Current status of
prostate cancer
in Queensland, 1982 to 2002

October 2005

Viertel Centre for Research in Cancer Control

Queensland
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ISBN: 1-876360-09-7

Suggested citation:

Baade PD, Steginga SK, Aitken JF. Current status of prostate cancer in Queensland: 1982 to 2002. Brisbane, Viertel Centre for Research in Cancer Control, Queensland Cancer Fund. 2005.

Executive summary

The Queensland Cancer Fund has a strong and ongoing commitment to reducing the burden of prostate cancer in Queensland. This includes the development of a comprehensive education program for general practitioners and a large randomised trial currently underway designed to identify ways of improving the quality of life of men diagnosed with prostate cancer.

As part of this commitment, we have provided in this report a comprehensive overview of the latest available information on prostate cancer incidence, mortality, survival and prevalence in Queensland, and comparisons made with available Australian and international data.

Most of the information contained in this report uses the latest available data from the Queensland Cancer Registry. The Queensland Cancer Registry is a population-based cancer registry and maintains a register of all cases of cancer diagnosed in Queensland since 1982, up to (at the time of publication of this report) 2002. Non-melanoma skin cancers are not registered by the Queensland Cancer Registry (nor most other cancer registries) and as such they are not included in the comparisons of cancer types throughout this report.

This report does not include any information about the stage of cancer when it was diagnosed. As is the case for all cancer registries in Australia, complete staging data is not routinely collected by the Queensland Cancer Registry. This limits our ability to differentiate between earlier diagnosis or improved treatment of prostate cancer as possible reasons for the observed patterns.

The main results from this report are briefly outlined below. Section numbers in brackets refer to the sections in the main report.

New cases of prostate cancer (Incidence - Section 1)

Prostate cancer is the most common cancer diagnosed among Queensland males, with 2163 new cases diagnosed in 2002 (130.3 cases per 100,000 men). Most of these cancers (over 80 per cent) were diagnosed among men aged 50 to 79 years. Internationally, Australia today has one of the highest incidence rates of prostate cancer behind the USA (particularly the African-American population) and similar to that of New Zealand and Canada, and Queensland's incidence rate is slightly lower than the Australian average.

Since the 1980s, trends in prostate cancer incidence have been greatly influenced by the introduction of PSA testing. Trends in incidence rates in Queensland are consistent with those for Australia, and increased between 1988 and 1994 coinciding with the introduction of PSA testing in Australia in 1987. After 1994 these incidence rates then decreased, probably because the prevalent cases had been identified and removed from the group of men being tested. Since 1997 the rates have increased slightly (but not significantly), but rates are above what would have been projected in the mid-1980s.

Similar trends have been reported in other countries with high uptakes of PSA testing such as the USA and Canada. Increases in prostate cancer incidence that have been reported in other countries with limited PSA testing may be due to lifestyle changes involving diet or physical activity.

Deaths from prostate cancer (Mortality - Section 2)

In 2002 there were 509 deaths due to prostate cancer among males in Queensland (34.8 deaths per 100,000 men). Between 1998 and 2002 prostate cancer was the sixth most common cause of death among males, behind heart disease, and the second most common cause of cancer-related death behind lung cancer.

The mortality rate due to prostate cancer increased sharply with age, and over 80 per cent of all prostate cancer deaths were among men aged 70 years and over. Deaths due to prostate cancer

among men aged under 50 years were extremely rare. Prostate cancer was the fifth most common cause of cancer-related death among males aged 50-64 years, the third most common among males aged 65-79 years, and the most common cause of cancer-related death among males aged 80 years and over.

The age distribution of prostate cancer deaths is reflected by prostate cancer having the lowest average number of years of life lost of all the various cancer types. On average eight years of life were lost for each prostate cancer death. The cancers with the highest number of years of life lost were brain cancer (15 years) and melanoma (13 years).

Mortality rates due to prostate cancer have been decreasing in Queensland by around 3 per cent each year since 1993. Prior to that they were increasing by about the same amount. Similar trends have been reported Australia wide, and the reductions in prostate cancer mortality rates are becoming more widespread internationally. It is impossible to determine the exact causes of the reduction in prostate cancer mortality based on these international mortality trends. That is only possible through randomised controlled trials. However the observation that reductions in mortality are becoming more widespread internationally suggests that some factor or factors, possibly working together, are contributing to the decrease. Although it is possible that the introduction of PSA testing and improvements in treatment have each played a role, more research is clearly needed to understand and establish the contribution of each of those factors.

The prostate cancer mortality rate in Queensland between 1998 and 2000 was slightly lower than the Australian average, and among the top half of the comparison international countries. Mortality was highest in the Scandinavian countries such as Sweden and Norway, followed by Portugal and the Netherlands. Japan had the lowest published mortality rate for prostate cancer, around one-third that of Queensland.

Survival after a diagnosis of prostate cancer (Section 3)

We used relative survival to look at how long men survive after being diagnosed with prostate cancer. Relative survival is the ratio between the observed survival and what would be expected in the general population, usually expressed as a percentage. The relative survival ratio for prostate cancer in Queensland after five years between 1982 and 2000 was 75 per cent, reducing to 62 per cent after 10 years. Relative survival has increased over time, the 10-year survival for men diagnosed between 1982 to 1985 was 46 per cent, compared to 70 per cent for men diagnosed between 1991 and 2000. In comparison to the other cancer types, survival from prostate cancer was among the highest. Although international comparisons of cancer survival are available, interpretation of these differences is difficult due to the many possible explanations.

Survival was dependent on both age at diagnosis and year of diagnosis. As age at diagnosis increased, the 10-year relative survival estimate decreased, from around 75 per cent for men aged up to 69 years to 68 per cent for men aged in their 70s at diagnosis, and 51 per cent for men aged over 80 years at diagnosis.

Geographical differences (Section 4)

There was evidence that prostate cancer incidence was higher in Brisbane and other large cities than in remote areas, while mortality was higher in more remote regions. Men living in remote areas were nearly twice as likely to die within 10 years of diagnosis than those living in major cities in Queensland. This pattern is generally consistent with what is observed nationally, with the relative survival estimates falling steadily with distance from the capital cities. This remoteness effect could be due to either the rural differential in the use of PSA testing, or the greater likelihood of active treatment of prostate cancer in capital cities, or a combination of both.

When comparing areas of differing socio-economic status (SES), men living in lower SES areas had a lower incidence of prostate cancer, similar mortality, and lower survival rates than men living in higher SES areas. Reasons for this are unclear.

Risk of prostate cancer (Section 5)

About 134 men in every 1000 Queensland men will be diagnosed with prostate cancer before 80 years of age. About 28 men in every 1000 will die of prostate cancer before 80 years of age. There are various limitations associated with using these risk estimates, and they need to be interpreted with some caution. Some of these reasons include

    (a) population risks depend on the age range examined, and so should be appropriate for the individual;

    (b) population risks are based on the general population as a whole, and incorrectly assume that every man living in Queensland has the same personal risk as everyone else in Australia;

    (c) population mortality risks do not differentiate between men already diagnosed with prostate cancer and those who haven't had prostate cancer; and

    (d) population incidence risks are based on diagnosed cancer only, and do not allow for the fact that many prostate cancers may not be diagnosed, while others that are diagnosed may not have the potential to progress further.

The risk of men dying from prostate cancer depends on the stage of the cancer when diagnosed. It also depends on the age at which men are diagnosed. A diagnosis of prostate cancer is more likely to result in premature death for men diagnosed in their 50s than for men diagnosed in their 70s. This is due in part to the longer period between time of diagnosis and expected lifetime, and also the higher impact of competing causes of death as men get older.

Use of PSA testing (Section 6)

Since 1989 there has been a consistent increase in the number of PSA tests conducted in Queensland, and between 2000 and 2004 there were over 700,000 PSA tests. However this Medicare data does not distinguish between those tests conducted to detect prostate cancer and those used to monitor the progression of the disease, and may also undercount the total number by about 14 per cent.

Prevalence (Section 7)

The prevalence of prostate cancer represents the number of men who have had a diagnosis of prostate cancer and are still alive. In this report we have limited prevalence estimates to those men diagnosed since 1982, the commencement of the Queensland Cancer Registry. It is also not known what proportion of these prevalent men require ongoing medical treatment or can be considered cured of the disease.

In 2002 there were an estimated 13,688 men in Queensland who were still alive after having had a diagnosis of prostate cancer. Nearly 90 per cent of these have had their diagnosis since 1992, and more than half (55 per cent) were diagnosed within the preceding five years.

Based on these estimates, about two per cent of all men aged 40 years and over living in Queensland in 2002 were living with a diagnosis of prostate cancer. This increased with age, up to nine per cent of all men over 80 years of age. In 2002 prostate cancer was the most prevalent cancer among men aged 65 years and over, and second (to melanoma) among men aged 50-64 years.

Hospital treatments (Section 8)

The routinely collected data on hospital treatments for prostate cancer do not include all possible treatments (radiation and medical androgen therapies do not always require hospital admission). However there were over 4000 hospital separations with a principal diagnosis of prostate cancer. Rates of treatment for prostate cancer using radical prostatectomy have increased since 1995/96, while rates of orchidectomies have decreased over the same period.

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Further information

The information contained in this report was based on the latest available information at the time of publication. However data and published research is continually being updated, and so it is recommended that readers also refer to the additional sources of information in Appendix A, and also seek the advice of their general practitioner.

Table of contents

This report is designed to give a statistical overview of prostate cancer in Queensland, using the latest data currently available. This includes estimates of how many men are diagnosed with prostate cancer (incidence), how many men die from prostate cancer (mortality), how long men live after being diagnosed with prostate cancer (survival), and how many people are still alive after being diagnosed with prostate cancer (prevalence). Where possible, comparisons of Queensland data with interstate and international data are made.

Since recommendations for detection and management of prostate cancer are continually changing, we have deliberately not included a detailed discussion of these topics in this report. However a list of other possible sources of information on these topics is included in the back of this report (Appendix A).

Full details of the data sources and methods used to generate these results are provided in the methods section (Appendix B). In some cases throughout this report more detailed comments or possible explanations for the results are provided in grey boxes.

Non-melanoma skin cancers are not registered by the Queensland Cancer Registry (nor most other cancer registries), since many are treated in doctor's surgeries using destructive techniques that preclude histological confirmation. As such they are not included in the comparisons of cancer types throughout this report.

1   How many prostate cancers are diagnosed (Incidence)?

1.1   All ages

In 2002 there were 2163 new cases of prostate cancer diagnosed among males in Queensland.

Between 1998 and 2002 prostate cancer was clearly the most common cancer diagnosed among males (Figure 1), with an average of 1854 cancers diagnosed each year.

This compares to an average of 1302 new cases of melanoma, 1238 colorectal cancers and 1042 lung cancers.

Figure 1: Most common cancers diagnosed among Queensland males between 1998 and 2002

Data source: Incidence data obtained from Queensland Cancer Registry
NHL = Non-Hodgkin Lymphoma

Cancer	Avg cases per year	Rate /100,000 males
Prostate cancer	1854.2	122.5
Melanoma	1302.2	79.5
Colorectal cancer	1238.0	79.5
Lung cancer	1042.4	67.5
Bladder cancer	506.8	33.9
N-H Lymphoma	317.4	20.1
Kidney cancer	272.2	17.0
Stomach cancer	218.6	14.5
Lip cancer	173.0	10.6
Pancreatic cancer	170.8	11.2

1.2   Age-specific comparisons

Prostate cancer was the most common cancer between 1998 and 2002 in Queensland among men aged 50 years and above, followed by colorectal cancer and lung cancer (Figure 2).

Prostate cancer did not rate in the top 10 cancers for men aged 50 years and under, with the most common cancer in this age group being melanoma.

In the 50-64 year age group, prostate cancer (with 470 cancers diagnosed per year) was the most common cancer, followed by melanoma (403) and colorectal cancer (379).

The majority of prostate cancers were diagnosed among males aged 65-79 years. In this age group prostate cancer was clearly the most common cancer diagnosed with 1022 cancers diagnosed annually between 1998 to 2002. This was about two-thirds higher than the number of colorectal (600) and lung cancers (564) diagnosed over the same period.

A similar pattern existed among men aged 80 years and over, with the average annual number of prostate cancers diagnosed (343) being nearly double that of the second most common cancer in this age group (colorectal cancer, 176 cases).

Additional comment: Prostate cancer has also risen in relative importance among men aged 50-64 years. In 1982-1986, prostate cancer was the fifth most common cancer diagnosed among this age group, while 15 years later it was the most common cancer. Much of this increase in prostate cancer diagnoses among this age group can be attributed to the effect of PSA testing. This will be discussed further in later sections.

Figure 2: Most common cancers diagnosed in Queensland (1998-2002) by age group (average per year)

0-34 years

Cancer	Average number
Melanoma	119
Testicular cancer	59
Brain Meninges	30
Lymphoid Leukaemia	22
N-H Lymphoma	22

35-49 years

Cancer	Average number
Melanoma	269
Colorectal Cancer	74
N-H Lymphoma	45
Lip	43
Lung cancer	41

50-64 years

Cancer	Average number
Prostate cancer	470
Melanoma	403
Colorectal Cancer	379
Lung cancer	279
Bladder cancer	113

65-79 years

Cancer	Average number
Prostate cancer	1,022
Colorectal Cancer	600
Lung cancer	564
Melanoma	398
Bladder cancer	257

80 years and over

Cancer	Average number
Prostate cancer	343
Colorectal Cancer	176
Lung cancer	155
Melanoma	113
Bladder cancer	110

Data Source: Queensland Cancer Registry

1.3 Are prostate cancers getting more common? (Trends in incidence over time)

1.3.1 Incidence trends in Queensland
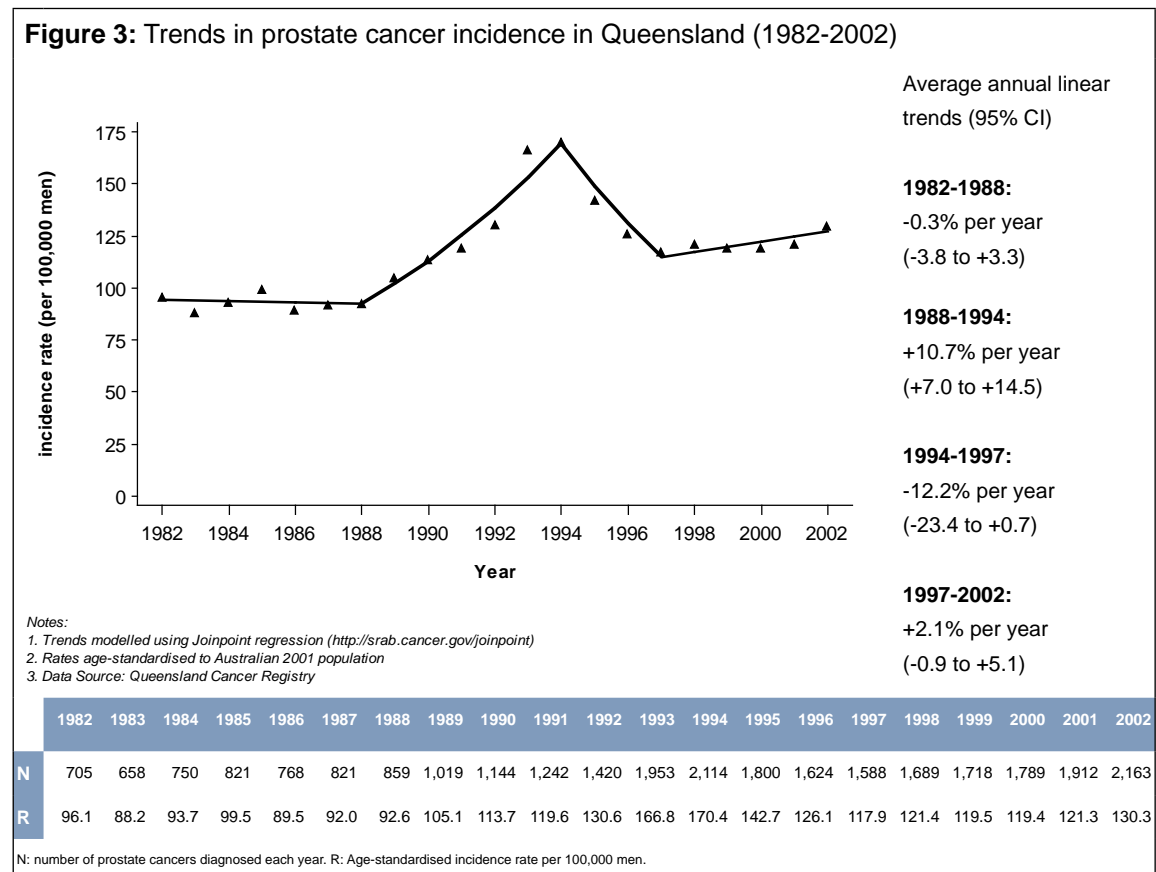
In 1982, there were 705 prostate cancers diagnosed among men in Queensland. This equates to an age-standardised incidence rate (Australia 2001) of 96.1 cases/100,000 men (Figure 3).

Between 1982 and 1988 prostate cancer incidence rates remained relatively stable, with 859 prostate cancers diagnosed in Queensland during 1988 (92.6 cases/100,000 men).

From 1988 to 1994 there was a sharp increase (nearly 11% per year) in the incidence of prostate cancer. In 1994 there were 2114 prostate cancers diagnosed, and the age-standardised incidence rate in 1994 (170.4/100,000) was about 80% higher than that in 1988.

The decrease in incidence between 1994 and 1997 was as pronounced as the previous increase (-12% per year)

Following these sharp changes in incidence trends, since 1997 the incidence rates have risen slightly (but not significantly) by about 2% per year.

Figure 3: Trends in prostate cancer incidence in Queensland (1982-2002)

Average annual linear trends (95% CI)

1982-1988:
-0.3% per year
(-3.8 to +3.3)

1988-1994:
+10.7% per year
(+7.0 to +14.5)

1994-1997:
-12.2% per year
(-23.4 to +0.7)

1997-2002:
+2.1% per year
(-0.9 to +5.1)

Notes:
1. Trends modelled using Joinpoint regression (http://srab.cancer.gov/joinpoint)
2. Rates age-standardised to Australian 2001 population
3. Data Source: Queensland Cancer Registry

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
N	705	658	750	821	768	821	859	1,019	1,144	1,242	1,420	1,953	2,114	1,800	1,624	1,588	1,689	1,718	1,789	1,912	2,163
R	96.1	88.2	93.7	99.5	89.5	92.0	92.6	105.1	113.7	119.6	130.6	166.8	170.4	142.7	126.1	117.9	121.4	119.5	119.4	121.3	130.3

N: number of prostate cancers diagnosed each year. R: Age-standardised incidence rate per 100,000 men.

1.3.2   International incidence trends

Compared to Australian trends, very similar incidence trends for prostate cancer have been reported in the United States[6] (Figure 4) .

Since PSA testing was introduced slightly earlier in the United States than Australia, their peak in incidence was about 1992 [6], compared to 1994 in Australia (and Queensland).

Slightly different trends in incidence have been reported in South East England[7], with prostate cancer incidence increasing steadily until 1996, then rates began to plateau till 2002. That is, the sharp rise followed by a sharp fall in incidence has not been reported in South East England.

Figure 4: International comparisons of prostate cancer incidence trends in Canada, Australia, South-east England and the United States.
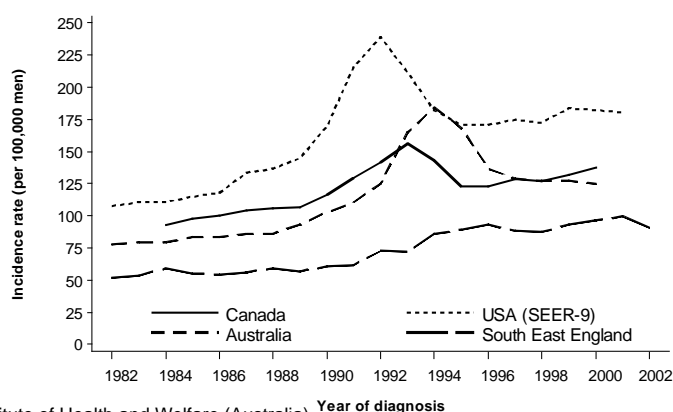
Data Sources: Australian Institute of Health and Welfare (Australia)
          Cancer Surveillance On-Line (Canada)
          Thames Cancer Registry (South-east England)
          SEER-9 (USA)

Additional comments:

Rises in prostate cancer incidence have been reported for many countries[8], including those with higher baseline incidence rates (classed as "high-risk" countries) and those with lower incidence rates (classed as "low-risk" countries). The authors of this study suggested that the increasing incidence in the high-risk countries could be attributed in part to the increasing use of PSA testing. For the low-risk countries it was suggested that the increasing incidence was consistent with westernization in these populations and with increases in the incidence of diabetes and colorectal cancer, increases in the intake of animal fat and protein, and reductions in physical activity [8].

Different trends in incidence have been reported in South East England[7], with prostate cancer incidence increasing steadily until 1996, then rates began to plateau till 1999. That is, the sharp rise followed by a sharp fall in incidence has not been reported in South East England. In addition, incidence rates are substantially lower in South East England compared to Australia and USA. PSA testing is relatively uncommon in the UK [9] compared to Australia [1,10] and the USA [11], although its use is increasing. These observed differentials in trends and incidence rates are almost certainly linked to the differentials in PSA testing. Combined with the incidence differential, the similar mortality rates due to prostate cancer in Australia, United States and South East England (see Section 2) reinforce this hypothesis.
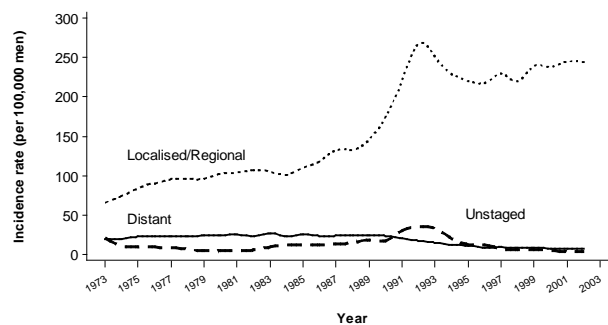
Figure 5: Trends in age-standardised incidence rates of prostate cancer by stage in United States (SEER-9 registries)

Notes:
1. Rates age-standardised to Australian 2001 population
2. Data Source: Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov)
*   Public-Use Data (1973-2002), National Cancer Institute, DCCPS, Surveillance Research Program,*
*   Cancer Statistics Branch, released April 2005, based on the November 2004 submission.*

As is demonstrated in the stage-specific trends from USA (Figure 5), most of the increase in incidence is caused by the increased detection of localised/regional cancers that have not progressed beyond the prostate, and a reduction in the detection of distant cancers.

Additional comments:

A similar trend differential has been reported for South East England [7], with localised prostate cancers increasing, and the incidence of non-localised prostate cancers decreasing. This pattern is consistent with an effect of screening.

Since stage-specific incidence data is not available in Queensland, it is unclear to what extent these international results reflect the stage-specific trend patterns in Queensland. It is also unclear how many of those additional localised/regional cancers would have progressed further to cause mortality if not detected.

When we look at the trends in incidence by age group (Figure 6), it is obvious that the overall trends in incidence are driven by the trends among men aged 65 years of age and over.

Very similar age-specific trends were evident in the USA, although again, the peak in incidence for USA was two years earlier than that observed for Queensland.

Figure 6: Trends in prostate cancer incidence in Queensland and United States, by age group, between 1982 and 2002

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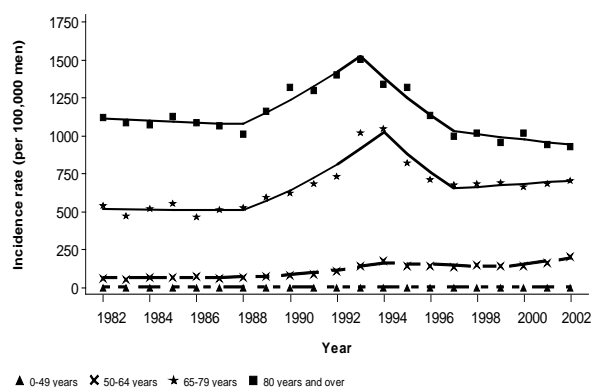
Notes:
1. Trends modelled using Joinpoint regression (http://srab.cancer.gov/joinpoint)
2. Rates age-standardised to Australian 2001 population
3. Data Source: Queensland Cancer Registry

United States (SEER-9)
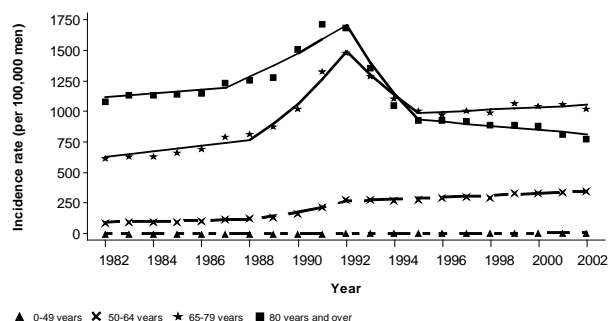
Notes:
1. Trends modelled using Joinpoint regression (http://srab.cancer.gov/joinpoint)
2. Rates age-standardised to Australian 2001 population
3. Data Source: Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov)
   Public-Use Data (1973-2002), National Cancer Institute, DCCPS, Surveillance Research Program,
   Cancer Statistics Branch, released April 2005, based on the November 2004 submission.

1.4   At what age are most prostate cancers diagnosed? (Age-specific incidence)

The majority of prostate cancers are diagnosed between the ages of 50 and 79 years (Figure 7).

Between 1998 and 2002 in Queensland, over 80% of all prostate cancers, or 7459 prostate cancers, were diagnosed in men aged between 50 and 79 years.

Just over 1% of all prostate cancers, or 99 prostate cancers, were diagnosed among men aged under 50 years during the same period.

The remaining prostate cancers (18%) were diagnosed among men aged over 80 years.

Figure 7: Age-specific incidence rates (per 100,000 men) for prostate cancer in Queensland (1998-2002)

(note that y-axis is on log scale)

Age group	Rate	Age group	Rate
0-4 years	0.0	45-49 years	13.4
5-9 years	0.0	50-54 years	57.0
10-14 years	0.0	55-59 years	168.7
15-19 years	0.0	60-64 years	327.8
20-24 years	0.2	65-69 years	551.1
25-29 years	0.0	70-74 years	685.6
30-34 years	0.0	75-79 years	866.7
35-39 years	0.3	80-84 years	927.3
40-44 years	1.8	85 and over	1031.1
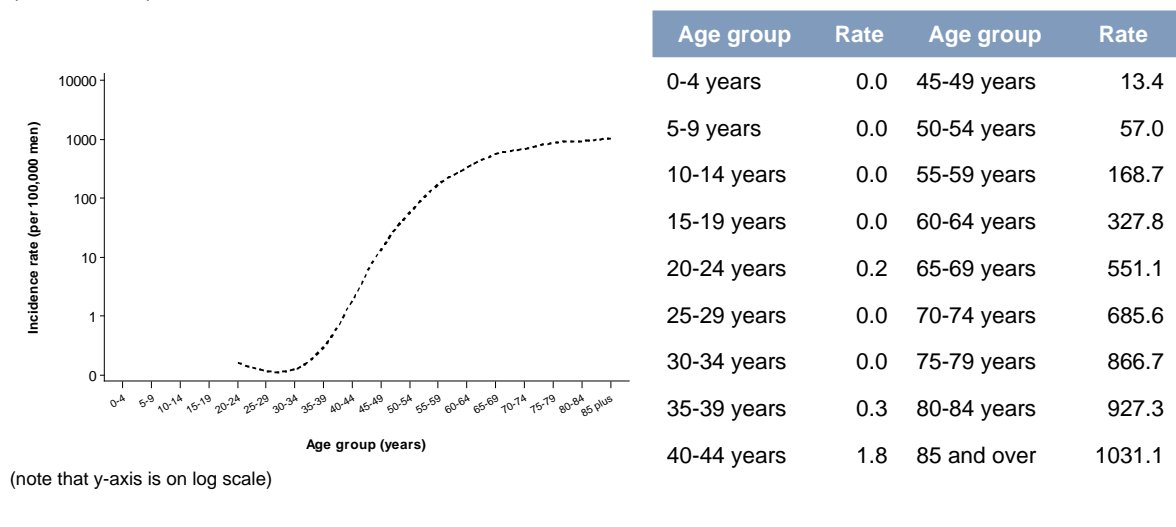
Figure 8: Median age at diagnosis (and interquartile range) for cancers among males in Queensland (1998-2002)

Data Source: Queensland Health
NHL = Non Hodgkin Lymphoma

Cancer type	Median Age at Diagnosis (Years)	Quartile 1 (Years)	Quartile 3 (Years)
Testicular cancer	33	27	42
Brain cancer	56	39	68
Lip cancer	59	44	71
Melanoma	59	47	71
Lymphoid Leukaemia	63	50	74
NHL	65	52	75
Kidney	66	55	74
Myeloid Leukaemia	69	53	78
Colorectal cancer	69	60	76
Oesophagus	69	61	76
Pancreatic cancer	70	60	77
Myeloma	70	60	77
Lung cancer	70	62	76
Stomach cancer	71	61	79
Prostate cancer	71	64	77
Bladder cancer	72	64	78

Between 1998 and 2002, the median age of diognosis of prostate cancer was 71, one of the highest of all the major cancers along with bladder and stomach cancer (Figure 8).

In comparison, the median ages at diognosis for testicular cancer, melanoma, colorectal cancer and lung cancer were 33 years, 59 years, 69 years and 70 years respectively.

Half of the prostate cancers diagnosed during this period were in men between the ages of 64 and 77 years, with a quarter of men diagnosed younger than 64 years, and a quarter diagnosed older than 77 years.

The median age at diagnosis for prostate cancer has decreased slightly since 1982-1986 when it was 73 years. This decrease in median age possibly reflects the increased detection of asymptomatic men at an earlier age through PSA testing.

1.5   Are incidence rates different outside Queensland?

The average incidence rate for prostate cancer in Queensland between 1996 and 2000 was about the lowest of all the states in Australia, and slightly lower than the Australian average (Figure 9).

Figure 9: Interstate prostate cancer incidence rates among males in Australia (1996-2000 and 1986-1990)
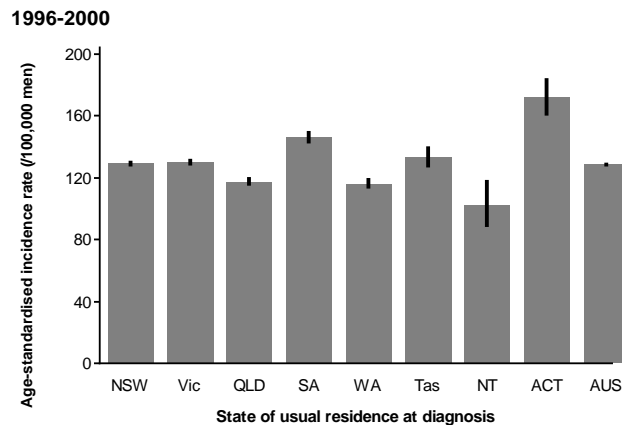
1996-2000

Data Source: Australian Institute of Health and Welfare

1986-1990
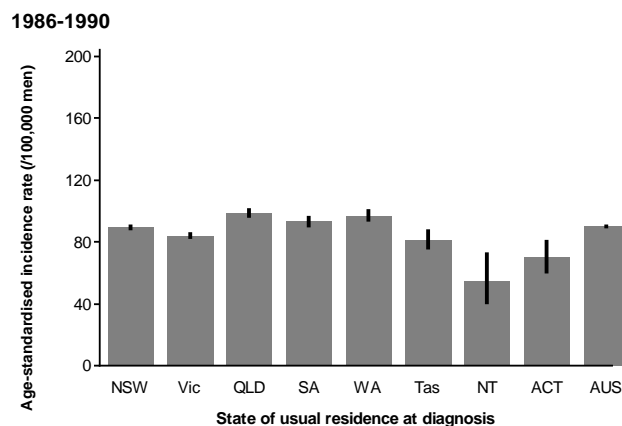
Data Source: Australian Institute of Health and Welfare

	1996 - 2000									1986-1990								
	NSW	Vic	QLD	SA	WA	Tas	NT	ACT	AUS	NSW	Vic	QLD	SA	WA	Tas	NT	ACT	AUS
N	3,612	2,595	1,640	1,040	817	283	36	159	10,180	1,773	1,203	918	495	439	130	9	32	4,998
R	129.2	130.3	117.7	146.2	116.4	133.5	102.6	172.4	128.4	89.4	84.1	98.8	93.2	97.1	81.6	54.8	70.0	90.2

N: Average number of prostate cancers diagnosed.
R: Average age-standardised incidence rate (/100,000 men)
Data source: Australian Institute of Health and Welfare. Rates standardised to Australia 2001 population

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International comparisons of prostate cancer incidence are shown in Figure 10.

The highest rates of prostate cancer incidence are clearly among African Americans. In the United States the rate of prostate cancer incidence among African Americans is about 70% higher than that of the white male population.

Countries with the lowest rates include predominantly Asian countries such as China, Japan, Korea and Vietnam, all with rates under 20 cases for every 100,000 men.

In contrast incidence rates in Canada, New Zealand, Australia (and Queensland individually) and the United States are at least 5 times as high as rates in these Asian countries, and all over 100 cases per 100,000 men.

Figure 10: International incidence rates for prostate cancer (1993-1997 unless specified)
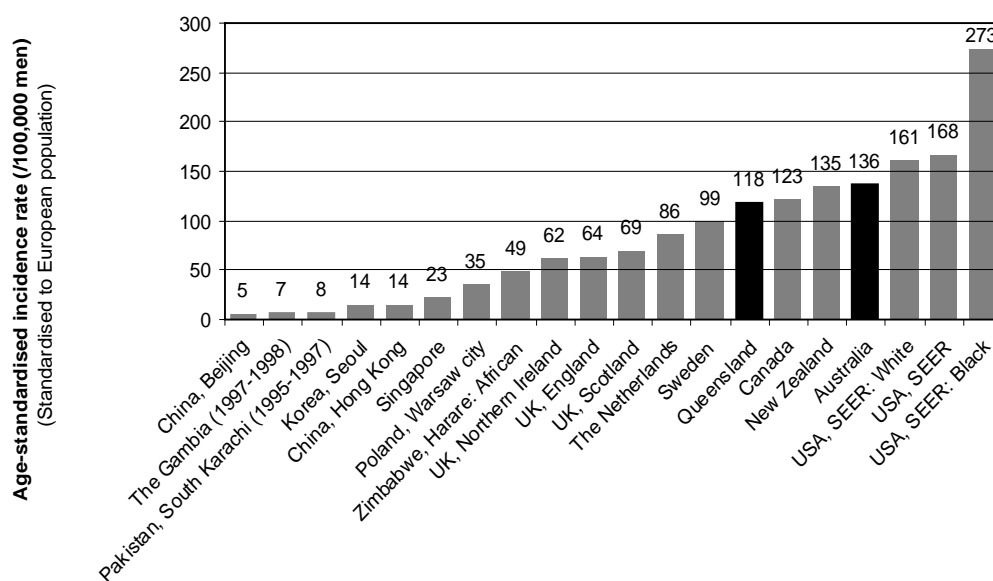
Data source: Parkin and colleagues [12]

It should be noted that, for most countries, this data was based on the period 1993-1997, when there was a substantial effect of PSA testing on incidence (particularly for countries such as Australia and the United States). Therefore it is possible that some of the international variation in prostate cancer incidence observed during this period can be attributed to different levels of uptake of PSA screening, rather than a true difference in incidence. However even in 1980 there was a 70-fold difference reported in the global range of prostate cancer incidence [13]. Based on a comparison of international trends in prostate cancer incidence to 1992 [8], even though the rate of change was different in different countries, the ranking of countries for prostate cancer incidence in 1973-1977 was very similar to that reported here.

As well as the effect of screening, there is some evidence to suggest that environmental or dietary exposure may also play a role in this international variability, rather than a country-specific genetic predisposition. Even though incidence rates of prostate cancer in Japan are very low, after two generations rates of prostate cancer among Japanese immigrants approach the overall United States rate [14]. Unfortunately the specific environmental or dietary risk factors that may have contributed to this increased risk have not been established.

Although not included in the graph, incidence rates in Nigeria have also been reported to be very high, with incidence rates between 1988 and 1993 based on hospital admissions of 127 cases per 100,000 patients [15]. Most of these cancers were advanced cancers (64% died within 2 years of diagnosis), reflecting the different screening or testing patterns in some countries compared to others (higher screening rates would generally be reflected by a greater proportion of localised or early cancers).

2 How many men die from prostate cancer (Mortality)?

2.1 Comparisons with all causes of death

Prostate cancer caused nearly 500 deaths per year among men in Queensland between 1998 and 2002 (Figure 11).

During the same period heart disease was the greatest cause of mortality among men, with an average of over 2,800 deaths per year.

Lung cancer and stroke both caused nearly 900 deaths per year among men in Queensland, chronic lower respiratory diseases caused nearly 700 deaths per year, while about 650 deaths were due to accidents.

Figure 11: Major causes of mortality among men in Queensland (1998-2002)

Data source: Australian Bureau of Statistics

Cause	Avg deaths per year	Age std. Rate /100,000
Heart disease	2818.8	207.0
Lung cancer	883.8	58.0
Stroke	880.6	69.1
Chronic lower respiratory diseases	675.8	49.3
Accidents	632.2	38.7
Prostate cancer	489.0	36.7
Colorectal cancer	453.6	30.1
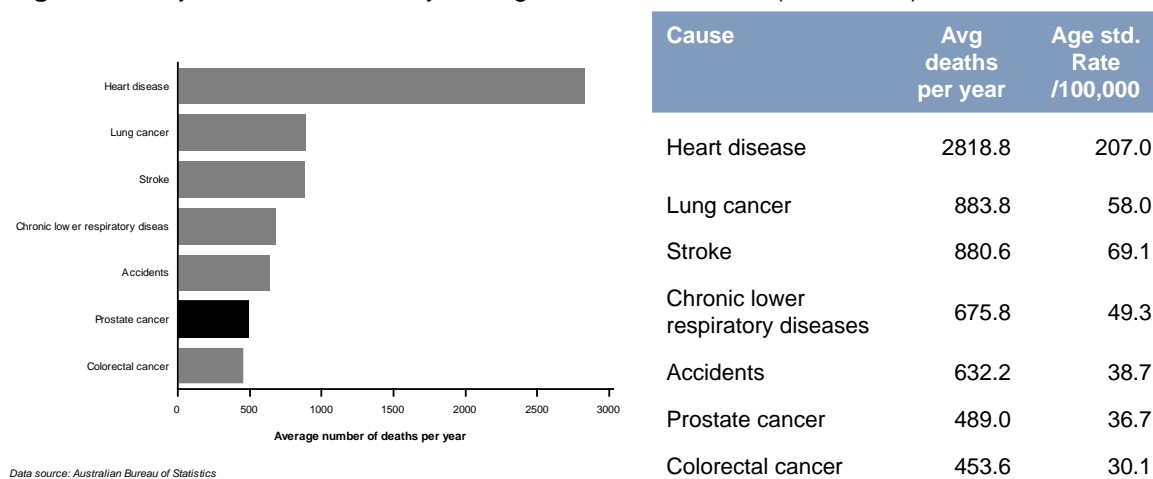
Combined, cancer caused an average of 3729 deaths per year among men in Queensland between 1998 and 2002, or slightly more than 30% of all deaths among men during this period.

2.2 Comparisons with other cancer causes of death

In 2002 there were 509 deaths due to prostate cancer in Queensland.

Between 1998 and 2002 prostate cancer was the second most common cause of cancer death among males in Queensland, with an average of 486 deaths per year (Figure 12). Lung cancer (877 deaths per year) was the most common cause of cancer-related death among males, followed by prostate cancer and colorectal cancer (477 deaths).

Additional comments:

Note that the differences in counts between Figures 11 and 12 are due to different data sources. Figure 11 is based on data coded by the ABS. Figure 12 is based on data coded by the Queensland Cancer Registry, which uses additional information from the pathology reports.

Figure 12: Top 10 causes of cancer death among males in Queensland between 1998 and 2002

Data source: mortality data obtained from Queensland Cancer Registry
NHL = Non-Hodgkin Lymphoma

Cancer	Avg deaths per year	Age std. Rate /100,000
Lung cancer	877.2	57.6
Prostate cancer	486.4	36.5
Colorectal cancer	477.0	31.7
Stomach cancer	155.8	10.6
Pancreatic cancer	154.8	10.2
Melanoma	141.2	9.2
NHL	131.2	8.8
Bladder cancer	112.6	8.2
Brain cancer	109.6	6.6
Oesophagus	99.6	6.6
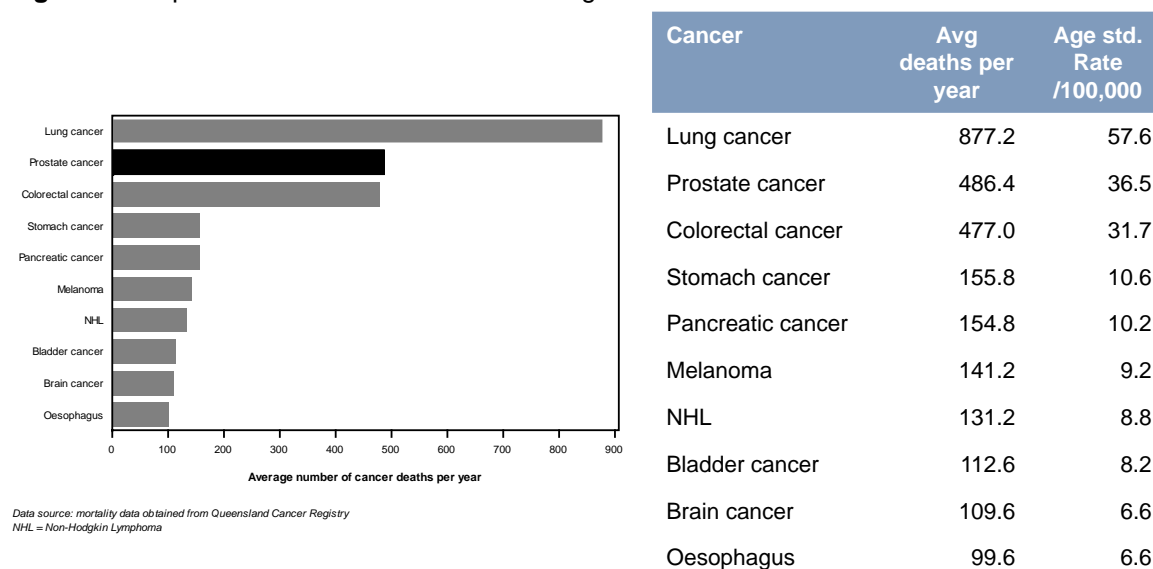
Prostate cancer was the most common cause of cancer death among men aged 80 years and over between 1998 and 2002 in Queensland (Figure 13).

Although the largest number of prostate cancer deaths was in the 65-79 year age group (230 per year), this ranked third in this age group behind lung cancer and colorectal cancer.

Prostate cancer was the fifth most common cause of cancer death (38 deaths per year) among men aged 50-64 years.

Prostate cancer did not rate in the top 20 cancer causes of death for men aged 50 years and under.

Additional comments:

In contrast to the change in incidence ranking over time (Section 1), there was very little difference in the relative ranking of prostate cancer mortality since 1986-1990, compared to other types of cancer.

Figure 13: Most common causes of cancer death among males in Queensland (1998-2002) by age group (average per year)
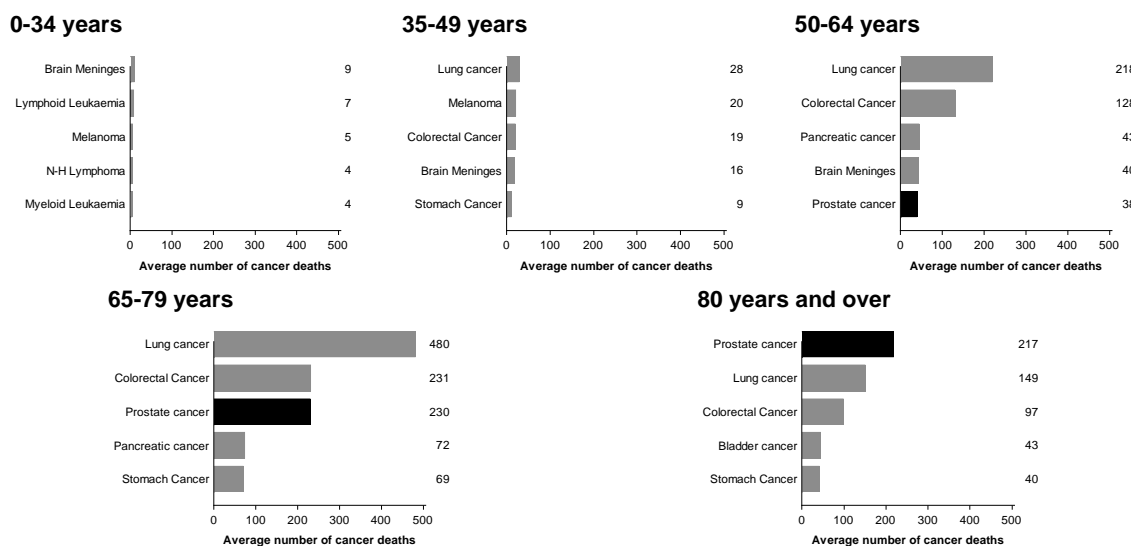
Data source: Queensland Cancer Registry

2.3   Premature mortality

Premature mortality (measured by years of life lost, or YLL) is based on how much of their "expected" lifetime a person loses when they die. For example, a person who dies at 30 years of age would lose a greater number of years of (expected) life than a person who dies at 60 years of age.

2.3.1   Total premature mortality

Between 1998 and 2002, all cancers combined were responsible for nearly a third (30.3%) of all premature mortality among Queensland men.

Lung cancer (with 9,718 YLL per year) and colorectal cancer (with 5,310 YLL per year) were the greatest cancer-related contributors to premature mortality in Queensland between 1998 and 2002 (Figure 14(a)).

Prostate cancer was the third greatest contributor to premature mortality with an average of 3,788 YLL per year.

Additional comment:

These rankings of total years of life lost are influenced by both the number of deaths and the age at which men die. Although prostate cancer makes up 13% of cancer deaths, it was responsible for only 9% of premature mortality. In comparison lung cancer makes up 24% of both the number of cancer deaths and cancer YLLs among males, while melanoma makes up a greater proportion of YLLS (5%) compared to overall cancer mortality (4%).

2.3.2   Average years of life lost per death

In terms of the average number of years of life lost for each cancer death, prostate cancer (7.8 YLL per death) was the lowest of the major cancer types (Figure 14(b)).

Cancer of the brain (15.5 YLL per death), melanoma (13.2 YLL per death) and pancreatic cancer (11.4 YLL per death) had the highest average number of YLLs for each death.

These patterns reflect the age at which people die. The majority of prostate cancer deaths are among older people, and prostate cancer mortality among young men is very rare.

Figure 14: Major causes of premature mortality among males due to cancer (1998 to 2002)

(a) Total number of years of life lost per year

Cancer	YLLs
Bladder cancer	974
N-H Lymphoma	1,488
Stomach Cancer	1,692
Brain Meninges	1,699
Pancreatic cancer	1,765
Melanoma	1,861
Prostate cancer	3,788
Colorectal Cancer	5,310
Lung cancer	9,718

Number of years of life lost (YLLs)
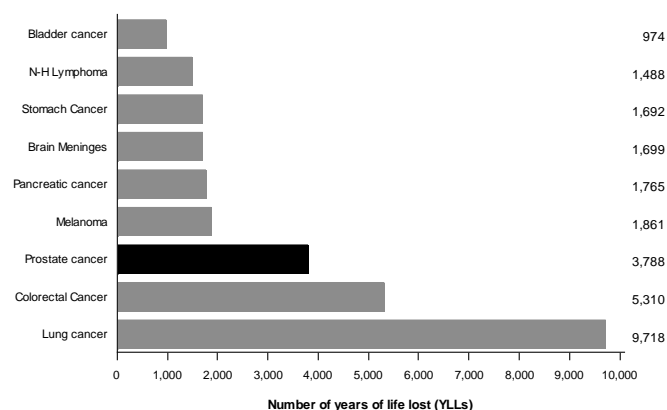
Only those cancers with an average of 100 deaths per year were included
Data source: Mortality data obtained from Queensland Cancer Registry
Age-specific estimates of Years life lost (YLL) due to a death were based on the
*   2002 Australian Burden of Disease study, and are discounted at 3% with no age weighting*

(b) Average years of life lost per death

Cancer	YLL/death
Prostate cancer	7.8
Bladder cancer	8.7
Stomach cancer	10.9
Lung cancer	11.1
Colorectal cancer	11.1
NHL	11.3
Pancreatic cancer	11.4
Melanoma	13.2
Brain Meninges	15.5

Number of years of life lost per death (YLL/death)
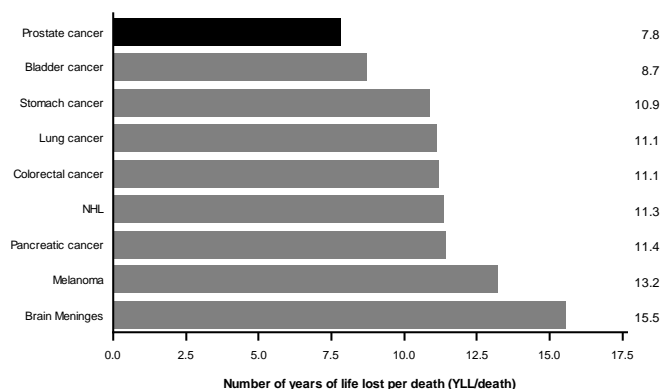
Notes:
Data source: Mortality data obtained from Queensland Cancer Registry
Age-specific estimates of Years life lost (YLL) due to a death were based on the
*   2002 Australian Burden of Disease study, and are discounted at 3% with no age weighting*
Top 5 contributors plus the 5 male-related NHPA cancers

2.4 Are more men dying from prostate cancer? (Mortality trends over time)

In 1982 there were 205 prostate cancer deaths among Queensland men. This equates to an age-standardised mortality rate (Australia 2001) of 30.9 deaths / 100,000 men.

Between 1982 and 1993 there was a 3.7% increase in mortality, with 463 prostate cancer deaths in Queensland in 1993 (46.4 deaths / 100,000 men).

Since 1993 there has been a 2.6% reduction in mortality rates.

In 2002 there were 509 deaths due to prostate cancer, with a mortality rate of 34.8 deaths / 100,000 men.

Similar trends are evident for Australia over the same period. [16,17]

Figure 15: Trends in prostate cancer mortality in Queensland (1982-2002)
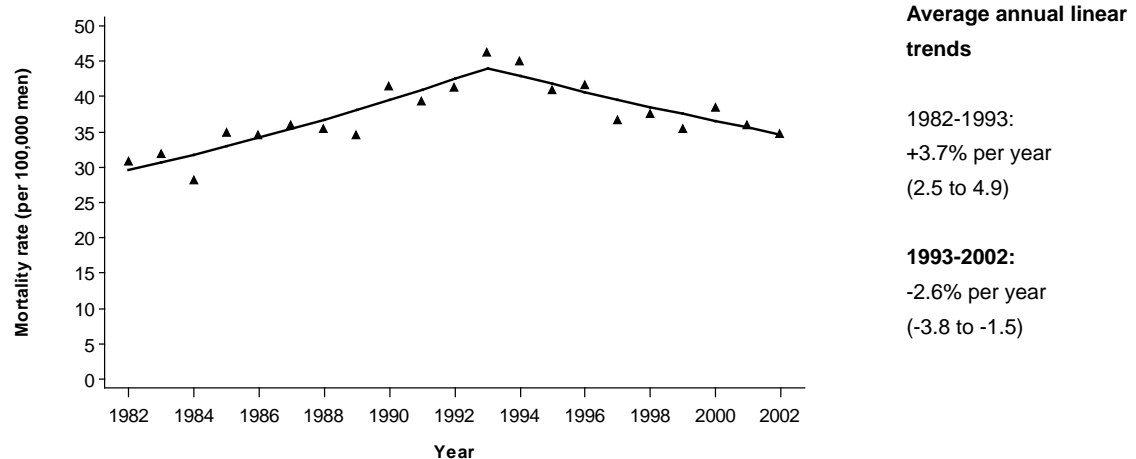
Average annual linear trends

1982-1993:
+3.7% per year
(2.5 to 4.9)

1993-2002:
-2.6% per year
(-3.8 to -1.5)

Notes:
1. Trends modelled using Joinpoint regression (http://srab.cancer.gov/joinpoint)
2. Rates age-standardised to Australian 2001 population
3. Data Source: Queensland Cancer Registry

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
N	205	212	211	252	273	284	305	306	369	368	404	463	481	452	476	435	464	440	512	507	509
R	30.9	32.0	28.3	35.0	34.7	36.1	35.6	34.8	41.5	39.5	41.5	46.4	45.1	41.0	41.8	36.9	37.7	35.5	38.5	36.1	34.8

N: number of prostate cancer deaths each year. R: Age-standardised mortality rate per 100,000 men.

Additional comment:

Although this recent reduction in mortality from prostate cancer is very encouraging, it does need to be interpreted in view of the long-term trends in prostate cancer mortality.

Since 1921, when national collection began for prostate cancer mortality data, mortality rates due to prostate cancer have been steadily increasing in Australia, at least until the early 1970s, then following a plateau during the 1970s and early 1980s began to increase until 1993. (Figure 16).

Queensland Cancer Fund

Figure 16: Long term historical prostate cancer mortality trends among males in Australia (1920-2000) [18]

Deaths per 1,000,000 population

Males

Source: Dunn C, Sadkowsky K, Jelfs P, Trends in deaths: Australian data, 1987-1998 with updates to 2000. Mortality Surveillance Series no. 3. CAt. No. PHE 40. Australian Institute of Health and Welfare. (http://www.aihw.gov.au/publications/phe/td00/td00c00.pdf), 2002

The proportion of all deaths among men that are attributed to prostate cancer is increasing.

In 1982 9.7% of all cancer deaths and 2.0% of all deaths among males in Queensland were due to prostate cancer (based on age-standardised mortality rate ratios).

In 2002 the corresponding percentages had both increased (13.4% and 4.0% respectively).

However, this differential is not due to an increase in prostate cancer mortality – as we have noted just above mortality from prostate cancer is now decreasing in Queensland. Rather (as shown in Figure 17) it is due to the decrease in all cause mortality, driven mainly by decreases in cardiovascular disease [18].

Between 2000 and 2002, about 1% of all deaths among men in their 50s in Queensland were due to prostate cancer, nearly 4% of deaths of men in their 60s, and about 5% of deaths of men over 70.

When we look at the trends in mortality by age group (Figure 18), the overall trends in mortality are driven primarily by the trends among men aged 80 years and over, and to a lesser extent among men aged 65-79.

Figure 17: Trends in mortality among males in Queensland (1982 to 2002)

Mortality rate (per 100,000 men)

····· Prostate cancer   —— All cancers
– – All causes

Year
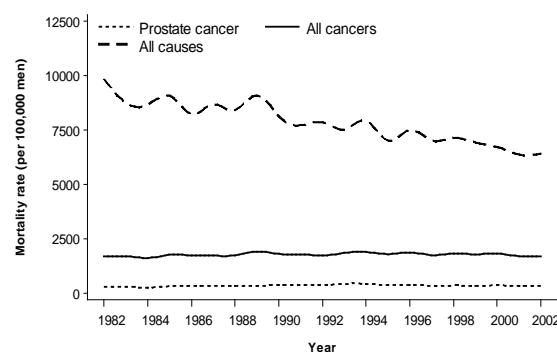
Notes:
1. Rates age-standardised to Australian 2001 population
2. Data Sources: Queensland Cancer Registry and Australian Bureau of Statistics

Figure 18: Age-specific trends in prostate cancer mortality in Queensland 1982-2002

▲ 0-49 years ✖ 50-64 years ★ 65-79 years ■ 80 years and over

Notes:
1. Trends modelled using Joinpoint regression (http://srab.cancer.gov/joinpoint)
2. Rates age-standardised to Australian 2001 population
3. Data Source: Queensland Cancer Registry
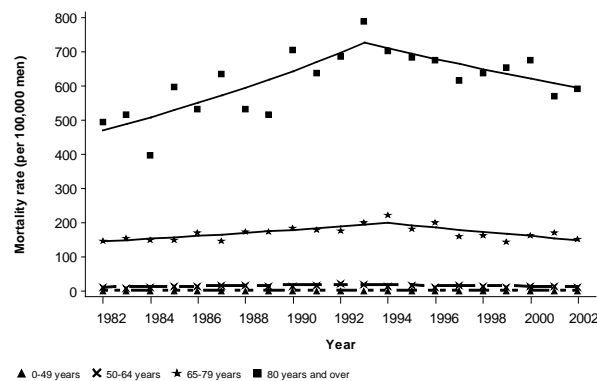
2.4.1 What is happening to mortality rates in other countries? (International trends)

In 2001, it was reported that a decrease in prostate cancer mortality was evident during the 1990s for 7 out of 24 industrialised countries [19].

In 2004 a separate paper also reported on international prostate mortality trends, and found that decreases were now evident in 12 of the 24 industrialised countries [16], suggesting that the reduction in mortality due to prostate cancer was becoming more widespread.

International trends in prostate cancer mortality among men in 24 industrialised countries are shown in Figure 19. Trends are shown separately for men aged 50-79 years and for men of all ages combined.

It is not possible to determine the exact causes of the reduction in prostate cancer mortality based on these international mortality trends. Possible reasons for the reduction in trends could include decreases in the prevalence of risk factors, changes in how prostate cancer deaths are recorded, better treatment or improved detection. [16,19] Although it is possible that improved detection (through PSA testing) and improved treatment could play a role, more research is needed to understand the true causes of the observed trends. [16]

Figure 19: International trends in prostate cancer mortality (1979 to 2001)

[Age-standardised rates per 100,000 men]
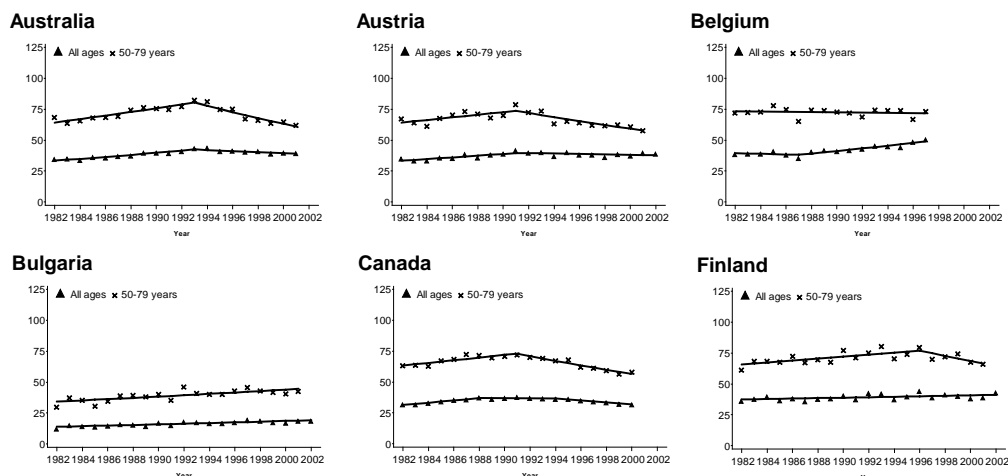
… continued

(continued)

France
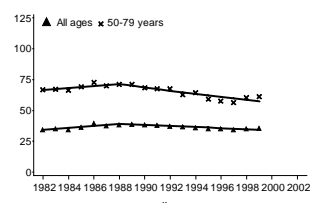
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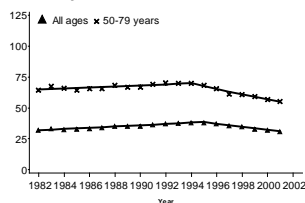
Greece
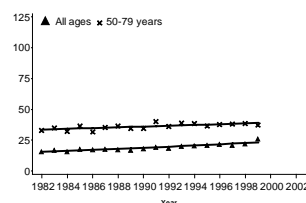
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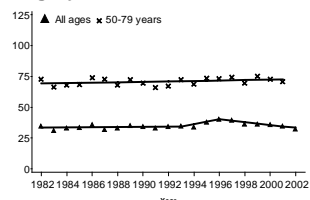
Ireland
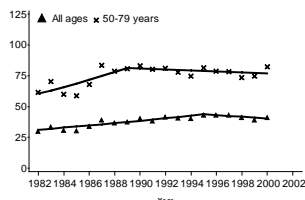
Israel
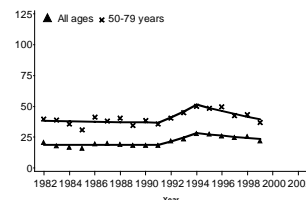
Italy
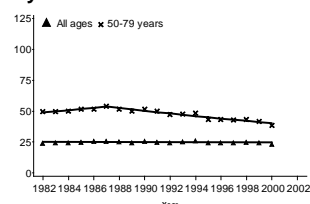
Japan
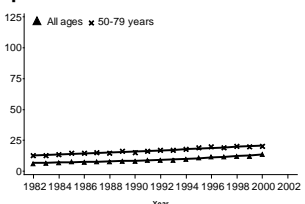
Netherlands
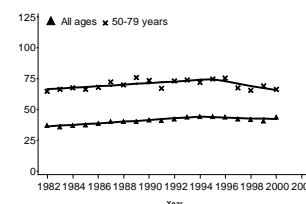
New Zealand
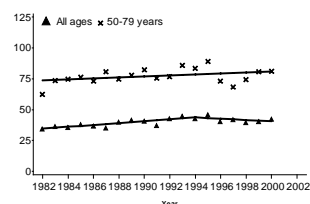
Norway
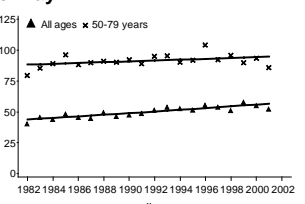
Poland
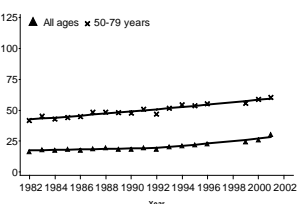
Portugal
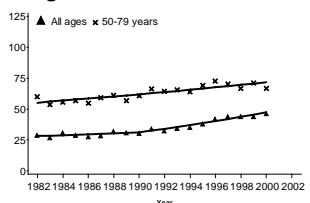
Romania
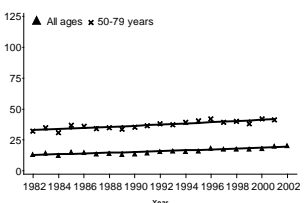
Spain
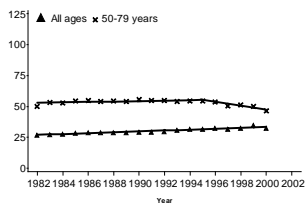
Sweden
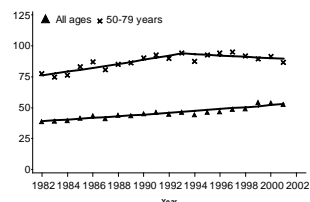
United Kingdom
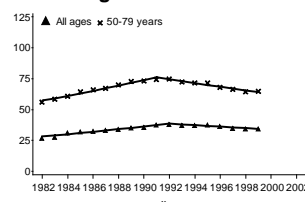
United States of America
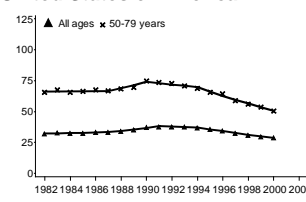
Mortality and population data extracted from the World Health Organisation (WHO)
Mortality database (www.who.int/whois/mort (1979-2001))
Trends modelled using Joinpoint regression (http://srab.cancer.gov/joinpoint)
Rates age-standardised to Australian 2001 population.

Additional comments

There are at least four possible reasons to explain the observed reduction in prostate cancer mortality internationally: decreases in the prevalence of risk factors, changes in how prostate cancer deaths are recorded, better treatment or improved detection [16,19].

Risk factors
It is unlikely that a change in risk factors can explain the reduction. Apart from short term changes in incidence generally attributed to PSA testing, there is no evidence that incidence has decreased in countries where there has been a decrease in mortality[20].

Cause of death coding
This is also unlikely to be a factor since there have been no recent changes to international recommendations for assigning the cause-of-death for prostate cancer. Also, in countries where a reduction in mortality was observed, it was immediately preceded by an increase; modern standards for recording cause-of-death are likely to have been applied equally to both intervals[21]. It does not appear that the determination of cause of death has changed after the introduction of PSA testing [22].

Treatment
Some of the improvements in treatment for prostate cancer during the 1990s included refinements in radical prostatectomy techniques[23,24] and radiation therapy[23,25,26] for early stage disease. The more widespread use of these treatments internationally [27,28] could be associated with increased numbers of men presenting with early stage disease [29,30]. Most of these are probably detected through PSA screening [27,30]. One recent randomised trial demonstrated significantly reduced disease-specific mortality for patients with localised prostate cancer following radical prostatectomy, compared to conservative treatment [31]. However it is not clear how widely the results of this randomised trial can be generalised since the study started before the widespread introduction of PSA screening [32].

Although not curative, the developments in hormonal treatments for advanced disease[33] (which seem more acceptable to men than surgical castration) could also be contributing to reduced mortality, even if just by deferring mortality until men succumb to other conditions. If, as has been suggested, conservative treatment (as distinct to radical prostatectomy or other treatment) is more common in the Scandinavian countries than elsewhere[23], this may explain at least some of the higher cause-specific mortality in those countries.

Early detection
PSA screening was introduced in many countries during the late 1980s and early 1990s. Since mortality has also decreased after 1990 in many countries[16], it has been suggested that prostate cancer screening using PSA has had a positive effect on the health of men[34].

Uncertainties
One argument against the hypothesis that PSA screening and/or improved treatment may have contributed to the recent reduction in prostate cancer mortality is the generally slow growth of prostate cancer[35]. A recent study demonstrated that men can die from prostate cancer more than 20 years after being initially diagnosed with localised prostate cancer[36] and the 5-year survival for men diagnosed with early stage prostate cancer is around 100%[37].

Given that the principal target of both PSA testing and prostatectomy is localised prostate cancer[33], this slow growth and (initial) high survival needs to be considered in terms of its possible effect on mortality, since there is only about a 5-6 year gap between the widespread introduction of PSA testing and the recently reported reduction in mortality. However it has also been acknowledged that there is wide variation in growth patterns of prostate cancers[33]. Although most are slow growing, others can display fast growth. It could be that part of the possible contribution PSA screening and prostatectomy have had on mortality is in preventing or at least postponing mortality from these fast-growing cancers. Also, Tarone and his co-workers analysed stage-specific survival rates in the United States and concluded that a rapid decrease in population-based mortality could be explained by the detection (perhaps through PSA testing) and successful treatment of high-grade tumours before they metastasise[38,39].

The second reason for scepticism is that the decline has not always been largest in areas with more screening[40,41]. However, as demonstrated by this data in comparison to that reported previously [19], one or two more years of additional data can mean that a population-based mortality decline suddenly becomes apparent.

Conclusion
*It is impossible to determine the exact causes of the reduction in prostate cancer mortality based on these international mortality trends. That is only possible through randomised controlled trials. However the observation that reductions in mortality are becoming more widespread internationally suggests that some factor or factors, possibly working together, are contributing to the decrease. Although it is possible that that PSA testing and treatment have played a role, more research is clearly needed to understand and establish the contribution of each of those factors.*

2.5 How old are men when they die from prostate cancer? (Age specific mortality)

Most of the deaths due to prostate cancer are among men at least 70 years of age (Figure 20).

Between 1998 and 2002 in Queensland, over 80% of all prostate cancer deaths, or 2018 deaths, were among men aged over 70 years.

About 14% of prostate cancer deaths were among men aged in their 60s, and about 3% were of men in their 50s.

Deaths due to prostate cancer among men under 50 years of age are very rare, and averaged about 1 per year between 1998 and 2002 in Queensland.

Figure 20: Age-specific mortality rates (per 100,000 men) due to prostate cancer in Queensland (1998-2002)
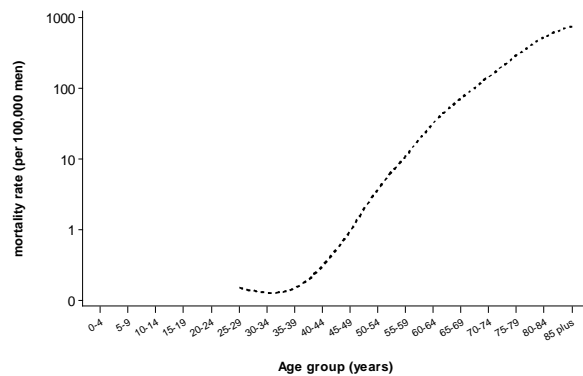
Data Source: Queensland Cancer Registry

note that y-axis is on log-scale

Age group	Rate	Age group	Rate
0-4 years	0.0	45-49 years	1.0
5-9 years	0.0	50-54 years	3.7
10-14 years	0.0	55-59 years	10.8
15-19 years	0.0	60-64 years	31.8
20-24 years	0.0	65-69 years	71.4
25-29 years	0.2	70-74 years	144.9
30-34 years	0.0	75-79 years	289.4
35-39 years	0.1	80-84 years	526.7
40-44 years	0.0	85 and over	749.3

Between 1998 and 2002, the median age of prostate cancer death in Queensland was 78 years, the highest of all the major cancers (Figure 21).

In comparison, the median ages for deaths due to testicular cancer, melanoma, colorectal cancer and lung cancer were 56 years, 67 years, 71 years and 71 years respectively.

Half of the prostate cancers deaths during this period were of men between the ages of 72 and 84, with a quarter of men who died being 71 years or younger, and a quarter of the deaths being among men aged 85 years and older.

The median age at death for prostate cancer has increased since 1982-1986 when it was 76 years.

Additional comment:

This increase in median age at death may in part reflect improvements in the management of advanced prostate cancer during the mid-1980s with the introduction of medical anti-androgen therapies. Even though drug-induced androgen deprivation has been suggested to have similar effectiveness to surgical castration [42], increased uptake of these more acceptable treatments could defer death from prostate cancer. This would have the effect of either increasing the median age at death or postponing death long enough for competing causes to intervene (and thus reducing the prostate cancer mortality rate). Both these outcomes have recently been observed in Queensland.

Figure 21: Median age at death (and interquartile range) for males in Queensland (1998-2002)

Data Source: Queensland Health
NHL = Non Hodgkin Lymphoma

Cancer	Median Age at Death (Years)	Quartile 1 (Years)	Quartile 3 (Years)
Brain cancer	61	51	71
Melanoma	67	53	77
Liver cancer	68	60	75
Mesothelioma	70	62	78
Kidney cancer	71	60	78
Pancreatic cancer	71	61	78
Oesophagus	71	62	78
Colorectal cancer	71	62	78
Lung cancer	71	63	77
NHL	72	62	79
Stomach cancer	72	62	80
Myeloma	73	65	80
Myeloid Leukaemia	74	62	81
Bladder cancer	77	69	83
Prostate cancer	78	72	84

2.6 Are mortality rates different outside Queensland?

The average prostate cancer mortality rate in Queensland (36.3 deaths per 100,000 men) was very similar to the Australian average (35.3) between 1999 and 2002 (Figure 22).

Figure 22 Interstate prostate cancer mortality rates among males (1999-2002)

Data Source: Australian Bureau of Statistics
Rates standardised to 2001 Australian population

State	Average deaths per year	Age-standardised rate /100,000 men
NSW	909.8	34.5
Vic	715.8	37.0
QLD	494.0	36.3
SA	247.8	35.8
WA	197.3	30.4
Tas	86.3	41.9
NT	5.8	22.6
ACT	24.8	31.4
AUS	2681.3	35.3

Between 1998 and 2000 the average prostate cancer mortality rate for all men in Queensland was 37.4 deaths per 100,000 men (Figure 23). This was slightly lower than the Australian average, and around the top third of all the countries considered. Mortality was highest in the Scandinavian countries such as Sweden and Norway, followed by Portugal and Netherlands.

Prostate cancer mortality was appreciably lower in Japan, with a mortality rate about a third that of Queensland.

Figure 23: International comparisons in prostate cancer mortality (1998-2000)

[Age-standardised rates per 100,000 men]
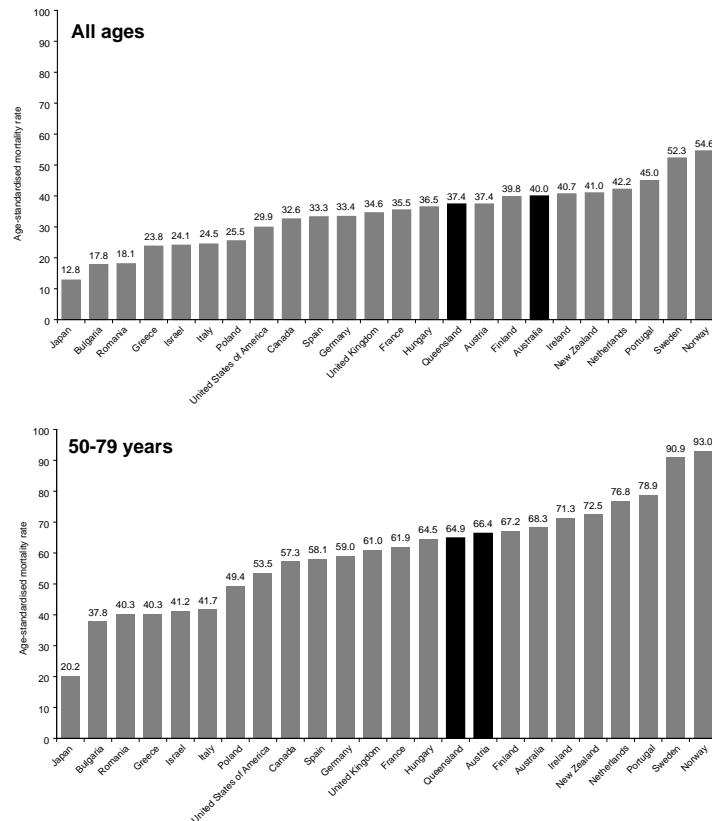
International mortality and population data extracted from the World Health Organisation (WHO) Mortality database (www.who.int/whois/mort (1998-2000))
Poland 1999-2000 only, Israel, France, Greece, UK 1998-1999 only, 1998-2000 for all the rest
Queensland mortality data sourced from Queensland Cancer Registry.
Rates age-standardised to Australian 2001 population.

Additional comment:

Reasons for geographical differences (both interstate and international) in prostate cancer mortality are difficult to interpret without having any information about the stage of the cancer when diagnosed.

For example, a difference in mortality could be due to earlier detection of the cancer, improved treatment or the effect of competing causes of death (that is, men die of other conditions instead of dying of prostate cancer).

3   How long do men survive after being diagnosed with prostate cancer (Survival)?

Cancer survival relates to the length of time that people are alive after being diagnosed with the cancer. Relative survival is the ratio of the observed survival time for prostate cancer patients to the expected survival of the general male population (See Appendix B for further details of the methods).

3.1   Survival from prostate cancer in Queensland

Of the 24,482 men who have been diagnosed with prostate cancer between 1982 and 2000, more than 9 out of 10 (92.8%) were still alive one year after diagnosis, after adjusting for the mortality of the general population (Table 1).

This survival proportion decreases with time after diagnosis, with the relative survival being 75.3% five years after being diagnosed.

More than half of all men (52.8%) diagnosed with prostate cancer were still alive 15 years after being diagnosed (after adjustment for the general population mortality).

Ten-year survival from prostate cancer has significantly increased over the last 20 years. Compared with men diagnosed between 1991 and 2000, men diagnosed in the 1980s were about two to three times more likely to have died within 10 years of being diagnosed with prostate cancer.

Compared to men diagnosed when aged 80 years and over, men diagnosed at younger ages were about 2-2.5 times less likely to die within 10 years of diagnosis. There was little difference in ten-year relative survival estimates whether they were diagnosed in their 40s, 50s or 60s.

Table 1: Survival from prostate cancer in Queensland

	N	Relative survival	
Years after diagnosis (1982-2000)	23,824		
1 year		92.8 (92.4, 93.2)	
2 years		87.0 (86.4, 87.5)	
3 years		81.4 (80.8, 82.1)	
4 years		78.3 (77.6, 79.1)	
5 years		75.3 (74.4, 76.2)	
10 years		61.9 (60.5, 63.4)	
15 years		52.8 (50.1, 55.5)	
	N	**Relative survival (after 10 years)**	**Hazard ratio (relative risk of dying)**
Period of diagnosis (1982-2000)			
1982-1985	2,828	45.9 (42.8, 49.1)	3.22 [2.5-4.2]
1986-1990	4,430	50.3 (47.7, 52.8)	1.76 [1.4-2.3]
1991-2000	16,566	69.9 (67.9, 72.0)	1.00
Age at diagnosis (1991-2000)			
0-49 years	131	76.6 (65.2, 85.1)	0.40 [0.3-0.6]
50-59 years	1,421	75.4 (70.6, 79.7)	0.36 [0.3-0.4]
60-69 years	5,094	76.7 (74.0, 79.4)	0.34 [0.3-0.4]
70-79 years	6,857	68.3 (64.8, 71.8)	0.55 [0.5-0.6]
80 years and over	3,063	51.4 (43.0, 60.7)	1.00

Incidence data from 1982-2000 unless otherwise specified, with mortality followup to 2002. Relative risk for period of diagnosis is adjusted for age group.
Data Source: Queensland Cancer Registry.

Figure 24 shows the relative survival for prostate cancer patients in Queensland by the number of years after diagnosis. Survival decreases fairly steadily as time after diagnosis increases, with a possible levelling off after about 13 years.

Figure 25 shows the same graph split up by year period of diagnosis. This clearly shows the improvement in relative survival for men diagnosed in the 1990s compared to men diagnosed during the 1980s.

Figure 24: Relative survival from prostate cancer by years after diagnosis, Queensland, 1982-2000
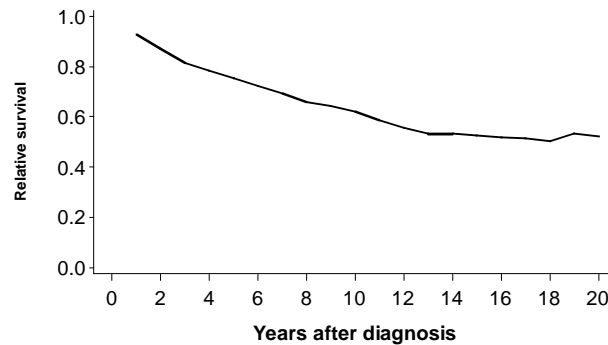
Data Source: Queensland Cancer Registry

Figure 25: Relative survival for prostate cancer by period of diagonsis, Queensland, 1982-2000
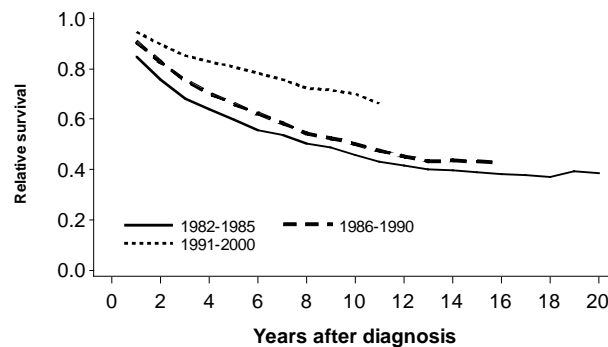
Data Source: Queensland Cancer Registry

3.2   How does survival from prostate cancer compare with other cancers?

We compared the relative survival of those common cancers (i.e. more than 1250 cases) diagnosed between 1982 and 2000. Men diagnosed with prostate cancer have one of the higher relative survival rates (after 5 and 15 years) of all the major cancers (Figure 26).

Figure 26: Relative survival estimates (%) by cancer type for males in Queensland (1982-2000)

(a) 5-year relative survival
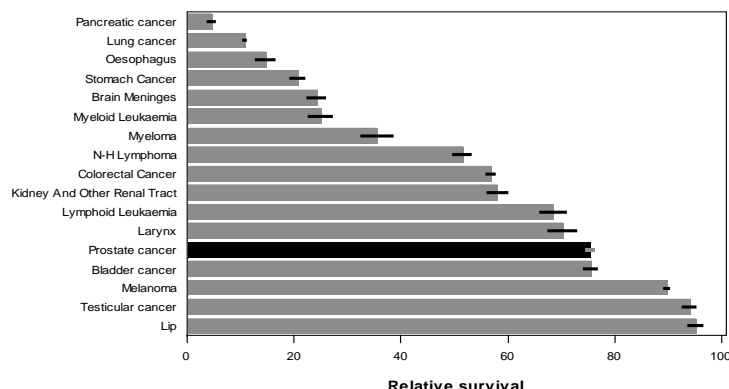
Cancer	5-year relative survival
Pancreatic cancer	4.5 (3.7, 5.4)
Lung cancer	10.7 (10.2, 11.2)
Oesophagus	14.6 (12.8, 16.5)
Stomach Cancer	20.5 (19.1, 22.1)
Brain Meninges	24.2 (22.4, 26.1)
Myeloid Leukaemia	24.8 (22.6, 27.2)
Myeloma	35.5 (32.5, 38.6)
N-H Lymphoma	51.5 (49.7, 53.3)
Colorectal Cancer	56.8 (55.9, 57.8)
Kidney cancer	58.0 (56.0, 60.0)
Lymphoid Leukaemia	68.5 (65.9, 71.0)
Larynx	70.2 (67.5, 72.9)
Prostate cancer	75.3 (74.4, 76.2)
Bladder cancer	75.5 (74.0, 76.9)
Melanoma	89.7 (89.0, 90.4)
Testicular cancer	93.9 (92.4, 95.2)
Lip cancer	95.2 (93.6, 96.7)

Data source: Queensland Cancer Registry
Horizontal lines represent 95% confidence intervals

(b) 15-year relative survival
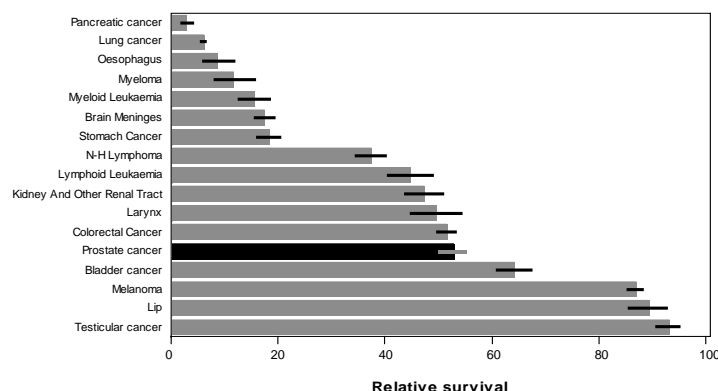
Cancer	15-year relative survival
Pancreatic cancer	2.8 (1.7, 4.3)
Lung cancer	6.0 (5.4, 6.7)
Oesophagus	8.7 (5.9, 12.1)
Myeloma	11.5 (8.0, 15.9)
Myeloid Leukaemia	15.4 (12.5, 18.7)
Brain Meninges	17.5 (15.5, 19.6)
Stomach Cancer	18.2 (15.9, 20.7)
N-H Lymphoma	37.3 (34.4, 40.4)
Lymphoid Leukaemia	44.8 (40.4, 49.2)
Kidney cancer	47.3 (43.6, 51.0)
Larynx	49.5 (44.6, 54.5)
Colorectal Cancer	51.4 (49.6, 53.4)
Prostate cancer	52.8 (50.1, 55.5)
Bladder cancer	64.1 (60.8, 67.5)
Melanoma	86.9 (85.3, 88.4)
Lip	89.3 (85.4, 93.0)
Testicular cancer	93.0 (90.5, 95.2)

Data source: Queensland Cancer Registry
Horizontal lines represent 95% confidence intervals

The relative survival rate for prostate cancer after 5 years was 75.3%. This is much higher than for cancers such as pancreatic cancer (4.5%), lung cancer (10.7%) and oesophageal cancer (14.6%), but lower than that for melanoma (89.7%), testicular cancer (93.9%) and lip cancer (95.2%).

Similar patterns held when comparing the 15 year relative survival estimates for cancers diagnosed between 1982 and 2000. The survival for most cancers was substantially lower when following patients for the longer time interval. However cancers with very good survival, such as melanoma, lip and testicular cancer tended to retain that very high relative survival even after 15 years. Similarly cancers with very low survival after 5 years also had the lowest survival after 15 years. After adjusting for the general population mortality, about half of prostate cancer patients (52.8%) were alive after 15 years.

3.3   Is survival from prostate cancer different in other countries?

In the USA the 5-year relative survival rate for 1995-2000 was 99.3% [6]. This has increased from 70% for prostate cancers diagnosed between 1975-1979.

This value of 99.3% for the United States is much higher than that for Queensland of 81% for the cancers diagnosed between 1996 and 2000[43]. As noted earlier, the introduction of PSA testing in the USA was earlier than Queensland and Australia, so it is possible that the higher survival in the USA is partly due to a higher proportion of earlier or latent cancers being diagnosed.

The 5-year relative survival for prostate cancers diagnosed in England and Wales during 1993-1995 was 60%, which represents an increase of about 30 percentage points since the early 1970s. [44] However it has been suggested that a large part of that apparent increase in survival would simply be a result of earlier diagnosis of cases (through the increasing uptake of PSA testing), with no actual lengthening of life[45].

International differences in survival are very difficult to interpret, and there are many possible explanations for the observed differences, apart from there being a real difference in survival from prostate cancer. These explanations are discussed further in Appendix B.

4   Are the patterns of prostate cancer different within Queensland? (Geographical differentials)

4.1   Remoteness

Although there was no evidence of a significant trend in prostate cancer incidence with remoteness (Figure 27), there was significant evidence that the incidence of prostate cancer was different across the four categories of remoteness (based on ARIA plus).

After taking age differences into account, the incidence rate of prostate cancer between 1998 to 2002 in remote areas was about 20% lower than the incidence rate in Major cities. There was a slight increase in Inner regional areas (6% higher than Major cities) and no incidence differential in Outer regional areas.

Major city | Inner Regional
Outer Regional | Remote
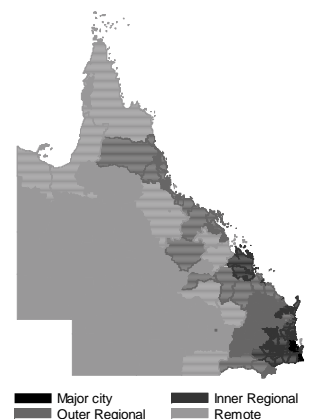
Figure 27: Remoteness differences in prostate cancer incidence in Queensland (1998-2002)

ARIA Plus category	N [a]	Age-standardised incidence rates [b]		Relative risk of prostate cancer incidence [c, d]	
Major city	915	120.1	116.6-123.6	1.00	
Inner regional	589	127.2	122.6-131.8	1.06	1.01-1.11
Outer regional	306	121.6	115.6-127.8	1.00	0.94-1.06
Remote	36	102.9	88.4-119.1	0.83	0.71-0.97
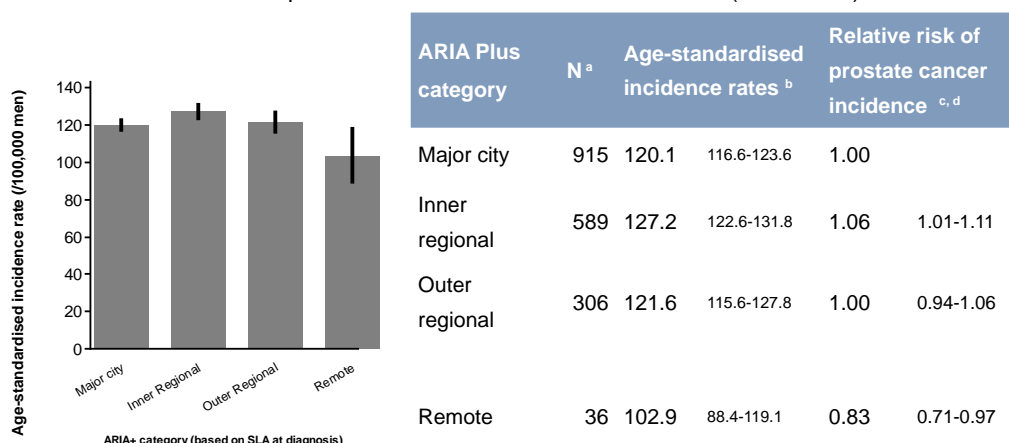
Data Source: Queensland Cancer Registry

a. Average number of new cases diagnosed per year;   b. Rates standardised by age to Australian 2001 population (per 100,000 men)
c. Relative risk of incidence is adjusted for age at diagnosis, and calculated using age-adjusted Poisson regression.
d. Major city is the reference group. See methodology for details of the ARIA Plus geographical areas.
   No significant remoteness trend in incidence (chi-sq=0.188, df=1, p=0.665), however there was a remoteness differential
   (chi-sq=14.468, df=3, p=0.002)

Additional comment:

At least part of this incidence differential may be attributable to PSA testing, rather than reflecting a true difference in risk factors. A recent study found that the rates of PSA testing was higher in capital city areas in Australia compared to the rest of Australia[46]. Therefore the higher incidence in non-remote areas may be due to the increased detection of "latent" prostate cancers through PSA testing.

Figure 28: Remoteness differences in prostate cancer mortality in Queensland (1998-2002)

ARIA Plus category	N [a]	Age-standardised mortality rates [b]		Relative risk of prostate cancer mortality [c,d]	
Major city	236	34.4	32.5-36.4	1.00	
Inner regional	144	35.5	32.9-38.2	1.02	0.90-1.16
Outer regional	89	41.6	37.8-45.7	1.22	1.05-1.41
Remote	12	38.0	28.9-49.0	1.24	0.87-1.75
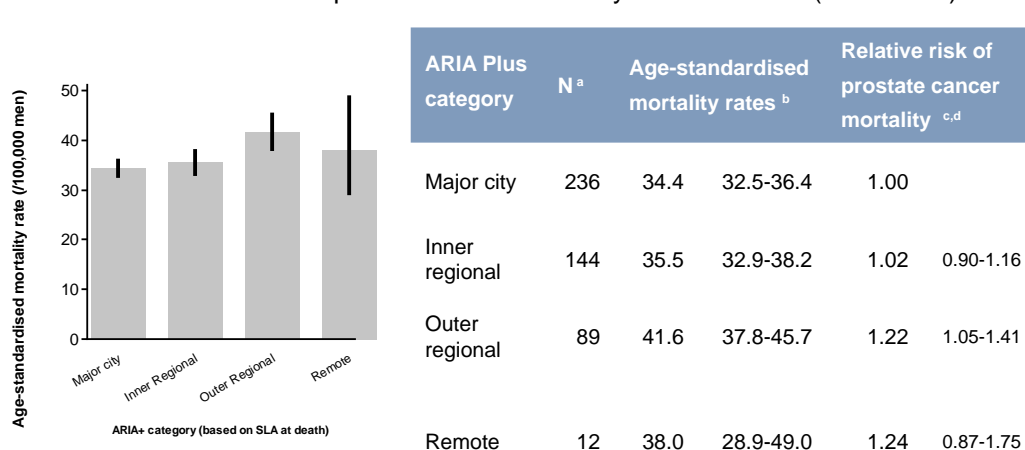
Data Source: Queensland Cancer Registry
Rates standardised to Australian 2001 population

a. Average number of deaths due to prostate cancer each year;
b. Rates standardised by age to Australian 2001 population (per 100,000 men)
c. Relative risk of mortality is adjusted for age at death, and calculated using age-adjusted Poisson regression.
d. Major city is the reference group. See methodology for details of the ARIA Plus geographical areas.
   Significant remoteness trend in mortality (chi-sq=11.395, df=1, p<0.001).

There was a significant increasing trend in prostate cancer mortality as areas became more remote (Figure 28). Assessing geographical differences in mortality is particularly difficult due to the small numbers of deaths in the more remote areas (and the resulting wide confidence intervals).

As can be seen in Figure 29, the 10-year survival from prostate cancer in Queensland among men diagnosed between 1991-2000 generally increased with increasing accessibility of where they lived when diagnosed.

The 10-year relative survival proportion for men diagnosed in major cities and inner regional areas was just over 70%, while the corresponding estimate for men living in outer regional and remote areas was around 60%.

After adjusting for age at diagnosis, the relative excess risk (RER) for men diagnosed in remote areas was about twice (RER=1.94 95% CI=1.5-2.5) that for men who were diagnosed while living in major cities.

Figure 29: Ten-year relative survival estimates for prostate cancer by remoteness of residence (at time of diagnosis), Queensland, 1991-2000

ARIA Plus category	Relative survival [95% CI]		Excess risk [a,c] [95% CI]	
Major city	71.7	[68.9, 74.5]	1.00 [b]	
Inner regional	71.1	[67.5, 74.8]	1.02	[0.9-1.1]
Outer regional	61.4	[56.2, 66.6]	1.31	[1.2-1.5]
Remote	61.3	[48.2, 74.5]	1.94	[1.5-2.5]
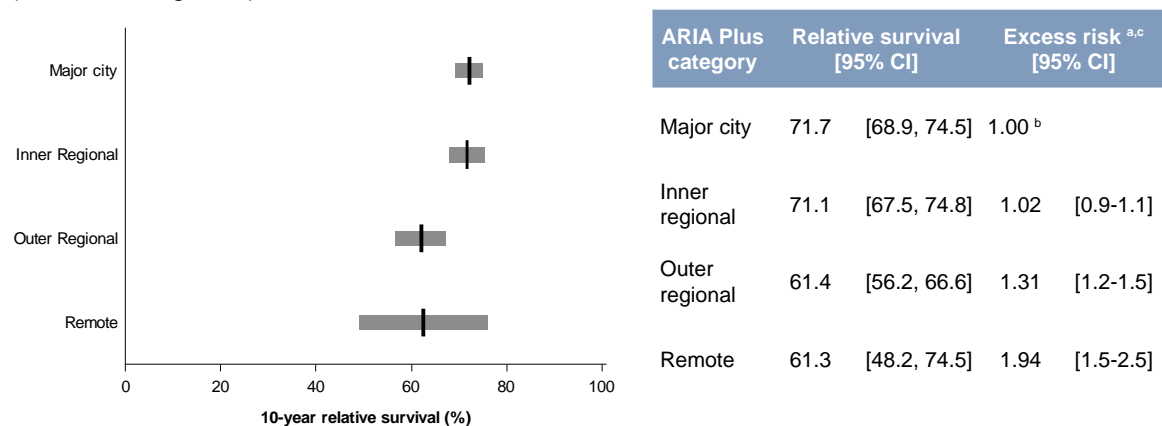
Notes:
a. Excess risk is adjusted for age at diagnosis. See methodology for specific details of analysis.
b. Major city is the reference group.
c. Significance of difference in 10-year survival by remoteness: chi-sq=36.42, df=3, p<0.001

Additional comment:

Nationally, the five year relative survival proportion for prostate cancer fell steadily with distance from capital cities [47]. The higher survival in capital cities has been attributed to the more widespread use of PSA testing by general practitioners in capital cities, which assists in diagnosing males with prostate cancer at a comparatively early state [47].

However a recent research paper[48] has found that the rates of prostatectomy were lower among men who lived in areas outside the capital cities in Australia, and this may also impact on the reduced survival in more regional areas.

Also, there was a similar differential in 10-year survival by remoteness for cancers diagnosed between 1982 and 1985, before the introduction of PSA screening as there was during and after the introduction of screening (1991-2000). This may suggest that, at least anecdotally, PSA testing is not the main contributor to this observed effect of remoteness.

4.2   Socio-economic status

Socioeconomic status (SES) is measured according to the area that men lived in when they were diagnosed with (or died from) prostate cancer.

It is possible that men who live in "disadvantaged areas" can themselves have, for example, very high income. More details about the geographic areas in each SES classification can be found in Appendix B.

Top 10%   Middle 80%   Bottom 10%

The incidence rate for prostate cancer was higher in affluent areas, and then decreased to the lowest rate for disadvantaged areas (Figure 30).

Men living in affluent areas were about 21% more likely to have a diagnosis of prostate cancer than men living in disadvantaged areas. The differential between middle and disadvantaged areas was about 7% (not significant).
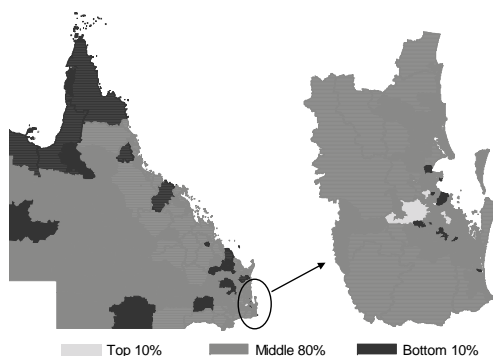
Figure 30: Socio-economic differences in prostate cancer incidence (1998-2002)
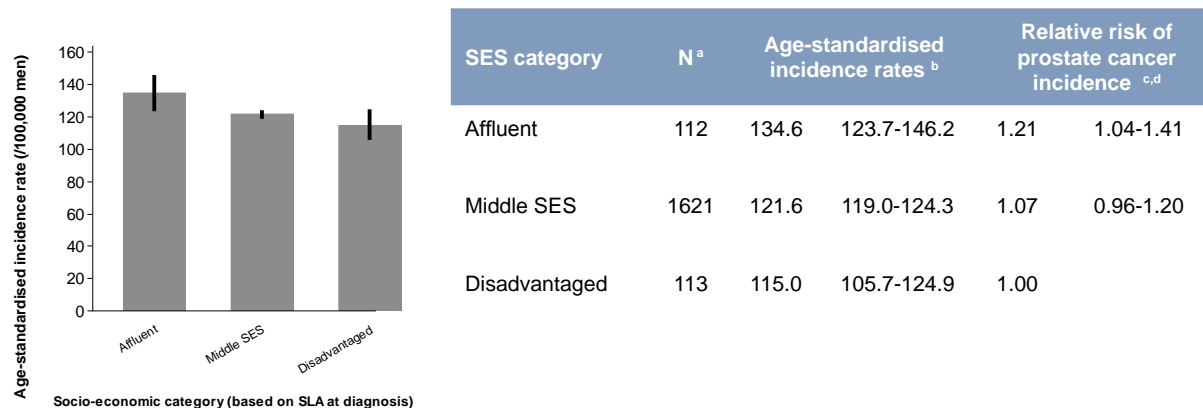
SES category	N [a]	Age-standardised incidence rates [b]		Relative risk of prostate cancer incidence [c,d]	
Affluent	112	134.6	123.7-146.2	1.21	1.04-1.41
Middle SES	1621	121.6	119.0-124.3	1.07	0.96-1.20
Disadvantaged	113	115.0	105.7-124.9	1.00	

a. Average number of new cases diagnosed per year;   b. Rates standardised by age to Australian 2001 population (per 100,000 men)
c. Relative risk of incidence is adjusted for age at diagnosis, and calculated using age-adjusted Poisson regression.
d. Disadvantaged is the reference group. See methodology for details of the SES geographical areas.
   Statistically significant trend in prostate cancer incidence by SES (chi-sq=10.0957, df=1, p=0.001).

Figure 31: Socio-economic differences in prostate cancer mortality in Queensland (1998-2002)
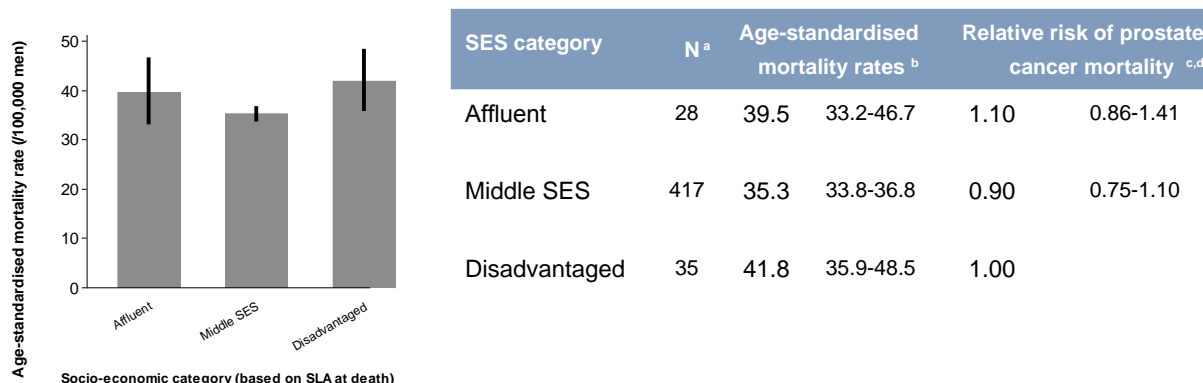
SES category	N [a]	Age-standardised mortality rates [b]		Relative risk of prostate cancer mortality [c,d]	
Affluent	28	39.5	33.2-46.7	1.10	0.86-1.41
Middle SES	417	35.3	33.8-36.8	0.90	0.75-1.10
Disadvantaged	35	41.8	35.9-48.5	1.00	

a. Average number of deaths due to prostate cancer each year;   b. Rates standardised by age to Australian 2001 population
   (per 100,000 men)
c. Relative risk of mortality is adjusted for age at death, and calculated using age-adjusted Poisson regression.
d. Disadvantaged is the reference group. See methodology for details of the SES geographical areas.
   Non-statistically significant trend in prostate cancer mortality by SES (chi-sq=1.092, df=1, p=0.295).

There was no evidence of a mortality differential among the areas of different socio-economic status (Figure 31).

Additional comment:

Even larger incidence differentials by SES were observed for the 1986-1990 period, with incidence rates being 44% and 21% higher in affluent and middle SES areas respectively compared to disadvantaged areas during that period. Therefore, it is unlikely that the SES differential in incidence is entirely due to different uptakes of PSA testing, since PSA testing was only widely introduced in the early 1990s.

However one study from the USA has demonstrated that, following the introduction of PSA testing, there has been a greater increase in prostate cancer incidence among men with high SES than those with low SES[49]. The authors suggest that this greater increase in incidence may reflect greater uptake of PSA testing among the more affluent men. It is not clear why similar patterns (i.e. increasing SES diffierential over time) are not evident for Queensland. However the USA study also found that the SES differential was greatest for localised cancers but reversed (to a smaller extent) for advanced cancers. It may be that the proportion of localised cancers is greater in the United States than in Queensland, or alternatively that the differential in uptake of PSA testing was higher in the USA regions than in Queensland.

The 10-year relative survival estimates suggest that survival of prostate cancer patients who were diagnosed while living in low SES areas was lower than men diagnosed while living in high SES areas (Figure 32).

Men diagnosed between 1991 and 2000 while living in low SES areas had an 80% greater risk of dying within 10 years than men diagnosed while living in high SES areas.

The corresponding differential for middle SES areas was 45% higher. A similar differential by SES was also reported nationally[47].

Figure 32: Ten-year relative survival estimates for prostate cancer by socio-economic status of area of residence in Queensland (at time of diagnosis). Diagnosed between 1991-2000 with survival measured to 2002.

SES category	Relative survival (95% CI)		Excess mortality risk [a,c] [95% CI]	
Affluent	81.3	[73.8, 88.5]	1.00[b]	
Middle SES	69.4	[67.2, 71.5]	1.45	[1.2-1.8]
Disadvantaged	57.8	[48.1, 67.7]	1.80	[1.3-2.4]
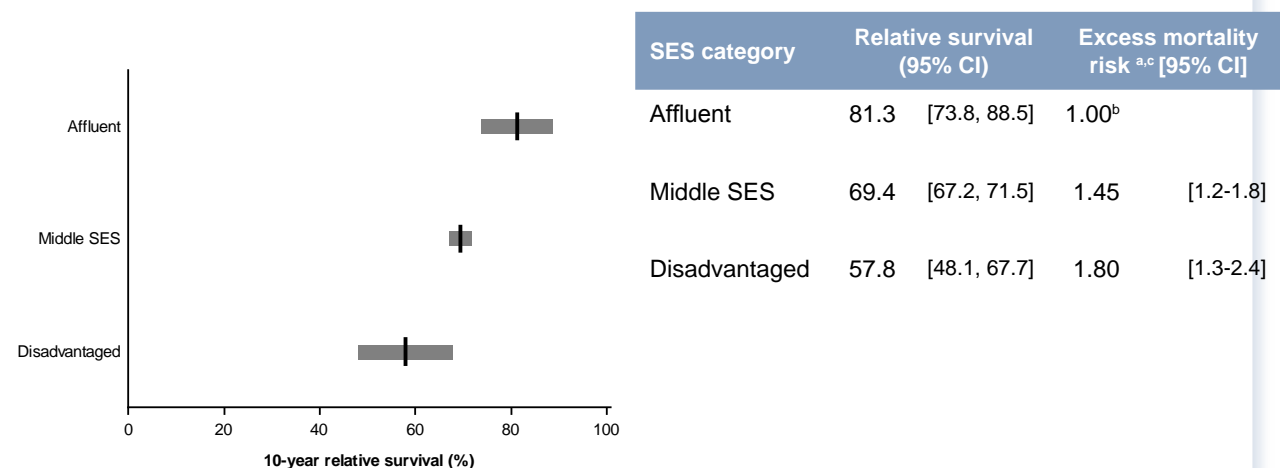
Notes:

a. Excess mortality risk is adjusted for age at diagnosis. See methodology for specific details of analysis.

b. Affluent is the reference group. See methodology for details of the geographical areas.

c. Significance of difference in 10-year survival by remoteness: chi-sq=18.08 df=2 p<0.001

> *Additional comment:*
>
> *We have found that men living in disadvantaged areas have lower incidence of prostate cancer, similar mortality, and lower survival compared to affluent areas. In the absence of stage-specific information it is only possible to hypothesise reasons for these differences, not offer definite explanations.*
>
> *Lower survival could reflect, at least in part, that although incidence is lower, the prostate cancers of men in lower SES areas are diagnosed at a later stage, and hence would have poorer survival. This would be consistent with the hypothesis that men in higher SES areas were more likely to have PSA tests [49]. The poorer survival could also be related to the higher overall mortality associated with lower SES areas [50].*
>
> *A similar gradient with socio-economic status has also been reported in England and Wales[45], in which men living in areas with lower socioeconomic status had lower survival compared to men living in areas with higher socioeconomic status.*

5 How likely am I to be diagnosed with, or die from, prostate cancer (Risk)?

There is considerable debate, within both the medical and general communities, about whether screening for prostate cancer is beneficial and whether opportunistic screening should be offered [29,51]. The current Australian position is to not recommend population based screening of asymptomatic men for prostate cancer[52-54]. However, most groups advocate that men should be able to access screening so long as they are fully informed of the potential risks and benefits of investigations and treatment. Such informed decision making should include an understanding of prostate cancer incidence and mortality providing, where possible, individualised risk estimates based on, for example, age and family history. A man's own perception of his personal risk and vulnerability to prostate cancer is a key element in the decision about whether or not to be tested [52,55-59].

A recent report[60] has used Australian data and published literature to demonstrate that the use of routine population risk statistics can be misleading in terms of personal risk, and outlines methods to make this risk information more specific to the patient. A brief overview of the findings of this study, combined with relevant data from Queensland, follows.

5.1 Population risk

The current population risk of Queensland men being diagnosed with prostate cancer before 80 years of age is 134 per 1,000 men (Table 2).

This risk clearly increases as age increases, with a diagnosis of prostate cancer being relatively rare among men in their 40s (less than 1 per 1,000).

In contrast, nearly 100 in every 1,000 80-year old men could expect to be diagnosed with prostate cancer in the next 10 years.

The population risk for Queensland men of dying from prostate cancer before 80 years of age is 28 per 1,000 men (Table 2).

There is a similar age differential with prostate mortality risk as there is with prostate diagnosis. Mortality from prostate cancer is relatively rare among men in their 50s (less than one in a thousand), while about 61 in every 1,000 80-year old men could expect to die from prostate cancer while in their 80s.

Table 2: Risk of diagnosis of, and mortality from, prostate cancer in Queensland – 1998 to 2002

Age Group (years)	Risk of diagnosis (per 1,000 men)	Risk of death (per 1,000 men)
<40	<0.1	<0.01
40-49	1	<0.1
50-59	11	1
60-69	44	5
70-79	78	22
80-89	98	61
0-79	134	28
50-79	133	28

5.2   Comparison of mortality risk with other causes of death

We looked at the risk of Queensland men aged 50 years dying from prostate cancer before 80 years of age, and compared this against other common causes of death (Figure 33).

The condition with the highest mortality risk among males is cardiovascular (heart) disease. The mortality risk for heart disease is about 5 times as great as for prostate cancer.

Of the cancers, prostate cancer has the third highest mortality risk, similar to that for colorectal cancer and less than half the mortality risk of lung cancer.

Figure 33: Risk of death for 50-year-old Queensland men to age 79, by leading causes of death – 1998 to 2002
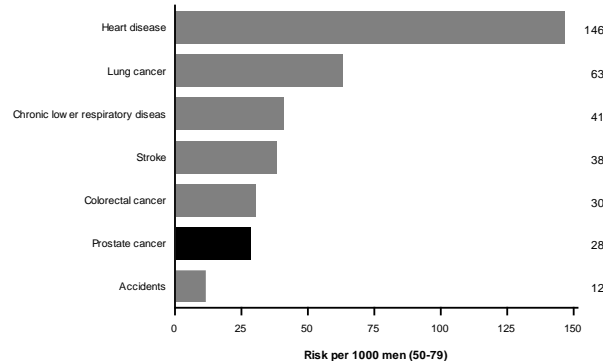
Data source: Australian Bureau of Statistics

5.3   Limitations of population risk estimates

Population risk estimates are typically used in educational and media activities to inform the public. However these risk estimates need to be interpreted with some caution for the following reasons:

1. The population risks generally vary depending on the age range examined. For example, a 60 year old man will not really be interested in his risk from birth to 79 years, he would be more interested in his future risk from 60 to 79 years.

2. The population risks are based on the general population as a whole, and assume that every man living in Australia has the same risk as every other man in Australia. For prostate cancer, and most other conditions, this is not the case. Each man's individual scenario (for example family history, age) needs to be taken into account when they are trying to assess their own risk.

> *Additional comments:*
>
> *Some factors are known to increase a man's risk of developing prostate cancer: these are African origin, older age and a family history of prostate cancer [20,29,61,62].*
>
> *The wide international variability in incidence rates of prostate cancer, with nearly an 8-fold difference in prostate cancer incidence rates between Japan and Australia, [12] suggests there may also be environmental or dietary exposures that influence an individual's risk of prostate cancer [14]. Also, even with very low incidence rates of prostate cancer among Japanese nationals, studies of Japanese migrants to the United States have shown that after two generations incidence rates of prostate cancer approach the overall United States rates [14]. As yet the factors involved, and the level to which those factors affect an individual's risk, are unclear [20,63].*
>
> *We already know that some men are at greater risk of certain conditions because they are exposed to established risk factors for that disease. An example of this is lung cancer. Since about 90% of lung cancer deaths are due to smoking [64], a non-smoker should interpret the high risk of lung cancer in Figure 33 differently to a smoker. In addition, if a non-smoking male had a family history of prostate cancer then that would increase his risk of prostate cancer, while reducing his risk of lung cancer.*

3. As well as not differentiating between men at different levels of risk, population mortality risk estimates do not distinguish between men that already have a diagnosis of prostate cancer and men who haven't yet been diagnosed. This is addressed in the next section (5.4).

4. Population risk estimates relate to diagnosed prostate cancer only. This means that some men who actually have prostate cancer may not be diagnosed, and other men may be diagnosed with a prostate cancer that is not going to progress further to cause any symptoms. Unfortunately at the moment it is not possible to tell the difference between the various types of prostate cancers.

> *Additional comment:*
>
> *Results of an autopsy study suggest that significant proportions of men have histological prostate cancer, even though it may not have caused symptoms or death [5]. It is likely that with the advent of PSA testing, some of these latent prostate cancers are now being diagnosed. This may have implications for assessing the true population risk. The challenge is to distinguish between those patients who have these latent cancers and those men whose prostate cancer has potential to cause mortality. To date, molecular markers have failed to provide sufficiently reliable predictive information to influence decision-making[65], and therefore enable accurate risk calculations.*

5.4   Risk of dying after being diagnosed with prostate cancer

For men diagnosed with prostate cancer, the risk of dying from the disease depends on the stage, or how serious it was, when diagnosed. Although Queensland information about stage is not routinely collected, we can use data from the United States as an example. There, the 5-year relative survival rates for men diagnosed with localised or regional prostate cancer is almost 100%, while it reduces to about 33% if their prostate cancers were diagnosed when distant metastases were present[6].

> *Additional comment:*
>
> *In the United States the majority of men diagnosed with prostate cancer have non-palpable disease and undergo a biopsy because of an elevated PSA level.[32] It is not clear how the United States data can be generalised to Australia (where stage-specific information is not routinely collected). However, survival and mortality risks are strongly associated with how far the prostate cancer has progressed.*

We have shown earlier (Table 1) that 10-year survival from prostate cancer depends on age of the patient, reducing from 75% for men diagnosed in their 50s to 68% for men diagnosed in their 70s. Similar age differentials in prostate cancer survival have been reported nationally. Five-year relative survival estimates for prostate cancer in Australia (1982-1997) range from 78% for men diagnosed in their 50s to 73% for men diagnosed in their 70s[66].

A man's life expectancy also influences his risk of dying from prostate cancer once diagnosed. The outlook for men diagnosed in their 50s needs to include the greater life expectancy they can generally look forward to compared to men diagnosed in their 70s.

The study by Baade et al [67] found that of 100 men diagnosed in their 50s, about 30 would have died from their prostate cancer within 10 years, while an additional 8 would have died from other causes within the same time period. For the same number of men diagnosed in their 70s, slightly more men (about 40) would have died from their prostate cancer within 10 years. However 29 of those men would have died from other causes within 10 years, or nearly 4 times as many than for men diagnosed in their 50s.

> *Additional comment:*
>
> *Another way of presenting this [67] is to consider the expected proportions of men still alive at 80 years of age (which is close to the current life expectancy of Australian men at birth [68]). By extrapolating the observed cause-specific survival curves (using exponential regression), the authors estimated the proportion of men expected to be still alive up to 30 years after diagnosis. Of men diagnosed in their 50s, the 30 year survival was 0.40, so about three-fifths (60%) of men diagnosed at 50 years of age could be expected to die a premature death from prostate cancer (ie. before reaching 80 years). Of men diagnosed in their 70s, the 10 year cause-specific survival was 0.62. Therefore about 38% of men diagnosed at 70 years of age could be expected to die a premature death caused by prostate cancer (compared to 60% of men diagnosed in their 50s).*

These figures highlight the observation that a diagnosis of prostate cancer is more likely to result in premature death for men diagnosed in their 50s than for men diagnosed in their 70s. This is due in part to the longer period between time of diagnosis and expected lifetime, and also the higher impact of competing causes of death as men get older.

These results suggest that the often used statement "men are more likely to die with prostate cancer than from prostate cancer" is misleading, particularly for men diagnosed at an early age.

Most men will not be interested in whether there is a one in eight risk of being diagnosed with prostate cancer, they want to know whether they are going to be that one[69]. Unfortunately, until there is better knowledge about the causes and risk factors for prostate cancer, that specific information is out of our reach.

6   How common is PSA testing?

The prostate-specific antigen (or PSA) test is a blood test that checks for elevated levels of the protein "prostate-specific antigen", which is the protein secreted almost exclusively by a normal prostate gland to help nourish sperm. The PSA test was introduced into clinical practice in the 1980s [61] and is now the most commonly used test to detect prostate cancer, even though its use is widely debated[29,41,51,70-76]. The PSA test can also be used for monitoring progression and response to treatment among some patients with prostate cancer, and for the detection of unsuspected cancer in patients undergoing active treatment of the prostate for benign disease[52]. Annual PSA tests are Medicare funded for men aged 50 years and over, and men aged 40 years and over with a family history of prostate cancer, or in the monitoring of previously diagnosed prostatic disease [72,77].

One method to examine the patterns and trends in PSA testing in Australia is to examine the number of PSA tests that were claimed under Medicare.

This data suggest that there has been a consistent increase in the rate of PSA tests conducted in Queensland since 1989.

Between 1989 and 1993 there were about 135,000 PSA tests conducted in Queensland among men aged 45 years and over (Figure 34).

In comparison, between 2000 and 2004 there have been over 700,000 PSA tests for the same age group.

It is important to note that these are the number of tests, not the number of men receiving tests. These Medicare data do not include services provided free to public patients in public hospitals, to Veteran's Affairs patients and to patients offered screening as part of research activities. One study has suggested that these combined exclusions under-numerate all PSA tests by 14%[1].

Figure 34: Trends in PSA tests in Queensland among men aged 45 years and over

Note: Rates age-standardised to Australian 2001 population
Data Source: 1989 to 1993 - Smith & Armstrong (1998) MJA Vol 169 pp 17-20
        1994 to 2004 - http://www.hic.gov.au/statistics/dyn_mbs/forms/mbs_tab4.shtml
        Data represent individual episodes, and do not represent the number of males having PSA tests

Age group	Number of PSA tests		
	1989-1993	1995-1999	2000-2004
45-54	21,383	95,364	148,795
55-64	41,281	146,310	235,041
65-74	43,519	156,029	217,102
75-84	24,811	60,469	87,733
85 and over	4,560	12,615	15,928

Based on Medicare item numbers 66655, 66656, 66657, 66658, 66659

7   How many men living with prostate cancer (Prevalence)?

Although incidence is a useful measure when describing the burden of prostate cancer, it describes only the number of newly diagnosed cancers each year. Men who have been diagnosed with prostate cancer in earlier years and are still alive would not be included in incidence counts for subsequent years. Therefore prevalence estimates are particularly important for cancer support personnel or health care planners who need to know how many people are living with a diagnosis of prostate cancer at specific points of time.

The prevalence of prostate cancer represents the number of men who have had a diagnosis of prostate cancer in the past and are still alive. It is important to remember that prevalence estimates relate to diagnosed cancers only. For prostate cancer in particular this is an important distinction, since it has been noted earlier that a substantial proportion of men have undiagnosed prostate cancer.[5,79] It is also important to note that, particularly for prostate cancer, the effect of screening (using PSA testing) can diagnose prostate cancers that would not otherwise have been detected due to lack of symptoms during a man's lifetime. It has been estimated that this percentage of "latent cancers" could be between 25 and 50%[80,81]. Thus the effect of increased use of PSA testing (Section 6) could be to increase observed incidence and prevalence, without there necessarily being a corresponding increase in the underlying incidence of invasive disease.

In 2002 there were an estimated 13,688 men in Queensland who were still alive after having had a diagnosis of prostate cancer some time since 1982 (Figure 35). This represents an age-standardised 20 year prevalence in 2002 of 875/100,000 men.

Of these nearly 14,000 men with a prostate cancer diagnosis who are still alive in Queensland in 2002, nearly 90% (12,080 men) had their diagnosis within the previous 10 years and over half (55% or 7,512 men) had their diagnosis within the previous 5 years.

Based on these estimates, about 2% of all men 40 years and over living in Queensland in 2002 had a diagnosis of prostate cancer since 1982. The proportion was higher among older age groups. It is estimated that 2.3% of all men in their 60s, 5.9% of all men in their 70s, and 9.0% of men over 80 were living with a diagnosis of prostate cancer (diagnosed since 1982) in Queensland in 2002.

Additional comment:

There was a large increase in the prevalence of prostate cancer between 1990 and 1995 (Figure 35). Following this the prevalence rates have levelled off. This pattern reflects the incidence trends described earlier (Section 1). Since a sizeable proportion of prostate cancers detected by PSA screening were of asymptomatic men, this suggests that a large proportion of the increase in incidence was of localised prostate cancers with high survival. Therefore the prevalence would also increase.

Figure 35: Trends in the limited-duration prevalence of prostate cancer among males in Queensland (1992 – 2002)
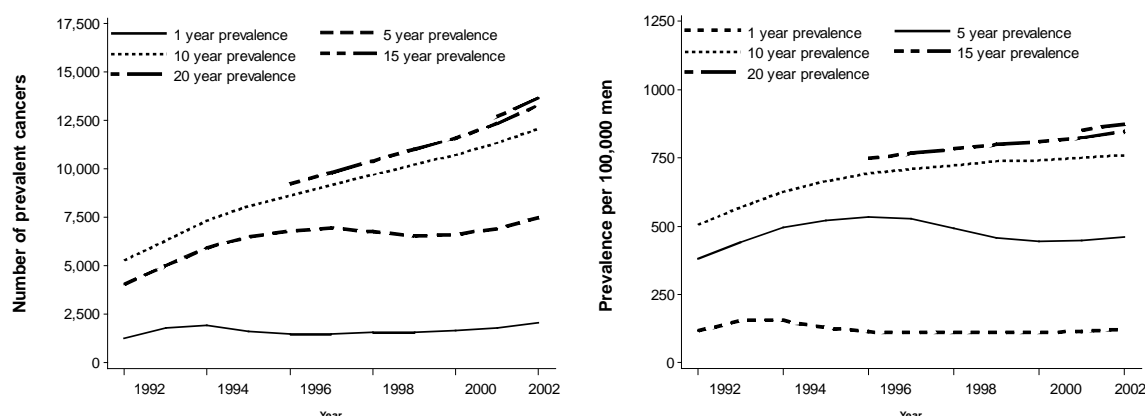
	Type of limited-duration prevalence estimate							
	5-year prevalence		**10-year prevalence**		**15-year prevalence**		**20-year prevalence**	
Year	Number	Rate /100,000	Number	Rate /100,000	Number	Rate /100,000	Number	Rate /100,000
1992	4,069	380	5,289	2504				
1993	5,024	443	6,315	569				
1994	5,955	497	7,347	626				
1995	6,507	522	8,111	664				
1996	6,809	534	8,639	692	9,250	749		
1997	6,971	527	9,170	708	9,825	767		
1998	6,774	491	9,717	723	10,414	783		
1999	6,556	459	10,263	737	11,019	800		
2000	6,630	446	10,746	742	11,606	809		
2001	6,939	447	11,363	751	12,348	824	12,707	853
2002	7,512	462	12,080	761	13,305	847	13,688	875

See Appendix B for full details of prevalence calculations. All estimates are limited duration prevalence estimates, and do not include any men diagnosed with prostate cancer before 1982, when the Queensland Cancer Registry was set up. 5-year prevalence is men alive 5-years after diagnosis, 10-year prevalence is men diagnosed in the previous 10 years who are still alive; 15-year prevalence is men diagnosed in the previous 15 years who are still alive; 20-year prevalence is men diagnosed in the previous 20 years who are still alive.

Figure 36: Most prevalent cancers among Queensland males in 2002 (20-year prevalence)

Cancer	Number of men alive
Melanoma	13,747
Prostate cancer	13,688
Colorectal cancer	8,095
Bladder cancer	3,987
Lip cancer	2,397
NHL	1,967
Lung cancer	1,927
Kidney cancer	1,813
Lymphoid Leukaemia	1,164
Stomach cancer	709
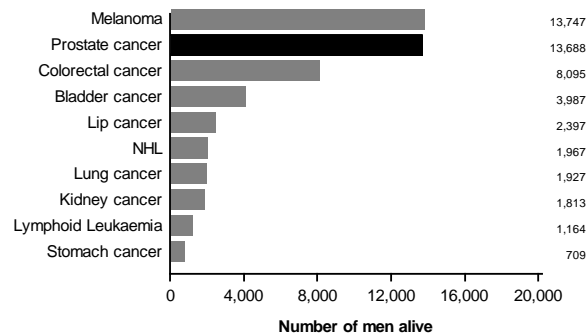
Data Source: Queensland Cancer Registry
Prevalence estimates include all those men diagnosed with cancer since 1982 who are still alive
NHL = Non-Hodgkin Lymphoma

Prostate cancer was the second most prevalent cancer behind melanoma among men in Queensland in 2002 (Figure 36) and was responsible for almost a quarter of all (20-year) prevalent cancers.

Additional comment:

Although the annual incidence of melanoma is lower than prostate cancer (Figure 1), the higher prevalence of melanoma can be mainly attributed to the higher survival of melanoma compared to prostate cancer and most other cancers.

In contrast, even though the incidence of lung cancer is about 56% that of prostate cancer (Figure 1), the estimated 20-year prevalence is only 14% that of the estimated prevalence of prostate cancer. Again this differential can be attributed to the much lower survival of lung cancer patients than prostate cancer patients.

Figure 37: Most prevalent cancers among males in Queensland (2002) by age group (20-year prevalence)

0-34 years

Cancer	Number of men alive
Melanoma	946
Testicular cancer	407
Brain cancer	253
Lymphoid Leukaemia	251
Hodgkins Disease	186

35-49 years

Cancer	Number of men alive
Melanoma	2,634
Testicular cancer	715
Lip cancer	485
Colorectal cancer	328
NHL	302

50-64 years

Cancer	Number of men alive
Melanoma	4,434
Prostate cancer	2,122
Colorectal cancer	2,017
Bladder cancer	784
Lip cancer	732

65-79 years

Cancer	Number of men alive
Prostate cancer	7,659
Melanoma	4,138
Colorectal cancer	4,068
Bladder cancer	1,996
Lung cancer	1,010

80 years and over

Cancer	Number of men alive
Prostate cancer	3,849
Colorectal cancer	1,637
Melanoma	1,595
Bladder cancer	1,014
Lip cancer	323

Data Source: Queensland Cancer Registry
NHL: Non Hodgkin Lymphoma

Prostate cancer did not rate in the top 10 prevalent cancers for men aged 50 years and under, with the most common prevalent cancer in this age group being melanoma (Figure 37).

In the 50-64 year age group, prostate cancer (with 2,122 men alive after being diagnosed with prostate cancer) was the second most prevalent cancer, behind melanoma (4,434 men).

Most men living with a diagnosis of prostate cancer are in the 65-79 year age group. In this age group prostate cancer was the most prevalent cancer among men with 7,659 men alive in 2002 with a diagnosis of prostate cancer. This was followed by melanoma (4,138 men) and colorectal cancer (4,068).

A similar pattern existed among men aged 80 years and over, with the number of men living with a diagnosis of prostate cancer (3,849 men) being over double that of the second most prevalent cancer in this age group (colorectal cancer, 1,637 men).

8   How many men with prostate cancer are treated in hospital?

Some estimates of the numbers of men treated for prostate cancer can be obtained using hospital data in Queensland.

There are four main types of treatment for prostate cancer: surgery (prostatectomy), radiation therapy, androgen therapy, and watchful waiting. Of these, surgical procedures (including prostatectomy and orchidectomy) are most commonly performed in hospitals, and data on these procedures are available from routinely collected hospital records in Queensland. However radiation and medical androgen therapies are often done in private practice or do not require admission into hospital, and so no Queensland data is available on these procedures.

Hospital data is based on the number of "separations", or discharges, from hospital. Therefore they do not represent the number of individual people in hospital, since some people might be in hospital more than once in any year.

In the 2002/03 financial year there were 3,110 hospital separations for men with a principal diagnosis of prostate cancer. The corresponding figure for the 2003/04 financial year was 4,114.

Approximately 40-45% of all hospital episodes that mention prostate cancer have prostate cancer as the principal diagnosis, or the main reason for being in hospital. Examples of the other reasons that men with prostate cancer are admitted to hospital include chemotherapy, secondary cancers of other sites, fitting and adjustment of medical devices, and other disorders of the urinary system.

Figure 38: Trends in hospital separations due to prostate cancer in Queensland
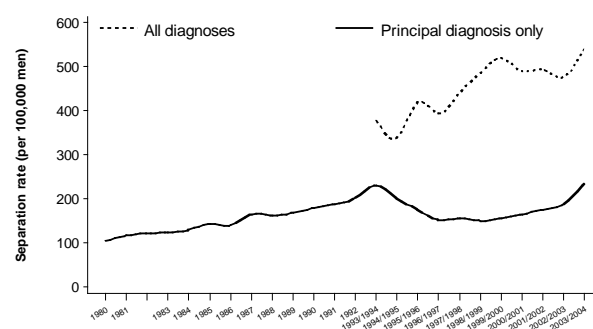
Note: Rates age-standardised to Australian 2001 population
Data Source: Queensland Hospital Admitted Patient Data Collection, Queensland Health
Data for 1982 not available, data to 1992 by calendar year, since 1993/94 by financial year
Up until 30 June 1995, Morbidity data were recorded as separations; from 1 July 1995, data were recorded as episodes of care

Figure 39: Trends in surgical procedures in Queensland hospitals for men with principal diagnosis of prostate cancer.
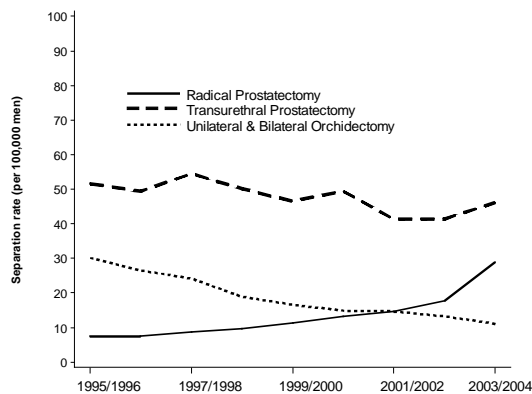
Note: Rates age-standardised to Australian 2001 population
Data Source: Queensland Hospital Admitted Patient Data Collection, Queensland Health

Figure 38 shows the trends in the hospital separation rate of men who were admitted into hospital with a principal diagnosis of prostate cancer (shown by the solid line), or with any principal diagnosis but with prostate cancer listed on the admission form (shown by the dotted line). The trends for the principal diagnosis reflect, to some extent, the trend observed for prostate cancer incidence (Section 1), although the apparent screening effect leading up to 1993/94 is not as pronounced.

Figure 39 shows the trends in selected procedures carried out in hospital among men with a principal diagnosis of prostate cancer. The transurethral prostatectomy (also called a transurethral resection of the prostate, or TURP) is a surgical procedure mainly for benign prostatic hyperplasia (BPH). This data suggests that these men are initially treated for BPH and then find out that they really have prostate cancer. It is therefore a diagnostic procedure for prostate cancer rather than a treatment procedure.

The other two main procedures are for treatment of prostate cancer. In 1995/96 there were 108 radical prostatectomies performed in Queensland hospitals, while in 2003/04 this had increased to 576. The rates of radical prostatectomy for prostate cancer patients have increased from 7.4 procedures per 100,000 male population in 1995/96 to 28.8 per 100,000 in 2003/04. Most of this increase has occurred in the last two years, with rates almost doubling from 14.7 per 100,000 males in 2001/02.

In contrast, the numbers of orchidectomies have reduced markedly, from 363 in 1995/96 to an estimated 201 in 2003/04. This is consistent with recent declines reported elsewhere.[23,83] It is also consistent with the advances in other forms of medical androgen therapy, and, based on the data from the USA, with a greater proportion of localised prostate cancers and a reduction in the advanced prostate cancers being diagnosed.

Further information
The information contained in this report was based on the latest available information at the time of publication. However data and published research is continually being updated, and so it is recommended that readers also refer to the additional sources of information in Appendix A, and seek the advice of their general practitioner.

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Appendix A: Other sources of information

Related publications

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Coory MD, Baade PD. Urban-rural differences in prostate-cancer mortality, radical prostatectomy and PSA testing in Australia. *Medical Journal of Australia 2005; 182: 112-115 (http://www.mja.com.au/public/issues/182_03_070205/coo10519_fm.pdf Accessed 27/05/2005)*

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Internet resources

These internet resources are provided as a source of additional information to complement this report. The Queensland Cancer Fund does not specifically endorse the information contained in these web sites, and it is not intended to take the place of medical advice. Much research on prostate cancer, including detection and treatment is currently under way, and information on prostate disease is constantly being updated. We encourage readers to discuss any specific issues with their general practitioner.

Lions Australian Prostate Cancer Website (www.prostatehealth.org.au)
Useful site for well men looking for information about PSA testing as well as men with a recent diagnosis of prostate cancer. (Australia)

Prostate Cancer Foundation of Australia (www.prostate.org.au)
Patient focussed website for men with prostate cancer and their families. (Australia)

U.S National Institute of Health - National Cancer Institute (http://www.cancer.gov/cancertopics/ types/prostate)
Comprehensive cancer website – this provides information on prevention through to the treatment of prostate cancer. Information for both patients and health professionals. (United States).

Continence Foundation of Australia (http://www.continence.org.au/)
General continence website which may be useful to men seeking additional assistance in managing their incontinence. The Foundation also provides a Continence Helpline 1800 330 066. (Australia)

Andrology Australia (http://www.andrologyaustralia.org/default.asp)
Male reproductive health website with information for consumers and health professionals. (Australia)

Appendix B: Methodology

B.1   Data sources

Queensland Cancer Registry: The majority of data reported in this publication was obtained from the Queensland Cancer Registry after getting Government Gazettal approval according to the *Health Act 1937.* Data was obtained in aggregated de-identified format so that no individuals could be identified from the data provided. The latest data currently available for analysis is 2002.

The Queensland Cancer Registry is a population-based cancer registry and maintains a register of all cases of cancer diagnosed in Queensland since 1982. The State Health Act legally requires details of all cancers diagnosed in Queensland to be included in the registry. Notifications are received for all persons with cancer admitted to public and private hospitals and nursing homes. Queensland pathology laboratories provide copies of pathology reports for cancer specimens. Non-melanoma skin cancers are not registered by the Queensland Cancer Registry (nor most other cancer registries), since many are treated in doctor's surgeries using destructive techniques that preclude histological confirmation. As such they are not included in the comparisons of cancer types throughout this report.

Since October 2000 the Queensland Cancer Fund has managed the processing operations of the Registry for Queensland Health. Further details of the Queensland Cancer Registry can be found in their annual report [84].

Throughout this report the definitions of cancer type are the same as that reported in the Queensland Cancer Registry annual report [84].

This report does not include any adjustment for stage or seriousness of cancer when it was diagnosed. As is the case for all cancer registries in Australia, complete staging data is not routinely collected by the Queensland Cancer Registry (although New South Wales collects a measure of degree of spread). The major implications of the absence of stage information are that we cannot differentiate between early/late diagnosis and better/worse management of the cancer as possible reasons for the observed patterns in prostate cancer.

Queensland Health

Median age at diagnosis and death. Additional data extracts for median age at diagnosis and death were provided by Queensland Health, since the original gazettal approval only included age in five year age groups. This extract of median age at death and diagnosis for all cancer types was provided by Epidemiology Services Unit, Queensland Health.

Hospital admissions and treatments in Queensland Hospitals was obtained from the Queensland Hospital Admitted Patient Data Collection. Specific aggregated data was provided from this data collection by Client Services Unit, Queensland Health. The data included patients admitted to Queensland public and private hospitals who were usual residents of Queensland. Hospital data is based on the number of "separations", or discharges, from hospital. Therefore they do not represent the number of individual people in hospital, since some people might be in hospital more than once in any year.

Up until 30 June 1995, morbidity data were recorded as separations; from 1 July 1995, data were recorded as episodes of care - if a patient received more than one type of care during their hospital stay (eg acute care followed by rehabilitation), then up until 30 June 1995 this patient would be counted as one separation, whereas from 1 July 1995 this patient would be counted as two episodes of care.

Specific ICD9CM and ICD10AM treatment codes used for this extract were:

Malignant Neoplasm of Prostate	ICD9 185, ICD9CM 185, ICD10AM C61
Radical Prostatectomy	ICD9CM 60.5, ICD10AM 37209-00, 37210-00, 37211-00
Transurethral Prostatectomy	ICD9CM 60.2, ICD10AM Block 1165
Unilateral & Bilateral Orchidectomy	ICD9CM 62.3, 62.4, ICD10AM Block 1184

Australian Bureau of Statistics: Estimated resident population data was obtained from the Australian Bureau of Statistics (ABS)[85] . This data includes estimated population counts by age group, sex, year and geographical area in Australia. Details about mortality from all causes of death were also obtained from the ABS [68]. Note that cancer mortality data is available from both the ABS and the Queensland Cancer Registry. Differences in coding practices and residential criteria can result in slight differences in the counts and rates calculated from the two data sources. These differences are generally only slight.

Australian Institute of Health and Welfare: National and inter-state cancer incidence data was provided by the Australian Institute of Health and Welfare for the period 1982-2000. Written permission was obtained from each of the state and territory cancer registries before these data could be released.

Health Insurance Commission: Data on PSA testing were obtained from the Health Insurance Commission (HIC). The figures provided include only those services that were performed by a registered provider, for services that qualify for Medicare Benefit and for which a claim has been processed by the HIC. They do not include services provided by hospital doctors to public patients in public hospitals or services that qualify for a benefit under the Department of Veterans' Affairs National Treatment Account. Queensland data was selected according to the address (at the time of claiming) of the patient to whom the service was rendered.

SEER-9 Cancer registries: The Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute is a principal source of information on cancer incidence, mortality and survival in the United States. SEER began collecting data on cases on January 1, 1973, in the states of Connecticut, Iowa, New Mexico, Utah, and Hawaii and the metropolitan areas of Detroit and San Francisco-Oakland. In 1974-1975, the metropolitan area of Atlanta and the 13-county Seattle-Puget Sound area were added. These comprise the SEER-9 cancer registries. Another five registries have since been added. The SEER Program is the only comprehensive source of population-based information in the United States that includes stage of cancer at the time of diagnosis and survival rates within each stage. Further details of the coverage, scope and data collected by the SEER registries can be found at http://seer.cancer.gov/about/.

World Health Organisation Mortality Database: Mortality and population data were extracted from the World Health Organisation (WHO) mortality database (www.who.int/whosis/mort) for the period 1979 to 2001, extracting data for the 24 countries with sufficient quantity and quality of data to estimate trends. The criteria for inclusion of countries were: averaging at least 200 deaths due to prostate cancer per year, assignment of cause of death by a medical practitioner in at least 95% of cases, and good population coverage for mortality registration. Records were selected when the death was coded to prostate cancer using the ninth and tenth revisions of the International Classification of Disease (ICD9: 185 and ICD10: C61).

B.2   Statistical measures

Incidence rate: The incidence rate for a particular event (for example a cancer diagnosis) is the number of new cancers diagnosed in a specified population during a year. In this report, rates are expressed as the number of cancers per 100,000 men. Since the risk of cancer varies with

age, it is common practice to age-standardise rates to allow for more valid comparisons between populations (see below). Incidence rates in this report have been age-standardised to the Australian Standard Population (2001), unless otherwise specified.

Mortality rate: The mortality rate is the number of deaths which had a given condition (eg prostate cancer) given as the underlying cause of death in a specified population during a year, expressed per 100,000 men. As for incidence rates, mortality rates were age-standardised to the Australian Standard Population (2001), unless otherwise specified.

Age-standardised rate: These rates are an attempt to remove any effect caused by different age structures in different (either geographical or time) populations. There are two methods of age-standardisation – direct and indirect. In this report directly standardised rates are reported. This means that the age-specific rates of the population of interest (e.g. Queensland) were applied to a standard population, which in this report was the Australian Standard Population (2001).

Annual percentage change (APC): This is the annual yearly increase or decrease in the age-standardised rates over the specified period. Negative APC values describe a decreasing trend, positive APC values describe an increasing trend. A trend is taken to be statistically significant if the 95% confidence interval does not include zero.

APC values were calculated using a statistical method called Joinpoint analysis[86,87]. This method describes changing trends (both in the direction and the magnitude of the trend) over successive segments of time. It also determines the amount of increase of decrease within each time segment. A joinpoint is the point at which the linear segment changes significantly. The analysis begins with the assumption of constant change over time (ie. no joinpoint). Up to three joinpoints were tested in each model. The final model is the simplest one (ie. the model with the least number of joinpoints) supported by the input data.

Relative risk of incidence and mortality:
Geographical differences in incidence and mortality were assessed by age-adjusted Poisson models. In each model the age-specific (incidence or mortality) counts were regressed against age group and geographical area (both as categorical variables). In the Poisson model a log-link function was used with the offset variable being the log of the age-specific population. Relative risks (incidence and mortality) were calculated by taking the exponential of the regression parameter estimate for the geographical categories, and 95% confidence intervals utilised the standard error of this estimate. Assessment of the overall effect of the geographical differences were made by calculating the difference in model deviance between the full model (including age and geographical area) and the age model alone. This difference in deviance was then compared to the chi-squared statistic with the appropriate degrees of freedom. To test for trend associations, geographical area was included in the model as a continuous variable.

Premature mortality: Premature mortality (measured by years of life lost, or YLL) is based on how much of their "expected" lifetime a person loses when they die. For example, a person who dies at 30 years of age would lose a greater number of years of (expected) life than a person who dies at 60 years of age. These calculations were carried out in accordance with the method used in the Australian burden of disease study[88], using a 3% discount rate and no age weighting. Expected lifetime was calculated using Australian mortality and population data for 2000. These results were then aggregated to produce YLL for Queensland by condition and sex. Five years of Queensland mortality data (1998-2002) were used to minimise the effects of random variation, particularly for those conditions with lower numbers of deaths. The average YLL was equal to the number of YLL for a given condition divided by the number of deaths for that condition.

Survival: In population-based survival analyses, survival time is taken to be the date of diagnosis to the date of death. However, since the eventual survival time of everyone diagnosed with a cancer is not known (for example they may still be alive), statistical adjustments are required to take into

account those unknown or "censored" survival times. In this report, relative survival is used to estimate survival from prostate cancer.

Relative survival compares the survival of people, who have a particular cancer, with the expected survival of a comparable group from the general population, taking into account age, sex and year of diagnosis. The method does not require knowledge of the specific cause of death, only knowledge of whether the patient has died. Only those patients who are still alive are considered censored.

The other type of survival is cause-specific survival, which considers the time from diagnosis of a cancer to death from that specific cancer. All other events (i.e. still alive or dying from another condition (including other cancers)) are considered censored. The main limitation of cause-specific survival is obtaining accurate cause of death information. However this is less of a problem in Australia than in less developed countries.

Cancer registries have traditionally used relative survival in preference to cause-specific survival when presenting population-based survival estimates. Although 5-year relative survival estimates are routinely reported by cancer registries[43,47,89], for prostate cancer, based on the known natural history of prostate cancer, it is possible that 5-year survival data do not provide the full picture. For example a study in Sweden found evidence to suggest that indolent early cancers may progress into metastatic disease in the long term [36]. Therefore estimates for longer-term survival are also presented in this report. Further details about cancer survival estimates in Queensland can be found in a recent survival publication[43].

Relative survival estimates were generated based on a suite of SAS®[90] programs[91]. The programs use a life table (or actuarial) method for calculating observed survival. This approach involves dividing the total period of "observation" into a series of discrete time intervals. The survival proportion was then calculated for each of these intervals, and these were multiplied together to get the observed survival estimate. Expected survival (based on total Queensland mortality) was calculated using the Ederer II method[92]. Relative survival is then obtained from the ratio of observed survival to expected survival, and presented with the corresponding 95% confidence intervals.

Excess risk of mortality: Modelling of the relative survival estimates used a generalised linear model using exact survival times and a Poisson assumption (with logarithmic link and offset)[93], including adjustments for age and sex where applicable. Differences in survival were expressed in terms of excess mortality (along with 95% confidence intervals). Excess risk of mortality was based on survival estimates up to (and including) 10-year survival. This longer-term mortality risk was based on the known natural history of prostate cancer, where a recent study in Sweden suggested indolent early cancers may progress into metastatic disease in the long term [36].

Note that geographical differences in excess risk of mortality are based on the place of diagnosis, not the place of death.

Interpreting survival differentials: There are a number of reasons that could explain differences or changes in survival for prostate cancer. These can relate to differences in the availability and effectiveness of medical care, including

> Improved treatment
> Improved supportive or general medical care
> Earlier detection of cancers with effective treatment
> Public education about screening programs and self-examination
> Effect of changing mortality patterns from other causes of death
> Increased referral speed
> More effective investigation and staging of disease [6,47].

However, there are other statistical reasons that may results in artificially improved cancer survival times. For prostate cancer, two of these are particularly relevant. The first is detecting cancer

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(among men without symptoms) that may not have progressed further and would not have caused death. As noted previously, a substantial proportion of men have undiagnosed prostate cancer when they died of other causes. Therefore if these men had been diagnosed earlier through say, PSA testing, they would have contributed to increased survival estimates without having actually increased survival from their cancer. The other method of artificially increasing survival is through lead time bias.

The concept of lead time bias relates to cancers being diagnosed earlier without resulting in a longer life for the patient. Consider the scenarios shown in the diagram on the right. Person A is diagnosed with prostate cancer when the symptoms appear, then after a period of survival, succumbs to the disease. Person B is diagnosed with prostate cancer before symptoms appear (probably through PSA testing), have a longer period of survival, and then dies from prostate cancer.

However, even though the measured survival time is longer for Person B, he does not live any longer than Person A. Person B has probably not benefited by the earlier detection of the prostate cancer, since he lived longer knowing that he had the cancer, without living longer overall. The difference in survival times for person A and person B is known as the lead time. Now consider Person C. His prostate cancer is detected at the same time as person B, but his actual life is longer than both A and B, possibly due to some form of effective treatment. Therefore, compared to person B, person C had a true increase in survival.
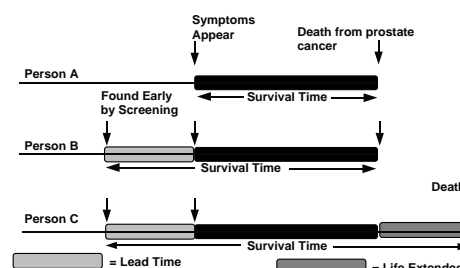
Period versus cohort approach for calculating survival: In this report, relative survival estimates have been calculated using the cohort approach. This choice was made to maintain consistency with the recently released cancer survival in Queensland publication[43]. However it will generate different survival estimates to the period approach which is being progressively implemented by some cancer registries[94].

Evaluations of the two approaches suggest that the cohort method under-estimates longer-term survival by about 10% compared to the period method, although there is substantial variation in this estimate for specific cancers, with this variation being particularly high for long-term survival of prostate cancer[95]. On the other hand, differences between the two methods are much smaller when considering shorter-term survival, and the precision tends to be less for the period-based approach due to the smaller numbers available for analysis.

Prevalence: Although incidence is a useful measure when describing the burden of prostate cancer, it describes only the number of newly diagnosed cancers. Men who have been diagnosed previously (and are still alive) are not included in incidence counts for subsequent years. Therefore incidence on its own has limited usefulness for health care planners or cancer support personnel who need to know how many people are living with a diagnosis of prostate cancer at specific points of time.

Prevalence is one measure that can provide this information. The prevalence of prostate cancer represents the number of men who have had a diagnosis of prostate cancer in the past and are still alive. The prevalence of a cancer is based on the combination of the number of new cancers (incidence), the length of time a person lives with a cancer following diagnosis (survival) and the number of deaths caused by that cancer (mortality). For example, two (hypothetical) types of cancer might have similar incidence, but if the first cancer has very low survival estimates and the second cancer has higher survival estimates, then the prevalence of the second cancer at any point in time will be higher than the first.

There are a number of ways of looking at prevalence. The first assumes that a case remains prevalent from the time of diagnosis until death. The second assumes there is some "time to cure" at which point a case is no longer considered prevalent. Finally, there is "limited duration" prevalence, which considers cases prevalent when they were diagnosed within a specific time period (say 10 years). Due to the difficulty of establishing a "time to cure", most reports of cancer prevalence make the first assumption (ie. no cure) or report on limited-duration prevalence.

Limited duration prevalence is used in this report. Therefore those men who were diagnosed with cancer prior to 1982 (the start of cancer recording by the Queensland Cancer Registry) are not included in the prevalence estimates. Limited-duration prevalence is reported for 5-, 10-, 15- and 20-year prevalence estimates.

B.3   Geographical areas

Statistical local areas (SLAs) were the building blocks used to create the following geographic groupings for this report. SLAs are part of the Australian Standard Geographic Classification used by the Australian Bureau of Statistics[96]. They correspond either to Local Government Areas (LGAs) or suburbs in larger LGAs. SLAs cover Queensland without gaps or overlaps. In 2002 there were 485 SLAs in Queensland with a median population of 5330 (range: 57 to 67772).

Remoteness

Categories of remoteness in Queensland were defined by the ARIA+ classification[97,98], where ARIA stands for Accessibility/Remoteness Index of Australia. The ARIA+ classification is an enhancement of the original ARIA classification, and defines remoteness on the basis of five categories: Major City, Inner regional, Outer regional, Remote and Very remote. For the purposes of this report we have combined Remote and Very remote into "Remote" category. Full details of the differences between the ARIA+, ARIA and other remoteness classifications have been described elsewhere[98].

Major city
Outer Regional
Inner Regional
Remote
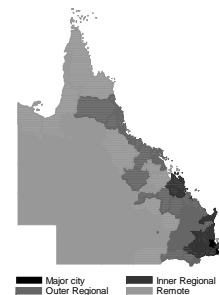
Socioeconomic Status (SES)

Although occupation is collected by the Queensland Cancer Registry, it is not reported well enough to provide an index of socio-economic status. Other standard approximations of socio-economic status (eg., income, education) are not collected. Consequently, we defined socio-economic status according to where the person lived at the time of diagnosis of the cancer.

Top 10%   Middle 80%   Bottom 10%
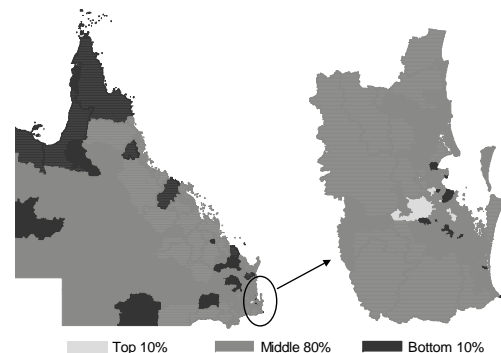
Using the Australian Bureau of Statistics (ABS) index of economic disadvantage[99], the SLAs were ranked from the most to the least disadvantaged. The ABS index is based on the percentage of people in the SLA with low income, low educational attainment or who are unemployed or employed in relatively unskilled occupations. The bottom 10% was assigned to the *disadvantaged* group, the top 10% to the *affluent* group and the middle 80% to the *intermediate* group. The middle 80% was not further subdivided because, in Queensland, many of these SLAs were not homogenous and included neighbourhoods with markedly different socio-economic characteristics.

Further details of the SES groups have been reported previously[100], with only minor changes to these published groups made to incorporate recent SLA boundary changes.

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