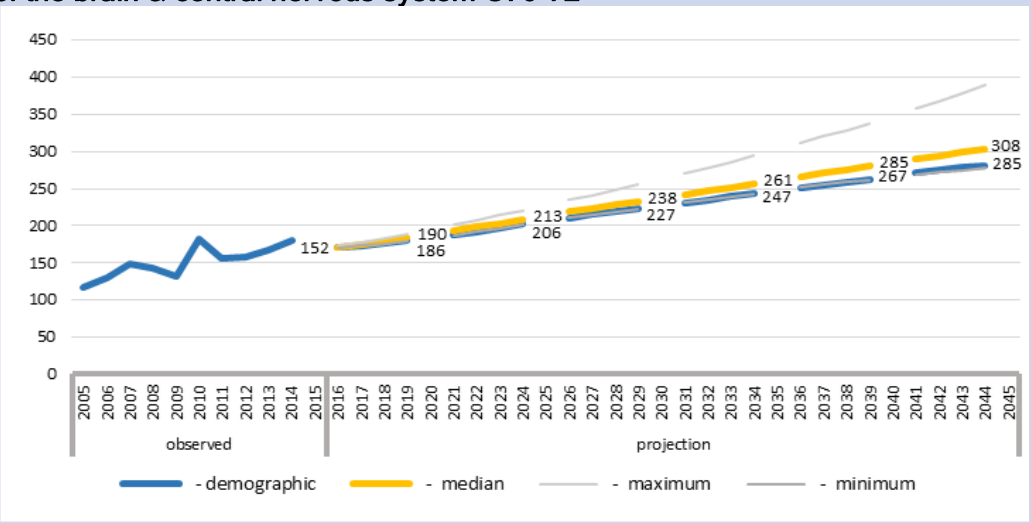
- Age-standardised rates of cancer of the brain and central nervous system in males have stayed approximately steady since 1994. As a result, the median projection is very similar to the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (9 cases per 100,000).
- The median age-standardised rates are projected to decrease by 3% by 2045, also giving a rate of 9 per 100,000.

Figure 3.38b.
Projections: Cancers of the brain & central nervous system C70-72

FEMALES - CASES
% 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	22%	25%
2025	35%	40%
2030	49%	56%
2035	63%	72%
2040	75%	88%
2045	87%	103%

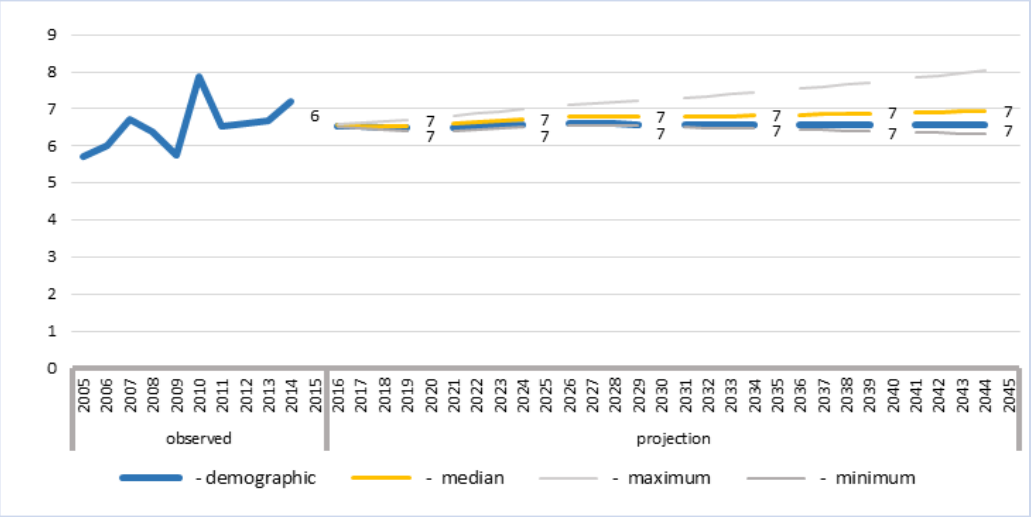
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	13%
2025	14%
2030	15%
2035	16%
2040	17%
2045	18%

projected age-standardised rates are shown in the graph on the right



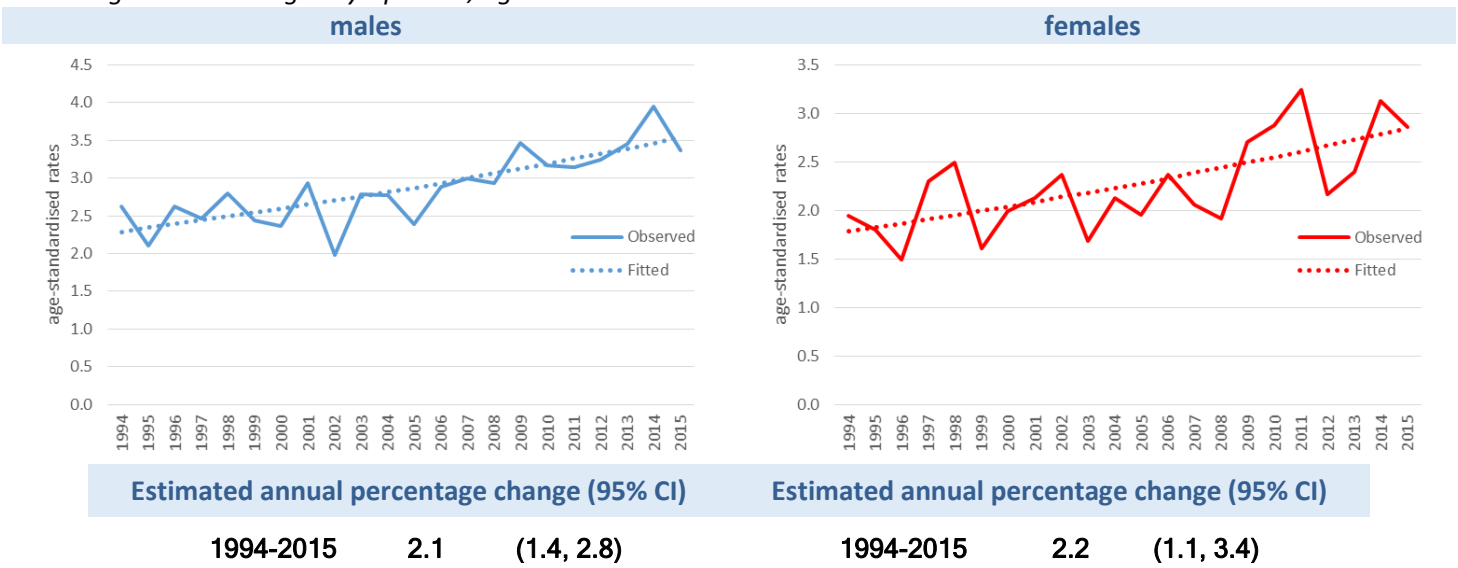
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of cancer of the brain and central nervous system in females have stayed fairly steady since 1994. As a result, the median projection is very similar to the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (7 cases per 100,000).
- The median age-standardised rates are projected to increase by 18% by 2045, giving a rate of 7 per 100,000.

Hodgkin lymphoma

Trends in incidence rates 1994-2015

Figure 3.39. Hodgkin lymphoma; age-standardised incidence rates 1994-2015



- Between 1994 and 2015, age-standardised rates of Hodgkin lymphoma increased significantly for males and females by, on average, 2.1% per year and 2.2% per year, respectively.

Summary of incidence projections to 2045

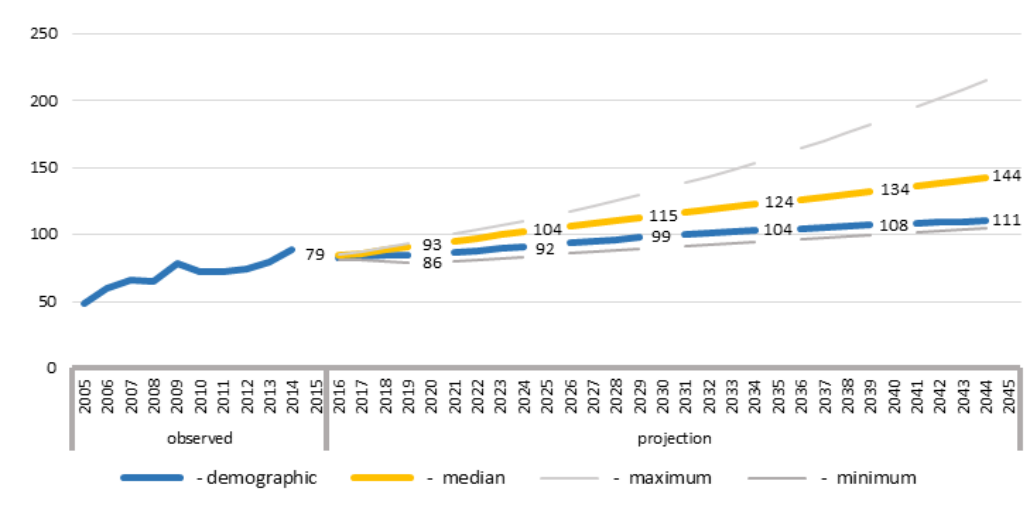
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of Hodgkin lymphoma are projected to increase in males from 79 in 2015 to 111 in 2045 (+41%) and in females from 68 in 2015 to 91 in 2045 (+34%) – an increase to 202 for males and females combined (+37%).
- Compared to the demographic projection, the median projection suggests a greater increase for males and females. For males, cases are projected to increase to 144 in 2045 (+82%), and for females, cases are projected to increase to 112 (+65%) – a 74% increase (to 256 cases) for both sexes combined.

Figure 3.40a.
Projections: Hodgkin Lymphoma C81

MALES - CASES
% 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	9%	18%
2025	17%	32%
2030	25%	45%
2035	32%	58%
2040	36%	70%
2045	41%	82%

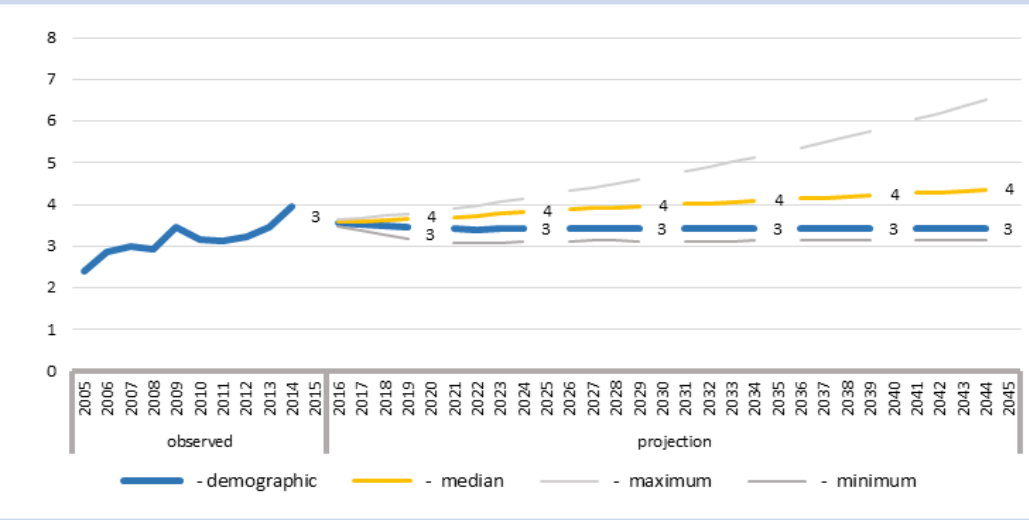
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	9%
2025	14%
2030	18%
2035	22%
2040	26%
2045	30%

projected age-standardised rates 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

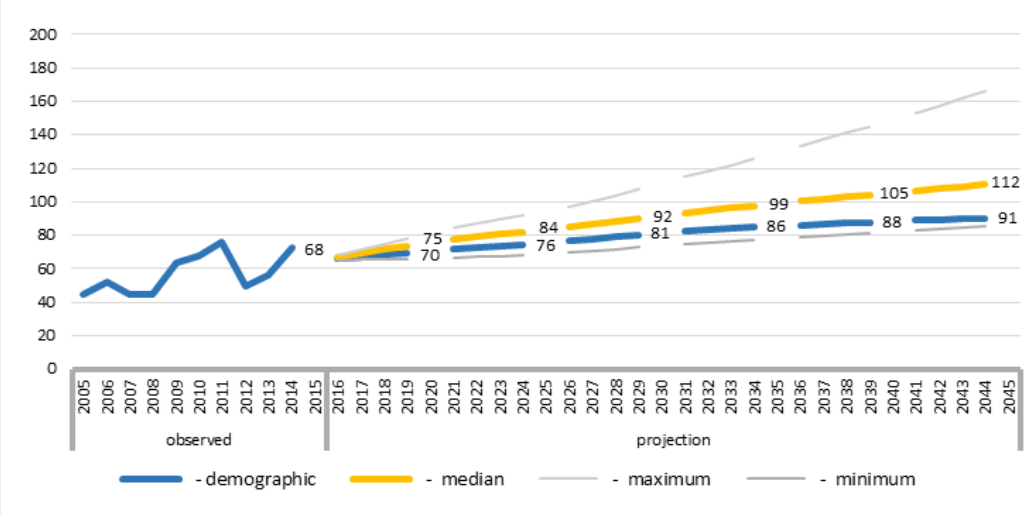
- Age-standardised rates of Hodgkin lymphoma in males have increased significantly since 1994. As a result, the median projection is higher than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (3 cases per 100,000).
- The median age-standardised rates are projected to increase by 30% by 2045, giving a rate of 4 per 100,000.

Figure 3.40b.
Projections: Hodgkin Lymphoma C81

FEMALES - CASES
% 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	3%	10%
2025	12%	23%
2030	20%	35%
2035	26%	46%
2040	30%	55%
2045	34%	64%

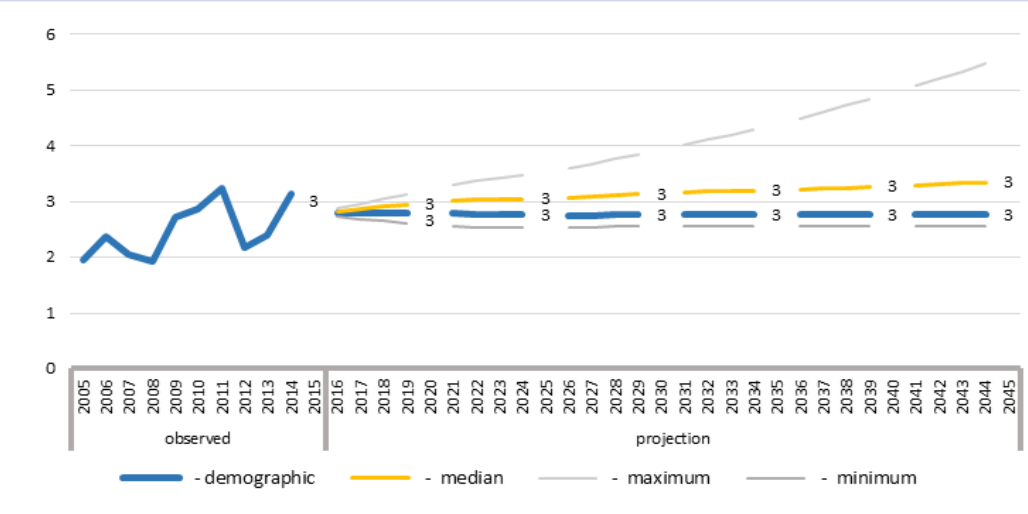
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	3%
2025	7%
2030	10%
2035	12%
2040	15%
2045	18%

projected age-standardised rates are shown in the graph on the right



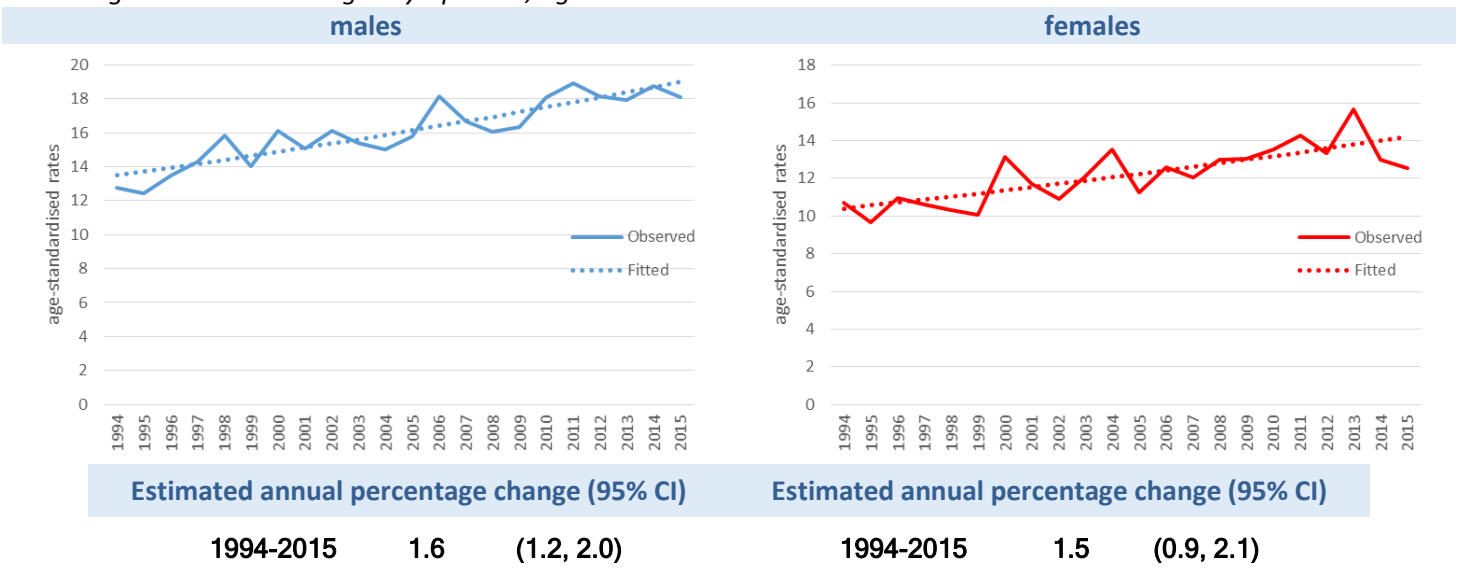
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of Hodgkin lymphoma in females have increased significantly since 1994. As a result, the median projection is higher than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (3 cases per 100,000).
- The median age-standardised rates are projected to increase by 18% by 2045, though the rate is projected to remain at 3 per 100,000.

Non-Hodgkin lymphoma

Trends in incidence rates 1994-2015

Figure 3.41. Non-Hodgkin lymphoma; age-standardised incidence rates 1994-2015



- Between 1994 and 2015, age-standardised rates of non-Hodgkin lymphoma increased significantly for males and females by, on average, 1.6% per year and 1.5% per year, respectively.

Summary of incidence projections to 2045

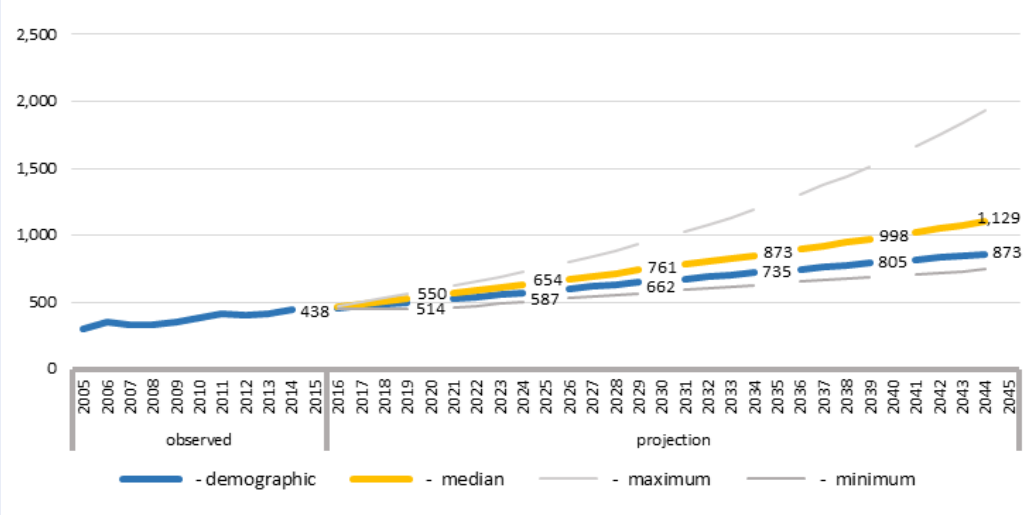
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of non-Hodgkin lymphoma are projected to increase in males from 438 in 2015 to 873 in 2045 (+99%) and in females from 339 in 2015 to 699 in 2045 (+106%) – an increase to 1,572 for males and females combined (+102 %).
- Compared to the demographic projection, the median projection suggests a greater increase for males and females. For males, cases are projected to increase to 1,129 in 2045 (+158%), and for females, cases are projected to increase to 888 (+162%) - a 160% increase (to 2,017 cases) for both sexes combined.

Figure 3.42a.
Projections: Non-Hodgkin Lymphoma C82-85

MALES - CASES
% 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	17%	26%
2025	34%	49%
2030	51%	74%
2035	68%	99%
2040	84%	128%
2045	99%	158%

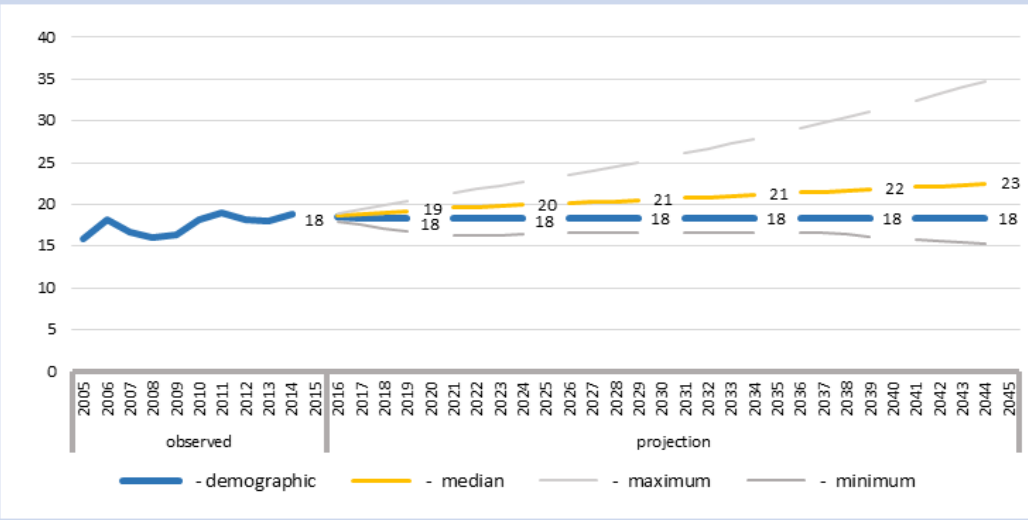
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	8%
2025	11%
2030	14%
2035	18%
2040	21%
2045	25%

projected age-standardised rates 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

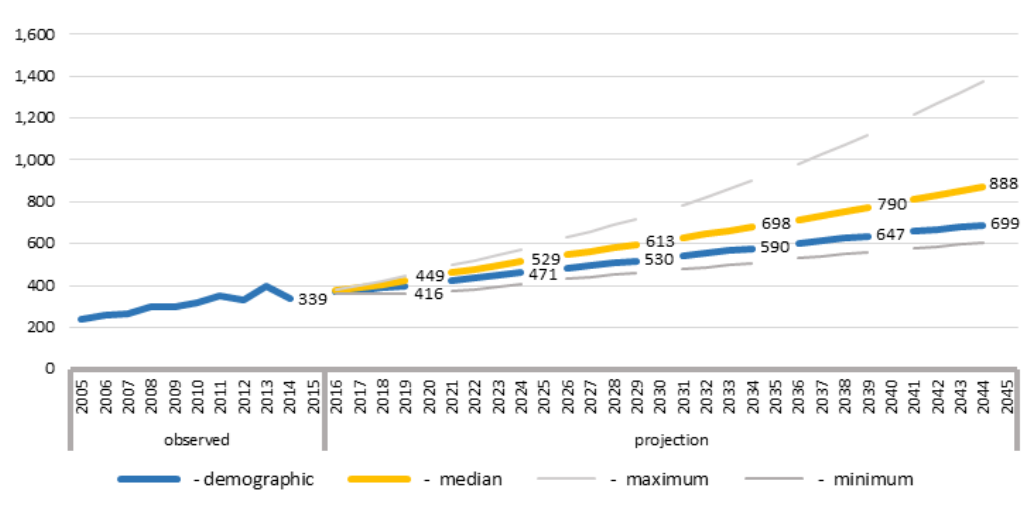
- Age-standardised rates of male non-Hodgkin lymphoma have increased significantly since 1994. As a result, the median projection is higher than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (18 cases per 100,000).
- The median age-standardised rates are projected to increase by 25% by 2045, giving a rate of 23 per 100,000.

Figure 3.42b.
Projections: Non-Hodgkin Lymphoma C82-85

FEMALES - CASES
% 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	23%	32%
2025	39%	56%
2030	56%	81%
2035	74%	106%
2040	91%	133%
2045	106%	162%

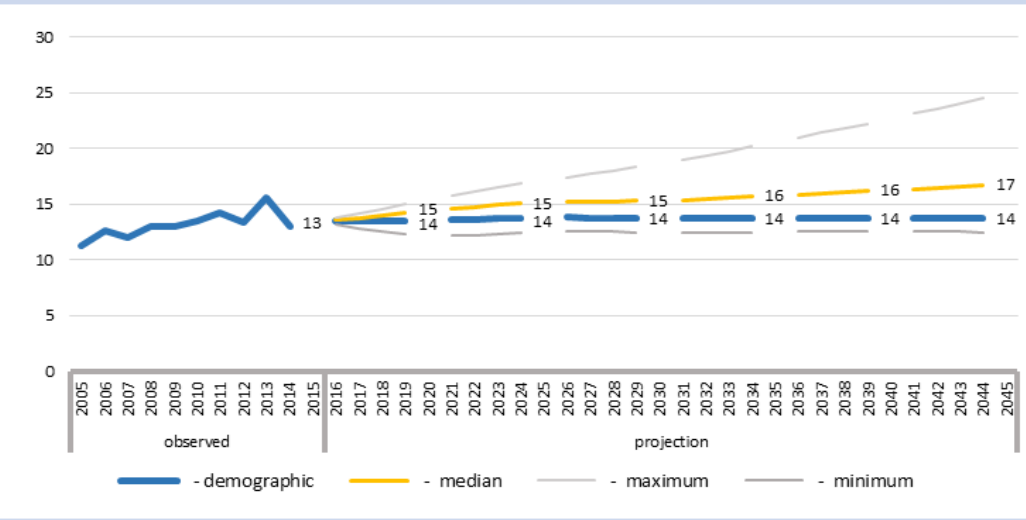
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	17%
2025	20%
2030	22%
2035	26%
2040	30%
2045	34%

projected age-standardised rates are shown in the graph on the right



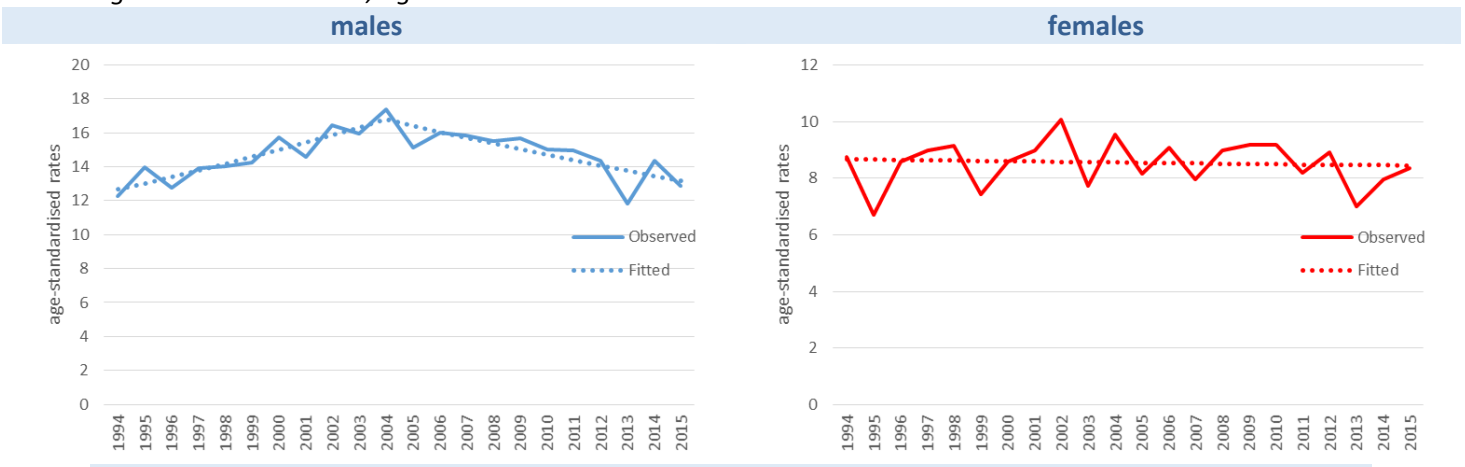
Demographic projection: the average annual rate for the period 2011-2015 was applied to the projected population up to 2045

- Age-standardised rates of female non-Hodgkin lymphoma have increased significantly since 1994. As a result, the median projection is higher than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (14 cases per 100,000).
- The median age-standardised rates are projected to increase by 34% by 2045, giving a rate of 17 per 100,000.

Leukaemia

Trends in incidence rates 1994-2015

Figure 3.43. Leukaemia; age-standardised incidence rates 1994-2015



Estimated annual percentage change (95% CI)			Estimated annual percentage change (95% CI)		
1994-2004	**2.9**	**(1.4, 4.3)**	1994-2015	-0.1	(-0.8, 0.6)
2004-2015	**-2.2**	**(-3.2, -1.1)**			

- Between 1994 and 2004, age-standardised rates of leukaemia increased significantly for males by, on average, 2.9% per year. Since 2004, rates have been falling significantly, with a decline of 2.2% on average per year. For females average age-standardised rates remained more or less unchanged between 1994 and 2015.

Summary of incidence projections to 2045

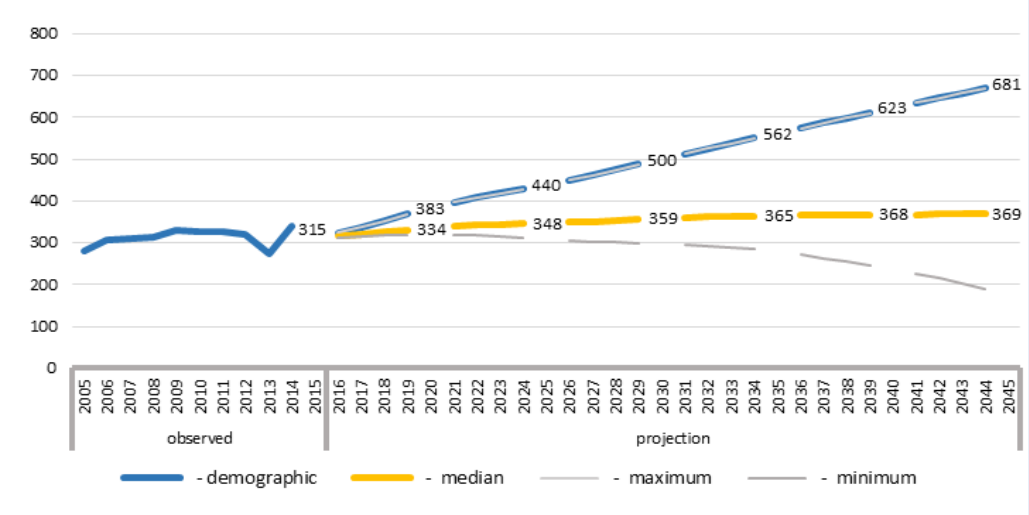
- Assuming that the average age-standardised rates during 2011-2015 continue to apply ('demographic' projection), annual numbers of cases of leukaemia are projected to increase in males from 315 in 2015 to 681 in 2045 (+116%) and in females from 227 in 2015 to 399 in 2045 (+76%) – an increase to 1,080 overall (+99%).
- Compared to the demographic projection, the median projection suggests a much more modest increase for males. Cases are projected to increase to 369 in 2045 (+17%). For females, the median projection is very similar to the demographic projection. Median cases are projected to increase to 401 (+77%). Overall the median projections suggest a 42% increase (to 770 cases) for both sexes combined.

Figure 3.44a.
Projections: Leukaemia C91-95

MALES - CASES
% 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	22%	6%
2025	40%	10%
2030	59%	14%
2035	79%	16%
2040	98%	17%
2045	116%	17%

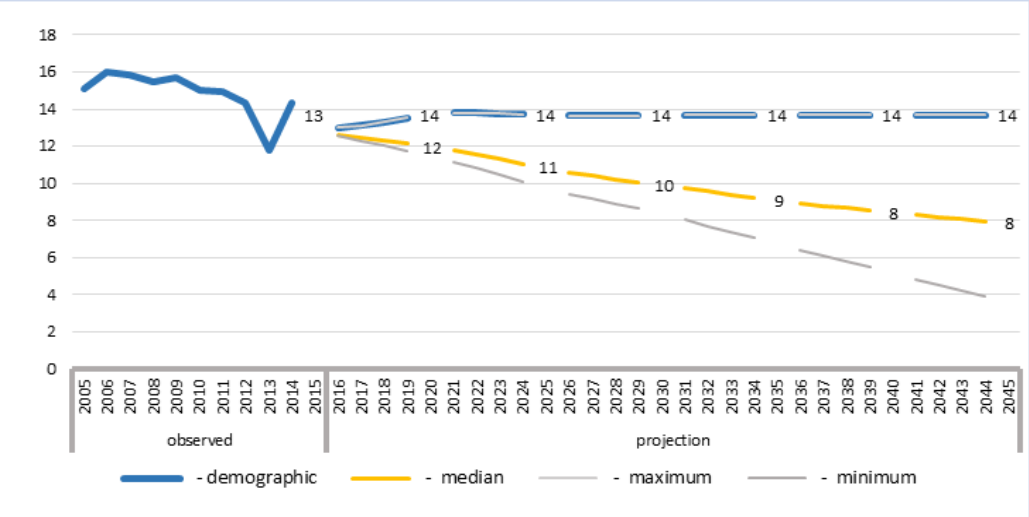
projected numbers of cases are shown in the graph on the right



MALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-7%
2025	-16%
2030	-23%
2035	-29%
2040	-35%
2045	-39%

projected age-standardised rates 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

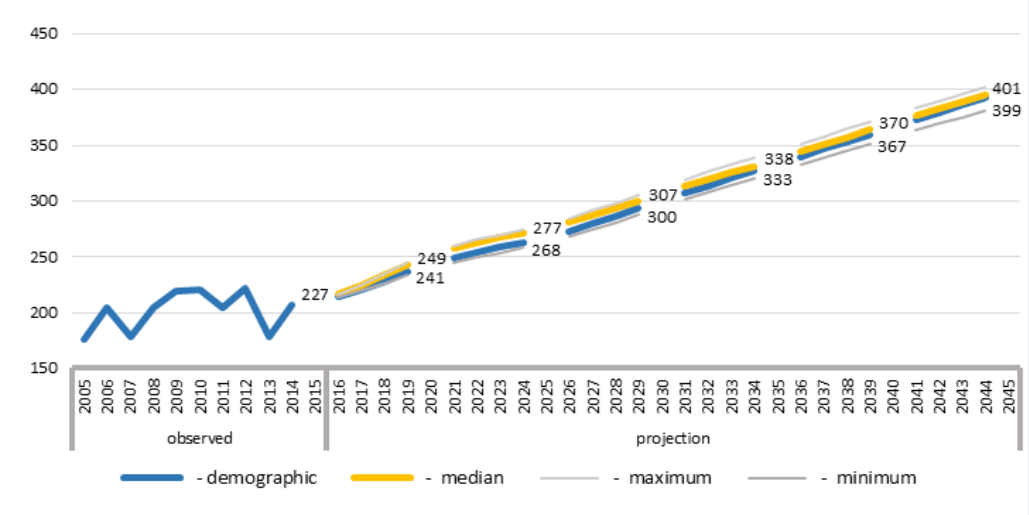
- Age-standardised rates of leukaemia in males increased significantly between 1994 and 2004. Since 2004 rates have been falling significantly. As a result, the Nordpred and HD models all project declining rates into the future, and the median projection is much lower than the demographic projection, which assumes the average 2011-2015 age-standardised rates apply into the future (14 cases per 100,000).
- The median age-standardised rates are projected to decrease by 39% by 2045, giving a rate of 8 per 100,000.

Figure 3.44b.
Projections: Leukaemia C91-95

FEMALES - CASES
% 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	6%	10%
2025	18%	22%
2030	32%	35%
2035	47%	49%
2040	61%	63%
2045	76%	77%

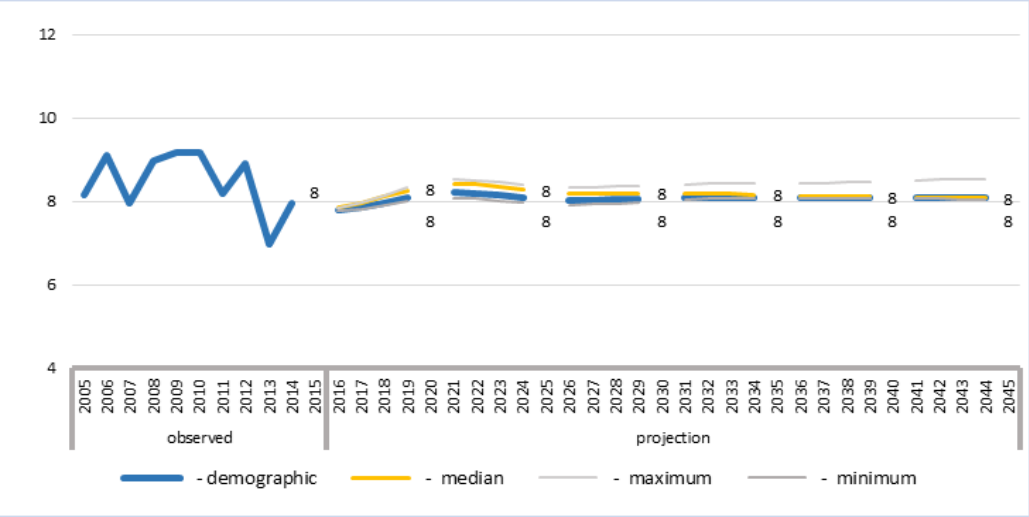
projected numbers of cases are shown in the graph on the right



FEMALES - ASR
% projected increase: represents the increase on the observed 2015 age-standardised rate based on the median of 5 model projection estimates *and* the demographic estimate (5+1)

	model median estimate projection
2020	-1%
2025	-1%
2030	-2%
2035	-3%
2040	-3%
2045	-3%

projected age-standardised rates 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

- Age-standardised rates of leukaemia in females stayed approximately the same between 1994 and 2015. As a result, all of the models, as well as the median, project results that are almost identical to that of the demographic model, which assumes the average 2011-2015 age-standardised rates apply into the future (8 cases per 100,000).
- The median age-standardised rates are projected to decrease by 3% by 2045, also giving a rate of 8 per 100,000.

4. METHODS

Population projections

The cancer case projections are based on the population projections of the Irish Central Statistics Office (CSO) [10], 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:

- 79.3 years in 2015 to 85.6 years in 2051 for males
- 83.3 years in 2015 to 88.3 years in 2051 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

Six different population projections, based on combinations of the above assumptions, have been published by the CSO: M1F1, M1F2, M2F1, M2F2, M3F1, and M3F2. The mortality assumptions are the same for all projections. 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.

Projected 2020 to 2045 populations for the M2F1 assumptions are shown in Table 4.1. These project a 22% increase in the male and female populations between 2020 and 2045. The size of population change ranges from an increase of 3 to 4% in males aged 40-54 to an increase of 268% in those aged over 85. For females the range varied from -1 to 4% for ages 35-54 to 181% in those aged over 85.

The projections presented in this report are based on the M2F1 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.

Table 4.1. Projected M2F1 populations 2020-2045, by sex

males	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
under 35	1137089	1165949	1193603	1211365	1227019	1229080
35-39	184118	160167	160762	178916	190905	210634
40-44	188339	186258	162532	163188	181332	193329
45-49	175530	188074	186208	162726	163464	181584
50-54	157017	174447	187080	185379	162247	163089
55-59	142940	154560	172011	184724	183241	160603
60-64	126225	138980	150736	168124	180911	179701
65-69	111006	121437	134230	146066	163293	176120
70-74	93881	103721	114238	126969	138801	155689
75-79	64026	82685	92501	102956	115389	127039
80-84	40993	51522	67701	77103	87097	98785
85 and over	28971	38521	51638	70829	88914	106662
females	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
under 35	1110358	1127340	1152447	1169011	1182916	1184165
35-39	198051	168810	159878	176213	188151	206514
40-44	194536	200793	171668	162788	179120	191062
45-49	178035	195126	201458	172505	163707	180032
50-54	158124	177740	194832	201215	172528	163862
55-59	146996	156543	176109	193200	199654	171389
60-64	129136	144412	154047	173515	190581	197130
65-69	112977	125847	141033	150743	170046	187061
70-74	97554	107952	120695	135699	145481	164492
75-79	70149	89625	99886	112378	127025	136841
80-84	50471	60194	77706	87598	99530	113464
85 and over	49884	59301	73181	95610	117523	140090

Cancer sites

Data were modelled for 21 invasive cancer sites or groups of sites, as well as all invasive cancers combined (excluding non-melanoma skin cancer) (Table 4.2). Only the most common invasive cancers are considered in this report, as trends in non-invasive cancers (predominantly in situ cancers) are largely dependent on screening activity rather than underlying risk, and so cannot be accurately modelled. Incidence data are collected and coded by the NCR according to the ICDO3 classification (including translation from ICDO2 codes for older data) [12].

Table 4.2. Cancer sites and groups of cancers for which projections are presented in this report

Cancer site	ICD10 codes
All invasive cancers, excl. NMSC	C00-43,C45-96
Head and neck	C01-C14, C30-32
Oesophagus	C15
Stomach	C16
Colon	C18
Rectum and anus	C19-21
Liver, gallbladder and biliary tract	C22-24
Pancreas	C25
Lung	C34
Melanoma of skin	C43
Non-melanoma skin cancer	C44
Female breast	C50
Cervix uteri	C53
Corpus uteri	C54
Ovary	C56
Prostate	C61
Kidney and renal pelvis	C64-65
Bladder	C67
Brain & central nervous system (CNS)	C70-72
Hodgkin lymphoma	C81
Non-Hodgkin lymphoma	C82-85
Leukaemia	C91-95

Calculation of rates

The age-standardised rate (ASR) is the annual rate of newly diagnosed cases 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 [13]. Age-standardised rates for incidence and mortality were weighted by the European standard population (ESP) as defined in 1976 [14].

Projection methods

Model fitting

Three different types of model have been used to produce a total of 6 projection models. These were, the demographic method (1 model), Hakulinen-Dyba methods (4 models), and the Nordpred method (1 model).

The median projection was calculated as the median of the 6 projections at each time point 2020-2045.

Demographic projections

Demographic projections were produced by calculating 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, 80-84 and 85+) for the years 2011-2015 and applying these rates to the projected age-specific populations up to 2045.

Hakulinen-Dyba (HD) age-period methods

Hakulinen and Dyba propose four age-period models to fit and project incidence [1-3]. 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 and age-standardised incidence rates. 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 patients, but a falling trend for 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.

Nordpred

The Nordpred software provides projections for a maximum of five future five-year periods. It fits a power age-period-cohort model [4,5], with a power coefficient of 0.2, to the historic trends, using a different slope parameter for each age group. This model is intermediate in its assumptions between the HD linear and log models. 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.

Case projections, and age-standardised rates, are presented graphically (Figure 3.2 to 3.44) 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 the six models.

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.

Demographic projections were based on the average annual age-specific incidence rates in the period 2011-2015 inclusive scaled to the future population.

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 [15-16]. Default constraints were applied in Joinpoint with no more than 3 inflexion points allowed, with at least 4 years between each inflexion point and 5 years, inclusive, 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, and 2011-2015. This is the minimum number of periods which is possible using the Nordpred method.

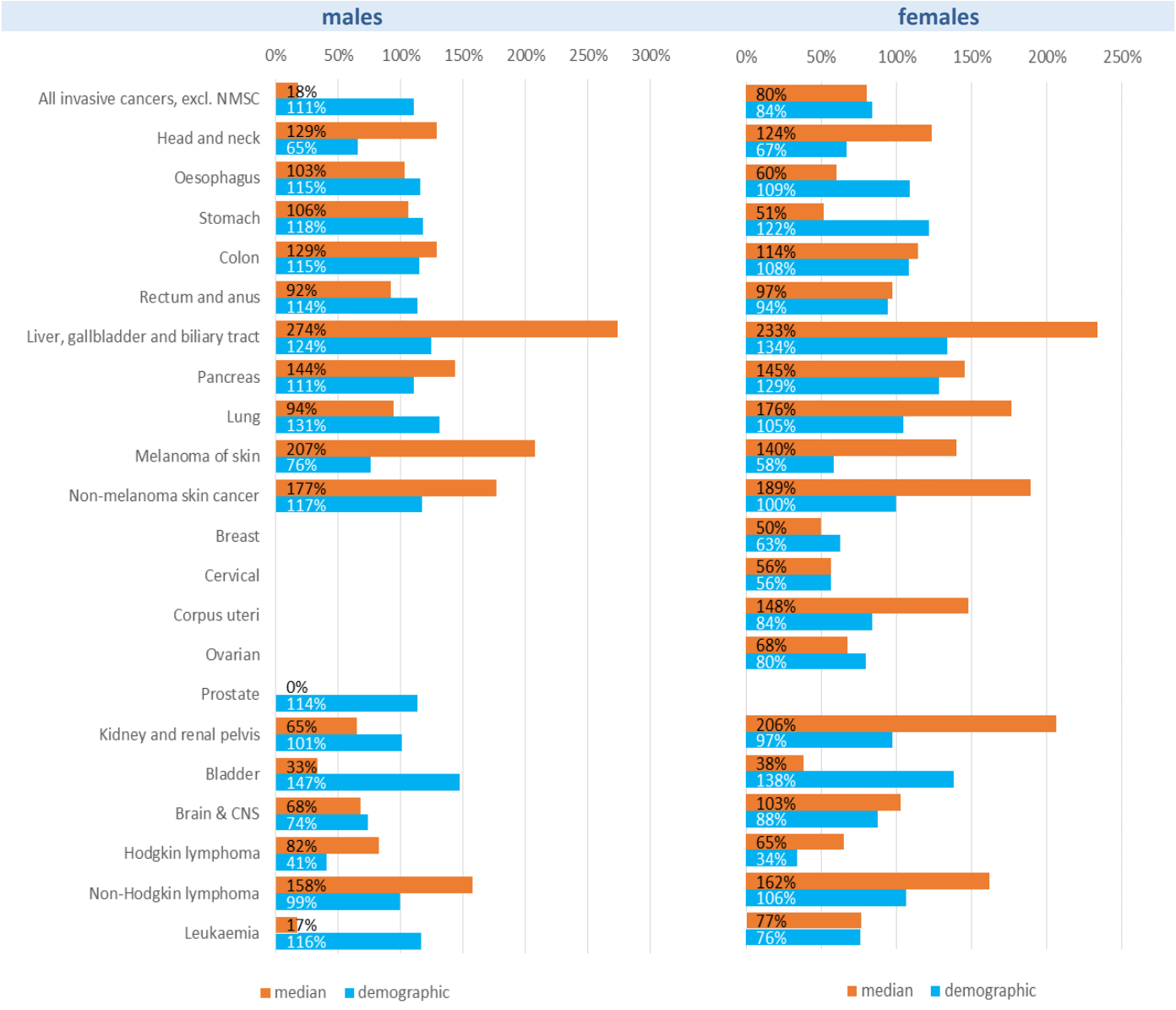
5. DISCUSSION

Summary

Figure 5.1 below shows the projected percentage increase in the number of cancer cases between 2015 and 2045, by cancer site and sex.

For all cancers combined, excluding non-melanoma skin cancer, the demographic model projected an increase of 111% increase for males and an 80% increase for females – a doubling of numbers overall. The median model projections showed a similar picture for females with an 84% increase in incidence, whereas for males the position was very different, showing a much more modest projected increase of only 18% - about a 50% increase overall for males and females combined.

Figure 5.1. Projected percentage increase in number of cancer cases 2015-2045, by cancer site and sex



Across individual cancer types, for males, the increases in case numbers ranged from 41% (Hodgkin lymphoma) to 147% (bladder) using demographic projections, and from 0% (prostate) to 274% (liver, gallbladder and biliary tract) using the median projection.

For females, the increases in case numbers ranged from 34% (Hodgkin lymphoma) to 138% (bladder) using demographic projections, and from 38% (bladder) to 233% (liver, gallbladder and biliary tract) using the median projection.

While the demographic method assumes that the age-standardised rates remain steady from 2015 to 2045, the HD and Nordpred methods assume that recent trends in age-standardised rates will continue into the future. As a result, the age-standardised rates of the median of the projected models, in most cases, will change over time.

Figure 5.2. Median projected percentage increase in age-standardised rates 2015-2045, by cancer site and sex

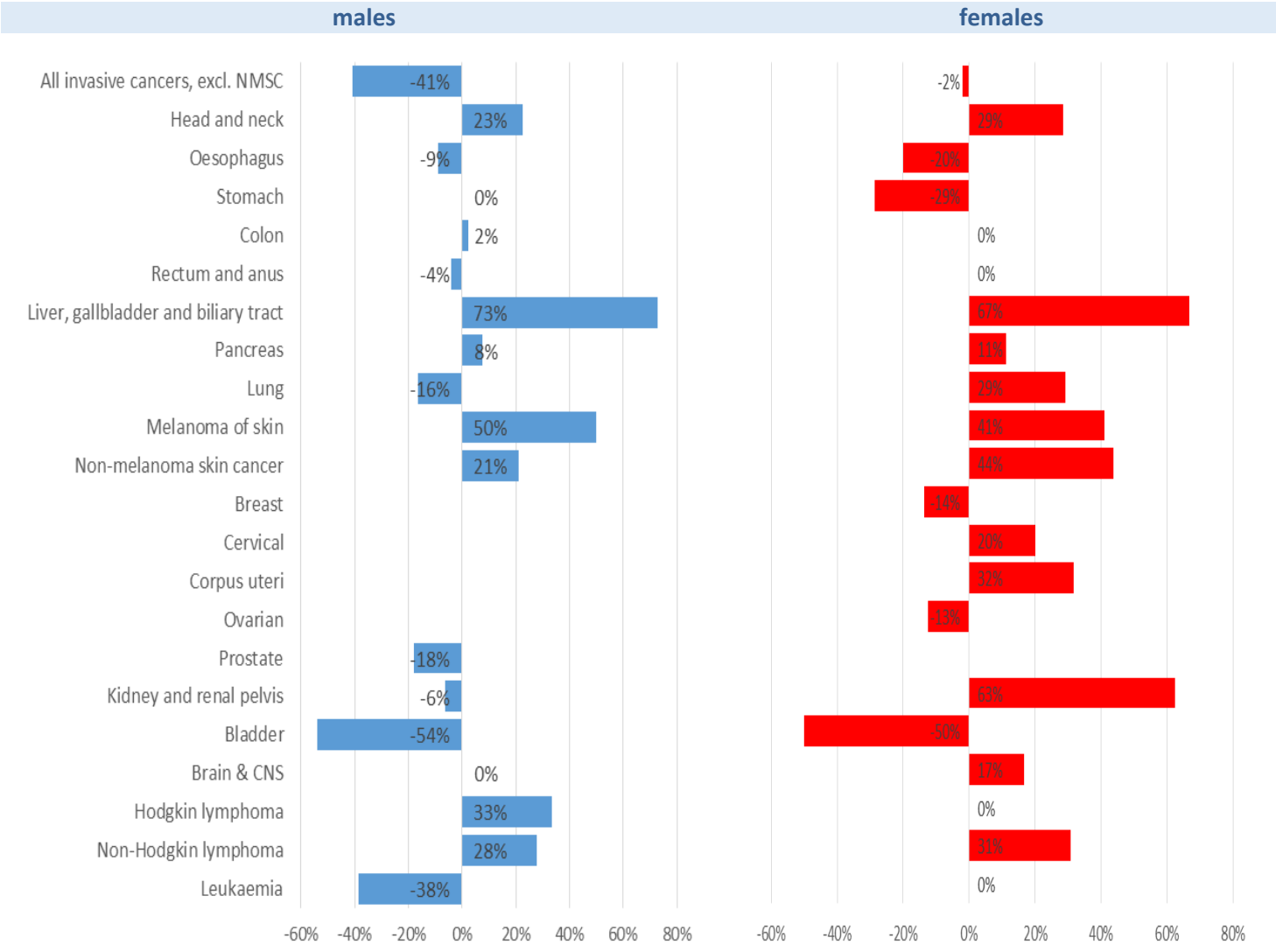


Figure 5.2, above, shows the percentage change in age-standardised rates between 2015 and 2045, based on the median of all six models used. For all cancers combined, excluding non-melanoma skin cancer, the median projection showed a decrease of 41% for males and a much more modest 2% decrease for females.

For males, eight sites showed increases in the median age-standardised rates between 2015 and 2045. These were: liver, gallbladder and biliary tract (+73%); melanoma of skin (+50%); Hodgkin lymphoma (+33%); non-Hodgkin lymphoma (+28%); head and neck (+23%); non-melanoma skin cancer (+21%); pancreas (+8%); and colon (+2%).

For males, seven sites showed decreases in the median age-standardised rates between 2015 and 2045. These were: bladder (-54%); leukaemia (-38%); prostate (-18%); lung (-16%); oesophagus (-9%); kidney and renal pelvis (-6%); and rectum and anus (-4%).

There were no projected changes in the median age-standardised rates between 2015 and 2045 for males for two sites: stomach; and brain and central nervous system.

For females, eleven sites showed increases in the median age-standardised rates between 2015 and 2045. These were: liver, gallbladder and biliary tract (+67%); kidney and renal pelvis (+63%); non-melanoma skin cancer (+44%); melanoma of skin (+41%); corpus uteri (+32%); non-Hodgkin lymphoma (+31%); head and neck (+29%); lung (+29%); cervix uteri (+20%); brain and central nervous system (+17%); and pancreas (+11%).

For females, five sites showed decreases in the median age-standardised rates between 2015 and 2045. These were: bladder (-50%); stomach (-29%); oesophagus (-20%); breast (-14%); and ovarian (-13%).

There were no projected changes in the median age-standardised rates between 2015 and 2045 for females for four sites: colon; rectum and anus; Hodgkin lymphoma; and leukaemia.

Comparison with previous reports

The most striking difference between the current report, and the three previous reports [6-8] produced by the NCRI, is that this is the first projections report to observe a recent decline (for males) or flattening off (for females) in the trend in age-standardised rates for all cancers combined (excluding non-melanoma skin cancer).

For males, age-standardised rates have declined significantly from 2011 to 2015, following on from a period of significantly increasing rates between 1994 and 2011. This is due in part to a significant

decline in the incidence of prostate cancer since 2011, which is likely a reflection of PSA testing in previous years having led to earlier detection of cases.

For females, although rates have not declined, there has been no change in age-standardised rates since 2010. This followed a period of significantly increasing rates from 1994 to 2010.
This is a very important development, and has significant implications for projections. For the first time, the age standardised rate for males, or the risk to the average Irish male of being diagnosed with cancer in a given year, is declining. For females, although the overall age-standardised risk is not yet declining, it has not increased in the most recent period.

The HD models, which use the most recent trend for the basis of future projections, show substantial reductions in the age-standardised rates up to 2045 for males. The median age-standardised rates for all cancers combined, excluding non-melanoma skin cancer, for males are estimated to decrease by 41%. For females the reduction is a much more modest 2%, reflecting the stability in recent rates for females.

One notable difference between the 2014 report and this report is that for all cancers combined, excluding non-melanoma skin cancer, the Demographic model no longer produces the most conservative projections of future cases. For males, it gives the second highest estimate of future cases, behind the Nordpred model which does not take the recent downturn in incidence rates into account. For females, the demographic model produces the third highest estimate of future cases, behind the Nordpred model and HD4, which tends to produce the highest estimates of the four HD models.

Projected age-standardised rates were not presented in the most recent reports [7-8] so it was not possible to make a comparison between rates across these reports. Also, in this report, the demographic projection and the median projection were the main results focused on, as the demographic model has the simplest assumptions, and the median represented the middle point of all the projections. In previous reports, more focus was placed on the Nordpred and individual HD model projections.

Implications for treatment

For each registered cancer case, the Registry records whether the patient had a specified modality of treatment (cancer-directed surgery, chemotherapy or radiotherapy) as part of the initial treatment regime. This is typically reported as treatments received from one month before diagnosis to twelve months after diagnosis.

Although this report is not intended to provide detailed treatment projections, the numbers of patients having each treatment modality have been extrapolated in broad terms to 2045. This was done by combining the number of cases projected using the demographic method, assuming:

- That the risk of cancer remains the same, i.e. that the number of cases change due only to changes in the population size and age distribution;
- That the average age-specific treatment proportions in the period 2011-2015 remains unchanged;
- For all cancers combined that the case-mix by stage and cancer type remains unchanged.

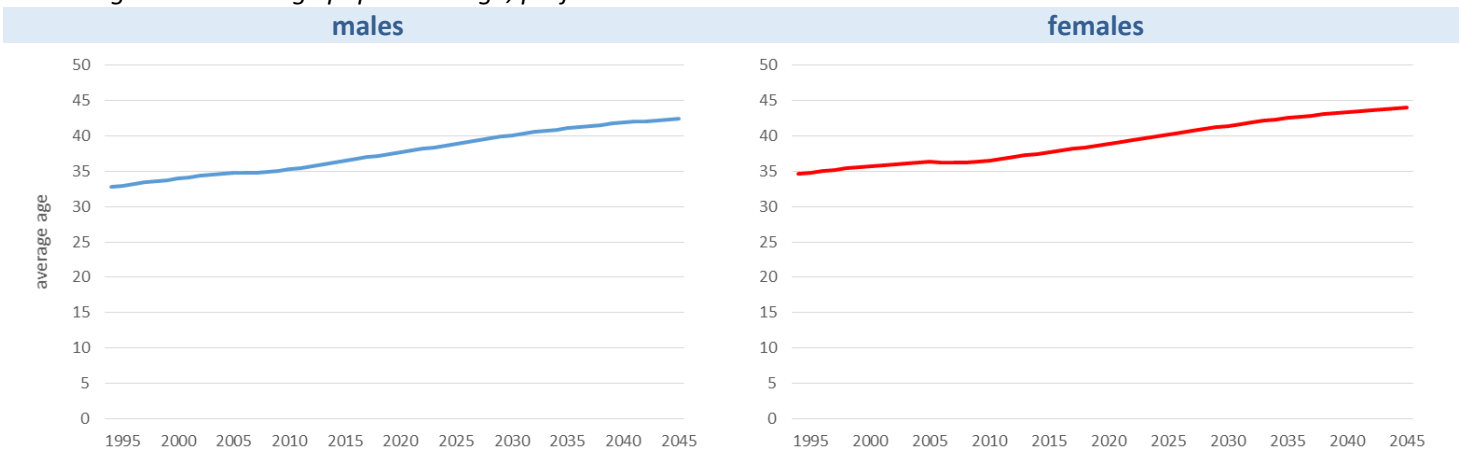
A fuller analysis could estimate treatment figures using each projection model, as well as the median projection. For technical reasons this analysis was considered beyond the scope of the current report. However, the median projection (for all cancers combined, excluding NMSC) results in fewer projected cases, which would imply fewer treatments if equivalent treatment percentages by age-groups were applied.

Whatever approach is taken, long-term treatment patterns are difficult to project and the figures presented here should be treated with caution. They are dependent on both the projected number of cases, which can vary widely depending on the model used (note that only the demographic model is used for treatment projections here), and on the additional assumptions noted above. In practice, treatment practices may change (i.e. increases or decreases in the use of specific modalities), as may the breakdown of cases by stage and cancer type.

When estimating the proportion of patients treated, the proportion treated in 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, 80-84 and 85+) has been calculated, and applied to the projected number of cancer cases in each age group.

This results in the overall proportion of cancer patients receiving treatment falling over time, as older patients are less likely to receive treatment, and the average age of the patients is projected to rise over time, reflecting increases in the average age of the population from 1994 to 2045 (Figure 5.3). However, if the proportions of elderly patients, or indeed younger patients, receiving treatment increased in future, an overall decline in the proportion might not occur.

Figure 5.3. Average population age, projected to 2045

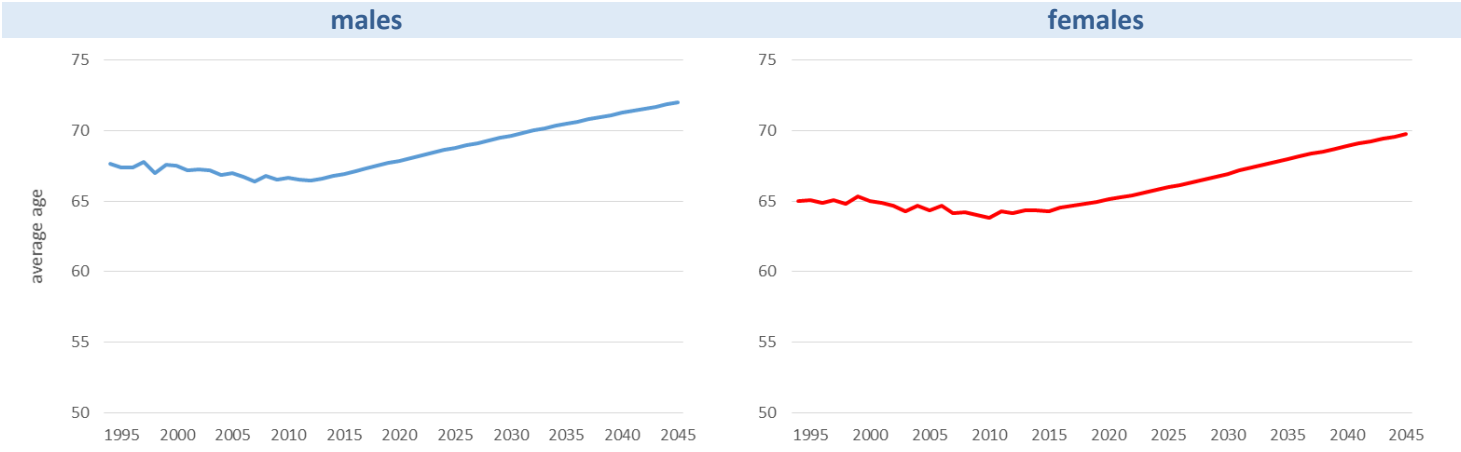


For males, the average age increased from 33.7 in 1994 to 36.5 in 2015. The average age is projected to increase to 42.4 in 2045. For females, the average age increased from 34.6 in 1994 to 37.7 in 2015. The average age is projected to increase to 44.0 in 2045.

However, despite population ageing in Ireland between 1994 and 2015, the average age of cancer patients actually fell slightly (Figure 5.4). This may reflect a shift in case-mix (to cancers less strongly associated with advanced age) or a shift towards diagnosis at earlier ages (perhaps partly influence by breast cancer screening in women and prostate cancer detection through PSA testing in men), sufficient to balance the influence of population ageing.

In contrast, the average age of cancer patients is projected to increase to 72.0 for males and 69.8 for females by 2045 (from 66.9 and 64.3, respectively, in 2015) – but this assumes no change in the breakdown of cancer types or in age-targeted diagnostic activity compared with 2011-2015.

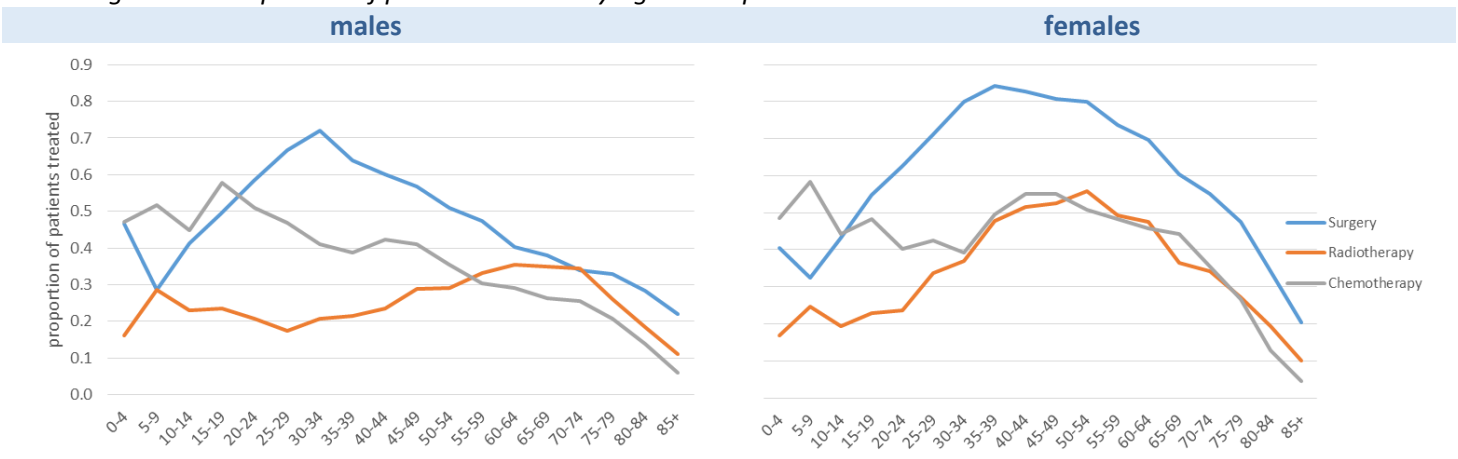
Figure 5.4. Average age of cancer patients (all invasive cancers, excluding NMSC), projected to 2045



Treatment by age

Figure 5.5 shows the proportion of cancer patients (all invasive cancers, excluding non-melanoma skin cancer), who received surgery, radiotherapy and chemotherapy within one year of diagnosis, broken down by age group and sex.

Figure 5.5. Proportion of patients treated by age in the period 2011-2015



For males, the percentage of patients undergoing surgery ranges from 72% of the 30-34 age group, down to only 22% of the 85+ age group. Men aged 60-64 are the most likely to undergo radiotherapy (36%), compared to only 11% of those aged 85+. For chemotherapy patients aged 15-19 had the highest percentage undergoing chemotherapy (58%). Again the 85+ age group had the lowest percentage, where only 6% received chemotherapy.

For females, the position is broadly similar. The percentage of patients undergoing surgery ranges from 84% of the 35-39 age group, down to only 20% of the 85+ age group. Women aged 50-54 are the most likely to undergo radiotherapy (56%), compared to only 10% of those aged 85+. For chemotherapy patients aged 5-9 had the highest percentage undergoing chemotherapy (58%). Again the 85+ age group had the lowest percentage, where only 5% received chemotherapy.

In general, the percentage of patients being treated declines steadily as patients get older.

Figure 5.6, below, shows the projected number of patients undergoing surgery, radiotherapy and chemotherapy within one year of their diagnosis, up to 2045. These projections use the demographic projections of cancer incidence for all invasive cancers excluding NMSC, and apply the average proportion of patients, within each age group, receiving each type of treatment in the period 2011-2015.

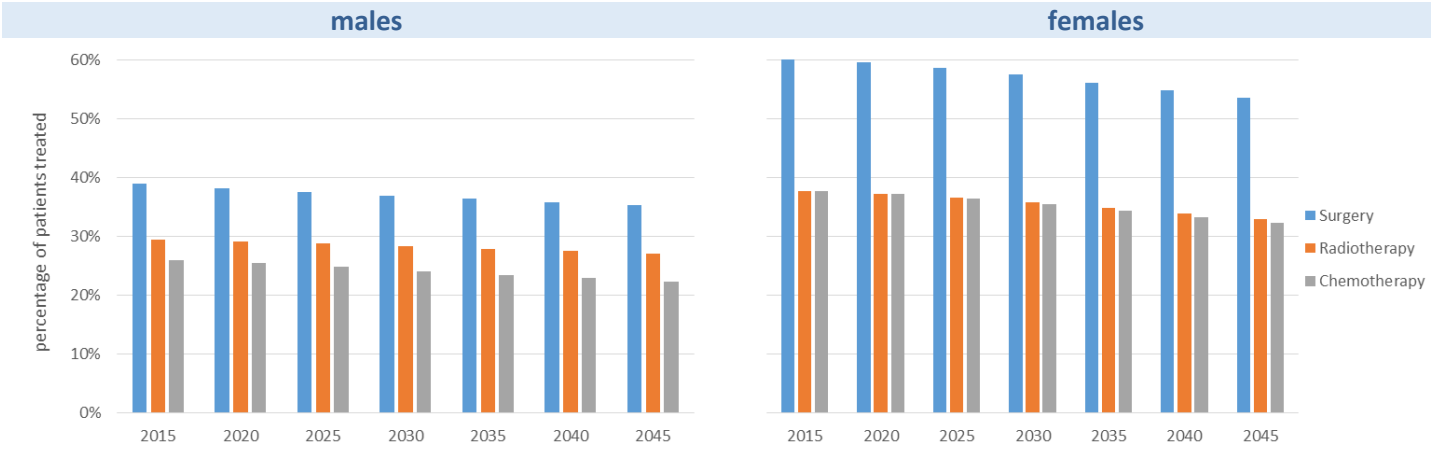
Figure 5.6. Number of patients treated 2015-2045, all invasive cancers excluding NMSC

For males, the number of patients undergoing surgery, radiotherapy and chemotherapy is projected to increase from 4,460, 3,369 and 2,980 in 2015 to 8,520, 6,542 and 5,404 in 2045 respectively.

For females, the number of patients undergoing surgery, radiotherapy and chemotherapy is projected to increase from 6,173, 3,852 and 3,863 in 2015 to 10,096, 6,214 and 6,092 in 2045 respectively.

Figure 5.7, below, shows the projected percentage of patients undergoing surgery, radiotherapy and chemotherapy within one year of their diagnosis, up to 2045, highlighting that a projected ageing in cancer patients could result in a reduction in overall proportions of patients treated (unless age-specific treatment proportions increase).

Figure 5.7. Percentage of patients treated 2015-2045, all invasive cancers, excluding NMSC



While Figure 5.6 shows a steady increase in the number of patients treated, Figure 5.7 shows a different picture, with the percentage of patients treated declining between 2015 and 2045.

This reflects the fact that the population is ageing, and the average age of cancer patients is projected to increase over time. This, combined with the fact that older patients are less likely to be treated, results in the decreasing percentage of patients treated in the future.

In the period 2011-2015, 39%, 29% and 26% of males underwent surgery, radiotherapy and chemotherapy respectively. This is projected to decline to 35%, 27% and 22% respectively by 2045.

For females in 2011-2015, 60%, 38% and 38% underwent surgery, radiotherapy and chemotherapy respectively. This is projected to decline to 54%, 33% and 32% respectively by 2045.

If overall treatment proportions (combining all ages for each sex) remain unchanged, projected numbers of patients treated in future would be higher than those shown in Figure 3.4, because this simpler assumption would assume no effect of changing age.

But it is important to re-stress that all these figures assume, in greater or lesser detail, that the current rate of treatment will continue into the future. In reality, a shift in the case-mix to different proportions of specific cancer types, or of stages or age-groups within cancer types, could alter these projections, perhaps substantially. Changes in the standard treatment for specific cancers, or increases in the proportions of patients (including older patients) receiving standard treatment, could further alter these projections.

Strengths and limitations

The strengths of the approach used here are that the methods are robust and widely used, use all the available data and make a minimal number of assumptions about the underlying trends.

By using multiple models however, this does then open up the question of which is the “best model”. There are sometimes large discrepancies between the results of different modelling approaches to the same data. Different models may project quite different trends, as can be seen in this report for cancers of the liver, gallbladder and biliary tract, melanoma of the skin and prostate cancer in males, and cancer of the lung in females. Models based on age-specific trends in rates may place too much reliance on apparent trends in these rates; on the other hand ignoring these would be a mistake if there are real differences in trend between different age groups. The Nordpred model has the advantage of using a fixed power relationship for all cancers, and avoiding the exponential trends sometimes fitted by the HD models. However, unlike the HD models, the Nordpred model doesn’t take account of significant recent changes in trends, and therefore may overemphasise longer term trends. Demographic projections take no account of trends in incidence rates, which may result in large discrepancies between future incidence rates and projected rates, but on the other hand they don’t assume that recent or longer-term rate trends will continue.

As there is no objective way to select a “best model”, and no single model that best fits all trends and all cancer sites, we have chosen to present the demographic model (with the simplest assumptions) as well as the median of all the projection models. The ‘median model’ is the middle

point of all the projections calculated, and may be a useful summary of the fuller range of model results, as it takes account of all the models without leading to estimates that are excessively high or low for any of the sites.

Estimates of future demand for cancer treatments are also provided, though these projections assume that treatment patterns remain stable into the future, which may not be the case.

The most significant limitations of the approaches taken is that they assume that recent incidence trends (or in the case of demographic models, current cancer rates) will continue unchanged into the future. This report itself gives an indication of how substantial these limitations may be - notably, the trends for a number of cancer sites (female breast, cervix uteri, prostate, and male kidney), as well as for all cancers combined, have changed significantly over the past five years, in some cases going from a significantly increasing rate to a significantly decreasing rate. Further changes in incidence trends in years to come - for example, through introduction of new screening programmes or other interventions, such as HPV vaccination, or if trends stabilize following initial screening-related increases - could lead to the projections presented here being substantially different to the actual number of cases of cancer in the future.

While these are limitations in terms of how accurate the projections are likely to be, the projection models can nevertheless be useful in assessing the impact of measures to reduce cancer incidence. If future incidence is in fact substantially lower than the estimates provided in this report, this could represent evidence that measures put in place to reduce cancer incidence had, in fact, been successful.

Models simplify what is a complex combination of changing risk factors, diagnosis, screening and classification. Although historic trends can be fitted using more complex models than those shown here, these models also make more assumptions about the continuity of trends into the future. Even over the relatively short period covered by the National Cancer Registry, incidence trends for quite a few cancers have changed significantly and therefore the assumption of continuity of trends into the future is not firmly based.

In particular, longer-term projections for individual cancer sites can have additional uncertainty when screening programmes are in place, as these can lead to initial increases followed by later decreases in cancer rates. Trends in incidence rates of breast cancer, cervical cancer and prostate cancer have all changed significantly since the introduction of screening (or, for prostate cancers, large-scale PSA testing), and it is not clear if the recent declining trends are likely to continue into the future. Changes in the trends in incidence rates for colon or rectal cancers may also occur, following the recent introduction of the BowelScreen programme, though changes in trend have not yet been observed.

Future Reports

As mentioned in the introduction, the NCRI will produce updated projections on a five yearly basis, with the next full projections report due to be published in 2024.

The NCRI is also intending to follow on from this publication with two further reports this year. These reports will focus on: the risk factors that contribute to cancer incidence; and the economic cost of cancer.

Risk Factors

The NCRI will publish a follow-on report (in November 2019) looking in detail at the contribution of various risk factors to the incidence of cancer, and will look at how these risk factors will contribute to cancer incidence into the future, based on the projected incidence figures presented in this report.

Cost of cancer: economic projections

The NCRI will publish a further report (in December 2019) using a health economics approach to estimate the cost of cancer in the future, based on the projected incidence figures presented in this report. This report will also take a more detailed look at treatment projections.

A final note on future projections reports

It is well known that it is difficult to make predictions or projections, especially about the future. Projecting future incidence of cancer relies on projecting both the number, sex and age distribution of the population and the age-standardised rate of cancer in that population. To make things more difficult, cancer is not a single disease, but a large number of different diseases, each with their own risk factors and underlying rates in populations unexposed to any risk factors.

To reliably predict the rate of cancer in the future, one would need to know how each risk factor was associated with each cancer, and also be able to reliably predict trends in risk factors into the future, and to understand the lag time between a change in a risk factor and a change in the incidence rate. NCRI therefore offers projections, rather than predictions, where current rates or recent trends are used to project case numbers into the future based on the population projections provided by the CSO.

As can be seen in the results in this report, the different projection models often produce vastly different results. The further into the future that incidence is projected, the greater the uncertainty in the population size, the potential for changes in risk factors, and the changes in trends in incidence.

Based on experience gained from compiling this report, the authors recommend that future reports restrict projections to 20 years into the future. While this does not eliminate the uncertainty around the projected incidence of cancer, it makes the results more likely to be reliable.

6. ACKNOWLEDGMENTS

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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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APPENDICES:

Appendix 1: Projected number of cases of cancer in males, 2015-2045, using 6 models plus median

	Demographic							HD1						
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
All invasive cancers, excl. NMSC	11461	13864	15920	18067	20225	22292	24161	11461	12055	12302	12163	11705	10876	10086
Head and neck	518	549	619	688	753	810	857	518	623	760	907	1061	1217	1360
Oesophagus	259	312	361	413	464	513	558	259	317	359	403	442	476	501
Stomach	387	455	531	611	690	768	842	387	451	521	590	654	711	755
Colon	1021	1158	1357	1567	1782	1994	2196	1021	1213	1456	1727	2025	2339	2665
Rectum and anus	585	722	830	943	1051	1155	1250	585	712	796	879	944	998	1037
Liver, gallbladder and biliary tract	266	324	378	434	489	544	597	266	378	493	626	772	930	1101
Pancreas	312	350	409	472	536	598	657	312	369	441	521	605	689	770
Lung	1356	1674	1958	2259	2562	2858	3137	1356	1598	1817	2051	2290	2526	2754
Melanoma of skin	546	566	646	726	807	885	960	546	674	873	1104	1361	1643	1950
Non-melanoma skin cancer	6004	6971	8146	9379	10623	11852	13058	6004	7477	9236	11239	13385	15727	18237
Prostate	3214	4181	4746	5324	5905	6441	6869	3214	2608	1696	884	312	289	295
Kidney and renal pelvis	398	483	549	616	681	742	800	398	406	399	394	405	442	513
Bladder	329	398	473	556	644	730	814	329	303	290	276	251	222	227
Brain & central nervous system (CNS)	220	248	276	303	331	358	382	220	250	282	316	354	396	439
Hodgkin lymphoma	79	86	92	99	104	108	111	79	92	103	115	127	141	154
Non-Hodgkin lymphoma	438	514	587	662	735	805	873	438	570	701	849	1012	1191	1386
Leukaemia	315	383	440	500	562	623	681	315	319	309	297	280	254	243
	HD2							**HD3**						
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
All invasive cancers, excl. NMSC	11461	12065	12359	12327	11905	11038	9712	11461	12172	12722	13137	13386	13433	13264
Head and neck	518	509	575	642	706	763	812	518	637	796	982	1193	1424	1673
Oesophagus	259	318	362	407	450	489	523	259	319	364	409	453	494	530
Stomach	387	454	524	596	666	733	796	387	454	524	597	667	735	799
Colon	1021	1152	1350	1557	1767	1974	2174	1021	1209	1440	1689	1949	2215	2480
Rectum and anus	585	715	806	896	978	1051	1112	585	718	811	904	990	1068	1135
Liver, gallbladder and biliary tract	266	249	290	334	378	421	462	266	423	600	837	1149	1554	2071
Pancreas	312	341	400	462	527	591	652	312	372	450	537	631	729	830
Lung	1356	1579	1763	1936	2085	2205	2291	1356	1588	1784	1974	2146	2299	2423
Melanoma of skin	546	408	463	520	578	634	689	546	798	1158	1663	2364	3319	4616
Non-melanoma skin cancer	6004	7005	8205	9467	10745	12015	13271	6004	7488	9202	11139	13266	15565	18039
Prostate	3214	-	-	-	-	-	-	3214	2871	2498	2149	1826	1527	1248
Kidney and renal pelvis	398	406	398	375	336	281	210	398	413	420	420	415	404	389
Bladder	329	-	-	-	-	-	-	329	332	340	343	341	332	319
Brain & central nervous system (CNS)	220	245	270	294	317	338	357	220	245	270	294	317	339	358
Hodgkin lymphoma	79	79	85	90	95	101	106	79	95	108	123	138	156	175
Non-Hodgkin lymphoma	438	455	517	579	640	699	755	438	573	705	857	1026	1214	1423
Leukaemia	315	324	321	307	279	236	179	315	334	345	353	356	354	347
	HD4							**Nordpred**						
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
All invasive cancers, excl. NMSC	11461	12182	12744	13176	13537	13721	13728	11461	15186	18362	21648	24910	28172	31352
Head and neck	518	639	800	986	1201	1441	1688	518	586	681	774	859	936	1008
Oesophagus	259	319	362	408	450	488	518	259	307	356	408	460	511	560
Stomach	387	455	530	608	681	751	813	387	421	473	532	596	660	723
Colon	1021	1225	1486	1789	2142	2539	2985	1021	1152	1331	1508	1682	1857	2010
Rectum and anus	585	718	810	902	983	1056	1117	585	715	824	948	1079	1216	1332
Liver, gallbladder and biliary tract	266	426	607	857	1179	1601	2164	266	393	499	602	699	795	887
Pancreas	312	373	448	533	625	718	811	312	367	441	517	594	674	752
Lung	1356	1614	1852	2117	2403	2699	3002	1356	1564	1759	1966	2174	2365	2513
Melanoma of skin	546	831	1257	1895	2826	4187	6189	546	720	904	1062	1185	1295	1405
Non-melanoma skin cancer	6004	7527	9443	11776	14467	17661	21437	6004	7640	9247	10790	12273	13751	15208
Prostate	3214	2895	2570	2331	2240	2432	3203	3214	6399	9273	12570	16105	19912	23900
Kidney and renal pelvis	398	445	523	691	1122	2257	5549	398	566	695	816	931	1045	1157
Bladder	329	344	364	387	409	425	438	329	317	336	367	404	429	447
Brain & central nervous system (CNS)	220	253	290	331	380	436	499	220	243	262	275	287	298	305
Hodgkin lymphoma	79	97	113	134	159	189	222	79	94	106	115	121	128	134
Non-Hodgkin lymphoma	438	595	763	978	1248	1589	2026	438	530	607	673	721	763	800
Leukaemia	315	335	350	365	375	383	390	315	382	435	494	555	614	670
	Median													
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**							
All invasive cancers, excl. NMSC	11461	12177	12733	13157	13461	13577	13496							
Head and neck	518	605	721	840	960	1076	1184							
Oesophagus	259	318	362	408	452	491	527							
Stomach	387	454	524	596	666	734	798							
Colon	1021	1183	1399	1628	1866	2104	2338							
Rectum and anus	585	716	810	903	986	1062	1126							
Liver, gallbladder and biliary tract	266	385	496	614	736	863	994							
Pancreas	312	368	441	519	599	681	761							
Lung	1356	1593	1800	2012	2232	2446	2633							
Melanoma of skin	546	697	889	1083	1273	1469	1678							
Non-melanoma skin cancer	6004	7482	9219	10965	12770	14658	16623							
Prostate	3214	2895	2570	2331	2240	2432	3203							
Kidney and renal pelvis	398	429	471	518	548	592	656							
Bladder	329	332	340	367	404	425	438							
Brain & central nervous system (CNS)	220	247	273	299	324	348	370							
Hodgkin lymphoma	79	93	104	115	124	134	144							
Non-Hodgkin lymphoma	438	550	654	761	873	998	1129							
Leukaemia	315	334	348	359	365	368	369							

Appendix 2: Projected ASRs in males, 2015-2045, using 6 models plus median

	demographic							HD1						
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
All invasive cancers, excl. NMSC	471	490	490	490	490	490	490	471	429	385	341	297	254	216
Head and neck	22	20	20	20	20	20	20	22	23	25	27	29	31	33
Oesophagus	11	11	11	11	11	11	11	11	11	11	11	11	10	10
Stomach	15	16	16	16	16	16	16	15	15	15	15	15	15	15
Colon	41	40	40	40	40	40	40	41	41	42	43	43	44	45
Rectum and anus	24	25	25	25	25	25	25	24	25	24	24	23	23	22
Liver, gallbladder and biliary tract	11	11	11	11	11	11	11	11	13	15	16	18	19	21
Pancreas	13	12	12	12	12	12	12	13	13	13	14	14	14	15
Lung	55	57	57	57	57	57	57	55	54	52	49	47	45	43
Melanoma of skin	22	20	20	20	20	20	20	22	24	27	31	34	37	40
Non-melanoma skin cancer	242	238	238	238	238	238	238	242	254	265	276	287	298	309
Prostate	134	150	150	150	150	150	150	134	96	59	30	12	12	12
Kidney and renal pelvis	16	17	17	17	17	17	17	16	15	13	12	11	12	12
Bladder	13	13	13	13	13	13	13	13	10	8	6	4	3	2
Brain & central nervous system (CNS)	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Hodgkin lymphoma	3	3	3	3	3	3	3	3	4	4	4	4	5	5
Non-Hodgkin lymphoma	18	18	18	18	18	18	18	18	20	22	23	24	25	27
Leukaemia	13	14	14	14	14	14	14	13	11	10	8	7	6	6
	HD2							**HD3**						
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
All invasive cancers, excl. NMSC	471	426	380	335	289	243	197	471	430	392	357	325	296	269
Head and neck	22	19	19	19	19	19	19	22	23	26	29	32	35	39
Oesophagus	11	11	11	11	11	10	10	11	11	11	11	11	10	10
Stomach	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Colon	41	39	39	40	40	40	40	41	41	42	43	44	45	45
Rectum and anus	24	25	24	24	23	23	22	24	25	25	24	24	23	23
Liver, gallbladder and biliary tract	11	9	9	9	9	9	9	11	15	18	22	26	32	39
Pancreas	13	12	12	12	12	12	12	13	13	13	14	14	15	15
Lung	55	54	52	49	47	45	43	55	54	52	50	49	47	45
Melanoma of skin	22	15	15	15	15	15	15	22	29	37	48	61	78	100
Non-melanoma skin cancer	242	239	240	240	241	242	242	242	256	269	283	298	313	329
Prostate	134	-	-	-	-	-	-	134	103	79	61	46	36	27
Kidney and renal pelvis	16	15	13	11	9	7	5	16	15	13	12	11	9	8
Bladder	13	-	-	-	-	-	-	13	11	10	8	7	6	5
Brain & central nervous system (CNS)	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Hodgkin lymphoma	3	3	3	3	3	3	3	3	4	4	4	5	5	5
Non-Hodgkin lymphoma	18	16	17	17	17	17	17	18	21	23	25	27	29	31
Leukaemia	13	12	10	8	7	5	4	13	12	11	10	9	8	7
	HD4							**Nordpred**						
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
All invasive cancers, excl. NMSC	471	433	397	365	336	310	286	471	535	563	583	598	611	624
Head and neck	22	24	26	29	33	37	41	22	22	22	22	22	22	22
Oesophagus	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Stomach	15	16	16	16	16	16	16	15	14	14	13	13	13	13
Colon	41	42	43	44	46	49	52	41	39	39	38	38	38	38
Rectum and anus	24	25	25	24	24	24	24	24	25	25	26	28	29	31
Liver, gallbladder and biliary tract	11	15	18	22	27	34	42	11	14	15	16	16	17	17
Pancreas	13	13	13	14	15	15	16	13	13	13	13	14	14	14
Lung	55	55	53	51	50	49	48	55	53	51	50	49	49	49
Melanoma of skin	22	29	39	51	67	89	118	22	25	27	28	27	26	25
Non-melanoma skin cancer	242	255	270	287	306	329	354	242	262	272	275	276	276	277
Prostate	134	106	85	72	69	78	110	134	232	297	359	411	459	507
Kidney and renal pelvis	16	16	17	23	38	77	179	16	20	22	23	24	25	26
Bladder	13	11	10	9	8	7	6	13	10	9	8	8	7	7
Brain & central nervous system (CNS)	9	9	9	9	10	10	10	9	9	9	8	8	8	8
Hodgkin lymphoma	3	4	4	5	5	6	7	3	4	4	4	4	4	4
Non-Hodgkin lymphoma	18	21	23	26	28	32	36	18	19	19	18	17	16	15
Leukaemia	13	12	11	10	10	9	9	13	14	14	14	14	14	14
	Median													
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**							
All invasive cancers, excl. NMSC	471	431	394	361	330	303	278							
Head and neck	22	22	24	25	26	27	27							
Oesophagus	11	11	11	11	11	11	10							
Stomach	15	15	15	15	15	15	15							
Colon	41	40	41	41	41	42	42							
Rectum and anus	24	25	25	24	24	23	23							
Liver, gallbladder and biliary tract	11	13	15	16	17	18	19							
Pancreas	13	13	13	13	14	14	14							
Lung	55	54	52	50	49	48	46							
Melanoma of skin	22	25	27	29	30	32	33							
Non-melanoma skin cancer	242	255	267	275	281	287	293							
Prostate	134	106	85	72	69	78	110							
Kidney and renal pelvis	16	15	15	15	14	15	15							
Bladder	13	11	10	8	8	7	6							
Brain & central nervous system (CNS)	9	9	9	9	9	9	9							
Hodgkin lymphoma	3	4	4	4	4	4	4							
Non-Hodgkin lymphoma	18	19	20	21	21	22	23							
Leukaemia	13	12	11	10	9	8	8							

Appendix 3: Projected number of cases of cancer in females, 2015-2045, using 6 models plus median

	Demographic							HD1						
site	2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
All invasive cancers, excl. NMSC	10238	11559	13017	14544	16061	17495	18839	10238	11473	12824	14246	15547	16848	18098
Head and neck	182	193	216	240	264	285	304	182	208	244	281	319	355	389
Oesophagus	157	170	197	229	262	295	328	157	161	176	193	209	224	234
Stomach	204	245	282	324	367	410	452	204	220	235	246	250	247	233
Colon	776	886	1020	1166	1317	1470	1617	776	894	1031	1180	1338	1501	1670
Rectum and anus	338	387	440	496	553	607	656	338	398	448	498	545	582	614
Liver, gallbladder and biliary tract	174	213	247	284	325	366	407	174	242	306	383	474	575	687
Pancreas	252	301	349	403	461	519	576	252	315	371	435	507	580	654
Lung	1130	1297	1492	1700	1911	2120	2313	1130	1461	1823	2245	2714	3221	3743
Melanoma of skin	584	598	661	729	796	862	925	584	695	842	1006	1189	1392	1613
Non-melanoma skin cancer	4669	5234	5988	6809	7654	8497	9320	4669	5977	7469	9191	11089	13163	15415
Female breast	3106	3438	3820	4182	4514	4788	5050	3106	3276	3529	3768	3962	4046	4249
Cervix uteri	251	311	328	344	362	379	392	251	171	139	144	175	216	257
Corpus uteri	460	542	610	678	745	803	846	460	610	748	901	1067	1237	1393
Ovary	407	455	513	573	630	684	731	407	446	497	551	607	667	725
Kidney and renal pelvis	215	254	286	321	356	391	424	215	305	380	464	558	663	775
Bladder	128	156	182	211	243	274	305	128	131	131	134	150	175	198
Brain & central nervous system (CNS)	152	186	206	227	247	267	285	152	195	221	251	282	313	347
Hodgkin lymphoma	68	70	76	81	86	88	91	68	77	86	97	106	116	126
Non-Hodgkin lymphoma	339	416	471	530	590	647	699	339	459	558	671	796	934	1077
Leukaemia	227	241	268	300	333	367	399	227	248	275	303	332	360	385

	HD2							HD3						
site	2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
All invasive cancers, excl. NMSC	10238	11468	12814	14189	15540	16789	17951	10238	11466	12812	14187	15538	16789	17955
Head and neck	182	175	197	221	244	267	287	182	212	256	306	363	423	486
Oesophagus	157	159	175	191	206	217	225	157	160	177	196	214	230	244
Stomach	204	221	236	250	260	264	263	204	223	242	262	280	295	308
Colon	776	899	1037	1188	1345	1502	1653	776	902	1042	1196	1356	1516	1672
Rectum and anus	338	400	454	511	567	621	672	338	400	454	511	568	622	673
Liver, gallbladder and biliary tract	174	183	211	244	278	313	347	174	250	324	418	533	670	830
Pancreas	252	303	352	408	467	527	586	252	315	371	435	505	577	651
Lung	1130	1108	1276	1455	1637	1817	1986	1130	1521	1958	2493	3133	3885	4745
Melanoma of skin	584	499	552	605	661	715	768	584	737	935	1176	1472	1828	2253
Non-melanoma skin cancer	4669	4677	5359	6107	6888	7668	8432	4669	6172	7957	10199	12939	16202	20042
Female breast	3106	3275	3502	3681	3810	3871	3902	3106	3279	3514	3709	3860	3950	4019
Cervix uteri	251	-	-	-	-	-	-	251	188	136	98	70	50	36
Corpus uteri	460	455	512	570	627	675	711	460	640	813	1023	1268	1541	1834
Ovary	407	444	488	531	570	603	629	407	445	490	534	575	610	638
Kidney and renal pelvis	215	215	243	273	303	332	360	215	322	420	544	697	881	1100
Bladder	128	133	130	123	110	89	62	128	140	146	151	155	156	156
Brain & central nervous system (CNS)	152	185	206	227	249	269	288	152	194	219	246	274	301	328
Hodgkin lymphoma	68	65	69	74	78	82	87	68	81	92	105	120	137	155
Non-Hodgkin lymphoma	339	370	418	469	519	568	613	339	467	573	697	837	994	1164
Leukaemia	227	250	280	312	345	377	407	227	250	280	312	345	377	408

	HD4							Nordpred						
site	2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
All invasive cancers, excl. NMSC	10238	11500	12914	14439	15887	17381	18893	10238	12206	14118	16034	17890	19672	21374
Head and neck	182	218	265	318	378	446	525	182	221	265	308	348	384	426
Oesophagus	157	162	180	201	222	242	257	157	167	188	213	240	261	277
Stomach	204	225	246	267	285	300	311	204	229	255	290	331	374	416
Colon	776	918	1085	1288	1543	1875	2329	776	881	1008	1149	1302	1445	1575
Rectum and anus	338	402	457	514	569	618	663	338	394	456	529	609	691	771
Liver, gallbladder and biliary tract	174	254	336	446	597	794	1049	174	234	286	337	389	436	474
Pancreas	252	317	375	441	518	597	681	252	302	351	406	463	523	582
Lung	1130	1529	1980	2553	3259	4115	5109	1130	1449	1733	1992	2202	2371	2504
Melanoma of skin	584	746	958	1228	1570	2008	2577	584	696	819	930	1026	1110	1186
Non-melanoma skin cancer	4669	6178	7991	10249	12940	16178	20093	4669	5844	7011	8189	9325	10454	11591
Female breast	3106	3319	3659	4035	4433	4817	5327	3106	3675	4196	4651	5043	5402	5750
Cervix uteri	251	217	231	312	518	980	1912	251	328	356	382	411	441	467
Corpus uteri	460	651	841	1078	1372	1726	2125	460	596	687	758	814	855	884
Ovary	407	451	507	568	632	700	770	407	426	457	488	515	529	540
Kidney and renal pelvis	215	325	430	563	735	961	1252	215	296	356	407	454	499	541
Bladder	128	145	159	175	194	214	233	128	127	129	137	149	154	156
Brain & central nervous system (CNS)	152	197	227	263	303	348	400	152	186	207	229	248	265	280
Hodgkin lymphoma	68	81	94	111	130	149	172	68	73	81	87	92	95	98
Non-Hodgkin lymphoma	339	477	599	752	939	1166	1435	339	438	501	555	600	636	660
Leukaemia	227	250	278	310	342	374	404	227	237	263	294	326	357	386

	Median						
site	2015	2020	2025	2030	2035	2040	2045
All invasive cancers, excl. NMSC	10238	11487	12869	14343	15717	17114	18469
Head and neck	182	210	250	294	333	369	407
Oesophagus	157	161	179	198	218	236	251
Stomach	204	224	244	264	283	298	309
Colon	776	897	1034	1184	1341	1501	1662
Rectum and anus	338	399	454	511	568	619	667
Liver, gallbladder and biliary tract	174	238	296	360	431	506	580
Pancreas	252	309	361	421	486	552	618
Lung	1130	1455	1778	2118	2458	2796	3124
Melanoma of skin	584	695	830	968	1108	1251	1400
Non-melanoma skin cancer	4669	5910	7240	8690	10207	11809	13503
Female breast	3106	3299	3594	3901	4198	4417	4650
Cervix uteri	251	217	231	312	362	379	392
Corpus uteri	460	603	718	830	940	1046	1139
Ovary	407	445	494	543	591	638	682
Kidney and renal pelvis	215	301	368	436	506	581	658
Bladder	128	136	139	144	152	166	177
Brain & central nervous system (CNS)	152	190	213	238	261	285	308
Hodgkin lymphoma	68	75	84	92	99	105	112
Non-Hodgkin lymphoma	339	449	529	613	698	790	888
Leukaemia	227	249	277	307	338	370	401

Appendix 4: Projected ASRs in females, 2015-2045, using 6 models plus median

	Demographic							HD1						
site	2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
All invasive cancers, excl. NMSC	388	388	388	388	388	388	388	388	385	382	380	377	374	371
Head and neck	7	7	7	7	7	7	7	7	7	8	8	9	9	10
Oesophagus	5	5	5	5	5	5	5	5	5	5	4	4	4	4
Stomach	7	7	7	7	7	7	7	7	7	6	6	5	5	5
Colon	28	27	27	27	27	27	27	28	27	27	27	27	27	27
Rectum and anus	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Liver, gallbladder and biliary tract	6	6	6	6	6	6	6	6	7	8	8	9	9	10
Pancreas	9	9	9	9	9	9	9	9	9	9	10	10	10	10
Lung	41	41	41	41	41	41	41	41	46	50	54	57	61	65
Melanoma of skin	22	21	21	21	21	21	21	22	24	26	28	31	33	35
Non-melanoma skin cancer	165	164	164	164	164	164	164	165	187	204	221	239	256	273
Female breast	124	123	123	123	123	123	123	124	116	111	106	101	95	92
Cervix uteri	10	12	12	12	12	12	12	10	6	4	4	4	4	4
Corpus uteri	19	19	19	19	19	19	19	19	21	23	25	27	29	30
Ovary	16	15	15	15	15	15	15	16	15	14	14	14	13	13
Kidney and renal pelvis	8	8	8	8	8	8	8	8	10	11	12	13	14	15
Bladder	4	4	4	4	4	4	4	4	4	3	2	2	2	2
Brain & central nervous system (CNS)	6	7	7	7	7	7	7	6	7	7	7	7	7	7
Hodgkin lymphoma	3	3	3	3	3	3	3	3	3	3	3	4	4	4
Non-Hodgkin lymphoma	13	14	14	14	14	14	14	13	15	16	17	18	19	20
Leukaemia	8	8	8	8	8	8	8	8	8	8	8	8	8	8

	HD2							HD3						
site	2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
All invasive cancers, excl. NMSC	388	385	382	380	377	374	371	388	385	382	380	377	374	371
Head and neck	7	6	6	6	6	6	6	7	7	8	8	9	10	10
Oesophagus	5	5	4	4	4	4	3	5	5	5	4	4	4	4
Stomach	7	7	6	6	5	5	4	7	7	6	6	6	5	5
Colon	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Rectum and anus	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Liver, gallbladder and biliary tract	6	5	6	6	6	6	6	6	8	8	9	11	12	13
Pancreas	9	9	9	9	9	9	9	9	9	9	10	10	10	10
Lung	41	35	35	35	35	35	35	41	48	54	60	67	76	85
Melanoma of skin	22	17	17	17	18	18	18	22	26	30	34	39	45	52
Non-melanoma skin cancer	165	146	147	147	148	148	148	165	193	218	246	277	312	352
Female breast	124	117	113	109	104	100	96	124	117	113	109	106	102	98
Cervix uteri	10	-	-	-	-	-	-	10	7	5	3	2	2	1
Corpus uteri	19	16	16	16	16	16	16	19	23	26	29	33	37	42
Ovary	16	15	15	15	14	14	14	16	15	15	15	14	14	14
Kidney and renal pelvis	8	7	7	7	7	7	7	8	11	12	14	17	19	22
Bladder	4	4	3	3	2	2	1	4	4	4	3	3	3	3
Brain & central nervous system (CNS)	6	7	7	7	7	7	7	6	7	7	7	7	7	8
Hodgkin lymphoma	3	3	3	3	3	3	3	3	3	3	4	4	4	5
Non-Hodgkin lymphoma	13	12	12	12	13	13	13	13	16	17	19	20	22	24
Leukaemia	8	8	8	8	8	8	8	8	8	8	8	8	8	8

	HD4							Nordpred						
site	2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
All invasive cancers, excl. NMSC	388	386	385	386	387	390	394	388	409	420	427	431	435	439
Head and neck	7	8	9	10	11	12	14	7	8	8	9	9	8	8
Oesophagus	5	5	5	4	4	4	4	5	5	5	4	4	4	4
Stomach	7	7	7	6	6	6	6	7	7	7	7	7	7	8
Colon	28	28	30	32	36	43	54	28	27	27	27	28	28	29
Rectum and anus	13	13	13	14	14	14	15	13	13	13	14	14	15	16
Liver, gallbladder and biliary tract	6	7	8	9	11	12	14	6	7	8	8	9	9	10
Pancreas	9	9	10	10	10	10	10	9	9	9	9	9	9	9
Lung	41	48	54	61	68	77	87	41	45	47	46	45	43	42
Melanoma of skin	22	25	29	34	39	45	53	22	24	25	26	26	26	26
Non-melanoma skin cancer	165	193	218	247	279	316	359	165	183	192	197	199	200	202
Female breast	124	117	115	113	113	113	115	124	131	134	134	134	134	133
Cervix uteri	10	8	7	7	10	14	24	10	12	13	13	14	14	14
Corpus uteri	19	23	26	30	34	39	45	19	20	21	20	19	18	17
Ovary	16	15	15	15	14	14	14	16	14	13	13	12	11	10
Kidney and renal pelvis	8	11	13	15	17	20	24	8	10	10	10	11	11	11
Bladder	4	4	4	3	3	3	3	4	4	3	3	3	2	2
Brain & central nervous system (CNS)	6	7	7	7	8	8	8	6	7	7	7	6	6	6
Hodgkin lymphoma	3	3	4	4	4	5	6	3	3	3	3	3	3	3
Non-Hodgkin lymphoma	13	16	17	19	21	23	25	13	14	14	14	13	13	12
Leukaemia	8	8	8	8	8	8	9	8	8	8	8	8	8	8

	Median						
Site	2015	2020	2025	2030	2035	2040	2045
All invasive cancers, excl. NMSC	388	386	384	383	382	381	380
Head and neck	7	7	8	8	9	9	9
Oesophagus	5	5	5	4	4	4	4
Stomach	7	7	6	6	6	6	5
Colon	28	28	28	28	28	28	28
Rectum and anus	13	13	13	13	13	13	13
Liver, gallbladder and biliary tract	6	7	8	8	9	9	10
Pancreas	9	9	9	9	9	10	10
Lung	41	46	48	50	51	52	53
Melanoma of skin	22	24	26	27	28	29	31
Non-melanoma skin cancer	165	185	198	209	219	228	237
Female breast	124	117	114	111	109	108	107
Cervix uteri	10	8	7	7	10	12	12
Corpus uteri	19	21	22	22	23	24	25
Ovary	16	15	15	15	14	14	14
Kidney and renal pelvis	8	10	11	11	12	12	13
Bladder	4	4	4	3	3	3	2
Brain & central nervous system (CNS)	6	7	7	7	7	7	7
Hodgkin lymphoma	3	3	3	3	3	3	3
Non-Hodgkin lymphoma	13	15	15	15	16	16	17
Leukaemia	8	8	8	8	8	8	8

Appendix 5: Projected male population, 2020-2045, M1F1-M3F2

	M1F1						M1F2					
	2020	**2025**	**2030**	**2035**	**2040**	**2045**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
under 35	1151667	1198585	1241993	1274124	1304770	1322326	1150862	1191295	1221730	1235037	1245281	1241316
35-39	186296	165856	172289	194711	207802	228229	186296	165856	172289	194711	207802	228229
40-44	190087	190638	170375	176852	199249	212346	190087	190638	170375	176852	199249	212346
45-49	176373	191030	191695	171662	178194	200553	176373	191030	191695	171662	178194	200553
50-54	157469	175858	190577	191388	171680	178273	157469	175858	190577	191388	171680	178273
55-59	143269	155427	173793	188568	189569	170314	143269	155427	173793	188568	189569	170314
60-64	126474	139619	151873	170160	184965	186197	126474	139619	151873	170160	184965	186197
65-69	111265	122005	135179	147494	165597	180386	111265	122005	135179	147494	165597	180386
70-74	94081	104220	115055	128147	140437	158162	94081	104220	115055	128147	140437	158162
75-79	64163	83027	93134	103880	116646	128720	64163	83027	93134	103880	116646	128720
80-84	41104	51777	68150	77800	88045	100029	41104	51777	68150	77800	88045	100029
85 and over	29072	38762	52078	71507	89897	108000	29072	38762	52078	71507	89897	108000
	M2F1						**M2F2**					
	2020	**2025**	**2030**	**2035**	**2040**	**2045**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
under 35	1137089	1165949	1193603	1211365	1227019	1229080	1136292	1158849	1174166	1174276	1170917	1152975
35-39	184118	160167	160762	178916	190905	210634	184118	160167	160762	178916	190905	210634
40-44	188339	186258	162532	163188	181332	193329	188339	186258	162532	163188	181332	193329
45-49	175530	188074	186208	162726	163464	181584	175530	188074	186208	162726	163464	181584
50-54	157017	174447	187080	185379	162247	163089	157017	174447	187080	185379	162247	163089
55-59	142940	154560	172011	184724	183241	160603	142940	154560	172011	184724	183241	160603
60-64	126225	138980	150736	168124	180911	179701	126225	138980	150736	168124	180911	179701
65-69	111006	121437	134230	146066	163293	176120	111006	121437	134230	146066	163293	176120
70-74	93881	103721	114238	126969	138801	155689	93881	103721	114238	126969	138801	155689
75-79	64026	82685	92501	102956	115389	127039	64026	82685	92501	102956	115389	127039
80-84	40993	51522	67701	77103	87097	98785	40993	51522	67701	77103	87097	98785
85 and over	28971	38521	51638	70829	88914	106662	28971	38521	51638	70829	88914	106662
	M3F1						**M3F2**					
	2020	**2025**	**2030**	**2035**	**2040**	**2045**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
under 35	1122526	1133117	1144546	1147681	1148476	1135355	1121739	1126204	1125920	1112553	1095671	1064036
35-39	181942	154537	149440	163193	173762	192603	181942	154537	149440	163193	173762	192603
40-44	186587	181702	154496	149481	163234	173811	186587	181702	154496	149481	163234	173811
45-49	174689	185069	180328	153386	148475	162223	174689	185069	180328	153386	148475	162223
50-54	156567	173005	183490	178939	152368	147599	156567	173005	183490	178939	152368	147599
55-59	142606	153652	170097	180694	176394	150348	142606	153652	170097	180694	176394	150348
60-64	125970	138287	149457	165859	176573	172596	125970	138287	149457	165859	176573	172596
65-69	110747	120908	133283	144549	160818	171637	110747	120908	133283	144549	160818	171637
70-74	93684	103276	113570	125899	137192	153167	93684	103276	113570	125899	137192	153167
75-79	63892	82372	91988	102235	114298	125451	63892	82372	91988	102235	114298	125451
80-84	40884	51338	67395	76625	86434	97802	40884	51338	67395	76625	86434	97802
85 and over	28881	38356	51420	70495	88391	105893	28881	38356	51420	70495	88391	105893

Appendix 6: Projected female population, 2020-2045, M1F1-M3F2

	M1F1						M1F2					
	2020	**2025**	**2030**	**2035**	**2040**	**2045**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
under 35	1124894	1160096	1201180	1231852	1260236	1276325	1124132	1153193	1181990	1194833	1203893	1199587
35-39	199875	173766	170628	191559	204762	223927	199875	173766	170628	191559	204762	223927
40-44	195974	204438	178437	175345	196267	209473	195974	204438	178437	175345	196267	209473
45-49	178718	197539	206032	180193	177171	198068	178718	197539	206032	180193	177171	198068
50-54	158502	178902	197719	206249	180663	177747	158502	178902	197719	206249	180663	177747
55-59	147268	157271	177604	196402	204987	179794	147268	157271	177604	196402	204987	179794
60-64	129351	144951	155024	175249	193997	202653	129351	144951	155024	175249	193997	202653
65-69	113214	126351	141854	151994	172036	190704	113214	126351	141854	151994	172036	190704
70-74	97735	108413	121432	136741	146940	166666	97735	108413	121432	136741	146940	166666
75-79	70277	89950	100485	113238	128170	138387	70277	89950	100485	113238	128170	138387
80-84	50585	60459	78160	88291	100460	114653	50585	60459	78160	88291	100460	114653
85 and over	50006	59601	73711	96410	118657	141617	50006	59601	73711	96410	118657	141617
	M2F1						**M2F2**					
	2020	**2025**	**2030**	**2035**	**2040**	**2045**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
under 35	1110358	1127340	1152447	1169011	1182916	1184165	1109603	1120613	1134034	1133859	1129741	1112030
35-39	198051	168810	159878	176213	188151	206514	198051	168810	159878	176213	188151	206514
40-44	194536	200793	171668	162788	179120	191062	194536	200793	171668	162788	179120	191062
45-49	178035	195126	201458	172505	163707	180032	178035	195126	201458	172505	163707	180032
50-54	158124	177740	194832	201215	172528	163862	158124	177740	194832	201215	172528	163862
55-59	146996	156543	176109	193200	199654	171389	146996	156543	176109	193200	199654	171389
60-64	129136	144412	154047	173515	190581	197130	129136	144412	154047	173515	190581	197130
65-69	112977	125847	141033	150743	170046	187061	112977	125847	141033	150743	170046	187061
70-74	97554	107952	120695	135699	145481	164492	97554	107952	120695	135699	145481	164492
75-79	70149	89625	99886	112378	127025	136841	70149	89625	99886	112378	127025	136841
80-84	50471	60194	77706	87598	99530	113464	50471	60194	77706	87598	99530	113464
85 and over	49884	59301	73181	95610	117523	140090	49884	59301	73181	95610	117523	140090
	M3F1						**M3F2**					
	2020	**2025**	**2030**	**2035**	**2040**	**2045**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
under 35	1095811	1094697	1104142	1106803	1106433	1093131	1095063	1088150	1086495	1073512	1056387	1025530
35-39	196230	163927	149280	161186	171927	189428	196230	163927	149280	161186	171927	189428
40-44	193102	197071	164889	150313	162220	172967	193102	197071	164889	150313	162220	172967
45-49	177347	192706	196719	164721	150247	162156	177347	192706	196719	164721	150247	162156
50-54	157739	176564	191942	196016	164302	149986	157739	176564	191942	196016	164302	149986
55-59	146718	155789	174560	189954	194120	162854	146718	155789	174560	189954	194120	162854
60-64	128919	143847	153000	171683	187077	191369	128919	143847	153000	171683	187077	191369
65-69	112744	125364	140208	149451	167981	183361	112744	125364	140208	149451	167981	183361
70-74	97371	107518	120040	134712	144043	162303	97371	107518	120040	134712	144043	162303
75-79	70019	89300	99342	111630	125956	135348	70019	89300	99342	111630	125956	135348
80-84	50357	59986	77341	87037	98785	112426	50357	59986	77341	87037	98785	112426
85 and over	49764	59064	72843	95103	116753	139022	49764	59064	72843	95103	116753	139022

Appendix 7: Projected incidence and treatment figures for males, 2020-2045

	Incidence							Surgery						
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
All invasive cancers, excl. NMSC	11461	13864	15920	18067	20225	22292	24161	4460	5295	5983	6680	7353	7980	8520
Head and neck	518	549	619	688	753	810	857	222	236	265	294	320	343	363
Oesophagus	259	312	361	413	464	513	558	64	74	82	90	97	103	108
Stomach	387	455	531	611	690	768	842	146	172	197	222	246	269	291
Colon	1021	1158	1357	1567	1782	1994	2196	803	899	1045	1195	1343	1490	1629
Rectum and anus	585	722	830	943	1051	1155	1250	420	510	578	647	710	771	824
Liver, gallbladder and biliary tract	266	324	378	434	489	544	597	70	79	89	98	107	115	123
Pancreas	312	350	409	472	536	598	657	45	50	56	62	67	72	76
Lung	1356	1674	1958	2259	2562	2858	3137	247	297	338	375	411	447	476
Melanoma of skin	546	566	646	726	807	885	960	514	532	606	681	755	828	898
Non-melanoma skin cancer	6004	6971	8146	9379	10623	11852	13058	5411	6281	7339	8448	9566	10669	11750
Prostate	3214	4181	4746	5324	5905	6441	6869	905	1140	1270	1404	1527	1623	1680
Kidney and renal pelvis	398	483	549	616	681	742	800	269	315	348	378	406	430	451
Bladder	329	398	473	556	644	730	814	241	293	346	403	462	521	577
Brain & central nervous system (CNS)	220	248	276	303	331	358	382	109	120	130	139	147	155	161
Hodgkin lymphoma	79	86	92	99	104	108	111	1	1	1	1	1	1	1
Non-Hodgkin lymphoma	438	514	587	662	735	805	873	42	48	54	60	66	71	77
Leukaemia	315	383	440	500	562	623	681	3	3	4	4	5	5	6
	Radiotherapy							**Chemotherapy**						
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
All invasive cancers, excl. NMSC	3369	4049	4582	5112	5633	6127	6542	2980	3524	3948	4356	4742	5101	5404
Head and neck	354	373	416	458	497	530	553	172	179	197	213	227	238	243
Oesophagus	135	162	186	211	234	257	277	131	156	174	192	209	225	237
Stomach	81	95	109	124	137	150	163	173	202	228	252	275	297	316
Colon	22	24	27	31	34	37	39	376	402	451	498	543	586	621
Rectum and anus	275	334	380	427	470	511	548	324	388	434	479	520	557	588
Liver, gallbladder and biliary tract	15	18	20	23	25	28	30	88	101	113	125	136	147	157
Pancreas	34	37	41	45	49	53	56	114	128	143	158	172	185	195
Lung	527	643	740	839	934	1025	1107	464	555	626	692	757	817	866
Melanoma of skin	25	26	30	34	37	41	45	29	30	33	35	38	40	42
Non-melanoma skin cancer	136	162	195	232	271	310	349	6	7	8	9	9	10	11
Prostate	1289	1676	1887	2093	2305	2506	2663	32	40	46	52	57	61	65
Kidney and renal pelvis	38	46	51	56	61	65	69	63	74	81	89	95	101	107
Bladder	57	71	86	103	119	135	152	93	114	131	148	164	181	195
Brain & central nervous system (CNS)	143	158	173	187	201	214	223	96	105	114	121	129	135	139
Hodgkin lymphoma	24	25	27	28	29	29	30	68	75	80	85	89	92	94
Non-Hodgkin lymphoma	71	82	93	105	115	125	135	296	346	392	438	480	521	560
Leukaemia	8	9	9	10	10	11	11	137	162	181	200	218	235	252

Appendix 8: Projected incidence and treatment figures for females, 2020-2045

	Incidence							Surgery						
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
All invasive cancers, excl. NMSC	10238	11559	13017	14544	16061	17495	18839	6173	6881	7633	8352	9013	9590	10096
Head and neck	182	193	216	240	264	285	304	97	104	115	127	138	148	157
Oesophagus	157	170	197	229	262	295	328	23	26	29	31	34	37	39
Stomach	204	245	282	324	367	410	452	71	86	98	110	121	132	141
Colon	776	886	1020	1166	1317	1470	1617	614	693	794	901	1004	1109	1208
Rectum and anus	338	387	440	496	553	607	656	231	261	294	328	359	388	412
Liver, gallbladder and biliary tract	174	213	247	284	325	366	407	37	48	54	60	65	70	75
Pancreas	252	301	349	403	461	519	576	33	39	44	48	53	56	60
Lung	1130	1297	1492	1700	1911	2120	2313	262	293	331	367	403	436	462
Melanoma of skin	584	598	661	729	796	862	925	559	573	633	696	759	821	880
Non-melanoma skin cancer	4669	5234	5988	6809	7654	8497	9320	4072	4568	5225	5941	6679	7412	8129
Female breast	3106	3438	3820	4182	4514	4788	5050	2639	2903	3198	3457	3674	3834	3978
Cervix uteri	251	311	328	344	362	379	392	166	198	205	212	221	231	235
Corpus uteri	460	542	610	678	745	803	846	434	507	568	630	689	739	774
Ovary	407	455	513	573	630	684	731	271	296	329	358	383	404	419
Kidney and renal pelvis	215	254	286	321	356	391	424	151	173	191	210	227	244	257
Bladder	128	156	182	211	243	274	305	88	106	123	142	160	179	196
Brain & central nervous system (CNS)	152	186	206	227	247	267	285	68	82	88	95	100	104	108
Hodgkin lymphoma	68	70	76	81	86	88	91	1	1	1	2	2	2	2
Non-Hodgkin lymphoma	339	416	471	530	590	647	699	33	41	46	52	57	63	67
Leukaemia	227	241	268	300	333	367	399	1	1	1	2	2	2	2
	Radiotherapy							**Chemotherapy**						
site	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
All invasive cancers, excl. NMSC	3852	4300	4767	5207	5603	5931	6214	3863	4300	4749	5156	5516	5828	6092
Head and neck	111	118	132	145	158	169	177	48	51	56	61	65	69	71
Oesophagus	81	87	100	114	127	141	153	67	71	81	90	99	107	115
Stomach	29	35	40	45	51	56	62	75	89	101	112	122	132	140
Colon	15	17	19	22	24	27	29	265	292	329	363	395	424	449
Rectum and anus	148	167	188	210	231	251	267	177	194	217	238	257	273	285
Liver, gallbladder and biliary tract	8	9	10	11	11	12	12	53	65	74	81	88	94	100
Pancreas	25	30	34	38	41	45	47	83	98	111	123	134	145	153
Lung	410	468	533	601	665	726	780	383	431	484	536	585	628	661
Melanoma of skin	12	12	13	15	17	19	21	13	13	14	15	17	18	18
Non-melanoma skin cancer	80	90	105	125	146	168	190	4	4	5	5	6	6	7
Female breast	2218	2437	2682	2897	3075	3199	3306	1478	1606	1739	1844	1922	1977	2030
Cervix uteri	135	174	186	196	207	216	224	96	123	130	134	139	144	148
Corpus uteri	195	226	255	283	311	335	352	92	104	116	128	139	148	153
Ovary	12	13	14	16	17	18	18	275	304	340	374	403	429	450
Kidney and renal pelvis	16	19	22	24	27	29	32	26	31	34	37	40	43	46
Bladder	24	30	35	41	47	54	60	34	40	46	52	57	62	66
Brain & central nervous system (CNS)	83	102	112	121	130	137	143	54	67	73	78	83	87	89
Hodgkin lymphoma	15	16	18	19	20	20	21	56	60	65	69	72	73	74
Non-Hodgkin lymphoma	59	71	80	90	101	111	120	208	255	287	322	355	388	416
Leukaemia	6	6	7	7	7	7	7	97	104	114	124	133	143	151