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Aboriginal and Torres Strait Islander people

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
ANZDATA	Australia and New Zealand Dialysis and Transplant (Registry)
AusDiab	Australian Diabetes, Obesity and Lifestyle Study
CKD	chronic kidney disease
CVD	cardiovascular disease
DRUID	Diabetes and Related Conditions in Urban Indigenous People in the Darwin Region (study)
ESKD	end-stage kidney disease
GFR	glomerular filtration rate
ICD-10	International Classification of Diseases, Tenth Revision
ICD-10-AM	International Classification of Diseases, Tenth Revision, Australian Modification
KRT	kidney replacement therapy
NATSIHS	National Aboriginal and Torres Strait Islander Health Survey
NHMD	National Hospital Morbidity Database
NHS	National Health Survey

Summary

Chronic kidney disease (CKD) is a serious and increasingly common health problem in Australia. People with CKD, particularly those with end-stage kidney disease (ESKD), suffer poor health outcomes and a decreased quality of life. Aboriginal and Torres Strait Islander people, especially those who live in remote communities, are at a greater risk of developing CKD, and have substantially poorer health outcomes than other Australians. To date, information on CKD in Aboriginal and Torres Strait Islander people at the national level has been limited to high-level summary information. *Chronic kidney disease in Aboriginal and Torres Strait Islander people 2011* presents the first detailed analysis of CKD in Indigenous Australians, using a variety of data sources.

End-stage kidney disease

- Over the period 2007 to 2008, almost 10% of new cases of treated ESKD were for Indigenous Australians, despite Indigenous Australians making up only 2.5% of the total Australian population.
- If Indigenous Australians had the same incidence rate of treated ESKD as non-Indigenous Australians, 89% of these cases would have been avoided.
- 12% of Indigenous Australians with treated ESKD have a functioning kidney transplant, compared with 45% of non-Indigenous treated ESKD patients.

Hospitalisations

- In 2008–09, the hospitalisation rate for regular dialysis treatment among Indigenous Australians was 11 times as high as for other Australians.

Deaths

- Indigenous Australians are almost 4 times as likely to die with CKD as a cause of death than non-Indigenous Australians.

Expenditure

- In 2006–07, over 12% of hospital admitted patient expenditure on CKD was for Indigenous Australians.

Remoteness

- Compared with those living in other areas, Indigenous Australians living in remote and very remote areas are more likely to have treated ESKD. This is also reflected in the higher hospitalisation rates for CKD among Indigenous Australians in these areas.

Trends over time

- Over the period 2001 to 2008, the number of Indigenous Australians receiving treatment for ESKD increased by 72%, compared with a 41% increase for non-Indigenous Australians.

1 Introduction

Background

Aboriginal and Torres Strait Islander people have higher prevalence rates of many health conditions than other Australians, particularly circulatory diseases (including heart disease), diabetes, respiratory diseases, musculoskeletal conditions, kidney disease and eye and ear problems (ABS & AIHW 2008). They are also more likely to report poorer self-assessed health, have higher rates of hospitalisation and typically die at much younger ages. Long-term health conditions contribute to much of the ill health experienced by Indigenous Australians, and onset is generally experienced at an earlier age than for other Australians.

Chronic kidney disease

The kidneys continuously filter the bloodstream, clearing waste products and playing a vital role in controlling the body's level of water and various chemicals. They also produce certain essential hormones (Kidney Health Australia 2007).

Chronic kidney disease (CKD) refers to all conditions of the kidney, lasting at least 3 months, where a person has had evidence of kidney damage and/or reduced kidney function, regardless of the specific diagnosis of disease or condition causing the disease (National Kidney Foundation of America 2002).

Evidence of kidney damage manifests as either urinary protein (proteinuria) or albumin (albuminuria, a type of protein that is a more sensitive and specific marker of kidney disease), blood in the urine (haematuria) or scarring detected by imaging tests. Kidney function is measured and diagnosed clinically by the glomerular filtration rate (GFR) which is the amount of blood the kidneys clear of waste products in 1 minute. As GFR cannot be measured directly, current practice is to estimate GFR (eGFR) by applying a formula which requires age, gender and creatinine levels in the blood.

CKD is categorised into five stages according to the level of reduced kidney function and evidence of kidney damage (Box 1.1). Stage 5—end-stage kidney disease (ESKD)—is the most severe form of CKD, where kidney function deteriorates so much that kidney replacement therapy (KRT) in the form of dialysis or kidney transplant is required to survive (Kidney Health Australia 2007). The most common causes of ESKD, including diabetes, glomerulonephritis and high blood pressure, are described in Chapter 2, Box 2.1. The early stages of CKD are potentially reversible, but once a person reaches Stage 5 (ESKD), kidney function does not usually improve.

Many people do not know they have CKD because up to 90% of kidney function can be lost before symptoms appear. For this reason, it is often called a 'silent killer'. Fortunately, simple tests of a person's urine and blood can identify most cases of CKD when the disease is in its early stages, enabling treatment to prevent or slow down the progression.

Indigenous Australians and chronic kidney disease

Early kidney damage is common among Indigenous Australians; however, large regional differences exist, with rates highest in remote areas and lowest in urban areas. Incidence rates for ESKD in some remote regions are up to 30 times the national incidence for all Australians (Cass et al. 2001).

Indigenous Australians have higher levels of risk factors associated with many chronic diseases such as smoking, overweight and obesity. Indigenous Australians are also disadvantaged across a number of socioeconomic factors that affect health outcomes including income, employment, educational attainment and home ownership.

In addition to higher rates of risk factors for chronic disease mentioned above, Indigenous Australians are at increased risk of developing CKD from other risk factors that are less common in non-Indigenous Australians. These include low birthweight, which is linked to reduced nephron endowment and development and reduced functioning, and inflammation from infection, among others (Hoy et al. 2006). Nephrons are the functional and structural units of the kidney and are responsible for the purification and filtration of the blood.

CKD in Indigenous Australians has also been linked to primary kidney disease, genetics, early development and socioeconomic disadvantage. A measure of socioeconomic disadvantage that includes measures of house crowding, low birthweight, educational attainment, employment and income has been shown to strongly correlate with ESKD in Indigenous Australians (Cass et al. 2002).

Hoy et al. (1998) also highlighted the multifactorial nature of kidney disease in the Indigenous Australian community and suggested that most of the risk factors specific to Aboriginal and Torres Strait Islander people have arisen out of poverty, disadvantage and accelerated lifestyle change.

Box 1.1: Stages of chronic kidney disease

Stage 1: Kidney damage with normal kidney function (eGFR ≥ 90 mL/min/1.73 m²)
Usually no symptoms but high blood pressure is more frequent than for patients without CKD.

Stage 2: Kidney damage with mild loss in kidney function (eGFR 60–89 mL/min/1.73 m²)
Most patients have no symptoms but high blood pressure is frequent.

Stage 3: Moderate loss of kidney function (eGFR 30–59 mL/min/1.73 m²)
Possibly no symptoms, or may experience an increased need to urinate during the night (nocturia), a mild feeling of being ill and loss of appetite. Common complications include high blood pressure, mineral and bone disorders, anaemia, sleep apnoea, restless legs, cardiovascular disease, malnutrition and depression.

Stage 4: Severe loss of kidney function (eGFR 15–29 mL/min/1.73 m²)
Symptoms are as for Stage 3, plus nausea, itching skin, restless legs and shortness of breath. Common complications of this stage are also as for Stage 3, along with electrolyte disturbances such as raised blood levels of phosphate and potassium and increased acidity of the blood.

Stage 5: End-stage kidney disease (eGFR <15 mL/min/1.73 m2 or on dialysis)
Symptoms are as for Stage 4. Additional common complications include inflammation of the tissue layers surrounding the heart, bleeding in the gastrointestinal tract, altered brain function and structure, and disturbances or structural or functional changes in the peripheral nervous system.

Source: Kidney Health Australia 2007.

The Indigenous population

In 2006 the Aboriginal and Torres Strait Islander population was estimated to be 517,000 or 2.5% of the total Australian population.

The Indigenous population is relatively young, with a median age of 21 years compared with 37 years for other Australians. Indigenous Australians aged less than 15 years constitute 38% of the total Indigenous population, whereas this age group represents about 20% of the total Australian population. Conversely, those aged 65 years and over comprise only 3% of the Indigenous population compared with 13% of the total Australian population (Figure 1.1).

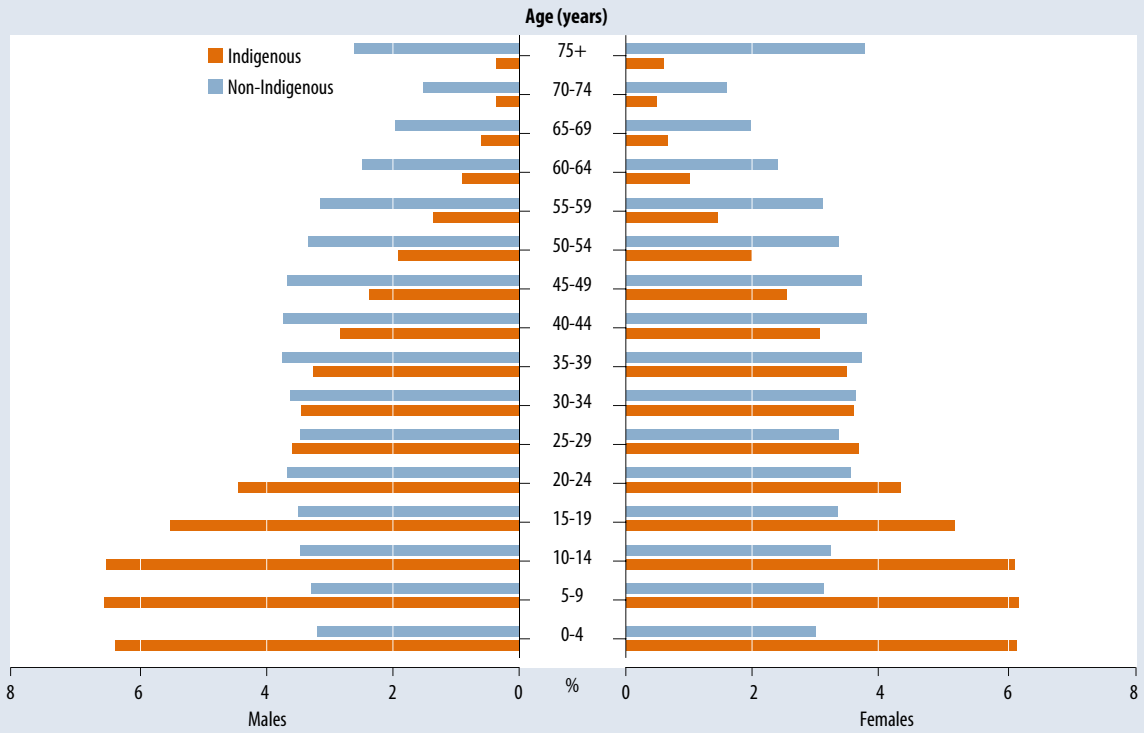
Over half (54%) of Indigenous Australians live in *Major cities* and *Inner regional* areas, however they make up only 1.2% and 2.7% of the total population in these areas, respectively (Table 1.1). In contrast, 15% of Aboriginal and Torres Strait Islander people live in *Very remote* areas compared with 0.4% of non-Indigenous Australians. Indigenous Australians make up 47% of the population in *Remote* and *Very remote* areas (see *Appendix B* for more information on the geographical classification system used throughout this report).

Estimates of life expectancy for Aboriginal and Torres Strait Islander people differ across states and territories, being highest in New South Wales and lowest in the

Table 1.1: Distribution of Australian population, by Indigenous status and geographical location, 2006

	Major cities	Inner regional	Outer regional	Remote	Very remote	Total
Geographical location population			**Per cent**			
Indigenous	1.2	2.7	5.8	15.2	48.0	2.5
Non-Indigenous	98.8	97.3	94.2	84.8	52.0	97.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total population						
Indigenous	32.1	21.4	21.9	9.3	15.4	100.0
Non-Indigenous	69.4	19.7	9.2	1.3	0.4	100.0

Source: ABS 2008.



Note: The age group 75+ includes all ages 75 years and over, and is not directly comparable with other 5-year age groups.

Source: ABS 2008.

Figure 1.1: Age structure of the Australian population, by Indigenous status, 2006

Northern Territory. Nationally, experimental estimates for Indigenous life expectancy at birth for the period 2005–2007 were 67.2 years for males (compared with 78.7 for all males) and 72.9 years for females (compared with 82.6 years for all females). This is a difference of 11.5 years for males and 9.7 for females (ABS 2009).

Data sources and methods

Methods such as age-standardisation and linear regression have been used in this report to assess differences between Indigenous and other Australians, between males and females and over time. **Where a comment has been made stating there is a difference or a change over time, this difference or change has been found to be statistically significant**. More information on methods can be found in Appendix B. In some cases, data have been reported for aggregated years to ensure statistical validity.

The latest Australian Bureau of Statistics (ABS) population estimates and projections were used in this report (Australian Bureau of Statistics 2009). These are based on the 2006 Census of Population and Housing for Australia and the states and territories, as well as assumptions of past and future fertility, mortality and migration of the Aboriginal and Torres Strait Islander population.

Data issues

While much progress has been made in collecting information on the health of Aboriginal and Torres Strait Islander people over recent years, many practical, analytical and conceptual challenges remain. This is due in part to varying levels of identification of Indigenous people in administrative records, and partly to the statistical and practical challenges of surveying a population that is relatively small, and of whom one-quarter live in *Remote* or *Very remote* areas. Analysis in this report has been limited to those jurisdictions assessed as having adequate identification of Indigenous people for these data collections.

The Australian Institute of Health and Welfare (AIHW) has completed an assessment of the level of Indigenous under-identification in hospital data in all states and territories. Results of this assessment indicate that, from 2004–05 onwards, New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory (public hospitals only) hospitals data have adequate Indigenous identification (80% or higher overall levels of Indigenous identification) for national reporting. The proportion of the Indigenous population covered by these six jurisdictions is 96%. For hospitalisations before 2004–05, data are limited to Queensland, Western Australia, South Australia, and

public hospitals in the Northern Territory.

The ABS has assessed the quality of Indigenous deaths in death registration data by state and territory in the Census Data Enhancement—Indigenous Mortality Quality Study (ABS 2008). This study involved linking Census records with death registration records to examine differences in reporting of Indigenous status across the two data sets. This assessment indicates that the Indigenous identification rate is 87% or higher for New South Wales, Queensland, Western Australia, South Australia and the Northern Territory, and around 65% for the remaining jurisdictions. Historically, Indigenous identification in South Australia, Western Australia and the Northern Territory has been of sufficient quality to include in analyses from 1991 onwards. Queensland was included in the analysis from 1998 and in 2010 a decision was made to include data from New South Wales from 2001 onwards. The proportion of the Indigenous population covered by these jurisdictions is 89%.

The incompleteness of Indigenous identification means the number of hospitalisations and deaths recorded as Indigenous are an underestimate of the true level of morbidity and mortality of Aboriginal and Torres Strait Islander people. As a result, the observed differences between the Indigenous and non-Indigenous populations may be underestimates of the true differences (AIHW 2008).

Data sources

Australia and New Zealand Dialysis and Transplant (ANZDATA) Registry

In Australia, persons who develop ESKD and undertake dialysis or have a kidney transplant are registered with the ANZDATA Registry. It compiles data on incidence and prevalence of treated ESKD, complications, comorbidities and patient deaths. All relevant hospitals and related satellite units in Australia and New Zealand participate. Indigenous identification in the Registry is based on self-identification to the reporting renal units. Due to the prolonged and repeated contact with renal units in hospitals and the heightened awareness of the extent of kidney disease in Indigenous Australians, it is believed that Indigenous identification in the Registry is more complete than in general hospital data (Cass et al. 2001) and for this reason data from all jurisdictions are used.

Hospitalisations

Information on hospitalisations in Australia is contained in the AIHW National Hospital Morbidity Database (NHMD). The AIHW compiles and maintains this national collection, using information supplied by state and territory health authorities. The database records information on patients who undergo a hospital's formal admission process, complete an episode of admitted patient care, and 'separate' from the hospital (AIHW 2009d).

Diagnoses and procedures in the NHMD for the years included in this report are classified according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) second to sixth editions. Until the 6th edition, CKD was not used as a medical term in the ICD-10-AM, nor generally used as a diagnosis in clinical settings. For this report, a list of conditions known to cause, or be caused by, CKD was used to identify hospitalisations for CKD (see Appendix B for coding list).

Mortality

The AIHW National Mortality Database is a national collection of de-identified information for all deaths in Australia and is maintained by the AIHW. Information on the characteristics and causes of death of the deceased is provided by the medical practitioner certifying the death on the Death Certificate, or by a coroner. The ABS determines the underlying and associated causes of death using standardised coding rules set down in the International Classification of Diseases (ICD). CKD is not used as a medical term in the ICD so a list of diseases known to cause, or be caused by, CKD is used to identify CKD-related deaths (see Appendix B for coding list).

National Aboriginal and Torres Strait Islander Health Survey (NATSIHS), 2004–05

This survey collected information relating to Indigenous health including health status, health action taken and lifestyle factors that may influence health. Information was collected from 10,439 Indigenous persons living in both remote and non-remote areas of Australia. The survey covered information similar to the National Health Survey (NHS), including self-assessed health status, health risk factors, long-term conditions, health-service use, social and emotional wellbeing, and basic demographic information. While the NATSIHS collects information on Aboriginal and Torres Strait Islander people self-reporting CKD as a long-term condition, there is no equivalent question in the NHS, meaning comparisons between Indigenous and non-Indigenous Australians are not possible.

AIHW Disease Expenditure Database

The AIHW gathers health expenditure data from many sources including the ABS, the Australian Government Department of Health and Ageing, the Australian Government Department of Veterans' Affairs and state/territory health authorities. This information is used to create the AIHW Health Expenditure Database which produces estimates published in the AIHW report *Health expenditure Australia*. These estimates form the base for various further analyses, including allocation between Indigenous and non-Indigenous Australians to produce the report *Expenditure on health for Aboriginal and Torres Strait Islander people*.

This report presents estimates of admitted patient expenditure for CKD drawn from the AIHW Disease Expenditure Database and additional analyses. The AIHW Disease Expenditure Database apportions total recurrent health expenditure from the AIHW Health Expenditure Database to 19 broad disease groups that largely correspond to a chapter-level heading in the International Classification of Diseases (ICD-10) (Begg et al. 2007). It is not possible to allocate all expenditure on health goods and services by disease or by Indigenous status.

2 Prevalence and incidence of CKD

Estimating the prevalence (the number of cases at a point in time) and incidence (the number of new cases during a specified time period) of a disease provides an important foundation for determining its burden on the health of Australians and its impact on the health system.

Current methods for estimating the incidence and prevalence of chronic conditions rely on disease registries or self-reported data from national surveys. Incidence is considered the more difficult to measure, requiring periodic follow-up to identify newly diagnosed cases. As yet, there is no registry for CKD, and while surveys can provide an estimate of diagnosed CKD, often it has no symptoms (particularly in stages 1–4) and many cases go undiagnosed (Chadban et al. 2003).

Prevalence of CKD

The best way to estimate the prevalence of CKD is through surveys in which blood and urine are taken for measurement—ideally in two separate samples 3 months apart to exclude acute kidney disease cases. Unfortunately there is a shortage of biomedical surveys, especially those which include an adequate sample of Aboriginal and Torres Strait Islander people.

The most recent national survey that collected measured data about CKD was the Australian Diabetes, Obesity and Lifestyle Study (AusDiab) in 1999–2000. This was a national, population-based cross-sectional survey of non-institutionalised Australians aged 25 years and older (Dunstan et al. 2002). The sampling method of this study excluded some areas, and those that had greater than 10% Indigenous population, and indeed only 0.8% of the AusDiab sample was Indigenous. AusDiab found that 16% of the predominantly non-Indigenous study sample had at least one marker of kidney damage, while 13.4% of participants had some degree of CKD (Chadban et al. 2003).

A similar study has been undertaken on urban Indigenous Australians in Darwin (the DRUID study—Diabetes and Related Conditions in Urban Indigenous People in the Darwin Region). To date, no data relating specifically to CKD are available, however it did find that 39% of those with diabetes also showed signs of kidney damage (Maple-Brown et al. 2008). Kidney damage (albuminuria) was over 2 times more likely in the DRUID study sample compared with the AusDiab study sample.

Table 2.1: Summary of existing literature on the incidence and prevalence of CKD trends in Indigenous Australians

Researchers	Study Sample	Results
Cass et al. (2001)	719 Indigenous Australians who began treatment for end-stage kidney disease (ESKD) in Australia between 1993 and 1998. The sample covered all the (former) 36 Aboriginal and Torres Strait Islander Commission (ATSIC) regions.	Marked regional variation in treated ESKD incidence rates, with rates as high as 30 times the non-Indigenous rate in some remote areas.
McDonald et al. (2003)	237 Indigenous adult volunteers from a remote Northern Territory community.	12% of adults had Stage 3, 4 or 5 chronic kidney disease (CKD) and 36% had evidence of reduced kidney function.
Stewart et al. (2004)	1,262 Indigenous and 13,574 non-Indigenous Australians who received treatment for ESKD in Australia from 1992 to 2001.	Indigenous Australians older than 15 years had significantly higher incidence rates of treated ESKD. The largest difference was for 45–64 year age group, with Indigenous Australians 13 times more likely than non-Indigenous Australians to have ESKD.
Preston-Thomas (2007)	1,194 Indigenous Australians receiving treatment for ESKD.	The incidence of treated ESKD was 3.2–10.3 times higher in indigenous Australians than non-Indigenous Australians, with higher prevalence rates in remote areas.
Hoy et al. (2007)	814 Indigenous adult volunteers from three remote Northern Territory communities and 10,434 non-Indigenous Australians from the AusDiab Study[(a)].	Compared with the AusDiab sample, signs of kidney damage were 2.5–5.3 more likely in the three communities.
Hoy et al. (2010)	Kidney biopsy data from 253 non-Indigenous Australians and 535 Indigenous Australians.	Indigenous Australians undergoing biopsy had increased proteinuria, and higher levels of diabetes and diabetes-related kidney damage. Samples from Indigenous Australians living in remote and very remote areas were also more likely than other Indigenous Australians and non-Indigenous Australians to show structural changes indicative of a predisposition to kidney damage.

(a) Only 0.8% of the AusDiab study sample were Indigenous Australians.

The recently commenced 2011–12 Australian Health Survey has a biomedical component, and also includes an Indigenous component. One of the aims of the survey is to obtain objective prevalence estimates for diabetes, cardiovascular disease (CVD), CKD and certain nutritional deficiencies. It is intended that this survey will be an ongoing series of national surveys conducted every 6 years. Results from the Aboriginal and Torres Strait Islander component of this survey are expected from July 2014 and will be instrumental in providing estimates of the prevalence of CKD in the future.

CKD in discrete Indigenous communities

Although there is no measured information on the overall incidence or prevalence of CKD in Indigenous Australians at the national level, several studies (Table 2.1) have identified high rates of CKD and indicators of kidney damage among Indigenous communities.

As seen in the Table 2.1, although CKD rates and markers are more prevalent in Indigenous Australians in general, wide variation is seen between different communities. Variation also exists in CKD risk factors, with Hoy et al. (2005b) finding differing levels of CKD risk factors like smoking, hypertension and diabetes between three remote Aboriginal communities.

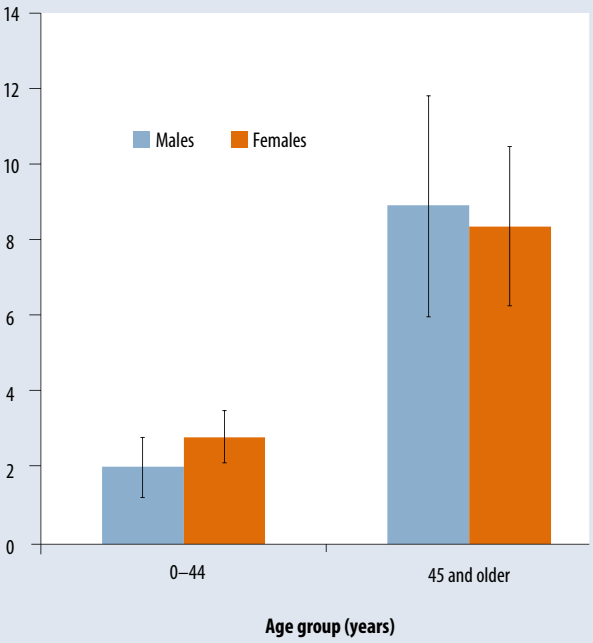
Self-reported CKD

Most health conditions in the 2004–05 NATSIHS are calculated by combining the self-reported categories *Ever told has condition, still current and long-term* and *Not known if ever told, but condition current and long-term*. Based on this method, an estimated 1.8% of Aboriginal and Torres Strait Islander people had kidney disease as a long-term condition in 2004–05.

The analysis of the NATSIHS data presented in this report also includes those people reporting conditions as *Ever told has condition, not current*. This is because certain conditions (including kidney disease and CVD) were assumed to be long term in the 2004–05 NATSIHS (ABS 2006a), and while the conditions may not necessarily be obvious in terms of symptoms, the underlying condition is likely to remain. However, for diabetes, those reporting as *Ever told has condition, not current* were not included so as to avoid potentially counting people who have previously had gestational diabetes (a non-chronic condition).

Using this method, an estimated 3.4% of Indigenous Australians had CKD in 2004–05. Slightly more Indigenous females than males reported having CKD (3.7% compared with 3.1%, respectively). Chronic kidney disease prevalence was related to age, being highest among those aged 45 years and older for males (8.9%) and females (8.4%) (Figure 2.1).

Because CKD is normally identified in the later stages, the prevalence of self-reported CKD is likely to be an underestimate of the true prevalence and caution is required in interpreting the figure.

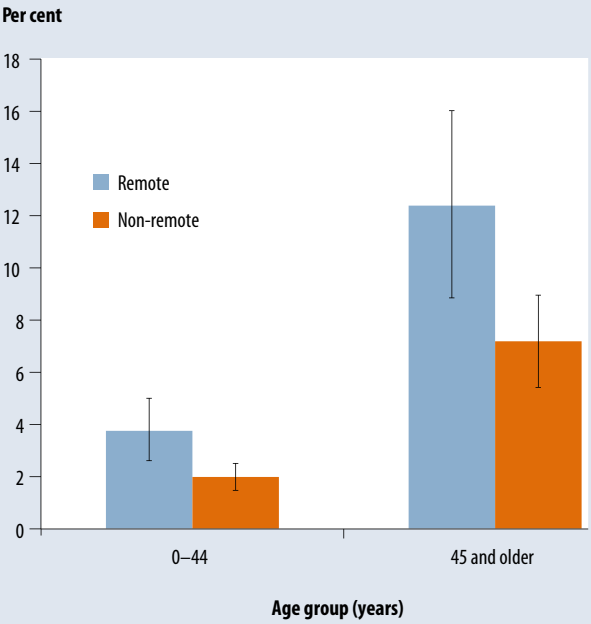


Source: AIHW analysis of NATSIHS 2004-05 data.

Figure 2.1: Proportion of Indigenous Australians self-reporting with CKD, by sex, 2004-05

The proportion of Indigenous Australians with CKD was higher for those living in remote areas than non-remote areas (5.5% compared with 2.8%, respectively). The greatest relative difference was among those aged 0–44 years where the proportion of Indigenous Australians living in remote areas with CKD was nearly twice the proportion of Indigenous Australians living in non-remote areas with CKD (3.8% compared with 2.0%, respectively) (Figure 2.2).

The proportion of Indigenous Australians with CKD increased with age in both remote and non-remote areas, and was highest among those older than 45 years (12.4% and 7.2%, respectively).



Source: AIHW analysis of NATSIHS 2004-05 data.

Figure 2.2: Proportion of Indigenous Australians self-reporting with CKD, by remoteness area, 2004-05

Incidence of end-stage kidney disease

Patients with ESKD almost always require KRT in the form of regular dialysis or a kidney transplant to survive.

Both of these treatments are resource intensive, with the most common form of dialysis (haemodialysis) requiring regular and frequent hospital admissions if not undertaken at home. This contributes greatly to the high burden that ESKD places on individuals with ESKD and on Australia's health-care system (AIHW 2010a).

Estimating the incidence of ESKD provides an important foundation for determining the burden of ESKD in Australia. In 2008, the Council of Australian Governments (COAG) recognised the impact that ESKD has on the health of Australians—particularly among Indigenous Australians—and therefore included a measure of the incidence of ESKD in the indicators for the National Healthcare Agreement (COAG Reform Council 2010).

Traditionally, the incidence of ESKD in Australia has been available only for those treated with KRT, with virtually all of these cases recorded on the ANZDATA Registry. These are referred to as 'treated ESKD' in this report and are analysed in detail later in this chapter. As not all people will be suitable candidates for KRT, and some others may choose not to take it up, this method of measuring the incidence of ESKD underestimates the total incidence of ESKD in the community (AIHW 2005).

In order to better measure the total incidence of ESKD, AIHW devised a method which uses data linkage to estimate the number of new cases of ESKD that are

Table 2.2: Total incidence of ESKD, NSW, Qld, WA, SA and NT, 2004–2007

	Males	Females	Persons
		Number	
Indigenous	440	543	983
Non-Indigenous	6,220	5,084	11,304
Total[a]	**6,660**	**5,627**	**12,287**
		ESKD patients per 100,000 population[b]	
Indigenous	114.1	117.9	115.3
Non-Indigenous	23.2	14.7	18.5
Rate difference (Indigenous – non-Indigenous)	*90.9**	*103.2**	*96.8**
Rate ratio (Indigenous : non-Indigenous)	*4.9**	*8.0**	*6.2**
		Excess Indigenous ESKD patients[c]	
Excess number of Indigenous ESKD cases	375	494	867
Excess proportion of Indigenous ESKD cases (%)	85.2	90.9	88.2

(a) Total does not include those for whom Indigenous status was not stated.

(b) Directly age-standardised to the 2001 Australian population.

(c) The number of Indigenous ESKD cases that would be avoided if the non-Indigenous rate applied to Indigenous Australians.

*Significant absolute difference (rate difference) or relative difference (rate ratio) between Indigenous and non-Indigenous incidence rates.

Source: AIHW (unpublished).

not treated with KRT. This is the first time this has been done in Australia, and such data linkage work is rare elsewhere in the world. This new method of estimating the incidence of ESKD in Australia is now used in the COAG National Healthcare Agreement indicator, with first results published in 2010 (COAG Reform Council 2010).

The data sets used in the linkage were the ANZDATA Registry, the National Death Index and the National Mortality Database. The aim is to use the deaths data coded using the ICD-10 to identify non-KRT-treated cases of ESKD, because we know that survival is short for those with ESKD who do not receive KRT. The data linkage is necessary to identify any overlap between the ANZDATA and mortality data sets, as some of the people who begin KRT will also die during the analysis period.

Total incidence of ESKD

Indigenous identification in deaths data is considered of sufficient quality for national reporting for New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only. Therefore the analyses in this section are limited to these jurisdictions.

Over the period 2004 to 2007, Indigenous Australians accounted for 8% (983) of the nearly 12,300 Australians who developed ESKD (Table 2.2). After adjusting for age, Indigenous Australians developed ESKD at over 6 times the rate of non-Indigenous Australians (115 compared with 19 per 100,000 population, respectively).

If the non-Indigenous age-specific ESKD incidence rates applied to Indigenous Australians, the number of new Indigenous ESKD cases would have decreased by 88% (from 983 to 116 cases).

While incidence rates for Indigenous males and females over this period were similar, non-Indigenous males had rates nearly twice those of non-Indigenous females. Incidence rates for Indigenous males and females were 5 and 8 times as high as their non-Indigenous counterparts, respectively.

A much higher proportion of Aboriginal and Torres Strait Islander people with ESKD were treated with KRT overall, however these crude proportions do not take into consideration the age at which their ESKD occurred. Across all age groups, a slightly higher proportion of non-Indigenous Australians with ESKD were treated with KRT. This is due to the age distribution of cases, with nearly 70% of Indigenous cases occurring before the age of 60 years, compared to 20% for non-Indigenous Australians. Overall, after adjusting for age, Indigenous Australians were treated with KRT at 96% the rate of non-Indigenous Australians.

Incidence of treated ESKD

In the 2-year period 2007–2008, nearly 10% (476) of the 4,842 new patients who registered with ANZDATA in Australia identified as being of Aboriginal and Torres Strait Islander descent (Table 2.3).

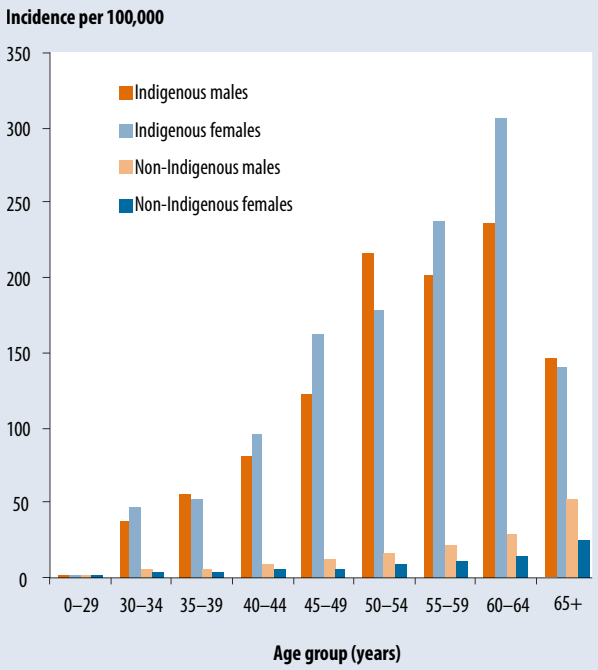
After adjusting for age, the incidence of treated ESKD among Indigenous Australians was 8 times the rate for non-Indigenous Australians (79 compared with 10 per 100,000 population, respectively). If Indigenous Australians had the same incidence rate of treated ESKD as non-Indigenous Australians, 89% (422) of the Indigenous cases would have been avoided.

While incidence rates for Indigenous males and females over this period were similar, non-Indigenous males had rates nearly twice that for non-Indigenous females. Incidence rates for Indigenous males and females were nearly 6 and 12 times as high as their non-Indigenous counterparts, respectively.

The incidence of treated ESKD increased with age for Indigenous males and females, and peaked among those aged 60–64 years at 236 and 307 per 100,000 population, respectively (Figure 2.3). Incidence rates for non-Indigenous Australian males and females were highest among those aged 65 years and older (53 and 26 per 100,000, respectively). In contrast, the Indigenous incidence rate for those aged 65 years and older was around half that of the 60–64 year age group.

The incidence of treated ESKD was higher for Indigenous males than females in the 0–29, 35–39, 50–54 and 65 years and older age groups. Non-Indigenous males had higher incidence rates for treated ESKD than non-Indigenous females across all age groups.

The greatest relative difference between the Indigenous and non-Indigenous male incidence rates for treated ESKD was in the 50–54 year age group, where Indigenous males were 13 times as likely as their non-Indigenous counterparts to be treated for ESKD. For females, the difference was greatest among those aged 45–49 years, where the incidence rate for Indigenous females was 25 times that of non-Indigenous females.



Source: AIHW analysis of ANZDATA Registry data.

Figure 2.3: Incidence of treated ESKD, by Indigenous status, age and sex, 2007–2008

Incidence of treated ESKD by geographical location of residence

Between 2005 and 2008 over half (52%) of new cases of treated ESKD for Indigenous Australians were for those living in *Remote* and *Very remote* areas. In contrast, only 1% of new cases of treated ESKD for non-Indigenous Australians were for those living in these areas (Table A1).

The incidence rate for treated ESKD reflects the same pattern (Figure 2.4 and Table A1), with the incidence rate for Indigenous Australians highest in *Remote* (156 per 100,000) and *Very remote* (163 per 100,000) areas. These incidence rates were more than 4 times that for *Major cities* (38 per 100,000).

Indigenous Australians living in *Remote* and *Very remote* areas were around 20 times as likely as non-Indigenous Australians living in these areas to begin treatment for ESKD in 2005–2008.

The pattern of geographical distribution of treated ESKD was very different for non-Indigenous Australians where the incidence rate was highest in *Major cities* (11 per 100,000 population).

There were no significant differences in the incidence rates between Indigenous males and females in any location. For non-Indigenous Australians, rates were higher for males in all locations except *Remote* and *Very remote* areas.

In general, the incidence of treated ESKD for Indigenous Australians increased with age in all geographical locations, peaking in the 60–64 year age group before decreasing for those aged 65 years and older. For non-Indigenous Australians, the highest incidence rates for all locations were for those aged 65 years and older.

Table 2.3: Incidence of treated ESKD, 2007–2008

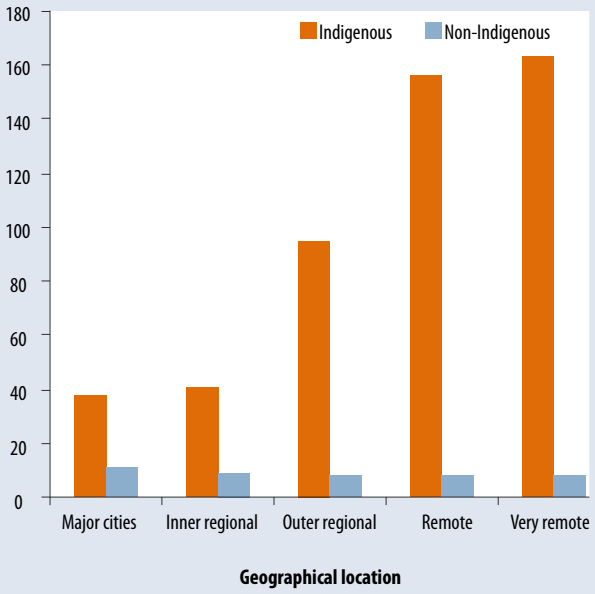
	Males	Females	Persons
		Number	
Indigenous	215	261	476
Non-Indigenous	2,754	1,612	4,366
Total	**2,969**	**1,873**	**4,842**
		ESKD patients per 100,000 population[(a)]	
Indigenous	76.1	82.3	79.4
Non-Indigenous	13.1	7.0	9.9
Rate difference (Indigenous – non-Indigenous)	*63.0**	*75.3**	*69.5**
Rate ratio (Indigenous : non-Indigenous)	*5.8**	*11.7**	*8.0**
		Excess Indigenous ESKD patients[(b)]	
Excess number of Indigenous treated ESKD cases	183	240	422
Excess proportion of Indigenous treated ESKD cases (%)	85.1	91.9	88.7

(a) Directly age-standardised to the 2001 Australian population.

(a) The number of new Indigenous ESKD patients that would be avoided if the non-Indigenous treated ESKD rate applied to Indigenous Australians.

*Significant absolute difference (rate difference) or relative difference (rate ratio) between Indigenous and non-Indigenous incidence rates.

Source: AIHW analysis of ANZDATA Registry data.



Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ANZDATA Registry data.

Figure 2.4: Incidence of treated ESKD, by Indigenous status and geographical location, 2005–2008

Causes of treated ESKD

Information on the primary kidney disease of patients is provided to the ANZDATA Registry by the treating hospital according to a modified European Dialysis and Transplant Association (EDTA) coding system.

Over the period 2007 to 2008, diabetic nephropathy (Box 2.1) was the most commonly attributed cause of new cases of treated ESKD for Indigenous Australians, accounting for 65% of all cases (Table 2.4). Diabetic nephropathy was also the most common cause for non-Indigenous Australians, however it accounted for a much smaller proportion (29%).

The next most common cause of treated ESKD was glomerulonephritis, accounting for 16% of new cases for Indigenous Australians and 24% for non-Indigenous Australians. Hypertension caused a further 9% of new cases for Indigenous Australians and 16% for non-Indigenous Australians.

Box 2.1: Major underlying disease causes of treated end-stage kidney disease (ESKD)

Diabetes and diabetic nephropathy

The most common cause of ESKD is diabetes—a chronic condition in which blood sugar levels are too high (McDonald et al. 2008). Diabetes occurs when the body produces too little or none of the sugar-regulating hormone insulin, or cannot use it properly. High blood sugar levels can damage the blood-filtering capillaries in the kidneys.

Glomerulonephritis

Glomerulonephritis involves inflammation and damage of the filtering units of the kidneys (glomeruli), affecting their ability to filter waste products and excess water from the blood. Chronic glomerulonephritis can be caused by infections, immune diseases, inflammation of the blood vessels or conditions that scar the glomeruli, however often the cause is unknown (Chadban & Atkins 2005).

High blood pressure

High blood pressure (hypertension) can damage the blood vessels supplying the kidneys. The walls of these blood vessels become thick and the internal diameter narrowed, leading to reduced blood supply and decreased kidney function. Factors that contribute to high blood pressure include age, obesity, high alcohol consumption and high dietary salt (National Heart Foundation of Australia 2008).

Table 2.4: Disease causes of new cases of treated ESKD, by Indigenous status, 2007–2008

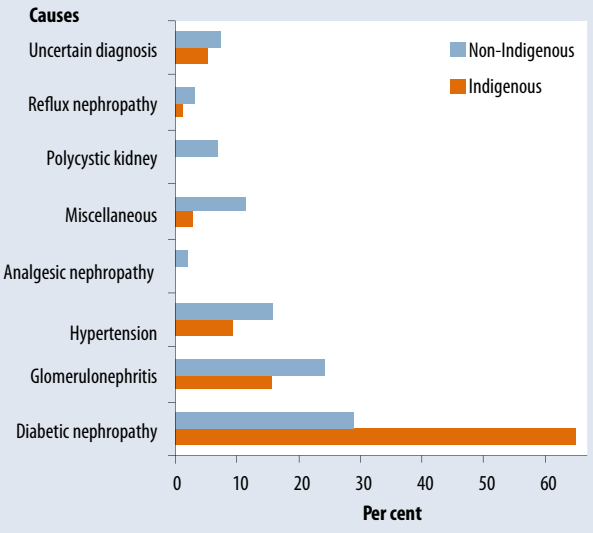
Disease cause	Indigenous		Non-Indigenous	
	Number	Per cent	Number	Per cent
Diabetic nephropathy	310	65.1	1,267	29.0
Glomerulonephritis	74	15.5	1,059	24.3
Hypertension	44	9.2	692	15.8
Uncertain diagnosis	25	5.3	320	7.3
Reflux nephropathy	6	1.3	138	3.2
Polycystic kidney	n.p.	n.p.	297	6.8
Analgesic nephropathy	n.p.	n.p.	91	2.1
Miscellaneous	14	2.9	502	11.5
Total	**476**	**100.0**	**4,366**	**100.0**

n.p. Not published due to small number of cases.

Source: AIHW analysis of ANZDATA Registry data.

Non-Indigenous Australians showed a greater spread over the different disease causes of new cases of treated ESKD than Indigenous Australians (Figure 2.5).

The causes of new ESKD cases treated differed with age and between Indigenous and non-Indigenous Australians. Diabetic nephropathy was the most common cause in all age groups for Indigenous Australians. In contrast, glomerulonephritis was the most common cause for non-Indigenous Australians up to 44 years, while diabetic nephropathy was the most common cause for those aged 45 years and older.



Source: AIHW analysis of ANZDATA Registry data.

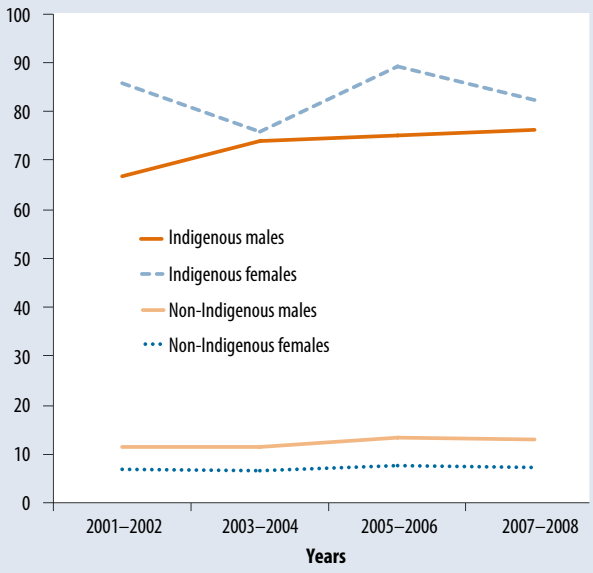
Figure 2.5: Disease causes of new cases of treated ESKD, by Indigenous status, 2007–2008

Trends over time

Over the period 2001–2002 to 2007–2008, the number of new cases of treated ESKD increased by 20% for Indigenous Australians (from 347 to 476 new cases) and by 15% for non-Indigenous Australians (from 3,453 to 4,366).

There was also an increase in the incidence rate for Indigenous males (7%, from 67 to 76 per 100,000) and non-Indigenous males (9%, from 11 to 13 per 100,000) (Figure 2.6) but not for Indigenous and non-Indigenous females.

There were no significant changes in the rate ratio or rate difference between Indigenous and non-Indigenous Australians between 2001–2002 and 2007–2008.



Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ANZDATA Registry data.

Figure 2.6: Trends in the incidence of treated ESKD, by Indigenous status and sex, 2001–2002 to 2007–2008

Prevalence of treated ESKD

At the end of 2008, there were 17,603 people receiving treatment for ESKD in Australia, 7.4% (1,306) of whom identified as Indigenous Australians.

Overall, the age-adjusted prevalence rate of treated ESKD was 6 times as high for Indigenous Australians as non-Indigenous Australians (439 compared with 72 per 100,000, respectively) (Table 2.5). If the non-Indigenous rate applied to Indigenous Australians, there would be a decrease in prevalence of 83% (1,082 cases).

Prevalence rates were similar for Indigenous males and females; however non-Indigenous males had higher prevalence rates of treated ESKD than non-Indigenous females.

In 2008, Indigenous males and females were treated for ESKD at 5 and 8 times the rate of their non-Indigenous counterparts, respectively.

Table 2.5: Prevalence of treated ESKD, by Indigenous status and sex, 2008

	Males	Females	Persons
		Number	
Indigenous	613	693	1,306
Non-Indigenous	9,951	6,346	16,297
Total	**10,564**	**7,039**	**17,603**
		ESKD patients per 100,000 population[(a)]	
Indigenous	438.6	439.0	438.6
Non-Indigenous	90.8	54.3	71.8
Rate difference (Indigenous – non-Indigenous)	*347.7**	*384.7**	*366.7**
Rate ratio (Indigenous : non-Indigenous)	*4.8**	*8.1**	*6.1**
		Excess Indigenous ESKD patients[(b)]	
Excess number of ESKD cases	481	603	1,082
Excess proportion of Indigenous ESKD cases (%)	78.5	87.0	82.8

(a) Directly age-standardised to the 2001 Australian population.

(b) The reduction in Indigenous ESKD patients if the non-Indigenous treated ESKD rate applied to Indigenous Australians.

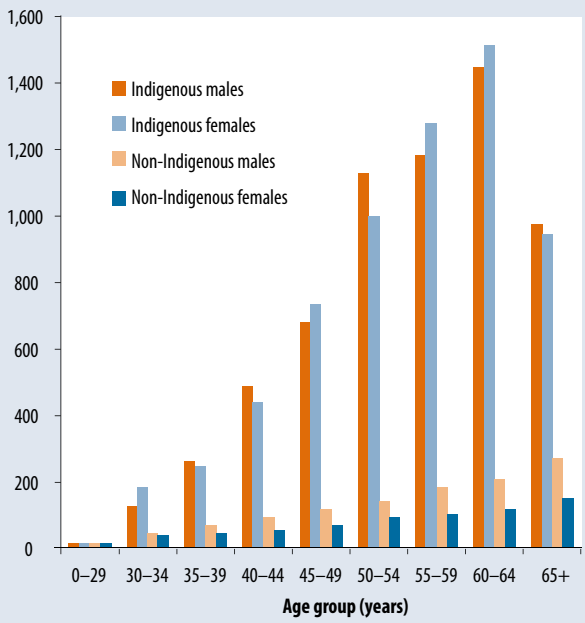
*Significant absolute difference (rate difference) or relative difference (rate ratio) between Indigenous and non-Indigenous prevalence rates.

Source: AIHW analysis of ANZDATA Registry data.

The prevalence of treated ESKD increased with age, with rates highest among those aged 60–64 years for Indigenous Australians, where 1 in 68 people were receiving treatment for ESKD (1,477 per 100,000). For non-Indigenous Australians, prevalence rates were highest in those aged 65 years and older (207 per 100,000) (Figure 2.7).

Indigenous males had higher prevalence rates than non-Indigenous males in all age groups, the exception being those aged 0–29 years, where rates were similar. Indigenous females had higher prevalence rates than non-Indigenous females in all age groups. The greatest relative difference was in the 50–54 year age group for Indigenous males and the 60–64 year age group for Indigenous females, where prevalence rates were 8 and 13 times as high as their non-Indigenous counterparts, respectively.

Non-Indigenous males had higher prevalence rates than non-Indigenous females in all age groups, while for Indigenous males and females there appeared to be no set pattern.



Source: AIHW analysis of ANZDATA Registry data.

Figure 2.7: Prevalence of treated ESKD, by Indigenous status and sex, 2008

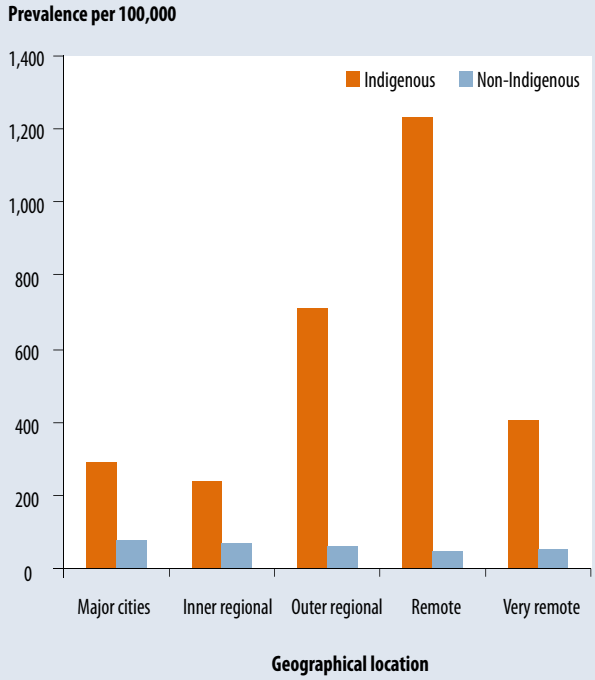
Prevalence of treated ESKD by geographical location

As at 31 December 2008, around one-third (429) of the prevalent cases of treated ESKD among Indigenous Australians were for Indigenous Australians living in *Outer regional* areas. In contrast, only 8% (1,244) of prevalent cases of treated ESKD for non-Indigenous Australians were for those living in these areas (Table A2).

The prevalence rate was highest in *Remote* areas for Indigenous Australians (1,226 per 100,000), 4 times as high as the Indigenous rate for *Major cities* (Figure 2.8 and Table A2).

The pattern of geographical distribution is very different for non-Indigenous Australians, where the prevalence rate was highest in *Major cities* (83 per 100,000), around 1.3 to 1.7 times as high as for other locations.

There were no significant differences in the prevalence rate between Indigenous males and females in any location. For non-Indigenous Australians, rates were higher for males in all areas except *Remote* and *Very remote* locations.



Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ANZDATA Registry data.

Figure 2.8: Prevalence of treated ESKD, by Indigenous status and geographical location of residence, 2008

Causes of prevalent cases of treated ESKD

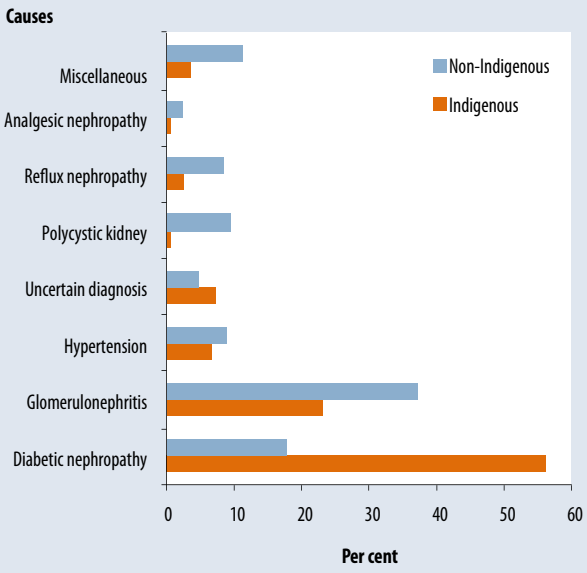
In 2008, the most common disease cause of prevalent cases of treated ESKD for Indigenous Australians was diabetic nephropathy (56%) followed by glomerulonephritis (23%) (Table 2.6). For non-Indigenous Australians, this order was reversed, with glomerulonephritis the most common cause (37%), followed by diabetic nephropathy (18%). Hypertension was the cause in 7% of Indigenous and 9% of non-Indigenous cases of treated ESKD.

Table 2.6 Disease causes of prevalent treated ESKD, by Indigenous status, 2008

Disease cause	Indigenous		Non-Indigenous	
	Number	Per cent	Number	Per cent
Diabetic nephropathy	734	56.2	2,900	17.8
Glomerulonephritis	301	23.0	6,065	37.2
Hypertension	86	6.6	1,451	8.9
Uncertain diagnosis	93	7.1	777	4.8
Reflux nephropathy	32	2.5	1,360	8.3
Polycystic kidney disease	7	0.5	1,553	9.5
Analgesic nephropathy	7	0.5	372	2.3
Miscellaneous	46	3.5	1,819	11.2
Total	**1,306**	**100.0**	**16,297**	**100.0**

Source: AIHW analysis of ANZDATA Registry data.

A higher proportion of cases of treated ESKD for non-Indigenous Australians than Indigenous Australians were caused by reflux nephropathy (8% compared with 3%, respectively) and polycystic kidney disease (10% compared with 1%, respectively) (Figure 2.9).

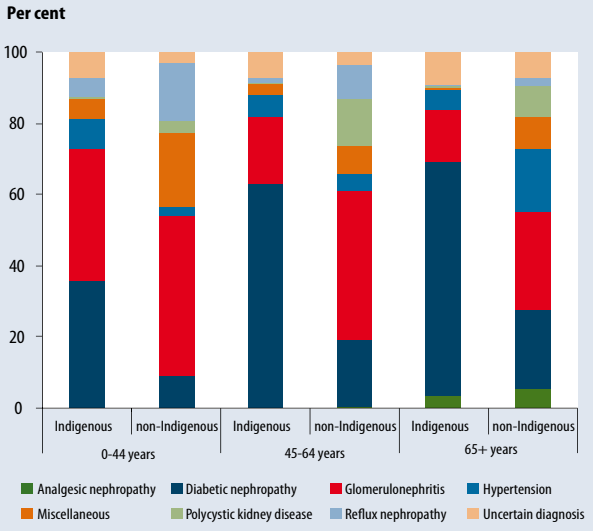


Source: AIHW analysis of ANZDATA Registry data.

Figure 2.9: Disease causes of prevalent treated ESKD, by Indigenous status, 2008

The causes of prevalent treated ESKD varied with age. The most common cause of prevalent treated ESKD for Indigenous Australians was glomerulonephritis for those under 45 years of age, and diabetic nephropathy in older cases (Figure 2.10).

Glomerulonephritis was the most common cause in non-Indigenous patients of all ages; however the proportion caused by diabetic nephropathy increased with age. The proportion of treated ESKD caused by hypertension increased with age for non-Indigenous Australians, but decreased for Indigenous Australians.



Source: AIHW analysis of ANZDATA Registry data.

Figure 2.10: Disease causes of prevalent treated ESKD, by Indigenous status and age, 2008

Trends over time

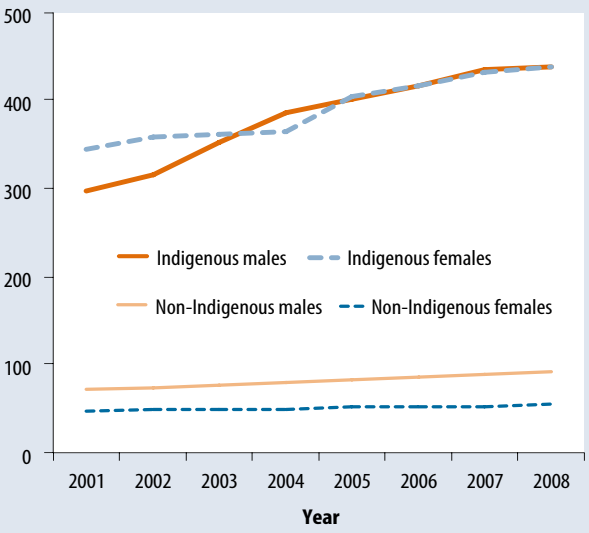
Over the period 2001 to 2008, the number of Indigenous Australians with treated ESKD increased by 72%, from 763 to 1,306. Over the same period, there was also a 41% increase in the number of non-Indigenous Australians with treated ESKD (from 11,608 to 16,297).

Prevalence rates also increased during this period, by 38% for Indigenous Australians (from 323 to 439 per 100,000) and by 23% for non-Indigenous

Australians (59 to 72 per 100,000) (Figure 2.11). The relative (rate ratio) and absolute (rate difference) difference between Indigenous and non-Indigenous Australians also increased between 2001 and 2008: the rate ratio increasing by 11% (from 5.5 to 6.1) and the rate difference increasing by 40% (from 264 to 369 per 100,000). Both of these increases were larger for Indigenous males than females.

In 2008, Indigenous males and females had similar prevalence rates of treated ESKD, however the trends indicate this has not always been the case. Between 2001 and 2003 females had higher rates, while in 2004 the male rate was higher and rates have been similar from 2005 onwards.

Non-Indigenous males have had consistently higher prevalence rates of treated ESKD than females, and this difference has increased slightly since 2001.



Note: Directly age-standardised to the 2001 Australian population.
Source: AIHW analysis of ANZDATA Registry data.

Figure 2.11: Trends in the prevalence of treated ESKD, by Indigenous status and sex, 2001 to 2008

From 2001–2008, the prevalence rates of treated ESKD for Indigenous Australians increased in all age groups over 40–44 years, with the greatest increase seen for those aged over 65 years (68%).

There was also an increase in prevalence rates for all age groups from 35–39 years for non-Indigenous Australians, while rates decreased for those younger than 35 years. Again, the greatest increase in rates was for those aged over 65 years (46%).

3 Risk factors

The major risk factors for CKD include fixed factors such as age, being male and ethnicity (Table 3.1). Other risk factors that are common in the Australian population include behavioural factors, such as smoking, and biomedical factors, such as high blood pressure and obesity. Progression of CKD can often be slowed by controlling these modifiable risk factors and by improving disease treatment and management. Many of the risk factors for CKD also apply to other chronic diseases such as CVD and diabetes, and these are in turn risk factors for CKD, and multiple risk factors can amplify the risk of kidney damage through their interaction (Hoy et al. 1998).

Many Indigenous people face challenges that may increase the risk of CKD. The accelerated lifestyle changes occurring in communities, socioeconomic disadvantage and limited resources lead to increased risk factors and CKD incidence in Indigenous Australians.

Risk factors for CKD are highly prevalent among Aboriginal and Torres Strait Islander people. Tobacco smoking, poor nutrition, high blood pressure, obesity, diabetes and preventable infections are common among Aboriginal and Torres Strait Islander people and have been associated with kidney impairment in this population (McDonald et al. 2003).

Indigenous and non-Indigenous comparison

Low birthweight

In some cases, low birthweight may be a risk factor for CKD (White et al. 2009). Low birthweight is often associated with intrauterine malnutrition, which has the potential to impair nephron development in the kidneys. Babies are defined as having low birthweight if their weight at birth is less than 2,500 grams, and babies weighing less than 1,500 grams are defined as having a very low birthweight (Laws & Sullivan 2009).

Data from the National Perinatal Data Collection show that the average birthweight of live born babies in Australia in 2007 was 3,374 grams. The average birthweight of live born babies of Aboriginal and Torres Strait Islander mothers was around 3,182 grams, 200 grams lighter than the average of 3,382 grams for live born babies of non-Indigenous mothers (Table 3.2). The proportion of live born babies of Aboriginal and Torres Strait Islander mothers that were of low birthweight was 12.5%, more than twice the proportion of babies of non-Indigenous mothers (5.9%). This can also vary substantially by remoteness, and the incidence of low birthweight has dropped very much in the last four decades. It is the birthweight of current adults that is greatly influencing their CKD risk (Hoy et al. 2010).

Table 3.1: Risk factors for chronic kidney disease

Fixed	Behavioural	Biomedical
Family history and genetics	Tobacco smoking	Diabetes
Increasing age	Physical inactivity	High blood pressure
Previous kidney disease or injury	Poor nutrition	Cardiovascular disease
Low birth weight		Overweight and obesity
Male sex		Systemic kidney inflammation

Table 3.2: Birthweight of live born babies for Indigenous and non-Indigenous Australians, 2007		
Birthweight	**Indigenous**	**Non-Indigenous**
	Mean birthweight	
	3,182g	3,382g
	Per cent	
Less than 1,500	2.1	1.0
1,500–2,499	10.4	4.9
2,500–2,999	22.0	14.8
3,000–3,499	33.9	35.9
3,500–3,999	22.8	31.3
4,000–4,499	7.4	10.3
4,500 and over	1.4	1.8
Total	**100.0**	**100.0**

Source: Laws and Sullivan (2009)

Tobacco smoking

Based on self-reported information, in 2008, Indigenous Australians aged 15 years and over were more than twice as likely to be current smokers as their non-Indigenous counterparts (47% compared with 20%) and these differences remained after adjusting for differences in age structure (Table 3.3). Indigenous Australians were also less likely to have never smoked than non-Indigenous Australians.

Physical inactivity

In 2004–05, Indigenous Australians aged 15 years and over were more likely than their non-Indigenous counterparts to self-report having a sedentary level of physical activity for the 2 weeks prior (47% compared with 33%, respectively). They were also less likely to report having a moderate or high level of physical activity in this period (Table 3.4).

After adjusting for differences in age structures, this trend remained the same, with 53% of Indigenous Australians and 33% of non-Indigenous Australians reporting their activity level as sedentary.

Overweight and obesity

Based on self-reported height and weight, the proportion of overweight and obese Indigenous adults in 2004–05 was 29% and 31%, respectively (Table 3.5). Comparatively, a slightly higher proportion of non-Indigenous Australians were estimated to be overweight (36%) but fewer were obese (18%). After adjusting for differences in age structure, the proportion of overweight and obese Indigenous Australians increased to 31% and 34%, respectively.

Table 3.3: Smoker status, by Indigenous status, persons aged 15 years and over, 2008				
	Crude rate (per cent)		**Age-standardised rate (per cent) [a]**	
	Indigenous	**Non-Indigenous**	**Indigenous**	**Non-Indigenous**
Current smoker				
Daily	44.6	18.0	43.3	18.3
Other[b]	2.2	1.8	1.8	1.9
Total smokers	*46.8*	*19.8*	*45.1*	*20.1*
Ex-smoker	19.7	28.6	23.7	28.2
Never smoked	33.5	51.6	31.3	51.7
Total	**100.0**	**100.0**	**100.0**	**100.0**

(a) Directly age-standardised to the 2001 Australian population.

(b) Comprises persons who smoked at least once a week, but not daily, and those who smoked less than weekly.

Source: ABS & AIHW analyses of 2008 NATSISS & 2007-08 NHS.

Diabetes

Diabetes (including high sugar levels) is a significant health issue among Aboriginal and Torres Strait Islander people, with an overall prevalence of 6% in 2004–05 based on self-reported data (Table 3.6). After adjusting for differences in age structure, Indigenous Australians were 3 times as likely to report having diabetes/high sugar levels as non-Indigenous Australians.

Table 3.4: Level of physical activity, persons aged 15 years and over from non-remote areas, by Indigenous status, 2004–05

	Crude rate (per cent)		Age standardised rate (per cent) [(a)]	
	Indigenous	**Non-Indigenous**	**Indigenous**	**Non-Indigenous**
Sedentary	47.2	33.3	53.0	33.3
Low	28.3	36.1	26.7	36.1
Moderate	17.9	23.8	15.6	23.7
High	6.6	6.8	4.7	6.9
Total	**100.0**	**100.0**	**100.0**	**100.0**

(a) Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of the 2004–05 NATSIHS and 2004–05 NHS .

Table 3.5: Proportion of Indigenous Australians aged 18 years and over who are overweight/obese, by Indigenous status, 2004–05

	Crude rate (per cent)		Age standardised rate (per cent) [(a)]	
	Indigenous	**Non-Indigenous**	**Indigenous**	**Non-Indigenous**
Overweight	29	36	31	36
Obese	31	18	34	18

Note: Excludes those with a BMI not known or not stated.

(a) Directly age-standardised to the 2001 Australian population.

Source: ABS and AIHW analysis of the 2004–05 NATSIHS.

Table 3.6: Australians reporting diabetes/high sugar levels, by Indigenous status, 2004–05

Rate	Indigenous	Non-Indigenous
Crude (per cent)	6	4
Age-standardised (per cent) [(a)]	**12**	**4**

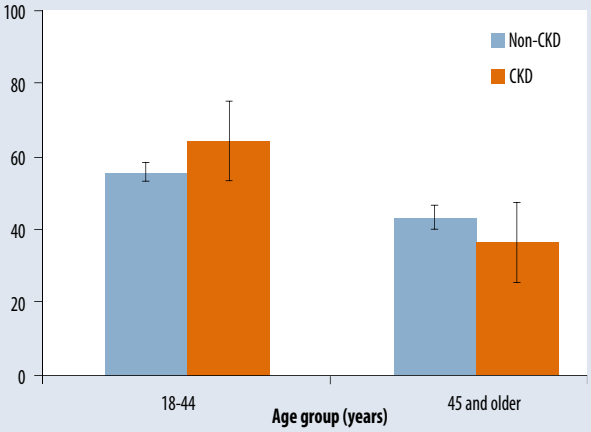
(a) Directly age-standardised to the 2001 Australian population.

Source: ABS 2006b.

Risk factor profile for Indigenous Australians with and without CKD

Tobacco smoking

There was little difference in the proportion of Indigenous Australians with and without CKD who were current smokers (51% compared with 52%, respectively). Among those aged between 18 and 45 years, those with CKD were slightly more likely to be a current smoker than those without CKD, however this trend was reversed among those older than 45 years (Figure 3.1).



Source: AIHW analysis of NATSIHS 2004-05 data.

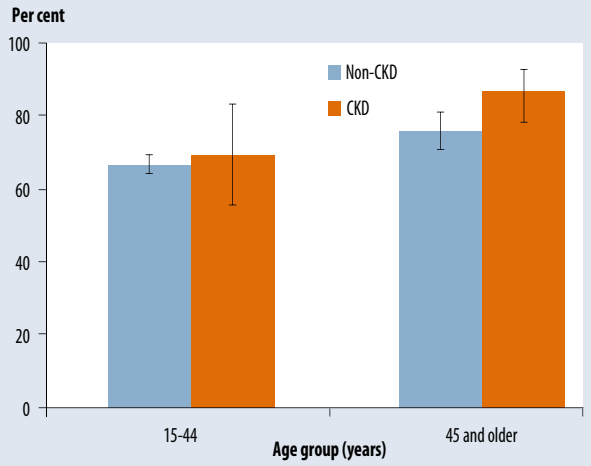
Figure 3.1: Proportion of Indigenous Australians who are current smokers, by age group and CKD status, 2004-05

Physical inactivity

Indigenous people aged over 15 years with CKD (non-remote areas only) were less likely to be sedentary or have a low exercise level than those without CKD (84% compared with 74%).

In general, people with CKD in both age groups were less likely to be sedentary or have a low exercise level than those without CKD (Figure 3.2).

The NATSIHS collects physical activity data for the 2 weeks prior to the survey.



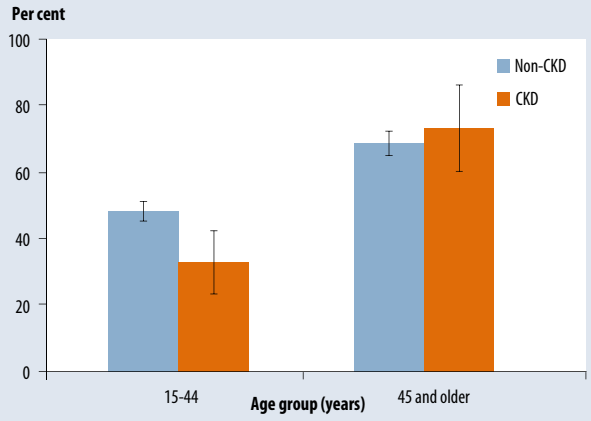
Source: AIHW analysis of NATSIHS 2004-05 data.

Figure 3.2: Proportion of Indigenous Australians reporting having sedentary/low exercise level, by age group and CKD status, non-remote areas only, 2004-05

Overweight and obesity

A similar proportion of Indigenous Australians with and without CKD were overweight or obese (54% compared with 56%), based on self-reported information.

A smaller proportion of Indigenous Australians with CKD than without CKD were categorised as overweight or obese for those aged 15–44 years, while those aged 45 years and older had a similar proportion (Figure 3.3).



Source: AIHW analysis of NATSIHS 2004-05 data.

Figure 3.3: Proportion of Indigenous Australians who are overweight/obese, by CKD status, 2004-05

4 Mortality

Indigenous identification in deaths data is considered of sufficient quality for national reporting for New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.

In this section, comparisons have been made throughout with 'non-Indigenous' Australians, with analysis excluding those for whom Indigenous status was not stated. Mortality data from 2003 to 2007 have been combined due to small numbers.

CKD can be recorded as an underlying or associated cause of death (CKD-related deaths). The underlying cause of death is the condition that initiated the chain of morbid events leading to death. An associated cause of death is either the condition that gave rise to the underlying cause, or that contributed to the death but was not related to the disease or condition causing it.

CKD contributes significantly to mortality in Australia. In 2006, CKD was found to have contributed to nearly 1 in 10 deaths (AIHW 2009b).

All CKD-related deaths

In the 5 years from 2003 to 2007 in New South Wales , Queensland, Western Australia, South Australia and the Northern Territory, there were 41,966 deaths where CKD was recorded as the underlying or associated cause of death—40,118 for non-Indigenous Australians, 1,443 for Indigenous Australians, and 405 with Indigenous status not stated.

Overall, the Indigenous age-standardised mortality rate for CKD-related deaths was 3.5 times the non-Indigenous rate (Table 4.1). Almost 82% (1,178) of the Indigenous CKD-related deaths would have been avoided if the non-Indigenous mortality rate applied to Indigenous Australians. Although Indigenous females recorded more CKD-related deaths than Indigenous males (781 compared with 662, respectively), there was no difference in the mortality rate after adjusting for age. In contrast, the non-Indigenous male mortality rate was 1.6 times the non-Indigenous female rate, reflecting the trends in the prevalence of KRT-treated ESKD which is 1.6 times the non-Indigenous female rate.

Table 4.1: All CKD-related deaths, by Indigenous status, NSW, Qld, WA, SA and NT, 2003–2007

	Males	Females	Persons
		Number	
Indigenous	662	781	1,443
Non-Indigenous	21,666	18,452	40,118
Total	**22,328**	**19,233**	**41,561**
		CKD deaths per 100,000 population[(a)]	
Indigenous	196.7	183.6	188.3
Non-Indigenous	67.4	42.6	53.2
Rate difference (Indigenous – non-Indigenous)	*129.2**	*140.9**	*135.1**
Rate ratio (Indigenous : non-Indigenous)	*2.9**	*4.3**	*3.5**
		Excess Indigenous deaths[(b)]	
Excess number of Indigenous deaths	522	659	1,178
Excess proportion of Indigenous deaths (%)	78.9	84.3	81.6

(a) Rates directly age-standardised to the 2001 Australian population.

(b) The number of CKD Indigenous deaths that would be avoided if the non-Indigenous mortality rate applied to Indigenous Australians.

*Significant absolute difference (rate difference) or relative difference (rate ratio) between Indigenous and non-Indigenous mortality rates.

Note: Excludes 405 cases where Indigenous status was not stated or inadequately described.

Source: AIHW National Mortality Database.

CKD-related deaths increased with age for both Indigenous and non-Indigenous Australians. Between 2003 and 2007, 1 in 66 Indigenous males and 1 in 84 females aged 75 years and older died of CKD-related causes (Figure 4.1). For Indigenous Australians aged 75 years and older, males died of CKD-related causes at 1.3 times the female rate. For non-Indigenous Australians aged 75 years and older, males died of CKD-related causes at 1.6 times the female rate.

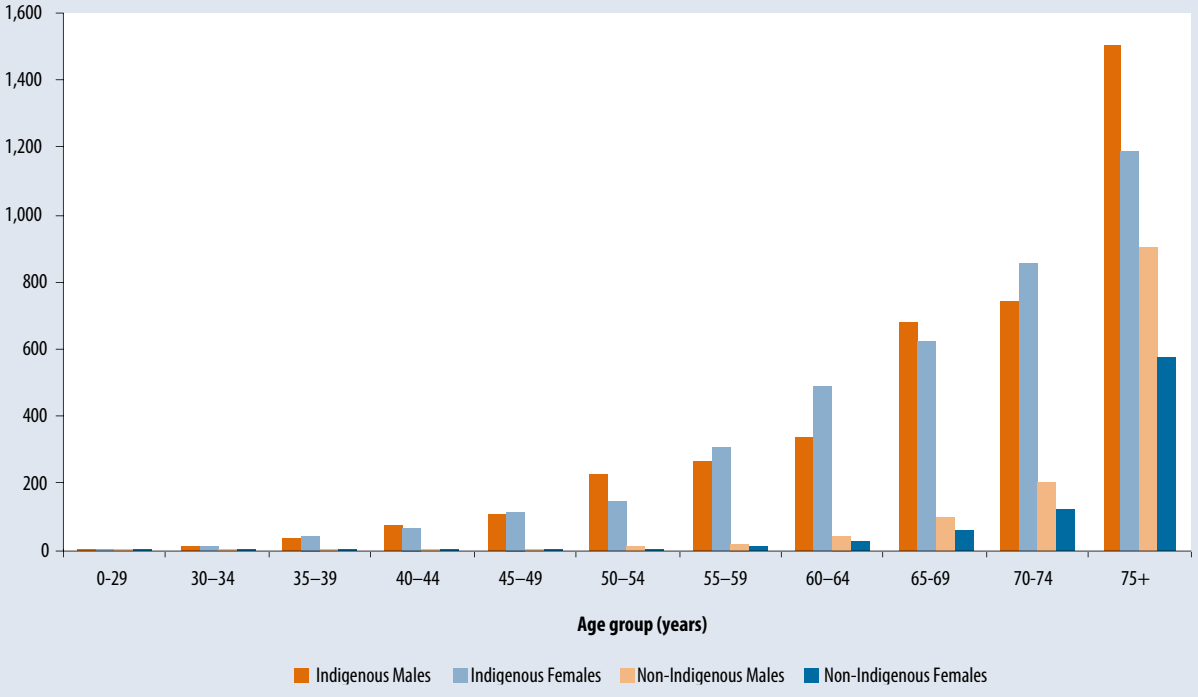
The greatest relative difference between the Indigenous and non-Indigenous male mortality rates was seen in the 40–44 year age group, where Indigenous males died at 22 times the rate of non-Indigenous males (76 compared with 3 per 100,000, respectively). For females, the greatest difference occurred in the 35–39 year age group, with Indigenous females dying at 28 times the rate of non-Indigenous females (45 compared with 2 per 100,000, respectively). The relative difference between Indigenous and non-Indigenous rates was smallest in those aged 75 years and older, where Indigenous males and females died at around twice the rate of their non-Indigenous counterparts.

CKD as the underlying cause of death

Indigenous Australians died with CKD as the underlying cause at 4 times the rate of non-Indigenous Australians (Table 4.2). This difference was greater for Indigenous females than males. Over 84% (300) of the Indigenous deaths where CKD was the underlying cause would have been avoided if the non-Indigenous mortality rate applied to Indigenous Australians.

Indigenous females recorded more deaths with CKD as the underlying cause than Indigenous males (196 compared with 160, respectively), however there was no difference in the mortality rate after adjusting for age. In contrast, the non-Indigenous male mortality rate was 1.2 times the non-Indigenous female rate.

For the period of 2003–2007, the most common CKD-related cause of death for Indigenous Australians and non-Indigenous Australians was for *Chronic kidney failure*, accounting for 41% and 42% of deaths where CKD was the underlying cause of death respectively (Table 4.3). *Hypertensive kidney disease* was the next most common diagnosis group for Indigenous Australians (19%), while the next most common cause of death for non-Indigenous Australians was *Unspecified kidney failure* (24%).



Source: AIHW National Mortality Database.

Figure 4.1: CKD-related deaths, by Indigenous status, sex and age, NSW, Qld, WA, SA and NT, 2003–2007

Table 4.2: Deaths where CKD was the underlying cause, by Indigenous status, NSW, Qld, WA, SA and NT, 2003–2007

	Males	Females	Persons
		Number	
Indigenous	160	196	356
Non-Indigenous	3,988	4,550	8,538
Total	**4,148**	**4,746**	**8,894**
		CKD deaths per 100,000 population[(a)]	
Indigenous	45.7	48.9	47.7
Non-Indigenous	12.4	10.5	11.3
Rate difference (Indigenous – non-Indigenous)	*33.4**	*38.5**	*36.4**
Rate ratio (Indigenous : non-Indigenous)	*3.7**	*4.7**	*4.2**
		Excess Indigenous deaths[(b)]	
Excess number of Indigenous deaths	134	167	300
Excess proportion of Indigenous deaths (%)	83.5	85.2	84.4

(a) Rates directly age-standardised to the 2001 Australian population.

(b) The number of CKD Indigenous deaths that would be avoided if the non-Indigenous mortality rate applied to Indigenous Australians.

*Significant absolute difference (rate difference) or relative difference (rate ratio) between Indigenous and non-Indigenous mortality rates.

Note: Excludes 82 cases where Indigenous status was not stated or inadequately described.

Source: AIHW National Mortality Database.

CKD as an associated cause of death

Indigenous Australians died with CKD as an associated cause at 3 times the rate of non-Indigenous Australians (Table 4.4). This difference was greater for Indigenous females than males.

Indigenous females recorded more deaths where CKD was an associated cause than Indigenous males (585 compared with 502, respectively); however, after adjusting for differences in age structure, the mortality rate for Indigenous males was higher. Non-Indigenous males were 1.7 times as likely as non-Indigenous females to die with CKD as an associated cause of death.

Table 4.3: CKD causes of death where CKD was the underlying cause, by Indigenous status, NSW, Qld, WA, SA and NT, 2003–07

	Indigenous		Non-Indigenous	
Underlying cause of death	**Number**	**Per cent**	**Number**	**Per cent**
Chronic kidney failure	145	40.7	3,623	42.4
Hypertensive kidney disease	67	18.8	1,703	19.9
Diabetic nephropathy	61	17.1	354	4.1
Unspecified kidney failure	42	11.8	2,031	23.8
Glomerular diseases	15	4.2	243	2.8
Kidney tubulo-interstitial diseases	10	2.8	300	3.5
Other disorders of the kidney and ureter	8	2.2	141	1.7
Congenital malformations of the kidney	8	2.2	143	1.7
All kidney diseases	**356**	**100.0**	**8,538**	**100.0**

Note: 1. Excludes 82 cases where Indigenous status was not stated or inadequately described.
2. Proportions may not add to 100 due to rounding.

Source: AIHW National Mortality Database.

The most common CKD associated cause of death for both Indigenous and non-Indigenous Australians was *Chronic kidney failure*—57% and 54% of CKD associated deaths, respectively (Table 4.5). Over 40% of non-Indigenous deaths where CKD was an associated cause had *Unspecified kidney failure* listed as an associated cause, compared with 28% for Indigenous Australians. Compared to non-Indigenous Australians, Indigenous Australians were more likely to have *Hypertensive kidney disease* as an associated cause of death (9% compared with 2%, respectively).

The most common underlying cause of death where CKD was an associated cause of death for Indigenous Australians and other Australians was *Cardiovascular diseases* (30% and 44%, respectively) (Table 4.6). The second most common underlying causes of death for Indigenous Australians was *Diabetes* (28%), however for non-Indigenous Australians this was the least common underlying cause of death (8%) in the list provided. The second most common underlying cause of death for non-Indigenous Australians was *Neoplasms* (19%).

Table 4.4: CKD as an associated cause of death, by Indigenous status, NSW, Qld, WA, SA and NT, 2003–2007

	Males	Females	Persons
		Number	
Indigenous	502	585	1,087
Non-Indigenous	17,678	13,902	31,580
Total	**18,180**	**14,487**	**32,667**
		CKD deaths per 100,000 population[(a)]	
Indigenous	150.9	134.6	140.6
Non-Indigenous	54.9	32.2	41.9
Rate difference (Indigenous – non-Indigenous)	*96.0**	*102.4**	*98.7**
Rate ratio (Indigenous : non-Indigenous)	*2.7**	*4.2**	*3.4**

(a) Rates directly age-standardised to the 2001 Australian population.

*Significant absolute difference (rate difference) or relative difference (rate ratio) between Indigenous and non-Indigenous mortality rates.

Note: Excludes 323 cases where Indigenous status was not stated or inadequately described.

Source: AIHW National Mortality Database.

Table 4.5: CKD associated causes of death, by Indigenous status, NSW, Qld, WA, SA and NT, 2003–2007

	Indigenous		**Non-Indigenous**	
Associated cause of death	**Number**	**Per cent**	**Number**	**Per cent**
Chronic kidney failure	623	57.3	16,989	53.8
Unspecified kidney failure	309	28.4	12,769	40.4
Hypertensive heart disease	95	8.7	694	2.2
Diabetic nephropathy	25	2.3	200	0.6
Other disorders of kidney and ureter	21	1.9	599	1.9
Kidney tubulo-interstitial diseases	15	1.4	318	1.0
Glomerular diseases	16	1.5	327	1.0
Congenital malformations of the kidney	n.p.	n.p.	156	0.5
Complications related to dialysis and kidney transplant	n.p.	n.p.	16	0.1
Total deaths with CKD an associated cause	**1,087**	**100.0**	**31,580**	**100.0**

n.p. Not published due to small number of cases.

Notes:

1. Excludes 323 cases where Indigenous status was not stated or inadequately described.
2. Columns will not add to total as more than one type of kidney disease may have been recorded.

Source: AIHW National Mortality Database.

Table 4.6: Underlying cause of death where CKD was an associated cause, by Indigenous status, NSW, Qld, WA, SA and NT, 2003–2007

	Indigenous		Non-Indigenous	
Underlying cause of death (ICD-10 codes)	**Number**	**Per cent**	**Number**	**Per cent**
Cardiovascular diseases (I00–I99)[(a)]	326	30.0	13,816	43.7
Diabetes (E10–E14)[(b)]	303	27.9	2,432	7.7
Neoplasms (C00–D48)	107	9.8	6,062	19.2
Respiratory diseases (J00–J99)	88	8.1	2,636	8.3
Other (balance)	263	24.2	6,634	21.0
Total	**1,087**	**100.0**	**31,580**	**100.0**

(a) Excludes hypertensive kidney disease.

(b) Excludes diabetic nephropathy.

Note: Excludes 323 cases where Indigenous status was not stated or inadequately described.

Source: AIHW National Mortality Database.

5 Comorbidities

CKD shares a number of risk factors with other chronic diseases; in particular, CVD and diabetes. For example, high blood pressure and diabetes increase the risk of CVD, but are also risk factors for CKD. CKD has also been found to independently increase the risk of hypertension and other CVDs, including heart attack, angina, coronary artery disease, stroke and heart failure. The risks of a cardiovascular event, such as heart attack or stroke, are greater in those with poorer kidney function (Go et al. 2004). The reasons for excess risk of CVD among people with CKD are not clearly understood. However, some established risk factors of CVD, such as obesity, abnormal lipid levels and diabetes, are also common among people with CKD. In addition, CKD complications, such as anaemia and disturbed mineral metabolism, also contribute to increased risk of CVD (Levin et al. 2002).

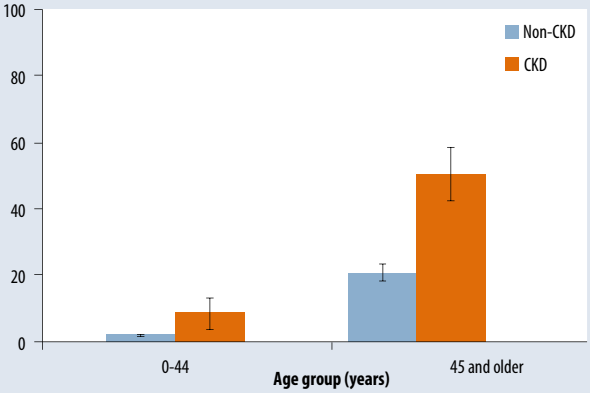
Patients who have a high level of comorbidities when they start KRT are more likely to have poorer health status, decreased quality of life and poorer outcomes of dialysis, as well as decreasing eligibility for kidney transplant (McDonald & Russ 2003). Indigenous Australians have higher rates of comorbidities than other Australians. The DRUID study found that, when compared with the general Australian population from the AusDiab study, and after adjusting for other risk factors, urban Indigenous Australians with Type 2 diabetes had a 2–3-fold increased risk of diabetes complications such as peripheral vascular disease (Maple-Brown et al. 2008).

Self-reported comorbidities from the NATSIHS

Diabetes

Based on self-reported data from the 2004–05 NATSIHS, among those Aboriginal and Torres Strait Islander people who reported having CKD, 28% also reported having diabetes as a long-term condition (Figure 5.1). This was 5 times the proportion of those without CKD who had diabetes (5%).

The proportion of people having both CKD and diabetes was highest among those aged 45 years and older, where 56% of those with CKD also had diabetes.



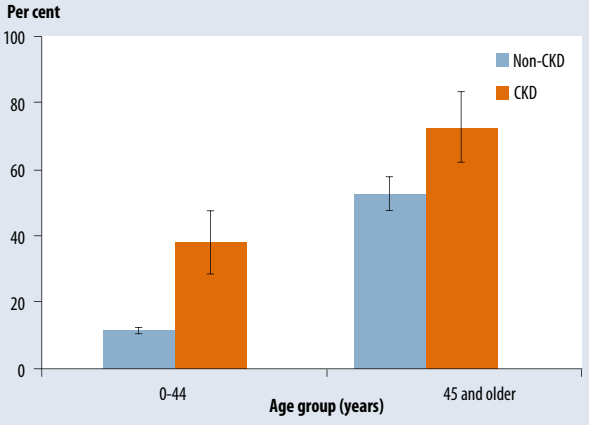
Note: Excludes those people reporting diabetes as ***Ever told has condition, not current***.
Source: AIHW analysis of NATSIHS 2004-05 data.

Figure 5.1: Proportion of Indigenous Australians with diabetes, by CKD status and age, 2004-05

Cardiovascular disease (CVD)

Over half (52%) of Indigenous Australians with CKD also had heart and circulatory disease as a long term condition, 3 times the proportion of those without CKD (18%).

People with CKD were more likely to also have heart and circulatory disease than those without CKD for both age groups (Figure 5.2). This difference was particularly marked for those aged 0–44 where 39% of those with CKD had heart or circulatory conditions compared with 12% of those without. Among those aged 45 years and older, 74% of Indigenous Australians with CKD also had heart disease compared with 54% of those without CKD.



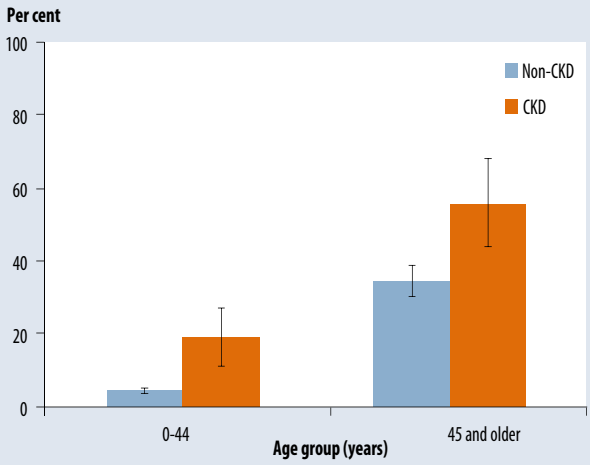
Source: AIHW analysis of NATSIHS 2004-05 data.

Figure 5.2: Proportion of Indigenous Australians with heart and circulatory disease, by CKD status and age, 2004-05

Hypertension

Indigenous Australians with CKD were 4 times more likely to have hypertension than people without CKD (36% compared with 9%, respectively).

Indigenous Australians with CKD were more likely to also have hypertension than those without CKD in both age groups (Figure 5.3).



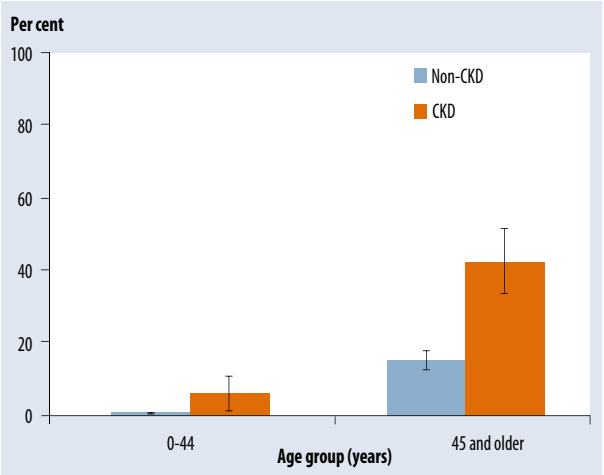
Source: AIHW analysis of NATSIHS 2004-05 data.

Figure 5.3: Proportion of Indigenous Australians with hypertension, by CKD status and age, 2004-05

Cardiovascular disease and diabetes

Nearly one-quarter (22%) of Indigenous Australians with CKD also reported having both heart and circulatory disease and diabetes as long-term conditions, 7 times the proportion of those without CKD (3%).

Indigenous Australians with CKD were more likely to also have heart and circulatory disease and diabetes than those without CKD in both age groups (Figure 5.4). This difference was particularly marked for those aged 0–44 years, where Indigenous Australians with CKD were almost 7 times as likely as those without CKD to also have heart and circulatory disease and diabetes. Among those aged 45 years and older, 45% of Indigenous Australians with CKD also had heart and circulatory disease and diabetes compared with 16% of those without CKD.



Note: Excludes those people reporting diabetes as ***Ever told has condition, not current***.

Source: AIHW analysis of NATSIHS 2004-05 data.

Figure 5.4: Proportion of Indigenous Australians with heart and circulatory disease and diabetes, by CKD status and age, 2004-05

Comorbidities in treated ESKD patients

Over the period 2007–2008, Indigenous Australians with ESKD were more likely than non-Indigenous Australians to begin treatment for ESKD with CVD, lung disease or diabetes (86% compared with 62%, respectively) (Table 5.1). The most common comorbid condition for Indigenous Australians starting treatment for ESKD was diabetes (78%), whereas the most common comorbid condition for non-Indigenous Australians starting treatment was CVD (43%).

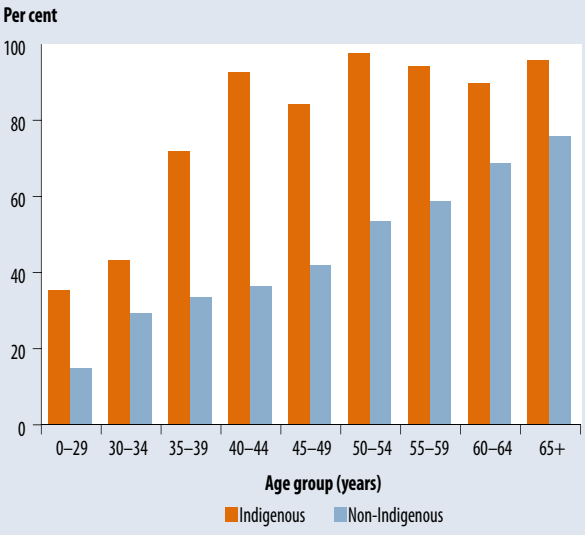
Table 5.1: New cases of KRT-treated ESKD patients with selected comorbidities at the time of first treatment, by Indigenous status, 2007–2008

	Indigenous		Non-Indigenous	
Comorbidity at first treatment	**Number**	**Per cent**	**Number**	**Per cent**
Cardiovascular disease (CVD)	225	47.3	1,885	43.2
Coronary artery disease	*166*	*34.9*	*1,451*	*33.2*
Peripheral vascular disease	*101*	*21.2*	*813*	*18.6*
Cerebrovascular disease	*42*	*8.8*	*533*	*12.2*
Lung disease	56	11.8	547	12.5
Diabetes	373	78.4	1,719	39.4
CVD and diabetes	197	41.4	1,049	24.0
Any comorbidity	**407**	**85.5**	**2,686**	**61.5**
Total incident patients	**476**	**100.0**	**4,366**	**100.0**

Source: AIHW analysis of ANZDATA Registry data.

The proportion of Indigenous Australians with a comorbidity of CVD, lung disease or diabetes at first ESKD treatment was highest among those aged 50–54 years, where nearly all (98%) had one of these comorbidities (Figure 5.5). For non-Indigenous Australians, the proportion of those with one of these comorbidities at first ESKD treatment increased with age, and was highest among those aged 65 years and older (76%).

For all age groups, there was a higher proportion of Indigenous Australians starting treatment for ESKD with a comorbidity of CVD, lung disease or diabetes. The greatest difference was seen in the 40–44 year age group, where Indigenous Australians were more than twice as likely as non-Indigenous Australians to have ESKD and one of these conditions (93% compared with 37%, respectively).



Source: AIHW analysis of ANZDATA Registry data.

Figure 5.5: New cases of KRT-treated ESKD patients with a comorbidity of CVD, diabetes or lung disease at first treatment, by Indigenous status and age, 2007–2008

The same pattern was observed for prevalent treated ESKD patients as at 31 December 2008, although a slightly lower proportion of patients had a comorbidity of CVD, lung disease or diabetes. Indigenous Australians with ESKD were more likely than non-Indigenous Australians with ESKD to have at least one of these comorbid conditions (Table 5.2). The most common comorbid condition for Indigenous Australians with treated ESKD was diabetes, with Indigenous Australians nearly 3 times as likely to have diabetes as non-Indigenous Australians (73% compared with 29%, respectively).

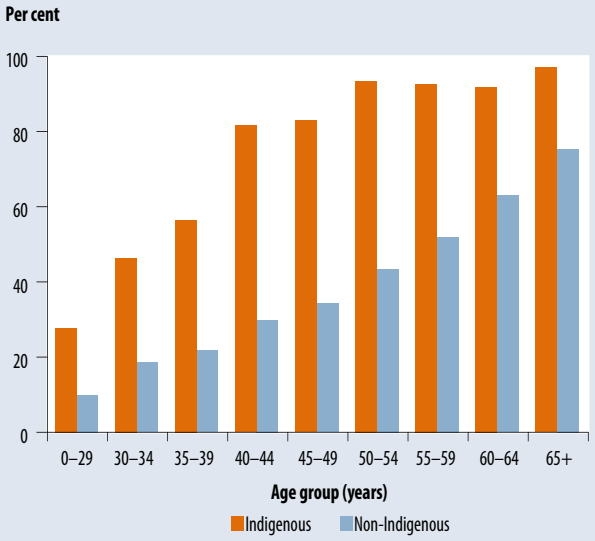
The proportion of Indigenous Australians with treated ESKD and a comorbidity of CVD, lung disease or diabetes at the end of 2008 increased with age up 50–54 years and peaked for those aged over 65 years (97%) (Figure 5.6). The proportion of non-Indigenous Australians with treated ESKD and at least one of these comorbidities also increased with age, peaking at 75% among those aged over 65 years.

At the end of 2008, there was a higher proportion of Indigenous Australians with a comorbidity of CVD, lung disease or diabetes in all age groups. The greatest relative difference was seen in the 0–29 year age group, where Indigenous Australians with treated ESKD were nearly 3 times as likely to have one of these conditions (28% compared with 10%, respectively).

Table 5.2: Prevalent KRT-treated ESKD patients with selected comorbidities as at 31 December 2008, by Indigenous status

	Indigenous		Non-Indigenous	
Comorbidity at first treatment	**Number**	**Per cent**	**Number**	**Per cent**
Cardiovascular disease (CVD)	681	52.1	6,070	37.2
Coronary artery disease	*514*	*39.4*	*4,605*	*28.3*
Peripheral vascular disease	*310*	*23.7*	*2,550*	*15.6*
Cerebrovascular disease	*156*	*11.9*	*1,654*	*10.1*
Lung disease	200	15.3	1,749	10.7
Diabetes	954	73.0	4,705	28.9
CVD and diabetes	575	44.0	2,786	17.1
Any comorbidity	**1,094**	**83.8**	**8,645**	**52.4**
Total prevalent patients	**1,306**	**100.0**	**16,297**	**100.0**

Source: AIHW analysis of ANZDATA Registry data.



Source: AIHW analysis of ANZDATA Registry data.

Figure 5.6: Prevalent KRT-treated ESKD patients with a comorbidity of CVD, diabetes or lung disease at 31 December 2008

Comorbidities in hospitalisations

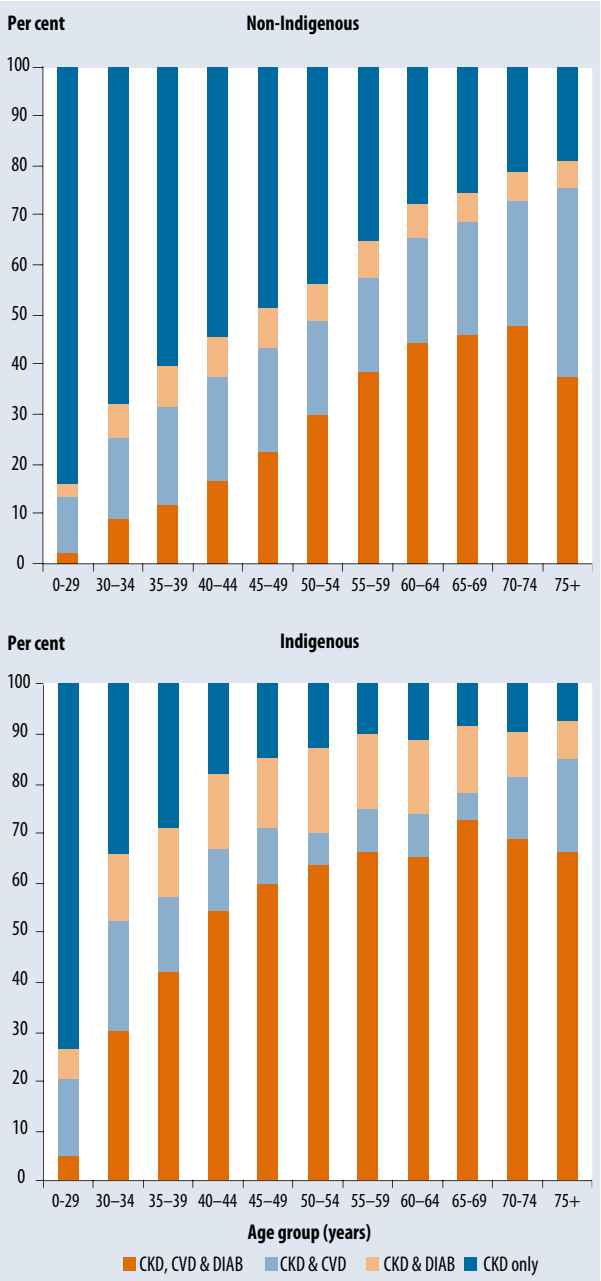
Indigenous identification in hospitalisation data is considered of sufficient quality for national reporting for New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory (public hospitals) only.

This section presents data on the number of hospitalisations with any diagnosis (principal or additional) of CKD, CVD and/or diabetes. Hospitalisations with a principal diagnosis of regular dialysis have been excluded from this analysis due to its unique characteristics. See the sections on hospitalisations in Chapter 6 and Appendix B for further information on methods.

Most diseases or conditions are only recorded as a diagnosis when they are considered to be the primary reason for the patient being hospitalised (principal diagnosis) or where they coexisted with the principal diagnosis, or arose during the episode of care and affected the management of patients in terms of requiring therapeutic treatment, diagnostic procedures, or increased nursing care and/or monitoring (additional diagnoses). Therefore, a disease will not be recorded as a diagnosis if it does not meet these criteria, even if patients had this disease when they were admitted to hospital. Consequently, the results of this analysis may underestimate the number of hospitalisations for CKD with a comorbidity of CVD or diabetes.

Over half (55%) of Indigenous Australians hospitalised with a principal or additional diagnosis of CKD in 2008–09 also had a diagnosis of CVD and diabetes, while 11% had a comorbidity of only CVD and 13% had a comorbidity of only diabetes. In contrast, the corresponding proportions for other Australians were lower at 35%, 29% and 6%, respectively. Overall, only 20% of hospitalisations for CKD for Indigenous Australians did not have CVD or diabetes recorded as a comorbidity, compared with 30% of hospitalisations for other Australians.

The proportion of CKD hospitalisations for Indigenous Australians with comorbidities of both CVD and diabetes increased with age up to 65–69 years where 73% of hospitalisations had all three diseases recorded as a diagnosis (Figure 5.7). Likewise, the proportion of hospitalisations for other Australians with all three diseases recorded as a diagnosis increased with age, but peaked at a substantially lower proportion of 48% for those aged 70–74 years.



Source: AIHW National Hospital Morbidity Database.

Figure 5.7: CKD hospitalisations with a comorbidity of diabetes or cardiovascular disease, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

Comorbidities in CKD-related deaths

Indigenous identification in deaths data is considered of sufficient quality for national reporting for New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.

This section presents data on the number of deaths with a cause of death (underlying or associated) of CKD, CVD and/or diabetes.

Most diseases or conditions are only recorded as a cause of death when they are considered to be the condition that initiated the chain of morbid events leading to the death (underlying cause) or where it was the condition that gave rise to the underlying cause, or contributed to the death but was not related to the disease or condition causing it (associated cause). Therefore, a disease will not be recorded as a cause of death if it does not meet these criteria, even if the person had this disease when they died. Consequently, the results of this analysis may underestimate the number of CKD-related deaths with a comorbidity of CVD or diabetes.

Between 2003 and 2007, only 19% of Indigenous and 22% of non-Indigenous Australian CKD-related deaths did not have also have CVD or diabetes listed as a cause (Table 5.3). Indigenous Australians with a CKD-related death were more than 3 times as likely as their non-Indigenous counterparts to also have diabetes as a cause of death (10% compared with 3%, respectively), and more than twice as likely to have both CVD and diabetes as a cause (38% compared with 15%, respectively).

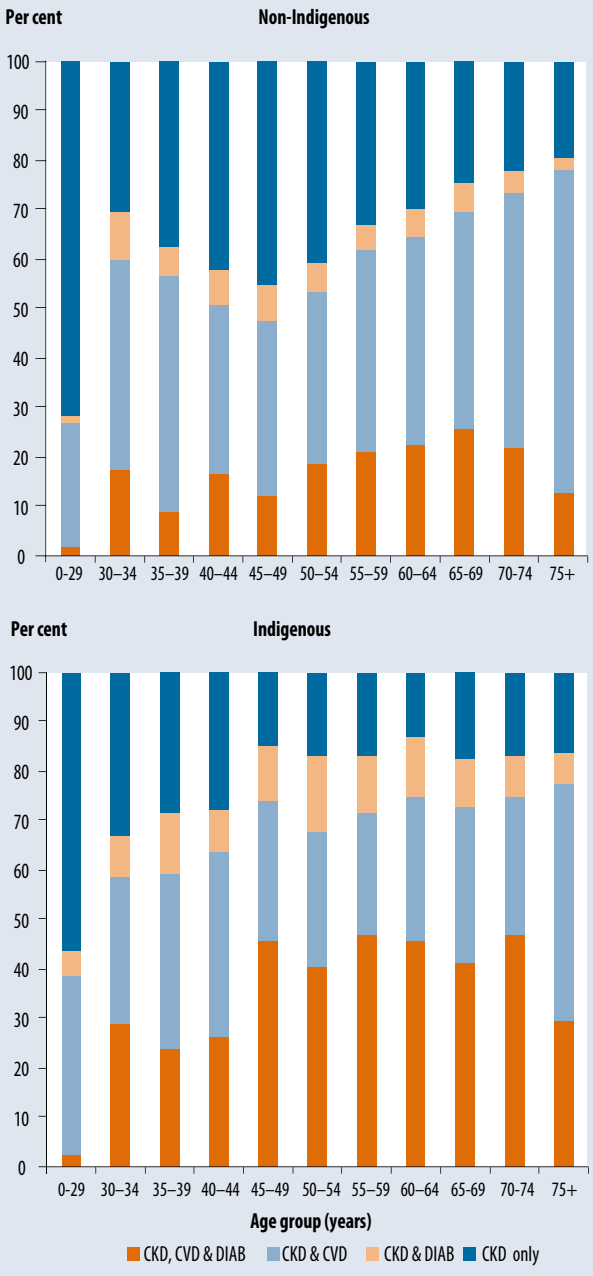
CKD-related deaths that also had CVD and/or diabetes as a cause of death were most common among those aged 60–64 years for Indigenous Australians (87%) and 75 years and over for non-Indigenous Australians (80%); while those aged less than 30 years who died of a CKD-related condition were most likely to not have either of these conditions as a cause of death (56% and 71%, respectively) (Figure 5.8). Nearly one in two (47%) CKD-related deaths among Indigenous Australians aged 55–59 years also had CVD and diabetes as a cause of death.

Table 5.3: Comorbidities in CKD-related deaths, by Indigenous status, NSW, Qld, WA, SA and NT, 2003–2007

	Indigenous		Non-Indigenous	
Comorbidity	**Number**	**Per cent**	**Number**	**Per cent**
CVD	475	32.9	24,200	60.3
Diabetes	147	10.2	1,193	3.0
CVD and diabetes	549	38.1	6,006	15.0
No comorbid conditions	272	18.8	8,719	21.7
Total	**1,443**	**100.0**	**40,118**	**100.0**

Note: Excludes 405 cases where Indigenous status was not stated or inadequately described.

Source: AIHW National Hospital Mortality Database.



Source: AIHW National Mortality Database.

Figure 5.8: Comorbidities in CKD-related deaths, by age and Indigenous status, NSW, Qld, WA, SA and NT, 2003–2007

6 Health service use

Aboriginal and Torres Strait Islander people do not use health services with the same frequency as other Australians, and many communities and individuals may not have ready access to services. Difficulties with spoken and written English, lack of available transport, financial difficulties and proximity of culturally appropriate health-care services present barriers to Aboriginal and Torres Strait Islander people accessing health care (ABS & AIHW 2008).

Some remote areas have limited services and Indigenous people with ESKD often need to move to more metropolitan regions to access treatment. However, some appropriate regional health centres do exist, so travel is reduced for some populations (Hoy et al. 2005a).

As shown in Table 6.1, Indigenous Australians with ESKD typically have worse outcomes, in terms of mortality rates and transplant failure when undergoing KRT. However, some studies have found little difference in mortality rates between Indigenous and non-Indigenous persons undergoing haemodialysis in remote areas (Marley et al. 2010) and transplant recipients (McDonald & Russ 2003).

Primary health care

Primary health-care-based preventative health programs have received increased attention in Australia in recent years. The Aboriginal and Torres Strait Islander Adult Health Check (Medicare Benefits Schedule (MBS) Item 710) was introduced in May 2004 and was available to Aboriginal and Torres Strait Islander persons aged 15–54 years once every 18 months to 2 years. The check partially assesses CKD risk factors by measuring tobacco or other substance use, blood pressure, height and weight and waist circumference, and proteinurea (Department of Health and Ageing (DOHA) 2009). The Aboriginal and Torres Strait Islander Adult Health Check was replaced by an all ages Indigenous health check (MBS Item 715) on 1 May 2010.

Over 18,000 services were claimed for the Aboriginal and Torres Strait Islander Adult Health Check between July 2008 and June 2009, at a rate of 6.1 services per 100 Indigenous adults aged 15–54 years (Table 6.2). Overall, more services for the check were claimed for women (55%) than men (45%), and this difference occurred in each age group. The rate of claims per 100 population

Table 6.1: Summary of existing literature on the ESKD treatment outcomes for Indigenous Australians

Researchers	Study sample	Results
	Transplant and dialysis research	
Spencer et al. (1998)	Hospital and clinical records from the Darwin-based ESKD treatment program from 1978–1996.	The median survival time for Aboriginal KRT- treated patients (3.6 years) was significantly lower than for KRT-treated non-Aboriginal patients (12.3 years). This trend remained for haemodialysis patients and kidney transplant recipients. Aboriginal transplant recipients also had higher rates of transplant failure after 1 and 5 years.
McDonald & Russ (2003)	All ESKD patients in Australia and New Zealand who began KRT between October 1991 and September 2000.	The KRT-treated Indigenous Australian mortality rate was 70% higher than the non-Indigenous rate. This trend remained when adjusting for comorbidities and differing age structures.
	Transplant research	
McDonald (2004)	Aboriginal (111) and non-Aboriginal (1,862) people who received a deceased donor kidney transplant from April 1997 to September 2003.	Aboriginal recipients were less likely to have a functioning transplant after 5 years (47.8% compared with 80% transplant survival rate). The 1-, 2- and 5-year survival rate for Aboriginal recipients was lower than the non-Aboriginal rate.
Rogers et al. (2006)	Indigenous (79) and non-Indigenous Australians who received a kidney transplant between July 1984 and July 2004.	Indigenous Australians were more than 4 times as likely to have an unsuccessful transplant in the reference period. This was mostly due to recipient death and infection.
	Dialysis research	
Marley et al. (2010)	Non-Indigenous Australians from all regions of Australia and Indigenous patients from the Kimberly region and other regions of Australia, who received haemodialysis treatment from January 2003 to December 2007.	Adjusted mortality rates for all Indigenous groups did not differ from the non-Indigenous Australian group.

Table 6.2: Number of services claimed for the Aboriginal and Torres Strait Islander Adult Health Check (MBS Item 710) by sex and age, July 2008 to June 2009

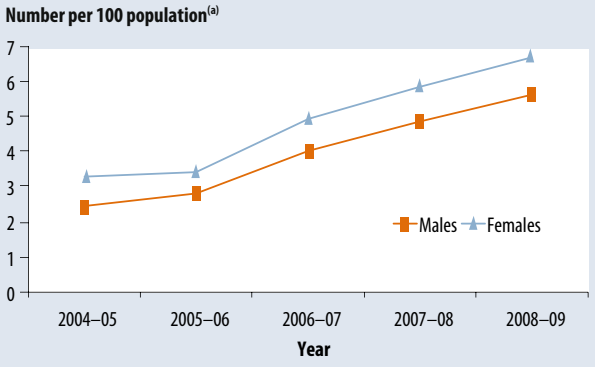
	Number of services			Number per 100 population[a]		
Age group (years)	Males	Females	Persons	Males	Females	Persons
15–24	2,301	2,911	5,212	4.1	5.4	4.7
25–34	1,924	2,318	4,242	5.2	6.0	5.6
35–44	2,193	2,637	4,830	7.0	7.5	7.3
45–54	1,850	2,236	4,086	8.4	9.1	8.8
Total	**8,268**	**10,102**	**18,370**	**5.6**	**6.6**	**6.1**

(a) Estimated Indigenous population for adults aged 15–54 years as at 31 December 2008 derived by averaging the 30 June 2008 and 2009 populations based on the experimental Indigenous population projections (based on the 2001 Census).

Source: AIHW (2009c).

increased with age from 4.7 services for 15–24 year olds to 8.8 per 100 for 45–54 year olds, and this was pattern was observed for both men and women.

Overall, the rate of claims for the Aboriginal and Torres Strait Islander Adult Health Check in the 2008–09 financial year (6.1 services per 100 population) was twice as high as that in 2004–05 (2.9) (Figure 6.1). This doubling in the rate of claims over the 5-year period occurred for both males and females.



(a) Estimated Indigenous population for adults aged 15–54 years as at 31 December of each year based on the experimental Indigenous population projections (based on the 2001 Census).

Source: AIHW (2009c).

Figure 6.1: Services claimed for the Aboriginal and Torres Strait Islander Adult Health Check (MBS Item 710) by sex and year, July 2004 to June 2009

Treatment for ESKD

People with ESKD require KRT (dialysis or a kidney transplant) to survive. The method and location of treatment depends on a number of factors, including a person's specific clinical disease, where they live, advances in dialysis treatment and the types of services offered at their hospital or kidney clinic. Because of the disruption dialysis causes to everyday life, some ESKD patients chose not to receive dialysis treatment. This is particularly the case for ESKD patients who have mobility issues due to other illness or old age (Noble et al. 2009).

The number of kidney transplants performed each year depends on the number of available donors. National and state-based allocation schemes determine who receives deceased donor kidneys, whereas close family members (not necessarily genetically related) are predominantly the source of live donor kidney transplants.

At the end of 2008, there were 17,603 people receiving treatment for ESKD, around 7.5% (1,306) of whom identified as Indigenous (McDonald et al. 2009).

Transplant

Of the Indigenous Australians receiving KRT, 1,147 (88%) were receiving dialysis and 159 (12%) had a functioning kidney transplant. In contrast, 45% of non-Indigenous Australians with treated ESKD had a functioning transplant.

The difference in functioning transplant rates could be due to several reasons including that many Indigenous Australians, particularly those in remote areas, have barriers in accessing health care due to cultural, transport and other factors (ABS 2010). Indigenous transplant recipients also tend to have a higher mortality rate (Table 6.1) and kidney transplant failure rate compared with non-Indigenous Australians. This is due in part to higher Indigenous rates of comorbid conditions, such as diabetes, which increase the risk of kidney transplant failure, although this trend still exists after adjusting for comorbidities (McDonald 2004).

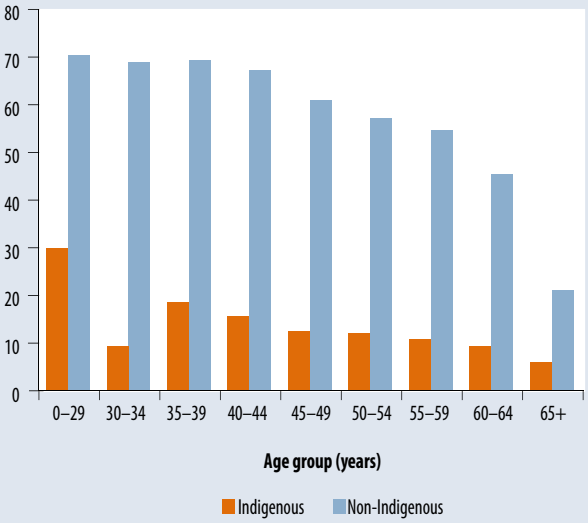
The relatively high prevalence of comorbid conditions in Indigenous ESKD patients may influence Indigenous transplant rates further, as most nephrologists are reluctant to recommend transplants for any ESKD patient with diabetes-related ESKD or a strong family history of diabetes (Cunningham et al. 2006). More information on comorbidities can be found in Chapter 5. Relatively low

functioning transplant rates for Indigenous Australians may also be due to a higher risk of kidney failure following transplant for Indigenous recipients. There is also some question regarding the long-term effects of kidney donation on Indigenous kidney donors which may reduce the possible donor pool. A recent study shows Indigenous kidney donors are more likely than non-Indigenous donors to develop kidney damage following the donation (Rogers et al. 2009).

At the end of 2008, 4% (48) of Indigenous Australians receiving dialysis were on the waiting list for a kidney transplant. In contrast, 13% of non-Indigenous Australians receiving dialysis were on the waiting list (McDonald et al. 2009).

In 2008, there were 813 kidney transplant operations, 31 (4%) of which were for Indigenous Australians (McDonald et al. 2009).

The proportion of treated ESKD patients with a functioning transplant decreased with age, however a much higher proportion of non-Indigenous Australians with treated ESKD had a functioning transplant than Indigenous Australians across all age groups (Figure 6.2). The greatest difference was seen in the 30–34 year age group, where the proportion of non-Indigenous patients with treated ESKD who had a functioning transplant was 7 times the proportion of Indigenous patients.



Source: AIHW analysis of ANZDATA Registry data.

Figure 6.2: Proportion of treated ESKD patients with a functioning kidney transplant, by Indigenous status and age, 2008

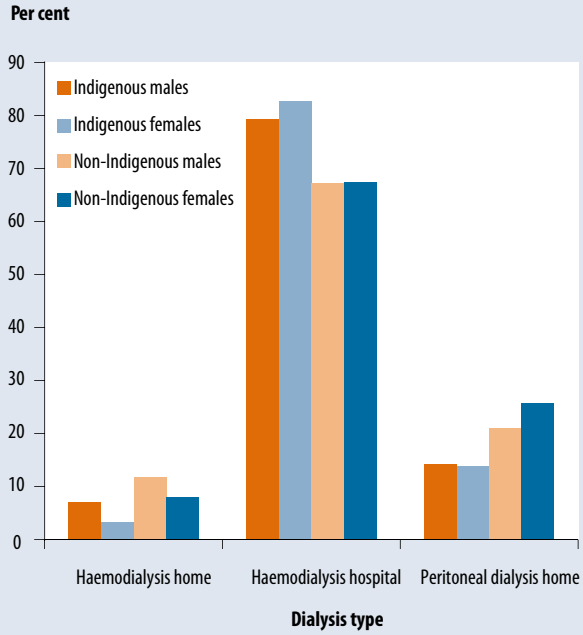
Dialysis

Type of dialysis

There are two types of dialysis treatment, haemodialysis and peritoneal dialysis (see Box 6.1). Haemodialysis is more commonly performed in hospitals (including satellite centres) while peritoneal dialysis is generally performed at home.

In 2008, 86% (985) of Indigenous ESKD patients on dialysis were receiving haemodialysis and 14% (162) were receiving peritoneal dialysis. In comparison, a smaller proportion of non-Indigenous patients were receiving haemodialysis (77%) and a higher proportion received peritoneal dialysis (23%).

Of the 985 Indigenous patients receiving haemodialysis as treatment for ESKD, only 6% did so at home compared with 13% of non-Indigenous patients (Figure 6.2). A higher proportion of Indigenous and non-Indigenous males than females had haemodialysis at home.



Source: AIHW analysis of ANZDATA Registry data.

Figure 6.3: Type of dialysis treatment, by Indigenous status and sex, 2008

Box 6.1: Dialysis

Dialysis is an artificial way of removing waste substances from the blood, a function usually performed by the kidneys. There are two main forms of dialysis: peritoneal dialysis, which occurs inside the body; and haemodialysis, which occurs outside the body. Which form is used depends on the patient's health, age and lifestyle and may also be influenced by the availability of local resources.

Haemodialysis

In haemodialysis, blood is diverted from the body to a dialysis machine, where it is filtered before being returned to the body. This type of dialysis can be done at home, in hospital, or in satellite clinics; however, the machine requires special plumbing and therefore the patient must limit their travel to places where dialysis facilities are available. In most cases, the patient requires assistance connecting to the machine, and a partner, relative or friend can be trained to do this for home dialysis patients. During haemodialysis, the patient is usually connected to the machine for around 4–5 hours 3 times per week, during which all their blood passes through the machine approximately 6 times. If performed at home, patients may have the option of dialysing more frequently for a shorter period (5–7 times per week for around 2 hours) or nocturnally (six nights per week for around 8 hours). During a haemodialysis session, the patient cannot get up and move away from the machine, although they can perform activities that do not require much movement, such as sleeping, reading, talking or using a computer.

Peritoneal dialysis

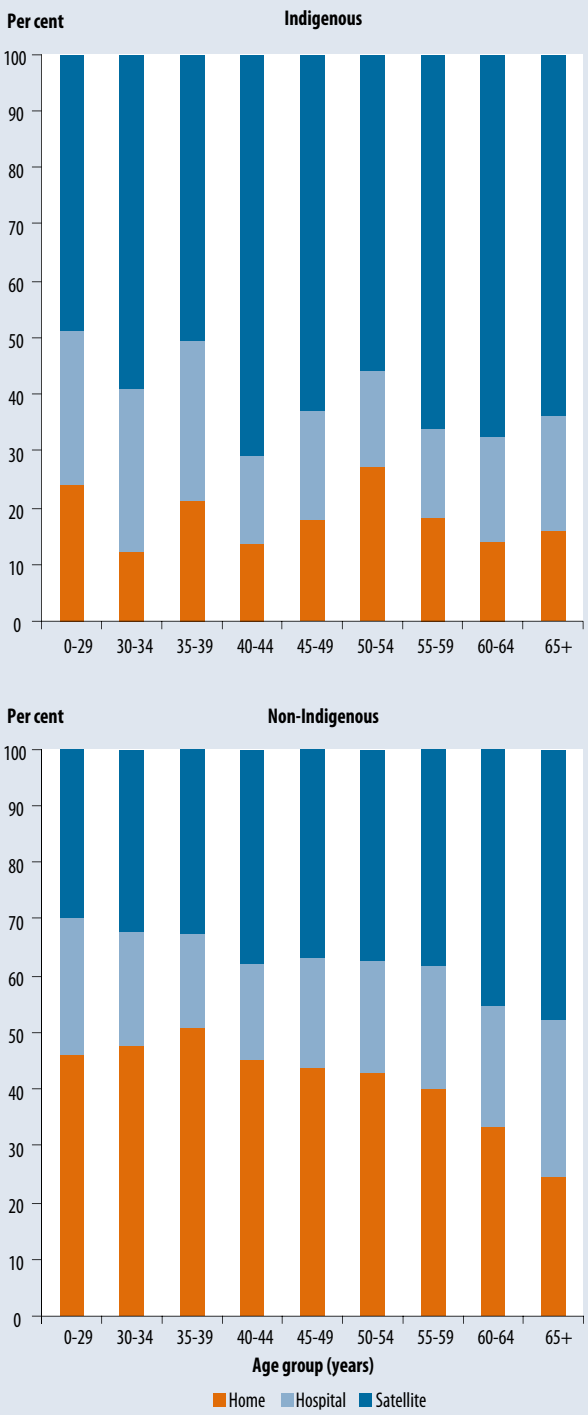
In peritoneal dialysis, the dialysis solution is pumped into the abdomen and the blood is filtered through the peritoneal membrane (the abdominal cavity which covers organs such as the stomach, liver and intestines). The dialysis solution contains a type of sugar (usually glucose or dextrose) that draws the waste products and extra fluid out of the blood, through the peritoneal membrane and into the solution. After a few hours, the used solution, now containing the wastes and extra fluid, is drained out of the body and replaced with fresh solution. This process is called an exchange, and takes about 30–45 minutes. In between exchanges, the patient is free to continue their usual activities. Peritoneal dialysis can either be performed by the patient during the day (continuous ambulatory peritoneal dialysis), usually 3 or 4 times, or automatically by a machine at night for around 8–10 hours while the patient sleeps (automated peritoneal dialysis). As the necessary equipment is portable, peritoneal dialysis can be performed almost anywhere. The patient does not need to be in a hospital or clinic, and can usually manage the procedure without assistance.

Location of treatment

Dialysis can be received in a hospital or in the home once the patient has been trained and the infrastructure required is set up within the home. Satellite units are defined as dialysis facilities, generally staffed by specialist nurses, that are geographically separate from a hospital nephrology service (Cass et al. 2001). Many Indigenous patients live in areas with only satellite dialysis services.

In 2008, 62% (715) of Indigenous dialysis patients visited a satellite dialysis centre for treatment, 19% (213) had dialysis at home and the other 19% (219) were treated in a hospital. In contrast, 43% of non–Indigenous patients received dialysis in a satellite centre, while a greater proportion dialysed at home (33%) and in hospital (24%).

A higher proportion of Indigenous patients than non-Indigenous patients were dialysed at satellite centres across all age groups (Figure 6.4). The proportion of non-Indigenous patients dialysing at home was higher than for Indigenous patients across all age groups. The greatest relative difference was in the 30–34 year age group, where 48% of non-Indigenous patients dialysed at home compared with 12% of Indigenous patients.



Source: AIHW analysis of ANZDATA Registry data.

Figure 6.4: Location of dialysis treatment, by Indigenous status and age, 2008

Hospitalisations

People with CKD, particularly those with ESKD, often require hospital services—in fact, dialysis treatment is the most common reason for hospitalisation in Australia and most patients who attend a hospital or satellite centre for dialysis treatment attend 3 times per week.

Where CKD was the primary reason for hospitalisation it is recorded as the principal diagnosis. In situations where CKD coexisted with another principal diagnosis and required treatment during hospitalisation, or where it arose as a complication, it is recorded as an additional diagnosis. Until the most recent edition of the ICD-10-AM, CKD was not used as a medical term in Australian hospital data. The 6th edition of the ICD-10-AM, which took effect in July 2008, replaced Chronic kidney failure (ICD-10-AM code N18) with chronic kidney disease and its stage (1–5 and unspecified). In this report, both this code and a list of other conditions known to cause, or be caused, by CKD has been used to identify CKD hospitalisations (see Appendix A for further information on the codes used).

For the purposes of this report, CKD hospitalisations have been split into three groups—hospitalisations with a principal diagnosis of regular dialysis, other hospitalisations where CKD was the principal diagnosis, and hospitalisations where CKD was an additional diagnosis (excluding those with a principal diagnosis of regular dialysis or CKD).

It is important to note that identification of Indigenous status in hospital data is only considered reliable in New South Wales, Victoria, Queensland, Western Australia, South Australia and the public hospitals in the Northern Territory and the majority of analyses of Indigenous hospitalisations in this report are based on these states and territories only (AIHW 2010b). For longer term trends (2001–02 to 2008–09), Queensland, Western Australia, South Australia and public hospitals in the Northern Territory are assessed as having adequate Indigenous identification, and hospital data have been analysed using these jurisdictions. The exclusion of some jurisdictions from the analyses will lead to an undercount of the total number of hospitalisations of Aboriginal and Torres Strait Islander people.

Comparisons are made throughout the hospitalisations sections of this report with 'other Australians', which include hospitalisations where Indigenous status was not stated or inadequately described as well as those identifying as non-Indigenous.

The data in this report were extracted from the AIHW NHMD in September 2010 and small changes may have occurred since this time.

Overview

In 2008–09 in New South Wales, Victoria, Queensland, Western Australia, South Australia and private hospitals in the Northern Territory, there were nearly 1.2 million CKD-related hospitalisations, making up 12% of the total

Table 6.3: Hospitalisations with a principal diagnosis of regular dialysis, by Indigenous status, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

	Males	Females	Persons
		Number	
Indigenous	56,675	66,850	123,525
Other Australian	546,782	340,975	887,757
Total	**603,457**	**407,825**	**1,011,282**
		Hospitalisations per 100,000[(a)]	
Indigenous	44,459	44,169	43,983
Other Australian	5,352.6	2,981.1	4,073.4
Rate difference (Indigenous – other)	*39,106**	*41,188**	*39,909**
Rate ratio (Indigenous : other)	*8.3**	*14.8**	*10.8**
		Excess Indigenous hospitalisations[(b)]	
Excess number of Indigenous Hospitalisations	51,421	63,272	114,573
Excess proportion of Indigenous Hospitalisations (%)	90.7	94.6	92.8

(a) Directly age-standardised to the 2001 Australian population.

(b) The number and proportion of hospitalisations that would have been avoided if the hospitalisation rate for other Australians applied to Indigenous Australians.

* Significant absolute difference (rate difference) or relative difference (rate ratio) between Indigenous and Other Australian hospitalisation rates.

Source: AIHW National Hospital Morbidity Database.

hospitalisations in these jurisdictions for this period. Of the CKD hospitalisations, 85% were for regular dialysis, 3% for hospitalisations where CKD was the principal diagnosis (excluding regular dialysis) and 12% for hospitalisations where CKD was an additional diagnosis.

Indigenous Australians were more likely than other Australians to be hospitalised for CKD, especially for regular dialysis where Indigenous Australians were hospitalised at almost 11 times the rate of other Australians. Indigenous hospitalisation rates where CKD was the principal diagnosis (excluding regular dialysis) were 5 times the other Australian rate, and the Indigenous hospitalisation rate where CKD was an additional diagnosis was over 5 times the other Australian rate.

Regular dialysis

A regular dialysis hospitalisation is defined in this publication as a hospitalisation with a principal diagnosis of ICD-10-AM code Z491 (haemodialysis) or Z492 (peritoneal dialysis). These have been analysed separately in this report due to their unique characteristics—admissions for dialysis are nearly always for a partial day, in specialised facilities, and therefore do not use the same facilities as other hospitalisations.

For a hospitalisation to record a principal diagnosis of ICD-10-AM codes Z491 or Z492, the intent for admission must be same day and the patient discharged on the same or next day of admission. In cases where the intent of a regular dialysis admission was same day, but was extended due to some other condition or complication of treatment, the condition responsible for extending the patient's length of stay is coded as the principal diagnosis, and regular dialysis (Z491 or Z492) is coded as an additional diagnosis.

As mentioned in Box 6.1, there are two types of dialysis used for the treatment of ESKD—haemodialysis and peritoneal dialysis. Haemodialysis requires specialised equipment and is usually performed in hospital. Peritoneal dialysis requires less complex apparatus and is nearly always performed at home, meaning that hospital data will not capture most episodes of peritoneal dialysis.

Indigenous identification in hospitalisation data is considered of sufficient quality for national reporting for New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory (public hospitals) only. In 2008–09 in these jurisdictions, there were over one million hospitalisations where the principal diagnosis was regular dialysis, 12% of which were for Aboriginal and Torres Strait Islander peoples.

After adjusting for age, Indigenous Australians were hospitalised for regular dialysis at 11 times the rate of other Australians (Table 6.3). Hospitalisation rates were

similar for Indigenous males and females—however, other Australian males were hospitalised at nearly 2 times the rate of other Australian females.

If the hospitalisation rate for other Australians applied to Indigenous Australians, the number of hospitalisations for regular dialysis for Indigenous Australians would have decreased by almost 93% (114,573).

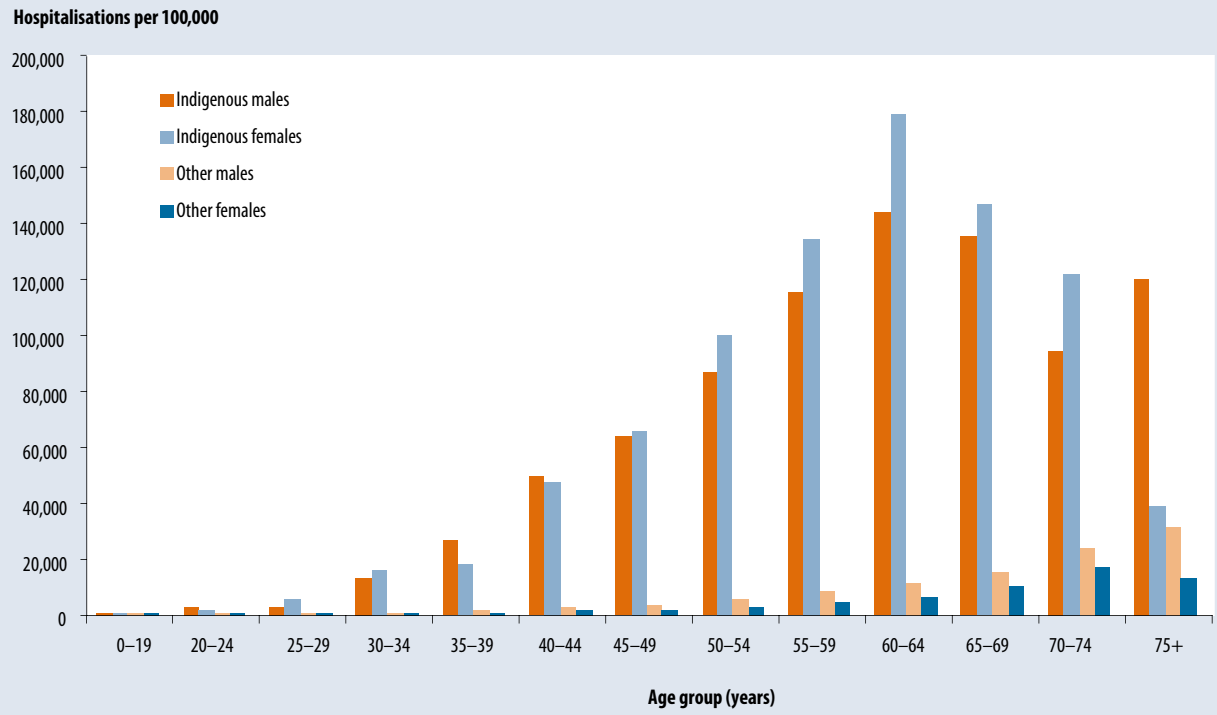
Hospitalisation rates for regular dialysis increased with age up to 60–64 years for Indigenous Australians, peaking at 144,523 per 100,000 for males and 179,339 per 100,000 for females (Figure 6.5). Indigenous females had higher hospitalisation rates for regular dialysis than Indigenous males for most age groups, however in those aged 75 years and older rates for Indigenous males were 3 times as high as for Indigenous females. In contrast, other males had higher hospitalisation rates than other females in all age groups. The greatest relative differences in hospital rates between Indigenous and other Australians for regular dialysis were in the 40–44 year to 60–64 year age groups, where Indigenous males and females were hospitalised at around 15 and 30 times the rate of other males and females, respectively.

Geographical location

Indigenous Australians were hospitalised for regular dialysis at a higher rate than other Australians in all geographical locations (Figure 6.6). The greatest difference in hospitalisation rates between Indigenous and other Australians was in *Remote* and *Very remote* locations, where Indigenous Australians were hospitalised for regular dialysis at 84 and 76 times the rate of other Australians, respectively.

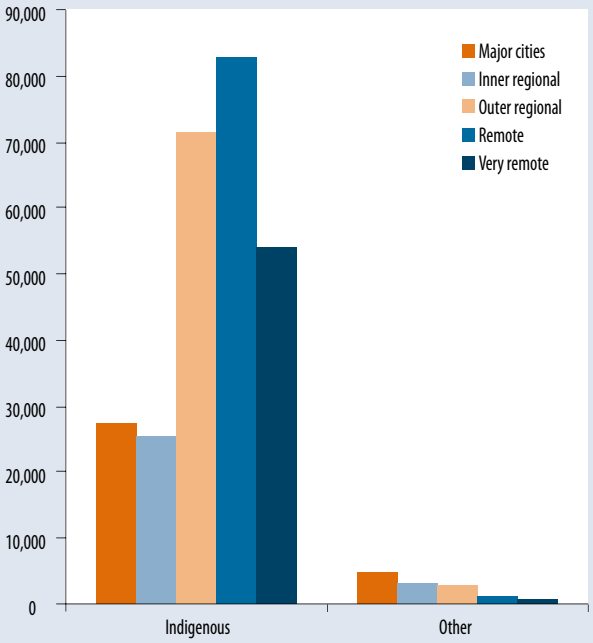
The proportion of regular dialysis hospitalisations that were for Indigenous Australians increased with increasing remoteness, making up only 3% of hospitalisations in *Major cities* and 97% of those in *Very remote* areas (Table A3).

The Indigenous hospitalisation rate was highest in *Remote* and *Outer regional* areas, while for other Australians hospitalisation rates decreased with increasing remoteness (Figure 6.6). Indigenous females had higher rates of hospitalisation for regular dialysis than Indigenous males in *Outer regional, Remote* and *Very remote* areas. In contrast, for other Australians, males had higher hospitalisation rates than females in all locations (Table A3).



Source: AIHW National Hospital Morbidity Database.

Figure 6.5: Hospitalisation rates for regular dialysis, by Indigenous status, age and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09



Note: Directly age-standardised to the 2001 Australian population.

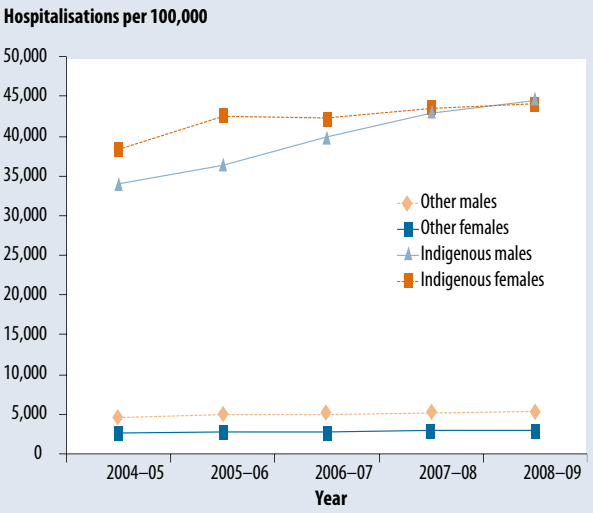
Source: AIHW National Hospital Morbidity Database.

Figure 6.6: Hospitalisation rates for regular dialysis, by Indigenous status and geographical location, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2006–07 to 2008–09

Trends for 2004–05 to 2008–09

Over the period 2004–05 to 2008–09, hospitalisation numbers and rates for regular dialysis increased for both Indigenous and other Australians, however these increases were larger for Indigenous Australians (Figure 6.7). There were also increases in the relative difference (rate ratio) and absolute difference (rate difference) between Indigenous and other Australians of 21% and 5%, respectively.

Between 2004–05 and 2008–09, the difference in hospitalisation rates for Indigenous males and females decreased significantly—the rate difference by 137% and the rate ratio by 17%. In contrast, the difference in hospitalisation rates for regular dialysis rates for other males and females increased, with a 3% increase in the rate ratio and a 20% increase in the rate difference.



Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 6.7: Hospitalisation rates for regular dialysis, by Indigenous status and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2004–05 to 2008–09

Trends for 2001–02 to 2008–09

Analysis for the period 2001–02 to 2008–09 has been limited to those jurisdictions assessed as having adequate Indigenous identification over this time frame—namely Queensland, Western Australia, South Australia and public hospitals in the Northern Territory.

The longer term trend from 2001–02 to 2008–09 showed similar characteristics to the 2004–05 to 2008–09 period. From 2001–02 to 2008–09, hospitalisation numbers and rates for regular dialysis increased for both Indigenous and other Australians, however these increases were larger for Indigenous Australians (Figure 6.8). The difference between hospitalisation rates for Indigenous and other Australians also increased—by 63% for males and 21% for females. There was also a significant increase in the rate ratio between Indigenous and other males of 14%.

Between 2001–02 and 2008–09, the difference between hospitalisation rates for Indigenous males and females decreased by 66%, while the rate ratio decreased by 18%. In contrast, over this period, there was an increase in the difference between hospitalisation rates for other Australian males and females, with the rate difference increasing by 38% and the rate ratio increasing by 5%.

Table 6.4: Hospitalisations with a principal diagnosis of CKD (excluding regular dialysis), by Indigenous status and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

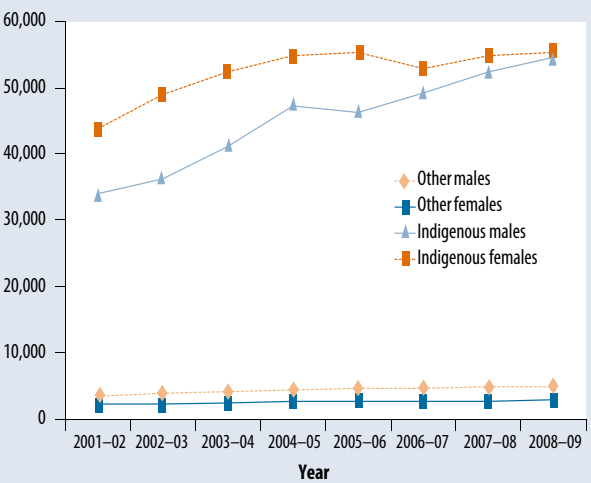
	Males	Females	Persons
		Number	
Indigenous	891	1,394	2,285
Other Australian	15,297	15,282	30,579
Total	**16,188**	**16,676**	**32,864**
		Hospitalisations per 100,000[a]	
Indigenous	590.8	780.2	688.1
Other Australian	150.3	140.8	144.0
Rate difference (Indigenous – other)	*440.5**	*639.4**	*544.1**
Rate ratio (Indigenous : other)	*3.9**	*5.5**	*4.8**
		Excess Indigenous hospitalisations[b]	
Excess number of Indigenous Hospitalisations	721	1,169	1,890
Excess proportion of Indigenous Hospitalisations (%)	80.9	83.9	82.7

(a) Directly age-standardised to the 2001 Australian population.

(b) The number and proportion of hospitalisations that would have been avoided if the other Australian hospitalisation rate applied to Indigenous Australians.

* Significant absolute difference (rate difference) or relative difference (rate ratio) between Indigenous and Other Australian hospitalisation rates.

Source: AIHW National Hospital Morbidity Database.



Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 6.8: Hospitalisation rates for regular dialysis, by Indigenous status and sex, Qld, WA, SA, and public hospitals in NT, 2001–02 to 2008–09

Hospitalisations where CKD was the principal diagnosis (excluding regular dialysis)

Indigenous identification in hospitalisation data is considered of sufficient quality for national reporting for New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory (public hospitals) only. In 2008–09, in these jurisdictions, there were 2,285 hospitalisations for Aboriginal and Torres Strait Islander people where CKD was the principal diagnosis (excluding regular dialysis—see Appendix B for a full list of ICD-10-AM codes used). Overall, 7% of hospitalisations with CKD as the principal diagnosis were for Indigenous Australians.

Indigenous Australians had higher rates of hospitalisation where CKD was the principal diagnoses than other Australians, 4 times as high for males and almost 6 times as high for females (Table 6.4). Indigenous females had higher hospitalisation rates than Indigenous males, while for other Australians this trend was reversed. Almost 83% (1,890) of the Indigenous hospitalisations where CKD was the principal diagnosis would have been avoided if the non-Indigenous hospitalisation rate applied to Indigenous Australians.

Hospitalisation rates for CKD as the principal diagnosis

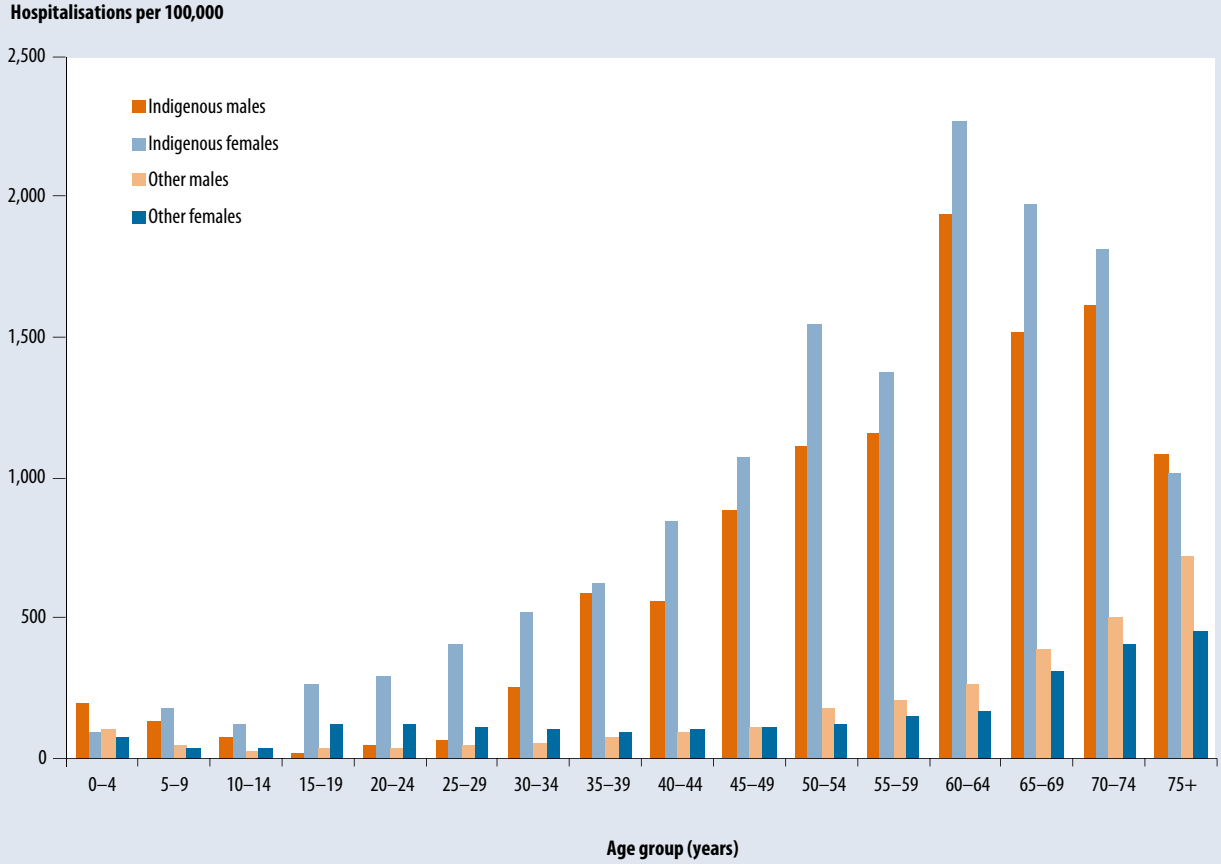
increased with age up to 60–64 years for Indigenous males and females, peaking at 1,937 and 2,267 per 100,000, respectively (Figure 6.9). For other Australians, hospitalisation rates were highest among those aged 75 years and older. Indigenous females had higher hospitalisation rates than Indigenous males in almost all age groups, the exceptions being those aged 0–4 years and 75 years and older. In general, other females had higher rates among the younger age groups, while other males had higher rates from 45–49 years onwards.

Geographical location

Indigenous Australians had higher rates of hospitalisation for CKD than other Australians in all geographical locations (Figure 6.10). Hospitalisation rates were highest for Indigenous Australians living in *Remote* locations while, for other Australians, rates were highest for those living in *Inner regional* and *Outer regional* locations.

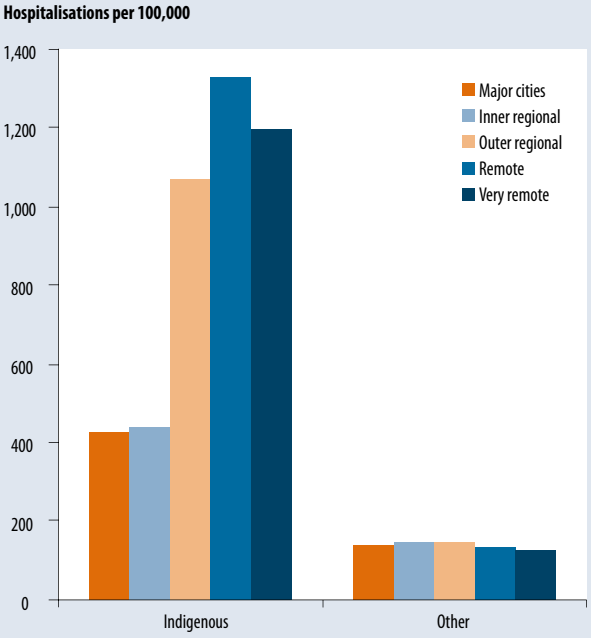
The greatest difference in rates between Indigenous and other Australians was in *Remote* areas, where Indigenous Australians were hospitalised at nearly 10 times the rate of other Australians. They also accounted for 54% of CKD hospitalisations in *Remote* areas despite making up only 15% of the population (Table A5).

Hospitalisation rates were higher for Indigenous females than Indigenous males in *Major cities, Remote* and *Very remote* areas. For other Australians, males had higher rates of hospitalisation in *Major cities,* while rates were similar in all other geographical locations.



Source: AIHW National Hospital Morbidity Database.

Figure 6.9: Hospitalisation rates for CKD as the principal diagnosis, by Indigenous status, sex and age, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09



Source: AIHW National Hospital Morbidity Database.

Figure 6.10: Hospitalisation rates where CKD was the principal diagnosis (excluding regular dialysis), by Indigenous status and geographical location, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2006–07 to 2008–09

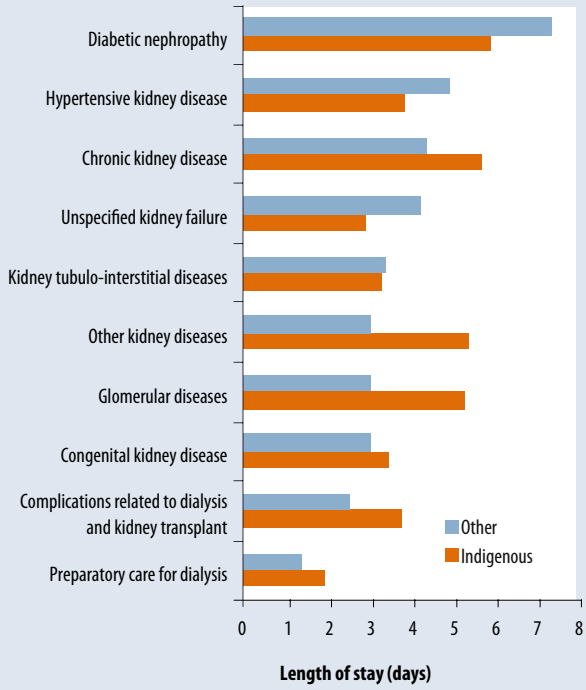
Diagnosis groups

The most common CKD diagnosis group (see Appendix B for details of ICD-10-AM codes used) for Aboriginal and Torres Strait Islander people was for *Diabetic nephropathy*, accounting for 34% of hospitalisations where CKD was the principal diagnosis (excluding regular dialysis—Table A4). *Kidney tubulo-interstitial diseases* was the next most common diagnosis group for Indigenous Australians (21%) and the second most common diagnosis group for other Australians, accounting for 20% of hospitalisations. This diagnosis group accounted for 30% of hospitalisations for Indigenous females and 33% for other females. This may be due to the high numbers of hospitalisations for *Pylenonephritis* (ICD-10-AM code N12), which is commonly caused by urinary tract infections.

As mentioned at the beginning of the 'Hospitalisation' section, *Chronic kidney disease* and its stages (ICD-10-AM code N18) were introduced as a diagnosis code in July 2008, replacing *Chronic kidney failure*. *Chronic kidney disease* was the most common CKD diagnosis group for non-Indigenous Australians in 2008–09, accounting for 22% of hospitalisations. This diagnosis code accounted for 13% of hospitalisations for Indigenous Australians. A greater proportion of Indigenous Australians were in CKD Stage 5 than other Australians (76% compared with 62%, respectively).

Length of stay

The average length of stay where CKD was the principal diagnosis was longer for Indigenous Australians than other Australians (4.7 compared with 4.1 days, respectively), and this difference remained after adjusting for age (5.7 compared with 5.0 days, respectively). Indigenous males had a longer average length of stay than Indigenous females (4.9 compared with 4.5 days, respectively). After adjusting for age, this difference was increased (6.4 compared with 5.1 days). There was no difference in the length of stay between other males and females. Those hospitalised for diabetic nephropathy had the longest stay (5.9 days for Indigenous Australians and 7.4 days for other Australians), while preparatory care for dialysis had the shortest length of stay (2.0 and 1.4 days, respectively) (Figure 6.11).



Note: Directly age-standardised to the 2008–09 Hospital population.

Source: AIHW National Hospital Morbidity Database.

Figure 6.11: Average length of stay where CKD was the principal diagnosis, by Indigenous status and diagnostic group, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

Separation mode

The majority of patients hospitalised with CKD as the principal diagnosis were discharged to their usual residence (77% of hospitalisations for Indigenous Australians and 88% of those for other Australians—Table 6.5). A greater proportion of Indigenous patients were transferred to another acute hospital than other Australians (10% compared with 6%, respectively) and

Table 6.5: Separation mode for hospitalisations where CKD was the principal diagnosis (excluding regular dialysis), by Indigenous status and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

	Discharge/ transfer to an (other) acute hospital	Discharge/ transfer to a residential aged care service	Discharge/ transfer to an(other) psychiatric hospital	Discharge/ transfer to other health care accommodation	Statistical discharge/ type change	Left against medical advice	Statistical discharge from leave	Died	Other (including usual residence/ own accommodation/ welfare institution
Indigenous				**Proportion of hospitalisations (per cent)**					
Males	12.3	1.3	0.0	2.5	0.4	4.2	0.1	2.5	76.7
Females	9.2	1.2	0.0	2.7	0.6	3.7	0.1	2.1	80.3
Persons	10.4	1.3	0.0	2.6	0.6	3.9	0.1	2.2	78.9
Other									
Males	5.9	1.0	—	0.2	1.1	0.6	0.1	3.7	87.5
Females	5.9	1.0	—	0.1	1.0	0.6	0.0	3.3	88.1
Persons	5.9	1.0	—	0.1	1.0	0.6	0.0	3.5	87.8

— Rounded to zero.

Source: AIHW National Hospital Morbidity Database.

left hospital against medical advice (4% compared with less than 1%, respectively).

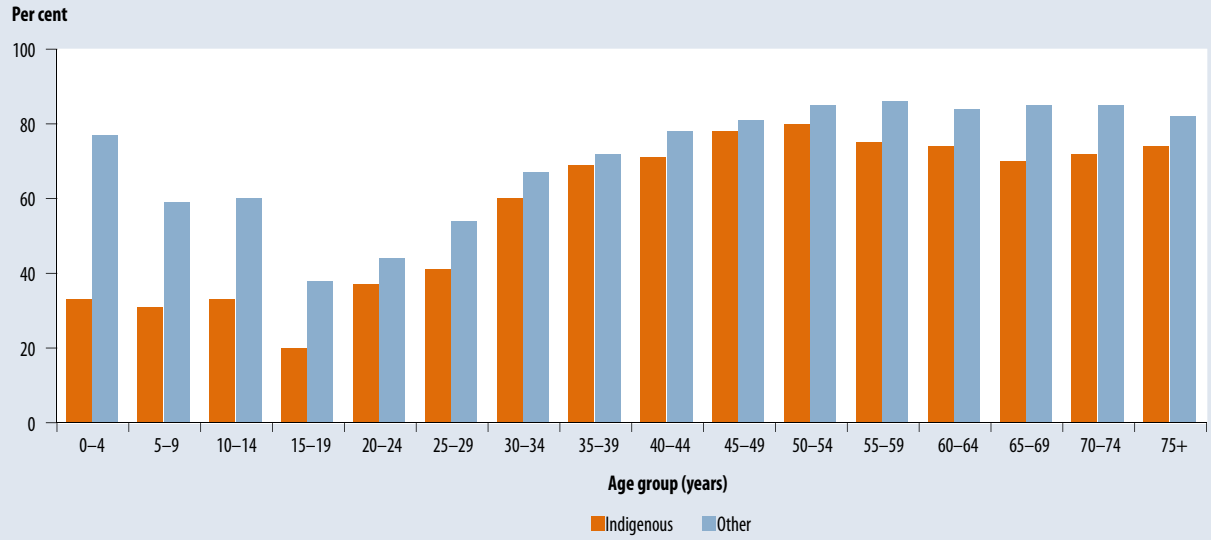
Of the patients who died in hospital, 55% of Indigenous patients were younger than 65 years, while the majority of non-Indigenous patients (90%) were 65 years or older.

Procedures

Indigenous Australians were less likely than other Australians to undergo a procedure while in hospital for CKD, and this difference remained after accounting for differences in age structure (66% of patients undergoing a procedure compared with 77%, respectively). This was true across all age groups, although the difference was greatest among those aged younger than 20 years (Figure 6.12). Both Indigenous and other Australian males were more likely to undergo a procedure while in hospital than their female counterparts.

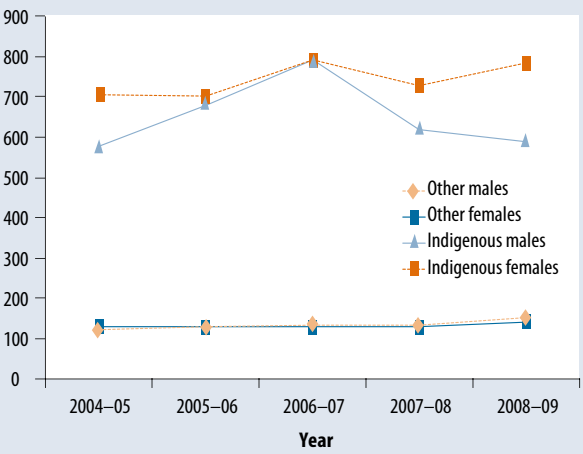
Trends for 2004–05 to 2008–09

Between 2004–05 and 2008–09, hospitalisations for Indigenous Australians where CKD was the principal diagnosis have fluctuated (Figure 6.13). An increase was seen in the number of hospitalisations for Indigenous females, however there was no change in the hospitalisation rate. There was an increase in the number and rate of hospitalisations for other Australians (14% and 24%, respectively). The absolute and relative difference in hospitalisation rates between Indigenous and other Australians did not change over this period.



Source: AIHW National Hospital Morbidity Database.

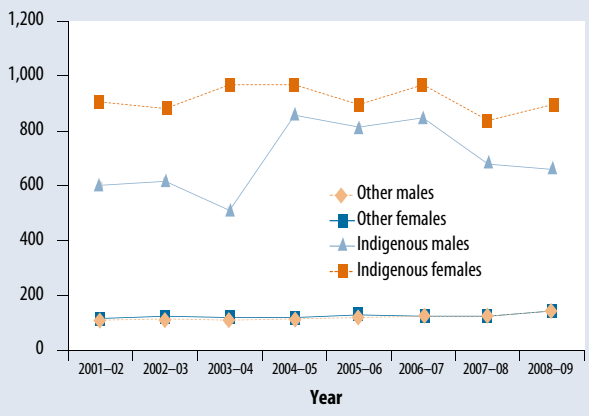
Figure 6.12: Hospitalisations with a procedure where CKD was the principal diagnosis (excluding regular dialysis), by Indigenous status and age, NSW, Vic, Qld, WA, SA and public hospitals in NT 2008–09



Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 6.13: Hospitalisation rates where CKD was the principal diagnosis, by Indigenous status and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2004–05 to 2008–09



Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 6.14: Hospitalisation rates where CKD was the principal diagnosis, by Indigenous status and sex, Qld, WA, SA, and public hospitals in NT, 2001–02 to 2008–09

Trends for 2001–02 to 2008–09

Analysis for the period 2001–02 to 2008–09 has been limited to those jurisdictions assessed as having adequate Indigenous identification over this time frame—namely Queensland, Western Australia, South Australia and public hospitals in the Northern Territory.

Between 2001–02 and 2008–09 in these jurisdictions, hospitalisations where CKD was the principal diagnosis varied, particularly for Indigenous Australians (Figure 6.14). The number of hospitalisations for Indigenous Australians increased by 57%, but there was no increase in the hospitalisation rate. Over the same period, there was a significant increase in the number and rate of hospitalisations for other Australians (42% and 20%, respectively). There were no significant changes in the rate difference between Indigenous and other Australians, however the rate ratio between Indigenous and other females decreased by 16%.

Hospitalisations where CKD was an additional diagnosis

This section excludes hospitalisations where CKD was the primary diagnosis (including regular dialysis).

Indigenous identification in hospitalisation data is considered of sufficient quality for national reporting for New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory (public hospitals) only. In 2008–09 in these jurisdictions, there were 8,262 hospitalisations for Indigenous Australians where CKD was recorded as an additional diagnosis, 6% of all hospitalisations where CKD was an additional diagnosis (Table 6.6). Indigenous Australians were hospitalised at 5 times the rate of other Australians, with larger differences seen between females than males (7 and 4 times as high, respectively). In contrast to other Australians, hospitalisation rates were higher for Indigenous females than Indigenous males.

Hospitalisation rates for CKD as an additional diagnosis increased with age up to 70–74 years for Indigenous Australians, peaking at 11,789 and 13,117 per 100,000 for males and females, respectively (Figure 6.15). For other Australians, hospitalisation rates also increased with age and were highest among those aged 75 and over.

The greatest differences in rates between Indigenous and other Australians occurred among those aged 40–44 years for males, with Indigenous males hospitalised at around 16 times the rate of other males. For females, the greatest difference was among those aged 45–49 years, where Indigenous females were hospitalised at around 22 times the rate of other females. Indigenous females had higher rates of hospitalisation across most age

Table 6.6: Hospitalisations with an additional diagnosis of CKD, by Indigenous status and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

	Males	Females	Persons
		Number	
Indigenous	3,666	4,596	8,262
Other Australian	77,095	58,171	135,266
Total	**80,761**	**62,767**	**143,528**
		Hospitalisations per 100,000[(a)]	
Indigenous	3,029.5	3,320.9	3,187.8
Other Australian	776.3	486.8	616.5
Rate difference (Indigenous – other)	*2,253.2**	*2,834.1**	*2,571.3**
Rate ratio (Indigenous : other)	*3.9**	*6.8**	*5.2**

(a) Directly age-standardised to the 2001 Australian population.

* Significant absolute difference (rate difference) or relative difference (rate ratio) between Indigenous and Other Australian hospitalisation rates.

Source: AIHW National Hospital Morbidity Database.

groups than Indigenous males. Other males had higher hospitalisation rates than other females for all age groups except those aged 15–34 years.

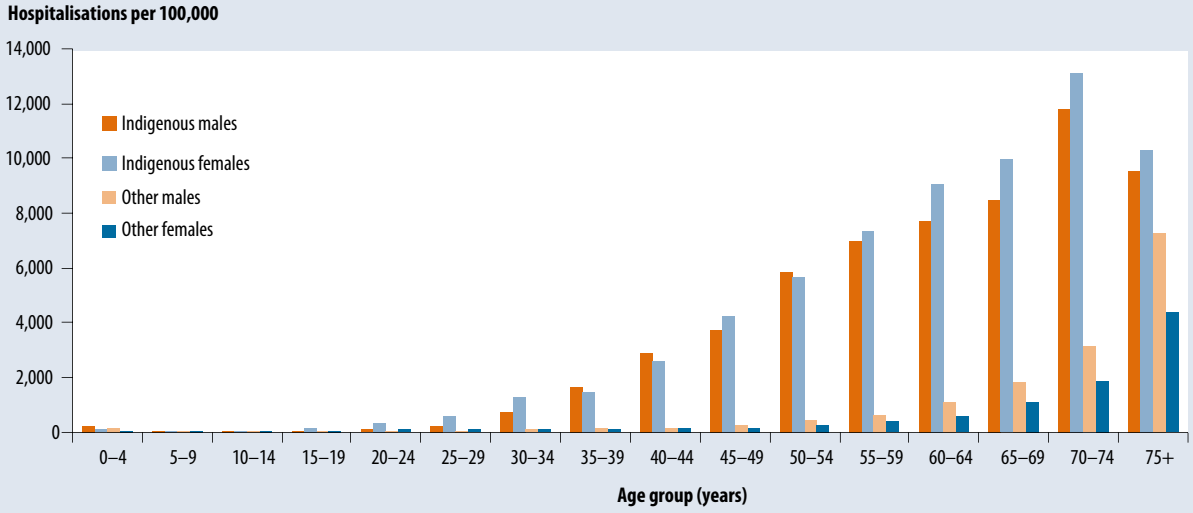
Geographical location

Indigenous Australians had higher rates of hospitalisation where CKD was an additional diagnosis than other Australians in all geographical locations (Figure 6.16).

The greatest difference in hospitalisation rates was in *Remote* areas, where Indigenous Australians were hospitalised at nearly 13 times the rate of other Australians for CKD as an additional diagnosis.

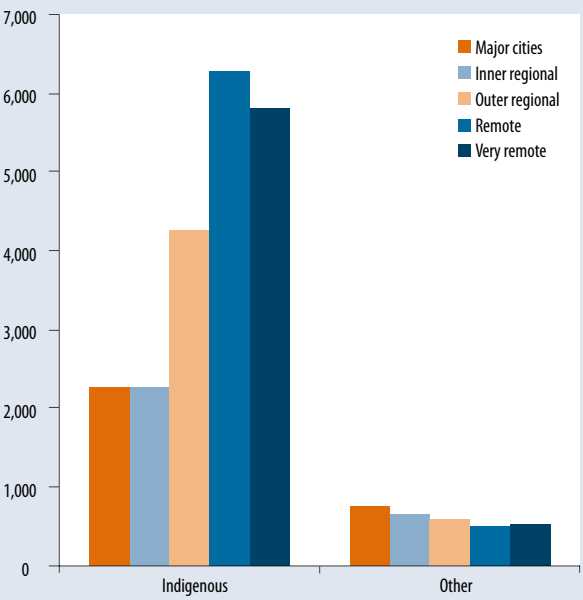
Indigenous Australians living in *Remote* areas had the highest rates of hospitalisation where CKD was an additional diagnosis compared with Indigenous Australians living in other geographical locations (Figure 6.16 and Table A8). In contrast, other Australians living in *Major cities* had the highest rates overall.

Rates were higher for Indigenous males than Indigenous females in *Inner regional* areas, and were higher for Indigenous females in *Outer regional* and *Very remote* areas. For other Australians, males had higher rates of hospitalisation than females in all locations.



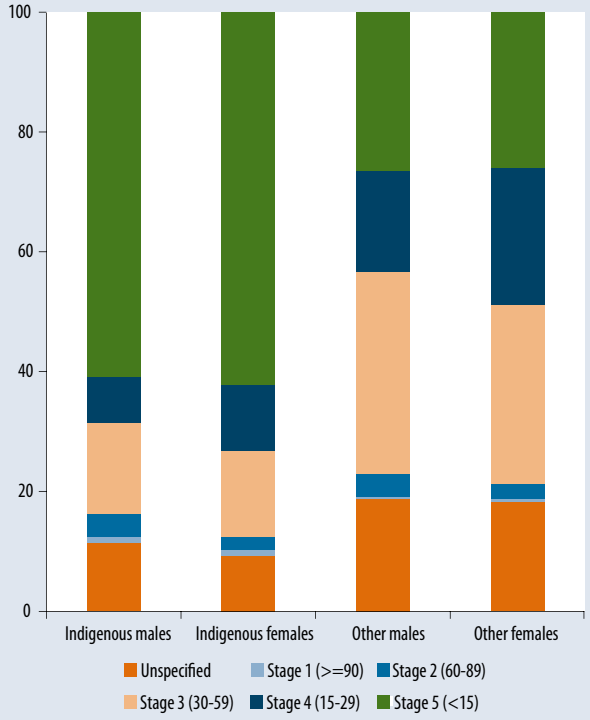
Source: AIHW National Hospital Morbidity Database.

Figure 6.15: Hospitalisation rates where CKD was an additional diagnosis, by Indigenous status and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09



Source: AIHW National Hospital Morbidity Database.

Figure 6.16: Hospitalisation rates where CKD was an additional diagnosis, by Indigenous status and geographical location, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2006–07 to 2008–09



Note: Refer to Box 1 in Chapter 1 for a description of the stages of CKD.

Source: AIHW National Hospital Morbidity Database.

Figure 6.17: Hospitalisations where *Chronic kidney disease* (ICD-10-AM code N18) was an additional diagnosis, by Indigenous status and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

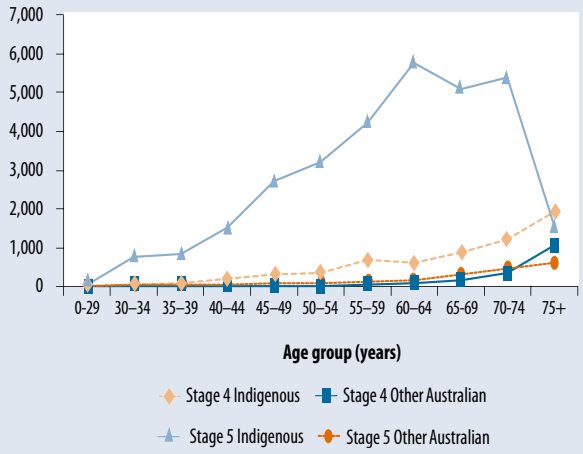
Diagnosis groups

The most common condition where CKD was an additional diagnosis for both Indigenous and other Australians was *Chronic kidney disease* (ICD-10-AM code N18)—84% and 76% of hospitalisations where CKD was an additional diagnosis, respectively (Table A6). Nearly 57% of hospitalisations where CKD was an additional diagnosis for Indigenous Australians had *Diabetic nephropathy* listed as an additional diagnosis, compared with 34% for other Australians. Compared with Indigenous Australians, other Australians were more likely to have *Unspecified kidney failure* recorded as an additional diagnosis (7% compared with 2%).

Of the hospitalisations where *Chronic kidney disease* (ICD-10-AM code N18) was recorded as an additional diagnosis, the vast majority were for stages 3 to 5 (Figure 6.17). A much higher proportion of Indigenous hospitalisations were for CKD Stage 5 than other Australians (61% compared with 26%, respectively), while other Australians had a higher proportion of hospitalisations for Stage 3, Stage 4 and unspecified CKD than Indigenous Australians.

In 2008–09, Indigenous Australians had a higher rate of hospitalisations than other Australians for hospitalisations with an additional diagnosis of all stages of *Chronic kidney disease* (N181 to N185). The largest difference was for Stage 5 CKD, where Indigenous Australians were hospitalised at 12 times the rate of other Australians.

Hospitalisations with an additional diagnosis of CKD stages 4 and 5 increased with age, and were higher for Indigenous Australians in all age groups (Figure 6.18). The greatest difference in rates for CKD Stage 5 was for those aged 45–49 years, where Indigenous Australians were hospitalised at nearly 40 times the rate of other Australians.



Source: AIHW National Hospital Morbidity Database.

Figure 6.18: Hospitalisations for *chronic kidney disease* (ICD-10-AM code N18), by Indigenous status and age, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

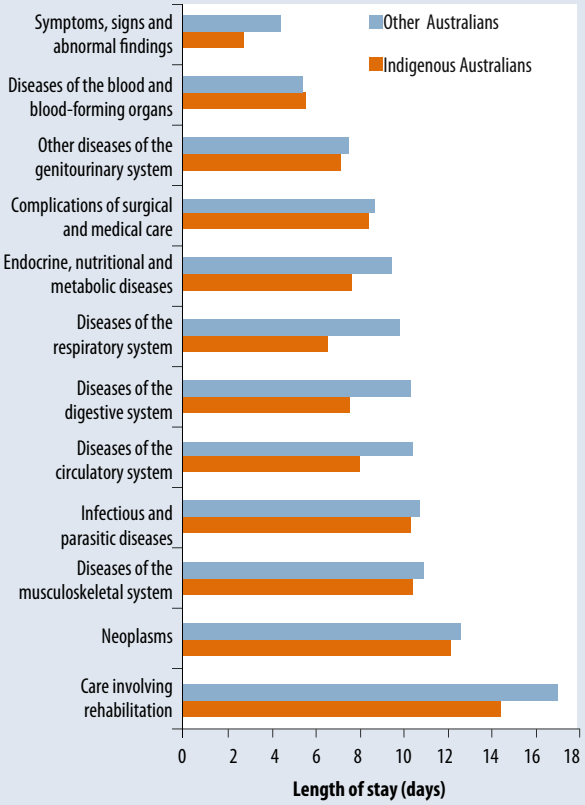
Principal diagnoses where CKD was an additional diagnosis

The most common principal diagnoses where CKD was an additional diagnosis for Indigenous Australians were *Endocrine, nutritional and metabolic diseases* (20%), followed by *Diseases of the circulatory system* (15%) and *Diseases of the respiratory system* (11%) (Table A7). These three diagnoses were also the most common for other Australians, however other Australians were more likely to have *Diseases of the circulatory system* (22%) and less likely to have *Endocrine, nutritional and metabolic diseases* (9%) and *Diseases of the respiratory system* (9%).

Length of stay

The average length of stay where CKD was an additional diagnosis was 10.4 days for Indigenous Australians and 8.1 days for other Australians. This trend remained after adjusting for differences in the age structure of the CKD hospital population. There were no differences in the length of stay between Indigenous males and females, while the stay for other females was slightly longer than for other males.

Care involving rehabilitation had the longest average length of stay for Indigenous and other Australians where CKD was an additional diagnosis (15 and 17 days, respectively) (Figure 6.19). Other Australians had a longer length of stay for all diagnoses with the exception of *Diseases of the blood and blood-forming organs*.



Source: AIHW National Hospital Morbidity Database.

Figure 6.19: Average length of stay where CKD was an additional diagnosis, by Indigenous status and principal diagnosis, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

Separation mode

The majority of patients hospitalised with CKD as an additional diagnosis were discharged to their usual residence, and this proportion was similar for both Indigenous and other Australians (72% compared with 68%, respectively) (Table 6.7). A greater proportion

Table 6.7: Separation mode for hospitalisations where CKD was an additional diagnosis, by Indigenous status and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

	Discharge/ transfer to an (other) acute hospital	Discharge/ transfer to a residential aged care service	Discharge/ transfer to an(other) psychiatric hospital	Discharge/ transfer to other health care accommodation	Statistical discharge/ type change	Left against medical advice	Statistical discharge from leave	Died	Other (including usual residence/ own accommodation/ welfare institution
Indigenous Australians					Proportion of hospitalisations (per cent)				
Males	12.5	1.2	—	1.6	3.7	6.7	0.1	3.7	70.5
Females	11.1	1.9	0.0	2.3	4.1	4.2	0.1	3.6	72.8
Persons	11.7	1.6	—	2.0	3.9	5.3	0.1	3.6	71.8
Other Australians									
Males	12.3	3.2	0.1	0.5	5.8	0.8	0.1	8.4	68.8
Females	12.6	5.0	0.0	0.6	6.5	0.5	0.1	8.1	66.7
Persons	12.4	3.9	0.1	0.5	6.1	0.7	0.1	8.3	67.9

— Rounded to zero.

Source: AIHW National Hospital Morbidity Database.

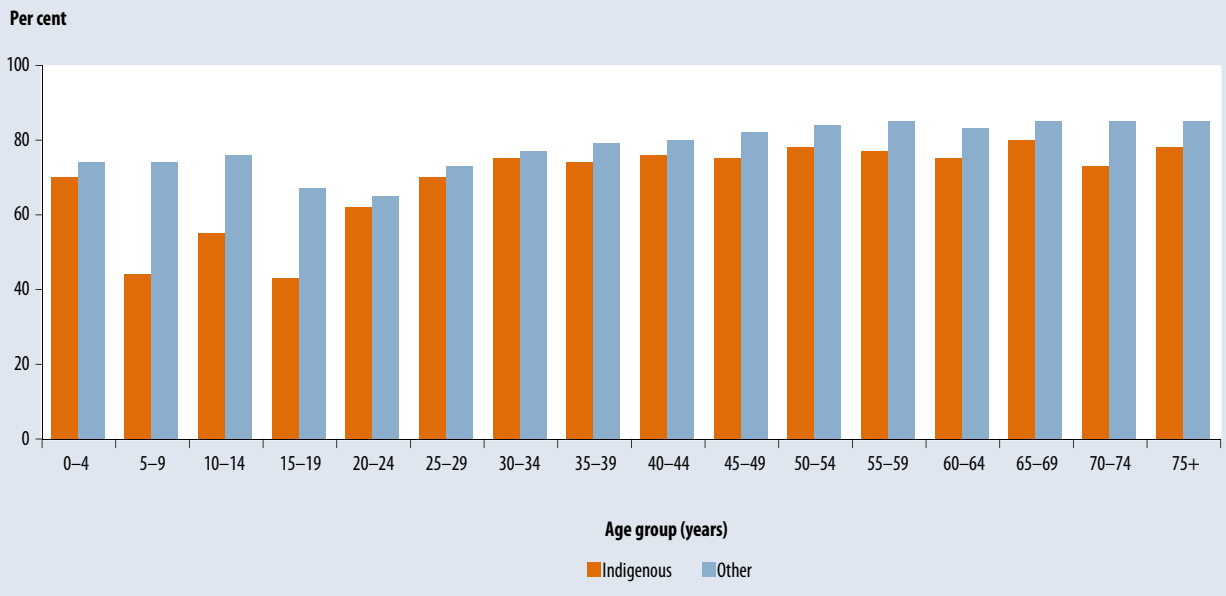
of Indigenous Australians than other Australians left hospital against medical advice (5% compared with less than 1%, respectively), however over 8% of other Australians died in hospital compared with 4% of Indigenous Australians. Of the patients who died in hospital, the majority of non-Indigenous patients (89%) were 65 years or older. In contrast, the majority of Indigenous patients (56%) were under 65 years of age.

Procedures

Just over 76% of Aboriginal and Torres Strait Islander people hospitalised with CKD as an additional diagnosis underwent a procedure, compared with 84% of other Australians. Indigenous Australians were less likely than other Australians to receive a procedure in all age groups (Figure 6.20), with the greatest differences seen among those aged between 5 and 19 years. There was no difference between males and females for Indigenous and other Australians.

Trends for 2004–05 to 2008–09

Over the period 2004–05 to 2008–09, the number of hospitalisations where CKD was an additional diagnosis increased for Indigenous Australians, from 6,855 to 8,262. This increase was larger for males than females (29% compared with 21%, respectively) (Figure 6.21).

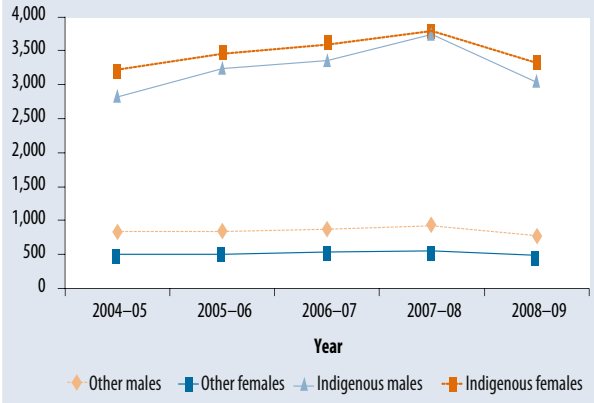


Source: AIHW National Hospital Morbidity Database.

Figure 6.20: Hospitalisations with a procedure where CKD was an additional diagnosis, by Indigenous status and age, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

Two major changes in coding practices were introduced into the ICD-10-AM 6th edition that may have contributed to the apparent decrease in hospitalisations (for CKD as an additional diagnosis) between 2007–08 and 2008–09, with hospitalisation rates decreasing by 14% for other Australians and 15% for Indigenous Australians. First, the replacement of the *Chronic kidney failure* code with *Chronic kidney disease* (N18) appears to have resulted in a reduction in the number of hospitalisations with this code, as documentation of CKD stage is required to code N18, and a concomitant increase in the number of hospitalisations coded for *Unspecified renal failure* (N19). This situation may change in future years as clinicians and coders become more familiar with the use of the new coding practices.

The second major change is that from 2008–09 there has also been a new emphasis on the need for diabetes mellitus to meet additional diagnoses criteria of 'increased clinical care and/or monitoring' to be coded. Before this, the routine taking of blood sugar levels had been used by coders to determine when to code diabetes mellitus and any associated conditions. This has resulted in a drop of nearly 12,000 hospitalisations with an additional diagnosis of diabetic nephropathy between 2007–08 and 2008–09.



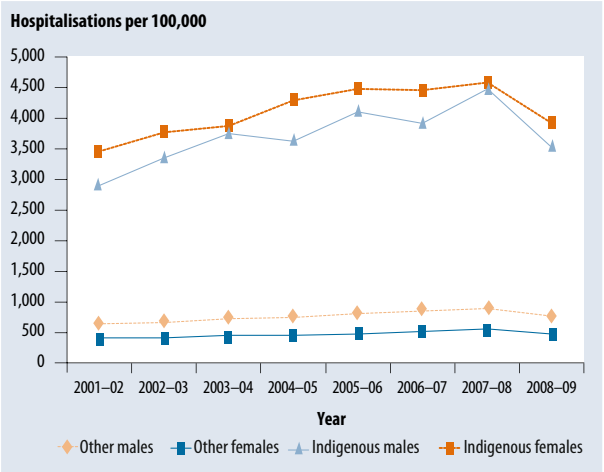
Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 6.21: Hospitalisation rates where CKD was an additional diagnosis, by Indigenous status and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2004–05 to 2008–09

Trends for 2001–02 to 2008–09

Analysis for the period 2001–02 to 2008–09 has been limited to those jurisdictions assessed as having adequate Indigenous identification over this time frame—namely Queensland, Western Australia, South Australia and public hospitals in the Northern Territory. Over the period 2001–02 to 2008–09 in these jurisdictions, the number and rate of hospitalisations where CKD was an additional diagnosis increased for Indigenous and other Australians for most of the period, but with some drop-off in the final year (Figure 6.22), as described in the previous section. This increase was larger for Indigenous than other Australians, and for males than females. There was no change in the rate ratio, but there was an increase of 22% in the rate difference between Indigenous and other females (from 3,039 to 3,443 per 100,000).



Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 6.22: Hospitalisation rates where CKD was an additional diagnosis, by Indigenous status and sex, Qld, WA, SA and public hospitals in NT, 2001–02 to 2008–09

7 Health care expenditure

CKD places a large burden on the Australian health-care system, especially the treatment of ESKD which can require regular and frequent admissions to hospital.

This section refers to estimated health-care expenditure on hospital-admitted patients with a principal diagnosis of CKD only and, like hospital morbidity data, is restricted to jurisdictions which have adequate Indigenous identification. In 2006–07, these were New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory. Unlike hospital morbidity data, however, private hospitals in the Northern Territory were included in the estimates.

Hospital expenditure

In 2006–07, hospital expenditure for CKD in New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory was $740.7 million (Table 7.1), equating to over 2.6% of recurrent expenditure for admitted patient services during this period (estimated at $28,195 million). Over 70% of CKD hospital expenditure was on dialysis treatment ($523.4 million), with the next major areas of expenditure being for diabetic nephropathy ($55.0 million) and chronic kidney failure ($50.5 million).

Over 12% of the hospital expenditure on CKD ($93.5 million) was for Indigenous Australians. Expenditure per person in the population for Indigenous Australians was almost 6 times that of expenditure per person for non-Indigenous Australians ($187 compared with $33, respectively).

Indigenous Australians accounted for 14% of the expenditure on dialysis ($75.0 million), with the average cost per dialysis hospitalisation higher for Indigenous Australians ($643) than non-Indigenous Australians ($566). The proportion of CKD hospital expenditure on Indigenous Australians was much less for unspecified kidney failure (1.1%), hypertensive kidney disease (3.6%), congenital malformations of the kidney (5.1%), chronic kidney failure (5.7%) and transplant procedures (5.9%).

In 2006–07, the average cost per CKD-related hospital hospitalisation was $790, with the average cost per hospitalisation being slightly lower for Indigenous Australians ($783) compared with other Australians ($791). This difference partly reflects the relatively high proportion (94%) of kidney transplant expenditure for non-Indigenous Australians.

When kidney transplants are not included in the expenditure estimates, the average cost per CKD-related hospitalisation for non-Indigenous Australians decreases by 4.3% (to $769), while for Indigenous Australians the average cost per hospitalisation decreases by only 1.9% (to $757).

Table 7: Expenditure on CKD-related hospitalisations, by Indigenous status, NSW, Vic, Qld, WA, SA and NT, 2006–2007

	Expenditure ($100,000)			Cost per Hospitalisation ($)		
Area of expenditure	**Indigenous**	**Non-Indigenous**	**Total**	**Indigenous**	**Non-Indigenous**	**Average**
Dialysis[(a)]	750.3	4,483.5	5,233.7	643	566	576
Diabetic nephropathy	67.2	482.3	549.5	9,773	9,955	9,932
Hypertensive kidney disease	1.8	48.8	50.5	5,240	7,984	7,842
Glomerular diseases	13.5	90.3	103.8	6,251	3,999	4,195
Kidney tubulo-interstitial diseases	27.2	240.3	267.4	5,338	3,712	3,831
Chronic kidney failure	29.0	475.8	504.8	6,512	10,424	10,077
Unspecified kidney failure	0.2	18.6	18.8	2,439	5,671	5,580
Other disorders of the kidney and ureter	8.2	86.1	94.3	17,617	5,192	5,531
Congenital malformations of the kidney	4.4	81.3	85.6	12,500	6,979	7,140
Complications related to dialysis and kidney transplant	1.2	90.7	92.0	6,271	11,794	11,657
Preparatory care for dialysis	13.9	94.1	108.0	2,621	2,766	2,746
Transplant procedures	17.7	280.7	298.4	50,293	44,664	44,963
Total	**934.5**	**6,472.5**	**7,406.9**	**783**	**791**	**790**

(a) Includes haemodialysis and peritoneal dialysis treatment.

Note: Columns may not add to totals due to rounding.

Source: AIHW Disease Expenditure Database.

8 Impact of CKD

Quality of life

Being diagnosed with CKD can significantly affect the quality of life of individuals, as well as their family and friends—particularly when kidney replacement therapy is required. The treatment and management of CKD, like other chronic diseases, may involve major lifestyle modifications. For Indigenous Australians from remote communities receiving dialysis, a particular issue is isolation and travel, which may prevent such patients receiving adequate dialysis treatment and, in addition to cultural factors, contribute to persistently high rates of withdrawal (Spencer et al. 1998). The need to relocate to distant urban areas to access treatment affects the patient, patient's family and community, and there is also some evidence that long travel times to dialysis treatment is associated with higher mortality rates (Moist et al. 2008).

Along with better survival rates, people with kidney transplants have better quality of life than those on dialysis (Cameron et al. 2000). Transplant rates in Australia are low however, and even fewer Indigenous Australians with ESKD receive a kidney transplant. In addition, while a functioning kidney transplant affords those with ESKD a life without the frequent and time-consuming need for regular dialysis, medical supervision and medications are still required for the life of the transplant. There are also a number of side effects associated with anti-rejection medications (immunosuppressants) such as infections, cardiovascular complications and higher rates of cancer (Magee & Pascual 2004).

Self-assessed health status for Indigenous Australians with CKD

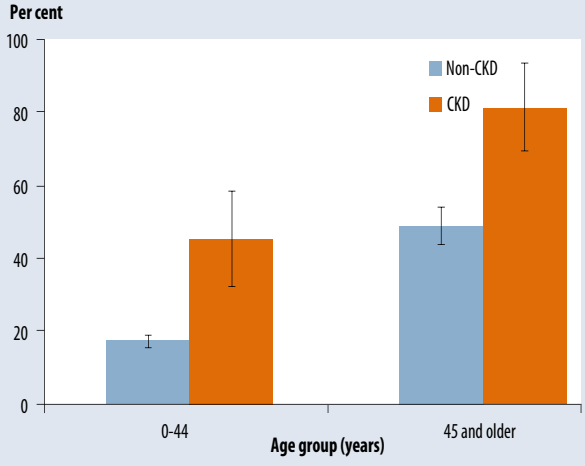
In 2004–05, Indigenous Australians with CKD were far more likely to report their health status as fair or poor, compared with those without CKD (58% versus 21%).

Table 8.1: Self-assessed health status of Indigenous Australians by CKD status, 2004-05

Self-assessed health	Non-CKD	CKD
Fair/poor	20.4	50.2
Good and above	79.6	49.8

Source: AIHW analysis of 2004–05 NATSIHS.

The proportion of people who reported having fair or poor health increased with age for those with and without CKD (Figure 8.1), however a greater proportion of those with CKD reported having fair or poor health in both age groups.



Source: AIHW analysis of NATSIHS 2004-05 data.

Figure 8.1: Proportion of Indigenous Australians reporting fair or poor health status, by age group and CKD status, 2004-05

Burden of disease

The *Burden of disease and injury in Australia 2003* report identifies and quantifies the impact of health problems in Australia, based in ICD-10 disease coding. Chronic kidney disease, as defined in this report, is not a disease grouping in that report. However, the report presents data for 'renal failure', based on diabetes-related cases of ESKD from ANZDATA 2002 (Begg et al. 2007). Renal failure was estimated to cause 2.6% of the total burden of disease and injury in Australia in 2003, but 5.1% of the burden for Indigenous Australians. The majority of this burden can be attributed to years of life lost due to premature death—94% of the burden for the Indigenous Australian population.

9 Discussion

Poor health status and health outcomes among the Aboriginal and Torres Strait Islander population are a well-known public health concern in Australia. Compared with other Australians, Indigenous Australians have excessive chronic disease morbidity and mortality—particularly those in remote communities—and CKD is no exception to this. The aim of this report is to present the first detailed analysis of CKD in Indigenous Australians.

There is a lack of data on CKD prevalence and incidence in Australia for both Indigenous and non-Indigenous Australians. To date, there have been no national biomedical surveys that include an adequate sample of Indigenous Australians, so self-reported data were used in this report. According to the 2004–05 NATSIHS, 3.4% of Indigenous Australians are estimated to have CKD. Due to the lack of symptoms in the early stages of CKD, it is likely that a measurement survey would find this proportion is much higher. Indeed, the last national measurement survey, AusDiab, showed that around 13% of participants (including Indigenous and non-Indigenous) had some degree of CKD.

Over the period 2007–2008, almost 10% of new treated ESKD patients identified as being Indigenous. The incidence rate of treated ESKD for Indigenous Australians was 8 times that of the non-indigenous population, and around 20 times as high in *Remote* and *Very remote* areas. The most common cause of new cases of treated ESKD for Indigenous Australians was overwhelmingly diabetes, accounting for 65%. In contrast, only half the proportion (29%) of new cases of treated ESKD for non-Indigenous Australians was attributed to diabetes.

At the end of 2008, 7.4% of people receiving KRT were Indigenous, with Indigenous Australians treated for ESKD at 6 times the rate of non-Indigenous Australians. This decrease in the rate ratio between treated ESKD incidence and prevalence (8 compared with 6), indicates that survival for Indigenous Australians being treated for ESKD is shorter than for non-Indigenous Australians. This is consistent with the majority of the ESKD outcome research which suggests that Indigenous Australians receiving KRT have higher mortality rates than non-Indigenous Australians.

The most common cause of prevalent cases of treated ESKD was also diabetes for Indigenous Australians (56%), while for non-Indigenous Australians it was glomerulonephritis (37%). The high proportion of prevalent and incident cases of treated ESKD caused by diabetes highlights the increased burden of diabetes in the Indigenous population.

Although disease and risk factor prevalence are high among Indigenous Australians in general, a wide variation is seen between different Indigenous communities. Hoy et al. (2005b) discovered marked variation in rates of smoking, alcohol use, hypertension, diabetes and kidney damage between three remote Aboriginal communities. This suggests that health interventions and preventive strategies for Indigenous Australians need to be adapted to address the different disease profiles of the various communities.

The incidence rate of treated ESKD was highest in *Remote* and *Very remote* areas, and treatment for ESKD is a particular problem for people living in these communities. The distance to the nearest dialysis facility may be hundreds or even thousands of kilometres, and the cost of travel and accommodation may be prohibitive. For Indigenous Australians, the cultural importance of family and place can mean the thought of leaving their home to receive treatment in a hospital or satellite dialysis facility too far away for them to easily visit family and friends is distressing and frightening (Willis 1995).

Despite this, hospitalisation rates for CKD for Aboriginal and Torres Strait Islander people are much higher than for other Australians. Indigenous Australians were hospitalised for dialysis at 11 times the rate of other Australians in 2008–09, and accounted for 12% of all dialysis hospitalisations. Rates of hospitalisation for other diagnoses of CKD (principal or additional) were also 5 times that of other Australians, with Indigenous Australians making up the vast majority of hospitalisations in *Very remote* areas.

It would appear that Indigenous Australians receiving treatment for CKD in hospital are doing so when their CKD is more advanced than other Australians. In 2008–09, 61% of Indigenous hospitalisations, where CKD (ICD-10-AM code N18) was recorded as an additional diagnosis, were recorded as being CKD Stage 5 compared with 26% of other Australians.

Indigenous Australians also had more comorbidities than other Australians when hospitalised. In 2008-09, over half (55%) of Indigenous hospitalisations for CKD (excluding dialysis) also had a diagnosis of both diabetes and CVD compared with 35% of other Australians. Overall, only 20% of Indigenous hospitalisations for CKD did not also have a diagnosis of CVD or diabetes compared with 30% of hospitalisations for other Australians.

Despite the disparity in disease severity and comorbidities, Indigenous Australians hospitalised for CKD have a shorter length of stay in hospital and are less likely to receive a procedure than other Australians.

Conclusion

CKD, and particularly ESKD, contributes significantly to the morbidity and mortality of Aboriginal and Torres Strait Islander people in Australia. Many Aboriginal and Torres Strait Islander people, particularly those in remote communities, face barriers in accessing health care. These barriers can impact on all stages of CKD, from the prevalence and management of risk factors and diseases associated with CKD, to the detection and management of kidney problems, and prevention of CKD progression.

The burden of CKD in Indigenous Australians is expected to continue to rise through an increase in risk factors such as diabetes. Reducing the level of risk factors among Indigenous Australians, as well as tackling the social conditions that promote them, will assist in reducing this burden in the future.

Appendix A Detailed data tables

Table A1: Incidence of treated ESKD, by Indigenous status, sex and geographical location, 2005–2008

	Major cities		Inner regional		Outer regional		Remote		Very remote	
	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]
Indigenous										
Male	56	38.2	47	43.6	110	93.4	73	128.9	122	141.3
LCL (95%)–UCL (95%)		(26.2–50.2)		(29.8–57.5)		(73.6–113.1)		(95.9–161.9)		(113.5–169.0)
Female	65	38.2	39	37.4	120	95.4	101	177.9	179	183.3
LCL (95%)–UCL (95%)		(27.9–48.4)		(24.5–50.2)		(76.7–114.0)		(140.6–215.1)		(154.9–211.6)
Persons	121	37.9	87	40.7	230	94.9	174	155.8	301	163.2
LCL (95%)–UCL (95%)		(27.7–48.2)		(31.2–50.2)		(81.3–108.5)		(130.5–181.1)		(143.4–183.0)
Non-Indigenous										
Male	3,819	14.3	1,050	11.9	452	10.9	58	10.7	17	8.1
LCL (95%)–UCL (95%)		(13.9–14.8)		(11.2–12.6)		(9.9– 11.9)		(7.9–13.5)		(4.1–12.1)
Female	2,358	7.8	601	6.4	264	6.4	27	5.8	10	7.6
LCL (95%)–UCL (95%)		(7.5–8.1)		(5.9– 6.9)		(5.6– 7.2)		(3.6–8.0)		(2.6–12.5)
Persons	6,177	10.8	1,652	9.0	716	8.7	85	8.4	27	7.9
LCL (95%)–UCL (95%)		(10.6–11.1)		(8.6– 9.5)		(8.0– 9.3)		(6.6–10.2)		(4.8–11.1)
Proportion [b] and rate ratio[c]	*1.9*	*3.5*	*5.0*	*4.5*	*24.3*	*11.0*	*67.1*	*18.5*	*91.9*	*20.6*

(a) Treated ESKD patients per 100,000 population, directly age-standardised to the 2001 Australian population.

(b) Indigenous proportion (%) of total number of new cases of treated ESKD.

(c) Rate ratio (Indigenous rate: non-Indigenous rate).

Note: LCL = lower confidence limit; UCL = upper confidence limit.

Source: AIHW analysis of ANZDATA Registry data.

Table A2: Prevalence of treated ESKD, by Indigenous status, sex and geographical location, 2008

	Major cities		Inner regional		Outer regional		Remote		Very remote	
	Number	Rate[(a)]	Number	Rate[(a)]	Number	Rate[(a)]	Number	Rate[(a)]	Number	Rate[(a)]
Indigenous										
Male	114	315.9	79	295.4	192	672.7	144	1,124.3	84	411.0
LCL (95%)–UCL (95%)		(247.5–384.4)		(221.3–369.4)		(566.0–779.4)		(919.2–1,329.5)		(313.6–508.5)
Female	125	272.2	51	194.0	236	748.3	183	1,314.6	98	413.8
LCL (95%)–UCL (95%)		(219.5–324.9)		(135.6–252.3)		(644.4–852.1)		(1,108.8–1,520.3)		(328.0–499.7)
Persons	239	289.6	130	242.9	429	714.5	326	1,226.0	183	409.6
LCL (95%)–UCL (95%)		(236.9–342.3)		(196.3–289.5)		(639.8–789.2)		(1,080.3–1,371.7)		(346.0–473.2)
Other										
Male	7,165	105.9	1,886	87.1	770	74.9	88	60.3	36	69.1
LCL (95%)–UCL (95%)		(103.4–108.3)		(83.2–91.1)		(69.6–80.3)		(47.5–73.1)		(45.8–92.3)
Female	4,618	61.8	1,180	51.9	474	47.3	49	38.4	15	42.2
LCL (95%)–UCL (95%)		(60.0–63.6)		(48.9–54.9)		(43.0–51.6)		(27.5–49.3)		(20.2–64.1)
Persons	11,783	82.5	3,066	69.0	1,244	61.3	137	50.2	52	58.2
LCL (95%)–UCL (95%)		(81.0–84.0)		(66.5–71.5)		(57.9–64.7)		(41.7–58.7)		(41.8–74.7)
Proportion [(b)] and rate ratio[(c)]	*2.0*	*3.5*	*4.1*	*3.5*	*25.6*	*11.7*	*70.4*	*24.4*	*77.9*	*7.0*

(a) Treated ESKD patients per 100,000 population, directly age-standardised to the 2001 Australian population.

(b) Indigenous proportion (%) of total number of treated ESKD cases.

(c) Rate ratio (Indigenous rate: non-Indigenous rate).

Note: LCL = lower confidence limit; UCL = upper confidence limit.

Source: AIHW analysis of ANZDATA Registry data.

Table A3: Hospitalisations for regular dialysis, by Indigenous status and geographical location, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2006–07 to 2008–09

	Major cities		Inner regional		Outer regional		Remote		Very remote	
	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]
Indigenous										
Male	31,065	28,723	20,370	31,655	46,065	64,394	26,990	78,032	31,560	51,248
LCL (95%)–UCL (95%)		(28,346–29,101)		(31,158–32,151)		(63,722–65,066)		(76,964–79,099)		(50,621–51,875)
Female	33,944	26,370	13,801	19,740	64,764	77,939	36,600	88,079	38,155	56,771
LCL (95%)–UCL (95%)		(26,060–26,680)		(19,380–20,101)		(77,290–78.588)		(87,112–89,047)		(56,173–57,368)
Persons	65,009	27,294	34,171	25,330	110,829	71,643	63,590	82,686	69,715	54,003
LCL (95%)–UCL (95%)		(27,055–27,532)		(25,030–25,630)		(71,176–72,109)		(81,978–83,394)		(53,573–54,432)
Other										
Male	1,196,067	6,166	252,502	4,079	95,622	3,312	5,202	1,244	1,088	775
LCL (95%)–UCL (95%)		(6,154–6,177)		(4,063–4,095)		(3,290–3,333)		(1,209–1,278)		(727–823)
Female	746,476	3,321	167,149	2,460	58,631	2,060	2,446	683	745	632
LCL (95%)–UCL (95%)		(3,313–3,329)		(2,448–2,471)		(2,043–2,077)		(655–710)		(586–679)
Persons	1,942,543	4,631	419,651	3,237	154,253	2,688	7,648	985	1833	712
LCL (95%)–UCL (95%)		(4,624–4,637)		(3,227–3,247)		(2,675–2,702)		(962–1,007)		(678–745)
Proportion [b] and rate ratio[c]	3.2	5.9*	7.5	7.8*	41.8	26.7*	89.3	84.0*	97.4	75.9*

(a) Hospitalisations per 100,000, directly age-standardised to the 2001 Australian population.

(b) Indigenous proportion (%) of hospitalisations.

(c) Rate ratio (Indigenous rate: other Australian rate).

* Significant relative difference (rate ratio) between Indigenous and other Australian hospitalisation rates.

Note: Numbers exclude patients for whom a remoteness classification could not be assigned due to missing data, non-Australian residency etc. LCL = lower confidence limit; UCL = upper confidence limit.

Source: AIHW National Hospital Morbidity Database.

Table A4: Diagnosis groups for hospitalisations where CKD was the principal diagnosis (excluding regular dialysis), NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

	Indigenous			Other Australians		
Principal diagnosis	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**
			Number of hospitalisations			
Diabetic nephropathy	334	448	782	3,480	2,556	6,036
Kidney tubulo-interstitial diseases	50	421	471	1,140	5,062	6,202
Chronic kidney disease	126	173	299	3,577	3,127	6,704
Preparatory care for dialysis	130	150	280	2,358	1,237	3,595
Glomerular diseases	135	108	243	1,677	1,005	2,682
Complications related to dialysis and kidney transplant	51	38	89	1,057	594	1,651
Congenital malformations of the kidney	23	9	32	563	455	1,018
Hypertensive kidney disease	15	13	28	269	234	503
Unspecified kidney failure	11	10	21	245	227	472
Other kidney diseases	16	24	40	931	785	1,716
Total	**891**	**1,394**	**2,285**	**15,297**	**15,282**	**30,579**
			Proportion of hospitalisations (per cent)			
Diabetic nephropathy	37.5	32.1	34.2	22.7	16.7	19.7
Kidney tubulo-interstitial diseases	5.6	30.2	20.6	7.5	33.1	20.3
Chronic kidney disease	14.1	12.4	13.1	23.4	20.5	21.9
Preparatory care for dialysis	14.6	10.8	12.3	15.4	8.1	11.8
Glomerular diseases	15.2	7.7	10.6	11.0	6.6	8.8
Complications related to dialysis and kidney transplant	5.7	2.7	3.9	6.9	3.9	5.4
Congenital malformations of the kidney	2.6	0.6	1.4	3.7	3.0	3.3
Hypertensive kidney disease	1.7	0.9	1.2	1.8	1.5	1.6
Unspecified kidney failure	1.2	0.7	0.9	1.6	1.5	1.5
Other kidney diseases	1.8	1.7	1.8	6.1	5.1	5.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: AIHW National Hospital Morbidity Database.

Table A5 : Hospitalisations where CKD was the principal diagnosis (excluding dialysis), by Indigenous status and geographical location, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2006–07 to 2008–09

	Major cities		Inner regional		Outer regional		Remote		Very remote	
	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]
Indigenous										
Male	461	363.9	328	411.5	842	1,328.9	446	1,056.8	738	1,019.9
LCL (95%)–UCL (95%)		(322.9–405.0)		(357.3–465.7)		(1,222.6–1,435.2)		(940.7–1,172.9)		(934.3–1,105.5)
Female	797	485.3	417	465.5	919	887.1	732	1,565.7	1,119	1,355.5
LCL (95%)–UCL (95%)		(446.6–524.0)		(413.0–518.0)		(821.8–952.5)		(1,436.9–1,694.5)		(1,267.9–1,443.1)
Persons	1,258	426.2	745	439.0	1,761	1,065.4	1,178	1,328.1	1,857	1,194.1
LCL (95%)–UCL (95%)		(398.3–454.2)		(401.3–476.7)		(1,007.0–1,123.8)		(1,240.2–1,416.0)		(1,132.8–1,255.3)
Other										
Male	28,364	144.2	8,583	142.0	3,930	140.7	503	130.4	186	145.5
LCL (95%)–UCL (95%)		(142.5–145.9)		(139.0–145.1)		(136.3–145.2)		(118.9–142.0)		(123.7–167.2)
Female	28,722	133.9	9,096	148.6	3,972	149.5	481	139.1	174	172.7
LCL (95%)–UCL (95%)		(132.4–135.5)		(145.5–151.7		(144.8–154.2)		(126.6–151.6)		(146.0–199.3)
Persons	57,086	137.6	17,679	144.6	7,902	144.5	984	134.5	360	125.2
LCL (95%)–UCL (95%)		(136.4–138.7)		(142.5–146.8)		(141.3–147.8)		(126.0–143.0)		(110.7–139.6)
Proportion [b] and rate ratio[c]	*2.2*	*3.1**	*4.0*	*3.0**	*18.2*	*7.4**	*54.5*	*9.9**	*88.5*	*9.5**

(a) Hospitalisations per 100,000, directly age-standardised to the 2001 Australian population.

(b) Indigenous proportion (%) of hospitalisations.

(c) Rate ratio (Indigenous rate : other Australian rate).

* Significant relative difference (rate ratio) between Indigenous and other Australian hospitalisation rates.

Note: Numbers exclude patients for whom a remoteness classification could not be assigned due to missing data, non-Australian residency etc.; LCL = lower confidence limit; UCL = upper confidence limit.

Source: AIHW National Hospital Morbidity Database.

Table A6: CKD diagnosis groups for hospitalisations with an additional diagnosis of CKD, by Indigenous status and sex, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

Additional diagnosis	Indigenous			Other Australians		
	Males	Females	Persons	Males	Females	Persons
			Number of hospitalisations			
Chronic kidney disease	3,080	3,830	6,910	59,192	42,974	102,166
Diabetic nephropathy	2,043	2,624	4,667	27,050	19,258	46,308
Transplant and dialysis status	359	375	734	5,550	3,713	9,263
Glomerular diseases	175	250	425	2,648	2,158	4,806
Other kidney diseases	163	250	413	4,075	3,079	7,154
Kidney tubulo-interstitial diseases	42	206	248	1,109	2,436	3,545
Unspecified kidney failure	92	82	174	4,872	4,150	9,022
Hypertensive kidney disease	92	70	162	1,328	928	2,256
Congenital malformations of the kidney	63	45	108	1,757	1,447	3,204
Dialysis	34	52	86	241	192	433
Complications related to dialysis and kidney transplant	n.p.	n.p.	n.p.	270	145	415
Preparatory care for dialysis	n.p.	n.p.	n.p.	11	14	25
Total	**3,666**	**4,596**	**8,262**	**77,095**	**58,171**	**135,266**
			Proportion of hospitalisations (per cent)			
Chronic kidney disease	84.0	83.3	83.6	76.8	73.9	75.5
Diabetic nephropathy	55.7	57.1	56.5	35.1	33.1	34.2
Transplant and dialysis status	9.8	8.2	8.9	7.2	6.4	6.8
Glomerular diseases	4.8	5.4	5.1	3.4	3.7	3.6
Other kidney diseases	4.4	5.4	5.0	5.3	5.3	5.3
Kidney tubulo-interstitial diseases	1.1	4.5	3.0	1.4	4.2	2.6
Unspecified kidney failure	2.5	1.8	2.1	6.3	7.1	6.7
Hypertensive kidney disease	2.5	1.5	2.0	1.7	1.6	1.7
Congenital malformations of the kidney	1.7	1.0	1.3	2.3	2.5	2.4
Dialysis	0.9	1.1	1.0	0.3	0.3	0.3
Complications related to dialysis and kidney transplant	n.p.	n.p.	n.p.	0.4	0.2	0.3
Preparatory care for dialysis	n.p.	n.p.	n.p.	0.0	0.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Not published due to small number of cases.

Note: One hospitalisation can have multiple additional diagnoses and therefore columns will not add up to the totals. If multiple diagnoses occurred in the same group only one diagnosis was counted.

Source: AIHW National Hospital Morbidity Database.

Table A7: Principal diagnosis chapters for hospitalisations with an additional diagnosis of CKD, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2008–09

Principal diagnosis (ICD-10-AM code)	Indigenous			Other Australians		
	Males	Females	Persons	Males	Females	Persons
	Number of hospitalisations					
Endrocrine, nutritional and metabolic diseases (E00–E89)[a]	830	860	1,690	7,179	4,927	12,106
Diabetes (E10–E14[a])	*484*	*459*	*943*	*5,258*	*3,290*	*8,548*
Diseases of the circulatory system (I00–I99) [b]	569	691	1,260	17,578	11,741	29,319
Ischaemic heart disease (I20–I25)	*235*	*240*	*475*	*5,864*	*3,230*	*9,094*
Diseases of the respiratory system (J00–J99)	410	514	924	7,034	4,783	11,817
Pneumonia (J12–J18)	*187*	*224*	*411*	*3,014*	*1,912*	*4,926*
Complications of surgical and medical care, not elsewhere classified (T80–T88)[c]	266	398	664	3,786	2,671	6,457
Diseases of the digestive system (K00–K93)	213	273	486	4,644	3,503	8,147
Infectious and parasitic diseases (A00–B99)	207	244	451	3,346	2,788	6,134
Other diseases of the genitourinary system (N00–N99)[d]	130	237	367	5,742	5,125	10,867
Care involving use of rehabilitation procedures (Z50)	122	145	267	4,369	3,651	8,020
Diseases of the musculoskeletal system and connective tissue (M00–M99)	126	135	261	2,643	2,394	5,037
Symptoms, signs involving circulatory and respiratory systems (R00–R09)	100	128	228	1,367	1,032	2,399
Neoplasms (C00–D48)	68	84	152	4,519	2,546	7,065
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50–D89)	29	56	85	1,556	1,248	2,804
Other diseases and conditions (balance)	596	831	1,427	13,332	11,762	25,094
Total	**3,666**	**4,596**	**8,262**	**77,095**	**58,171**	**135,266**
	Proportion of hospitalisations (per cent)					
Endrocrine, nutritional and metabolic diseases (E00–E89)[a]	22.6	18.7	20.5	9.3	8.5	8.9
Diabetes (E10–E14[a])	*13.2*	*10.0*	*11.4*	*6.8*	*5.7*	*6.3*
Diseases of the circulatory system (I00–I99) [b]	15.5	15.0	15.3	22.8	20.2	21.7
Ischaemic heart disease (I20–I25)	*6.4*	*5.2*	*5.7*	*7.6*	*5.6*	*6.7*
Diseases of the respiratory system (J00–J99)	11.2	11.2	11.2	9.1	8.2	8.7
Pneumonia (J12–J18)	*5.1*	*4.9*	*5.0*	*3.9*	*3.3*	*3.6*
Complications of surgical and medical care, not elsewhere classified (T80–T88)[c]	7.3	8.7	8.0	4.9	4.6	4.8
Diseases of the digestive system (K00–K93)	5.8	5.9	5.9	6.0	6.0	6.0
Infectious and parasitic diseases (A00–B99)	5.6	5.3	5.5	4.3	4.8	4.5
Other diseases of the genitourinary system (N00–N99)[d]	3.5	5.2	4.4	7.4	8.8	8.0
Care involving use of rehabilitation procedures (Z50)	3.3	3.2	3.2	5.7	6.3	5.9
Diseases of the musculoskeletal system and connective tissue (M00–M99)	3.4	2.9	3.2	3.4	4.1	3.7
Symptoms, signs involving circulatory and respiratory systems (R00–R09)	2.7	2.8	2.8	1.8	1.8	1.8
Neoplasms (C00–D48)	1.9	1.8	1.8	5.9	4.4	5.2
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50–D89)	0.8	1.2	1.0	2.0	2.1	2.1
Other diseases and conditions (balance)	16.3	18.1	17.3	17.3	20.2	18.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Excludes diabetic nephropathy.
(b) Excludes hypertensive kidney disease.
(c) Excludes complications related to kidney replacement therapy.
(d) Excludes glomerular diseases, kidney tubule-interstitial diseases, chronic kidney failure and unspecified kidney failure, and other disorders of the kidney and ureter.
Source: AIHW National Hospital Morbidity Database.

Table A8: Hospitalisations where CKD was an additional diagnosis, by Indigenous status and geographical location, NSW, Vic, Qld, WA, SA and public hospitals in NT, 2006–07 to 2008–09

	Major cities		Inner regional		Outer regional		Remote		Very remote	
	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]
Indigenous										
Male	2,126	2,287.5	1,458	2,398.6	2,738	4,006.3	2,095	6,047.3	3,141	5,426.1
LCL (95%)–UCL (95%)		(2,172.9–2,402.1)		(2,257.4–2,539.8)		(3,833.3–4,179.3)		(5,746.9–6,347.7)		(5,211.3–5,640.9)
Female	2,618	2,250.9	1,408	2,120.5	3,559	4,454.0	2,537	6,475.5	4,076	6,137.7
LCL (95%)–UCL (95%)		(2,153.0–2,348.8)		(1,997.3–2,243.6)		(4,293.4–4,614.5)		(6,198.6–6,752.3)		(5,934.9–6,340.4)
Persons	4,744	2,264.0	2,866	2,251.4	6,297	4,249.1	4,632	6,275.4	7,217	5,798.9
LCL (95%)–UCL (95%)		(2,189.7–2,338.3)		(2,158.4–2,344.3)		(4,131.5–4,366.7)		(6,072.2–6,478.5)		(5,652.0–5,945.8)
Other										
Male	175,682	925.6	49,791	797.8	20,032	704.7	2,201	600.3	682	586.4
LCL (95%)–UCL (95%)		(921.3–929.9)		(790.7–804.8)		(694.9–714.5)		(574.8–625.8)		(540.7–632.1)
Female	133,450	588.2	36,236	529.8	13,586	474.2	1,234	390.3	367	439.3
LCL (95%)–UCL (95%)		(585.1–591.4)		(524.3–535.3)		(466.2–482.2)		(368.3–412.2)		(392.3–486.3)
Persons	309,133	740.0	86,027	655.9	33,618	588.0	3,435	502.8	1,049	528.1
LCL (95%)–UCL (95%)		(737.4–742.6)		(651.5–660.3)		(581.7–594.3)		(485.8–519.8)		(494.8–561.3)
Proportion [b] and rate ratio[c]	*1.5*	*3.1**	*3.2*	*3.4*	*15.8*	*7.2**	*57.4*	*12.5**	*87.3*	*11.0**

(a) Hospitalisations per 100,000, directly age-standardised to the 2001 Australian population.

(b) Indigenous proportion (%) of hospitalisations.

(c) Rate ratio (Indigenous rate: other Australian rate).

* Significant relative difference (rate ratio) between Indigenous and other Australian hospitalisation rates.

Note: Numbers exclude patients for whom a remoteness classification could not be assigned due to missing data, non-Australian residency etc.; LCL = lower confidence limit; UCL = upper confidence limit.

Source: AIHW National Hospital Morbidity database.

Appendix B Methods

International Classification of Diseases (ICD-10) codes used

Table B1: ICD-10 and ICD-10-AM[(a)] codes used to define diagnosis groups for CKD

Group of chronic kidney disease	ICD-10 codes
Regular dialysis	
Haemodialysis	Z49.1*
Peritoneal dialysis	Z49.2*
Other CKD	
Diabetic nephropathy	E10.2, E11.2, E12.2^, E13.2, E14.2
Hypertensive kidney disease	I12, I13, I15.0, I15.1
Glomerular diseases	N00–N07, N08*
Kidney tubulo-interstitial diseases	N11, N12, N14, N15, N16*
Chronic kidney failure (mortality data and hospital data to 2007–08) / Chronic kidney disease (hospital data from 2008–09)	N18
Unspecified kidney failure	N19
Other disorders of kidney and ureter	N25–N28, N39.1, N39.2, E85.1^, D59.3^, B52.0^
Congenital malformations of the kidney	Q60–Q63
Complications related to dialysis and kidney transplant	T82.4, T86.1
Preparatory care for dialysis	Z49.0*
Kidney transplant and dialysis status	Z94.0*, Z99.2*

(a) ICD-10 = International Classification of Diseases, 10th Revision; ICD-10-AM = International Classification of Diseases, 10th Revision, Australian Modification.

* These codes are used for identification of CKD in hospital morbidity data only.

^ These codes are used to identify CKD in mortality data only.

Age-specific rates

Age-specific rates 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 persons). Information on the populations used in this report is provided in the section on populations below.

Age-standardised rates

Age-standardisation is a technique used to eliminate the effect of differences in population age structures when comparing rates for different periods of time, and/or different geographical areas and/or different population groups. Definitions are included in the *National health data dictionary* (Health Data Standards Committee 2006).

There are two methods of age-standardisation, direct and indirect. The method used in this report is direct age-standardisation.

Direct age-standardisation

Direct age-standardisation applies the age-specific rates to a 'standard population' in order to determine the rate that would have occurred in the standard population. This allows direct comparison of different rates applied to the same standard population. When selecting the 'standard population' to use in age-standardisation, it is necessary to consider the 'population at risk'. For the vast majority of rates which are age-standardised, such as the hospitalisation rates presented in this report, the 'population at risk' is the total population. For these types of rates, the Australian population as at 30 June 2001 has been used as the standard. Procedure and length of stay rates are quite different, however, with the denominator being a subset of the whole population—people who have been hospitalised for CKD. For these calculations, the 2008–09 CKD hospitalisation population was used as the standard population.

The method used for the calculation of age-standardised rates consists of three steps:

Step 1: Calculate the age-specific rate for each age group.

Step 2: Calculate the expected number of cases in each age group by multiplying the age-specific rate by the corresponding standard population to get the expected number of cases.

Step 3: Sum the expected number of cases in each age group, divide by the total of the standard population and multiply by 100,000. This gives the age-standardised rate.

In general, the age-standardised rates presented in this report have been calculated using 5-year age groups to 75+. Rates calculated using small numbers (less than five events in the numerator) can be unstable, show considerable fluctuation from year to year, and exhibit wide confidence intervals. In some cases, it has been necessary to combine younger age groups (0–29 years) to prevent this from occurring.

Significance testing

The rate measured for a population in a given year based on a complete count can be considered as a sample of one of a large number of possible measurements, all of which cluster in a normal distribution (bell curve) around the 'true' (unknown) rate of the population. Calculating a confidence interval for a rate based on a complete count recognises that an observed rate is not a precise estimate of the underlying rate.

Typically, rates based on large numbers provide stable estimates from one year to the next. Conversely, rates based on small numbers might fluctuate dramatically from year to year, or differ considerably from one region to another, even when there is no meaningful difference. Meaningful analysis of differences in rates between regions or over time requires that the random variation in rates be quantified; this is especially important when rates or percentages have small numerators, as is the case with some analyses contained in this report.

There are several methods for calculating confidence intervals for these types of data. For this report, the method described in Box A2.1 was chosen. Another commonly used method for these types of data (Dobson et al. 1991) results in almost identical confidence intervals at the national level. The confidence intervals are used to provide an indication of the differences between rates. Where the confidence intervals of two rates do not overlap, the corresponding rates are statistically different from each other; that is, there is at least 95% confidence that the difference in a rate is greater than that which could be explained by chance.

Time series analyses presented throughout this report have used linear regression analysis to determine whether there have been significant increases or decreases in the observed rates over the period. Comments in this report have been made on significant increases or decreases only.

Box B1.1: Formulae for calculating standard errors (SEs) and 95% confidence intervals (CIs)

There are a number of methods for calculating SE s and CIs for administrative data. For this report we have chosen to use the following method:

For directly standardised rates:

Standard error of the age-standardised rate has been estimated as:

$$SE(ASR) = \sqrt{\left[\sum \left(N_i^2 p_i / n_i\right) / \left(\sum N\right)^2\right]}$$

i = Age group

N = Number of subjects in standard population

R = Number of events in standard population

P = Standard population event rate (R/N)

p = Special population event rate (r/n)

n = Number of subjects in special population

r = Number of events in special population

95% confidence intervals:

- p' (ASR or Ratio) as $p' \pm \left(1.96 \times SE(ASR)\right)$.
- Rate Ratios as $95\%\ \text{CI} = \text{RR}^{(1 \pm 1.96/x)}$

  where $x = (\text{ASR}_{Qx} - \text{ASR}_{Q5}) / \sqrt{(\text{se}(\text{ASR}_{Qx})^2 + \text{se}(\text{ASR}_{Q5})^2)}$
- Rate differences as $\text{se(RD)} = \sqrt{(\text{se}(\text{ASR}_{Qx})^2 + \text{se}(\text{ASR}_{Q5})^2)}$

  where x = 1 to 4

  $95\%\ \text{CI} = \text{RD} \pm 1.96 \times \text{se(RD)}$

Populations used in this report

Population data are used throughout this report to calculate rates. The population data used are estimated resident populations (ERPs) derived from the Australian Bureau of Statistics (ABS) Census of Population and Housing. ERPs adjust Census data to add people missed by the Census and people overseas on census night, and to remove overseas visitors. In between-census years, the ERPs are updated using indicators of population change such as deaths, births and net migration. The ERPs used in this report are based on the 2006 Census.

Australia's Indigenous population is calculated from the Census, and uses ERPs as described above. However, because of the smaller Indigenous population, it is not possible to accurately estimate Indigenous populations by age, sex and remoteness area between census years. Therefore, all calculations of Indigenous rates by remoteness in this report use the Indigenous populations as at 30 June 2006, the census year.

Where a rate is calculated for a calendar year—for example, with death data—the population used is the ERP as reported at 30 June of that year. Where a rate is calculated for a financial year, as with hospitalisation data, the population used is the average of the ERP at 30 June for each year spanning the financial year. For example, to calculate the hospitalisation rate of the 2008–09 financial year, the average of the ERPs from 2008 and 2009 would be used.

Throughout this report, rates of deaths and hospitalisations are age-standardised. In these cases, the standard population used to calculate the age-standardised rate is the Australian ERP as at 30 June 2001.

Reporting data by geographical location

Comparisons of region in this report use the Australian Standard Geographical Classification (ASGC). The ASGC is a classification system developed by the ABS to group Australian regions into six areas, called remoteness areas, based on their distance from major population centres and services. The six remoteness areas are:

- *Major cities*
- *Inner regional*
- *Outer regional*
- *Remote*
- *Very remote*
- *Migratory*

Data from *Migratory* areas are not analysed in this report.

The boundaries of the different remoteness areas are re-drawn after each Census to account for changes to available services and population change. The remoteness areas used in this report are based on the 2006 Census.

Methods specific to data sources

National Hospital Morbidity Database

The data in this report were extracted from the Australian Institute of Health and Welfare (AIHW) National Hospital Morbidity Database (NHMD) in September 2010 and small changes may have occurred since this time.

Information on hospitalisations in Australia is contained in the NHMD. The AIHW compiles and maintains this national collection, using information supplied by state and territory health authorities. The database records information on every patient who undergoes a hospital's formal admission process, completes an episode of admitted patient care, and 'separates' from the hospital (AIHW 2009c). In this report, a 'hospitalisation' refers to an episode of admitted care, which can be a total hospital stay (from admission to discharge, transfer or death) or a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute to rehabilitation). The same person can have multiple 'separations' within the same hospitalisation period and, as the database is event based, it is currently not possible to track individuals. For this reason, the data presented in this report do not represent the number or proportion of people admitted to hospital in Australia with CKD.

Most of the data for each hospitalisation are based on information provided at the end of an episode of care, when the length of stay and procedures carried out are known and diagnostic information is more accurate. There are two distinct types of diagnoses recorded in the database—principal and additional. If a condition was the primary reason for hospitalisation, it is recorded as the principal diagnosis (AIHW 2009c). Regular dialysis, although a procedure, is recorded as the principal diagnosis where the patient was discharged on the same or next day of admission. In situations where a condition coexisted with another principal diagnosis and required treatment during hospitalisation, it will be recorded as an additional diagnosis. Complications arising during the hospitalisation are also listed as additional diagnoses. Dialysis as the principal diagnosis has been analysed separately to other hospitalisations where CKD was the principal diagnosis in this report.

The AIHW NHMD also contains information on any surgical, investigative and therapeutic procedures carried out for each hospitalisation. This report presents information on CKD hospitalisations for which one or more procedures were reported, as well as information on the type of procedures CKD patients received.

Diagnoses and procedures in the NHMD for the years included in this report (2001–02 to 2008–09) are classified according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM), second to sixth editions. CKD has not been used as a medical term in the ICD-10-AM, nor generally used as a diagnosis in clinical settings until recently. Although the sixth edition of the ICD-10-AM—introduced in July 2008 and used for hospital data from 2008–09—included a new code for CKD and its stages (1–5), a list of the conditions known to cause, or be caused by, CKD is also used to identify hospitalisations for CKD (see beginning of Appendix A).

Analysis of hospitalisations in this report was restricted to hospitals in New South Wales, Victoria, Queensland, Western Australia, South Australia and public hospitals in the Northern Territory due to data quality issues related to Indigenous identification. Hospitalisations where Indigenous status was not stated or inadequately described were amalgamated with those identifying as non-Indigenous or 'other' Australians.

The following caveats have also been recommended for analysis of hospitalisation data from selected jurisdictions (AIHW 2010b):

- There are limitations imposed by jurisdictional differences in data quality, and the data may not necessarily be representative of the jurisdictions that are not included.
- For trends analyses, changes in ascertainment of Indigenous status for Indigenous patients over time may possibly contribute to changes in hospitalisation rates for Indigenous people.
- Analyses based on remoteness area are limited by jurisdictional differences in data quality, and the data may not necessarily be representative of the jurisdictions that are not included.

AIHW National Mortality Database

Information on the cause of death is supplied by the medical practitioner certifying the death or by a coroner. Registration of deaths is the responsibility of the state and territory Registrars of Births, Deaths and Marriages. Registrars provide the information to the ABS for coding of cause of death, which is then provided to the AIHW.

In this report, death data are assembled based on the year of registration and not the year of death. While for the most part, year of death and registration coincide, deaths at the end of each calendar year may be held over until the following year, as will deaths in which the cause requires further examination by a coroner. In recent years, less than 5% of deaths were held over from one year to the next for processing.

Analysis of deaths for Aboriginal and Torres Strait Islander people in this report was restricted to those from New South Wales, Queensland, Western Australia, South Australia and the Northern Territory due to data quality issues related to Indigenous identification.

AIHW Disease Expenditure Database

This report presents the first estimates of admitted patient expenditure for Aboriginal and Torres Strait Islander people for CKD. Expenditure on these services is part of the 2006–07 admitted patient expenditure for Aboriginal and Torres Strait Islander people (estimated at $1,156 million) and make up about 40% of total Indigenous health expenditure.

In this report, separations and expenditure per separation were calculated from data in the AIHW Hospital Morbidity Costing Model. This model applies Diagnosis Related Group weights and length of stay adjustment to both Indigenous and non-Indigenous cases for each hospital. This model, therefore, takes into account differences in casemix and hospital operating costs across the regions. A loading of 5% was added to the Aboriginal and Torres Strait Islander patients' costs to take into account known differences in comorbidity for similar Diagnosis Related Groups in Aboriginal and Torres Strait Islander patients (AIHW 2009c).

As with hospital morbidity data, the analysis in this report is limited to jurisdictions considered to have acceptable Indigenous identification—New South Wales, Victoria, Queensland, Western Australia, South Australia and public hospitals in the Northern Territory. Some of the expenditure in this report may be influenced by variations in the completeness of Indigenous identification. It is possible that health expenditure estimates for Indigenous Australians may slightly overestimate or underestimate the actual level of health expenditure for Indigenous Australians.

The disease groups used in the AIHW Disease Expenditure Database are based on those published in *The burden of disease and injury in Australia 2003* (Begg et al. 2007). The codes used to identify CKD are spread across several disease groups and therefore do not directly relate to a specific category in the AIHW Disease Expenditure Database. Expenditure on CKD was estimated according to the CKD coding list, which involves various disease groupings. Parts of the expenditure on CKD overlap with disease categories such as diabetes, therefore the results presented here are a complex combination of those presented in other AIHW disease expenditure publications. For this reason, comparison with other diseases or disease groupings is not possible.

In addition, there are some other diseases or conditions not listed in the coding list that can, but do not generally, result in CKD. In these cases, CKD cannot be identified without medical evidence to indicate that there is kidney damage and/or reduced kidney function. Administrative databases, from which the AIHW Disease Expenditure Database is compiled, do not contain pathology information. As such, these cases cannot be identified and this may lead to some underestimation of health-service usage due to CKD in Australia (AIHW 2005).

In the case of hospitalisations and other health-services usage, the disease that is considered the primary reason behind the episode of care is recorded as the principal diagnosis. Where a disease coexists with a principal diagnosis, either by being present before admission or arising during an episode of care, and affecting the management of the patient by requiring therapeutic treatment, diagnostic procedures or increased nursing care, it is recorded as an additional diagnosis. This report presents estimated health expenditure only where CKD is the principal diagnosis. CKD shares many risk factors with cardiovascular disease (CVD) and diabetes, and these diseases often appear together due to a complex causal relationship where each may be caused by, or be a complication of, one or both of the other diseases. This is known as *comorbidity*, and the clinical management for people with comorbid conditions is much more complex and time consuming than for those with single diseases (AIHW: Tong & Stevenson 2007).

As is the case with estimates of expenditure for other diseases based on data in the AIHW Disease Expenditure Database, no attempt has been made to estimate expenditure due to the complications of CKD, or treatment for CKD where it coexists with other diseases. Complications and comorbidities may contribute substantially to overall expenditure and other costs for people with CKD. However, as the method used here is to estimate the direct health expenditure where CKD was the *primary* cause, these other costs have not been included. It is also important to note that while there is a proportion of cost for CKD not included here, there will also be a proportion of costs for other diseases included in the CKD expenditure estimate.

National Aboriginal and Torres Strait Islander Health Survey (NATSIHS), 2004–05

This survey collected information relating to Indigenous health including health status, health action taken and lifestyle factors that may influence health. Information was collected from 10,439 Indigenous persons living in both remote and non-remote areas of Australia. The survey covered information similar to the National Health Survey (NHS), including self-assessed health status, health risk factors, long-term conditions, health-service use, social and emotional wellbeing, and basic demographic information. While the NATSIHS collects information on Aboriginal and Torres Strait Islander people self-reporting CKD as a long-term condition, there is no equivalent question in the NHS, meaning comparisons between Indigenous and non-Indigenous Australians are not possible.

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