Australian Government
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Prostate cancer in Australia

CANCER SERIES NO. 79

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Australian Institute of Health and Welfare

Authoritative information and statistics to promote better health and wellbeing

CANCER SERIES
Number 79

Prostate cancer in Australia

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The Australian Institute of Health and Welfare is a major national agency which provides reliable, regular and relevant information and statistics on Australia's health and welfare. The Institute's mission is *authoritative information and statistics to promote better health and wellbeing*.

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Contents

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Abbreviations

AACR	Australasian Association of Cancer Registries
ABS	Australian Bureau of Statistics
ACD	Australian Cancer Database
ACHI	Australian Classification of Health Interventions
ADT	androgen deprivation therapy
AIHW	Australian Institute of Health and Welfare
ASGC	Australian Standard Geographical Classification
ASR	age standardised rate
BEACH	Bettering the Evaluation and Care of Health
DRE	digital rectal examination
GP	general practitioner
IARC	International Agency for Research on Cancer
ICD-10	International Statistical Classification of Diseases and Related Health Problems, tenth revision
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, tenth revision, Australian modification
ICD-O	International Classification of Diseases for Oncology
IRSD	index of relative socioeconomic disadvantage
MBS	Medicare Benefits Schedule
MIR	mortality-to-incidence ratio
NCCH	National Centre for Classification in Health
NDI	National Death Index
NHMD	National Hospital Morbidity Database
NHMRC	National Health and Medical Research Council
PSA	prostate-specific antigen
SACC	Standard Australian Classification of Countries
SEIFA	socioeconomic indexes for areas
SLA	statistical local area

Symbols

$	Australian dollars, unless otherwise specified
%	per cent

Summary

The effect of prostate cancer is wide reaching—affecting males diagnosed with the condition, their families and communities.

Prostate cancer in Australia is the first comprehensive national report on prostate cancer in Australia. It provides an overview of the condition, its risk factors, diagnosis and management, and key summary measures including incidence, mortality and survival. Comparisons over time and by age, selected population groups and international region are also presented.

Prostate cancer is the most commonly diagnosed cancer in Australia

There were 21,808 new cases of prostate cancer diagnosed in 2009. The age-standardised incidence of prostate cancer has increased over time, from 79 new cases per 100,000 males in 1982 to 194 per 100,000 in 2009. This increase is expected to continue, reaching 25,000 new cases per year in 2020, due to increases in the number of men presenting for testing, changes in diagnostic practices and the ageing of the population.

Mortality rates are decreasing

There were 3,294 deaths from prostate cancer recorded in 2011, making it the fourth leading cause of death among Australian males, behind coronary heart diseases, lung cancer and cerebrovascular diseases. The age-standardised mortality rate has decreased over time, from 34 deaths per 100,000 males in 1982 to 31 deaths per 100,000 in 2011. This decline is expected to continue, to 26 deaths per 100,000 males in 2020.

Survival is high and improving

In 2006–2010, around 9 in 10 (92%) males diagnosed with prostate cancer survived 5 years from diagnosis. This is higher than for all cancers among males (65%), as well as other leading cancers among males, including melanoma of the skin (89%) and lung cancer (13%). Prostate cancer 5-year survival is high and has improved from 59% in 1986 to 90% in 2007.

Expenditure on prostate cancer has increased

Health-care expenditure on prostate cancer was estimated to be $349 million in 2008–09, an increase of 23% on expenditure in 2004–05. This increase in expenditure on prostate cancer corresponds with the increase in new cases of prostate cancer identified between 2002 and 2008.

There are differences between some population groups

Aboriginal and Torres Strait Islander males were less likely to be diagnosed with prostate cancer, but similarly likely to die from prostate cancer, compared with non-Indigenous males. Males living in *Inner regional* areas were more likely to be diagnosed with prostate cancer (186 new cases per 100,000 males) and those living in *Remote/Very remote* areas were less likely (150 per 100,000), compared with males living in all other regions.

The observed differences between these population groups could be due to variations in: rates of presenting for testing, population risk profiles and population age structures.

1 Introduction

Prostate cancer is the most commonly diagnosed cancer in Australia (excluding non-melanoma skin cancers). In 2009, prostate cancer accounted for 33% of newly diagnosed cancers among males and 19% of all newly diagnosed cancers (AIHW & AACR 2012). In 2007, there were 72,582 males living who had been diagnosed with prostate cancer in the previous 5 years. The effect of prostate cancer is therefore wide reaching—affecting males diagnosed with the condition, their families and communities.

Overview

This report is the first comprehensive report on prostate cancer in Australia, and:

- provides a comprehensive overview of the most recent available national statistics on prostate cancer in Australia
- increases awareness and understanding of the burden of disease associated with prostate cancer, at a national and subpopulation level
- helps to inform service planning, resource allocation and the evaluation of prostate cancer-related programs and policies.

The report presents a broad overview of prostate cancer, its diagnosis and management and summary measures including incidence, mortality, survival and expenditure. Comparative information by age, population group, internationally and over time is presented where data are available.

Technical information—including classifications, data sources and limitations, statistical methods and technical notes—is summarised in information boxes throughout the report and in 'Appendix 1'.

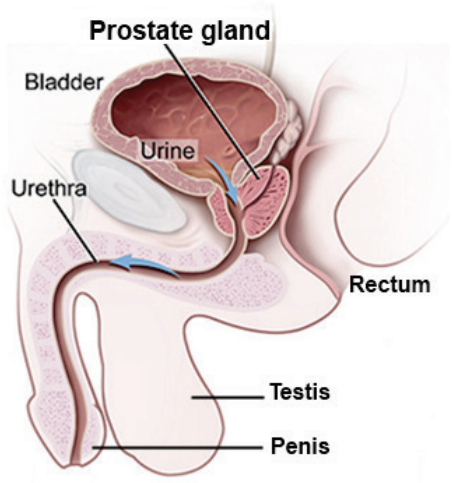
Supplementary tables to figures are available online as a companion document to this report.

For online supplementary material and general information on cancer and cancer data, see:

- <http://www.aihw.gov.au/cancer-publications>
- <http://www.aihw.gov.au/cancer>
- *Cancer in Australia: an overview 2012* (AIHW & AACR 2012).

The prostate

The prostate gland is a walnut-sized organ that surrounds the urethra at the base of the bladder and forms part of the male reproductive system (Figure 1.1). The main function of the prostate is to produce the fluid that protects and enriches sperm.



Note: Adapted from National Cancer Institute image (National Cancer Institute 2011).

Figure 1.1: Anatomy of the male genital organs

Prostate cancer

Cancer is a group of conditions in which an abnormality in cell replication causes cells to multiply in an uncontrolled manner. The resulting mass of cells is called a tumour. Cancers (tumours) are named for the tissue or organ in which they develop (site). Prostate cancer results from the uncontrolled replication of cells in the prostate.

Characteristics

Prostate (and other) tumours are further characterised based on behaviour and cell type (histology) (AIHW & AACR 2012).

The main behavioural characteristics of tumours are related to their ability to spread to other parts of the body (invasiveness).

A malignant tumour is characterised by its ability to spread to and 'invade' other parts of the body. A benign tumour will not spread, although it may interfere with nearby organs and structures in the body as it grows. Tumours that are located at the site where they first formed are called primary tumours and contain cells of that same organ or tissue. Those that have spread (metastasised) from the primary site are called secondary tumours. Although named for the organ or tissue where they are found (for example, the prostate), these secondary tumours will contain cells from the primary site (for example, the lung).

The histological characteristics of tumours are defined by the broad type of cell they involve.

A tumour that involves skin cells, internal organ tissue or lining cells is called a carcinoma, and a tumour that involves connective or supportive tissue (muscle, bone) cells is called a sarcoma. Each of these broad cellular types can further be categorised by their microscopic properties.

The main histological types of prostate cancer, categorised in consultation with the Australasian Association of Cancer Registries (AACR), are:

- carcinoma—cancer that begins in the tissue that lines the prostate gland (the epithelium)
- other specified malignant neoplasm
- unspecified malignant neoplasm.

In 2009, the most common prostate cancer histology type was 'acinar adenocarcinoma', accounting for 96% of all newly diagnosed prostate tumours (Table S1.2). For more information on prostate cancer histology coding, see (supplementary) Table S1.2.

In this report, 'prostate cancer' refers only to primary malignant tumours of the prostate: that is, those prostate cancers that first developed in the prostate (primary) and have the ability to spread to other areas of the body (malignant). It does not include benign or secondary prostate tumours.

Risk factors

A risk factor is any determinant that increases the likelihood of a person developing a health condition. Although the cause of prostate cancer is not fully understood, research suggests that age, family history, ethnicity, lifestyle and environmental factors are risk factors for developing prostate cancer (Boyle & Levin 2008; Alam et al. 2009). Having one or more risk factors does not mean a male will develop prostate cancer, and the absence of any risk factors does not protect a male from developing prostate cancer.

Age

The risk of developing prostate cancer increases with age. Males aged under 50 are rarely diagnosed with prostate cancer, while it is estimated that by age 85, 1 in 5 males will be diagnosed (Alam et al. 2009). For more information on age-specific risk of prostate cancer, see 'Chapter 3—Incidence'.

Family history

Males with a family history of prostate cancer have a higher risk of developing the disease than those with no such history (Alam et al. 2009). Males with one first-degree relative (parent, sibling or child) with prostate cancer are 2.2 to 2.8 times as likely to develop prostate cancer compared with other males (Johns & Houlston 2003). For males with two first-degree relatives with prostate cancer, the risk increases to 3.5.

Ethnicity

Males of African descent are at a greater risk of developing prostate cancer, while males from an Asian background have a lower risk (Gray & Sims 2006; Heidenreich et al. 2012). However, variation in prostate cancer diagnoses between ethnic groups may be because groups participate in screening at different rates, or may access health-care services differently (Roder 2005; Stumpers & Thomson 2009).

Lifestyle and environmental factors

Research has suggested that sexually transmissible infections and consuming diets high in calcium and processed meats may increase the risk of developing prostate cancer. However, the evidence for these factors is inconclusive (Bagnard et al. 2001; Chan et al. 2005; WCRF & AICR 2007; Alam et al. 2009; Sutcliffe 2010; Heidenreich et al. 2012; Rota et al. 2012).

2 Detection, diagnosis and management

Key findings

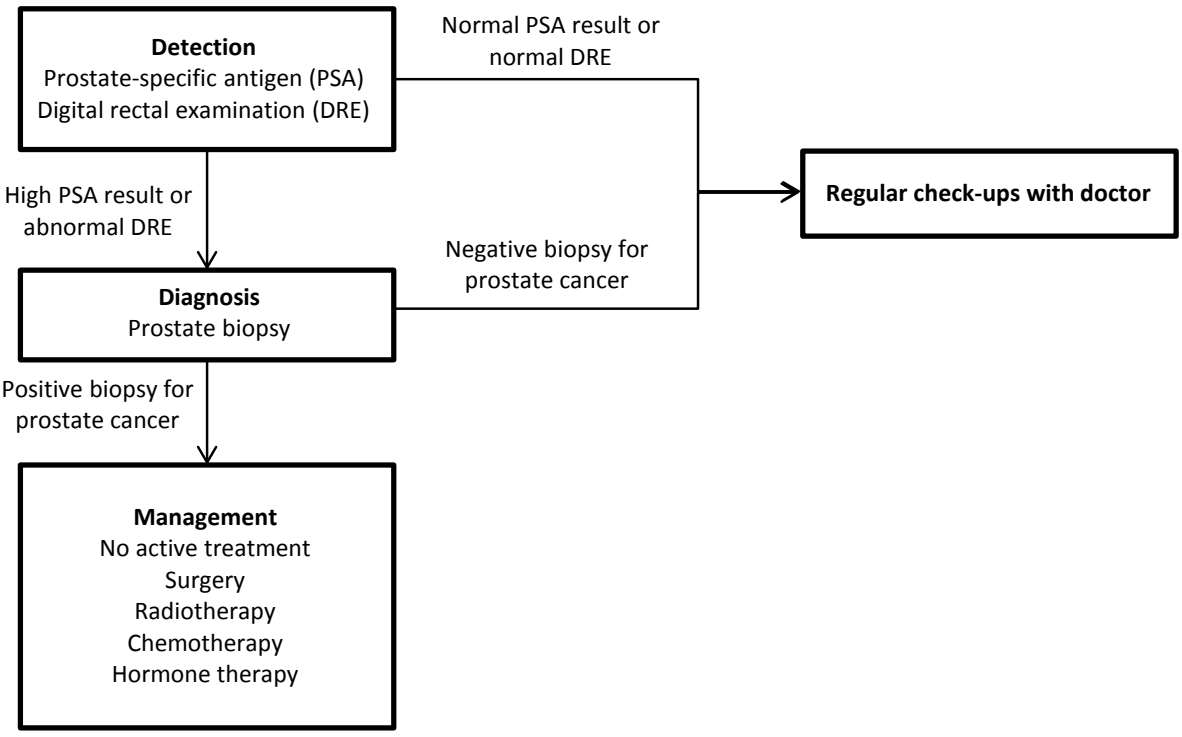
- The prostate specific antigen (PSA) test and digital rectal examination (DRE) are two common tests used by doctors to detect possible signs of prostate cancer.
  - In 2012, there were about 778,500 PSA tests performed in Australia. Eighty per cent of tests were for males aged 45–74.
  - In 2011–12, 16,663 'biopsy of the prostate' procedures were performed in prostate cancer-related hospitalisations.
- Prostate cancer can be managed by no initial treatment, active surveillance (by a GP) or active treatment (by a specialist or in a hospital setting).
  - In 2009–10, there were an estimated 101,349 patient encounters with males where prostate cancer was managed by a GP: a rate of an estimated 37 per 10,000 encounters.
  - In 2011–12, there were 51,328 prostate cancer-related hospitalisations, accounting for 1% of all hospitalisations among males.

Detection and diagnosis

Prostate cancer often has a long asymptomatic stage. There are two common tests used by doctors to detect possible signs of prostate cancer:

- prostate-specific antigen (PSA) test
- digital rectal examination (DRE) (Figure 2.1).

Abnormal results on either of these tests indicate an increased risk of prostate cancer, but neither are diagnostic tests. A diagnosis of prostate cancer can only be made after a biopsy of the prostate. A man with a high PSA level or abnormal DRE may choose to undergo a biopsy of the prostate to confirm a diagnosis.



Source: American Urological Association 2007; Andrology Australia 2011.

Figure 2.1: Flow chart of prostate cancer detection, diagnosis and management

Prostate-specific antigen testing

PSA is a protein produced within the prostate and is quantifiable by a blood test (PSA test). PSA levels in the blood naturally increase with increasing age, and a PSA level that is higher than 'normal' for that age can be an indicator of risk of prostate cancer.

It is important to note that not all males with prostate cancer have abnormal PSA levels and that high PSA levels are not specific to prostate cancer. Inflammation and benign enlargement of the prostate can also result in elevated or high PSA levels (American Urological Association 2007; Andrology Australia 2007). For more information on PSA testing and prostate cancer, see Box 2.1 and Box 3.1.

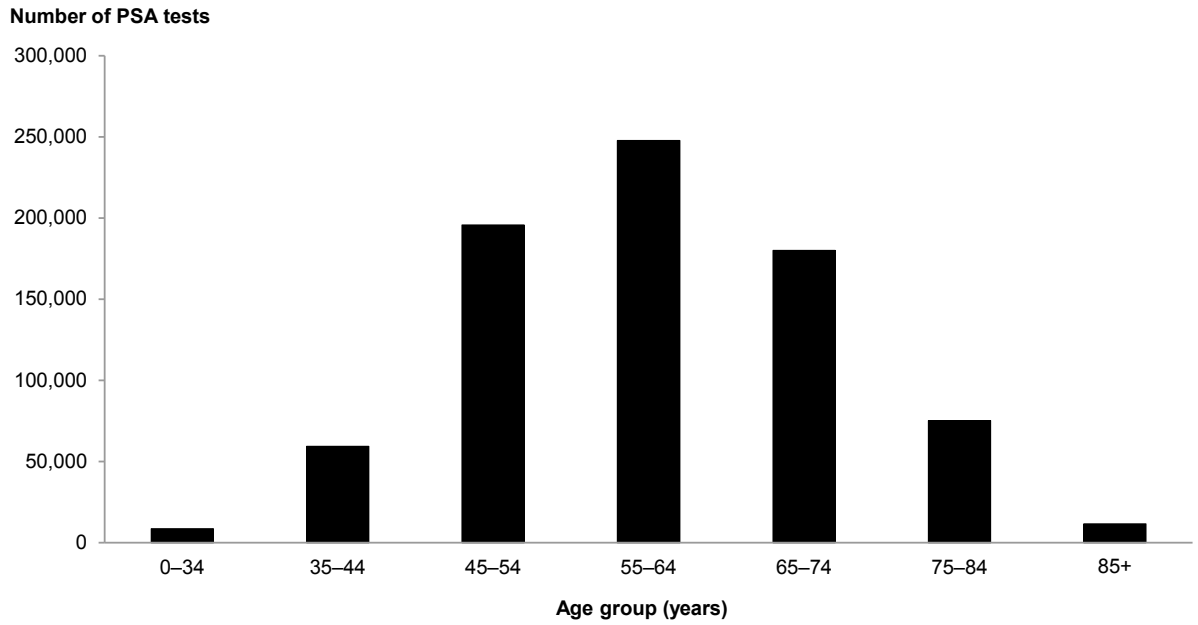
There are three main uses for the PSA test, in relation to prostate cancer:

- to estimate the risk of prostate cancer
- to assess prostate cancer stage and virulence
- to monitor the success of treatment.

The following information relates only to the first of these uses, presenting data from the 2012 Medicare Benefits Schedule (MBS) database on the number of claims for 'Item 66655—prostate specific antigen, quantification' (DoHA 2013).

The MBS database records the number of tests and demographic information on the recipients of those tests. There is no information in this data set on the results of those tests. Three other PSA-related items in this database are for the monitoring of pre-existing prostate disease or elevated PSA levels (Items 66656, 66659 and 66660).

In 2012, there were nearly 778,500 PSA tests performed in Australia and 80% of tests were for males aged 45–74 (Figure 2.2). The rate of PSA testing followed a similar pattern to the number of tests, although was highest for males aged 65–74 (with 206 tests per 1,000 males).



Note: Number of PSA tests recorded as MBS item number 66655 from 1 January to 31 December 2012, as at 1 March 2013.

Source: Medicare Australia 2013; Table S2.2.

Figure 2.2: Number of PSA tests, by age group, males, Australia, 2012

Box 2.1: Is there a screening program for prostate cancer in Australia?

The early detection and management of prostate cancer is a complex and widely debated issue and, in Australia, there is currently no population-based screening program for prostate cancer.

Cancer screening involves the use of a single test to identify individuals at risk of cancer. Population-based screening is an organised, integrated process with strict assessment criteria. In Australia, these criteria are defined in the Australian Population-based Screening Framework (APHDPC Screening Subcommittee 2008).

Based on the available evidence, prostate cancer is not currently considered a suitable candidate for a population-based screening program in Australia (NHMRC 2013).

For more information, see *Prostate-specific antigen (PSA) testing in asymptomatic men: evidence evaluation report* (NHMRC 2013).

Digital rectal examination

A DRE involves a doctor inserting a gloved finger into the rectum to feel the surface of the prostate, which is located close to the rectum wall (Figure 1.1). Irregularities such as swelling, hardening or lumps on the surface of the prostate may be signs of prostate cancer (American Urological Association 2007; Andrology Australia 2011). Although not all prostate tumours are palpable (able to be felt), a DRE may detect prostate tumours that do not produce abnormal PSA levels and therefore would not be picked up by a PSA test alone.

There are currently no available data on the number of DRE procedures performed in Australia.

Biopsy of the prostate

A biopsy is a procedure in which a small sample of tissue is removed using a biopsy needle under ultrasound guidance. After the sample is taken, it is examined under a microscope by a pathologist to determine whether cancer cells are present (Andrology Australia 2011).

A biopsy is the only way to make a definitive prostate cancer diagnosis. A male will be referred to a doctor (usually a urologist) for a biopsy of the prostate if the results of a PSA test are high or a DRE reveals irregularities in the prostate.

The following data on 'biopsy of the prostate' procedures come from the AIHW National Hospital Morbidity Database (NHMD), and refer to biopsy procedures for admitted patients only. For more information on the NHMD, see Box 2.2.

In 2011–12, there were 16,663 'biopsy of the prostate' procedures performed in 16,469 prostate cancer-related hospitalisations. This equates to 32% of all prostate cancer-related hospitalisations in which at least one biopsy of the prostate procedure was performed. Three-quarters (75%) of these hospitalisations were for males aged 55–74.

Management and treatment

After a diagnosis of prostate cancer, there are a number of management and treatment options. Clinical guidelines for the management of localised prostate cancer, endorsed by the National Health and Medical Research Council (NHMRC), include:

- no initial treatment, active surveillance
- prostatectomy (removal of the prostate)
- radiotherapy (use of high energy X-rays to kill cancer cells) (NHMRC 2003).

Other treatment and management options for both localised and advanced prostate cancer include chemotherapy (use of chemicals to kill cancer cells) and hormone (androgen deprivation) therapy (ACN & APCC 2009; Cancer Council Australia 2010).

The most appropriate option to manage prostate cancer is determined for each male on an individual basis, considering factors such as life expectancy, age, general health status, the grade and stage of the prostate tumour and the impact of treatment side-effects on quality of life (Alam et al. 2009; Cancer Council Australia 2010). An overview and related data for these management options are presented in the sections below.

For more information on the management of prostate cancer in Australia, see:

- *Clinical practice guidelines: evidence-based information and recommendations for the management of localised prostate cancer* (NHMRC 2003)
- *Localised prostate cancer: a guide for men and their families* (Cancer Council Australia 2010)
- *Advanced prostate cancer: a guide for men and their families* (ACN & APCC 2009).

No initial treatment, active surveillance

No initial treatment ('watchful waiting') and active surveillance are approaches to prostate cancer management in which aggressive treatment of prostate cancer is deferred if or until

the cancer advances or symptoms develop. Males may choose to undergo regular PSA tests to monitor the progress of their cancer (surveillance). These management strategies may be suitable for those males who:

- have low-risk prostate cancer that does not pose an immediate threat to their health or life
- have a shortened life-expectancy due to age or other health conditions
- are concerned that the side effects of active treatment will reduce their quality of life more than the cancer itself (ACN & APCC 2009).

These approaches are consistent with prostate cancer being predominantly a slower growing, localised and non-fatal cancer, primarily among older males—giving rise to the statement that many more males die *with* prostate cancer than *from* prostate cancer (that is, prostate cancer does not directly contribute to their death) (Chief Medical Officer 2009). However, this is not true for all prostate cancers, particularly those that are more aggressive, are diagnosed in younger males (aged under 65), or diagnosed at an advanced stage. In these cases, more active approaches to treatment may be appropriate (ACN & APCC 2009).

General practice

It is not possible to determine the number of males with prostate cancer who have chosen to defer or forego treatment. However, it is possible to provide some information about how prostate cancer is managed in general practice more generally.

The following data come from the Bettering the Evaluation and Care of Health (BEACH) survey—a continuous cross-sectional national study of general practitioners (GPs) who report on consecutive patient encounters. The 2009–10 BEACH data set contains information on approximately 1,000 GPs and 100,000 patient encounters (Britt et al. 2010). BEACH estimates are derived from a sample survey of GPs and their encounters with patients and need to be treated with caution.

In 2009–10, there were an estimated 101,349 patient encounters with males where prostate cancer was managed by the GP, at a rate of an estimated 37 encounters per 10,000 male patient encounters.

From 1998–00 to 2009–10, the GP management rate of prostate cancer increased by 57%, from an estimated 23 to 37 per 10,000 encounters (Table 2.1). Similarly, the rate of pathology referrals for PSA tests increased significantly from an estimated 47 per 10,000 encounters in 2000–01 to an estimated 86 per 10,000 encounters in 2007–08 (Britt et al. 2009).

Table 2.1: Changes in management rates of prostate cancer, Australia 1998–00, 2006–08 and 2009–10

Prostate cancer	1998–00	2006–08	2009–10
Rate (per 10,000 encounters)	23.3	28.9	36.5
Total encounters	**203,100**	**188,300**	**101,349**

Source: Britt et al. 2009; Britt et al. 2010.

This increase in referrals may be a result of increased awareness in the community about the risks of prostate cancer and the availability of the PSA test (Chapman et al. 2010). The increase in the rate of encounters for the management of prostate cancer in the past decade may be indicative of both the increased number of PSA tests and of cases of prostate cancer diagnosed (see 'Chapter 3—Incidence').

Active treatment

Active or aggressive treatments for prostate cancer are those management options that seek to cure, slow or stop tumour growth, or reduce symptoms associated with prostate cancer.

Common active treatment options include androgen deprivation therapy (ADT), prostatectomy, radiotherapy and chemotherapy. The data within this section (with the exception of ADT) come from the NHMD 2011–12 (Box 2.2).

Box 2.2: Interpreting prostate cancer hospitalisations

The AIHW National Hospital Morbidity Database

The NHMD 2011–12, is a comprehensive data set containing records for all episodes of admitted patient care from public and private hospitals in Australia during 2011–12. Admitted patients are those who undergo a hospital's formal admission process (AIHW 2013).

A hospitalisation (also known as a 'separation') refers to either an episode of care beginning with admission and ending with discharge, transfer or death, or one that is defined by a change in care type, such as from acute care to rehabilitation. Hospitalisations (or separations) refer to admitted patients only.

The data in the NHMD do not refer to individuals. An individual may be captured in the database multiple times in 1 year for each episode of care they receive as an admitted patient.

Diagnosis information recorded in the NHMD is coded according to the *International statistical classification of diseases and related health problems, 10th revision, Australian modification* (ICD-10-AM) (NCCH 2010).

Procedure (intervention) information recorded in the NHMD is coded according to the Australian Classification of Health Interventions (ACHI) procedure codes (NCCH 2010).

In this report, prostate cancer-related hospitalisations are defined as those where:

- the principal diagnosis (the diagnosis that is chiefly responsible for the episode of care) is prostate cancer (ICD-10-AM code C61)
- the principal diagnosis is related to the treatment or management of cancer, and prostate cancer is recorded as an additional diagnosis (a diagnosis that coexists with the principal diagnosis or arises during the episode of care) for that hospitalisation.

For more information on the codes used to define prostate cancer related hospitalisations and procedures in this report, see Table A2.

Chemotherapy

The number and rate of prostate cancer-related chemotherapy procedures may be an under-count of actual procedures, due to the admission processes of public hospitals in New South Wales, South Australia and the Australian Capital Territory. These hospitals provide same-day chemotherapy for outpatients on a non-admitted basis. This means that patients who receive same-day chemotherapy treatment for prostate cancer in those hospitals are usually not recorded in the NHMD.

(continued)

Box 2.2 (continued): Interpreting prostate cancer hospitalisations

Palliative care

In this report, palliative care hospitalisations are defined as those where the care type is palliative care, and/or palliative care is recorded as an additional diagnosis, for admitted patients only (ICD-10-AM code Z51.5).

For more information on the NHMD, see the *National Hospital Morbidity Database Data Quality Statement: 2010–11.* <http://meteor.aihw.gov.au/content/index.phtml/itemId/511338>.

Androgen deprivation therapy

Testosterone is one of a class of male hormones called androgens. Prostate cancers use testosterone and other androgens to fuel their growth. Consequently, blocking the action of testosterone, or removing or reducing the supply, inhibits tumour growth. This form of treatment is known as ADT and is often used in conjunction with other curative treatments, for example, to reduce the size or growth of a localised tumour before surgery (prostatectomy) or radiation therapy (ACN & APCC 2009).

There are currently no national data available on the use of ADT for the treatment of prostate cancer, in Australia.

Prostate cancer-related hospitalisations

In 2011–12, there were 51,328 prostate cancer-related hospitalisations among males of all ages, at a rate of 46 hospitalisations per 10,000 males. Prostate cancer-related hospitalisations accounted for 11% of all cancer-related hospitalisations, and 1% of all hospitalisations, among males in that year.

Seventy-two per cent (36,868) of prostate cancer-related hospitalisations had a principal diagnosis of prostate cancer (Table 2.2). The remainder had a principal diagnosis related to the treatment or management of cancer with an additional diagnosis of prostate cancer. The most common of these cancer-related diagnoses was 'pharmacotherapy session for neoplasm' (Z51.1) (28%) (Box 2.2).

Table 2.2: Prostate cancer-related hospitalisations[(a)], males, 2011–12

Principal diagnosis (ICD-10-AM code)	Number	Per cent	Rate[(b)]
Prostate cancer (C61)	36,868	71.8	33.0
Prostate cancer-related[(c)]			
Pharmacotherapy session for neoplasm (Z51.1)	14,285	27.8	12.8
Other[(d)]	175	0.3	0.2
Total	**51,328**	**100.0**	**45.9**

(a) Hospitalisation for which the care type was reported as *Newborn with no qualified days* and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.

(b) Number of hospitalisations per 10,000 males, based on the 31 December 2011 preliminary rebased estimated resident population of males.

(c) The principal diagnosis is related to the management or treatment of cancer and prostate cancer is recorded as an additional diagnosis.

(d) Includes ICD-10-AM codes Z08, Z29.2, Z40, Z45.1, Z45.2, Z51.0, Z54.1 and Z54.2.

Source: AIHW National Hospital Morbidity Database 2011–12; NCCH 2010.

In 2011–12, nearly two-thirds (65%) of prostate cancer-related hospitalisations were same-day (where the patient was admitted and separated on the same day). When same-day

separations were excluded, the average length of stay was 4.8 days. This was shorter than the average for all male cancer-related hospitalisations (7.6 days) and that for all male hospitalisations (5.9 days).

In 2011–12, 1 in 5 (21%) prostate cancer-related hospitalisations were for males aged 65–69. Males aged under 45 accounted for less than 1%, males aged 45–64 accounted for 34% and those aged 70 and over accounted for 46%. The age-specific rate of prostate cancer-related hospitalisations generally increased with age: from less than 1 per 10,000 males aged under 45, to 263 per 10,000 males aged 75–79, and decreasing again among males aged 80 and over.

Procedures

Procedures are clinical interventions that are surgical in nature, carry an anaesthetic risk and require specialised training and/or special facilities or services that are only available in an acute care setting (AIHW 2013).

In 2011–12, there were 114,275 procedures performed in prostate cancer-related hospitalisations. This equates to 2.2 procedures for each prostate cancer-related hospitalisation. Almost all (97%) of prostate cancer-related hospitalisations included at least one procedure. A selection of common procedures related to the management and treatment of prostate cancer—prostatectomy, radiation and pharmacotherapy (chemotherapy)—are summarised in the following sections, and include both same-day and overnight hospitalisations.

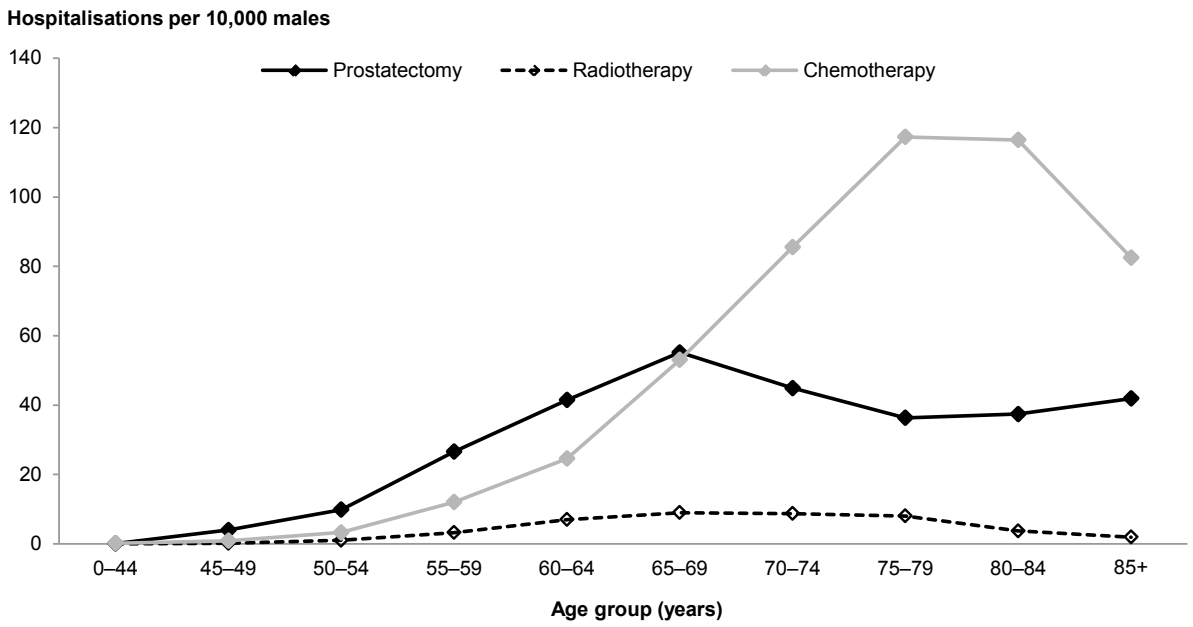
Prostatectomy

A prostatectomy is the surgical removal of all or part of the prostate. The removal of the entire prostate gland and seminal vesicles is called a radical prostatectomy. This surgery can be curative and is recommended for males who:

- have localised prostate cancer
- are fit for surgery
- have a life expectancy of greater than 10 years (NHMRC 2003).

In 2011–12, 23% of prostate cancer-related hospitalisations included at least one prostatectomy procedure: a total of 12,074 procedures. Seven in 10 (69%) were radical prostatectomies.

The age-specific rate of prostate cancer-related hospitalisations involving at least one prostatectomy procedure was 11 per 10,000 males and was highest among males aged 65–69 (55 per 10,000) (Figure 2.3).



Notes

1. Prostatectomy includes all prostate cancer-related hospitalisations (same-day and overnight) with at least one ACHI procedure code from blocks 1165, 1166 and 1167.
2. Chemotherapy includes all prostate cancer-related hospitalisations (same-day and overnight) with at least one of the following ACHI procedure codes: 96196-00, 96197-00, 96198-00, 96199-00, 96200-00, 96201-00, 96202-00, 96203-00, 96205-00, 96206-00, 96209-00.
3. Radiotherapy includes all prostate cancer-related hospitalisations (same-day and overnight) with at least one ACHI procedure code from blocks 1786, 1787, 1788, 1789, 1791, 1792, 1793, 1794, 1795, 1796, 1797, 1798 and 1799.
4. Data are expressed as age-specific rates, based on the 31 December 2011 preliminary rebased estimated resident population of males, by age group.

Source: AIHW National Hospital Morbidity Database 2011–12; NCCH 2010; Table S2.3.

Figure 2.3: Age-specific rates of prostate cancer-related hospitalisations involving prostatectomy, chemotherapy and radiotherapy, males, by age group, Australia, 2011–12

Radiotherapy

Radiotherapy uses X-rays to ablate (kill) cancer cells. There are three main forms: external beam radiotherapy (external source); brachytherapy or sealed source radiotherapy (internal implant); and systemic radioisotope or unsealed source radiotherapy (injected or ingested). As with a radical prostatectomy, radiotherapy can be curative for prostate cancer and is recommended for males who:

- have localised or locally advanced prostate cancer
- have a life expectancy of greater than 10 years (NHMRC 2003).

In 2011–12, 4% of prostate cancer-related hospitalisations included radiotherapy: a total of 2,090 procedures. Just over one-third (35%) of these procedures were same-day procedures; the remainder had at least one overnight stay.

Brachytherapy, also known as sealed source or internal radiotherapy, accounted for 62% of radiotherapy procedures in prostate cancer-related hospitalisations. Computerised planning (27%) and external beam therapy (11%) were other common radiotherapy interventions.

The age-specific rate of prostate cancer-related hospitalisations involving at least one radiotherapy procedure was 2 per 10,000 males, and was highest among males aged 65–69 and 70–74 (9 per 10,000) (Figure 2.3).

Chemotherapy

Chemotherapy uses pharmaceuticals or chemicals to kill cancer cells. Chemotherapy is not usually recommended as a treatment for localised prostate tumours, but is increasingly used to treat advanced metastatic prostate cancer (ACN & APCC 2009; Cancer Council Australia 2010).

In 2011–12, 29% of prostate cancer-related hospitalisations included chemotherapy, a total of 15,080 procedures. Almost all (96%) of these procedures were antineoplastic (anti-cancer) treatments, with the remainder (4%) including treatment with thrombolytics and other pharmacological agents.

The age-specific rate of prostate cancer-related hospitalisations involving at least one chemotherapy procedure was 13 per 10,000 males, and was highest among males aged 75–79 (117 per 10,000) (Figure 2.3).

For more information on interpreting chemotherapy hospitalisations, see Box 2.2.

Palliative care

Palliative care, sometimes referred to as 'hospice' or 'end-of-life' care, provides patients and families who face life-threatening illness with support that is aimed at improving quality of life (AIHW 2012d). This support can include pain relief and social, emotional and spiritual support and may be delivered in hospitals, hospices, at home or in residential care facilities (AIHW 2012d).

In 2011–12, palliative care was provided in 17% (8,971) of prostate cancer-related hospitalisations. For the majority (97%) of these, palliative care was the intended mode of clinical care for that hospitalisation; that is, the care type was recorded as palliative care. For the remaining 3%, palliative care was recorded as an additional diagnosis and provided as part of hospitalisations where the intended care type was acute care, rehabilitation care or other modes of care (NCCH 2010; AIHW 2012d).

3 Incidence

Key findings

- Prostate cancer is the most commonly diagnosed cancer in Australia. In 2009, there were 21,808 new prostate cancer diagnoses, accounting for 33% of new cases of cancer among males.
- Between 1982 and 2009, the age-standardised prostate cancer incidence rate increased by 144%, from 79 to 194 new cases per 100,000 males.
- It is projected that prostate cancer incidence will continue to increase, and that in 2020 there will be just over 25,000 new cases, at a rate of 164 per 100,000 males.

Overview

Prostate cancer incidence refers to the number of new cases of prostate cancer diagnosed in a given period. It does not refer to the number of males newly diagnosed, although the two numbers are likely to be similar.

Prostate cancer incidence data come from the Australian Cancer Database (ACD), which contains information on Australians diagnosed with primary, invasive cancer (excluding basal cell and squamous cell carcinomas of the skin) since 1982. The first release of national cancer incidence data for 2009 contained estimated data for NSW and the ACT (AIHW & AACR 2012). The actual 2009 incidence data have since become available for NSW and the ACT and this report uses those data instead of the estimates. Therefore, these data will differ from data on prostate cancer incidence previously published by AIHW.

For more information on these data, refer to Box 3.1, and see 'Appendix 1—AIHW data sources' and the *Australian Cancer Database 2009 Data Quality Statement* <http://meteor.aihw.gov.au/content/index.phtml/itemId/500417>.

Box 3.1: Interpreting prostate cancer incidence

Prostate cancer is a slow growing cancer with a long asymptomatic period. The number of new cases of prostate cancer can be affected by changes in the:

- detection of prostate cancer (using the PSA test)
- clinical guidelines for the diagnostic process
- underlying risk (factors) for developing prostate cancer.

The PSA test

PSA testing was introduced in 1987 and listed on the MBS in 1989, and is thought to have contributed to the peak in incidence during the early 1990s by uncovering a large pool of asymptomatic cases (Figure 3.2). Many of those cases may have remained undiagnosed until symptoms developed years later (AIHW & AACR 2010a).

Clinical guidelines

The PSA threshold at which males were referred for a prostate biopsy was lowered in 2002 and may have contributed to the peak in incidence during the mid to late 2000s (Smith et al. 2008) (Figure 3.2). Many of these males would previously have been considered 'lower risk' and their prostate cancer may have remained undetected for many years.

Risk for prostate cancer

Changes in the underlying risk profile for developing prostate cancer are more difficult to identify and quantify. Age is a known risk factor for prostate cancer and it is likely that prostate cancer incidence will increase in line with the ageing population (Figure 3.3).

In 2009, there were 21,808 new diagnoses of prostate cancer among males, accounting for 33% of all cancers diagnosed among males in that year, at a crude rate of 201 new cases per 100,000 males (Table 3.1). This was nearly 3 times as common as bowel cancer (72 per 100,000) and more than 3 times as common as melanoma of the skin (61 per 100,000).

Prostate cancer was the most commonly diagnosed cancer among all persons in 2009, accounting for 19% of all new cancers in that year, ahead of bowel (12%), breast (12%), melanoma (10%) and lung (9%) cancers (Table 3.1).

Table 3.1: The ten most commonly diagnosed cancers[(a)] among males and all persons, Australia, 2009

Males				Persons			
Cancer type (ICD-10-AM code)	**New cases**	**Crude rate[(b)]**	**Per cent[(c)]**	**Cancer type (ICD-10-AM code)**	**New cases**	**Crude rate[(b)]**	**Per cent[(c)]**
Prostate (C61)	21,808	201.2	32.9	Prostate (C61)	21,808	100.1	18.8
Bowel (C18–C20)	7,848	72.4	11.8	Bowel (C18–C20)	14,214	65.3	12.3
Melanoma (C43)	6,571	60.6	9.9	Breast (C50)	13,855	63.6	12.0
Lung (C33–C34)	6,062	55.9	9.1	Melanoma (C43)	11,264	51.7	9.7
Non-Hodgkin Lymphoma (C82–C85)	2,447	22.6	3.7	Lung (C33–C34)	10,241	47.0	8.8
Kidney (C64)	1,773	16.4	2.7	Non-Hodgkin Lymphoma (C82–C85)	4,367	20.1	3.8
Bladder (C67)	1,727	15.9	2.6	Kidney (C64)	2,762	12.7	2.4
Unknown primary site (C80)	1,386	12.8	2.1	Unknown primary site (C80)	2,696	12.4	2.3
Pancreas (C25)	1,327	12.2	2.0	Pancreas (C25)	2,567	11.8	2.2
Stomach (C16)	1,289	11.9	1.9	Bladder (C67)	2,344	10.8	2.0
Other[(d)]	*14,122*	*121.1*	*19.8*	*Other[(d)]*	*29,779*	*136.7*	*25.7*
Total	**66,360**	**612.4**	**100.0**	**Total**	**115,897**	**532.2**	**100.0**

(a) Most commonly diagnosed for males and for all persons, excluding basal and squamous cell carcinomas of the skin.

(b) Crude rates are based on the 2011 Census preliminary rebased estimated resident population for 30 June 2009 and expressed per 100,000 males.

(c) Proportion of the total for each group (males and persons).

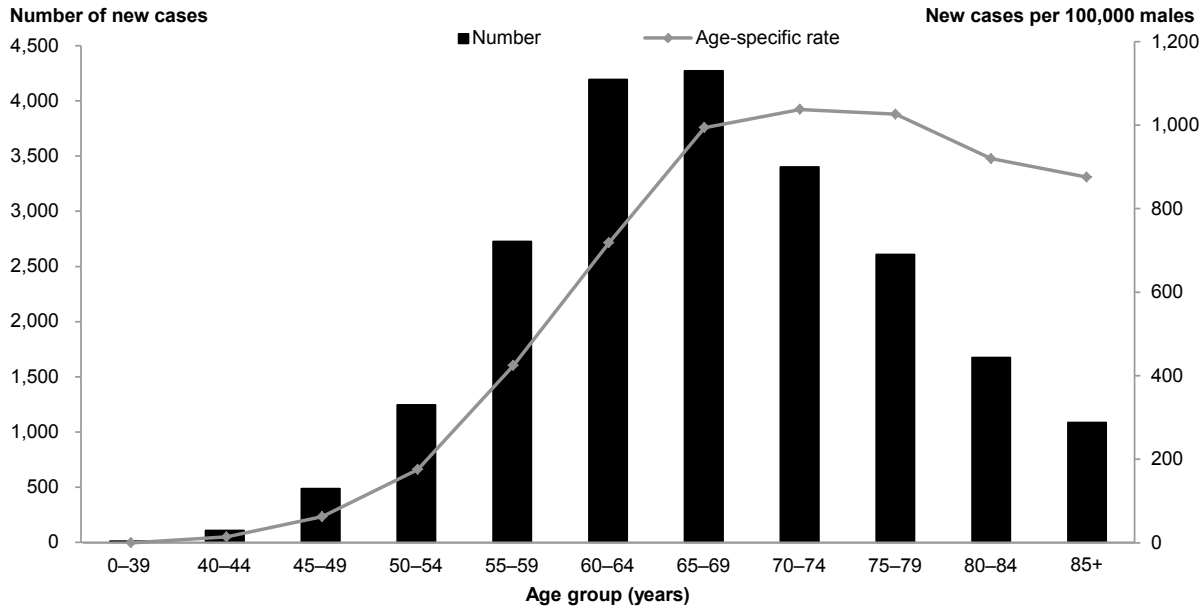
(d) Includes all other cancers not listed, but excludes basal and squamous cell carcinomas of the skin.

Source: AIHW Australian Cancer Database 2009.

Age comparison

Prostate cancer is an age-related condition. In 2009, the risk of being diagnosed with prostate cancer, increased with age: from 1 in 1,317 (less than 0.1%) before age 45, to 1 in 4 (27%) before age 85 (AIHW 2012a).

In 2009, 9 in 10 new cases of prostate cancer were diagnosed among males aged 55 and over. The number of new cases of prostate cancer increased from less than 10 cases among males aged 0–39 to nearly 4,300 cases among males aged 65–69, and then decreased again to nearly 1,100 cases among males aged 85 and over (Figure 3.1).



Note: Age-specific rates are based on the 2011 Census preliminary rebased estimated resident population for 30 June 2009 and expressed per 100,000 males.

Source: AIHW Australian Cancer Database 2009; Table S3.1.

Figure 3.1: Prostate cancer incidence (number and age-specific rate) among males, by age group, Australia, 2009

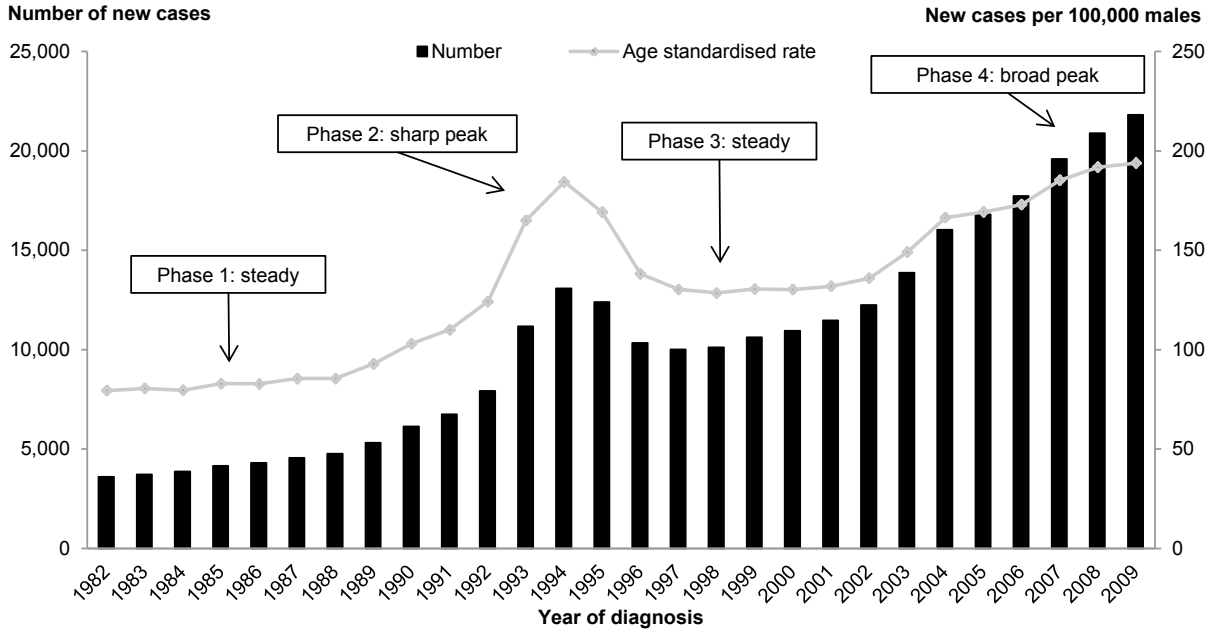
Similarly, the age-specific incidence rate (new cases per 100,000 males by age group) increased steeply from less than 1 case per 100,000 males aged 0–39 to 994 per 100,000 males aged 65–69. The incidence rate was highest among males aged 70–74 (1,037 per 100,000) and decreased to 875 per 100,000 males aged 85 and over.

Time trend

Between 1982 and 2009, there was an overall 144% increase in the incidence of prostate cancer (Figure 3.2). This increase occurred in four broad phases, with some annual fluctuation. Across this 28-year period, age-standardised prostate cancer incidence rates:

- were steady between 1982 and 1988 at around 82 new cases per 100,000 males
- increased sharply from 86 per 100,000 in 1988 to 184 per 100,000 in 1994, followed by a sharp decline to 130 per 100,000 in 1997
- were steady between 1997 and 2001, at around 130 new cases per 100,000 males
- increased from 136 per 100,000 in 2002 to 192 per 100,000 in 2008 and 194 per 100,000 in 2009.

The influence of PSA testing on the incidence of prostate cancer over time is discussed in Box 3.1.



Note: Rates are directly age-standardised to the Australian population as at 30 June 2001 and expressed per 100,000 males.

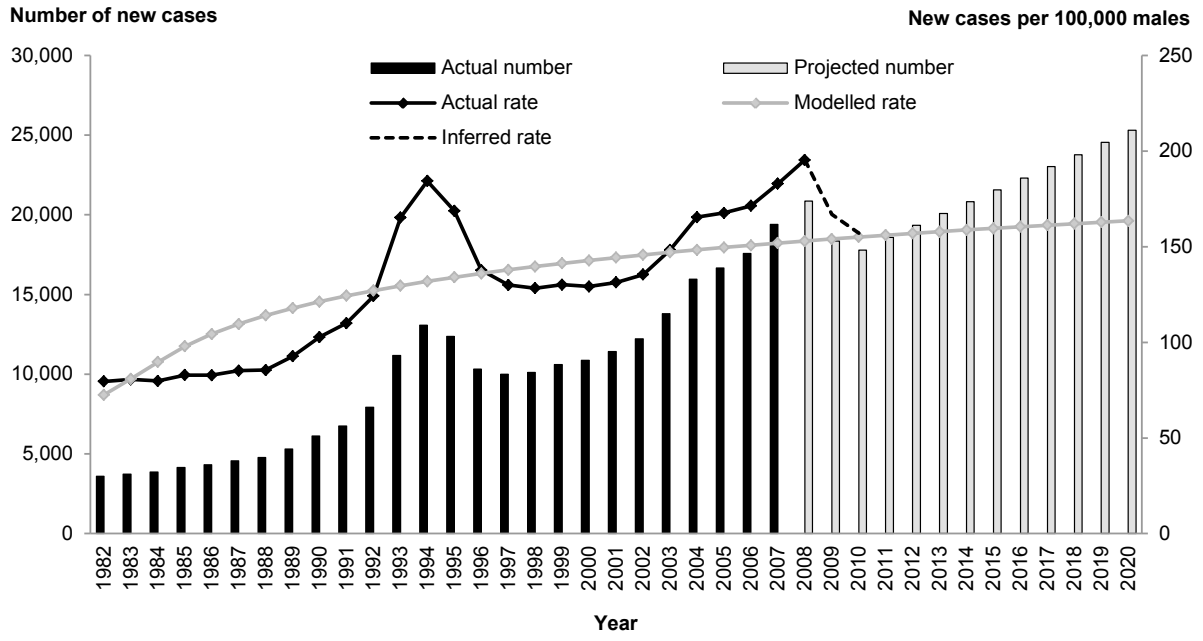
Source: AIHW Australian Cancer Database 2009; Table S3.2.

Figure 3.2: Prostate cancer incidence among males, Australia, 1982 to 2009

Projected incidence to 2020

The incidence of prostate cancer is likely to continue to increase over time (AIHW 2012b).

Logarithmic extrapolation of trend data from 1982 to 2007 suggests that the incidence of prostate cancer will continue to increase and is projected to be more than 25,300 new cases in 2020 (Figure 3.3). The modelled age-standardised incidence rate is projected to increase steadily from 156 per 100,000 in 2011 to 164 per 100,000 in 2020.



Notes

1. Data for 2011–2020 are a logarithmic extrapolation of actual incidence data for 1982 to 2007, and estimated incidence for 2008 to 2010.
2. Rates are age-standardised to the Australian population as at 30 June 2001 and expressed per 100,000 males.
3. Projections were derived by using a combination of ordinary least squares and joint point analysis. For more information, see AIHW 2012b.

Source: AIHW 2012b; Table S3.3.

Figure 3.3: Prostate cancer incidence among males, logarithmic trend, Australia: actual 1982 to 2007, inferred 2008 to 2010 and projected 2011 to 2020

4 Mortality

Key findings

- Prostate cancer is a leading cause of mortality among Australian males. In 2011, 3,294 males died from prostate cancer, making it the fourth leading cause of death for males.
- Between 1982 and 2011, the age-standardised prostate cancer mortality rate decreased overall: from 34 deaths per 100,000 males in 1982 to 31 per 100,000 in 2011.
- From 2010 to 2020, the number of deaths from prostate cancer is projected to increase to more than 3,900 per year, while the age-standardised mortality rate is projected to decrease to 26 deaths per 100,000 males.

Overview

Prostate cancer mortality refers to males who died from prostate cancer. Analysis of prostate cancer mortality data can help to measure and understand the burden of prostate cancer in the population, changes in the disease process and the effect of interventions on disease outcomes, and to plan for future health service needs.

Prostate cancer mortality data come from the AIHW National Mortality Database, which contains information provided by the Registries of Births, Deaths and Marriages and the National Coroners Information System, and coded by the Australian Bureau of Statistics (ABS), for deaths from 1964 to 2011.

For more information on these data, see *Quality declaration summary*: *Deaths, Australia, 2011*, (ABS Cat. no 3302.0), *Quality declaration summary*: *Causes of death, 2011*, (ABS Cat. no. 3303.0) and Box 4.1.

Box 4.1: Interpreting prostate cancer mortality

Although the *number* of deaths from prostate cancer is likely to be an artefact of an ageing population, the age-standardised mortality *rate* may be influenced, both positively and negatively, by:

- the virulence (severity) of the cancer
- diagnosis, management and treatment
- individual characteristics of the male.

The observed overall decrease in the prostate cancer mortality rate in Australia can be broadly attributed to improvements in prostate cancer diagnosis and treatment practices, in general health among males and in interventions for coexisting medical problems among males with prostate cancer (Etzioni et al. 1999; Feuer et al. 1999; Hankey et al. 1999) (Figure 4.2).

Although not definitive, the observed increase in the prostate cancer mortality rate can be attributed to an increase in the population risk for prostate cancer, improved diagnosis of prostate cancer and improved recording of prostate cancer as an underlying cause of death (Figure 4.2).

In 2011, there were 3,294 male deaths from prostate cancer, representing 4% of all male deaths, with a crude rate of 30 deaths per 100,000 males (Table 4.1). Prostate cancer was the fourth leading cause of death among males that year, behind coronary heart diseases (16%), lung cancer (7%) and cerebrovascular diseases (6%).

Prostate cancer was the tenth leading cause of death for all persons.

Table 4.1: Top ten leading causes of death[(a)] among males, Australia, 2011

Leading cause (ICD-10 code)	Number	Per cent[(b)]	Rate[(c)]
Coronary heart diseases (I20–I25)	11,733	15.6	105.7
Lung cancer (C33, C34)	4,959	6.6	44.7
Cerebrovascular diseases (I60–I69)	4,427	5.9	39.9
Prostate cancer (C61)	3,294	4.4	29.7
Chronic obstructive pulmonary disease (J40–J44)	3,278	4.4	29.5
Dementia and Alzheimer disease (F01, F03, G30)	3,268	4.3	29.4
Colorectal cancer (C18–C21)	2,248	3.0	20.3
Diabetes (E10–E14)	2,178	2.9	19.6
Unknown primary site cancers (C26, C39, C76–C80)	1,920	2.5	17.3
Suicide (X60–X84)	1,726	2.3	15.6
All causes[(d)]	**75,327**	**100.0**	**678.6**

(a) Leading causes of death are grouped according to AIHW classification of leading causes of death. These are based on the classification proposed by Becker et al. 2006 and modified so that cause groups are relevant to Australia.

(b) Percentage of total deaths among males.

(c) Crude rates are based on the 30 June 2011 preliminary rebased estimated resident population and expressed per 100,000 males.

(d) Total deaths among males.

Note: Mortality data for 2011 are preliminary and are subject to revision.

Source: AIHW National Mortality Database.

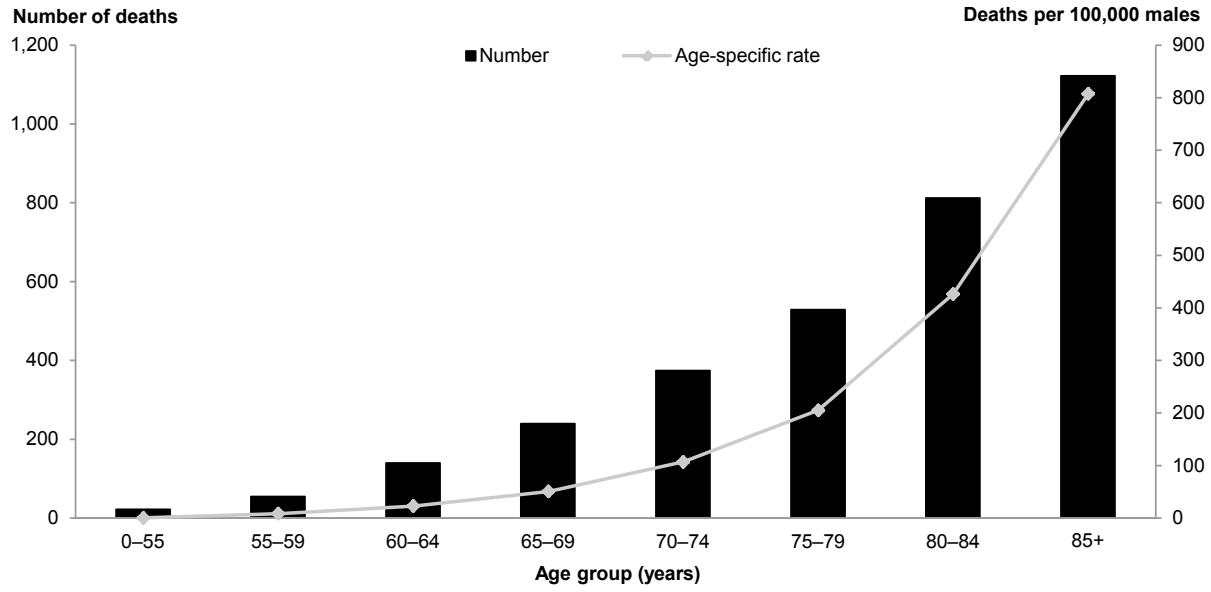
Prostate cancer may also be recorded as an associated (contributing) cause of death.

In 2011, there were an additional 1,803 male deaths where prostate cancer was a contributing cause of death. The most common underlying cause of death (grouped according to leading causes of death codes) in these cases were coronary heart diseases (388 deaths, 22%), followed by chronic obstructive pulmonary disease (130 deaths), dementia and Alzheimer disease (129), cerebrovascular disease (120) and diabetes (83).

Age comparison

Prostate cancer-related mortality is strongly age-related. In 2010, the risk of dying from prostate cancer changed with age: increasing from 1 in 12,000 before age 55, to 1 in 25 before age 85 (AIHW 2012a).

In 2011, 75% of deaths due to prostate cancer as an underlying cause of death occurred among males aged 75 and over and the mean age at death was 80. The number and rate of prostate cancer deaths increased steadily with increasing age: from less than 1 death per 100,000 males aged under 55 (22 deaths) to 808 per 100,000 males aged 85 and over (1,122 deaths) (Figure 4.1).



Notes

1. Mortality data for 2011 are preliminary and are subject to revision.
2. Data are based on year of registration of death.
3. Includes deaths with an underlying cause of death of prostate cancer (ICD-10 C61).
4. Age-specific rates are based on the 30 June 2011 estimated resident male population and expressed per 100,000 males by age group.

Source: AIHW National Mortality Database; Table S4.1.

Figure 4.1: Prostate cancer mortality among males, by age at death, Australia, 2011

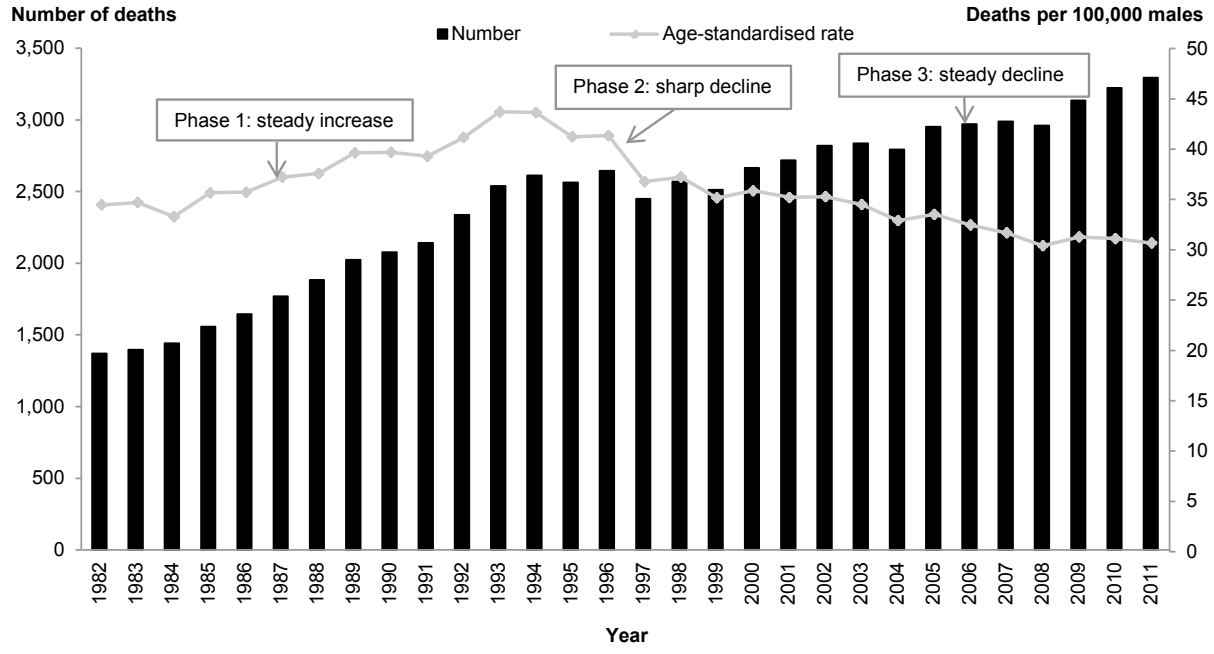
Time trend

Between 1982 and 2011, the prostate cancer mortality rate declined overall, although the number of deaths increased (Figure 4.2).

Over the 28-year period, the increase in prostate cancer deaths was generally steady, with some annual fluctuation. The overall decrease in the age-standardised mortality rate occurred in three broad phases:

- a steady increase from 34 deaths per 100,000 in 1982 to 44 per 100,000 in 1993
- a sharper decline from 44 per 100,000 in 1993 to 35 per 100,000 in 1999
- a steady decline from 35 per 100,000 in 1999 to 31 per 100,000 in 2011.

More information on interpreting this trend is presented in Box 4.1.



Notes

1. Data for 1982 to 2010 are based on year of death, data for 2011 are based on year of registration of death.
2. Mortality data up to and including 2009 are final. Mortality data for 2010 are revised and those for 2011 are preliminary; data for these years are subject to revision.
3. Rates are directly age-standardised to the Australian population as at 30 June 2001 and expressed per 100,000 males.

Source: AIHW National Mortality Database; Table S4.2.

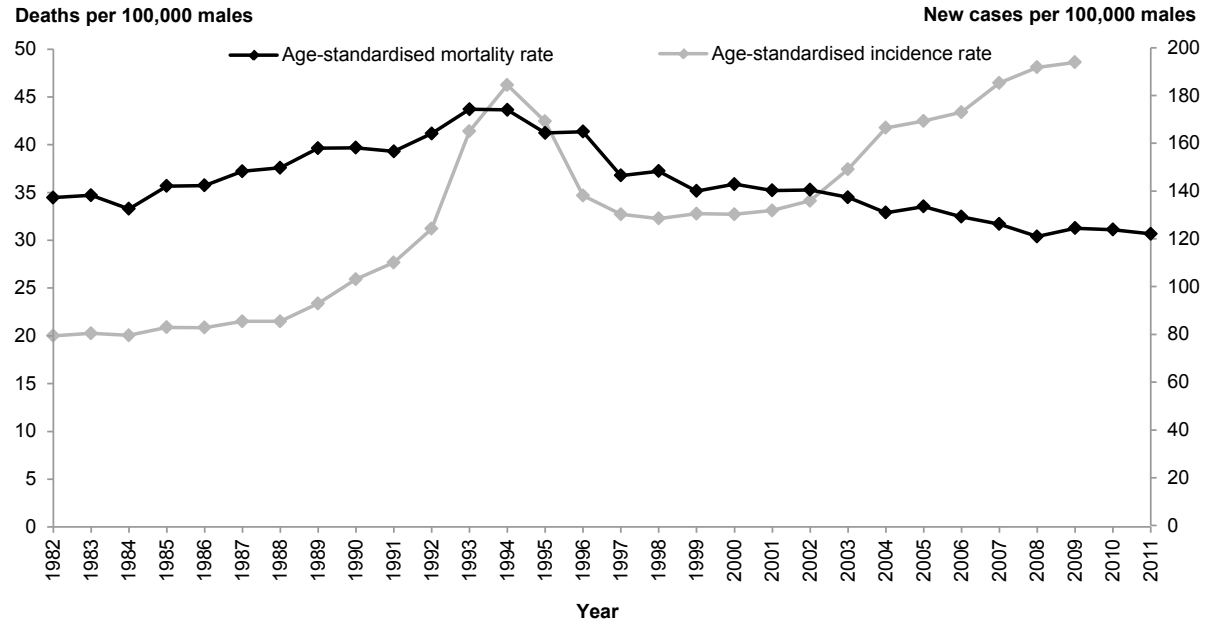
Figure 4.2: Prostate cancer mortality among males, Australia, 1982 to 2011

The influence of incidence on mortality

Prostate cancer mortality is influenced by prostate cancer incidence and virulence (severity), among other factors described in Box 4.1.

Comparing mortality and incidence rates over time shows that the age-standardised rates followed a similar increasing trend from 1982 to the mid-1990s, followed by a decline to the mid- to late-1990s. From 2002, the prostate cancer mortality rate continued on a steady decline, while the prostate cancer incidence rate increased (Figure 4.3).

For more information on interpreting the incidence trend data, see Box 3.1 and Figure 3.2.



Notes

1. Mortality data for 1982 to 2010 are based on year of death, data for 2011 are based on year of registration of death.
2. Mortality data up to and including 2009 are final. Mortality data for 2010 are revised and those for 2011 are preliminary; data for these years are subject to revision.
3. Rates are directly age-standardised to the Australian population as at 30 June 2001 and expressed per 100,000 males.

Source: AIHW National Mortality Database; AIHW Australian Cancer Database 2009; Table S3.2; Table S4.2.

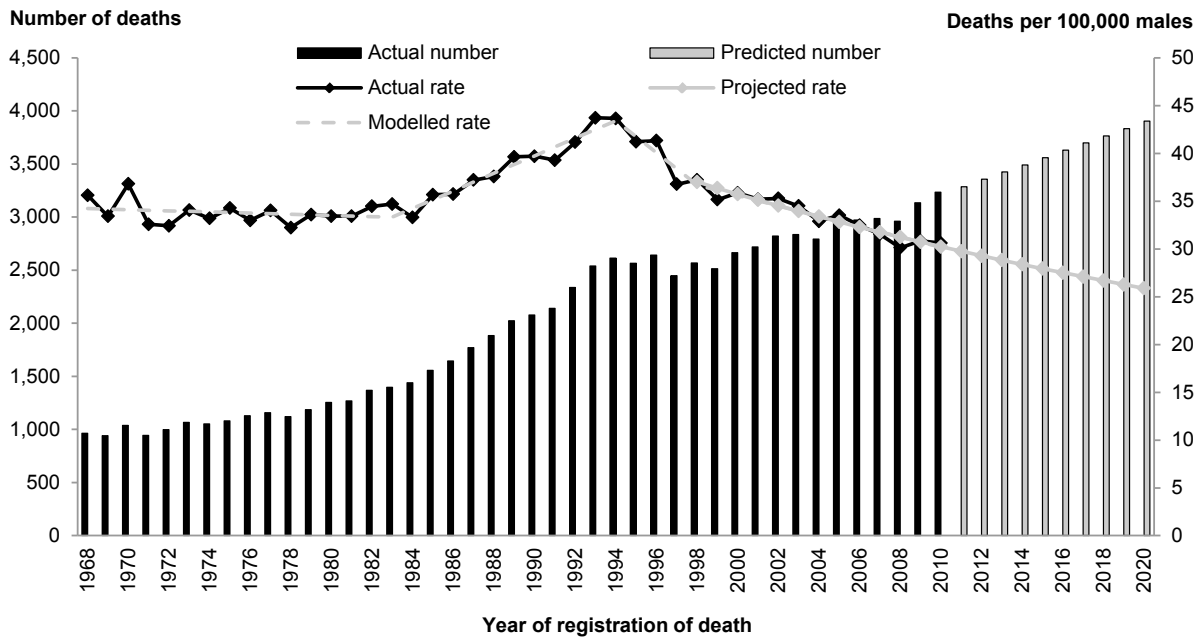
Figure 4.3: Prostate cancer incidence (1982 to 2009) and mortality (1982 to 2011) among males, Australia

Projected mortality to 2020

The age-standardised prostate cancer mortality rate is projected to continue to decrease over time (AIHW 2012b).

Extrapolation of prostate cancer mortality trend data from 1968 to 2010 suggests that between 2011 and 2020:

- the number of deaths each year is projected to increase from nearly 3,300 to more than 3,900
- the age-standardised mortality rate is projected to decrease from 30 deaths per 100,000 males to 26 per 100,000 (Figure 4.4).



Notes

1. Although mortality data from 1986 to 2008 are final, the data used in this analysis for 2009 were revised and those for 2010 were preliminary. Data for these years have since been revised and differ to the analyses presented elsewhere in this chapter.
2. These data were not adjusted for the additional deaths arising from outstanding registrations of deaths in Queensland in 2010. For more detail, please refer to Technical note 3 in ABS 2012.
3. Rates are directly age-standardised to the Australian population as at 30 June 2001 and expressed per 100,000 males.
4. Projections were derived by using a combination of ordinary least squares and joint point analysis.

Source: AIHW National Mortality Database; Table S4.4.

Figure 4.4: Prostate cancer mortality among males, Australia: actual 1968 to 2010, projected 2011 to 2020

5 Survival

Key findings

- Around 9 in 10 males diagnosed with prostate cancer survive 5 years from diagnosis. In 2006–2010 in Australia, 5-year relative survival from prostate cancer was:
  - higher than that from other frequently diagnosed cancers, such as bowel cancer, melanoma of the skin, lung cancer and non-Hodgkin lymphoma.
  - highest for men aged 50–69 (97%) and lowest for men aged 80 and over (72%).
- From 1986 to 2007, 5-year relative survival increased from 59% to 90% for males diagnosed with prostate cancer.

Overview

Prostate cancer survival refers to the probability of living (surviving) a given number of years after cancer diagnosis. These data provide an indication of the prognosis of prostate cancer (how virulent it is) and of the success of available treatments.

Prostate cancer survival is derived from analysis of the ACD and the AIHW National Death Index. For more information on these data, see Box 3.1 and Appendix 1, respectively. For information on survival analysis, refer to Box 5.1.

Box 5.1: Interpreting prostate cancer survival

Survival estimates provide an indication of the average survival experience for males diagnosed with prostate cancer in a given period. They are not indicative of an individual male's chance of surviving prostate cancer.

Prostate cancer survival can be affected by:

- age and stage at diagnosis
- treatment options
- individual factors (comorbidities, decisions regarding treatment approach).

For example, the lower survival seen in older men may be the result of choosing less aggressive treatment options, entering into clinical trials and the presence of comorbid conditions (Yancik et al. 1996; Townsley et al. 2005; Chaimer & Litwin 2011).

Estimating survival

There are two methods of calculating survival, relative and conditional survival.

Relative survival is the ratio of observed survival of males with prostate cancer to the expected survival for males of the same age in the general population. Conditional survival is the likelihood of a male with prostate cancer living another year, given they had already survived a certain number of years from diagnosis. Conditional survival is not presented in this report.

(continued)

Box 5.1 (continued): Interpreting prostate cancer survival

The effect of lead-time bias on prostate cancer survival data

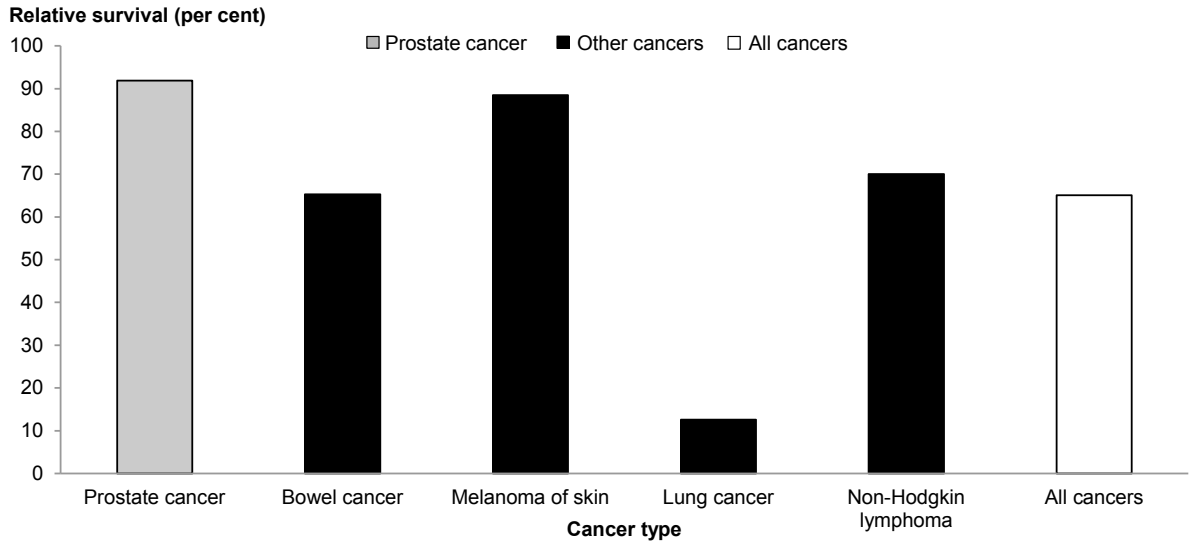
Cancer survival is based on the time between cancer diagnosis and death, and is therefore sensitive to anything that affects the timing of either date. For example:

- changes in detection can mean cancer diagnosis can be brought forward, resulting in an artificial or inflated increase in survival
- effective treatment and management of cancer can improve survival by delaying the time until death.

This time shift in the detection of cancer, is known as lead-time bias (Welch et al. 2000; Duffy et al. 2008; Gigerenzer et al. 2008; de Vries et al. 2010). Prostate cancer is prone to lead-time bias, due to the detection and diagnosis of asymptomatic tumours and the subsequent inclusion of potentially non-fatal prostate cancer in the survival analysis (AIHW 2012c).

In 2006–2010, the 5-year relative survival for males diagnosed with prostate cancer in that period was 92%. That is, males with prostate cancer had a 92% chance of surviving another 5 years relative to their counterparts in the general population. Prostate cancer 1-year survival was higher at 98% and 10-year survival lower at 84%.

The 5-year relative survival for males diagnosed with prostate cancer (92%) was higher than for all cancers combined (65%) and for the other most commonly diagnosed cancers among males, including melanoma (89%) and lung cancer (13%) (Figure 5.1).



Notes

1. Includes survival for the most commonly diagnosed cancers among males in 2009 (excluding non-melanoma skin cancers) and all cancers.
2. 'All cancers' include cancers coded in ICD-10 as C00-C97, D45, D46, D47.1 and D47.3, with the exception of basal or squamous cell carcinoma of the skin (C44).
3. For information on the method used to derive cumulative relative survival, see AIHW 2012c.

Source: AIHW analysis of the Australian Cancer Database 2007; Table S5.1.

Figure 5.1: 5-year relative survival from the five most commonly diagnosed cancers among males, Australia, 2006–2010

Age comparison

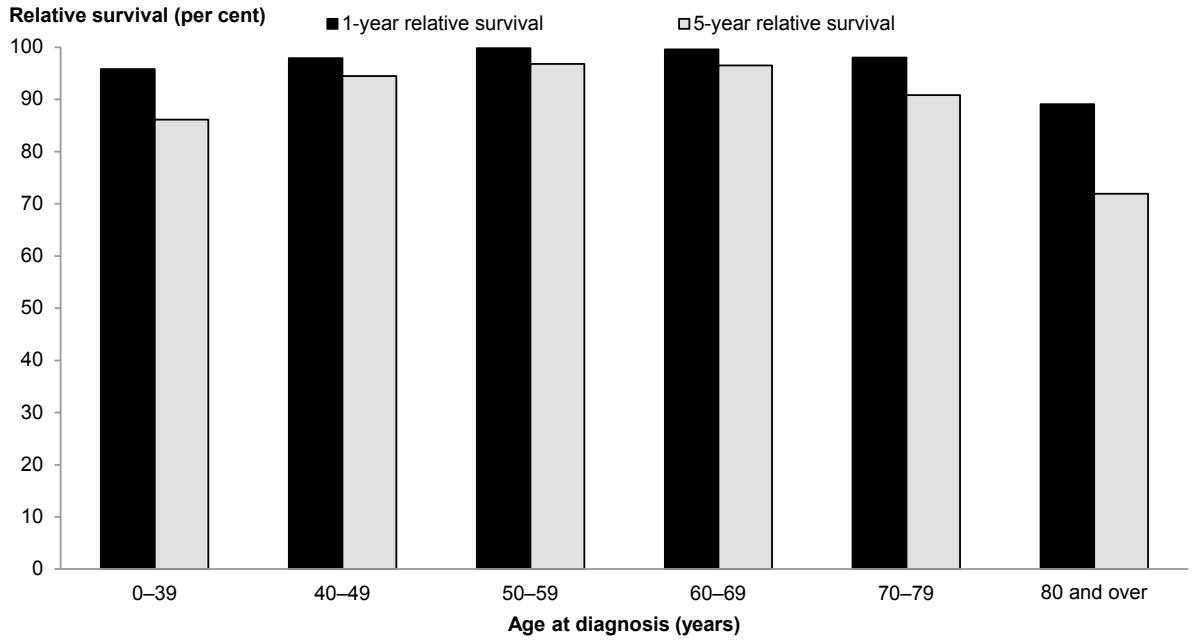
Prostate cancer relative survival varies with age.

In the period 2006–2010, there was little variation by age for 1-year relative survival: ranging from 96% to nearly 100% among males aged 0–79. Males aged 80 and over were less likely than younger males to survive 1-year (89%) (Figure 5.2).

There was greater variation by age for 5-year relative survival, which was:

- highest for men aged 40–69 (ranging between 95% and 97%)
- lower for men aged under 40 (86%) and men aged 70–79 (91%)
- lowest for men aged 80 and over (72%).

For all age groups, 5-year relative survival was lower than 1-year relative survival and the difference was greatest for males aged 70 and over at diagnosis.



Source: AIHW analysis of the Australian Cancer Database 2007; Table S5.2.

Figure 5.2: Relative survival (1-year and 5-year) from prostate cancer among males, by age at diagnosis, Australia, 2006–2010

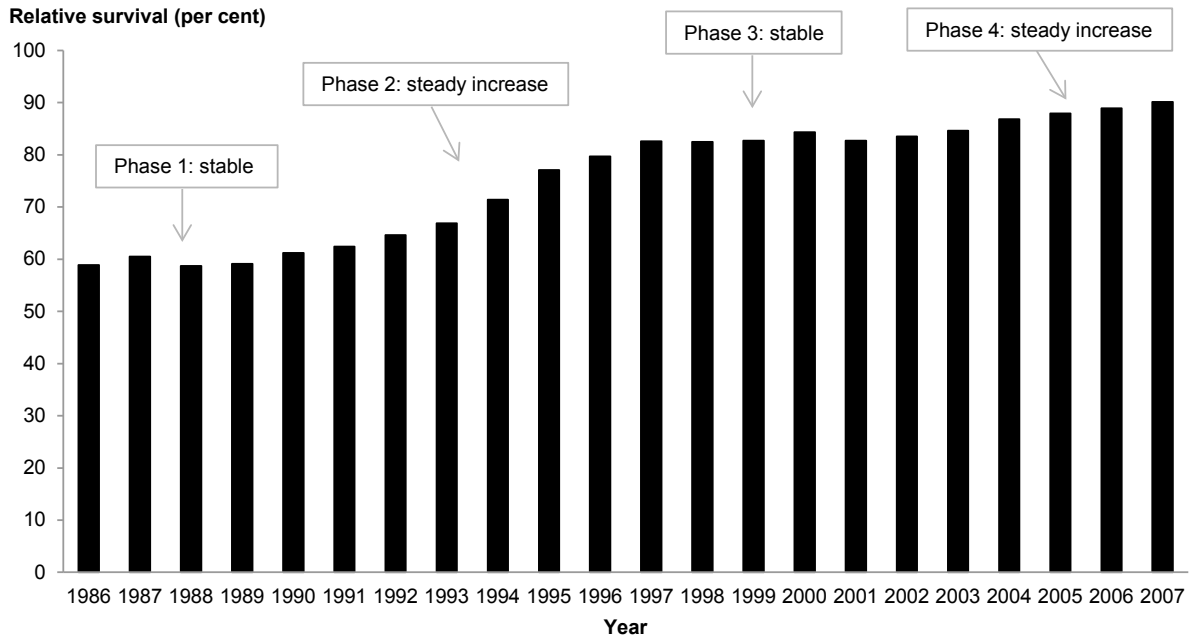
Time trend

The 5-year relative survival for males diagnosed with prostate cancer has generally increased over time: from 59% in 1986 to 90% in 2007 (Figure 5.3).

This increase occurred in four broad phases, in which survival:

- was stable at around 62% between 1986 and 1993
- increased sharply between 1993 (67%) and 1994 (71%), followed by a steadily increasing trend to 1997 (83%)
- was stable at around 83% from 1997 to 2003
- increased steadily from 2003 (85%) to 2007 (90%).

For information on interpreting these trend data, see Box 5.1.



Source: AIHW analysis of the Australian Cancer Database 2007; Table S5.3.

Figure 5.3: Yearly trends in 5-year relative survival from prostate cancer among males, Australia, 1986 to 2007

6 Expenditure on prostate cancer

Key findings

- Health-care expenditure on prostate cancer accounts for a large component of cancer expenditure among males in Australia. In 2008–09, expenditure on prostate cancer was estimated to be $349 million, accounting for 16% of cancer expenditure for males.
- Between 2004–05 and 2008–09, prostate cancer expenditure increased by 23%, from $284 million in 2004–05.

Overview

Disease expenditure data can be used to measure and understand differences in the allocation and use of health system resources by disease group and over time.

Prostate cancer expenditure data come from the AIHW Disease Expenditure Database 2008–09 and include total recurrent health system expenditure on admitted patient hospital services, out-of-hospital medical services and prescription pharmaceuticals. The data set does not include expenditure on prostate cancer research.

For more information on these data, see *Disease expenditure database 2008–09 data quality statement* <http://meteor.aihw.gov.au/content/index.phtml/itemId/512599> and Box 6.1.

Box 6.1: Interpreting prostate cancer expenditure data

Disease expenditure data provide a conservative estimate of total recurrent health system expenditure in Australia. It is not possible to allocate all expenditure on health goods and services by disease. For some areas of expenditure, such as capital expenditure and general aids and appliances (where the costs are not part of hospital admitted patient services costs), it is not intuitive to allocate the costs by disease. For other areas of expenditure, such as over-the-counter pharmaceuticals and non-admitted patient services, there is a lack of available data that would enable the broad expenditure cost to be linked to a particular disease.

Hospital admitted patient services

Expenditure data for hospital admitted patient services are an underestimate of the total expenditure on prostate cancer and do not include:

- hospitalisations for same-day chemotherapy
- hospitalisations where prostate cancer was recorded as an additional diagnosis.

Out-of-hospital medical services and prescription pharmaceuticals

Expenditure data for out-of-hospital medical services and prescription pharmaceuticals are reliant on sample survey data, and comparison of these data with other sectors or over time should be treated with caution.

(continued)

Box 6.1 (continued): Interpreting prostate cancer expenditure data

The influence of incidence, mortality and treatment on prostate cancer expenditure

The most current available health expenditure data on prostate cancer are for 2008–09, which corresponds with the peak in prostate cancer incidence in 2008 (see Figure 3.2). The process of detection and diagnosis has predictable costs related to those procedures, and could be expected to increase in line with increasing incidence. The combined influence of increasing incidence, decreasing mortality, high survival and the distinct management options (ranging from no treatment to active treatment) is less predictable, and should be considered when interpreting changes in expenditure on prostate cancer over time.

In 2008–09, health expenditure on prostate cancer was estimated to be $349 million: the majority (56%) of this expenditure was for hospital admitted patient services, followed by prescription pharmaceuticals (36%) and the remainder (9%) on out-of-hospital medical expenses (Table 6.1). Prostate cancer expenditure accounted for 16% of all cancer expenditure for males in that year and around 1% of all disease expenditure for males.

Table 6.1: Estimated health expenditure, by disease and by area of expenditure, males, Australia, 2008–09

	Prostate cancer		All cancers[(a)]		All diseases	
	$(million)	Per cent	$(million)	Per cent	$(million)	Per cent
Hospital admitted patient services[(b)]	195	55.8	1,701	79.1	18,738	63.0
Out-of-hospital medical expenses	30	8.7	162	7.5	6,368	21.4
Prescription pharmaceuticals	124	35.6	286	13.3	4,632	15.6
Total expenditure[(c)]	**349**	**100.0**	**2,150**	**100.0**	**29,739**	**100.0**

(a) Includes cancers coded in the ICD-10 as C00–C97. Cancers coded as D45, D46, D47.1 and D47.3 are excluded.

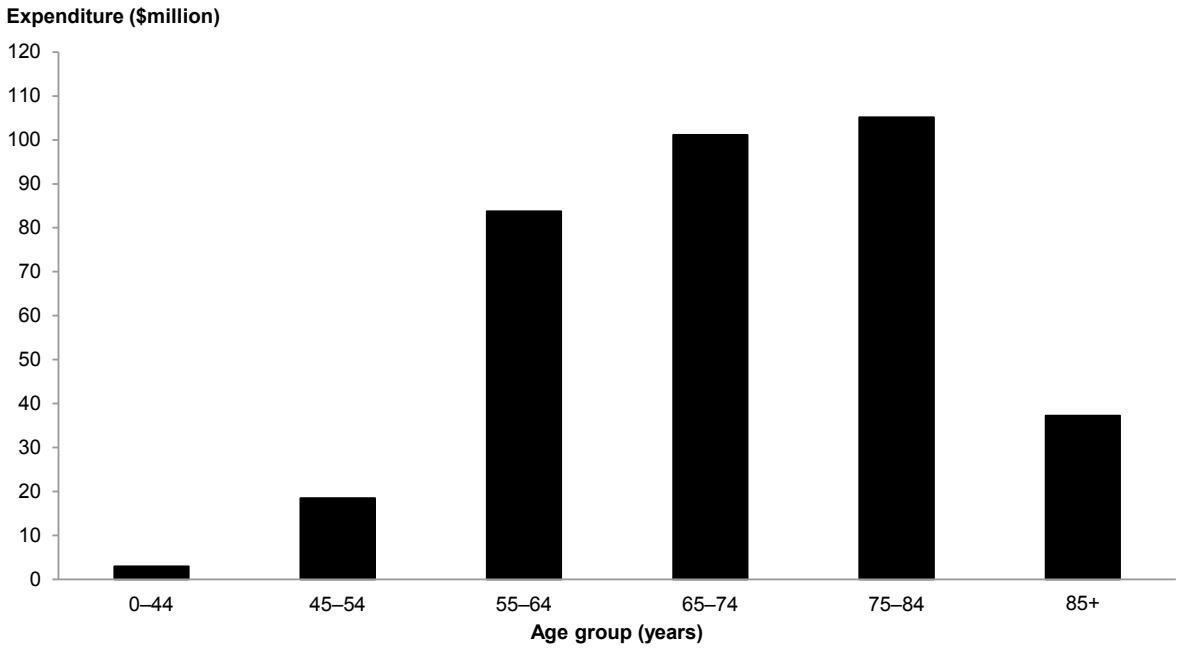
(b) Expenditure for hospital admitted patient services for prostate cancer includes only those hospitalisations for which the principal diagnosis was prostate cancer (ICD-10-AM C61). Hospitalisations for prostate cancer as an additional diagnosis, where the principal diagnosis was related to cancer treatment or care, are excluded.

(c) Total expenditure does not include cancer screening. Components may not sum to the total due to rounding.

Source: AIHW Disease expenditure database.

Age comparison

In 2008–09, prostate cancer expenditure generally increased with increasing age, from a low of nearly $3 million among males aged 0–44 to a high of more than $105 million among males aged 75–84 (Figure 6.1). Expenditure decreased again to around $37 million among males aged 85 and over.



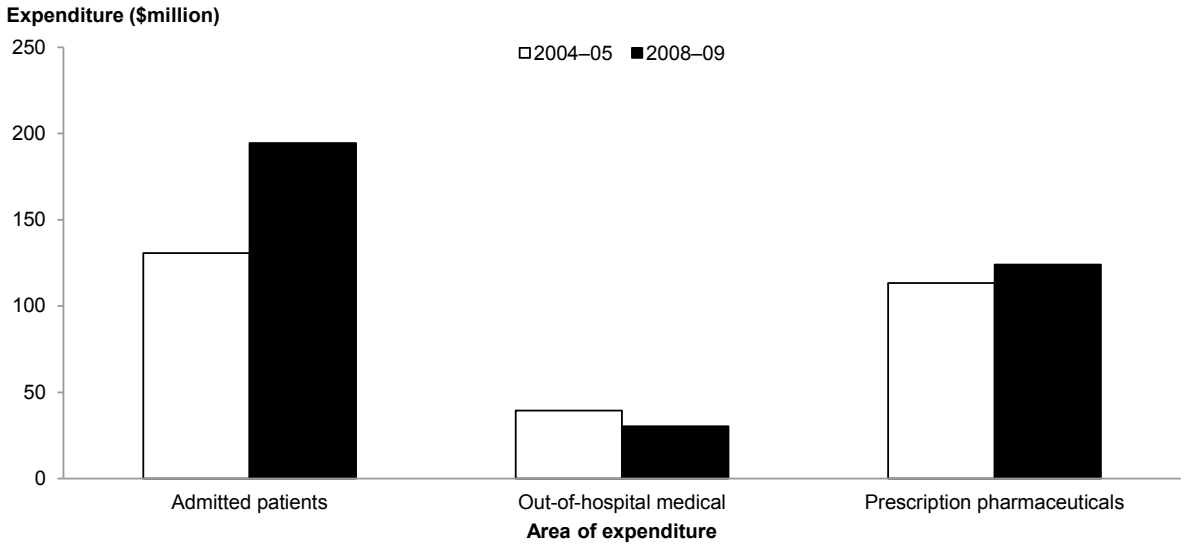
Source: AIHW Disease expenditure database; Table S6.1.

Figure 6.1: Estimated health expenditure for prostate cancer among males, all areas of expenditure, by age group, Australia, 2008–09

Time trend

Between 2004–05 and 2008–09, there was a 23% real increase in the estimated health expenditure on prostate cancer, from $284 million (in 2008–09 prices) in 2004–05 to $349 million in 2008–09. This was lower than the increase in the estimated expenditure on males for all cancers (42%) and for all diseases (31%), and corresponds with the peak in prostate cancer incidence in 2008 (Box 6.1). Although increasing incidence carries predictable costs associated with diagnosis and detection, the combined cost of increasing incidence, decreasing mortality, high survival and the distinct management options (ranging from no treatment to active treatment) is less predictable, and should be considered when interpreting this trend in expenditure.

The largest increase in prostate cancer expenditure was for hospital admitted patient services (49%) (Figure 6.2). There was a modest 9% increase in prescription pharmaceutical expenditure and a 23% decrease in expenditure on out-of-hospital medical expenses.



Notes

1. Constant price health expenditure for 2004–05 is shown in 2008–09 dollars.
2. Expenditure for hospital admitted patient services for prostate cancer includes only those hospitalisations for which the principal diagnosis was prostate cancer (ICD-10-AM C61). Hospitalisations for prostate cancer as an additional diagnosis, where the principal diagnosis was related to cancer treatment or care, are excluded.

Source: AIHW Disease expenditure database; Table S6.2.

Figure 6.2: Estimated health expenditure for prostate cancer among males, by area of expenditure, Australia, 2004–05 and 2008–09

7 Population groups

Key findings

- When differences in age structure were accounted for, there were differences between population groups for prostate cancer incidence (2004–2008 data) and mortality (2006–2010 data):
  - Indigenous males were less likely to be diagnosed with prostate cancer compared with non-Indigenous males. Prostate cancer mortality was similar for both Indigenous and non-Indigenous males.
  - Males living in *Major cities* were less likely than those living in *Inner regional* and *Outer regional* areas to die from prostate cancer.
  - Males born overseas were less likely to be diagnosed with, or to die from, prostate cancer, compared with males born in Australia.

Overview

Comparison of prostate cancer data between population groups is a valuable approach to identify disparities and assess areas of need for targeted interventions. This chapter presents prostate cancer incidence and mortality data by five population groups: state and territory of residence, Aboriginal and Torres Strait Islander status, remoteness area of residence, relative socioeconomic disadvantage and country/region of birth.

Limited survival and prevalence data are available for some, but not all, population groups and are therefore not included in this chapter.

The data sources used in this chapter are the ACD (see Box 3.1) and the AIHW National Mortality Database (see Box 4.1). For information on interpreting these data in the context of population comparisons, see Box 7.1.

Box 7.1: Interpreting population comparisons

Observed differences in prostate cancer incidence and mortality between population groups can be affected by:

- different population age structures
- small numbers
- differences in access to detection, diagnosis and treatment services
- individual and cultural factors (comorbidities, decisions regarding treatment approach).

Although difference in age structures and the effect of small numbers on the stability of rates can be accounted for using age-standardisation and multiple reporting years (described below), these and other factors should be considered when interpreting observed differences in prostate cancer incidence and mortality presented in this chapter.

(continued)

Box 7.1 (continued): Interpreting population comparisons

Age-standardised rates

Prostate cancer incidence and mortality are strongly age-related (see 'Chapter 1', 'Chapter 3' and 'Chapter 4' for more information). Observed differences in these measures between population groups may be misleading where those populations have different age structures. For example, a population with a higher proportion of older males is likely to have a higher rate of prostate cancer incidence than a population with a lower proportion of older males.

Age-standardisation adjusts for variations in age structure, between populations and over time. This procedure converts the age structure of the different populations to the same standard structure and removes the influence of age from the comparison. For more information, see 'Appendix 1—Statistical methods'.

Multiple reporting years

Incidence data presented in this chapter are for the 5 years 2004–2008, and mortality data for the 5 years 2006–2010, as a means of reducing the random variation in rates that occur in smaller populations. Incidence data are not available for 2009 by all population groups and mortality data are not presented for 2011, due to a break in series for some populations.

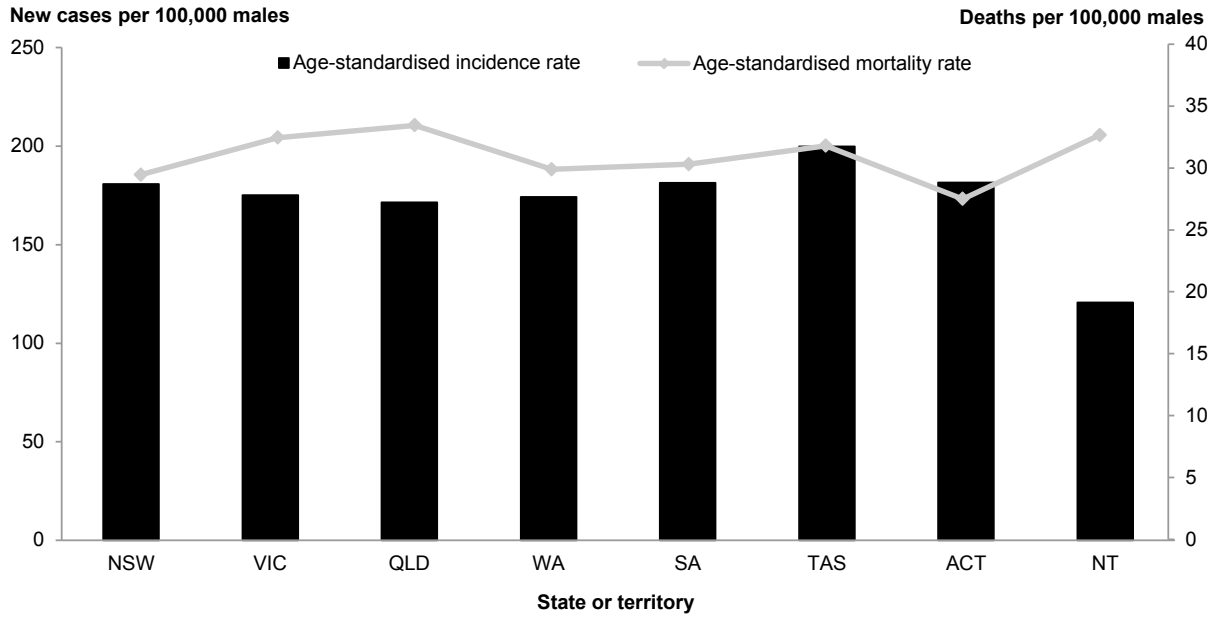
State and territory

New South Wales had the highest number of new cases of prostate cancer (31,243) and prostate cancer deaths (4,895) and the Northern Territory had the lowest (351 and 47, respectively). These numbers are reflective of the relative population size of each jurisdiction.

In 2004–2008, the age-standardised prostate cancer incidence rate was higher among males living in Tasmania (200 new cases per 100,000 males) than other jurisdictions, while that among males living in the Northern Territory was lower (121 new cases per 100,000 males) (Figure 7.1).

In 2006–2010, age-standardised prostate cancer mortality rates were similar across most jurisdictions, although there were some observed differences.

The prostate cancer mortality rate in Queensland (33 deaths per 100,000 males) was similar to that in Victoria (32 per 100,000) and higher than that in New South Wales (29 per 100,000) and the Australian Capital Territory (27 per 100,000). The mortality rate in Victoria was also higher than that in New South Wales (Figure 7.1).



Notes

1. Incidence data are for 2004–2008, mortality data are for 2006–2010.
2. Mortality data for 2010 are revised and are subject to further revision.
3. Rates are directly age-standardised to the Australian population as at 30 June 2001, based on the total number of cases over the 5-year period (2004–2008 or 2006–2010) and expressed per 100,000 males.
4. Mortality data may not be comparable with mortality data published in state and territory cancer reports because the data shown in this report relate to the place of residence at the time of death, not the place of residence at the time of diagnosis as shown in some state and territory reports.

Source: AIHW Australian Cancer Database 2009; AIHW National Mortality Database; Table S7.1.

Figure 7.1: Prostate cancer incidence (2004–2008) and mortality (2006–2010) among males, by state and territory, Australia

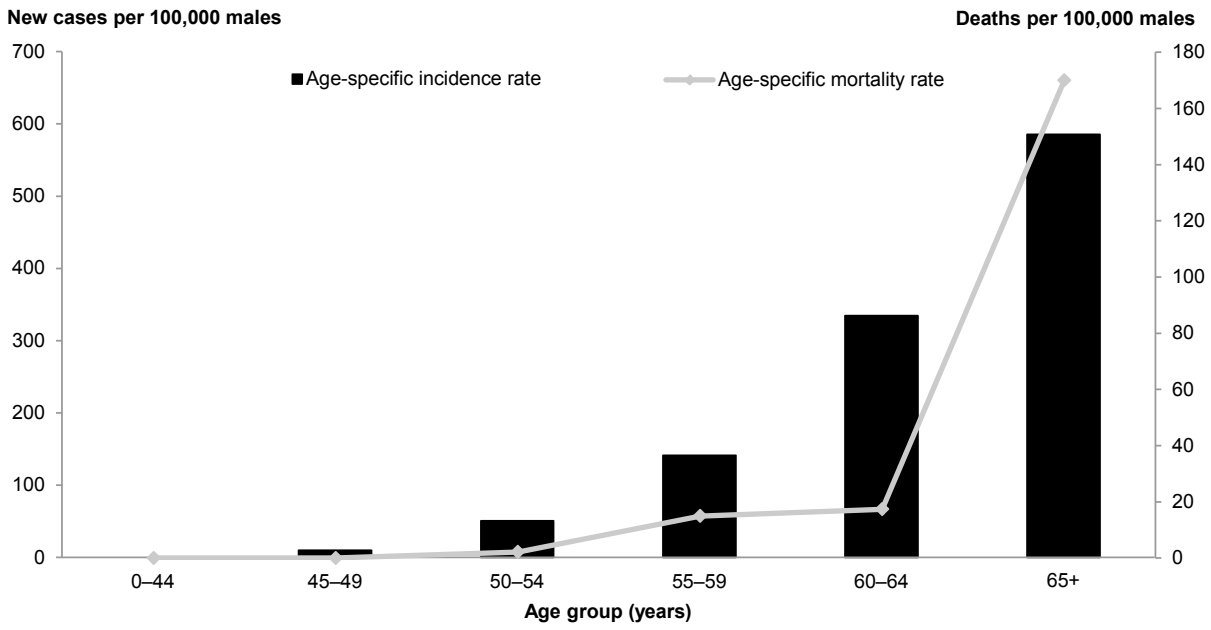
Aboriginal and Torres Strait Islander status

In 2004–2008, there were 291 new cases of prostate cancer diagnosed among Aboriginal and Torres Strait Islander males in New South Wales, Queensland, Western Australia and the Northern Territory: a rate of 27 new cases per 100,000 Indigenous males in those jurisdictions. Prostate cancer incidence among Indigenous males increased with age: from 10 cases per 100,000 males aged 45–49 to 586 per 100,000 males aged 65 and over (Figure 7.2) There were no new cases of prostate cancer among Indigenous males aged 0–44.

When differences in age structure were accounted for (age-standardised), Indigenous males were less likely to be diagnosed with prostate cancer, compared with non-Indigenous males (Table S7.2b).

In 2006–2010, there were 66 prostate cancer-related deaths among Aboriginal and Torres Strait Islander males in New South Wales, Queensland, Western Australia, South Australia and the Northern Territory: a rate of 6 per 100,000 Indigenous males in those jurisdictions. Prostate cancer mortality among Indigenous males increased with age: from less than 1 death per 100,000 males aged 0–44 to 170 per 100,000 males aged 65 and over (Figure 7.2).

When differences in age structure were accounted for (age-standardised), prostate cancer-related mortality was similar for both Indigenous and non-Indigenous males (Table S7.2b).



Notes

1. Incidence data are for 2004–2008 and include New South Wales, Queensland, Western Australia and the Northern Territory only.
2. Mortality data are for 2006–2010 and include New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.
3. Mortality data for 2010 are revised and are subject to further revision.
4. Age-specific rates are based on the total number of cases per 100,000 Aboriginal and Torres Strait Islander males in those jurisdictions, across each 5-year period.

Source: AIHW Australian Cancer Database 2009; AIHW National Mortality Database; Table S7.2a.

Figure 7.2: Prostate cancer incidence (2004–2008) and mortality (2006–2010) among Aboriginal and Torres Strait Islander males, selected states and territories, by age group, Australia

Remoteness area

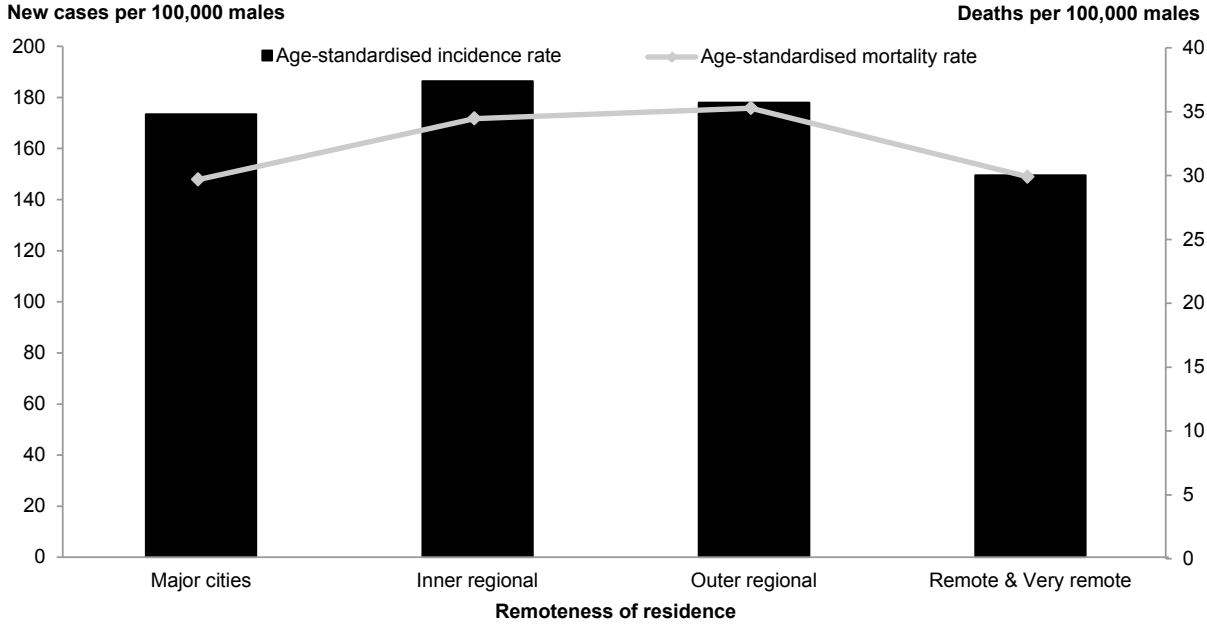
The distribution by remoteness area was similar for new cases of prostate cancer (in 2004–2008) and for prostate cancer-related deaths (in 2006–2010):

- more than 6 in 10 (62–64%) occurred among males living in *Major cities*
- around 2 in 10 (25%) occurred among those living in *Inner regional* areas
- around 1 in 10 (10%) occurred among those in *Outer regional* areas.

Less than 2% of new cases and deaths occurred among those males living in *Remote/Very remote* areas of Australia. This reflects the population distribution by remoteness area.

In 2004–2008, there were observed differences in prostate cancer incidence by remoteness area. Compared with males living in all other regions, males living in *Inner regional* areas were more likely to be diagnosed with prostate cancer (186 new cases per 100,000 males) and those living in *Remote/Very remote* areas were less likely (150 per 100,000) (Figure 7.3).

In 2006–2010, there were also observed differences in prostate cancer mortality by remoteness area. Males living in *Major cities* (30 deaths per 100,000 males) were less likely than those living in *Inner regional* areas (34 per 100,000) and *Outer regional* areas (35 per 100,000) to die from prostate cancer (Figure 7.3).



Notes

1. Remoteness of residence was assigned using the Australian Standard Geographical Classification—Remoteness Area (ASGC-RA).
2. Incidence data are for 2004–2008. In those years, 315 incidence records had a missing postcode and could not be assigned a remoteness area. These records were excluded from the analysis.
3. Mortality data are for 2006–2010. In those years, 19 mortality records could not be assigned a remoteness area. These records were excluded from the analysis.
4. Mortality data for 2010 are revised and are subject to further revision.
5. Rates are directly age-standardised to the Australian population as at 30 June 2001, based on the total number of cases over the 5-year period (2004–2008 or 2006–2010) and expressed per 100,000 males.

Source: AIHW Australian Cancer Database 2009; AIHW National Mortality Database; Table S7.3.

Figure 7.3: Prostate cancer incidence (2004–2008) and mortality (2006–2010) among males, by remoteness of residence, Australia

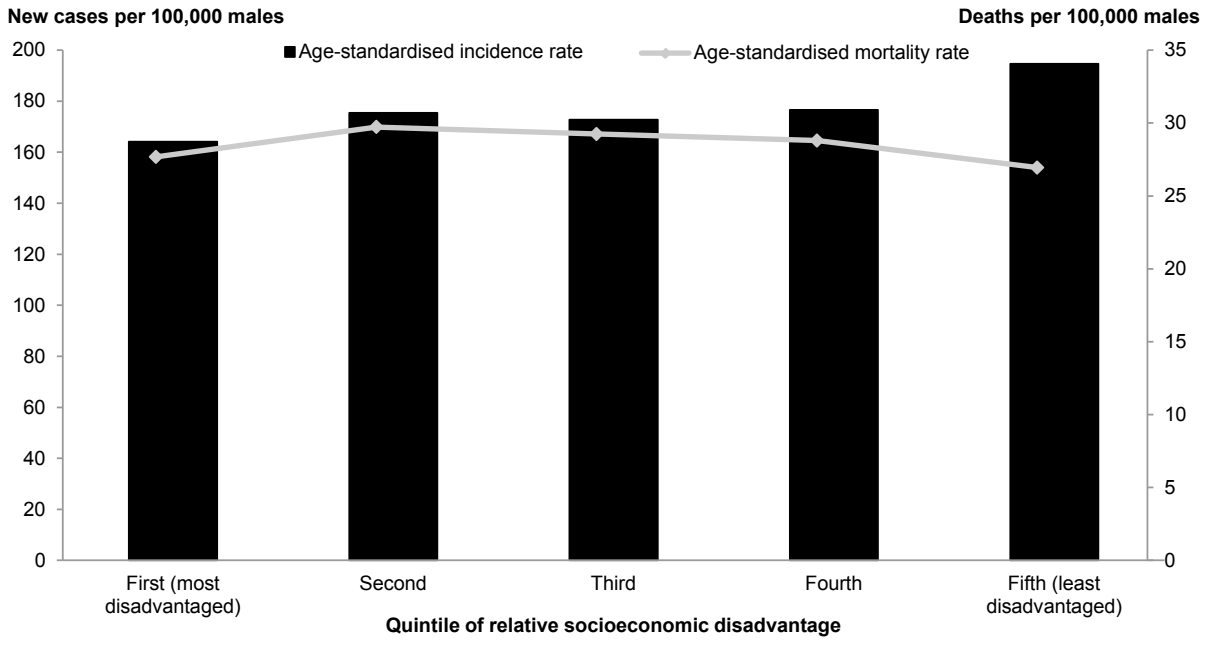
Socioeconomic disadvantage

The distribution of prostate cancer incidence (in 2004–2008) and mortality (in 2006–2010) by quintile of relative socioeconomic disadvantage reflected the population distribution, with approximately 20% of incidence records in each quintile.

In 2004–2008, there was variation in prostate cancer incidence by relative socioeconomic disadvantage. The age-standardised prostate cancer incidence rate was highest among males living in the least disadvantaged (fifth quintile) areas (195 new cases per 100,000 males) and lowest among males living in the most disadvantaged (first quintile) areas (164 per 100,000) (Figure 7.4).

Males living in the second, third and fourth quintile areas had similar incidence rates, with around 173–177 new cases per 100,000 males in those areas.

In 2006–2010, there was also variation in prostate cancer mortality by relative socioeconomic disadvantage. The age-standardised prostate cancer-related mortality rate among males living in the least disadvantaged (fifth quintile) areas (27 deaths per 100,000 males) was lower than for males living in the second and third quintiles areas (29 and 30 per 100,000, respectively) (Figure 7.4).



Notes

1. Socioeconomic status was assigned using the socioeconomic index for areas (SEIFA) Index of Relative Socio-economic Disadvantage (IRSD).
2. Incidence data are for 2004–2008. In those years, 328 incidence records could not be mapped to the 2006 SLA boundaries or assigned a SEIFA quintile. These records were excluded from the analysis.
3. Mortality data are for 2006–2010. In those years, 1,228 mortality records could not be mapped to the 2006 SLA boundaries or assigned a SEIFA quintile. These records were excluded from the analysis.
4. Mortality data for 2010 are revised and are subject to further revision.
5. Rates are directly age-standardised to the Australian population as at 30 June 2001, based on the total number of cases over the 5-year period (2004–2008 or 2006–2010) and expressed per 100,000 males.

Source: AIHW Australian Cancer Database 2009; AIHW National Mortality Database; Table S7.4.

Figure 7.4: Prostate cancer incidence (2004–2008) and mortality (2006–2010) among males, by quintile of relative socioeconomic disadvantage, Australia

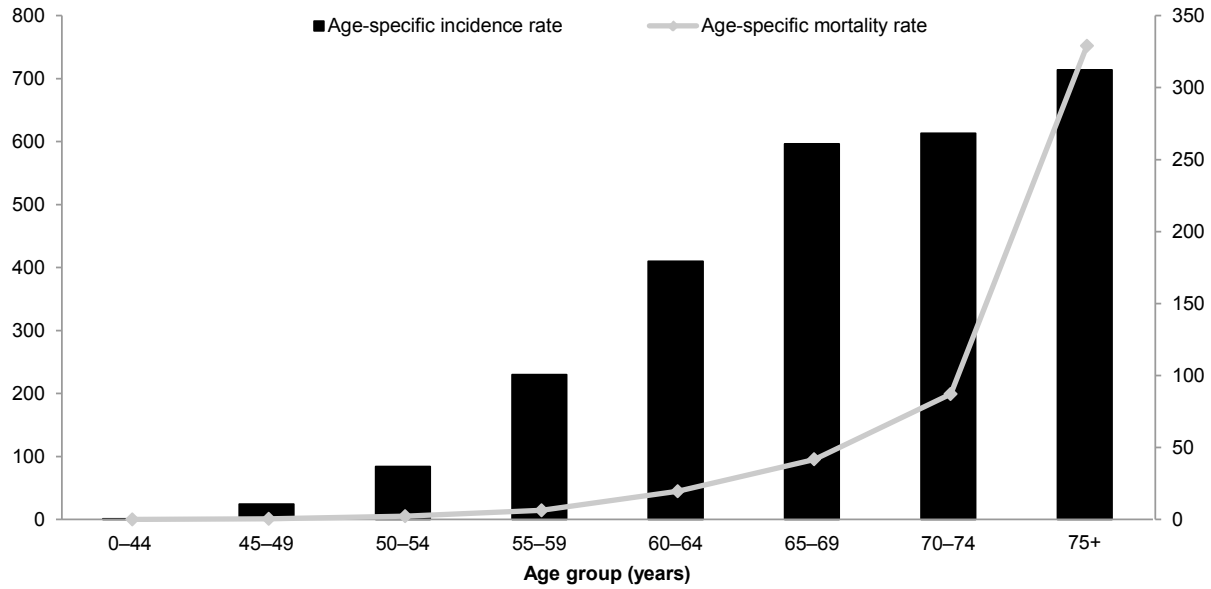
Country of birth

In 2004–2008, there were 22,325 new cases of prostate cancer diagnosed among males born overseas: a rate of 176 new cases per 100,000 males. The age distribution of prostate cancer incidence increased with increasing age: from 1 per 100,000 males aged 0–44 to 714 per 100,000 males aged 75 and over (Figure 7.5).

When differences in age structure were accounted for (age-standardised), males born overseas were less likely to be diagnosed with prostate cancer, compared with males born in Australia (Table S7.5b).

In 2006–2010, there were 4,399 prostate cancer-related deaths among males born overseas: a rate of 32 deaths per 100,000 males. The prostate cancer mortality rate increased with increasing age up to 329 per 100,000 males aged 75 and over (Figure 7.5).

When differences in age structure were accounted for (age-standardised), males born overseas were less likely to die from prostate cancer, compared with males born in Australia (Table S7.5b).



Notes

1. Country of birth was classified according to the Standard Australian Classification of Countries (SACC), 2nd edition.
2. Incidence data are for 2004–2008. In those years, 13,102 incidence records had an unknown, inadequately described or not stated country of birth. These records were excluded from the analysis.
3. Mortality data are for 2006–2010. In those years, 43 mortality records had a missing or unknown country of birth. These records were excluded from the analysis.
4. Mortality data for 2010 are revised and are subject to further revision.
5. Age-specific rates are based on the total number of cases per 100,000 overseas-born males, across each 5-year period.

Source: AIHW Australian Cancer Database 2009; AIHW National Mortality Database; Table S7.5a.

Figure 7.5: Prostate cancer incidence (2004–2008) and mortality (2006–2010) among males born overseas, by age group, Australia

8 International comparisons

Key findings

In 2008, based on age-standardised rates:

- Prostate cancer incidence and survival (as shown by the mortality-to-incidence ratio), were higher in Australia than in other country groups (regions).
- Prostate cancer mortality in Australia was similar to Northern Europe and New Zealand, higher than Northern America and all Asian regions and lower than the Caribbean.

Overview

International comparison of prostate cancer data, including incidence, mortality and survival, is a valuable means of comparing the Australian experience of prostate cancer with that in other regions.

International prostate cancer data are available from the 2008 GLOBOCAN database, which is prepared by the International Agency for Research on Cancer (IARC) (Ferlay et al. 2010c). Australian estimates used in the international context are age-standardised to the World Standard Population and are not comparable to national data presented elsewhere in this report.

For more information on international data and interpreting differences by region, see Box 8.1.

Box 8.1: Interpreting international comparisons

Incidence and mortality

Incidence and mortality estimates for international comparison are derived from national data and standardised to the World Standard Population. Caution must be taken when interpreting comparisons between regions and countries, as differences could be due to:

- underlying differences in prostate cancer risk
- differences in diagnostic processes (such as availability of PSA testing)
- differences in access to, and availability of, treatments
- underlying differences in population exposure to modifiable risk factors
- cancer coding and registration practices (Ferlay et al. 2010b ; Center et al. 2012).

In Australia, cancer is a notifiable disease and the completeness of cancer data is relatively high in comparison to some countries (Curado et al. 2007).

Mortality-to-incidence ratio

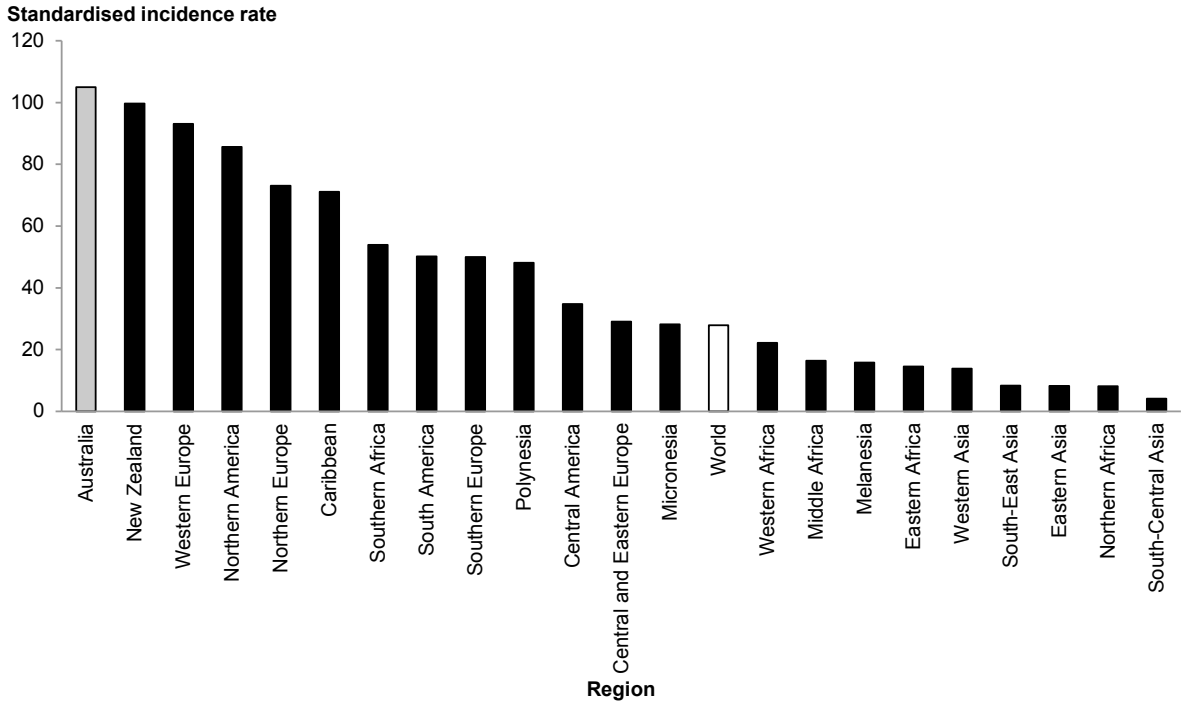
The mortality-to-incidence ratio is used as a proxy measure of survival in the international context. This ratio describes the number of prostate cancer deaths in 2008, relative to the number of new cases of prostate cancer diagnosed that year, using age-standardised data. A ratio approaching 1.0 suggests that survival is low, with similar numbers of deaths and incident cases. A ratio approaching zero suggests that survival is higher, with many more incident cases than deaths.

Incidence

The prostate cancer incidence rate in Australia, age-standardised to the World Standard Population, was 105 new cases per 100,000 males (Figure 8.1).

This rate was higher than all other regions, including New Zealand (100 per 100,000), Western Europe (93 per 100,000) and Northern America (86 per 100,000).

In contrast, the estimated incidence rate of prostate cancer was lowest in South-Central Asia (4 per 100,000), Northern Africa, Eastern Asia and South-Eastern Asia (each 8 per 100,000).



Notes

1. The rates are estimates for 2008, derived by the International Agency for Research on Cancer (IARC) and are based on data from approximately 3 to 5 years earlier.
2. Rates are age-standardised (by the IARC) to the World Standard Population described by Doll et al. 1966 and expressed per 100,000 males.

Source: Ferlay et al. 2010c; Table S8.1.

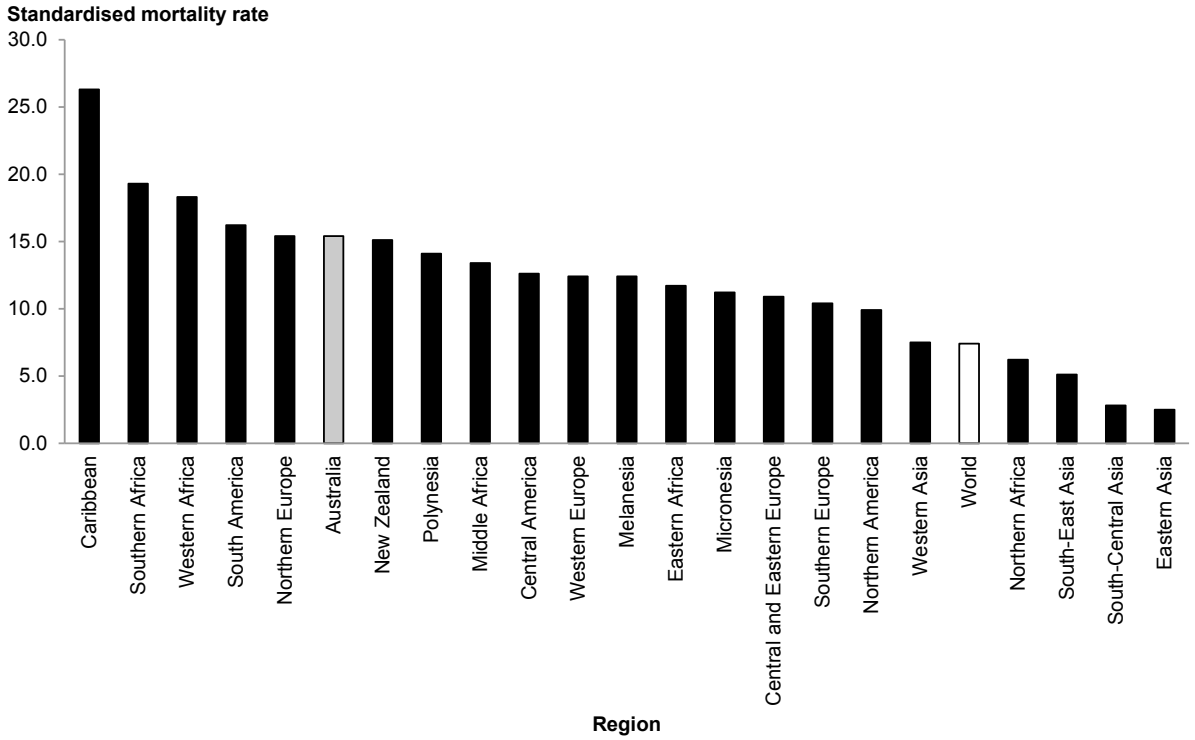
Figure 8.1: Estimated incidence of prostate cancer among males, by international region, 2008

Mortality

The prostate cancer mortality rate in Australia, age-standardised to the World Standard Population, was 15 deaths per 100,000 males (Figure 8.2). This was:

- similar to the rates in Northern Europe, New Zealand, Polynesia and Micronesia
- higher than the World rate (7 per 100,000) and the rates in other European regions, Northern and Central America and Asian regions
- lower than the rates in the Caribbean, Southern and Western Africa and South America.

The prostate cancer mortality rate was higher in the Caribbean (26 per 100,000) and lower in Eastern Asia (3 per 100,000), compared with all other regions.



Notes

1. The rates are estimates for 2008, derived by the International Agency for Research on Cancer (IARC), and are based on data from approximately 3 to 5 years earlier.
2. Rates are age-standardised (by the IARC) to the World Standard Population described by Doll et al. 1966 and expressed per 100,000 males.

Source: Ferlay et al. 2010c; Table S8.2.

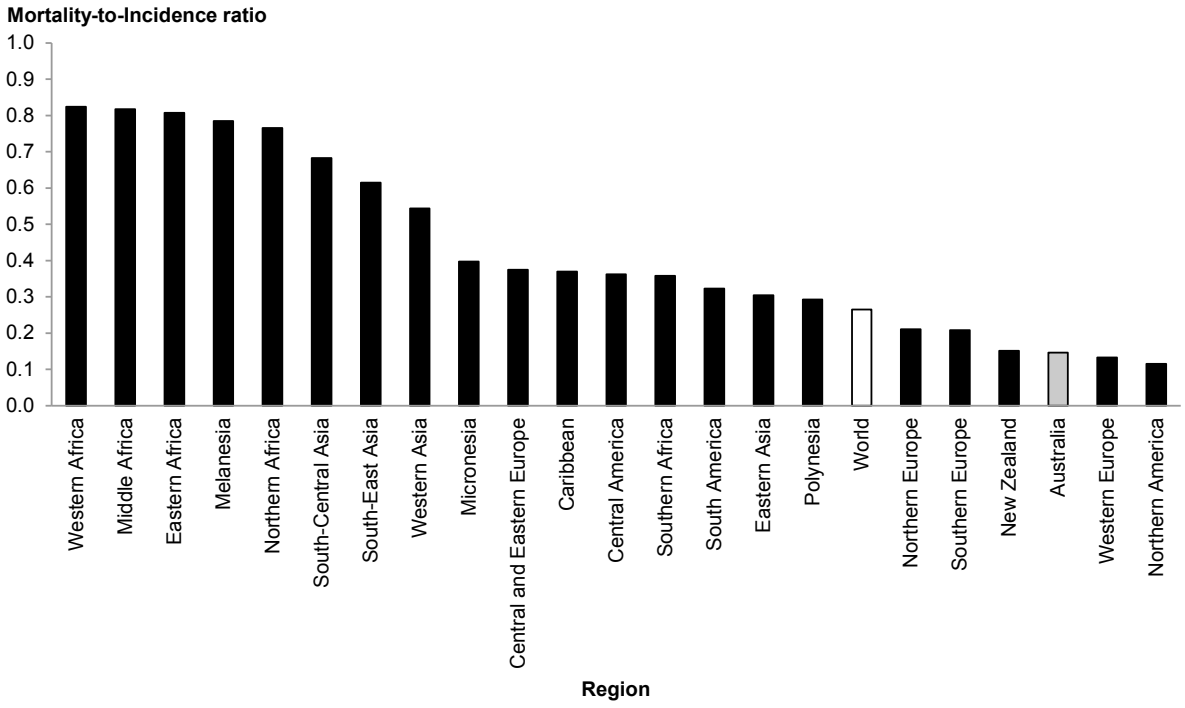
Figure 8.2: Estimated mortality from prostate cancer among males, by international region, 2008

Mortality-to-incidence ratio

The mortality-to-incidence ratio (MIR) for prostate cancer in Australia was 0.1 (Figure 8.3). This means that the age-standardised prostate cancer mortality rate in Australia was low in 2008, compared with the age-standardised incidence rate. The MIR in Australia was:

- similar to that for New Zealand, Western Europe and Northern America
- lower than that for all other regions.

Western, Middle and Eastern African regions had the highest MIR (0.8). The estimated MIR for the World was 0.3.



Notes

1. The ratios are based on estimates for 2008 by the International Agency for Research on Cancer (IARC) that are based on data from approximately 3 to 5 years earlier.
2. The rates used to derive the ratios are age-standardised (by the IARC) to the World Standard Population described by Doll et al. 1966.
3. The mortality-to-incidence ratio equals the age-standardised mortality rate divided by the age-standardised incidence rate.
4. A ratio of 1.0 indicates that the mortality and incidence rates are equivalent and a ratio less than 1.0 indicates that the incidence rate is greater than the mortality rate.

Source: Ferlay et al. 2010c; Table S8.3.

Figure 8.3: Mortality-to-incidence ratio for prostate cancer among males, by international region, 2008

Appendix 1 Technical information

This section presents a summary of the technical information related to the analyses in this report. It includes:

- classifications
- data sources and limitations
- statistical methods and technical notes.

For more detailed technical information, see *Cancer in Australia: an overview 2012* (AIHW & AACR 2012).
Supplementary tables to the figures presented in this report are available online, as a companion document to this report <http://www.aihw.gov.au/cancer-publications>.

Classifications

Health classifications

International Classification of Disease

The International Statistical Classification of Diseases (ICD) and Related Health Conditions is used to classify diseases and other health problems (including symptoms and injuries) in clinical and administrative records. In Australia, mortality cause of death data are coded according to the ICD. Data for 1987—1996 are based on the ninth revision (ICD-9) and data from 1997 are based on the tenth revision (ICD-10).

International Statistical Classification of Diseases, Australian modification

The ICD-10 was modified for the Australian setting by the National Centre for Classification in Health (NCCH) with assistance from clinicians and clinical coders, and is referred to as the ICD-10-AM (NCCH 2010). Hospital morbidity diagnoses have been coded according to the ICD-10-AM since 1999–00, in all Australian states and territories (AIHW 2000).

International Classification of Diseases for Oncology

The International Classification of Diseases for Oncology (ICD-O) is used to classify cancer by both morphology (histology type and behaviour) and topography (site). The first edition was released in 1976 and has since been updated to include lymphomas and leukaemias. In Australia, cancer morphology and topography is coded according to the ICD-O 3rd edition in most state and territory cancer registries and the AIHW Australian Cancer Database (Fritz et al. 2000).

Australian Classification of Health Interventions

The Australian Classification of Health Interventions (ACHI) is used to classify health interventions (procedures). The ACHI was developed in parallel with the ICD-10-AM and implemented in 1998. Hospital surgical procedures and other health interventions are coded using the ACHI, in conjunction with the ICD-10-AM, in all Australian states and territories.

Area-based classifications

Australian Standard Geographical Classification Remoteness Areas

Comparisons of region in this report use the Australian Standard Geographical Classification (ASGC) Remoteness Areas (ABS 2006). The ASGC-RA is a classification system developed by the ABS, which groups Australian regions into five areas: *Major cities*, *Inner regional*, *Outer regional*, *Remote* and *Very remote* (AIHW 2004). Remoteness is assigned to incident records according to the postal area of residence at the time of diagnosis and to mortality records according to the statistical local area (SLA) of residence at time of death.

Index of relative socio-economic disadvantage

There are four socioeconomic indexes for areas (SEIFA) constructed by the Australian Bureau of Statistics and used to classify areas on the basis of social and economic information collected in the Census of Population and housing (ABS 2008a). The SEIFA index of relative socioeconomic disadvantage (IRSD) is derived from social and economic characteristics of disadvantage, such as low income, low educational attainment, high levels of public sector housing, high unemployment and jobs in relatively unskilled occupations. This index is applied to statistical areas, these are ranked according to disadvantage, and commonly grouped as quintiles (equivalent to 20% of the population). Quintiles of socioeconomic disadvantage are assigned to cancer data according to the IRSD of the postal area of residence at the time of diagnosis (incidence), or the SLA of residence at the time of death (mortality).

Standard Australian Classification of Countries

The Standard Australian Classification of Countries (SACC) is the Australian statistical standard for classifying countries, based on the concept of geographic proximity (ABS 2008b). Under the SACC, neighbouring countries are grouped into progressively broader geographical areas on the basis of their similarity in terms of social, cultural, economic and political characteristics. The SACC is applied to incident and mortality data according to reported country of birth.

Data sources and limitations

AIHW data sources

Australian Cancer Database

The Australian Cancer Database (ACD) contains information on Australians who were diagnosed with cancer (excluding basal cell and squamous cell carcinomas of the skin) between 1982 and 2009. Data are collected by state and territory cancer registries from a number of sources and are supplied annually to the AIHW. The AIHW compiles and maintains the ACD, in partnership with the Australasian Association of Cancer Registries (AACR).

In Australia, cancer is a notifiable disease. This means that reporting all cancers (excluding basal cell and squamous cell carcinomas of the skin) is mandatory under legislation in each Australian state and territory.

Cancer reporting and registration is a dynamic process and records in the state and territory cancer registries may be modified if new information is received. As a result, the number of cancer cases reported by the AIHW for any particular year may change slightly over time and may not always align with state and territory reporting for that same year (AIHW & AACR 2010b).

The most recent year of complete national cancer incidence data currently available in the ACD is 2009 and these data have been used in this report. The 2009 prostate cancer incidence data reported here differ from 2009 prostate cancer incidence data published in previous AIHW reports because the 2009 incidence data published previously included estimates for NSW and the ACT in 2009, rather than actual incidence data for 2009.

The Data Quality Statement for the Australian Cancer database 2009 can be found on the AIHW website at <http://meteor.aihw.gov.au/content/index.phtml/itemId/500417>.

AIHW National Mortality Database

The AIHW National Mortality Database contains information provided by the Registries of Births, Deaths and Marriages, the ABS and the National Coroners Information System, for deaths from 1964 to 2011.

Registration of deaths is the responsibility of the state and territory Registrars of Births, Deaths and Marriages. These data are then collated and coded by the ABS and are maintained at the AIHW in the National Mortality Database.

In the AIHW National Mortality Database, both the year of occurrence of the death and the year in which the death was registered are provided. For this report, unless otherwise stated mortality data relate to the *year of death*, except for the most recent year (2011) where the *year of registration* is used. Previous investigation has shown that, due to a lag in processing of deaths, year of death information for the latest available year generally underestimates the true number of deaths, whereas the number of deaths registered in that year is closer to the true value.

Statements on data quality relating to the AIHW National Mortality Database are available from the ABS website:

- Quality declaration summary, *Deaths, Australia, 2011*, ABS Cat. no 3302.0 <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/3302.0Quality%20Declaration02011?opendocument&tabname=Notes&prodno=3302.0&issue=2011&num=&view=>.
- Quality declaration summary, *Causes of death, 2011*, ABS Cat. no. 3303.0 <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/3303.0Quality%20Declaration02011?opendocument&tabname=Notes&prodno=3303.0&issue=2011&num=&view=>.

AIHW National Hospital Morbidity Database

The AIHW National Hospital Morbidity Database (NHMD) is compiled from data supplied by the state and territory health authorities. It is a collection of electronic confidentialised summary records for episodes of admitted patient care (separations or hospitalisations) in essentially all public and private hospitals in Australia. The data include demographic, administrative and clinical information, including patient diagnoses and other procedures.

For more information on the specific use of the NHMD in cancer reporting, see 'Technical notes—Defining prostate cancer-related hospitalisations'.

The Data Quality Statement for the AIHW National Hospital Morbidity Database 2010–11 can be found on the AIHW website at <http://meteor.aihw.gov.au/content/index.phtml/itemId/511338>.

National Death Index

The National Death Index (NDI) is maintained by the AIHW and contains information on all deaths in Australia since 1980. This database exists solely for linkage purposes for health and medical research, such as to gain epidemiological mortality information on individuals in a particular cohort, or with a known disease state. Ethics approval is required to use the NDI for any particular research project.

Cancer incidence data were linked to the NDI in 2007 and used to calculate the survival and prevalence data presented in this report.

The Data Quality Statement for the NDI can be found on the AIHW website at <http://meteor.aihw.gov.au/content/index.phtml/itemId/480010>.

AIHW Disease Expenditure Database

The AIHW Disease Expenditure Database allows expenditure estimates to be produced by source of funds (that is, Australian Government, state government or private) for each area of expenditure. This report provides direct health expenditure on prostate cancer under three categories:

- admitted patient hospital services, covering the expenditure on services provided to an admitted patient, including expenditure on medical services delivered to private admitted patients in hospitals
- prescription pharmaceuticals, including prescriptions subsidised under government schemes (for example, Pharmaceutical Benefits Scheme) and private prescriptions
- out-of-hospital medical services, comprising medical services funded under the Medical Benefits Schedule, such as primary health visits, pathology and specialist services. Practice Incentive Payments are also included in this category.

For more information on the AIHW Disease Expenditure Database, see:

- *Health system expenditures on cancer and other neoplasms in Australia 2000–01* (AIHW 2005)
- *Health system expenditure on disease and injury in Australia, 2004–05* (AIHW 2010)
- the Data Quality Statement for the Disease Expenditure Database <http://meteor.aihw.gov.au/content/index.phtml/itemId/512599>.

External data sources

GLOBOCAN

The GLOBOCAN database, which is prepared by the International Agency for Research on Cancer (IARC), contains cancer incidence and mortality data from cancer registries around the world (Ferlay et al. 2010a). The IARC uses this data to produce estimates for a 'common year'. The most recent GLOBOCAN estimates are for 2008 and are based on incidence data from 3 to 5 years earlier.

The GLOBOCAN database can be accessed at <globocan.iarc.fr/>.

Population data

Population data, sourced from the ABS and referred to as 'estimated resident populations' are used to derive age specific and age-standardised rates.

The populations used in this report were derived from the 2011 Census of Population and Housing. Populations for 2007 to 2012 are the preliminary rebased populations, and the standard population for all analyses is the 2001 Australian Standard Population (at 30 June 2001) (Table A1).

These populations are updated over time, and those used in this report are presented in Table A1 for information. They are also available from the ABS website, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3101.0Main+Features1Jun%20201 2?OpenDocument>.

Table A1: Preliminary rebased estimated resident population of males (2007 to 2012) and the 2001 Australian standard population (all at 30 June)

	Males						
Age group (years)	2007	2008	2009	2010	2011	2012	2001 Australian standard (persons)
0–4	686,068	705,904	727,453	739,890	748,101	760,271	1,282,357
5–9	686,058	686,599	689,611	694,048	704,447	721,135	1,351,664
10–14	716,750	715,275	714,549	710,668	708,887	708,804	1,353,177
15–19	738,592	750,658	756,292	752,183	746,817	748,674	1,352,745
20–24	766,883	789,463	817,621	825,743	823,241	827,157	1,302,412
25–29	731,683	766,611	806,027	828,785	840,165	854,925	1,407,081
30–34	733,268	734,076	743,043	752,332	768,866	795,158	1,466,615
35–39	777,976	792,074	797,990	795,306	782,289	774,443	1,492,204
40–44	754,125	750,279	753,410	762,180	782,809	806,875	1,479,257
45–49	754,201	768,000	776,460	776,963	769,849	763,031	1,358,594
50–54	686,971	696,249	710,100	723,362	739,179	755,992	1,300,777
55–59	631,844	636,310	642,249	648,937	659,220	672,254	1,008,799
60–64	533,279	564,174	583,812	601,376	615,406	612,489	822,024
65–69	399,225	411,464	429,882	450,375	473,457	509,422	682,513
70–74	310,684	318,326	327,914	339,282	349,421	364,420	638,380
75–79	253,706	253,592	254,224	254,959	258,072	264,739	519,356
80–84	171,733	177,322	181,941	187,051	190,455	192,032	330,050
85+	111,757	117,756	123,890	130,736	138,934	148,983	265,235
Total	**10,444,803**	**10,634,132**	**10,836,468**	**10,974,176**	**11,099,615**	**11,280,804**	**19,413,240**

Aboriginal and/or Torres Strait Islander populations used in this report were sourced from the Indigenous experimental estimated resident populations released by the ABS (ABS 2009). These estimates are based on the 2006 Census of Population and Housing, and can be

sourced from the ABS website, <http://www.abs.gov.au/ausstats/abs@.nsf/PrimaryMainFeatures/3238.0?OpenDocument>.

Data limitations

This report aims to present the most comprehensive available picture of prostate cancer in Australia by drawing on the range of data sets described above. However, there are a number of data and information gaps at the national level and limitations in the use and interpretation of cancer data.

Aboriginal and Torres Strait Islander status

Reliable national data on the incidence of cancer and on the mortality from cancer for Aboriginal and Torres Strait Islander people are not available. Although all cancer registries collect information on Aboriginal and Torres Strait Islander status, in some jurisdictions the quality of the data is insufficient for analyses.

Prostate cancer incidence data by Aboriginal and Torres Strait Islander status is presented for four jurisdictions with sufficient data quality for reporting purposes—New South Wales, Queensland, Western Australia and the Northern Territory—for the combined years 2004–2008. Prostate cancer mortality data by Indigenous status is presented for five jurisdictions with sufficient data quality for reporting purposes—New South Wales, Queensland, Western Australia, South Australia and the Northern Territory—for the combined years 2006–2010.

Cancer grade and stage

Although some cancer registries collect information on the grade of prostate cancer, there were insufficient data available for comprehensive analysis. Data on the stage (severity) of prostate cancer is not recorded in the cancer registries data. Information on prostate cancer grade and stage are not presented in this report.

Cancer treatment

There are no data available at the national level on the treatments applied to prostate cancer, complications with prostate cancer treatment or the frequency of recurrence of prostate cancer after treatment. However, there are comprehensive national data on treatments provided through admitted patient hospitalisations, such as surgery and non-surgical care (see, 'Chapter 2 Management'). Pilot projects to collect treatment (as well as cancer stage) data on a small scale are currently underway, with the aim of eventually expanding the methodology to national data collection (Cancer Australia 2010).

Statistical methods

Age-specific rates

Age-specific rates provide information on the incidence of a particular event in an age group relative to the total number of people at risk of that event in the same age group. They are calculated by dividing the number of cases occurring in each specified age group by the corresponding population in the same age group, expressed as a rate (for example, number per 100,000 population).

Age-standardisation

Age-standardisation is a method used to eliminate the effect of differences in population age structures when comparing populations with different age structures, and where age affects the variable being compared. This is the case with prostate cancer, which occurs more often among older Australians. Age-standardisation is used in this report when comparing rates and across different periods of time, different geographical areas, different socioeconomic groups or other different populations. The direct method of age-standardisation is used throughout the report.

Incidence

In this report, data on the incidence of prostate cancer refers to the number of cases newly diagnosed and not to the number of males newly diagnosed with prostate cancer. However, because it is rare that a male would be diagnosed with more than one primary prostate cancer during a 1-year period, the number of new prostate cancers and the number of males newly diagnosed with prostate cancer are similar.

Prevalence

In this report, 5-year limited-duration prevalence is presented and refers to the number of males alive at the end of 2007 that had been diagnosed with prostate cancer in Australia during the 5-year period from 2003 to the end of 2007.

Risk to age 45, 55, 65, 75 or 85

The calculations of risk shown in this report are measures that approximate the risk of developing (or dying from) cancer before the age 45, 55, 65, 75 or 85, assuming that the risks at the time of estimation remained throughout life. These data are based on a mathematical relationship with the cumulative incidence or mortality rates.

Survival

Relative survival analysis

Relative survival is a measure of the survival of people with cancer compared with that of the general population.

It is calculated as the ratio of *observed survival* of a group of people diagnosed with cancer to the *expected survival* of the general population, matched for age, sex, calendar year and, where applicable, remoteness or socioeconomic status. Relative survival measures the excess mortality associated with a cancer diagnosis and is the standard approach used by cancer registries to produce population-level survival statics.

For more information, see *Cancer survival and prevalence in Australia: period estimates from 1982 to 2010* (AIHW 2012c).

Mortality-to-incidence ratio

Mortality-to-incidence ratios (MIRs) can be used to estimate survival from a particular disease for a population. The MIR is defined as the age-standardised mortality rate divided by the age-standardised incidence rate. For example, an MIR of 0.42 in a given year for all types of cancers means that, for every 100 new cancer cases diagnosed that year, there were

42 deaths due to cancer in the same year (though the deaths need not be of the same people as the cases). If people tend to die relatively soon after diagnosis from a particular cancer (that is, the death rate is nearly as high as the incidence rate for that cancer), then the MIR will be close to 1.00. In contrast, if people tend to survive a long time after being diagnosed, then the MIR will be close to zero.

The MIR only gives a valid measure of the survival experience in a population if:

- cancer registration and death registration are complete or nearly so, and
- the incidence rate, mortality rate and survival proportion are not undergoing rapid change.

Technical notes

Defining prostate cancer-related hospitalisations

Hospitalisation data are an administrative record of episodes of care that include the principal diagnosis (the diagnosis determined to be chiefly responsible for the hospitalisation) and additional diagnoses (a diagnosis that coexists with the principal diagnosis or arises during the episode of care) (AIHW 2013). The database also includes interventions (procedures) carried out during the episode of care.

Based on the *International statistical classification of diseases and related health problems, 10th revision, Australian modification* (ICD-10-AM), the principal diagnosis can be a disease, injury or poisoning, or a specific treatment of an already diagnosed condition, such as chemotherapy for cancer (NCCH 2010).

Consequently, it is insufficient to count only those hospitalisations for which cancer was recorded as the principal diagnosis. For completeness, those hospitalisations where a cancer-related treatment was recorded as the principal diagnosis must also be counted.

In this report, 'prostate cancer–related hospitalisations' were identified as those in which primary malignant prostate cancer was recorded as the principal diagnosis, or as the additional diagnosis in a hospitalisation where the principal diagnosis was directly related to the investigation, treatment or care of prostate cancer. The relevant ICD-10-AM codes are defined in Table A2.

Table A2: Defining prostate cancer-related hospitalisations

Principal diagnosis (ICD–10-AM code)	Additional diagnosis (ICD–10-AM code)
Prostate cancer (C61)	Any
Follow-up examination after treatment for malignant neoplasms (Z08)	Prostate cancer (C61)
Special screening examination for neoplasm of prostate (Z12.5)	
Prophylactic immunotherapy (Z29.1)	
Other prophylactic chemotherapy (Z29.2)	
Prophylactic surgery for risk factors related to malignant neoplasms (Z40.0)	
Adjustment and management of infusion pump (Z45.1)	
Adjustment and management of vascular access device (Z45.2)	
Radiotherapy session (Z51.0)	
Pharmacotherapy session for neoplasm (Z51.1)	
Convalescence following radiotherapy (Z54.1)	
Convalescence following chemotherapy (Z54.2)	
Family history of malignant neoplasms (Z80)	
Personal history of malignant neoplasms (Z85)	

Source: Adapted from AIHW & AACR 2012.

Interpreting comparison data

In this report, comparisons are made using international and state or territory-based data, as well as between population groups. Caution should be taken when interpreting these comparisons, as observed differences may be influenced by:

- methods of cancer detection
- types of treatment provided and access to treatment services
- characteristics of the cancer such as histology type, stage and grade at diagnosis
- coding practices and cancer registration methods, as well as accuracy and completeness of recording of all prostate cancer cases.

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List of tables

List of figures

List of boxes

Related publications

This report, *Prostate Cancer in Australia*, is part of the cancer series. The following AIHW publications, also part of the cancer series, might be of interest:

- AIHW 2012. Cancer incidence projections, Australia 2011 to 2020. Cancer series no. 66. CAN 62. Canberra: AIHW
- AIHW 2012. Cancer survival and prevalence in Australia: period estimates from 1982 to 2010. Cancer Series no. 69. CAN 65. Canberra: AIHW
- AIHW & AACR 2012. Cancer in Australia: an overview 2012. Cancer series no. 74. Cat. no. CAN 70. Canberra: AIHW.

These and other cancer-related reports can be downloaded free of charge from the AIHW website <http://www.aihw.gov.au/cancer-publications/>. The website also includes information on ordering printed copies of these reports.

This is the first comprehensive national report on prostate cancer in Australia. It presents an overview of the condition and analysis of key summary measures including incidence, mortality and survival. Findings include:

- Prostate cancer is the most commonly diagnosed cancer in Australia (excluding non-melanoma skin cancer), with 21,808 new diagnoses in 2009.
- Prostate cancer is the fourth leading cause of mortality among Australian males, with 3,294 deaths from prostate cancer in 2011.
- Around 9 in 10 (92%) males diagnosed with prostate cancer survive 5 years from diagnosis. This is higher than for all cancers among males (65%).