Cancer projections 2005-2035

National Cancer Registry

National Cancer Registry Ireland

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Summary

Introduction

In 2006 the National Cancer Registry published projections of cancer numbers to 2020, based on trends from 1994-2003 and population projections to 2036 (1). With the availability of revised population projections (2) and some additional years of incidence data, we have decided to revise these projections.

Current trends in incidence

Trends in cancer numbers depend on two factors—the underlying risk of developing cancer and the number of persons at risk. The underlying risk of cancer is best estimated from age-standardised incidence rates; recent trends in these rates for the commoner cancers are given in Table S1.

Table S1. Trends in cancer incidence rates 1994-2006
Figures in bold indicate statistically significant trends (p<.05).

	females		males	
cancer site	**period**	**annual percentage change (95% confidence limits)**	**period**	**annual percentage change (95% confidence limits)**
all invasive cancers (C00-C96)	1994-2006	**0.8% (0.5%, 1.1%)**	1994-2006	**0.8% (0.4%, 1.1%)**
all invasive cancers (C00-C96) excluding non-melanoma skin (C44)	1994-2006	**0.8% (0.5%, 1.2%)**	1994-2006	**1.1% (0.7%, 1.5%)**
head and neck (C01-C14)	1994-2006	1.2% (-0.4%, 2.9%)	1994-2002	**-5.6% (-7.5%, -3.6%)**
			2002-2006	4.9% (-1.0%, 11.1%)
oesophagus (C15)	1994-2006	**-1.3% (-2.5%, 0.0%)**	1994-2006	0.1% (-1.4%, 1.5%)
stomach (C16)	1994-2006	**-2.2% (-2.9%, -1.5%)**	1994-2006	**-2.5% (-3.0%, -2.0%)**
colorectal (C18-C21)	1994-2006	0.0% (-0.6%, 0.7%)	1994-2006	0.0% (-0.3%, 0.3%)
pancreas (C25)	1994-2006	0.5% (-0.9%, 1.9%)	1994-2006	-0.3% (-1.5%, 0.9%)
lung (C34)	1994-2006	**2.2% (1.6%, 2.7%)**	1994-2006	**-1.2% (-1.7%, -0.7%)**
melanoma of skin (C43)	1994-2006	**2.3% (1.2%, 3.4%)**	1994-2006	**4.2% (3.0%, 5.4%)**
non-melanoma skin (C44)	1994-2006	**0.7% (0.0%, 1.3%)**	1994-2002	**-1.8% (-2.9%, -0.6%)**
			2002-2006	**2.9% (1.1%, 4.8%)**
female breast (C50)	1994-1999	1.3% (0.0%, 2.7%)		
	1999-2002	5.1% (-0.5%, 11.0%)		
	2002-2006	**-2.0% (-3.5%, -0.4%)**		
gynaecological (C51-C58)	1994-2006	**0.6% (0.0%, 1.2%)**		
prostate (C61)			1994-2004	**7.9% (6.6%, 9.2%)**
			2004-2006	-5.3% (-16.1%, 7.0%)
kidney (C64)	1994-2006	**3.7% (2.3%, 5.1%)**	1994-2002	**5.5% (2.8%, 8.3%)**
			2002-2006	-3.3% (-9.3%, 3.2%)
bladder (C67)	1994-2006	-1.3% (-3.2%, 0.6%)	1994-2006	**-2.1% (-2.9%, -1.4%)**
brain and central nervous system (C70-C72)	1994-2006	0.4% (-1.4%, 2.2%)	1994-2006	0.3% (-0.5%, 1.0%)
lymphoma (C81-C85)	1994-2006	**1.6% (0.4%, 2.8%)**	1994-2006	**1.7% (0.8%, 2.6%)**
leukaemia (C91-C95)	1994-2006	-0.2% (-2.0%, 1.7%)	1994-2004	**2.9% (1.4%, 4.5%)**
			2004-2006	-13.4% (-28.3%, 4.5%)

There have been statistically significant increases for both sexes in rates for all invasive cancers combined, both including and excluding non-melanoma skin cancer. Statistically significant increases in rate have occurred over the period 1994-2006 for lung cancer, melanoma and non-melanoma cancers of the skin, gynaecological cancers, cancers of kidney and lymphoma for women and for melanoma of skin and lymphoma in men.

For women, there were significant overall decreases in rate for oesophageal and stomach cancer, and for men there were decreases in rate for cancers of the stomach, lung and bladder.

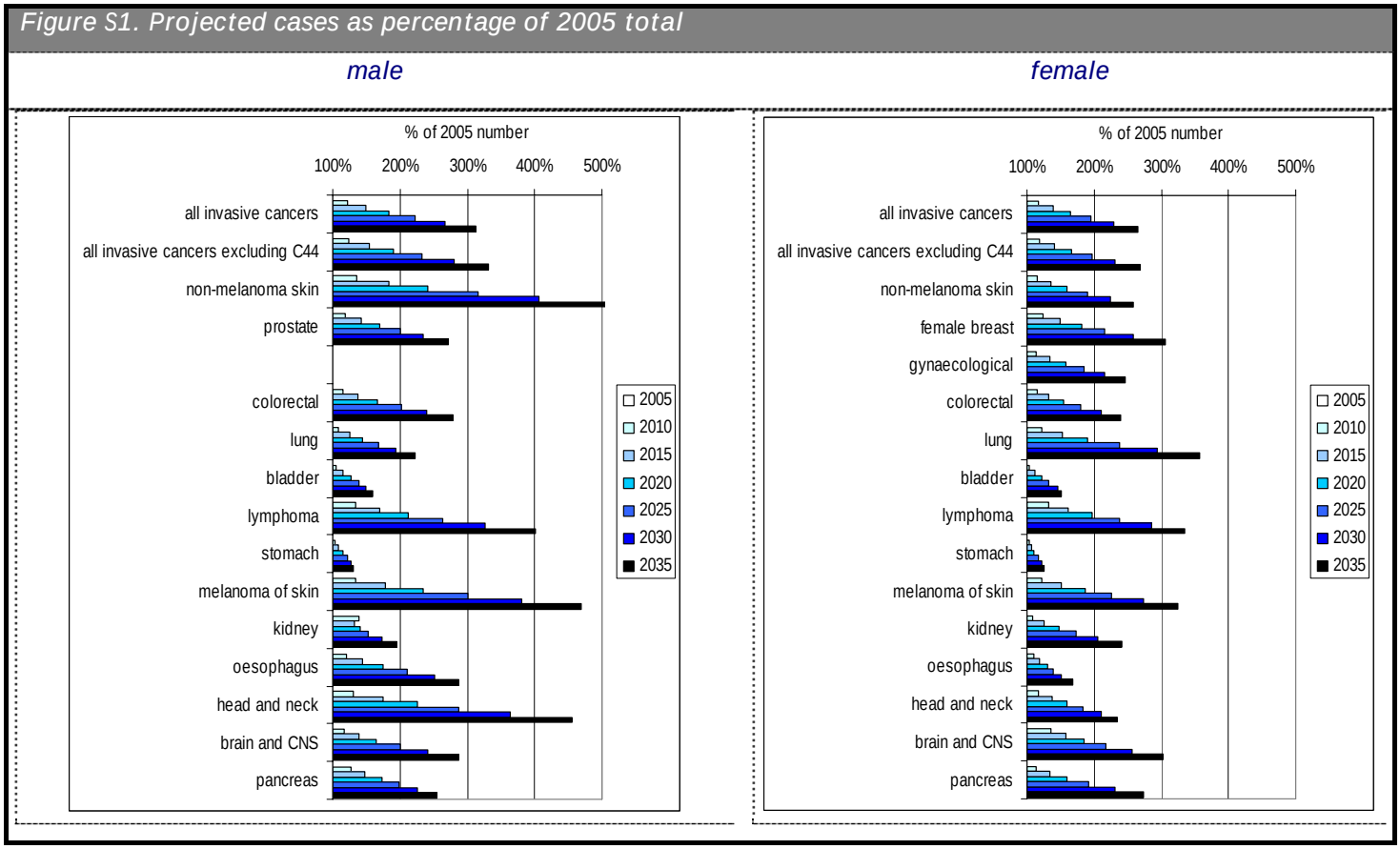
The time trends for a number of cancers changed during the period studied. Cancer of the breast in women showed a slow rate of increase from 1994 to 1999 (1.3% per year) which accelerated to 5.1% per year in 1999-2002, and then fell by 2.0% per year between 2002 and 2006. Cancer of the prostate increased rapidly (7.9% per year) between 1994 and 2004 but appears now to be falling in rate. For men, cancers of the head and neck, non-melanoma skin cancer, kidney cancer and leukaemia all showed reversals of the incidence trend during the period studied. With the exception of female breast and non-melanoma skin cancer, the more recent trends were not statistically significant.

Projections

Between 2005 and 2035, the overall number of invasive cancers is projected to increase by 17063 (165%, 6% annually) for females and by 24809 (213%, 7% annually) for males (Table S2, Figure S1). If non-melanoma cancer of the skin is excluded, over the same period the number of invasive cancers is projected to increase by 12479 (168%, 6% annually) for females and by 19139 (232%, 8% annually) for males.

Over the ten-year period 2010 to 2020, the total number of cancers is projected to increase by 40% for women and by just over 50% for men. An increase is expected in the numbers of all common cancer types, ranging from 1% for kidney cancer to 78% for non-melanoma skin cancer in men, and from 6% for stomach cancer to 66% for kidney cancer in women.

Figure S1. Projected cases as percentage of 2005 total



Over the period 2010 to 2030 the projected overall increase in numbers is 95% for women and 120% (127% excluding non-melanoma skin cancer) for men, with the largest increases being expected in skin cancers (melanoma and non-melanoma) in men and kidney cancer in women. By 2025, the number of lung cancers in women is projected to exceed the number in men.

As noted in the previous report, most of the projected increase is attributable to expected demographic change. Although the size of the national population is projected to increase by 37% between 2010 and 2030, the number aged over 65 (the great majority of cancer patients) is expected to increase by 90% for females and 112% for males (2). This demographic change alone (assuming no change in underlying cancer rates) would increase the number of invasive cancer cases in females by 12338 and by 19882 in males between 2005 and 2035.

Table S2.Actual case numbers for 2005 and projected case numbers 2010-2035 (± 95% prediction intervals)

site	sex	2005	2010	2015	2020	2025	2030	2035	% increase 2010-2020	% increase 2010-2030
all invasive cancers (C00-C96)	female	10341	12165 ± 281	14380 ± 379	17024 ± 519	20127 ± 703	23708 ± 942	27404 ± 1236	40%	95%
	male	11632	14118 ± 305	17418 ± 430	21355 ± 616	25922 ± 878	31072 ± 1232	36441 ± 1696	51%	120%
all invasive cancers (C00-C96) excluding non-melanoma skin (C44)	female	7439	8838 ± 239	10460 ± 324	12387 ± 441	14632 ± 596	17230 ± 796	19918 ± 1038	40%	95%
	male	8239	10222 ± 259	12727 ± 365	15723 ± 522	19199 ± 741	23169 ± 1038	27378 ± 1424	54%	127%
head and neck (C01-C14)	female	83	97 ± 25	114 ± 34	133 ± 46	152 ± 62	175 ± 83	194 ± 108	37%	80%
	male	194	255 ± 68	338 ± 133	440 ± 222	557 ± 339	707 ± 492	884 ± 682	73%	177%
oesophagus (C15)	female	120	132 ± 30	143 ± 41	156 ± 57	168 ± 80	181 ± 110	202 ± 149	18%	37%
	male	214	257 ± 41	310 ± 58	374 ± 84	452 ± 119	537 ± 167	613 ± 227	46%	109%
stomach (C16)	female	167	174 ± 33	179 ± 40	185 ± 49	195 ± 61	204 ± 74	209 ± 87	6%	17%
	male	286	294 ± 43	312 ± 54	331 ± 68	350 ± 85	365 ± 103	372 ± 121	13%	24%
colorectal (C18-C21)	female	888	1020 ± 82	1176 ± 111	1367 ± 154	1601 ± 211	1867 ± 287	2128 ± 381	34%	83%
	male	1223	1402 ± 97	1687 ± 137	2035 ± 199	2464 ± 284	2938 ± 398	3409 ± 545	45%	110%
pancreas (C25)	female	207	235 ± 39	278 ± 53	331 ± 74	398 ± 102	477 ± 139	565 ± 187	41%	103%
	male	177	224 ± 40	262 ± 56	306 ± 83	353 ± 121	401 ± 172	451 ± 242	37%	79%
lung (C34)	female	741	904 ± 76	1131 ± 102	1413 ± 140	1763 ± 190	2182 ± 254	2642 ± 331	27%	61%
	male	1090	1180 ± 91	1326 ± 130	1493 ± 189	1697 ± 273	1904 ± 387	2104 ± 531	32%	78%
melanoma of skin (C43)	female	360	438 ± 52	545 ± 69	671 ± 92	816 ± 122	983 ± 159	1170 ± 204	53%	124%
	male	246	329 ± 45	440 ± 61	576 ± 83	740 ± 114	935 ± 154	1153 ± 205	75%	184%
non-melanoma skin (C44)	female	2092	3328 ± 147	3924 ± 199	4642 ± 273	5502 ± 373	6489 ± 504	7504 ± 669	39%	95%
	male	3393	4616 ± 253	6197 ± 471	8208 ± 788	10751 ± 1227	13786 ± 1815	17181 ± 2580	78%	199%
female breast (C50) based on 1994-1996	female	2196	2720 ± 359	3294 ± 542	3976 ± 773	4752 ± 1056	5670 ± 1411	6724 ± 1818	46%	108%
female breast (C50) based on 2002-2006	female	2196	2696 ± 157	2781 ± 137	3040 ± 315	3484 ± 623	4123 ± 1100	4833 ± 1771	13%	53%
gynaecological (C51-C58)	female	1002	1146 ± 86	1350 ± 117	1587 ± 157	1850 ± 210	2154 ± 277	2464 ± 356	38%	88%
prostate (C61)	male	2415	no projection possible							
kidney (C64)	female	148	185± 34	240 ± 45	307 ± 60	384 ± 80	477 ± 105	578 ± 135	66%	158%
	male	227	316 ± 56	302 ± 45	318 ± 103	347 ± 191	393 ± 313	445 ± 445	1%	24%
bladder (C67)	female	143	147 ± 31	160 ± 43	174 ± 60	190 ± 83	208 ± 114	216 ± 152	18%	41%
	male	331	350 ± 47	383 ± 61	420 ± 80	460 ± 105	497 ± 133	529 ± 166	20%	42%
brain and central nervous system (C70-C72)	female	118	161 ± 33	187 ± 44	219 ± 60	257 ± 80	303 ± 105	357 ± 135	36%	88%
	male	188	221 ± 39	261 ± 53	311 ± 72	377 ± 98	454 ± 131	539 ± 171	41%	105%
lymphoma (C81-C85)	female	274	363 ± 48	443 ± 64	539 ± 86	652 ± 115	782 ± 151	919 ± 194	48%	115%
	male	327	441 ± 53	553 ± 73	692 ± 101	862 ± 138	1070 ± 188	1314 ± 247	57%	143%
leukaemia (C91-C95)	female	94	193 ± 36	221 ± 49	252 ± 67	287 ± 90	329 ± 120	384 ± 159	31%	70%
	male	116	no projection possible							

As the older male population is expected to increase more rapidly than the corresponding female population, numbers of almost all cancers are expected to increase more rapidly for men than for women (Figure 1).This demographic effect is expected to account for 72% of the expected increase in numbers in females and 80% in males.

The contribution of demography to trends in the individual cancer types will depend on the underlying trend in incidence. For colorectal cancer, for instance, there is no current upward or downward trend, and so demography will contribute about 95% of the expected increase. For lung cancer in women, on the other hand, demography will contribute only 51% of the expected increase, the rest being attributable to the underlying upward trend in female lung cancer risk. For men, the projected increase in lung cancer numbers is only 56% of that predicted by demography alone, as lung cancer risk is already declining in men.

Conclusions

As noted in our previous report (1), the number of newly diagnosed cancers is increasing by 6-7% annually and, unless major reversals of trends occur in the near future, the number is likely to double in the next 20 years. The underlying risk of developing cancer is increasing by less than 1% annually and the expected increase in numbers is primarily attributable to the projected rise in our older population. Given that both our knowledge of the modifiable causes of cancer (3) and our ability to change these are both limited, immediate action to reduce cancer risk is unlikely to have a major impact at the population level. However, specific problems, particularly the continuing rise in smoking-related cancers in women, will need decisive action.

The projected increase in non-melanoma skin cancers in men is difficult to interpret. These cancers occur mainly in an elderly population and there are well-known problems in identifying all of them. The recent trends in men may be due to better diagnosis and ascertainment rather than to a real increase in risk. The increase in melanoma, on the other hand, is likely to be real, and suggests that consideration should be given to programmes focussed on earlier diagnosis and better awareness of sun risk. The expected increase in head and neck cancers in men is based on a recent upturn in incidence rates, which may not be sustained. However, this may represent an increase in HPV-related oropharyngeal cancers, as most of the recent increase in male head and neck cancer has been in the oropharynx (data not shown).

The limitations of projections of this kind can be seen for the two commonest cancers—breast and prostate. The models used assume that fluctuations in cancer risk occur slowly and predictably; while this is generally true for aetiological factors, health care interventions such as innovations in diagnosis, screening or treatment may happen on a much shorter time-scale. Screening, in particular, gives rise to an initial increase in cancer numbers, as cancers which would have been picked up symptomatically over a number of years are diagnosed over a much shorter period during the first screening round. Once these prevalent cancers have been detected, the incidence rate tends to settle back to the pre-screening level, or to somewhat above it if over-diagnosis is occurring.

The expected effect of demography on cancer numbers is striking, but not specific to cancer. The burden of many diseases is expected to increase dramatically in the next 20 years, with clear consequences for the provision of services (4). The changing demography of cancer patients will also pose challenges in diagnosis and treatment. We have previously noted the low levels of treatment of the elderly in the Irish population compared to other countries (5), and there is a well-recognised scarcity of clinical trial evidence for older patients (6). The clear improvements in cancer survival seen over the last twenty years (7) and our improving life expectancy (2) will contribute to continuing falls in mortality, despite an increase in disease burden, but will also result in an increasing number of ageing cancer survivors in the population.

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Methods

Introduction and disclaimer

This report presents extrapolations of National Cancer Registry incidence data for 1994-2006 to the years 2010-2035. These extrapolations are statistical procedures, based on two assumptions:

- that the data collected are adequate for the production of accurate estimates of time trends in incidence;
- that the trends observed to date will continue unchanged for the next 25 years.

Details of this methodology, and its limitations, have been given in a previous report (1). The models used in this report were mainly linear, fitted as described previously. Linear models assume that incidence rates and case numbers change by a fixed amount annually, while log-linear models assume that they change by a fixed percentage (exponentially). Over short periods, or when the underlying rate trend is small, the difference in prediction between linear and log-linear models is small. However, over longer periods an assumption of exponential increase is rarely justified in practice and, as the majority of cancers are increasing in rate, linear models have been used in this report in almost all cases. Some exceptions have been made to this practice, if the use of a linear model with decreasing incidence rates gave unrealistic estimates (sometimes with negative numbers of cases).

Model fitting and projection

The models used (linear or log-linear) and the baseline period on which the projections were based are listed for each cancer in Table 1.

Table 1. Models and baseline period used for projections

	females		**males**	
cancer site	model type	baseline period	model type	baseline period
all invasive cancers (C00-C96)	linear	1994-2006	linear	1994-2006
all invasive cancers (C00-C96) excluding non-melanoma skin (C44)	linear	1994-2006	linear	1994-2006
head and neck (C01-C14)	linear	1994-2006	linear	2002-2006
oesophagus (C15)	linear	1994-2006	linear	1994-2006
stomach (C16)	log-linear	1994-2006	log-linear	1994-2006
colorectal (C18-C21)	linear	1994-2006	linear	1994-2006
pancreas (C25)	linear	1994-2006	linear	1994-2006
lung (C34)	linear	1994-2006	linear	1994-2006
melanoma of skin (C43)	linear	1994-2006	linear	1994-2006
non-melanoma skin (C44)	linear	1994-2006	linear	1994-2001
			linear	2001-2006
female breast (C50)	linear	1994-1999		
	log-linear	2003-2006		
gynaecological (C51-C58)	linear	1994-2006		
prostate (C61)			no model fitted	
kidney (C64)	linear	1994-2006	log-linear	2002-2006
bladder (C67)	linear	1994-2006	log-linear	1994-2006
brain and central nervous system (C70-C72)	linear	1994-2006	linear	1994-2006
lymphoma (C81-C85)	linear	1994-2006	linear	1994-2006
leukaemia (C91-C95)	linear	1994-2006	no model fitted	

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The projections are based, as in the previous work, on modelling of the 1994-2006 cancer incidence data using the method of Hakulinen and Dyba (8, 9). The previous report assumed a constant trend in rates over the years modelled (1994-2003). As the data available for the current report covers a longer period, the trends have been tested for linearity using the Joinpoint software (10, 11). In all but a small number of instances, the rates for 1994-2006 fitted a linear trend. Where the Joinpoint programme showed a change in trend, the model was fitted only to the most recent linear section, provided that this extended over at least five years. If the trend extended over a shorter period, no attempt was made to fit a model. This was the case for prostate cancer and for leukaemia in males.

Poisson models were fitted to age-specific cancer incidence rates for the age groups 0-44, 45-54, 55-64, 65-74, 75-84 and 85 and over. The parameters produced by these models were used to calculate estimated age-specific rates for the age groups mentioned, for the years 2010, 2015, 2020, 2025, 2030 and 2035. The age-specific rates were then used to calculate future case numbers, using Central Statistics Office population projections to 2041 (2). The projection "M1F1" was used, which gives the highest potential estimate of numbers. However, most of the difference in population projections is in the younger age groups, and the different population projections do not have a major impact on cancer numbers.

The model provides 95% confidence limits of the estimates, based on the uncertainty in the model parameters, and 95% prediction intervals, which include an additional uncertainty term based on the Poisson uncertainty of the individual case number estimates. The 95% prediction intervals, which are given here, are a truer estimate of the uncertainty of the prediction.

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Recent trends in incidence

Trends in age-standardised incidence rates for the commoner cancers are shown in Table 2. There have been statistically significant increases in rates for all invasive cancers for both sexes, both including and excluding non-melanoma skin cancers. Statistically significant overall rate increases occurred for women in lung cancer, melanoma and non-melanoma cancers of the skin, gynaecological cancers, cancers of kidney and lymphoma, and for men in melanoma of skin and lymphoma. For women, there were significant overall decreases in rate for oesophageal and stomach cancer, while for men there were decreases in rate for cancers of the stomach, lung cancer and bladder cancer.

Table 2. Trends in cancer incidence rates 1994-2006
Figures in bold indicate statistically significant trends (p<.05).

	females		males	
cancer site	**period**	**annual percentage change (95% confidence limits)**	**period**	**annual percentage change (95% confidence limits)**
all invasive cancers (C00-C96)	1994-2006	**0.8% (0.5%, 1.1%)**	1994-2006	**0.8% (0.4%, 1.1%)**
all invasive cancers (C00-C96) except non-melanoma skin (C44)	1994-2006	**0.8% (0.5%, 1.2%)**	1994-2006	**1.1% (0.7%, 1.5%)**
head and neck (C01-C14)	1994-2006	1.2% (-0.4%, 2.9%)	1994-2002	**-5.6% (-7.5%, -3.6%)**
			2002-2006	4.9% (-1.0%, 11.1%)
oesophagus (C15)	1994-2006	**-1.3% (-2.5%, 0.0%)**	1994-2006	0.1% (-1.4%, 1.5%)
stomach (C16)	1994-2006	**-2.2% (-2.9%, -1.5%)**	1994-2006	**-2.5% (-3.0%, -2.0%)**
colorectal (C18-C21)	1994-2006	0.0% (-0.6%, 0.7%)	1994-2006	0.0% (-0.3%, 0.3%)
pancreas (C25)	1994-2006	0.5% (-0.9%, 1.9%)	1994-2006	-0.3% (-1.5%, 0.9%)
lung (C34)	1994-2006	**2.2% (1.6%, 2.7%)**	1994-2006	**-1.2% (-1.7%, -0.7%)**
melanoma of skin (C43)	1994-2006	**2.3% (1.2%, 3.4%)**	1994-2006	**4.2% (3.0%, 5.4%)**
non-melanoma skin (C44)	1994-2006	**0.7% (0.0%, 1.3%)**	1994-2002	**-1.8% (-2.9%, -0.6%)**
			2002-2006	**2.9% (1.1%, 4.8%)**
female breast (C50)	1994-1999	1.3% (0.0%, 2.7%)		
	1999-2002	5.1% (-0.5%, 11.0%)		
	2002-2006	**-2.0% (-3.5%, -0.4%)**		
gynaecological (C51-C58)	1994-2006	**0.6% (0.0%, 1.2%)**		
prostate (C61)			1994-2004	**7.9% (6.6%, 9.2%)**
			2004-2006	-5.3% (-16.1%, 7.0%)
kidney (C64)	1994-2006	**3.7% (2.3%, 5.1%)**	1994-2002	**5.5% (2.8%, 8.3%)**
			2002-2006	-3.3% (-9.3%, 3.2%)
bladder (C67)	1994-2006	-1.3% (-3.2%, 0.6%)	1994-2006	**-2.1% (-2.9%, -1.4%)**
brain and central nervous system (C70-C72)	1994-2006	0.4% (-1.4%, 2.2%)	1994-2006	0.3% (-0.5%, 1.0%)
lymphoma (C81-C85)	1994-2006	**1.6% (0.4%, 2.8%)**	1994-2006	**1.7% (0.8%, 2.6%)**
leukaemia (C91-C95)	1994-2006	-0.2% (-2.0%, 1.7%)	1994-2004	**2.9% (1.4%, 4.5%)**
			2004-2006	-13.4% (-28.3%, 4.5%)

More complex trend patterns for a number of other cancers can be seen in Figure 1, which shows actual rates, with trend lines fitted by the Joinpoint program. Cancer of the breast in women showed a slow rate of increase from 1994 to 1999 (1.3% per year) which accelerated to 5.1% per year in 1999-2002, and then fell by 2.0% per year between 2002 and 2006. Cancer of the prostate increased rapidly (7.9% per year) between 1994 and 2004 but now appears to be falling in rate. For men, cancers of the head and neck, non-melanoma skin cancer, kidney cancer and leukaemia all showed reversals of the incidence trend during the period studied. With the exception of female breast and non-melanoma skin cancer, the more recent trends were not statistically significant. However, the fact of a change in slope was statistically significant in all cases.

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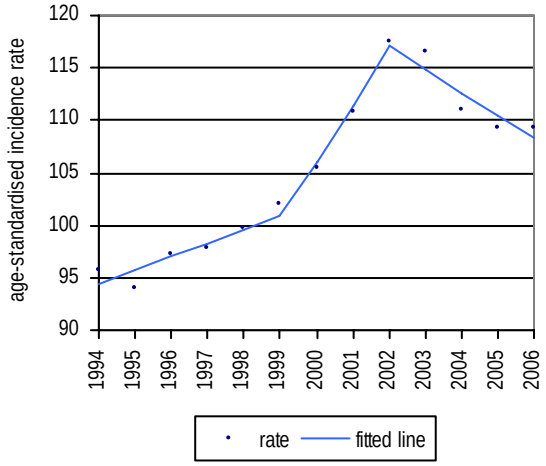
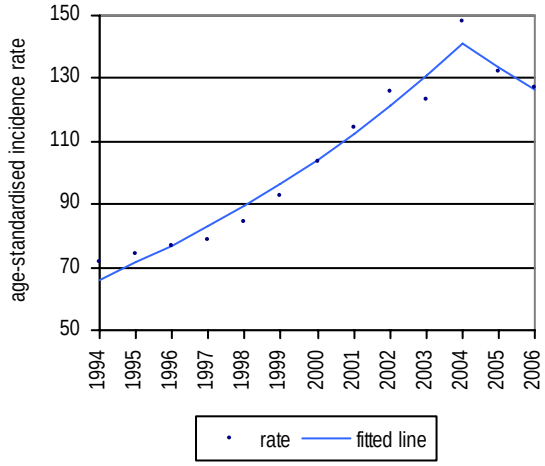
Figure 1. Estimated annual percentage change in age-standardised rate 1994-2006; cancers with at least one inflection point

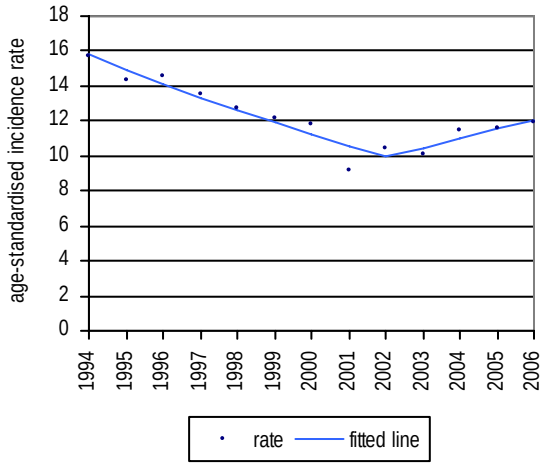
breast cancer; females



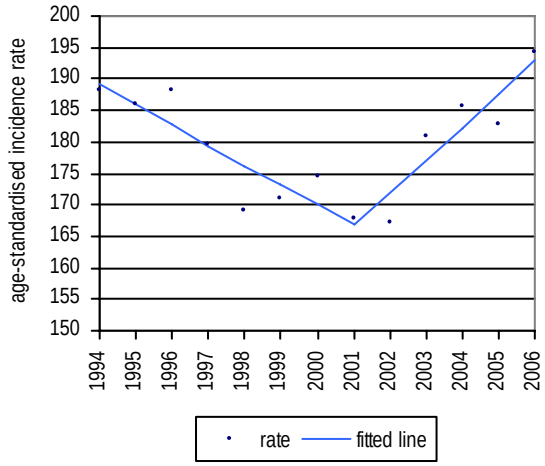
prostate cancer



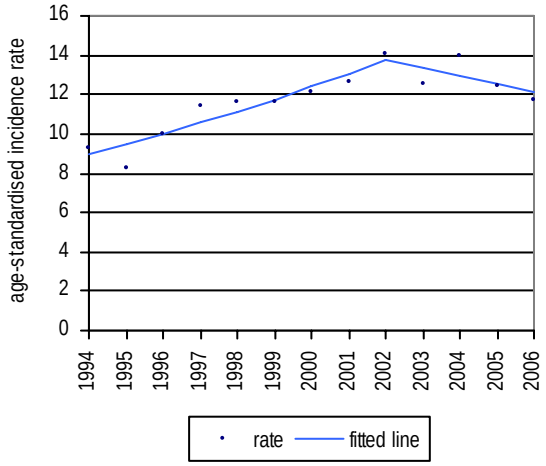
head and neck cancer; males



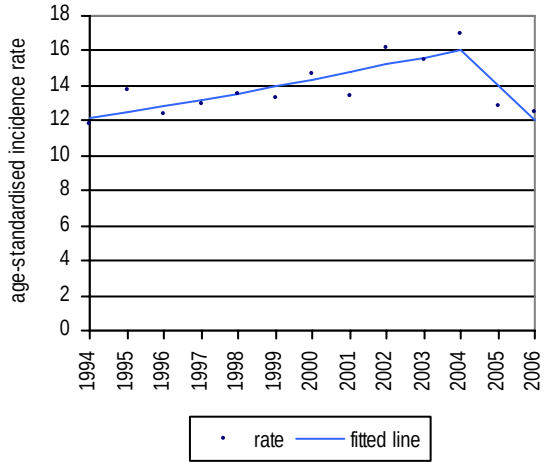
non-melanoma skin cancer; males



kidney cancer; males



leukaemia; males



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Projections

The models and baseline period on which these projections are based have been given in Table 1. A summary of projections of case numbers from 2010 to 2035 is given in Table 3 below. The data given show the best estimate of the projected numbers, with, in parentheses, the 95% prediction intervals of this estimate. The 95% limits include two sources of uncertainty:

- the inherent uncertainty of the model parameters, as the baseline data never fits the model perfectly;
- the uncertainty of any future estimate of cases, due to Poisson variation in numbers.

It can be seen that, in some cases, the prediction intervals are quite large relative to the projections made. This may be due to a number of factors:

- a poor fit of the model to the baseline data;
- small numbers of cases in the baseline period;
- a short baseline period, if changes in trend happened after 1994.

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*Table **3**. Actual case numbers for 2005 and projected case numbers 2010-2035 (95% prediction intervals)*

site	sex	2005	2010	2015	2020	2025	2030	2035
all invasive cancers (C00-C96)	female	10341	12165 (11884, 12446)	14380 (14001, 14760)	17024 (16505, 17543)	20127 (19424, 20830)	23708 (22766, 24650)	27404 (26168, 28639)
	male	11632	14118 (13813, 14423)	17418 (16988, 17847)	21355 (20739, 21971)	25922 (25044, 26800)	31072 (29840, 32304)	36441 (34745, 38137)
all invasive cancers (C00-C96) excluding non-melanoma skin (C44)	female	7439	8838 (8599, 9078)	10460 (10136, 10783)	12387 (11946, 12828)	14632 (14036, 15228)	17230 (16434, 18026)	19918 (18880, 20957)
	male	8239	10222 (9963, 10481)	12727 (12362, 13091)	15723 (15201, 16244)	19199 (18458, 19941)	23169 (22131, 24207)	27378 (25954, 28803)
head and neck (C01-C14)	female	83	97 (72, 122)	114 (80, 148)	133 (87, 179)	152 (90, 214)	175 (92, 257)	194 (86, 302)
	male	194	255 (187, 324)	338 (205, 471)	440 (218, 662)	557 (218, 895)	707 (215, 1198)	884 (202, 1566)
oesophagus (C15)	female	120	132 (102, 162)	143 (102, 184)	156 (99, 213)	168 (88, 248)	181 (71, 291)	202 (53, 352)
	male	214	257 (216, 299)	310 (252, 369)	374 (290, 458)	452 (333, 572)	537 (370, 704)	613 (386, 841)
stomach (C16)	female	167	174 (141, 207)	179 (139, 219)	185 (136, 235)	195 (134, 256)	204 (130, 278)	209 (122, 296)
	male	286	294 (251, 337)	312 (258, 366)	331 (263, 399)	350 (265, 435)	365 (262, 468)	372 (251, 493)
colorectal (C18-C21)	female	888	1020 (938, 1102)	1176 (1065, 1288)	1367 (1213, 1521)	1601 (1390, 1813)	1867 (1580, 2154)	2128 (1747, 2509)
	male	1223	1402 (1305, 1500)	1687 (1550, 1825)	2035 (1836, 2233)	2464 (2180, 2748)	2938 (2540, 3336)	3409 (2864, 3954)
pancreas (C25)	female	207	235 (196, 275)	278 (225, 331)	331 (257, 405)	398 (296, 500)	477 (338, 616)	565 (378, 751)
	male	177	224 (184, 263)	262 (206, 319)	306 (223, 389)	353 (232, 473)	401 (229, 574)	451 (209, 693)
lung (C34)	female	741	904 (828, 979)	1131 (1029, 1233)	1413 (1273, 1553)	1763 (1573, 1952)	2182 (1928, 2436)	2642 (2311, 2974)
	male	1090	1180 (1089, 1271)	1326 (1196, 1456)	1493 (1304, 1682)	1697 (1424, 1971)	1904 (1517, 2290)	2104 (1573, 2635)
melanoma of skin (C43)	female	360	438 (386, 490)	545 (476, 615)	671 (579, 764)	816 (694, 937)	983 (824, 1142)	1170 (966, 1374)
	male	246	329 (284, 373)	440 (379, 500)	576 (493, 660)	740 (626, 854)	935 (781, 1090)	1153 (948, 1359)
non-melanoma skin (C44)	female	2092	3328 (3181, 3475)	3924 (3725, 4122)	4642 (4369, 4915)	5502 (5129, 5875)	6489 (5985, 6994)	7504 (6835, 8174)
	male	3393	4616 (4363, 4868)	6197 (5726, 6669)	8208 (7420, 8995)	10751 (9524, 11978)	13786 (11971, 15600)	17181 (14601, 19760)
female breast (C50) based on 1994-1996 trend	female	2196	2720 (2361, 3079)	3294 (2752, 3836)	3976 (3203, 4749)	4752 (3696, 5809)	5670 (4259, 7081)	6724 (4906, 8542)
female breast (C50) based on 1994-1996 trend	female	2196	2696 (2539, 2853)	2781 (2644, 2917)	3040 (2725, 3355)	3484 (2861, 4106)	4123 (3023, 5222)	4833 (3062, 6605)
gynaecological (C51-C58)	female	1002	1146 (1060, 1232)	1350 (1233, 1466)	1587 (1430, 1745)	1850 (1640, 2060)	2154 (1877, 2431)	2464 (2108, 2820)
prostate (C61)	male	2415	projections not possible					
kidney (C64)	female	148	185 (151, 218)	240 (195, 285)	307 (247, 368)	384 (304, 465)	477 (372, 582)	578 (443, 713)
	male	227	316 (260, 371)	302 (257, 348)	318 (215, 421)	347 (156, 538)	393 (80, 707)	445 (0, 912)
bladder (C67)	female	143	147 (116, 179)	160 (117, 203)	174 (114, 234)	190 (107, 273)	208 (94, 321)	216 (64, 368)
	male	331	350 (303, 397)	383 (322, 444)	420 (340, 500)	460 (355, 564)	497 (364, 630)	529 (363, 695)
brain and central nervous system (C70-C72)	female	118	161 (128, 193)	187 (143, 231)	219 (159, 279)	257 (177, 337)	303 (198, 408)	357 (222, 493)
	male	188	221 (182, 259)	261 (208, 313)	311 (239, 383)	377 (279, 475)	454 (323, 586)	539 (368, 709)
lymphoma (C81-C85)	female	274	363 (315, 411)	443 (379, 507)	539 (453, 626)	652 (537, 767)	782 (631, 933)	919 (725, 1113)
	male	327	441 (388, 495)	553 (480, 626)	692 (591, 794)	862 (724, 1001)	1070 (882, 1257)	1314 (1067, 1562)
leukaemia (C91-C95)	female	94	193 (157, 229)	221 (172, 269)	252 (185, 318)	287 (197, 377)	329 (209, 450)	384 (225, 542)
	male	10341	projections not possible					

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All invasive cancers (ICD10 C00 - C96)

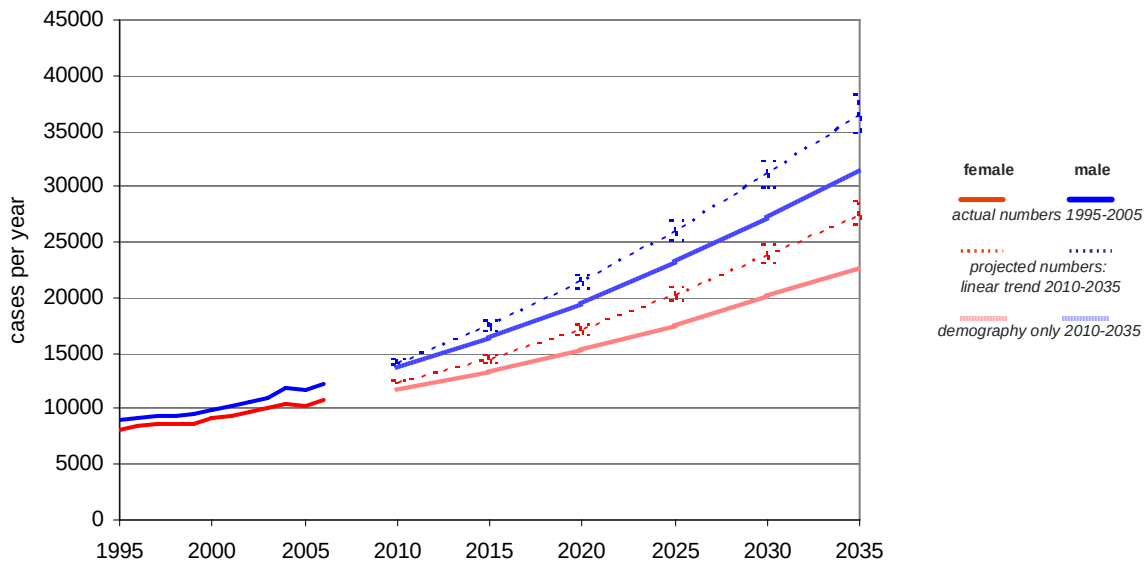
Table 4. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	8090	9013
2000	9149	9986
2005	10341	11632
projected case numbers		
2010	12165 (11884, 12446)	14118 (13813, 14423)
2015	14380 (14001, 14760)	17418 (16988, 17847)
2020	17024 (16505, 17543)	21355 (20739, 21971)
2025	20127 (19424, 20830)	25922 (25044, 26800)
2030	23708 (22766, 24650)	31072 (29840, 32304)
2035	27404 (26168, 28639)	36441 (34745, 38137)
projections based on demographic change only		
2010	11701	13734
2015	13350	16377
2020	15292	19508
2025	17545	23147
2030	20113	27238
2035	22679	31514

The overall number of invasive cancers is projected to increase by 17063 (165%, 6% annually) for females and 24809 (213%, 7% annually) for males between 2005 and 2035 (Table 4, Figure 2). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 12338 (119%, 4% annually) and male cases by 19882 (171%, 6% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 4859 (40%) and in males by 7237 (51%). Between 2010 and 2030 the increase for females is expected to be 11543 (95%) and, for males, 16954 (120%).

Figure 2. Actual and projected number of cases 1995-2035



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All invasive cancers (ICD10 C00 – C96), excluding non-melanoma skin cancer (C44)

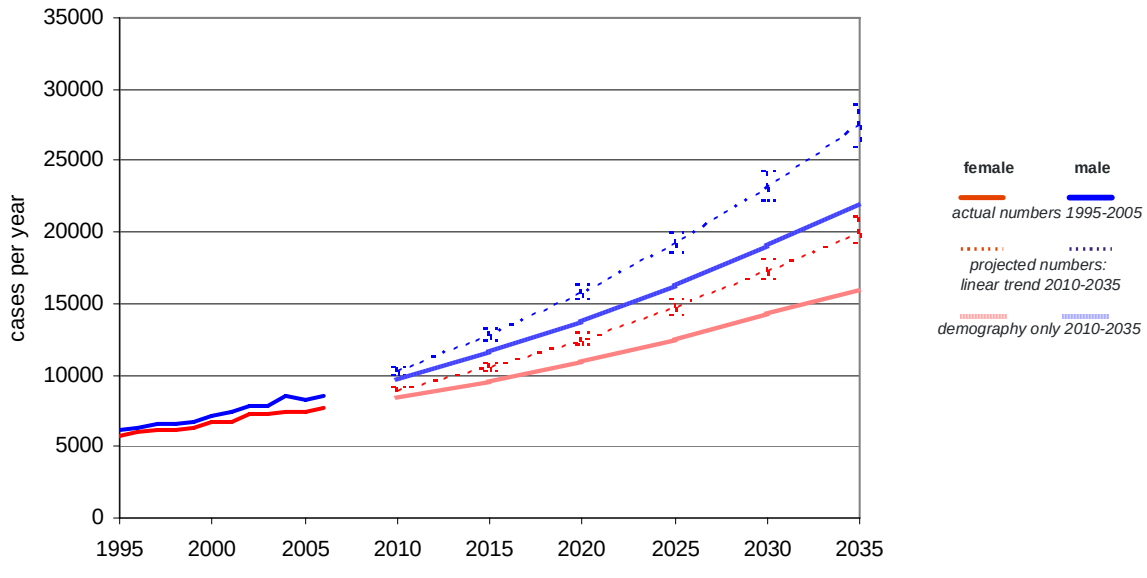
Table 5. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	5761	6190
2000	6690	7131
2005	7439	8239
projected case numbers		
2010	8838 (8599, 9078)	10222 (9963, 10481)
2015	10460 (10136, 10783)	12727 (12362, 13091)
2020	12387 (11946, 12828)	15723 (15201, 16244)
2025	14632 (14036, 15228)	19199 (18458, 19941)
2030	17230 (16434, 18026)	23169 (22131, 24207)
2035	19918 (18880, 20957)	27378 (25954, 28803)
projections based on demographic change only		
2010	8384	9706
2015	9548	11555
2020	10910	13731
2025	12469	16239
2030	14239	19059
2035	15977	22002

The overall number of invasive cancers (excluding non-melanoma skin cancer) is projected to increase by 12479 (168%, 6% annually) for females and 19139 (232%, 8% annually) for males between 2005 and 2035 (Table 5, Figure 3). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 8538 (115%, 4% annually) and male cases by 13763 (167%, 6% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 3549 (40%) and in males by 5501 (54%). Between 2010 and 2030 the increase for females is expected to be 8392 (95%) and, for males, 12947 (127%).

Figure 3. Actual and projected number of cases 1995-2035



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Cancers of the head and neck (ICD10 C01 - C14)

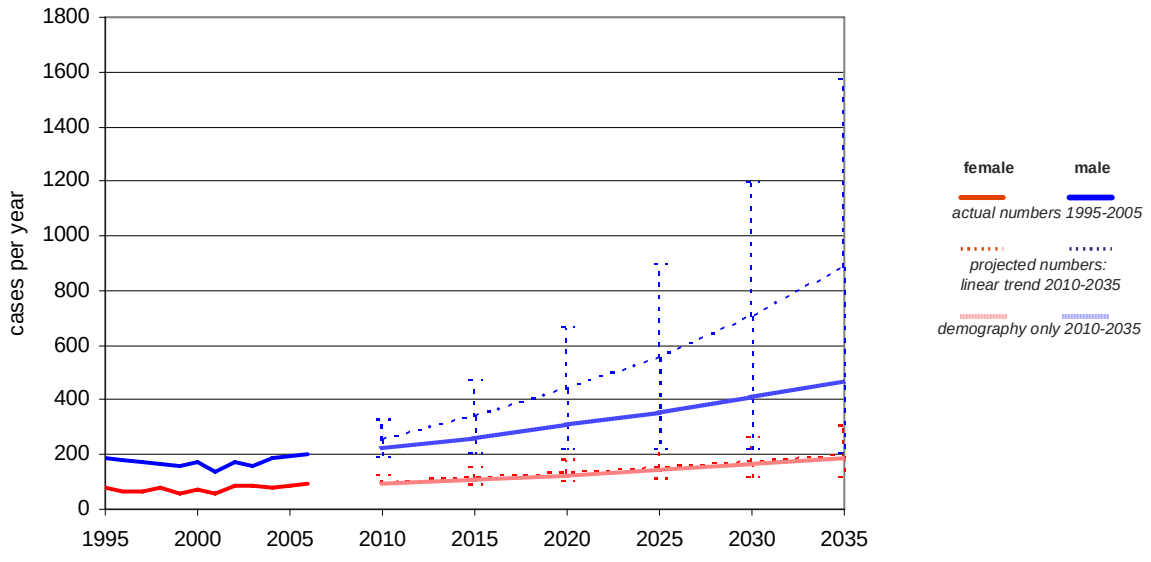
Table 6. Actual and projected number of cancer cases 1995-2035

number of registered cases		
	females	**males**
1995	77	186
2000	69	170
2005	83	194
projected case numbers (male cases based on 2002-2006 data only)		
2010	97 (72, 122)	255 (187, 324)
2015	114 (80, 148)	338 (205, 471)
2020	133 (87, 179)	440 (218, 662)
2025	152 (90, 214)	557 (218, 895)
2030	175 (92, 257)	707 (215, 1198)
2035	194 (86, 302)	884 (202, 1566)
projections based on demographic change only		
2010	96	224
2015	110	262
2020	126	306
2025	143	356
2030	164	413
2035	184	470

The number of cancers of head and neck is projected to increase by 111 (134%, 4% annually) for females and 690 (356%, 12% annually) for males between 2005 and 2035 (Table 6, Figure 4). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 101 (121%, 4% annually) and male cases by 276 (142%, 5% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 36 (37%) and in males by 185 (73%). Between 2010 and 2030 the increase for females is expected to be 78 (80%) and, for males, 452 (177%).

Figure 4. Actual and projected number of cases 1995-2035 (*male cases based on 2002-2006 data only*)



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Cancers of the oesophagus (ICD10 C15)

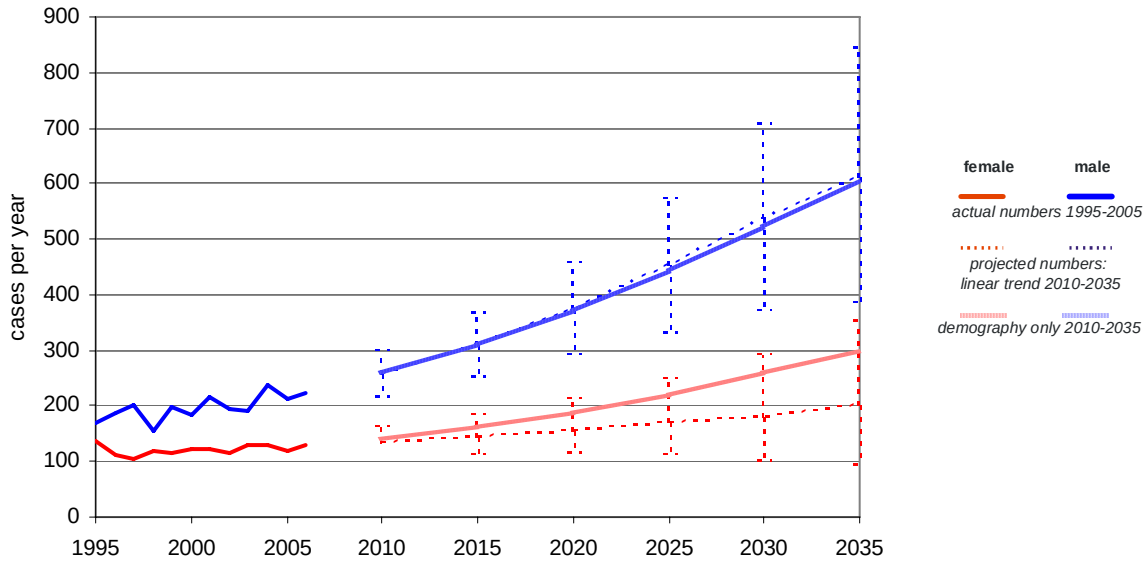
Table 7. Actual and projected number of cancer cases 1995-2035

number of registered cases		
	females	**males**
1995	136	169
2000	124	182
2005	120	214
projected case numbers		
2010	132 (102, 162)	257 (216, 299)
2015	143 (102, 184)	310 (252, 369)
2020	156 (99, 213)	374 (290, 458)
2025	168 (88, 248)	452 (333, 572)
2030	181 (71, 291)	537 (370, 704)
2035	202 (53, 352)	613 (386, 841)
projections based on demographic change only		
2010	140	259
2015	161	310
2020	187	370
2025	220	442
2030	258	523
2035	300	606

The number of cancers of the oesophagus is projected to increase by 82 (69%, 2% annually) for females and 399 (187%, 6% annually) for males between 2005 and 2035 (Table 7, Figure 5). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 180 (150%, 5% annually) and male cases by 392 (183%, 6% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 24 (18%) and in males by 117 (45%). Between 2010 and 2030 the increase for females is expected to be 49 (37%) and, for males, 280 (109%).

Figure 5. Actual and projected number of cases 1995-2035



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Cancers of the stomach (ICD10 C16)

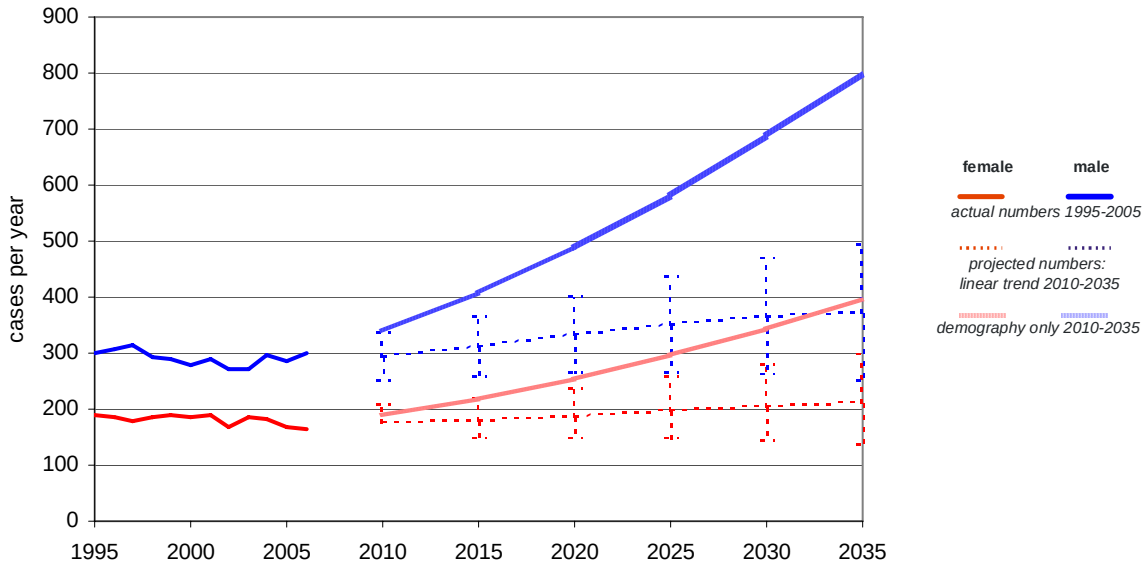
Table 8. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	191	301
2000	185	279
2005	167	286
projected case numbers		
2010	174 (141, 207)	294 (251, 337)
2015	179 (139, 219)	312 (258, 366)
2020	185 (136, 235)	331 (263, 399)
2025	195 (134, 256)	350 (265, 435)
2030	204 (130, 278)	365 (262, 468)
2035	209 (122, 296)	372 (251, 493)
projections based on demographic change only		
2010	190	340
2015	219	407
2020	254	488
2025	296	583
2030	344	690
2035	395	799

The number of cancers of stomach is projected to increase by 42 (25%, 1% annually) for females and 86 (30%, 1% annually) for males between 2005 and 2035 (Table 8, Figure 6). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 228 (136%, 5% annually) and male cases by 513 (180%, 6% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 11 (6%) and in males by 37 (13%). Between 2010 and 2030 the increase for females is expected to be 30 (17%) and, for males, 71 (24%).

Figure 6. Actual and projected number of cases 1995-2035



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Colorectal cancers (ICD10 C18 - C21)

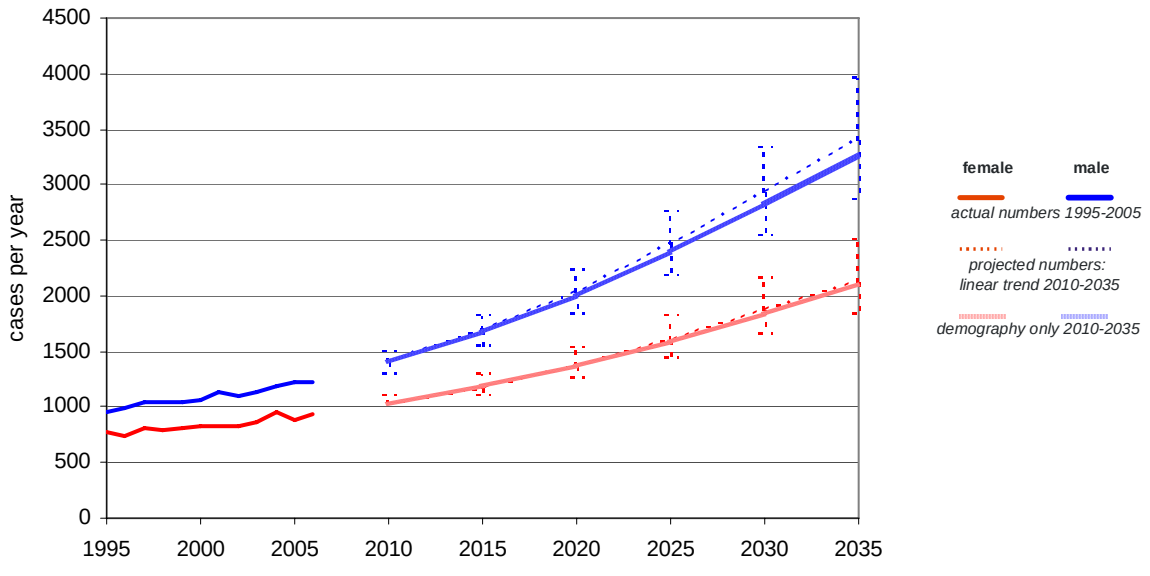
Table 9. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	767	949
2000	828	1058
2005	888	1223
projected case numbers		
2010	1020 (938, 1102)	1402 (1305, 1500)
2015	1176 (1065, 1288)	1687 (1550, 1825)
2020	1367 (1213, 1521)	2035 (1836, 2233)
2025	1601 (1390, 1813)	2464 (2180, 2748)
2030	1867 (1580, 2154)	2938 (2540, 3336)
2035	2128 (1747, 2509)	3409 (2864, 3954)
projections based on demographic change only		
2010	1028	1400
2015	1181	1675
2020	1366	2003
2025	1587	2394
2030	1838	2827
2035	2097	3272

The number of colorectal cancers is projected to increase by 1240 (140%, 5% annually) for females and 2186 (179%, 6% annually) for males between 2005 and 2035 (Table 9, Figure 7). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 1209 (136%, 5% annually) and male cases by 2049 (168%, 6% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 347 (34%) and in males by 633 (45%). Between 2010 and 2030 the increase for females is expected to be 847 (83%) and, for males, 1536 (110%).

Figure 7. Actual and projected number of cases 1995-2035



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Cancers of the pancreas (ICD10 C25)

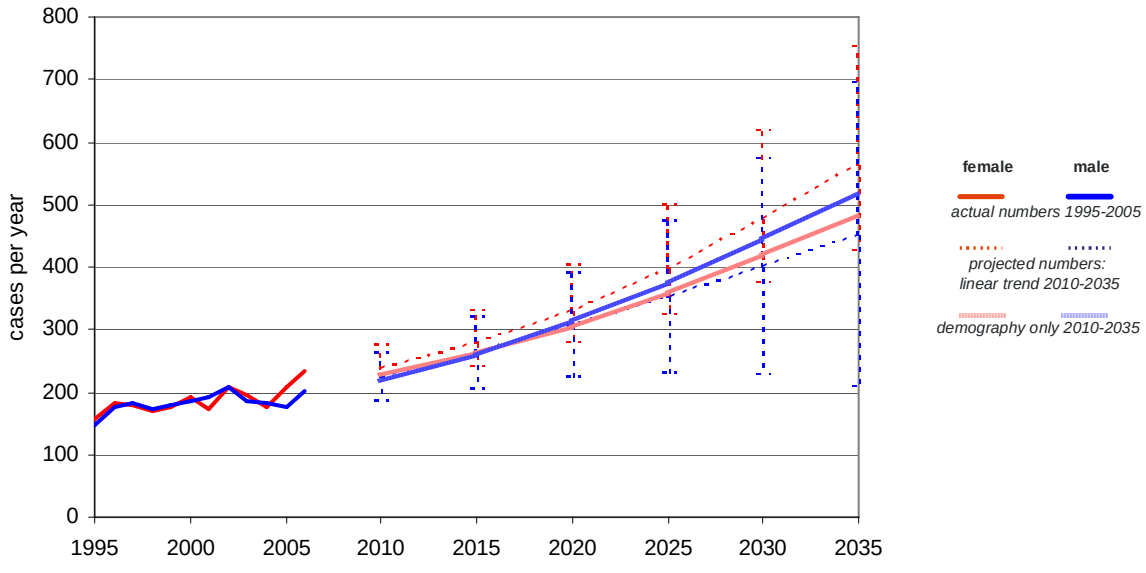
Table 10. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	156	148
2000	192	185
2005	207	177
projected case numbers		
2010	235 (196, 275)	224 (184, 263)
2015	278 (225, 331)	262 (206, 319)
2020	331 (257, 405)	306 (223, 389)
2025	398 (296, 500)	353 (232, 473)
2030	477 (338, 616)	401 (229, 574)
2035	565 (378, 751)	451 (209, 693)
projections based on demographic change only		
2010	227	217
2015	261	260
2020	304	312
2025	357	374
2030	419	444
2035	484	519

The number of cancers of pancreas is projected to increase by 358 (173%, 6% annually) for females and 274 (155%, 5% annually) for males between 2005 and 2035 (Table 10, Figure 8). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 277 (134%, 4% annually) and male cases by 342 (193%, 6% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 96 (41%) and in males by 82 (37%). Between 2010 and 2030 the increase for females is expected to be 242 (103%) and, for males, 177 (79%).

Figure 8. Actual and projected number of cases 1995-2035



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Cancers of the lung (ICD10 C34)

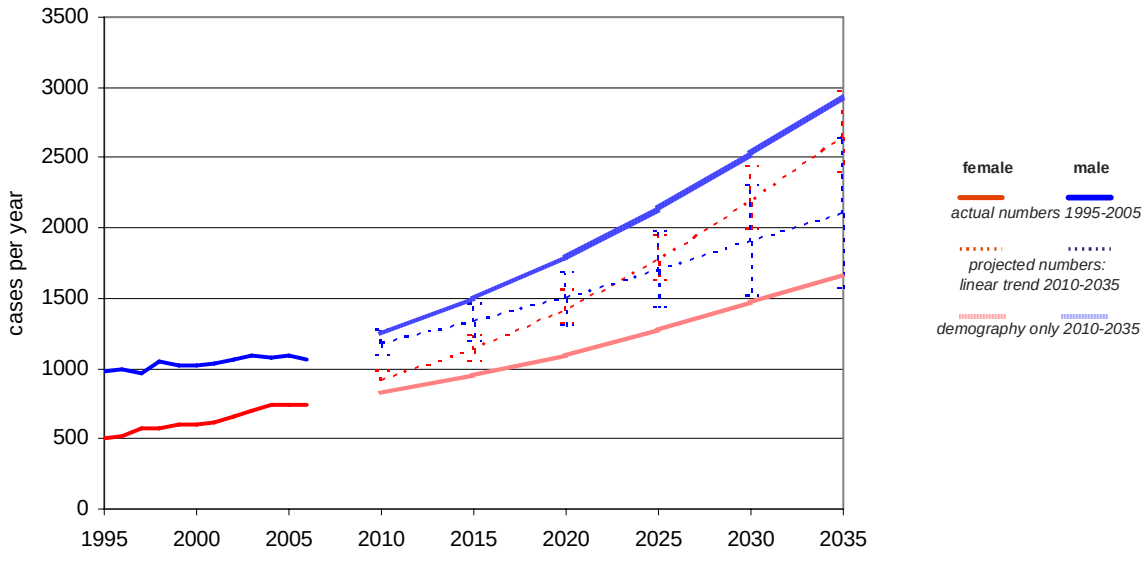
Table 11. Actual and projected number of cancer cases 1995-2035

number of registered cases		
	females	**males**
1995	510	977
2000	605	1022
2005	741	1090
projected case numbers		
2010	904 (828, 979)	1180 (1089, 1271)
2015	1131 (1029, 1233)	1326 (1196, 1456)
2020	1413 (1273, 1553)	1493 (1304, 1682)
2025	1763 (1573, 1952)	1697 (1424, 1971)
2030	2182 (1928, 2436)	1904 (1517, 2290)
2035	2642 (2311, 2974)	2104 (1573, 2635)
projections based on demographic change only		
2010	824	1246
2015	948	1496
2020	1098	1793
2025	1273	2143
2030	1470	2533
2035	1666	2941

The number of cancers of lung is projected to increase by 1901 (257%, 9% annually) for females and 1014 (93%, 3% annually) for males between 2005 and 2035 (Table 11, Figure 9). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 925 (125%, 4% annually) and male cases by 1851 (170%, 6% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 509 (56%) and in males by 313 (27%). Between 2010 and 2030 the increase for females is expected to be 1278 (141%) and, for males, 724 (61%).

Figure 9. Actual and projected number of cases 1995-2035



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Melanomas of skin (ICD10 C43)

Table 12. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	235	123
2000	283	166
2005	360	246
projected case numbers		
2010	438 (386, 490)	329 (284, 373)
2015	545 (476, 615)	440 (379, 500)
2020	671 (579, 764)	576 (493, 660)
2025	816 (694, 937)	740 (626, 854)
2030	983 (824, 1142)	935 (781, 1090)
2035	1170 (966, 1374)	1153 (948, 1359)
projections based on demographic change only		
2010	388	288
2015	437	335
2020	492	390
2025	551	452
2030	617	521
2035	680	591

The number of melanomas of skin is projected to increase by 810 (225%, 7% annually) for females and 907 (369%, 12% annually) for males between 2005 and 2035 (Table 12, Figure 10). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 320 (89%, 3% annually) and male cases by 345 (140%, 5% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 233 (53%) and in males by 247 (75%). Between 2010 and 2030 the increase for females is expected to be 545 (124%) and, for males, 606 (184%).

Figure 10. Actual and projected number of cases 1995-2035

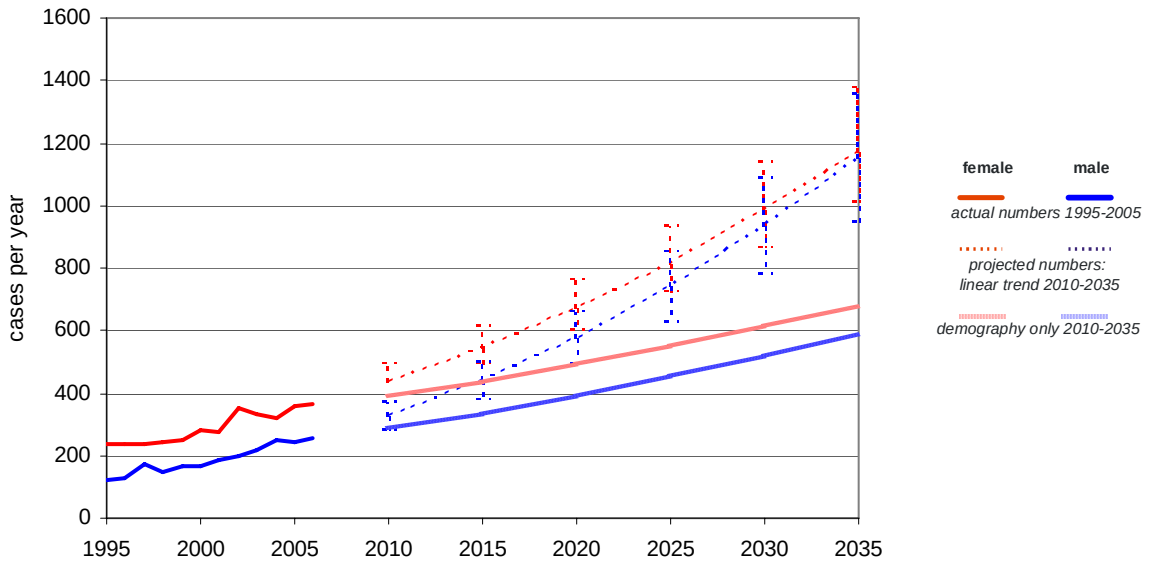

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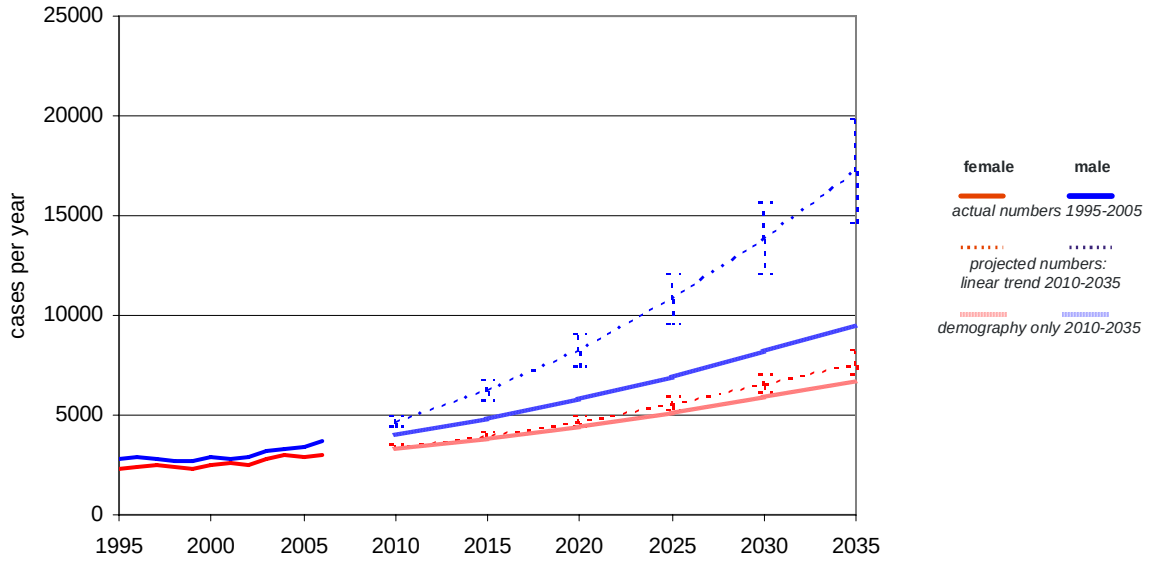
Table 13. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	2329	2823
2000	2459	2855
2005	2902	3393
projected case numbers (male cases based on 2001-2006 data only)		
2010	3328 (3181, 3475)	4616 (4363, 4868)
2015	3924 (3725, 4122)	6197 (5726, 6669)
2020	4642 (4369, 4915)	8208 (7420, 8995)
2025	5502 (5129, 5875)	10751 (9524, 11978)
2030	6489 (5985, 6994)	13786 (11971, 15600)
2035	7504 (6835, 8174)	17181 (14601, 19760)
projections based on demographic change only		
2010	3318	4028
2015	3802	4822
2020	4383	5777
2025	5076	6908
2030	5874	8179
2035	6701	9512

The number of non-melanoma cancers of the skin is projected to increase by 4602 (159%, 5% annually) for females and 13788 (406%, 14% annually) for males between 2005 and 2035 (Table 13, Figure 11). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 3799 (131%, 4% annually) and male cases by 6119 (180%, 6% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 1314 (39%) and in males by 3592 (78%). Between 2010 and 2030 the increase for females is expected to be 3161 (95%) and, for males, 9170 (199%).

Figure 11. Actual and projected number of cases 1995-2035 (*male cases based on 2001-2006 data only*)



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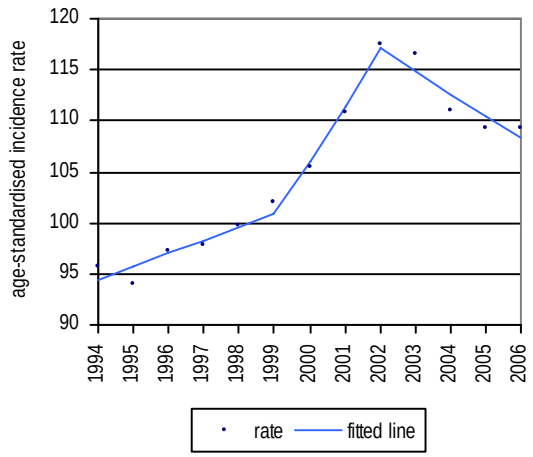
Cancers of breast (female) (ICD10 C50)

Breast cancer has had the most complex time trend of any of the common cancers, with two distinct phases of increase between 1994 and 2002, followed by a fall in incidence (Figure 12). This is possibly a screening effect related to the establishment of the BreastCheck service in 2000, in the eastern part of the country, with an initial rise in numbers due to the rapid detection of prevalent cancers in the first round of screening in 2000-2002, followed by a decrease to what would have been the baseline level of incidence by 2006.

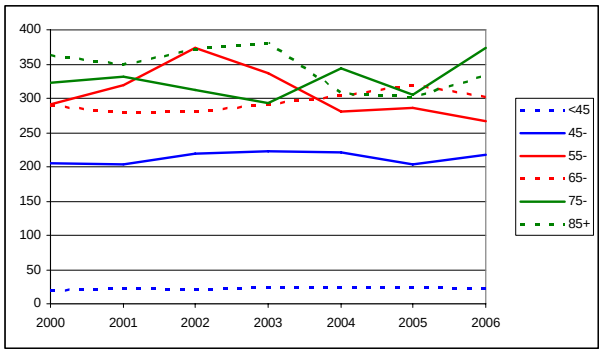
Figure 12. Estimated annual percentage change in age-standardised rate 1994-2006; female breast cancer



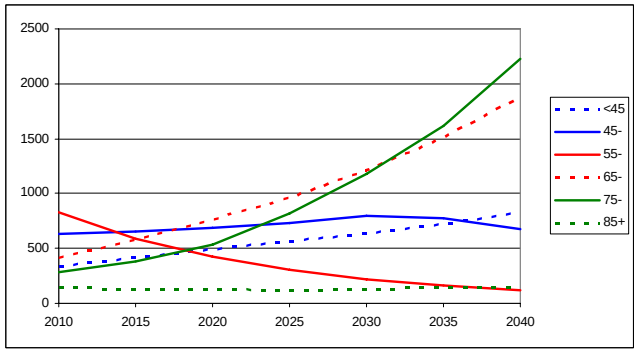
Modelling these trends is difficult because of the difficulty of establishing the underlying rate of incidence independently of screening effects, and because the recent extension of BreastCheck to the rest of Ireland is likely to cause another "prevalent" rise in the next three years. In addition, the effects of screening apply to specific age groups, and trends in other age groups may be quite different. In particular, detection of breast cancers by screening in the 60-64 year age group should decrease the incidence in the 65-69 year age group in subsequent years. Figure 13a shows an increase and subsequent fall in incidence in the 55-64 age group between 2000 and 2006, with little change in incidence in younger women, but with recent increases in rate in the oldest age groups. Extrapolation (using a log-linear model) of these age-specific trends to the future (Figure 13b) shows the expected fall in incidence for the population in the screening age groups (55-64), but also a major increase in incidence in women aged 65-84.

Figure 13. Actual and projected age-specific incidence rates 2000-2040

a. Actual 2000-2006



b. Projected 2010-2040



As it is impossible to verify the long-term validity of these trends so soon after the introduction of screening, Table 14 presents two possible scenarios: one based on the initial 1994-1999 trends, and the other based on the most recent 2002-2006 trends. In the long-term, the former seems more likely. The two models give different, but overlapping, estimates of incidence ranging from 4833 (3062, 6605) to 6724 (4906, 8542) new cases per year in 2035.

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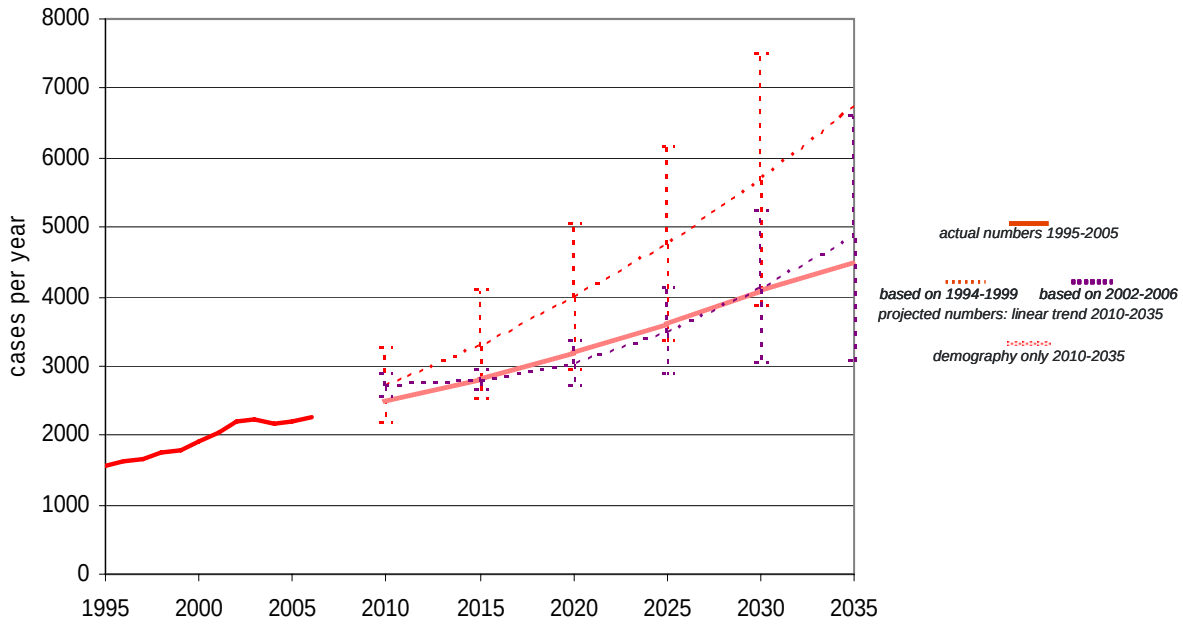
Table 14. Actual and projected number of cancer cases 1995-2035

number of registered cases		
1995	1559	
2000	1907	
2005	2196	
projected case numbers		
	based on 1994-1999 trends	**based on 2002-2006 trends**
2010	2720 (2361, 3079)	2696 (2539, 2853)
2015	3294 (2752, 3836)	2781 (2644, 2917)
2020	3976 (3203, 4749)	3040 (2725, 3355)
2025	4752 (3696, 5809)	3484 (2861, 4106)
2030	5670 (4259, 7081)	4123 (3023, 5222)
2035	6724 (4906, 8542)	4833 (3062, 6605)
based on demographic change only		
2010	2483	
2015	2808	
2020	3180	
2025	3593	
2030	4065	
2035	4492	

Between 2005 and 2035 the number of female breast cancers is projected to increase by between 4528 (206%, 7% annually), based on 1994-1999 trends, and by 2637 (120%, 4% annually) based on 2002-2006 trends (Table 14, Figure 15). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of cases by 2296 (105%, 3% annually) over the same period.

Over the ten-year period 2010-2020, based on 1994-1999 trends, the number of cancers is expected to increase by 1256 (46%), while between 2010 and 2030 the increase is expected to be 2950 (108%). Based on the 2002-2006 trends these figures are projected to be 344 (13%) and 1427 (53%) respectively.

Figure 14. Actual and projected number of cases 1995-2035



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Gynaecological cancers (ICD10 C51 - C58)

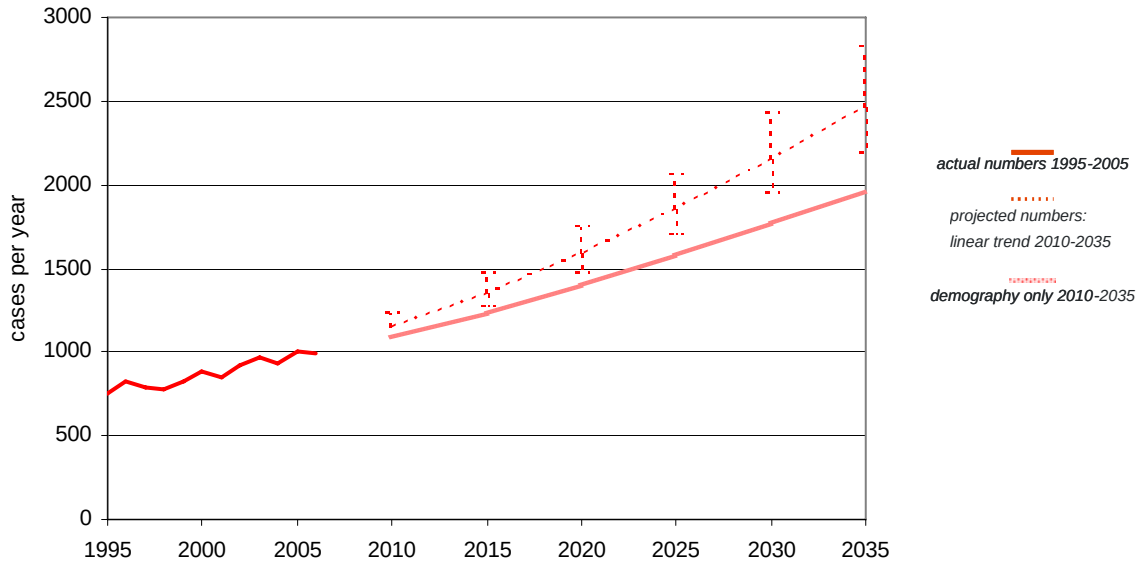
Table 15. Actual and projected number of cancer cases 1995-2035

	females
number of registered cases	
1995	758
2000	890
2005	1002
projected case numbers	
2010	1146 (1060, 1232)
2015	1350 (1233, 1466)
2020	1587 (1430, 1745)
2025	1850 (1640, 2060)
2030	2154 (1877, 2431)
2035	2464 (2108, 2820)
projections based on demographic change only	
2010	1088
2015	1234
2020	1398
2025	1574
2030	1773
2035	1962

The number of gynaecological cancers is projected to increase by 1462 (146%, 5% annually) between 2005 and 2035 (Table 15, Figure 15). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of cases by 960 (96%, 3% annually).

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 441 (38%). Between 2010 and 2030 the increase is expected to be 1008 (88%).

Figure 15. Actual and projected number of cases 1995-2035



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Cancers of prostate (ICD10 C61)

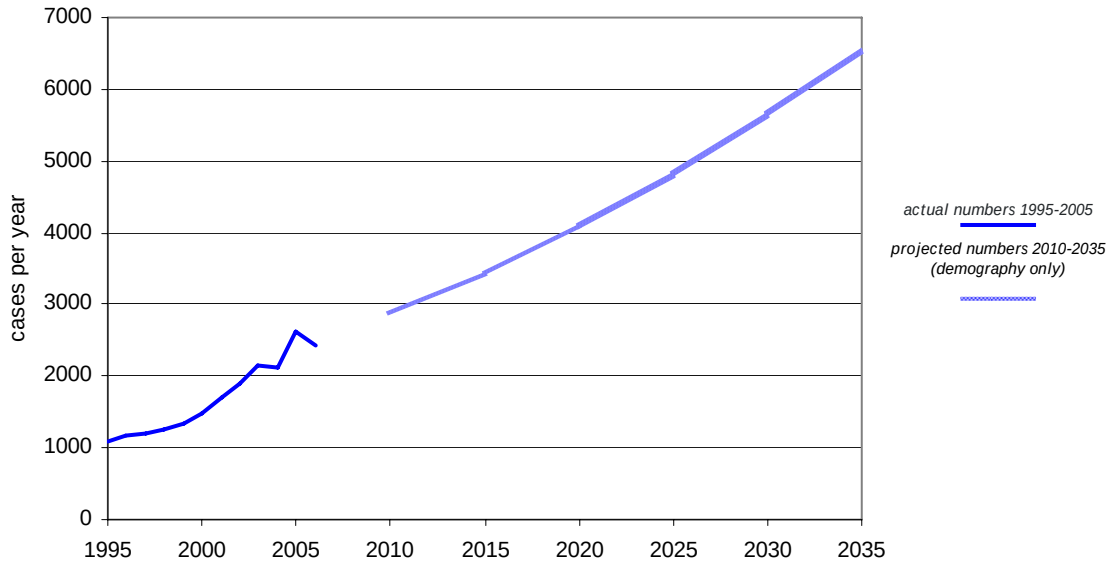
Because of the recent change in trend in prostate cancer incidence rates, and the likelihood that the increases in PSA testing have obscured the underlying trends in prostate cancer incidence, no plausible projections of prostate cancer incidence could be made, other than those based solely on demographic change.

Table 16. Actual and projected number of cancer cases 1995-2035

	males
number of registered cases	
1995	1160
2000	1694
2005	2415
projections based on demographic change only	
2010	2871
2015	3437
2020	4093
2025	4828
2030	5668
2035	6559

Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of cases by 4144 (172%, 6% annually) between 2005 and 2035 (Table 16, Figure 16). Over the ten-year period 2010-2020 the number of cancers is expected to increase (due to demography alone) by 1222 (43%), while between 2010 and 2030 the increase is expected to be 2797 (97%).

Figure 16. Actual and projected number of cases 1995-2035



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Cancers of kidney (ICD10 C64)

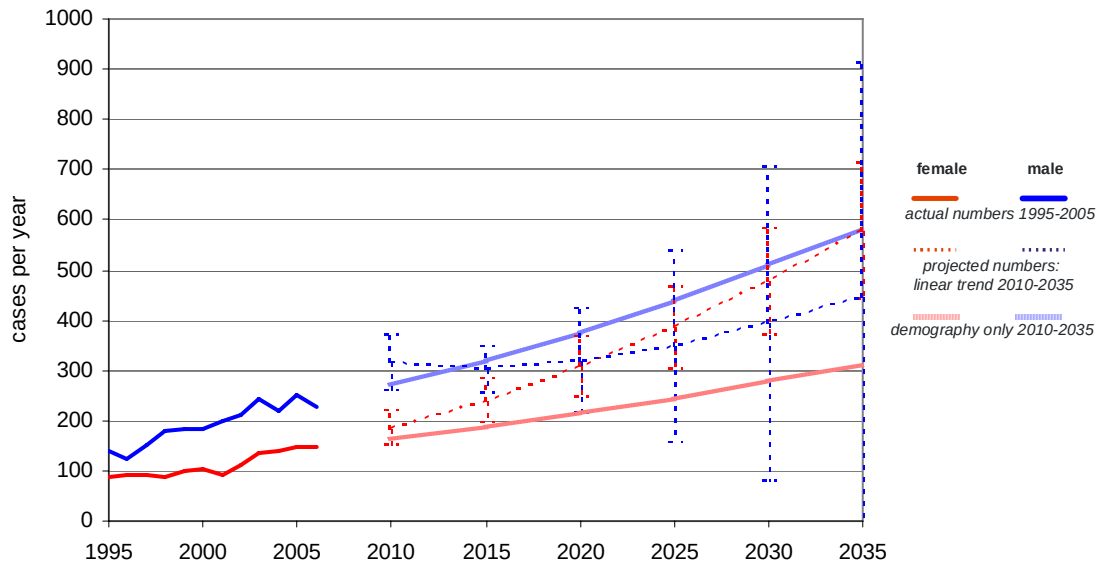
Table 17. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	90	125
2000	92	198
2005	148	227
projected case numbers (male cases based on 2002-2006 data only)		
2010	185 (151, 218)	316 (260, 371)
2015	240 (195, 285)	302 (257, 348)
2020	307 (247, 368)	318 (215, 421)
2025	384 (304, 465)	347 (156, 538)
2030	477 (372, 582)	393 (80, 707)
2035	578 (443, 713)	445 (-21, 912)
projections based on demographic change only		
2010	163	271
2015	186	319
2020	214	375
2025	244	437
2030	278	508
2035	311	581

The number of cancers of kidney is projected to increase by 430 (290%, 10% annually) for females and 218 (96%, 3% annually) for males between 2005 and 2035 (Table 17, Figure 17). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 163 (110%, 4% annually) and male cases by 354 (156%, 5% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 122 (66%) and in males by 2 (1%). Between 2010 and 2030 the increase for females is expected to be 292 (158%) and, for males, 77 (24%).

Figure 17. Actual and projected number of cases 1995-2035 (male cases based on 2002-2006 data only)



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Cancers of bladder (ICD10 C67)

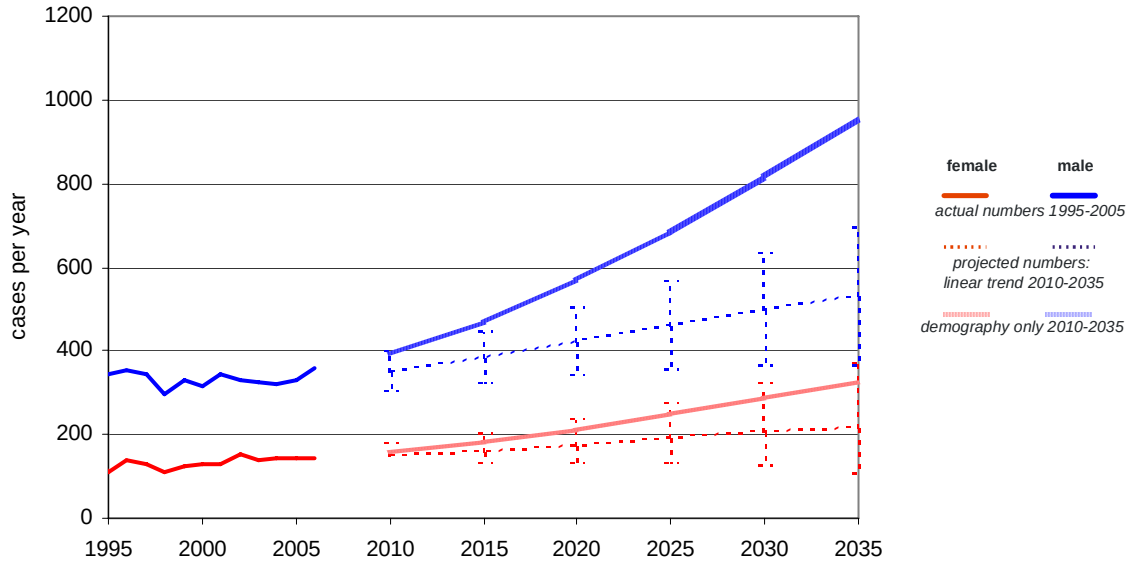
Table 18. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	110	344
2000	128	317
2005	143	331
projected case numbers		
2010	147 (116, 179)	350 (303, 397)
2015	160 (117, 203)	383 (322, 444)
2020	174 (114, 234)	420 (340, 500)
2025	190 (107, 273)	460 (355, 564)
2030	208 (94, 321)	497 (364, 630)
2035	216 (64, 368)	529 (363, 695)
projections based on demographic change only		
2010	158	390
2015	183	470
2020	212	568
2025	247	684
2030	287	816
2035	327	956

The number of cancers of bladder is projected to increase by 73 (51%, 2% annually) for females and 198 (60%, 2% annually) for males between 2005 and 2035 (Table 18, Figure 18). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 184 (129%, 4% annually) and male cases by 625 (189%, 6% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 27 (18%) and in males by 70 (20%). Between 2010 and 2030 the increase for females is expected to be 61 (41%) and, for males, 147 (42%).

Figure 18. Actual and projected number of cases 1995-2035



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Cancers of brain and central nervous system (ICD10 C70 - C72)

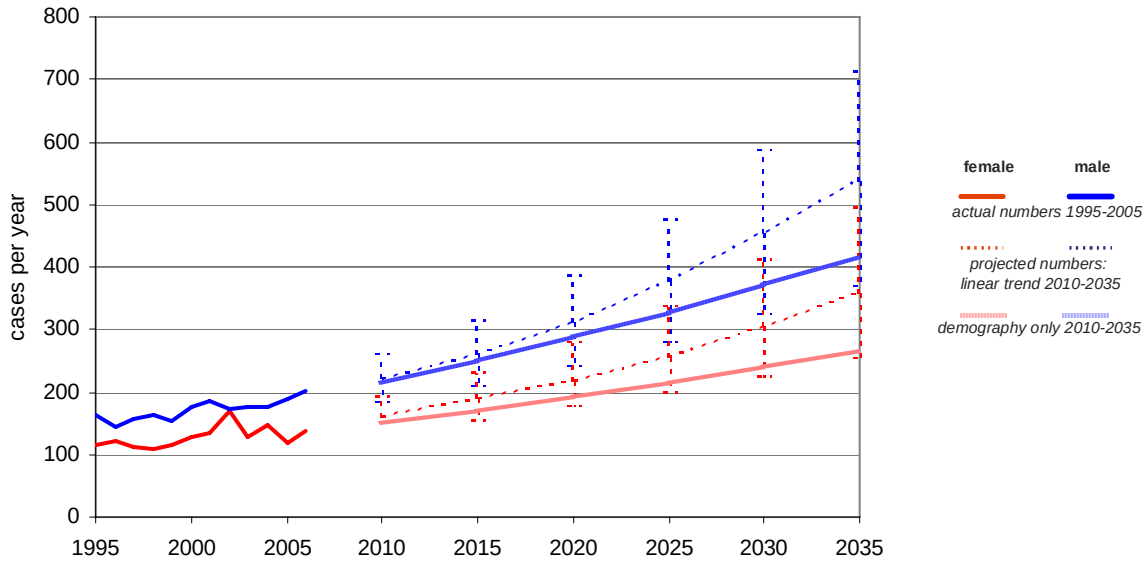
Table 19. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	116	164
2000	127	175
2005	118	188
projected case numbers		
2010	161 (128, 193)	221 (182, 259)
2015	187 (143, 231)	261 (208, 313)
2020	219 (159, 279)	311 (239, 383)
2025	257 (177, 337)	377 (279, 475)
2030	303 (198, 408)	454 (323, 586)
2035	357 (222, 493)	539 (368, 709)
projections based on demographic change only		
2010	149	215
2015	169	249
2020	191	286
2025	215	328
2030	240	373
2035	266	416

The overall number of cancers of brain and central nervous system is projected to increase by 239 (203%, 7% annually) for females and 351 (187%, 6% annually) for males between 2005 and 2035 (Table 19, Figure 19). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 148 (125%, 4% annually) and male cases by 228 (121%, 4% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 58 (36%) and in males by 90 (41%). Between 2010 and 2030 the increase for females is expected to be 142 (88%) and, for males, 233 (105%).

Figure 19. Actual and projected number of cases 1995-2035



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Lymphomas (ICD10 C81 - C85)

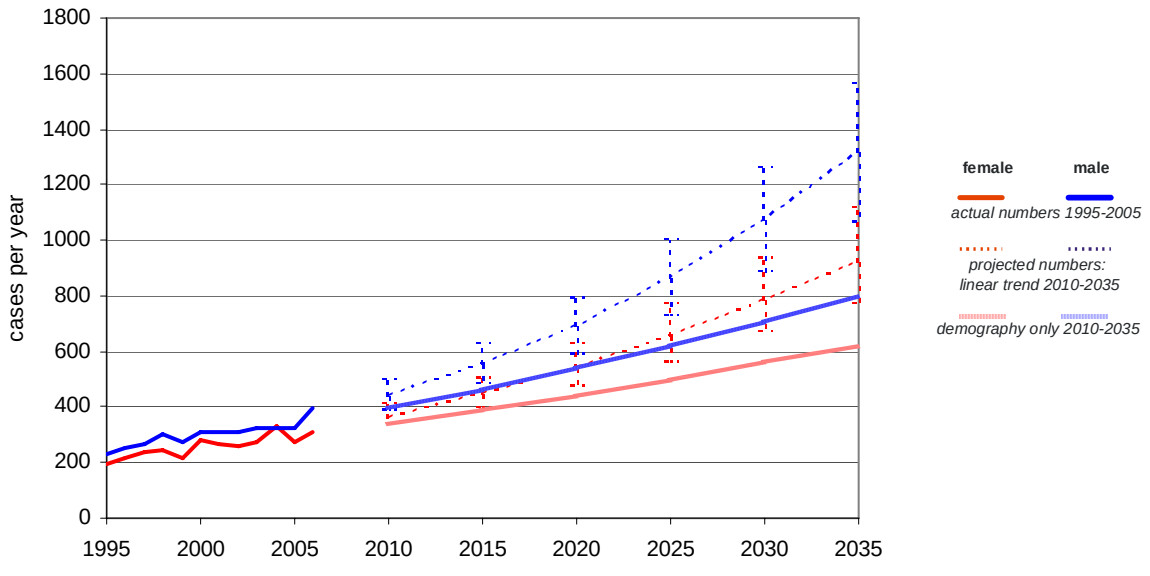
Table 20. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
	198	229
	280	312
	274	327
projected case numbers		
2010	363 (315, 411)	441 (388, 495)
2015	443 (379, 507)	553 (480, 626)
2020	539 (453, 626)	692 (591, 794)
2025	652 (537, 767)	862 (724, 1001)
2030	782 (631, 933)	1070 (882, 1257)
2035	919 (725, 1113)	1314 (1067, 1562)
projections based on demographic change only		
2010	339	399
2015	385	463
2020	438	536
2025	496	617
2030	559	706
2035	621	798

The number of lymphomas is projected to increase by 645 (235%, 8% annually) for females and 987 (302%, 10% annually) for males between 2005 and 2035 (Table 20, Figure 20). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 347 (127%, 4% annually) and male cases by 471 (144%, 5% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 176 (48%) and in males by 251 (57%). Between 2010 and 2030 the increase for females is expected to be 419 (115%) and, for males, 629 (143%).

Figure 20. Actual and projected number of cases 1995-2035



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Leukaemias (ICD10 C91 - C95)

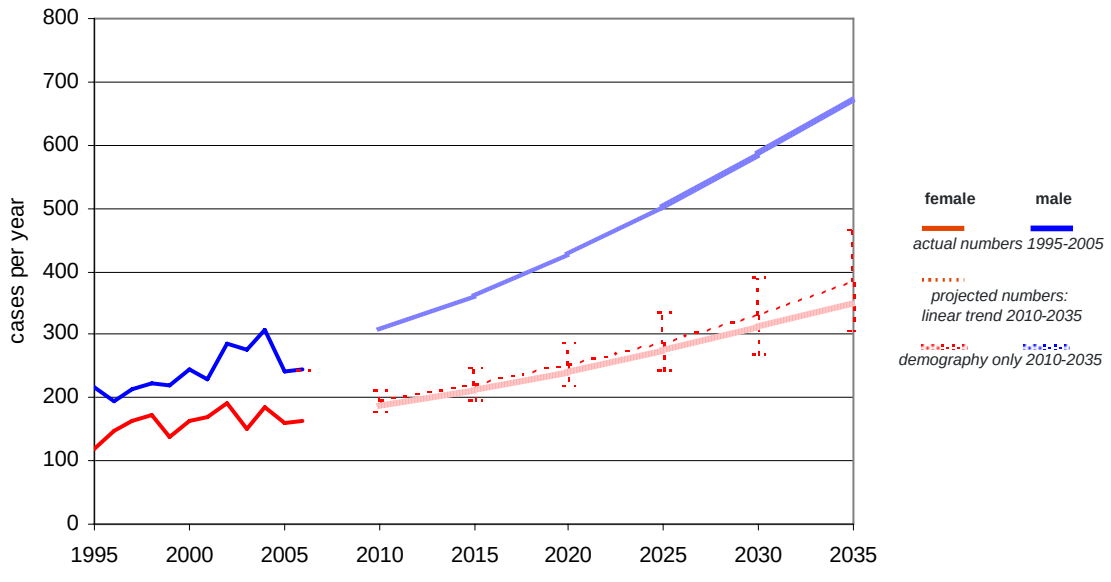
Table 21. Actual and projected number of cancer cases 1995-2035

	females	males
number of registered cases		
1995	120	217
2000	163	244
2005	160	243
projected case numbers		
2010	193 (157, 229)	no projections possible
2015	221 (172, 269)	
2020	252 (185, 318)	
2025	287 (197, 377)	
2030	329 (209, 450)	
2035	384 (225, 542)	
projections based on demographic change only		
2010	188	307
2015r	213	362
2020	242	427
2025	275	502
2030	312	586
2035	350	674

As the rate trends for males changed in 2004, no plausible projections could be made for male incident cases. The number of leukaemias is projected to increase by 224 (140%, 5% annually) for females between 2005 and 2035 (Table 21, Figure 21). Demography alone (assuming no change in underlying cancer rates) would be expected to increase the number of female cases by 190 (119%, 4% annually) and male cases by 431 (177%, 6% annually) over the same period.

Over the ten-year period 2010-2020 the number of cancers in females is expected to increase by 59 (31%), while between 2010 and 2030 the increase is expected to be 136 (70%).

Figure 21. Actual and projected number of cases 1995-2035



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Discussion

Recent trends

The gradual upward trend in overall cancer incidence continues, with an average annual increase of 0.8% for all invasive cancers combined in both sexes, and similar trends for when non-melanoma skin cancers are excluded.

Significant increases in incidence occurred between 1994 and 2006 for females in kidney cancer (3.7% annually), melanoma of skin (2.3%), lung cancer (2.2%), lymphoma (1.6%), non-melanoma cancer of skin (0.7%) and gynaecological cancers (0.6%). Although the trend for breast cancer varied over the period 1994-2006, there was an overall significant increase of 1.6% annually. For males there were significant increases in kidney cancer (5.5% annually from 1994-2002), melanoma of skin (4.2%) and lymphoma (1.7%). For prostate cancer, the trend was not constant, but there was an overall significant trend of 6.1% annually. Despite a fall in 2002-2006, the overall trend for kidney cancer was upwards by 2.8% annually.

Downwards trends in stomach cancer (2.2% decrease annually) and oesophageal cancer (1.3%) were seen for females and in stomach cancer (2.5% annual decrease), bladder cancer (2.1%) and lung cancer (1.2%) for males.

Projections

All cancers

An overall increase in the number of incident cases is projected, by 165% for females and by 213% for males between 2005 and 2035. 72% of this increase in women, and 80% in men, is predicted to be due to demographic change. Over the next 20 years, from 2010-2030, we expect the number of new cases to increase by 95% in women, 120% in men and 108% overall.

If non-melanoma cancers of the skin are excluded, the predictions of increase between 2005 and 2035 are almost the same—a 168% increase in women and a 232% increase in men, 70% of this attributable to demographic change. Between 2010 and 2030, we project that the number of new cases of invasive cancer diagnosed annually (excluding non-melanoma skin cancer) will more than double, from 19060 to 40399, an increase of 21339 cases (112%) per year.

Major cancer sites

Colorectal cancer

There is no observable incidence trend in colorectal cancer at present, so 96% of the predicted increase in incidence is attributable to demographic change. The number of cases in women is projected to increase by 140% and in men by 179% between 2005 and 2035 and by 98% overall in the twenty-year period 2010 to 2030.

Lung cancer

There are significant but opposite incidence trends in men and women, but demographic trends ensure that the number of cases will continue to increase in both sexes. The number of cases is projected to increase by 138% by 2025 and by 257% by 2035, for women. For men the expected increases are much smaller—by 56% by 2025, and 93% by 2035. The increase in men is well below that which would be expected from demographic change alone. If current trends continue, the number of new cases diagnosed annually in women will exceed that in men at some time between 2020 and 2025.

Breast cancer

As noted above, there has been an overall annual increase of 1.6% in female breast cancer incidence between 1994 and 2006, consisting of a period of increase up to 2002 and an apparent (but not statistically significant) fall subsequently. Making projections on the basis of these trends is difficult, but the most plausible assumption is that the pre-screening trend (1994-1999) is the best approximation to the underlying trend in incidence. Modelling this projects a doubling of breast

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cancer cases by 2020-2025, 55% of this due to demographic change. However, these projections may change significantly as additional years of incidence data accumulate.

Prostate cancer

The impact of PSA screening on prostate cancer incidence since 1994 appears to have obscured any underlying trend; however the historical trend in mortality was upwards before the introduction of anti-androgen therapy (12) and it is probable that the underlying incidence trend is upwards. The projected increase of 172% by 2035 due to demographic change should represent the lower estimate of any projection.

Projected relative frequency of cancers

As the majority of the expected change in incidence is due to demographic factors, few major changes are expected in the relative frequencies of the major cancers. For females (Table 22), lung cancer will move from being the 4th commonest cancer (excluding non-melanoma skin cancer) to the 3rd most common (replacing colorectal cancer), and from 10% to 11% of the overall total. Kidney and brain cancer are expected to become relatively more common, while stomach cancer will become relatively less common.

Table 22. Number of female cases per year, rank order and % of total, 2005 and 2020

	cases per year		rank order[1]		% of all invasive cancers[1]	
	2005	**2020**	**2005**	**2020**	**2005**	**2020**
female breast (C50)	2196	3976	1	1	30%	32%
gynaecological (C51-C58)	1002	1587	2	2	13%	13%
lung (C34)	741	1413	4	3	10%	11%
colorectal (C18-C21)	888	1367	3	4	12%	11%
melanoma of skin (C43)	360	671	5	5	5%	5%
lymphoma (C81-C85)	274	539	6	6	4%	4%
pancreas (C25)	207	331	7	7	3%	3%
kidney (C64)	148	307	10	8	2%	2%
leukaemia (C91-C95)	160	252	9	9	2%	2%
brain and central nervous system (C70-C72)	118	219	13	9	2%	2%
stomach (C16)	167	185	8	11	2%	1%
bladder (C67)	143	174	11	12	2%	1%
oesophagus (C15)	120	156	12	13	2%	1%
head and neck (C01-C14)	83	133	14	14	1%	1%

Table 23. Number of male cases per year, rank order and % of total, 2005 and 2020

	cases per year		rank order[1]		% of all invasive cancers[1]	
	2005	**2020**	**2005**	**2020**	**2005**	**2020**
prostate (C61) (based on demography only)	2415	4093	1	1	29%	26%[8]
colorectal (C18-C21)	1223	2035	2	2	15%	13%
lung (C34)	1090	1568	3	3	13%	10%
lymphoma (C81-C85)	327	692	5	4	4%	4%
melanoma of skin (C43)	246	576	7	5	3%	4%
head and neck (C01-C14)	194	440	10	6	2%	3%
bladder (C67)	331	420	4	7	4%	3%
oesophagus (C15)	214	374	9	8	3%	2%
stomach (C16)	286	331	6	9	3%	2%
kidney (C64)	227	318	8	10	3%	2%
brain and central nervous system (C70-C72)	188	311	11	11	2%	2%
pancreas (C25)	177	306	12	12	2%	2%

[1] Excluding non-melanoma skin cancer

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For males (Table 23) no projections can be made for prostate cancer, but based on demography alone it seems likely to remain by far the commonest cancer. Colorectal and lung cancer will remain second and third most common cancers respectively, but will both reduce their proportion of the overall cancer burden from 15% to 13% and from 13% to 10% respectively. Head and neck cancer (based on 2002-2006 trends) and melanoma are expected to become relatively more common, while cancer of the bladder is expected to become relatively less common.

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Appendix. Consistency of projections

Comparison of current and previous projections

The Registry made projections using broadly similar methods in 2006 (1). Three changes have occurred since those projections:

- Incidence data is available for a longer period (1994-2006 compared to 1994-2003).
- Revised population projections, based on the most recent census (2006) have been incorporated.
- Trends have been tested for linearity prior to modelling.

However, given these changes, the original projections have proven to be quite robust (Table 24).

For females, the current projections are a little lower than those made in 2006, while for males they are a little higher. For both sexes combined, and excluding non-melanoma skin cancers, the previous projection was of 19682 cases in 2010, while the current projection suggests 19060, a difference of 622 cases, or 3%. A similar gap of about 675 cases (2%) separates the projections for 2020.

The largest relative discrepancy in projections is for cancers of the head and neck for males, which in the current analysis has been projected (on the basis of more recent data) to be rising more rapidly than was previously thought. However, the case numbers are relatively small and the projections should be treated with caution. Cancers of female breast are also projected to reach lower numbers than in the previous analysis, but these projections have been particularly difficult, and the current estimates disregard the rapid rise from 2000 to 2002, which formed part of the previous projections.

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Table 24. Comparison of current and former (2006) projections (± 95% prediction intervals)

site	sex	2010 current projections	2010 2006 projections	2010 current/2006	2020 current projections	2020 2006 projections	2020 current/2006
all invasive cancers (C00-C96)	female	12165 ± 281	12408 ± 189	98%	17024 ± 519	17169 ± 380	99%
	male	14118 ± 305	13466 ± 201	105%	21355 ± 616	19153 ± 432	111%
all invasive cancers (C00-C96) excluding non-melanoma skin (C44)	female	8838 ± 239	9391 ± 162	94%	12387 ± 441	13328 ± 324	93%
	male	10222 ± 259	10291 ± 172	99%	15723 ± 522	15457 ± 366	102%
head and neck (C01-C14)	female	97 ± 25	103 ± 17	94%	133 ± 46	138 ± 34	96%
	male	255 ± 68	144 ± 19	177%	440 ± 222	122 ± 29	361%
oesophagus (C15)	female	132 ± 30	138 ± 21	96%	156 ± 57	165 ± 43	95%
	male	257 ± 41	252 ± 28	102%	374 ± 84	347 ± 60	108%
stomach (C16)	female	174 ± 33	192 ± 23	91%	185 ± 49	218 ± 43	85%
	male	294 ± 43	277 ± 27	106%	331 ± 68	290 ± 45	114%
colorectal (C18-C21)	female	1020 ± 82	979	104%	1367 ± 154	1273	107%
	male	1402 ± 97	1358	103%	2035 ± 199	1920	106%
pancreas (C25)	female	235 ± 39	235 ± 26	100%	331 ± 74	324 ± 54	102%
	male	224 ± 40	259 ± 28	86%	306 ± 83	388 ± 60	79%
lung (C34)	female	904 ± 76	923 ± 49	98%	1413 ± 140	1437 ± 101	98%
	male	1180 ± 91	1236 ± 62	95%	1493 ± 189	1638 ± 137	91%
melanoma of skin (C43)	female	438 ± 52	426 ± 33	103%	671 ± 92	633 ± 64	106%
	male	329 ± 45	293 ± 27	112%	576 ± 83	468 ± 54	123%
non-melanoma skin (C44)	female	3328 ± 147		87%	4642 ± 273		84%
	male	4616 ± 253		86%	8208 ± 788		64%
female breast (C50)	female[1]	2720 ± 359	3117 ± 90	95%	3976 ± 773	4734 ± 175	95%
	female[2]	2696 ± 157		90%	3040 ± 315		78%
gynaecological (C51-C58)	female	1146 ± 86	1202 ± 58	88%	1587 ± 157	1676 ± 115	52%
prostate (C61)	male		3409 ± 88	99%		6330 ± 183	97%
kidney (C64)	female	161 ± 33	179 ± 21	102%	219 ± 60	282 ± 42	106%
	male	316 ± 56	360 ± 30	84%	318 ± 103	612 ± 62	77%
bladder (C67)	female	147 ± 31	148 ± 21	100%	174 ± 60	180 ± 42	103%
	male	350 ± 47	344 ± 31	103%	420 ± 80	396 ± 57	107%
brain and central nervous system (C70-C72)	female	161 ± 33	192 ± 22	102%	219 ± 60	285 ± 44	106%
	male	221 ± 39	222 ± 26	117%	311 ± 72	303 ± 52	138%
lymphoma (C81-C85)	female	363 ± 48	353 ± 31	98%	539 ± 86	504 ± 62	99%
	male	441 ± 53	434 ± 35	105%	692 ± 101	650 ± 70	111%
leukaemia (C91-C95)	female	193 ± 36	165 ± 23	94%	252 ± 67	182 ± 47	93%
	male		308 ± 30	99%		437 ± 63	102%

[1] Based on 1994-1996 trend

[2] Based on 2002-2006 trend

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Comparison of actual case numbers for 2005 with previous projections

Estimates given in the previous report (1) have been compared to the incidence as directly measured for 2005, as a rough guide to the validity of the methods used.

In general, the case numbers were found to be close to those projected (Table 25). While this is unsurprising, given that the data modelled extended to 2003, the close accord, especially for all cancers combined, suggests that the models used were robust.

site	sex	actual 2005 numbers	previous estimate	actual numbers as percentage of estimate
all invasive cancers (C00-C96)	female	10341	10632	103%
	male	11632	11475	99%
all invasive cancers (C00-C96) excluding non-melanoma skin (C44)	female	7439	7905	106%
	male	8239	8497	103%
head and neck (C01-C14)	female	83	88	106%
	male	194	160	82%
oesophagus (C15)	female	120	128	107%
	male	214	219	102%
stomach (C16)	female	167	186	111%
	male	286	278	97%
colorectal (C18-C21)	female	888	883	99%
	male	1223	1180	96%
liver (C25)	female	48	52	108%
	male	91	90	99%
pancreas (C25)	female	207	207	100%
	male	177	216	122%
lung (C34)	female	741	752	101%
	male	1090	1113	102%
melanoma of skin (C43)	female	360	346	96%
	male	246	227	92%
female breast (C50)	female	2196	2472	113%
gynaecological (C51-C58)	female	1002	1019	102%
prostate (C61)	male	2415	2422	100%
testis (C62)	male	158	164	104%
kidney (C64)	female	148	143	97%
	male	227	273	120%
bladder (C67)	female	143	139	97%
	male	331	332	100%
brain and central nervous system (C70-C72)	female	118	159	135%
	male	188	194	103%
lymphoma (C81-C85)	female	274	297	108%
	male	327	356	109%
myeloma (C90)	female	94	80	85%
	male	116	126	109%
leukaemia (C91-C95)	female	160	156	98%
	male	243	262	108%

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