

## ■ All adult cancer

Cancer is a heterogeneous group of conditions with multiple independent and interacting causes. Nevertheless, it is useful to analyse and forecast the burden of cancer as a whole.

Age is arguably the strongest determinant of the risk of cancer, typically being correlated with risk in an exponential fashion. This chapter is restricted to cancer among adults (15 years and above). To obtain a complete picture of the entire cancer burden, results presented in this chapter should be read alongside the corresponding analysis of cancers among children (0–14 years) presented in the next chapter. Results for individual cancer sites among adults are then presented in alphabetical order from Chapter 9 to Chapter 34.

### Historical trends

#### *Incidence*

Among adult males the average annual age standardised incidence rate of cancer (all sites combined) increased rapidly from 1956 (245 per 100,000) to the early 1980s (437 per 100,000). Thereafter the trend has slowed considerably, though still rising. During the 1990s the rate was ‘artefactually’ elevated by widespread prostate specific antigen (PSA) testing. Using modelled instead of observed prostate cancer<sup>1</sup> data from 1994, the rate would have continued to increase slowly, reaching 478 per 100,000 in 1996. This would have corresponded to 7336 annual registrations in the mid 1990s<sup>2</sup> compared to around 1900 in the mid 1950s. Only one-third of this nearly four-fold increase in the number of registrations is attributable to increasing risk of cancer over the 40 year observation period. Population growth, and to a much lesser extent the structural ageing of the population, were responsible for the remaining two-thirds of the observed increase in the adult male cancer burden.

Trends in female all adult cancer registrations are similar to those for males, with a rapid rise in the average annual age standardised incidence rate from 219 per 100,000 in 1956 to over 350 per 100,000 in the late 1970s. Thereafter the rate has continued to rise more slowly, reaching 423 per 100,000 in 1996. Over the observation period, however, the number of annual registrations increased by more than four-fold, from just over 1800 per year in the mid 1950s to 7472 per year in the mid 1990s. Again, demographic changes – particularly increasing population size – were responsible for the majority of this increase.

By the mid 1990s annual numbers of male and female registrations were similar if the ‘PSA effect’ is adjusted for, although the age standardised incidence rate for males was over 10% higher than that of females. Among males significant ethnic differences were seen in the age standardised all adult cancer incidence rates for ‘sole’ but not for ‘total’ Māori versus non-Māori; this may disguise substantial undercounting of Māori cancer registrations. Among females, the cancer incidence rate for Māori was higher than for non-Māori, for both ethnic classifications.

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<sup>1</sup> See Chapter 30 on prostate cancer for details of modelling 1994–98 data.

<sup>2</sup> Unadjusted rates and counts were 549 per 100,000 and 8448 registrations, respectively.

Examination of NZDep96 quintiles in the mid 1990s reveals a direct deprivation gradient in cancer incidence for both genders. After controlling for age, the incidence rate for the most deprived quintile was more than 20% higher than that for the least deprived quintile.

### *Mortality*

Trends in all cancer mortality contrast with those for incidence. Among males the average annual age standardised mortality rate increased from 261 per 100,000 (or around 2500 deaths) in 1972 to peak at approximately 270 per 100,000 in the 1980s, but has since declined to 246 per 100,000 (or 3898 deaths) in 1997. The number of cancer deaths, however, has increased by over 50% over the observation period despite this decline in mortality risk. Population growth and structural ageing in the interim have together outweighed the effect of the declining cancer mortality risk.

Among females trends in cancer mortality rates were similar to those in males. The average annual age standardised mortality rate increased from 178 per 100,000 (or nearly 2100 deaths) in 1972 to peak in the late 1980s at approximately 190 per 100,000, but then fell back to 181 per 100,000 (or 3549 deaths) in 1997. The annual number of female cancer deaths has, however, increased steadily over the observation period, as the decline in mortality risk has been more than offset by demographic trends, as for males.

In the mid 1990s males experienced an all cancer mortality rate about 35% higher than that of females, once age was taken into account; this contrasts with an incidence excess of 'only' 10%. Māori age standardised cancer mortality rates exceeded those of non-Māori (more strongly than was the case for registrations). An even stronger direct deprivation gradient is seen for cancer mortality than incidence in the mid 1990s: the difference in the age standardised mortality rates between the most and the least deprived quintiles was 40–50% (compared to 20% for the corresponding incidence rates).

For all cancer sites combined, both incidence and mortality rates increased steeply with age (among adults). Female incidence rates exceed the corresponding male rates until old age, reflecting inter alia the occurrence of breast cancer among middle aged females. Thereafter male incidence and mortality rates exceed those of their female counterparts, reflecting in part the (currently greater) impact of tobacco related cancers on males.

Comparing New Zealand with Australian cancer rates in the mid 1990s – a comparison that is possible because cancer registries and death registries in both countries operate similarly – New Zealand experienced all cancer incidence and mortality rates about 9% higher for males and 22% higher for females (Skegg and McCredie 2002). Much of the difference was contributed by lung and breast cancer for females, and colorectal cancer for males. While the inequalities in incidence probably reflect differential exposure to tobacco, dietary patterns and reproductive behaviours, the mortality variations may also reflect differences in access to and effectiveness of cancer care. This hypothesis will be answered when the analysis of New Zealand survival data for the period 1994 to 1999, currently being carried out by the NZHIS, becomes available.

## Projections to 2011/12

Adult cancer (all sites combined) is forecast in this report in two ways:

- projecting ‘all adult cancer’ as if it was a single entity (site) in itself.
- adding up the projections for all of the individual sites

This chapter reports the results obtained using the former method. However, results from both methods agree reasonably closely: within 5% for registrations and 8% for death counts for each gender (ages pooled) (see Table 4.2).

The ‘all adult cancer’ model forecasts that the age standardised incidence rate of cancer will continue to increase for both genders, albeit more slowly than previously. Among males, after adjusting for the ‘PSA effect’ (which should be largely over by 2011 in any case), the rate is projected to reach 510 per 100,000 (CI 429 – 624) by 2011, a 7% increase over 1996. When the impacts of population growth and (especially) of population ageing are superimposed on this increase in risk, the number of registrations in 2011 is projected to reach 11,005 (CI 9050 – 13,790) – a 50% increase over the 1996 level.

The forecast for females is similar, with the age standardised incidence rate continuing to increase, but more slowly than prior to 1996, reaching 450 per 100,000 (CI 370 – 553) by 2011; this is a 6% increase over 1996. This corresponds to approximately 10,772 registrations (CI 8584 – 13,360) in 2011, an increase of 44% since 1996. As for males, the ageing of the female population is anticipated to emerge as an increasingly important driver of the growth in the cancer burden.

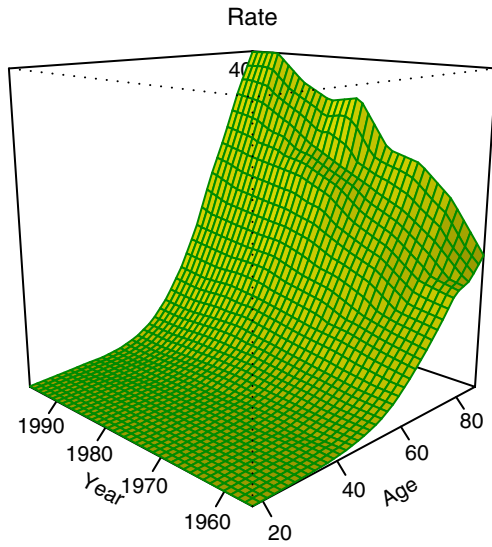
By contrast, the age standardised ‘all adult cancer’ mortality rates are forecast to continue to decline for both genders. Among males the rate is projected to reach 198 per 100,000 (CI 173 – 233) by 2012, corresponding to 4554 deaths (CI 3845 – 5537). However, this still represents a 17% increase in the absolute number of cancer deaths over 1997.

Similarly, the ‘all adult cancer’ age standardised mortality rate for females is projected to reach 162 per 100,000 (CI 140 – 188) by 2012, corresponding to 4409 deaths (CI 3681 – 5294) in that year. This nevertheless represents a 24% increase in the female cancer death count since 1997.

In both genders, population growth and structural ageing, which are expected to be impacting almost equally on the cancer burden by 2012, are able to offset the declining cancer mortality risks so as to yield a net increase in the number of cancer deaths.

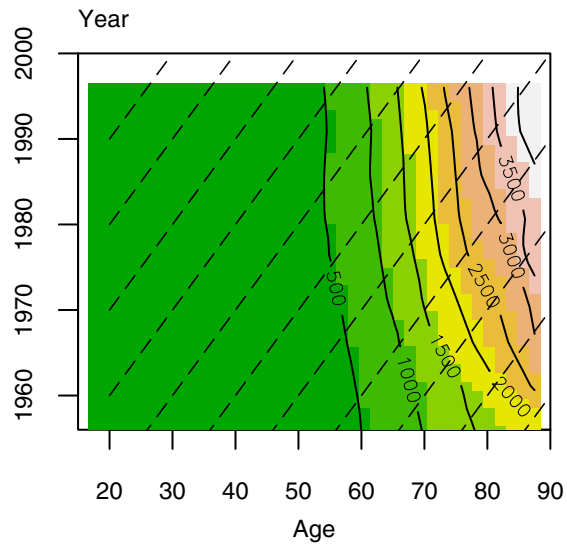
**Figure 7.1** Historical trends in age specific rates, all adult cancer, males

(a) Male incidence rates\*, perspective plot

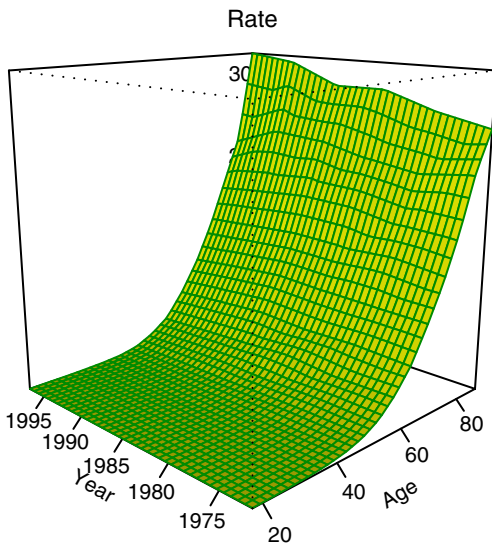


Maximum rate = 4314 per 100,000  
\* Adjusted for the 'PSA effect'.

(b) Male incidence rates\*, contour plot

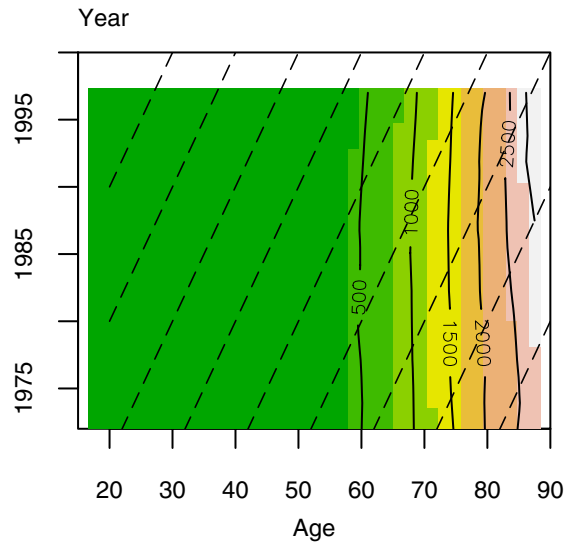


(c) Male mortality rates, perspective plot



Maximum rate = 3265 per 100,000

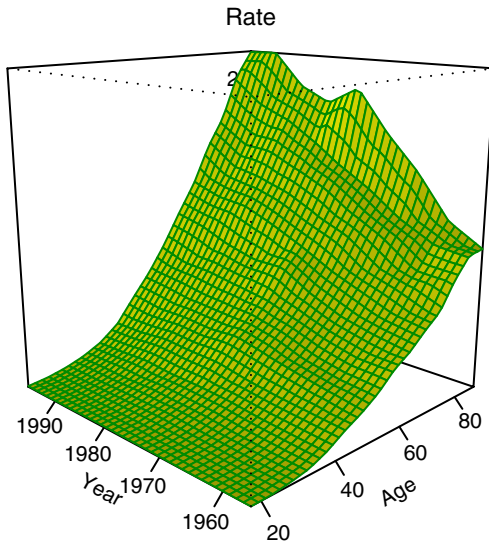
(d) Male mortality rates, contour plot



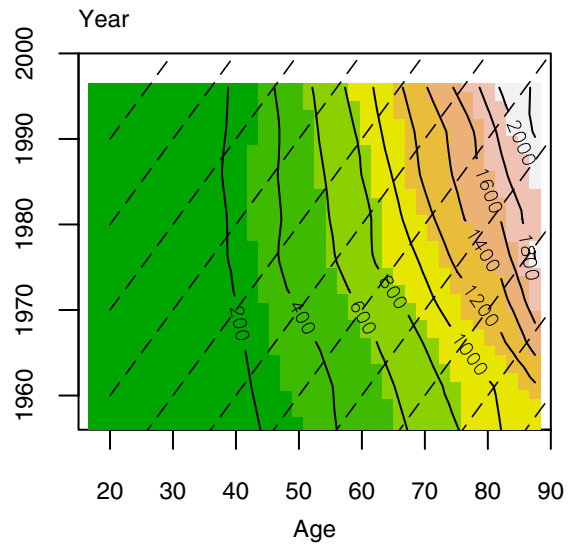
Please refer to Chapter 2 for interpretation of charts

**Figure 7.2** Historical trends in age specific rates, all adult cancer, females

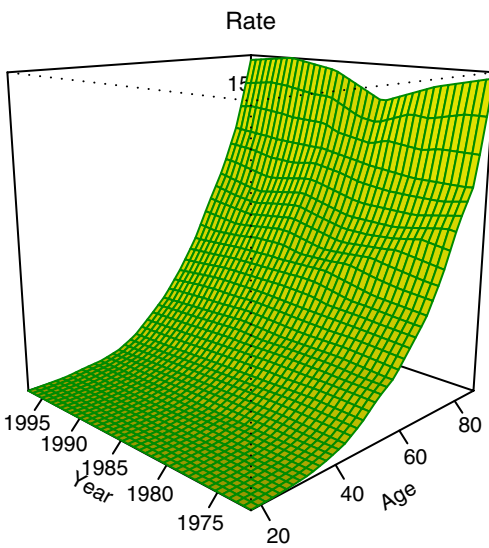
(a) Female incidence rates, perspective plot



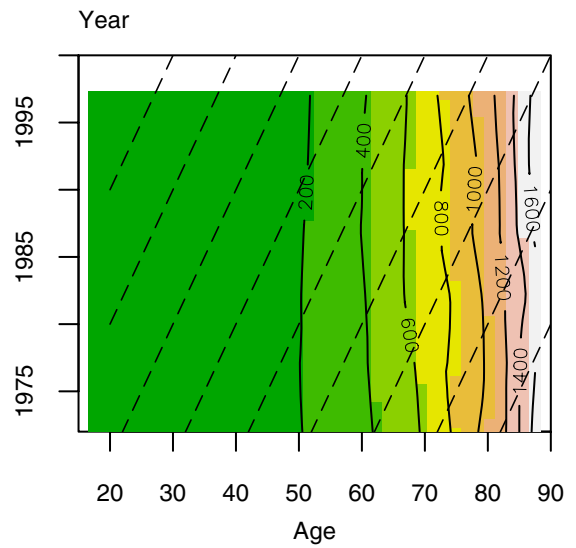
(b) Female incidence rates, contour plot



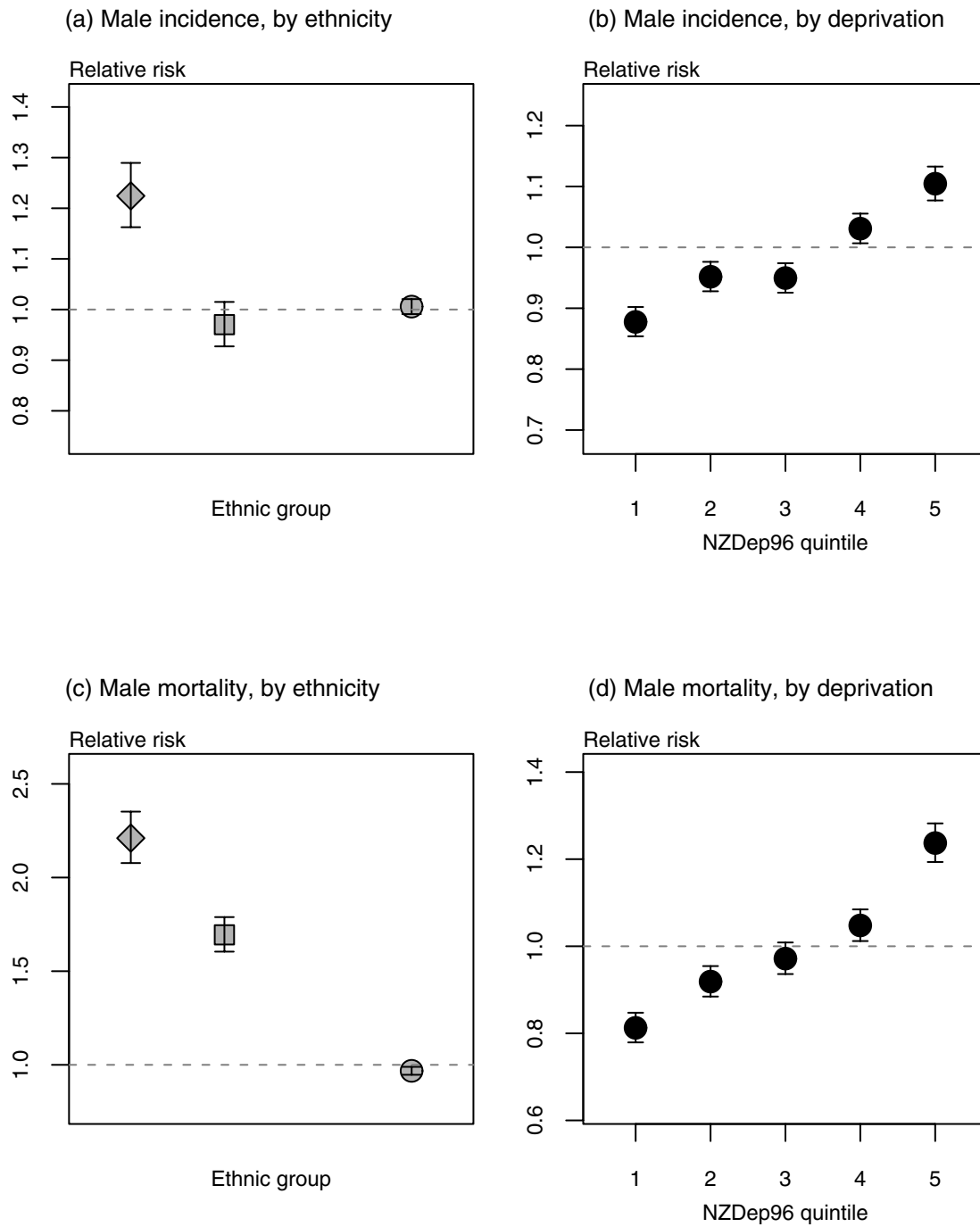
(c) Female mortality rates, perspective plot



(d) Female mortality rates, contour plot



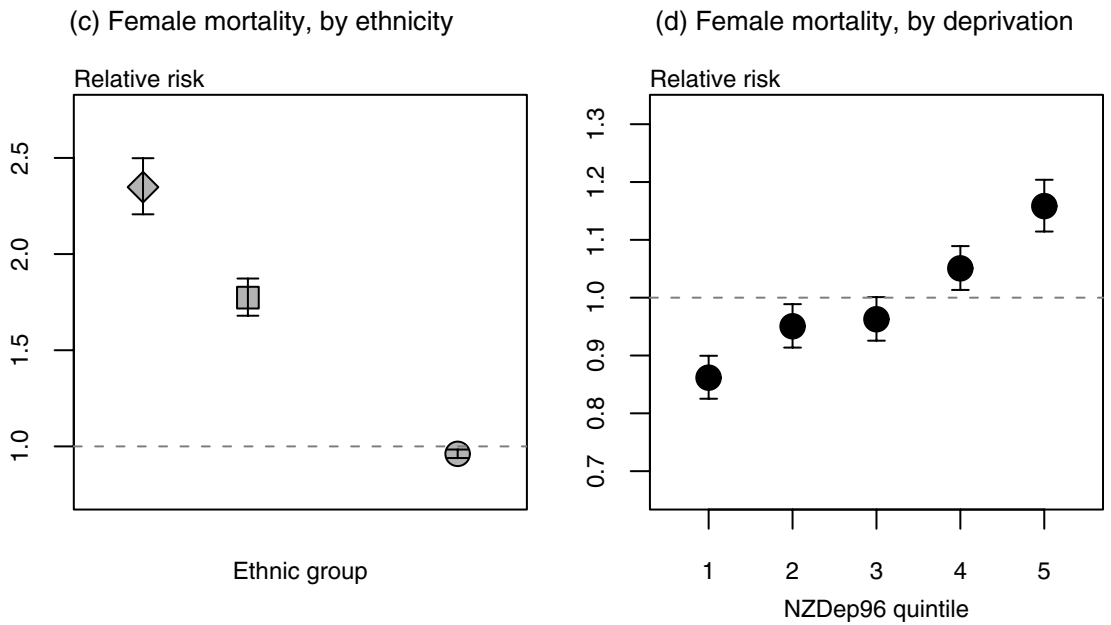
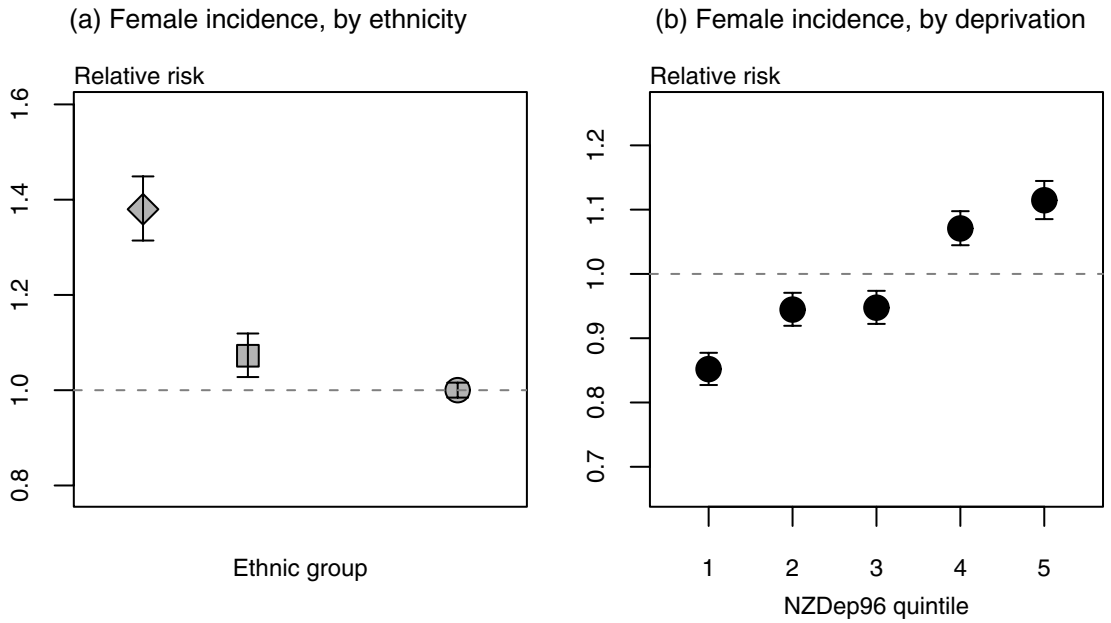
**Figure 7.3** Relative risk 1996/97, all adult cancer, males



Ethnic group key:

- ◆ sole Māori
- total Māori
- non-Māori

**Figure 7.4** Relative risk 1996/97, all adult cancer, females

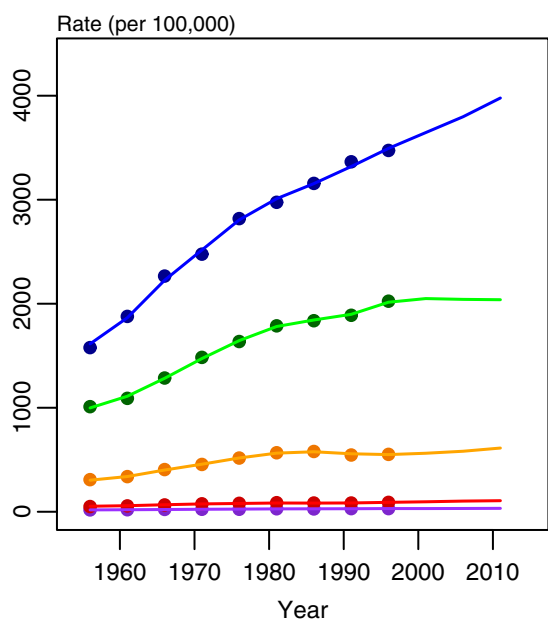


Ethnic group key:

- ◆ sole Māori
- total Māori
- non-Māori

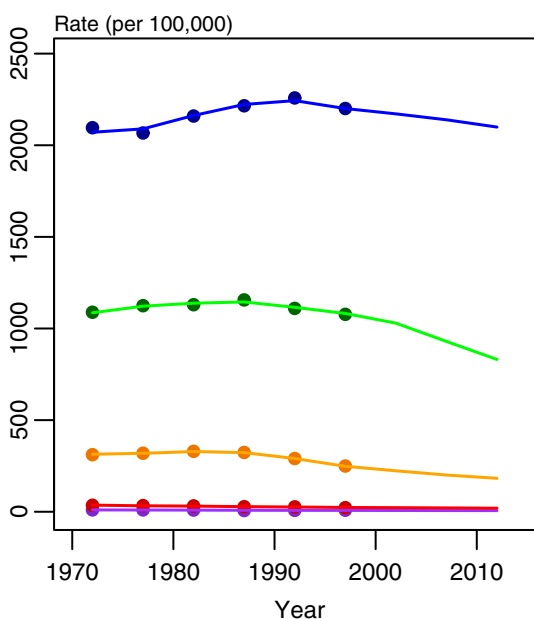
**Figure 7.5** Trends and projections of life cycle stage specific rates, all adult cancer

(a) Male incidence rates\*

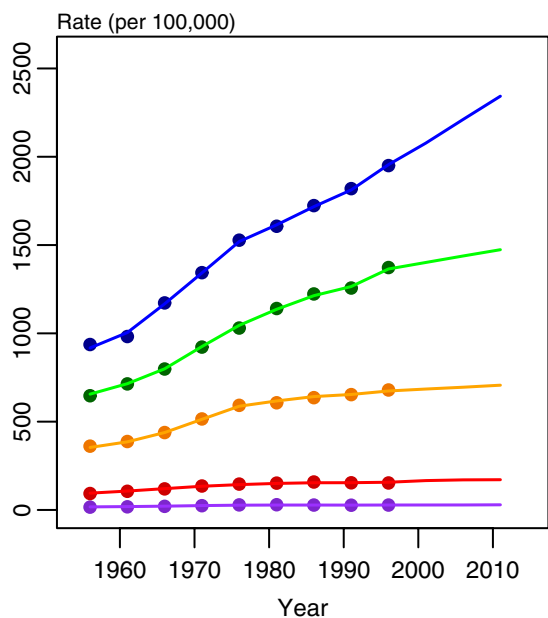


\* Adjusted for the 'PSA effect'.

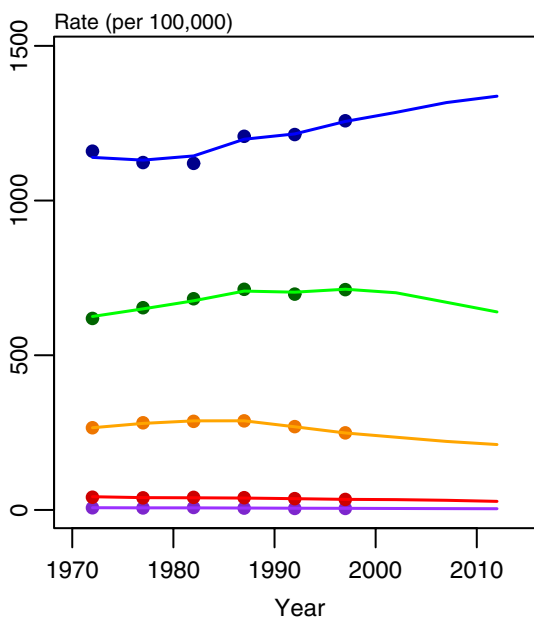
(b) Male mortality rates



(c) Female incidence rates



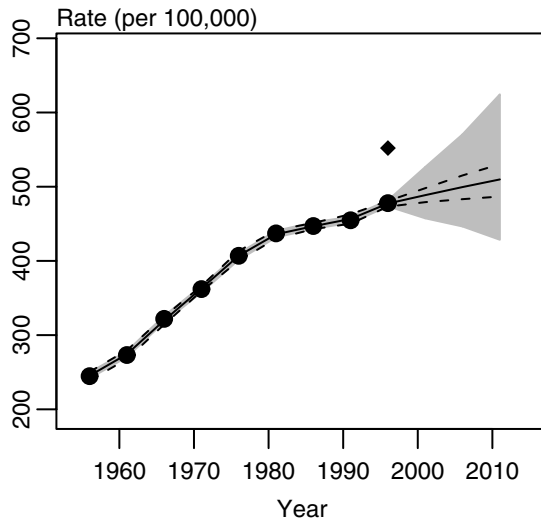
(d) Female mortality rates



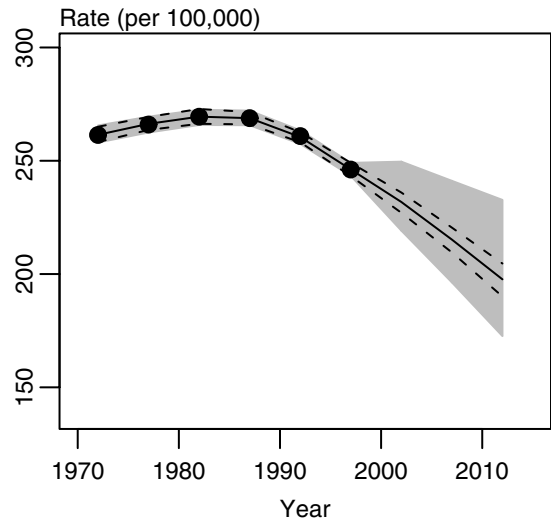
- Key:
- 15-24 years
  - 25-44 years
  - 45-64 years
  - 65-74 years
  - 75 years and above

**Figure 7.6** Trends and projections of age standardised rates, all adult cancer

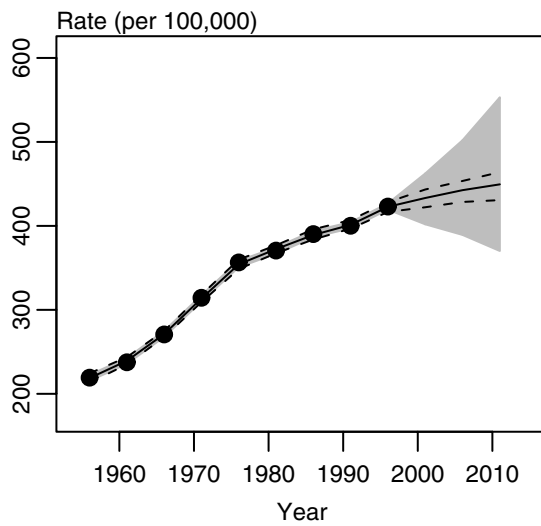
(a) Male incidence rates



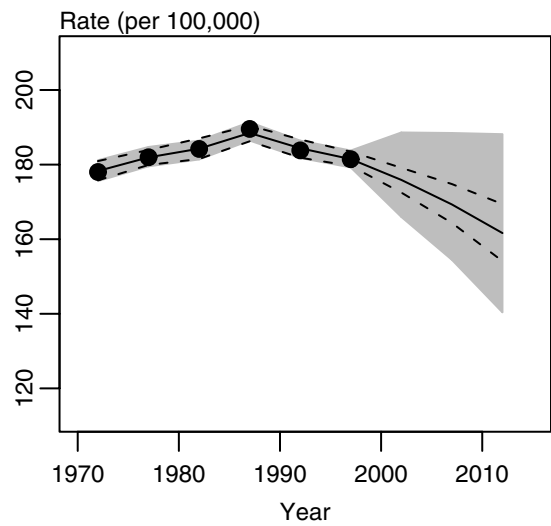
(b) Male mortality rates



(c) Female incidence rates



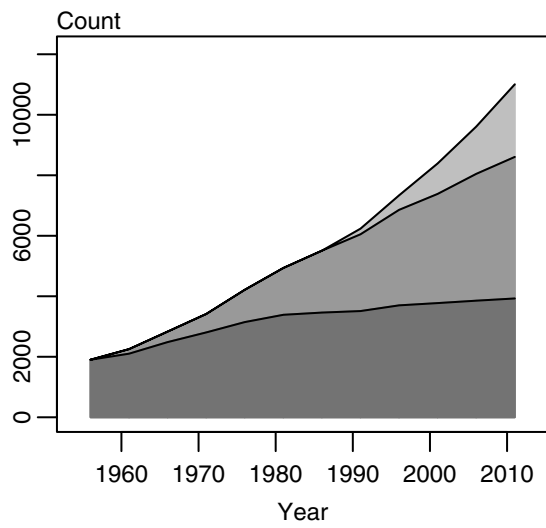
(d) Female mortality rates



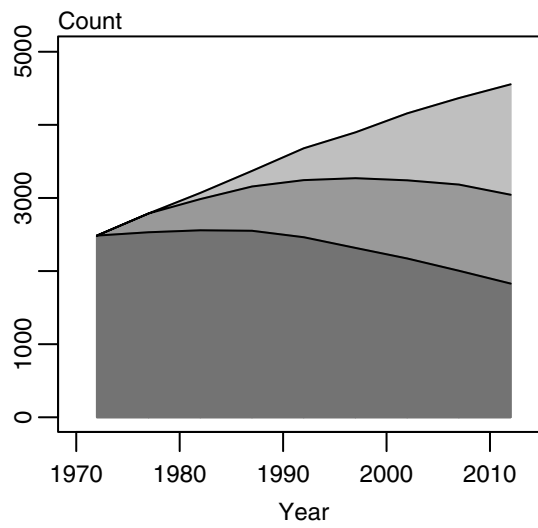
- Key:
- Observed (other than 1994–98 prostate cancer registration data, figure (a))
  - ◆ Observed using prostate cancer 1994–98 registration data
  - Fitted and projected (with adjustment for the ‘PSA effect’ in Figure (a))
  - - Minimum and maximum estimates
  - 90% Bayesian credible interval

**Figure 7.7** Drivers of change in the cancer burden, all adult cancer

(a) Male registrations\*

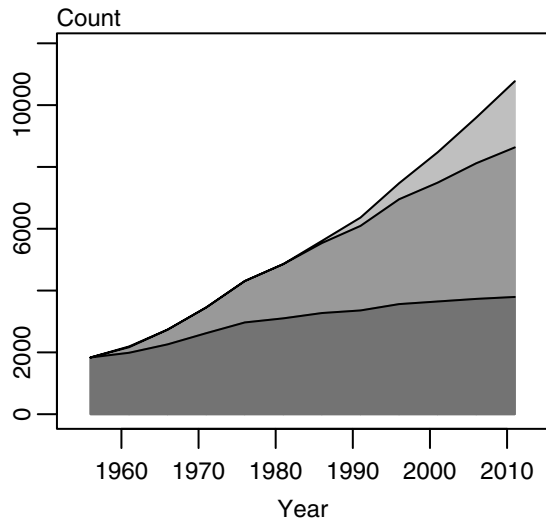


(b) Male deaths

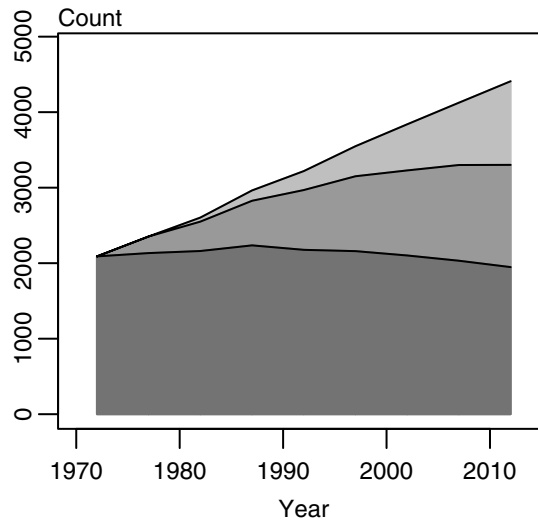


\* Adjusted for the 'PSA effect'.

(c) Female registrations



(d) Female deaths



Key:

- Risk effect
- Population size effect
- Population ageing effect

**Table 7.1** Key results, all adult cancer

## Males

	Incidence*			Mortality		
	1996	2011 (CI)	change (%)	1997	2012 (CI)	change (%)
<i>Age standardised or age specific rate (per 100,000)</i>						
15+	478	510 (429 – 624)	7	246	198 (173 – 233)	-20
15–44	71	80 (59 – 92)	14	18	15 (11 – 17)	-18
45–64	552	613 (503 – 772)	11	249	182 (161 – 234)	-27
65+	2547	2823 (2346 – 3555)	11	1489	1336 (1117 – 1602)	-10
<i>Number of cases</i>						
15+	7336	11,005 (9050 – 13,790)	50	3898	4554 (3845 – 5537)	17
15–44	586	683 (504 – 785)	17	149	125 (93 – 141)	-16
45–64	2045	3290 (2702 – 4148)	61	948	991 (877 – 1271)	5
65+	4704	7033 (5844 – 8857)	50	2801	3438 (2875 – 4124)	23

\* Adjusted for the 'PSA effect'.

## Females

	Incidence			Mortality		
	1996	2011 (CI)	change (%)	1997	2012 (CI)	change (%)
<i>Age standardised or age specific rate (per 100,000)</i>						
15+	423	450 (370 – 553)	6	181	162 (140 – 188)	-11
15–44	113	124 (104 – 164)	9	25	20 (16 – 25)	-21
45–64	679	706 (579 – 904)	4	249	212 (181 – 262)	-15
65+	1640	1887 (1460 – 2261)	15	969	966 (799 – 1143)	0
<i>Number of cases</i>						
15+	7472	10772 (8584 – 13360)	44	3549	4409 (3681 – 5294)	24
15–44	960	1039 (873 – 1376)	8	213	165 (138 – 208)	-23
45–64	2525	3945 (3234 – 5049)	56	952	1197 (1023 – 1483)	26
65+	3988	5788 (4478 – 6934)	45	2385	3047 (2520 – 3603)	28

CI = 90% Bayesian credible interval



## (b) Male mortality

Calendar period	Age group														ASR Credible interval	
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84		85+
<i>Rate (per 100,000 per year)</i>																
1970-74	9.2	10.9	16.9	22.8	38.8	67.6	121.6	219.9	385.8	610.7	939.3	1309.0	1763.5	2325.9	2705.1	261.4
1975-79	8.6	12.1	17.4	22.4	40.1	64.6	126.4	230.6	375.1	636.2	949.0	1375.5	1787.0	2245.4	2816.6	266.0
1980-84	8.9	10.0	16.2	19.4	33.8	66.8	116.6	214.6	424.1	622.8	962.6	1349.4	1884.3	2320.2	2987.2	269.5
1985-89	5.9	8.2	13.8	20.0	27.2	55.5	100.4	222.5	383.3	654.1	991.1	1366.7	1900.1	2442.1	2978.4	268.8
1990-94	7.3	7.7	15.1	17.1	27.8	49.4	93.6	202.0	352.6	617.1	946.4	1332.7	1850.0	2477.6	3196.2	260.9
1995-99	7.1	9.5	10.9	15.9	24.0	40.2	81.4	175.7	319.0	575.9	894.6	1298.3	1789.8	2282.7	3264.6	246.1
2000-04	6.1	7.9	11.5	14.1	23.1	39.0	73.4	147.4	285.6	511.1	836.5	1245.8	1762.3	2316.9	3073.3	231.8 (219.2 – 249.6)
2005-09	5.7	7.4	10.6	14.4	20.2	36.4	65.4	130.4	245.7	449.9	754.7	1163.3	1678.1	2279.1	3009.8	215.2 (196.3 – 241.1)
2010-14	5.3	7.0	10.0	13.4	20.6	31.6	60.5	115.2	217.3	389.0	667.1	1055.1	1574.6	2174.6	2960.6	197.7 (172.6 – 232.7)
<i>Deaths (per year)</i>																
1970-74	13	13	17	20	30	55	98	158	248	347	414	393	301	224	153	2485
1975-79	14	16	21	24	37	51	102	183	254	380	476	482	372	226	151	2788
1980-84	14	14	20	23	35	59	89	167	311	387	500	536	461	279	173	3069
1985-89	9	12	19	25	33	57	89	164	282	448	534	574	543	361	221	3370
1990-94	10	11	20	24	36	60	96	174	255	441	596	617	588	447	306	3680
1995-99	10	13	15	23	35	53	101	181	268	398	584	698	641	479	399	3898
2000-04	9	10	15	20	34	58	98	181	288	412	532	706	752	570	473	4157 (3715 – 4721)
2005-09	9	10	13	20	30	55	98	173	296	434	560	646	762	683	578	4367 (3813 – 5104)
2010-14	8	11	13	17	29	47	91	171	281	448	597	691	711	709	730	4554 (3845 – 5537)

Notes: (1) cells shaded in grey indicate projected values; (2) ASR = age standardised rate, to WHO world population

## (c) Female registration

Calendar period	Age group											ASR Credible interval				
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69		70-74	75-79	80-84	85+
<i>Rate (per 100,000 per year)</i>																
1954-58	14.4	16.7	32.1	55.2	107.2	182.5	245.3	324.2	432.1	505.4	606.2	695.3	876.4	1010.8	1024.9	219.3
1959-63	15.6	20.8	33.7	63.6	121.4	200.6	285.3	344.5	439.9	544.7	646.3	793.7	894.0	1043.4	1167.4	237.6
1964-68	15.9	26.8	45.1	77.4	137.1	219.2	326.7	389.5	493.6	599.2	740.2	870.4	1067.5	1165.3	1478.0	270.6
1969-73	19.9	29.6	55.5	100.1	162.0	246.4	373.2	470.4	569.2	695.4	833.5	1035.6	1195.4	1336.5	1722.4	314.4
1974-78	20.9	36.7	69.3	109.5	173.4	286.5	422.5	518.2	644.8	828.0	953.1	1131.0	1353.5	1474.8	2022.6	356.4
1979-83	23.1	35.7	67.1	119.5	175.0	290.8	406.0	531.8	682.1	830.0	1056.4	1243.6	1460.1	1636.9	1893.6	370.5
1984-88	20.6	34.7	65.4	110.0	193.6	304.4	420.9	547.9	720.0	890.7	1144.8	1313.4	1563.6	1778.2	1999.6	390.2
1989-93	18.6	35.1	63.1	113.1	180.8	281.2	414.8	584.6	733.3	979.7	1169.2	1359.8	1582.7	1870.2	2236.5	400.1
1994-98	19.8	35.0	64.1	108.0	173.9	277.1	447.9	610.3	805.7	1031.5	1241.4	1516.6	1724.7	2043.5	2228.8	423.0
1999-03	21.2	35.5	62.4	109.5	183.4	297.6	446.5	616.3	808.8	1036.6	1273.6	1536.6	1814.5	2093.9	2475.6	433.2 (401.9 – 462.4)
2004-08	21.6	36.0	64.1	108.4	183.6	297.4	447.1	610.1	821.4	1055.4	1316.9	1587.5	1900.5	2215.2	2632.8	442.5 (389.3 – 502.0)
2009-13	22.1	36.5	64.6	110.7	180.8	296.7	445.9	609.6	812.2	1070.7	1340.1	1644.3	1970.0	2327.0	2790.0	449.5 (370.1 – 553.1)
<i>Cases (per year)</i>																
1954-58	11	11	23	42	78	128	156	177	204	211	228	216	186	109	56	1836
1959-63	15	16	24	48	93	148	199	215	232	246	252	260	215	144	82	2190
1964-68	19	26	37	57	107	173	240	270	299	305	317	298	273	182	136	2738
1969-73	26	34	53	84	121	192	289	340	381	408	400	390	321	228	187	3454
1974-78	31	46	84	111	151	219	326	400	451	537	532	483	405	277	254	4308
1979-83	35	48	82	142	174	248	296	399	499	550	634	607	505	348	290	4858
1984-88	31	49	89	140	230	301	349	396	522	632	713	704	630	452	367	5606
1989-93	26	50	89	162	231	335	407	483	526	698	789	775	726	566	497	6361
1994-98	26	49	92	165	259	368	545	600	659	720	847	947	852	721	621	7472
1999-03	28	45	84	165	287	451	596	744	783	826	847	965	988	815	848	8473 (7462 – 9416)
2004-08	32	45	80	157	284	474	683	814	982	997	1002	978	1050	958	1060	9595 (8116 – 11139)
2009-13	32	50	80	144	268	464	711	923	1066	1244	1209	1162	1073	1033	1311	10772 (8584 – 13360)

Notes: (1) cells shaded in grey indicate projected values; (2) ASR = age standardised rate, to WHO world population

(d) Female mortality

Calendar period	Age group															ASR Credible interval
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
<i>Rate (per 100,000 per year)</i>																
1970-74	6.0	8.0	14.8	25.1	50.3	84.6	147.9	233.4	299.7	418.7	538.5	722.1	964.9	1144.6	1656.2	178.0
1975-79	6.4	6.6	14.1	22.2	46.5	92.0	158.2	237.5	321.0	436.6	563.7	770.2	911.2	1145.3	1591.9	182.0
1980-84	6.6	9.4	12.9	28.0	44.6	91.4	148.0	239.7	320.4	450.7	628.7	748.3	918.4	1179.7	1489.0	184.2
1985-89	5.2	6.7	12.1	23.9	48.8	85.7	140.2	231.7	340.6	470.0	626.1	815.8	996.8	1231.7	1635.5	189.5
1990-94	4.9	5.2	10.6	22.1	41.9	78.6	128.5	219.8	325.7	474.1	625.0	781.7	953.4	1245.1	1687.2	183.8
1995-99	4.1	6.2	9.8	25.3	37.1	65.6	121.2	213.4	313.4	449.6	611.0	821.8	1018.3	1274.0	1657.0	181.4
2000-04	3.9	5.6	9.8	18.1	36.4	65.2	112.1	194.4	291.2	431.1	602.3	808.9	1022.4	1285.4	1691.0	175.9 (166.0 – 188.6)
2005-09	3.6	5.1	8.9	17.1	30.9	61.7	104.7	175.1	273.7	405.7	578.1	789.5	1024.1	1305.5	1714.6	169.3 (154.5 – 188.5)
2010-14	3.2	4.7	8.1	15.5	29.1	52.3	98.9	163.7	247.2	382.9	546.6	760.3	1004.3	1312.6	1740.4	161.6 (140.4 – 188.2)
<i>Deaths (per year)</i>																
1970-74	8	9	15	22	38	66	115	172	202	252	266	279	263	198	185	Total count
1975-79	10	8	17	23	42	71	121	183	228	283	321	338	281	221	207	2090
1980-84	10	13	16	34	46	81	109	178	234	305	379	374	328	259	238	2354
1985-89	8	9	17	31	59	88	120	169	246	333	396	440	413	325	310	2604
1990-94	7	7	15	32	55	96	132	189	236	338	426	459	443	390	394	2963
1995-99	5	8	14	38	57	90	151	219	266	316	415	514	517	457	481	3220
2000-04	5	7	13	27	57	101	154	240	295	357	404	506	560	516	598	3549
2005-09	5	7	11	24	48	97	164	239	334	401	456	491	564	569	716	3839 (3409 – 4351)
2010-14	5	7	10	20	42	82	156	254	332	454	516	558	552	583	838	4126 (3583 – 4788)
																4409 (3681 – 5294)

Notes: (1) cells shaded in grey indicate projected values; (2) ASR = age standardised rate, to WHO world population

Please refer to the Annex for the full results for individual cancers in adults

