

## Cancer projections for Ireland 2015-2040





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National Cancer Registry

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## Introduction

Projections of the number of cancer cases are valuable in setting priorities for prevention and in anticipating the demand for cancer services. Adequate health service planning, especially with regard to staff training and recruitment, and the development of long-term capital projects such as radiotherapy units, requires estimates of the likely future burden of cancer.

This is the third set of projections of future cancer cases produced by the National Cancer Registry. Although a wide range of methods is available for projecting cancer incidence and mortality [1-8] we have, to a large extent, adhered to the methods used in previous reports [5, 9, 10], as they have been proven over time and also provide some continuity.

This report presents

1. Current trends in numbers of new cancers and incidence rates over the period 1994 to 2010.
2. Estimates of the future number of cancer cases, at five year intervals from 2015 to 2040.

These estimates are presented for all cancer types combined, both with, and without, the inclusion of non-melanoma skin cancers; and for 22 individual cancers or cancer groups. At least two sets of estimates are given for each cancer, based on different methodologies for projecting future trends in incidence. The expected number of treatments (for surgery, chemotherapy and radiotherapy separately) for each cancer type, based on 2010 treatment utilization patterns, is also provided for 2025.

## 1. Summary

Cancer incidence data from the National Cancer Registry from 1994 to 2010 and population projections from the Central Statistics Office have been combined to estimate the number of new cancer cases expected in the years 2015, 2020, 2025, 2030, 2035 and 2040, as well as the number of first treatment episodes expected in 2025. A number of different estimation methods were used.

The total number of new invasive cancer cases (including non-melanoma skin cancer) is projected to increase by 84% for females and 107% for males between 2010 and 2040, based only on changes in population size and age distribution (demography). If trends in incidence since 1994 are also taken into account, the number of cases is expected to increase by between 86% and 125% for females (depending on the method of projection used) and by between 126% and 133% for males. The projected increases are a little less than those published by the Registry previously, mainly due to changes in the CSO population projections following the 2011 census. If non-melanoma skin cancer is excluded, the numbers are expected to increase by 81% for females and 108% for males, based on demography alone. If trends in incidence are taken into account the expected increase in incidence for females is 48-112% and for males 114%-128%.

With the exception of leukaemia in males, the number of cancers is projected to increase for all sites between 2010 and 2040 (Figure 1.1). The most rapidly increasing cancers in coming decades are expected to be those of skin—both melanoma and non-melanoma—in both sexes. Cancers of the upper gastrointestinal tract—oesophagus, pancreas and hepatobiliary tract—are also expected to increase by over 100% by 2040.

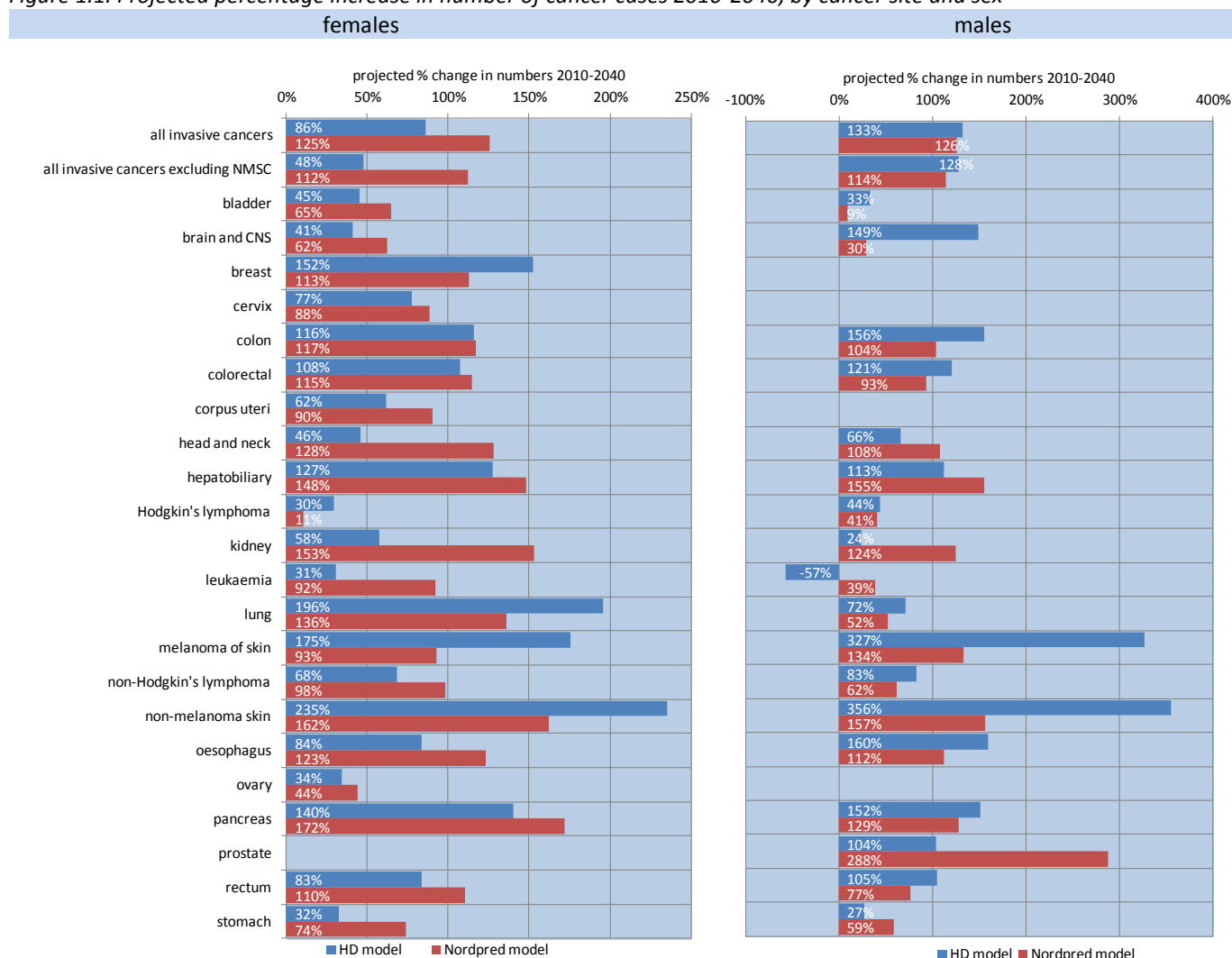
Of the other common cancers

- cancers of the colon and rectum are projected to increase largely in line with demographic change, by 120%-130% between 2010 and 2040;
- lung cancer incidence is rising more rapidly in females than in males and by 2040 the rate is projected to increase by 136% in females (Nordpred) and 52% in males;
- female breast cancer is difficult to project, due to recent short-term variations in incidence trends, but is expected to increase by about 130% between 2010 and 2040. However one HD model projects a much slower rate of increase for females;
- future trends in prostate cancer rates are unclear; the HD models project an increase of 104% in new cases by 2040, while Nordpred projects an increase of 288%; the latter, which is based on the rapid increase in rate in the early 2000s, driven by PSA testing, seems implausible;
- the models for cancer of the bladder and for leukaemia in males were heterogeneous, and future trends in these are difficult to project.

Although demographic change will be the main factor driving an increase in cancer numbers, trends in risk factor prevalence will also have an impact. 40% of the total cancer risk in the UK population (44% in males, 35% in females) has been attributed to five lifestyle factors—tobacco, diet, overweight/obesity, alcohol and low physical activity [11]. The attributable risks in Ireland are likely to be similar. Smoking prevalence in Ireland is high, although decreasing slowly, and more rapidly in males than females [12]. Obesity and overweight are increasing in both sexes, as is alcohol consumption (although there may have been a recent decrease in the latter) [13, 14]. Levels of self-reported physical activity are low, and have not changed appreciably in the last two decades [15]. Apart from changes in risk factor prevalence, the expansion of population-based screening for breast, cervical and colorectal cancers may also bring some transient increases in cancer incidence. Modelling the expected impact of all of these changes is beyond the scope of this report, but would be worthwhile.



Figure 1.1. Projected percentage increase in number of cancer cases 2010-2040, by cancer site and sex



The models project an increase of about 50% in cancer cases by 2025, and treatment numbers are expected to increase correspondingly. The total number of patients having cancer-directed surgery is projected to increase by 50%-55% between 2010 and 2025, the number having chemotherapy by 42%-48% and the number having radiotherapy by 32%-35%. These changes, combined with increasing survival, will inevitably increase the burden on the cancer services. With the ageing of the population, and improving life expectancy, the median age of cancer patients at diagnosis will increase. Cancers will be diagnosed in an older population, which will have different needs, and clear guidelines will be needed on the assessment and treatment of older patients. The growing availability and use of ever more sophisticated and expensive targeted therapy will contribute to better survival, but the high costs of these therapies, especially for advanced disease, will need to be balanced against other priorities in cancer care.

The coming decades will challenge the Irish cancer services to reduce the burden of cancer and to improve the quality of care, in the face of changing lifestyles and an increasing and more complex cancer burden. These projections, in indicating the likely future burden of cancer in the absence of effective primary prevention, can quantify the benefits and cost savings from effective action to reduce cancer risk. They can also inform decisions on allocation of resources between prevention, early detection and treatment.

## 2. Methods

Three methods have been used in this report to project cancer numbers:

1. demographic projections, which apply the average age-specific incidence rates for 2006-2010 to the future projected populations. 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 [5, 9, 10], which apply linear, non-linear and log-linear models to historical data;
3. the Nordpred method, which uses a special version of the age-period-cohort model [8, 16] with a power link.

Details of the application of these methodologies are given below.

The advantages and limitations of cancer projections have been described in previous reports [17-19]. It is important to note that this report gives projections of current data into the future, and not predictions. To make predictions, we would require knowledge of trends in underlying risk, which are not available in most cases.

### 2.1 Cancer sites

Data were modelled for 24 invasive cancer sites or groups of sites, including all invasive cancers combined, with and without the inclusion of non-melanoma skin cancer (Table 2.1).

*Table 2.1. Cancer sites and groups of sites for which projections are presented in this report*

Cancer site	ICD10 codes
1. All invasive cancers	C00-C96
2. All invasive cancers, excluding non-melanoma cancer of skin	C00-C43; C45-C96
3. Head and neck	C01-C14, C30, C31, C32
4. Oesophagus	C15
5. Stomach	C16
6. Colon	C18
7. Rectum and anus	C19-C21
8. Liver, gallbladder and biliary tract	C22-C24
9. Pancreas	C25
10. Lung	C34
11. Melanoma of skin	C43
13. Non-melanoma cancer of skin	C44
14. Female breast	C50
15. Cervix uteri	C53
16. Corpus uteri	C54
17. Ovary	C56
18. Prostate	C61
19. Kidney and renal pelvis	C64-C65
20. Bladder	C67
21. Brain and other central nervous system	C70-C72
22. Hodgkin's lymphoma	C81
23. Non-Hodgkin's lymphoma	C82-85
24. Leukaemia	C91-C95

## 2.2 Projected populations

The cancer case projections are based on the population projections of the Irish Central Statistics Office (CSO) [20]. A number of future projections have been published simultaneously by the CSO, based on different assumptions regarding mortality, migration (M) and fertility (F). These give expected population numbers for each year 2015-2046, by five year age group and sex.

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

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

Two fertility assumptions were used:

- F1: Total Fertility Rate to remain at the 2010 level of 2.1 for the lifetime of the projections
- F2: Total Fertility Rate to decrease to 1.8 by 2026 and to remain constant.

Four migration assumptions were used:

- M0: No net migration
- M1: Net migration returning to positive by 2016 and rising steadily thereafter to + 30,000 per annum by 2021
  - -19,100 annual average per annum in 2011/2016 .
  - +18,200 annual average per annum in 2016/2021
  - +30,000 per annum in 2021/2026
  - +30,000 per annum in 2026/2046.
- M2: Net migration returning to positive by 2018 and rising thereafter to +10,000 per annum by 2021
  - -21,600 annual average per annum in 2011/2016
  - +4,700 annual average per annum in 2016/2021
  - +10,000 per annum in 2021/2026
  - +10,000 per annum in 2026/2046.
- M3: Net migration remaining negative for the whole period
  - -25,100 annual average per annum in 2011/2016
  - -10,000 annual average per annum in 2016/2021
  - -5,000 per annum in 2021/2026.

Eight different population projections, based on combinations of the above assumptions, have been published by the CSO: M0F1, M0F2, 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 2040, will have a minimal impact on numbers of cancer cases over the period studied, since cancer is predominantly a disease of the elderly. Projected 2015 to 2040 populations for the M0F1 assumptions are shown in Table 2.2. These project a 15% increase in the male population and a 14% increase in the female population between 2015 and 2040. The size of population change ranges from a fall of 20-22% in those aged 35-49 to an increase of 170% in males and 298% in females aged over 85. The population aged over 70 is projected to increase by 136% (females) and 119% (males).

Figure 2.1 shows the differences between the projected 2015 and 2040 populations for the different assumptions. The largest 2015-2040 differences for all the assumptions are in the youngest age groups, which have the lowest cancer rates. For most ages over 50 the projections suggest a population increase of just over 50,000 in each five-year age group.

Table 2.2. Projected M0F1 populations 2015-2040

age group	year					
	2015	2020	2025	2030	2035	2040
<b>females</b>						
under 35	1132979	1133075	1149540	1171807	1188221	1205124
35-39	184426	172136	140319	127681	139839	151300
40-44	175829	181963	169860	138288	125762	137916
45-49	160066	174680	180938	169041	137768	125378
50-54	147690	159026	173707	180099	168450	137570
55-59	129921	144970	156443	171163	177703	166374
60-64	115227	125644	140733	152319	167029	173726
65-69	100381	108949	119555	134586	146229	160832
70-74	72554	91618	100472	111154	125932	137516
75-79	51404	62153	79872	88812	99327	113507
80-84	32847	38968	48760	64157	72727	82591
85 and over	21934	29077	38112	50840	69712	87323
<b>males</b>						
under 35	1118279	1102441	1109944	1130282	1146392	1162231
35-39	189321	188471	150191	130754	140968	152580
40-44	176948	188338	187549	149428	130075	140294
45-49	159297	176926	188360	187649	149752	130519
50-54	149751	158604	176234	187715	187099	149521
55-59	131361	147937	156887	174493	186021	185529
60-64	116252	128874	145415	154462	172006	183573
65-69	101960	112553	125179	141613	150749	168167
70-74	76655	96450	107069	119622	135834	145038
75-79	59130	69363	88151	98669	110979	126743
80-84	44026	49297	59000	76055	86173	97906
85 and over	45278	52763	62305	76727	99929	123269

Figure 2.1. Projected population increase 2015-2040, by age group and population growth model

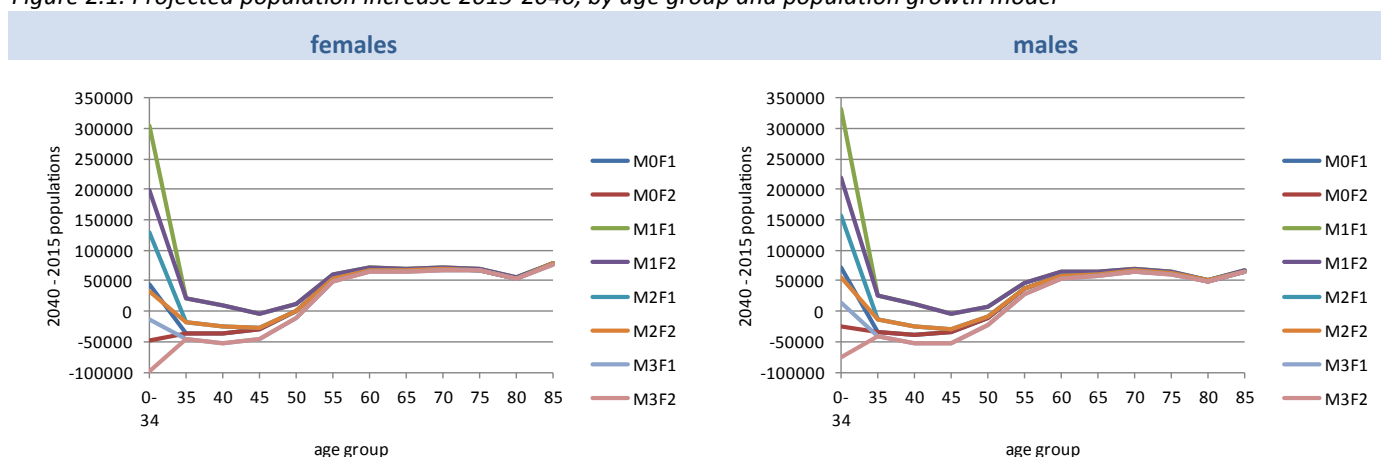
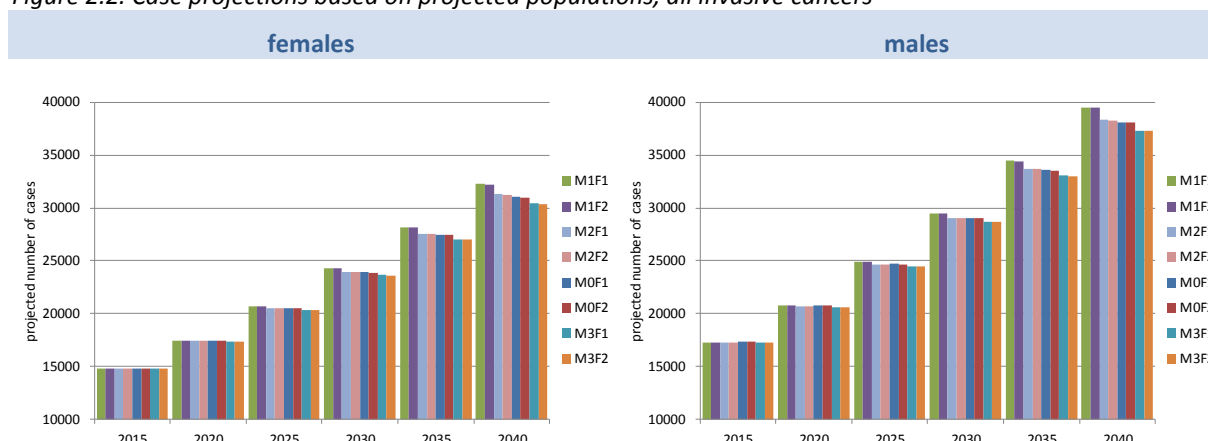


Figure 2.2 shows the impact of the different population assumptions on projected overall cancer numbers, assuming that incidence rates remain constant over the period (i.e. method 3, demographic projections, as described on page 2). As most of the difference between the models is in the population under 60, who have a low cancer incidence, the impact of using different population projections is small, 6-7% of the overall

expected numbers in 2040. The overall number of invasive cancer cases, based only on population change, is projected to increase from 28,400 in 2010 to between 54,700 and 58,200 in 2040. The M1 assumptions give the highest projected population in 2040, and consequently the largest number of new cancer cases, while the M3 assumptions give the lowest. Throughout the rest of this report we have used the M0F1 populations for making projections as these make the fewest assumptions and produce projected case numbers which are approximately midway between the lowest and highest estimates.

Figure 2.2. Case projections based on projected populations, all invasive cancers



## 2.3 Historic incidence rates

Projections are based on the assumption that current trends in incidence will continue into the future. The precision of the model is greatest if a long prior period of observation can be used. Where possible, all years of data from the National Cancer Registry, beginning from 1994, were used. For the Hakulinen and Dyba (HD) models (method 1 on page 2), trends in age-standardised incidence rate for each cancer were tested for linearity over the period 1994-2010, using Joinpoint software [21]. Joinpoint was constrained so that changes in rate over periods less than five years were not modelled. For cancers with a linear trend in incidence rate over the full period 1994-2010, cancer rates over this period have been 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 (see section 2.4), for each sex separately, where relevant. For Nordpred (method 2 on page 2), aggregated incidence data for three five-year periods were used: 1996-2000, 2001-2005 and 2006-2010. This is the minimum number of periods which is possible with the Nordpred software. Demographic projections were based on the average age-specific incidence rates in the period 2006-2010 inclusive. Details of the models fitted to the data, and the historic period used, are given in the corresponding chapter for each cancer site or combination of sites.

Only 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 convincingly modelled.

## 2.4 Model fitting

### 1. Demographic projections

Demographic projections were produced by applying the population projections to the average age-specific incidence rates for each age group (0-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79 and 80+) for each cancer for the years 2006-2010.

## 2. Hakulinen/Dyba age-period methods

Hakulinen and Dyba [5, 9, 10] propose four age-period models to fit and project incidence data. These are:

Model 1.	$n_{i,t}=p_{i,t} \times (\alpha_i + \beta_i t)$	where
Model 2.	$n_{i,t}=p_{i,t} \times e^{(\alpha_i+\beta_i t)}$	$n$ = number of cases
Model 3.	$n_{i,t}=p_{i,t} \times e^{(\alpha_i+\beta t)}$	$p$ =population at risk
Model 4.	$n_{i,t}=p_{i,t} \times (\alpha_i \times (1 + \beta t))$	$i$ =age group
		$t$ =time period
		$\alpha$ is the intercept
		$\beta$ the slope

These models use single year of incidence data and calculate projected numbers of cases, age-standardised incidence rates and 95% confidence limits for both.

Hakulinen/Dyba (HD) model 1 is a linear model, which assumes that the cancer incidence rate increases by a fixed amount ( $\beta$ ) annually. It estimates a different slope ( $\beta$ ) for each age-group  $i$ , which can give a better fit to the data when there are opposing trends for different age groups e.g. an increasing trend for older, but a falling trend for the younger, patients.

Models 2 and 3 are log-linear models, which assume that the incidence rate increases by a fixed proportion ( $\beta$ ) annually. Model 2 allows for a different slope ( $\beta$ ) for each age-group  $i$ , whereas model 3 does not. These models provide larger estimates of future increase and smaller estimates of decrease than the linear model.

Model 4 is a non-linear model, which gives estimates which are similar to those from Model 1. However, the estimates of increase or decrease are always less than for Model 1, and the difference between these models becomes more pronounced with increasing time and/or when the rate of increase is greatest. This model is the most conservative of the four and gives estimates which are closest to the assumption of no change in underlying trend (i.e. demographic change only).

The model with the best fit, as judged by the scaled standard errors of the projections, was used for the projections for each site, with a few exceptions, which are described in the chapters for individual cancers.

## 3. Nordpred

The Nordpred software provides projections for a maximum of four future five-year periods, and does not give confidence intervals for the projections (although these may be calculated using computationally intensive bootstrap methods [22]). It fits a power age-period-cohort model, with a power coefficient of 0.2, to the historic trends, using a different slope parameter for each age group (0-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79 and 80+). This model is intermediate in its assumptions between the HD linear and log models. The Nordpred software gives aggregate case numbers for the four five-year periods 2015-2019, 2020-2024, 2025-2029 and 2030-2034. Projected numbers for the years 2015, 2020, 2025, 2030, 2035 and 2040 were derived from these estimates by linear interpolation and extrapolation.

The application of the four HD models, Nordpred and the demographic projections to the incidence rate of all cancers combined (ICD 10 C00-C96) from 2015 to 2040 is shown in Figure 2.3. For all cancers combined, the projections made by the four models are similar.

As there is an upward trend in age-standardised incidence rate in the historic data for all cancer sites combined, the demographic model gives the lowest projected numbers (Figures 2.3, 2.4). Nordpred projections are within the HD projection limits for females, but are a little below the lower bounds of projection for males, probably because the five-year aggregated data is less affected by small changes in trend around the year 2000. The 95% confidence limits for the HD four models overlap for most time periods, and these limits are similar for all models. It is important to note that the Nordpred software models each age

group separately and that there can be an apparent discrepancy between the aggregate historic trend and a projection which is based on the sum of trends for different age groups. This also occurs in the HD models (1 and 3) where each age group is fitted to a different slope, and can give an apparent discontinuity between the historic and modelled numbers.

Figure 2.3. Projections of cancer cases based on HD models 1-4, Nordpred and demographic trends, using MOF1 population projections: all invasive cancers

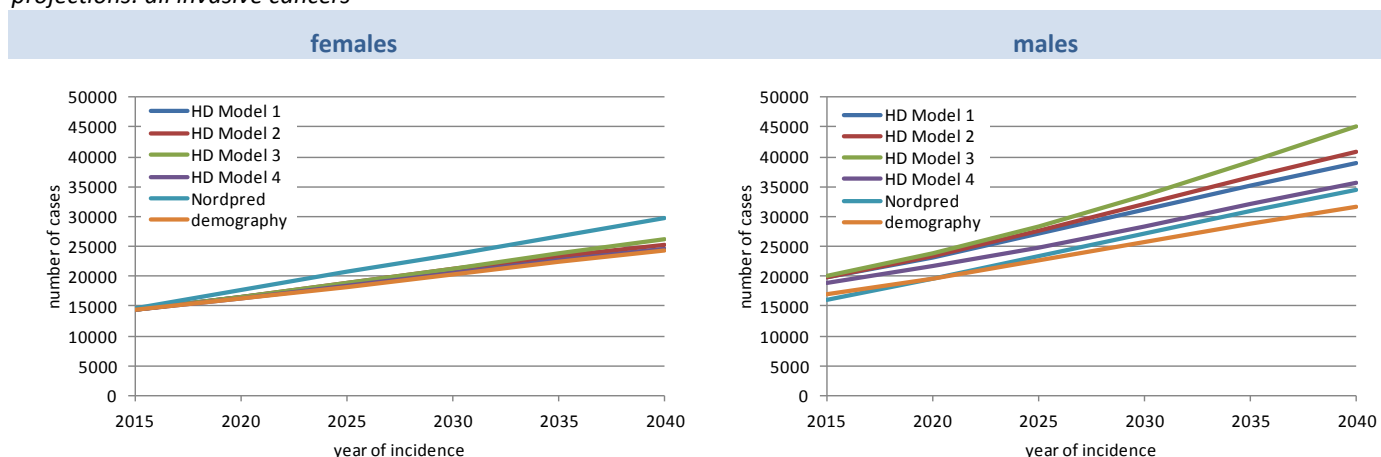
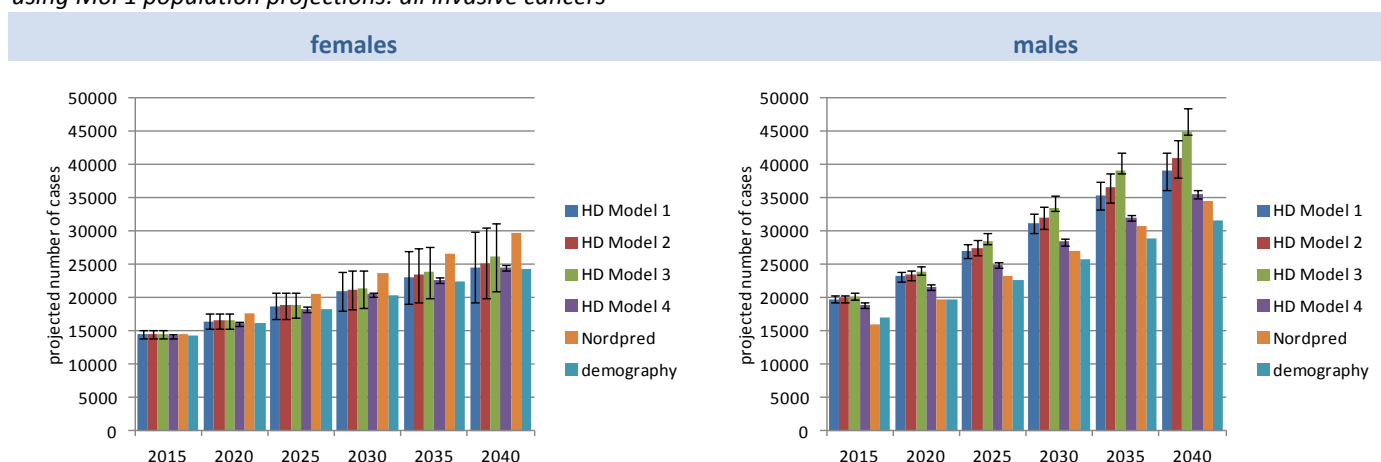


Figure 2.4. Projections of cancer cases based on HD models 1-4 (with 95% projection limits), Nordpred and demographic trends, using MOF1 population projections: all invasive cancers



Note. Nordpred produces projections for aggregate five-year periods. Figures 2.3 and 2.4 use linear interpolation and extrapolation to project the average midpoint values (2017, 2022, 2027, 2032 and 2037) to the years 2015, 2020, 2030, 2035 and 2040.

## 2.5 Treatments

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. The proportion of patients estimated to have each treatment has been extrapolated to 2025, using the projected number of cases and the treatment proportions in 2010. Long-term treatment patterns are difficult to project, so we have given data for a more recent period than for the incidence numbers, and with the caution that the projections depend on an assumption of stability in treatment practices (i.e. no increase or decrease in the use of therapies).

# Projections by cancer site

## 3. All invasive cancer sites combined

### Trends

Figure 3.1. All invasive cancer sites combined; case numbers, 1994-2010

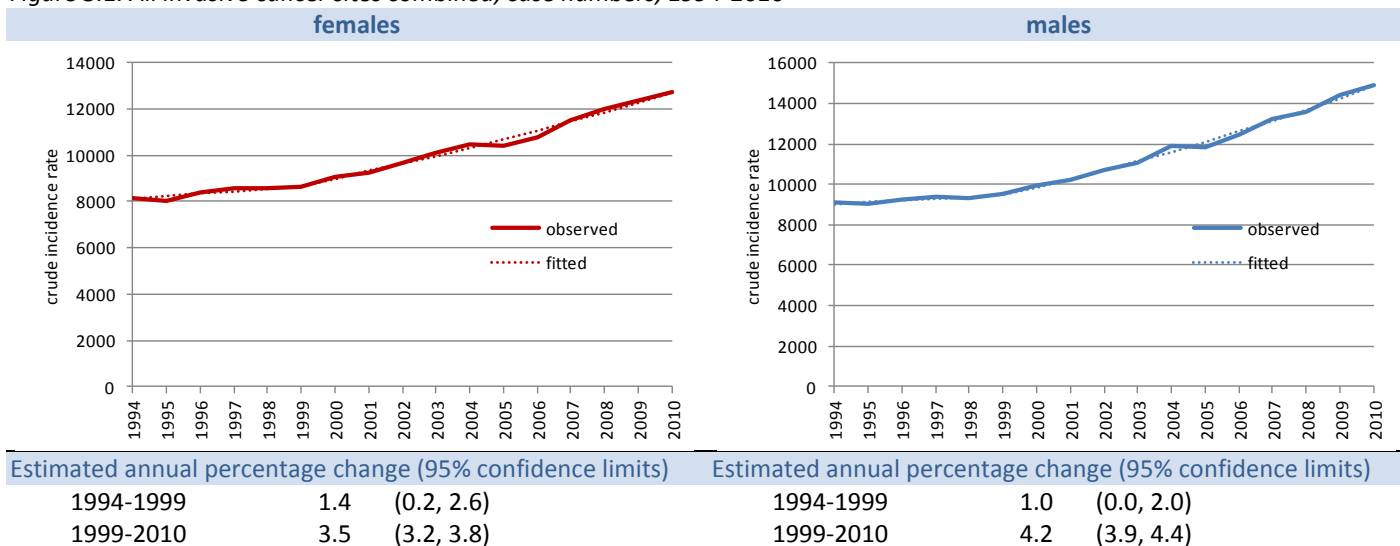
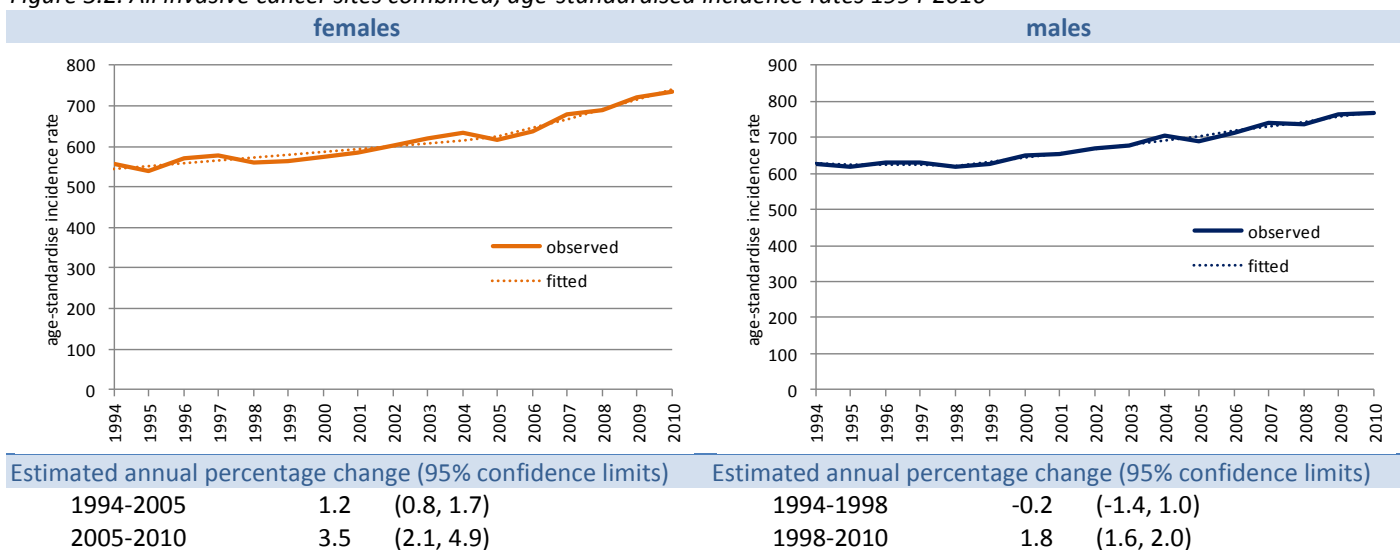


Figure 3.2. All invasive cancer sites combined; age-standardised incidence rates 1994-2010



Case numbers increased between 1994 and 2010. Between 1994 and 1999, there was a significant increase of 1.4% annually for females and 1.0% for males, with a sharper increase, 3.5% annually for females and 4.2% for males, from 1999 onwards.

The age-standardised incidence rates also increased during 1994-2010, but the increase was not significant for males before 1998. In contrast to case numbers, the overall increase in incidence rate was greater for females.

### Projections

For females, the base of projection for the HD models was 2005-2010, and for males 1998-2010. HD model 4 gave the best fit for both males and females. For both sexes the HD projections of the number of cases were above those due to demographic change alone (Figure 3.3, Table 3.1). Nordpred gave a higher estimate of female incidence and a slightly lower estimate of male incidence than the HD model; these were outside the 95% confidence limits of the HD model. The models project that female case numbers will increase by 86%-125% between 2010 and 2040 and male cases by 126%-133%, with proportionate increases in treatment rates (Table 3.2).



Figure 3.3. Projected numbers of all invasive cancers, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010

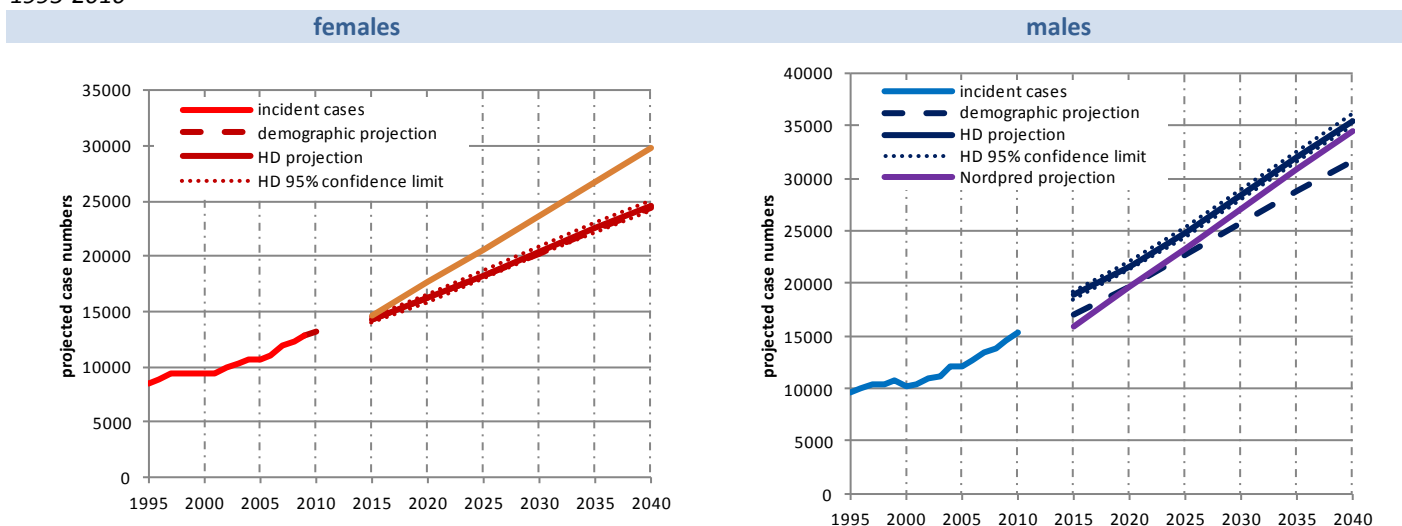


Table 3.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): all invasive cancers

	demography only	Nordpred	HD projections	lower 95% HD confidence limit	upper 95% HD confidence limit
<b>females</b>					
2010	13185				
2015	14322 (9%)	14602 (11%)	14271 (8%)	13975 (6%)	14566 (10%)
2020	16172 (23%)	17624 (34%)	16155 (23%)	15832 (20%)	16477 (25%)
2025	18202 (38%)	20647 (57%)	18284 (39%)	17931 (36%)	18637 (41%)
2030	20295 (54%)	23670 (80%)	20461 (55%)	20077 (52%)	20846 (58%)
2035	22368 (70%)	26693 (102%)	22580 (71%)	22163 (68%)	22998 (74%)
2040	24287 (84%)	29715 (125%)	24548 (86%)	24098 (83%)	24998 (90%)
<b>males</b>					
2010	15295				
2015	17008 (11%)	15916 (4%)	18880 (23%)	18539 (21%)	19220 (26%)
2020	19692 (29%)	19643 (28%)	21640 (41%)	21265 (39%)	22015 (44%)
2025	22658 (48%)	23370 (53%)	24858 (63%)	24442 (60%)	25274 (65%)
2030	25775 (69%)	27097 (77%)	28387 (86%)	27923 (83%)	28851 (89%)
2035	28855 (89%)	30824 (102%)	32026 (109%)	31508 (106%)	32545 (113%)
2040	31704 (107%)	34551 (126%)	35561 (133%)	34986 (129%)	36137 (136%)

Table 3.2 Number of cancers treated in 2010, with estimates for 2025, all invasive cancers

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	13185	18202	20647	18284
surgery	9019	12450	14123	12506
chemotherapy	3429	4734	5370	4755
radiotherapy	3758	5187	5884	5211
<b>males</b>				
all cases	15295	22658	23370	24858
surgery	8382	12417	12807	13622
chemotherapy	2925	3897	4020	4276
radiotherapy	4766	5483	5655	6016

## 4. All invasive cancer sites combined, excluding non-melanoma skin cancer

Non-melanoma skin cancers have been excluded from this analysis, as their recorded incidence is more dependent on case-finding than most other cancers.

### Trends

Figure 4.1. All invasive cancer sites combined, excluding non-melanoma skin; case numbers, 1994-2010

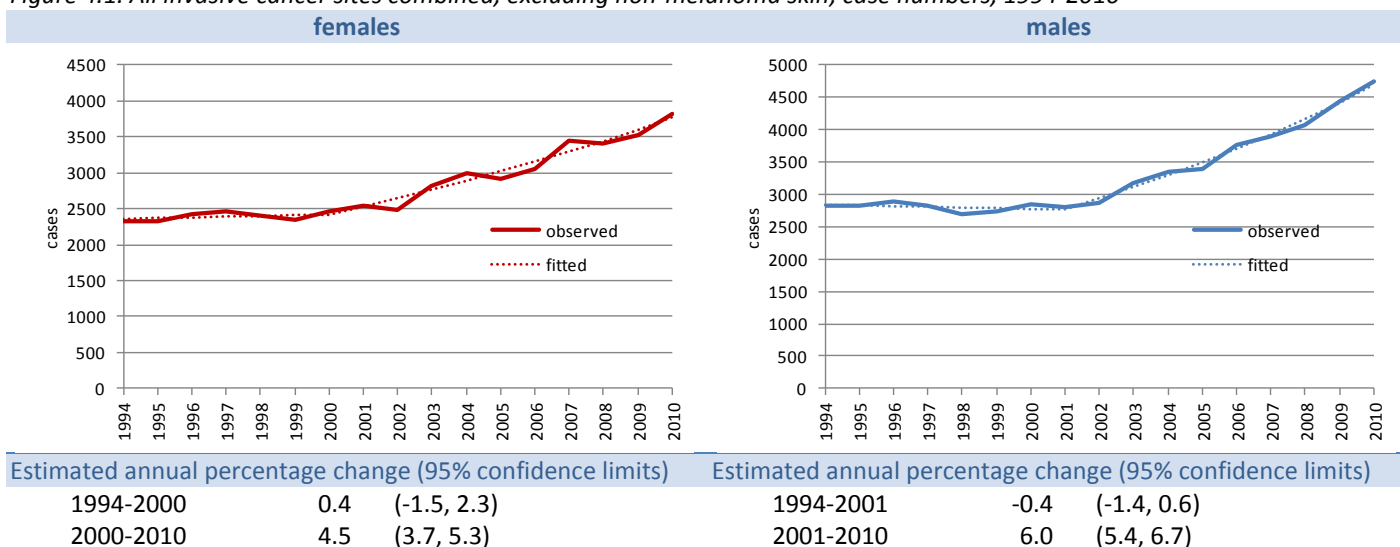
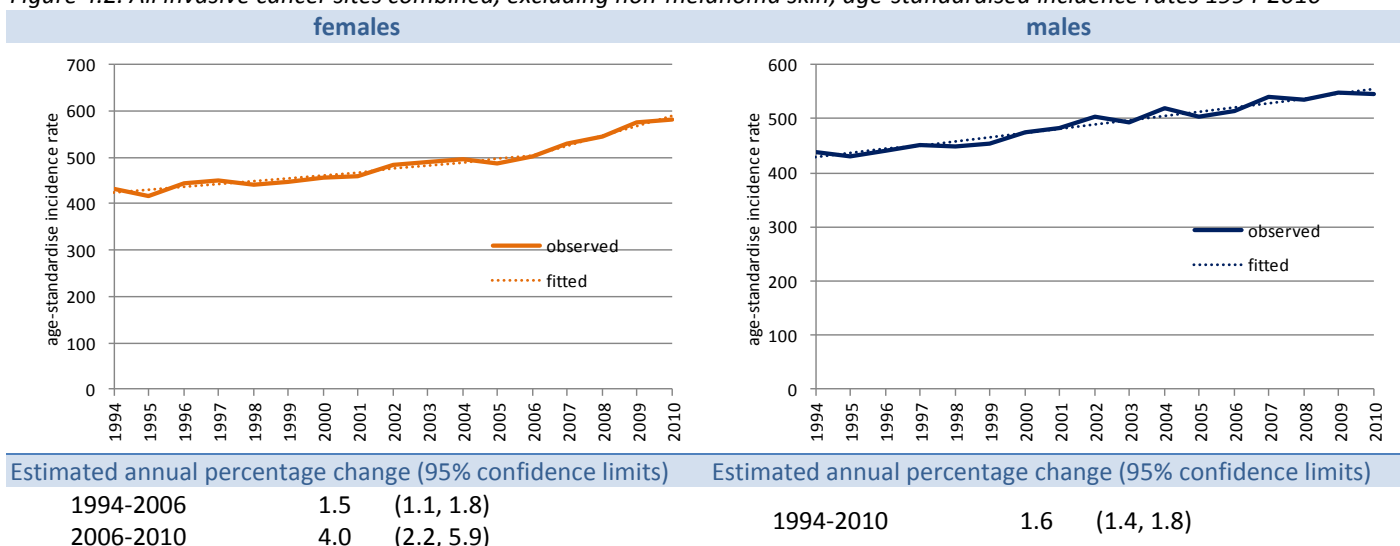


Figure 4.2. All invasive cancer sites combined, excluding non-melanoma skin; age-standardised incidence rates 1994-2010



Case numbers increased between 1994 and 2010 (Figure 4.1). This trend was not significant between 1994 and 2000, but from 2000 onwards the numbers increased by 4.5% annually for females and 6.0% for males. The age-standardised incidence rates also increased during 1994-2010, but the increase was significant throughout—1.5% annually from 1994 to 2006 and 4.0% thereafter for females, and 1.6% annually from 1994 to 2009 for males (Figure 4.2).

### Projections

For females, the base of projection for the HD models was 2006-2010, and for males 1994-2010. HD model 2 gave the best fit for females and model 4 for males. For females the HD projections of the number of cases were below those due to demographic change alone while for males they were very close (Figure 4.3, Table 4.1). Nordpred gave a higher estimate of female incidence and a slightly lower estimate of male incidence than the HD model; these were outside the 95% confidence limits of the HD model. The models project that female case numbers will increase by 48%-112% between 2010 and 2040; male cases are projected to increase by 114%-128% in the same period, with proportionate increases in treatment rates (Table 4.2).

Figure 4.3. Projected numbers of all invasive cancers, excluding non-melanoma skin, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010

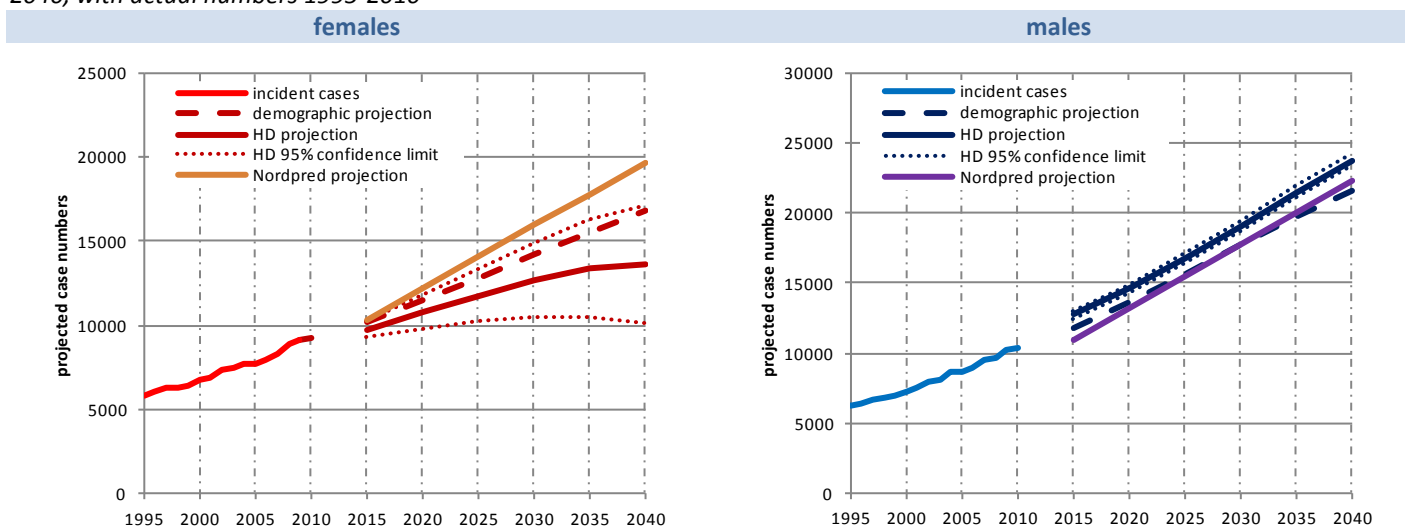


Table 4.1 Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): all invasive cancers, excluding non-melanoma skin

	demography only	Nordpred	HD projections	lower 95% HD confidence limit	upper 95% HD confidence limit
<b>females</b>					
2010	9266				
2015	10192 (10%)	10362 (12%)	9768 (5%)	9238 (0%)	10297 (11%)
2020	11471 (24%)	12225 (32%)	10754 (16%)	9766 (5%)	11743 (27%)
2025	12849 (39%)	14087 (52%)	11785 (27%)	10233 (10%)	13338 (44%)
2030	14233 (54%)	15950 (72%)	12702 (37%)	10507 (13%)	14898 (61%)
2035	15576 (68%)	17813 (92%)	13397 (45%)	10515 (13%)	16279 (76%)
2040	16787 (81%)	19676 (112%)	13676 (48%)	10184 (10%)	17168 (85%)
<b>males</b>					
2010	10436				
2015	11816 (13%)	10971 (5%)	12757 (22%)	12477 (20%)	13037 (25%)
2020	13635 (31%)	13252 (27%)	14605 (40%)	14297 (37%)	14914 (43%)
2025	15639 (50%)	15534 (49%)	16753 (61%)	16411 (57%)	17095 (64%)
2030	17734 (70%)	17815 (71%)	19097 (83%)	18716 (79%)	19478 (87%)
2035	19784 (90%)	20097 (93%)	21500 (106%)	21075 (102%)	21926 (110%)
2040	21655 (108%)	22378 (114%)	23822 (128%)	23351 (124%)	24293 (133%)

Table 4.2 Number of cancers treated in 2010, with estimates for 2025, all invasive cancers excluding non-melanoma skin

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	9266	12849	14087	11785
surgery	5680	7876	8636	7224
chemotherapy	3428	4754	5212	4361
radiotherapy	3669	5088	5579	4667
<b>males</b>				
all cases	10436	15639	15534	16753
surgery	4154	6224	6182	6668
chemotherapy	2962	3920	3893	4199
radiotherapy	4622	5301	5266	5679

## 5. Cancer of the head and neck

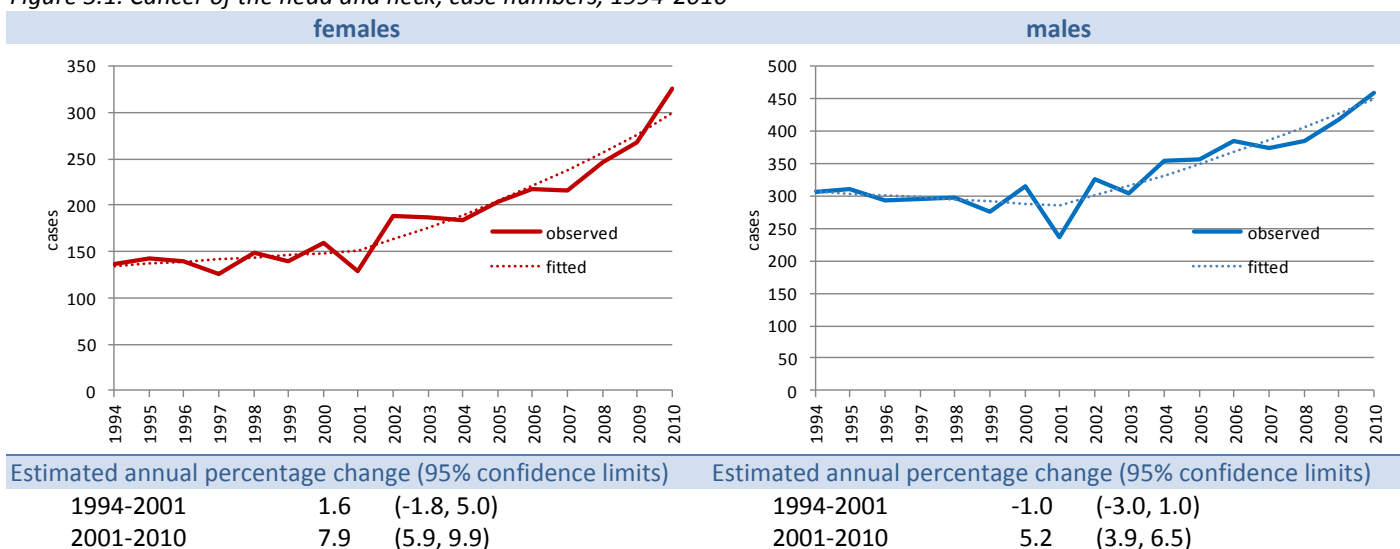
Cancer of the head and neck includes a number of distinct sub-sites, of which larynx is by far the commonest (Table 5.1).

**Table 5.1. Subsites of cancer of the head and neck; number of cases and % of all cancers of the head and neck 2006-2010**

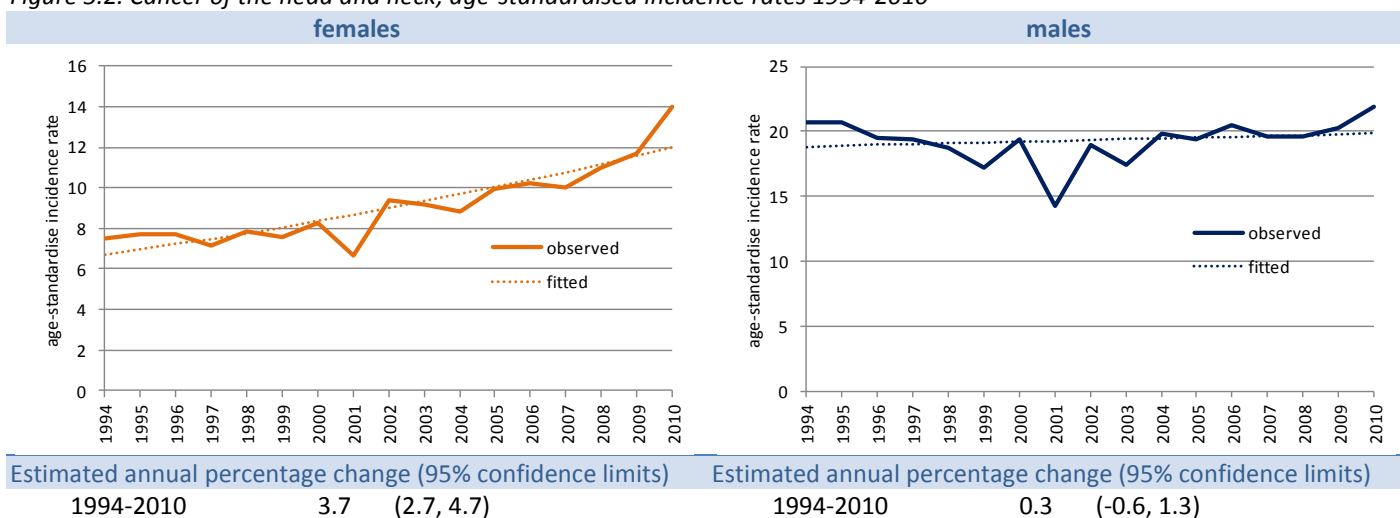
site	ICD10 code	average cases 2006-2010	% of cases 2006-2010	site	ICD10 code	average cases 2006-2009	% of cases 2006-2010
base of tongue	C01	26	5.1%	tonsil	C09	41	8.1%
other tongue	C02	59	11.9%	oropharynx	C10	10	1.9%
gum	C03	15	3.0%	nasopharynx	C11	16	3.2%
floor of mouth	C04	25	5.0%	pyriform	C12	24	4.7%
palate	C05	19	3.8%	hypopharynx	C13	15	3.0%
other mouth	C06	28	5.5%	other mouth/pharynx	C14	15	2.9%
parotid	C07	30	6.0%	nasal cavity/middle ear	C30	13	2.7%
other salivary	C08	7	1.4%	sinuses	C31	10	2.1%
				larynx	C32	148	29.7%

### Trends

**Figure 5.1. Cancer of the head and neck; case numbers, 1994-2010**



**Figure 5.2. Cancer of the head and neck; age-standardised incidence rates 1994-2010**



Case numbers increased for females by 1.6% annually between 1994 and 2001 and by 7.9% annually from 2001 onward. For males there was no significant trend in numbers until 2001 and a 5.2% increase thereafter (Figure 5.1). Age-standardised incidence rates for females increased by 3.7% annually between 1994 and 2010, but there was no significant change for males (Figure 5.2).

## Projections

For both sexes the base of projection for the HD model was 1994-2010. HD model 4 gave the best fit for females, and model 3 for males. For both sexes the HD estimates were close to those due to demographic change alone (Figure 5.3, Table 5.1). The Nordpred estimates were much higher than the HD estimates for females, and a little higher for males; the latter was mostly within the HD model 95% confidence limits. The models project that female case numbers will increase by 46%-128% between 2010 and 2040 and male cases by 66%-108%, with proportionate increases in treatment rates (Table 5.2).

Figure 5.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the head and neck

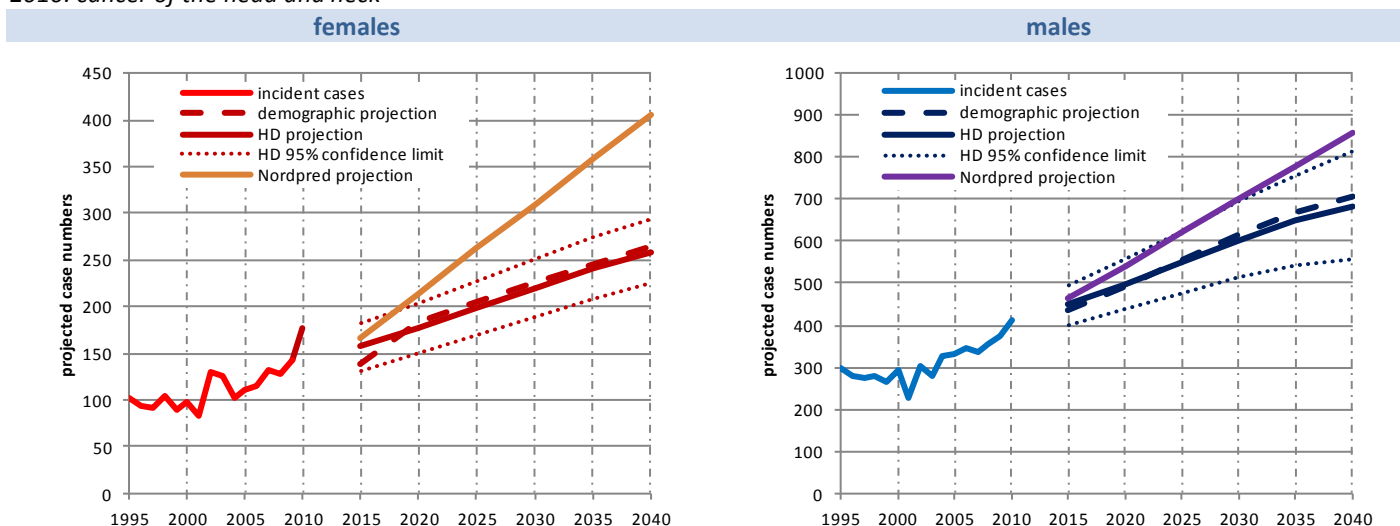


Table 5.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the head and neck

	demography only				Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
females												
	2010	178										
	2015	139	(-22%)	165	(-7%)	157	(-12%)	132	(-26%)	183	(3%)	
	2020	183	(3%)	214	(20%)	177	(-1%)	149	(-16%)	204	(15%)	
	2025	204	(15%)	262	(47%)	198	(11%)	169	(-5%)	227	(27%)	
	2030	225	(26%)	310	(74%)	220	(23%)	189	(6%)	250	(41%)	
	2035	245	(38%)	358	(101%)	241	(35%)	208	(17%)	273	(54%)	
	2040	264	(48%)	406	(128%)	259	(46%)	225	(26%)	293	(65%)	
males												
	2010	412										
	2015	436	(6%)	462	(12%)	448	(9%)	399	(-3%)	497	(21%)	
	2020	494	(20%)	542	(31%)	498	(21%)	438	(6%)	557	(35%)	
	2025	555	(35%)	621	(51%)	551	(34%)	478	(16%)	624	(51%)	
	2030	615	(49%)	700	(70%)	603	(46%)	514	(25%)	693	(68%)	
	2035	668	(62%)	779	(89%)	649	(58%)	541	(31%)	757	(84%)	
	2040	708	(72%)	858	(108%)	684	(66%)	556	(35%)	812	(97%)	

Table 5.2 Number of cancers treated in 2010, with estimates for 2025: cancer of the head and neck

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	178	204	262	198
surgery	133	153	196	148
chemotherapy	22	25	32	25
radiotherapy	93	106	137	103
<b>males</b>				
all cases	412	555	621	552
surgery	218	293	328	291
chemotherapy	121	154	173	153
radiotherapy	332	372	417	370

## 6. Cancer of the oesophagus

Cancer of the oesophagus is of two main types: squamous carcinoma and adenocarcinoma. Squamous carcinomas have remained fairly constant in number since 1994, but adenocarcinomas are increasing rapidly, by 4% a year for females and 5% for males [23]. Due to the small number of cases, it was not feasible to model these histological types separately, and projections are presented here for all oesophageal cancers combined.

### Trends

Figure 6.2. Cancer of the oesophagus; case numbers, 1994-2010

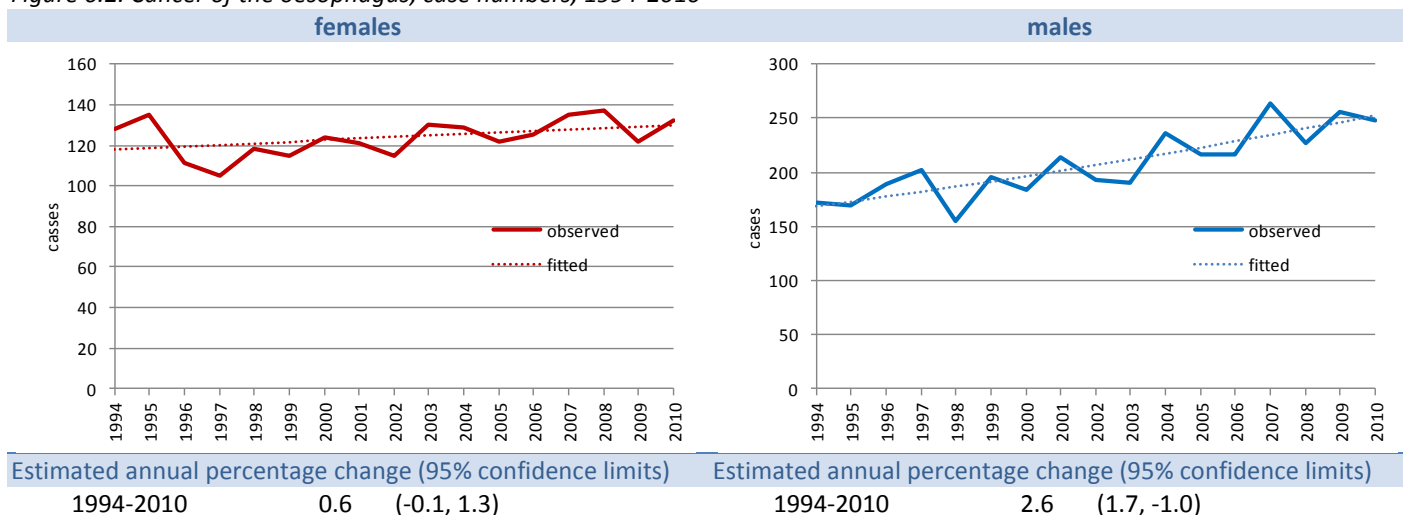
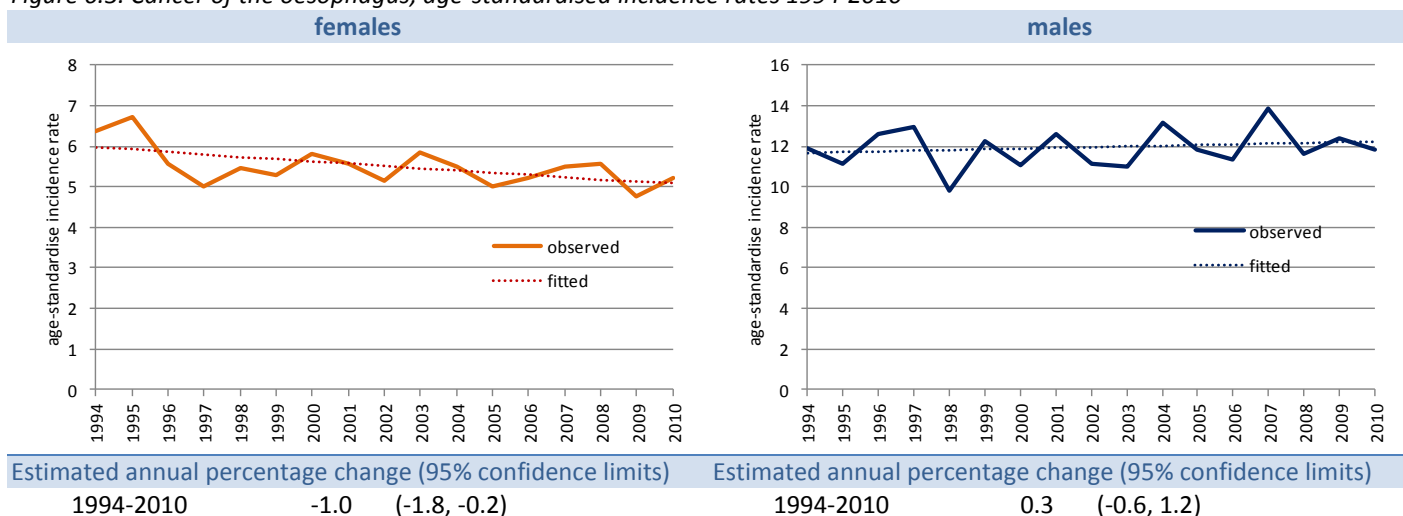


Figure 6.3. Cancer of the oesophagus; age-standardised incidence rates 1994-2010



Case numbers did not increase significantly for females from 1994 to 2010, but increased by 2.6% annually for males (Figure 6.2). Age-standardised incidence fell significantly for females, by 1.0% a year, and remained constant for males (Figure 6.3).

### Projections

The base of projection for the HD models for both sexes was 1994-2010. HD model 3 gave the best fit for females and model 4 for males. For females the HD estimates were below those due to demographic change alone (Figure 6.4, Table 6.1). Nordpred estimates were close to those of the HD model, but suggest a greater increase in female cases in later years. The models project that female case numbers will increase by 84%-123% between 2010 and 2040 and male cases by 112%-160%, with proportionate increases in treatment rates (Table 6.2).

Figure 6.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the oesophagus

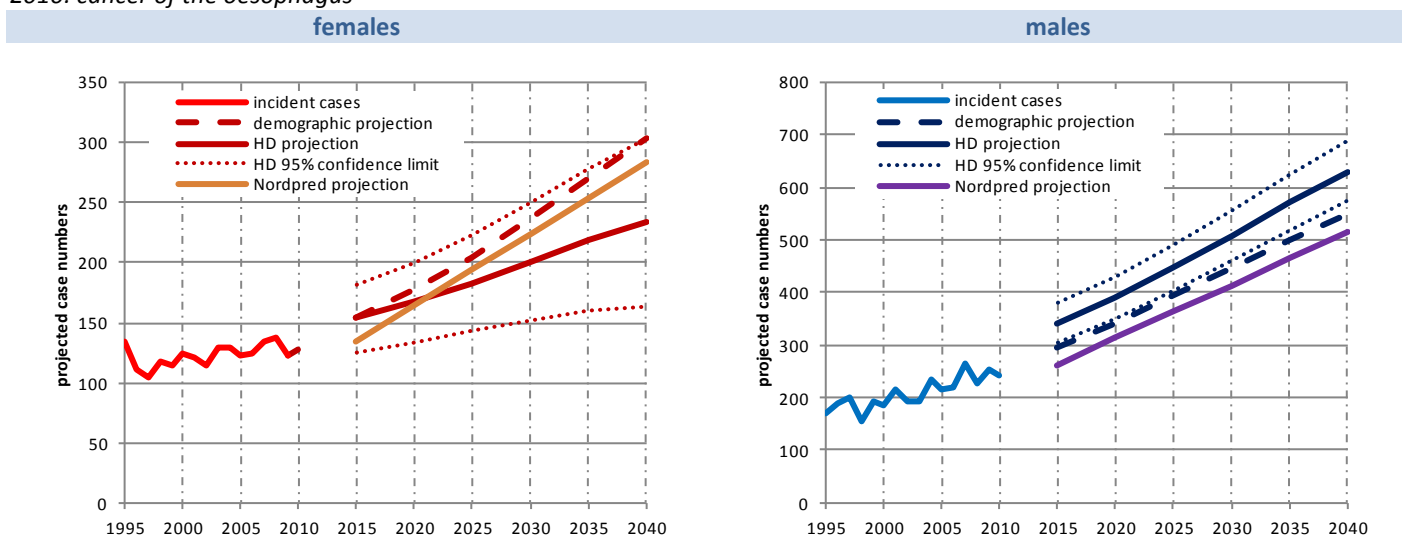


Table 6.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the oesophagus

Desophagus

	demography only				Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
females												
	2010	127										
	2015	154	(21%)	134	(6%)	154	(21%)	125	(-1%)	182	(44%)	
	2020	177	(39%)	164	(29%)	167	(32%)	134	(5%)	201	(58%)	
	2025	205	(61%)	194	(53%)	183	(44%)	143	(13%)	224	(76%)	
	2030	237	(86%)	224	(76%)	201	(58%)	152	(20%)	250	(97%)	
	2035	271	(113%)	254	(100%)	218	(72%)	159	(25%)	278	(119%)	
	2040	305	(140%)	283	(123%)	233	(84%)	163	(28%)	303	(139%)	
males												
	2010	243										
	2015	296	(22%)	263	(8%)	342	(41%)	303	(25%)	380	(56%)	
	2020	342	(41%)	313	(29%)	390	(61%)	349	(44%)	431	(78%)	
	2025	393	(62%)	364	(50%)	446	(84%)	402	(65%)	491	(102%)	
	2030	449	(85%)	415	(71%)	509	(109%)	460	(89%)	557	(129%)	
	2035	501	(106%)	465	(91%)	571	(135%)	519	(114%)	623	(156%)	
	2040	549	(126%)	516	(112%)	631	(160%)	576	(137%)	687	(183%)	

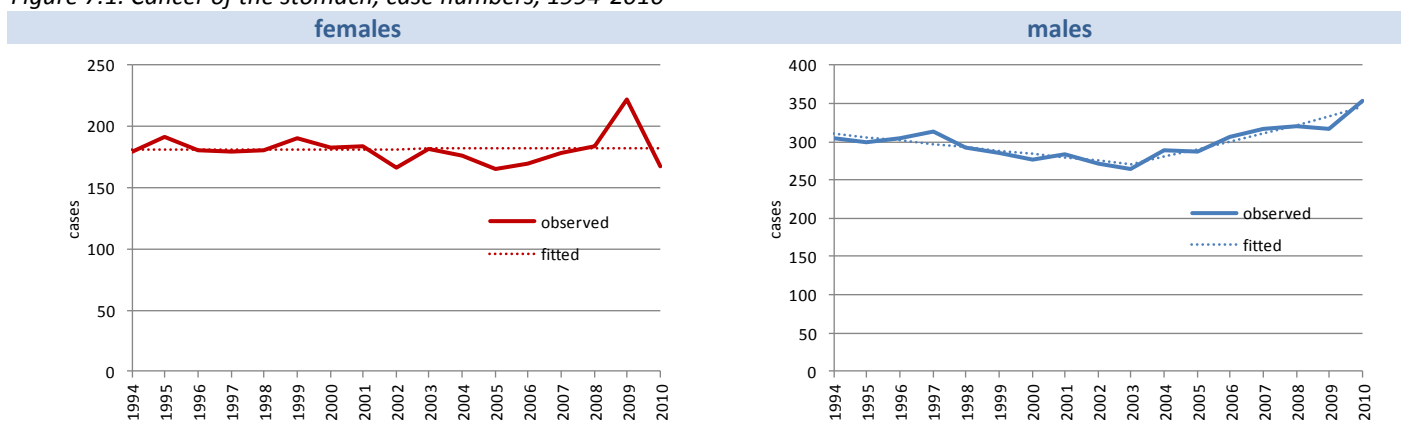
Table 6.2 Number of cancers treated in 2010, with estimates for 2025: cancer of the oesophagus

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	127	205	194	183
surgery	29	47	44	42
chemotherapy	50	81	76	72
radiotherapy	53	85	81	76
<b>males</b>				
all cases	243	393	364	446
surgery	90	145	135	165
chemotherapy	125	167	154	189
radiotherapy	153	176	163	200

## 7. Cancer of the stomach

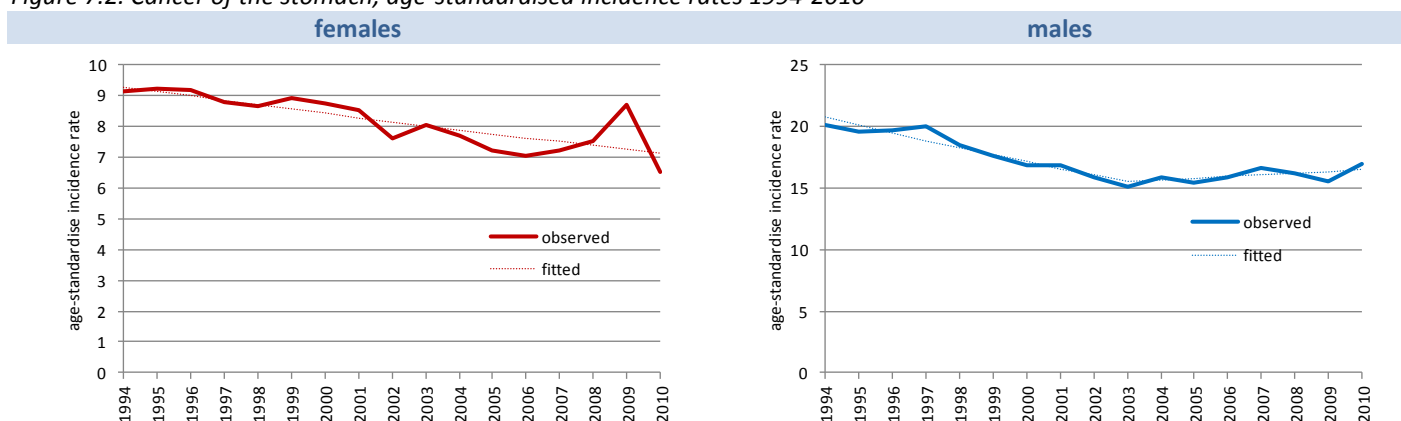
### Trends

Figure 7.1. Cancer of the stomach; case numbers, 1994-2010



Estimated annual percentage change (95% confidence limits)			Estimated annual percentage change (95% confidence limits)		
1994-2010	0.0	(-0.7, 0.7)	1994-2003	-1.5	(-2.3, -0.7)
			2003-2010	3.5	(2.3, 4.7)

Figure 7.2. Cancer of the stomach; age-standardised incidence rates 1994-2010



Estimated annual percentage change (95% confidence limits)			Estimated annual percentage change (95% confidence limits)		
1994-2010	-1.6	(-2.3, -1.0)	1994-2003	-3.2	(-4.0, -2.3)
			2003-2010	0.8	(-0.5, 2.2)

Case numbers did not change significantly for females from 1994 to 2010. They fell by 1.5% annually between 1994 and 2003 but increased for males by 3.5% annually from 2003 onward (Figure 7.1). Age-standardised incidence rates fell by 1.6% a year for females. For males there was a significant decrease of 3.2% annually from 1994 to 2003, with no significant trend after that time (Figure 7.2).

### Projections

The base of projection for the HD model for females was 1994-2010 and for males 2003-2010. HD model 3 gave the best fit for both males and females. For both sexes the HD projections of the number of cases were well below those due to demographic change alone (Figure 7.3, Table 7.1). The Nordpred projections were similar to those of the HD model. The models project that female case numbers will increase by 32%-74% between 2010 and 2040, and male cases by 27%-59%, with proportionate increases in treatment rates (Table 7.2).



Figure 7.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the stomach

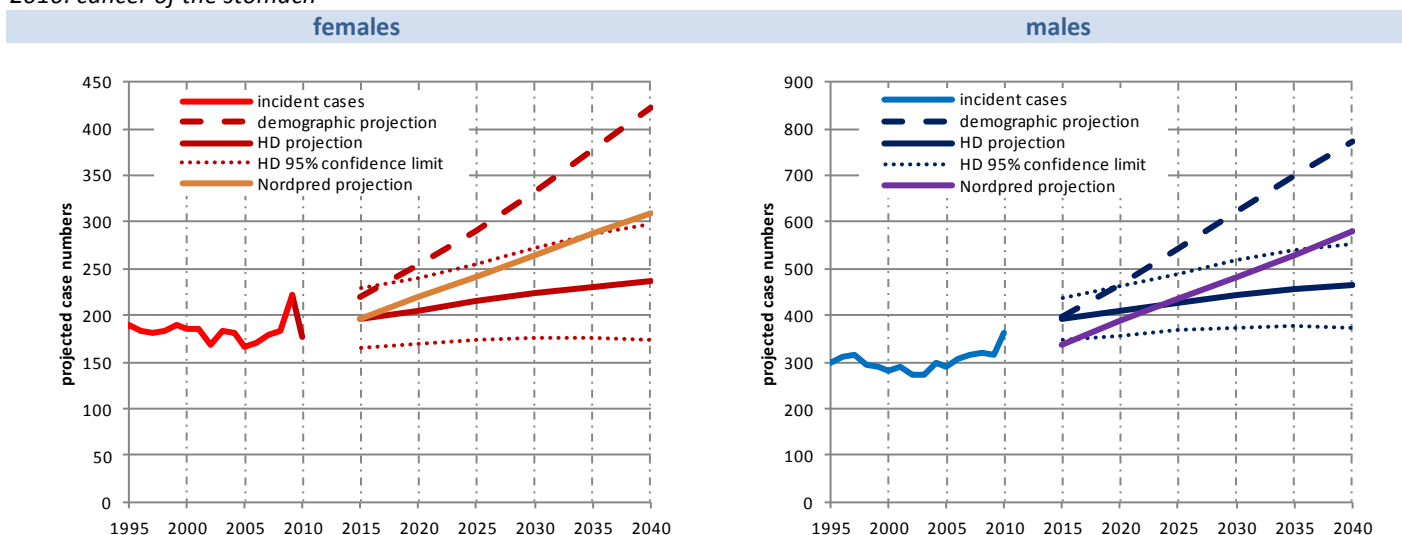


Table 7.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the stomach

table 12.14 Projected numbers of incident cases 2010-2040 (with % increase/decrease compared to 2010), cancer of the stomach											
demography only				Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
females											
2010	178										
2015	221	(24%)	196	(10%)	197	(11%)	165	(-7%)	229	(29%)	
2020	253	(42%)	219	(23%)	205	(15%)	169	(-5%)	241	(35%)	
2025	291	(63%)	242	(36%)	214	(20%)	173	(-3%)	256	(44%)	
2030	333	(87%)	264	(49%)	224	(26%)	176	(-1%)	272	(53%)	
2035	378	(112%)	287	(61%)	231	(30%)	177	(-1%)	286	(61%)	
2040	423	(138%)	310	(74%)	236	(32%)	174	(-2%)	297	(67%)	
males											
2010	364										
2015	399	(9%)	339	(-7%)	393	(8%)	347	(-5%)	439	(21%)	
2020	467	(28%)	387	(6%)	410	(13%)	357	(-2%)	462	(27%)	
2025	542	(49%)	435	(19%)	428	(18%)	367	(1%)	489	(34%)	
2030	621	(71%)	483	(33%)	445	(22%)	375	(3%)	516	(42%)	
2035	699	(92%)	531	(46%)	457	(26%)	376	(3%)	539	(48%)	
2040	773	(112%)	579	(59%)	463	(27%)	371	(2%)	554	(52%)	

Table 7.2. Number of cancers treated in 2010, with estimates for 2025: cancer of the stomach

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	178	291	242	214
surgery	70	114	94	84
chemotherapy	52	85	70	62
radiotherapy	18	29	24	22
<b>males</b>				
all cases	364	542	435	428
surgery	172	256	206	203
chemotherapy	163	221	177	175
radiotherapy	80	93	74	73

## 8. Cancer of the colon

### Trends

Figure 8.1. Cancer of the colon; case numbers, 1994-2010

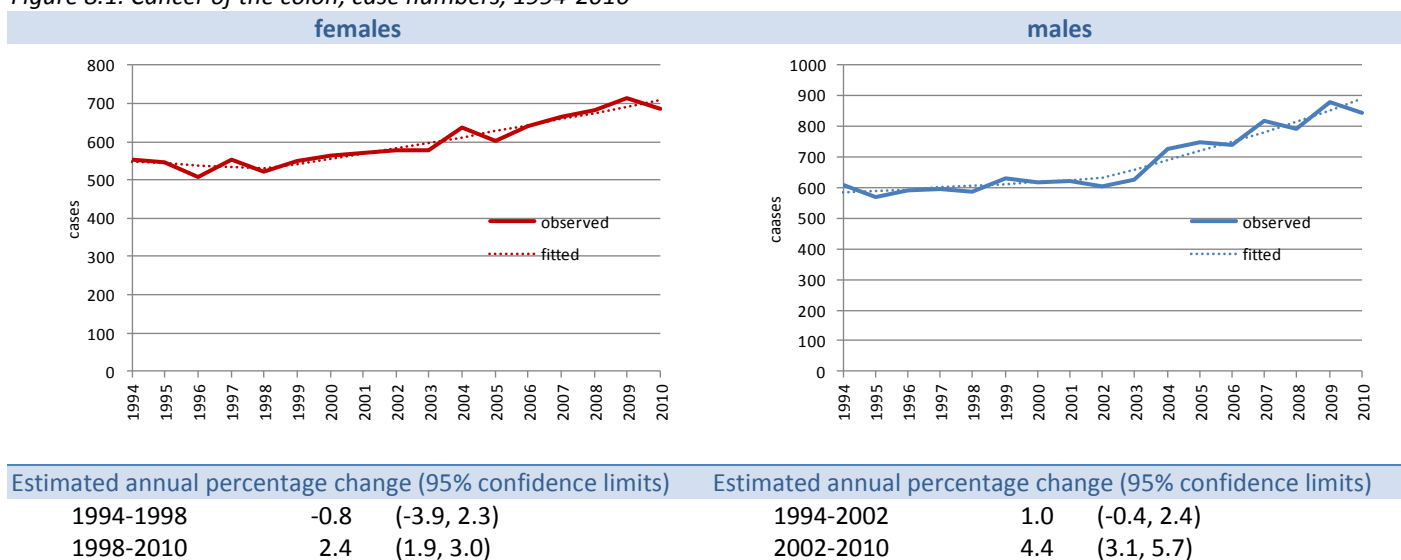
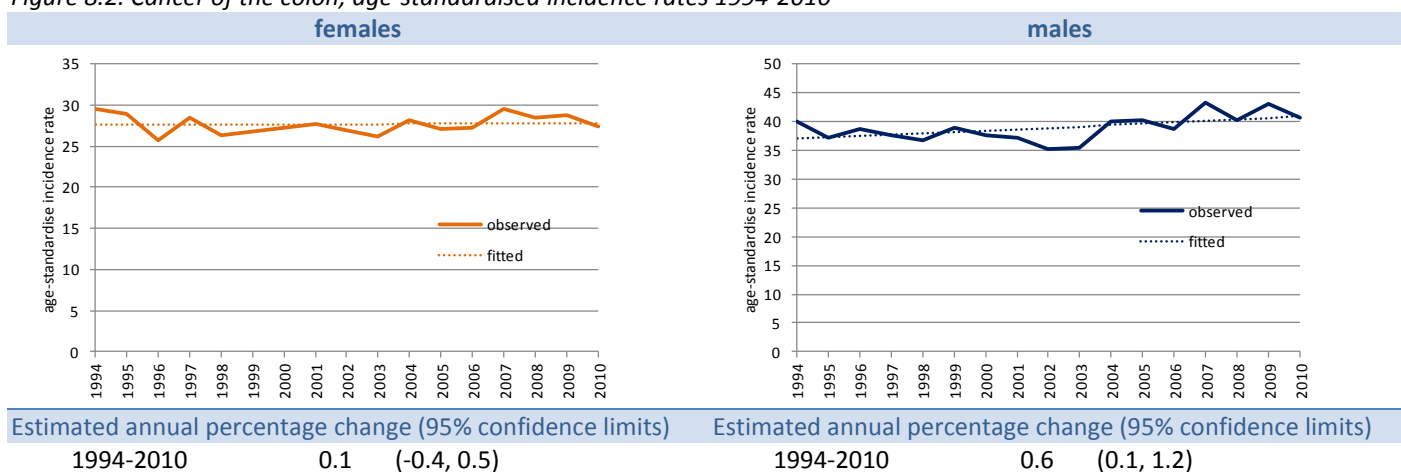


Figure 8.2. Cancer of the colon; age-standardised incidence rates 1994-2010



Case numbers did not change significantly for females from 1994 to 1998. Between 1998 and 2010 they increased significantly, by 2.4% annually. For males there was no significant trend from 1994 to 2002 and a significant increase, 4.4% annually, thereafter (Figure 8.1). Age-standardised incidence rates did not change significantly for females, and rose slightly, by 0.6% a year, for males during 1994-2010 (Figure 8.2).

### Projections

The base of projection for the HD model for both sexes was 1994-2010. HD model 4 gave the best fit for both males and females. For females the HD estimates were the same as for the Nordpred and demographic models (Figure 8.3, Table 8.1) while for males the demographic projections were intermediate between those from Nordpred and the HD model. The models project that female case numbers will increase by 116%-117% between 2010 and 2040, and male cases by 104%-156%, with proportionate increases in treatment rates (Table 8.2).

Figure 8.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the colon

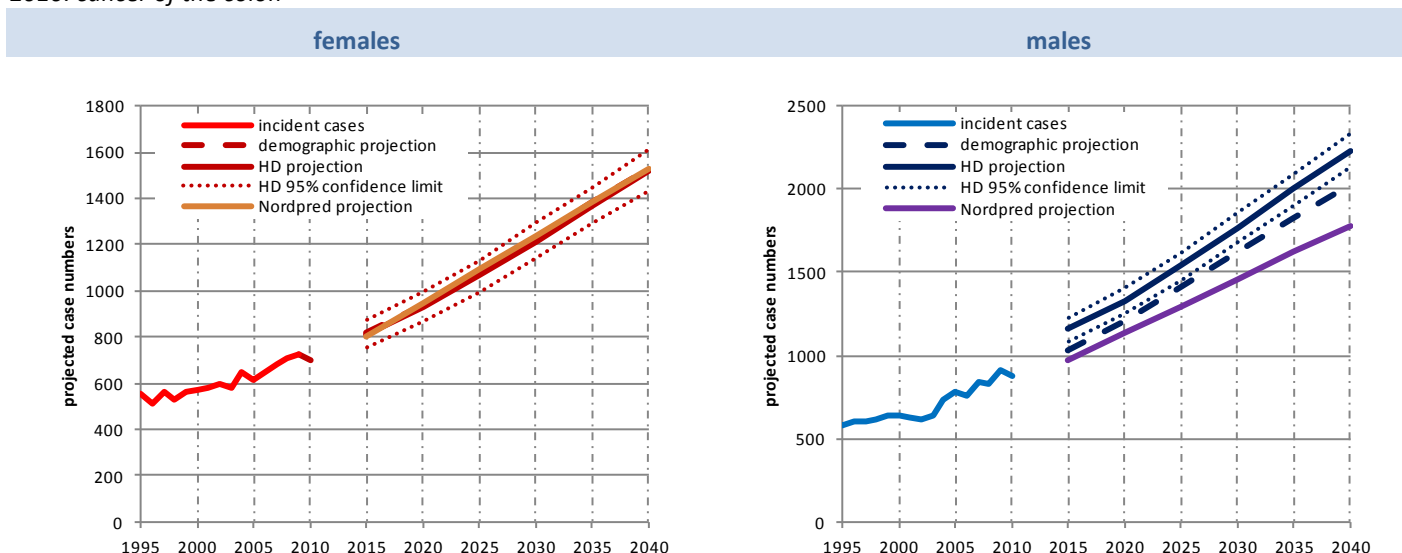


Table 8.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the colon

	demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit
<b>females</b>									
2010	703								
2015	818 (16%)		802 (14%)		811 (15%)		753 (7%)		870 (24%)
2020	937 (33%)		947 (35%)		928 (32%)		865 (23%)		991 (41%)
2025	1075 (53%)		1092 (55%)		1066 (52%)		997 (42%)		1134 (61%)
2030	1226 (74%)		1237 (76%)		1216 (73%)		1141 (62%)		1291 (84%)
2035	1382 (97%)		1382 (97%)		1370 (95%)		1289 (83%)		1451 (106%)
2040	1529 (118%)		1526 (117%)		1518 (116%)		1431 (103%)		1605 (128%)
<b>males</b>									
2010	872								
2015	1033 (19%)		974 (12%)		1158 (33%)		1087 (25%)		1228 (41%)
2020	1210 (39%)		1136 (30%)		1331 (53%)		1255 (44%)		1407 (61%)
2025	1409 (62%)		1297 (49%)		1537 (76%)		1455 (67%)		1620 (86%)
2030	1620 (86%)		1458 (67%)		1764 (102%)		1675 (92%)		1854 (113%)
2035	1829 (110%)		1620 (86%)		1998 (129%)		1901 (118%)		2096 (140%)
2040	2030 (133%)		1781 (104%)		2230 (156%)		2125 (144%)		2334 (168%)

Table 8.2. Number of cancers treated in 2010, with estimates for 2025: cancer of the colon

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	703	1075	1092	1066
surgery	557	853	866	845
chemotherapy	257	393	399	389
radiotherapy	38	58	59	58
<b>males</b>				
all cases	872	1409	1297	1537
surgery	700	1132	1041	1235
chemotherapy	381	520	479	567
radiotherapy	56	65	60	71

## 9. Cancer of the rectum and anus

### Trends

Cancers of the rectum and anus consist of three subsites: rectosigmoid junction, rectum and anus. Rectal cancers make up the majority and anal cancers are uncommon (Table 9.1).

Table 9.1. Subsites of cancers of the rectum and anus; number of cases and % of all cancers of the rectum and anus 2006-2010

site	ICD10 code	females		males	
		average number of cases	% of cases	average number of cases	% of cases
rectosigmoid junction	C19	55	23%	86	20%
rectum	C20	168	69%	325	77%
anus	C21	19	8%	13	3%

Figure 9.1. Cancer of the rectum and anus; case numbers, 1994-2010

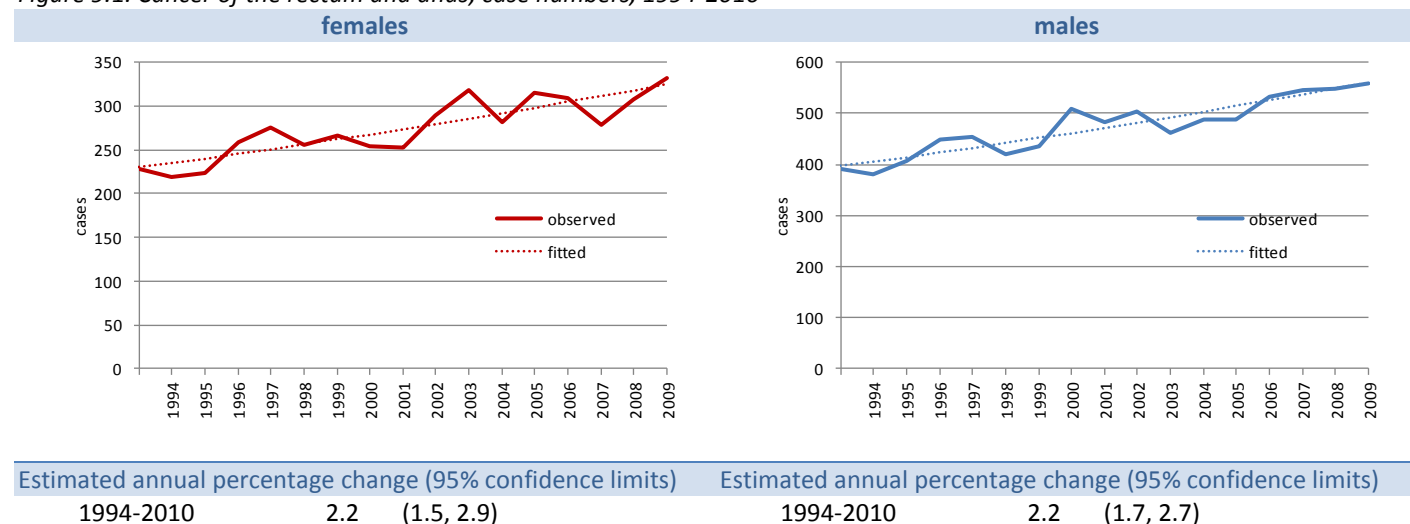
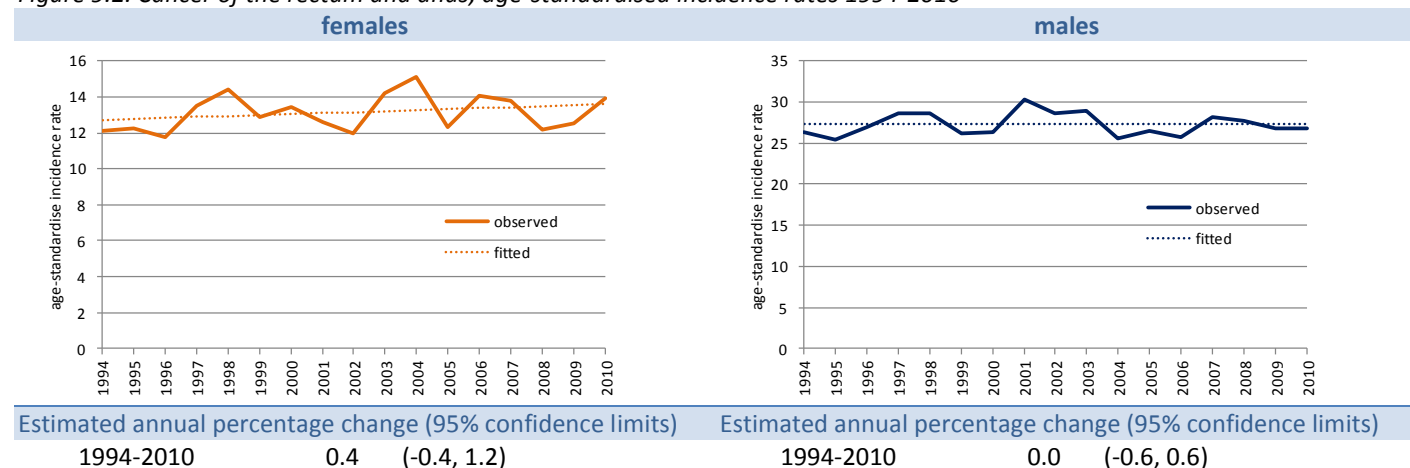


Figure 9.2. Cancer of the rectum and anus; age-standardised incidence rates 1994-2010



Case numbers increased significantly for females and males from 1994 to 1998, by 2.2% a year (Figure 9.1). There was no significant trend for either sex in age-standardised incidence rates (Figure 9.2).

### Projections

The base of projection for the HD model for both sexes was 1994-2010. HD model 3 gave the best fit for both males and females. For both sexes the HD projections of the number of cases were almost identical to those due to demographic change alone (Figure 9.3, Table 9.2). The Nordpred projections were within the 95% confidence limits of the HD model for females, but below them for males. The model projects that female case numbers will increase by 83%-110% between 2010 and 2040 and male cases by 77%-105%, with proportionate increases in treatment rates (Table 9.2).

Figure 9.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the rectum and anus

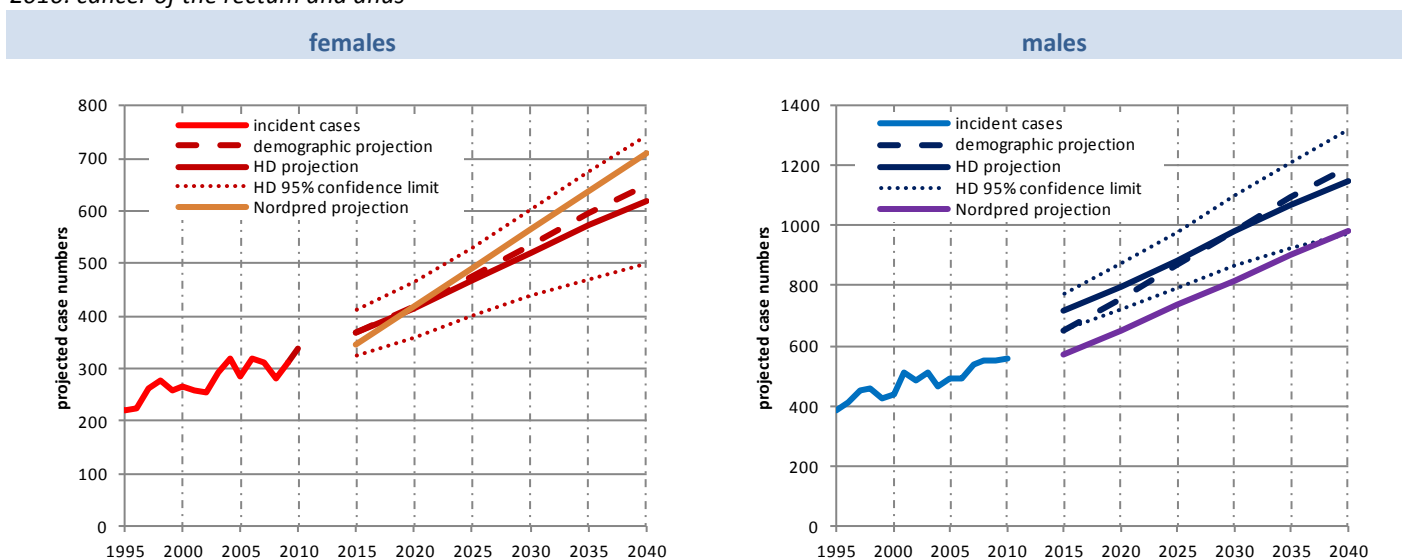


Table 9.2. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the rectum and anus

		demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
females											
	2010	338									
	2015	367	(9%)	343	(2%)	367	(9%)	323	(-4%)	411	(22%)
	2020	417	(23%)	417	(23%)	413	(22%)	360	(7%)	466	(38%)
	2025	475	(40%)	490	(45%)	465	(38%)	399	(18%)	531	(57%)
	2030	535	(58%)	564	(67%)	519	(54%)	437	(29%)	601	(78%)
	2035	594	(76%)	637	(89%)	572	(69%)	470	(39%)	673	(99%)
	2040	648	(92%)	711	(110%)	620	(83%)	497	(47%)	742	(120%)
males											
	2010	558									
	2015	653	(17%)	567	(2%)	714	(28%)	651	(17%)	776	(39%)
	2020	755	(35%)	651	(17%)	794	(42%)	719	(29%)	870	(56%)
	2025	868	(56%)	734	(32%)	886	(59%)	792	(42%)	979	(75%)
	2030	984	(76%)	818	(47%)	981	(76%)	865	(55%)	1098	(97%)
	2035	1094	(96%)	901	(62%)	1069	(92%)	926	(66%)	1212	(117%)
	2040	1194	(114%)	985	(77%)	1146	(105%)	975	(75%)	1317	(136%)

Table 9.2. Number of cancers treated in 2010, with estimates for 2025: cancer of the rectum and anus

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	338	475	490	465
surgery	243	341	352	334
chemotherapy	165	232	240	227
radiotherapy	173	243	251	238
<b>males</b>				
all cases	558	868	734	886
surgery	416	647	548	661
chemotherapy	370	492	416	502
radiotherapy	391	449	380	459

## 10. Cancer of the liver, biliary tract and gallbladder

### Trends

Cancer of the liver, biliary tract and gallbladder (hepatobiliary) cancers consist of hepatocellular carcinoma of the liver, intrahepatic bile duct carcinoma, extrahepatic bile duct carcinoma and a small number of other histological types. 37% were not histologically verified (Table 10.1).

Table 10.1. Subsites of cancers of liver, biliary tract and gallbladder; number of cases and % of all cancers of the liver, biliary tract and gallbladder 2006-2010

site	ICD10 code	adenocarcinoma		hepatocellular carcinoma		other and unspecified types	
		average number of cases	% of cases	average number of cases	% of cases	average number of cases	% of cases
liver	C22	30	12%	53	21%	59	23%
gallbladder	C23	26	11%	<1	0%	14	6%
other biliary	C24	47	19%	1	0%	20	8%
Total		103	41%	54	22%	93	37%

Figure 10.2 Cancer of the liver, biliary tract and gallbladder; case numbers, 1994-2010

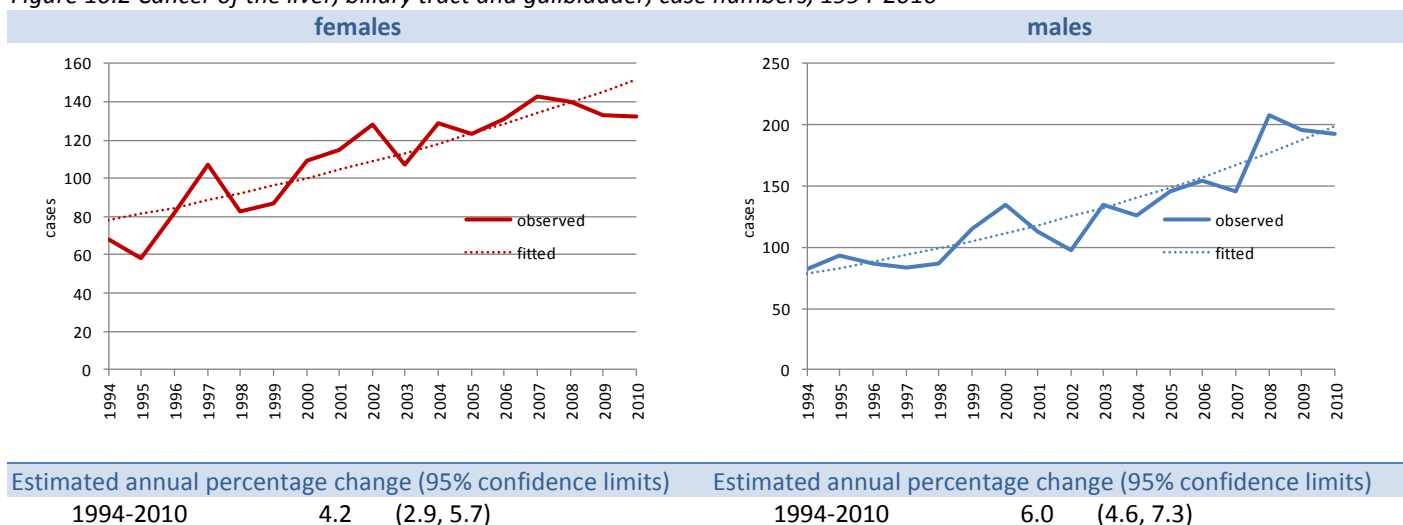
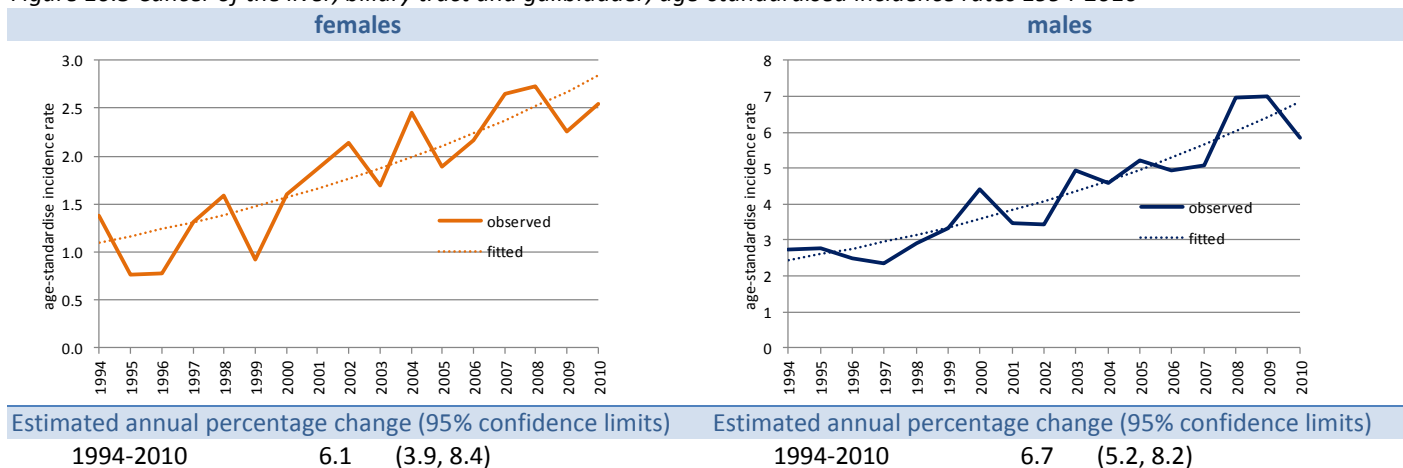


Figure 10.3 Cancer of the liver, biliary tract and gallbladder; age-standardised incidence rates 1994-2010



Case numbers increased significantly for females and males from 1994 to 2010, by 4.2% annually for females and 6.0% for males (Figure 10.1). There was also a significant increase in age-standardised incidence rates, 6.1% annually for females and 6.7% for males (Figure 10.2). Most of this increase was in adenocarcinoma [24].

### Projections

The base of projection for the HD model for both sexes was 1994-2010. HD model 4 gave the best fit for both sexes (Figure 10.3). The three sets of projections were close for females, but Nordpred projected a higher incidence for males from 2020

onwards than the other methods. The models project that female case numbers will increase by 127%-148% between 2010 and 2040 and male cases by 113%-155% (Table 10.2), with proportionate increases in treatment rates (Table 10.3).

Figure 10.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the liver, biliary tract and gallbladder

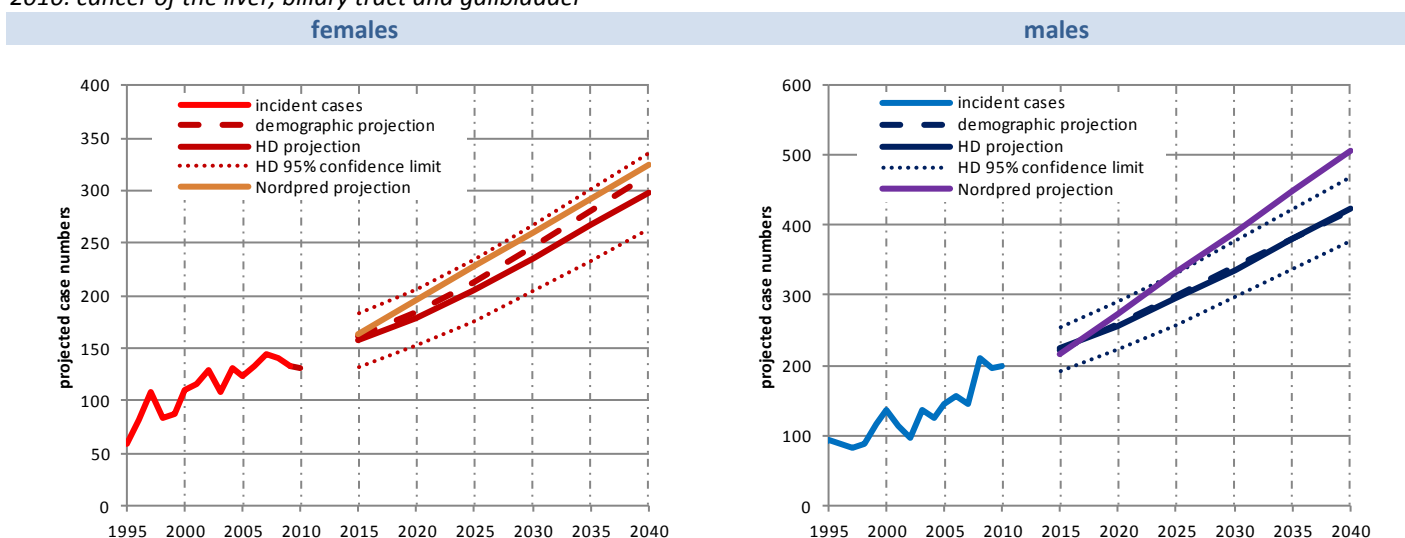


Table 10.2. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the liver, biliary tract and gallbladder

			demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
females												
	2010	131										
	2015	161	(23%)	163	(25%)	157	(20%)	132	(0%)	183	(39%)	
	2020	185	(41%)	196	(49%)	179	(37%)	152	(16%)	206	(57%)	
	2025	213	(63%)	228	(74%)	205	(57%)	176	(34%)	235	(79%)	
	2030	246	(88%)	260	(99%)	235	(80%)	204	(55%)	267	(104%)	
	2035	281	(115%)	293	(123%)	267	(104%)	233	(78%)	301	(130%)	
	2040	315	(141%)	325	(148%)	298	(127%)	262	(100%)	334	(155%)	
males												
	2010	199										
	2015	221	(11%)	215	(8%)	224	(13%)	193	(-3%)	255	(28%)	
	2020	257	(29%)	274	(38%)	256	(29%)	223	(12%)	290	(46%)	
	2025	298	(50%)	332	(67%)	295	(48%)	258	(30%)	331	(66%)	
	2030	340	(71%)	391	(96%)	336	(69%)	297	(49%)	376	(89%)	
	2035	382	(92%)	449	(126%)	380	(91%)	337	(70%)	423	(113%)	
	2040	421	(111%)	507	(155%)	423	(113%)	377	(90%)	469	(136%)	

Table 10.3. Number of cancers treated in 2010, with estimates for 2025: cancer of the liver, biliary tract and gallbladder

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	131	213	228	205
surgery	33	54	58	53
chemotherapy	34	56	60	54
radiotherapy	5	8	9	8
<b>males</b>				
all cases	199	298	332	295
surgery	54	80	90	80
chemotherapy	73	98	110	97
radiotherapy	17	19	22	19

# 11. Cancer of the pancreas

## Trends

Figure 11.1. Cancer of the pancreas; case numbers, 1994-2010

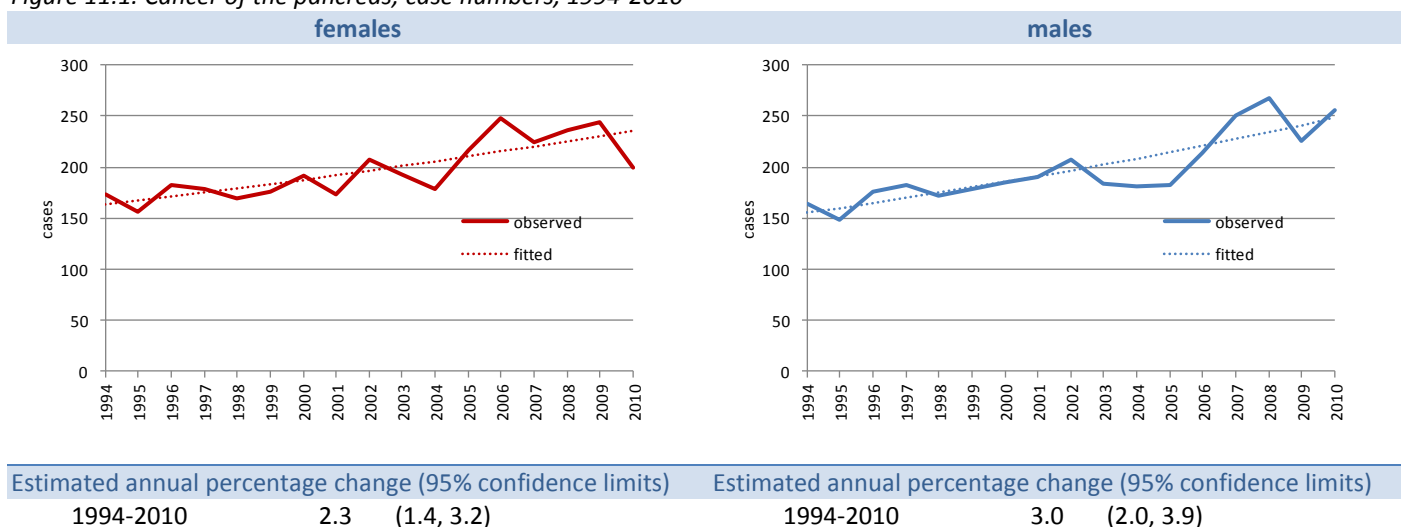
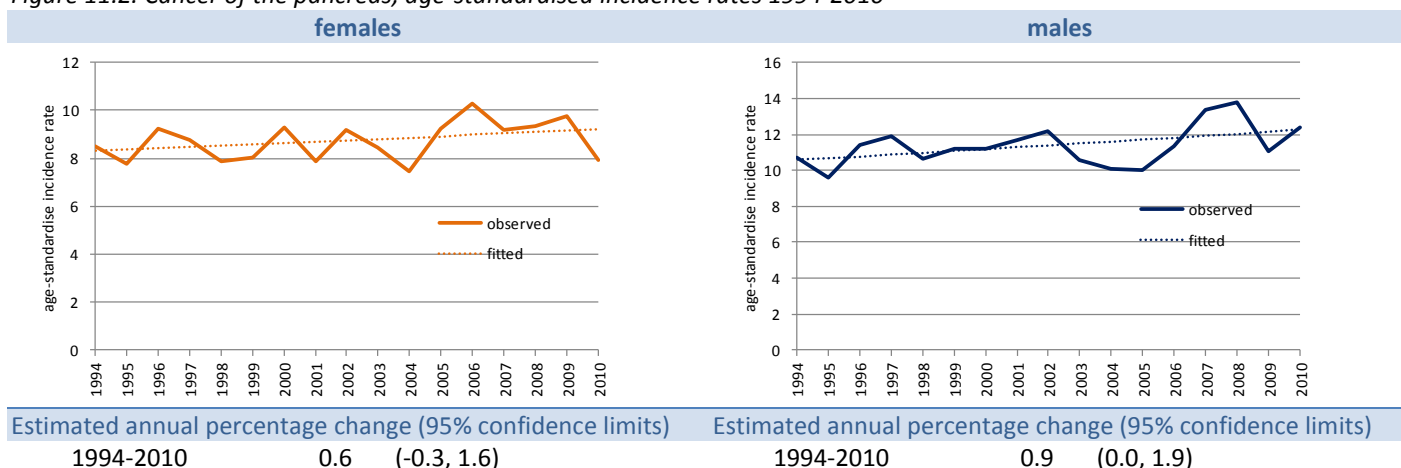


Figure 11.2. Cancer of the pancreas; age-standardised incidence rates 1994-2010



Case numbers of cancer of the pancreas increased significantly for females and males from 1994 to 2010, by 2.3% annually for females and 3.0% for males (Figure 11.1). There was a slight upward trend in age-standardised incidence rates for both sexes but this was not statistically significant (Figure 11.2).

## Projections

The base of projection for the HD model for both sexes was 1994-2010. HD model 4 gave the best fit for both males and females. The HD projections of the number of cases were close to those due to demographic change alone (Figure 11.3, Table 11.1). The Nordpred and demographic projections for both sexes were mostly within the 95% confidence limits for the HD models. The models project that female case numbers will increase by 140%-172% between 2010 and 2040 and male cases by 129%-152%, with proportionate increases in treatment rates (Table 11.2).



Figure 11.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the pancreas

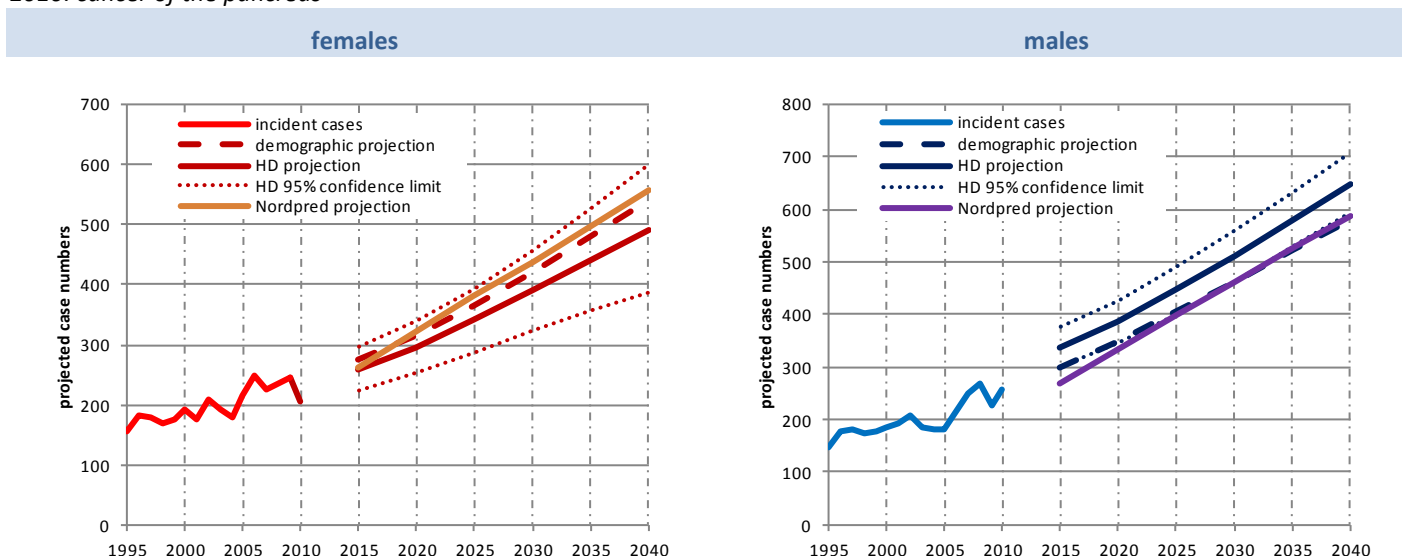


Table 11.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the pancreas

demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit		
females										
2010	205									
2015	275	(34%)	263	(28%)	260	(27%)	224	(9%)	296	(44%)
2020	316	(54%)	322	(57%)	296	(44%)	253	(23%)	340	(66%)
2025	366	(79%)	381	(86%)	340	(66%)	286	(40%)	394	(92%)
2030	423	(106%)	440	(114%)	390	(90%)	322	(57%)	458	(123%)
2035	482	(135%)	498	(143%)	442	(115%)	356	(74%)	527	(157%)
2040	540	(164%)	557	(172%)	492	(140%)	386	(88%)	598	(192%)
males										
2010	258									
2015	299	(16%)	269	(4%)	338	(31%)	299	(16%)	376	(46%)
2020	349	(35%)	333	(29%)	387	(50%)	346	(34%)	428	(66%)
2025	404	(57%)	397	(54%)	446	(73%)	401	(56%)	491	(90%)
2030	463	(79%)	461	(79%)	511	(98%)	462	(79%)	559	(117%)
2035	524	(103%)	525	(104%)	581	(125%)	528	(105%)	633	(146%)
2040	580	(125%)	590	(129%)	650	(152%)	593	(130%)	706	(174%)

Table 11.2 Number of cancers treated in 2010, with estimates for 2025: cancer of the pancreas

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	205	366	381	340
surgery	33	59	62	55
chemotherapy	53	94	98	87
radiotherapy	15	26	27	24
<b>males</b>				
all cases	258	404	397	446
surgery	52	81	80	90
chemotherapy	123	167	164	184
radiotherapy	46	53	52	58

## 12. Cancer of the lung

### Trends

Figure 12.1. Cancer of the lung; case numbers, 1994-2010

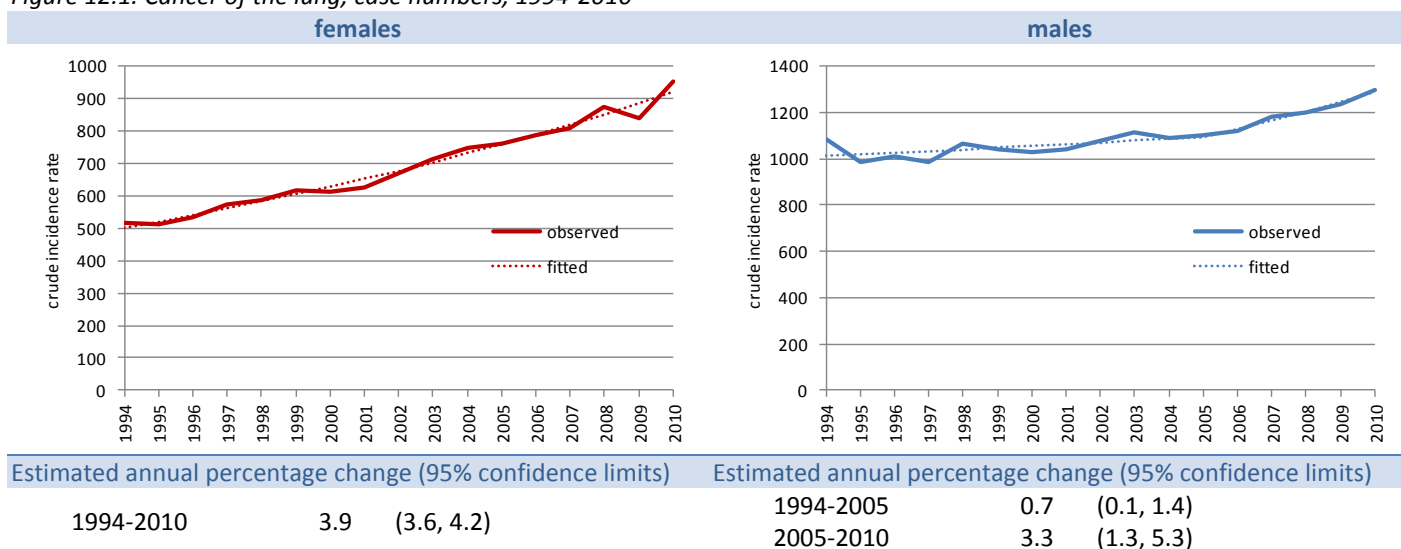
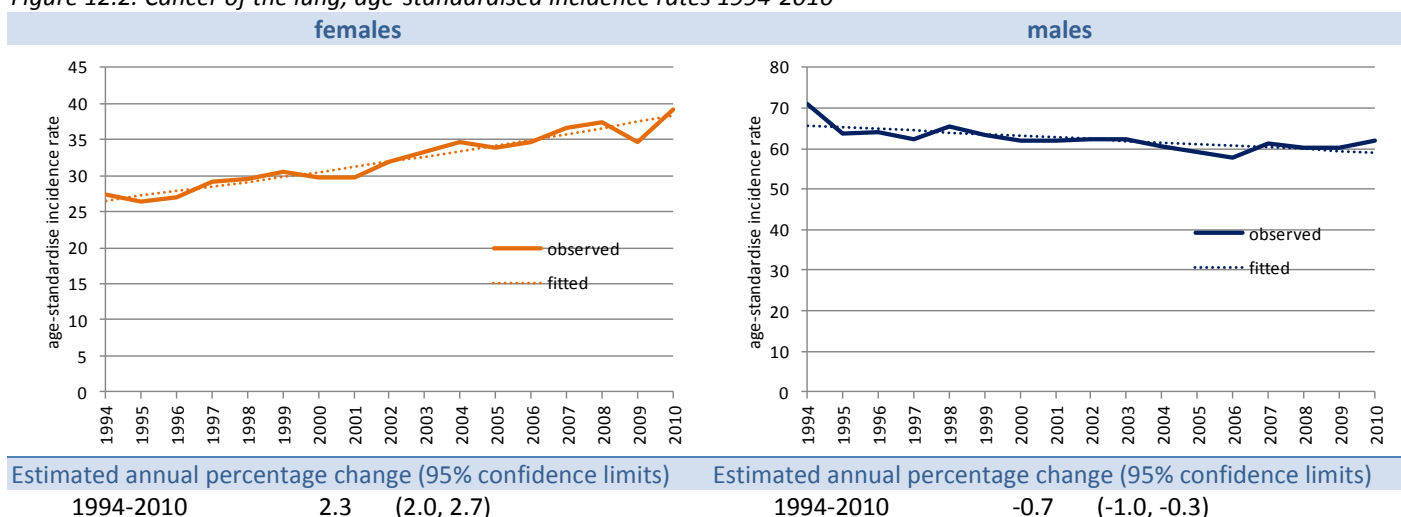


Figure 12.2. Cancer of the lung; age-standardised incidence rates 1994-2010



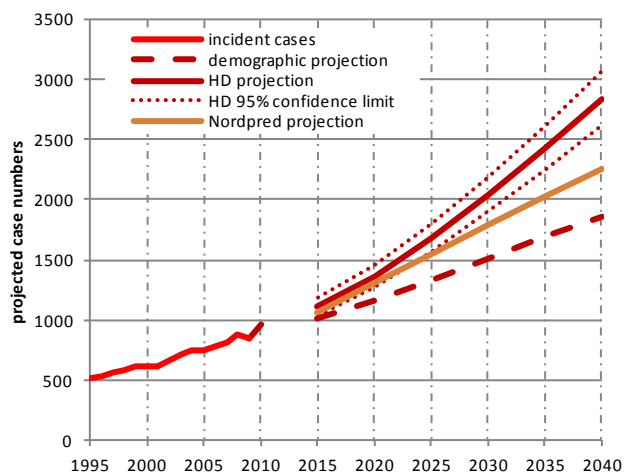
Lung cancer case numbers increased significantly for females from 1994 to 2010, by 3.9% annually. For males the numbers increased by 0.7% annually from 1994 to 2005 and by 3.3% thereafter (Figure 12.1). The incidence rates increased by 2.3% annually in females and decreased by 0.7% annually in males (Figure 12.2).

### Projections

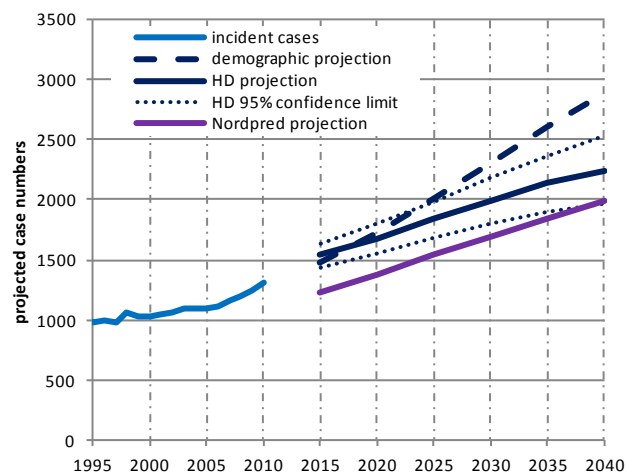
The base of projection for the HD model for both sexes was 1994-2010. Two HD models—1 and 4—gave an equally good fit for females, while HD model 4 gave the best fit for males. As the projected number of cases from the two HD models for females is quite different, they are both shown below (Figure 12.3). The Nordpred projections lie between the two HD projections. For males the HD projections were a little above those produced by Nordpred and both were below the demographic projections (Figure 12.3, Table 12.1). The models project that female case numbers will increase by 77%-196% between 2010 and 2040 and male cases by 52%-72%, with proportionate increases in treatment rates (Table 12.2).

Figure 12.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the lung

females (HD model 1)



males



females (HD model 4)

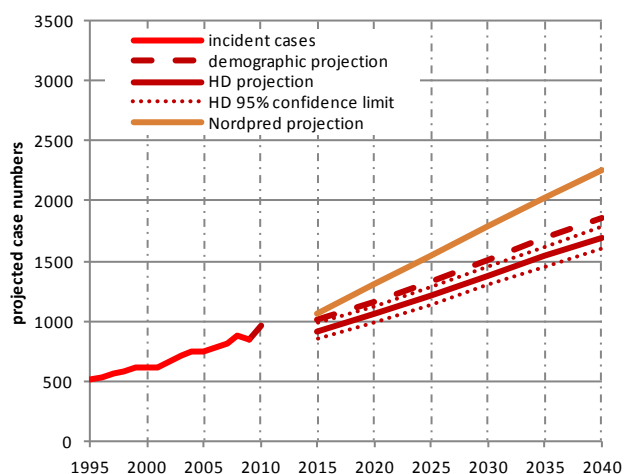


Table 12.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the lung

demography only			Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
females (HD model 1)										
2010	957									
2015	1013	(6%)	1068	(12%)	1108	(16%)	1033	(8%)	1183	(24%)
2020	1161	(21%)	1307	(37%)	1366	(43%)	1274	(33%)	1459	(52%)
2025	1334	(39%)	1545	(61%)	1682	(76%)	1565	(64%)	1798	(88%)
2030	1515	(58%)	1784	(86%)	2042	(113%)	1896	(98%)	2188	(129%)
2035	1694	(77%)	2022	(111%)	2429	(154%)	2247	(135%)	2611	(173%)
2040	1862	(95%)	2260	(136%)	2830	(196%)	2606	(172%)	3054	(219%)
females (HD model 4)										
2010	957									
2015	1013	(6%)	1068	(12%)	916	(-4%)	853	(-11%)	979	(2%)
2020	1161	(21%)	1307	(37%)	1053	(10%)	985	(3%)	1121	(17%)
2025	1334	(39%)	1545	(61%)	1210	(26%)	1136	(19%)	1283	(34%)
2030	1515	(58%)	1784	(86%)	1374	(44%)	1295	(35%)	1453	(52%)
2035	1694	(77%)	2022	(111%)	1538	(61%)	1453	(52%)	1623	(70%)
2040	1862	(95%)	2260	(136%)	1693	(77%)	1603	(68%)	1783	(86%)
males										
2010	1307									
2015	1477	(13%)	1232	(-6%)	1538	(18%)	1438	(10%)	1638	(25%)
2020	1728	(32%)	1383	(6%)	1677	(28%)	1553	(19%)	1801	(38%)
2025	2012	(54%)	1534	(17%)	1834	(40%)	1678	(28%)	1990	(52%)
2030	2314	(77%)	1685	(29%)	1992	(52%)	1797	(37%)	2186	(67%)
2035	2610	(100%)	1836	(40%)	2132	(63%)	1894	(45%)	2370	(81%)
2040	2889	(121%)	1987	(52%)	2245	(72%)	1962	(50%)	2527	(93%)

Table 12.2. Number of cancers treated in 2010, with estimates for 2025, cancer of the lung

	2010	2025 demography	2025 Nordpred	2025 HD model 1	2025 HD model 4
<b>females</b>					
all cases	957	1334	1545	1682	1210
surgery	189	263	304	331	238
chemotherapy	320	446	516	562	404
radiotherapy	409	570	660	718	517
<b>males</b>					
all cases	1307	2012	1534		1834
surgery	248	382	291		348
chemotherapy	477	650	495		592
radiotherapy	745	867	661		790



## 13. Melanoma of the skin

### Trends

Figure 13.1. Melanoma of the skin; case numbers, 1994-2010

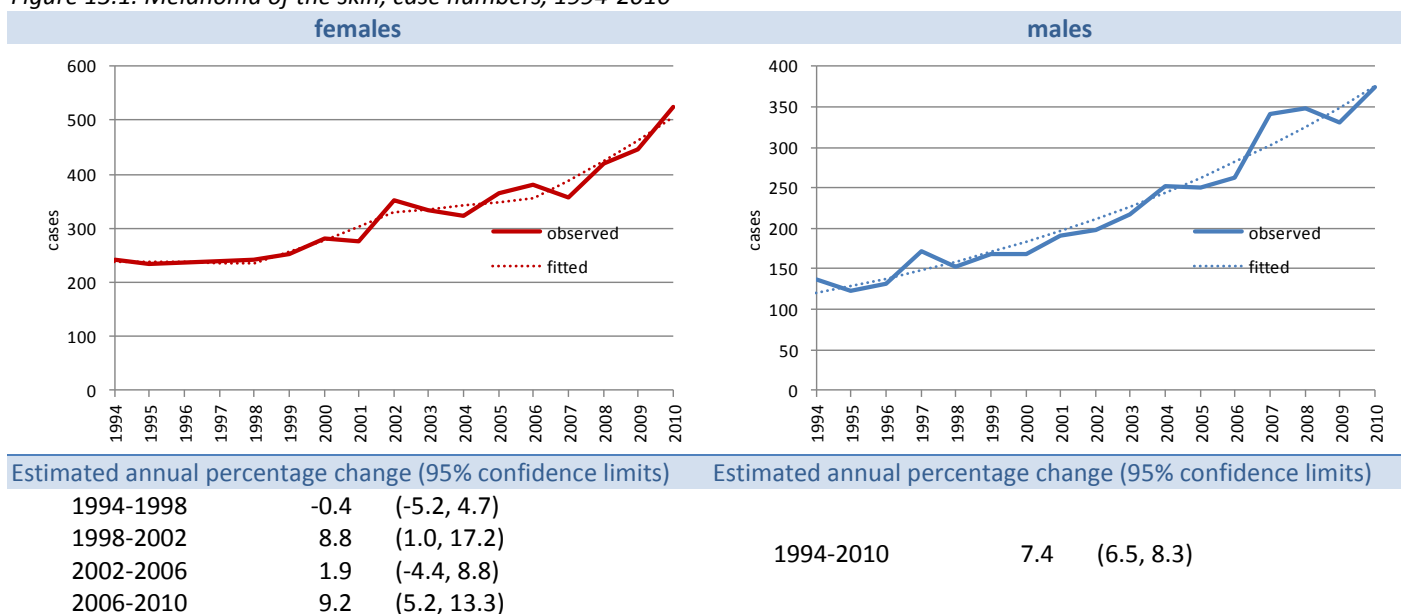
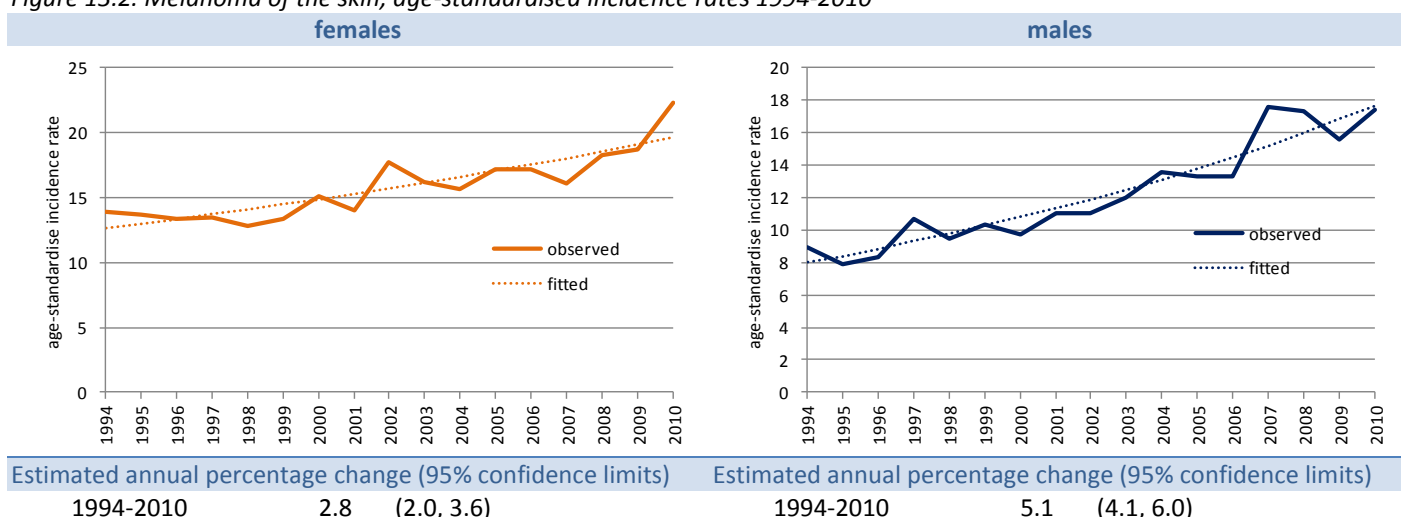


Figure 13.2. Melanoma of the skin; age-standardised incidence rates 1994-2010



The rate of increase in female melanoma numbers varied over the period 1994 to 2010, with a rapid increase (9.2% annually) between 2006 and 2010. For males there was a similar but more constant trend, 7.4% annually between 1994 and 2010 (Figure 13.1). For both males and females there was also an upward trend in age-standardised incidence rates, 2.8% annually for females and 5.1% for males (Figure 13.2).

### Projections

The base of projection for the HD model for both sexes was 1994-2010. HD model 1 gave the best fit for females and males. For both females and males the projected number of cases from the HD models was well above that projected by demographic change or the Nordpred model (Figure 13.3, Table 13.1). The models project that female case numbers will increase by a factor of 93%-175% between 2010 and 2040 and male cases by 134%-327%, with proportionate increases in treatment rates (Table 13.2).

Figure 13.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: melanoma of the skin

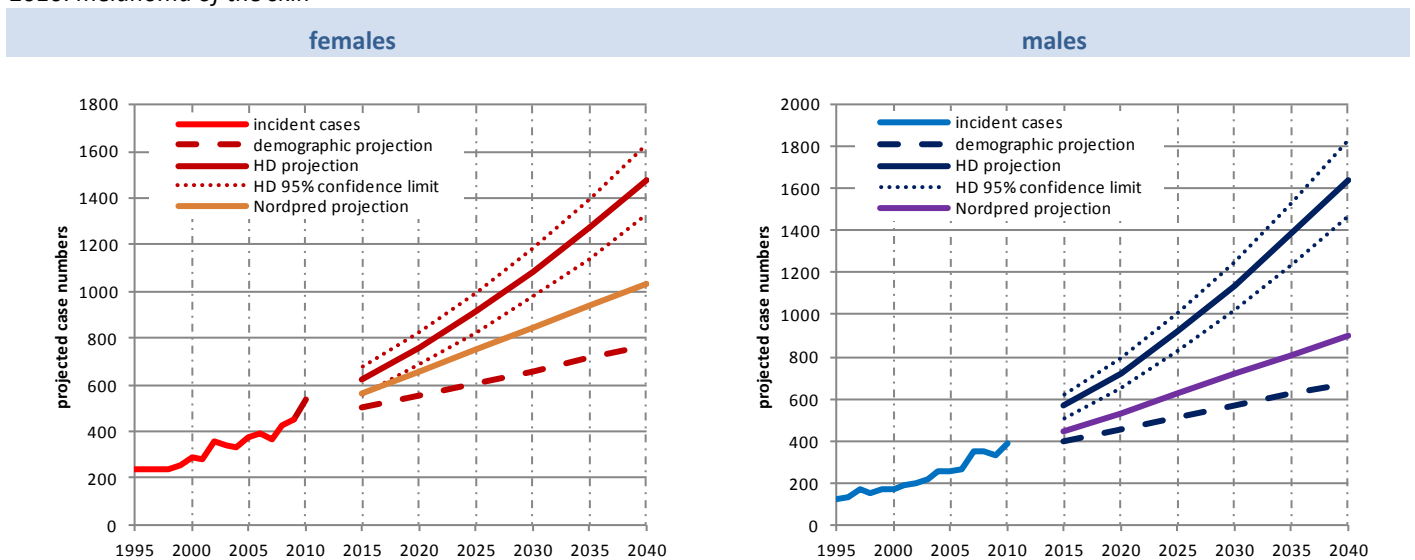


Table 13.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): melanoma of the skin

demography only			Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
females										
2010	536									
2015	500	(-7%)	564	(5%)	620	(16%)	562	(5%)	677	(26%)
2020	554	(3%)	658	(23%)	757	(41%)	687	(28%)	826	(54%)
2025	607	(13%)	752	(40%)	911	(70%)	826	(54%)	997	(86%)
2030	659	(23%)	846	(58%)	1081	(102%)	978	(82%)	1185	(121%)
2035	713	(33%)	940	(75%)	1269	(137%)	1143	(113%)	1395	(160%)
2040	766	(43%)	1034	(93%)	1476	(175%)	1325	(147%)	1628	(204%)
males										
2010	385									
2015	398	(3%)	441	(15%)	564	(46%)	507	(32%)	620	(61%)
2020	452	(17%)	533	(38%)	724	(88%)	653	(70%)	795	(107%)
2025	508	(32%)	625	(62%)	914	(138%)	824	(114%)	1004	(161%)
2030	565	(47%)	716	(86%)	1137	(195%)	1022	(166%)	1251	(225%)
2035	622	(62%)	808	(110%)	1381	(259%)	1235	(221%)	1527	(297%)
2040	674	(75%)	900	(134%)	1645	(327%)	1461	(279%)	1829	(375%)

Table 13.2 Number of cancers treated in 2010, with estimates for 2025: melanoma of the skin

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	536	607	752	911
surgery	514	582	721	874
chemotherapy	26	29	36	44
radiotherapy	20	22	28	34
<b>males</b>				
all cases	385	508	625	914
surgery	357	471	579	848
chemotherapy	27	34	42	61
radiotherapy	36	41	50	73

## 14. Non-melanoma cancer of skin

### Trends

Figure 14.1. Non-melanoma skin cancer; case numbers, 1994-2010

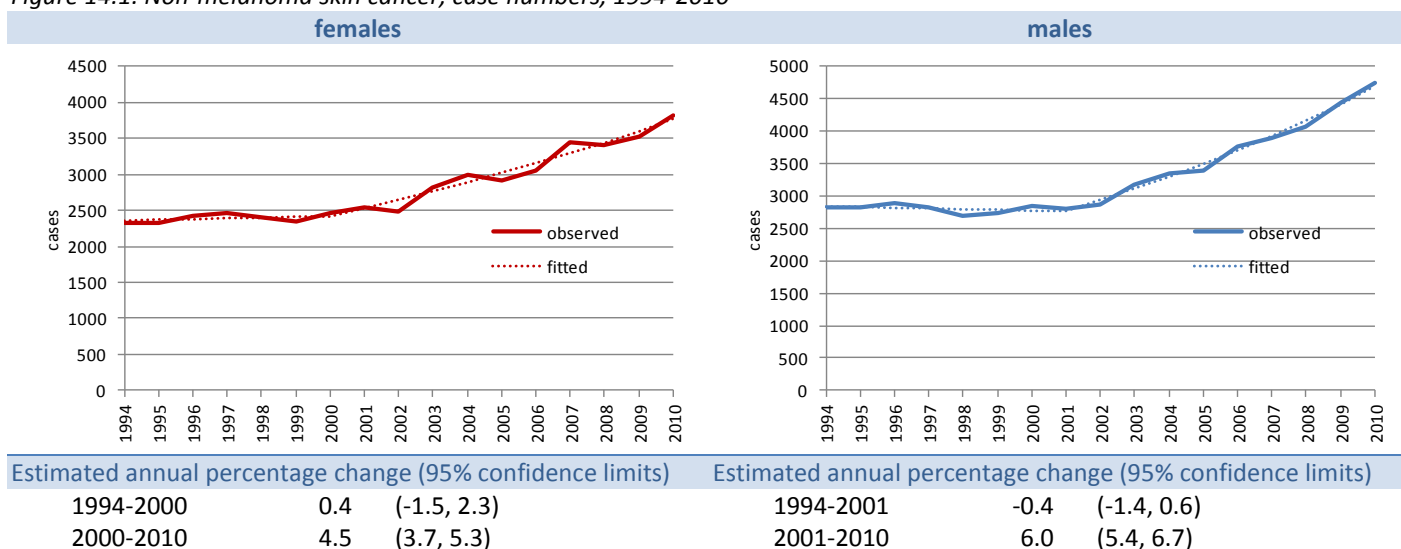
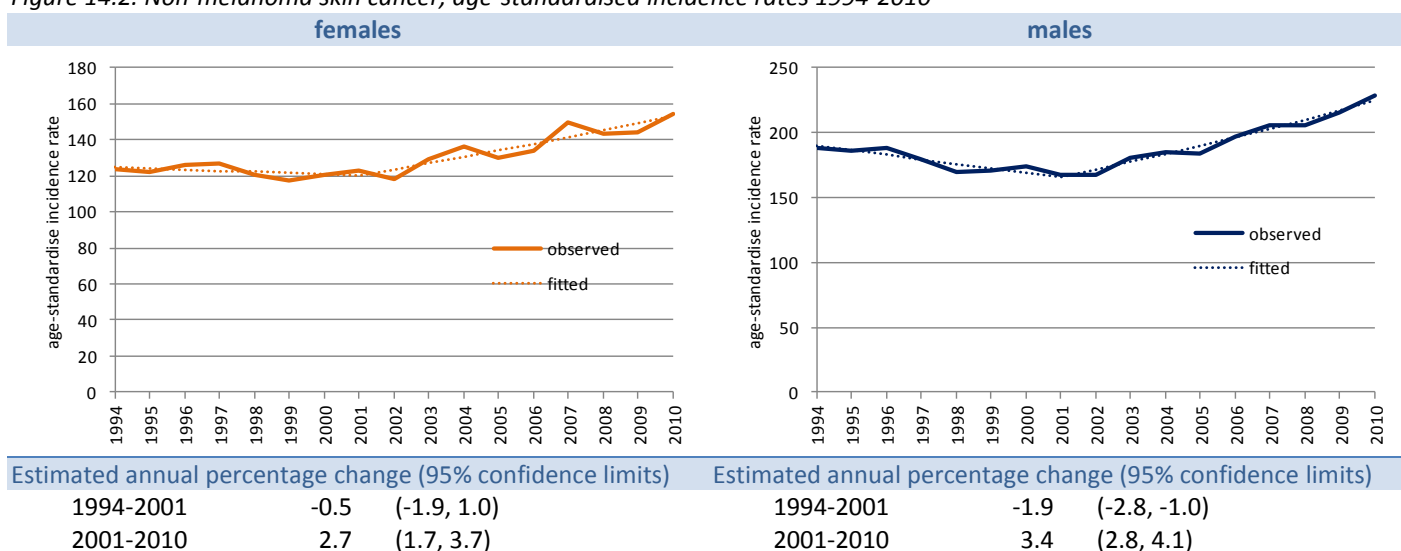


Figure 14.2. Non-melanoma skin cancer; age-standardised incidence rates 1994-2010



There was no significant trend in case numbers for females between 1994 and 2000, followed by a 4.5% annual increase from 2000 to 2010. For males there was a similar trend, with the increase in case numbers (6.0% annually) beginning in 2001 (Figure 14.1). Trends in age-standardised incidence rates followed the same patterns with a significant 2.7% annual increase for females and 3.4% for males from 2001 to 2010 (Figure 14.2).

### Projections

The base of projection for the HD model for both sexes was 2001-2010. HD model 1 gave the best fit for both females and males. For both females and males the HD estimates were well above those due to demographic change alone and for males also much higher than the Nordpred projections (Figure 14.3, Table 14.1). The model projects that female case numbers will increase by 162%-235% between 2010 and 2040 and male cases by 157%-356%, with proportionate increases in treatment rates (Table 14.2).



Figure 14.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: non-melanoma skin cancer

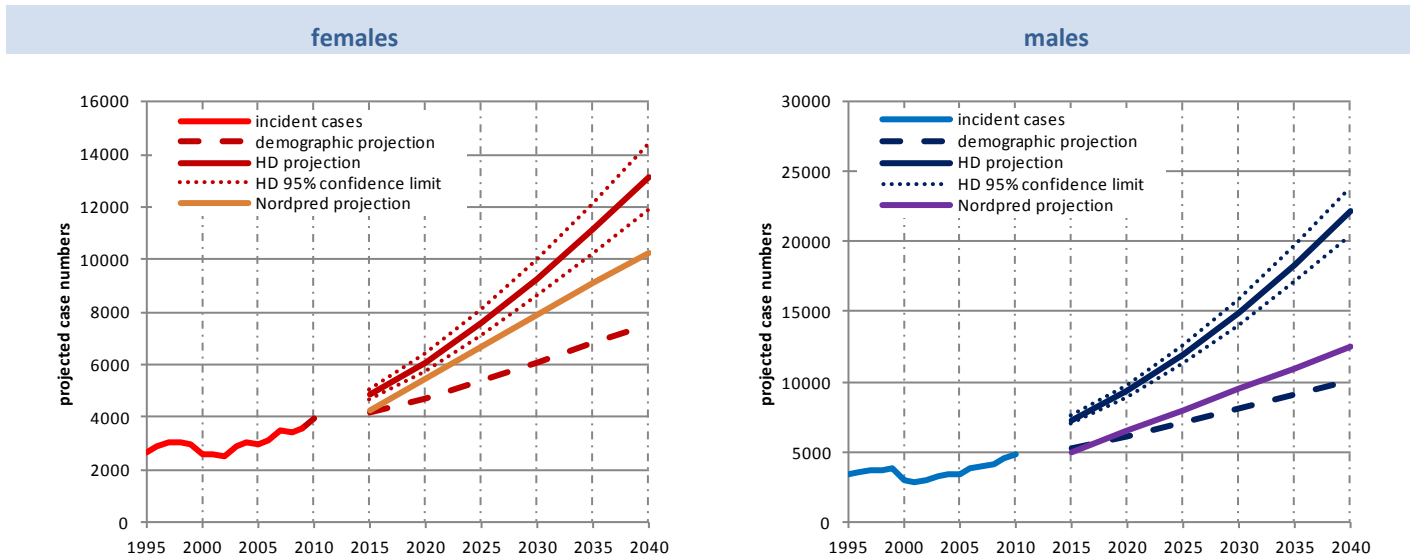


Table 14.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): non-melanoma skin cancer

	demography only	Nordpred	HD projections	lower 95% HD confidence limit	upper 95% HD confidence limit
<b>females</b>					
2010	3919				
2015	4131 (5%)	4275 (9%)	4848 (24%)	4633 (18%)	5063 (29%)
2020	4701 (20%)	5474 (40%)	6069 (55%)	5739 (46%)	6400 (63%)
2025	5353 (37%)	6673 (70%)	7565 (93%)	7077 (81%)	8053 (105%)
2030	6062 (55%)	7872 (101%)	9274 (137%)	8585 (119%)	9963 (154%)
2035	6791 (73%)	9070 (131%)	11143 (184%)	10205 (160%)	12080 (208%)
2040	7500 (91%)	10269 (162%)	13138 (235%)	11906 (204%)	14369 (267%)
<b>males</b>					
2010	4859				
2015	5192 (7%)	5011 (3%)	7273 (50%)	7006 (44%)	7540 (55%)
2020	6057 (25%)	6502 (34%)	9331 (92%)	8913 (83%)	9749 (101%)
2025	7020 (44%)	7993 (64%)	11886 (145%)	11258 (132%)	12514 (158%)
2030	8041 (65%)	9483 (95%)	14943 (208%)	14032 (189%)	15853 (226%)
2035	9071 (87%)	10974 (126%)	18407 (279%)	17126 (252%)	19689 (305%)
2040	10049 (107%)	12465 (157%)	22140 (356%)	20410 (320%)	23870 (391%)

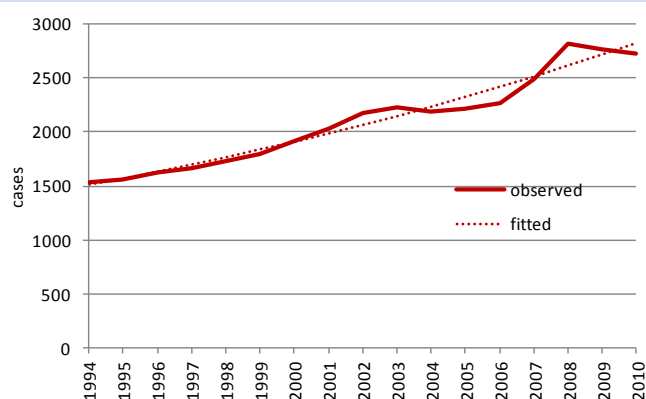
Table 14.2. Number of cancers treated in 2010, with estimates for 2025: non-melanoma skin cancer

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	3919	5353	6673	7565
surgery	3339	4561	5685	6446
chemotherapy	4	5	7	8
radiotherapy	94	128	160	182
<b>males</b>				
all cases	4859	7020	7993	11886
surgery	4237	6121	6970	10364
chemotherapy	10	14	16	24
radiotherapy	206	239	272	404

## 15. Female breast cancer

### Trends

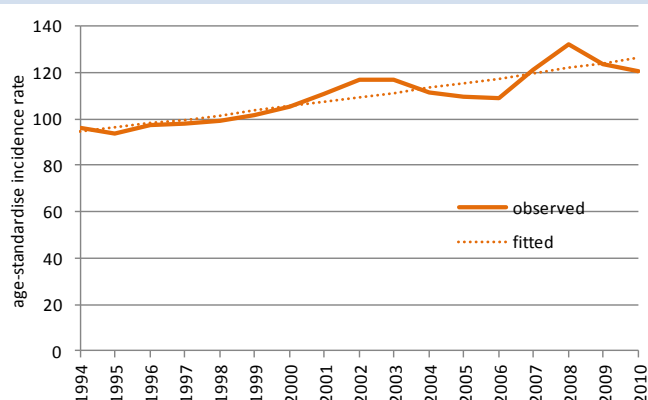
Figure 15.1. Female breast cancer; case numbers, 1994-2010



Estimated annual percentage change (95% confidence limits)

1994-2010 4.0 (3.6, 4.4)

Figure 15.2. Female breast cancer; age-standardised incidence rate, 1994-2010



Estimated annual percentage change (95% confidence limits)

1994-2010 1.8 (1.4, 2.3)

There was a significant upward trend in breast cancer numbers for females between 1994 and 2010 of 4.0% annually. Some deviation from this trend can be seen at the time of commencement of BreastCheck in 2001, and at the time of its extension to the south and west of the country in 2007 (Figure 15.1) but this seems to be overlaid on a steady long-term upward trend. A similar pattern, but with a smaller rate of increase (1.8% annually) can be seen for age-standardised incidence rates (Figure 15.2).

### Projections

The base of projection for the HD model was 1994-2010. Two HD models—1 and 4—gave an equally good fit, but give quite different estimates, so both are presented here (Figure 15.3, Table 15.1). HD model 1 projects an increase of 152% in cases between 2010 and 2040, while HD model 4 projects an increase of 55%. The Nordpred projection (an increase of 113%) lies between the two HD projections, with proportionate increases in treatment rates (Table 15.2).

Figure 15.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the female breast

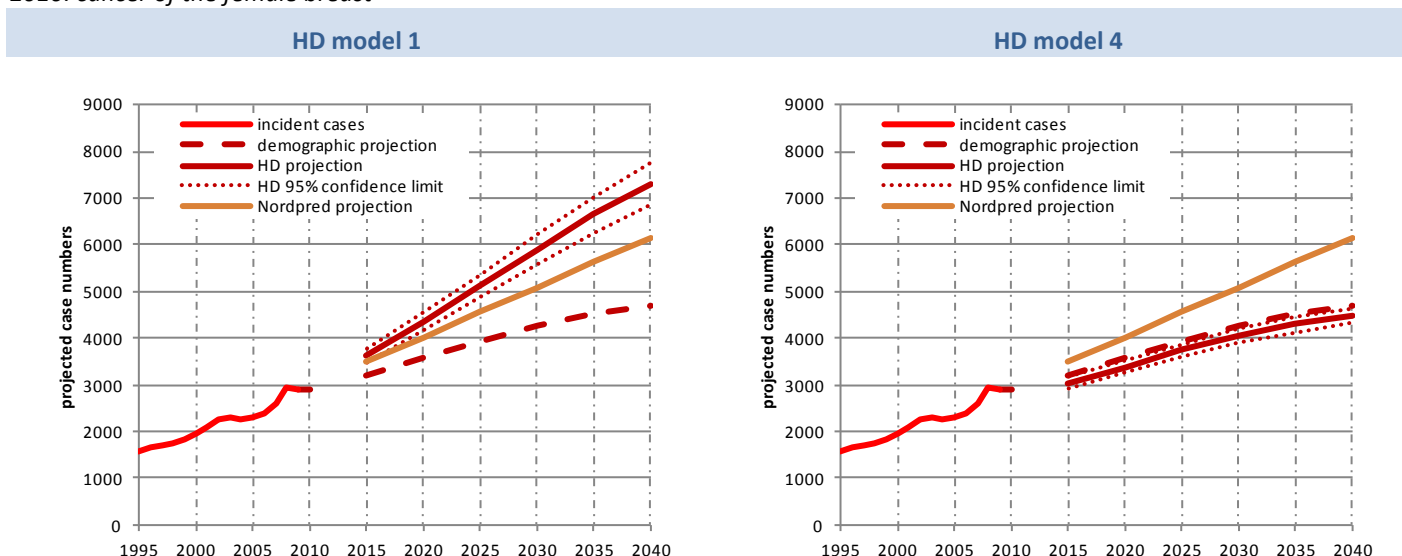


Table 15.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the female breast

	demography only	Nordpred	HD projections	lower 95% HD confidence limit	upper 95% HD confidence limit
<b>HD model 1</b>					
2010	2891				
2015	3209 (11%)	3494 (21%)	3631 (26%)	3478 (20%)	3784 (31%)
2020	3577 (24%)	4024 (39%)	4333 (50%)	4138 (43%)	4527 (57%)
2025	3937 (36%)	4555 (58%)	5117 (77%)	4870 (68%)	5364 (86%)
2030	4252 (47%)	5085 (76%)	5894 (104%)	5585 (93%)	6203 (115%)
2035	4514 (56%)	5615 (94%)	6639 (130%)	6260 (117%)	7018 (143%)
2040	4701 (63%)	6146 (113%)	7291 (152%)	6835 (136%)	7746 (168%)
<b>HD model 4</b>					
2010	2891				
2015	3209 (11%)	3494 (21%)	3044 (5%)	2920 (1%)	3167 (10%)
2020	3577 (24%)	4024 (39%)	3383 (17%)	3251 (12%)	3515 (22%)
2025	3937 (36%)	4555 (58%)	3735 (29%)	3594 (24%)	3875 (34%)
2030	4252 (47%)	5085 (76%)	4042 (40%)	3894 (35%)	4190 (45%)
2035	4514 (56%)	5615 (94%)	4289 (48%)	4134 (43%)	4443 (54%)
2040	4701 (63%)	6146 (113%)	4472 (55%)	4311 (49%)	4632 (60%)

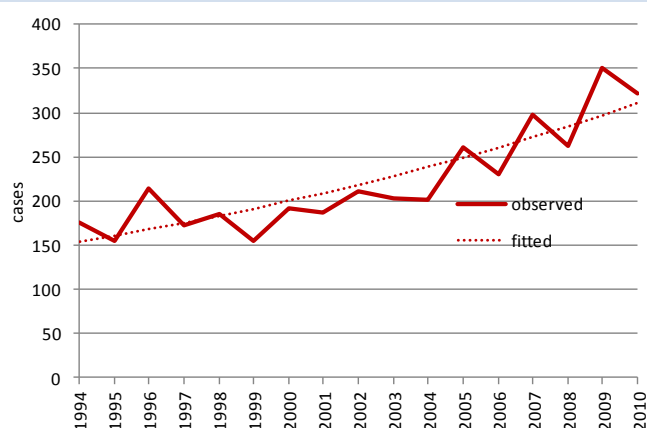
Table 15.2. Number of cancers treated in 2010, with estimates for 2025, cancer of the female breast

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>HD model 1</b>				
all cases	2891	3937	4555	5117
surgery	2541	3461	4003	4498
chemotherapy	1388	1890	2186	2456
radiotherapy	2058	2803	3243	3643
<b>HD model 4</b>				
all cases	2891	3937	4555	3735
surgery	2541	3461	4003	3283
chemotherapy	1388	1890	2186	1793
radiotherapy	2058	2803	3243	2659

## 16. Cancer of the cervix uteri

### Trends

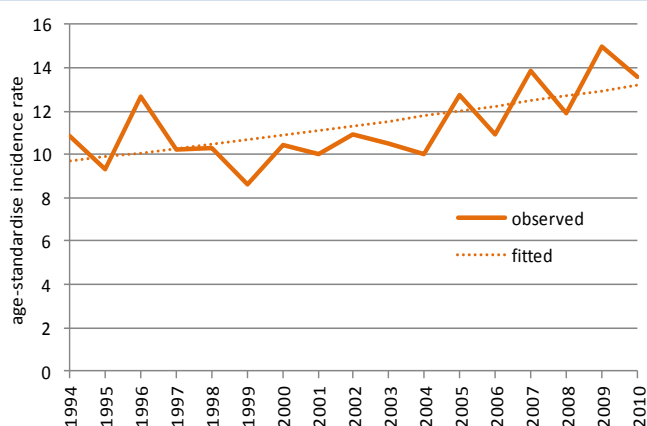
Figure 16.1. Cancer of the cervix uteri; case numbers, 1994-2010



Estimated annual percentage change (95% confidence limits)

1994-2010 4.5 (3.2, 5.9)

Figure 16.2 Cancer of the cervix uteri; age-standardised incidence rate, 1994-2010



Estimated annual percentage change (95% confidence limits)

1994-2010 1.9 (0.7, 3.2)

There was a significant upward trend in cases of cancer of the cervix uteri, of 4.5% annually between 1994 and 2010. Although there is some year-to-year variation, this trend seems steady, with no apparent impact of the introduction of the population-based screening programme, CervicalCheck, in 2008 (Figure 16.1). There was a similar pattern for age-standardised incidence rates, with an increase of 1.9% annually (Figure 16.2) although a model with no significant trend before 2006 and an annual percentage increase of 3.5% (95% confidence limits 1.4, 5.7) from 2006 to 2010 fitted the data equally well as the linear trend shown here ( $p=0.05$ ). The more conservative long-term trend was chosen, as the recent increase is likely to be partly due to the initiation of national cervical screening.

### Projections

The base of projection for the HD model was 1994-2010. HD model 1 gave the best fit. The HD estimates were well above those due to demographic change alone (Figure 16.3, Table 16.1). The Nordpred projections were close to those of the HD model and both project that case numbers will increase by 77%-88% between 2015 and 2040, with proportionate increases in treatment rates (Table 16.2).

Figure 16.3 Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the cervix uteri

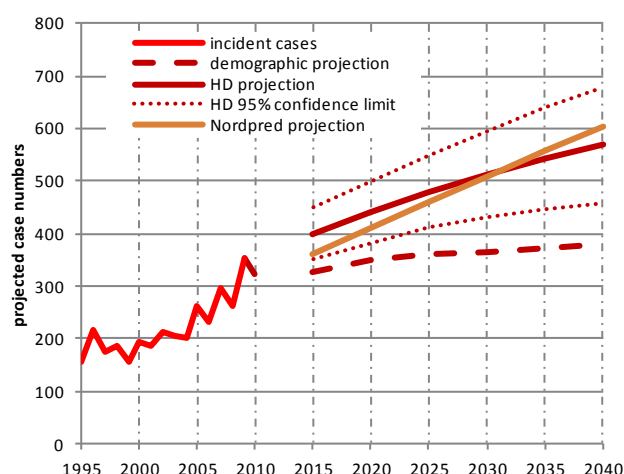


Table 16.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the cervix uteri

	demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
2010	321									
2015	327	(2%)	361	(13%)	399	(24%)	350	(9%)	448	(40%)
2020	350	(9%)	410	(28%)	441	(38%)	383	(19%)	500	(56%)
2025	361	(13%)	459	(43%)	480	(49%)	410	(28%)	549	(71%)
2030	365	(14%)	507	(58%)	511	(59%)	430	(34%)	593	(85%)
2035	372	(16%)	556	(73%)	542	(69%)	447	(39%)	638	(99%)
2040	379	(18%)	604	(88%)	569	(77%)	459	(43%)	679	(112%)

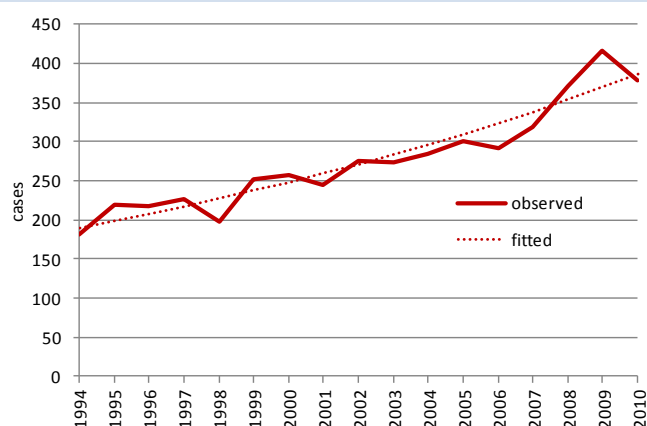
Table 16.2. Number of cancers treated in 2010, with estimates for 2025, cancer of the cervix uteri

	2010	2025 demography	2025 Nordpred	2025 HD model
all cases	321	361	459	480
surgery	189	213	270	283
chemotherapy	122	137	174	182
radiotherapy	182	205	260	272

## 17. Cancer of the corpus uteri

### Trends

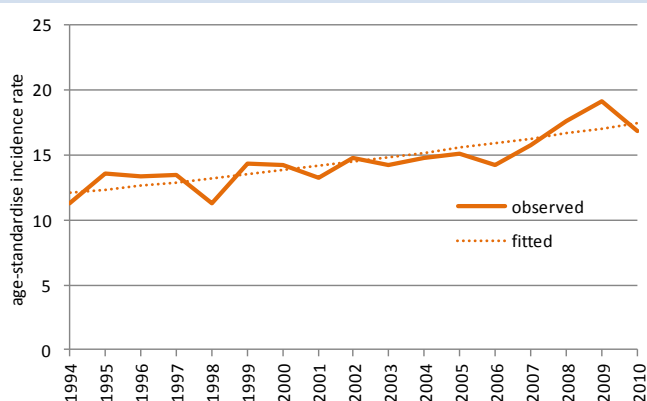
Figure 17.1. Cancer of the corpus uteri; case numbers, 1994-2010



Estimated annual percentage change (95% confidence limits)

1994-2010 4.5 (3.7, 5.3)

Figure 17.2. Cancer of the corpus uteri; age-standardised incidence rate, 1994-2010



Estimated annual percentage change (95% confidence limits)

1994-2010 2.3 (1.6, 3.1)

There was a significant upward trend in cases of cancer of the corpus uteri of 4.5% annually between 1994 and 2010 (Figure 17.1). There was a similar trend, a 2.3% annual increase, for age-standardised incidence rates (Figure 17.2).

### Projections

The base of projection for the HD model was 1994-2010. HD model 4 gave the best fit. The projected number of cases from this model was a little below that due to demographic change alone (Figure 17.3, Table 17.1) and also below the Nordpred projections. The models project that case numbers will increase by 62%-90% between 2015 and 2040, with proportionate increases in treatment rates (Table 17.2).

Figure 17.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the corpus uteri

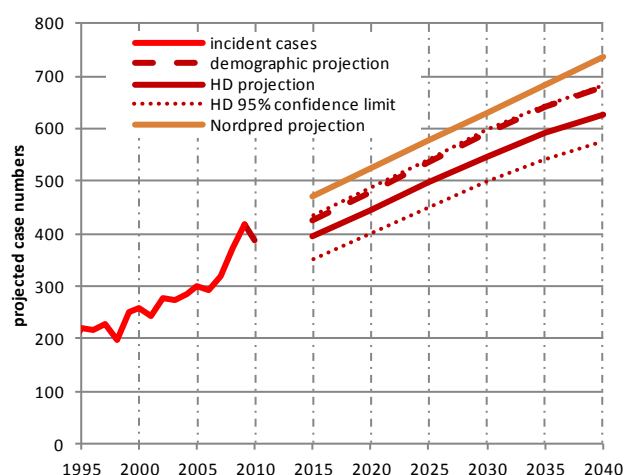


Table 17.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the corpus uteri

	demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
2010	388									
2015	423	(9%)	472	(22%)	393	(1%)	352	(-9%)	434	(12%)
2020	479	(23%)	525	(35%)	443	(14%)	399	(3%)	487	(25%)
2025	537	(38%)	578	(49%)	495	(28%)	448	(16%)	542	(40%)
2030	593	(53%)	631	(63%)	547	(41%)	497	(28%)	596	(54%)
2035	643	(66%)	684	(76%)	593	(53%)	541	(39%)	644	(66%)
2040	680	(75%)	738	(90%)	627	(62%)	573	(48%)	680	(75%)

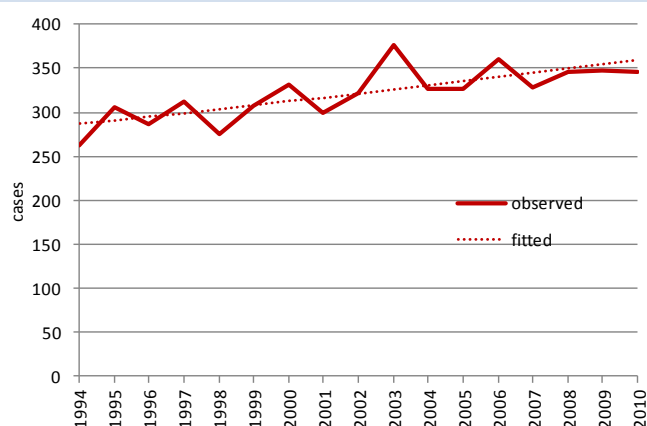
Table 17.2 Number of cancers treated in 2010, with estimates for 2025: cancer of the corpus uteri

	2010	2025 demography	2025 Nordpred	2025 HD model
all cases	388	537	578	495
surgery	370	511	551	472
chemotherapy	52	72	77	66
radiotherapy	182	251	271	232

## 18. Cancer of the ovary

### Trends

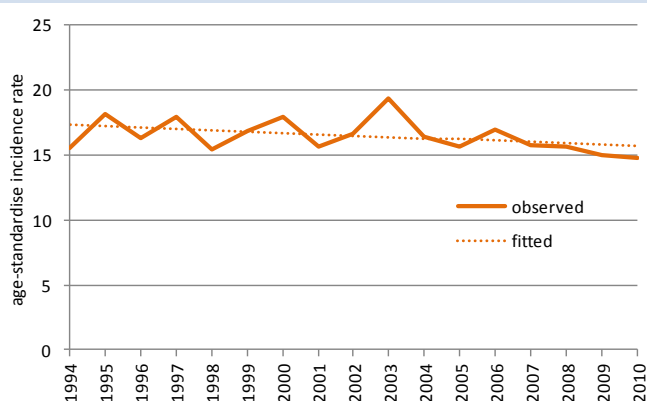
Figure 18.1. Cancer of the ovary; case numbers, 1994-2010



Estimated annual percentage change (95% confidence limits)

1994-2010      1.4      (0.7, 2.1)

Figure 18.2. Cancer of the ovary; age-standardised incidence rate, 1994-2010



Estimated annual percentage change (95% confidence limits)

1994-2010      -0.6      (-1.4, 0.2)

There was a significant upward trend in cases of cancer of the ovary of 1.4% annually, between 1994 and 2010 (Figure 18.1). The trend in age-standardised incidence rates was downwards (0.6% annually) but not statistically significant (Figure 18.2).

### Projections

The base of projection for the HD model was 1994-2010. HD model 3 gave the best fit. The projected number of cases from this model was less than that due to demographic change alone but close to the Nordpred projections (Figure 18.3, Table 18.1). The models project that female case numbers will increase by 34%-44% between 2010 and 2040, with proportionate increases in treatment rates (Table 18.2).



Figure 18.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the ovary

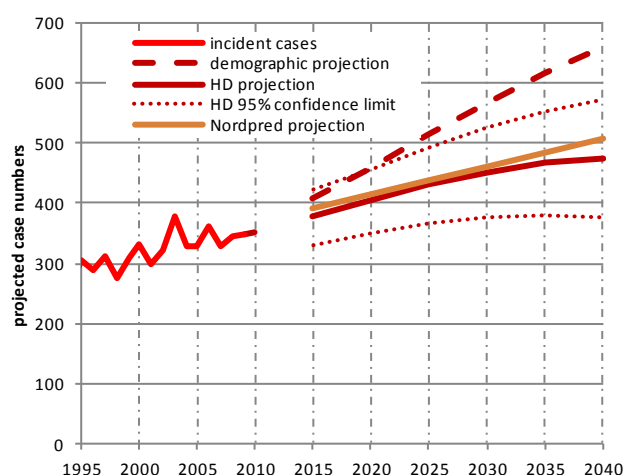


Table 18.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the ovary

	demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
2010	353									
2015	407	(15%)	392	(11%)	377	(7%)	332	(-6%)	422	(20%)
2020	459	(30%)	416	(18%)	403	(14%)	350	(-1%)	457	(29%)
2025	515	(46%)	439	(24%)	430	(22%)	366	(4%)	493	(40%)
2030	569	(61%)	462	(31%)	452	(28%)	377	(7%)	527	(49%)
2035	619	(75%)	485	(38%)	467	(32%)	380	(8%)	554	(57%)
2040	662	(87%)	509	(44%)	474	(34%)	375	(6%)	573	(62%)

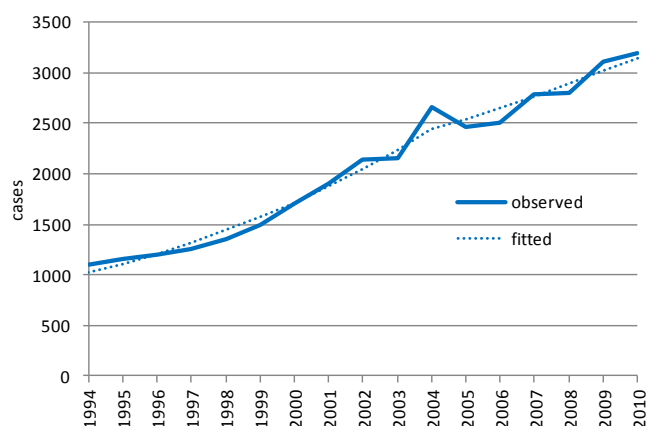
Table 18.2. Number of cancers treated in 2010, with estimates for 2025: cancer of the ovary

	2010	2025 demography	2025 Nordpred	2025 HD model
all cases	353	515	439	430
surgery	216	314	268	263
chemotherapy	222	323	276	270
radiotherapy	14	20	17	17

## 19. Cancer of the prostate

### Trends

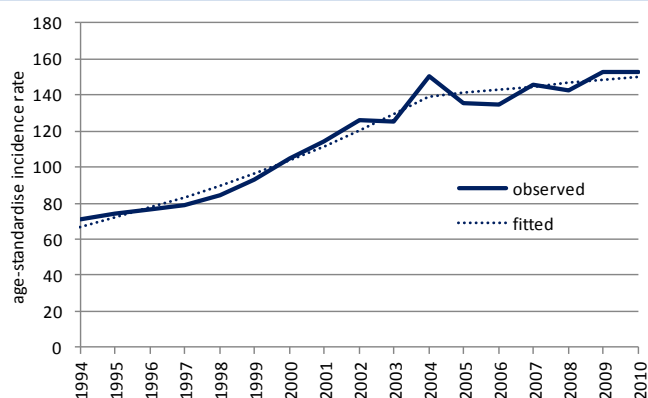
Figure 19.1. Cancer of the prostate; case numbers, 1994-2010



Estimated annual percentage change (95% confidence limits)

1994-2004	9.1	(8.0, 10.3)
2004-2010	4.4	(2.6, 6.2)

Figure 19.2 Cancer of the prostate; age-standardised incidence rate, 1994-2010



Estimated annual percentage change (95% confidence limits)

1994-2004	7.6	(6.6, 8.7)
2004-2010	1.3	(-0.5, 3.0)

There was a significant upward trend in cases of cancer of the prostate of 9.1% annually between 1994 and 2004 and of 4.4% annually between 2004 and 2010 (Figure 19.1). The trend in age-standardised incidence rates was similar but smaller: 7.6% annually between 1994 and 2004 and 1.3% from 2004 onwards (Figure 19.2).

### Projections

The base of projection for the HD models was 2004-2010. HD model 4 gave the best fit. The projected number of cases from this model was similar to that due to demographic change alone but much less than the Nordpred projection (Figure 19.3, Table 19.1). The models project that case numbers will increase by 104%-288% between 2010 and 2040, with proportionate increases in treatment rates (Table 19.2).

Figure 19.3 Incidence 1994-2010 with incidence projections 2015-2040 based on M1F0 population projections: cancer of the prostate

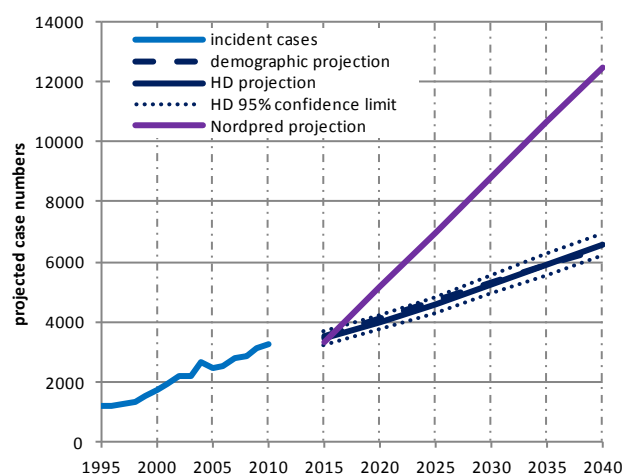


Table 19.1 Incidence projections 2015-2040 with % increase/decrease compared to 2010: cancer of the prostate

	demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit
2010	3222								
2015	3541	(10%)	3303	(3%)	3436	(7%)	3232	(0%)	3641 (13%)
2020	4091	(27%)	5141	(60%)	3959	(23%)	3728	(16%)	4190 (30%)
2025	4687	(45%)	6980	(117%)	4560	(42%)	4298	(33%)	4822 (50%)
2030	5307	(65%)	8818	(174%)	5222	(62%)	4923	(53%)	5521 (71%)
2035	5908	(83%)	10657	(231%)	5907	(83%)	5565	(73%)	6249 (94%)
2040	6426	(99%)	12495	(288%)	6563	(104%)	6177	(92%)	6950 (116%)

Table 19.2 Number of cancers treated in 2010, with estimates for 2025, cancer of the prostate

	2010	2025 demography	2025 Nordpred	2025 HD model
all cases	3222	4687	6980	4560
surgery	876	1275	1899	1240
chemotherapy	32	42	63	41
radiotherapy	2009	2301	3427	2239

## 20. Cancer of the kidney and renal pelvis

### Trends

Figure 20.1. Cancer of the kidney and renal pelvis; case numbers, 1994-2010

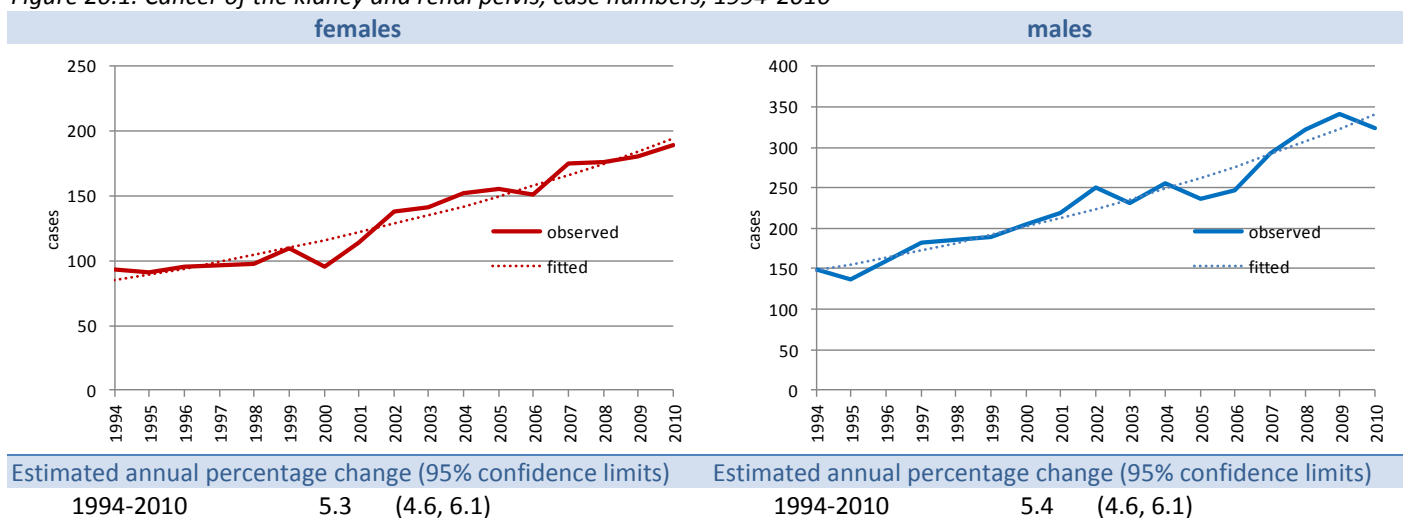
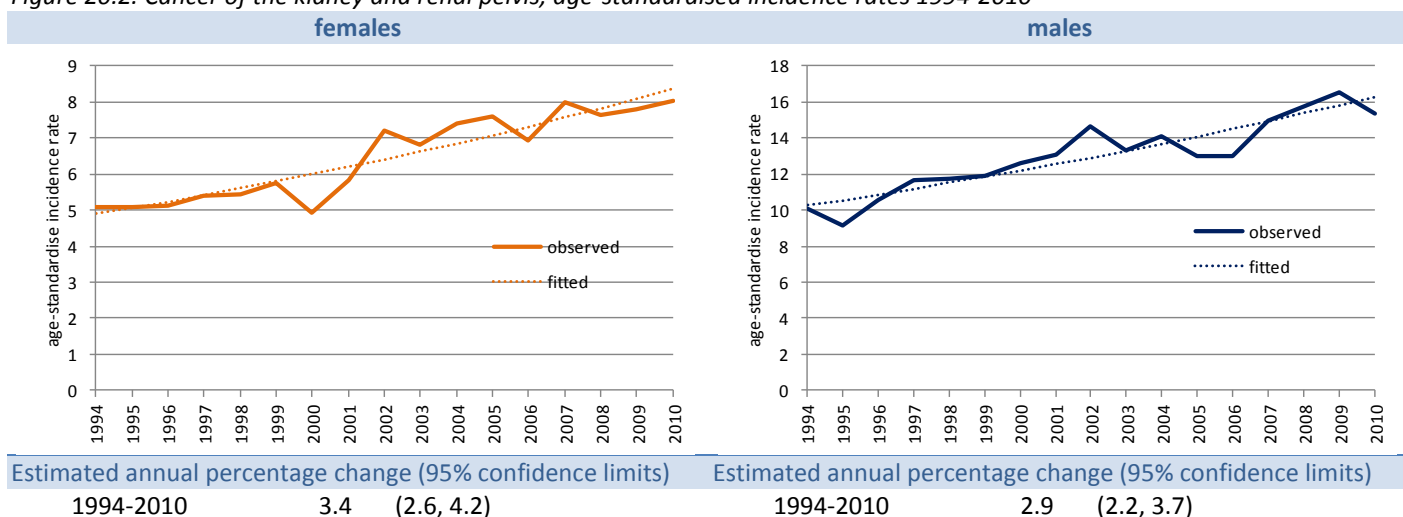


Figure 20.2. Cancer of the kidney and renal pelvis; age-standardised incidence rates 1994-2010



There was a significant 5.3% annual upward trend in cases of cancer of the kidney and renal pelvis for females between 1994 and 2010 and 5.4% for males (Figure 20.1). Trends in age-standardised incidence rates were smaller but also statistically significant: a 3.4% annual increase for females and 2.9% for males (Figure 20.2).

### Projections

The base of projection for the HD model for both sexes was 1994-2010. HD model 4 gave the best fit for both males and females. For both females and males the HD estimates were well above those due to demographic change alone and a little above the Nordpred projections (Figure 20.3, Table 20.1). For males the Nordpred projections were below the 95% confidence limits of the HD model. The models project that female case numbers will increase by 58%-153% between 2015 and 2040, and male cases by 24%-124%, with proportionate increases in treatment rates (Table 20.2).

Figure 20.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the kidney and renal pelvis

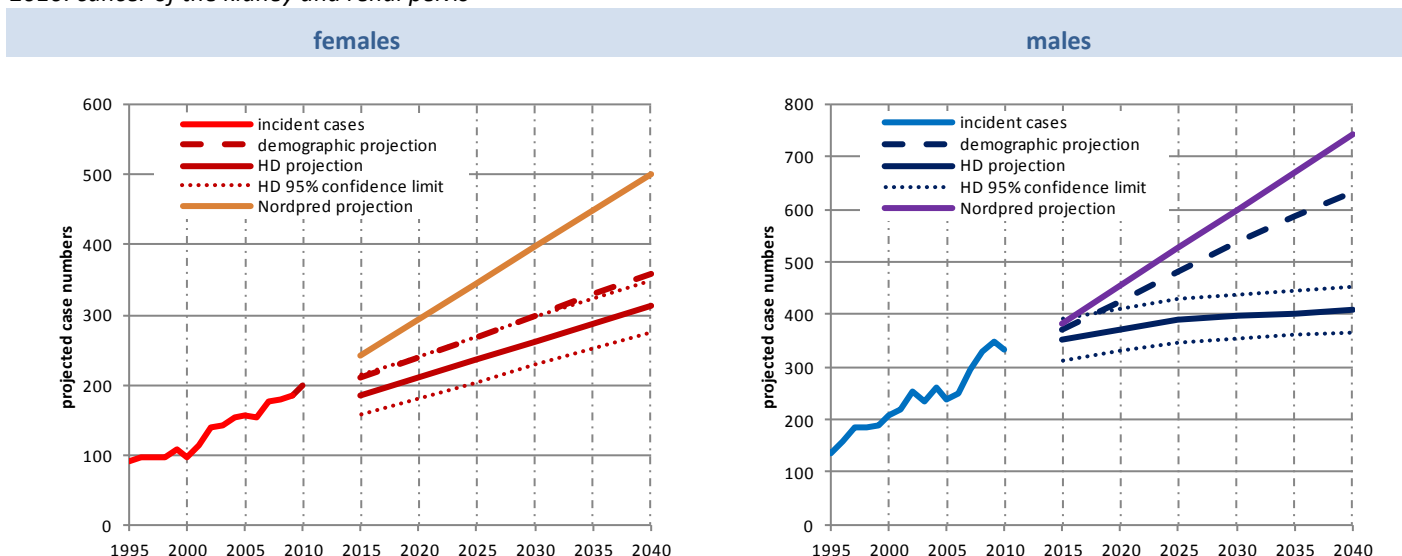


Table 20.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the kidney and renal pelvis

		demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
females											
2010	198										
2015	210	(6%)	241	(22%)	186	(-6%)	158	(-20%)	214	(8%)	
2020	238	(20%)	293	(48%)	210	(6%)	180	(-9%)	240	(21%)	
2025	268	(35%)	345	(74%)	236	(19%)	204	(3%)	268	(35%)	
2030	299	(51%)	397	(101%)	262	(33%)	228	(15%)	296	(50%)	
2035	330	(67%)	449	(127%)	288	(46%)	252	(27%)	324	(64%)	
2040	359	(81%)	501	(153%)	312	(58%)	274	(39%)	350	(77%)	
males											
2010	332										
2015	372	(12%)	383	(15%)	353	(6%)	314	(-6%)	392	(18%)	
2020	425	(28%)	456	(37%)	373	(12%)	333	(0%)	413	(24%)	
2025	481	(45%)	528	(59%)	389	(17%)	348	(5%)	430	(30%)	
2030	537	(62%)	600	(81%)	397	(20%)	355	(7%)	439	(32%)	
2035	589	(77%)	673	(103%)	403	(21%)	360	(9%)	445	(34%)	
2040	633	(91%)	745	(124%)	410	(24%)	368	(11%)	453	(36%)	

Table 20.2 Number of cancers treated in 2010, with estimates for 2025: cancer of the kidney and renal pelvis

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	198	268	345	236
surgery	146	198	254	174
chemotherapy	23	32	41	28
radiotherapy	23	32	41	28
<b>males</b>				
all cases	332	481	528	389
surgery	233	338	371	273
chemotherapy	60	78	85	63
radiotherapy	46	52	58	42

## 21. Cancer of the bladder

### Trends

Figure 21.1. Cancer of the bladder; case numbers, 1994-2010

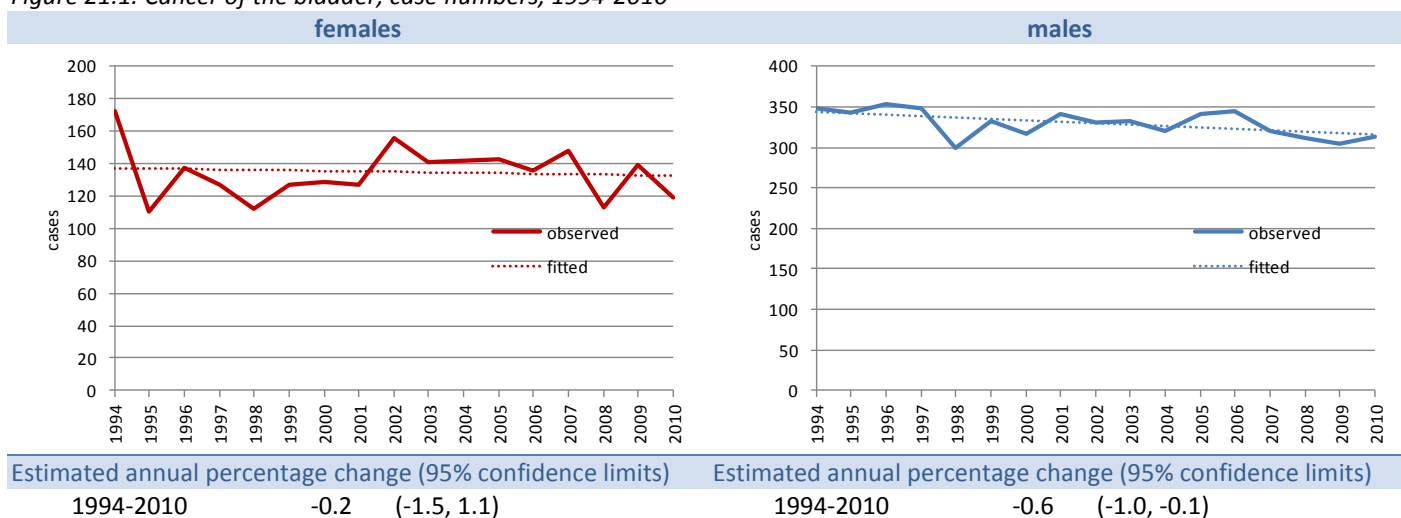
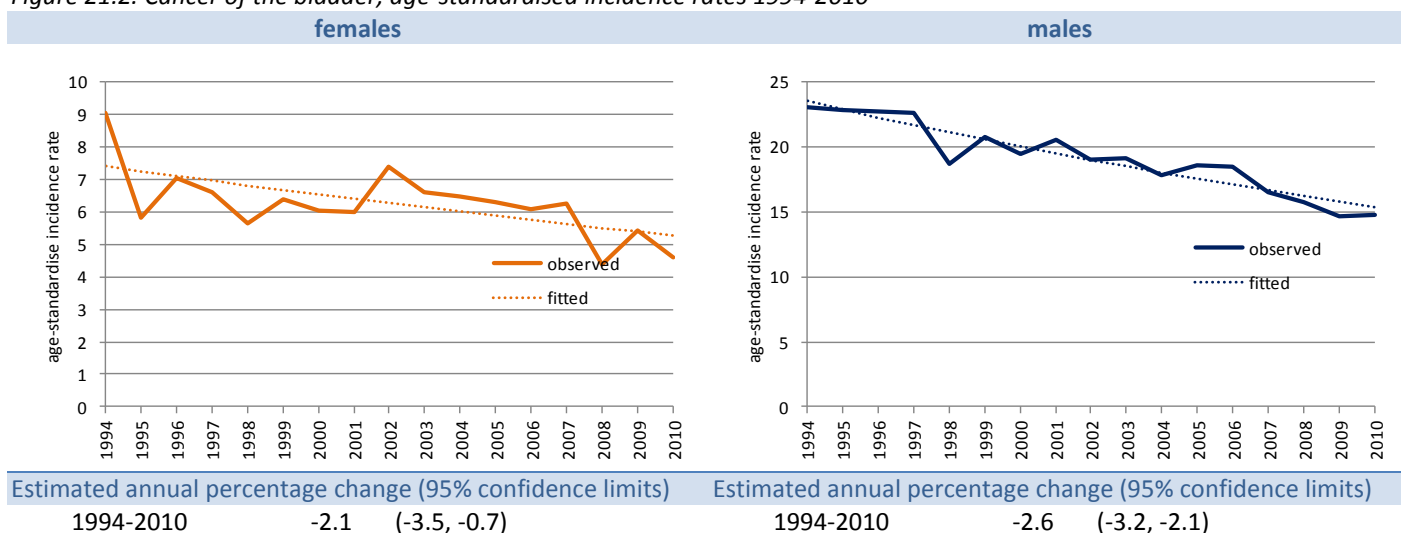


Figure 21.2. Cancer of the bladder; age-standardised incidence rates 1994-2010



There was no significant trend in case numbers for cancer of the bladder for either females or males (Figure 21.1). Trends in age-standardised incidence rates were significantly downwards for both sexes: 2.1% annually for females and 2.6% for males (Figure 21.2).

### Projections

The base of projection for the HD models for both sexes was 1994-2010. HD model 3 gave the best fit for both males and females. For both females and males the HD estimates were well below those due to demographic change alone (Figure 21.3, Table 21.1). Nordpred and HD models gave similar figures for females, but the Nordpred projections were much lower than the HD projections for males. There is an apparent discontinuity between the actual 1994-2010 incidence and the HD projections for males. The models project that female case numbers will increase by 45%-65% between 2010 and 2040 and male cases by 9%-33%, with proportionate increases in treatment rates (Table 21.2).

Figure 21.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the bladder

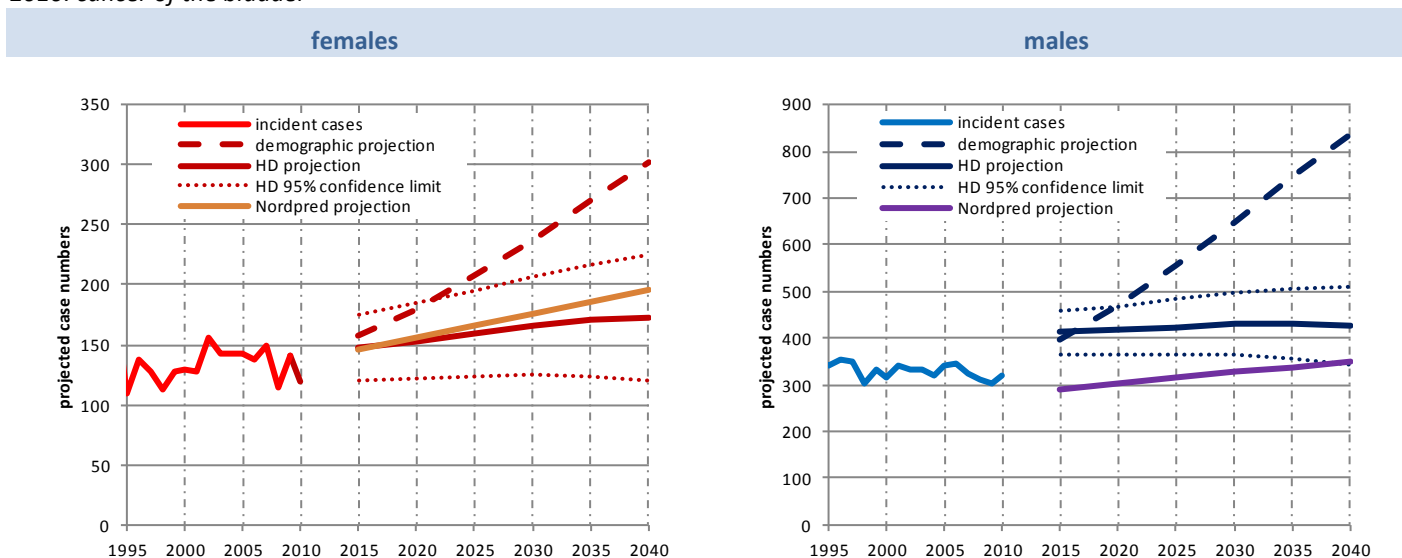


Table 21.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the bladder

Table E11.1.7: Projected numbers of incident cases 2010-2040 (with % increase/decrease compared to 2010): cancer of the bladder										
	demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit	
females										
2010	119									
2015	157	(32%)	145	(22%)	148	(24%)	120	(1%)	175	(47%)
2020	180	(51%)	156	(31%)	153	(29%)	122	(3%)	184	(55%)
2025	207	(74%)	166	(39%)	160	(34%)	124	(4%)	195	(64%)
2030	237	(99%)	176	(48%)	166	(39%)	125	(5%)	207	(74%)
2035	270	(127%)	186	(56%)	171	(43%)	124	(4%)	217	(83%)
2040	302	(154%)	196	(65%)	173	(45%)	120	(1%)	225	(89%)
males										
2010	320									
2015	397	(24%)	290	(-10%)	413	(29%)	366	(14%)	460	(44%)
2020	470	(47%)	302	(-6%)	417	(30%)	364	(14%)	469	(47%)
2025	555	(73%)	314	(-2%)	424	(32%)	364	(14%)	483	(51%)
2030	647	(102%)	326	(2%)	429	(34%)	362	(13%)	496	(55%)
2035	745	(133%)	338	(6%)	432	(35%)	357	(11%)	507	(58%)
2040	838	(162%)	350	(9%)	426	(33%)	344	(8%)	509	(59%)

Table 21.2 Number of cancers treated in 2010, with estimates for 2025: cancer of the bladder

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
	119	207	166	160
surgery	75	130	104	101
chemotherapy	35	61	49	47
radiotherapy	27	47	38	36
<b>males</b>				
	320	555	314	424
surgery	199	345	195	263
chemotherapy	104	145	82	111
radiotherapy	91	108	61	82

## 22. Cancer of the brain and other central nervous system

### Trends

Figure 22.1. Cancer of the brain and other central nervous system; case numbers, 1994-2010

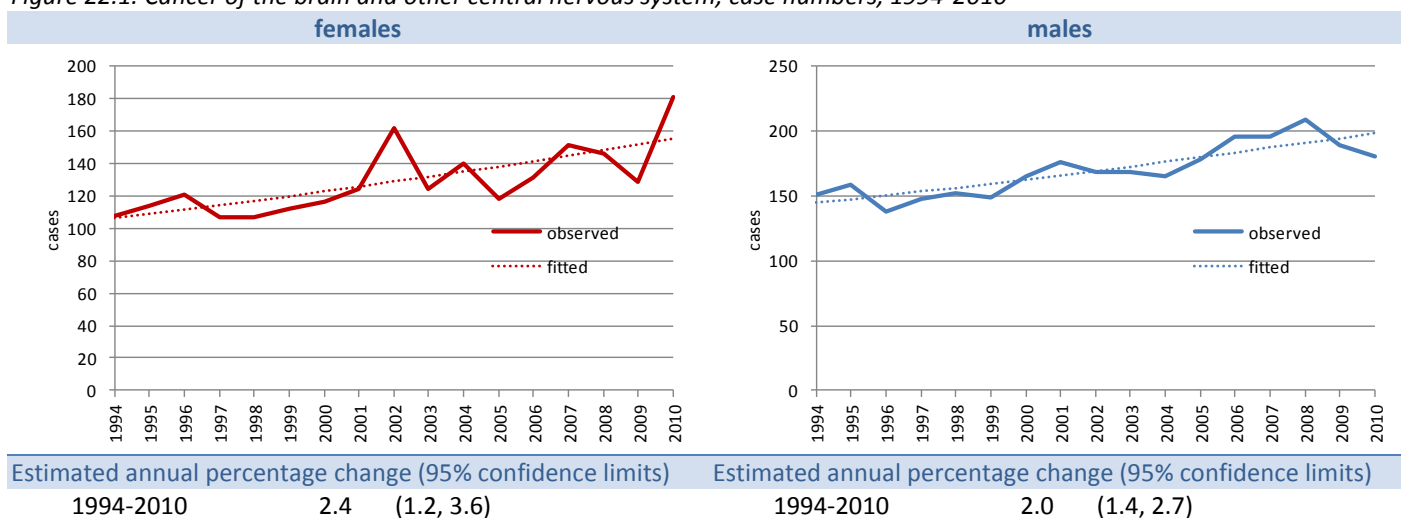
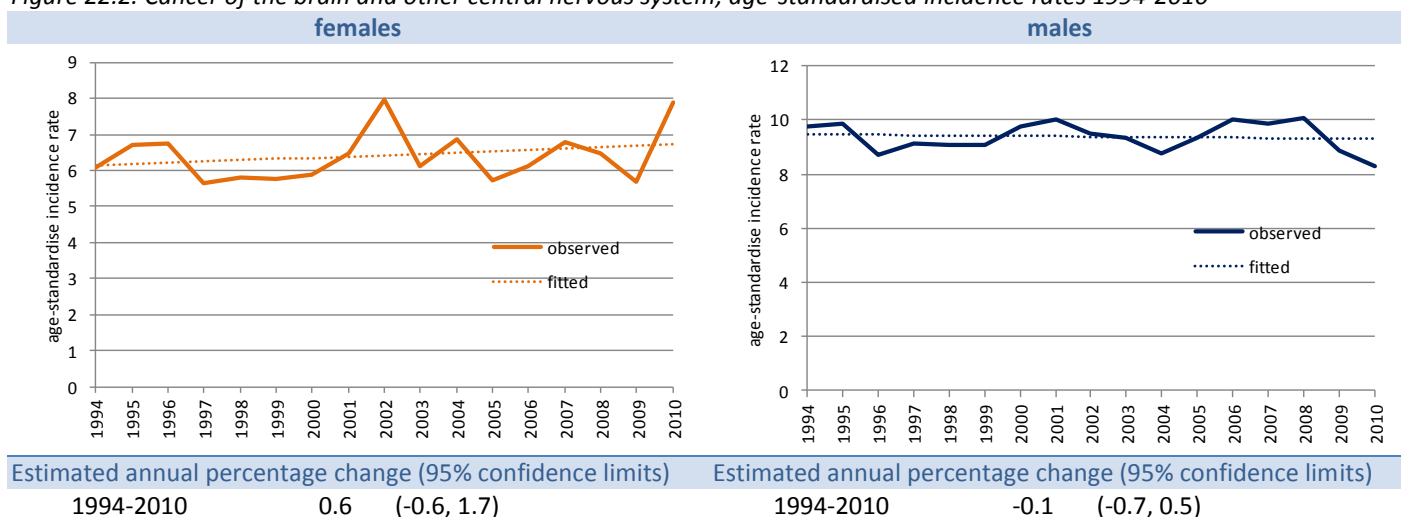


Figure 22.2. Cancer of the brain and other central nervous system; age-standardised incidence rates 1994-2010



There was a significant increase in case numbers of cancer of the brain and central nervous system for both sexes: 2.4% annually for females and 2.0% for males (Figure 22.1). There was no significant trend in age-standardised incidence rates (Figure 22.2).

### Projections

The base of projection for the HD model for both sexes was 1994-2010. HD model 4 gave the best fit for females and model 1 for males. For both females and males the HD estimates were similar to those due to demographic change alone and for males the Nordpred projections were much lower than the HD projections (Figure 22.3, Table 22.1). The models project that female case numbers will increase by 41%-62% between 2010 and 2040 and males by 30%-149%, with proportionate increases in treatment rates (Table 22.2).



Figure 22.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: cancer of the brain and other central nervous system

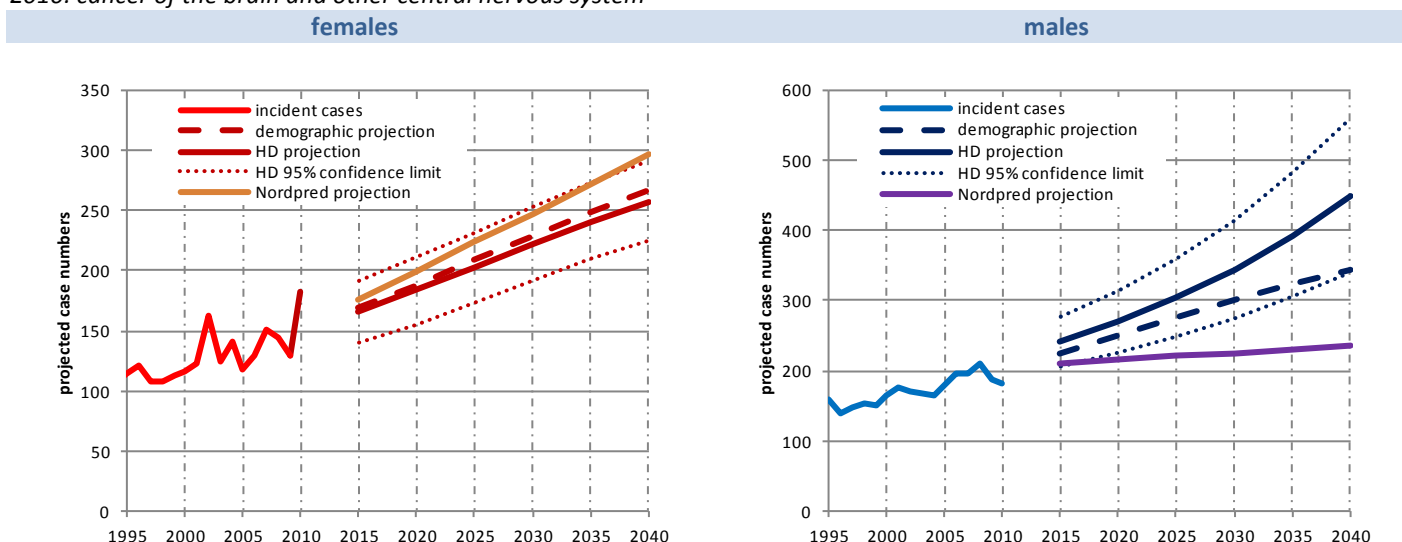


Table 22.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): cancer of the brain and other central nervous system

and other central nervous system							lower 95% HD confidence limit		upper 95% HD confidence limit	
demography only			Nordpred		HD projections					
females										
2010	183									
2015	170	(-7%)	175	(-4%)	165	(-10%)	139	(-24%)	191	(5%)
2020	188	(3%)	200	(9%)	183	(0%)	156	(-15%)	211	(15%)
2025	209	(14%)	224	(22%)	203	(11%)	174	(-5%)	232	(27%)
2030	229	(25%)	248	(36%)	222	(22%)	192	(5%)	253	(38%)
2035	249	(36%)	272	(49%)	241	(32%)	209	(14%)	273	(49%)
2040	267	(46%)	297	(62%)	258	(41%)	224	(23%)	291	(59%)
males										
2010	181									
2015	225	(24%)	211	(17%)	241	(33%)	205	(13%)	277	(53%)
2020	250	(38%)	216	(19%)	270	(49%)	226	(25%)	314	(73%)
2025	276	(52%)	220	(22%)	304	(68%)	249	(38%)	359	(98%)
2030	301	(66%)	225	(24%)	345	(90%)	275	(52%)	414	(129%)
2035	325	(80%)	230	(27%)	393	(117%)	305	(68%)	481	(166%)
2040	345	(91%)	234	(30%)	451	(149%)	341	(88%)	560	(210%)

Table 22.2 Number of cancers treated in 2010, with estimates for 2025: cancer of the brain and other central nervous system

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	183	209	224	203
surgery	88	100	108	98
chemotherapy	44	50	53	48
radiotherapy	102	116	125	113
<b>males</b>				
all cases	181	276	220	304
surgery	87	132	105	145
chemotherapy	69	85	68	94
radiotherapy	164	180	144	199

## 23. Hodgkin's lymphoma

### Trends

Figure 23.1. Hodgkin's lymphoma; case numbers, 1994-2010

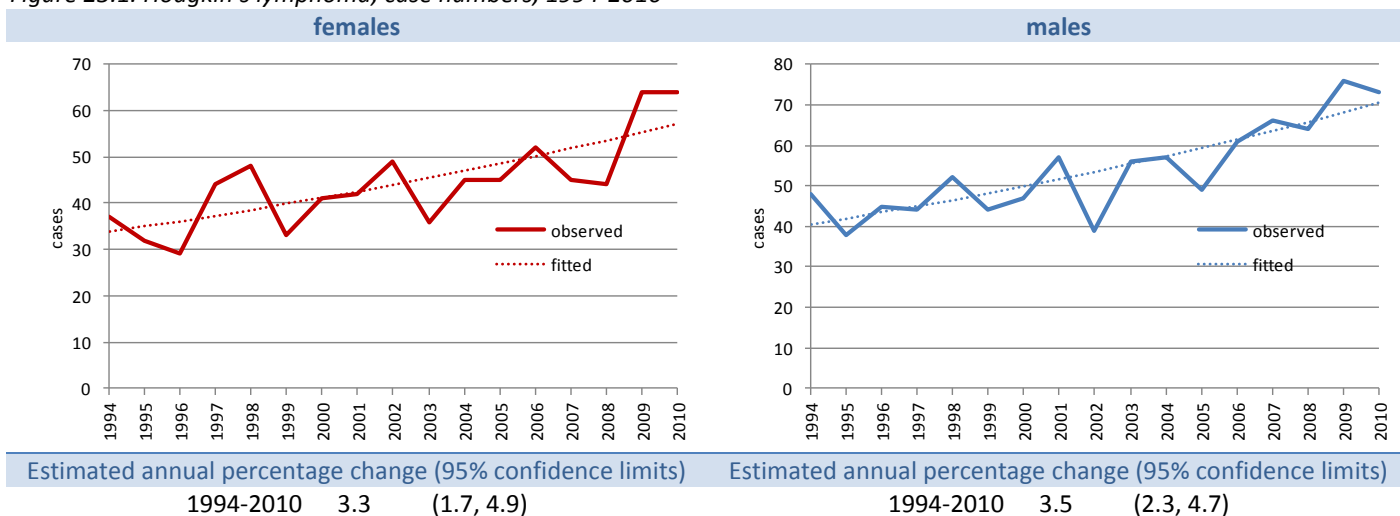
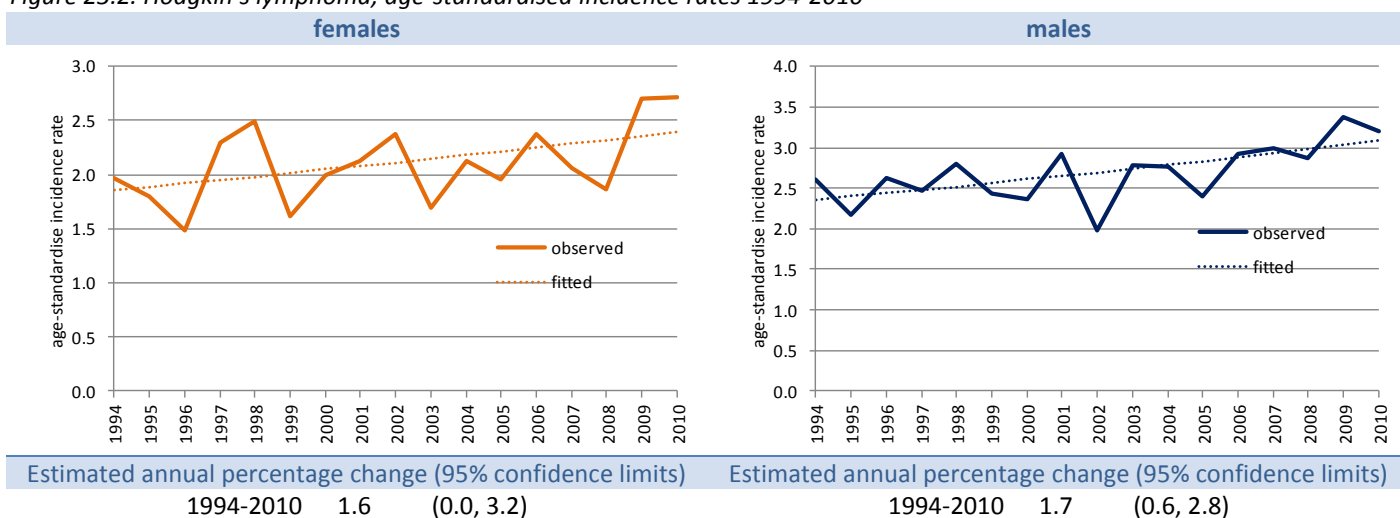


Figure 23.2. Hodgkin's lymphoma; age-standardised incidence rates 1994-2010



There was a significant upward trend in case numbers of Hodgkin's lymphoma for both sexes: 3.3% annually for females and 3.5% for males (Figure 23.1). Trends in age-standardised incidence rates followed the same pattern, with a significant 1.6% annual upward trend for females and 1.7% for males (Figure 23.2).

### Projections

The base of projection for the HD model for both sexes was 1994-2010. HD model 4 gave the best fit for both males and females. For both females and males the projected number of cases from this model was a little above that due to demographic change alone, and higher than the Nordpred projections for females (Figure 23.3, Table 23.1). The model projects that female case numbers will increase by 11%-30% and male cases by 41%-44%, with proportionate increases in treatment rates (Table 23.2).

Figure 23.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: Hodgkin's lymphoma

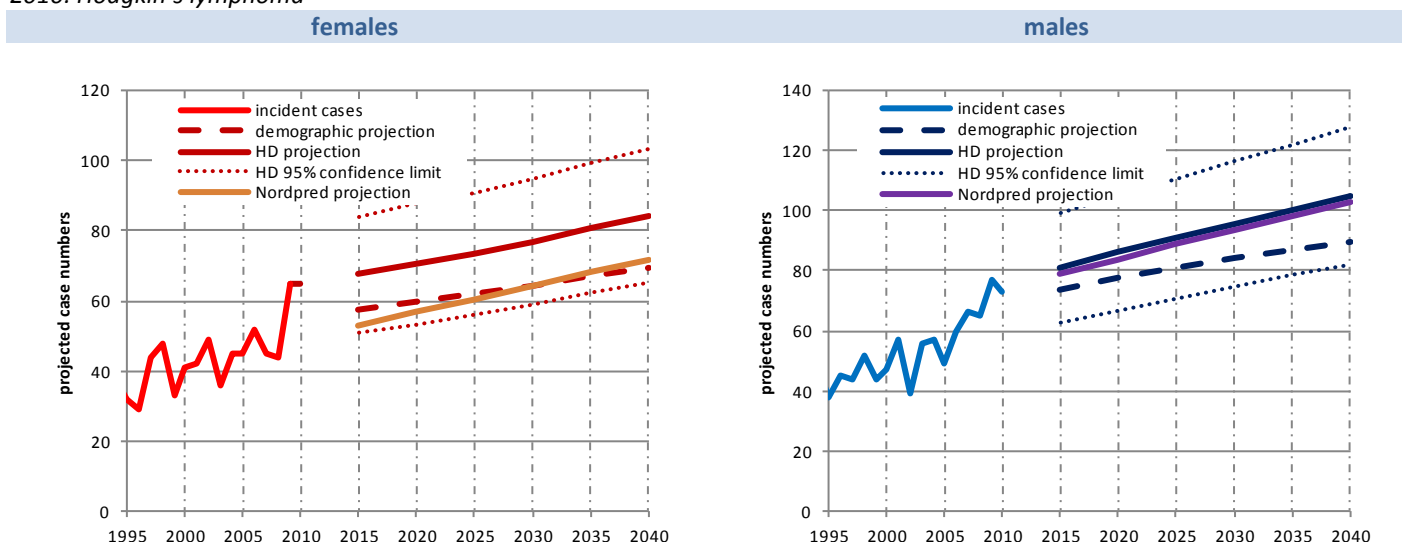


Table 23.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): Hodgkin's lymphoma

demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit		
females										
2010	65									
2015	57	(-12%)	53	(-19%)	67	(4%)	51	(-22%)	84	(29%)
2020	59	(-9%)	57	(-13%)	71	(9%)	53	(-18%)	88	(35%)
2025	62	(-5%)	60	(-7%)	73	(13%)	56	(-14%)	91	(40%)
2030	64	(-1%)	64	(-1%)	77	(18%)	59	(-10%)	95	(46%)
2035	67	(3%)	68	(5%)	81	(24%)	62	(-5%)	99	(52%)
2040	69	(7%)	72	(11%)	84	(30%)	65	(0%)	103	(59%)
males										
2010	73									
2015	73	(1%)	79	(8%)	81	(11%)	62	(-14%)	100	(36%)
2020	78	(7%)	84	(15%)	86	(18%)	67	(-9%)	105	(44%)
2025	81	(11%)	89	(21%)	91	(24%)	71	(-3%)	111	(52%)
2030	84	(15%)	93	(28%)	95	(31%)	75	(2%)	116	(59%)
2035	87	(19%)	98	(35%)	100	(37%)	78	(7%)	122	(67%)
2040	90	(23%)	103	(41%)	105	(44%)	82	(12%)	128	(75%)

Table 23.2 Number of cancers treated in 2010, with estimates for 2025: Hodgkin's lymphoma

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	65	62	60	73
surgery	8	8	7	9
chemotherapy	52	49	48	59
radiotherapy	20	19	19	23
<b>males</b>				
all cases	73	81	89	91
surgery	24	26	29	29
chemotherapy	59	65	71	72
radiotherapy	23	24	26	27

## 24. Non-Hodgkin's lymphoma

### Trends

Figure 24.1. Non-Hodgkin's lymphoma; case numbers, 1994-2010

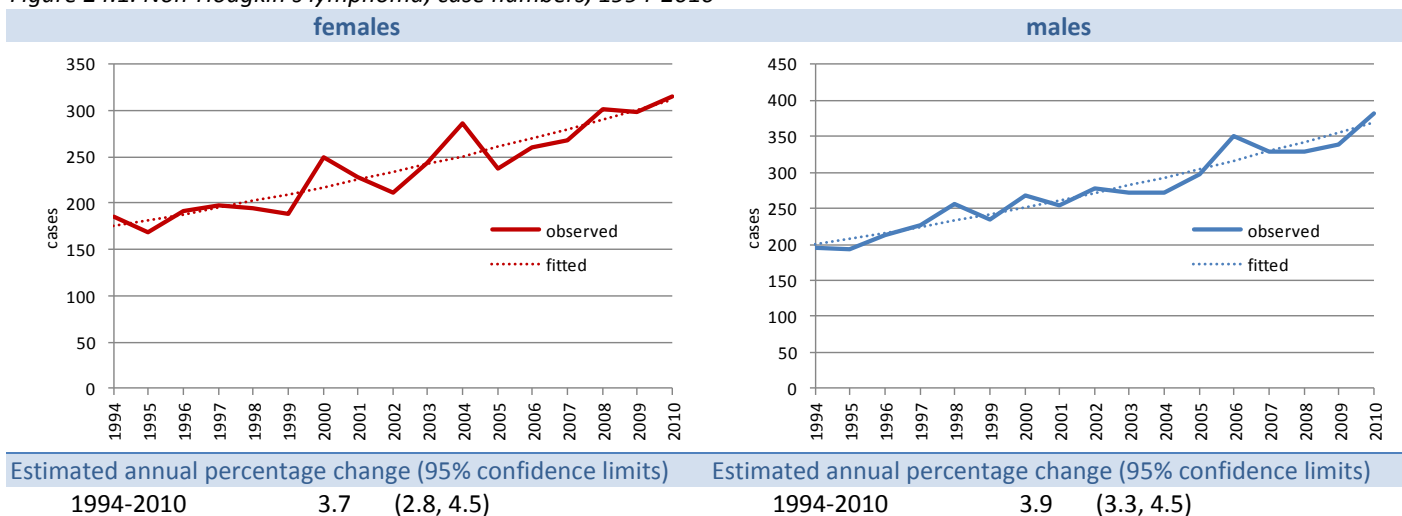
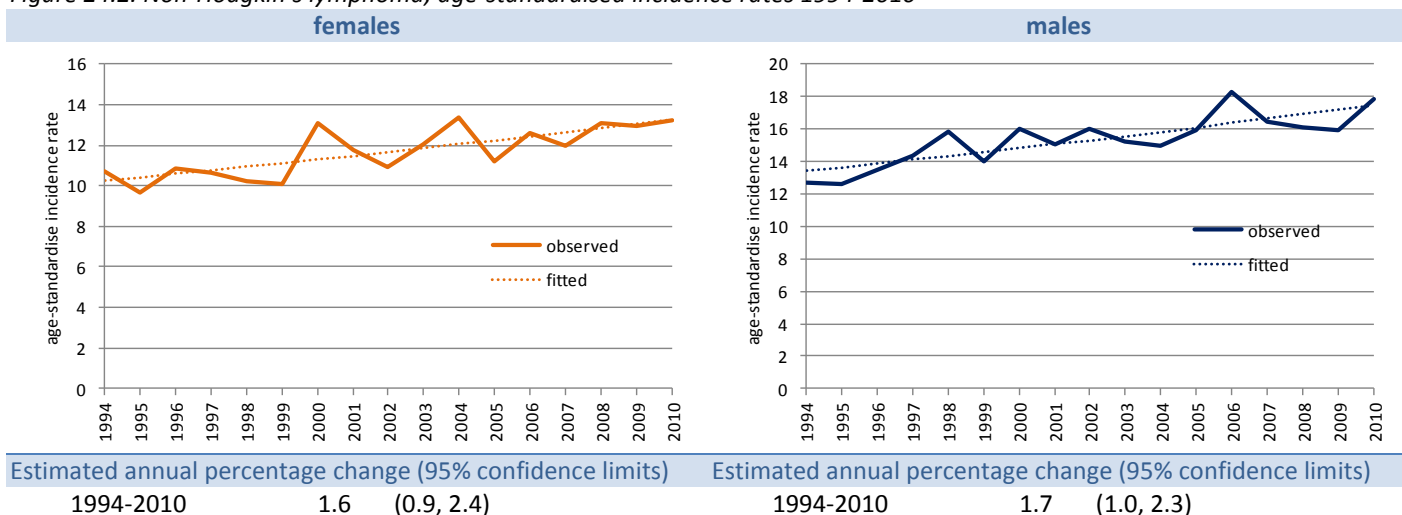


Figure 24.2. Non-Hodgkin's lymphoma; age-standardised incidence rates 1994-2010



The trends for non-Hodgkin's lymphoma were similar to those for Hodgkin's lymphoma. For females there was a significant upward trend in case numbers of 3.7% annually, and for males, 3.9% annually (Figure 24.1). Age-standardised incidence rates increased by 1.6% annually for females and by 1.7% for males (Figure 24.2).

### Projections

The base of projection for the HD model for both sexes was 1994-2010. HD model 4 gave the best fit for both sexes. For both females and males the HD estimates were similar to those due to demographic change alone (Figure 24.3, Table 24.1). The Nordpred projections for females were above those from the HD model, while the male Nordpred projections were a little lower. The models project that female case numbers will increase by 68%-98% and male cases by 62%-83%, with proportionate increases in treatment rates (Table 24.2).

Figure 24.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: non-Hodgkin's lymphoma

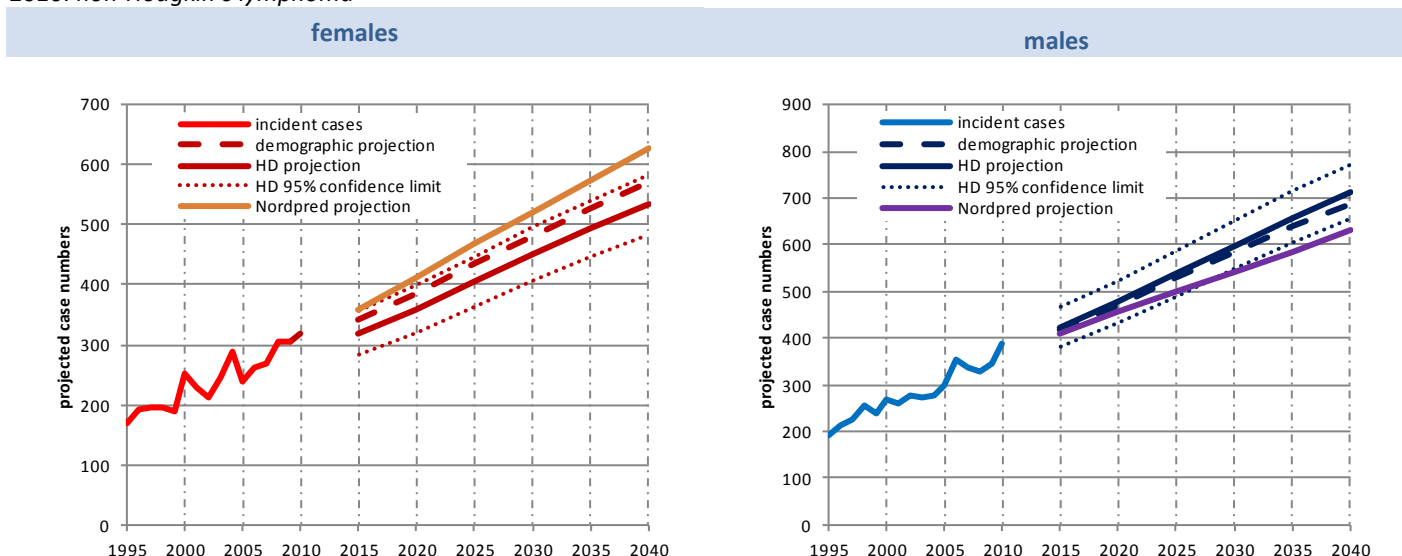


Table 24.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): non-Hodgkin's lymphoma

demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit		
females										
2010	317									
2015	341	(8%)	359	(13%)	320	(1%)	283	(-11%)	356	(12%)
2020	385	(22%)	413	(30%)	360	(14%)	321	(1%)	399	(26%)
2025	433	(37%)	467	(47%)	405	(28%)	363	(15%)	446	(41%)
2030	482	(52%)	520	(64%)	451	(42%)	406	(28%)	495	(56%)
2035	528	(66%)	574	(81%)	494	(56%)	447	(41%)	541	(71%)
2040	570	(80%)	627	(98%)	533	(68%)	484	(53%)	582	(84%)
males										
2010	390									
2015	416	(7%)	411	(5%)	424	(9%)	381	(-2%)	466	(20%)
2020	471	(21%)	455	(17%)	477	(22%)	432	(11%)	523	(34%)
2025	529	(36%)	499	(28%)	537	(38%)	489	(25%)	586	(50%)
2030	586	(50%)	542	(39%)	599	(54%)	547	(40%)	651	(67%)
2035	639	(64%)	586	(50%)	658	(69%)	602	(54%)	713	(83%)
2040	688	(76%)	630	(62%)	713	(83%)	654	(68%)	771	(98%)

Table 24.2 Number of cancers treated in 2010, with estimates for 2025: non-Hodgkin's lymphoma

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	317	433	467	405
surgery	54	74	80	69
chemotherapy	200	273	294	255
radiotherapy	46	63	68	59
<b>males</b>				
all cases	390	529	499	537
surgery	92	125	118	127
chemotherapy	260	331	312	336
radiotherapy	93	105	99	106

## 25. Leukaemia

### Trends

Figure 25.1. Leukaemia; case numbers, 1994-2010

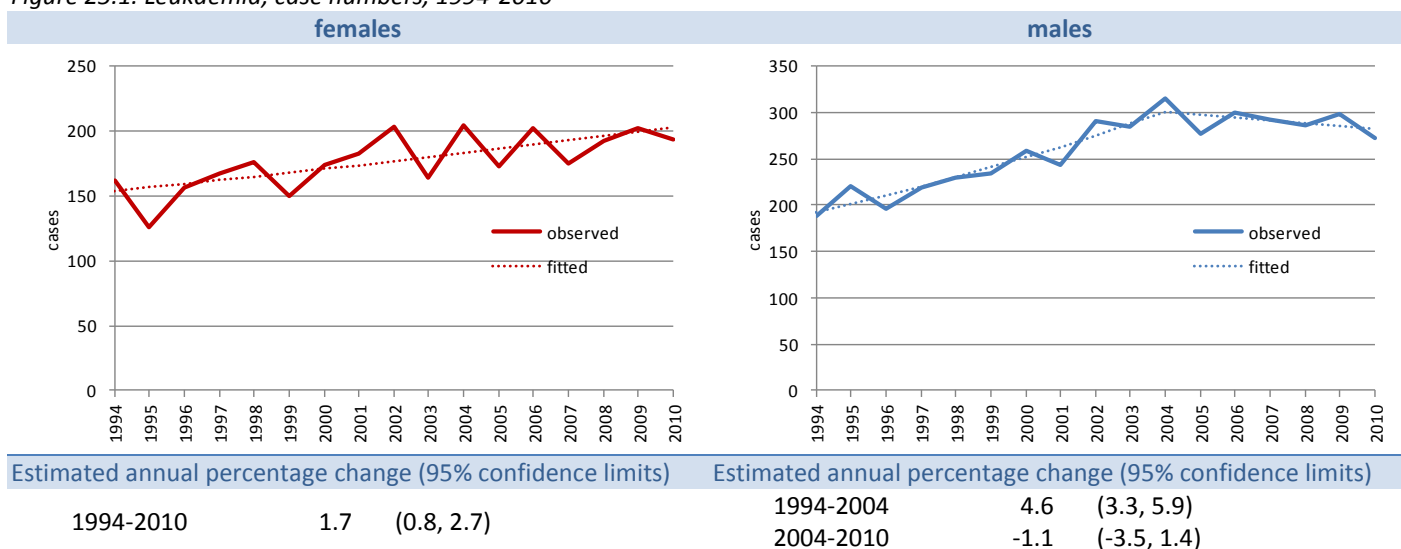
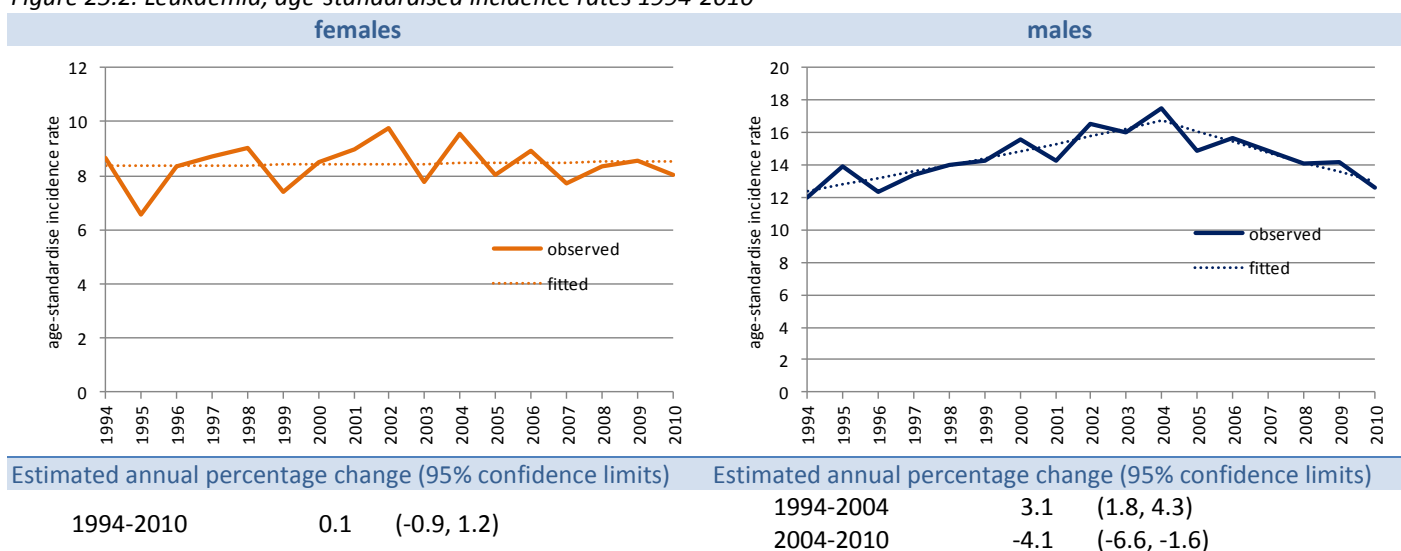


Figure 25.2. Leukaemia; age-standardised incidence rates 1994-2010



There was a significant upward trend in leukaemia case numbers for females of 1.7% annually. For males there was a significant upward trend of 4.6% annually between 1994 and 2004, with no significant change in case numbers from 2004 onwards (Figure 25.1). There was no significant change in female age-standardised incidence rates between 1994 and 2010, while for males there was a 3.1% annual increase between 1994 and 2004, and a 4.1% annual fall after 2004 (Figure 25.2).

### Projections

The base of projection for the HD models for females was 1994-2010 and for males 2004-2010. HD model 3 gave the best fit for both sexes. For females there was reasonable agreement between the HD and Nordpred model, but for males the projected numbers were quite different (Figure 25.3, Table 25.1). The HD model projects a fall in cases, while Nordpred projects an increase; both were below the increase based on demographic change. The models project that female case numbers will increase by 31%-92% between 2015 and 2040, while male cases are projected to increase by 39% (Nordpred) or decrease by 57% (HD), with proportionate changes in treatment rates (Table 25.2).

Figure 25.3. Projected numbers of incident cases, based on M1F0 population projections 2015-2040, with actual numbers 1995-2010: leukaemia

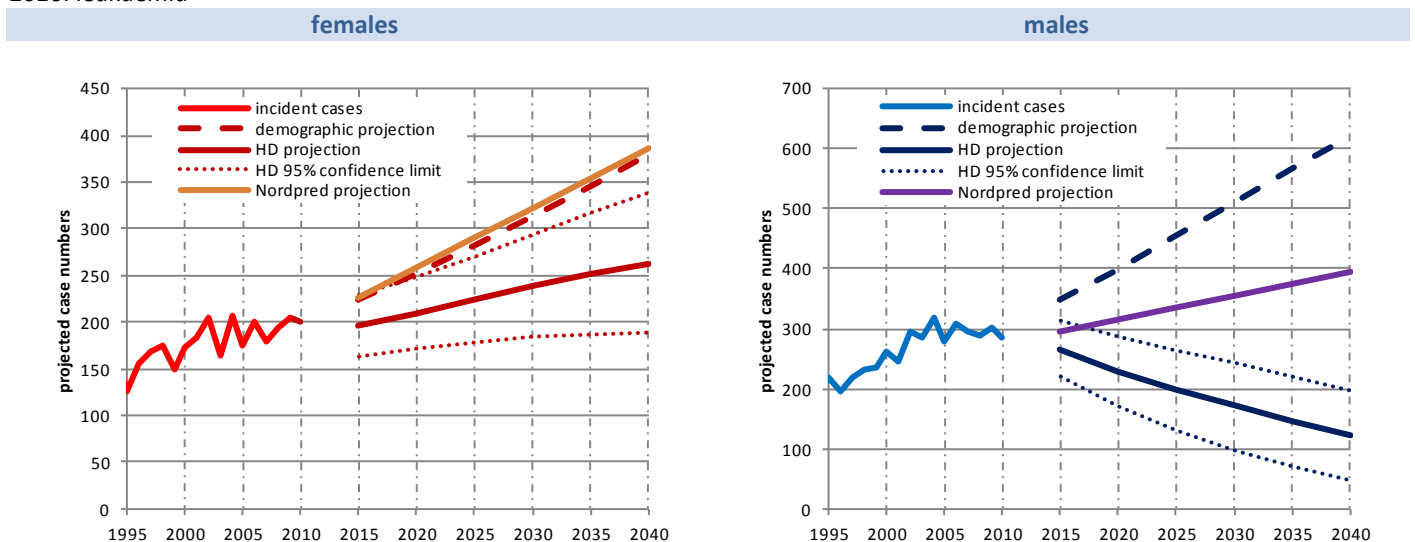


Table 25.1. Projected numbers of incident cases 2015-2040 (with % increase/decrease compared to 2010): leukaemia

	demography only		Nordpred		HD projections		lower 95% HD confidence limit		upper 95% HD confidence limit
<b>females</b>									
2010	201								
2015	225 (12%)		226 (12%)		197 (-2%)		164 (-18%)		230 (14%)
2020	251 (25%)		258 (28%)		210 (4%)		171 (-15%)		248 (23%)
2025	282 (40%)		290 (44%)		224 (11%)		178 (-11%)		270 (34%)
2030	314 (56%)		322 (60%)		239 (19%)		184 (-8%)		293 (46%)
2035	347 (72%)		354 (76%)		252 (25%)		188 (-7%)		317 (57%)
2040	379 (88%)		386 (92%)		263 (31%)		188 (-7%)		338 (68%)
<b>males</b>									
2010	286								
2015	349 (22%)		293 (3%)		265 (-7%)		219 (-24%)		312 (9%)
2020	398 (39%)		314 (10%)		229 (-20%)		171 (-40%)		287 (0%)
2025	453 (59%)		335 (17%)		198 (-31%)		132 (-54%)		265 (-7%)
2030	511 (79%)		355 (24%)		171 (-40%)		99 (-66%)		244 (-15%)
2035	567 (98%)		376 (31%)		147 (-49%)		71 (-75%)		222 (-22%)
2040	620 (117%)		396 (39%)		124 (-57%)		49 (-83%)		198 (-31%)

Table 25.2 Number of cancers treated in 2010, with estimates for 2025: leukaemia

	2010	2025 demography	2025 Nordpred	2025 HD model
<b>females</b>				
all cases	201	282	290	224
surgery	2	3	3	2
chemotherapy	89	124	128	99
radiotherapy	12	17	17	13
<b>males</b>				
all cases	286	453	335	198
surgery	6	9	7	4
chemotherapy	164	213	157	93
radiotherapy	26	30	22	13





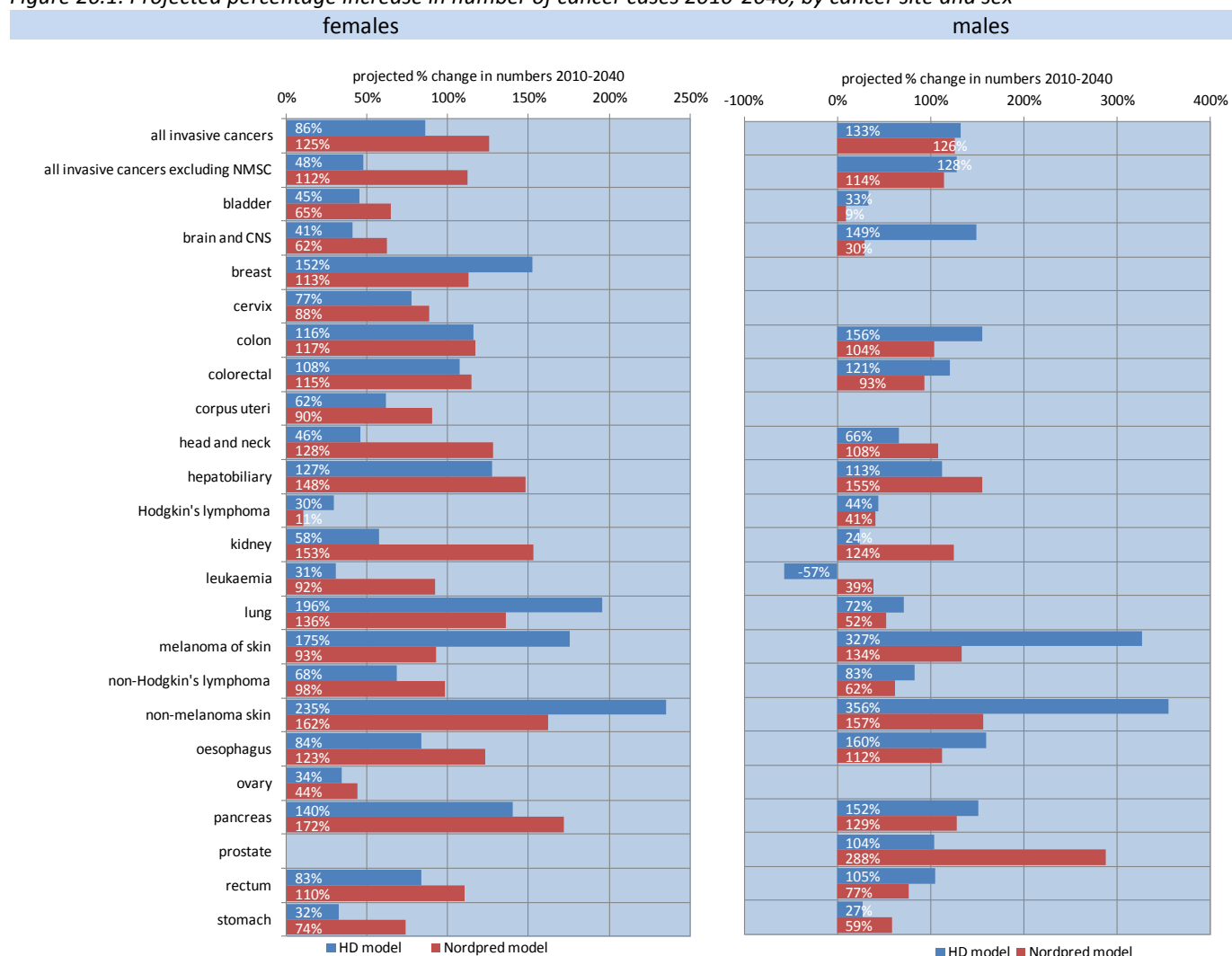
## 26. Discussion

### 26.1 Summary

This report shows, as have previous projections of cancer numbers by the Registry [17, 18], that the number of new cancers in Ireland is expected to increase significantly in the next three decades. Based only on changes in demography, the total number of new invasive cancers will almost double between 2010 and 2040, from 28,480 to 55,991. In the decade 2010-2020 alone, we expect a 25% increase in new cancer cases, with a proportionate increase in the numbers of treatments.

With the exception of leukaemia in males, the number of cancers is projected to increase for all sites between 2010 and 2040 (Figure 26.1).

Figure 26.1. Projected percentage increase in number of cancer cases 2010-2040, by cancer site and sex



The most rapidly increasing cancers in coming decades are likely to be those of skin—both melanoma and non-melanoma—in both sexes. Cancers of the upper gastrointestinal tract—oesophagus, pancreas and hepatobiliary tract—are also expected to increase by over 100% by 2040.

Of the other common cancers

- cancers of the colon and rectum are projected to increase largely in line with demographic change, by 120%-130% between 2010 and 2040;

- lung cancer incidence is rising more rapidly in females than in males and by 2040 the rate is projected to increase by 136% in females (Nordpred) and 52% in males;
- female breast cancer is difficult to project, due to recent short-term variations in incidence trends, but is expected to increase by about 130% between 2010 and 2040. However one HD model projects a much slower rate of increase for females;
- future trends in prostate cancer rates are unclear; the HD models project an increase of 104% in new cases by 2040, while Nordpred projects an increase of 288%; the latter, which is based on the rapid increase in rate in the early 2000s, driven by PSA testing, seems implausible;
- the models for cancer of the bladder and for leukaemia in males were heterogeneous, and future trends in these are difficult to project.

## 26.2 Comparison with previous projections

Table 26.1 compares the projections in this report to those made in 2008 [18]. For all invasive cancers combined, the projections of all models in this report were lower than those made in 2008. This was largely due to the revision of CSO population projections following the 2011 census. The difference in projected case numbers was larger for males than for females, probably due to the rapid increase in prostate cancer in the late 1990s and early 2000s, which had not levelled off when the previous projections were made. As the definition of “head and neck” cancers differed between the two reports, the figures are not comparable. Projections for oesophageal and stomach cancers for females, and for stomach cancer in males, are higher than in the previous reports, but lower for oesophageal cancer in males. Projections for colorectal cancer are slightly lower than in the previous report. Melanoma and non-melanoma skin cancer projections were variable, some higher and some lower than the previous figures. Projections for cancer of the kidney and renal pelvis in females were well below those in the previous report; the expected increase in renal cancer incidence, probably due to incidental findings on imaging [25-27], was not sustained. Projections for cancers of the bladder, brain and CNS and for lymphoma were all a little lower than previous projections. Projections for prostate cancer or leukaemia in males are not in Table 26.1 as projections for these were not made in 2008.

Table 26.1. Comparison of 2008 projections [18] to those in this report

	2008 report	demographic projections		Nordpred projections		HD projections	
	projected cases	% of 2008 projections		projected cases	% of 2008 projections	projected cases	% of 2008 projections
<b>females</b>							
all invasive cancers	27404	22368	82%	26693	97%	22580	82%
all invasive excluding NMSC <sup>1</sup>	19918	15576	78%	17813	89%	13397	67%
head and neck <sup>2</sup>	194	245	126%	358	185%	241	124%
oesophagus	202	271	134%	254	126%	218	108%
stomach	209	378	181%	287	137%	231	111%
colorectal <sup>3</sup>	2128	1976	93%	2019	95%	1942	91%
pancreas	565	482	85%	498	88%	442	78%
lung	2642	1694	64%	2022	77%	2429 <sup>7</sup> /1538 <sup>8</sup>	92% <sup>7</sup> /58% <sup>8</sup>
melanoma of skin	1170	713	61%	940	80%	1269	108%
non-melanoma skin	7504	6791	90%	9070	121%	11143	148%
breast	4833	4514	93%	5615	116%	6639 <sup>7</sup> /4289 <sup>8</sup>	137% <sup>7</sup> /89% <sup>8</sup>
gynaecological <sup>4</sup>	2464	1634	66%	1725	70%	1602	65%
kidney	578	330	57%	449	78%	288	50%
bladder	216	270	125%	186	86%	171	79%
brain and CNS <sup>5</sup>	357	249	70%	272	76%	241	68%
lymphoma <sup>6</sup>	919	595	65%	642	70%	575	63%
leukaemia	384	347	90%	354	92%	252	66%
<b>males</b>							
all invasive cancers	36441	28855	79%	30824	85%	32026	88%
all invasive excluding NMSC	27378	19784	72%	20097	73%	21500	79%
head and neck	884	668	76%	779	88%	649	73%
oesophagus	613	501	82%	465	76%	571	93%
stomach	372	699	188%	531	143%	457	123%
colorectal	3409	2923	86%	2521	74%	3067	90%
pancreas	451	524	116%	525	116%	581	129%
lung	2104	2610	124%	1836	87%	2132	101%
melanoma of skin	1153	622	54%	808	70%	1381	120%
non-melanoma skin	17181	9071	53%	10974	64%	18407	107%
kidney	445	589	132%	673	151%	403	91%
bladder	529	745	141%	338	64%	432	82%
brain and CNS	539	325	60%	230	43%	393	73%
lymphoma	1314	726	55%	684	52%	758	58%

Notes:

1. NMSC: non-melanoma skin cancer
2. Head and neck includes larynx in this report but not in 2008.
3. Total of projections for colon and rectum.
4. Total of cervix, corpus uteri and ovary from this report; included some rare additional sites in 2008.
5. CNS: central nervous system
6. Total of projections for Hodgkin's and non-Hodgkin's lymphoma in this report
7. HD model 1
8. HD model 4

## 26.3 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. We also, for the first time, provide estimates of future demand for cancer treatments, with the caveat that these depend on the stability of treatment patterns into the future.

The most significant limitation of the approach is that it assumes that current incidence trends will continue unchanged into the future. The use of projection models can be useful in assessing future needs for cancer services and, in some situations, for estimating the impact of measures to reduce cancer incidence. However, 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 [28] 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 a quite a few cancers have changed significantly and therefore the assumption of continuity of trends into the future is not very firmly based. The methods used here are similar to those in previous projections [18] and may be partially validated by comparing previous projections with current data (Figures 26.2, 26.3). In general, the previous projections for 2010 are close to the actual 2010 incidence figures for most sites, although the projections slightly under-estimated the increase in cancer numbers for the majority of sites. For males there was a slight under-estimation of numbers of cancers of lung, stomach and melanoma and, for females, an under-estimation of numbers of non-melanoma skin cancers and an over-estimation of brain and CNS cancer. However this comparison is for only a few years following the publication of the previous projections and the validity of longer-term projections is less secure.

Another limitation of modelling is the 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 lung, female breast, bladder, and for leukaemia in males. For most cancers, case numbers by age group and year are relatively sparse and subject to considerable year-to-year variation. Models based on age-specific rates may place too much reliance on apparent trends in these rates; on the other hand ignoring these would be mistaken if there are real differences in trend between different age groups. Even when rates are modelled for all age groups combined, an increase in case numbers may fit an exponential growth curve closely, although long-term exponential growth in cancer rate is extremely unlikely. Consequently, less reliance can be placed on projections for 20 years than on those for 10. It must also be remembered that for some cancers, the period which was the basis of projection was less than 10 years. 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.

Figure 26.2. Actual and projected<sup>1</sup> (with 95% confidence limits) case numbers 2010

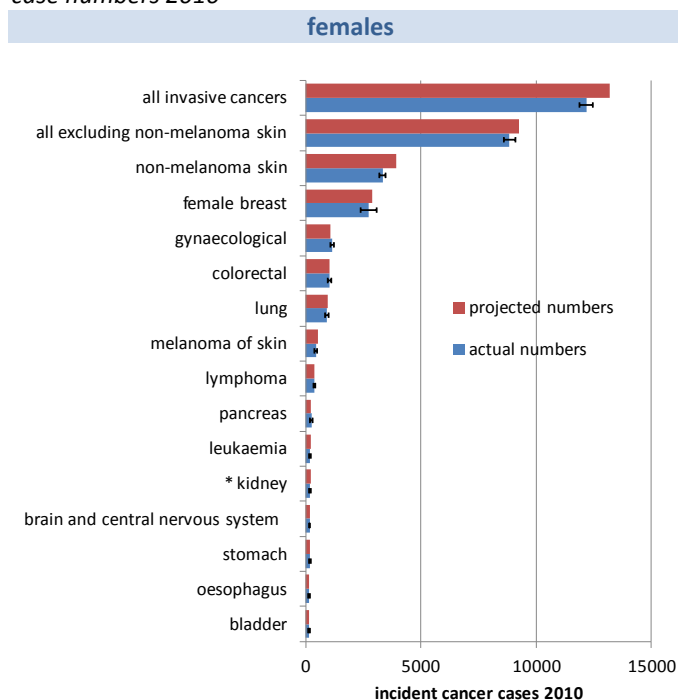
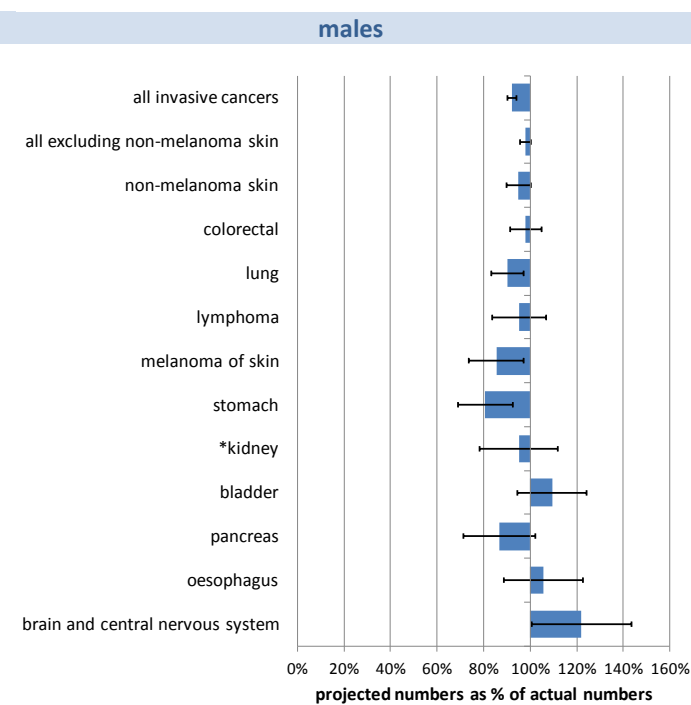
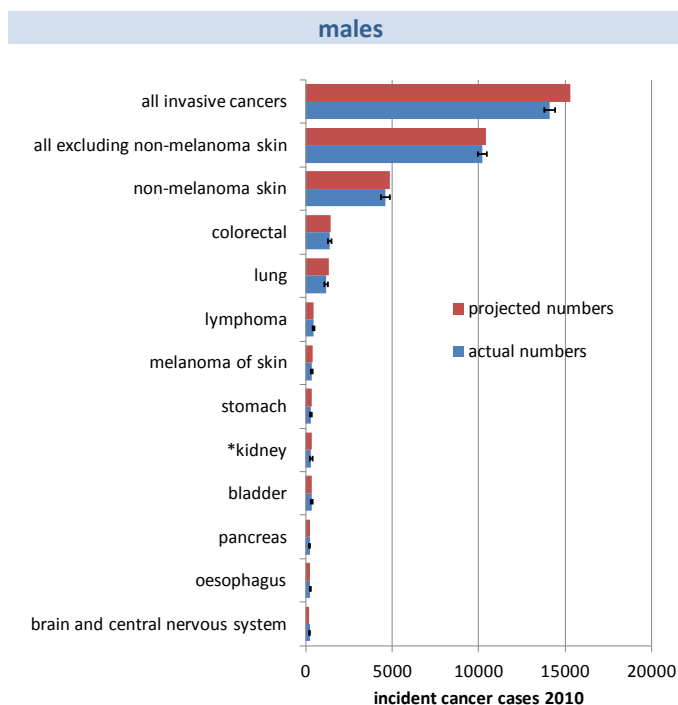
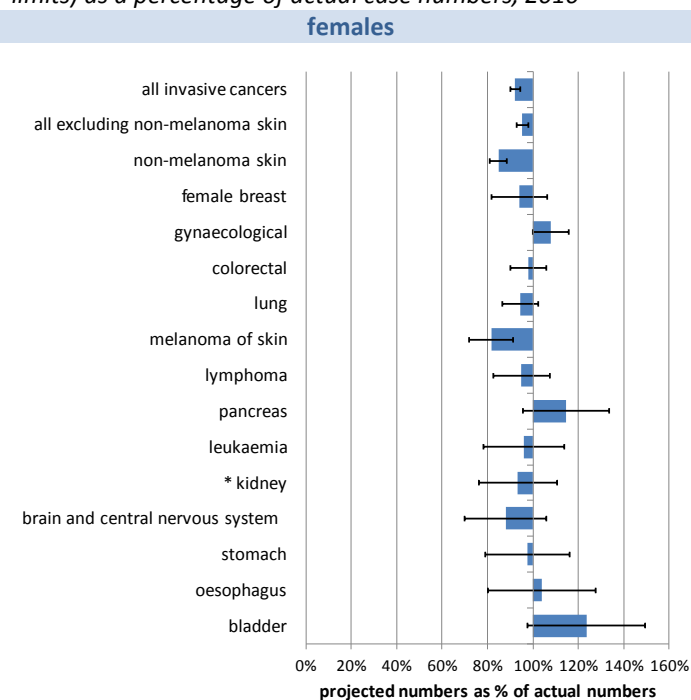


Figure 26.3. Projected case numbers<sup>1</sup> (with 95% confidence limits) as a percentage of actual case numbers, 2010



1. Projected case numbers are taken from "Cancer projections 2005-2035", National Cancer Registry, 2008 [18].

For a number of cancers, there were substantial differences between the HD and Nordpred projections. There were a number of possible reasons for these discrepancies.

1. Nordpred software needs a minimum of three 5-year periods and always used the entire period 1996-2010 as the base of projection, even when there were changes in trend during that period. HD projections used a shorter base of projection when there were recent significant changes in incidence rate. Nordpred is therefore more reliable when trends were stable over the entire period.

2. The HD models which fit best in most cases (models 3 and 4) did not fit trends separately to each age group, whereas Nordpred does, so in cases where the trends for younger patients were different from those for older patients, the models differed. This may be seen as a weakness of the HD model, but the number of cases in each age group is small and the modelled trends by age group are not necessarily reliable.
3. For a small number of sites, the HD log-linear age-period model gave the best fit, although exponential growth in cancer numbers is implausible over long periods. In those cases, the Nordpred estimates are probably more reliable, especially in the longer term.

As a consequence, although statistical tests for choosing the best fit of a model to the historic data are a reasonable guide, there is some degree of subjectivity in the final choice of model. For this reason we have offered a number of possible models in this report, where the best choice was not obvious. A review of different methods for case projections has suggested that Nordpred projections may be more reliable in the longer term [22, 29], but this has not yet been verified against real data.

As population projections are now available up to 2040 we have attempted to make some projections of cancer case numbers for the same period. However, these need to be viewed with caution, as there have been significant changes in incidence trends for many cancers in the past two decades, as well as documented changes in risk factor prevalence. Projections for the next decade (2015-2025) are likely to be reliable; our comparison of previous projections to actual incidence supports this. For longer periods, the best we can hope for is that projections can give some general indication of future cancer burden. As few cancers currently have a decreasing trend in incidence rate, demographic projections tend to be the most conservative and provide a “best-case” scenario for most cancers.

## 26.4 Determinants of changing cancer incidence

Trends in cancer incidence are determined principally by two elements: population change and changes in exposure to risk factors. More information is usually available on population trends, which are readily incorporated into projections of cancer numbers. A number of projections have been attempted on the basis of current and projected changes in risk factor prevalence [30-34] but there is a long lag period, estimated at 15-20 years for solid tumours, between changes in risk factor prevalence and the development of the associated cancers, so these models are difficult to verify. Most projections are based on the assumption that risk factor prevalence tends to be stable over long periods of time, changes only slowly and can be modelled indirectly from changes in age-standardised rate. While this may be valid for some risk factors, others, such as obesity, are increasing rapidly. Case numbers may also be affected by a number of other factors: screening programmes, changes in medical practice leading to the discovery of more incidental cancers, advances in diagnostic procedures or changes in histological classification and changes in the completeness of registration. These may lead to short-term changes in incidence which are difficult to incorporate into models and the assumption is generally made that, apart from screening programmes, their impact is slight.

### Demographic change

The models of population change provided by the CSO make a number of assumptions with regard to mortality, migration and fertility. Only the first of these is likely to have any major impact on future cancer numbers, as the others affect the younger population, which has a low cancer incidence. The projections used here project a continuing improvement in life expectancy of approximately one year of life for each five calendar years between 2010 and 2046. However the increase in life expectancy at birth has been more rapid than this since the late 1990s, and it is possible that the number of older people in the population will increase more rapidly than is projected in the CSO figures. This would result in a larger number of cancer cases than projected here.

## Risk factor prevalence

Four risk factors have been shown to determine the majority of the attributable risk of cancer (excluding non-melanoma skin cancer) in the UK [35]—tobacco [36], diet (including energy balance, obesity and physical activity) [37], alcohol [38] and reproductive factors [39, 40]. No equivalent calculations have been done for Ireland, but given the similarity in lifestyle between the populations of Ireland and the UK, it is reasonable to assume that the distribution and prevalence of attributable risks due to these major factors are similar. In addition to these general risk factors, we must also consider some cancer-specific causes—UV light for skin cancers, H pylori for stomach cancer and HPV for cervical cancer.

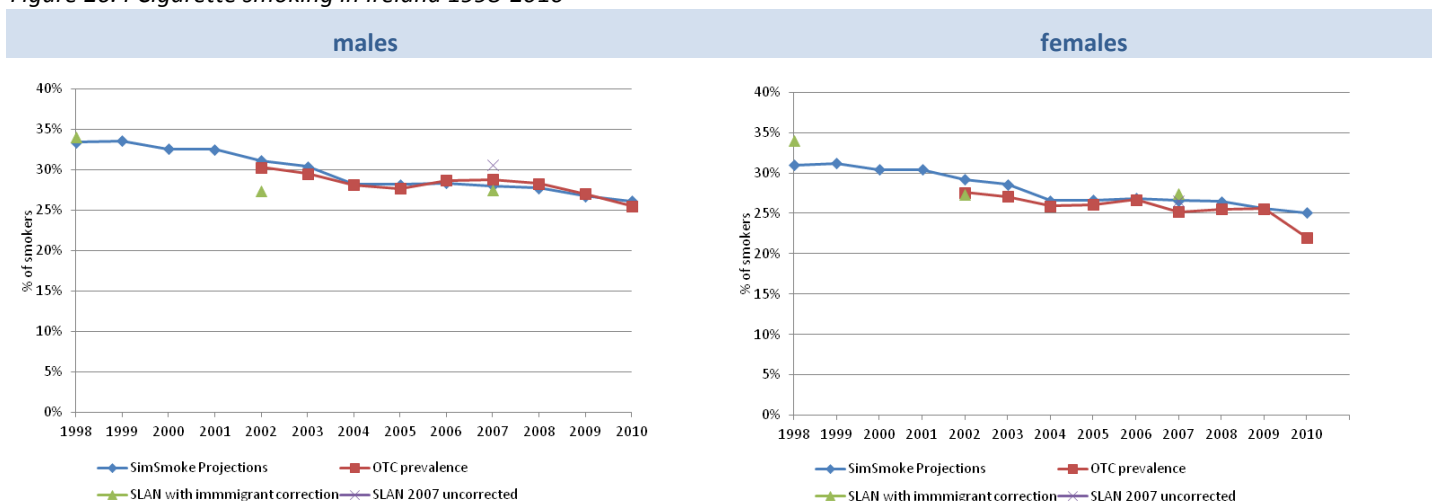
### Tobacco

Although reliable long-term data on smoking prevalence are difficult to obtain for Ireland, it is estimated that smoking prevalence in males was 35% in 1986-1987, falling to 32% by 1998, while, for females, prevalence remained at 31% throughout the 1990s [41, 42]. The SLÁN surveys [43] reported a smoking prevalence of 34% in males in 1998, 27% in 2002 and 31% in 2007 and 32%, 27% and 27% in females in the same period. Data from the Office of Tobacco Control (OTC) shows a prevalence of 30% for males and 28% for females in 2002, falling to 25% in males and 22% in females in 2010 [44, 45] (Figure 26.4). Overall, there has been a fall of about 9% in smoking prevalence for males and of about 8% for females since 1986. The rate of decrease seems more rapid since about 2003. The HSE/OTC data show a rapid decline in smoking prevalence in younger adults, which is likely to be sustained.

### Diet and energy balance

Obesity and lack of physical exercise are probably more important in cancer aetiology than individual dietary components [46-48]. The most comprehensive data on diet, exercise and energy balance in Ireland come from the SLÁN surveys [45]. These show a steady increase in BMI and weight from 1998 to 2007. The percentage whose self-reported weight was in the “over-weight” or “obese” range increased from 51% to 59% (males) and 35% to 41% (females) in the same period. The largest increases in weight and BMI were in the oldest age group. Most age groups, apart from the oldest, reported a fall in their mean energy intake over this period, with falls in fat and carbohydrate intake. The percentage reporting that they had taken no exercise in the previous week also fell between 1998 and 2007. These reports are somewhat inconsistent with the BMI data, but point to the possible adoption of a healthier lifestyle.

Figure 26.4 Cigarette smoking in Ireland 1998-2010



## Alcohol

Alcohol consumption per adult seems to have peaked in 2000-2002 at over 14 litres alcohol/adult/year and has fallen slightly since then (Figure 26.5) [14]. Patterns of drinking may also have changed [14]. The number of heavy drinkers has fallen considerably in the younger age groups but much less in those 45 and over (Figure 26.6) [49].

Figure 26.5. Alcohol consumption (litres of alcohol per person), selected countries and OECD average 1990-2011

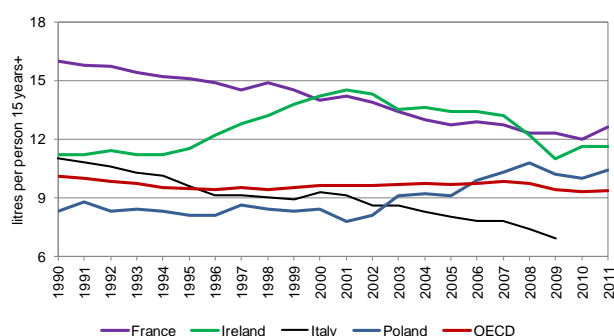
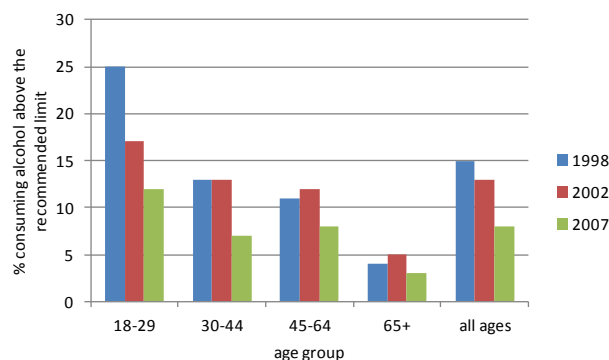


Figure 26.6. Percentage of drinkers who consumed alcohol above the recommended weekly limit in the previous 12 months 1998, 2002 and 2007



## Reproductive life

Parity, age at first birth, age at menarche and age at menopause are among the most important risk factors for breast cancer, as they are markers of oestrogen exposure. There is little information on the last two in Ireland. Mean age at menarche appears to have decreased from 13.5 in 1986 to 12.5 in 2007 [50]; no information could be retrieved on trends in age at menopause. Parity has fallen from 3.4, for females in the 1940 birth cohort, to 1.7 for those in the 1969 cohort (data from 2006) [51]. In the 2011 census, females aged 70+ reported 4.4 live births over their reproductive life, compared to 2.9 for those aged 50-54 [52]. Age of the mother at first birth has risen from 24.5 in 1950-1960 to 28.6 in 2002-2011 [53]. All of these trends suggest increasing lifetime oestrogen exposure.



## 26.5 Trends by cancer site

### *All invasive cancer sites combined*

Of the four most important modifiable cancer risk factors—tobacco consumption, alcohol abuse, obesity and changes in reproductive and hormonal patterns—the first two are decreasing in prevalence in Ireland, while the others are increasing. The overall impact of these changes on cancer trends is difficult to predict, but early reductions in incidence rates seem unlikely. The number of cases of invasive cancer is projected to increase from 28,480 in 2010 to almost 60,000 in 2040, based on demographic change alone, in the absence of any change in incidence rates. Similar trends can be seen if non-melanoma cancers of the skin are excluded. A worrying trend is the greater rate of increase in tobacco-related cancers in females.

It is estimated that the interval between initiation of a solid tumour and its diagnosis is 15 to 20 years, so most of the projected increase between now and 2030 has been determined by prior exposures and will not be affected by future preventive measures. Changes in lifestyle in the past decade are unlikely to have yet manifested in incidence changes, but the changes in tobacco and alcohol consumption should manifest as some reduction in cancer incidence rates in the next few decades.

### *Tobacco-related cancers*

Tobacco smoking has been implicated as a causal factor in many cancers [54]. However, the estimated relative risk due to smoking ranges widely, from 14.6 for laryngeal cancer in males to 1.2 for colorectal (Table 26.2).

*Table 26.2. Estimated relative risks (RR) for current smokers aged 35 compared with never-smokers [36]*

cancer	males	females
larynx	14.6	13.0
lung	21.3	12.5
oesophagus	6.8	7.8
oral cavity and pharynx	10.9	5.1
urinary bladder	3.0	2.4
pancreas	2.2	2.2
ovary (mucinous)	—	2.1
stomach	2.2	1.5
liver	2.3	1.5
cervix	—	1.5
kidney and renal pelvis	2.5	1.5
colon–rectum	1.2	1.3
acute myeloid leukaemia	1.9	1.2

The estimated increase in tobacco-related cancers in Ireland between 2010 and 2040 is, in general, greater for females than for males (Table 26.3). Cancer of the lung is projected to increase by 95%-196% in females and by 72%-121% in males, cancer of the oesophagus by 84%-140% in females and 112%-160% in males and cancer of the bladder by 45%-65% in females and 9%-33% in males. The projections for cancer of the head and neck are inconsistent—the HD model projects a larger relative increase in incidence in males, while Nordpred projects a larger increase in females. The overall projected increase between 2010 and 2040 in the number of tobacco-related cancers listed in Table 26.2 is 110%-115% for females, and 83%-91% for males; these cancer sites represent approximately half of all invasive cancers, excluding non-melanoma skin.

*Table 26.3 Projected % increase 2010-2040 in tobacco-related cancers: HD and Nordpred models*

	females		males	
	HD	Nordpred	HD	Nordpred
head and neck <sup>1</sup>	46%	128%	66%	108%
oesophagus	84%	123%	160%	112%
stomach	32%	74%	27%	59%
colon	116%	117%	156%	104%
rectum	83%	110%	105%	77%
liver, biliary tract and gallbladder	127%	148%	113%	155%
pancreas	140%	172%	152%	129%
lung	196%	136%	72%	52%
cervix	77%	88%	-	-
ovary	34%	44%	-	-
kidney	58%	153%	24%	124%
bladder	45%	65%	33%	9%
<b>all cancers listed above</b>	<b>110%</b>	<b>115%</b>	<b>91%</b>	<b>83%</b>

*Note: The category “head and neck” corresponds largely to cancers of the oral cavity, pharynx and larynx in Table 26.2.*

### *Cancers of the head and neck*

Cancers of the head and neck are a heterogeneous group, but tobacco and alcohol are important in their aetiology [55, 56]. HPV infection is considered a causal factor for cancers of the oropharynx [57], but has only a minor effect on overall head and neck cancer incidence [58]. The overall trend resembled that for other primarily tobacco-related cancers, with an increase in rate for females, but not males. This is reflected in the larger projected increase for females (48%-108% between 2010 and 2040) than for males, which was greater than projected from demographic change alone. The variability in trends for males has resulted in the Nordpred projection being higher than that of the HD model because, although there was no statistically significant trend in rates for males, the aggregate rate for males in 2006-2010 was higher than that for 1996-2000.

### *Cancer of the oesophagus*

The main risk factors for cancer of the oesophagus are smoking and obesity [59, 60]. Adenocarcinoma of the oesophagus is increasing in incidence, while squamous carcinoma is decreasing [23] and the interaction of these trends has led to a modest projected increase in incidence, slightly below the demographic trend for females and slightly above it for males.

### *Cancer of the stomach*

*Helicobacter pylori* is the most firmly established risk factor for this cancer in European populations [61, 62]. In common with most other European countries [63] cancer of the stomach in Ireland is decreasing in incidence. There are no reliable data on trends in prevalence of *H. pylori* in Ireland, and the studies carried out have been on small and unrepresentative population samples. However, as the incidence of stomach cancer in Ireland remains 50% above that in most Nordic countries [63] it seems reasonable to expect that the incidence will continue to decrease as projected. The rate of this decrease is uncertain, as there appears to have been some levelling off of the downward trends in rate for both males and females, as evidenced by the differences between the Nordpred and HD projections.

### *Cancer of the colon, rectum and anus*

Dietary factors, including consumption of fruit, vegetable and fibre, are known to be protective against cancers of the colon and rectum, while obesity, red meat consumption and lack of physical activity are known to be causative factors [64-66]. Screening (which has not yet been introduced on a full population basis in Ireland)

may, in the longer term, also result in a reduction in incidence [67, 68]. The incidence rate for these cancers has remained fairly constant since 1994, with a small increase in colon cancer in males. Consequently, the projected figures are very close to those expected from demographic change. Similar trends are seen in other European countries, although the Netherlands has had a recent increase in incidence [63].

### *Cancer of the liver, biliary tract and gallbladder*

As previously reported, there has been an increase in cholangiocarcinoma incidence in Ireland and other countries [24]. The reasons for this are unclear and some of the increase may be due to improved diagnostic localization. Alcohol abuse is the main aetiological factor for hepatocellular carcinoma, with chronic infective hepatitis being a secondary factor [57]. Viral infection, diabetes and cholelithiasis are possible risk factors for extrahepatic cholangiocarcinoma [69, 70]. All projections suggest a similar increase in rate over the next 25 years, of approximately 2-fold.

### *Cancer of the pancreas*

Tobacco and heavy alcohol intake are important causative factors for cancer of the pancreas [54]. However, unlike some other tobacco-related cancers, female pancreatic cancer rates are not increasing, while there has been a small increase in male rates. However, only about 30% of pancreatic cancers are histologically verified and median survival is only 3 months of diagnosis, so diagnostic accuracy is not as high for this cancer as it is for others [71] and incidence rates are consequently less reliable. Because of the absence of any time trends in the historic data, projections based on the Nordpred, HD and demographic models were all similar.

### *Cancer of the lung*

Tobacco is the cause of the overwhelming majority of lung cancer, although radon is considered to contribute about 8% of the attributable risk [72]. There has been a long-term increase in female lung cancer incidence rates since 1994; however, there has been no increase between 2004 and 2009. Given the gradual decrease in female smoking rates in the 1990s, there is likely to be an eventual levelling-off in female incidence rates. For females, the consequence is that three quite different estimates of future case numbers fit the models reasonably well, with estimates of cases in 2040 ranging from 1693 (HD model 4) to 2830 (HD model 1). The Nordpred model, which assumes the greatest stability of trends over time, gives an estimate of 2260 female cases in 2040, and this intermediate estimate is the most plausible, although possibly an over-estimate if we are seeing the start of a levelling-off in rate. Male rates show a long-term decrease but, again, no real change between 2004 and 2010. For males the HD model gives a higher estimate than the Nordpred model, which lies outside the 95% confidence limits of the HD model.

### *Melanoma of skin*

The primary risk factor for melanoma is UV exposure (including sunbeds), with burning in childhood and adolescence probably more important than total sun exposure [73, 74]. The recent rate of increase in incidence rates for melanoma of skin is greater than for most other common cancers, and almost twice as fast for males as for females. The HD models, which are based on more recent trends, project much higher numbers than either the Nordpred or demographic models.

### *Non-melanoma cancer of skin*

The primary risk factor for non-melanoma cancer of the skin is UV exposure (including sunbeds) [73, 74]. Incidence rates have been increasing since 2001 for both males and females at about 3% annually. Evidence suggests that this is mainly due to recreational exposure [75]. For females the HD and Nordpred models give similar results, but for males the Nordpred estimates are much lower than those given by the HD model.

### *Female breast cancer*

The main risk factors for breast cancer are early age at menarche [76], late age at first birth [77] low parity [76, 77], late menopause [76] and breastfeeding [78]. Obesity [79] and alcohol consumption [80] also significantly increase the risk of female breast cancer. The Nordpred projections lie between the two HD projections for female breast cancer. Projections are difficult for this cancer because of the short-term effects of the introduction of a national breast screening programme, which was rolled out in two phases over a relatively long period between 2000 and 2009. Prior to the screening programme there was an upward trend in both numbers and incidence rate, which would be expected from the trends in earlier menarche and reproductive patterns previously described. It seems likely that this will continue, giving breast cancer numbers somewhat above the demographic model. The Nordpred projection, which is based on long-term trends, is the most plausible under these circumstances.

### *Cancer of the cervix uteri*

The main risk factors for cancer of the cervix are HPV infection, smoking, parity and oral contraceptive use [54, 57]. Changing sexual behaviour and an increase in HPV prevalence are probably the most important factors influencing recent trends in Ireland. However, the incidence is also affected by screening activity. Incidence tends to rise at the beginning of screening, and opportunistic screening may also increase incidence. However, a well-organised population-based programme would be expected to reduce incidence [81]. Although the national screening programme has only recently been introduced in Ireland, opportunistic screening has been occurring for some time at quite a high level. Both the HD and Nordpred projections are similar and suggest a doubling in case numbers between 2010 and 2040. However, the recent introduction of the national screening programme, CervicalCheck, should reduce these numbers.

### *Cancer of the corpus uteri*

Obesity is the best-attested risk factor for cancer of the corpus uteri [82]. The projected increase in numbers and rate is consistent with the reported increase in obesity in the population. The Nordpred projections are higher than those from the HD model and the demographic projections lie between the two.

### *Cancer of ovary*

A number of reproductive and hormonal risk factors have been identified for ovarian cancer. The risk of this cancer reduces with parity, breast-feeding, tubal ligation, hysterectomy and oral contraceptive use (for 5 years or more), but other aspects of the aetiology are still not well understood [83]. The trend in incidence rate has been downward since 1994 and the projected increase in numbers is small. Both the HD and Nordpred models suggest an increase of 34%-44%, much less than the demographic projections.

### *Cancer of prostate*

Age, race, and a family history of prostate cancer are the only established risk factors for prostate cancer. Androgens, diet, physical activity, sexual factors, inflammation, and obesity have been implicated, but their roles remain unclear [84]. There was a rapid increase in prostate cancer cases in the 1990s and early 2000s, due to the widespread use of PSA testing [85], but this trend began to level off around 2004 and return to the rate of increase seen in the early 1990s. Due to the large variations in trend in the past two decades, the projections for this site vary widely and cannot be regarded as currently very reliable.

### *Cancer of kidney and renal pelvis*

Smoking and obesity are the main risk factors for cancer of the kidney [86, 87] although incidental discovery on abdominal imaging is also thought to contribute to rising incidence, especially in females [27, 88]. Cancer of the kidney and renal pelvis is increasing in incidence at a rate greater than that for all cancers combined, and there is consequently a high number of projected cases. For females, the HD and Nordpred projections gave

similar results, but for males the Nordpred projections were much lower than those from the HD method, and not much above the demographic projections. This may have been due to the relatively low incidence rates in 2006 and 2007, and the HD projections are probably more reliable.

### *Cancer of bladder*

Smoking accounts for about 50% of all bladder cancers [89]. Occupational exposures are also risk factors, while the role of diet and environmental pollution are unproven [90]. The incidence of cancer of the bladder is decreasing for both males and females. The Nordpred and HD projections were consistent for females, but different for males and much lower than those for demography only.

### *Cancer of brain and other central nervous system*

Cancers of the brain and other central nervous system are a heterogeneous group, with no common aetiological factors. There was no significant trend in incidence for either females or males. For females the demographic, Nordpred and HD projections were very similar. For males, the demographic projections lay between the HD and Nordpred projections. The Nordpred method projected almost no increase in male brain cancer numbers over the next 20 years.

### *Hodgkin's lymphoma*

The main aetiological agent for Hodgkin's lymphoma is Epstein-Barr virus, but the role of this common infection in the causation of the disease is unclear [91]. The number of incident Hodgkin's lymphomas is small and there are upward trends for both males and females. For females the HD projections were higher than either Nordpred or demographic projections, while for males the HD and Nordpred projections were similar.

### *Non-Hodgkin's lymphoma*

The aetiology of non-Hodgkin's lymphoma is poorly understood, with the only established risk factors being infection and immune dysregulation [92]. Epidemiological studies have suggested that certain environmental and occupational exposures and lifestyle factors may be associated with the risk of NHL; however, these factors are uncommon and can explain only a small portion of NHL cases. The upward trends in non-Hodgkin's lymphoma are almost identical to those for Hodgkin's lymphoma. The projections for HD, Nordpred and demographic models were all quite similar.

### *Leukaemia*

About 50% of leukaemias are of lymphoid cell type and 25% are myeloid [93]. No important common aetiological factors have been identified for either cell type. Recent leukaemia trends in males are downwards, while there was no significant trend for females. Most of the decrease has been in lymphoid leukaemias and those described as "unspecified" [93]. Nordpred and demographic projections were similar for females, and higher than the HD projections. For males, the projections varied widely, with the demographic projections being highest, and the HD projections showing a 50% fall in case numbers by 2040.

## 27. Conclusions

All the models described here project an increase of around one-third in cancer cases in the decade 2015-2025. For females the Nordpred estimate was of an increase of 41% while the HD and demographic projections were close to 30%. For males the figures were a little higher, ranging from 33% (demography) to 47% (Nordpred). Almost all cancer types are expected to increase in number. This almost inevitable increase will place additional burdens on the cancer services, for diagnosis, treatment, support and aftercare.

We have assumed that current trends in incidence will continue into the near future. However, we have seen how, for three common cancers—breast, cervix and prostate—screening has led to a considerable increase in the number of diagnosed cancer cases; screening for colorectal cancer has recently begun and it is to be expected that novel methods of screening for other cancers will appear in the next decade. While some screening may eventually bring about a reduction in health service costs, screening will initially increase case numbers and costs above what might be expected from natural increase. The introduction of each new screening method must therefore be preceded by a careful cost-utility analysis.

With the ageing of the population, and improved life expectancy, the median age of cancer patients at diagnosis will increase. For all invasive cancers combined the percentage of patients aged over 70 is expected to increase, for females, from 31% in 2015 to 44% in 2025 and, for males, from 40% to 51%. As a result there will not only be more cancer patients, but they will be older on average. This older population will have different needs, responses to treatment and susceptibility to side-effects. Clear guidelines on the assessment and treatment of older patients are urgently needed. Clinical trial data on older patients remains quite limited and there is a tendency to under-estimate the capacity of fit older patients to tolerate curative treatments. The combination of increasing incidence and improving survival of cancer patients will place a growing burden of follow-up on the cancer services. With greater life expectancy and better survival, the number of prevalent cases is increasing even faster than incident cases, with clear consequences for surveillance, support and aftercare services.

A further challenge is the growing availability and use of ever more sophisticated and expensive targeted therapy. The proportion of patients having chemotherapy in Ireland increased by 13% between 2000-2004 and 2005-2009, and it is noticeable that most of this increase was in cancers where chemotherapy levels were previously quite low [94]. While the greater efficacy and more widespread use of chemotherapy has contributed to an improvement in survival [94, 95], the high cost of some therapies, particularly those for advanced disease, will need to be balanced against the benefits to the patient, and also against other priorities in cancer care. These decisions will become increasingly difficult as more therapies become available and life expectancy increases; they cannot be based on the length of survival alone, but also on the quality of this survival. The development of expensive therapies and screening interventions has driven a programme of research at the Registry into the economics of cancer care [96-99] both from the patient and the provider perspective. We have, for instance, investigated the cost-effectiveness of different methods of reducing morbidity and mortality from colorectal cancer [100]; is it best to set up a prevention programme, to establish a screening programme, or to provide more surgery, chemotherapy and radiotherapy?

Recognising the importance of outcome measures other than length of survival, the Registry has also developed an extensive programme of research to augment our data with measures such as patient- and carer-reported outcome measures, from physical and psychological well-being and patient experiences of cancer services, through employment issues, supportive care needs and financial problems [101, 102]. Drawing on our database of over 100,000 cancer survivors, we can examine these issues in large, representative population samples. This research continues to give us valuable insights into patient experiences and has allowed us to develop better methods of assessing the quality of service which patients receive. While patients

are generally happy with their quality of care, we have identified a number of remediable shortcomings, particularly in the areas of communication and information.

As noted throughout this report, projections of cancer cases based on existing trends in incidence are limited in their ability to predict the future cancer burden. More sophisticated methods, which can model trends in risk factors and attempt to predict the impact of measures such as programmes of prevention and screening, may be more useful, particularly in informing choices between different interventions such as prevention and screening. However, the overall conclusions from these projections are clear. Although we cannot modify the effects of demographic change, the majority of cancer risk is due to a small number of well-understood and potentially modifiable behaviours—UV exposure, smoking, alcohol consumption, diet and exercise. The majority of HPV infection is also now preventable, although other risk factors, such as hormonal and reproductive factors and *Helicobacter pylori* infection, are less amenable to change. Many of these risk factors are also implicated in the causation of cardiovascular and respiratory disease, and their reduction through programmes of prevention must be a high priority for health policy. Detailed and comprehensive information on risk factor prevalence and its distribution in the population is essential to target and monitor preventive programmes. Such information is patchy, episodic and lacking in detail in Ireland at present, a situation which needs to be addressed.

Obviously, reports such as this are dependent on accurate and comprehensive cancer registration. The National Cancer Registry has operated in Ireland since 1994 with the full cooperation of all health service providers and with the active assistance of histopathology laboratories, HIPE units and many others. In recent times, some hospitals have had to withdraw or reduce their level of assistance to us due to resource limitations, forcing us to partially suspend or restrict cancer registration in these hospitals. We hope that these restrictions will be temporary; we are working with some hospitals on ways of integrating our activities with other cancer data collection by the hospital, to reduce overlap and duplication. We look forward to continuing our productive partnership with all healthcare providers in Ireland, both public and private, in the future, and hope that the projections contained in this report will be of lasting value to them.

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## 29. Appendix

Projections of new cases and percentage increase in numbers by year, sex and cancer site

**Table 29.1 Projected number of new cases: demographic and Nordpred projections**

demographic projections							Nordpred projections					
<b>females</b>	2015	2020	2025	2030	2035	2040	2015	2020	2025	2030	2035	2040
<i>all invasive</i>	14322	16172	18202	20295	22368	24287	14602	17624	20647	23670	26693	29715
<i>all invasive excluding NMSC</i>	10192	11471	12849	14233	15576	16787	10362	12225	14087	15950	17813	19676
<i>head and neck</i>	139	183	204	225	245	264	165	214	262	310	358	406
<i>oesophagus</i>	154	177	205	237	271	305	134	164	194	224	254	283
<i>stomach</i>	221	253	291	333	378	423	196	219	242	264	287	310
<i>colon</i>	818	937	1075	1226	1382	1529	802	947	1092	1237	1382	1526
<i>rectum</i>	367	417	475	535	594	648	343	417	490	564	637	711
<i>hepatobiliary</i>	161	185	213	246	281	315	163	196	228	260	293	325
<i>pancreas</i>	275	316	366	423	482	540	263	322	381	440	498	557
<i>lung</i>	1013	1161	1334	1515	1694	1862	1068	1307	1545	1784	2022	2260
<i>melanoma of skin</i>	500	554	607	659	713	766	564	658	752	846	940	1034
<i>non-melanoma skin</i>	4131	4701	5353	6062	6791	7500	4275	5474	6673	7872	9070	10269
<i>breast</i>	3209	3577	3937	4252	4514	4701	3494	4024	4555	5085	5615	6146
<i>cervix</i>	327	350	361	365	372	379	361	410	459	507	556	604
<i>corpus uteri</i>	423	479	537	593	643	680	472	525	578	631	684	738
<i>ovary</i>	407	459	515	569	619	662	392	416	439	462	485	509
<i>kidney</i>	210	238	268	299	330	359	241	293	345	397	449	501
<i>bladder</i>	157	180	207	237	270	302	145	156	166	176	186	196
<i>brain and CNS</i>	170	188	209	229	249	267	175	200	224	248	272	297
<i>Hodgkin's lymphoma</i>	57	59	62	64	67	69	53	57	60	64	68	72
<i>Non-Hodgkin's lymphoma</i>	341	385	433	482	528	570	359	413	467	520	574	627
<i>leukaemia</i>	225	251	282	314	347	379	226	258	290	322	354	386
<b>males</b>	2015	2020	2025	2030	2035	2040	2015	2020	2025	2030	2035	2040
<i>all invasive</i>	17008	19692	22658	25775	28855	31704	15916	19643	23370	27097	30824	34551
<i>all invasive excluding NMSC</i>	11816	13635	15639	17734	19784	21655	10971	13252	15534	17815	20097	22378
<i>head and neck</i>	436	494	555	615	668	708	462	542	621	700	779	858
<i>oesophagus</i>	296	342	393	449	501	549	263	313	364	415	465	516
<i>stomach</i>	399	467	542	621	699	773	339	387	435	483	531	579
<i>colon</i>	1033	1210	1409	1620	1829	2030	974	1136	1297	1458	1620	1781
<i>rectum</i>	653	755	868	984	1094	1194	567	651	734	818	901	985
<i>hepatobiliary</i>	221	257	298	340	382	421	215	274	332	391	449	507
<i>pancreas</i>	299	349	404	463	524	580	269	333	397	461	525	590
<i>lung</i>	1477	1728	2012	2314	2610	2889	1232	1383	1534	1685	1836	1987
<i>melanoma of skin</i>	398	452	508	565	622	674	441	533	625	716	808	900
<i>non-melanoma skin</i>	5192	6057	7020	8041	9071	10049	5011	6502	7993	9483	10974	12465
<i>prostate</i>	3541	4091	4687	5307	5908	6426	3303	5141	6980	8818	10657	12495
<i>kidney</i>	372	425	481	537	589	633	383	456	528	600	673	745
<i>bladder</i>	397	470	555	647	745	838	290	302	314	326	338	350
<i>brain and CNS</i>	225	250	276	301	325	345	211	216	220	225	230	234
<i>Hodgkin's lymphoma</i>	73	78	81	84	87	90	79	84	89	93	98	103
<i>Non-Hodgkin's lymphoma</i>	416	471	529	586	639	688	411	455	499	542	586	630
<i>leukaemia</i>	349	398	453	511	567	620	293	314	335	355	376	396

Table 29.2 Projected number of new cases: Hakulinen/Dyba models with 95% confidence limits

	Hakulinen-Dyba projections±95% confidence limits					
<b>females</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>	<b>2035</b>	<b>2040</b>
<i>all invasive</i>	14271±296	16155±323	18284±353	20461±385	22580±417	24548±450
<i>all invasive excluding NMSC</i>	9768±529	10754±988	11785±1552	12702±2196	13397±2882	13676±3492
<i>head and neck</i>	157±26	177±27	198±29	220±31	241±33	259±34
<i>oesophagus</i>	154±29	167±33	183±40	201±49	218±59	233±70
<i>stomach</i>	197±32	205±36	214±41	224±48	231±55	236±62
<i>colon</i>	811±59	928±63	1066±69	1216±75	1370±81	1518±87
<i>rectum</i>	367±44	413±53	465±66	519±82	572±101	620±123
<i>hepatobiliary</i>	157±26	179±27	205±29	235±32	267±34	298±36
<i>pancreas</i>	260±36	296±43	340±54	390±68	442±85	492±106
<i>lung (model 1)</i>	1108±75	1366±93	1682±116	2042±146	2429±182	2830±224
<i>lung (model 4)</i>	916±63	1053±68	1210±74	1374±79	1538±85	1693±90
<i>melanoma of skin</i>	620±57	757±70	911±85	1081±104	1269±126	1476±152
<i>non-melanoma skin</i>	4848±215	6069±331	7565±488	9274±689	11143±938	13138±1232
<i>breast(model 1)</i>	3631±153	4333±194	5117±247	5894±309	6639±379	7291±456
<i>breast(model 4)</i>	3044±124	3383±132	3735±140	4042±148	4289±155	4472±160
<i>cervix</i>	399±49	441±59	480±70	511±82	542±95	569±110
<i>corpus uteri</i>	393±41	443±44	495±47	547±49	593±52	627±54
<i>ovary</i>	377±45	403±53	430±63	452±75	467±87	474±99
<i>kidney</i>	186±28	210±30	236±32	262±34	288±36	312±38
<i>bladder</i>	148±28	153±31	160±36	166±41	171±47	173±52
<i>brain and CNS</i>	165±26	183±28	203±29	222±31	241±32	258±33
<i>Hodgkin's lymphoma</i>	67±17	71±17	73±18	77±18	81±19	84±19
<i>Non-Hodgkin's lymphoma</i>	320±37	360±39	405±42	451±44	494±47	533±49
<i>leukaemia</i>	197±33	210±38	224±46	239±55	252±65	263±75
<b>males</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>	<b>2035</b>	<b>2040</b>
<i>all invasive</i>	18880±341	21640±375	24858±416	28387±464	32026±519	35561±575
<i>all invasive excluding NMSC</i>	12757±280	14605±309	16753±342	19097±381	21500±425	23822±471
<i>head and neck</i>	448±49	498±59	551±73	603±90	649±108	684±128
<i>oesophagus</i>	342±38	390±41	446±45	509±48	571±52	631±56
<i>stomach</i>	393±46	410±52	428±61	445±71	457±81	463±92
<i>colon</i>	1158±70	1331±76	1537±83	1764±90	1998±97	2230±104
<i>rectum</i>	714±62	794±76	886±94	981±116	1069±143	1146±171
<i>hepatobiliary</i>	224±31	256±34	295±36	336±39	380±43	423±46
<i>pancreas</i>	338±38	387±41	446±45	511±48	581±53	650±57
<i>lung</i>	1538±100	1677±124	1834±156	1992±195	2132±238	2245±283
<i>melanoma of skin</i>	564±56	724±71	914±90	1137±114	1381±146	1645±184
<i>non-melanoma skin</i>	7273±267	9331±418	11886±628	14943±910	18407±1281	22140±1730
<i>prostate</i>	3436±205	3959±231	4560±262	5222±299	5907±342	6563±387
<i>kidney</i>	353±39	373±40	389±41	397±42	403±42	410±43
<i>bladder</i>	413±47	417±52	424±59	429±67	432±75	426±82
<i>brain and CNS</i>	241±36	270±44	304±55	345±70	393±88	451±110
<i>Hodgkin's lymphoma</i>	81±19	86±19	91±20	95±21	100±22	105±23
<i>Non-Hodgkin's lymphoma</i>	424±43	477±46	537±49	599±52	658±55	713±59
<i>leukaemia</i>	265±47	229±58	198±67	171±73	147±75	124±75

Table 29.3 Projected % increase in number of new cases: demographic, Hakulinen/Dyba and Nordpred models																		
	demographic projections						Hakulinen/Dyba projections						Nordpred projections					
females	2015	2020	2025	2030	2035	2040	2015	2020	2025	2030	2035	2040	2015	2020	2025	2030	2035	2040
all invasive	9%	23%	38%	54%	70%	84%	8%	23%	39%	55%	71%	86%	11%	34%	57%	80%	102%	125%
all invasive exc NMSC	10%	24%	39%	54%	68%	81%	5%	16%	27%	37%	45%	48%	12%	32%	52%	72%	92%	112%
head and neck	-22%	3%	15%	26%	38%	48%	-12%	-1%	11%	23%	35%	46%	-7%	20%	47%	74%	101%	128%
oesophagus	21%	39%	61%	86%	113%	140%	21%	32%	44%	58%	72%	84%	6%	29%	53%	76%	100%	123%
stomach	24%	42%	63%	87%	112%	138%	11%	15%	20%	26%	30%	32%	10%	23%	36%	49%	61%	74%
colon	16%	33%	53%	74%	97%	118%	15%	32%	52%	73%	95%	116%	14%	35%	55%	76%	97%	117%
rectum	9%	23%	40%	58%	76%	92%	9%	22%	38%	54%	69%	83%	2%	23%	45%	67%	89%	110%
hepatobiliary	23%	41%	63%	88%	115%	141%	20%	37%	57%	80%	104%	127%	25%	49%	74%	99%	123%	148%
pancreas	34%	54%	79%	106%	135%	164%	27%	44%	66%	90%	115%	140%	28%	57%	86%	114%	143%	172%
lung (model 1)	6%	21%	39%	58%	77%	95%	16%	43%	76%	113%	154%	196%	12%	37%	61%	86%	111%	136%
lung (model 4)	6%	21%	39%	58%	77%	95%	-4%	10%	26%	44%	61%	77%	12%	37%	61%	86%	111%	136%
melanoma of skin	-7%	3%	13%	23%	33%	43%	16%	41%	70%	102%	137%	175%	5%	23%	40%	58%	75%	93%
non-melanoma skin	5%	20%	37%	55%	73%	91%	24%	55%	93%	137%	184%	235%	9%	40%	70%	101%	131%	162%
breast(model 1)	11%	24%	36%	47%	56%	63%	26%	50%	77%	104%	130%	152%	21%	39%	58%	76%	94%	113%
breast(model 4)	11%	24%	36%	47%	56%	63%	5%	17%	29%	40%	48%	55%	21%	39%	58%	76%	94%	113%
cervix	2%	9%	13%	14%	16%	18%	24%	38%	49%	59%	69%	77%	13%	28%	43%	58%	73%	88%
corpus uteri	9%	23%	38%	53%	66%	75%	1%	14%	28%	41%	53%	62%	22%	35%	49%	63%	76%	90%
ovary	15%	30%	46%	61%	75%	87%	7%	14%	22%	28%	32%	34%	11%	18%	24%	31%	38%	44%
kidney	6%	20%	35%	51%	67%	81%	-6%	6%	19%	33%	46%	58%	22%	48%	74%	101%	127%	153%
bladder	32%	51%	74%	99%	127%	154%	24%	29%	34%	39%	43%	45%	22%	31%	39%	48%	56%	65%
brain and CNS	-7%	3%	14%	25%	36%	46%	-10%	0%	11%	22%	32%	41%	-4%	9%	22%	36%	49%	62%
Hodgkin's lymphoma	-12%	-9%	-5%	-1%	3%	7%	4%	9%	13%	18%	24%	30%	-19%	-13%	-7%	-1%	5%	11%
Non-Hodgkin's lymphoma	8%	22%	37%	52%	66%	80%	1%	14%	28%	42%	56%	68%	13%	30%	47%	64%	81%	98%
leukaemia	12%	25%	40%	56%	72%	88%	-2%	4%	11%	19%	25%	31%	12%	28%	44%	60%	76%	92%
males	2015	2020	2025	2030	2035	2040	2015	2020	2025	2030	2035	2040	2015	2020	2025	2030	2035	2040
all invasive	11%	29%	48%	69%	89%	107%	23%	41%	63%	86%	109%	133%	4%	28%	53%	77%	102%	126%
all invasive exc NMSC	13%	31%	50%	70%	90%	108%	22%	40%	61%	83%	106%	128%	5%	27%	49%	71%	93%	114%
head and neck	6%	20%	35%	49%	62%	72%	9%	21%	34%	46%	58%	66%	12%	31%	51%	70%	89%	108%
oesophagus	22%	41%	62%	85%	106%	126%	41%	61%	84%	109%	135%	160%	8%	29%	50%	71%	91%	112%
stomach	9%	28%	49%	71%	92%	112%	8%	13%	18%	22%	26%	27%	-7%	6%	19%	33%	46%	59%
colon	19%	39%	62%	86%	110%	133%	33%	53%	76%	102%	129%	156%	12%	30%	49%	67%	86%	104%
rectum	17%	35%	56%	76%	96%	114%	28%	42%	59%	76%	92%	105%	2%	17%	32%	47%	62%	77%
hepatobiliary	11%	29%	50%	71%	92%	111%	13%	29%	48%	69%	91%	113%	8%	38%	67%	96%	126%	155%
pancreas	16%	35%	57%	79%	103%	125%	31%	50%	73%	98%	125%	152%	4%	29%	54%	79%	104%	129%
lung	13%	32%	54%	77%	100%	121%	18%	28%	40%	52%	63%	72%	-6%	6%	17%	29%	40%	52%
melanoma of skin	3%	17%	32%	47%	62%	75%	46%	88%	138%	195%	259%	327%	15%	38%	62%	86%	110%	134%
non-melanoma skin	7%	25%	44%	65%	87%	107%	50%	92%	145%	208%	279%	356%	3%	34%	64%	95%	126%	157%
prostate	10%	27%	45%	65%	83%	99%	7%	23%	42%	62%	83%	104%	3%	60%	117%	174%	231%	288%
kidney	12%	28%	45%	62%	77%	91%	6%	12%	17%	20%	21%	24%	15%	37%	59%	81%	103%	124%
bladder	24%	47%	73%	102%	133%	162%	29%	30%	32%	34%	35%	33%	-10%	-6%	-2%	2%	6%	9%
brain and CNS	24%	38%	52%	66%	80%	91%	33%	49%	68%	90%	117%	149%	17%	19%	22%	24%	27%	30%
Hodgkin's lymphoma	1%	7%	11%	15%	19%	23%	11%	18%	24%	31%	37%	44%	8%	15%	21%	28%	35%	41%
Non-Hodgkin's lymphoma	7%	21%	36%	50%	64%	76%	9%	22%	38%	54%	69%	83%	5%	17%	28%	39%	50%	62%
leukaemia	22%	39%	59%	79%	98%	117%	-7%	-20%	-31%	-40%	-49%	-57%	3%	10%	17%	24%	31%	39%





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