

Appendix 2: Methodology

A2.1. Case definitions

A2.1.1. Summary statistics, age distribution, time trends and geographical patterns

The data presented here are based on complete registration of invasive and in situ neoplasms, and tumours of uncertain behaviour, for persons normally resident in the Republic of Ireland. Benign tumours of intracranial or intraspinal tissues, but not other sites, are also registered by the National Cancer Registry and presented here, as appropriate. The latter group are recorded by the Registry as they have greater clinical significance (higher fatality rates) than other benign tumours. Tumours of uncertain behaviour are those for which benign or malignant status could not be confirmed.

The major emphasis in this report is on malignant (invasive) cancers, as these account for the vast majority of neoplasm-related deaths. Non-malignant conditions have been excluded from text, tables or figures, except where this has been specifically noted.

Both cases and deaths are classified according to the site of the primary cancer; sites of secondary tumours have not been considered. Where only a secondary site was known, the cancer was registered and reported as “primary site unknown”.

The cancer sites/combinations used have been defined by the first three characters of the ICD 10 “site” codes, e.g. C50 represents all malignant cancers of breast (C50.0 to C50.9).⁵ For deaths, mortality data presented here are based on cause of death as notified on death certificates. The codes used in this report have been derived by translation of the ICD 9 codes allocated by the Central Statistics Office to ICD 10, using (with minor modifications) a conversion program supplied by the International Agency for Research on Cancer.⁶

For incident cases, registry data were initially coded to sites defined by the second edition of the International Classification of Diseases for Oncology⁷, before translation to ICD-10 codes, using the conversion program mentioned above.

A summary of the cases and deaths analysed in the report is given in Table A2.1.

Table A2.1 Cases analysed in this report

	FEMALE		MALE		BOTH SEXES	
	cases	%	cases	%	cases	%
all registered cancers	49562	100%	47433	100%	96995	100%
all malignant	40746	82%	44729	94%	85475	88%
in situ	7570	15%	1689	4%	9259	10%
benign	462	1%	283	1%	745	1%
uncertain behaviour	784	2%	732	2%	1516	2%
specific sites (malignant cases only)						
colon	2554	5%	2862	6%	5416	6%
rectosigmoid	265	1%	429	1%	694	1%
rectum	864	2%	1569	3%	2433	3%
anus	58	0%	52	0%	110	0%
breast	7921	16%	64	0%	7985	8%
lung	2537	5%	4858	10%	7395	8%
prostate	0	0%	5752	12%	5752	6%
lymphoma	1112	2%	1278	3%	2390	2%
stomach	871	2%	1474	3%	2345	2%
bladder	640	1%	1639	3%	2279	2%
melanoma skin	1174	2%	701	1%	1875	2%
leukaemia	727	1%	994	2%	1721	2%
all cancers at sites listed above	18723	38%	21672	46%	40395	42%

A2.1.2. Treatment

Data on nine cancer sites was used for treatment analysis (Table A2.3). The cases selected for this analysis were patients with primary invasive tumours affecting these sites who were diagnosed in the Republic during the five-year period from 1994 to 1998. As shown in Table A2.1, 40395 cases satisfied these criteria. In the case of patients who had more than one cancer, the record with the earlier date of diagnosis was retained, leaving a total of 39681 cases. A further 248 patients were excluded because they were under 15 or above 100 years of age at the time of diagnosis (n=244) or had no known addresses (n=4). A further 63 male breast cancer cases were also excluded from analysis, leaving a total of 39370 patients (Table A2.2).

Table A2.2 Case definition for treatment analysis

DESCRIPTION	CASES EXCLUDED	CASES REMAINING
all cancers from nine sites listed		40395
first cancers, where patients had more than one	714	39681
patients > = 15 and < = 100	244	39437
known addresses	4	39433
exclude male breast cancers	63	39370

Table A2.3 Cases used in treatment analysis

SITE	FEMALE	MALE	BOTH SEXES
all cases analysed	18372	20998	39370
stomach	853	1441	2294
colorectal	3669	4788	8457
lung	2504	4773	7277
skin melanoma	1155	683	1838
breast (female)	7856		7856
prostate		5618	5618
bladder	625	1588	2213
lymphomas	1078	1222	2300
leukaemia	632	885	1517

A2.1.3. Survival

Survival was calculated for the sites listed in Table A2.5. Cases used in the treatment analysis were used for survival calculations, but with a number of further exclusions.

Of the 39370 incident cancers summarised in Table A2.3, 87 cases were flagged as having died but with no date of death available, and were excluded from survival analysis. For the remaining 39283 cases, we defined the vital status as of 31st Dec. 1999, as death certificate data at the National Cancer Registry is effectively complete up to that date. Hence all deaths prior to 31st Dec. 1999 were defined as deaths, while all patients dying since that date or whose death was not recorded were “censored” (i.e. considered as alive) on 31st Dec. 1999.

For all defined deaths, a cause of death was necessary in order to examine cancer survival (as opposed to crude survival). However, 260 deaths were recorded on dates prior to 31st Dec. 1999 with no cause of death, so these records were also dropped from analysis. A further 380 deaths were recorded as having occurred on the date of incidence, giving a zero follow-up time which cannot be included in survival analysis. This left a total of 38643 analysable records, as summarised in Table A2.5.

Of the 38643 records that were used in the cancer survival section (Chapter 10), as shown in Table A2.4, 133 records with missing date of birth were dropped for relative survival analysis, leaving the final data set for analysis as shown in Table A2.5

Table A2.4 Case definition for survival analysis

DESCRIPTION	CASES EXCLUDED	CASES REMAINING
all cancers in treatment analysis		39370
no date of death	87	39283
no cause of death	260	39023
death on date of incidence	380	38643
no date of birth	133	38510

Table A2.5 Cancers diagnosed in 1994 – 1998 and included in survival analysis.

	1994	1995	1996	1997	1998	TOTAL
all cases analysed	7788	7415	7612	7847	7981	38643
colorectal	1701	1595	1592	1701	1701	8290
breast	1498	1509	1564	1588	1658	7817
lung	1477	1346	1365	1383	1446	7017
prostate	1042	1080	1111	1114	1196	5543
lymphoma	438	393	445	472	500	2248
stomach	457	449	452	443	429	2230
bladder	496	422	454	438	375	2185
melanoma	371	354	345	396	375	1832
leukaemia	308	276	284	312	301	1481

A2.2. Duplicate registrations

All registrations are checked for duplication at the time of entry and as part of the quality control programme during processing at the Registry. The Registry has an extensive set of rules to determine if a second cancer in an already registered patient is a new primary or a recurrence of an already registered cancer. These rules determine if a cancer is registered. Once a decision has been made to exclude a cancer this is essentially irreversible, so the rules tend to be inclusive and, in case of doubt, a new registration is made. However, for the purposes of analysis and presentation simpler and more exclusive rules, as proposed by the International Agency for Research on Cancer (IARC)⁴, are applied to the data.

Most patients had only one tumour registered between 1994 and 1998. However, 8143 (8.8%) of patients had more than one primary tumour (Table A2.6) and 5644 (6.1%) had more than one primary tumour at the same anatomical site. As can be seen, most multiple primary cancers were in the skin. Some patients had large numbers of non-melanoma skin cancers, up to 30 in a few cases.

All of these duplicate tumours were identified and, where appropriate, deleted, using the rules suggested by Parkin et al.⁴ These rules apply to malignant cancers only, so in processing our data, we extended the rules to all neoplasms, with the further qualification that, where a malignant cancer and a non-malignant neoplasm of the same morphological type arose in the same organ, the malignant cancer was retained and the non-malignant deleted from the data. The outcome of this de-duplication process is shown in Table A2.9.

For the 104192 cancers on the Registry database 92106 patients were registered, 1.13 tumours per person. 91182 invasive tumours were registered in 85475 patients, 1.12 per person. The multiple primary tumours were identical at the most specific measure of primary site (3rd digit of ICD10) in 4715 cases, and at the less specific site (2nd digit of ICD10) in 9126 cases. Application of the IARC rules⁴ reduced the number of unique primary tumours to 96995, 1.05 per patient. Broadly similar results were found for invasive tumours alone.

Table A2.6 Multiple primary tumours affecting the same person

NUMBER OF TUMOURS PER PERSON	NUMBER OF PATIENTS	% OF TOTAL	NUMBER OF TUMOURS	% OF TOTAL
1	83963	91.2%	83963	80.6%
2	6130	6.7%	12260	11.8%
3	1213	1.3%	3639	3.5%
4	412	0.4%	1648	1.6%
5	157	0.2%	785	0.8%
6	91	0.1%	546	0.5%
7	48	0.1%	336	0.3%
8	30	0.0%	240	0.2%
9	17	0.0%	153	0.1%
10	9	0.0%	90	0.1%
> 10	36	0.0%	532	0.5%
total	92106		104192	

Table A2.7 Multiple primary cancers at the same anatomical site

SITE	NUMBER OF CANCERS					ALL PATIENTS
	TWO	THREE	FOUR	FIVE	> FIVE	
skin	3701	985	361	132	219	5398
colon	106	7	0	0	0	113
breast	78	4	0	0	0	82
lung	28		0	0	0	28
rectum	8	0	0	0	1	9
stomach	2	0	0	0	0	2
rectosigmoid	2	0	0	0	0	2
cervix	2	0	0	0	0	2
corpus uteri	2	0	0	0	0	2
bladder	2	0	0	0	0	2
connective tissues	1	0	0	0	0	1
ovary	1	0	0	0	0	1
testis	1	0	0	0	0	1
kidney	1	0	0	0	0	1
all sites	3935	996	361	132	220	5644

Table A2.8 Number of non-melanoma skin cancers per person

NUMBER OF CANCERS PER PATIENT	NUMBER OF PATIENTS	NUMBER OF CANCERS
1	25102	25102
2	3701	7402
3	985	2955
4	361	1444
5	132	660
6	87	522
7	47	329
8	26	208
9	14	126
10	10	100
11	8	88
12	8	96
13	5	65
14	2	28
15	3	45
16	1	16
17	2	34
18	1	18
19	1	19
20	1	20
21	1	21
32	1	32
33	1	33
all patients	30500	39363

Table A2.9 De-duplication of tumour data

	ALL CANCERS	ALL INVASIVE CANCERS
all tumours	104192	91182
tumours with same 3 digit site	99477	87677
number of "unique" tumours by IARC rules	96995	85475
tumours with same 2 digit site	95066	84211
number of patients	92106	81717

A2.3. Death certificate only (DCO) cases

Death certificates were the most important non-hospital source of cases (1.4%). However, the importance of death certificates as a primary source of case notification has been decreasing, from 1.8% of 1994 cases to 0.9% of 1998 cases. The Registry, at present, does not register a case based on death certification alone, but only after the diagnosis has been confirmed from another source. Our reason for doing this is that almost all cases which first come to our attention from death certificates have turned out to pertain to pre-1994 incident cases. On the basis that almost all current death certificate only (DCO) cases are likely to pre-date the establishment of the Registry, we have decided to exclude them for the present. The number and sites of these cancers are shown in Table A2.10.

Table A2.10 Death certificate only cases

	NUMBER OF CASES					% OF ALL REGISTRATIONS FOR THE SITE
	1994	1995	1996	1997	1994 – 1998	
lip	0	1	0	1	2	0.9%
base of tongue	0	0	1	0	1	1.1%
other tongue	1	2	0	0	3	1.4%
gum	0	0	1	0	1	3.0%
floor of mouth	0	1	0	0	1	0.7%
palate	2	0	0	1	3	4.6%
other mouth	2	0	1	0	3	3.0%
parotid	1	0	0	1	2	1.5%
other salivary	0	0	0	0	0	0.0%
tonsil	0	1	0	1	2	1.5%
pyriform	0	0	0	0	0	0.0%
hypopharynx	0	1	0	0	1	1.6%
other mouth/pharynx	0	0	0	1	1	1.5%
oesophagus	8	8	5	13	34	2.3%
stomach	12	24	18	24	78	3.1%
small intestine	1	0	0	1	2	0.7%
colon	24	38	47	52	161	2.8%
rectosigmoid	1	1	1	1	4	0.6%
rectum	6	8	8	7	29	1.1%
anus	0	0	0	0	0	0.0%
liver	0	2	2	3	7	2.2%
gallbladder	1	0	0	1	2	1.1%
other biliary	0	2	4	4	10	3.1%
pancreas	11	16	24	15	66	4.1%
other digestive	4	22	15	20	61	42.7%
nasal cavity/middle ear	0	0	0	0	0	0.0%
sinuses	1	0	0	0	1	1.4%
larynx	1	1	2	1	5	0.8%
trachea	0	0	0	1	1	4.6%
lung	51	69	64	83	267	3.6%
thymus	1	0	1	0	2	11.1%
mediastinum	0	1	2	1	4	2.7%
other chest	1	0	0	1	2	50.0%
bones, joints head & trunk	0	0	1	6	7	7.0%
haematopoietic & reticulendothelial	23	21	21	33	98	2.8%

skin	3	4	2	3	12	0.0%
peripheral nerves	0	1	1	1	3	5.3%
peritoneum	0	0	0	0	0	0.0%
connective tissues	0	0	2	0	2	0.5%
breast	14	25	17	30	86	1.0%
vulva	0	0	0	0	0	0.0%
cervix	2	2	6	7	17	0.4%
corpus uteri	1	6	1	5	13	1.2%
uterus NOS	2	0	1	1	4	4.2%
ovary	2	6	7	14	29	1.8%
other female genital	0	0	0	0	0	0.0%
penis	1	1	0	0	2	1.7%
prostate	17	27	31	34	109	1.9%
testis	0	0	0	0	0	0.0%
kidney	8	5	7	10	30	2.5%
bladder	6	4	7	9	26	1.1%
other urinary	0	0	0	2	2	6.7%
eye	0	0	1	1	2	0.9%
meninges	1	2	1	0	4	1.2%
brain	5	7	11	14	37	2.8%
spinal cord	1	1	0	1	3	1.2%
thyroid	1	1	1	2	5	1.5%
adrenal	0	0	0	1	1	2.0%
other endocrine	0	0	1	0	1	0.3%
ill-defined site	3	1	3	3	10	4.2%
lymph nodes	4	6	8	5	23	1.4%
unknown primary site	15	28	37	42	122	3.5%

A2.4. Accuracy of death certificates

The accuracy of death certificates as a source of notification of cancer is questionable. In matching death certificates with registered cases, we have noticed significant discrepancies between the cause of death as given on the death certificate and the cancer as registered by the National Cancer Registry. In all of these cases, we have gone back to the original medical record to attempt to confirm the diagnosis.

An example of this process is shown below for deaths from lung cancer in 1996 (Table A2.11). In 1996, 1446 deaths were registered as due to lung cancer. Of these, the National Cancer Registry failed to find any trace of the patient in 55 (4%) cases; in 38 cases we are still attempting to find a matching patient. In 89 (6%) cases the patient was identified, but death was due to a cancer incident before January 1st, 1994. In 57 cases (4%), investigation of the medical record showed that there was no record of cancer being present at the time of death. In total, 1202 (83%) of the death certificates matched with a registered cancer.

The majority of cancers confirmed in these 1202 patients were lung cancer (1084; 90%). However, in the other 118 (10%) a cancer other than lung cancer was confirmed, and no record of lung cancer was found in the medical record. In most of these cases, the lung cancer was judged to be secondary and the site of the primary unknown (66 cases; 5%).

Conservatively, therefore, we can estimate lung cancer to have been wrongly registered as a cause of death in the 57 cases in which no cancer was present, and in the 118 cases in which the cancer was not a primary lung cancer. As a consequence, in 12% of all "lung cancer" deaths there was no evidence that the patient had lung cancer, which has been over-registered as a cause of death by at least this amount.

Table A2.11 Matching of cancer death certificates with registered cancers: lung cancer

	NUMBER OF DEATHS	% OF TOTAL
all death certificates	1446	100%
death certificate only	55	4%
unresolved	38	3%
pre-1994 incident case	89	6%
not cancer	57	4%
cancer confirmed	1202	83%
site of registered cancer		
lung	1084	90%
unknown primary site	66	5%
mediastinum	4	< 1%
non-melanoma skin	8	1%
breast	7	1%
prostate	2	< 1%
mesothelioma	3	< 1%
other	28	2%

A2.5. Histology

A precise histological classification was possible for 90% of all invasive cancers (Table A2.12). The most common cell types were adenocarcinoma, basal cell carcinoma and squamous carcinoma.

In situ cancers are registered only if histologically verified (Table A2.13). The commonest types of in situ cancer were CIN III and Bowen's disease (squamous carcinoma in situ of skin).

In some cases, histological examination cannot verify if a tumour is of benign or malignant behaviour. All neoplasms of this type are registered, if histologically verified (Table A2.14). Most of these were haematological conditions. The commonest histological types were myelodysplastic syndrome and villous adenoma.

Tumours of the central nervous system, intracranial and intraspinal tumour are registered, regardless of behaviour (with the exception of congenital malformations). The commonest types were pituitary adenoma, neurilemmoma (almost all acoustic neuromas) and meningioma (Table A2.15).

Table A2.12 The twenty most common histological types of invasive tumour

adenocarcinoma NOS*	M-8140/3	16359	19.1%
basal cell carcinoma, NOS	M-8090/3	15478	18.1%
squamous cell carcinoma NOS	M-8070/3	12462	14.6%
neoplasm malignant	M-8000/3	8588	10.0%
infiltrating duct carcinoma	M-8500/3	4913	5.7%
carcinoma NOS	M-8010/3	2306	2.7%
squamous cell carcinoma large cell, keratinizing	M-8071/3	1600	1.9%
papillary transitional cell carcinoma	M-8130/3	1120	1.3%
multicentric basal cell carcinoma	M-8091/3	1085	1.3%
transitional cell carcinoma NOS	M-8120/3	1023	1.2%
malignant melanoma NOS	M-8720/3	910	1.1%
multiple myeloma	M-9732/3	824	1.0%
lobular carcinoma NOS	M-8520/3	789	0.9%
mucous adenocarcinoma	M-8480/3	757	0.9%
small cell carcinoma NOS	M-8041/3	717	0.8%
renal cell carcinoma	M-8312/3	640	0.7%
mucin-secreting adenocarcinoma	M-8481/3	625	0.7%
chronic lymphoid leukaemia	M-9823/3	605	0.7%
signet ring cell carcinoma	M-8490/3	491	0.6%
superficial spreading melanoma	M-8743/3	461	0.5%

* NOS - not otherwise specified

Table A2.13 The ten most common histological types of in situ cancer

cervical intraepithelial neoplasia, grade111	M-8077/2	3666	39.6%
Bowen's disease	M-8081/2	2269	24.5%
squamous cell carcinoma in situ, NOS	M-8070/2	1369	14.8%
Hutchinson's melanotic freckle, NOS	M-8742/2	601	6.5%
carcinoma in situ, NOS	M-8010/2	534	5.8%
intraductal carcinoma, noninfiltrating, NOS	M-8500/2	252	2.7%
melanoma in situ	M-8720/2	188	2.0%
adenocarcinoma in situ in adenomatous polyp	M-8210/2	70	0.8%
adenocarcinoma in situ, NOS	M-8140/2	63	0.7%
lobular carcinoma in situ	M-8520/2	55	0.6%

Table A2.14 The ten most common histological types of neoplasm of uncertain behaviour

myelodysplastic syndrome, NOS	M-9989/1	267	17.6%
villous adenoma, NOS	M-8261/1	207	13.7%
polycythaemia vera	M-9950/1	155	10.2%
carcinoid tumour, NOS, of appendix	M-8240/1	130	8.6%
chronic myeloproliferative disease	M-9960/1	121	8.0%
idiopathic thrombocythemia	M-9962/1	115	7.6%
monoclonal gammopathy	M-9765/1	37	2.4%
lymphoproliferative disease NOS	M-9970/1	37	2.4%
refractory anaemia with sideroblasts	M-9982/1	29	1.9%
craniopharyngioma	M-9350/1	28	1.8%

Table A2.15 The ten most common types of benign tumour

adenoma NOS	M-8140/0	210	28.2%
neurilemmoma, NOS	M-9560/0	167	22.4%
meningioma NOS	M-9530/0	140	18.8%
transitional meningioma	M-9537/0	103	13.8%
meningotheliomatous meningioma	M-9531/0	52	7.0%
fibrous meningioma	M-9532/0	21	2.8%
neoplasm benign	M-8000/0	7	0.9%
neurofibroma NOS	M-9540/0	7	0.9%
psammomatous meningioma	M-9533/0	6	0.8%
lipoma NOS	M-8850/0	5	0.7%

* NOS - not otherwise specified

A2.6. Definitions

A2.6.1. Incident cases (malignant cancers)

Any invasive or malignant case first diagnosed in a resident of the Republic of Ireland during the calendar years 1994 – 1998. The procedures used to deal with multiple primary cancers in the same individual are described in section A2.2. Cases notified by death certificate only and not confirmed from other sources (“DCOs”) were excluded from incidence figures (see section A2.3).

A2.6.2. Deaths

All deaths registered by the Central Statistics Office for Ireland (CSO) where the main cause of death was given as cancer (ICD9 140.0 to 239.9) were considered “cancer deaths” and are analysed here. Some of these were, in our view, not deaths from cancer, or were due to a cancer other than that given on the death certificate (see section A2.4). However, the cause of death as officially registered has been used for analysis in all cases. As death registration for 1998 was not closed at the time of analysis, there may be minor discrepancies between the data published here and that in the annual “Reports on Vital Statistics” published by the CSO.

A2.6.3. Population at risk

Official Central Statistics Office census figures² were used for the 1996 population at national and health-board level (Table A2.16). As there are no reliable intercensal population estimates, the denominator population for 1994 to 1998 was taken to be that in 1996. For the time trends analysis, interpolated and extrapolated estimates (Table A2.17) were used.

A2.6.4. Crude rate

The number of incident cases or deaths divided by the population at risk; usually expressed per 100000 persons per year.

A2.6.5. Age-specific rate

The number of cases per person in a specific age-class, usually for five-year age-classes up to age 85+, generally expressed per 100000 persons per year.

A2.6.6. European (EASR) and World (WASR) age-standardised rate (incidence and mortality)

The incidence rate that would have been found if the population being studied had the same age-composition (proportion of total population in each five-year age-class) as a hypothetical European or World population. The rates are calculated by applying the age-specific rates for Ireland (or any subdivision thereof) to a theoretical European or World standard population; usually expressed per 100000 persons per year:

$$ASR = \frac{\sum_{i=1}^{15} a_i \cdot w_i}{\sum_{i=1}^{15} w_i}$$

where: a_i = age-specific rate for the i^{th} age group; w_i = standard “World” or “European” weights

Directly standardised rate ratio (DSRR)

This is the ratio between two directly age-standardised rates (e.g. EASRs). The numerical value of the DSRR is similar to a standardised incidence ratio (SIR) but is calculated quite differently. The DSRR is generally expressed as a percentage of a reference (e.g. national) value.

A.2.6.7. Cumulative rate

The total accumulated cancer incidence or mortality rate up to a given age, i.e. the sum of the annual incidence or mortality rates (per 100000 per year). For childhood cancers, ages 0 – 14 are used; for overall lifespan, ages 0 – 74 are generally used. Cumulative rate to age 74 is calculated as:

$$\text{cumulative rate} = \sum_{i=1}^{15} a_i * 5$$

where: a_i = age specific rate for the i^{th} age-class; 5 = number of years included in each of the 15 age-classes used (0 – 4 to 70 – 74 years).

A.2.6.8. Cumulative risk to age 74

The risk to an “average” individual, given current cancer rates, of developing a cancer before his or her 75th birthday (assuming survival to that date); usually expressed as a percentage. Cumulative risk is derived from cumulative rate as follows:

$$\text{cumulative risk} = 1 - (1 - e^{-\text{cumulative rate}})$$

Note that cumulative risk takes no account of differences in risk factors between individuals or of possible future changes in incidence, but is based on the average Irish male or female, and the most recent (1994 – 96) estimates of incidence rates for the Irish population. Note also that that substantial numbers of cancer cases occur in individuals aged 75 years or more. As the normal life expectancy in Ireland is close to 75 years, the cumulative risk to age 74 is a good approximation to the “lifetime risk” of developing cancer.

A.2.6.9. Mortality/incidence (M/I) ratio

The number of deaths for a period (usually a year) divided by the number of incident cases of the same condition for the same period. This ratio is primarily intended for monitoring data quality, as major variation in the ratio, e.g. between cancer registries, countries or years, may indicate variation in case ascertainment (proportion of incident cases registered). However, it can also provide a crude indication of cause-specific survival rate (cancers with poorer average survival rates usually having a higher M/I ratio). For a few cancers, more deaths than incident cases are recorded annually at present. This may reflect methodological factors (e.g. differences in diagnostic criteria applied to deaths and incident cases), poor average survival rates, and/or different time-trends in incidence and mortality rates.

A.2.6.10. Annual percentage change (APC) in the European age-standardised rate

The APC values were calculated for each site by fitting a model that assumed a constant rate of change in the European age standardised incidence and mortality rates, that is a linear model applied to these rates after logarithmic transformation. The estimated slope resulting from the fit was then transformed back to represent a percentage increase or decrease. The actual calculations themselves are performed by first fitting a regression line to the natural logarithm of the rates (r) using calendar year (x) as a regressor variable. If $\ln(r) = ax + b$ is the resulting regression equation (with slope m) and n is the number of years, then

$$\frac{n * \sum [x * \ln(r)] - (\sum x) * (\sum \ln(r))}{n * \sum [x^2] - (\sum x)^2}$$

and $APC = 100(e^a - 1)$

where $e = 2.71826$ is the base of natural logarithms. The calculations were performed using the Microsoft Excel spreadsheet package.

Testing the hypothesis that the actual mean annual percentage change is 0 is equivalent to testing the hypothesis that the theoretical slope estimated by the slope m of the line representing the equation $\ln(r) - ax + b = 0$. The latter hypothesis is tested using the 0.25% F distribution of a/SE_m with $n-1$ numerator degrees of freedom. For five observations, representing each incident year between 1994 to 1998, a critical value of 3.715 was used to calculate the 95% confidence level. The standard error of m , SE_m is obtained from the fit of the regression. This calculation assumes that the rate increased/decreased at a constant rate over the entire calendar year interval; the validity of this assumption was not assessed. In those few instances where at least one of the rates was 0, the linear regression was not calculated.

A2.6.11. Geographical patterns: comparison of rates between populations or years

Comparative incidence data presented in this report are calculated as directly age-standardised rates (based on a notional standard European population: see above). Where rates are expressed as “% of expected”, or % greater or less than another rate, this is based on directly age-standardised rate ratios (DSRRs), rather than indirectly age-standardised ratios (SIRs). Where multiple comparisons are made among populations or years (for a given cancer and sex), a statistical correction is made to minimise the number of “chance” differences that would otherwise be highlighted as statistically significant.

A2.6.12. Relative survival

For our relative survival analysis, we used Irish population life tables for the period 1995 – 1997, which provide mortality figures for every one-year age group from 0 – 1 to 99 – 100. For patients aged 100 at diagnosis, we assume the population mortality for 100 – 101 is the same as that for 99 – 100. As recent official life tables were not available, the life tables were constructed by the Registry from the 1996 census population data and 1995 to 1997 mortality data.

For this analysis, we used the STREL program which runs in the Stata package. This program actually requires date of birth (rather than age at diagnosis) and uses this together with date of diagnosis and date of death to determine age and follow-up time. The program also requires the user to specify an “exit date” (i.e. the date patients can be assumed alive if there is no date of death recorded) which we have set to be 31st Dec 1999 as discussed earlier.

A2.7. Populations

Table A2.16 Census and estimated intercensal populations, 1991 to 1998, as used in this report

	FEMALE								MALE							
	1991	1992	1993	1994	1995	1996	1997	1998	1991	1992	1993	1994	1995	1996	1997	1998
all ages	1772301	1783012	1793723	1804433	1815144	1825855	1836565	1847277	1753418	1762781	1772144	1781506	1790869	1800232	1809595	1818958
0 – 4	133179	130874	128569	126264	123959	121654	119349	117044	140564	138199	135834	133470	131105	128740	126375	124010
5 – 9	155157	151647	148137	144628	141118	137608	134098	130588	163346	159744	156142	152539	148937	145335	141733	138131
10 – 14	169400	167262	165124	162986	160848	158710	156572	154434	178928	176618	174308	171997	169687	167377	165067	162757
15 – 19	163618	164012	164405	164799	165192	165586	165980	166373	171408	171916	172425	172933	173442	173950	174458	174967
20 – 24	130093	132917	135740	138564	141387	144211	147035	149858	136479	139012	141545	144077	146610	149143	151676	154209
25 – 29	125661	126465	127269	128074	128878	129682	130486	131290	120660	122401	124141	125882	127622	129363	131104	132844
30 – 34	125903	127361	128819	130278	131736	133194	134652	136110	123168	124081	124995	125908	126822	127735	128648	129562
35 – 39	119165	121239	123313	125388	127462	129536	131610	133684	118724	120207	121690	123174	124657	126140	127623	129106
40 – 44	111827	113537	115247	116957	118667	120377	122087	123797	113856	115098	116339	117581	118822	120064	121306	122547
45 – 49	92319	96172	100025	103878	107731	111584	115437	119290	95443	99118	102792	106467	110141	113816	117491	121165
50 – 54	76945	79922	82899	85875	88852	91829	94806	97783	79861	82852	85844	88835	91827	94818	97809	100801
55 – 59	70884	71907	72930	73952	74975	75998	77021	78044	71665	72894	74123	75351	76580	77809	79038	80267
60 – 64	68975	69031	69087	69144	69200	69256	69312	69368	65591	66211	66831	67450	68070	68690	69310	69930
65 – 69	69796	69147	68499	67850	67202	66553	65904	65256	60956	60816	60676	60536	60396	60256	60116	59976
70 – 74	60142	60597	61052	61508	61963	62418	62873	63328	49183	49371	49559	49748	49936	50124	50312	50500
75 – 79	48369	48469	48569	48669	48769	48869	48969	49069	35713	35616	35519	35422	35325	35228	35131	35034
80 – 84	30336	31208	32080	32953	33825	34697	35569	36441	18965	19387	19809	20230	20652	21074	21496	21918
85+	20532	21244	21956	22669	23381	24093	24805	25517	8908	9240	9573	9905	10238	10570	10902	11235

Table A2.17 Health board populations, 1996 census

age	FEMALE								MALE							
	EHB	MHB	MWHB	NEHB	NWHB	SEHB	SHB	WHB	EHB	MHB	MWHB	NEHB	NWHB	SEHB	SHB	WHB
0 – 4	43664	7193	10603	10494	7025	13323	18032	11320	46806	7429	11106	11212	7472	13929	18918	11868
5 – 9	47138	8213	11961	12631	8422	15446	20271	13526	49404	8702	12822	13156	8910	16287	21692	14362
10 – 14	51888	9959	14379	14690	9759	17816	24096	16123	55151	10402	15009	15493	10366	18792	24997	17167
15 – 19	58017	9618	14889	14143	9790	17967	24824	16338	59996	10490	15724	15222	10151	19292	26032	17043
20 – 24	61772	6640	12053	10144	7045	13107	20721	12729	58907	7590	13304	11601	7589	14883	22019	13250
25 – 29	55929	6316	10043	9678	6271	12734	18370	10341	52389	6778	10575	10177	6492	13196	18856	10900
30 – 34	53790	6942	10786	10652	6707	13754	19406	11157	49251	7117	10615	10439	6467	13637	19401	10808
35 – 39	48739	7093	10778	10976	6976	13657	19130	12187	45654	7264	11066	10835	6809	13600	19071	11841
40 – 44	44416	6701	10430	10107	6703	12623	17867	11530	41396	6981	10757	10653	6834	13203	18290	11950
45 – 49	40737	6002	9896	9530	6435	11751	16797	10436	38947	6339	10339	10004	6799	12473	17549	11366
50 – 54	33421	4954	8198	7628	5079	10088	13967	8494	32177	5254	8576	8282	5844	10606	14631	9448
55 – 59	28051	4074	6491	5989	4468	8207	11724	6994	26292	4363	6998	6414	4784	8864	12190	7904
60 – 64	24528	3953	5897	5544	3962	7796	10830	6746	22208	4156	6294	5649	4318	7896	10832	7337
65 – 69	22643	3887	5886	5363	4079	7257	10469	6969	18242	3700	5549	5062	4102	7164	9614	6823
70 – 74	19894	3744	5614	5265	4125	7143	9807	6826	14129	3359	4643	4457	3659	5940	7875	6062
75 – 79	15031	2921	4337	4168	3421	5330	7863	5798	9105	2343	3254	3150	2827	4096	5799	4654
80 – 84	10586	1898	3038	2880	2542	3666	5653	4434	5083	1329	1996	1785	1907	2276	3574	3124
85+	7899	1204	2165	1853	1751	2576	3835	2810	2659	634	998	829	982	1142	1638	1688
all ages	668143	101312	157444	151735	104560	194241	273662	174758	627796	104230	159625	154420	106312	197276	272978	177595