Cancer incidence and mortality in Western Australia, 1999 and 2000

A report of the Western Australian Cancer Registry

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Summary

The Western Australian Cancer Registry has operated since 1981 to provide population-based cancer data for use in the planning of health care services and in the prevention and treatment of cancer. Methods are described in Section 1, with technical details now found in Appendix 1.

Sections 2 and 3 of this report are concerned with invasive tumours, or "cancers", and adhere to standard reporting practices as used in other cancer registries in Australia and overseas; they deal with cancer incidence and cancer-related mortality in Western Australian residents, who comprise approximately 10% of the Australian population.

This report deals with data for two years, 1999 and 2000, in one volume, in an effort to re-establish timeliness of reporting; however, timeliness of case registration has been maintained during recent years in the face of an increasing workload. Electronic notification systems continue to facilitate data handling, and data linkage procedures are increasingly allowing better reconciliation with death and hospitalization information.

New cases of cancer
There were 7391 new cases of cancer recorded in Western Australians in 1999, and 7317 in 2000, 55% occurring in males in both years. Age-standardized rates were 328 per 100,000 males, and 257 per 100,000 females, for 2000. There has been no significant change in all-cancers incidence rates over the last five years. The estimated lifetime risk of cancer to age 75 years was 1 in 3 for males, and 1 in 4 for females.

The most common cancers in males in 2000 were prostate cancer, colorectal cancer, melanoma of the skin, and lung cancer. Breast cancer predominated among females, followed by colorectal cancer, melanoma and lung cancer, a pattern unchanged over recent years. There were 66 cases of cancer diagnosed in children under the age of 15 years in 1999, and 57 cases in 2000, predominantly brain tumours, leukaemias, soft tissue sarcomas and lymphomas.

Cancer-related deaths
Among Western Australian residents, there were 3105 deaths due to cancer in 1999, and 3064 in 2000 (57% males in both years, as in 1998). Mortality rates for 2000 were 136 deaths per 100,000 males and 87 per 100,000 females, with no substantial change since 1998. The most common causes of cancer-related death in males were lung, prostate and colorectal cancers, while lung, breast and colorectal cancers were the most common in females. In 2000, lung cancer caused more deaths than breast cancer in women for the first time, although preliminary data for 2001 suggest breast cancer may continue as the leading cause of cancer-related death.

Time trends
This report presents time trends for many cancer types. Incidence and mortality related to prostate cancer have decreased significantly over the period 1996-2000. There were also significant decreases in stomach cancer and leukaemia incidence in females, however the incidence of melanoma of the skin increased significantly by 4-5% per year in both males and females. Myeloma and kidney cancers (males) and bladder cancers (females) also increased.

Common cancers
Prostate and breast cancers remain the most common incident cancers in persons over the age of 40 years. However, malignant melanoma of the skin was - as in most years since 1982 - the most common cancer in both males and females in the 15-39 years age range. Other common cancers in the young were testicular and cervical cancer.

There were 52 cases of malignant mesothelioma diagnosed in Western Australians in 2000, 87% of them in males. While time-series graphs suggest declining incidence and mortality, there has been no significant change in the last 5 years. The asbestos mining industry and the building industry remain the most common occupational settings.

Based on data for 2000, 1 in 11 women could be expected to develop breast cancer before the age of 75, and 1 in 66 could be expected to die as a result of it. Breast cancer incidence and mortality rates showed no significant change between 1996 and 2000. Recent data confirm that tumours detected at a small size are less likely to have tumour in the adjacent lymph nodes.

Other neoplasms
There were 1239 reports of *in situ* melanoma of the skin, and 1003 in situ cervical carcinomas in 1999-2000 combined. Among the "uncertain behaviour" neoplasms, soon to be included as cancers, the most common types were myelodysplastic syndrome (56 cases for 1999-2000) and idiopathic thrombocythaemia (42 cases). Numbers of benign CNS tumours have increased recently, possibly in association with reporting improvements, and totalled 75 cases for 1999-2000 combined. There was no change in the incidence of borderline tumours of the ovary, which totalled 13-28 cases per year over the period 1991 - 2000.

Cancer in indigenous Australians
There were 111 cancer diagnoses in persons of Aboriginal descent in 1999-2000 combined, and all-cancers age-standardized incidence rates continue to be lower than in the population as a whole. However, at some ages, cancer risk continues to be higher in persons of Aboriginal descent than in the general population. The most common cancer types were similar to those in the State as a whole, apart from an absence of melanoma of the skin.

The future
Projections published in the Registry's last report over-estimated the eventual totals for 2000 by 1-3% for incidence, and 6% for mortality. New projections are not presented, as there is expected to be an increase of 2-3% in "cancers" as a result of a new coding system that will see polycythaemia, myelodysplastic syndrome and various other diseases counted as "cancers" for the first time. Similar changes are expected elsewhere as Australian and overseas registries adopt the ICDO-3 coding scheme.

1 Overview and Methods

1.1 This Report

Overview of this report

This Report is this Registry's first all-cancers incidence and mortality report since December 2000 (*Cancer incidence and mortality in Western Australia, 1998*)[11], and comprises a summary of Registry activities and topical issues, and details of cancer incidence and mortality for 1999 and 2000. Sections concerning coding and other Registry practices and statistical methods include relevant material for the period 1999 to date.

The Western Australian Cancer Registry is a population-based cancer registry established in 1981 and receives notifications of cancers from pathologists, haematologists and radiation oncologists, and cancer information from death records. The Registry works to collect and disseminate reliable population-based cancer data to assist in the planning of services and in the prevention and treatment of cancer.

The Registry acts with the delegated authority of the Executive Director of Public Health with respect to the Health (Notification of Cancer) Regulations. These, as amended in February 1996, require the notification of *in situ* neoplasms and all non-melanoma skin cancers other than basal cell and squamous cell carcinomas, as well as all invasive malignancies and benign CNS tumours (see Appendix 2E).

General structure; how to find information

The major statistical sections are based on cancers diagnosed, and deaths due to cancer, in 1999 and 2000. Data for the more common forms of cancer are presented under headings based on incidence, mortality and age, while data for common cancers in selected geographic areas are presented in Appendices 3D (1999) and 4D (2000). Special topics concerned with selected cancer types or aspects of Registry operations, in Section 4, may be based on data from other years as well.

Detailed data for all types of cancers for 1999 and 2000 are found in the tables of Appendices 3A, 3B, 4A and 4B. The layout of those tables follows the coding system summarized in Appendix 2F. Readers seeking detailed information for a particular cancer type which does not appear among the tables of more common cancers, should refer to Appendix 2H which will assist in locating the relevant information in Appendices 3 and 4.

Interpretation of changes

With respect to geographical location, Western Australia is particularly polarized into metropolitan and rural areas, and there are likely to be some statistical biases due to the difficulties of transport and the location of services within the State. Throughout this report, statistics are presented in various ways and some comparisons are made in an attempt to demonstrate that assessing the importance of changes in cancer incidence and mortality is complex and depends on the underlying population sizes and their age structures. As in previous years, caution is required in assessing changes on the basis of single rate comparisons. In addition, the Cancer Registry database is dynamic and data are continually updated in the

light of the most recent available information; thus it can be expected that numbers quoted for previous years may vary slightly from those in previous publications. As a guide, while total cancers for 1998 were quoted at 6520 in our previous report, the total currently recorded for 1998 is 6694 cases.

Statistical methods

Statistics from the Registry commonly fall into one of two major groups: incidence (all malignancies except some non-melanoma skin cancer) and mortality (all malignancies, and certain other tumours or tumour-like conditions). The usual statistics calculated for both types of report are briefly discussed below; formulae and relevant details are in Appendix 2B.

Rates

Rates in this report are calculated separately for males and females and are expressed as events (diagnoses or deaths) per 100,000 person-years.

Age-specific rates (ASPR) are based on five-year age intervals and are calculated by dividing the numbers of cases by the population of the same sex and age group.

Age-standardized rates (ASR in Tables) are calculated by the direct method and represent a summation of weighted age-specific rates. The standard deviation, or Estimated Standard Error (ESE) is used as a measure of variability for rates in tables; an approximate 95% confidence interval for a rate is (rate ± 1.96 ESE).

Where a subset of age groups is considered, the term **age-adjusted rate** is used instead of ASR, to indicate that standardization has taken only the age groups of interest into account for both cases and population.

Cumulative Incidence and Lifetime Risk

The **cumulative incidence** of a condition is an estimate of the proportion of all persons, up to a specific age, who have been affected by the condition at some time. For cancer incidence statistics, this estimates the proportion of persons who have had a cancer diagnosis; for cancer mortality, it is an estimate of the proportion of persons below the specific age, who have died of a cancer-related cause. In Registry reports, cumulative incidence is generally expressed as a percentage.

A closely-related statistic is the **lifetime risk** (LR), an estimate of the probability of being diagnosed as having cancer (incidence) or of dying because of cancer (mortality) throughout life, up to a specific age. This is derived from the relevant cumulative incidence figure obtained by summing age-specific rates, and is calculated for ages 0 to 74 years (see **Appendix 2B** for formulae). In this report, LR is expressed as a "1 in *n*" chance of diagnosis or death.

Person years of life lost

Person-years of life lost (PYLL) is an estimate of the number of years of life lost due to specific causes of death, and is calculated up to age 75 years, as an index of premature death.

Comparisons

It should be noted that incidence and mortality rates and lifetime risks may not be in proportion to one another because of underlying differences in the age structures of populations.

2. Cancer in Western Australia, 1999
2.1 All cancers

Incidence

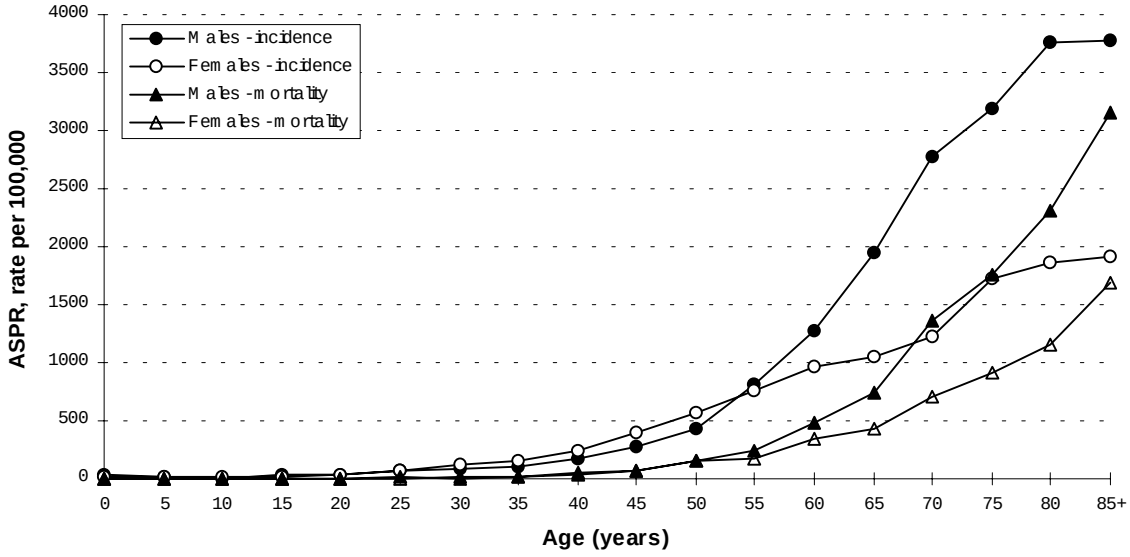
In 1999, there were 7391 new diagnoses of cancer in Western Australia, 4073 (55%) in males and 3318 (45%) in females, a slight increase since 1998. These corresponded to age-standardized incidence rates of 344 per 100,000 (males) and 260 per 100,000 (females). These rates represented an increase for both males and for females, compared with data reported for 1998.

The estimated lifetime risk of cancer to age 75 years was 1 in 3 for males and 1 in 4 for females. The cumulative incidence of cancer - the proportion of persons in whom cancer had been diagnosed by age 75 years - was 40% for males and 28% for females.

Cancer incidence rates changed with age as they have in previous years (Fig. 1). Cancer incidence in males was higher than in females at some ages under 25 years, and at all ages over 55 years. Between ages 25 and 55 years, cancer rates in women exceeded those in men, the female/male rate ratio peaking at 1.5 in the age range 30-39 years. Breast cancer accounted for the bulk of the excess risk in females between ages 30 and 54, while prostate cancer and lung cancer were responsible for the high male/female rate ratio (approximately 2) in old age.

The proportion of all cancers with a microscopic diagnosis was high (94% in both males and females, essentially unchanged since 1998). Of the major cancer types, pancreatic cancer was the most often diagnosed by non-histological methods (36% in males, 47% in females), little different from 1998 data. Lung cancer was diagnosed by non-histological methods in a moderate proportion of cases (14 % in males, 16% in females), but non-histological diagnoses of colorectal cancer were uncommon (4% in males, 5% in females).

Figure 1. Age-specific all-cancers incidence and mortality rates, Western Australia, 1999.



Mortality

Among Western Australian residents, there were 1769 deaths in 1999 due to cancer in males and 1336 in females. Mortality rates were 143 deaths per 100,000 males and 90 per 100,000 females, both slightly higher than for 1998. These statistics include 34 deaths due to non-melanocytic skin cancer (24 males, 10 females), both slightly increased since 1998. The estimated lifetime risk of death due to cancer before age 75 years was 1 in 7 for males and 1 in 11 for females, unchanged since 1998.

There were 28 cancer-related deaths of non-residents in Western Australia in 1999, which are not included in the mortality statistics in this report.

Other 1999 deaths recorded by the Cancer Registry included:

Deaths due to benign tumours (such as meningiomas) - none.

Deaths due to "uncertain malignant potential" lymphohaematopoietic neoplasms - 34 (25 men, 9 women)

Deaths due to non-tumour-related causes among persons with a Registry tumour record - 755 males (an increase since 1998), 654 females (also increased).

Deaths of unresolved cause among persons with a tumour record - 26 (19 males, 7 females) (a slight increase since 1998).

The "person-years of life lost" (PYLL) statistics in this report are, as in the Registry's most recent reports, based on an upper limit of 75 years, yielding higher figures than reported in earlier years. Before the age of 75 years, a total of 12337 person-years of life were lost due to cancer among males, and 9860 in females; both slightly increased since 1998.

There was no significant change in the age-pattern of cancer mortality in 1999. Cancer death rates generally increased for both males and females from age 20 (Fig. 1), with low case numbers and less reliable rates at earlier ages. All-cancers death rates were consistently higher for males than for females at ages greater than 55 years.

Mortality to incidence ratios

Except in situations where incidence and/or mortality are changing rapidly, or notification of cancer is incomplete, the ratio of mortality to incidence for a cancer gives a crude indication of its impact. In 1999 the mortality/incidence rate ratio for prostate cancer was 0.22, unchanged from 1998, but much increased from the figure of 0.16 in 1995 when the reported incidence of prostate cancer was at its peak.[7] The mortality/incidence ratio for breast cancer in females was unchanged at 0.19. The all-cancers mortality/incidence ratios for 1999 were higher for males than for females (0.46 and 0.35), unchanged since 1998.

2.2 Common cancers

Incidence

In females, breast cancer continued to be the most common incident cancer (1025 cases; ASR 86 per 100,000, 31% of all cancers in females) (Table 1; Fig. 2). This was followed by colorectal cancer (13%) and malignant melanoma of the skin (12%). These rankings were similar to those observed in 1998.
There were an additional 134 cases of *in situ* breast carcinoma recorded.

The most common cancers in males were prostate cancer (924 cases; 23%), melanoma of the skin (13%), colorectal cancer (13%) and lung cancer (12%) (Table 1; Fig. 2). The incidence rate of prostate cancer was 78 per 100,000 males, higher than the rate for any other cancer type in males, and increased slightly since 1998.

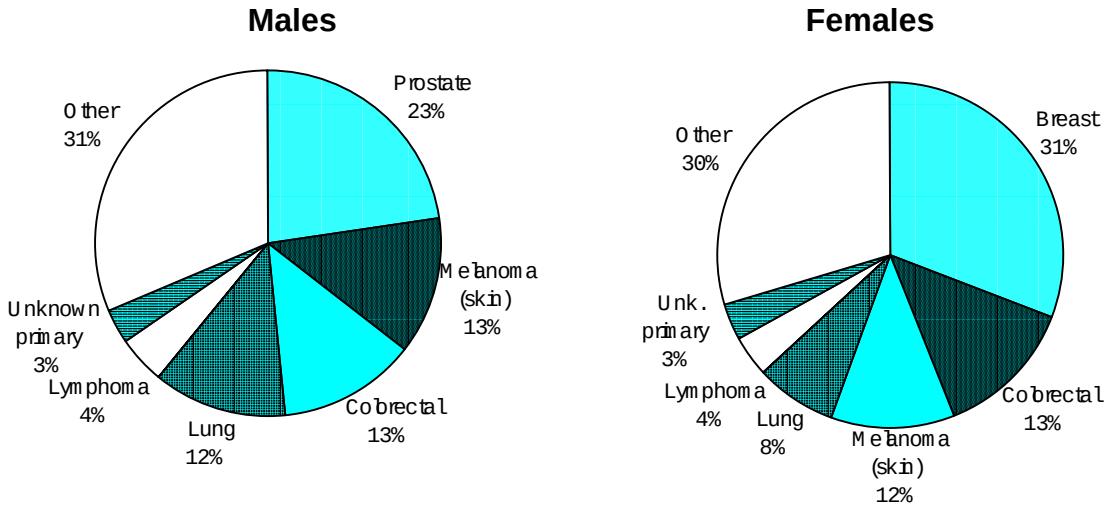
The incidence rate of reported prostate cancer in Western Australia has halved since a peak in 1994. There has not yet been any firm evidence for any associated change in prostate cancer mortality, which was highest in 1996. The mortality rate for 1999 (13.6 per 100,000 males) was slightly higher than that in 1998 (12.9 per 100,000). Prostate cancer ranked only third as a cause of cancer-related death among males in 1999.

For the major cancers affecting both males and females, males had a higher incidence than females. For lung cancer, the ASRs were 41 in males and 18 in females, both slightly higher than in 1998. Differences between rates in males and females were smaller for colorectal cancer (M 43, F 30) and melanoma (M 46, F 34).

Cancers of unknown primary site were recorded in 140 males (ASR 12, 3.4% of all cancers) and 109 females (ASR 6, 3.3%); incidence remains relatively stable.

Skin cancer (excluding BCC, SCC and melanoma) was more common in 1999 than in 1998 and 1997; there were 103 reported cases, 65% of them in males.

Figure 2. Cancer incidence, Western Australia, 1999: common cancers



Other common specific cancer types diagnosed included:

Lymphomas - 178 cases in men (ASR 15), 127 in women (ASR 10)
Stomach - 116 cases in men (ASR 10), 62 in women (ASR 4); increased in both
Bladder - 98 cases in men (ASR 8), 42 in women (ASR 2); slightly increased in both
Leukaemias - 105 cases in men (ASR 10), 74 in women (ASR 6); both increased.

In women -

Ovarian cancer - 80 cases, ASR 6 (similar to 1998)
Uterine cancer - 104 cases, ASR 9 (also similar)
Cervical cancer - 60 cases, ASR 5 (decreased).

Mortality

Commonest causes of cancer-related death in males were lung cancer (25%), colorectal cancer (13%) and prostate cancer (11%) (Table 1; Fig. 3). Breast cancer (18%), lung cancer (16%) and colorectal cancer (15%) were the most common in females. Other major causes of cancer-related mortality included tumours of the pancreas and of unknown primary site in both sexes, stomach cancer and leukaemia in males, and lymphomas and ovarian cancer in females. With minor changes in rankings, these most common causes of cancer-related death are little changed from year to year.

In 1999, lung cancer was responsible for 657 deaths (443 males, ASR 36 per 100,000; 214 females, ASR 15; both higher than in 1998). Prostate cancer was the third most common cause of cancer death in males, at 14 per 100,000, similar to the rates for 1997 and 1998, but reduced since 1996.

In women, lung cancer continued as the second most common cause of cancer-related death; breast cancer was the most common, causing 240 deaths at an ASR of 18 per 100,000 females. As in 1997 and 1998, deaths due to colorectal cancer ranked second in males and third in females: 226 deaths in males (ASR 18) and 198 females (ASR 13).

Tumours of unknown primary site were again the fourth most common cause of cancer death in both sexes (107 males, 99 females), and accounted for 6% of all cancer deaths in men, and 7% in women.

Figure 3. Cancer mortality, Western Australia, 1999: common cancers

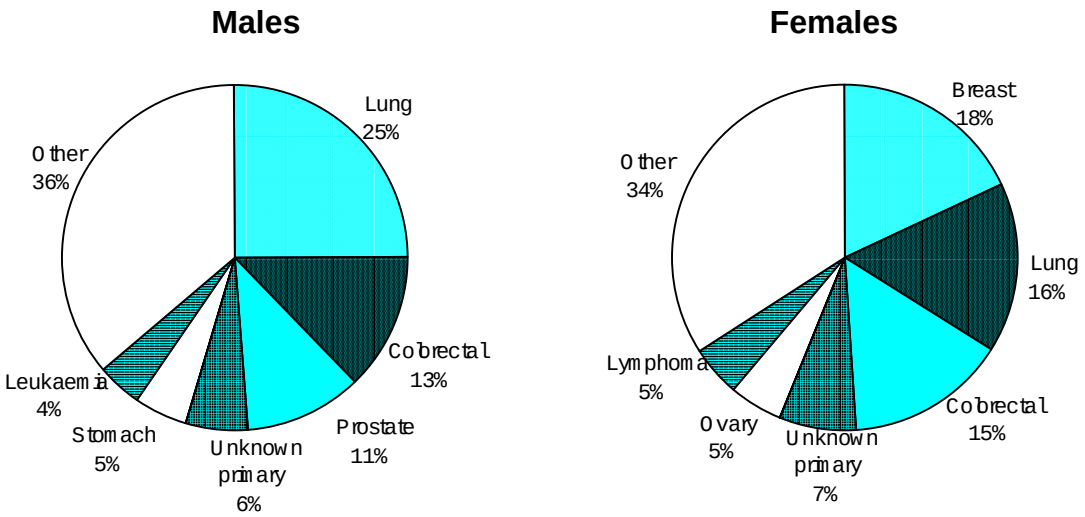


Table 1. Cancer incidence and mortality, Western Australia, 1999: leading types in males and females

Incidence

Males

	Total	%	ASR	ESE	Risk
Prostate	**924**	22.7	**77.5**	2.6	11
Melanoma (skin)	**529**	13.0	**45.9**	2.0	20
Colorectal	**516**	12.7	**43.1**	1.9	20
Colon	**315**	7.7	**26.0**	1.5	34
Rectum	**200**	4.9	**17.0**	1.2	47
Lung	**507**	12.4	**41.1**	1.9	20
Lymphoma	**178**	4.4	**15.4**	1.2	68
Lymphoma NOS	**9**	0.2	**0.7**	0.2	1401
NHL	**149**	3.7	**12.6**	1.1	80
Hodgkin's lymphoma	**20**	0.5	**2.0**	0.5	688
Unknown primary	**140**	3.4	**11.6**	1.0	82
Kidney	**121**	3.0	**10.4**	1.0	83
Stomach	**116**	2.8	**9.9**	0.9	81
Leukaemia	**105**	2.6	**9.6**	1.0	95
Lymphoid leukaemia	**32**	0.8	**3.4**	0.6	381
Myeloid leukaemia	**53**	1.3	**4.3**	0.6	182
Bladder	**98**	2.4	**7.6**	0.8	110
Pancreas	**77**	1.9	**6.5**	0.8	121
Brain	**74**	1.8	**7.1**	0.9	145
Lip	**67**	1.6	**5.8**	0.7	161
Skin (NMSC exc. SCC/BCC)	**67**	1.6	**5.4**	0.7	197
Oesophagus	**61**	1.5	**5.1**	0.7	166
Larynx	**61**	1.5	**5.3**	0.7	146
Testis	**59**	1.4	**5.4**	0.7	231
Mesothelioma	**49**	1.2	**3.9**	0.6	234
Myeloma	**44**	1.1	**3.6**	0.6	223
Liver	**40**	1.0	**3.4**	0.6	211
All cancers	**4073**	100.0	**344.5**	5.5	3

Females

	Total	%	ASR	ESE	Risk
Breast	**1025**	30.9	**86.2**	2.8	11
Colorectal	**427**	12.9	**30.0**	1.6	30
Colon	**306**	9.2	**20.9**	1.3	44
Rectum	**120**	3.6	**9.1**	0.9	95
Melanoma (skin)	**391**	11.8	**33.6**	1.8	30
Lung	**251**	7.6	**18.0**	1.2	46
Lymphoma	**127**	3.8	**9.8**	0.9	100
Lymphoma NOS	**3**	0.1	**0.2**	0.1	6075
NHL	**102**	3.1	**7.6**	0.8	119
Hodgkin's lymphoma	**22**	0.7	**2.1**	0.5	698
Unknown primary	**109**	3.3	**6.5**	0.7	150
Uterus	**104**	3.1	**8.9**	0.9	90
Ovary	**80**	2.4	**6.1**	0.7	150
Kidney	**76**	2.3	**6.4**	0.8	151
Leukaemia	**74**	2.2	**6.2**	0.8	188
Lymphoid leukaemia	**28**	0.8	**3.1**	0.6	471
Myeloid leukaemia	**42**	1.3	**3.0**	0.5	320
Pancreas	**66**	2.0	**4.2**	0.6	202
Stomach	**62**	1.9	**4.1**	0.6	210
Thyroid gland	**61**	1.8	**5.6**	0.7	205
Cervix	**60**	1.8	**4.9**	0.7	213
Myeloma	**49**	1.5	**3.5**	0.5	259
Brain	**44**	1.3	**3.6**	0.6	256
Bladder	**42**	1.3	**2.3**	0.4	426
Skin (NMSC exc. SCC/BCC)	**36**	1.1	**2.3**	0.4	506
Oesophagus	**30**	0.9	**2.2**	0.4	336
Lip	**28**	0.8	**2.0**	0.4	506
All cancers	**3318**	100.0	**260.5**	4.8	4

Mortality

Males

	Total	%	ASR	ESE	Risk
Lung	**443**	25.0	**35.8**	1.7	24
Colorectal	**226**	12.8	**18.3**	1.2	50
Colon	**128**	7.2	**10.0**	0.9	101
Rectum	**98**	5.5	**8.3**	0.9	97
Prostate	**189**	10.7	**13.6**	1.0	92
Unknown primary	**107**	6.0	**8.8**	0.9	103
Stomach	**85**	4.8	**7.1**	0.8	114
Leukaemia	**76**	4.3	**6.2**	0.7	152
Lymphoid leukaemia	**23**	1.3	**2.0**	0.4	718
Myeloid leukaemia	**44**	2.5	**3.4**	0.5	246
Pancreas	**75**	4.2	**6.1**	0.7	131
Lymphoma	**73**	4.1	**5.7**	0.7	161
Lymphoma NOS	**7**	0.4	**0.5**	0.2	2113
NHL	**66**	3.7	**5.3**	0.7	174
Hodgkin's lymphoma	**0**				-
Oesophagus	**54**	3.1	**4.5**	0.6	189
Melanoma (skin)	**51**	2.9	**4.2**	0.6	253
Brain	**50**	2.8	**4.5**	0.7	209
Mesothelioma	**44**	2.5	**3.8**	0.6	199
Bladder	**43**	2.4	**3.4**	0.5	269
Liver	**32**	1.8	**2.6**	0.5	278
Kidney	**31**	1.8	**2.5**	0.5	359
Myeloma	**27**	1.5	**2.1**	0.4	418
Skin (not melanoma)	**24**	1.4	**1.7**	0.4	836
All cancer deaths	**1769**	100.0	**142.7**	3.5	7

Females

	Total	%	ASR	ESE	Risk
Breast	**240**	18.0	**18.1**	1.2	50
Lung	**214**	16.0	**14.6**	1.1	58
Colorectal	**198**	14.8	**12.6**	1.0	76
Colon	**129**	9.7	**8.0**	0.8	123
Rectum	**69**	5.2	**4.7**	0.6	196
Unknown primary	**99**	7.4	**5.9**	0.7	165
Ovary	**65**	4.9	**4.5**	0.6	200
Lymphoma	**64**	4.8	**4.3**	0.6	212
Lymphoma NOS	**3**	0.2	**0.2**	0.1	6928
NHL	**57**	4.3	**3.9**	0.6	227
Hodgkin's lymphoma	**4**	0.3	**0.2**	0.1	5437
Pancreas	**60**	4.5	**3.7**	0.5	230
Stomach	**50**	3.7	**3.3**	0.5	234
Leukaemia	**40**	3.0	**2.3**	0.4	494
Lymphoid leukaemia	**12**	0.9	**0.4**	0.1	*
Myeloid leukaemia	**25**	1.9	**1.7**	0.4	537
Brain	**31**	2.3	**2.5**	0.5	323
Oesophagus	**30**	2.2	**1.8**	0.3	449
Cervix	**26**	1.9	**2.1**	0.4	415
Bladder	**26**	1.9	**1.3**	0.3	882
Melanoma (skin)	**25**	1.9	**1.8**	0.4	573
Kidney	**19**	1.4	**1.1**	0.3	855
Gallbladder / bile ducts	**18**	1.3	**1.0**	0.2	1600
Uterus	**18**	1.3	**1.3**	0.3	565
Liver	**16**	1.2	**1.1**	0.3	1040
Myeloma	**16**	1.2	**1.0**	0.3	739
All cancer deaths	**1336**	100.0	**89.7**	2.7	11

Other specific cancers of particular prominence in cancer mortality in 1999 included:

Pancreatic cancer - 135 deaths (75 males, 60 females; slight reduction in females since 1998)
Stomach cancer - 135 deaths (85 males, 50 females; both increased)
Leukaemia - 116 deaths (76 males, 40 females; slight increase in both)
Lymphomas - 137 deaths (73 males, 64 females; slight increase in both)
Malignant brain tumours - 81 deaths (50 males, 31 females; decreased in both)
Malignant melanoma of the skin - 76 deaths (51 males, 25 females; both decreased)

In females: Cancer of the ovary - 65 deaths (slight increase)

In males: Mesothelioma - 44 deaths (decreased since 1998)

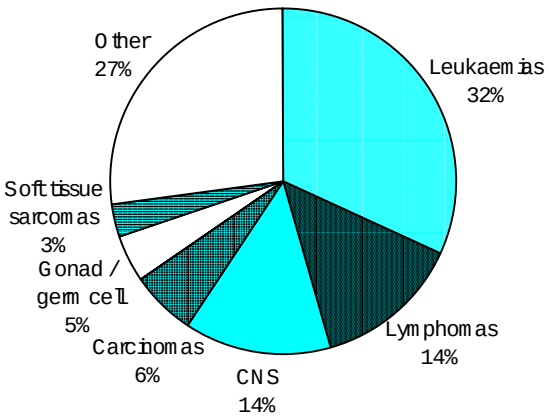
2.3 Cancer in different age groups

Incidence

In children under the age of 15 years, there were 66 cases of cancer diagnosed in 1999, 35 males and 31 females; corresponding ASRs were 18.9 per 100,000 for males and 16.7 per 100,000 in females, both increased since 1998 (**Appendix 3C**). The estimated childhood population in Western Australia in 1999 was 397,368 (204,092 males and 193,276 females).

Diagnoses have been classified mainly in terms of tumour morphology (ICD-O 2nd edition)[13] into 12 major diagnostic groups; these are shown in detail in **Appendix 3C**. The most common tumours diagnosed in children in 1999 are shown in Figure 4. The leukaemias and tumours of the CNS accounted for 46% of all diagnoses, however lymphomas in 1999 were as common as CNS tumours (14% of cases). As in previous years, the most common individual tumour type was acute lymphoblastic leukaemia, with 19 children newly diagnosed (ASR 4.5 in males, 5.8 in females); increased since 1998, but only marginally higher than in 1997. There were two cases of melanoma in children in 1999, one male, one female, both in the 10-14 age group; there had been none in 1998.

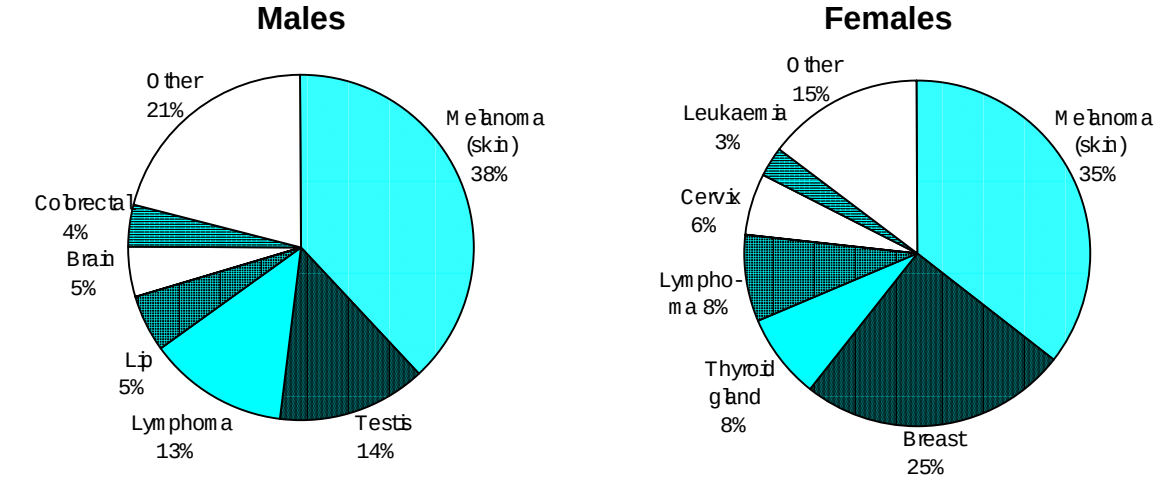
Figure 4. Cancer in children under 15 years of age, Western Australia, 1999: most common types.



There were 9 deaths (7 males, 2 females) from childhood cancer in 1999 at age-adjusted death rates per 100,000 child-years of 3.4 for males and 1.0 for females; little changed since 1998, but still reduced since 1997 when there were 14 childhood cancer deaths.

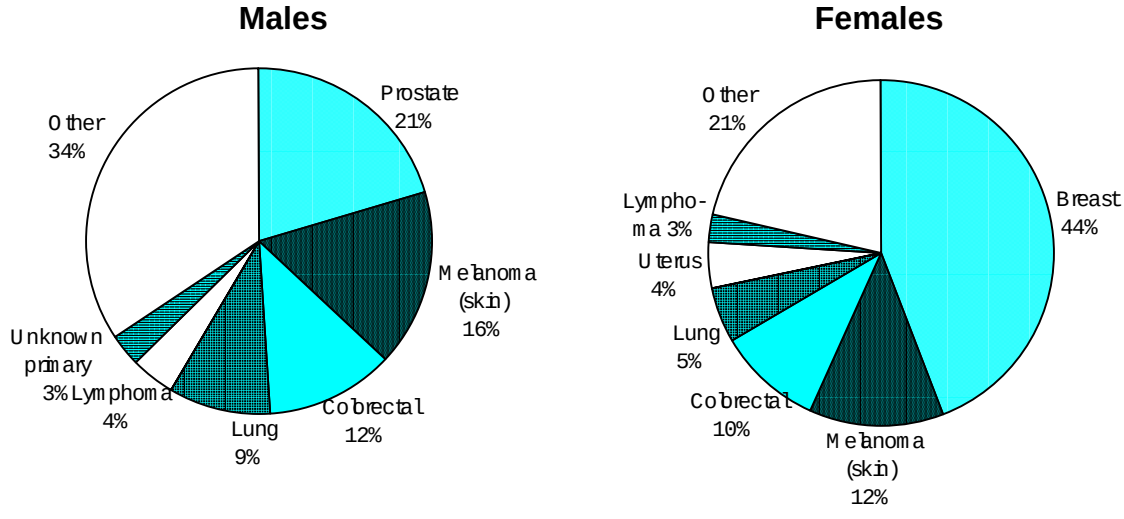
In the 15 to 39 years age range, there were 544 cancer diagnoses in 1999. Of these, 55% were in women, mainly melanoma (106 cases, increased since 1998) and breast cancer (75 cases, similar to 1998). Melanoma of the skin was also increased in males (93 cases) but the next most common cancer in males, testicular cancer, was unchanged since 1998 (34 cases). (Fig. 5). There were 199 melanoma cases diagnosed in this age range in 1999 (Table 2), a marked rise since 1998 when there were only 142 cases. Other common cancers in males were lymphomas and cancers of the lip, while lymphoma and thyroid cancers were common in females.

Figure 5. Cancer incidence, Western Australia, 1999: common cancers in the 15 to 39 years age group



In the age range 40 to 64 years, breast cancer continued to dominate reported incident cancers (620 cases, 44% of all female cancers in this age group) (Table 2; Fig. 6); just over half of all cancers in this age range occurred in females. In males, prostate cancer (21%) was most common, followed by melanoma (16%) and colorectal cancer (12%). In 1999, melanoma cases outnumbered colorectal cancers in this age group. Lung cancer was more common in this age group than in younger persons, 9% of cancers in males and 5% of those in females, and as in 1998, was the fourth most common major cancer type in each sex.

Figure 6. Cancer incidence, Western Australia, 1999: common cancers in the 40 to 64 years age group



Over the age of 65 years, prostate cancer (638 cases) was significantly more common than in 1998, and outnumbered any other specific cancer type in either sex (Table 2; Fig. 7). Prostate cancer accounted for 26% of diagnoses in males in this group (22% in 1998, 24% in 1997, 30% in 1996). The numbers, rates and relative importance of prostate cancer in this age group appeared to be rising once more.

Among females, breast cancer predominated (330 cases; 21% of all cancers, as in 1998). Other common cancer types in this age range were colorectal cancer (14% in males, 18% in females) and lung cancer (16%, 11%, unchanged since 1998).

Malignant melanoma of the skin was, as in 1998, the fourth most common cancer type in males and in females. Tumours of unknown primary site accounted for significant proportions of cancers, more in females (6%) than in males (4%), but the age-standardized rate in males (96 per 100,000) was, as in 1998, much greater than that in females (65) (Table 2). This reflects a difference in age distributions, in that the peak incidence of such tumours in males lies in the 75-79 years age group, whereas in females the peak lies in those over 85 years.

Figure 7. Cancer incidence, Western Australia, 1999: common cancers in the 65 years & over age group

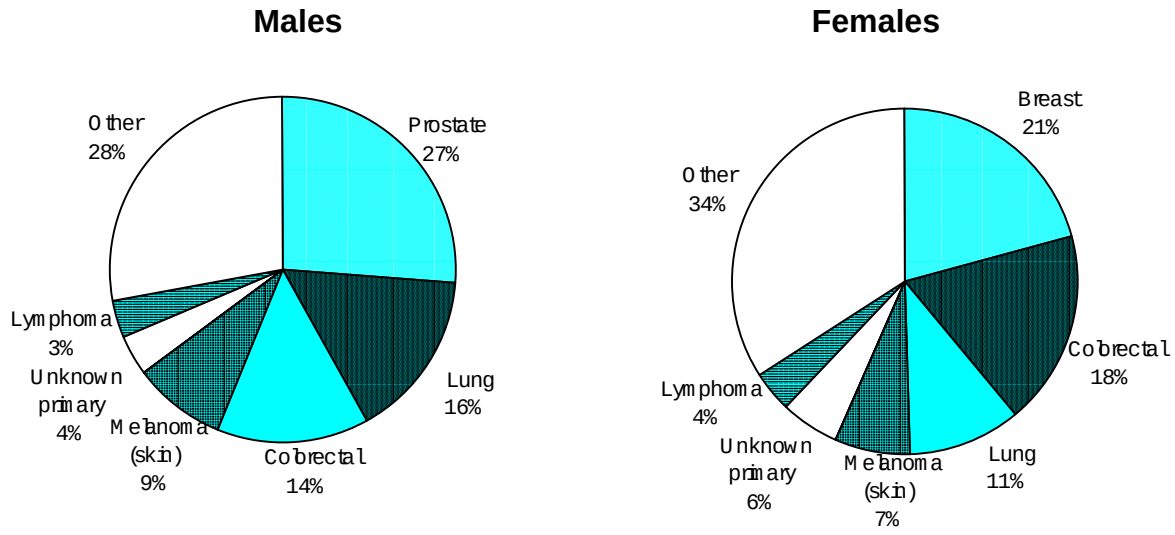


Table 2. Cancer incidence, Western Australia, 1999: leading types by sex and age group (ASR: age-adjusted rate)

15 to 39 years

Males

	Total	%	ASR	SE	Risk
Melanoma (skin)	**93**	38.0	**24.2**	2.5	158
Testis	**34**	13.9	**8.5**	1.5	432
Lymphoma	**32**	13.1	**8.4**	1.5	456
Lymphoma NOS	**0**				
NHL	**19**	7.8	**4.8**	1.1	762
Hodgkin's lymphoma	**13**	5.3	**3.7**	1.0	1136
Lip	**13**	5.3	**3.1**	0.9	1121
Brain	**12**	4.9	**3.2**	0.9	1230
Colorectal	**9**	3.7	**2.3**	0.8	1640
Colon	**7**	2.9	**1.8**	0.7	2114
Rectum	**2**	0.8	**0.4**	0.3	7309
Leukaemia	**8**	3.3	**2.2**	0.8	1827
Lymphoid leukaemia	**2**	0.8	**0.6**	0.4	7328
Myeloid leukaemia	**4**	1.6	**1.0**	0.5	3708
Thyroid gland	**7**	2.9	**1.6**	0.6	2078
Kidney	**6**	2.4	**1.4**	0.6	2460
Unknown primary	**5**	2.0	**1.4**	0.6	2965
All cancers	**245**	100.0	**62.9**	4.1	60

Females

	Total	%	ASR	SE	Risk
Melanoma (skin)	**106**	35.5	**27.9**	2.8	134
Breast	**75**	25.1	**17.4**	2.0	194
Thyroid gland	**24**	8.0	**6.5**	1.3	583
Lymphoma	**24**	8.0	**6.1**	1.3	593
Lymphoma NOS	**0**				
NHL	**9**	3.0	**2.0**	0.7	1618
Hodgkin's lymphoma	**15**	5.0	**4.1**	1.1	936
Cervix	**18**	6.0	**4.3**	1.0	790
Leukaemia	**8**	2.7	**2.4**	0.9	1702
Lymphoid leukaemia	**2**	0.7	**0.7**	0.5	6594
Myeloid leukaemia	**5**	1.7	**1.5**	0.7	2748
Colorectal	**7**	2.3	**1.7**	0.6	2052
Colon	**2**	0.7	**0.5**	0.3	6930
Rectum	**5**	1.7	**1.2**	0.5	2915
Lung	**5**	1.7	**1.1**	0.5	2987
Brain	**4**	1.3	**1.1**	0.5	3536
Unknown primary	**4**	1.3	**0.9**	0.5	3528
All cancers	**299**	100.0	**75.5**	4.4	48

40 to 64 years

Males

	Total	%	ASR	SE	Risk
Prostate	**286**	20.6	**111.6**	6.6	31
Melanoma (skin)	**225**	16.2	**83.6**	5.6	45
Colorectal	**168**	12.1	**65.3**	5.1	54
Colon	**84**	6.1	**33.0**	3.6	105
Rectum	**83**	6.0	**31.9**	3.5	111
Lung	**130**	9.4	**51.2**	4.5	68
Lymphoma	**58**	4.2	**21.8**	2.9	167
Lymphoma NOS	**1**	0.1	**0.5**	0.5	7070
NHL	**54**	3.9	**20.3**	2.8	178
Hodgkin's lymphoma	**3**	0.2	**1.0**	0.6	4436
Unknown primary	**44**	3.2	**17.0**	2.6	206
Kidney	**41**	3.0	**15.5**	2.4	232
Lip	**40**	2.9	**14.3**	2.3	270
Stomach	**38**	2.7	**14.8**	2.4	234
Leukaemia	**32**	2.3	**11.9**	2.1	307
All cancers	**1387**	100.0	**527.0**	14.2	7

Females

	Total	%	ASR	SE	Risk
Breast	**620**	44.2	**236.3**	9.5	16
Melanoma (skin)	**174**	12.4	**65.0**	5.0	61
Colorectal	**135**	9.6	**53.9**	4.7	66
Colon	**89**	6.3	**35.5**	3.8	98
Rectum	**46**	3.3	**18.4**	2.7	196
Lung	**76**	5.4	**30.3**	3.5	115
Uterus	**58**	4.1	**23.4**	3.1	151
Lymphoma	**38**	2.7	**14.4**	2.3	257
Lymphoma NOS	**0**				
NHL	**35**	2.5	**13.2**	2.2	278
Hodgkin's lymphoma	**3**	0.2	**1.2**	0.7	3456
Ovary	**34**	2.4	**13.5**	2.3	266
Kidney	**32**	2.3	**12.5**	2.2	289
Cervix	**25**	1.8	**9.2**	1.9	451
Thyroid gland	**24**	1.7	**8.9**	1.8	459
Unknown primary	**17**	1.2	**6.6**	1.6	545
All cancers	**1402**	100.0	**540.2**	14.5	7

65 years and over

Males

	Total	%	ASR	SE	Risk
Prostate	**638**	26.5	**708.2**	28.7	16
Lung	**373**	15.5	**399.6**	21.2	29
Colorectal	**339**	14.1	**370.1**	20.6	32
Colon	**224**	9.3	**243.8**	16.7	51
Rectum	**115**	4.8	**126.3**	12.1	82
Melanoma (skin)	**210**	8.7	**228.0**	16.1	46
Unknown primary	**90**	3.7	**95.6**	10.4	143
Lymphoma	**82**	3.4	**85.1**	9.6	164
Lymphoma NOS	**8**	0.3	**8.4**	3.0	1746
NHL	**72**	3.0	**74.7**	9.0	188
Hodgkin's lymphoma	**2**	0.1	**2.0**	1.4	4950
Bladder	**81**	3.4	**84.8**	9.6	139
Stomach	**74**	3.1	**83.8**	10.0	126
Kidney	**71**	3.0	**77.6**	9.4	141
Leukaemia	**55**	2.3	**57.2**	7.8	168
All cancers	**2406**	100.0	**2623.3**	54.1	5

Females

	Total	%	ASR	SE	Risk
Breast	**330**	20.8	**296.1**	17.6	36
Colorectal	**285**	18.0	**227.7**	14.7	56
Colon	**215**	13.6	**169.8**	12.6	78
Rectum	**69**	4.4	**57.2**	7.5	198
Lung	**170**	10.7	**143.7**	11.8	77
Melanoma (skin)	**110**	6.9	**97.8**	10.1	107
Unknown primary	**88**	5.5	**64.6**	7.5	218
Lymphoma	**62**	3.9	**50.1**	6.9	237
Lymphoma NOS	**3**	0.2	**2.4**	1.6	6075
NHL	**56**	3.5	**46.0**	6.6	247
Hodgkin's lymphoma	**3**	0.2	**1.7**	1.0	0
Pancreas	**53**	3.3	**40.6**	6.0	295
Stomach	**48**	3.0	**37.7**	6.0	317
Uterus	**44**	2.8	**40.8**	6.5	227
Ovary	**42**	2.6	**32.7**	5.5	382
Leukaemia	**42**	2.6	**32.8**	5.6	384
All cancers	**1586**	100.0	**1319.8**	35.8	9

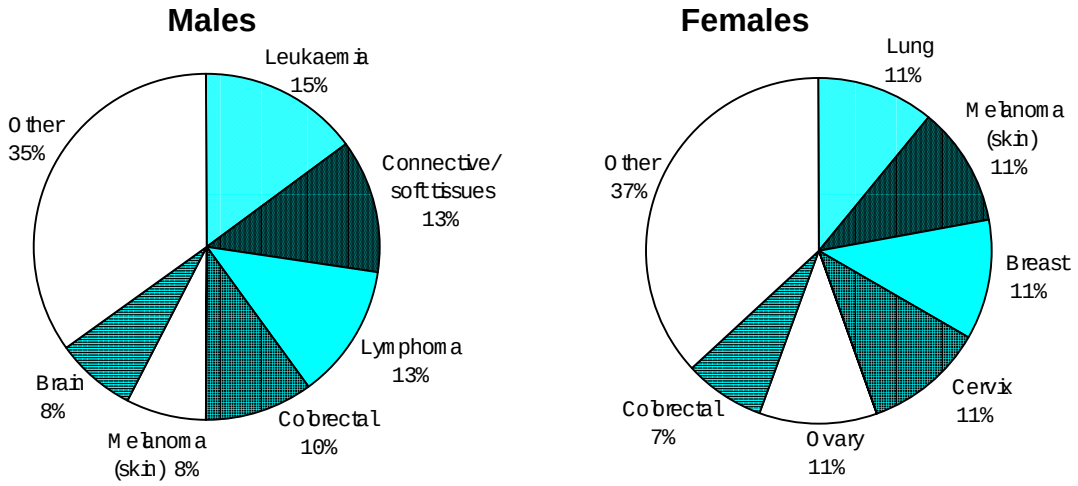
Mortality

Common causes of cancer-related death for males and females in each major age group are shown in Table 3 and Figures 8, 9 and 10.

Among persons aged 15 to 39 years, there were 67 cancer-related deaths in 1999, 14 less than in 1998, and 27 less than in 1997 (Table 3). In females, there were 3 deaths due to each of lung, cervical, breast and ovarian cancers, and melanoma.

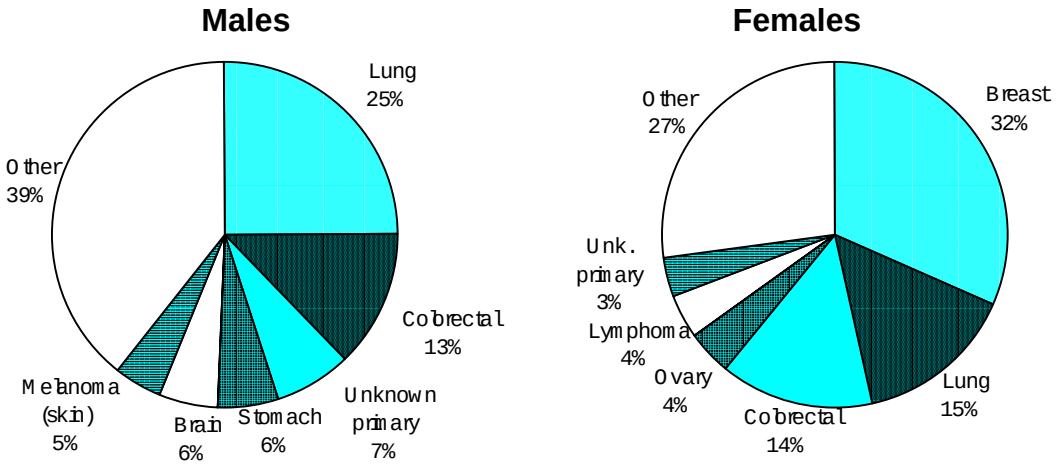
Due to low numbers, changes in the relative importance of cancer types in this age group are in general not thought to be reliable indicators of significant trends. As an example, even the reduction of breast cancer cases from 10 deaths to 3, a large apparent change, was only of marginal statistical significance (p = 0.054). In males, leukaemia was the leading cause of cancer death in this age group (6 cases, 8 in 1998).

Figure 8. Cancer mortality, Western Australia, 1999: common cancers in the 15 to 39 years age group



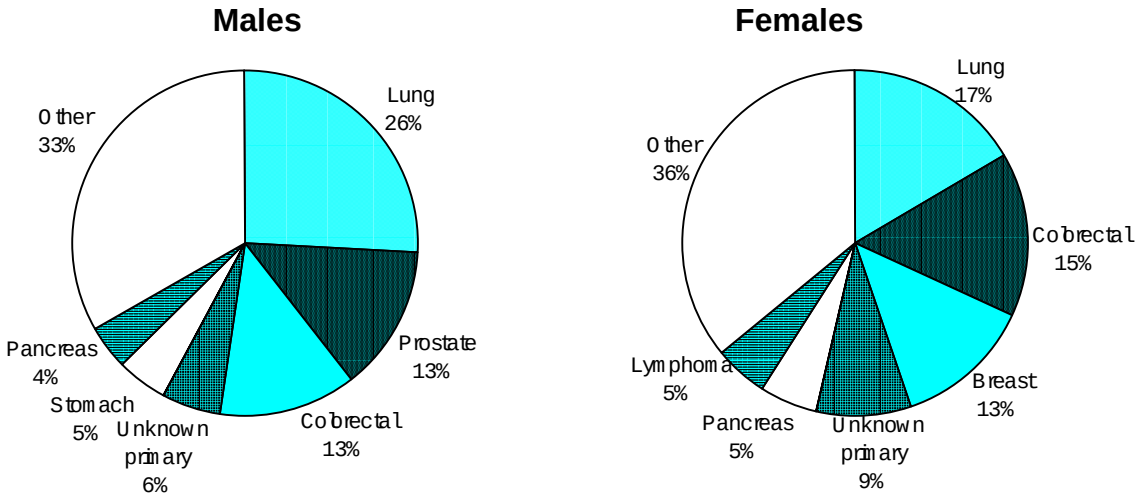
In the age range 40 to 64 years, lung cancer was the most common cause of cancer death in 1999 among males (112 deaths at an age-adjusted rate of 44 per 100,000 males, slightly more than in 1998) (Table 3). Other leading causes of death in males were colorectal cancer (58 deaths) and cancers of unknown primary site (32). Leading causes of death among females were breast cancer (118 deaths), lung cancer (56 deaths) and colorectal cancer (53 deaths).

Figure 9. Cancer mortality, Western Australia, 1999: common cancers in the 40 to 64 years age group



Over the age of 65 years, lung cancer was, as in 1998 and 1997, the most common cause of cancer-related death in males (330 deaths, age-adjusted rate of 352 per 100,000) and in females (155 deaths, rate 127) (both similar to 1998 rates) (Table 3). Prostate cancer ranked second in males (171 deaths, rate 169) and colorectal cancer ranked second in females (143 deaths, rate 103) and third in males (164 deaths, rate 176). Other leading causes of cancer death in this age range were cancers of unknown primary site in males (71 deaths), and breast cancer in females (119 deaths).

Figure 10. Cancer mortality, Western Australia, 1999: common cancers in the 65 years & over age group



2.4 Cancer incidence and mortality in areas within Western Australia

The most common cancers and the most common causes of cancer-related death in major subdivisions of Western Australia have been discussed in previous reports, together with comparisons based on standardized incidence and mortality rates. Most rates, even when based on large geographic areas, have been found to be statistically indistinguishable, and as in the Registry's 1998 report, it is not proposed to discuss the 1999 data in detail.

The most common cancer types for major subdivisions of Western Australia can be found in **Appendix 3D** (incidence) and **Appendix 3E** (mortality). Within these, there are separate tables for the South-East and South-West Metropolitan Health Zones, to reflect current Department of Health administrative arrangements, and for a combined South Metropolitan Health Zone, to allow historical comparisons.

Statistical comparisons between areas within Western Australia are presented, for selected cancer types, in **Section 4.14**.

Separate tabulations for previous years, and for each of the individual Health Service areas, can be obtained on request from the Registry (refer to the Internet address and contact information at the beginning of this report).

Table 3. Cancer mortality, Western Australia, 1999: leading types by sex and age group (ASR: age-adjusted rate)

15 to 39 years

Males

	Total	%	ASR	SE	Risk
Leukaemia	**6**	15.0	**1.7**	0.7	2453
Lymphoid leukaemia	**6**	15.0	**1.7**	0.7	2453
Myeloid leukaemia	**0**				-
Connective/ soft tissues	**5**	12.5	**1.6**	0.7	2912
Lymphoma	**5**	12.5	**1.3**	0.6	2947
Lymphoma NOS	**0**				-
NHL	**5**	12.5	**1.3**	0.6	2947
Hodgkin's lymphoma	**0**				-
Colorectal	**4**	10.0	**1.0**	0.5	3669
Colon	**2**	5.0	**0.4**	0.3	7309
Rectum	**2**	5.0	**0.5**	0.4	7368
Melanoma (skin)	**3**	7.5	**0.7**	0.4	4911
Brain	**3**	7.5	**0.9**	0.5	4874
Unknown primary	**3**	7.5	**0.8**	0.5	4937
Stomach	**2**	5.0	**0.4**	0.3	7309
Testis	**2**	5.0	**0.6**	0.4	7328
All cancer deaths	**40**	100.0	**10.9**	1.8	367

Females

	Total	%	ASR	SE	Risk
Lung	**3**	11.1	**0.7**	0.4	4978
Melanoma (skin)	**3**	11.1	**0.7**	0.4	4902
Breast	**3**	11.1	**0.7**	0.4	4978
Cervix	**3**	11.1	**0.7**	0.4	4620
Ovary	**3**	11.1	**0.7**	0.4	4902
Colorectal	**2**	7.4	**0.4**	0.3	7466
Colon	**0**				-
Rectum	**2**	7.4	**0.4**	0.3	7466
Stomach	**2**	7.4	**0.5**	0.4	7031
Brain	**2**	7.4	**0.6**	0.4	6957
Unknown primary	**2**	7.4	**0.4**	0.3	7466
All cancer deaths	**27**	100.0	**6.5**	1.3	537

40 to 64 years

Males

	Total	%	ASR	SE	Risk
Lung	**112**	24.9	**44.3**	4.2	77
Colorectal	**58**	12.9	**22.5**	3.0	154
Colon	**26**	5.8	**10.1**	2.0	343
Rectum	**32**	7.1	**12.3**	2.2	280
Unknown primary	**32**	7.1	**12.2**	2.2	290
Stomach	**25**	5.6	**9.9**	2.0	342
Brain	**25**	5.6	**9.3**	1.9	393
Melanoma (skin)	**21**	4.7	**7.8**	1.7	482
Oesophagus	**19**	4.2	**7.6**	1.8	441
Pancreas	**19**	4.2	**7.1**	1.6	520
Prostate	**18**	4.0	**7.1**	1.7	479
Leukaemia	**15**	3.3	**5.4**	1.4	675
Lymphoid leukaemia	**4**	0.9	**1.5**	0.8	2696
Myeloid leukaemia	**10**	2.2	**3.5**	1.1	1031
Mesothelioma	**13**	2.9	**5.3**	1.5	625
All cancer deaths	**450**	100.0	**173.7**	8.3	21

Females

	Total	%	ASR	SE	Risk
Breast	**118**	31.6	**44.8**	4.1	85
Lung	**56**	15.0	**21.7**	2.9	168
Colorectal	**53**	14.2	**21.1**	2.9	165
Colon	**29**	7.8	**11.7**	2.2	292
Rectum	**24**	6.4	**9.4**	1.9	377
Ovary	**16**	4.3	**6.4**	1.6	543
Lymphoma	**16**	4.3	**6.6**	1.7	501
Lymphoma NOS	**1**	0.3	**0.5**	0.5	6928
NHL	**15**	4.0	**6.2**	1.6	540
Hodgkin's lymphoma	**0**				-
Unknown primary	**13**	3.5	**5.2**	1.4	700
Cervix	**11**	2.9	**4.3**	1.3	884
Pancreas	**9**	2.4	**4.0**	1.3	821
Brain	**9**	2.4	**3.5**	1.2	1053
Leukaemia	**8**	2.1	**2.9**	1.0	1379
Lymphoid leukaemia	**0**				-
Myeloid leukaemia	**8**	2.1	**2.9**	1.0	1379
All cancer deaths	**374**	100.0	**146.9**	7.6	25

65 years and over

Males

	Total	%	ASR	SE	Risk
Lung	**330**	25.9	**352.3**	19.9	34
Prostate	**171**	13.4	**169.4**	13.2	113
Colorectal	**164**	12.9	**175.9**	14.0	74
Colon	**100**	7.9	**103.7**	10.6	146
Rectum	**64**	5.0	**72.1**	9.2	151
Unknown primary	**71**	5.6	**75.2**	9.2	167
Stomach	**58**	4.6	**64.1**	8.6	175
Pancreas	**55**	4.3	**61.1**	8.4	177
Lymphoma	**55**	4.3	**57.2**	7.9	219
Lymphoma NOS	**6**	0.5	**5.8**	2.4	2475
NHL	**49**	3.9	**51.4**	7.5	240
Hodgkin's lymphoma	**0**				-
Leukaemia	**54**	4.2	**56.7**	7.9	217
Lymphoid leukaemia	**12**	0.9	**11.9**	3.5	1854
Myeloid leukaemia	**34**	2.7	**35.7**	6.2	323
All cancer deaths	**1272**	100.0	**1345.1**	38.3	10

Females

	Total	%	ASR	SE	Risk
Lung	**155**	16.6	**127.3**	11.0	91
Colorectal	**143**	15.3	**103.0**	9.4	142
Colon	**100**	10.7	**72.0**	7.8	211
Rectum	**43**	4.6	**31.0**	5.1	433
Breast	**119**	12.8	**95.5**	9.6	126
Unknown primary	**83**	8.9	**61.0**	7.3	226
Pancreas	**50**	5.4	**37.1**	5.6	326
Lymphoma	**47**	5.0	**35.5**	5.6	376
Lymphoma NOS	**2**	0.2	**1.1**	0.8	*
NHL	**41**	4.4	**31.6**	5.3	404
Hodgkin's lymphoma	**4**	0.4	**2.8**	1.5	5437
Ovary	**46**	4.9	**36.9**	6.0	339
Stomach	**41**	4.4	**34.4**	5.8	298
Leukaemia	**31**	3.3	**21.2**	4.2	814
Lymphoid leukaemia	**12**	1.3	**6.4**	1.9	*
Myeloid leukaemia	**16**	1.7	**12.4**	3.4	939
All cancer deaths	**933**	100.0	**717.3**	25.5	18

3. Cancer in Western Australia, 2000

3.1 All cancers

Incidence

In 2000, there were 7317 new diagnoses of cancer in Western Australia, 3996 (55%) in males and 3321 (45%) in females. The corresponding age-standardized incidence rates were 328 per 100,000 (males) and 257 per 100,000 (females). These rates represented small decreases for both males and for females, since 1999.

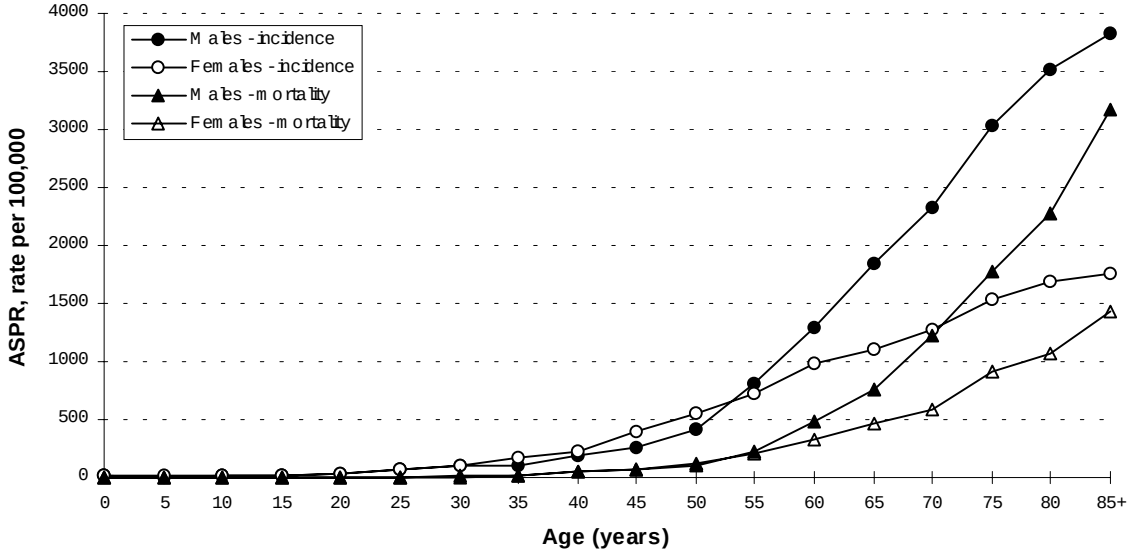
The estimated lifetime risk of cancer to age 75 years was 1 in 3 for males and 1 in 4 for females. The cumulative incidence of cancer - the proportion of persons in whom cancer had been diagnosed by age 75 years - was 38% for males and 29% for females, both slightly higher than in 1999.

As always, cancer incidence rates varied with age. Cancer was more common in males than in females under the age of 5 years, and at all ages over 55 years (fig. 11). Between ages 25 and 55 years, cancer rates in women were generally higher than in men, the female/male rate ratio peaking at 1.7 in the 35-39 years age group.

Most of the excess cancer risk in females between ages 30 and 54 was due to breast cancer, while prostate cancer and lung cancer were responsible for the high male/female rate ratio (approximately 2) at ages over 65 years.

The proportion of all cancers with a microscopic diagnosis was high (94% in males and in females, relatively stable over the last 4 years). Among relatively common cancer types, pancreatic cancer was most often diagnosed by non-histological methods (35% in males, 47% in females); slight increases since 1999.

Figure 11. Age-specific all-cancers incidence and mortality rates, Western Australia, 2000.



Mortality

Among Western Australian residents, there were 1758 deaths in 2000 due to cancer in males and 1306 in females. Mortality rates were 136 deaths per 100,000 males and 87 per 100,000 females, both slightly lower than for 1999, and similar to rates in 1998. The estimated lifetime risk of death due to cancer before age 75 years was 1 in 7 for males and 1 in 11 for females, as in 1998 and 1999. These statistics include 17 deaths due to non-melanocytic skin cancers of the types (SCC, BCC) not included in incidence data (12 males, 5 females).

There were 23 cancer-related deaths of non-residents in Western Australia in 2000, which are not included in mortality statistics in this report.

Other 2000 deaths recorded by the Cancer Registry included:

Deaths due to benign tumours - none

Deaths due to "uncertain malignant potential" lymphohaematopoietic neoplasms - 26 (14 men, 12 women; most due to myelofibrosis or myelodysplasia; unchanged from 1999)

Deaths due to non-tumour-related causes among persons with a Registry tumour record - 733 males (increased since 1999), 498 females (also increased).

Deaths of unresolved cause among persons with a tumour record - 32 (19 males, 13 females). (These are higher than in 1999, largely as a consequence of efforts to bring forward the Registry's reporting time frame, while resolution of coronial-enquiry cases still takes considerable time.)

The "person-years of life lost" (PYLL) statistics in this report are, as in the Registry's most recent reports, based on an upper limit of 75 years, yielding higher figures than reported in earlier years. Before the age of 75 years, a total of 11328 person-years of life were lost due to cancer among males (lower than in 1999), and 10542 in females (more than in 1999).

There was no significant change in the age-pattern of cancer mortality in 2000. Cancer death rates generally increased for both males and females from age 20 (Fig. 11), with low case numbers at earlier ages. All-cancers death rates among males were consistently higher than in females at ages greater than 55 years.

Mortality to incidence ratios

Except in situations where incidence and/or mortality are changing rapidly, or notification of cancer is incomplete, the ratio of mortality to incidence for a cancer gives a crude indication of its impact. In 2000 the mortality/incidence rate ratio for prostate cancer was 0.22, as in 1998 and 1999. The mortality/incidence ratio for breast cancer in females was slightly reduced at 0.17, compared with 1999. The all-cancers mortality/incidence ratios for 2000 were higher for males than for females (0.42 and 0.34), slightly reduced since 1999.

3.2 Common cancers

Incidence

In females, breast cancer continued to be the most common incident cancer (1010 cases; ASR 83 per 100,000, 30% of all cancers in females). This was followed by colorectal cancer (13%), malignant melanoma of the skin (11%) and lung cancer (8%). These rankings were similar to those observed in 1998 and 1999. There were an additional 195 cases of *in situ* breast carcinoma reported, increased from 134 cases in 1999.

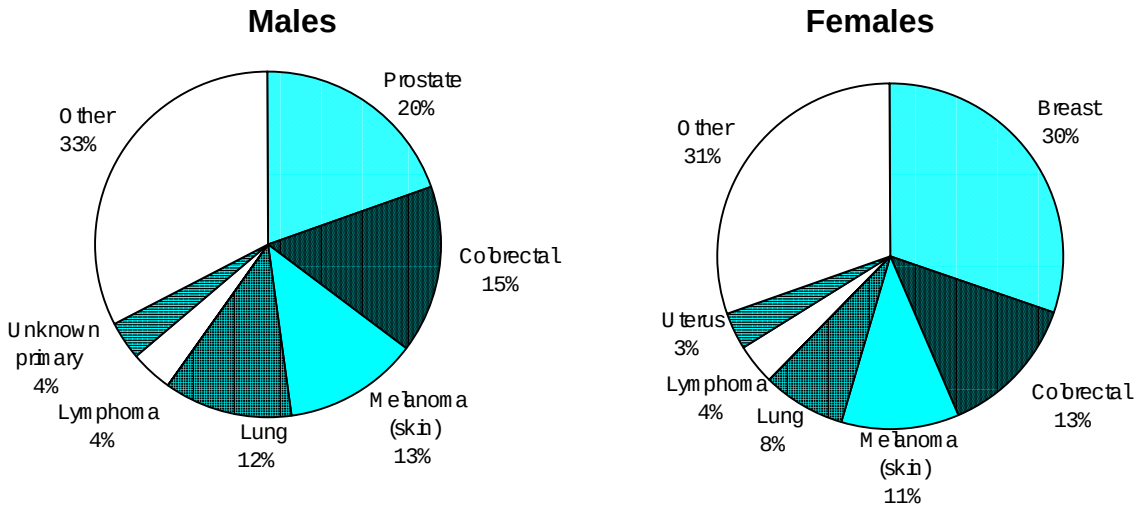
The most common cancers in males were prostate cancer (789 cases; 20%), colorectal cancer (15%), melanoma (13%) and lung cancer (12%) (Table 4; Fig. 12). The incidence rate of prostate cancer was 64 per 100,000 males, decreased from 78 in 1999.

The incidence rate of reported prostate cancer in Western Australia has halved since a peak in 1994, however there is as yet no reliable evidence of an associated change in mortality. The mortality rate for 2000 (14.1 per 100,000 males) was marginally, but not significantly, higher than in 1999 (13.6 per 100,000). Prostate cancer again ranked third as a cause of cancer-related death among males in 2000.

For the major cancers affecting both males and females, males had a higher incidence than females. For lung cancer, the ASRs were 38 in males and 18 in females, lower for males than in 1999. Differences between rates in males and females were again smaller for colorectal cancer (M 50, F 31) and melanoma (M 42, F 30).

Cancers of unknown primary site were recorded in 146 males (ASR 11, 4% of all cancers) and 106 females (ASR 6, 3%); the incidence of unknown-primary cancers remains relatively stable.

Figure 12. Cancer incidence, Western Australia, 2000: common cancers



Other common specific cancer types diagnosed included:

Lymphomas - 153 cases in men (ASR 13), 135 in women (ASR 11)
Stomach - 110 cases in men (ASR 8), 49 in women (ASR 3); decreased in both
Bladder - 123 cases in men (ASR 9), 43 in women (ASR 3); increased in both
Leukaemias - 109 cases in men (ASR 9), 59 in women (ASR 6) (both decreased)
Kidney - 123 cases in men (ASR 10), 67 in women (ASR 5) (unchanged from 1999).

In women -

Ovarian cancer - 103 cases, ASR 8 (increase since 1999)
Uterine cancer - 106 cases, ASR 8 (stable)
Cervical cancer - 71 cases, ASR 6 (decreased).

Mortality

The most common causes of cancer-related death in males were lung cancer (24%), colorectal cancer (13%) and prostate cancer (11%) (Table 4; Fig. 13). Lung cancer (17%), breast cancer (16%) and colorectal cancer (14%) were the most common in females, with lung cancer, unusually, outranking breast cancer as a cause of death. Other major causes of cancer-related mortality included tumours of unknown primary site in both sexes, leukaemia and stomach cancer in males, and pancreatic cancer and lymphoma in females. With minor changes, these are consistent with the usual common causes of cancer-related death in recent years.

In 2000, lung cancer was responsible for 649 deaths (428 males, ASR 33 per 100,000; 221 females, ASR 15; almost unchanged since 1999). Prostate cancer remained a common cause of cancer death in males at a rate of 14 deaths per 100,000, as in 1999.

In women, lung cancer was for the first time the most common cause of cancer-related death (221 deaths, ASR 15 per 100,000 females), followed by breast cancer (causing 202 deaths at an ASR of 14 per 100,000 females). Among causes of cancer-related death, colorectal cancer again ranked second in males and third in females: 229 deaths in males (ASR 18) and 177 females (ASR 12).

Tumours of unknown primary site were, as in 1996-1999, the fourth most common cause of cancer death in both sexes (105 males, 95 females), and accounted for 6% of all cancer deaths in men, and 7% in women.

Figure 13. Cancer mortality, Western Australia, 2000: common cancers

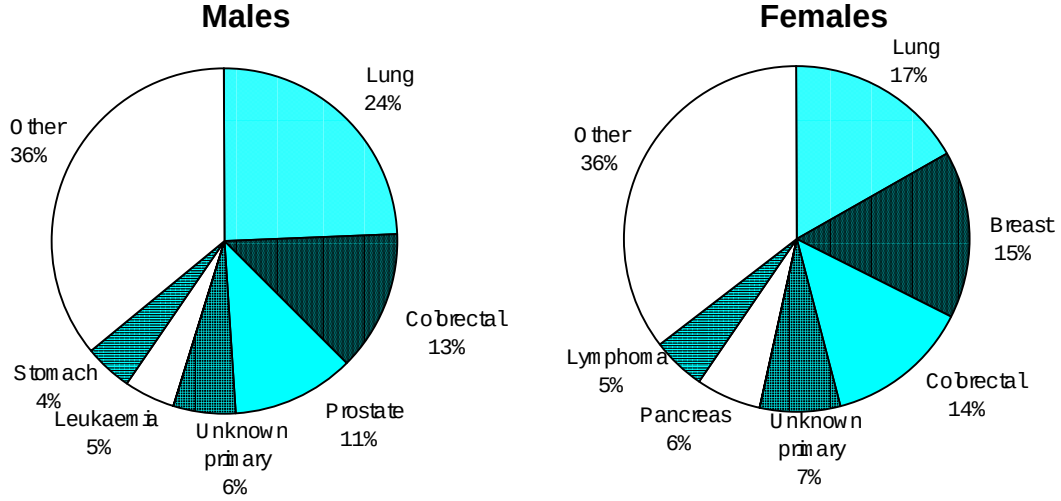


Table 4. Cancer incidence and mortality, Western Australia, 2000: leading types in males and females

Incidence

Males

	Total	%	ASR	SE	Risk
Prostate	**789**	19.7	**63.7**	2.3	13
Colorectal	**617**	15.4	**50.1**	2.1	17
Colon	**350**	8.8	**28.7**	1.6	29
Rectum	**265**	6.6	**21.2**	1.3	39
Melanoma (skin)	**503**	12.6	**42.5**	1.9	22
Lung	**475**	11.9	**38.3**	1.8	22
Lymphoma	**153**	3.8	**12.6**	1.0	70
Lymphoma NOS	**5**	0.1	**0.4**	0.2	1998
NHL	**128**	3.2	**10.4**	0.9	82
Hodgkin's lymphoma	**20**	0.5	**1.9**	0.4	633
Unknown primary	**146**	3.7	**11.4**	1.0	83
Kidney	**123**	3.1	**10.5**	1.0	82
Bladder	**123**	3.1	**9.3**	0.9	113
Stomach	**110**	2.8	**8.5**	0.8	110
Leukaemia	**109**	2.7	**9.4**	1.0	102
Lymphoid leukaemia	**45**	1.1	**4.4**	0.7	232
Myeloid leukaemia	**50**	1.3	**4.0**	0.6	238
Pancreas	**79**	2.0	**6.5**	0.7	130
Lip	**72**	1.8	**6.3**	0.7	145
Brain	**70**	1.8	**6.3**	0.8	147
Myeloma	**63**	1.6	**4.9**	0.6	179
Skin (NMSC exc.SCC/BCC)	**62**	1.6	**4.9**	0.6	184
Oesophagus	**60**	1.5	**4.7**	0.6	189
Testis	**58**	1.5	**5.1**	0.7	248
Mesothelioma	**45**	1.1	**3.6**	0.6	281
Larynx	**40**	1.0	**3.5**	0.6	244
Liver	**37**	0.9	**3.0**	0.5	267
All cancers	**3996**	100.0	**328.0**	5.3	3

Females

	Total	%	ASR	SE	Risk
Breast	**1010**	30.4	**82.8**	2.7	11
Colorectal	**436**	13.1	**30.7**	1.6	29
Colon	**293**	8.8	**20.4**	1.3	44
Rectum	**142**	4.3	**10.2**	0.9	85
Melanoma (skin)	**359**	10.8	**30.1**	1.7	34
Lung	**260**	7.8	**18.5**	1.2	41
Lymphoma	**135**	4.1	**10.7**	1.0	81
Lymphoma NOS	**10**	0.3	**0.8**	0.3	1080
NHL	**112**	3.4	**8.7**	0.9	98
Hodgkin's lymphoma	**13**	0.4	**1.3**	0.4	821
Uterus	**106**	3.2	**8.5**	0.9	95
Unknown primary	**106**	3.2	**6.5**	0.7	179
Ovary	**103**	3.1	**8.5**	0.9	110
Pancreas	**78**	2.3	**5.1**	0.6	192
Cervix	**71**	2.1	**5.7**	0.7	167
Thyroid gland	**68**	2.0	**6.2**	0.8	173
Kidney	**67**	2.0	**5.1**	0.7	158
Leukaemia	**59**	1.8	**5.5**	0.8	221
Lymphoid leukaemia	**25**	0.8	**2.9**	0.6	470
Myeloid leukaemia	**28**	0.8	**2.1**	0.4	541
Brain	**51**	1.5	**4.5**	0.7	231
Stomach	**49**	1.5	**3.2**	0.5	286
Bladder	**43**	1.3	**2.6**	0.4	306
Myeloma	**42**	1.3	**3.0**	0.5	244
Skin (NMSC exc.SCC/BCC)	**36**	1.1	**2.7**	0.5	333
Oesophagus	**33**	1.0	**2.2**	0.4	404
Lip	**29**	0.9	**2.1**	0.4	461
All cancers	**3321**	100.0	**257.2**	4.7	4

Mortality

Males

	Total	%	ASR	SE	Risk
Lung	**428**	24.3	**33.1**	1.6	27
Colorectal	**229**	13.0	**18.1**	1.2	47
Colon	**124**	7.1	**9.9**	0.9	87
Rectum	**105**	6.0	**8.2**	0.8	102
Prostate	**201**	11.4	**14.1**	1.0	93
Unknown primary	**105**	6.0	**8.1**	0.8	118
Leukaemia	**84**	4.8	**6.8**	0.8	127
Lymphoid leukaemia	**31**	1.8	**2.6**	0.5	506
Myeloid leukaemia	**40**	2.3	**3.2**	0.5	229
Stomach	**76**	4.3	**6.0**	0.7	144
Lymphoma	**67**	3.8	**5.1**	0.6	187
Lymphoma NOS	**4**	0.2	**0.3**	0.2	2121
NHL	**58**	3.3	**4.4**	0.6	219
Hodgkin's lymphoma	**5**	0.3	**0.4**	0.2	3349
Pancreas	**62**	3.5	**5.0**	0.7	189
Brain	**60**	3.4	**5.2**	0.7	174
Mesothelioma	**56**	3.2	**4.5**	0.6	192
Bladder	**53**	3.0	**3.9**	0.5	297
Kidney	**46**	2.6	**3.7**	0.6	250
Oesophagus	**43**	2.4	**3.2**	0.5	281
Melanoma (skin)	**41**	2.3	**3.1**	0.5	249
Myeloma	**29**	1.6	**2.2**	0.4	435
Liver	**27**	1.5	**2.1**	0.4	381
Gallbladder / bile ducts	**21**	1.2	**1.7**	0.4	576
Skin (not melanoma)	**19**	1.1	**1.3**	0.3	1027
Larynx	**18**	1.0	**1.5**	0.4	526
All cancer deaths	**1758**	100.0	**136.4**	3.3	7

Females

	Total	%	ASR	SE	Risk
Lung	**221**	16.9	**15.2**	1.1	58
Breast	**202**	15.5	**14.2**	1.1	66
Colorectal	**177**	13.6	**11.7**	1.0	77
Colon	**126**	9.6	**8.1**	0.8	113
Rectum	**51**	3.9	**3.6**	0.5	233
Unknown primary	**95**	7.3	**5.3**	0.6	222
Pancreas	**81**	6.2	**5.1**	0.6	180
Lymphoma	**65**	5.0	**4.2**	0.6	237
Lymphoma NOS	**4**	0.3	**0.3**	0.2	2067
NHL	**59**	4.5	**3.8**	0.5	296
Hodgkin's lymphoma	**2**	0.2	**0.1**	0.1	2773
Ovary	**54**	4.1	**3.9**	0.6	208
Brain	**46**	3.5	**3.5**	0.6	244
Stomach	**36**	2.8	**2.1**	0.4	580
Leukaemia	**35**	2.7	**2.9**	0.5	343
Lymphoid leukaemia	**8**	0.6	**0.8**	0.3	1263
Myeloid leukaemia	**25**	1.9	**2.0**	0.4	510
Cervix	**32**	2.5	**2.3**	0.4	338
Melanoma (skin)	**28**	2.1	**2.1**	0.4	520
Myeloma	**26**	2.0	**1.5**	0.3	730
Kidney	**22**	1.7	**1.4**	0.3	657
Bladder	**22**	1.7	**1.1**	0.3	1082
Uterus	**21**	1.6	**1.5**	0.4	525
Oesophagus	**19**	1.5	**1.2**	0.3	688
Gallbladder / bile ducts	**19**	1.5	**1.2**	0.3	631
Liver	**14**	1.1	**1.0**	0.3	1004
Skin (not melanoma)	**8**	0.6	**0.4**	0.2	3902
All cancer deaths	**1306**	100.0	**87.2**	2.6	11

Other specific cancers of particular prominence in cancer mortality in 2000 included:

Pancreatic cancer - 143 deaths (62 males, 81 females; increased in females since 1999)
Stomach cancer - 112 deaths (76 males, 36 females; little changed)
Leukaemia - 119 deaths (84 males, 35 females; increased in males, decreased in females)
Lymphomas - 132 deaths (67 males, 65 females; little changed)
Malignant brain tumours - 106 deaths (60 males, 46 females; increased in both)
Bladder cancer - 75 deaths (53 males, 22 females)

In females: Cancer of the ovary - 54 deaths (decreased since 1999)

In males: Mesothelioma - 56 deaths; increased since 1999)

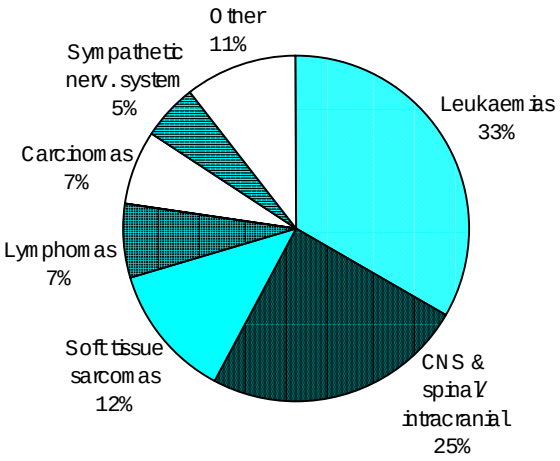
3.3 Cancer in different age groups

Incidence

In children under the age of 15 years, there were 57 cases of cancer diagnosed in 2000, 27 males and 30 females. The corresponding ASRs were 13.7 per 100,000 males, 15.3 per 100,000 females, decreased since 1999 (**Appendix 4C**). The estimated 0-14 years population in Western Australia in 2000 was 397,760 children (204,557 males and 193,203 females).

Diagnoses have been classified mainly in terms of tumour morphology (ICD-O 2nd edition)[13] into 12 major diagnostic groups; these are shown in detail in **Appendix 4C**. The most common tumours diagnosed in children in 2000 are shown in Figure 14. The leukaemias and tumours of the CNS accounted for 58% of all diagnoses. The most common individual tumour type was acute lymphoblastic leukaemia, with 19 children newly diagnosed (ASR 3.8 in males, 6.3 in females), similar to 1999 data. There was a single case of melanoma, in a boy in the 10-14 age group, in 2000.

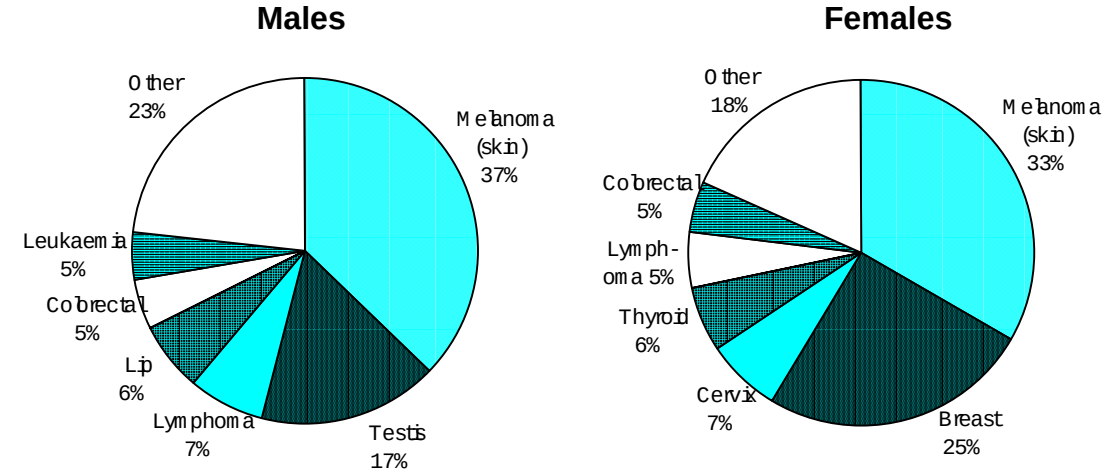
Figure 14. Cancer in children under 15 years of age, Western Australia, 2000: most common types.



There were 8 deaths (4 males, 4 females) from childhood cancer in 2000 at age-adjusted death rates per 100,000 child-years of 2.1 for males and 1.8 for females; little changed since 1999.

In the 15 to 39 years age range, there were 537 cancer diagnoses in 2000, 56% in women, mainly melanoma (100 cases) and breast cancer (76 cases). Malignant melanoma of the skin (88 cases) and testicular cancer (40 cases) were the most common cancers in males (Fig. 15). Melanoma rates were similar to those in 1999. Cervical and thyroid cancer were the next most common cancers in females, and lymphoma ranked third in males.

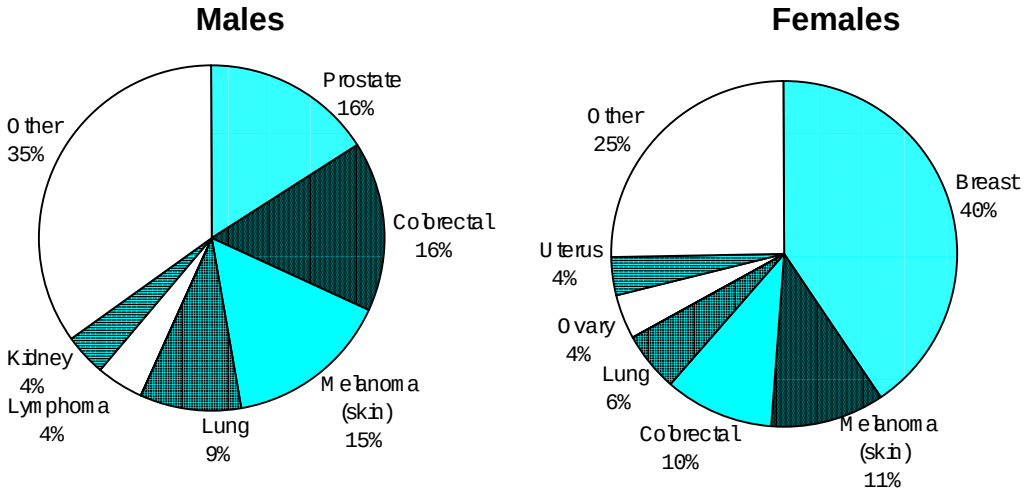
Figure 15. Cancer incidence, Western Australia, 2000: common cancers in the 15 to 39 years age group



In the age range 40 to 64 years, breast cancer continued to dominate reported incident cancers (579 cases, 40% of all female cancers in this age group, similar to 1999 data) (Table 5; Fig. 16). The risk of cancer occurring in this age range was 1 in 7 for both males and females. Just under half (49.7%) of all cancers in this age range occurred in females. In males, prostate cancer (16%) was most common, followed by colorectal cancer (16%) and melanoma (15%).

As in 1999, melanoma cases outnumbered colorectal cancers in this age group in females. Lung cancer was the fourth most common cancer type in males and in females, as in 1998 and 1999.

Figure 16. Cancer incidence, Western Australia, 2000: common cancers in the 40 to 64 years age group



Over the age of 65 years, prostate cancer (555 cases) outnumbered any other specific cancer type in either sex (Table 5; Fig. 17), and accounted for 24% of diagnoses in males in this group (26% in 1999, 22% in 1998).

Among females, breast cancer predominated (355 cases, 23% of all cancers, slightly higher than in 1999). Other common cancer types in this age range were colorectal cancer (16% in males, 18% in females) and lung cancer (15%, 11%) (both similar to 1999).

Malignant melanoma of the skin was the fourth most common cancer type in males and in females, followed by tumours of unknown primary site - for which the age-adjusted rate in males (105 per 100,000) was, as in 1999, much greater than in females (48) (Table 5).

Figure 17. Cancer incidence, Western Australia, 2000: common cancers in the 65 years & over age group

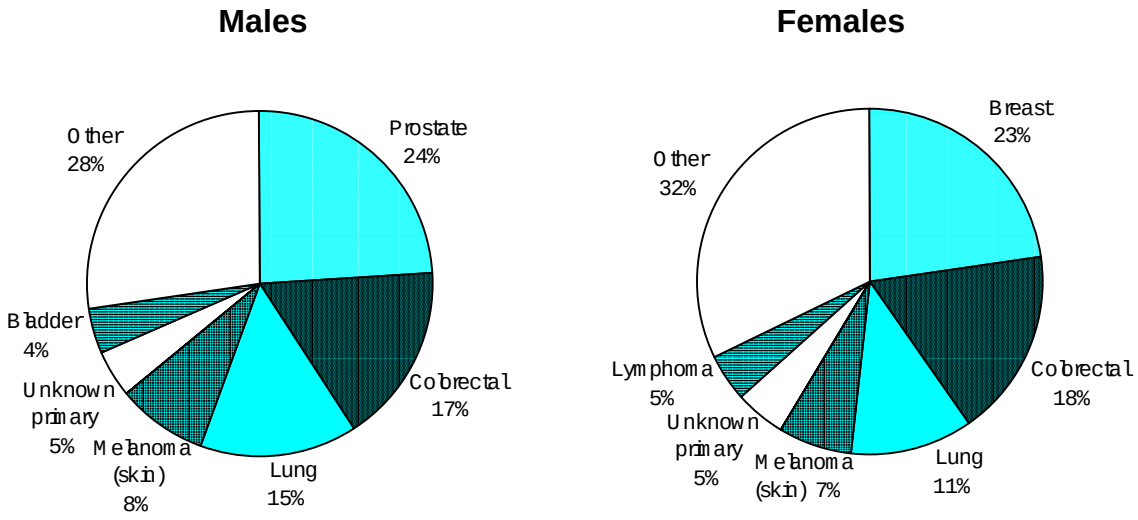


Table 5. Cancer incidence, Western Australia, 2000: leading types by sex and age group (ASR: age-adjusted rate)

15 to 39 years

Males

	Total	%	ASR	SE	Risk
Melanoma (skin)	**88**	37.1	**22.1**	2.4	168
Testis	**40**	16.9	**9.8**	1.6	365
Lymphoma	**17**	7.2	**4.4**	1.1	864
Lymphoma NOS	**0**				
NHL	**9**	3.8	**2.3**	0.8	1624
Hodgkin's lymphoma	**8**	3.4	**2.1**	0.8	1846
Lip	**15**	6.3	**3.6**	0.9	976
Colorectal	**11**	4.6	**2.6**	0.8	1341
Colon	**8**	3.4	**1.9**	0.7	1843
Rectum	**3**	1.3	**0.7**	0.4	4925
Leukaemia	**11**	4.6	**3.1**	1.0	1312
Lymphoid leukaemia	**7**	3.0	**2.1**	0.8	2056
Myeloid leukaemia	**4**	1.7	**1.0**	0.5	3622
Brain	**10**	4.2	**2.5**	0.8	1474
Thyroid gland	**8**	3.4	**2.1**	0.7	1842
Kidney	**6**	2.5	**1.4**	0.6	2485
Lung	**5**	2.1	**1.3**	0.6	2951
All cancers	**237**	100.0	**59.5**	3.9	62

Females

	Total	%	ASR	SE	Risk
Melanoma (skin)	**100**	33.3	**26.2**	2.7	143
Breast	**76**	25.3	**17.7**	2.0	191
Cervix	**21**	7.0	**5.1**	1.1	687
Thyroid gland	**18**	6.0	**4.7**	1.1	796
Lymphoma	**16**	5.3	**4.2**	1.1	893
Lymphoma NOS	**2**	0.7	**0.5**	0.3	7193
NHL	**9**	3.0	**2.1**	0.7	1610
Hodgkin's lymphoma	**5**	1.7	**1.6**	0.7	2777
Colorectal	**14**	4.7	**3.4**	0.9	1035
Colon	**9**	3.0	**2.2**	0.8	1611
Rectum	**5**	1.7	**1.1**	0.5	2896
Ovary	**9**	3.0	**2.3**	0.8	1600
Leukaemia	**7**	2.3	**2.2**	0.8	2007
Lymphoid leukaemia	**0**				
Myeloid leukaemia	**6**	2.0	**1.8**	0.7	2358
Brain	**6**	2.0	**1.6**	0.7	2411
Kidney	**5**	1.7	**1.1**	0.5	2896
All cancers	**300**	100.0	**75.2**	4.4	48

40 to 64 years

Males

	Total	%	ASR	SE	Risk
Prostate	**234**	16.2	**87.9**	5.8	39
Colorectal	**228**	15.8	**84.4**	5.6	41
Colon	**125**	8.6	**47.0**	4.2	73
Rectum	**102**	7.0	**37.1**	3.7	96
Melanoma (skin)	**223**	15.4	**79.2**	5.3	48
Lung	**135**	9.3	**51.4**	4.5	67
Lymphoma	**63**	4.4	**22.8**	2.9	158
Lymphoma NOS	**1**	0.1	**0.3**	0.3	9388
NHL	**53**	3.7	**19.2**	2.7	185
Hodgkin's lymphoma	**9**	0.6	**3.2**	1.1	1250
Kidney	**58**	4.0	**21.3**	2.8	168
Unknown primary	**39**	2.7	**14.9**	2.4	231
Lip	**37**	2.6	**13.4**	2.2	283
Pancreas	**35**	2.4	**13.1**	2.2	271
Brain	**33**	2.3	**11.6**	2.0	332
Leukaemia	**32**	2.2	**11.6**	2.1	321
Lymphoid leukaemia	**11**	0.8	**4.0**	1.2	949
All cancers	**1447**	100.0	**531.2**	14.0	7

Females

	Total	%	ASR	SE	Risk
Breast	**579**	40.5	**213.6**	8.9	18
Melanoma (skin)	**152**	10.6	**55.6**	4.5	70
Colorectal	**148**	10.3	**56.7**	4.7	63
Colon	**95**	6.6	**36.9**	3.8	97
Rectum	**53**	3.7	**19.9**	2.7	180
Lung	**80**	5.6	**30.2**	3.4	117
Ovary	**56**	3.9	**21.6**	2.9	164
Uterus	**55**	3.8	**20.9**	2.8	174
Lymphoma	**46**	3.2	**18.0**	2.7	196
Lymphoma NOS	**2**	0.1	**0.9**	0.6	3567
NHL	**40**	2.8	**15.6**	2.5	224
Hodgkin's lymphoma	**4**	0.3	**1.5**	0.7	2848
Thyroid gland	**39**	2.7	**13.9**	2.2	289
Unknown primary	**29**	2.0	**11.0**	2.1	338
Cervix	**28**	2.0	**10.1**	1.9	406
Kidney	**26**	1.8	**9.9**	2.0	366
Pancreas	**23**	1.6	**8.9**	1.9	400
All cancers	**1430**	100.0	**533.3**	14.2	7

65 years and over

Males

	Total	%	ASR	SE	Risk
Prostate	**555**	24.3	**595.7**	26.0	20
Colorectal	**378**	16.5	**400.2**	21.1	29
Colon	**217**	9.5	**232.3**	16.2	50
Rectum	**160**	7.0	**167.1**	13.6	67
Lung	**335**	14.7	**357.0**	20.1	33
Melanoma (skin)	**191**	8.4	**205.6**	15.3	51
Unknown primary	**103**	4.5	**105.0**	10.6	133
Bladder	**93**	4.1	**90.1**	9.6	184
Stomach	**77**	3.4	**77.9**	9.1	175
Lymphoma	**71**	3.1	**72.4**	8.9	149
Lymphoma NOS	**4**	0.2	**3.8**	1.9	2538
NHL	**65**	2.8	**66.4**	8.5	163
Hodgkin's lymphoma	**2**	0.1	**2.2**	1.6	5950
Leukaemia	**59**	2.6	**59.8**	8.0	184
Lymphoid leukaemia	**20**	0.9	**21.3**	4.9	445
Myeloid leukaemia	**29**	1.3	**29.0**	5.6	451
Kidney	**58**	2.5	**64.9**	8.8	172
All cancers	**2285**	100.0	**2413.7**	51.4	5

Females

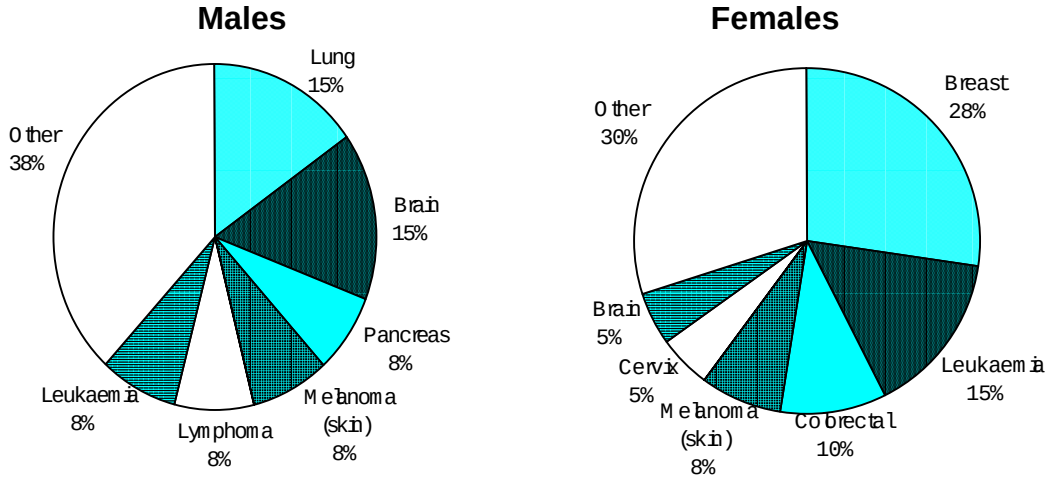
	Total	%	ASR	SE	Risk
Breast	**355**	22.7	**326.0**	18.7	32
Colorectal	**274**	17.6	**217.5**	14.4	56
Colon	**189**	12.1	**148.3**	11.8	84
Rectum	**84**	5.4	**68.2**	8.1	171
Lung	**178**	11.4	**154.4**	12.4	64
Melanoma (skin)	**107**	6.9	**93.0**	9.8	123
Unknown primary	**73**	4.7	**48.4**	6.3	422
Lymphoma	**71**	4.5	**62.4**	8.0	167
Lymphoma NOS	**6**	0.4	**5.3**	2.4	1972
NHL	**61**	3.9	**52.8**	7.3	201
Hodgkin's lymphoma	**4**	0.3	**4.3**	2.3	1972
Pancreas	**53**	3.4	**38.6**	5.8	387
Uterus	**47**	3.0	**42.2**	6.6	223
Ovary	**36**	2.3	**27.3**	4.9	440
Kidney	**36**	2.3	**31.8**	5.7	306
Bladder	**36**	2.3	**28.4**	5.2	385
Stomach	**34**	2.2	**25.7**	4.8	481
All cancers	**1561**	100.0	**1304.6**	35.7	9

Mortality

Common causes of cancer-related death for males and females in each major age group in 2000 are shown in Table 6 and Figures 18, 19 and 20.

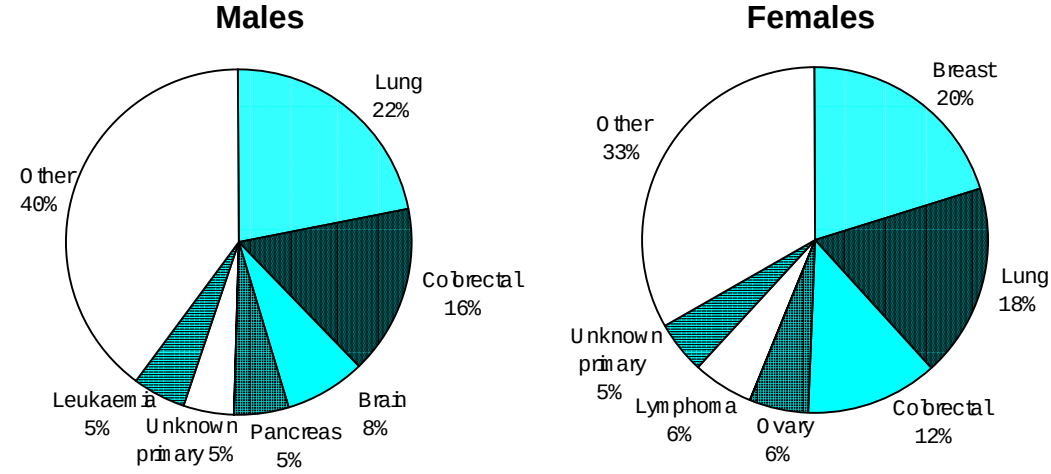
Among persons aged 15 to 39 years, there were 66 cancer-related deaths in 2000, one less than in 1999 (Table 6). In females, breast cancer was the leading cause of cancer death (11 cases, 28% of female deaths), followed by leukaemia (6 deaths) and colorectal cancer (4). In males, lung cancer and cancers of the brain were the leading causes of cancer death in this age group. As in 1999, due to low numbers, changes in the relative importance of cancer types in this age group are not thought to be reliable indicators of significant trends.

Figure 18. Cancer mortality, Western Australia, 2000: common cancers in the 15 to 39 years age group



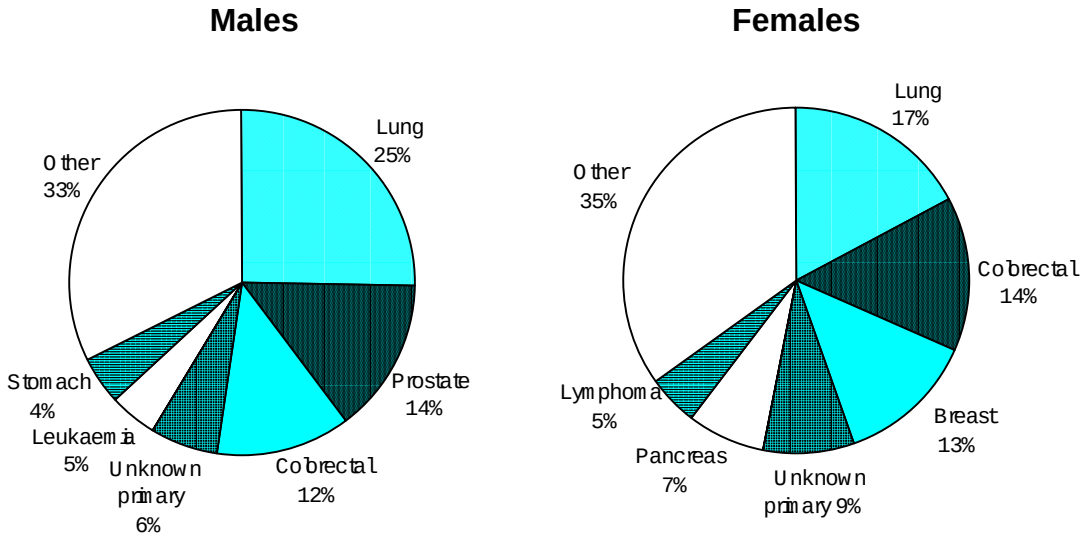
In the age range 40 to 64 years, lung cancer was the most common cause of cancer death in 2000 among males (96 deaths at an age-adjusted rate of 37 per 100,000 males, marginally lower than in 1999) (Table 6). Other leading causes of death in males were colorectal (69 deaths), brain (33 deaths) and pancreatic cancers (21 deaths). Leading causes of death among females were breast cancer (76 deaths), lung cancer (68 deaths) and colorectal cancer (46 deaths). These rankings were the same as in 1999 for females, but death due to cancers of unknown primary site was relatively less common in males than in 1999.

Figure 19. Cancer mortality, Western Australia, 2000: common cancers in the 40 to 64 years age group



Over the age of 65 years, lung cancer was, as in recent years, the most common cause of cancer-related death in males (328 deaths, age-adjusted rate of 335 per 100,000) and in females (153 deaths, rate 122) (Table 6). Prostate cancer ranked second in males (186 deaths, rate 181) and colorectal cancer ranked third in males (159 deaths, rate 165) and second in females (127 deaths, rate 99). Other leading causes of cancer deaths in this age range were cancers of unknown primary site in males (83 deaths), and breast cancer in females (115 deaths).

Figure 20. Cancer mortality, Western Australia, 2000: common cancers in the 65 years & over age group



3.4 Cancer incidence and mortality in areas within Western Australia

The most common cancers and the most common causes of cancer-related death in major subdivisions of Western Australia have been discussed in previous reports, together with comparisons based on standardized incidence and mortality rates. Most rates, even when based on large geographic areas, have been found to be statistically indistinguishable, and as in the Registry's 1998 report, it is not proposed to discuss the 2000 data in detail.

The most common cancer types for major subdivisions of Western Australia for 2000 can be found in **Appendix 4D** (incidence) and **Appendix 4E** (mortality). Within these, there are separate tables for the South-East and South-West Metropolitan Health Zones, to reflect current Department of Health administrative arrangements, and for a combined South Metropolitan Health Zone, to allow historical comparisons.

Statistical comparisons between areas within Western Australia are presented, for selected cancer types, in **Section 4.14**.

Table 6. Cancer mortality, Western Australia, 2000: leading types by sex and age group (ASR: age-adjusted rate)

15 to 39 years

Males

	Total	%	ASR	SE	Risk
Lung	**4**	15.4	**0.9**	0.4	3764
Brain	**4**	15.4	**1.1**	0.6	3708
Pancreas	**2**	7.7	**0.4**	0.3	7319
Melanoma (skin)	**2**	7.7	**0.4**	0.3	7319
Lymphoma	**2**	7.7	**0.5**	0.3	7123
Lymphoma NOS	**0**				-
NHL	**0**				-
Hodgkin's lymphoma	**2**	7.7	**0.5**	0.3	7123
Leukaemia	**2**	7.7	**0.6**	0.5	7160
Lymphoid leukaemia	**1**	3.8	**0.3**	0.3	14436
Myeloid leukaemia	**0**				-
All cancer deaths	**26**	100.0	**6.7**	1.3	564

Females

	Total	%	ASR	SE	Risk
Breast	**11**	27.5	**2.7**	0.8	1308
Leukaemia	**6**	15.0	**1.9**	0.8	2310
Lymphoid leukaemia	**2**	5.0	**0.7**	0.5	6740
Myeloid leukaemia	**4**	10.0	**1.2**	0.6	3514
Colorectal	**4**	10.0	**0.9**	0.5	3540
Colon	**3**	7.5	**0.7**	0.4	4745
Rectum	**1**	2.5	**0.2**	0.2	13940
Melanoma (skin)	**3**	7.5	**0.7**	0.4	4847
Cervix	**2**	5.0	**0.5**	0.3	7193
Brain	**2**	5.0	**0.4**	0.3	7430
Lymphoma	**2**	5.0	**0.5**	0.3	7193
Lymphoma NOS	**0**				-
NHL	**2**	5.0	**0.5**	0.3	7193
Hodgkin's lymphoma	**0**				-
All cancer deaths	**40**	100.0	**9.9**	1.6	359

40 to 64 years

Males

	Total	%	ASR	SE	Risk
Lung	**96**	22.0	**37.0**	3.8	92
Colorectal	**69**	15.8	**25.8**	3.1	136
Colon	**39**	8.9	**14.8**	2.4	233
Rectum	**30**	6.9	**11.0**	2.0	326
Brain	**33**	7.6	**11.8**	2.1	326
Pancreas	**21**	4.8	**8.1**	1.8	439
Unknown primary	**21**	4.8	**8.2**	1.8	422
Leukaemia	**21**	4.8	**7.6**	1.7	461
Lymphoid leukaemia	**6**	1.4	**2.1**	0.9	1911
Myeloid leukaemia	**14**	3.2	**5.2**	1.4	649
Lymphoma	**19**	4.4	**6.5**	1.5	569
Lymphoma NOS	**1**	0.2	**0.3**	0.3	9388
NHL	**16**	3.7	**5.5**	1.4	670
Hodgkin's lymphoma	**2**	0.5	**0.6**	0.4	6318
Stomach	**18**	4.1	**6.9**	1.6	505
Mesothelioma	**16**	3.7	**6.1**	1.5	539
Prostate	**15**	3.4	**5.6**	1.5	603
All cancer deaths	**436**	100.0	**163.5**	7.9	22

Females

	Total	%	ASR	SE	Risk
Breast	**76**	20.2	**27.8**	3.2	137
Lung	**68**	18.1	**26.4**	3.2	132
Colorectal	**46**	12.2	**17.7**	2.6	200
Colon	**28**	7.4	**11.0**	2.1	313
Rectum	**18**	4.8	**6.7**	1.6	556
Ovary	**21**	5.6	**8.0**	1.8	433
Lymphoma	**21**	5.6	**7.9**	1.7	457
Lymphoma NOS	**1**	0.3	**0.4**	0.4	7133
NHL	**20**	5.3	**7.5**	1.7	488
Hodgkin's lymphoma	**0**				-
Unknown primary	**19**	5.1	**7.3**	1.7	517
Pancreas	**17**	4.5	**6.6**	1.6	521
Brain	**15**	4.0	**5.6**	1.5	630
Melanoma (skin)	**12**	3.2	**4.8**	1.4	728
Cervix	**11**	2.9	**4.1**	1.2	921
Leukaemia	**11**	2.9	**4.3**	1.3	834
All cancer deaths	**376**	100.0	**143.0**	7.4	26

65 years and over

Males

	Total	%	ASR	SE	Risk
Lung	**328**	25.4	**335.4**	19.0	38
Prostate	**186**	14.4	**180.8**	13.5	110
Colorectal	**159**	12.3	**165.1**	13.5	72
Colon	**84**	6.5	**86.8**	9.8	141
Rectum	**75**	5.8	**78.2**	9.3	147
Unknown primary	**83**	6.4	**85.3**	9.6	165
Leukaemia	**59**	4.6	**61.8**	8.2	185
Lymphoid leukaemia	**22**	1.7	**23.0**	5.1	810
Myeloid leukaemia	**26**	2.0	**27.4**	5.5	353
Stomach	**57**	4.4	**60.2**	8.2	204
Bladder	**49**	3.8	**50.1**	7.3	339
Lymphoma	**46**	3.6	**47.1**	7.2	290
Lymphoma NOS	**3**	0.2	**3.6**	2.1	2739
NHL	**42**	3.3	**42.7**	6.8	324
Hodgkin's lymphoma	**1**	0.1	**0.8**	0.8	*
All cancer deaths	**1292**	100.0	**1319.8**	37.5	11

Females

	Total	%	ASR	SE	Risk
Lung	**153**	17.3	**122.3**	10.8	103
Colorectal	**127**	14.3	**98.9**	9.7	128
Colon	**95**	10.7	**73.1**	8.3	184
Rectum	**32**	3.6	**25.8**	5.0	413
Breast	**115**	13.0	**88.7**	9.1	142
Unknown primary	**76**	8.6	**49.5**	6.2	387
Pancreas	**63**	7.1	**48.7**	6.7	279
Lymphoma	**42**	4.7	**29.9**	5.0	527
Lymphoma NOS	**3**	0.3	**2.9**	1.8	2909
NHL	**37**	4.2	**24.9**	4.5	837
Hodgkin's lymphoma	**2**	0.2	**2.1**	1.5	2773
Ovary	**32**	3.6	**25.2**	4.9	410
Stomach	**28**	3.2	**18.7**	3.9	1176
Brain	**27**	3.0	**23.8**	5.0	450
Myeloma	**22**	2.5	**15.8**	3.7	970
Bladder	**21**	2.4	**14.0**	3.4	1176
All cancer deaths	**886**	100.0	**675.2**	24.8	20

4 Cancer in Western Australia: special topics

4.1 Time trends in cancer incidence and mortality

Large changes in the apparent incidence of cancer, or cancer-related mortality, have been apparent in Western Australia at various times, the best example being changes in prostate cancer incidence. Smaller changes are more common, and may result from changes in detection, true disease prevalence, completeness of notification or, in the case of mortality, improvements in cancer treatment. Assessment of the significance of changes is made difficult when numbers of cases or deaths are small. In this section, five-year trends for the most common cancer types are presented in graphical form (Figure 21).

Rates are used for trend assessment, rather than numbers of cases, as the population is growing. In the graphs which follow, both sexes are shown where applicable; the ASRs are the age-standardized rates per 100,000 persons of the relevant sex.

The assessment method used Poisson regression to calculate an annual percentage change, and a likelihood-ratio chi-square based on year to year rate ratios, to assess significance of the trend.

In the following pages, if a comment is found under a particular graph, the change cited was statistically-significant; no comment indicates there was no significant trend. Some graphs - e.g. thyroid cancer mortality - are based on extremely small numbers, and are less-reliable than initial examination may suggest.

Figure 21. Selected cancers, Western Australia, 1996-2000: trends in incidence and mortality rates for males (——) and females (- - - -)

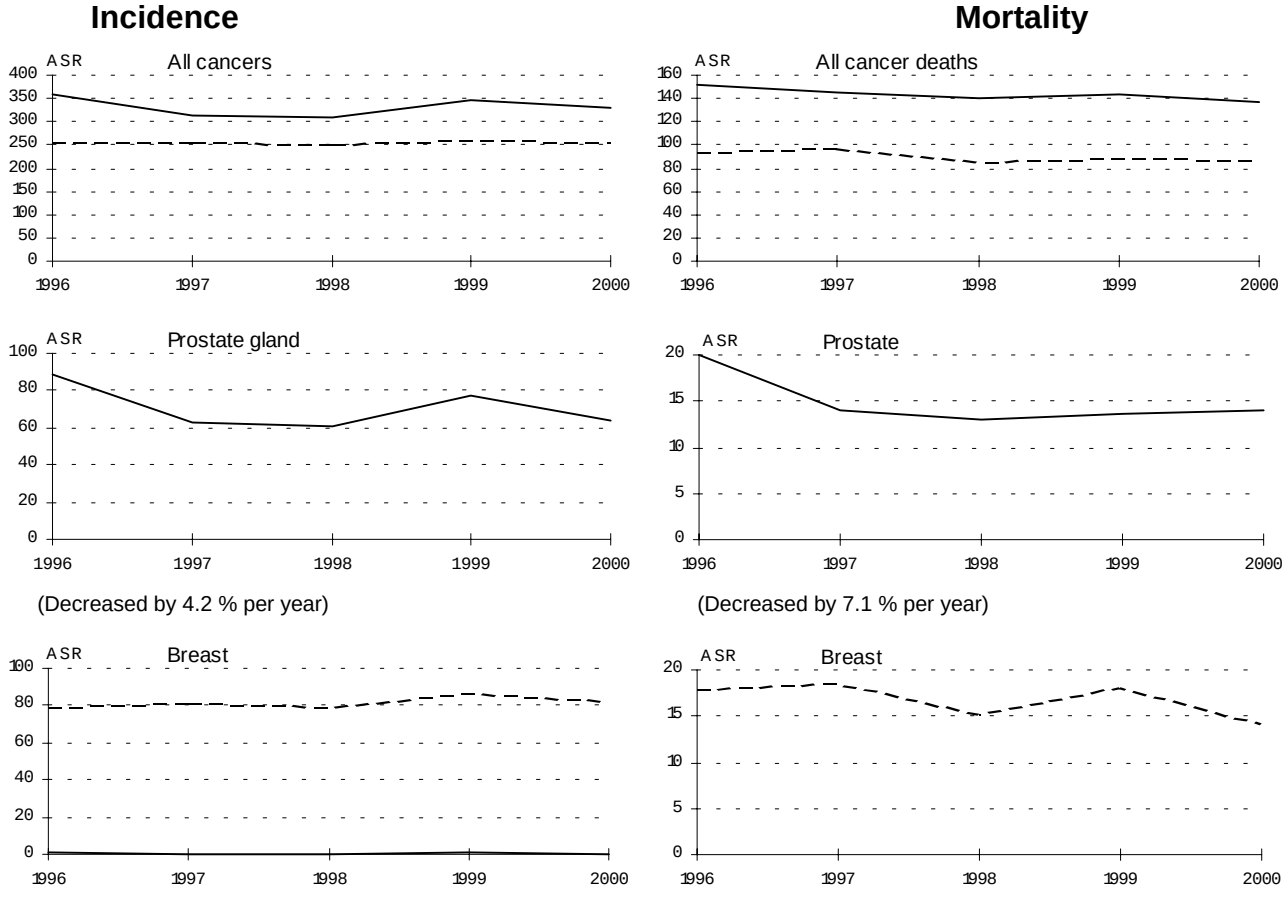


Figure 21 (cont.). Selected cancers, Western Australia, 1996-2000: trends in incidence and mortality rates for males (——) and females (- - - -)

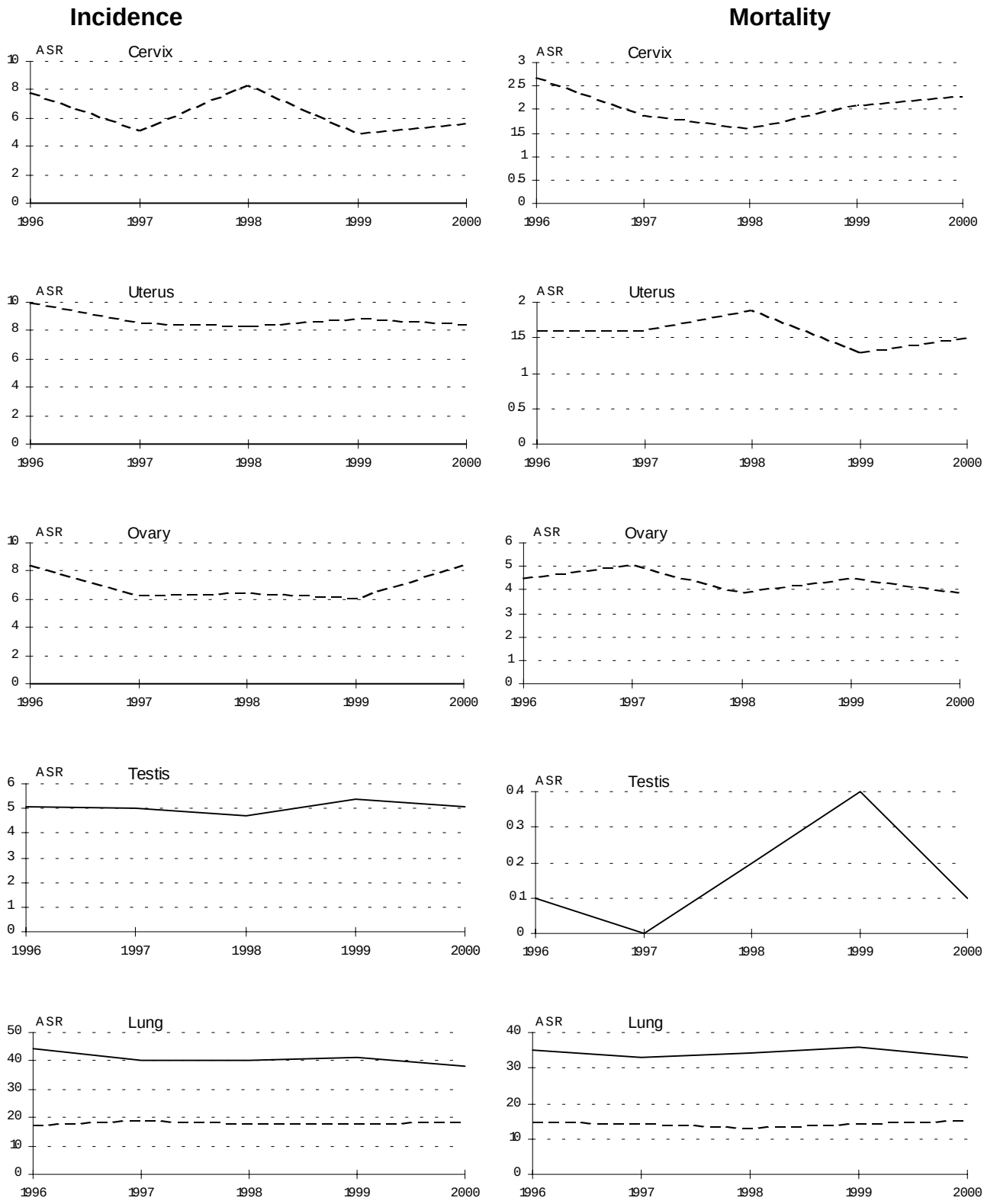


Figure 21 (cont.). Selected cancers, Western Australia, 1996-2000: trends in incidence and mortality rates for males (——) and females (- - - -)

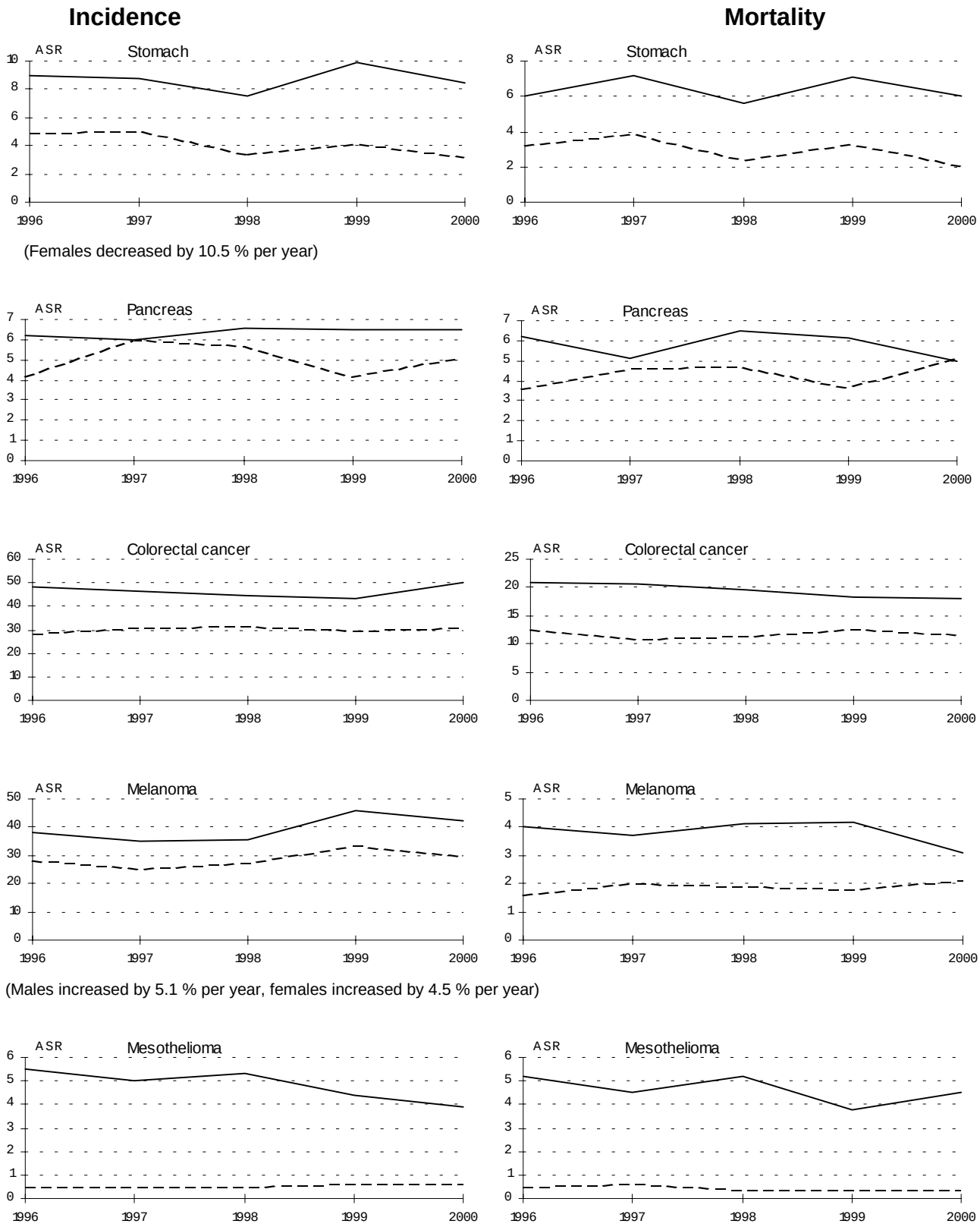


Figure 21 (cont.). Selected cancers, Western Australia, 1996-2000: trends in incidence and mortality rates for males (——) and females (- - - -)

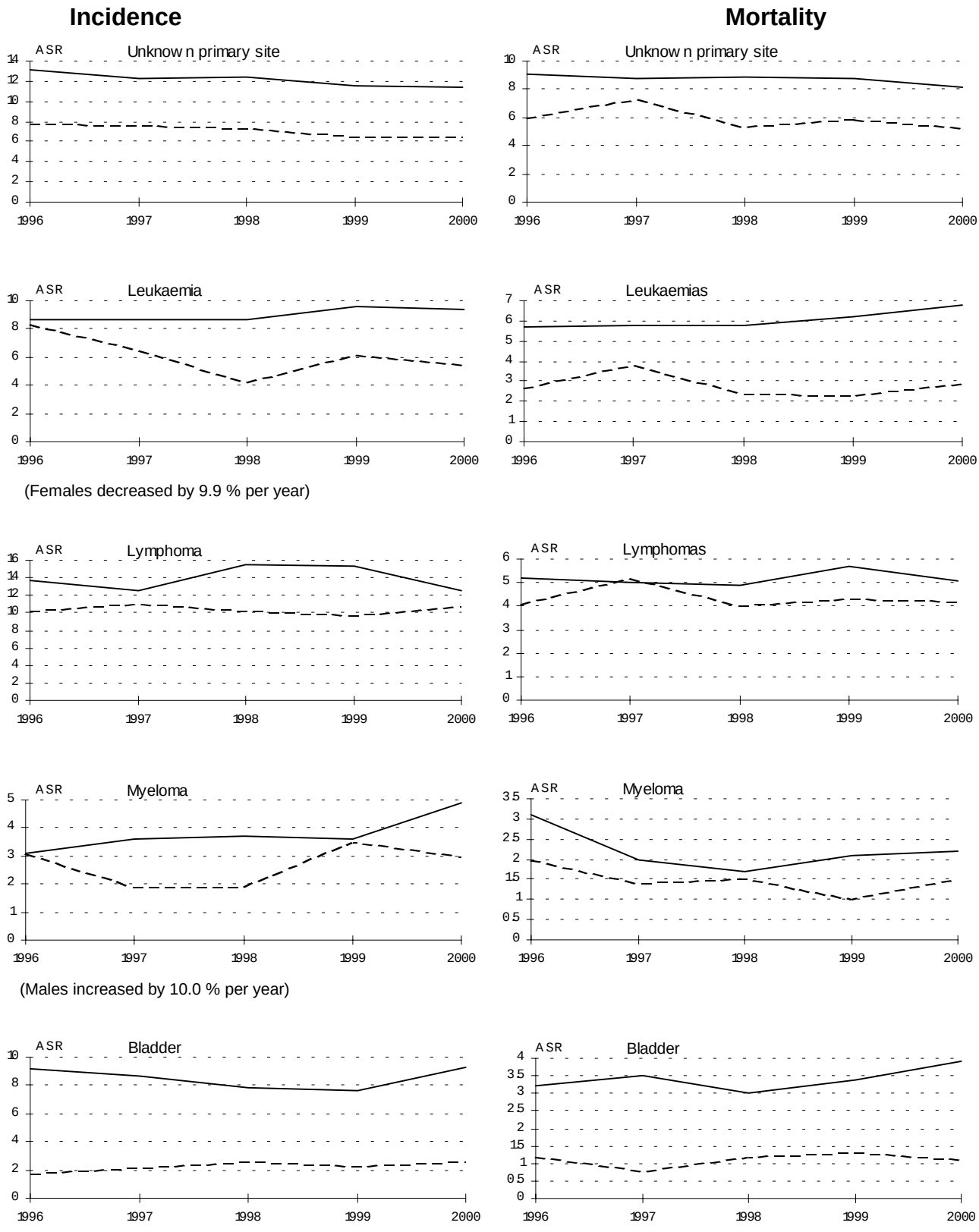
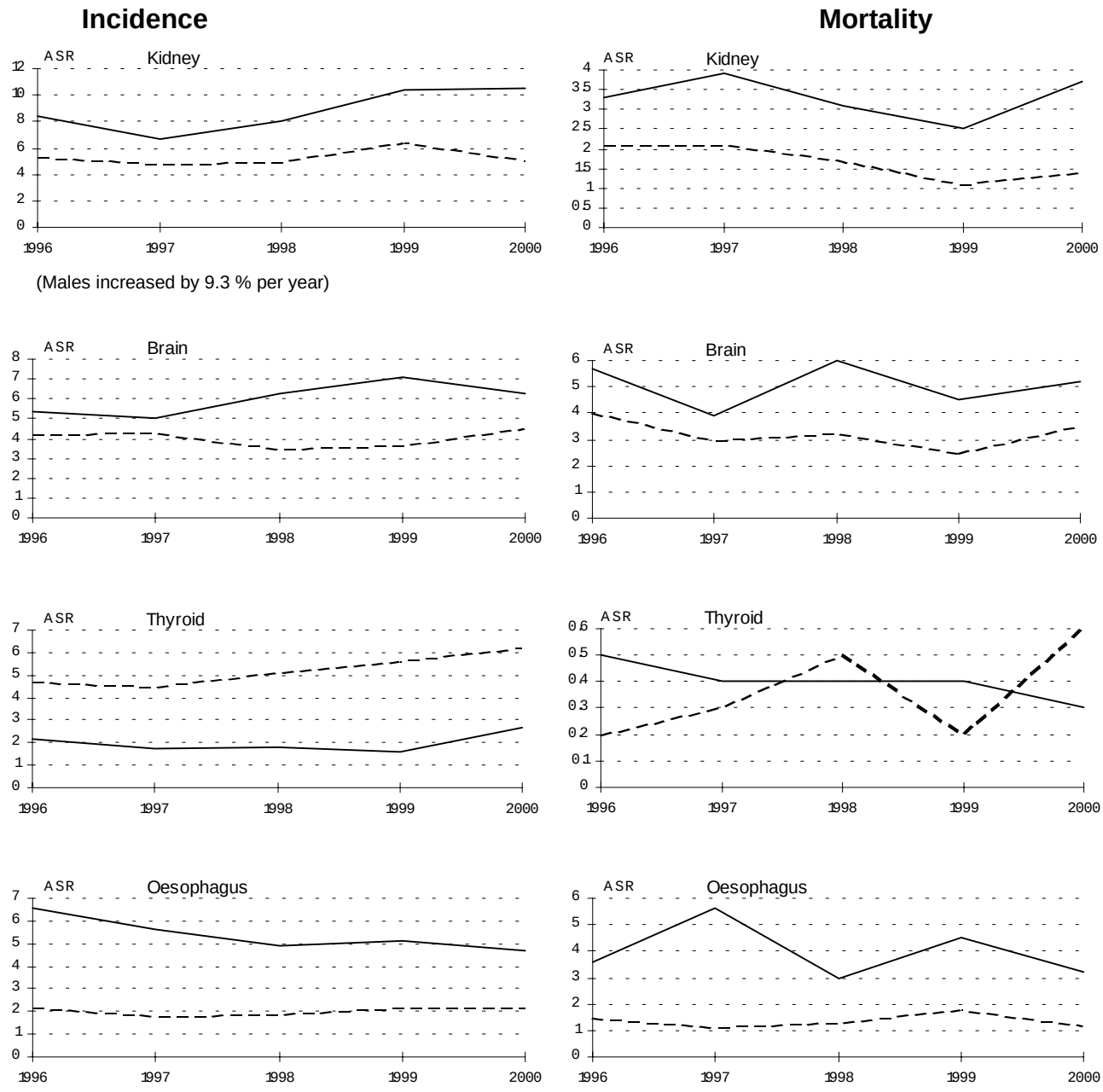


Figure 21 (cont.). Selected cancers, Western Australia, 1996-2000: trends in incidence and mortality rates for males (——) and females (- - - -)



4.2 Malignant melanoma of the skin (cutaneous melanoma)

Melanoma is relatively common in Western Australia, increasing by 4-5% per year in both males and females (Fig. 21), and in 2000 ranked third among the most common major cancer types in either sex (Fig. 12). It was the most common cancer type diagnosed in persons aged between 15 and 39 years (Fig. 15).

Melanoma is less often fatal then many other cancers, and as a cause of cancer-related death, ranked only 14th in males and 12th in females in 2000 (Table 4).

Many melanomas are now diagnosed at a time when they have not invaded deeply into the skin. In addition to the 862 invasive melanoma cases reported for 2000, there were 707 cases of *in situ*, or pre-invasive, melanoma.

The Registry records the thickness (Breslow[1]) and depth of invasion (Clark[2]) of histologically-diagnosed melanomas. These two measures are correlated to some degree but vary with location on the body, as described in the Registry's 1997 report[9]. Summarized data for the 1991-2000 period are shown in Table 7. In 2000, 70% of invasive melanomas were less then 1mm thick, increased from 65% in the 1991-1995 period. For invasive melanoma cases with data available (97.5% of cases in 2000), the median thickness was 0.6mm, essentially unchanged over the last ten years (Table 7).

Table 7. Cutaneous melanoma, Western Australia, 1991-2000: Breslow thickness (invasive histologically-confirmed cases only)

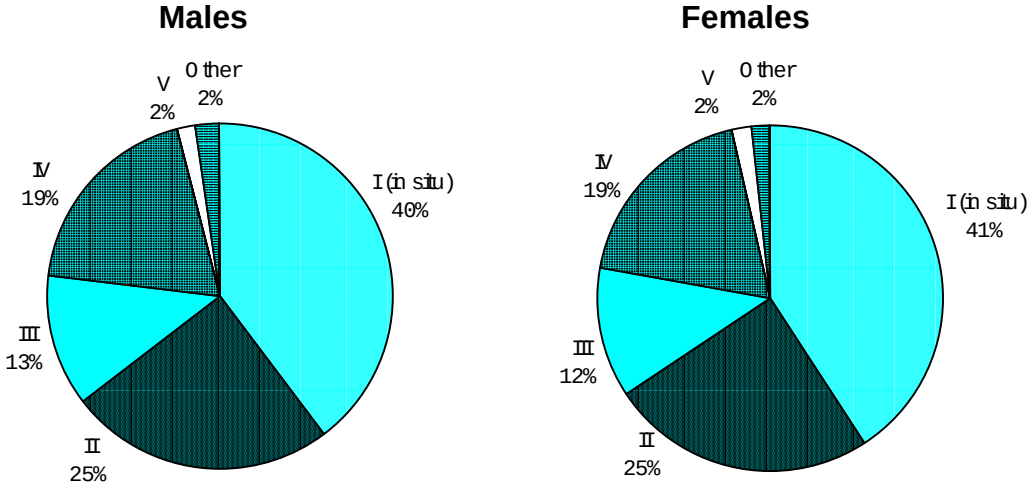
	Year of diagnosis					
Thickness	**1991-95**		**1996-2000**		**2000**	
(mm)	**Cases**	**(%)**	**Cases**	**(%)**	**Cases**	**(%)**
0.01 - 0.49	1139	33.7	1330	34.4	301	35.2
0.50 - 0.99	1062	31.4	1287	33.3	296	34.6
1.00 - 1.99	464	13.7	616	15.9	136	15.9
>= 2.00	452	13.4	529	13.7	101	11.8
Unknown/ not assessed	264	7.8	103	2.7	21	2.5
Total	3381	(100)	3865	(100)	855	(100)
Median (mm)	0.6		0.6		0.59	

Melanomas are classified by Clark level in Table 8. While there has been no apparent trend towards reduction in the proportions represented by tumours of levels III and IV, the proportion of all melanomas that are detected at the *in situ* stage has increased from 35% to 40%, and was 45% in 2000. While the incidence of melanoma continues to be higher in males, the distribution of levels of invasion was similar in males and females (Fig. 22).

Table 8. Cutaneous melanoma, Western Australia, 1991-2000: Clark level (invasive and *in situ* histologically-confirmed cases only)

	Year of diagnosis					
	1991-95		1996-2000		2000	
Clark level	**Cases**	**(%)**	**Cases**	**(%)**	**Cases**	**(%)**
I *(in situ)*	1828	35.0	2603	40.2	707	45.3
II	1545	29.6	1600	24.7	333	21.3
III	701	13.4	800	12.3	204	13.1
IV	750	14.4	1226	18.9	276	17.7
V	102	2.0	111	1.7	19	1.2
Unknown/ not assessed	292	5.6	143	2.2	23	1.5
Total	5218	(100)	6483	(100)	1562	(100)

Figure 22. Cutaneous melanoma, Western Australia, 1996-2000: Clark level by sex (invasive and *in situ* histologically-confirmed cases only)



In the Registry's 1997 report[9] it was noted that melanoma in older persons tended to be thicker and have a higher Clark level in the elderly than in the young. Data for 2000 confirm this situation persists, and are cause for continuing concern. In persons aged 75 or more, 23% of tumours in males, and 32% in females, were greater than 2mm deep at diagnosis, compared with 6% in males and 3% in females, in the 10-39 years age range (Table 9). Coexisting illness and other physical factors may limit treatment options in the elderly, and these data suggest that increased efforts at melanoma detection in the elderly may be justified, as it is possible that tumour growth rates may be higher in this group.

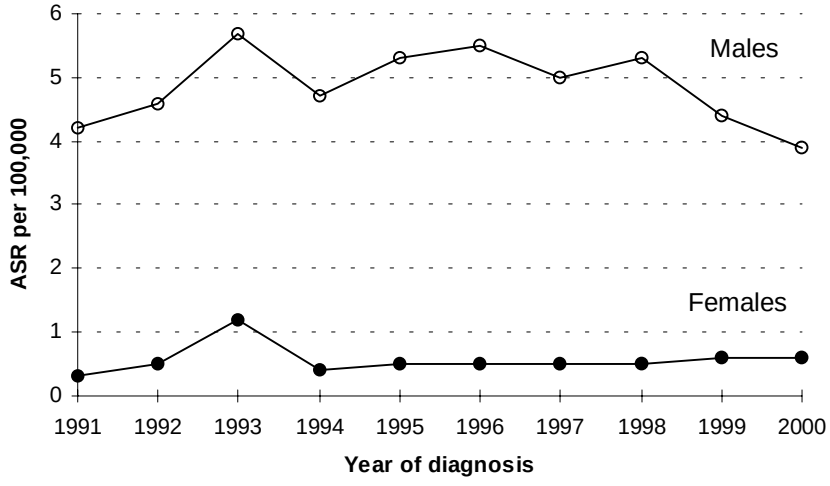
Table 9. Cutaneous melanoma, Western Australia, 2000: thickness by age group, for males and females (invasive histologically-confirmed cases only)

Tumour	Age (years)			
Thickness	**10-39**	**40-59**	**60-74**	**75+**
Males	(%)	(%)	(%)	(%)
0.01 - 0.49	33.7	36.6	34.6	29.3
0.50 - 0.99	44.9	40.7	29.5	30.5
1.00 - 1.99	15.7	16.3	12.8	13.4
>= 2.00	5.6	5.8	17.3	23.2
Unknown/ not assessed	0	0.6	5.8	3.7
All	(100)	(100)	(100)	(100)
Median (mm)	0.51	0.55	0.6	0.6
Females				
0-0.49mm	40.4	37.1	35.1	30.5
0.5-0.99mm	33.3	40.3	27	20.3
1.0-1.99mm	21.2	15.3	18.9	15.3
>=2.0mm	3	5.6	14.9	32.2
Unknown/ not assessed	2	1.6	4.1	1.7
All	(100)	(100)	(100)	(100)
Median (mm)	0.5	0.6	0.5	0.75

4.3 Time trends in incidence of malignant mesothelioma

There were 52 cases of malignant mesothelioma diagnosed in Western Australians in 2000, 87% in males. Incidence in females appeared stable. Incidence in males showed some signs of declining in recent years, although the ten-year trend was not statistically-significant (Fig. 23). The Registry is planning a further specialized report on mesothelioma. Mortality due to mesothelioma mirrors incidence quite closely as the disease is almost uniformly fatal.

Figure 23. Malignant mesothelioma incidence, Western Australia, 1991 - 2000



4.4 Incidence of *in situ* neoplasms

In situ neoplasms are those detected at a stage such that neoplastic cells, although cytologically abnormal and similar to those seen in invasive cancers, are still confined to the tissue layer of origin, and have not penetrated beyond a basement membrane. This terminology is most appropriately restricted to neoplasms of "epithelial" surfaces such as the skin (external) or mucosal surface of internal organs - i.e. carcinomas - and has no real meaning in the context of the lymphomas/leukaemias, nor for soft-tissue tumours such as sarcomas.

The most commonly-reported *in situ* neoplasm affecting both males and females was melanoma in both sexes (Table 10), with an average of 620 cases per year for the period 1999-2000. Other common *in situ* tumour types were cervical cancer (501 cases per year) and bladder cancer (236 cases per year).

As noted in the Registry's last report, these data include only the first tumour of any particular type in a person. The number of second or subsequent *in situ* melanomas, cervical neoplasms and transitional cell carcinomas of the bladder and urinary system, recorded but not presented here, is considerable, and indicates a significant burden of morbidity.

The presence of most *in situ* neoplasms is seen as an indicator of risk for the development of invasive cancer, and screening programs which detect *in situ* neoplasms such as those of the breast or cervix, are thought to do far more for the reduction of long-term morbidity than the number of detected invasive cancers alone would suggest.

Table 10. *In situ* tumours, Western Australia, 1999-2000: incidence

Males	Cases			Females	Cases		
Tumour type	**(2 yrs)**	**%**	**ASR**	**Tumour type**	**(2 yrs)**	**%**	**ASR**
Melanoma	659	55.3	28.1	Cervix	1003	46.1	49.4
Bladder	359	30.1	14.1	Melanoma	580	26.7	24.6
Colorectal cancer	78	6.5	3.2	Breast	324	14.9	14.3
Larynx	18	1.5	0.8	Bladder	114	5.2	4.0
Eye	13	1.1	0.5	Vulva	45	2.1	2.0
Kidney/renal tract	12	1	0.5	Colorectal cancer	48	2.2	1.7
Stomach	8	0.7	0.3	Vagina	15	0.7	0.6
Floor of mouth	7	0.6	0.3	NMSC	9	0.4	0.4
Anus	7	0.6	0.3	Uterus	8	0.4	0.4
Prostate	7	0.6	0.3	Kidney/renal tract	6	0.3	0.2
Other	24	2	1.0	Other	22	1	0.9
All *in situ* tumours	1192	(100)		All *in situ* tumours	2174	(100)	

*NMSC - skin (non-melanoma/ SCC/ BCC)

4.5 Incidence of "uncertain malignant potential" neoplasms

There are a number of neoplasms for which the label "uncertain behaviour" or "uncertain malignant potential" has, historically, reflected true uncertainty and unpredictability about their impact on health, rather than poor data quality. These neoplasms may be serious in their effects, and may cause death, commonly via mechanisms such as compromising the immune system or promoting blood clotting, rather than by direct destruction of other tissues of the body.

It has now been confirmed that cancer registries around the world and in Australia will adopt the 3rd revision of the ICD-O (International Classification of Disease - Oncology) as a coding standard, and these neoplasms will be classed as "malignant" in due course and will accordingly be included in "Total cancers" statistics. The new classification will be implemented in Australian hospital inpatient data collections in July 2002, and will be used by this and other cancer registries as and when reporting time-frames permit.

Table 11. Lymphohaematopoietic neoplasms of uncertain malignant potential, Western Australia, 1999-2000: incidence.

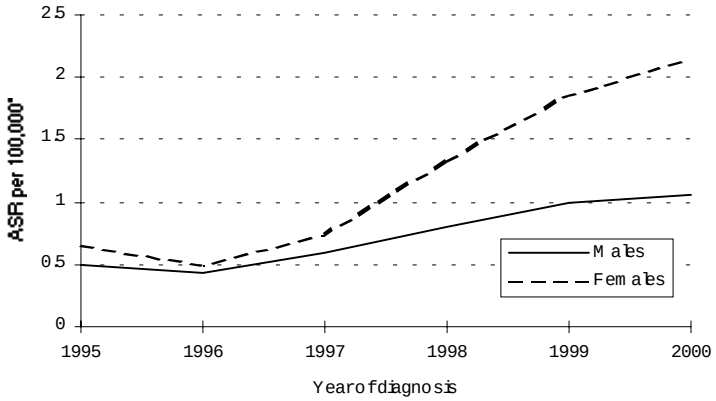
	Males			Females			Total
Condition	**Cases**	**ASR***	**Risk****	**Cases**	**ASR***	**Risk****	**cases**
Polycythaemia rubra vera (M-9950)	2	0.1	5013	3	0.1	14061	5
Chronic myeloproliferative disease NOS (M-9960)	8	0.3	4828	10	0.2	12833	18
Myelofibrosis/sclerosis (non-acute) (M-9961)	6	0.2	10543	4	0.2	9207	10
Idiopathic thrombocythaemia (M-9962)	17	0.7	1043	25	0.9	1046	42
Refractory anaemias (M-9980-9984)	15	0.6	1698	9	0.2	-	24
Myelodysplastic syndrome (M-9989)	42	1.6	657	14	0.3	4784	56
All (M-9950-9989)	**93**	**3.5**	**269**	**69**	**2.1**	**577**	162

4.6 Benign central nervous system (CNS) tumours

Since the February 1996 amendments to the Health (Notification of Cancer) Regulations, benign CNS neoplasms have been subject to the same reporting requirements as malignant tumours, if diagnosed via pathology. However, the Registry had been recording those that were notified directly (or indirectly as a result of death information), and data for the most recent six-year period are presented in Fig. 24. The graph is presented as a three-year moving average to smooth the large variations between years, as case numbers are small.

Although in the Registry's report for 1998 it was noted that there had been little recent change, there have since been increases that are likely to be due to better reporting in some areas. There may also have been better detection due to the use of diagnostic imaging. The most common tumour types are shown in Table 12; these were dominated in 1999-2000 by meningiomas and neurilemmomas, which together accounted for 82% of all benign CNS tumours.

Figure 24. Benign CNS neoplasms, Western Australia, 1995-2000: trends in incidence rates for males (———) and females (- - - -)



(plotted as 3-year moving average)

Table 12. Benign CNS neoplasms, Western Australia, 1999-2000: morphology.

Tumour type	Cases	%
Meningiomas	46	61
Neurilemmoma	16	21
Tumour NOS	3	4
Adenoma NOS	2	3
Cavernous haemangioma	2	3
Prolactinoma	1	1
Choroid Plexus Papilloma	1	1
Ependymoma	1	1
Neurocytoma	1	1
Neurofibromatous tumour	1	1
Neuroma, NOS	1	1
Total	75	(100)

4.7 Borderline ovarian tumours

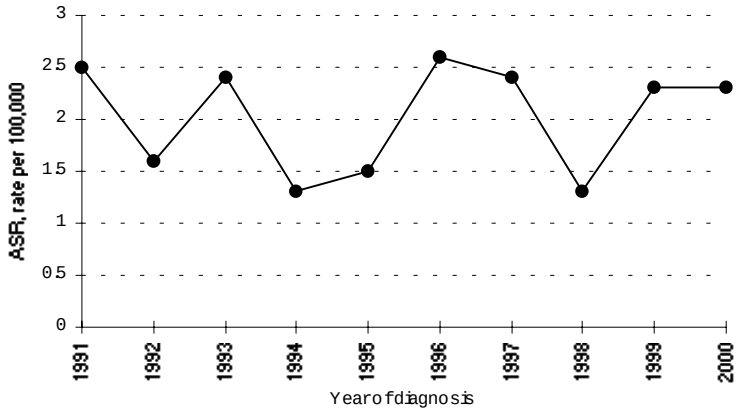
Ovarian tumours described as being of "borderline malignancy", or of "low malignant potential", are not included in "Total cancers" statistics by the Registry, although they are consistently notified. These borderline tumours occasionally behave aggressively by spreading throughout the peritoneal cavity, a condition known as pseudomyxoma peritonei, without being "invasive" in the usual cancer-related sense, and may cause death (2 reported cases in 1997).

Although there are specific ICDO-2 morphology codes (8442, 8451, 8462, 8472, 8473) for "borderline" tumours, consultation with pathologists suggests that other ovarian tumour morphologies may also be classed as borderline, (by assigning a Behaviour code of "1" rather than "3") on the basis of the descriptive section of the pathology report. Since 1991, the number of cases recorded has ranged from 13 to 28 per year, with no significant trend; total of these microscopically-confirmed cases was 214.

In coded hospital discharge data, the number of such cases (for which no pathology report was received) ranged from 12 - 36 per year, a total of 182 additional cases from 1991-2000.

Although as noted in a previous report, some of these may represent unreported borderline tumours, little faith can be placed in these codes at present: while 22 of the 214 microscopically-confirmed cases had died (of any cause) by late 2001, only 2 of the 182 "Hospital-only" cases had died.

Figure 25. Borderline ovarian tumours, Western Australia, 1991-2000: incidence



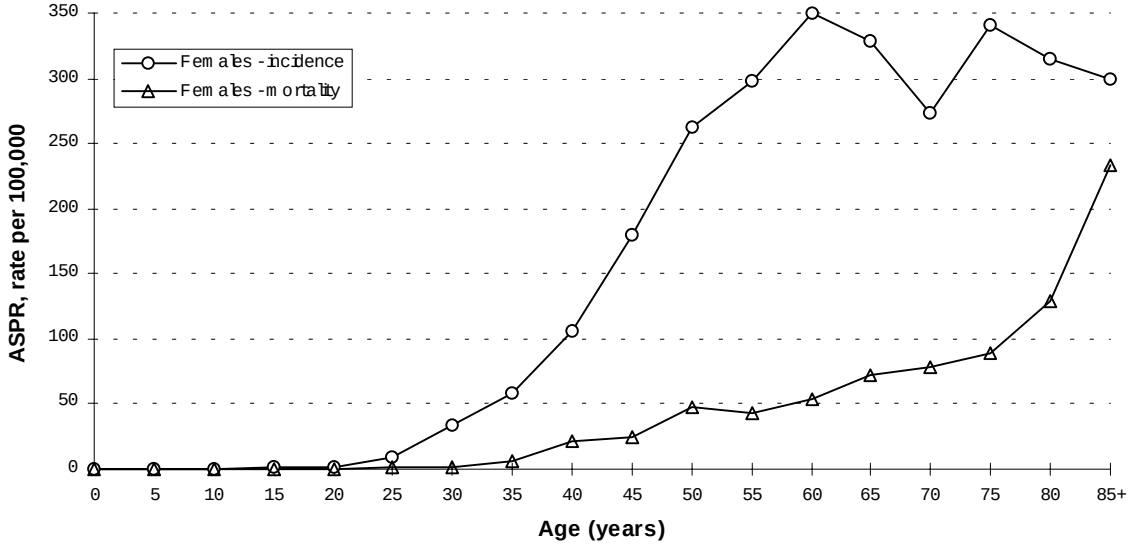
4.8 Breast cancer

Between 1996 and 2000, there were 4767 cases of breast cancer recorded in Western Australian women. Of these, 98.7% were confirmed microscopically (histology or cytology), 0.5% by clinical methods, but 0.5% were known to the Registry only from death and/or hospital information. In 2000, breast cancer was the most common cancer in females over 40 years of age, and ranked second to melanoma in those aged 15-39 years. Incidence and mortality rates showed no significant change between 1996 and 2000 (Figure 21). Based on data for 2000, 1 in 11 women could be expected to develop breast cancer before the age of 75, and 1 in 66 could be expected to die as a result of breast cancer (Table 4).

Breast cancer incidence rose, as in previous years, most rapidly after the age of 35 years, while mortality rose most sharply after the age of 75 years (Fig. 26).

The most common forms of breast carcinoma in 2000 were infiltrating ductal carcinoma (73%), lobular carcinoma (10%) and mixed ductal and lobular carcinoma (3.4%). Carcinomas of unspecified type were marginally less common than in 1997, at 4.3%.

Figure 26. Breast cancer, Western Australia, 1999 and 2000: age-specific incidence and mortality rates in females



Beast cancer tumour size and lymph node status

Since 1997 the registry has recorded, where possible, primary tumour size and numbers of affected lymph nodes, for histologically-confirmed breast cancer cases. These measures are thought to give some guide to the likely outcome, and do influence choice of surgical procedure. Hospital data included in the report *Cancer survival in Western Australian residents, 1982-1997*,[10] showed survival was better for less-advanced tumours.

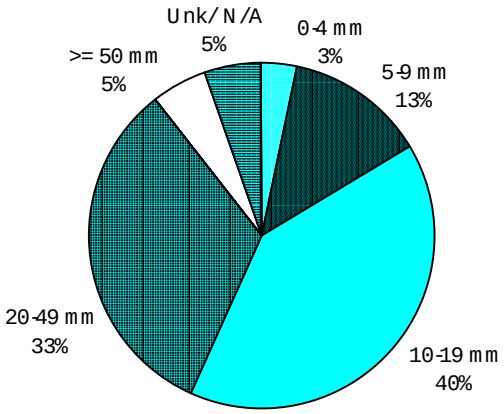
There are a number of difficulties with the collection and reporting of data concerning primary tumour size and numbers of positive and negative lymph nodes, for breast cancer cases. Size data are commonly available from pathology reports, however the Western Australian legislation has, historically, not made the reporting of "negative" (i.e. no cancer) pathology reports compulsory. Accordingly, where an axillary lymph node dissection has occurred and

nothing of concern has been found, this information has not routinely been made available. The Registry is planning changes in recording practices and in legislation, aimed at addressing this situation.

Meanwhile, in some of the charts which follow, the "Unknown" and "Not applicable" (not assessed) categories may contain some cases in which no lymph nodes were assessed, despite histological assessment of the presumed primary tumour.

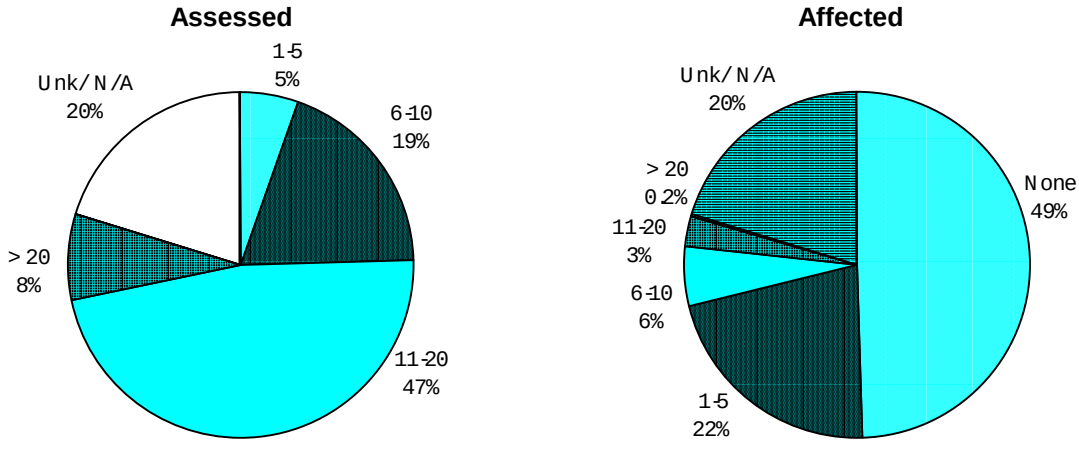
Over 50% of tumours were less than 20mm in diameter at diagnosis (Fig. 27). The distribution is essentially the same as in 1997. The median size, for tumours where data were available, was 16.5mm for 2000, unchanged over the last 5 years.

Figure 27. Breast cancer, Western Australia, 2000: size of histologically-confirmed primary tumours.



Information about numbers of affected lymph nodes was available for 80% of cases in 2000, slightly better than reported for 1997. The majority (69%) of cases for which data were available, had more than the generally-accepted[9] 10 or more nodes assessed (Fig. 28). In 49% of cases, no nodes were found to be affected, a result similar to that reported for 1997.[9]

Figure 28. Breast cancer, Western Australia, 2000: number of lymph nodes assessed, and number of affected nodes, for histologically-confirmed tumours.



The Western Australian data suggest that the detection of breast cancer while the tumour is small reduces the risk that lymph nodes will already be affected at the time of diagnosis. As in 1997, numbers of tumour-affected lymph nodes were higher for tumours of larger diameter (Table 13). While between 78% and 85% of cases with tumour size of 10mm or less had no affected lymph nodes, only 21% of tumours 50mm or greater in size had no affected nodes.

Table 13. Breast cancer, Western Australia, 1996-2000: tumour size and number of tumour-affected lymph nodes.

	Lymph nodes affected by cancer											
Tumour	**None**		**1-5**		**6-10**		**11-20**		**> 20**		**Total**	
size (mm)	Cases	**%**	Cases	**%**	Cases	**%**	Cases	**%**	Cases	**%**	Cases	**(%)**
0-4	49	**77.8**	10	**15.9**	4	**6.3**	0	**0**	0	**0**	63	**(100)**
5-9	295	**85.3**	48	**13.9**	2	**0.6**	1	**0.3**	0	**0**	346	**(100)**
10-19	890	**68.7**	353	**27.3**	41	**3.2**	9	**0.7**	2	**0.2**	1295	**(100)**
20-49	547	**45.7**	486	**40.6**	96	**8**	61	**5.1**	7	**0.6**	1197	**(100)**
50 or more	38	**21.3**	64	**36**	43	**24.2**	29	**16.3**	4	**2.2**	178	**(100)**
All	1819	**59.1**	961	**31.2**	186	**6**	100	**3.2**	13	**0.4**	3079	**(100)**

(Includes **only** cases for which both size and node information were available)

4.9 Death Certificate Only cancers

"Death certificate only" (DCO) cancers are those for which no information other than a death certificate is available. There were 22 DCO cancers recorded for 2000, representing only 0.3% of all cancers. These included cancers of the lung (5 cases) and cancers of unknown primary site (5), colorectal cancer (3) and chronic lymphoid leukaemia (2).

The Registry continues to use computerized hospital discharge data to eliminate some letter-based enquiries, and an additional 228 cancers (3% of total cancers) were recorded on the basis of a death certificate and a coded hospital discharge record alone, with the date of diagnosis taken from the hospital discharge date. Most common types were lung (59), pancreas (35) and prostate cancers (14), and cancers of unknown primary site (33).

While the data thus gained are recognized to be potentially less reliable than those sourced from clinical notes, such a process is cost-effective in improving the timeliness and reliability of data based on death certificates alone; an audit of the hospital data is yet to be funded.

4.10 Cancer in indigenous Australians

All-cancers age-standardized incidence rates in persons of Aboriginal descent were lower, particularly in males, than in all Western Australians combined. In 1999 and 2000 combined there were 59 cancer cases reported in Aboriginal males (ASR 229) and 52 cases in females (ASR 182). In males, age-specific cancer rates in the indigenous population were similar to or greater than those in the remainder up to age 59, but were lower over age 60 years (Fig. 29). Assessment is problematic as case numbers are small, and the excess is based on one case for many cancer types. The bulk of the excess rates in Aboriginal males in the 55-59 year age group was due to lung and colorectal cancers.

In indigenous females, rates were lower than in others up to the age 55, then rose sharply to exceed rates in the non-indigenous population at ages 60-64 (Fig. 30). Only breast cancer appeared markedly more common in indigenous than non-indigenous women in this age group.

Figure 29. Age-specific cancer incidence rates for indigenous and non-indigenous males, Western Australia, 1999 and 2000.

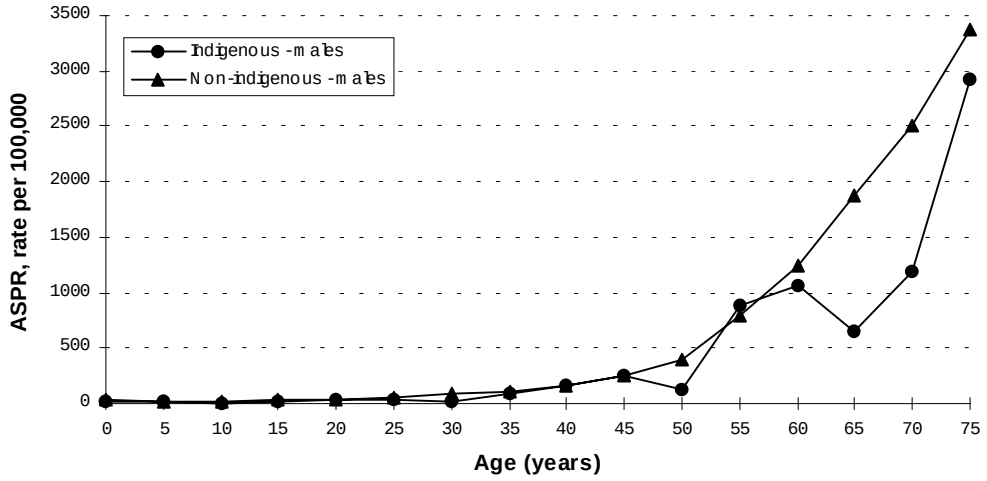
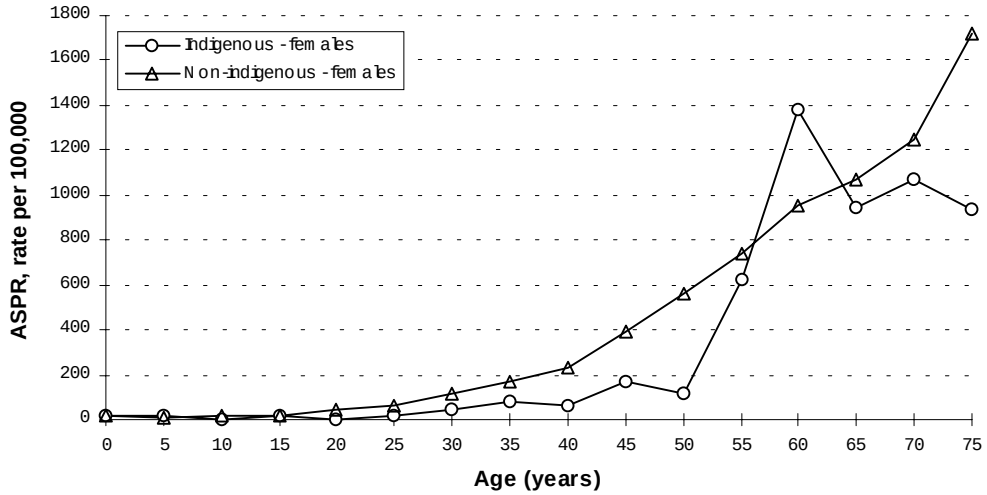


Figure 30. Age-specific cancer incidence rates for indigenous and non-indigenous females, Western Australia, 1999 and 2000.



The most common cancer types reported in Aboriginal persons for the period 1996-2000 are shown in Table 14. The most common cancer types in persons of Aboriginal descent were similar to those in the State as a whole, apart from an absence of melanoma in both males and females, and fewer colorectal cancers in females. Melanoma was reported in only 1 male and 2 females over the period 1996-2000.

Table 14. Most common incident cancers in indigenous Australians, Western Australia, 1996-2000.

Cancer type	Cases (5 years)	ASR	SE	Risk*
Males				
Lung	21	35.0	8.0	30
Prostate	16	31.7	8.1	35
Unknown primary	11	19.3	6.1	50
Colorectal	11	16.8	5.3	71
Pancreas	9	17.6	6.1	44
Oesophagus	6	6.7	3.0	134
Stomach	6	8.2	3.5	109
Tongue	5	7.0	3.3	132
Palate	5	7.3	3.4	182
Liver	5	7.8	3.7	325
Lymphoma	5	5.8	2.9	321
Leukaemia	5	6.5	3.5	102
Other	35			
All cancers	140	216.9	19.5	5
Females				
Breast	34	45.7	8.2	19
Cervix	11	7.6	2.3	167
Lung	10	15.6	5.0	44
Unknown primary	9	12.8	4.4	67
Gallbladder	8	12.4	4.5	61
Pancreas	7	10.5	4.0	72
Uterus	7	9.4	3.8	63
Thyroid	7	6.7	2.7	160
Colorectal	7	10.4	4.0	114
Lymphoma	6	7.5	3.2	116
Other	38			
All cancers	144	188.6	16.5	5

* Risk- lifetime risk to age 75, 1 in *n*.

4.11 Cancer incidence and mortality projections

The total-cancers incidence rate for 2000 in this report was 3.3% lower than projected in the Registry's report for 1998, and total cases were 3.6% fewer than predicted at that time. Female incidence projections, not being influenced by changes in prostate cancer reporting, proved more reliable, both ASR and case numbers being lower than, but within 1.2% of, the predictions. All-cancers mortality rates were 6.6% lower than predicted for males, and 6.1% lower for females.

As the Registry will, in the next year, adopt a new coding system that will see the scope of the term "cancers" widened, no new incidence or mortality projections are presented in this report, as they will not be relevant under the new scheme.

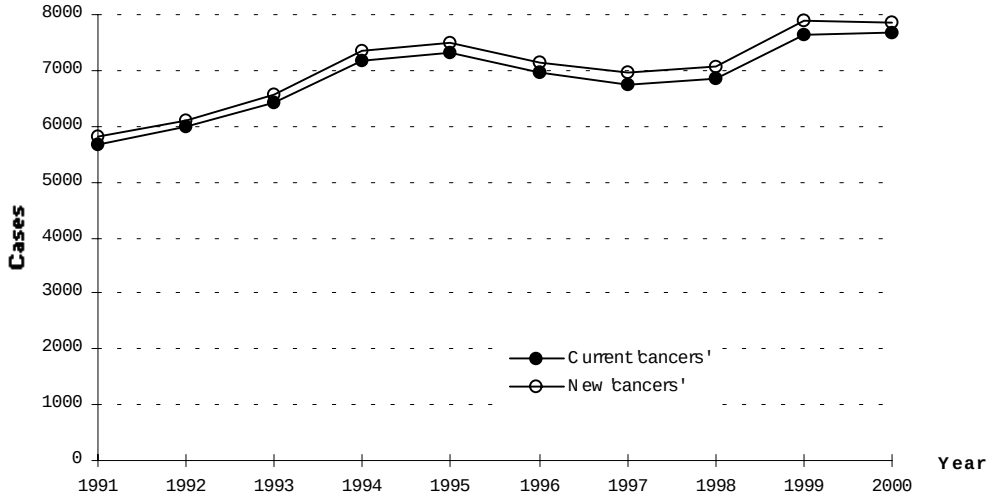
4.12 Impact of a new coding scheme on future cancer data

The introduction of the ICDO-3 coding system throughout Australian Cancer Registries will follow the introduction of the new system in hospital inpatient data systems in July 2002, although changes in reporting time frames may vary between States. The WACR and other Australian cancer registries have been involved in finalizing the new tumour morphology table for use in hospitals, and have collaborated in developing data re-coding routines.

Essentially, the new tables will provide new codes for conditions previously not having their 'own' code, and will scale back the codes in some areas (e.g. specific codes for "subacute" leukaemias will no longer exist). Most importantly, however, some conditions previously regarded as "lymphohaematopoietic neoplasms of uncertain malignant potential", such as polycythaemia and myelodysplastic syndrome, will now be regarded as true malignancies, and will accordingly be counted in total-cancers statistics.

The impact of these changes was discussed by Tim Threlfall in a presentation at the Clinical Oncological Society of Australia's annual scientific meeting in November 2001; it is expected to amount to an increase of between 2% and 3% per year in total-cancers data. The estimated "new" data for 1991-2000 are shown, with that under the current coding system, in Fig. 31.

Figure 31. Effect of introduction of ICDO-3 on "Total cancers", Western Australia, 1991-2000



4.13 Hospital-based cancer registries

Hospital-based cancer registries (HBCRs) have operated within Perth's largest Teaching Hospitals for a number of years - at Fremantle, King Edward Memorial, Royal Perth and Sir Charles Gairdner Hospitals. These were initially conceived as a means of supporting the collection of some clinical data items, not available from the population-based Western Australian Cancer Registry, relating to staging of cancer, and cancer treatment.

These registries, concentrating on cancer types for which there is a special interest among the hospital staff, rely heavily on the cooperation of clinicians within the hospitals to enable data to be complete and comparable with those elsewhere. There already existed within the hospitals, various smaller databases in various clinical departments, and part of the process followed has been aimed at making some of the information within these available to the HBCRs.

The Western Australian Cancer Registry (WACR) receives extracts from the HBCRs, and after case linkage, supplies updated survival details for matched cases, permitting staged survival analysis if hospitals choose. The WACR can be updated with unmatched cases, and staff exchange information on coding and previous diagnoses. There are two enhancements currently being negotiated by the WACR and individual hospitals: the addition of staging information - to permit more meaningful State-wide survival analysis - and basis of diagnosis, to the regular extracts from HBCRs.

Though there have been concerns expressed in some quarters about the provision of such data to a central registry, the WACR's involvement with the HBCRs extends to a willingness to pool data for better analysis, but not to any involvement in audit, identification of individual hospitals, or clinicians.

Currently all HBCRs use the same cancer coding systems as the WACR, and should be able to use ICDO-3 in the near future. A coordinated approach is being promoted to simplify the revision of coding reconciliation procedures.

There is considerable variation between the HBCRs regarding computer software, and frequency of reconciliation with WACR. Nevertheless, these differences pose relatively minor difficulties in maintaining reconciliation utilities, and the timelines and completeness of data at the hospitals remain major issues. Analysis is complex in some cases: survival data from Sir Charles Gairdener Hospital have been included in previous WACRreports,[10] and some HBCRs release their own reports; the most recent received is *Breast Cancer at Sir Charles Gairdner Hospital, 1996-2000* (2002, SCGH Cancer Registry, Sir Charles Gairdner Hospital).

4.14 Regional variations in cancer occurrence

Requests for area-based information commonly address issues such as cancer incidence, mortality and hospitalization. Hospitalization data are heavily influenced by the actual availability of services, and mortality data are influenced by the choices people may make, when diagnosed with cancer, as to whether they will re-locate to areas where medical and other supports are available. Only incidence data can give a realistic assessment of whether residence in particular areas poses significant risks of cancer. However, the information available to most cancer registries does not embrace possible risk factors such as occupation, smoking and alcohol intake, or duration of residence in particular areas.

The Registry supports, but cannot itself undertake, studies that assess such factors; hence the area-based incidence comparisons presented here cannot in isolation, identify area-based risks with any certainty.

The most common cancer types for major subdivisions of Western Australia can be found in Appendices 3D and 4D (incidence) and Appendices 3E and 4E (mortality).

In the graphs which follow, the **standardized (incidence) rate ratio** (SIRR) is shown, which is based on comparison of cases in each area of concern, with the numbers expected based on age- and sex-specific rates for the whole of WA. The horizontal bars represent the 95% confidence interval for the SIRR. A bar crossing the vertical line at SIRR=1 indicates that any difference from the State average is not statistically-significant. Bars that lie wholly to the left of the vertical line indicate a significantly lower rate than expected, bars to the right indicate a statistically-significant excess of cases.

Figure 32 shows the all-cancers incidence data for the combined years 1999 and 2000, for males and females, for various areas including both Health Zones and the smaller Health Service areas. For both males and females, cancer incidence in rural (country) areas in general, appeared to be lower than expected based on State data. Conversely, the Inner City Health Service area appeared to have higher cancer incidence rates than expected. This pattern has been seen repeatedly in reports on many types of health data, and is thought to be due, in part, to the provision of a local address by persons from outside the area, when visiting Perth for medical treatment.

As we restrict analysis to individual cancer types, the statistical confidence intervals widen, as seen especially for the Murchison Health Service area, where case numbers were very small. However, for the most common cancers, there are some statistically-significant results - which, if based on very small case numbers, can be quite misleading, and pooling of data over several years may be needed.

The Harvey-Yarloop and Swan Health Service areas appeared to have lower cancer incidence rates than expected for both males and females. All-cancers rates were also lower than the State average for females in the Kimberley and East Pilbara areas. Prostate cancer appeared elevated in the North Metropolitan, Peel and Wellington Health Service areas, and reduced in the Kimberley, Harvey-Yarloop and Swan areas (Fig. 33). In females, breast cancer appeared elevated in the Bunbury Health Service area and the Inner City Health Service area, and reduced in the East Pilbara and Harvey-Yarloop Health Service areas.

Colorectal cancer appeared elevated in the Inner City Health Service area in both males and females, and was reduced in the Gascoyne Health Service in males. For females, rates appeared

lower than expected for the Avon, Harvey-Yarloop and Kimberley Health Service areas (Fig. 34).

Figure 32. All-cancers standardized incidence rate ratios for Western Australia, 1999-2000, for males and females

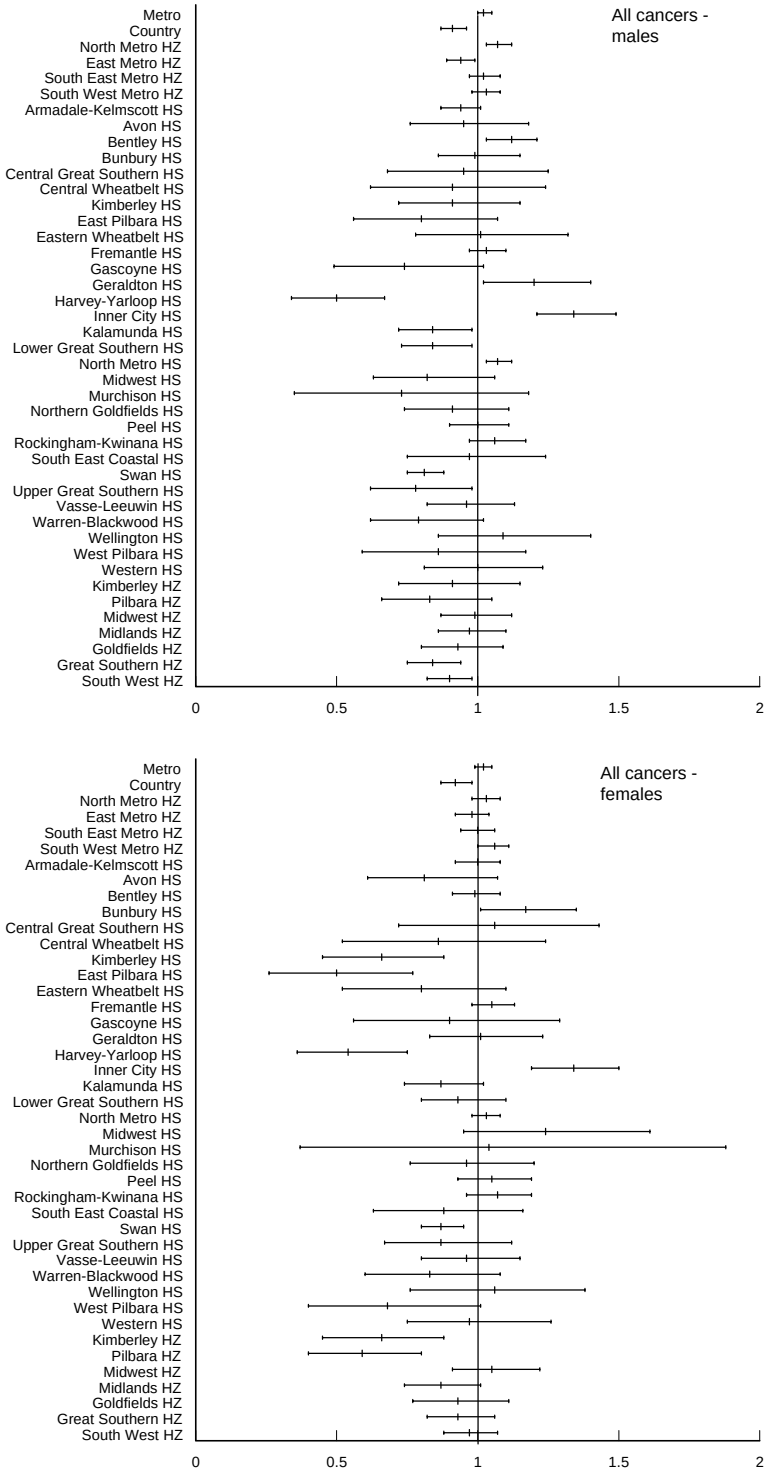
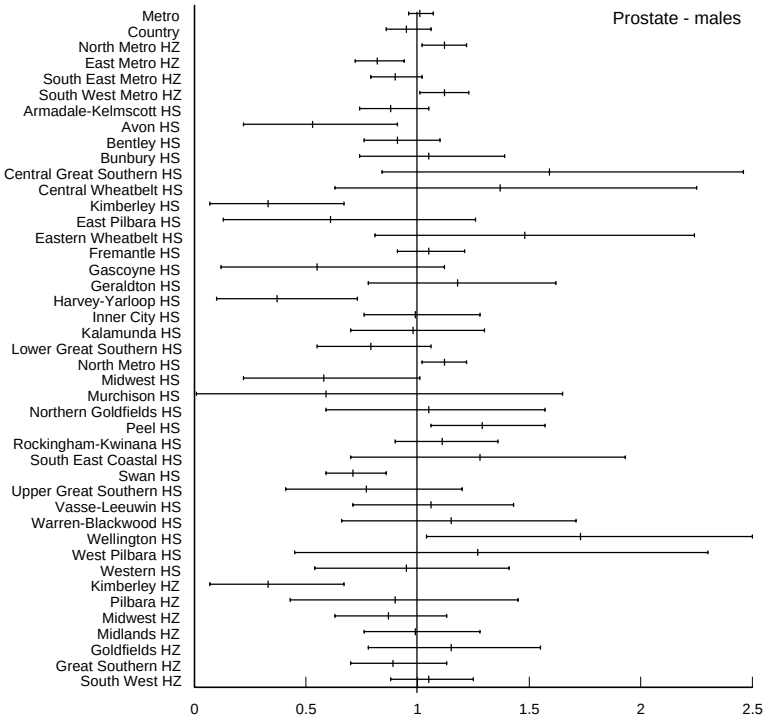


Figure 33. Prostate cancer and breast cancer standardized incidence rate ratios for Western Australia, 1999-2000



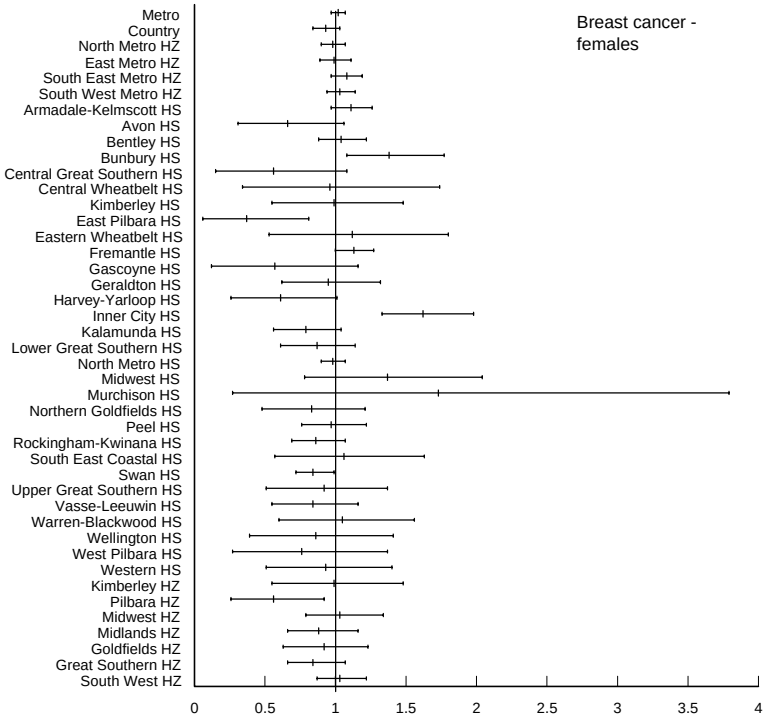
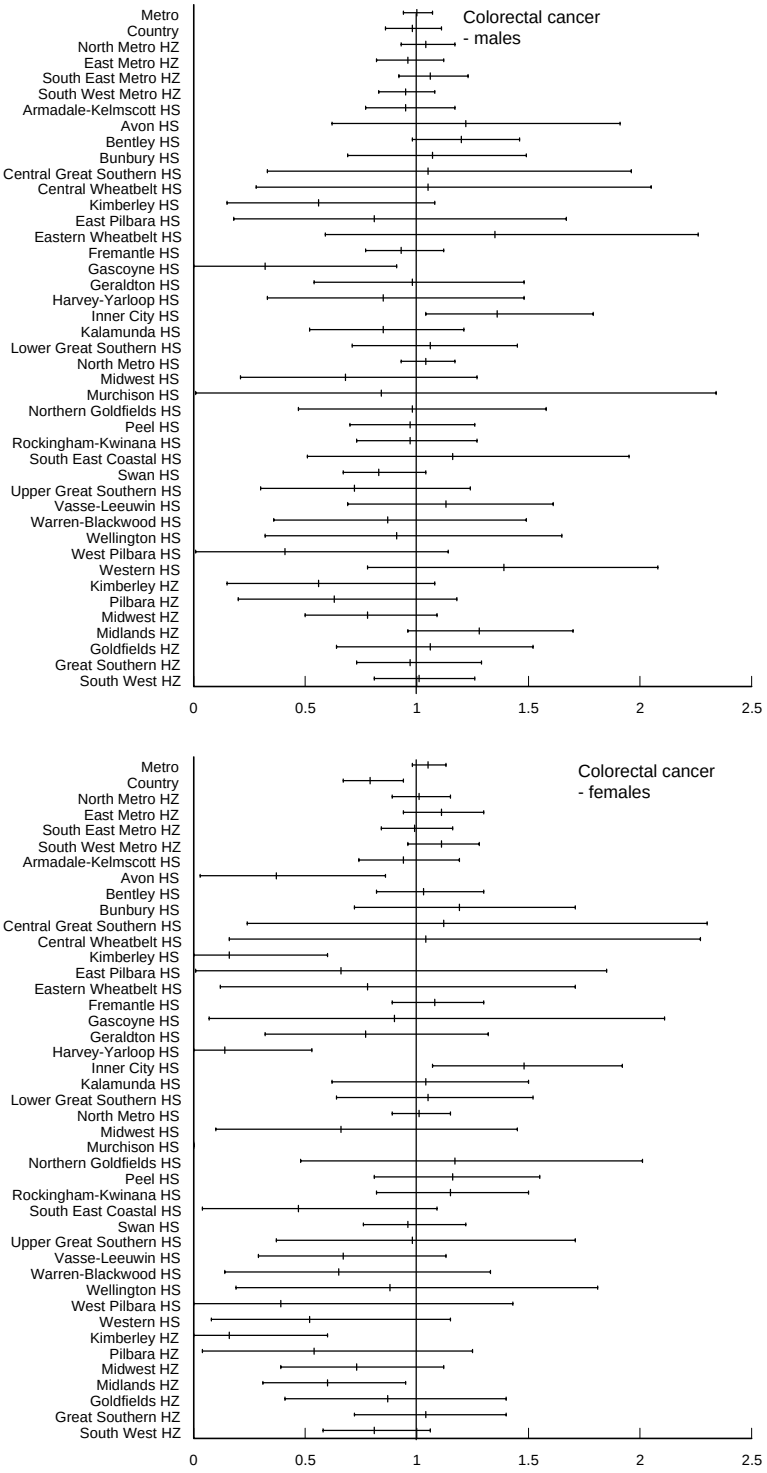


Figure 34. Colorectal cancer standardized incidence rate ratios for Western Australia, 1999-2000, for males and females



4.15 Current issues: small-area cancer statistics

Anecdotal reports of persons moving out of particular areas because of concerns over cancer risks, for which no objective evidence can be found with the data available, are a cause for great concern. In the course of dealing with such issues, the Registry must walk a fine line between making data freely available, and ensuring that the public are not alarmed without adequate scientific reasons.

In late 2001, allegations of industry-related health problems and local concern over planned developments, were responsible for a series of cancer-related data requests concerning areas just south of Perth. In the ensuing 6 months, the Registry has logged more than 35 tasks related to provision of such data, or related advice to local action groups and individuals, journalists, doctors and politicians, and from the Minister for Health and Department of Health senior staff.

This series of tasks began with a request for time-series of cancer data for the Rockingham-Kwinana area. Graphs were produced, with interpretation concerning confidence intervals and the lack of evidence that they showed any significant difference between State and local rates. The data were passed on by the recipient to other persons including journalists, and this has since been followed by a series of related newspaper articles and guest-editorials. Only a few of such publications have referred in any way to the Registry's initial advice concerning the limitations of such data.

In successive weeks, the Registry was asked to produce data for small areas based on postcode. Because of a lack of appropriate population data, and the significant risk that the Registry's advice (about the impossibility of drawing useful conclusions from case counts alone) would be disregarded, such data was not provided. It is regrettable that this appeared to be interpreted, by some, as being due to a bias towards industry, or an unwillingness to reveal facts.

Based on a series of methodologies still under development, the Department has progressively released data for various Local Government Areas (LGA) (which in this part of the State are the same as Statistical Local Areas (SLA)). There has since been a request from local industry, urging the Department of Health to examine other areas.

Geo-coding, or the assignment of events to a geographic area, can be done at various levels. State cancer data are routinely reported, but the Registry also produces data at Health Service area level, based on postcode. Production of data at Local Government Area (LGA) or Statistical Local Area (SLA) level usually relies upon mapping an exact address. However, this can leave as many as 45% of events uncoded, due to misspellings and missing data, and the use of PO Box, RMB, RSM, Lot numbers and farm names, especially in rural areas.

At short notice, in attempting to assign all cases to a small area, geo-coding was used for incident cases, and the percentage of un-codeable addresses in the region as a whole was used to estimate a number of cases, and produce rates. However, it must be recognized that the inherent assumption that un-codeable addresses are evenly-distributed cannot be supported, and when further data became available, a new methodology was developed.

In this extension of geo-coding of exact addresses, records which "failed" the exact-address coding process were assigned to an LGA on the basis of postcode, if the postcode was confined to one SLA, and on locality name if not. This process is currently being extended to cover the

whole of Western Australia, and should result in a capacity to report at small-area level for most of the State. However, in some areas - where, for example, addresses in both the Shire and Township of Narrogin (each a separate LGA) share a postcode and an area name - it will not be possible to report at an LGA level, but a combined area with known population can be defined.

Among the specific points that have been presented, in response to requests about small-area statistics, some of the most important are as follows:

- Hospitalization data are affected by the availability of services, death data are likewise associated with where people can get support and a comfortable lifestyle in old age, rather than where they sustained a "risk".

- Only incidence data can shed light on what might possibly be high-risk areas in which to live.

- Even incidence data, without knowledge of people's previous full residential and occupational histories, family history, and lifestyle factors such as tobacco, alcohol and diet, cannot reliably attribute risk to an area of residence.

- In country areas particularly, postal addresses may not adequately reflect where persons spend their time.

- In communities which are common destinations amongst persons of retirement age, there are technical reasons that might affect reported cancer incidence, independent of the fact that incidence rates, or ASRs, are adjusted for age. These may include the availability of free time to seek medical advice about existing symptoms; and the chance of a coincidental finding of cancer when seeking attention for other complaints.

- Whenever a large number of statistical tests are done, it can be expected that some may yield a "significant" result, without indicating an underlying health problem. There is a risk that recipients of such data will concentrate on the unusual results and ignore the vast majority that indicate no significant difference, or even a reduction in risk.

  This has occurred with the areas south of Perth, for which standardized incidence rate ratios were calculated for 57 cancer types, for males and females, for 8 areas, a total of over 900 comparisons. Among these, there were approximately 3% of results that appeared "significant", and of these, the majority showed a deficit of cases when compared to the State as a whole. Selective reporting of this information, supplied by the Registry on request, resulted in the public being inadequately informed of the true facts.

Dealing with these issues is time consuming, but necessary to ensure that the high-quality information contained within the Registry is used as appropriately as possible. In addition to the actual data, interpretation and information about limitations are necessary - but all too often ignored.

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Appendices