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Chronic kidney disease hospitalisations in Australia

2000–01 to 2007–08

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Contents

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Summary

People with chronic kidney disease (CKD) require extensive hospital services, particularly those patients with end-stage kidney disease (ESKD) who require kidney replacement therapy to survive. This report examines hospital usage for the treatment of CKD, and how this varies with different population groups.

The main findings

- Overall, CKD contributed to 15% (nearly 1.2 million) of all hospitalisations in Australia, one million of which were for regular dialysis.
- Indigenous Australians were hospitalised at 11 times the rate of other Australians for regular dialysis, and at 5 times the rate for other principal and additional CKD diagnoses.
- Hospitalisations for regular dialysis increased by an average of 60,000 per year between 2000–01 and 2007–08, equating to a 71% increase over this period. Increases of 12% for other principal diagnoses of CKD and 48% for additional diagnoses were also recorded.

Some numbers behind the picture

Regular dialysis as the principal diagnosis, 2007–08

- Males were 1.6 times as likely as females to be hospitalised for regular dialysis, with the difference between male and female rates increasing by 82% since 2000–01.
- Hospitalisation rates for regular dialysis in the Northern Territory were five times that of Australia as a whole.

Non-dialysis hospitalisations, 2007–08

- Kidney tubulo-interstitial diseases and diabetic nephropathy were the most common principal CKD diagnoses, while chronic kidney failure and diabetic nephropathy were the most common additional CKD diagnoses.

Population groups

- Australians living in remote areas were more likely to be hospitalised with CKD than those living in major cities.
- Hospitalisation rates for CKD increased with decreasing socioeconomic status.
- People born in Oceania, Southern and Eastern Europe, and Africa and the Middle East were more likely to be hospitalised for CKD than those born in Australia.

1 Introduction

Chronic kidney disease and hospitalisations

Chronic kidney disease (CKD) is a long-term health condition where a person has kidney damage and/or reduced kidney function, lasting for 3 months or more. It has been estimated that as many as one in seven Australians aged 25 years and over have some degree of CKD (Chadban et al. 2003). In 2004–05, it accounted for nearly $900 million in health-care expenditure in Australia, or 1.7% of expenditure that was able to be allocated to a specific disease or condition. Around 80% of this expenditure was on hospital services where CKD was the principal diagnosis (AIHW 2009a).

In severe cases, kidney function may deteriorate to the extent that it is no longer sufficient to sustain life and, if untreated, will most likely cause death. This is called 'end-stage kidney disease' (ESKD) and those with ESKD require kidney replacement therapy (KRT)—either dialysis or kidney transplant—to survive. The number of people receiving treatment for ESKD increased by 44% between 2000 and 2007 (McDonald et al. 2009). At the end of 2007, there were 16,808 people receiving kidney replacement therapy in Australia, and by the end of 2008 this had increased to 17,578 people. Over 10,000 were receiving regular dialysis and the rest were living with a functioning kidney transplant, 813 of whom had the transplant in 2008 (McDonald et al. 2009). Of those on dialysis, most (69%) were receiving haemodialysis in a hospital or satellite centre attached to a hospital. The remainder were receiving dialysis at home and are not captured in hospital data.

People with CKD, particularly people with ESKD, often require hospital services—in fact, dialysis treatment is the most common reason for hospitalisation in Australia. Most patients on dialysis attend a hospital or satellite centre attached to a hospital 3 times a week for treatment. There are also a number of non-dialysis hospitalisations occurring for CKD each year, meaning this disease is a significant burden on the hospital system. CKD also occurs with, or leads to, other health conditions. In 1999–2000, over 39% of Australians aged 25 years and over with CKD had high blood pressure and 14% had diabetes. A further 10% reported being treated for or suffering from cardiovascular disease (AIHW 2009b) People who have a combination of diseases require additional health care services, including more hospital admissions and longer stays in hospital (AIHW 2005).

Hospitalisation data provide valuable information about health service provision. For CKD it can give an indication of the impact of the disease and can help provide information on people who are accessing services. The purpose of this report is to provide up-to-date data for CKD hospitalisations, including trends across an 8-year period (2000–01 to 2007–08). Data are also presented for different population groups, including Aboriginal and Torres Strait Islander peoples, socioeconomic groups, by geographic location and by country/region of birth. Information on patterns for CKD hospitalisations can help to inform policy makers, as well as assist in service planning.

Hospitalisation data

Information on hospitalisations in Australia is contained in the Australian Institute of Health and Welfare (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 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. In this report, dialysis as the principal diagnosis has been analysed separately to other hospitalisations where CKD was the principal diagnosis.

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 (2000–01 to 2007–08) are classified according to the *International Statistical Classification of Diseases and Related Health Problems Tenth Revision, Australian Modification* (ICD-10-AM) 2nd to 5th editions. CKD has not been 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 2*).

CKD is usually categorised into five stages according to the level of reduced kidney function and/or evidence of kidney damage (see Box 1). 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 stage (1–5). At the time of writing this report, 2008–09 hospital data were not available for analysis and these codes have not been able to be included. However, an in-depth report on hospitalisations is particularly timely considering these coding changes, as it will allow us to improve our understanding of possible changes in hospitalisation patterns that have been seen with coding changes for other diseases.

In this report, methods such as age-standardisation and linear regression have been used to assess differences between sexes, groups 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.

The data in this report were extracted from the AIHW NHMD in July 2009 and small changes may have occurred since this time. See Appendix 2 for a full description of methods.

Overview

In 2007–08, CKD was responsible for 1,017,992 hospitalisations and contributed to a further 167,628 (Table 1.1). Overall, CKD was a contributing factor in 15% of all hospitalisations in Australia for that year.

For the purposes of this report, CKD hospitalisations have been split into three groups—regular dialysis, other hospitalisations where CKD was the principal diagnosis, and hospitalisations where CKD was an additional diagnosis.

Regular dialysis as a principal diagnosis has been considered separately to other hospitalisations where CKD was the principal diagnosis due to its unique characteristics. Patients who receive regular dialysis usually attend a hospital or satellite centre 3 times per week which amounts to around 156 hospital admissions over the course of a year. Admissions for dialysis are nearly always for a partial day in specialised facilities, however, and therefore do not use the same facilities as other hospitalisations.

Table 1.1: Hospitalisations for CKD, 2007–08

	Number of hospitalisations[a]			Hospitalisations per 100,000[b][c]		
	Males	Females	Persons[d]	Males	Females	Persons
Regular dialysis	587,402	399,423	986,825	5,576.7	3,477.4	4,444.9
CKD as a principal diagnosis (excluding regular dialysis)	14,930	15,773	31,167	141.9	141.3	140.1
CKD as an additional diagnosis	95,328	72,076	167,628	939.8	578.3	735.1
Total CKD hospitalisations	**697,660**	**487,272**	**1,185,620**	**6,658.4**	**4,197.0**	**5,320.0**
Total hospitalisations in Australia	**3,724,423**	**4,149,381**	**7,873,946**	**35,323.2**	**36,976.9**	**35,913.4**

(a) Numbers include patients for whom demographic information was not stated.

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

(c) Rates exclude those patients for whom demographic information was not stated.

(d) Persons includes those for whom sex was not stated.

Source: AIHW National Hospital Morbidity Database.

Box 1: Chronic kidney disease

What are the kidneys and what do they do?

The kidneys are bean-shaped organs, about the size of an adult fist, located in the back, above the waist and below the lower ribs. They continuously filter the bloodstream, playing a vital role in controlling the body's level of water and various chemicals and in clearing waste products. They also produce certain essential hormones. The kidneys are highly active and selective filters, with vital substances first being filtered then reabsorbed into the bloodstream through the kidneys' 'process line'. This includes glucose (fully reabsorbed) and water and sodium (almost fully). Waste products and any excess water filtered out by the kidneys are eliminated from the body through the bladder in the form of urine.

What is chronic kidney disease?

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 (a type of protein that is a more sensitive and specific marker of kidney disease, albuminuria), blood in the urine (haematuria) or scarring detected by imaging tests.

Measuring CKD

Kidney function is measured 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.

Stage 1: Kidney damage (GFR at least 90 mL/min/1.73 m^2)

Evidence of kidney damage but without decreased GFR. Usually no symptoms.

Stage 2: Kidney damage (GFR 60 to 89 mL/min/1.73 m^2)

Stage 3: GFR 30 to 59 mL/min/1.73 m^2*
GFR significantly reduced. May show signs of kidney damage and often indications of dysfunction in other organs. Often asymptomatic despite a reduction in kidney function of up to 70%.

Stage 4: GFR 15 to 29 mL/min/1.73 m^2*
Kidney function significantly reduced. Blood levels of urea and creatinine increase, and greater evidence of dysfunction in other organs. Usually only mild symptoms.

Stage 5: End-stage kidney disease (ESKD) GFR less than 15 mL/min/1.73 m^2*
Range of symptoms and laboratory abnormalities in several organ systems, collectively referred to as uraemia. Kidney replacement therapy (dialysis or transplant) is required when kidney function is no longer sufficient to sustain life, typically at a GFR of around 7–8mL/min/1.73m^2.

* with or without evidence of kidney damage

Source: Adapted from Obrador & Pereira (2002).

2 CKD as the principal diagnosis

In 2007–08, there were 1,017,992 hospitalisations where CKD was recorded as the principal diagnosis. Of these hospitalisations, 986,825 (97%) were for regular dialysis treatment, and 31,167 (3%) were for other CKD diagnoses. Altogether, CKD as the principal diagnosis accounted for 13% of all hospitalisations in Australian hospitals in 2007–08.

Males were 1.6 times as likely as females to be hospitalised for CKD as the principal diagnosis (Table 2.1).

Table 2.1: Hospitalisations with a principal diagnosis of chronic kidney disease, 2007–08

	Males	Females	Persons
Number [(a)]	602,332	415,196	1,017,992
Hospitalisations per 100,000 [(b) (c)]	5,718.6	3,618.7	4,585.0

(a) Numbers include 464 for which no demographic information was stated.

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

(c) Rates exclude 464 for which no demographic information was stated.

Source: AIHW National Hospital Morbidity Database.

A total of 1,122,836 hospital bed days were occupied by people with a principal diagnosis of CKD in 2007–08, 4.4% of total hospital bed days in Australia. The average length of stay for hospitalisations where CKD was the principal diagnosis was 1.1 days, reflecting the fact that the vast majority of admissions for regular dialysis are same-day admissions.

Regular dialysis as the principal diagnosis

Dialysis is recorded in two ways in the AIHW NHMD—as the principal diagnosis and as a procedure. Data in this section refer to hospitalisations where the principal diagnosis was regular dialysis—that is, where the intent for admission was same day and the patient was discharged on the same or next day of admission.

In 2007–08, there were 986,825 hospitalisations for CKD where the principal diagnosis was regular dialysis (Table 2.2)—12.5% of all hospitalisations.

Table 2.2: Hospitalisations with a principal diagnosis of regular dialysis, 2007—08

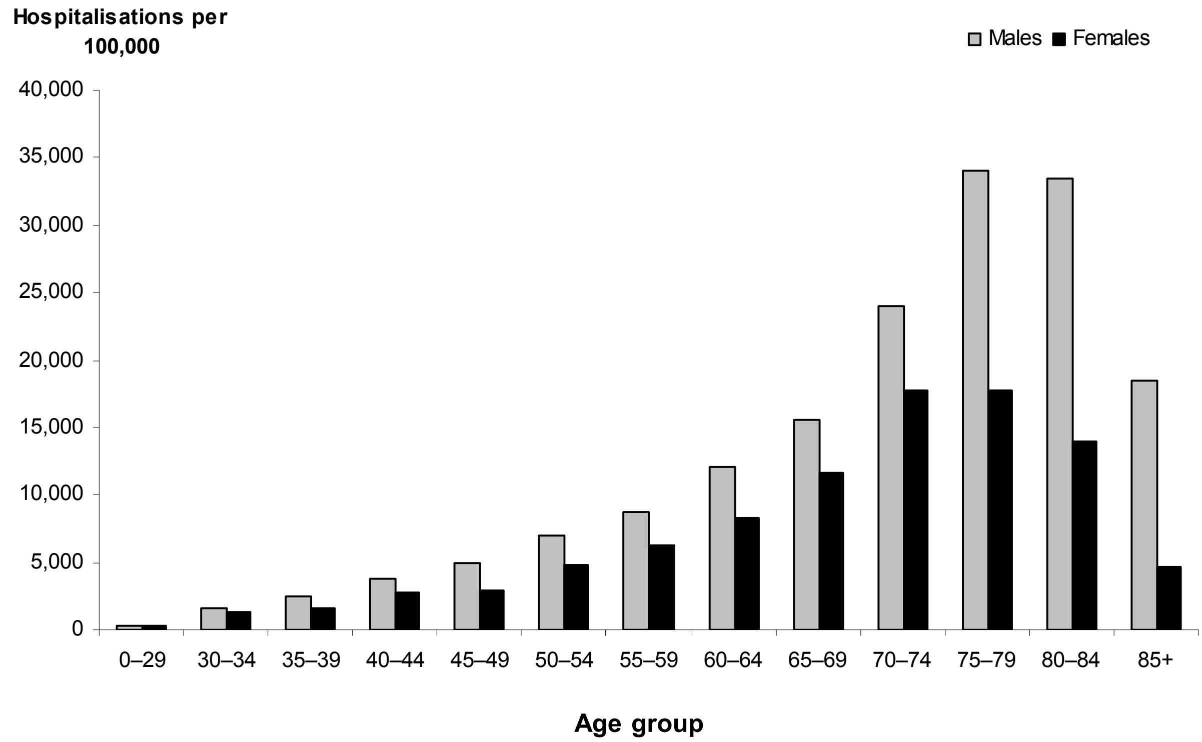
	Males	Females	Persons
Number	587,402	399,423	986,825
Hospitalisations per 100,000	5,576.7	3,477.4	4,444.9

*Note: D*irectly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

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. As at 31 December 2007, there were 9,700 people receiving regular dialysis treatment, around two-thirds of whom received regular haemodialysis in a hospital or satellite centre (McDonald et al. 2009). As haemodialysis is required a minimum of 3 times a week, or around 156 times a year, it is easy to see how this equates to so many hospitalisations overall.

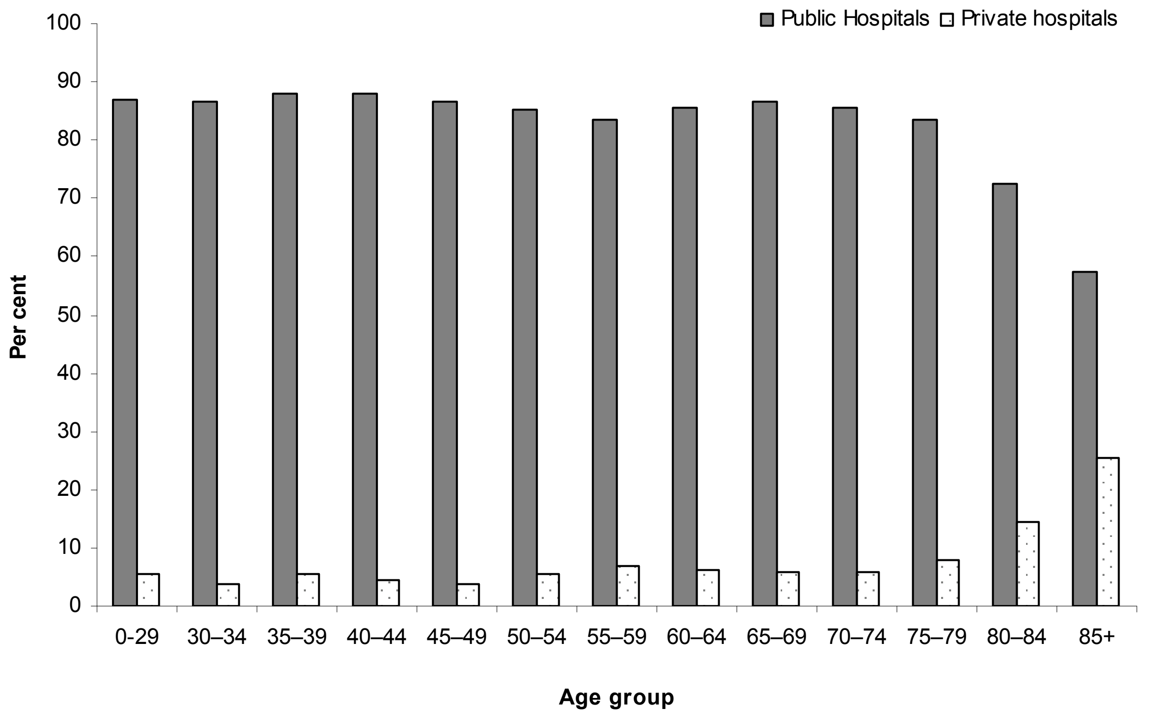
Hospitalisation rates for regular dialysis increased with age, with those in the 75–79 year age group having the highest rates (Figure 2.1). Males had higher rates of hospitalisation for regular dialysis than females across all age groups. When hospitalisation rates were age-standardised, males were hospitalised at 1.6 times the rate of females. In 2007, males were also 1.6 times as likely as females to be registered with ANZDATA as receiving any sort of kidney replacement therapy (McDonald et al. 2009).



Source: AIHW National Hospital Morbidity Database.

Figure 2.1: Hospitalisations with a principal diagnosis of regular dialysis, by age and sex, 2007–08

The majority of dialysis patients attend a public hospital for treatment, with only around 17% of regular dialysis admissions occurring in private hospitals in 2007–08. People over the age of 80 years were more likely to attend a private hospital than younger patients (Figure 2.2). Overall, males were slightly more likely than females to attend a private hospital (17% compared with 16%).



Source: AIHW National Hospital Morbidity Database.

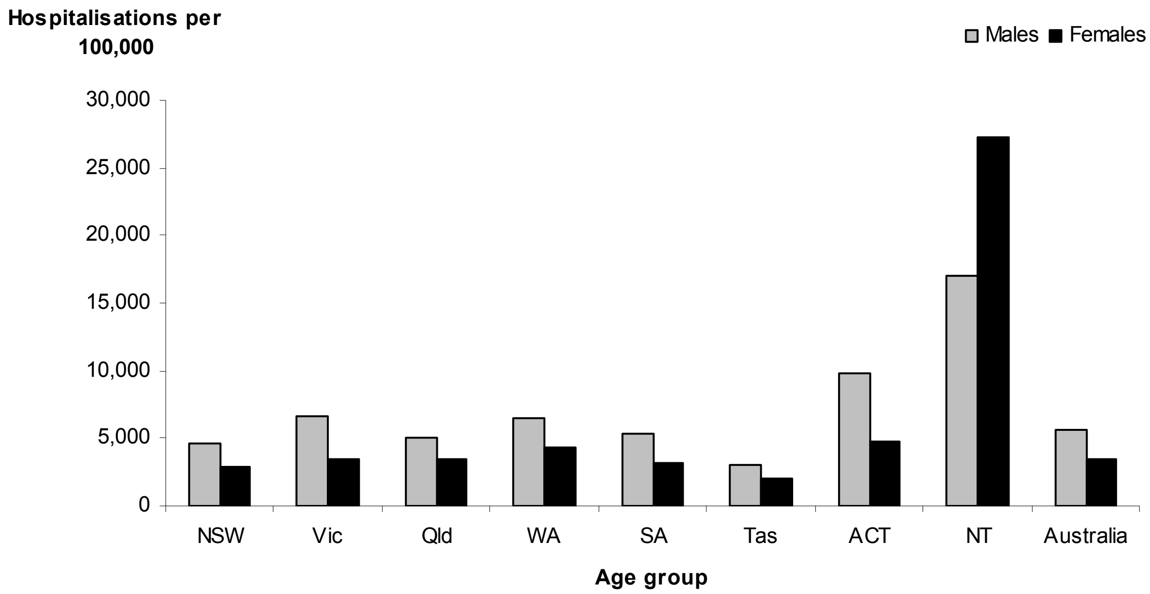
Figure 2.2: Distribution of dialysis hospitalisations between public and private hospitals, by age group, 2007–08

States and territories

In 2007–08, Tasmania had the lowest rates of hospitalisations for regular dialysis while the Northern Territory (NT) had the highest—five times that of the Australian rate (Figure 2.3—also see *Appendix 1* for detailed tables). Males were around 1.5 to 2 times as likely as females to be hospitalised for regular dialysis across all jurisdictions, with the exception of the NT where females were hospitalised at 1.5 times the rate of men.

The higher rates seen in the NT and the higher rates among females in the NT are likely to be due in part to the high rates of ESKD among Aboriginal and Torres Strait Islander peoples and the high proportion of Aboriginal and Torres Strait Islander peoples in the NT (nearly one-third in 2006—ABS & AIHW 2008). In contrast to the non-Indigenous population, ESKD rates are higher among Indigenous women than Indigenous men throughout Australia, and this is due to a number of factors. Type 2 diabetes is more common among Indigenous women than Indigenous men, and a large proportion of Indigenous women carry high levels of body fat around their abdomen—both substantial risk factors for CKD.

The higher rate of hospitalisations seen in the Australian Capital Territory (ACT) are predominantly due to people living in parts of NSW surrounding the ACT using hospital services in the ACT, but not being included in the ACT population for the calculation of the rate. In 2007–08, more than one-quarter (27%) of patients hospitalised for regular dialysis in the ACT resided in NSW (see *Appendix 2* for further information).



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

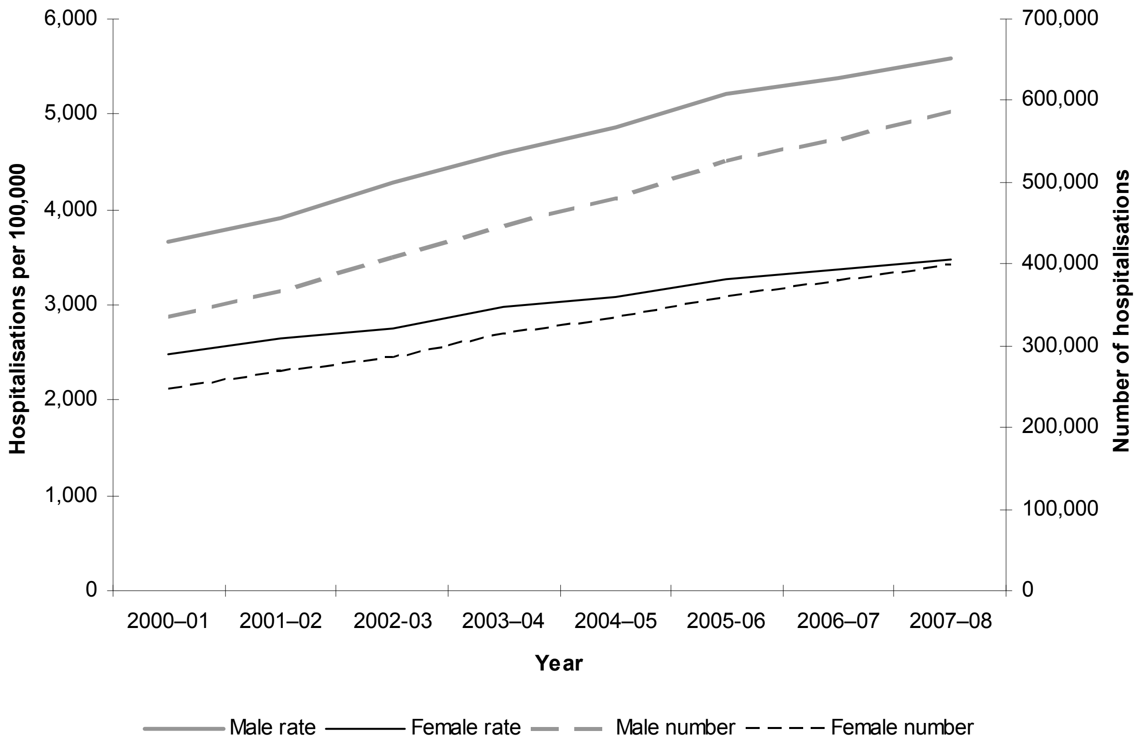
Source: AIHW National Hospital Morbidity Database.

Figure 2.3: Hospitalisations with a principal diagnosis of dialysis, by state/territory of hospital, 2007–08

Hospitalisation rates for dialysis increased with age for all states and territories. There were some differences in the age distribution of dialysis patients in some jurisdictions compared to the Australian distribution. In the NT and Tasmania, the highest rate of hospitalisation was among the 65–69 year age group, while in WA it was among those aged 80–84 years. In all other states and territories, the highest hospitalisation rates for dialysis were in the 75–79 year age group.

Trends

Between 2000–01 and 2007–08, the number of hospitalisations for regular dialysis in Australia increased by 71%, an average increase of nearly 60,000 hospitalisations per year. This increase was larger for males than for females over the 7-year period—76% compared with 64% (Figure 2.4). In addition, the age-standardised rate of hospitalisations for dialysis increased by nearly 50%, and the increase was also larger for males than females (54% compared with 41%). Over this period there was an increase in the difference between male and female hospitalisation rates for dialysis of 82%, from 1,170 to 2,100 per 100,000 population. Males went from being 1.5 times as likely as females to be hospitalised for dialysis to 1.6 times as likely.



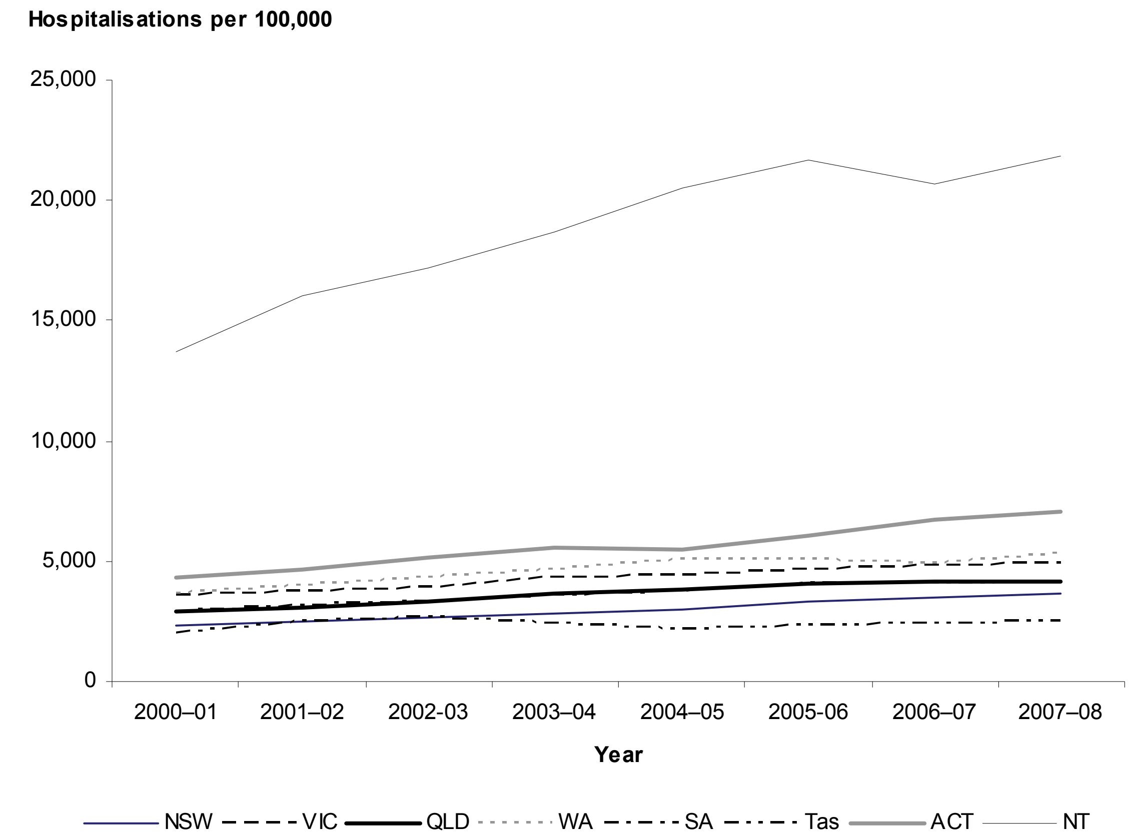
Note: Hospitalisation rate directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 2.4: Hospitalisations with a principal diagnosis of dialysis, by sex, 2000–01 to 2007–08

States and territories

Hospitalisations for dialysis increased in all states and territories between 2000–01 and 2007–08, with the exception of Tasmania (Figure 2.5). The largest absolute increase in hospitalisation rates was seen in the NT (from 13,700 to 21,800 per 100,000 population), with the ACT having the largest relative increase (62%). All states and territories (excluding Tasmania) recorded increases in the hospitalisation rate for dialysis of between 40% and 62% over this period (see *Appendix 1* for detailed tables).



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

Source: AIHW National Hospital Morbidity Database.

Figure 2.5: Hospitalisations with a principal diagnosis of dialysis, by state/territory, 2000–01 to 2007–08

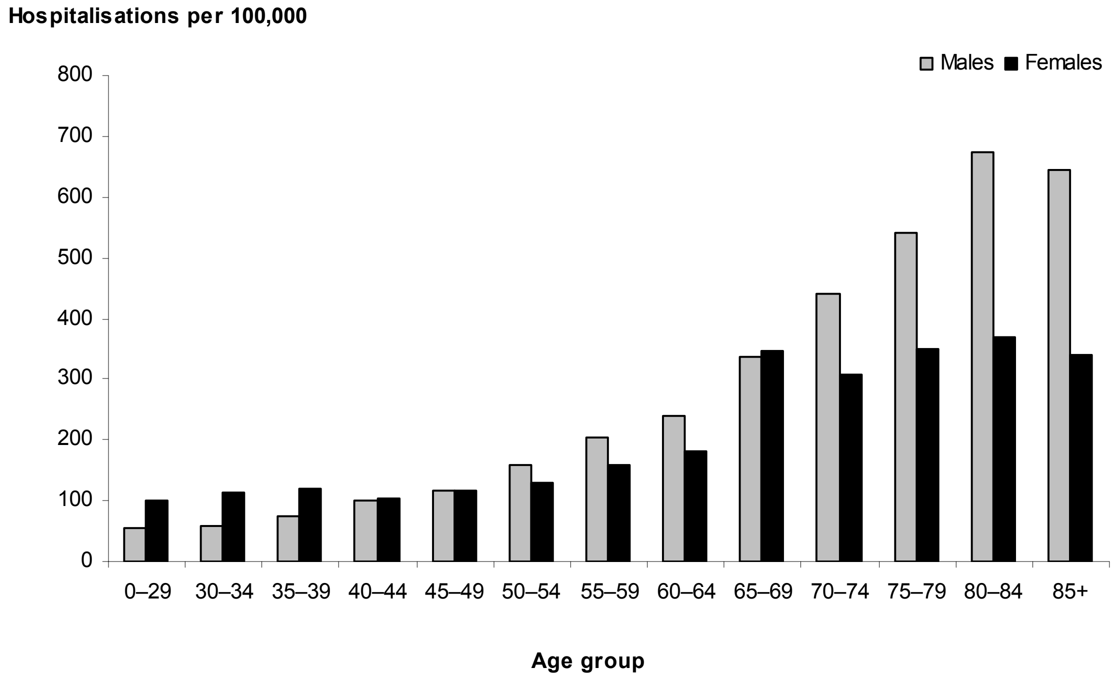
CKD as the principal diagnosis (excluding regular dialysis)

In addition to the nearly 990,000 hospitalisations for regular dialysis described in the previous section, there were another 31,167 hospitalisations where CKD was the principal diagnosis in 2007–08. These accounted for 0.4% of total hospitalisations in Australia. There were 464 hospitalisations which had only the diagnosis recorded—that is, no demographic information was available—and these are therefore excluded from the rest of the analysis in this section.

Males and females were fairly equally represented in the data in 2007–08, with 48.6% of hospitalisations where CKD was the principal diagnosis being for males and 51.4% for females. There was also little difference in the age-standardised male and female hospitalisation rates (141.9 and 141.3 per 100,000 respectively).

The age-specific hospitalisation rates for CKD increased with age for both males and females, and were highest among those aged 80–84 years (Figure 2.6). However, while the male rate increased steadily up to 80–84 years, the female rate remained fairly stable from 65–69 years onwards.

Males had substantially higher rates of hospitalisation for CKD among older age groups; however, females had higher rates among those aged less than 45 years, due in part to the much higher number of hospitalisations for tubulo-interstitial nephritis (ICD-10-AM code N12) among females. Included in this code is pyelonephritis, the most common cause being urinary tract infections for which adult women are at 50 times higher risk than men (Masson et al. 2009).

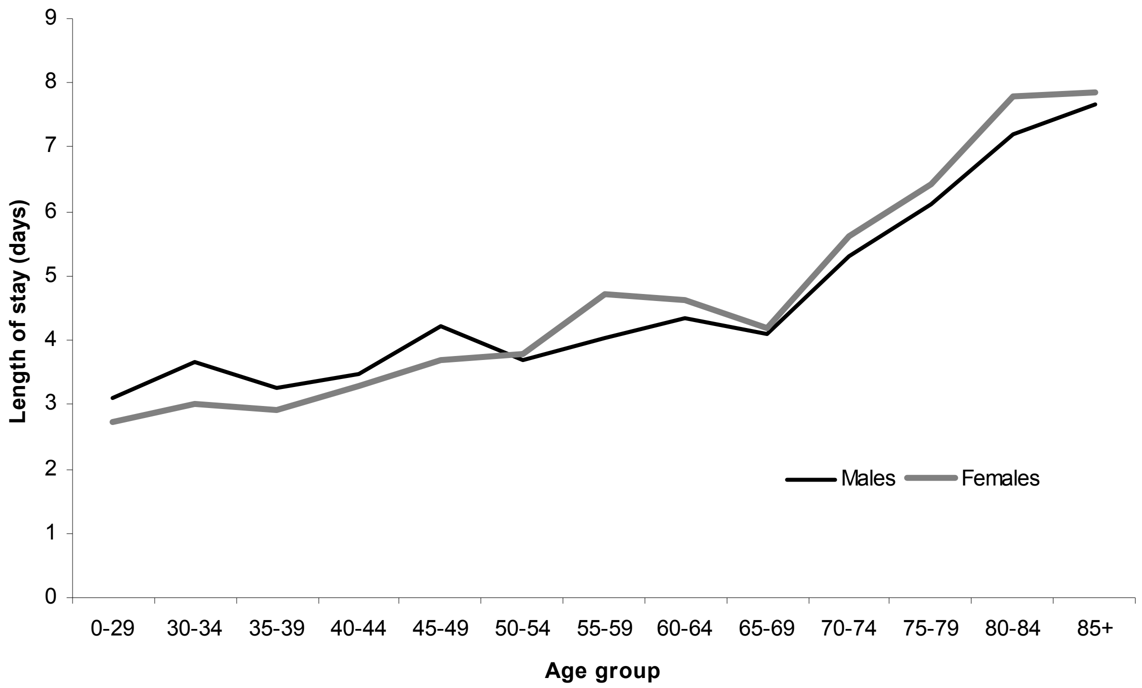


Source: AIHW National Hospital Morbidity Database.

Figure 2.6: Hospitalisations with a principal diagnosis of CKD (excluding dialysis), by age and sex, 2007–08

People with a principal diagnosis of CKD (excluding regular dialysis) occupied 135,544 hospital bed days in 2007–08. This was 0.5% of the total number of bed days for all diagnoses in Australia. The average length of stay where CKD was the principal diagnosis was 4.4 days, longer than the average length of stay for all hospitalisations in Australia which was 3.3 days.

Males had a slightly higher average length of stay than females overall (4.6 compared with 4.3 days). The average length of stay increased with age, especially over 70 years of age, and patients aged over 85 years had hospital stays of 7.7 days on average (Figure 2.7).



Source: AIHW National Hospital Morbidity Database.

Figure 2.7: Average length of stay for CKD hospitalisations as the principal diagnosis (excluding regular dialysis), by age and sex, 2007–08

Diagnoses

The most common principal diagnoses among patients with a principal diagnosis of CKD (excluding regular dialysis) were kidney tubulo-interstitial diseases (24%) and diabetic nephropathy (20%), followed by chronic kidney failure (15%) and preparatory care for dialysis (13%) (Table 2.3). Details of the ICD-10-AM codes used to define CKD and the diagnosis groups for CKD can be found in *Appendix 2*.

The age-standardised hospitalisation rates for each disease group varied by sex. This was most significant for kidney tubulo-interstitial diseases, where females were hospitalised at 5 times the rate of males. This was due largely to the number of hospitalisations for tubulo-interstitial nephritis (ICD-10-AM code N12) among females (5,644 compared with 1,016 for males). As mentioned previously, this is most likely due to pyelonephritis, the most common cause being urinary tract infections—adult women are at 50 times higher risk of developing such infections than men (Masson et al. 2009).

Large differences also occurred for hypertensive kidney disease, where males were hospitalised at nearly twice the rate of females; and for diabetic nephropathy, glomerular diseases, and preparatory care for dialysis for which males were around 1.6 times as likely as females to be hospitalised.

Table 2.3: Diagnosis groups for CKD hospitalisations as the principal diagnosis (excluding regular dialysis), 2007–08

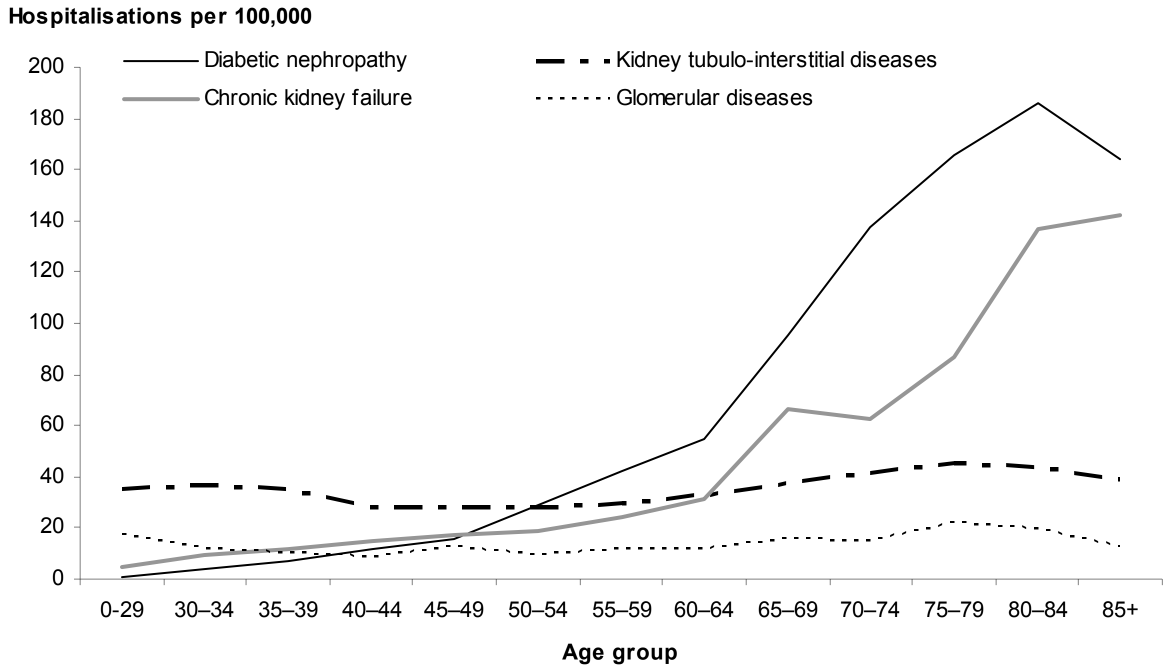
	Number of hospitalisations[(a)]			Hospitalisations per 100,000[(b)]			Proportion
Principal diagnosis	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**	**%**
Kidney tubulo-interstitial diseases	1,189	6,041	7,230	11.2	57.1	34.0	23.6
Diabetic nephropathy	3,609	2,532	6,141	34.6	21.0	27.3	20.0
Chronic kidney failure	2,612	2,009	4,621	25.4	16.9	20.6	15.1
Preparatory care for dialysis	2,388	1,574	3,962	22.3	14.0	18.0	12.9
Glomerular diseases	1,825	1,171	2,996	17.3	11.0	14.1	9.8
Other disorders of kidney and ureter	1,063	913	1,976	10.0	8.0	9.0	6.4
Complications related to dialysis and kidney transplant	812	544	1.356	7.6	5.0	6.3	4.4
Congenital malformations	708	505	1,213	6.7	4.8	5.7	4.0
Hypertensive kidney disease	520	300	820	4.9	2.5	3.7	2.7
Unspecified kidney failure	204	184	388	2.0	1.5	1.7	1.3
Total	**14,930**	**15,773**	**30,703**	**141.9**	**141.3**	**140.1**	**100.0**

(a) Excludes 464 episodes for which demographic information was not available.

(b) Directly age-standardised to the 2001 Australian population. Columns do not add to total due to younger age groups being combined during the age-standardisation process for diagnosis groups.

Source: AIHW National Hospital Morbidity Database.

The rate of the different specific diagnoses also varied with age. In 2007–08, the most common principal diagnosis for those less than 50 years of age was kidney tubulo-interstitial diseases, while diabetic nephropathy was the most common among those aged over 50 years (Figure 2.8). Of the top four CKD diagnoses shown in Figure 2.8, hospitalisation rates for kidney tubulo-interstitial diseases and glomerular diseases were fairly stable across the age groups, while diabetic nephropathy and chronic kidney failure increased with age. This most likely reflects the different age pattern of the underlying disease causes—for example Type 2 diabetes occurs mostly in those aged over 40 years, with severe complications like nephropathy developing some time later (AIHW 2008a).

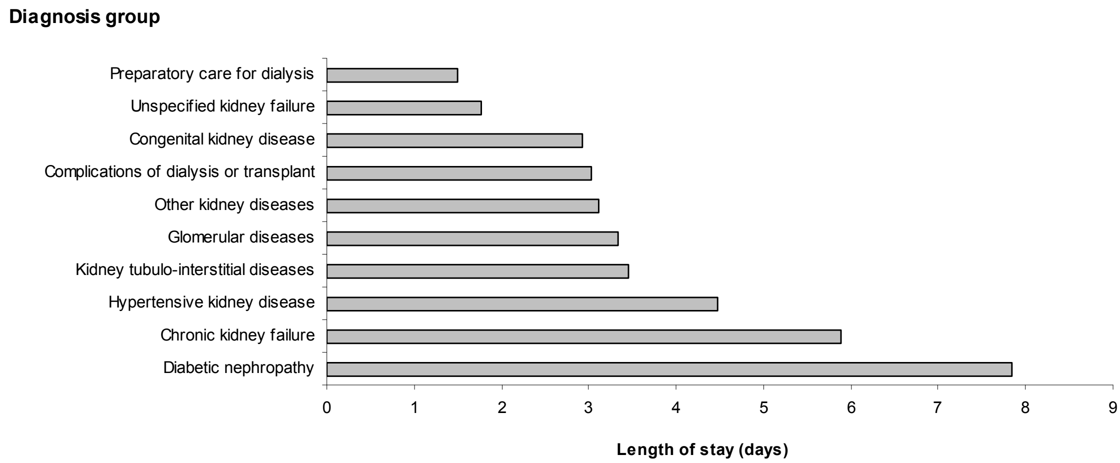


Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 2.8: CKD as the principal diagnosis (excluding regular dialysis), top four diagnosis groups, by age, 2007–08

The average length of stay also varied by diagnosis group (Figure 2.9). Those with a principal diagnosis of diabetic nephropathy had the longest stay with an average of 7.8 days, as well as the most bed days (48,182). This was followed by chronic kidney failure with an average stay of 5.9 days and 27,230 bed days. Preparatory care for dialysis had the shortest average stay (1.5 days).



Source: AIHW National Hospital Morbidity Database.

Figure 2.9: Average length of stay for CKD diagnosis groups, 2007–08

Mode of discharge

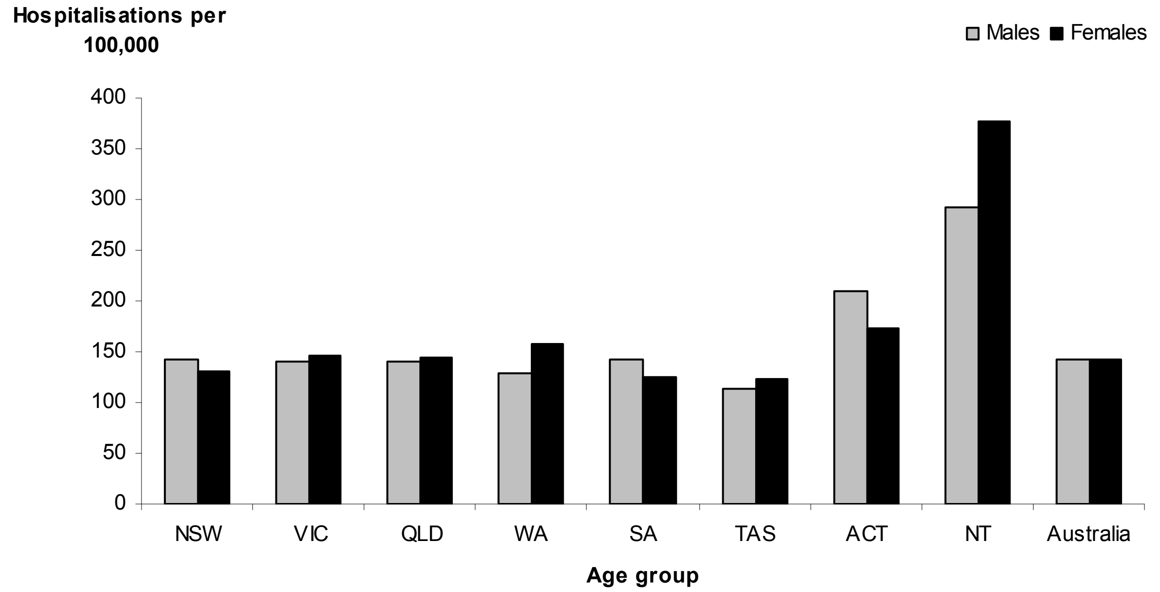
The vast majority (87%) of patients hospitalised with CKD as the principal diagnosis (excluding regular dialysis) were discharged to their usual residence, however there were 1,088 (4%) patients who died in hospital, and 1,984 (6%) who were discharged/transferred to another hospital. Of the patients who died in hospital, 80% were aged over 70 years. There were 265 (1%) patients who were discharged from hospital against medical advice.

Patients with a principal diagnosis of diabetic nephropathy or chronic kidney failure had the highest proportion who died in hospital (9% and 8% respectively). Patients with diabetic nephropathy also had the highest proportion of patients discharged/transferred to another hospital (14%).

State and territories

Hospitalisation rates for CKD as the principal diagnosis (excluding regular dialysis) were similar for most states and territories in 2007–08 with two exceptions—the NT and the ACT. The NT recorded a rate that was 2.4 times the Australian average and the ACT recorded a rate 35% higher (Figure 2.10). The latter is likely to be due to the number of people living in parts of NSW surrounding the ACT who were treated in the ACT, but were not counted in the denominator population for the calculation of the rate (see *Appendix 2* for further information).

In most states and territories, hospitalisation rates for males and females were similar, however larger differences were seen in the NT and WA where females were hospitalised at more than 1.2 times the rate of males. The rate of hospitalisation increased with age, although this was more apparent for males than females.



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

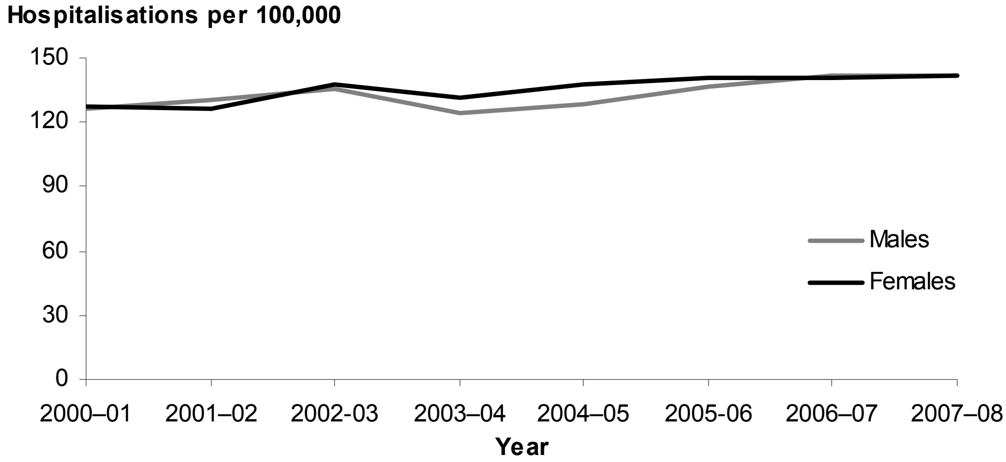
Source: AIHW National Hospital Morbidity Database.

Figure 2.10: Hospitalisations for CKD (excluding regular dialysis), by sex and state/territory, 2007–08

The main CKD principal diagnoses were similar across the states and territories, with diabetic nephropathy and kidney tubulo-interstitial diseases among the most common for all. Chronic kidney failure, unspecified kidney failure and glomerular diseases were also among the most common. The proportion of people with CKD as the principal diagnosis who were hospitalised for chronic kidney failure in the NT was less than half that of the national proportion, while a higher proportion was hospitalised for unspecified kidney failure. Nearly one-third (29%) of CKD hospitalisations in the ACT had a principal diagnosis of other kidney disorders, much higher than the Australian total (6%).

Trends

Between 2000–01 and 2007–08, the number and rate of hospitalisations where CKD was the principal diagnosis increased significantly. In 2000–01 there were 24,492 hospitalisations where CKD was the principal diagnosis, increasing by 27% to 31,167 hospitalisations in 2007–08. Over this period, the age-standardised rate for males increased by 11% and the female rate increased by 12% (Figure 2.11).



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

Source: AIHW National Hospital Morbidity Database.

Figure 2.11: Hospitalisations for CKD as a principal diagnosis, by sex, 2000–01 to 2007–08.

Between 2000–01 and 2007–08, the average length of stay for hospitalisations with a principal diagnosis of CKD (excluding regular dialysis) decreased, by 5% for males and 15% for females.

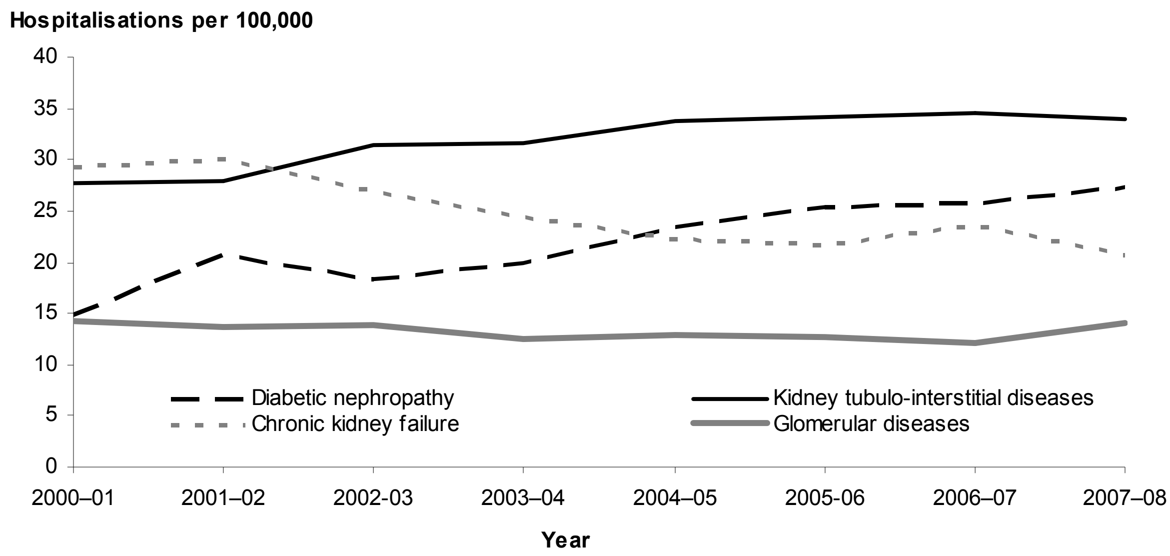
Diagnoses

Between 2000–01 and 2007–08, trends in hospitalisation rates for the specific diagnosis groups varied. Hospitalisation rates for diabetic nephropathy and kidney tubulo-interstitial diseases both increased overall (76% and 26%respectively) and in all age groups, while those for chronic kidney failure decreased (31%). There was no change in the rate of hospitalisations for glomerular diseases over this period (see Figure 2.12).

Over the period 2000–01 to 2007–08:

- Males had higher hospitalisation rates for diabetic nephropathy than females and this gap increased—the rate ratio by 16% (from 1.4 to 1.6 times) and the rate difference by 164% (from 5 to 14 per 100,000).
- Females had higher hospitalisation rates for kidney tubulo-interstitial disease—the rate ratio increasing by 13% (from 4.3 to 5.1 times) and the rate difference increasing by 34%(from 35 to 46 per 100,000).
- Although hospitalisation rates for chronic kidney failure remained higher for males than for females, the rate difference decreased by 29% (from 11 to 8 per 100,000).

It is possible that the decrease in hospitalisation rates for chronic kidney failure and increases for diabetic nephropathy and kidney tubulo-interstitial disease reflect a growing propensity to code the specific disease cause rather than the outcome.



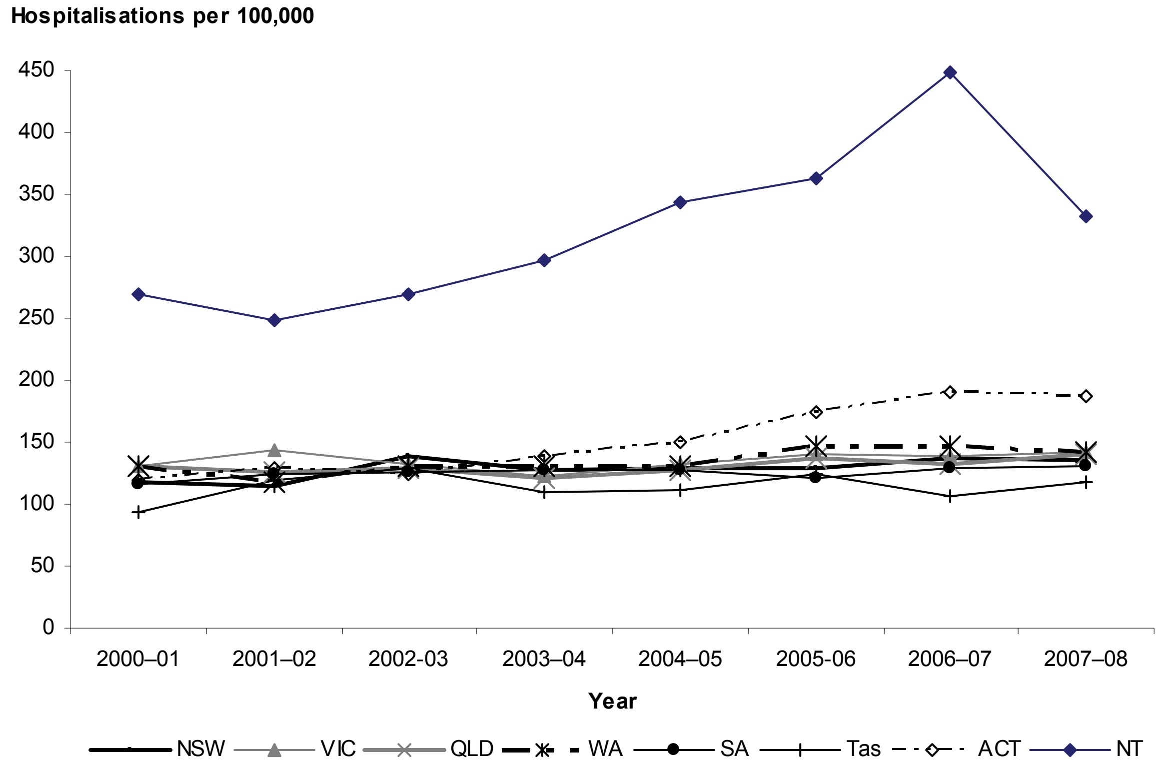
Note: Age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 2.12: Hospitalisation rates for top four CKD principal diagnosis groups, 2000–01 to 2007–08

States and territories

The age-standardised hospitalisation rates for CKD as the principal diagnosis (excluding regular dialysis) showed some fluctuation from year to year across the states and territories (Figure 2.13—also see *Appendix 1* for detailed tables). Between 2000–01 and 2007–08, significant increases were seen in NSW, WA, SA, the ACT and the NT. The greatest absolute increase was seen in the NT, where the age-standardised rate increased from 269 to 332 per 100,000 population. The largest relative increases were seen in the ACT and the NT, with increases of 66% and 55% respectively.



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

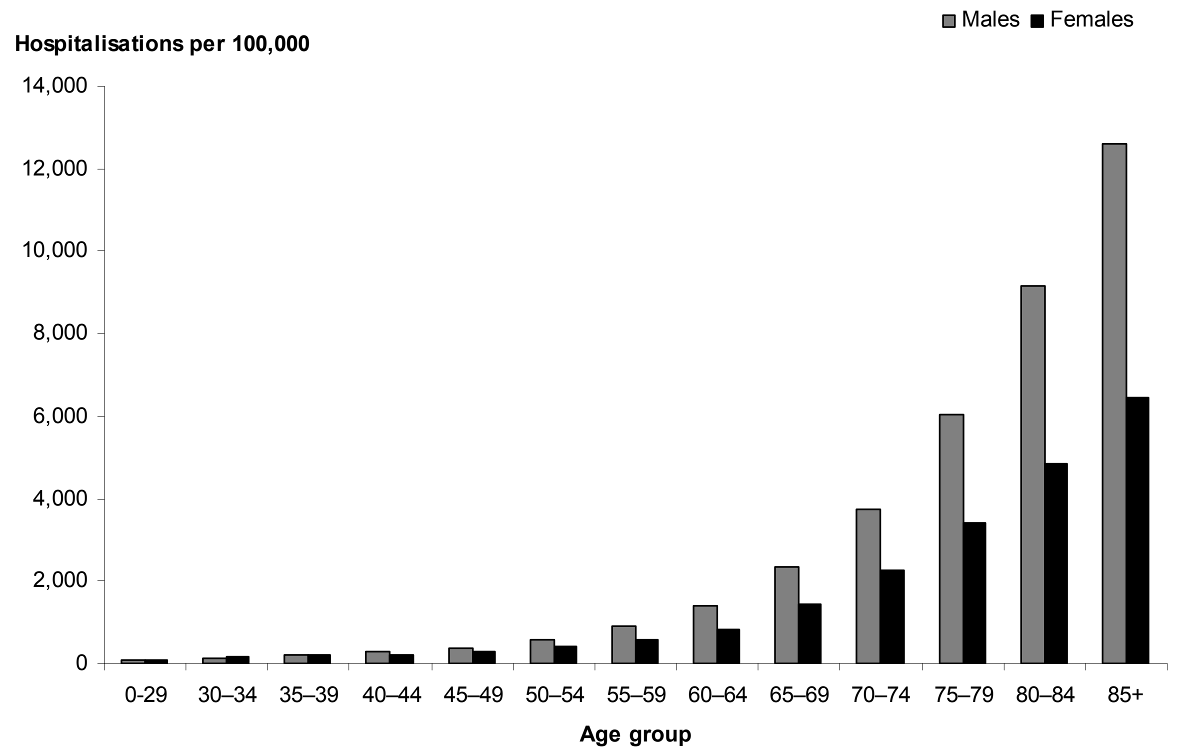
Source: AIHW National Hospital Morbidity Database.

Figure 2.13: Hospitalisations for CKD as the principal diagnosis (excluding regular dialysis), by state/territory, 2000–01 to 2007–08

3 CKD as an additional diagnosis

In situations where CKD coexisted with a different principal diagnosis and required treatment during hospitalisation, it is recorded as an additional diagnosis. When dialysis is excluded, CKD is more often coded as an additional diagnosis than as the principal diagnosis. Due to the multiple coding list used to classify CKD, there may be more than one diagnosis of CKD on a hospital record. This section looks at CKD as an additional diagnosis, where CKD was not recorded as the principal diagnosis.

In 2007–08, there were 167,628 hospitalisations where CKD was recorded as an additional diagnosis. This was just over 2% of all hospitalisations for that year. There were 223 records with the CKD diagnosis recorded but no other demographic information and these are therefore excluded from the calculation of rates. Of the hospitalisations for which demographic information was available, 57%were for males and 43% for females and one record had sex not stated. The age-standardised hospitalisation rate for males was 1.6 times that of females, with the vast majority of hospitalisations occurring in those aged over 60 years (Figure 3.1).



Note: Excludes 192 hospitalisations where sex not stated.

Source: AIHW National Hospital Morbidity Database.

Figure 3.1: Hospitalisations for CKD as an additional diagnosis, by sex, 2007–08

The average length of stay for hospitalisations where CKD was an additional diagnosis was 9.6 days, more than double that of CKD as a principal diagnosis, and older people were more likely to require a longer stay. This long length of stay is likely to reflect the complexity of cases where people are hospitalised with multiple conditions.

Diagnosis groups

CKD is most commonly recorded as an additional diagnosis with a principal diagnosis of cardiovascular disease (CVD—21% of cases), and this is true across all age groups. Other common principal diagnoses where CKD was an additional diagnosis include respiratory diseases, digestive system diseases and diabetes (Table 3.1). The longest average length of stay was for care involving rehabilitation services (18 days). Hospitalisations for each diagnosis group increased with age.

Table 3.1: Hospitalisations with an additional diagnosis of CKD, 2007–08, by principal diagnosis

Principal diagnosis (ICD-10-AM code)	Number of hospitalisations	Proportion of hospitalisations	Average length of stay (days)
Diseases of the circulatory system (I00–I99)[(a)]	35,498	21.2	9.3
Ischaemic heart disease (I20–I25)	*11,578*	*6.9*	*7.9*
Endocrine, nutritional and metabolic diseases (E00–E89)[(b)]	14,334	8.6	8.9
Diabetes (E10–E14)[(b)]	*10,117*	*6.0*	*10.2*
Diseases of the respiratory system (J00–J99)	14,321	8.5	9.2
Pneumonia (J12–J18)	*5,814*	*3.5*	*9.6*
Diseases of the digestive system (K00–K93)	12,527	7.5	8.5
Other diseases of the genitourinary system (N30–N99)	12,086	7.2	7.4
Neoplasms (C00–D48)	9,165	5.5	11.4
Care involving use of rehabilitation procedures (Z50.9)	8,809	5.3	18.0
Complications of surgical and medical care, not elsewhere classified (T80–T88)	7,684	4.6	8.0
Diseases of the musculoskeletal system and connective tissue (M00–M99)	6,057	3.6	10.5
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50–D89)	5,667	3.4	4.3
Infectious and parasitic diseases (A00–B99)	5,629	3.4	11.1
Symptoms, signs involving the circulatory and respiratory systems (R00–R09)	3,722	2.2	3.7
Other diseases and conditions	32,129	19.2	10.6
Total	**167,628**	**100.0**	**9.7**

(a) Excludes hypertensive kidney disease.

(b) Excludes diabetic nephropathy.

Note: Excludes hospitalisations where CKD was the principal diagnosis.

Source: AIHW National Hospital Morbidity Database.

The most common CKD additional diagnosis in 2007–08, where the principal diagnosis was not CKD, was chronic kidney failure (75%) followed by diabetic nephropathy (39%) (Table 3.2). Hospitalisations for both diagnoses increased with age, more sharply from age 60.

Almost half (more than 75,000) of hospitalisations with an additional diagnosis of CKD had more than one CKD diagnosis, a small number of them with more than one diagnosis within the same CKD diagnosis grouping. Details of the ICD-10-AM codes used to define CKD and the diagnosis groups for CKD can be found in Appendix 2.

For most diagnosis groups, males were more likely to be hospitalised than females, with the biggest differences occurring for chronic kidney failure, hypertensive kidney disease, diabetic nephropathy, and unspecified kidney failure (Table 3.2). In contrast, females were hospitalised for kidney tubulo-interstitial diseases at nearly three times the male rate.

Table 3.2: Additional diagnoses of CKD recorded on hospital records, 2007–08

	Number of hospitalisations			Hospitalisations per 100,00[(a)]			Proportion
Additional diagnosis	**Males**	**Females**	**Persons[(b)]**	**Males**	**Females**	**Persons**	**%**
Chronic kidney failure	73,347	53,134	126,483	729.3	416.4	551.6	75.5
Diabetic nephropathy	37,533	27,162	64,696	367.8	218.3	284.5	38.6
Other disorders of kidney and ureter	6,745	5,292	12,079	64.1	45.2	53.9	7.2
Kidney transplant and dialysis status	6,768	4,939	11,708	63.0	44.4	53.2	7.0
Glomerular diseases	3,078	2,544	5,622	29.1	23.1	25.7	3.4
Congenital malformations	2,319	1,866	4,366	22.0	16.9	19.3	2.6
Unspecified kidney failure	2,118	1,724	3,843	21.0	13.1	16.5	2.3
Kidney tubulo-interstitial diseases	948	2,834	3,782	9.1	25.8	17.5	2.3
Hypertensive kidney disease	1,637	1,100	2,737	16.1	9.2	12.2	1.6
Preparatory care for dialysis	348	256	604	3.3	2.2	2.7	0.4
Complications related to treatment	269	307	576	2.5	2.9	2.7	0.3
Total[(c)]	**95,328**	**72,076**	**167,628**	**939.9**	**578.9**	**735.4**	**100.0**

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

(b) Includes records for which sex was not stated.

(c) One hospitalisation can have multiple associated diagnoses. Therefore numbers will not add up to total. If multiple diagnoses occurred in the same group, only one diagnosis was counted.

Note: Excludes hospitalisations where CKD was the principal diagnosis.

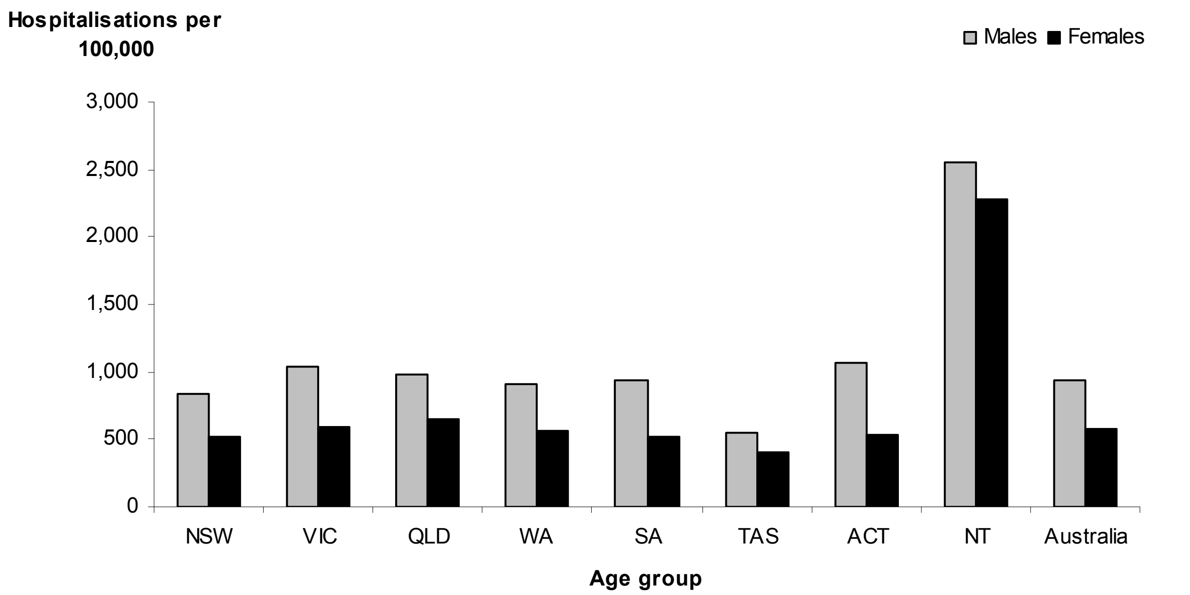
Source: AIHW National Hospital Morbidity Database

Mode of discharge

The majority (71%) of patients hospitalised with CKD as an additional diagnosis were discharged to their usual residence. Over 12,500 (7%) patients died in hospital, while more than 19,500 (12%) were discharged/transferred to another hospital and another 6,100 (4%) were discharged/transferred to a residential aged care service. Of the patients who died in hospital, 81% were aged over 70 years. Nearly 1,500 patients left hospital against medical advice.

States and territories

Hospitalisation rates for CKD as an additional diagnosis were highest in the NT and lowest in Tasmania in 2007–08 (Figure 3.2). Males were more likely than females to be hospitalised with an additional diagnosis of CKD in all jurisdictions—more than 1.5 times as likely in most states and territories—however this difference was not significant in the NT.



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

Source: AIHW National Hospital Morbidity Database.

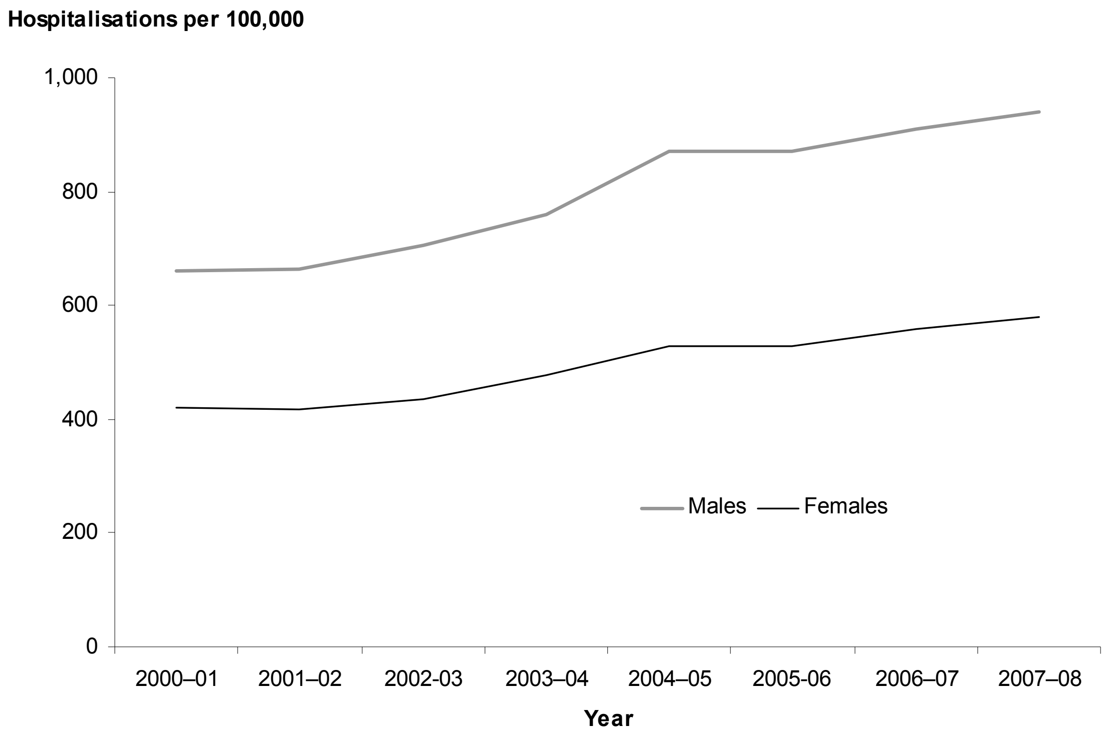
Figure 3.2: Hospitalisations for CKD as an additional diagnosis, by sex and state/territory, 2007–08

The main principal diagnoses for hospitalisations where CKD was an additional diagnosis were similar across the jurisdictions, with the cardiovascular, respiratory and endocrine, nutritional and metabolic diseases (including diabetes, but excluding diabetic nephropathy) being amongst the most common. The proportion of people hospitalised in the NT with an additional diagnosis of CKD whose principal diagnosis was endocrine, nutritional and metabolic disease was more than twice the Australian proportion, while half the proportion were hospitalised for CVD.

The average length of stay in hospital for patients with an additional diagnosis of CKD ranged from 8.2 days in the NT to 10.3 days in NSW.

Trends

Between 2000–01 and 2007–08, the number of hospitalisations where CKD was an additional diagnosis increased by 74%, while the age-standardised rate increased by 48% for males and 43% for females (Figure 3.3). For hospitalisations with an additional diagnosis of CKD where CVD was the principal diagnosis the age-standardised rate increased by 33%, for respiratory diseases 50% and for endocrine, metabolic and nutritional diseases (including diabetes, but excluding diabetic nephropathy) 71%. All of these increases were significant.



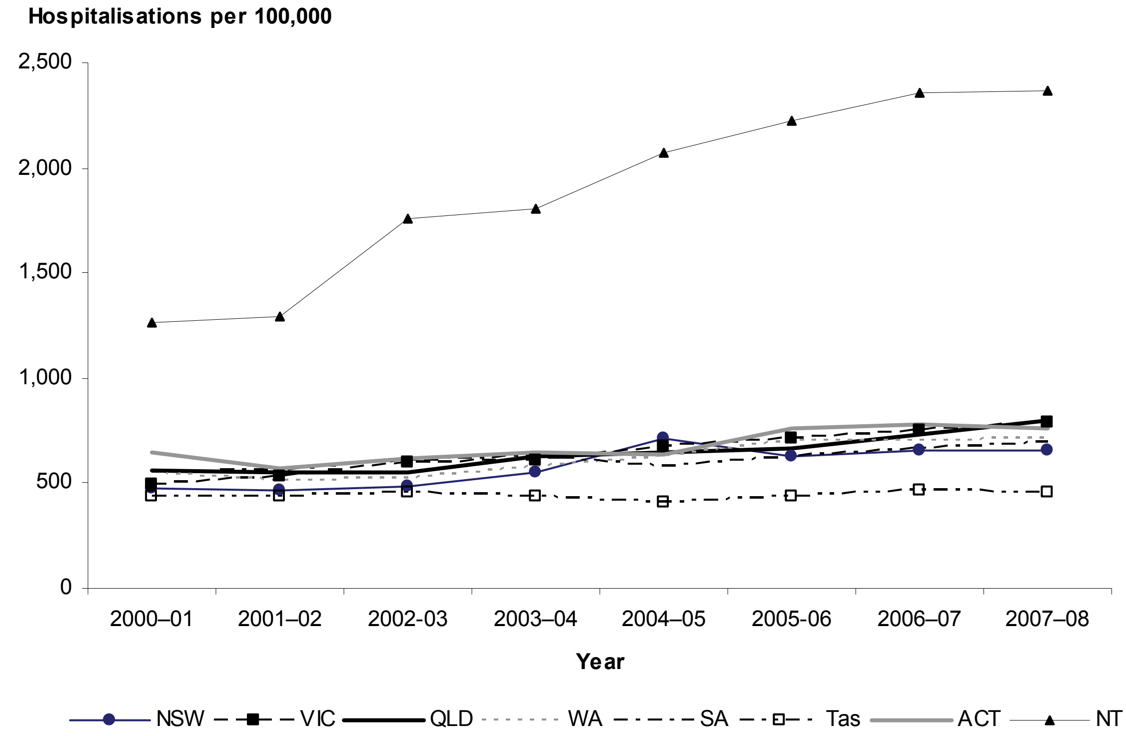
Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 3.3: Trends in CKD hospitalisations as an additional diagnosis, 2000–01 to 2007–08

States and territories

Between 2000–01 and 2007–08, the number of hospitalisations where CKD was an additional diagnosis increased significantly in all states and territories. The age-standardised hospitalisation rates also increased over this period, and were significant in all jurisdictions except Tasmania (Figure 3.4). The NT recorded the largest absolute and relative increase, with the number of hospitalisations increasing by 120% and the hospitalisation rate nearly doubling (see *Appendix 1* for detailed tables).



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

Source: AIHW National Hospital Morbidity Database.

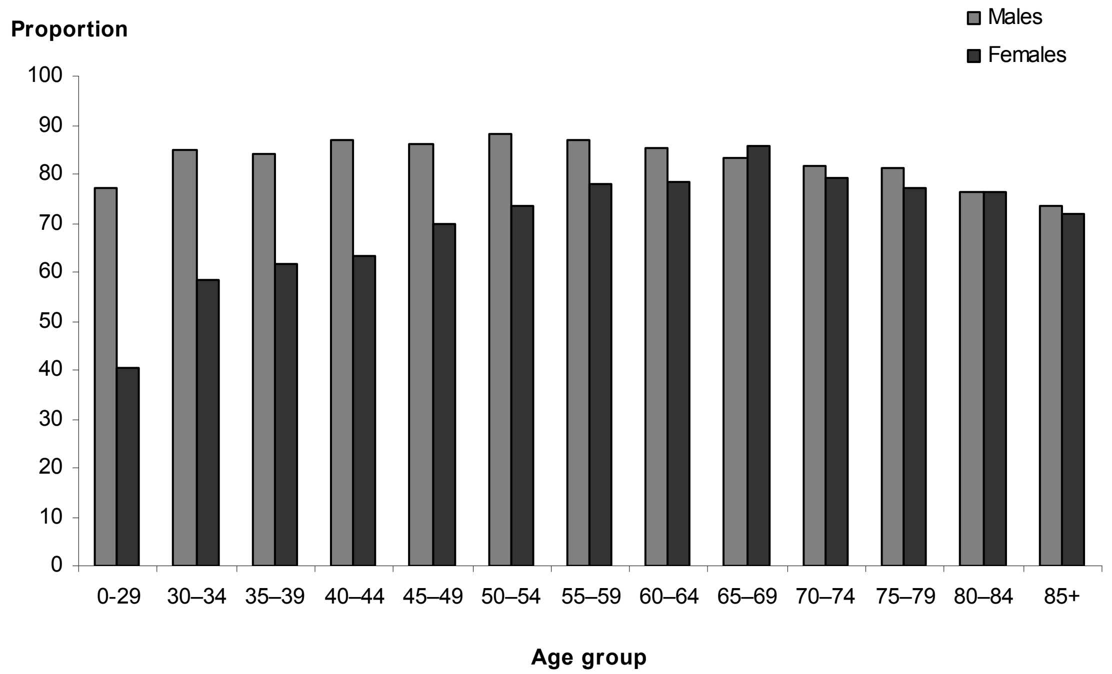
Figure 3.4: Hospitalisations for CKD as an additional diagnosis, by state/territory, 2000–01 to 2007–08

4 Hospital procedures

A procedure is a clinical intervention that is surgical in nature, carries a procedural risk, carries an anaesthetic risk, requires specialised training, and/or requires special facilities or equipment available only in an acute care setting. Procedures therefore encompass surgical and non-surgical investigative and therapeutic procedures, such as X-rays and chemotherapy. Client support interventions that are neither investigative nor therapeutic (such as anaesthesia) are also included (AIHW 2009c). Procedures are coded using the *Australian classification of health interventions* (ACHI) (NCCH 2006). One or more procedures can be recorded for each hospitalisation, but not all hospitalisations will have a procedure undertaken. The procedure classification is divided into chapters by anatomical site and then divided into nearly 1,600 procedure block numbers, which in turn group the very specific procedure codes. In this chapter, block numbers have been used for analysis.

Regular dialysis, when recorded as the principal diagnosis, actually refers to a procedure —namely haemodialysis or peritoneal dialysis. Therefore this section concentrates on the procedures received by patients who were hospitalised with a principal diagnosis of CKD other than regular dialysis.

Of the 30,703 hospitalisations where CKD was the principal diagnosis (excluding regular dialysis and records without demographic information) in 2007–08, 73% had a procedure recorded. A total of 60,231 procedures were recorded for hospitalisations with a principal diagnosis of CKD, an average of 2.7 procedures per hospitalisation with a procedure recorded. Overall, males were more likely to undergo a procedure than females (82% compared with 68% respectively) and this was particularly pronounced in the younger age groups (Figure 4.1). The proportion of male patients recording a procedure was highest for those aged 50–54 years, but remained fairly stable across all age groups. Comparatively, the proportion of female patients recording a procedure increased with age up to 65–69 years, and then gradually declined.

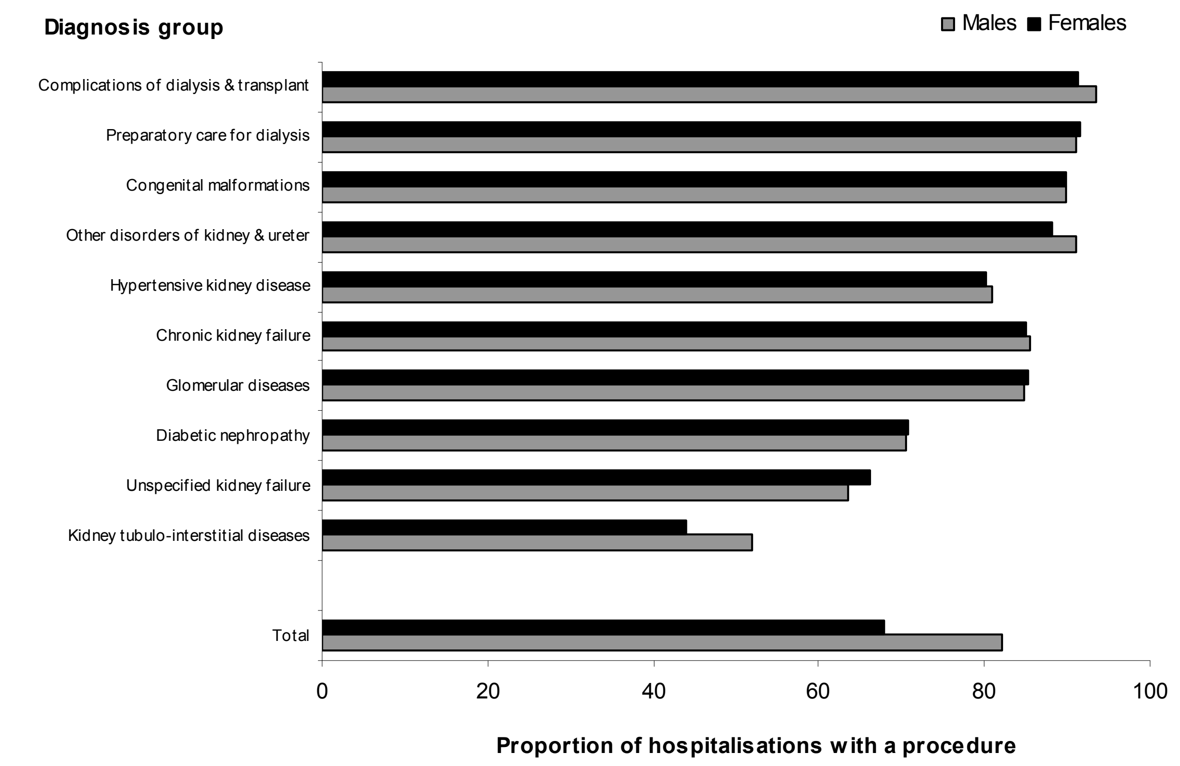


Source: AIHW National Hospital Morbidity Database.

Figure 4.1: Proportion of hospitalisations with CKD as a principal diagnosis (excluding dialysis) with a procedure recorded, by age and sex, 2007–08

The proportion of hospitalisations with a procedure recorded varied by diagnosis group (Figure 4.2). Hospitalisations for complications of dialysis and transplant were most likely to have a procedure recorded, while those hospitalised for kidney tubulo-interstitial diseases were least likely.

Of those with a procedure recorded, hospitalisations for chronic kidney failure recorded the highest average number of procedures (four). Diabetic nephropathy, congenital malformations, hypertensive kidney disease, other disorders of the kidney and ureter, and complications of dialysis and transplant all had an average of around three procedures per hospitalisation, while the other diagnoses had an average of around two procedures per hospitalisation.

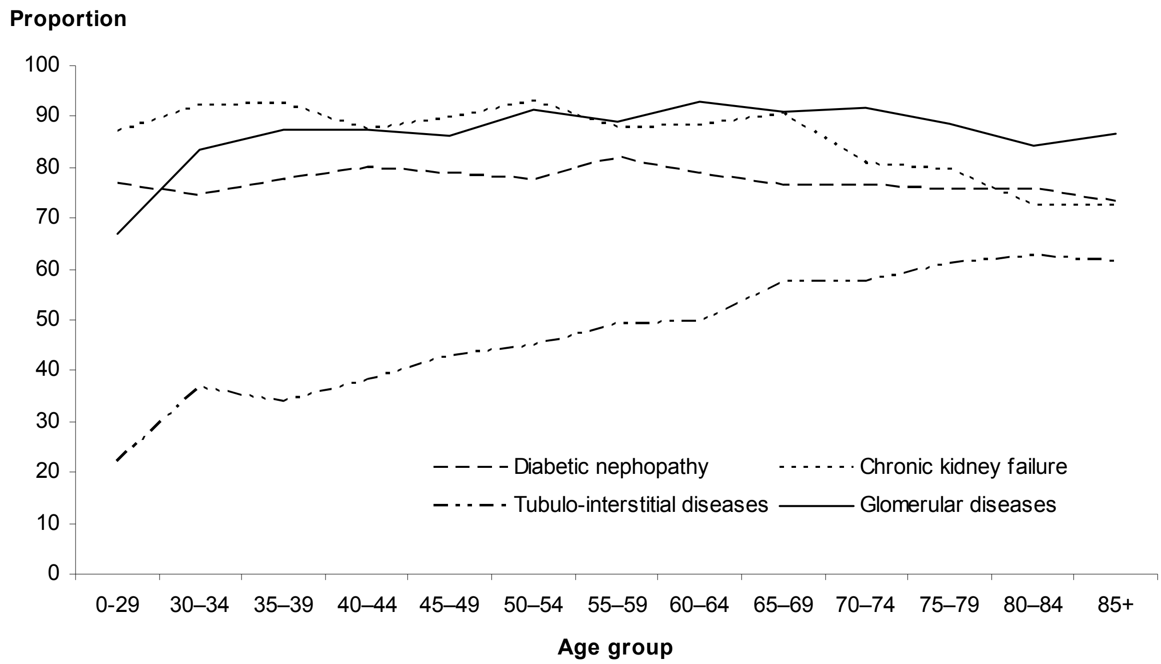


Note: Directly age-standardised to the 2007–08 CKD principal diagnosis (excluding dialysis) patient population.

Source: AIHW National Hospital Morbidity Database.

Figure 4.2: Hospitalisations for CKD as a principal diagnosis with a procedure recorded, by sex and diagnosis group, 2007–08

The proportion of hospitalisations with a procedure was relatively stable across all age groups for glomerular diseases and diabetic nephropathy (Figure 4.3). For kidney tubulo-interstitial diseases, the proportion of hospitalisations with a procedure increased with age, while for chronic kidney failure it decreased from 65 years onwards.



Source: AIHW National Hospital Morbidity Database.

Figure 4.3: Proportion of hospitalisations with CKD as a principal diagnosis (excluding regular dialysis) with a procedure recorded, by age and diagnosis group, 2007–08

There were over 440 different procedures (at block level) recorded for hospitalisations where CKD was the principal diagnosis (excluding regular dialysis). The 20 most frequently recorded procedures make up 80% of the total, however, and these have been analysed below.

Over one-quarter (26%) of patients hospitalised for CKD received a conduction or cerebral anaesthesia during their stay, and 23% had a diagnostic procedure (Table 4.1). Of the patients hospitalised where CKD was the principal diagnosis (excluding regular dialysis), nearly one-fifth (18%) received dialysis treatment during their hospitalisation.

Table 4.1: Most commonly recorded procedures for hospitalisations for CKD as the principal diagnosis (excluding regular dialysis), by sex, 2007–08

	Number			% of CKD hospitalisations[(a)]		
Procedure (block number/s)	**Males**	**Females**	**Total**	**Males**	**Females**	**Total**
Anaesthesia (1910, 1909)	4,638	3,422	8,060	30.5	23.3	26.3
Diagnostic procedures (1047, 1963, 1962, 2008, 1952, 1949)	3,666	3,328	6,994	25.8	21.3	22.8
Dialysis (1061, 1060)	3,274	2,216	5,490	22.1	14.8	17.9
Dialysis preparation (765, 1063, 1062)	3,222	2,164	5,386	21.8	14.5	17.5
Renal transplantation (1058)	427	247	674	3.2	1.6	2.2
Other (1916, 1893, 1920, 738, 1066, 1067)	7,907	6,753	14,660	52.0	45.5	47.8
Total[(b)]	**23,134**	**18,130**	**41,264**	**100.0**	**100.0**	**100.0**

Notes:

(a) Proportions have been directly age-standardised to the 2007–08 CKD principal diagnosis (excluding regular dialysis) patient population.

(b) As each patient can undergo multiple procedures, proportions will not add up to the totals. If multiple procedures were recorded from the same block number, only one procedure was counted.

Source: AIHW National Hospital Morbidity Database.

5 Population groups

Some population groups have higher rates of CKD and higher rates of hospitalisation for CKD than other Australians. These groups include Aboriginal and Torres Strait Islander peoples and some other ethnic groups, people from lower socioeconomic groups and people living in remote areas (Table 5.1). This chapter explores the differences in hospitalisations for these groups.

Table 5.1: Hospitalisation rates for CKD, by population group, 2007–08

Population group	Regular dialysis	Other principal diagnoses	Additional diagnosis
Aboriginal and Torres Strait Islander Status[a]		**Hospitalisations per 100,000**	
Indigenous	42,752	674	3,752
Other Australians	3,934	132	713
Socioeconomic status[a]			
Group 1 (lowest SES)	5,831	179	923
Group 2	4,542	165	770
Group 3	4,605	136	766
Group 4	3,892	127	694
Group 5 (highest SES)	3,618	99	572
Geographic location[b]		**Standardised hospitalisation ratio**	
Major cities	1.0	1.0	1.0
Inner regional	0.6	0.9	0.8
Outer regional	0.8	1.1	0.8
Remote	1.9	1.9	1.6
Very remote	4.5	3.9	4.0
Region of birth [c]			
Australia	1.0	1.0	1.0
All overseas	1.1	1.0	1.0
Oceania and Antarctica	*1.7*	*1.4*	*1.3*
North-West Europe	*0.8*	*0.9*	*0.9*
Southern and Eastern Europe	*1.5*	*1.0*	*1.2*
Africa and Middle East	*1.5*	*1.2*	*1.3*
Asia	*1.1*	*0.9*	*0.8*
The Americas	*0.5*	*0.8*	*0.7*

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

(b) Indirectly age-standardised to the 2007–08 *Major cities* population.

(c) Overseas-born rates are for 3 years, 2005–06 to 2007–08 and are indirectly age-standardised to the Australian-born population.

Source: AIHW National Hospital Morbidity Database.

Aboriginal and Torres Strait Islander peoples

In 2007, the estimated resident population of Indigenous Australians was around 530,000 and comprised 2.5% of the total population.

CKD is a significant contributor to morbidity and mortality among Aboriginal and Torres Strait Islander peoples (ABS & AIHW 2008). It has been well established that rates of CKD and ESKD in Indigenous Australians are significantly higher than for non-Indigenous Australians. As at the end of 2007, Indigenous Australians were being treated for ESKD at six times the rate of non-Indigenous Australians, and made up 9% of patients commencing treatment that year. Indigenous Australians who were being treated for ESKD were also less likely to be living with a functioning transplant compared to non-Indigenous Australians (12% compared to 45%), meaning a far greater proportion were reliant on dialysis for kidney replacement therapy (McDonald et al. 2009). A number of factors contribute to this, including the generally poorer socioeconomic situation of Indigenous Australians, higher rates of risk factors, time to diagnosis, and access to treatment centres (Cass et al. 2002a; Cass et al. 2002b; Cass et al. 2001b).

Aboriginal and Torres Strait Islander peoples 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).

Analysis and presentation of hospital data by Indigenous status was restricted to hospitals in NSW, Vic, Qld, WA, SA and public hospitals in the NT, due to data quality issues relating to Indigenous identification. Comparisons are made throughout with 'other Australians', which include hospitalisations where Indigenous status was missing or unknown as well as those identifying as non-Indigenous.

Across the three types of CKD hospitalisations, Aboriginal and Torres Strait Islander peoples have higher hospitalisation rates than other Australians (Table 5.2). In contrast to other Australians, Indigenous females have higher hospitalisation rates than Indigenous males across the three types of CKD hospitalisations.

Table 5.2: Hospitalisations for CKD, by Indigenous status and sex, 2007–08[(a)]

Aboriginal and Torres Strait Islander status	Number of hospitalisations			Hospitalisations per 100,000[(b)]		
	Dialysis	Principal diagnosis	Additional diagnosis	Dialysis	Principal diagnosis	Additional diagnosis
				Males		
Indigenous	52,279	914	4,192	42,686	620	3,723
Other Australians	513,194	13,416	88,140	5,159	135	909
% of hospitalisations / rate ratio	9.2	6.4	4.5	8.3	4.6	4.1
				Females		
Indigenous	62,663	1,280	4,929	43,338	729	3,788
Other Australians	323,487	13,868	64,924	2,899	132	555
% of hospitalisations / rate ratio	16.2	8.4	7.1	14.9	5.5	6.8

(a) Data restricted to hospitals in NSW, Vic, Qld, WA, SA, and public hospitals in the NT only.

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

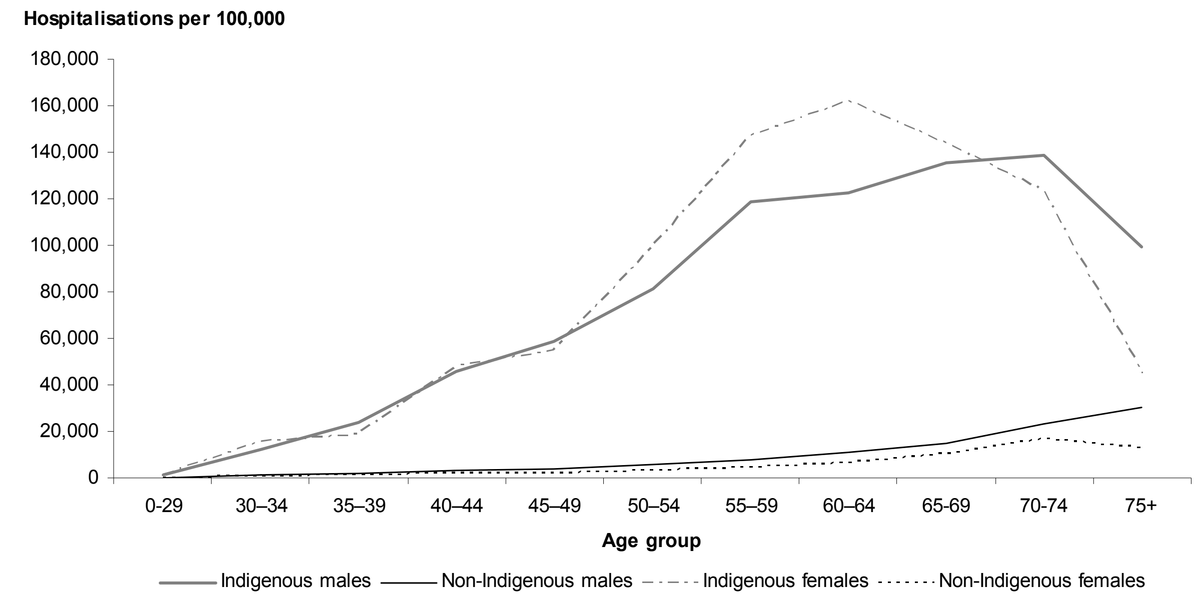
Source: AIHW National Hospital Morbidity Database.

Dialysis as the principal diagnosis

In 2007–08, there were 114,942 hospitalisations for regular dialysis for Indigenous Australians, representing 12.1% of all regular dialysis hospitalisations. Overall, Indigenous Australians were hospitalised for regular dialysis at 11 times the rate of other Australians. Indigenous females were 15 times as likely as other females to be hospitalised for regular dialysis, while Indigenous males were 8 times as likely as other males.

In contrast to other Australians, where the male rate was 1.6 times that of the female rate, the age-standardised hospitalisation rates for regular dialysis were similar for Indigenous males and females.

Hospitalisation rates for regular dialysis increased with age for Indigenous males, peaking at 70–74 years, whereas the Indigenous female rate peaked at 60–64 years (Figure 5.1).



Note: Data restricted to hospitals in NSW, Vic, Qld, WA, SA, and public hospitals in the NT only.

Source: AIHW National Hospital Morbidity Database.

Figure 5.1: Hospitalisation rates for regular dialysis, by Indigenous status, sex and age group, 2007–08

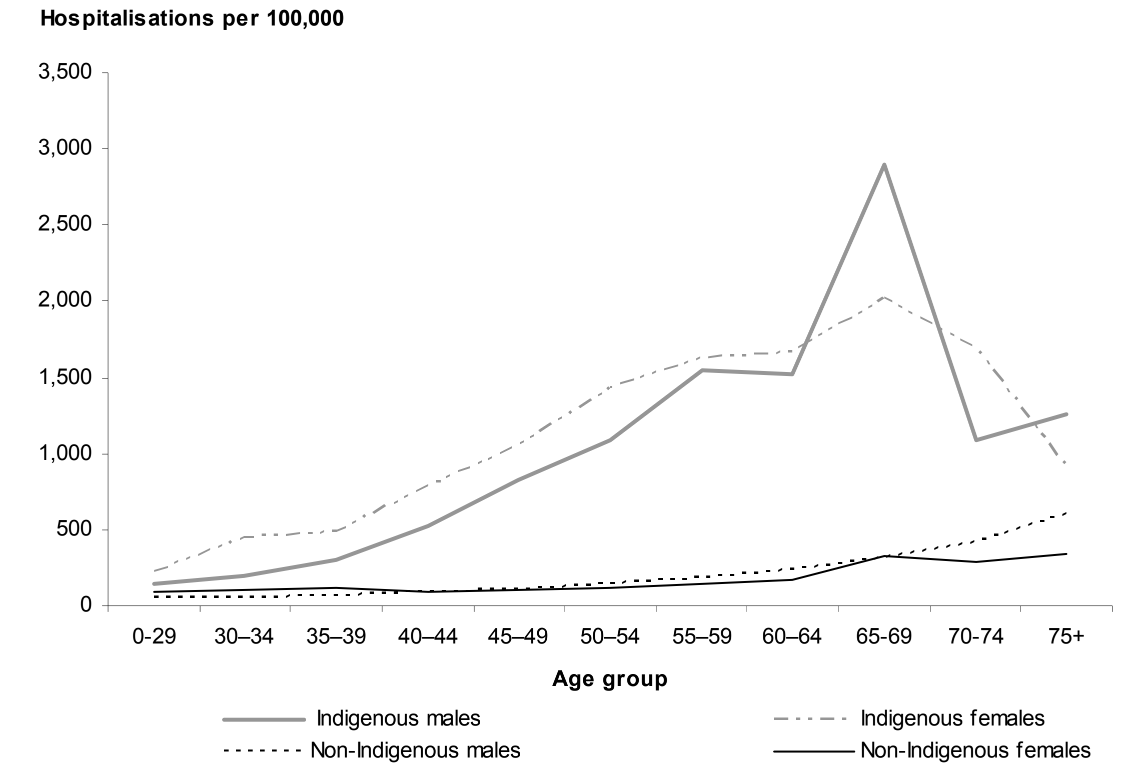
CKD as the principal diagnosis (excluding regular dialysis)

In 2007–08, there were 2,194 hospitalisations for Indigenous Australians where CKD was recorded as the principal diagnosis (excluding regular dialysis). This represents 7.4% of all hospitalisations where CKD was the principal diagnosis.

Indigenous Australians were hospitalised at more than 5 times the rate of other Australians for CKD as the principal diagnosis. The age-standardised hospitalisation rate for Indigenous females was higher than that of their male counterparts, whereas the male and female rates for other Australians were similar.

Hospitalisation rates increased with age for Indigenous and other Australians however decreased after 65–69 years for Aboriginal and Torres Strait Islander males and females (Figure 5.2).

Indigenous Australians were less likely than other Australians to undergo a procedure when hospitalised with CKD, with 64% receiving a procedure compared to 74% respectively.



*Note: D*ata restricted to hospitals in NSW, Vic, Qld, WA, SA, and public hospitals in the NT only.

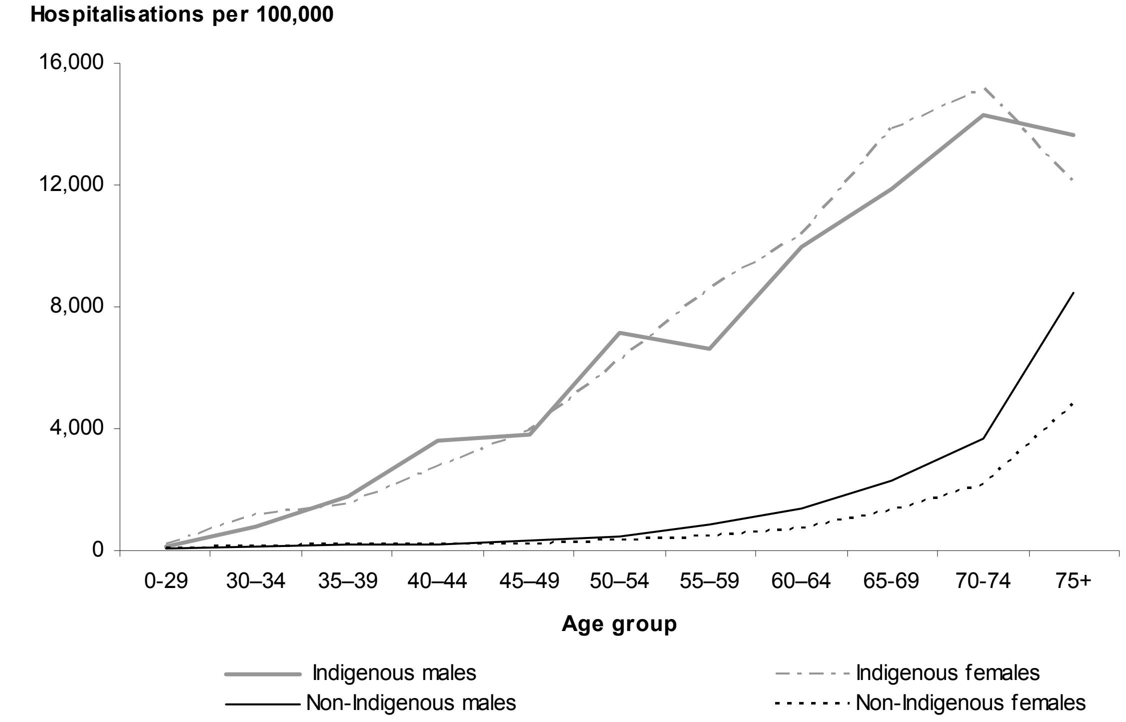
Source: AIHW National Hospital Morbidity Database.

Figure 5.2: Hospitalisation rates for CKD as the principal diagnosis by Indigenous status, sex and age group, 2007–08

CKD as an additional diagnosis

There were 9,121 hospitalisations for Indigenous Australians where CKD was recorded as an additional diagnosis in 2007–08, representing 5.6% of the total hospitalisations where CKD was an additional diagnosis. Indigenous Australians were more than 5 times as likely to be hospitalised with CKD as an additional diagnosis than other Australians.

Unlike other Australians, there was little difference between Indigenous male and female hospitalisation rates for CKD as an additional diagnosis. Hospitalisation rates increased with age for Indigenous and other Australians, however the Indigenous rate fell after age 70–74 years while for other Australians it continued to increase (Figure 5.3).



Note: Data restricted to hospitals in NSW, Vic, Qld, WA, SA, and public hospitals in the NT only.

Source: AIHW National Hospital Morbidity Database.

Figure 5.3: Hospitalisation rates for CKD as an additional diagnosis by Indigenous status, sex and age group, 2007–08

Geographical location

Australians living in *Regional* and *Remote* areas generally have poorer health than their *Major city* counterparts (AIHW 2008b). In 2002–04, death rates in *Regional* and *Remote* areas were between 10% and 70% higher than in *Major cities* (AIHW 2007). On average, people living in more inaccessible regions of Australia are disadvantaged in terms of educational and employment opportunities, income, access to goods and services, and in some areas access to basic necessities, such as clean water and fresh food (AIHW 2008c). Analysis of the ANZDATA Registry has also shown that Indigenous Australians living in remote regions had higher rates of treated ESKD than those living in urban areas (Cass et al. 2001a).

The data presented in this section are based on the patient's place of usual residence. Across all types of CKD hospitalisations, those living in remote areas were more likely than those living in cities and regional areas to be hospitalised (Table 5.3 and Figure 5.4). These differences were more marked for females than males. Rates in remote areas also peaked at a younger age.

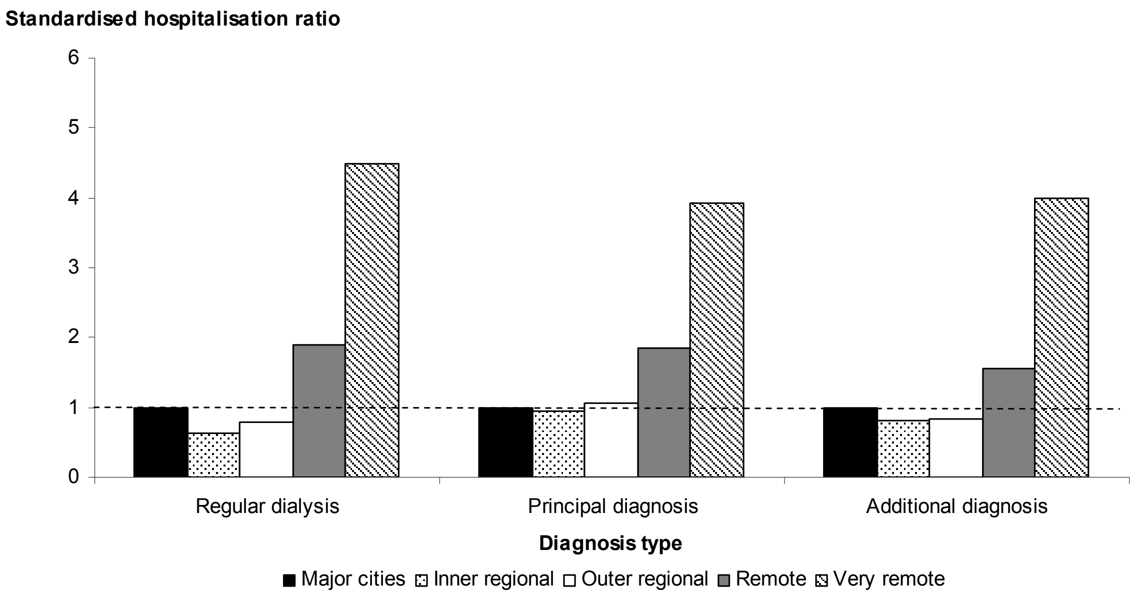
Table 5.3: Hospitalisations for CKD, by geographical location and sex, 2007–08

Geographical location	Number of hospitalisations[(a)]			Standardised hospitalisation ratio[(b)]		
	Dialysis	Other principal diagnoses	Additional diagnosis	Dialysis	Principal diagnosis	Additional diagnosis
			Males			
Major cities	471,569	9,434	64,019	1.0	1.0	1.0
Inner regional	95,947	3,116	19,061	0.7	1.0	0.9
Outer regional	50,282	1,620	8,884	0.8	1.1	0.9
Remote	11,291	306	1,604	1.2	1.5	1.3
Very remote	11,015	318	1,376	2.9	3.3	2.8
			Females			
Major cities	266,007	9,849	48,004	1.0	1.0	1.0
Inner regional	63,094	3,251	14,241	0.7	1.1	0.9
Outer regional	42,354	1,689	6,614	1.1	1.3	1.0
Remote	13,787	423	1,395	3.0	2.3	1.9
Very remote	13,176	407	1,569	7.2	4.6	5.8

(a) Numbers exclude those patients for whom a remoteness classification could not be assigned due to missing data, non-Australian residency etc.

(b) Indirectly age-standardised to the 2007–08 *Major cities* population.

Source: AIHW National Hospital Morbidity Database.



Note: Indirectly age-standardised to the 2007–08 *Major cities* population.

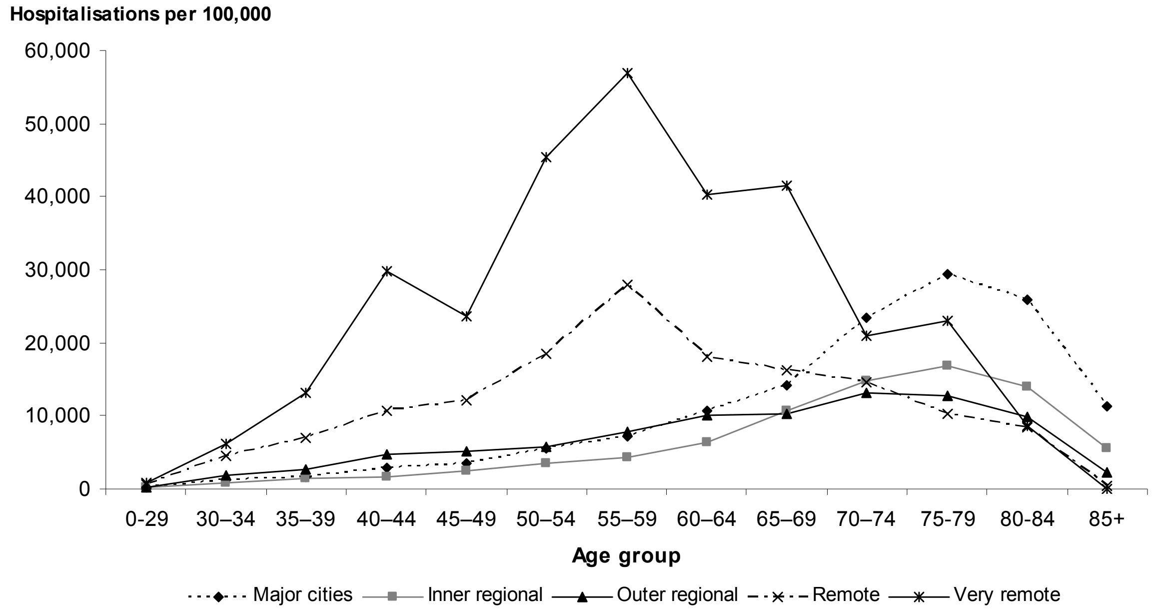
Source: AIHW National Hospital Morbidity Database.

Figure 5.4: Chronic kidney disease hospitalisations, by geographic location, 2007–08

Regular dialysis as the principal diagnosis

Rates of regular dialysis hospitalisations vary across regions. In 2007–08, people living in *Remote* and *Very remote* areas had higher rates of hospitalisation for regular dialysis than those living in *Major cities*, with those in *Very remote* areas 4.5 times as likely to be hospitalised (Figure 5.4). Those living in *Inner regional* and *Outer regional* areas were less likely to be hospitalised for regular dialysis than those in *Major cities.*

Regular dialysis hospitalisations increased up to the 75–79 year age group for people living in *Major cities*, *Inner regional* and *Outer regional* areas and then fell off sharply (Figure 5.5). A different pattern was seen in *Remote* and *Very remote* areas, where the rate of hospitalisations for regular dialysis rose more sharply in younger age groups and peaked in the 55–59 year age group. Among those aged over 80 years, those living in *Remote* and *Very remote* areas had the lowest rates of hospitalisation for regular dialysis.



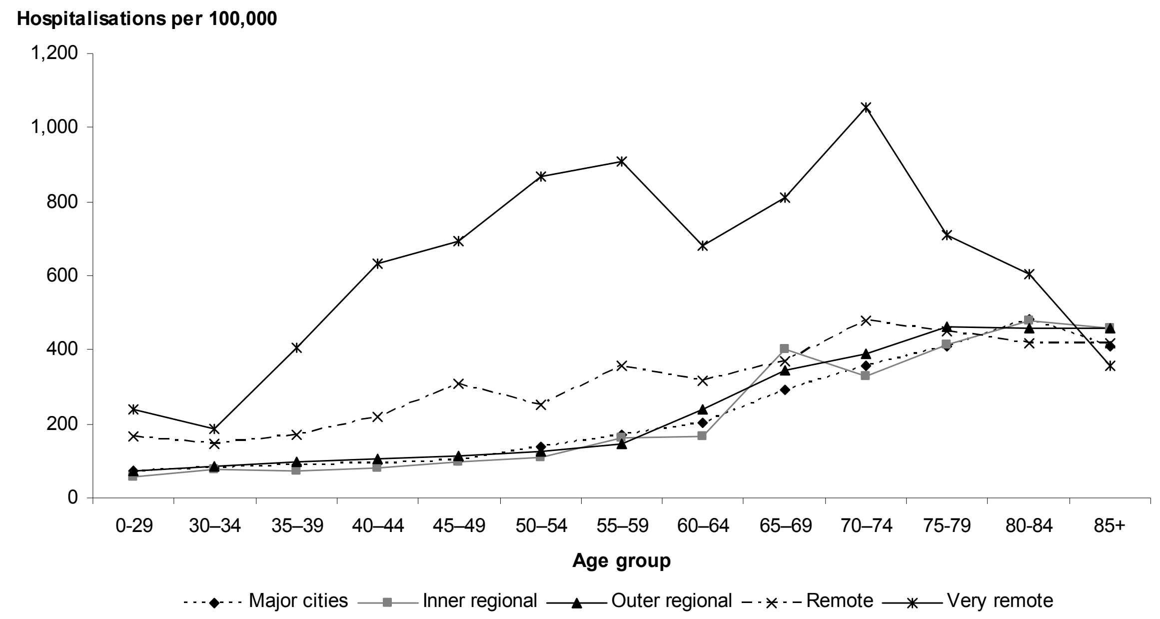
Source: AIHW National Hospital Morbidity Database.

Figure 5.5: Regular dialysis hospitalisations, by geographical location and age, 2007–08

CKD as the principal diagnosis (excluding regular dialysis)

In 2007–08, *Inner regional* and *Outer regional* areas had similar rates of hospitalisation for CKD as a principal diagnosis as *Major cities.* Rates for *Remote* areas were a little higher and those for *Very remote* areas even more so (Figure 5.4). People living in *Very remote* areas had rates almost 4 times that of *Major cities*.

Hospitalisation rates for regular dialysis generally increased with age in all geographical areas except *Very remote*, where the highest rates peaked at a younger age before dropping sharply. Those living in *Very remote* areas had higher rates across all age groups, with the exception of those aged over 85 years where rates were highest in *Outer regional* areas.



Source: AIHW National Hospital Morbidity Database.

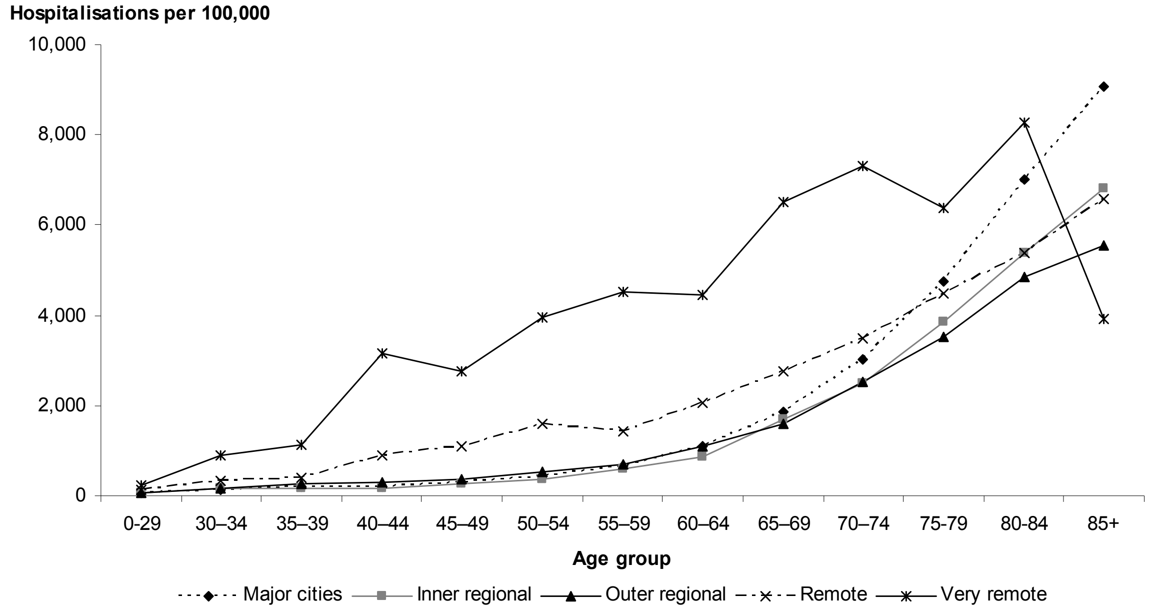
Figure 5.6: CKD as the principal diagnosis (excluding regular dialysis) hospitalisations by geographical location and age, 2007–08

Hospitalisations where CKD was the principal diagnosis which had one or more procedures recorded decreased with increasing remoteness. Compared with people from *Major cities*, people from *Inner regional* areas were 8% less likely to have one or more procedures, people from *Outer regional* areas were 18% less likely and people from *Remote* and *Very remote* areas had a procedure rate 27% less than *Major cities*.

CKD as an additional diagnosis

A similar pattern to hospitalisations for regular dialysis was seen where CKD was an additional diagnosis. *Inner regional* and *Outer regional* areas had slightly lower rates of hospitalisation than those in *Major cities*, while *Remot*e and *Very remote* areas had higher hospitalisation rates than *Major cities* (Figure 5.4).

Rates of hospitalisation increased with age, peaking for those aged 85 years and older in all regions except for *Very remote* areas, where the rate peaked in those aged 80–84 and then dropped sharply (Figure 5.7).



Source: AIHW National Hospital Morbidity Database.

Figure 5.7: CKD as an additional diagnosis, by geographical location and age, 2007–08

Socioeconomic status

There are a number of socioeconomic characteristics that have been shown to be associated with differences in health status. These include education, employment status and occupation, income and wealth, and family structure. Disadvantage in any of these areas has the potential to impact on health and can increase disease incidence and prevalence (AIHW 2008c).

In this section, the measure of socioeconomic status (SES) is based on the ABS Socioeconomic Index for Areas (SEIFA), which is a measure constructed at the level of geographic area of residence. Although it does not necessarily represent the SES of all households or individuals living within the area, it provides an adequate indication of SES in Australia (Dutton et al. 2005).

For the analysis presented here, the population was divided into five equal-sized groups based on the area-measure of SES. That is, the fifth of the population living in the most disadvantaged areas are the group with the lowest SES and similarly, the fifth of the population living in the least disadvantaged areas are the group with the highest SES.

Across all types of CKD hospitalisations, hospitalisation rates generally increased with lower SES (Table 5.4). Males had higher rates of hospitalisation for regular dialysis and CKD as an additional diagnosis across all fifths, while male and female rates for CKD as the principal diagnosis were similar.

Table 5.4: Hospitalisations for CKD, by SES and sex, 2007–08

Socioeconomic status	Number of hospitalisations[a]			Hospitalisations per 100,000[b]		
	Dialysis	Principal diagnosis	Additional diagnosis	Dialysis	Principal diagnosis	Additional diagnosis
				Males		
Group 1 (lowest SES)	152,043	4,026	24,243	6,921	186	1,132
Group 2	121,885	3,571	21,188	5,475	164	973
Group 3	118,352	2,769	19,117	5,756	133	975
Group 4	95,276	2,526	16,120	5,086	130	911
Group 5 (highest SES)	99,467	2,010	14,844	5,045	100	780
				Females		
Group 1 (lowest SES)	112,572	3,915	18,982	4,858	176	760
Group 2	89,471	3,848	15,951	3,727	169	612
Group 3	80,188	3,092	14,528	3,602	142	606
Group 4	60,189	2,637	11,886	2,888	126	530
Group 5 (highest SES)	56,685	2,255	10,931	2,498	102	424

(a) Numbers exclude those patients for whom a SEIFA classification could not be assigned due to missing data, non-Australian residency etc.

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

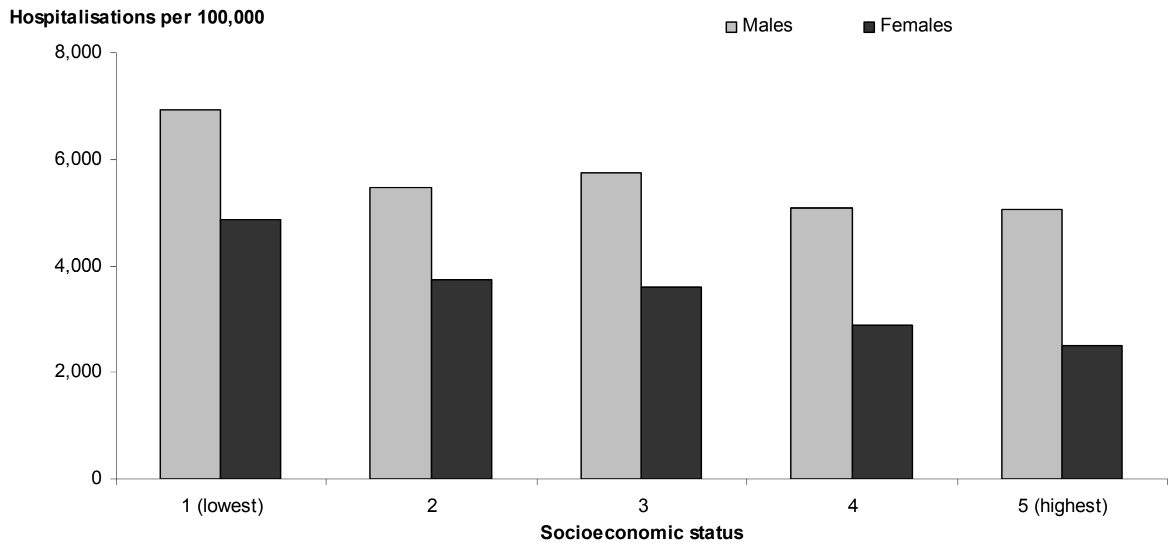
Source: AIHW National Morbidity Database.

Regular dialysis as the principal diagnosis

In 2007–08, hospitalisations for regular dialysis generally increased with lower SES, however rates were similar for the 2nd and 3rd fifths (Figure 5.8). The rate of dialysis hospitalisations among people in the lowest SES fifth was 1.6 times as high as people in the highest SES fifth.

Males had higher rates of hospitalisation for regular dialysis than females in all SES fifths, with the difference increasing with higher SES. Males in the highest SES fifth were twice as likely to be hospitalised for regular dialysis as females in the same fifth. In contrast, males in the lowest SES fifth were 1.4 times as likely to be hospitalised for regular dialysis as females in the same fifth.

For all SES groups, dialysis hospitalisations increased with increasing age, however the peak age did differ a little across SES groups. The highest hospitalisations rate was recorded in the 75–79 year age group among those in the lowest SES fifth, while the rate peaked in the 80–84 year age group for people in the highest SES fifth.



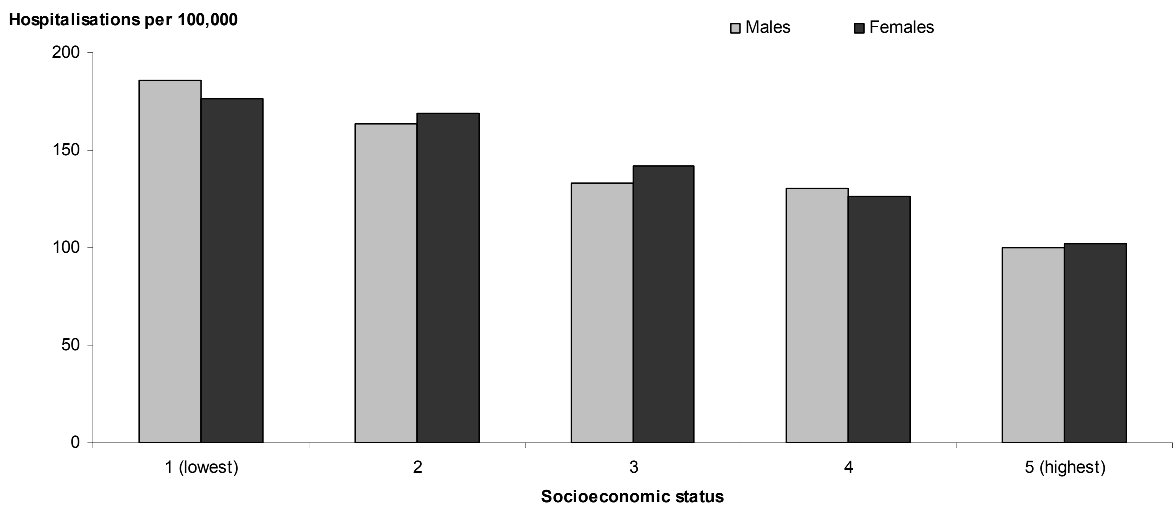
Note: Directly age-standardised to the 2001 Australian population.

Source: AIHW National Morbidity Database.

Figure 5.8: Regular dialysis hospitalisations, by SES and sex, 2007–08

CKD as the principal diagnosis (excluding regular dialysis)

In 2007–08, hospitalisations with CKD as a principal diagnosis increased with lower SES, however there was very little difference between those in the 3rd and 4th fifths (Figure 5.9). The rate of hospitalisation among people in the lowest SES fifth was 1.8 times as high as for those in the highest fifth. For all SES groups, hospitalisation rates increased with age and there was little difference in hospitalisation rates between males and females.



Note: Directly age-standardised to the 2001 Australian population

Source: AIHW National Morbidity Database

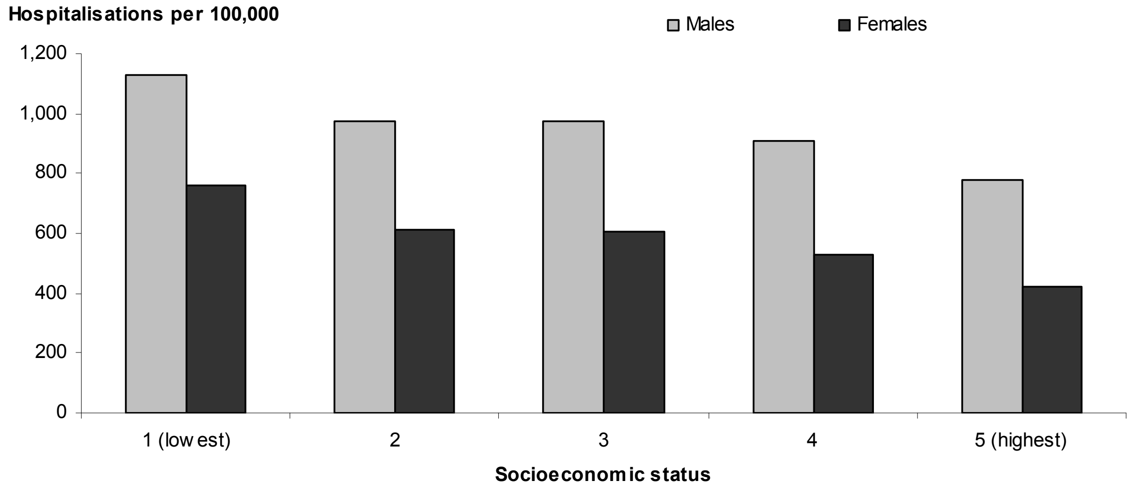
Figure 5.9: Hospitalisations with CKD as the principal diagnosis, by SES and sex, 2007–08

CKD as an additional diagnosis

In 2007–08, hospitalisations for CKD as an additional diagnosis increased with decreasing SES, however there was no difference between the 2nd and 3rd fifths (Figure 5.10). The rate of hospitalisation among people in the lowest SES fifth was 1.6 times as high as people in highest SES fifth. This difference was more marked between females, with those in the lowest SES fifth being hospitalised at 1.8 times the rate of those in the highest SES fifth.

Males had higher rates of hospitalisation for CKD as an additional diagnosis than females in all SES fifths, with greater differences seen between the sexes with higher SES. Males in the highest SES fifth were 1.8 times as likely to be hospitalised as females in the same fifth, whereas males in the lowest SES fifth were 1.5 times as likely to be hospitalised as females in the same fifth.

For all SES fifths, hospitalisation rates for CKD as an additional diagnosis increased with age.



Note: Directly age-standardised to the 2001 Australian population

Source: AIHW National Morbidity Database

Figure 5.10: Hospitalisations where CKD was an additional diagnosis, by SES and sex, 2007–08.

Region of birth

In Australia in 2007, 25% of the total population was born overseas. Data on ethnicity is not commonly collected in Australian health databases, and so region of birth has been used as a proxy for ethnicity in this section. An important consideration is that results for country of birth hospitalisations may not completely represent the effect of ethnicity on the diagnosis and hospitalisation for CKD. It is likely that people who have migrated or travelled to Australia and have CKD may have different characteristics than people in their original country who also have CKD. People born overseas but treated in Australia may be healthier due to health requirements prescribed in migration law, or be of different socioeconomic backgrounds for them to be able to travel (AIHW: O'Brien et al. 2006).

In general, people born in Oceania and Antarctica, Southern and Eastern Europe and Africa and the Middle East were more likely than those born in Australia to be hospitalised for any of the three types of CKD hospitalisations, and these differences were more pronounced for males than females (Table 5.5 and Figure 5.11).

Table 5.5: Hospitalisations for CKD, by region of birth and sex, 2005–06 to 2007–08

	Number of hospitalisations			Standardised hospitalisation ratio[(a)]		
Region of birth	**Dialysis**	**Principal diagnosis**	**Additional diagnosis**	**Dialysis**	**Principal diagnosis**	**Additional diagnosis**
			Males			
Australian born	1,008,358	29,595	172,864	1.0	1.0	1.0
All overseas born[(b)]	657,644	13,419	94,153	1.2	1.0	1.0
Oceania and Antarctica	*70,509*	*1,618*	*7,032*	*1.8*	*1.5*	*1.3*
North-West Europe	*167,414*	*4,149*	*32,875*	*0.8*	*0.8*	*0.9*
Southern and Eastern Europe	*243,745*	*3,751*	*34,991*	*1.7*	*1.1*	*1.2*
Africa and Middle East	*65,927*	*1,386*	*7,889*	*1.6*	*1.3*	*1.3*
Asia	*99,919*	*2,229*	*9,642*	*1.1*	*0.9*	*0.8*
The Americas	*9,592*	*282*	*1,671*	*0.6*	*0.7*	*0.8*
			Females			
Australian born	781,968	33,544	140,779	1.0	1.0	1.0
All overseas born[(b)]	356,540	12,626	62,071	0.9	1.0	1.0
Oceania and Antarctica	*43,872*	*1,479*	*4,928*	*1.5*	*1.2*	*1.3*
North-West Europe	*91,101*	*3,891*	*22,193*	*0.6*	*0.9*	*0.9*
Southern and Eastern Europe	*103,249*	*2,610*	*20,051*	*1.1*	*0.9*	*1.1*
Africa and Middle East	*31,869*	*1,206*	*4,791*	*1.2*	*1.1*	*1.2*
Asia	*80,384*	*2,997*	*8,924*	*1.1*	*0.9*	*0.8*
The Americas	*5,827*	*439*	*1,165*	*0.5*	*0.9*	*0.6*

(a) Indirectly age-standardised to the 2005–06 to 2007–08 Australian-born population.

(b) Includes countries that were not able to be allocated to a region of birth.

Source: AIHW National Hospital Morbidity Database.

Regular dialysis as the principal diagnosis

Between 2005–06 and 2007–08, 36% of hospitalisations where the principal diagnosis was regular dialysis were for people born overseas. During this period, people born in all regions other than North-West Europe and The Americas were more likely to be hospitalised for dialysis than their Australian-born counterparts (Figure 5.11). The greatest differences were for those born in the Oceania and Antarctica region and The Americas, who were 1.7 times and half as likely as those born in Australia to be hospitalised for regular dialysis respectively.

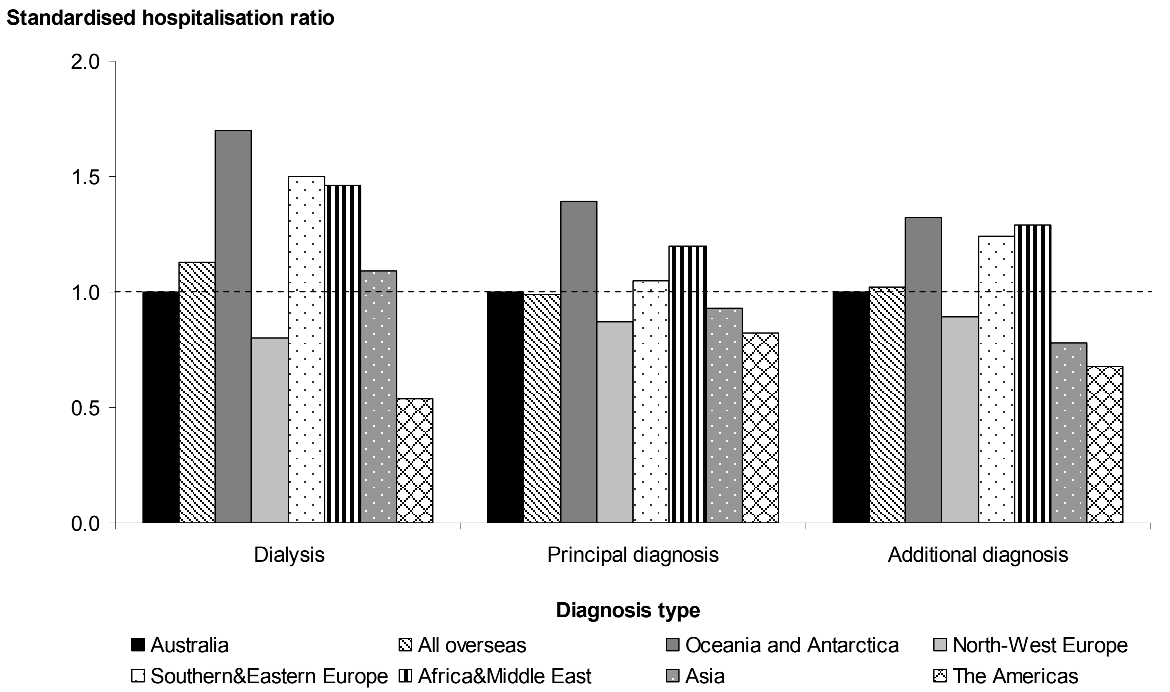
CKD as the principal diagnosis (excluding regular dialysis)

Between 2005–06 and 2007–08, 29% of hospitalisations in Australia where CKD was the principal diagnosis were for people born overseas. Over this period, those born in Oceania and Antarctica, and Africa and the Middle East were more likely to be hospitalised with CKD as the principal diagnosis than those born in Australia (Figure 5.11).

There was no difference by region of birth in the proportion of hospitalisations for CKD as the principal diagnosis recording one or more procedures.

CKD as an additional diagnosis

Between 2005–06 and 2007–08, people born in Oceania and Antarctica, Southern and Eastern Europe and Africa and the Middle East were all more likely to be hospitalised with CKD as an additional diagnosis than people born in Australia (Figure 5.11).



Note: Indirectly age-standardised to the 2005–06 to 2007–08 Australian born population.

Source: AIHW National Hospital Morbidity Database.

Figure 5.11: Chronic kidney disease hospitalisations by region of birth, 2005–06 to 2007–08

6 Discussion

Chronic kidney disease (CKD) was a contributing factor in 15% of all hospitalisations in Australia in 2007–08. Regular dialysis is the most common reason for hospitalisation in Australia and this accounted for 12.5% of all hospitalisations and 3.9% of all bed days in 2007–08. Of all CKD admissions, 83% were for regular dialysis and 17% were for other CKD diagnoses (principal or additional). After regular dialysis, CKD was most likely to be recorded as an additional diagnosis—that is, where CKD co-existed with one or more other conditions and was not the principal cause for hospitalisation.

Analysis of time-trend data between 2000–01 and 2007–08 showed increases in the hospitalisation numbers and rates for all types of CKD admissions, most notably for regular dialysis. Over this period, the number of hospitalisations for regular dialysis increased by 71% (an average of nearly 60,000 per year), while the age-standardised rate increased by 50%.

CKD is a highly interactive disease, having direct and indirect causal relationships with both diabetes and cardiovascular diseases. Diabetic nephropathy was the second most common principal diagnosis for CKD hospitalisations (20% of hospitalisations), and diabetes was the principal diagnosis for 6% of hospitalisations where CKD was an additional diagnosis. Between 2000–01 and 2007–08, hospitalisation rates for diabetic nephropathy increased by 76%. The number of new cases of treated ESKD attributed to diabetic nephropathy is also increasing among older patients and this reflects the increase of Type 2 diabetes in the community.

Males had higher rates of hospitalisation for regular dialysis than females, which reflect the higher rates of CKD among males, and this difference increased over the 8-year period 2000–01 to 2007–08. This difference was seen in all age groups and all states and territories except the NT, where females had higher rates of hospitalisations for regular dialysis and other CKD principal diagnoses. Previous studies on CKD in the NT found that the female Aboriginal and Torres Strait Islander population contributes to these higher rates—within the non-Indigenous population males have higher rates than females (Spencer et al. 1998).

Males also had higher rates of hospitalisation than females where CKD was an additional diagnosis. Rates were higher for males in all diagnosis groups except kidney tubulo-interstitial diseases, and across all states and territories. Where CKD was the principal diagnosis (excluding regular dialysis) there was no difference between male and female hospitalisation rates overall. However, males had higher rates in older age groups and females had higher rates in some of the younger age groups. Again males had the highest rates for all diagnosis groups except kidney tubulo-interstitial diseases, where females were hospitalised at 5 times the rate of males.

There are a number of contributing factors to the disparity in hospitalisation rates between males and females. Males have higher rates of some CKD risk factors including overweight and obesity, cardiovascular disease and diabetes. After adjusting for age, males are treated for ESKD (dialysis or transplant) at 1.6 times the rate of women, and are 1.7 times as likely to have CKD listed as a cause of death. It is also thought that CKD progression may be associated with gender-based biological differences that affect functions such as blood pressure and hormone regulation. Women may not progress to ESKD as rapidly as males due to oestrogens reducing the cardiovascular stress response to kidney damage, perhaps explaining why more males require dialysis (Norris & Nissenson 2008). However, many other behavioural, environmental and social factors may also contribute to these differences.

Hospitalisation rates for CKD increased with age for males and females for most CKD diagnoses. This is unsurprising as CKD is a chronic disease that primarily affects the elderly (Levey et al. 2009). The United States Renal Data System's 2009 Annual Data Report also shows that age is strongly associated with CKD hospitalisations (US Renal Data System 2009). The study of United States Medicare patients aged 65 years and older illustrated the significant upward trend in CKD hospitalisations with increasing age. The study also examined data from large employer-run private health plans, thus giving an indication of CKD in the younger, working-age groups in comparison with the older Medicare patients. This comparison showed that the hospitalisation rate for Medicare patients was 1.5 times greater than the younger group (US Renal Data System 2009). It has also been suggested the CKD may be affected by age not only because of age itself but because of the high prevalence of comorbidities in elderly people (Iseki 2005).

Analysis of different population groups has highlighted some differences in hospitalisation rates for CKD. These reflect not only the underlying disease rates—associated with behavioural, biological, environmental and sociocultural factors, and combinations of any of these—but also access to, and use of, health care services.

This report provides further evidence to add to the findings from many previous studies which show that Aboriginal and Torres Strait Islander peoples have higher rates of CKD compared to other Australians. Indigenous Australians were hospitalised at 11 times the rate of other Australians for dialysis and 5 times the rate for CKD as a principal or additional diagnosis. This is most likely due to a combination of factors, including environmental health determinants such as geographical location and SES (Haysom et al. 2007). This situation is similar to overseas indigenous populations in Canada and New Zealand, where indigenous people have overall poorer health, higher rates of CKD and limited access to services (Tareen et al. 2005; Yeates et al. 2009).

It is known that people living in rural and remote areas of Australia have poorer health than those in the major cities and regional areas. This was evident for males and females for hospitalisations for dialysis and CKD as a principal or additional diagnosis. It has also been observed in other studies carried out in Australia, where a significant gradient in CKD incidence rates was found between urban and rural locations (Cass et al. 2001b).

Previous studies have found that SES is also a well-established factor in health, and this report confirms those findings. Hospitalisation rates for CKD—dialysis, principal and additional diagnoses—all increased with decreasing SES. In 2007–08, the fifth of the population with the lowest SES had hospitalisation rates for CKD 1.6 to 2 times as high as the fifth with the highest SES. It is believed the excess burden of CKD in lower SES groups is due to environmental and infectious causes, access to services and sociocultural differences, which may also lead to an increase in comorbidities (White et al. 2008; Norris & Nissenson 2008).

A large proportion of the Australian population is born overseas and people from different regions of birth have different hospitalisation rates for CKD. Some are lower, but many are higher. Overall, people born in Oceania and Antarctica, Southern and Eastern Europe and Africa and the Middle East now living in Australia were more likely to be hospitalised for CKD. Previous studies provide evidence for this claim, stating that one-third of the non-Indigenous population with CKD are from overseas origins (Stewart et al. 2004).

It is likely that the population groups discussed above overlap, which can further impact on the health profile of these groups. For example, in 2006, Aboriginal and Torres Strait Islander peoples made up 25–28% of the total population in *Remote* and V*ery remote* areas and Indigenous people in the labour force were 3 times more likely than non-Indigenous people to be unemployed (ABS & AIHW 2008).

Conclusion

This report is the first to provide detailed hospital data for CKD in Australia. The data were analysed to investigate differences in CKD hospitalisations for age and sex in all states and territories and a range of population groups, including Indigenous Australians, geographical location, socioeconomic status and region of birth.

It is important to note that hospital data presented in this report refer to episodes of admitted care, which can be a whole hospital stay, or a part of a hospital stay that begins or ends with a change in the type of care. The same patient can have multiple hospitalisations within the same period, and therefore individual patients may be represented by more than one episode of care. For this reason the data do not represent the number or proportion of people in Australia with CKD admitted to hospital, but rather health service usage by those with CKD.

Despite this, it is clear that CKD contributes substantially to the morbidity burden in Australia, particularly since dialysis is the most common diagnosis of all hospitalisations in Australian hospitals. Of particular interest are the higher rates of hospitalisation among Indigenous Australians, those of low socioeconomic status and those born in certain overseas regions.

A major finding of this report is the increase in CKD hospitalisations over time. This—coupled with the knowledge that CKD is strongly related to increasing age, and Australia's population is ageing—indicates that CKD will continue to contribute a significant burden to Australia's health and health-care system into the future.

Appendix 1

Table A1.1: Hospitalisations for CKD, Australia, 2000–01 to 2007–08

State/territory	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	% change
Dialysis									
Number	582,445	633,422	692,365	759,272	811,493	884,466	933,772	986,825	71*
Rate	3,031.2	3,231.2	3,463.5	3,725.1	3,902.2	4,167.0	4,302.1	4,444.9	48*
Other CKD principal diagnosis									
Number	24,080	24,842	26,812	25,654	27,132	28,770	29,943	30,703	27*
Rate	125.2	126.8	134.5	126.7	131.6	136.8	139.6	140.1	12*
CKD additional diagnosis									
Number	99,371	102,301	110,812	122,490	142,220	145,889	157,821	167,596	74*
Rate	518.3	519.9	550.1	594.7	674.6	674.9	711.4	735.1	47*

* Represents results with statistically significant increases over the period 2000–01 to 2007–08.

Note: Rates directly age-standardised to the 2001 Australian Population.

Source: AIHW National Hospital Morbidity Database.

Table A1.2: Hospitalisations for CKD, New South Wales, 2000–01 to 2007–08

State/territory	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	% change
Dialysis									
Number	156,774	168,652	183,148	197,259	210,560	237,643	257,111	272,986	76*
Rate	2,343.2	2,480.7	2,659.0	2,826.0	2,972.0	3,304.4	3,509.8	3,658.4	58*
Other CKD principal diagnosis									
Number	7,771	7,679	9,398	8,749	8,984	9,070	9,843	9,910	27*
Rate	117.1	114.1	137.9	127.1	129.0	128.3	136.5	135.4	15*
CKD additional diagnosis									
Number	32,069	32,156	33,729	38,995	51,810	46,803	50,078	50,819	71*
Rate	476.3	467.3	481.4	547.3	711.7	630.0	658.6	652.0	49*

* Represents results with statistically significant increases over the period 2000–01 to 2007–08.

Note: Rates directly age-standardised to the 2001 Australian Population.

Source: AIHW National Hospital Morbidity Database.

Table A1.3: Hospitalisations for CKD, Victoria, 2000–01 to 2007–08

State/territory	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	% change
Dialysis									
Number	173,216	183,066	197,507	218,958	229,922	246,062	263,209	273,222	60*
Rate	3,585.8	3,720.4	3,940.3	4,289.6	4,412.1	4,622.3	4,838.8	4,912.9	40*
Other CKD principal diagnosis									
Number	6,310	7,073	6,642	6,238	6,805	7,356	7,422	7,730	19*
Rate	131.1	144.2	133.1	123.3	132.4	140.2	138.6	141.5	5
CKD additional diagnosis									
Number	23,961	26,758	30,357	31,679	35,843	39,192	42,495	45,808	91*
Rate	492.4	536.1	594.9	607.2	671.2	714.7	754.7	791.8	61*

* Represents results with statistically significant increases over the period 2000–01 to 2007–08.

Note: Rates directly age-standardised to the 2001 Australian Population.

Source: AIHW National Hospital Morbidity Database.

Table A1.4: Hospitalisations for CKD, Queensland, 2000–01 to 2007–08

State/territory	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	% change
Dialysis									
Number	100,426	108,272	123,834	138,674	149,874	163,218	170,657	176,766	81*
Rate	2,900.1	3,034.1	3,356.3	3,649.5	3,834.7	4,053.9	4,119.8	4,146.5	47*
Other CKD principal diagnosis									
Number	4,590	4,546	4,799	4,590	4,996	5,507	5,463	5,963	30*
Rate	130.7	126.0	129.4	120.2	127.0	136.4	132.2	140.3	8
CKD additional diagnosis									
Number	19,010	19,160	20,192	23,440	25,068	26,565	30,010	33,893	79*
Rate	560.2	546.6	555.9	623.9	647.0	665.3	727.4	796.7	43*

* Represents results with statistically significant increases over the period 2000–01 to 2007–08.

Note: Rates directly age-standardised to the 2001 Australian Population.

Source: AIHW National Hospital Morbidity Database.

Table A1.5: Hospitalisations for CKD, Western Australia, 2000–01 to 2007–08

State/territory	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	% change
Dialysis									
Number	64,652	73,366	80,308	88,745	98,669	101,587	102,475	114,441	73*
Rate	3,626.6	4,002.3	4,296.1	4,643.2	5,029.2	5,044.3	4,925.2	5,322.9	44*
Other CKD principal diagnosis									
Number	2,378	2,178	2,465	2,515	2,599	2,968	3,046	3,039	37*
Rate	130.8	117.6	130.7	130.5	131.4	146.9	147.4	141.8	18*
CKD additional diagnosis									
Number	9,471	9,036	9,514	10,770	12,074	13,851	14,308	15,075	70*
Rate	551.4	512.4	524.6	578.2	627.7	700.3	700.4	712.7	40*

* Represents results with statistically significant increases over the period 2000–01 to 2007–08.

Note: Rates directly age-standardised to the 2001 Australian Population.

Source: AIHW National Hospital Morbidity Database.

Table A1.6: Hospitalisations for CKD, South Australia, 2000–01 to 2007–08

State/territory	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	% change
Dialysis									
Number	46,581	51,893	54,821	59,295	63,604	70,530	71,479	74,734	62*
Rate	2,904.2	3,186.8	3,323.8	3,545.7	3,758.1	4,085.0	4,036.2	4,154.4	44*
Other CKD principal diagnosis									
Number	1,833	2,007	2,058	2,069	2,114	2,046	2,185	2,234	17*
Rate	116.3	124.9	126.0	126.7	127.2	121.5	129.1	131.1	8*
CKD additional diagnosis									
Number	9,255	9,659	10,655	11,173	10,600	11,750	12,619	13,519	43*
Rate	548.7	560.7	608.1	623.1	580.9	630.3	666.1	697.3	24*

* Represents results with statistically significant increases over the period 2000–01 to 2007–08.

Note: Rates directly age-standardised to the 2001 Australian Population.

Source: AIHW National Hospital Morbidity Database.

Table A1.7: Hospitalisations for CKD, Tasmania, 2000–01 to 2007–08

State/territory	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	% change
Dialysis									
Number	9,974	12,440	13,264	12,727	11,461	12,441	13,217	13,806	23*
Rate	2,030.9	2,511.8	2,618.1	2,433.5	2,164.3	2,321.1	2,405.8	2,476.8	6
Other CKD principal diagnosis									
Number	452	580	643	553	579	647	570	623	22
Rate	93.0	120.1	129.5	109.7	112.0	123.8	107.1	117.2	8
CKD additional diagnosis									
Number	2,192	2,221	2,369	2,285	2,239	2,403	2,652	2,655	21*
Rate	440.3	438.4	457.4	434.4	411.4	432.8	466.3	458.8	3

* Represents results with statistically significant increases over the period 2000–01 to 2007–08.

Note: Rates directly age-standardised to the 2001 Australian Population.

Source: AIHW National Hospital Morbidity Database.

Table A1.8: Hospitalisations for CKD, Australian Capital Territory, 2000–01 to 2007–08

State/territory	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	% change
Dialysis									
Number	11,944	13,167	14,610	15,872	15,787	17,851	20,071	21,393	77*
Rate	4,283.5	4,674.2	5,114.3	5,567.7	5,445.7	6,048.2	6,692.3	7,019.9	62*
Other CKD principal diagnosis									
Number	337	373	361	409	450	525	591	578	82*
Rate	119.3	128.8	124.0	138.8	150.6	173.4	190.6	187.8	66*
CKD additional diagnosis									
Number	1,649	1,480	1,610	1,719	1,733	2,152	2,241	2,259	49*
Rate	646.5	568.6	613.5	642.5	633.1	763.2	780.0	765.0	30*

* Represents results with statistically significant increases over the period 2000–01 to 2007–08.

Note: Rates directly age-standardised to the 2001 Australian Population.

Source: AIHW National Hospital Morbidity Database.

Table A1.9: Hospitalisations for CKD, Northern Territory, 2000–01 to 2007–08

State/territory	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	% change
Dialysis									
Number	18,878	22,566	24,873	27,742	31,616	35,134	35,553	39,477	108*
Rate	13,702.1	15,988.7	17,191.9	18,664.9	20,536.7	21,651.6	20,661.9	21,806.1	58*
Other CKD principal diagnosis									
Number	409	406	446	531	605	651	823	626	87*
Rate	269.4	248.3	268.9	296.2	343.3	362.5	448.3	332.0	55*
CKD additional diagnosis									
Number	1,586	1,686	2,210	2,273	2,689	2,993	3,230	3,377	121*
Rate	1,261.1	1,291.2	1,761.2	1,804.2	2,075.0	2,226.7	2,355.9	2,366.6	97*

* Represents results with statistically significant increases over the period 2000–01 to 2007–08.

Note: Rates directly age-standardised to the 2001 Australian Population.

Source: AIHW National Hospital Morbidity Database.

Appendix 2

Methods

The data in this report were extracted from the AIHW National Hospital Morbidity Database (NHMD) in July 2009 and small changes may have occurred since this time.

ICD-10 codes used

Table A2.1: ICD-10 and ICD-10-AM 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	
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	N18
Unspecified kidney failure	N19
Other disorders of kidney and ureter	N25–N28, N391, N392
Congenital malformations	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*

* These codes are used for identification of CKD in hospital morbidity data only. There are also some codes (E85.1, D59.3, B52.0) used to identify CKD in mortality data only.

Age-standardised hospitalisation 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 geographic areas and/or different population groups. Definitions are included in the *National health data dictionary* (AIHW: 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, except in the case of the geographic location and overseas-born population groups, where indirect age-standardisation has been used to compare between groups.

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 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 2007–08 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 85+. 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.

Indirect age-standardisation

In situations where populations are small or where there is some uncertainty about the stability of age-specific rates, indirect standardisation has been used. This effectively removes the influence of the age structure, but does not provide a measure of prevalence in terms of a rate. Rather, the summary measure is a comparison of the number of observed cases compared to the number expected if the age-specific prevalence rates of the standard population are applied to the study population. The method used for this calculation entails three steps:

Step 1: Calculate the age-specific rates for each age group in the standard population.

Step 2: Apply these age-specific rates to the number in each age group of the study population and sum to derive the total expected number of cases for the study population.

Step 3: Sum the observed cases in the study population and divide this number by the expected number derived in Step 2 to calculate the Standardised Hospitalisation Ratio.

A standardised hospitalisation ratio of 1.0 indicates the same number of observed cases as was expected (suggesting rates in the study and standard populations are similar). A result greater than 1.0 indicates more cases than expected. A result less than 1.0 indicates fewer cases than expected. In this report, the indirect method has been used for two population groups to compare hospitalisation rates. It has been used to compare between people born overseas and people born in Australia, using the Australian-born population as the standard. It has also been used to compare between people living in *Major cities* and other geographic locations, using the *Major cites* population as the standard.

Significance testing

The observed value of a rate may vary due to chance even where there is no variation in the underlying value of the rate. Therefore, where indicators include a comparison between males and females, states and population groups, a 95% confidence interval has been calculated (Box A2.1). In this report, where a comment has been made stating there is a difference between groups, the 95% confidence intervals do not overlap.

Box A2.1: Formulae for calculating standard errors and 95% confidence intervals

For direct standardised rates:

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

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

For indirect standardised rates:

$$SE\ (Ratio) = \sqrt{\left[\sum r_i / [\ \sum (n_i P_i)\ ]^2\right]}$$

95% confidence

for p' (ASR or Ratio) as $p' \pm (1.96 \times SE(ASR))$.

$_i$ = 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

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.

Methods specific to population groups

States and territories

State and territory analysis has been based on the state of the hospital where the hospitalisation occurred, not the state of residence of the person hospitalised. However the denominator populations used to calculate rates are based on the population of the jurisdiction. This can lead to overinflated rates in jurisdictions were a significant amount of services are provided to out-of-jurisdiction residents, such as occurs in the ACT.

Table A2.2: Percentage of patients treated who are non-residents, by state/territory, 2007–08

	Principal diagnosis			
State/territory	Regular dialysis	Other CKD	Additional diagnosis	All CKD hospitalisations
NSW	1.1	2.9	1.6	**1.2**
Vic	1.7	2.3	1.7	**1.7**
Qld	2.5	2.6	2.8	**2.5**
WA	0.2	0.8	0.4	**0.2**
SA	0.5	4.8	2.3	**0.9**
Tas	1.6	1.3	0.7	**1.4**
ACT	27.0	33.7	26.3	**27.1**
NT	9.6	11.0	9.4	**9.6**

Source: AIHW National Hospital Morbidity Database.

Aboriginal and Torres Strait Islander peoples

Analysis of hospitalisations for Aboriginal and Torres Strait Islander peoples was restricted to hospitals in New South Wales, Victoria, Queensland, Western Australia, South Australia and public hospitals in the Northern Territory only, due to data quality issues related to Indigenous identification. Hospitalisations where Indigenous status was missing or unknown were amalgamated with those identifying as non-Indigenous Australians or 'other' Australians.

Geographic region

Analysis by geographical location was based on the Australian Standard Geographical Classification Remoteness Structure (ASGC), categorised as *Major cities*, *Inner regional*, *Outer regional*, *Remote* and *Very remote*. This classification determines the remoteness of an area in Australia by assessing the average Accessibility/Remoteness Index of Australia (ARIA) index value. Hospitalisations for which geographical area was not stated, or that were classed as migratory or offshore, have not been included in the analysis. Hospitalisations are categorised based on the usual residence of the person hospitalised.

Socioeconomic status (SES)

Analysis of CKD hospitalisations by SES is based on the Index of Disadvantage from the Socio-Economic Indexes for Areas 2007 (SEIFA 2007). These were grouped into quintiles—the first representing the most disadvantaged areas and the fifth representing the least disadvantaged areas. Hospitalisations are categorised based on the usual residence of the person hospitalised and those for which no SEIFA is available have not been included in the analysis.

Overseas-born population

Analyses by country of birth are based on the Standard Australian Classification of Countries (SACC) (ABS 2008), and were grouped by seven major regions: Australia, Oceania, North-West Europe, South-East Europe, Africa and the Middle East, Asia and The Americas. Hospitalisations for which country of birth is unknown have not been included in the analysis.

Glossary

Absolute difference (hospitalisation rates)	The hospitalisation rate of one population subtracted by the hospitalisation of another population (e.g. male/female, Indigenous/non-Indigenous).
Age-standardisation	A set of techniques used to remove as far as possible the effects of differences in age when comparing two or more populations.
Hospitalisation rate	The total number of hospitalisations divided by the total number of persons in the population under study.
Hospitalisation rate ratio	Refers to the relative difference between two hospitalisation rates and is the hospitalisation rate for one population divided by the hospitalisation rate of another (e.g. male/female, Indigenous/non-Indigenous).
Length of stay	The length of stay of an overnight patient is calculated by subtracting the date the patient is admitted from the date of separation.
Principal diagnosis	The diagnosis after study to be chiefly responsible for occasioning an episode of admitted patient care.
Procedure	A clinical intervention that is surgical in nature, carries a procedural risk, requires specialised training and/or requires special facilities or equipment available only in the acute care setting.
Relative difference (hospitalisation rates)	The hospitalisation rate for one population divided by the hospitalisation rate of another (e.g. male/female, Indigenous/non-Indigenous).
Remoteness area	A classification of the remoteness of a location using the Australian Standard Geographical Classification Remoteness Structure, based on the Accessibility/Remoteness Index of Australia (ARIA), which measures the remoteness of a point based on the physical road distance to the nearest urban centre. The categories are: *Major cities*, *Inner regional*, *Outer regional*, *Remote*, *Very remote*, *Migratory*.

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