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Incidence of end-stage kidney disease in Australia 1997–2013

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Authoritative information and statistics to promote better health and wellbeing

Incidence of end-stage kidney disease in Australia

1997–2013

Australian Institute of Health and Welfare
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Contents

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
ANZDATA	Australia and New Zealand Dialysis and Transplant Registry
CKD	chronic kidney disease
CVD	cardiovascular disease
ESKD	end-stage kidney disease
eGFR	estimated glomerular filtration rate
ICD-10	International Classification of Diseases, 10th Revision
KRT	kidney replacement therapy
mL	millilitre
m^2	square metre
NDI	National Death Index
NMD	National Mortality Database

Symbols

. .	not applicable

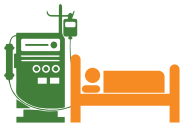
Summary

End-stage kidney disease (ESKD) is the most severe form of chronic kidney disease, where kidney function deteriorates to the extent that kidney replacement therapy (KRT) in the form of dialysis or kidney transplantation is required to survive. This report estimates the total number of new cases (incidence) of ESKD in Australia, including cases treated with KRT and those not receiving these treatments.

The total incidence of ESKD has been estimated by using data from the Australian and New Zealand Dialysis and Transplant Registry and Australian Institute of Health and Welfare National Mortality Database.

In 2013, the number of new cases of ESKD in Australia was around 5,100, or around 14 cases per day. This equates to an age-adjusted incidence rate of 19 cases per 100,000 population.

A similar number of people with ESKD in 2013 were receiving kidney replacement therapy (KRT-treated) and not receiving these treatments (non-KRT-treated)—around 2,500 each.



While the number of new cases of ESKD (KRT-treated and non-KRT-treated) increased between 1997 and 2013, the ESKD incidence rate for both treatment groups remained relatively stable between 2001 and 2013: an average of 10 cases per 100,000 population per year for both treatment groups over this period.

In 2013, ESKD incidence rates among males were 1.5 times that of females. Overall, this pattern was similar between 1997 and 2013.

The incidence of ESKD increased rapidly with age, with rates highest among those aged 75 and over—almost 4 times the rate as those aged 65–74 in 2013.

In 2009–2013, the incidence rate of ESKD was almost 5 times as high among Indigenous compared with non-Indigenous Australians, with the gap considerably higher for those middle aged—around 12 times as high for those aged 35–64. This reflects the earlier onset of ESKD among Indigenous Australians.

The earlier onset of ESKD among Indigenous Australians compared with non-Indigenous Australians occurs among both treatment groups—on average 10 years earlier for KRT-treated and 18 years earlier for non-KRT-treated.

In 2009–2013, those living in *Remote and very remote* areas of Australia had higher incidence rates of ESKD, with rates twice as high as those in *Major cities*.

In 2009–2013, living in an area with socioeconomic disadvantage was also associated with higher ESKD incidence rates, with rates 1.6 times as high in the lowest compared with the highest socioeconomic areas.

In 2009–2013, there were an estimated 25,700 new cases of ESKD in Australia. Of these, around 80% also died within this period. Common causes of death included cardiovascular disease and diabetes.

1 Introduction

End-stage kidney disease (EKSD) is the most severe form of chronic kidney disease (CKD). CKD itself is defined as the presence of impaired or reduced kidney function for longer than 3 months. It can occur in association with other chronic diseases, particularly vascular disease, or following injury. When a person's kidney function has deteriorated to the extent that KRT is required for an affected person to survive, this is referred to as CKD Stage 5 or ESKD (See Box 1.1) (Kidney Health Australia 2007). Diagnosis of ESKD is often not made until a person has lost most of their kidney function because over 90% of this loss can occur without the occurrence of symptoms. By this stage, a person with ESKD will be dependent on KRT—either dialysis or a kidney transplant (see Box 1.1)—for their survival.

Not all people with ESKD receive KRT. For a person near the end of their life, for example, 'non-KRT related medical management' of the disease, which focuses on providing the best care, quality of life and control of symptoms, may be the more suitable form of patient care (Chandna et al. 1999). Decisions on whether to commence KRT are informed by the health-care team including general practitioner and nephrologist, and take into account people's prognosis, assessments of their anticipated quality of life (with or without dialysis), treatment burdens and the preferences of the patient and their families (Murtagh et al. 2011).

The number of new cases receiving KRT treatment for ESKD has tripled over the last 2 decades, with rates doubling between 1989 and 2009. Further, incidence rates of treated ESKD are projected to increase by nearly 80%—from 11 per 100,000 population in 2009 to 19 per 100,000 population in 2020. The increase is projected to be mainly among patients aged 70 and over. Further, the characteristics of new cases may also be changing over time, in particular the increasing proportion of diabetes among new cases of ESKD—increasing from 48% to 60% between 2010 and 2020 (AIHW 2011a).

These increases are due to a combination of factors, and include growth in and the ageing of the total population, the improved treatment of cardiovascular disease events (resulting in people living longer who have the potential to be diagnosed with ESKD at a later stage in life), changes in treatment propensities and the increased occurrence of Type 2 diabetes (AIHW 2011a, Couchoud & Villar 2013).

The increasing burden of ESKD, in combination with increasing comorbidities and complications, means that access to accurate and reliable estimates of new cases of ESKD each year is critical for the ongoing monitoring and surveillance of ESKD in Australia.

The AIHW routinely uses disease register and mortality data for this purpose. The incidence of treated ESKD can be accurately determined using data from the Australian and New Zealand Dialysis and Transplant Registry (ANZDATA). To enumerate the total number of new cases of ESKD more fully, it is necessary also to count those with ESKD who have not received KRT treatment, through analyses of mortality data (see Chapter 2 for further details on methods).

Few studies have investigated the incidence of KRT-treated and non-KRT-treated ESKD patients together (Perneger et al. 1993; AIHW 2011b). In 2011, AIHW published the first estimates of the total incidence of ESKD in Australia (AIHW 2011b; Sparke et al. 2013). Regular monitoring and reporting on the total incidence of ESKD provides an important foundation for assessing the burden of ESKD in Australia. It also supports service planning,

health policy design and assessment and research into the effectiveness of health initiatives aiming to prevent and effectively manage ESKD in Australia.

Aims of this report

The primary aim of this report is to provide updated estimates and trend information about the total incidence of ESKD in Australia for 1997–2013. It builds on the total ESKD estimates first published in the AIHW report *End-stage kidney disease in Australia: total incidence, 2003–2007* and last updated as a National Healthcare Agreement performance indicator in 2012. The report explores the following questions:

1. What is the total ESKD incidence in Australia and how has it varied over time?
2. Are there differences in KRT-treated and non-KRT-treated populations by demographic, geographical and other population characteristics?
3. What are the causes of death among KRT-treated and non-KRT-treated cases of ESKD?

Structure of this report

The rest of this report is structured as follows:

- Chapter 2 describes the data sources and methods used to estimate the total incidence of ESKD, including the data linkage process.
- Chapter 3 presents estimates of total ESKD incidence by year of occurrence, sex, age and population groups.
- Chapter 4 compares new cases of KRT-treated ESKD with non-KRT-treated ESKD.
- Chapter 5 presents results of the analysis on the causes of death.
- Appendices provide further information on the data sources, methods and detailed statistical tables.

Box 1.1: Terminology used in this report

Associated cause(s) of death: All causes listed on the death certificate, other than the **underlying cause of death**. They include the immediate cause, any intervening causes, and conditions that contributed to the death but were not related to the disease or condition causing the death.

Dialysis: An artificial method of removing waste substances from the blood and regulating levels of circulating chemicals—functions normally performed by the kidneys.

ESKD (CKD stage 5): The most severe form of CKD and requires KRT to survive (defined as eGFR <15 mL/min/1.73 m^2 or on dialysis). Symptoms include nausea, itching skin, restless legs and shortness of breath. Additional common complications include inflammation of the tissue layers surrounding the heart, bleeding in the gastrointestinal tract, altered brain function and structure, and disturbances or structural or functional changes in the peripheral nervous system (Kidney Health Australia 2007, 2012).

Incidence: The number of new cases (of an illness or event, and so on) occurring during a given period. In this report, incidence of ESKD refers to the number of new cases of ESKD from 1 January to 31 December in the year/s being reported.

Incidence rate: The number of new cases (of an illness or event) occurring per 100,000 population during a given period.

International Classification of Diseases and Related Health Problems (ICD): The World Health Organization's internationally accepted classification of death and disease. Causes of death are coded according to the ICD, which is revised periodically. From 1997 onwards, deaths registered in Australia include both the underlying and associated causes of death and are coded according to the 10th revision (ICD-10).

Kidney transplant: A healthy kidney is taken from one person and surgically placed into someone with ESKD. The kidney can come from a live or deceased donor. Transplantation is widely regarded as the preferred treatment for people with ESKD, both by the patients and health-care professionals (Mathew et al. 2005).

KRT-treated cases: Cases of ESKD first receiving dialysis or transplant during 1997–2013. This group will include some cases where individuals commenced KRT treatment, but for various reasons this treatment ceased some time before death.

Mortality data: A broad term to include the 2 national death data sources used in this report: the AIHW National Death Index and the AIHW National Mortality Database, both of which were used in the construction of the combined data set.

Non-KRT-treated cases: Cases identified in the mortality data where the individual is recorded as having died with ESKD but there was no matching record on the Australian and New Zealand Dialysis and Transplant Registry—indicating that the individual did not receive dialysis or transplant during the study period. Note these cases may still have received some form of palliative care or treatment for the management of other conditions.

Total incidence: The sum of new cases of KRT-treated and non-KRT-treated over the study period.

Underlying cause of death: The disease or injury that initiated the train of events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury.

2 Estimating total incidence of ESKD

This chapter describes the method used to estimate total incidence of ESKD, the underlying definitions and the data set used in this report. As this report uses similar methods to ESKD incidence estimates published previously, more detailed description on the methodology and construction of the data set can be found in the 2011 AIHW report *End-stage kidney disease in Australia: total incidence, 2003–2007*.

Data sources and data linkage

The current study uses 2 primary sources of data to create a combined data set from which the total incidence of ESKD in Australia for the years 1997–2013 can be estimated.

The first data source is the Australian and New Zealand Dialysis and Transplant Registry (ANZDATA), which records all cases of KRT-treated ESKD in Australia and New Zealand (but only Australian cases are included in this analysis).

The second source of data is the AIHW National Mortality Database (NMD). This contains information on the causes of death and demographic information for all deaths registered in Australia since 1964. Cause of death data—coded using the International Classification of Diseases and Related Health Problems (ICD)—are used in this report to identify non-KRT-treated cases. This is on the basis that survival for people with ESKD who do not receive dialysis or a transplant can be short. In this report, year of death is used to identify deaths in a particular year (these 2 data sets are described in more detail in Appendix A).

There is overlap between the 2 data sources, as some of the people who commenced KRT will also have died. A third source of data, which is necessary to identify these people present in both data sets, is the AIHW National Death Index (NDI). The NDI is a register of all the deaths that have occurred in Australia since 1980 and contains identifying information (date of birth, name, sex, date of death and postcode). A probabilistic data linkage (Fellegi & Sunter 1969) between ANZDATA records and the NDI was used to identify these people. As a result of this process, KRT-treated deaths already recorded in the ANZDATA could be confirmed and additional deaths—currently not reported to the ANZDATA—could be identified from the NDI (Figure 2.1).

The resulting data set of KRT-treated cases was then restricted to cases that commenced treatment in Australia between 1997 and 2013. For a small number of linked records where demographic information differed between the ANZDATA and AIHW NDI, the ANZDATA information was used because it is regarded as being more accurate.

Following the linkage process, cause of death and demographic information were extracted from the AIHW NMD for the non-KRT-treated deaths, where the date of death occurred between 1997 and 2013. These deaths were selected on the basis of the definition of ESKD specified in Box 2.1. Lastly, these non-KRT-treated deaths were compared against the ANZDATA list of deaths to identify duplicate records.

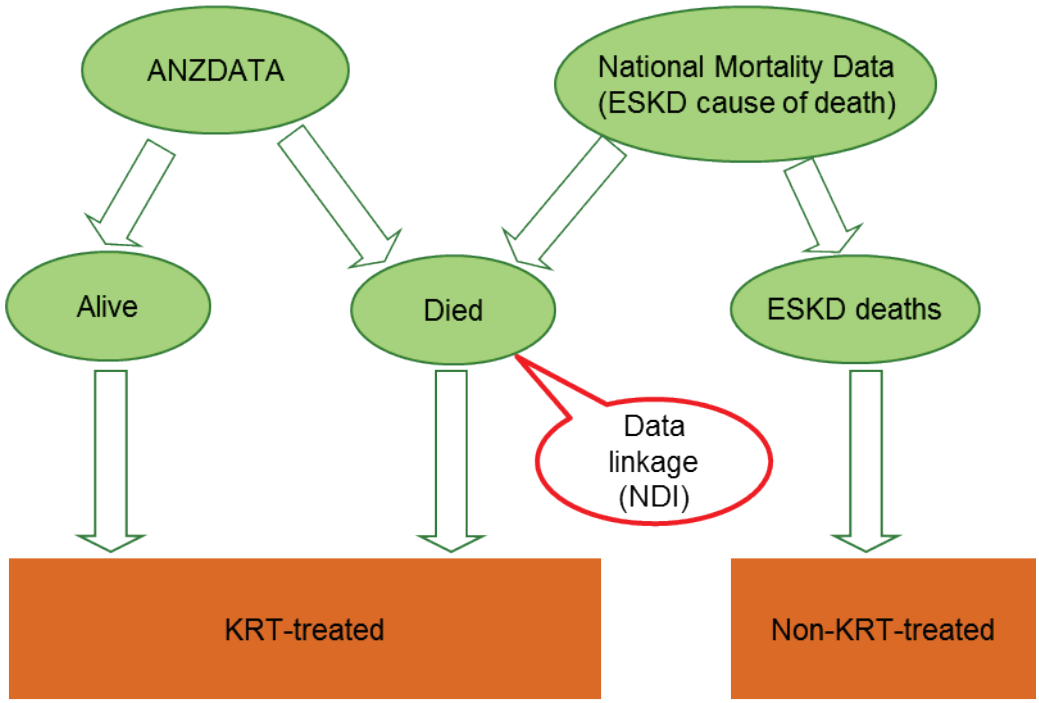


Figure 2.1: Data set construction flowchart

Defining total incidence of ESKD

The definition of the total incidence of ESKD used in this report has been developed in consultation with experts and updated to include the most recent improvements in coding of underlying and associated causes of death for ESKD. The definition of incidence of ESKD is outlined in Box 2.1.

Box 2.1: Standard definition of total incidence of ESKD used in this study

Total incidence of ESKD is:

- the number of individuals who were registered as new cases on the ANZDATA during the study period (KRT-treated—including living and dead patients), plus
- the number of people who died during the study period of an ESKD-related death and were not registered with the ANZDATA (non-KRT-treated). This is a proxy measure for non-KRT-treated cases in the absence of a more appropriate data source, and is at present the best approach given that survival for people with ESKD is assumed to be relatively short for those not receiving KRT.

An ESKD-related death in mortality data is defined as a person who died with:

- chronic kidney failure (ICD-10 codes N18.0, N18.5, N18.8, N18.9), hypertensive kidney failure (ICD-10 codes I12.0, I13.1, I13.2) or unspecified kidney failure (ICD-10 code N19) as the underlying cause of death, or
- chronic kidney failure, end-stage (ICD-10 code N18.0, N18.5) as an associated cause of death.

Description of the data set used in the analysis

Figure 2.2 illustrates the data components and number of ESKD cases identified in the analysis. Between 1997 and 2013, there were just over 75,200 new ESKD cases. Around 36,400 of these were registered on the ANZDATA (KRT-treated) while just fewer than 47,000 were from the AIHW NMD.

Of the 36,400 people registered on the ANZDATA (KRT-treated cases), 52% (19,000) were alive at the end of the analysis period, while the remaining 48% (17,400) had died. Of the 47,000 cases identified from the AIHW NMD, around 83% (39,000) were non-KRT-treated cases.

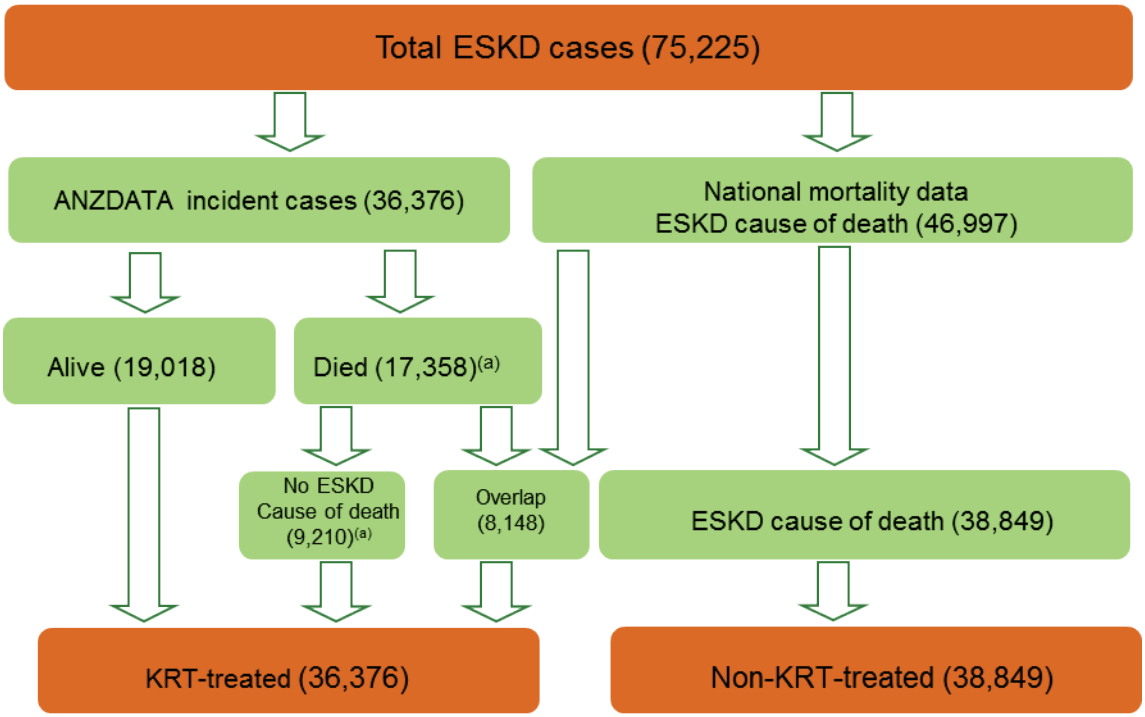
Of the 17,400 ANZDATA registrants who had died, around 47% (8,100) had ESKD recorded as a cause of death on their death certificate (see Box 2.1 for ESKD death definition). These records are presented as the overlap cases found on both data sets. The remaining 53% (9,200) had no ESKD-related cause of death recorded on their death certificate, either as an underlying or an associated cause of death.

In light of the finding that 53% of KRT-treated deaths (based on the ANZDATA) had no ESKD-related cause of death (based on mortality data), it is likely then that the number of non-KRT-treated deaths identified in this study may under-count the number of deaths where ESKD was present as a condition (but not recorded on the death certificate). Other work by the AIHW also found that there was an under-count in deaths from ESKD for WA and NSW, for those hospitalised with this condition (AIHW 2014a). Overall, these factors may lead to an underestimate of the total incidence of ESKD.

There are also factors that may lead to an overestimate of total ESKD incidence. This is because the definition for non-KRT-treated cases, which includes some ESKD associated causes of death, may have selected people who, on a clinical basis, did not require dialysis or transplantation. A sensitivity analysis examined the possible extent of this overestimation and showed that only 6% of the total ESKD incidence was due to ESKD as an associated cause of death (see Appendix A for further details).

Deaths among the ANZDATA cases have been defined as cases with a valid match in the AIHW NDI. Note that only 1.4% (518) deaths recorded on the ANZDATA were not matched to a record in the NDI. It is difficult to determine why these records were not found in the NDI. However, it is possible that some of the individuals may have died overseas or the death may not have been registered in time to be included in the data linkage process.

The combined data set contained 156 deaths of ANZDATA registrants who linked with a NDI record but did not have cause of death information available on the AIHW NMD. Additionally, 81 deaths found on the NDI had not been recorded as deaths on the ANZDATA at the time of data linkage.



(a) Includes 156 cases for which cause of death information was not available at the time of data linkage.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Figure 2.2: Data set components including KRT-treated and non-KRT-treated cases, 1997–2013

Limitations of the study

Australia has led the way in developing the methods used in this report to capture information about the incidence of ESKD. Although the method is well established and provides robust estimates of total incidence of ESKD, based on the ANZDATA and mortality data, there are limitations with these data sets in capturing all cases of ESKD in Australia.

Linking national hospitalisation data on ESKD to the combined ANZDATA-mortality data set has the potential to more completely enumerate ESKD incident cases by including non-KRT-treated ESKD cases among people that are still alive. Further, inclusion of hospital data may assist with assessing disease severity, survival and levels of comorbidity for treated and non-KRT-treated ESKD.

Analysis of the combined ANZDATA-mortality data set provides epidemiological insight into the characteristics of ESKD patients (using the ANZDATA) and mortality outcomes. However, further data linkage (for example, to hospital and primary care data) would provide further insight into care pathways for patients following diagnosis, including information about health-care patterns and possible gaps. Currently, national linkage to hospitalisation data requires considerable ethical and data approvals, resulting in complex and lengthy data linkage processes. However, much progress is being made in this area, with linkage potentially being more routinely available for future projects.

3 Total incidence of ESKD

This chapter reports on the total incidence of ESKD, combining the number of new cases of KRT-treated and non-KRT-treated ESKD. This combined measure provides important information on the burden of ESKD in Australia. In this chapter, the most up-to-date data are presented first, followed by trends for 1997–2013 where possible.

In 2013, there were around 5,100 new cases of ESKD in Australia, or around 14 cases per day. After adjusting for age, the incidence rate of ESKD was 19 per 100,000 population.

Trends

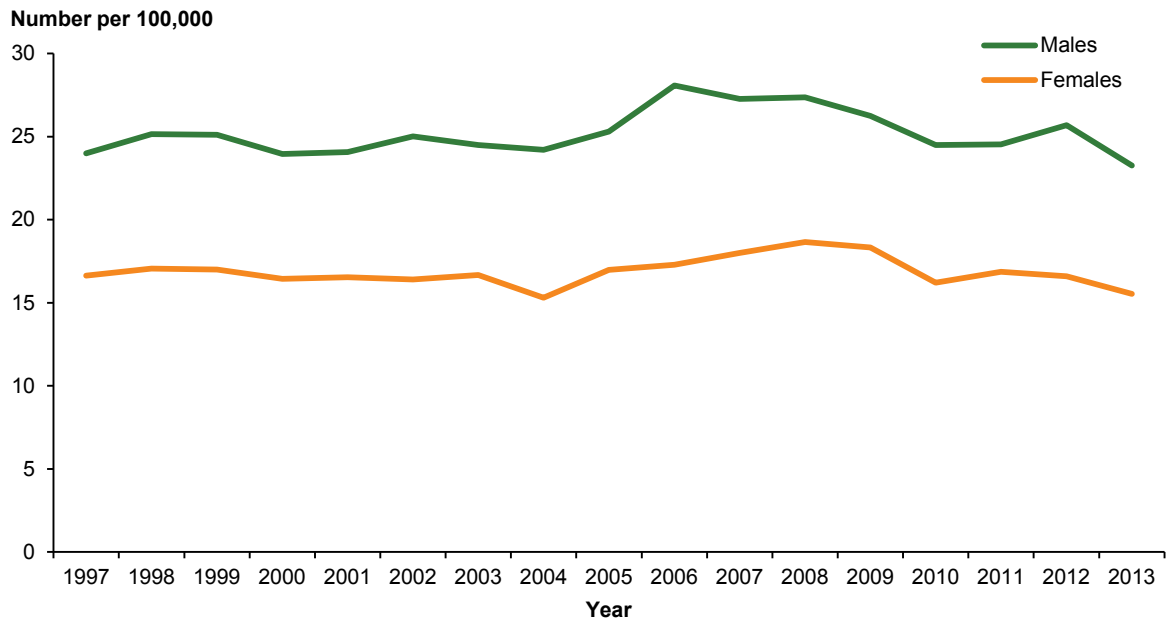
Between 1997 and 2013, there were an estimated 75,200 new cases of ESKD: an average of around 4,400 cases per year (Table B1). There were more cases among males (53% of cases) than females (47%).

The number of new cases of ESKD increased by 51% over this period—from around 3,400 in 1997 to 5,100 in 2013. The rate of increase was higher among males than females (58% and 43%, respectively) (Table B1). The total incidence of ESKD has increased twice as fast as population growth over this period (51% compared with 25%, respectively). This pattern is driven by the high ESKD incidence rates among the population aged 75 and over (as discussed in the next section).

Despite this increase in the number of new ESKD cases, the age-standardised incidence rate of ESKD has remained relatively stable between 1997 and 2013 (an average of 21 cases per 100,000 per year). This overall pattern is largely influenced by age-specific rates in younger age groups (less than 75 years) remaining relatively stable over this period (see Figure 3.2).

Over this period, the ESKD incidence rate among males was consistently higher than that for females—between 1.4 and 1.6 times as high (an average of 25 cases compared with 17 per 100,000 per year, respectively) (Figure 3.1). This pattern of higher incidence rates of ESKD among males may in part be due to higher levels of CKD risk factors, such as smoking, overweight and obesity, and high blood pressure, and higher comorbidity among the male population in Australia (AIHW 2014b).

Given that these trends cover a 17-year time span, it is important to note that during this time, there have been improvements in the diagnosis and treatment of ESKD. For example, around 2005, national pathology technique standardisation, automatic estimated glomerular filtration rate (eGFR) reporting and primary care provider education regarding CKD commenced, and these factors may have had an impact on the results presented here.



Note: Age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B1.

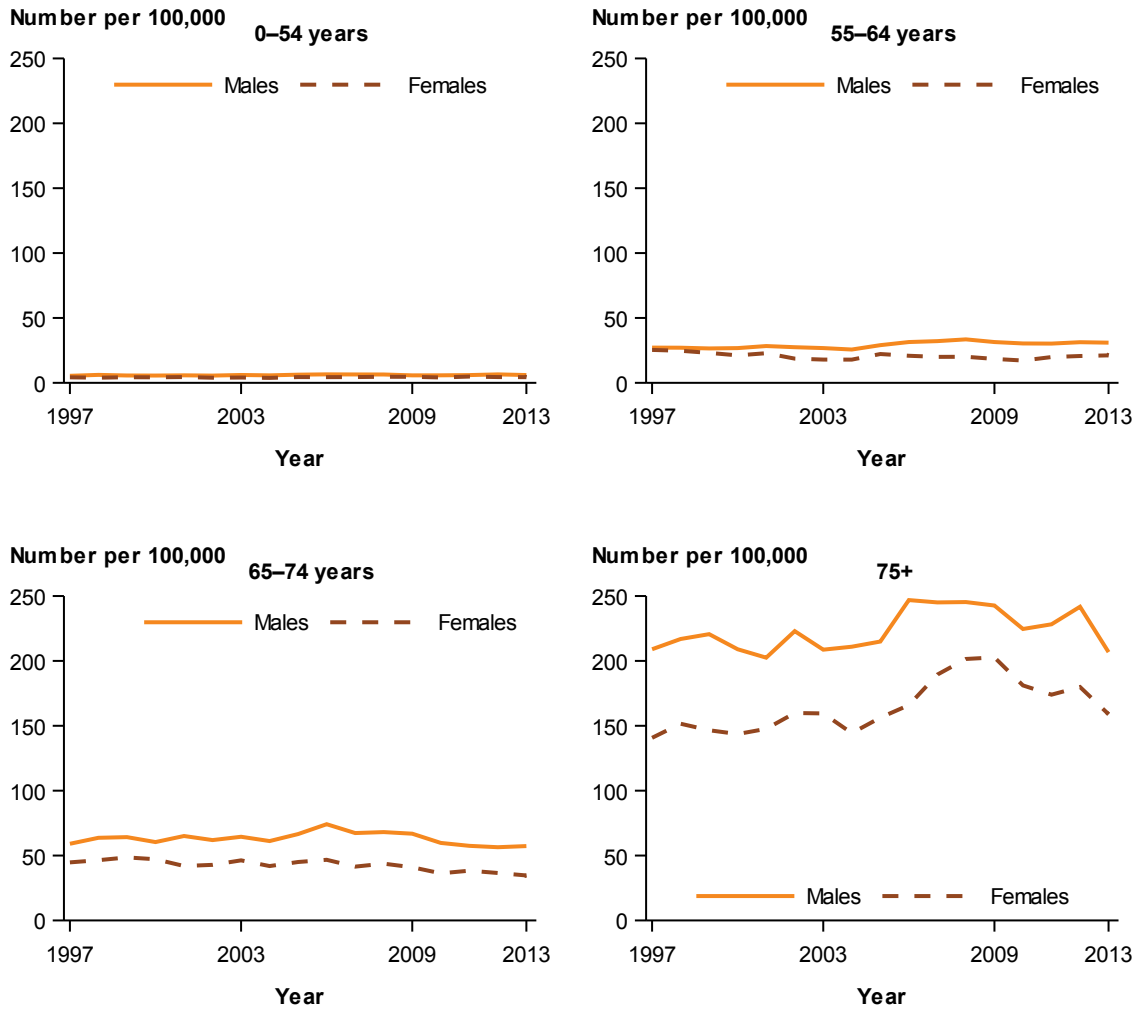
Figure 3.1: Trends in total incidence of ESKD, by sex, 1997–2013

Sex and age

The ESKD incidence rate was higher for males than females across all age groups—overall it was 1.5 times as high among males in 2013 (23 and 16 per 100,000, respectively) (Figure 3.1). This pattern may reflect the higher levels of CKD risk factors and comorbidity among males, as described earlier.

The total incidence rate of ESKD increased with age for both males and females. In 2013, the rate of ESKD was highest among those aged 75 and over, and was almost 4 and 7 times as high as for those aged 65–74 and 55–64, respectively (179 compared with 46 and 26 per 100,000, respectively).

Between 1997 and 2013, the total incidence of ESKD among those aged 75 and over increased faster than population growth (68% and 56%, respectively), reflecting increasing longevity and high levels ESKD and comorbidity in this age group. However, for younger age groups (aged 0–74), the age-specific incidence rate remained relatively stable over this period (Figure 3.2).



Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B2.

Figure 3.2: Total incidence of ESKD, by age and sex, 1997–2013

Population groups

The following section presents data for 5 years combined (2009–2013). This is to ensure statistical validity where the number of events is low due to small populations. Further, the remoteness and socioeconomic disadvantage categories used in this report were derived from the 2011 Census, and reporting on years too far removed from a Census year decreases robustness of estimates (see Appendix A for more information on methods and definitions).

Aboriginal and Torres Strait Islander people

In 2009–2013, there were around 1,400 new cases of ESKD among Aboriginal and Torres Strait Islander people compared with about 16,400 among the non-Indigenous population (Table B3)—in the five jurisdictions (New South Wales, Queensland, Western Australia, South Australia, and the Northern Territory) with sufficient data quality (for more information see Appendix A).

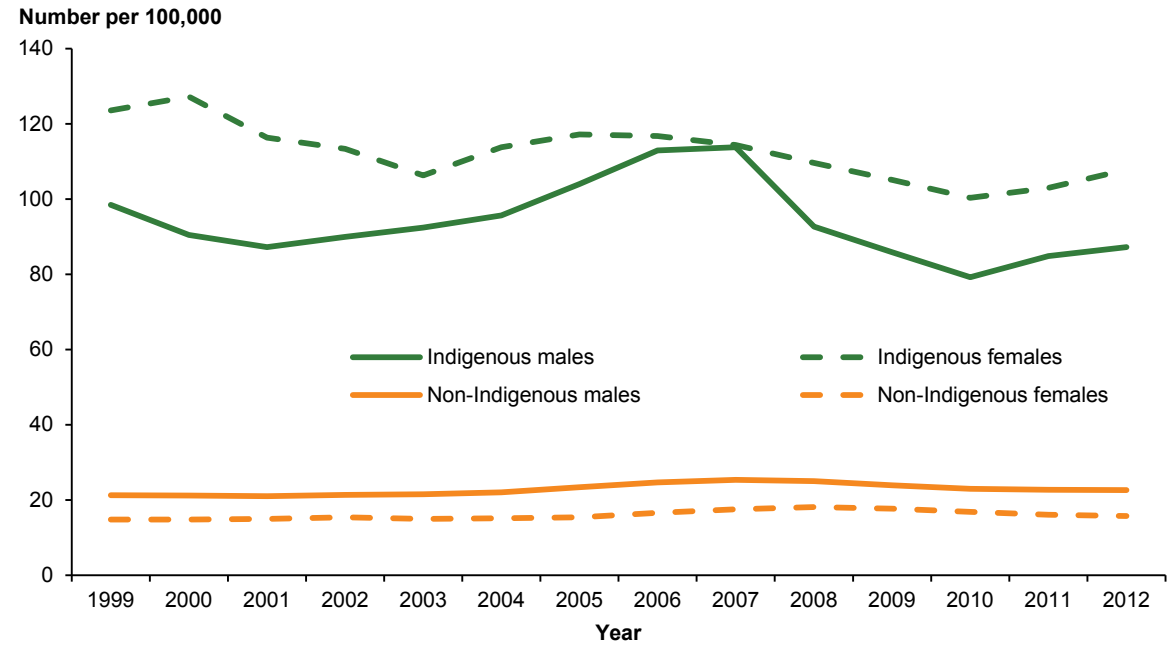
After adjusting for age, the incidence rate of ESKD among Indigenous Australians was almost 5 times as high as that for non-Indigenous Australians (95 compared with 19 per 100,000, respectively).

Trends

Between 1999 and 2012, the age-standardised rate of ESKD among Indigenous Australians fluctuated between 79 and 114 per 100,000 population for males, while for females it ranged between 100 and 127 per 100,000. In contrast, the age-standardised rate for non-Indigenous Australians has remained relatively stable for both males and females over this period (an average of 23 compared with 16 per 100,000 per year, respectively) (Figure 3.3).

Although the gap in age-standardised rates between Indigenous and non-Indigenous Australians slightly declined over this period—from 6 to 5 times as high—the gap continues to remain substantial.

Indigenous females had consistently higher incidence rates of ESKD compared with Indigenous males and non-Indigenous Australians (Figure 3.3). This may in part be due to Indigenous females having higher levels of albuminuria—the early marker of CKD (AIHW 2014c, Hoy et al. 2012). The reasons for this are complex and likely to be influenced by several factors, including Indigenous females having higher rates of diabetes and obesity—both key risk factors for CKD (Hoy et al. 2010, 2012).



Notes

1. Data are for those first treated/registered in New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.
2. Age-standardised rates are based on a 3-year moving average between 1998 and 2013.

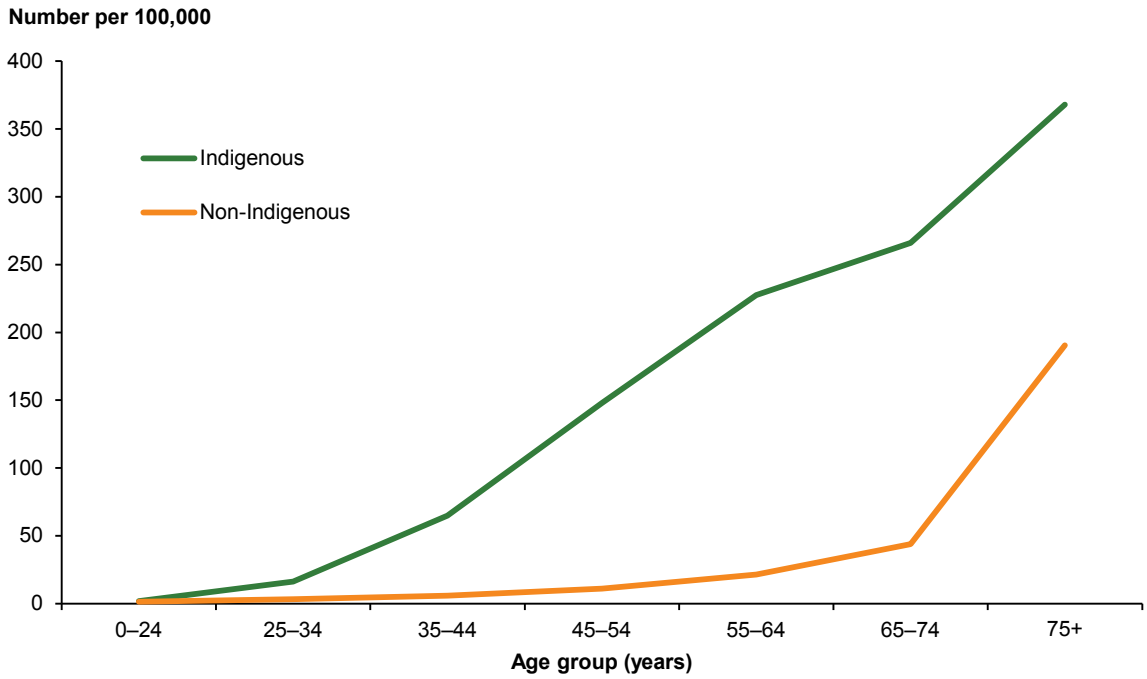
Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B4.

Figure 3.3: Total incidence of ESKD, by Indigenous status and sex, 1999–2012

Sex and age

In 2009–2013, for both Indigenous and non-Indigenous Australians ESKD incidence rates increased with age. However, the onset of ESKD occurred at much younger ages for Indigenous Australians. Among those aged 35–44 to 55–64, ESKD incidence rates were around 12 times as high for Indigenous Australians than non-Indigenous Australians, declining to 2 times as high for those aged 75 and over (Figure 3.4).

These findings are consistent with other studies, which have also shown that the incidence of ESKD among Indigenous Australians is much higher than for non-Indigenous Australians particularly at younger ages (Hoy et al. 2010; McDonald 2010; Cass et al. 2004).



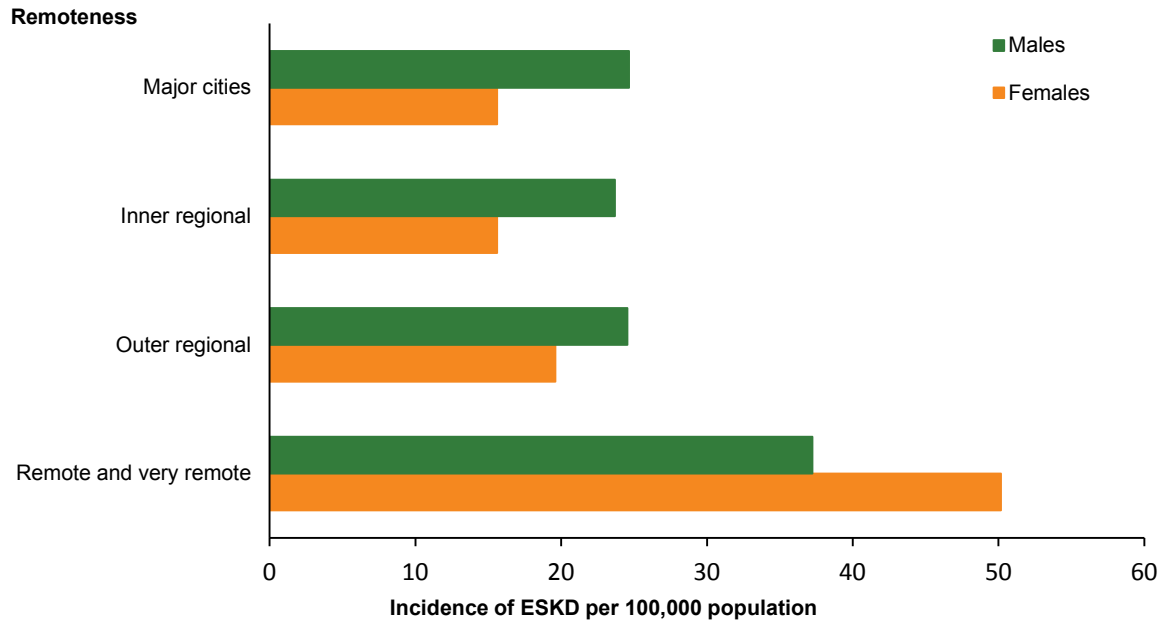
Note: Data are for those first treated/registered in New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B3.

Figure 3.4: Total incidence of ESKD, by Indigenous status and age, 2009–2013

Remoteness

Over the 2009–2013 period, the age-standardised incidence rates of ESKD was around twice as high in *Remote and very remote* areas (43 per 100,000 population) as in *Major cities* (20 per 100,000 population). Rates of ESKD among males were higher than those for females in *Major cities*, *Inner* and *Outer regional* areas (Figure 3.5; Table B5). However, females had higher ESKD incidence rates in *Remote and very remote* areas.

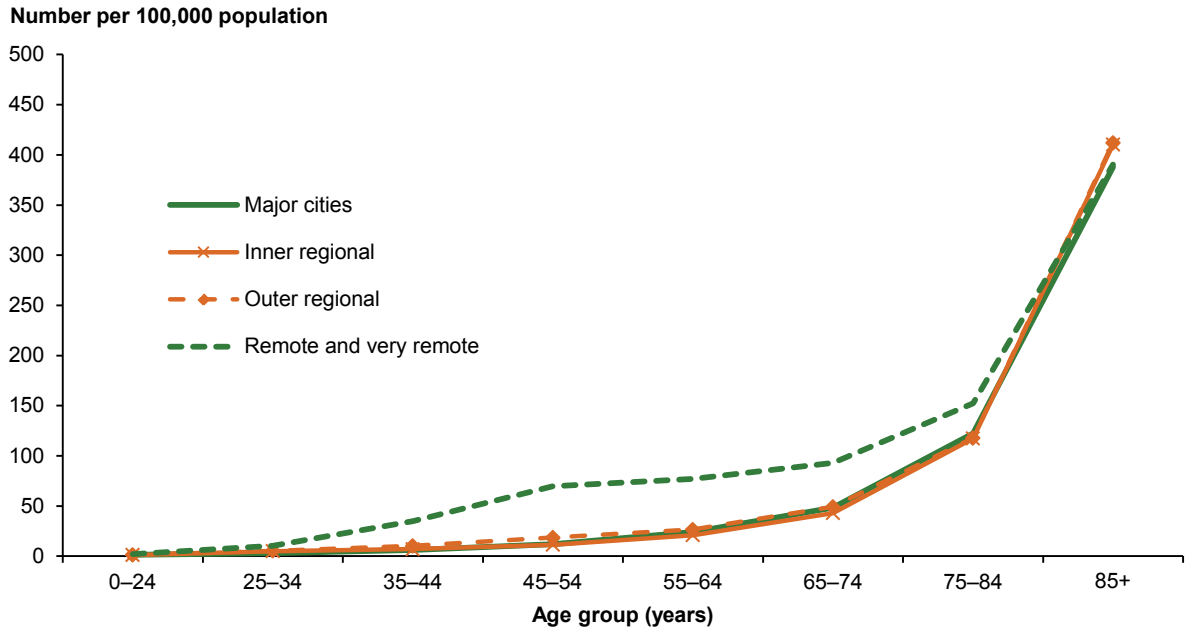


Note: Age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B5.

Figure 3.5: Total incidence of ESKD, by remoteness and sex, 2009–2013

The higher rates of ESKD in *Remote and very remote* areas were driven by higher rates of ESKD in younger age groups. For example, among those aged 45–54 to 65–74, ESKD rates in *Remote and very remote* areas were 2 to 6 times as high as rates in *Major cities* or *Inner regional areas* (Figure 3.6).



Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Figure 3.6: Total incidence of ESKD, by remoteness and age, 2009–2013

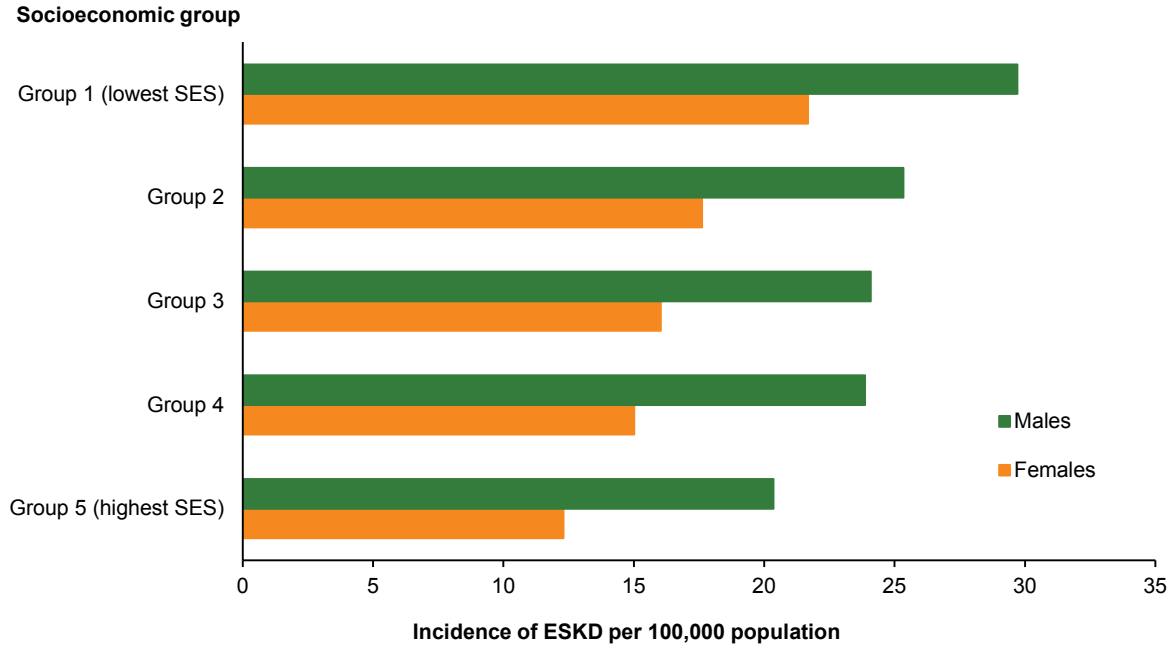
These patterns of higher rates in *Remote and very remote* areas and at younger ages is influenced by the high ESKD incidence rates among Indigenous Australians, particularly Indigenous females, as seen in figures 3.3 and 3.4. These findings are consistent with other studies showing similar patterns (AIHW 2011b; Hoy et al. 2010, 2012). Note, 1 in 4 people in *Remote and very remote* areas are Indigenous, compared with around 1% in *Major cities* (at June 2011) (ABS 2013).

Socioeconomic disadvantage

In 2009–2013, living in an area of socioeconomic disadvantage was associated with higher incidence rates of ESKD (Figure 3.7; see Appendix A for more information). Age-standardised ESKD incidence rates were highest among those in the lowest socioeconomic areas (25 per 100,000 population) and lowest among those in the highest socioeconomic areas (16 per 100,000 population) (Table B5). Rates of ESKD among males were higher than those for females across all socioeconomic groups.

These patterns are influenced by the population composition of each socioeconomic group. In particular, the lowest socioeconomic group is characterised by higher proportions of Indigenous Australians and those aged 75 and over, whereas the highest socioeconomic group has higher proportions of non-Indigenous Australians with ESKD and people aged 30–69.

These findings are supported by the work of Cass et al. (2004), which also demonstrated an association between socioeconomic disadvantage and incidence of ESKD among Indigenous Australians, with factors such as reduced access to health services—resulting in late referral to specialists who may have been able to prevent the onset of ESKD—identified as contributing to this association.



Note: Age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B5.

Figure 3.7: Total incidence of ESKD, by socioeconomic groups and sex, 2009–2013

4 Treatment status

A person with ESKD usually requires KRT—dialysis or a kidney transplant (from either a living or a deceased donor) to survive. This chapter provides further information about the characteristics of those treated, compared with those not treated, with KRT.

In 2013, there were around 2,500 new cases of each KRT-treated and non-KRT-treated ESKD in Australia. After adjusting for age, the incidence rate of KRT-treated and non-KRT-treated ESKD was 10 and 9 per 100,000 population, respectively.

Trends

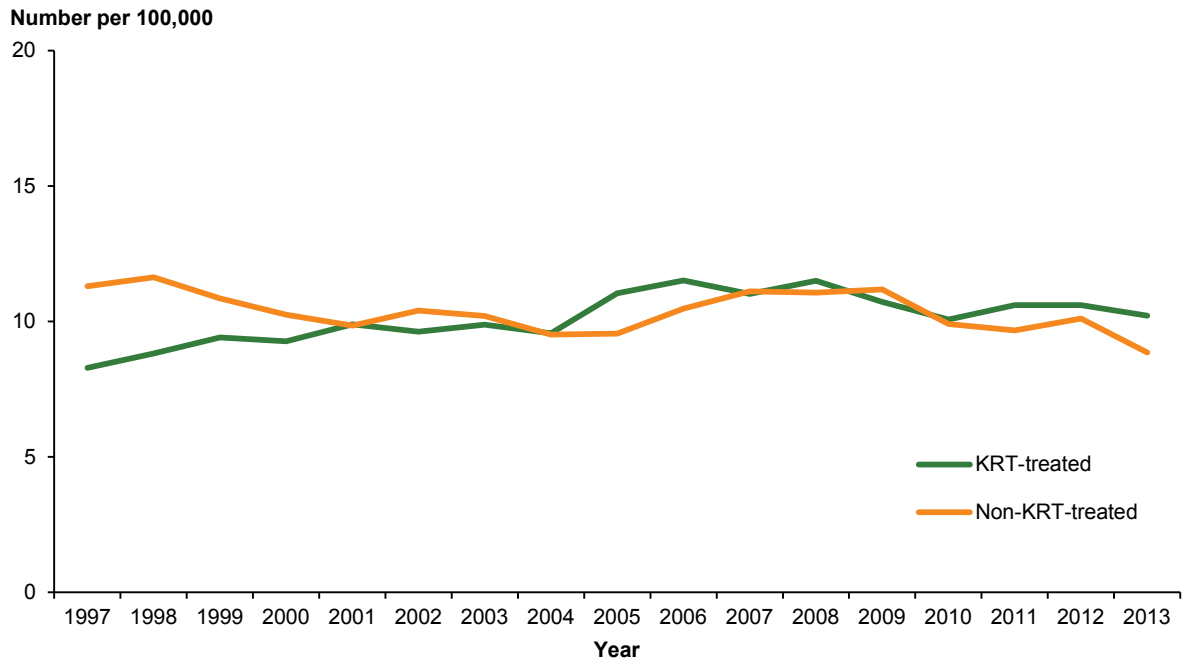
Between 1997 and 2013, the number of new KRT-treated cases increased by 71%—from around 1,500 in 1997 to 2,500 in 2013. Over this period, the number of kidney transplants has increased by 75%—from around 500 in 1997 to just under 900 in 2013, and the number of people newly treated with dialysis has increased by 69% from 980 to 1,700. The increase in transplants has been driven by rapid growth in deceased donors, while most of the growth in dialysis services has occurred through increased numbers of people being treated in hospital and satellite centres (a dialysis unit that provides dialysis away from a hospital) (ANZDATA 1998, 2015; MTAA 2014).

The number of new ESKD cases not receiving KRT treatment has also increased during this time by 35%—from around 1,900 in 1997 to 2,500 in 2013.

While the number of new KRT-treated and non-KRT-treated cases has increased by 71% and 35% over this period, age-adjusted incidence rates have remained relatively stable since 2001—an average of 10 per 100,000 population per year for both treatment groups (Figure 4.1).

Overall incidence rates of KRT-treated and non-KRT- treated have remained similar over this period, although there are a few fluctuations to this overall pattern. These fluctuations may have been influenced by factors such as improved access through increase of satellite centres to dialysis from 2001, and the introduction in 2005 of national pathology technique standardisation, automatic eGFR reporting and primary care provider education, which improved screening for CKD.

The increase in the absolute numbers of new cases of ESKD among both treatment groups has considerable implications for health service planning and future resource allocation, including the probable increasing need for dialysis services, kidney transplants and palliative care for those not receiving KRT.



Note: Age-standardised to the Australian population as at 30 June 2001.

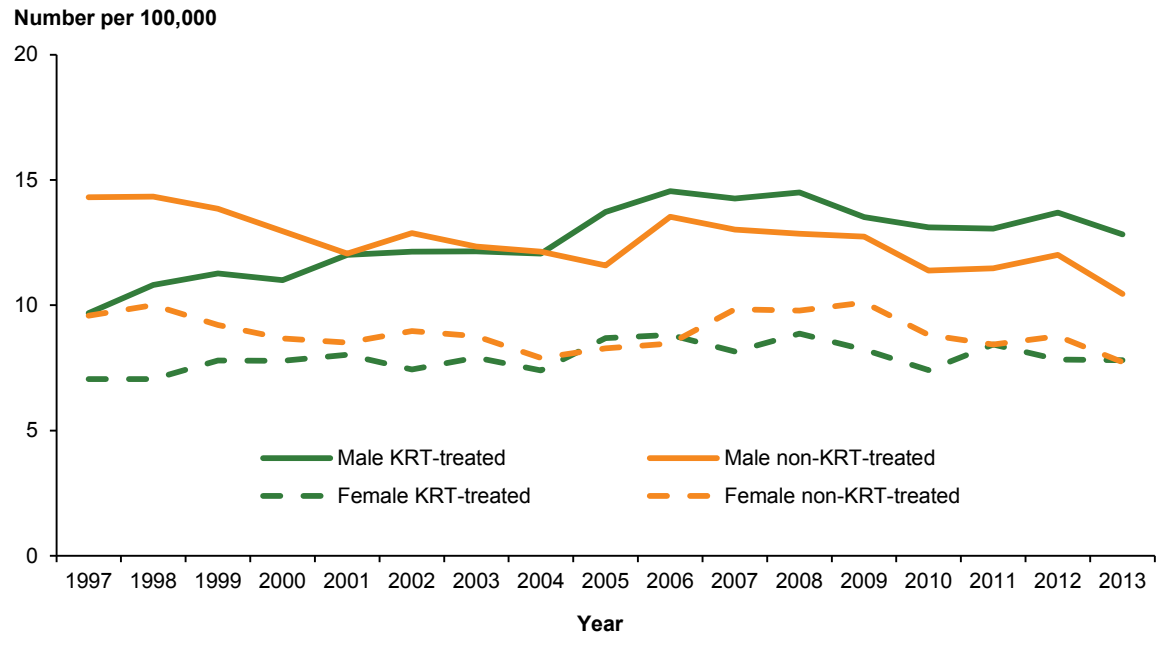
Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B6.

Figure 4.1: Total incidence rate of ESKD, by treatment status, 1997–2013

Sex

In 2013, males had a higher incidence rate of KRT-treated compared with non-KRT-treated ESKD (13 and 10 cases per 100,000, respectively), while for females, incidence rates were similar for both treatment groups (7.8 and 7.7 per 100,000) (Figure 4.2).

Between 1997 and 2013, incidence rates for KRT-treated and non-KRT-treated ESKD varied for males and females. For males, the rate of KRT-treated cases has remained consistently higher than that for non-KRT-treated cases since 2004. This is likely due to a higher number of males under 85 years of age receiving KRT treatment for ESKD. For females, the opposite was observed: the rate of non-KRT-treated cases was generally higher than for KRT-treated cases, except between 2005 and 2006 when rates became similar and in 2011 and 2013 when the rates for both treatment groups again converged. The narrowing of the gap between the treatment groups in 2005–2006 may reflect the introduction of eGFR reporting around this time, which improved screening for CKD. Further, the overall pattern is likely influenced by the relative longevity of women, with more women in the 85 and over age group than males, and the considerably higher incidence of non-KRT-treated in this age group.



Note: Age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B6.

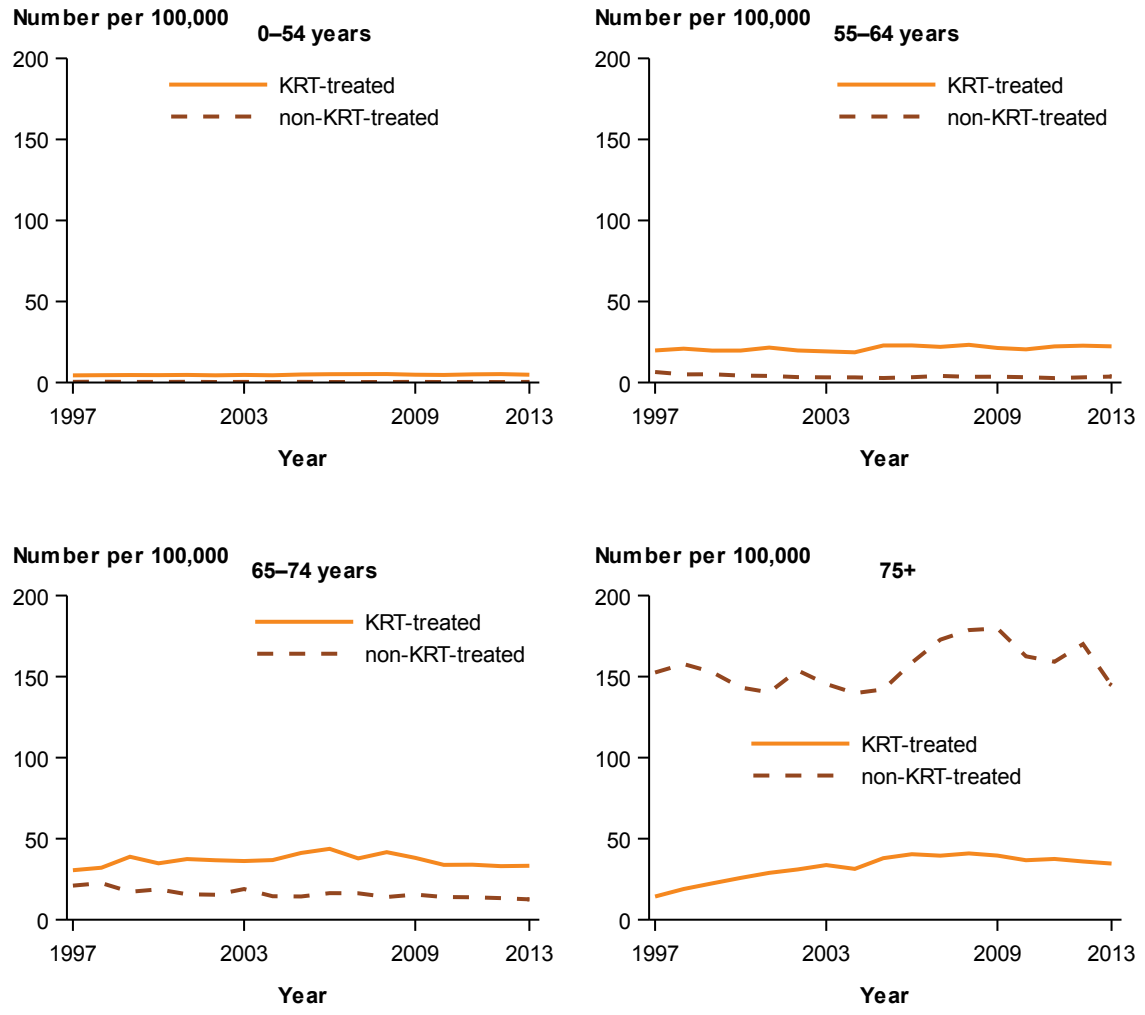
Figure 4.2: Total incidence rate of ESKD, by treatment status and sex, 1997–2013

Age

In 2013, the incidence rate of KRT-treated and non-KRT-treated ESKD increased with age for all age groups up to the age of 74. However, the pattern was different for both treatment groups among those aged 75 and over. Among the KRT-treated group, the rates for those aged 65–74 and 75 and over were similar (33 and 35 cases per 100,000), while for the non-KRT-treated ESKD group the incidence rate rose rapidly between ages 65–74 and 75 and over: an 11-fold increase (13 and 145per 100,000 population, respectively).

Further, incidence rates were higher among KRT-treated compared with non-KRT-treated cases across all age groups, except for those aged 75 and over (Figure 4.3).

Between 1997 and 2013, the incidence rates for both KRT-treated and non-KRT-treated ESKD have remained relatively stable for those aged 0–74. In contrast, annual rates for both treatment groups have fluctuated for those aged 75 and over, although overall the pattern indicates that rates have been increasing over this period. Among those aged 75 and over, the rate of KRT-treated cases has fluctuated from 14 to 41 per 100,000, while for non-KRT-treated cases, it ranged between 140 and 180 over this period (Figure 4.3).



Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B7.

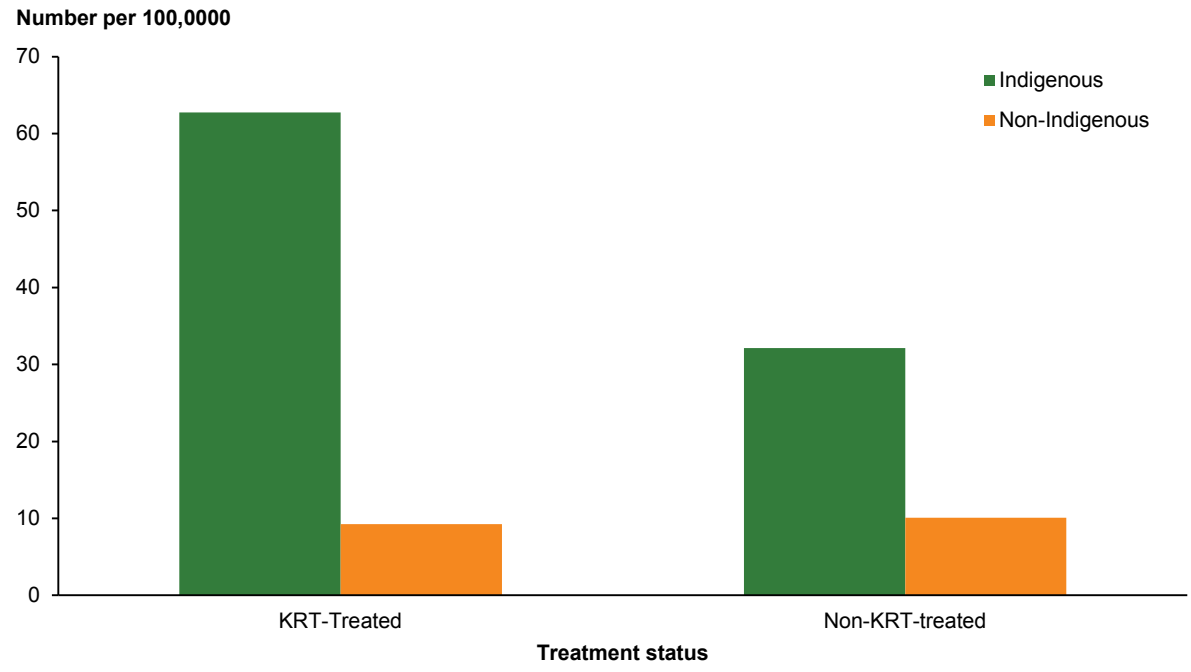
Figure 4.3: Total incidence of ESKD, by treatment status and age, 1997–2013

Population groups

Aboriginal and Torres Strait Islander people

In 2009–2013, over 3 in 4 (79%) new cases of ESKD among Indigenous Australians received KRT—for those first treated/registered in New South Wales, Queensland, Western Australia, South Australia and the Northern Territory. The proportion for non-Indigenous Australians was considerably lower (47%).

After adjusting for age, the incidence rate of KRT-treated ESKD among Indigenous Australians was twice as high as that for non-KRT-treated ESKD (63 and 32 per 100,00 population, respectively). In comparison, the age-standardised rates for non-Indigenous Australians were considerably lower and similar for both treatment groups (9 and 10 per 100,000) (Figure 4.4). It follows that the gap between Indigenous and non-Indigenous Australians was greater for KRT-treated than non-KRT-treated ESKD in 2009–2013 (7 and 3 times as high, respectively).



Notes

1. Data are for those first treated/registered in New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.
2. Age-standardised to the Australian population as at 30 June 2001.

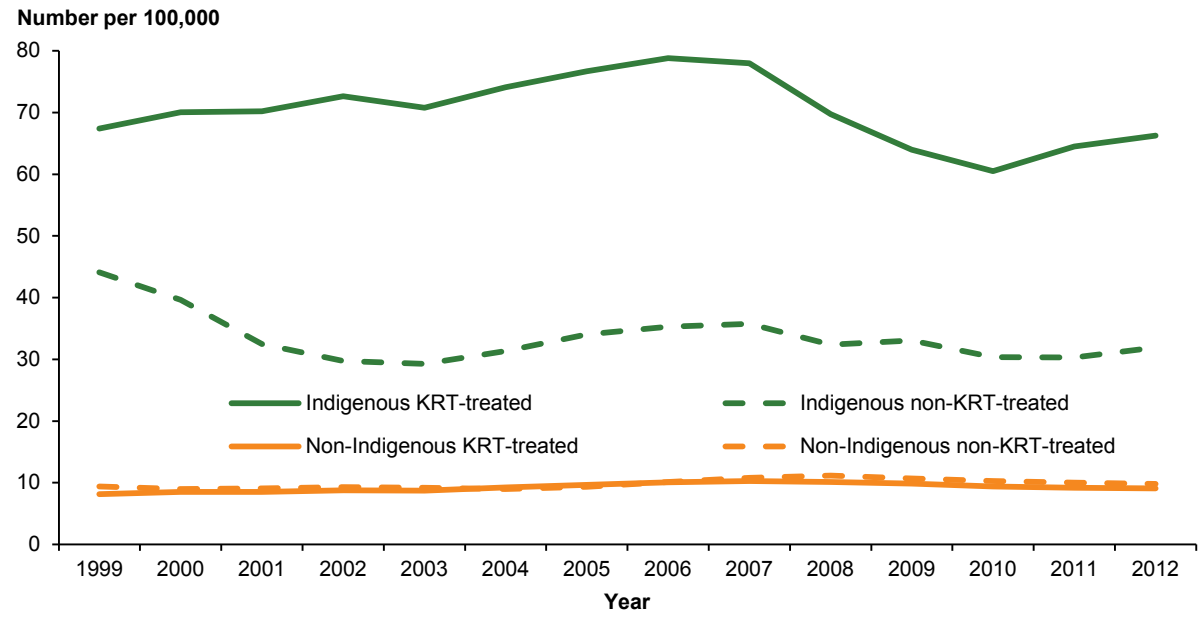
Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B8.

Figure 4.4: Total incidence of ESKD, by treatment and Indigenous status, 2009–2013

Trends

Between 1999 and 2012, the age-standardised incidence rate of KRT-treated ESKD among Indigenous Australians was on average twice as high as that for non-KRT-treated ESKD, although both rates fluctuated over this period (Figure 4.5). For those receiving KRT, the rate fluctuated between 61 and 79 per 100,000 population, while for the non-KRT-treated group it ranged between 29 and 44 per 100,000. In contrast, the age-standardised rates for non-Indigenous Australians by treatment status were stable and similar over this period (an average of 9 and 10 per 100,000 population per year, respectively) (Figure 4.5).

Between 1999 and 2012, the age-standardised rates for both KRT-treated and non-KRT-treated cases among Indigenous Australians were consistently higher (an average of 8 and 3 times, respectively) than that for non-Indigenous Australians.



Notes

1. Data are for those first treated/registered in New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.
2. Age-standardised rates are based on a 3-year moving average between 1998 and 2013.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B9.

Figure 4.5: Total incidence of ESKD, by treatment and Indigenous status, 1999–2012

Age

Age patterns for KRT-treated and non-KRT-treated ESKD varied for Indigenous and non-Indigenous Australians. For KRT-treated ESKD, the majority of cases among Indigenous Australians occurred before the age of 60 (76%), and peaked at age 50–54. For non-Indigenous Australians 40% of KRT-treated ESKD cases occurred before the age of 60, with cases plateauing at 60–79 and then declining.

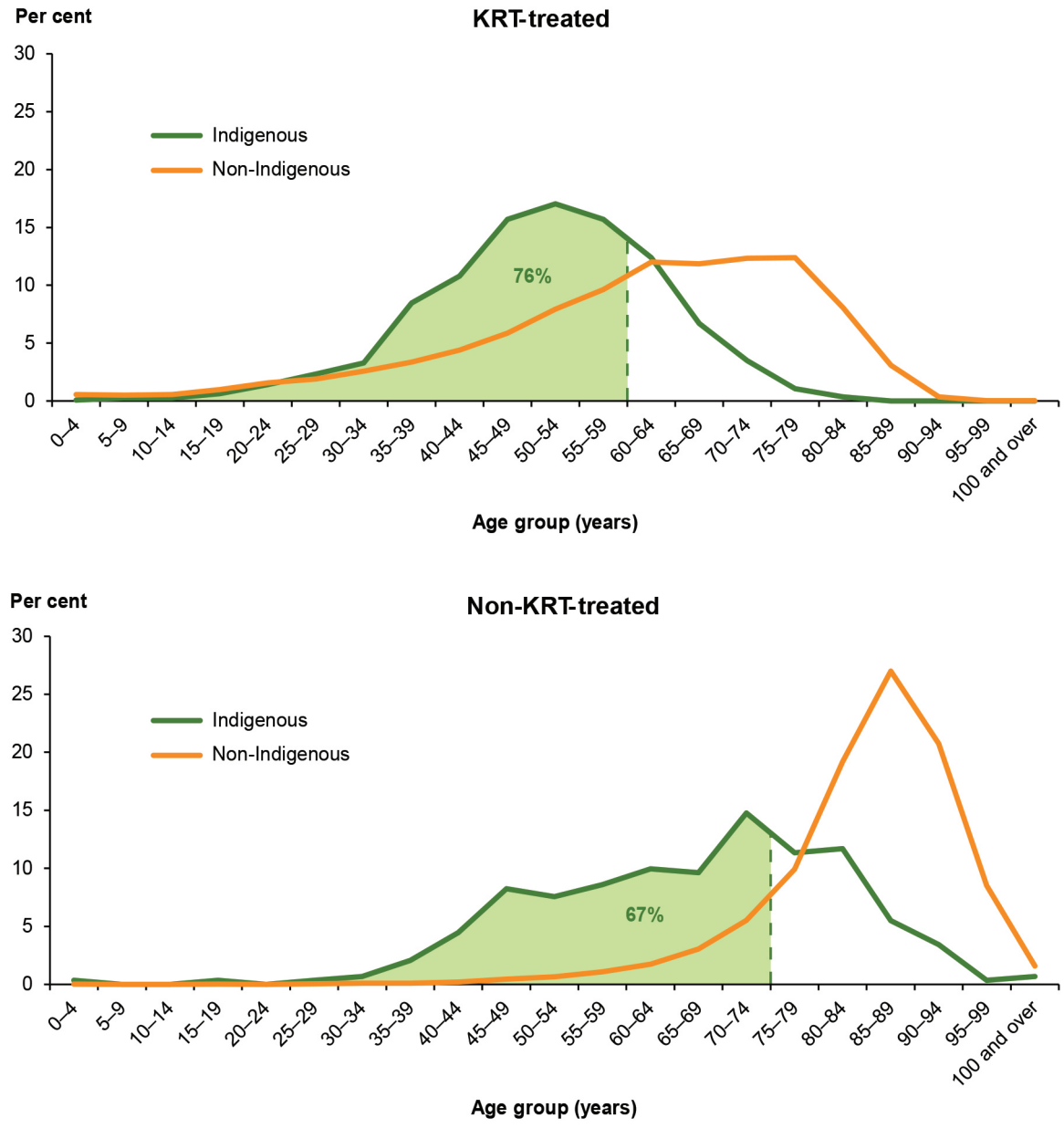
For non-KRT-treated ESKD, a similar pattern was observed. The majority of cases among Indigenous Australians also occurred in younger age groups, with 67% occurring before the age of 75 (Figure 4.6). For non-Indigenous Australians the comparable proportion was 13%.

Overall, this shows that Indigenous Australians have an earlier onset of ESKD for both treatment groups compared with non-Indigenous Australians—on average 10 years earlier for KRT-treated and 18 years earlier for non-KRT-treated.

The early onset and fast progression of ESKD among Indigenous Australians is likely due to multiple contributory factors, including socioeconomic disadvantage, early life experiences (low birthweight, post-streptococcal glomerulonephritis, recurrent infections), and high rates of smoking, metabolic syndrome and diabetes. High rates of albuminuria, elevated C-reactive protein-associated with central obesity, and commencement of medications to block the renin-angiotensin system have also been shown to have an impact on the rate of decline in kidney function in all ESKD cases (Maple-Brown et al. 2016).

In addition, for non-KRT-treated ESKD among Indigenous Australians, the distribution pattern was relatively flat between the ages 45–49 and 80–84. In contrast, for non-Indigenous

Australians, the majority of non-KRT-treated ESKD cases were found among those aged 75 and over (87%), and peaked at age 85-89 (Figure 4.6). This suggests that for non-Indigenous Australians, age appears to be a key factor in ESKD treatment choice.



Note: Data are for New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.

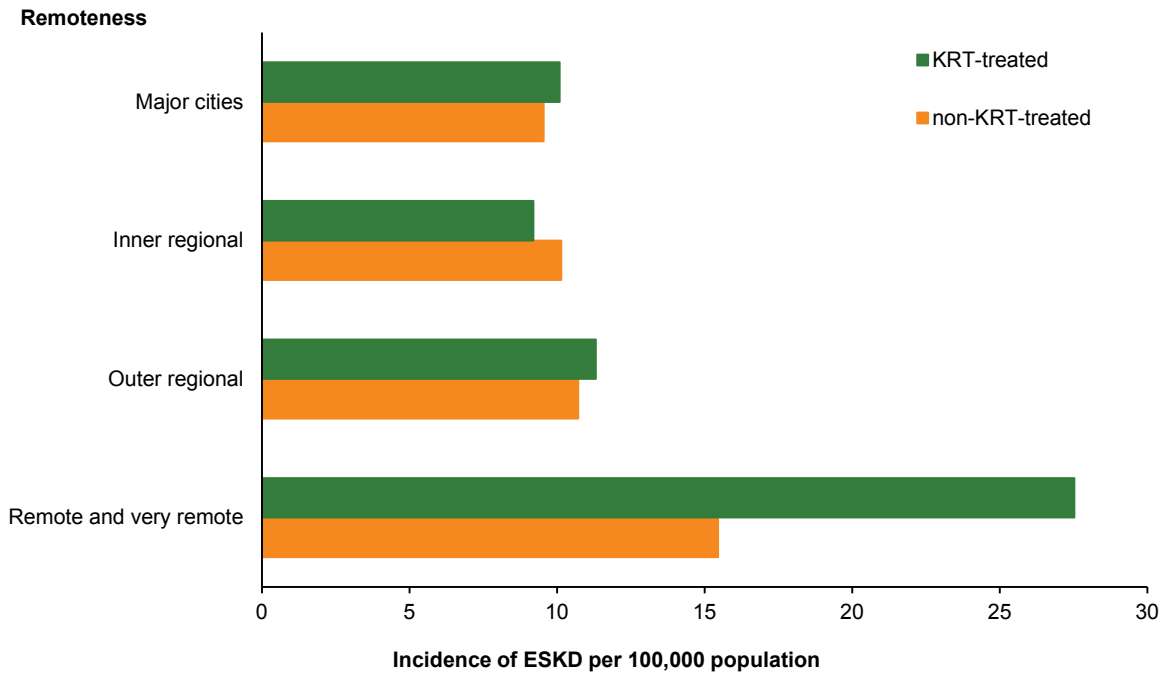
Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Figure 4.6: Proportion of total incidence of ESKD, by age, treatment and Indigenous status, 2009–2013

Remoteness

In 2009–2013, the age-standardised incidence rates of KRT-treated and non-KRT-treated ESKD were similar across most remoteness areas (an average of 10 per 100,000 population for both treatment groups). The exception was in *Remote and very remote* areas where the KRT-treated rate was almost 3 times that of other areas and the non-KRT-treated rate was lower (28 and 15 per 100,000 population, respectively).

Further, in *Remote and very remote* areas, the incidence rate of KRT-treated ESKD was around twice as high as non-KRT-treated ESKD. This pattern was largely driven by the high proportion of Indigenous Australians residing in these areas who have considerably higher rates of KRT-treated ESKD (Figure 4.7).



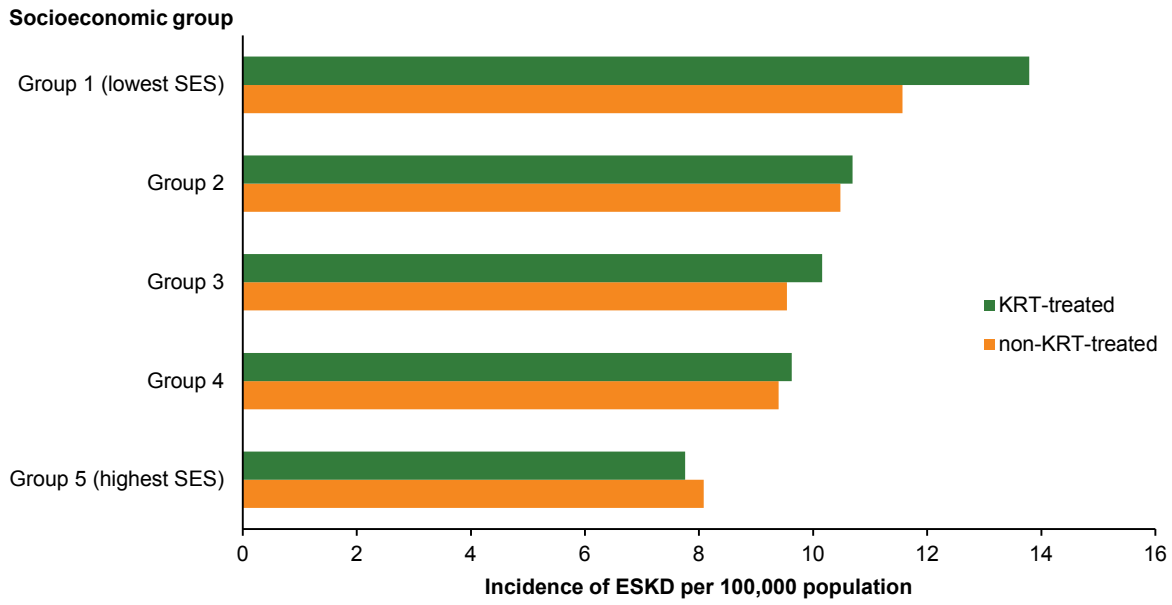
Note: Age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B10.

Figure 4.7: Total incidence of ESKD, by treatment status and remoteness, 2009–2013

Socioeconomic disadvantage

In 2009–2013, living in an area with socioeconomic disadvantage was associated with higher incidence rates for both treatment groups. For those treated with KRT, age-standardised incidence rates were highest among those in the lowest socioeconomic areas (14 per 100,000 population) and lowest among those in the highest socioeconomic areas (8 per 100,000). Similar findings were observed for non-KRT-treated ESKD: incidence rates in the lowest socioeconomic areas were 1.4 times that of the highest socioeconomic areas (12 and 8 per 100,000 population, respectively) (Figure 4.8). These patterns reflect the population composition of each socioeconomic group, as described in Chapter 3.



Note: Age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index. See Table B10.

Figure 4.8: Total incidence of ESKD, by treatment status and socioeconomic groups, 2009–2013

5 Causes of death

This chapter examines deaths (both KRT-treated and non-KRT-treated) that occurred among new cases of ESKD to provide a greater understanding of the causes of death among these cases. Further, it also examines conditions that may have coexisted with ESKD (that is, comorbidities) where these are recorded on the death certificate.

It is well known that CKD (for which ESKD is the most severe form), cardiovascular disease (CVD) and diabetes have complex causal relationships and share many risk factors (AIHW 2015). Several studies have highlighted the relationship between ESKD and these chronic conditions. For example, a study by Atkins (2005) showed that diabetes, together with hypertension, is a major cause of ESKD. Further, in Australia, the most recent ANZDATA report has shown that over the last 10 years, around 30–40% of new KRT-treated patients had a comorbidity of CVD or diabetes (ANZDATA 2015). These findings highlight that ESKD commonly occurs with other conditions, in particular CVD and diabetes. As such, this chapter presents information on multiple causes of death, with a focus on ESKD, CVD and diabetes, given that it is common for 2 or more comorbid conditions to contribute to death.

It is important to note that although KRT-treated cases can be identified through the ANZDATA, this report has defined non-KRT-treated cases as those who died of an ESKD-related cause (see Box 2.1) and were not registered on the ANZDATA. Therefore, by definition, all non-KRT-treated cases have ESKD listed as either an underlying or associated cause of death in the mortality data. As a result, causes of death for the KRT-treated and non-KRT-treated groups are analysed separately in this chapter.

In 2009–2013, there were an estimated 25,700 new cases of ESKD in Australia. Of these, around 20,700 (80%) also died within this period. When examining these deaths by treatment status, about 7,400 (36%) were KRT-treated, while 13,300 (64%) were non-KRT-treated.

For KRT-treated cases, the top 5 leading underlying causes of death were CVD, chronic kidney failure, cancer, diabetes (excluding diabetic nephropathy) and diabetic nephropathy. For non-KRT-treated cases, chronic kidney failure, unspecified kidney failure, hypertensive kidney failure, CVD and cancer were the leading underlying causes of death.

KRT-treated

Table 5.1 shows that, among the KRT-treated cases who died, CVD and ESKD (in particular, chronic kidney failure) were the most common associated causes of death when ESKD, CVD or diabetes was the underlying cause of death.

For KRT-treated deaths with ESKD (chronic, hypertensive or unspecified kidney failure) as the underlying cause of death, cardiovascular diseases were listed as the most common associated causes of death. For example, almost 60% of deaths due to hypertensive kidney failure had hypertensive disease as an associated cause of death. Further, around 25% and 11%, respectively, of deaths due to unspecified kidney failure had coronary heart disease and heart failure and cardiomyopathy as associated causes. For KRT-treated deaths with CVD or diabetes as the underlying cause, 55% and 64%, respectively, had chronic kidney failure as an associated cause of death.

Diabetes was also a common associated cause of death when ESKD or CVD were the underlying cause of death.

Table 5.1: Most common associated causes of death, where ESKD, CVD or diabetes are the underlying cause of death among KRT-treated ESKD deaths, 2009–2013

Underlying cause of death	Most common associated causes of death (percentage of deaths)				
Chronic kidney failure	Coronary heart disease (27.2)	Other CVD (25.0)	Septicaemia (14.5)	Diabetes (13.2)	Heart failure and cardiomyopathy (12.3)
Hypertensive kidney failure	Hypertensive disease (58.7)	Chronic kidney failure (41.7)	Other CVD (24.3)	Diabetes (19.6)	Unspecified kidney failure (19.2)
Unspecified kidney failure[(a)]	Other CVD (27.0)	Coronary heart disease (24.9)	Heart failure and cardiomyopathy (11.1)	Septicaemia (10.6)	Diabetes (9.5)
Cardiovascular disease	Chronic kidney failure (54.8)	Other CVD (33.5)	Coronary heart disease (26.0)	Hypertensive disease (25.1)	Diabetes (22.7)
Diabetes	Chronic kidney failure (63.8)	Coronary heart disease (47.0)	Hypertensive disease (27.0)	Diabetes (26.4)	Other CVD (25.7)

(a) Table does not include ill-defined associated causes of death, which contributed to 12.7% of deaths due to unspecified kidney failure.

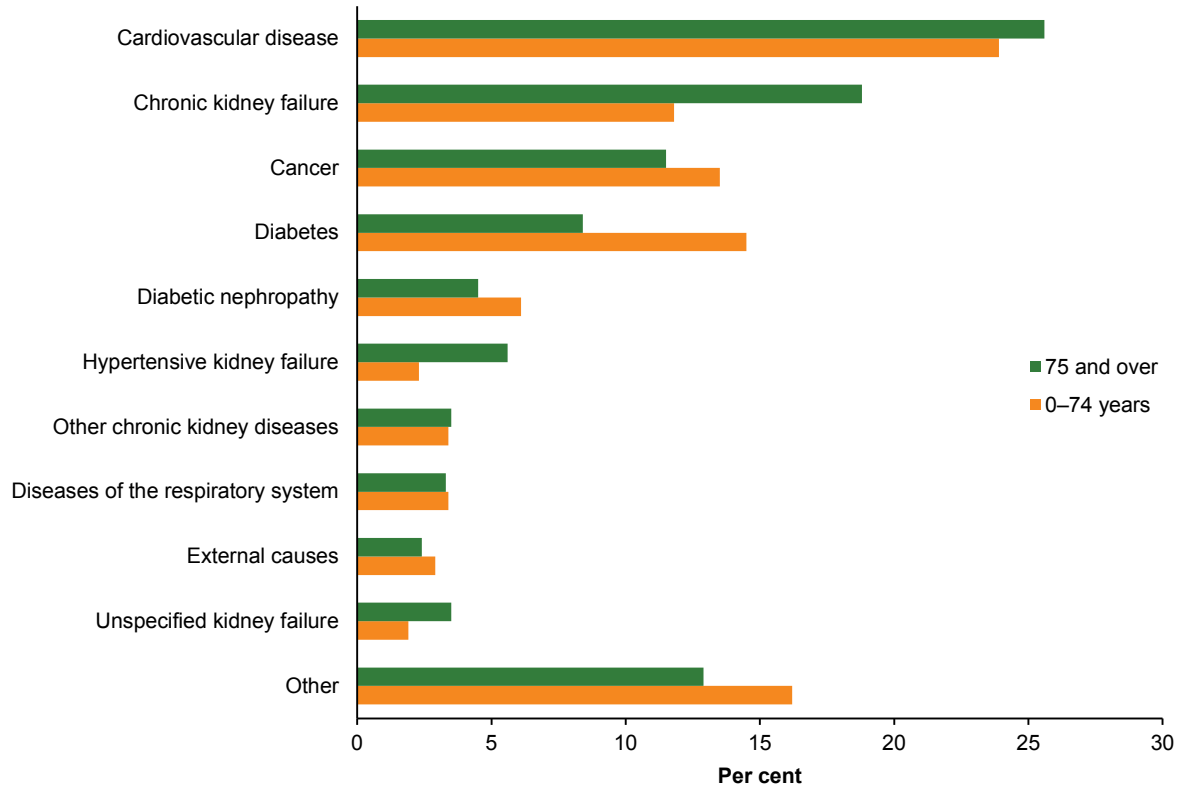
Note: See Table A3 for disease classifications.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Age

To better understand patterns associated with specific causes of death, it is of particular interest to look at causes of deaths by age. Figure 5.1 shows the proportion of cases with a particular underlying cause of death by 2 broad age groups. Overall, for KRT-treated deaths, the most common underlying causes of death were CVD (25% of deaths), chronic kidney failure (15%), cancer (13%) and diabetes (excluding diabetic nephropathy) (12%) (See Table B11).

For those aged 75 and over, CVD (26%) and chronic kidney failure (19%) were the leading underlying causes of death. In comparison, for those aged 0–74, CVD, diabetes (excluding diabetic nephropathy) and cancer were prominent causes of death, accounting for 24%, 15% and 14%, respectively, of the underlying causes of death among people in this age group.



Notes

1. Excludes I12 and I13 because they are codes for hypertensive kidney failure or other chronic kidney diseases.
2. Excludes diabetic nephropathy.
3. See Table A3 for disease classifications.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Figure 5.1: Underlying causes of death for KRT-treated deaths, by 2 broad age groups, 2009–2013

Non-KRT-treated

By definition, all non-KRT-treated cases are those with an ESKD-related cause of death (that is, chronic, hypertensive or unspecified kidney failure) who were not registered on the ANZDATA. Therefore, all non-KRT-treated cases have ESKD listed as either an underlying or associated cause of death. As a result, a high proportion of non-KRT-treated cases had chronic (43%), unspecified (22%) or hypertensive (20%) kidney failure as the underlying cause of death, and a further 15% had chronic kidney failure as an associated cause (Table B12).

As previously noted, CVD and diabetes often occur together with CKD (AIHW 2014d) and are leading causes of death among non-KRT-treated cases of ESKD.

Table 5.2 shows that, for those not receiving KRT, CVD was the most common associated cause of death when ESKD, CVD or diabetes were the underlying cause of death. For non-KRT-treated deaths with ESKD (chronic, hypertensive or unspecified) as the underlying cause of death, at least 3 types of CVD featured among the 5 leading associated causes of death. For example, hypertensive disease, heart failure and cardiomyopathy and other CVD

contributed to 87%, 31% and 29% of deaths, respectively, when hypertensive kidney failure was the underlying cause.

For deaths with CVD or diabetes as the underlying cause of death, by definition, all had chronic kidney failure as an associated cause (see Box 2.1). Other common associated causes included heart failure and cardiomyopathy, coronary heart disease and diabetes.

Table 5.2: Most common associated causes of death, where ESKD, CVD or diabetes are the underlying cause of death among non-KRT-treated ESKD deaths, 2009–2013

Underlying cause of death	Most common associated causes of death (percentage of deaths)				
Chronic kidney failure[a]	Acute kidney injury (35.4)	Heart failure and cardiomyopathy (34.3)	Coronary heart disease (24.6)	Other CVD (23.4)	Influenza and pneumonia (12.4)
Hypertensive kidney failure	Hypertensive disease (87.2)	Chronic kidney failure (54.2)	Unspecified kidney failure (31.3)	Heart failure and cardiomyopathy (30.5)	Other CVD (28.5)
Unspecified kidney failure[a]	Heart failure and cardiomyopathy (31.5)	Other CVD (22.3)	Coronary heart disease (20.2)	Influenza and pneumonia (14.3)	Dementia and Alzheimer (14.2)
Cardiovascular disease[b]	Heart failure and cardiomyopathy (32.2)	Other CVD (28.9)	Coronary heart disease (18.8)	Diabetes (14.3)	Hypertensive disease (8.5)
Diabetes[b]	Diabetes (36.3)	Coronary heart disease (33.3)	Heart failure and cardiomyopathy (24.8)	Other CVD (19.1)	Hypertensive disease (16.4)

(a) Table does not include ill-defined associated causes of death, which contributed to 14.5% and 20.4% of deaths due to chronic kidney failure and unspecified kidney failure, respectively.

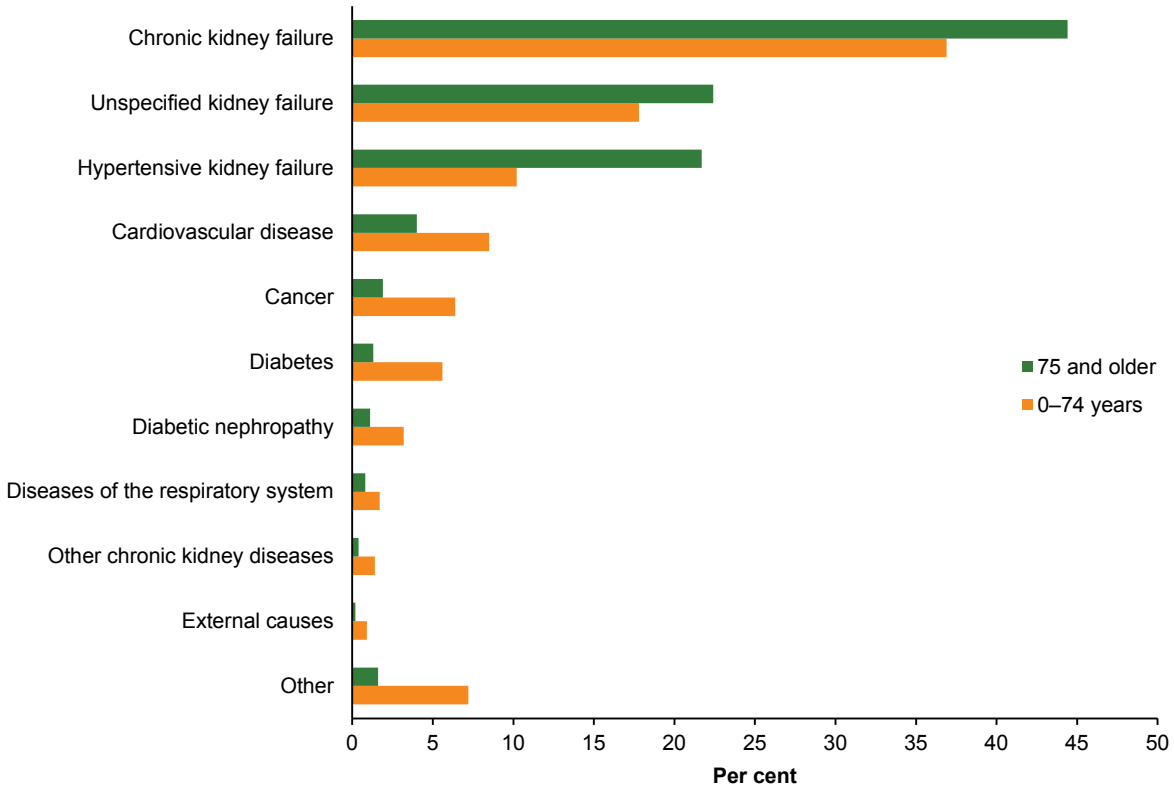
(b) Table does not include chronic kidney failure as an associated cause of death because by definition all non-KRT-treated cases have ESKD listed as either an underlying or associated cause of death. Therefore, 100% of deaths with cardiovascular disease or diabetes as the underlying cause of death have chronic kidney failure as an associated cause of death.

Note: See Table A3 for disease classifications.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Age

Examining patterns by age shows that, among non-KRT-treated deaths aged 75 and over, almost 90% had kidney failure (chronic, unspecified or hypertensive kidney failure) as an underlying cause of death. In comparison, this proportion was much lower for those aged 0–74 (65%), because these cases had higher proportions of CVD, cancer or diabetes (excluding diabetic nephropathy) as an underlying cause of death (Figure 5.2).



Notes

1. Excludes I12 and I13 because they are codes for hypertensive kidney failure or other chronic kidney diseases.
2. Excludes diabetic nephropathy.
3. See Table A3 for disease classifications.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Figure 5.2: Underlying causes of death for non-KRT-treated deaths, by 2 broad age groups, 2009–2013

Appendix A: Methods

Data sources

Australia and New Zealand Dialysis and Transplant Registry (ANZDATA)

The ANZDATA collects information to monitor dialysis and transplant treatments from all kidney units in Australia and New Zealand on all patients receiving kidney replacement therapy where the intention to treat is long term. Cases of acute kidney failure are excluded. The Registry is coordinated within the Queen Elizabeth Hospital in Adelaide, and compiles data on incidence and prevalence of treated ESKD, complications, comorbidities and patient deaths. All relevant hospitals and related dialysis units participate. Although patients have the option of opting out of having part or all of their data recorded, this rarely happens. The interpretation and reporting of these data are the responsibility of the AIHW and in no way should be seen as an official policy or interpretation of the ANZDATA. Information about the data quality of the ANZDATA can be found in the 38th annual report (ANZDATA 2015), available at: <http://www.anzdata.org.au/v1/report_2015.html>.

AIHW National Mortality Database (NMD)

Cause of Death Unit Record File data are provided to the AIHW by the Registries of Births, Deaths and Marriages and the National Coronial Information System (managed by the Victorian Department of Justice) and include cause of death coded by the ABS. The data are maintained by the AIHW in the NMD.

As the registration of deaths is a legal requirement in Australia, this data set is considered to be nearly complete, although there is no formal validation of completeness. Deaths were coded according to the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10). Data in this report are based on year of death.

Deaths registered in 2011 and earlier are based on the final version of cause of death data; deaths registered in 2012 and 2013 are based on revised and preliminary versions, respectively, and are subject to further revision by the ABS.

The data quality statements underpinning the AIHW NMD can be found in the following ABS publications: *Deaths Australia* (ABS cat. no. 3302.0) <http://www.abs.gov.au/ausstats/abs%40.nsf/mf/3302.0/>, and *Causes of death, Australia* (ABS cat. no. 3303.0) <http://www.abs.gov.au/ausstats/abs%40.nsf/ mf/3303.0/>.

National Death Index (NDI)

The NDI is a catalogue of death records that is used in data linkage for epidemiological studies. Its use is strictly confined to AIHW Ethics Committee approved health and medical research. The NDI contains person level records of all deaths occurring in Australia since 1980 obtained from the Registrars of Births, Deaths and Marriage in each state and territory.

Sensitivity analysis of ESKD cause-of-death codes

In this report, non-KRT-treated cases were identified by using the AIHW NMD to extract cases that had an ICD-10 code for ESKD as either the underlying or associated cause of death (for full definition see Box 2.1). This method was used because individuals with ESKD who do not receive KRT treatment are unlikely to survive for long. Consequently, date of death was used as a substitute for incidence date.

It is important to note that counting non-KRT-treated cases from the AIHW NMD relies on ESKD being accurately recorded in this data set. Additionally, because the date of death is used as a substitute for incidence date, it cannot count people whose death has not been registered. However, it is expected that these people would be captured in following years, instead of being missed entirely. For these 2 reasons, it is unknown whether the current method of counting non-KRT-treated cases overestimates or underestimates the true number.

There are several other reasons why the estimate may be an under-count. The first and most important is that not all non-KRT-treated cases will result in death due to ESKD, and if ESKD is not contributing as the underlying or an associated cause of death then it may not be recorded on the death certificate and coded in the mortality data. This was shown to be the case for the KRT-treated cases examined in this report—only 47% of KRT-treated incident cases who died during 1997–2013 had ESKD recorded on their death certificate. The second reason is that we are not currently able to count the non-KRT-treated cases that are still alive.

It is also possible that this estimate is higher than the true number, as it may include some non-KRT-treated cases who met the definition for ESKD (Box 2.1), but who clinically had not yet required dialysis or transplantation. This would only be applicable to the relatively small number of cases included in this report who had 'chronic kidney failure, end-stage' as an associated cause of death only. On the other hand, non-KRT-treated cases who had chronic kidney failure as an underlying cause of death would likely reflect the actual disease.

For these reasons, a sensitivity analysis was conducted to determine the effect of excluding the non-KRT-treated cases with an associated cause of death of chronic kidney failure (end-stage, as indicated by codes N18.0 and N18.5).

There were around 4,700 (6%) cases with 'chronic kidney failure, end-stage' as an associated cause of death. This accounted for 7% of the male and 6% of the female total incidence cases. Excluding these cases resulted in the total incidence rate of ESKD falling only slightly, from 21 to 19 per 100,000 population (age-standardised) (Table A1).

Table A1: Total incidence of ESKD, by sex, 1997–2013

	All records excluding N18.0 and/or N18.5	All records including N18.0 and/or N18.5
	Number of cases	
Males	37,232	39,916
Females	33,323	35,309
Total	**70,555**	**75,225**
	Number per 100,000 population[(a)]	
Males	23.5	25.2
Females	15.9	16.9
Total	**19.3**	**20.5**

(a) Directly age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

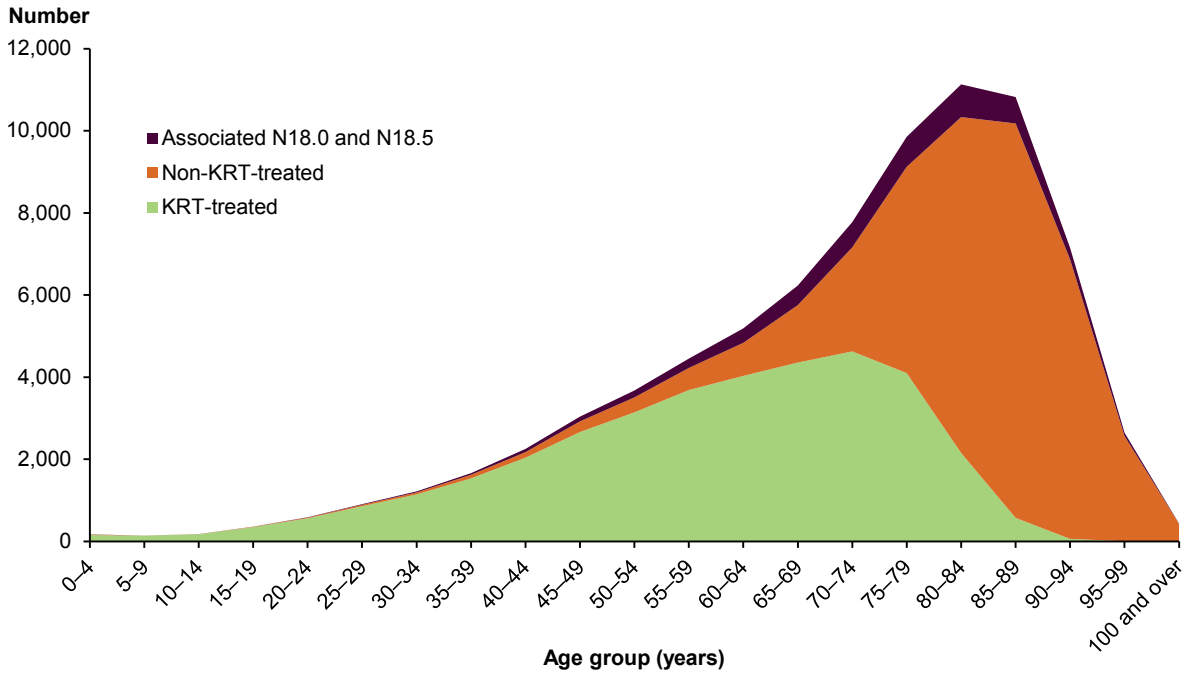
The non-KRT-treated incidence rate fell from 10.3 to 9.1 per 100,000 population when excluding 'chronic kidney failure, end-stage' as an associated cause of death (Table A2). The excluded cases were in almost all age groups, but were more common among those aged 65–90, accounting for more than three-quarters of the excluded cases (Figure A1).

Table A2: Total incidence of ESKD, by treatment status, 1997–2013

	All records excluding N18.0 and/or N18.5	All records including N18.0 and/or N18.5
	Number of cases	
KRT-treated cases	36,376	36,376
Non-KRT-treated cases	34,179	38,849
Total	**70,555**	**75,225**
	Number per 100,000 population[(a)]	
KRT-treated cases	10.2	10.2
Non-KRT-treated cases	9.1	10.3
Total	**19.3**	**20.5**

(a) Directly age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.



Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Figure A1: Number of KRT-treated and non-KRT-treated cases, and cases with N18.0 and/or N18.5 listed as an associated cause of death, by age group, 1997–2013

The result of this sensitivity analysis is that the removal of all the non-KRT-treated cases with an associated cause of death of 'chronic kidney failure, end-stage' does not substantially alter the estimates of the total incidence of ESKD contained in this report.

Populations used in this report

Aboriginal and Torres Strait Islander status

When reporting data by Aboriginal and Torres Strait Islander status, the terminology differs between the ANZDATA and the AIHW NMD due to the way the data are collected in the 2 main data sources. In this report, individuals were classified as Indigenous (Aboriginal or Torres Strait Islander) if they were recorded as such in either the ANZDATA or in the mortality data (AIHW NMD). The ANZDATA collects all information from the registered individuals and, as such, consists of complete record for each participant. In contrast, the quality of Indigenous identification in death registration data by state and territory has been of sufficient quality in South Australia, Western Australia and the Northern Territory since 1991 and in Queensland and New South Wales since 1998. Therefore the data analysis and comparisons between Indigenous and non-Indigenous Australians are based on the 5 jurisdictions listed above, where people were first treated/registered and the time series starts from 1998. Registered deaths where Indigenous status was not stated are excluded from analyses that compare outcomes for Indigenous and non-Indigenous Australians. Consequently the estimation of total incidence of ESKD for comparison among Indigenous and non-Indigenous Australians is based on 49,694 records.

Analysis of Indigenous and non-Indigenous mortality data by remoteness has not been presented in this report because it is confounded by identification issues listed above that, at present, cannot be adjusted.

Remoteness and socioeconomic disadvantage

In this report, remoteness and socioeconomic disadvantage information has been presented only for the combined 5-year period 2009–2013, as postcode information close to the 2011 Census year increases the quality of the data with matching postcode information from numerous data sources. These data are derived from postcode for the KRT-treated cases and from statistical area level 2 for non-KRT-treated cases. Further information on the ASGS is available on the ABS website at: <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/2901.0Chapter23102011>. In this report, less than 1% of attrition in records occurred due to some postcodes recorded on the ANZDATA corresponding with postal services rather than the usual area of residence.

Classifications

Reporting by remoteness

Comparisons of regions in this report use the Australian Statistical Geography Standard (ASGS) 2011 Remoteness Structure, developed by the ABS, which groups Australian regions into 6 remoteness areas. The 6 remoteness areas are *Major cities*, *Inner regional*, *Outer regional*, *Remote*, *Very remote* and *Migratory*. These areas are defined using the Accessibility/Remoteness Index for Australia (ARIA). ARIA is a measure of the remoteness of a location from the services that large towns or cities provide. Accessibility is based on distance to a metropolitan centre. A higher ARIA score denotes a more remote location. The category *Major cities* include Australia's capital cities, with the exceptions of Hobart and Darwin, which are classified as *Inner regional*. The sixth Remoteness Area, *Migratory*, is not used in this publication.

Further information on the ASGS is available on the ABS website at: <http://www.abs.gov.au/websitedbs/d3310114.nsf/home/australian+statistical+geography+standard+(asgs)>.

Reporting by socioeconomic disadvantage

The ABS has constructed a number of socioeconomic indexes to classify areas on the basis of social and economic information collected in the Census of Population and Housing. In this report, the Socio-economic Indexes for Areas (SEIFA) Index of Relative Socio-economic Disadvantage (IRSD) is used. This is derived from social and economic characteristics of the local area such as low income, low educational attainment, high levels of public-sector housing, high unemployment and jobs in relatively unskilled occupations.

Because the IRSD summarises variables that indicate disadvantage, a low score indicates that an area has many low-income families, many people with little training and many people working in unskilled occupations, and this area may be considered as disadvantaged relative to other areas. It is important to understand that a high score reflects a relative lack of disadvantage rather than advantage, and that the IRSD relates to the average disadvantage of all people living in a geographical area. Thus it cannot be presumed to apply to all

individuals living within the area. As the population of many areas covers a broad range of socioeconomic disadvantage, these measures will generally underestimate the true effect of disadvantage on health.

For analysis, the population was divided into 5 socioeconomic status (SES) groups with roughly equal populations (each around 20% of the total) based on the level of disadvantage of the statistical local area of their usual residence. The first group includes the 20% of the population living in areas with the highest levels of relative disadvantage (lowest SES), while the last group includes the 20% of the population living in areas with the lowest levels of relative disadvantage (highest SES).

Note, in this report not all geographical areas are assigned to the SEIFA IRSD index and therefore adding counts for all socioeconomic groups will not match the total incidence of ESKD. The SEIFA IRSD values used in this report are based on the 2011 Census. Further information is available on the ABS website at: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/2033.0.55.0012011?OpenDocument>.

Disease classifications

Cause of death is coded according to rules set forward in various versions of the International Classification of Diseases (ICD) published by the World Health Organization. The relevant codes for deaths during the period covered by this report are provided in Table A3.

Table A3: ICD-10 codes used to define conditions recorded as the underlying or associated cause of death

Conditions	ICD-10 codes
Chronic kidney disease	**B52.0, D59.3, E10.2, E11.2, E12.2, E13.2, E14.2, E85.1, I12–I13, I15.0, I15.1, N00–N07, N11, N12, N14, N15, N18, N19, N25–N28, N39.1, N39.2, Q60–Q63, T82.4, T86.1,**
Chronic kidney failure	N18.0, N18.5, N18.8, N18.9
Hypertensive kidney failure	I12.0, I13.1, I13.2
Unspecified kidney failure	N19
Diabetic nephropathy	E10.2, E11.2, E12.2, E13.2, E14.2
Other chronic kidney diseases	B52.0, D59.3, E85.1, I12.9, I13.0, I13.9, N00–N07, N11, N12, N14, N15, N18.1, N18.2, N18.3, N18.4, N25–N28, N39.1, N39.2, Q60–Q63, T82.4, T86.1
Cardiovascular disease	**I00–I99**
Hypertensive disease	I10–I15
Coronary heart disease	I20–I25
Heart failure and cardiomyopathy	I25.5, I42.0, I42.5–I42.9, I43, I50
Cerebrovascular disease	I60–I69
Peripheral vascular disease	I70–I74
Other CVD	I00–109, I26–I28, I30–I39, I40, I41, I42.1–I42.4, I44–I49, I51, I52, I77–I79, I80–I89, I95–I99
Diabetes	**E10–E11, E13–E14, O24.0–O24.4, O24.9**
Septicaemia	**A40–A41**
Cancer	**C00–D48**
Dementia and Alzheimer	**F00–F03, G30**
Respiratory disease	**J00–J99**
Influenza and pneumonia	J09–J18
Acute kidney Injury	**N00, N10, N17, O08.4, O90.4, O99.0**
Ill-defined	**R00–R94, R96–R99**
External causes	**V01–Y98**

Statistical measures

Age-specific rates

Age-specific rates are calculated by dividing the number of cases occurring in a specified age group by the corresponding population in the same age group, expressed as a rate (for example, number per 100,000 persons).

Age-standardised rates

Age-standardisation is a method of removing the influence of age when comparing populations with different age structures—either different populations at one time or the same population at different times. Two different methods of age-standardisation can be used: direct and indirect. Direct age-standardisation is used in this report. The Australian estimated resident population as at 30 June 2001 has been used as the standard population.

Rate ratio

The rate ratio measures the relative difference between 2 population groups. In this report, the ratio is calculated by dividing the age-standardised rate for one population group by the age-standardised rate for another population group. A rate ratio of 1 indicates that the rate of the characteristic is the same in both populations.

Appendix B: Detailed statistical tables

Table B1: Trends in total incidence of ESKD, by sex, 1997–2013

	Number			Number per 100,000 population[(a)]		
Year	Males	Females	Persons	Males	Females	Persons
1997	1,733	1,627	3,360	24.0	16.6	19.6
1998	1,890	1,716	3,606	25.1	17.1	20.5
1999	1,921	1,755	3,676	25.1	17.0	20.3
2000	1,902	1,747	3,649	23.9	16.4	19.5
2001	1,992	1,815	3,807	24.1	16.5	19.7
2002	2,097	1,867	3,964	25.0	16.4	20.0
2003	2,131	1,930	4,061	24.5	16.7	20.1
2004	2,139	1,805	3,944	24.2	15.3	19.1
2005	2,328	2,045	4,373	25.3	17.0	20.6
2006	2,648	2,148	4,796	28.1	17.3	22.0
2007	2,665	2,329	4,994	27.3	18.0	22.1
2008	2,753	2,504	5,257	27.4	18.7	22.6
2009	2,721	2,519	5,240	26.3	18.3	21.9
2010	2,621	2,303	4,924	24.5	16.2	20.0
2011	2,708	2,404	5,112	24.5	16.9	20.3
2012	2,921	2,468	5,389	25.7	16.6	20.7
2013	2,746	2,327	5,073	23.3	15.5	19.1
Total	**39,916**	**35,309**	**75,225**	. .	. .	. .

(a) Age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B2: Total incidence of ESKD, by age and sex, 1997–2013 (number per 100,000 population)

	Age group (years)							
	0–54		55–64		65–74		75+	
Year	Males	Females	Males	Females	Males	Females	Males	Females
1997	5.4	4.2	27.1	25.4	59.1	44.7	209.0	140.7
1998	6.1	4.0	27.1	24.7	63.7	46.4	216.9	151.6
1999	5.7	4.3	26.5	23.1	64.2	48.6	220.6	146.6
2000	5.6	4.2	26.8	21.2	60.4	47.2	209.0	143.6
2001	5.8	4.5	28.4	22.8	65.1	41.9	202.5	147.7
2002	5.6	3.9	27.5	18.7	61.9	42.8	223.0	159.8
2003	6.0	4.1	26.8	17.9	64.5	46.3	208.7	159.5
2004	5.8	3.8	25.7	17.9	61.2	41.9	210.9	144.3
2005	6.3	4.4	29.0	22.2	66.6	45.0	214.9	156.3
2006	6.5	4.4	31.4	20.9	74.2	46.7	246.9	165.9
2007	6.5	4.4	32.1	20.0	67.3	41.5	245.1	189.5
2008	6.4	4.7	33.5	20.1	68.1	43.8	245.4	201.5
2009	5.8	4.6	31.4	18.4	66.8	41.0	242.7	202.7
2010	5.8	4.1	30.3	17.2	59.7	36.3	224.6	181.1
2011	6.0	4.8	30.2	19.9	57.5	38.3	228.2	174.0
2012	6.5	4.4	31.3	20.7	56.4	36.6	241.7	179.9
2013	6.0	4.4	30.9	21.2	57.3	34.7	206.8	158.9

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B3: Total incidence of ESKD, by Indigenous status, 2009–2013

	Indigenous	Non-Indigenous	Rate ratio (Indigenous/ non-Indigenous)
		Number	
Males	605	8,820	. .
Females	807	7,577	. .
Persons	*1,412*	*16,397*	. .
Age group (years)		**Number per 100,000 population**	
0–24	1.9	1.4	1.4
25–34	16.3	3.3	4.9
35–44	65.0	5.8	11.3
45–54	148.0	11.0	13.4
55–64	227.5	21.5	10.6
65–74	265.9	43.8	6.1
75 and over	368.0	190.4	1.9
		Number per 100,000 population[(a)]	
Males	84.6	22.8	3.7
Females	103.5	16.3	6.4
Persons	*94.9*	*19.3*	*4.9*

(a) Age-standardised to the Australian population as at 30 June 2001.

Notes

1. Data are for those first treated/registered in New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.
2. Excludes deaths with no stated information on Aboriginal and Torres Strait Islander status.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B4: Total incidence of ESKD, by Indigenous status and sex, 1999–2012 (number per 100,000 population)[(a)]

	Indigenous		Non-Indigenous		Rate ratio (Indigenous/non-Indigenous)	
Year	Males	Females	Males	Females	Males	Females
1999	98.4	123.5	21.3	14.7	4.6	8.4
2000	90.4	127.2	21.1	14.7	4.3	8.6
2001	87.2	116.4	21.0	15.0	4.2	7.8
2002	89.9	113.3	21.3	15.4	4.2	7.4
2003	92.4	106.3	21.5	14.9	4.3	7.1
2004	95.6	113.8	22.0	15.1	4.4	7.5
2005	104.0	117.2	23.4	15.4	4.4	7.6
2006	112.9	116.7	24.6	16.5	4.6	7.1
2007	113.8	114.4	25.4	17.5	4.5	6.5
2008	92.6	109.6	25.0	18.1	3.7	6.1
2009	85.8	105.1	23.9	17.6	3.6	6.0
2010	79.2	100.3	22.9	16.8	3.5	6.0
2011	84.9	102.9	22.7	16.1	3.7	6.4
2012	87.2	107.8	22.6	15.7	3.9	6.8

(a) Age-standardised rates are based on a 3-year moving average between 1998 and 2013.

Notes

1. Data are for those first treated/registered in New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.
2. Excludes deaths with no stated information on Aboriginal and Torres Strait Islander status.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B5: Total incidence of ESKD, by selected population characteristics and sex, 2009–2013

	Number			Number per 100,000 population[(a)]		
Population subgroup	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**
Remoteness						
Major cities	9,146	7,857	17,003	24.6	15.6	19.6
Inner regional	2,726	2,357	5,083	23.7	15.6	19.3
Outer regional	1,342	1,224	2,566	24.6	19.6	22.0
Remote and very remote	453	531	984	37.2	50.2	43.0
Socioeconomic group						
Group 1 (lowest SES)	3,524	3,173	6,697	29.7	21.7	25.4
Group 2	3,003	2,685	5,688	25.3	17.6	21.2
Group 3	2,674	2,309	4,983	24.1	16.0	19.7
Group 4	2,408	2,041	4,449	23.9	15.0	19.0
Group 5 (highest SES)	2,055	1,760	3,815	20.4	12.3	15.8

(a) Age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B6: Total incidence of ESKD, by treatment status and sex, 1997–2013

	Number						Number per 100,000 population[(a)]					
	KRT-treated			Non-KRT-treated			KRT-treated			Non-KRT-treated		
Year	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons
1997	839	647	1,486	894	980	1,874	9.7	7.1	8.3	14.3	9.6	11.3
1998	950	656	1,606	940	1,060	2,000	10.8	7.0	8.8	14.3	10.0	11.6
1999	1,007	742	1,749	914	1,013	1,927	11.3	7.8	9.4	13.8	9.2	10.9
2000	996	756	1,752	906	991	1,897	11.0	7.8	9.3	13.0	8.7	10.3
2001	1,112	796	1,908	880	1,019	1,899	12.0	8.0	9.9	12.1	8.5	9.8
2002	1,139	752	1,891	958	1,115	2,073	12.1	7.4	9.6	12.9	9.0	10.4
2003	1,163	815	1,978	968	1,115	2,083	12.1	7.9	9.9	12.3	8.8	10.2
2004	1,174	774	1,948	965	1,031	1,996	12.1	7.4	9.6	12.1	7.9	9.5
2005	1,362	932	2,294	966	1,113	2,079	13.7	8.7	11.0	11.6	8.3	9.6
2006	1,474	960	2,434	1,174	1,188	2,362	14.5	8.8	11.5	13.5	8.5	10.5
2007	1,480	903	2,383	1,185	1,426	2,611	14.3	8.2	11.0	13.0	9.8	11.1
2008	1,547	1,006	2,553	1,206	1,498	2,704	14.5	8.9	11.5	12.9	9.8	11.1
2009	1,478	953	2,431	1,243	1,566	2,809	13.5	8.2	10.7	12.7	10.1	11.2
2010	1,461	874	2,335	1,160	1,429	2,589	13.1	7.4	10.1	11.4	8.8	9.9
2011	1,492	1,019	2,511	1,216	1,385	2,601	13.1	8.4	10.6	11.5	8.4	9.7
2012	1,601	972	2,573	1,320	1,496	2,816	13.7	7.8	10.6	12.0	8.8	10.1
2013	1,546	998	2,544	1,200	1,329	2,529	12.8	7.8	10.2	10.4	7.7	8.9
Total	**21,821**	**14,555**	**36,376**	**18,095**	**20,754**	**38,849**	. .	. .	. .	. .	. .	. .

(a) Age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B7: Total incidence of ESKD, by treatment status and age, 1997–2013 (number per 100,000 population)

Year	Age group (years)							
	0–54		55–64		65–74		75+	
	KRT-treated	Non-KRT-treated	KRT-treated	Non-KRT-treated	KRT-treated	Non-KRT-treated	KRT-treated	Non-KRT-treated
1997	4.4	0.4	19.8	6.5	30.5	21.0	14.3	152.5
1998	4.5	0.5	20.9	5.0	32.1	22.6	18.9	157.8
1999	4.6	0.4	19.7	5.1	38.8	17.2	22.4	152.8
2000	4.6	0.4	19.7	4.3	34.8	18.7	25.8	143.3
2001	4.7	0.4	21.6	4.1	37.4	15.7	28.9	140.3
2002	4.4	0.3	19.8	3.3	36.7	15.4	31.0	153.8
2003	4.7	0.4	19.2	3.2	36.2	18.9	33.7	145.4
2004	4.5	0.3	18.6	3.2	36.8	14.5	31.4	139.8
2005	5.0	0.4	22.9	2.8	41.2	14.3	38.0	142.1
2006	5.1	0.3	22.9	3.3	43.7	16.4	40.4	158.6
2007	5.2	0.3	22.0	4.1	37.8	16.3	39.5	172.8
2008	5.2	0.3	23.3	3.5	41.7	14.0	40.9	178.7
2009	4.8	0.4	21.3	3.6	38.2	15.5	39.6	179.7
2010	4.7	0.3	20.5	3.3	33.8	14.0	36.7	162.5
2011	5.0	0.4	22.3	2.7	33.9	13.9	37.5	159.2
2012	5.2	0.3	22.7	3.2	33.1	13.3	35.9	170.1
2013	4.8	0.4	22.3	3.7	33.3	12.6	34.6	144.6

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B8: Total incidence of ESKD, by treatment and Indigenous status, 2009–2013

Treatment status	Indigenous	Non-Indigenous	Rate ratio (Indigenous/ non-Indigenous)
	Number		
KRT-treated	1,121	7,747	. .
Non-KRT-treated	291	8,650	. .
Total	**1,412**	**16,397**	**. .**
	Number per 100,000 population[(a)]		
KRT-treated	62.7	9.2	6.8
Non-KRT-treated	32.1	10.1	3.2
Total	**94.9**	**19.3**	**4.9**

(a) Age-standardised to the Australian population as at 30 June 2001.

Notes

1. Data are for those first treated/registered in New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.
2. Excludes deaths with no stated information on Aboriginal and Torres Strait Islander status.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B9: Total incidence of ESKD, by treatment and Indigenous status, 1999–2012 (number per 100,000 population)[(a)]

	Indigenous		Non-Indigenous		Rate ratio (Indigenous/Non-Indigenous)	
Year	KRT-treated	Non-KRT-treated	KRT-treated	Non-KRT-treated	KRT-treated	Non-KRT-treated
1999	67.4	44.1	8.2	9.4	8.2	4.7
2000	70.0	39.7	8.5	9.0	8.2	4.4
2001	70.2	32.5	8.5	9.1	8.2	3.6
2002	72.7	29.7	8.8	9.3	8.3	3.2
2003	70.8	29.2	8.7	9.2	8.1	3.2
2004	74.1	31.3	9.2	9.0	8.0	3.5
2005	76.7	34.0	9.7	9.3	7.9	3.6
2006	78.8	35.3	10.1	10.1	7.8	3.5
2007	78.0	35.7	10.3	10.8	7.6	3.3
2008	69.7	32.4	10.1	11.2	6.9	2.9
2009	64.0	33.0	9.8	10.7	6.5	3.1
2010	60.5	30.4	9.4	10.3	6.4	3.0
2011	64.5	30.3	9.2	10.0	7.0	3.0
2012	66.2	31.9	9.1	9.8	7.3	3.2

(a) Age-standardised rates are based on a 3-year moving average between 1998 and 2013.

Notes

1. Data are for those first treated/registered in New South Wales, Queensland, Western Australia, South Australia and the Northern Territory only.
2. Excludes deaths with no stated information on Aboriginal and Torres Strait Islander status.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B10: Total incidence of ESKD, by treatment status and selected population characteristics, 2009–2013

Population subgroup	Number		Number per 100,000 population[(a)]	
	KRT-treated	Non-KRT-treated	KRT-treated	Non-KRT-treated
Remoteness				
Major cities	8,149	8,854	10.1	9.5
Inner regional	2,197	2,886	9.2	10.1
Outer regional	1,281	1,284	11.3	10.7
Remote and very remote	702	282	27.5	15.5
Socioeconomic group				
Group 1 (lowest SES)	3,347	3,350	13.8	11.6
Group 2	2,634	3,054	10.7	10.5
Group 3	2,435	2,548	10.2	9.5
Group 4	2,151	2,298	9.6	9.4
Group 5 (highest SES)	1,760	2,055	7.8	8.1

(a) Age-standardised to the Australian population as at 30 June 2001.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B11: Underlying cause of death for KRT-treated deaths, 2009–2013

Underlying cause of death	ICD code/s	Number	Per cent
Chronic kidney failure	N18.0, N18.5, N18.8, N18.9	1,094	14.9
Hypertensive kidney failure	I12.0, I13.1, I13.2	276	3.8
Unspecified kidney failure	N19	189	2.6
Diabetic nephropathy	E10.2, E11.2, E12.2, E13.2, E14.2	399	5.4
Diabetes[(a)]	E10–E11, E13–E14, O24.0–O24.4, O24.9	870	11.8
Other chronic kidney diseases	B52.0, D59.3, E85.1, I12.9, I13.0, I13.9, N00–N07, N11, N12, N14, N15, N18.1, N18.2, N18.3, N18.4, N25–N28, N39.1, N39.2, Q60–Q63, T82.4, T86.1	254	3.5
Cardiovascular disease[(b)]	I00–I99	1,810	24.6
Cancer	C00–D48	929	12.6
Respiratory disease	J00–J99	250	3.4
External causes	V01–Y98	199	2.7
Other[(c)]	A00–A99, B00–B99, D50–D89, E00–E90, F00–F99, G00–G99, H00–H59, K00–K93, L00–L99, M00–M99, N00–N99, O00-O99, Q00–Q99, R00–R99	1,084	14.7
Total		**7,354**	**100.0**

(a) Excludes diabetic nephropathy.

(b) Excludes I12 and I13 because they are ICD-10 codes for hypertensive kidney failure or other chronic kidney diseases.

(c) Excludes codes for diseases defined above.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

Table B12: Underlying cause of death for non-KRT-treated deaths, 2009–2013

Underlying cause of death	ICD code/s	Number	Per cent
Chronic kidney failure	N18.0, N18.5, N18.8, N18.9	5,789	43.4
Hypertensive kidney failure	I12.0, I13.1, I13.2	2,684	20.1
Unspecified kidney failure	N19	2,904	21.8
	Deaths with an associated cause of N18.0 and/or N18.5		
Diabetic nephropathy	E10.2, E11.2, E12.2, E13.2, E14.2	185	1.4
Diabetes[(a)]	E10–E11, E13–E14, O24.0–O24.4, O24.9	259	1.9
Other chronic kidney diseases	B52.0, D59.3, E85.1, I12.9, I13.0, I13.9, N00–N07, N11, N12, N14, N15, N18.1, N18.2, N18.3, N18.4, N25–N28, N39.1, N39.2, Q60–Q63, T82.4, T86.1	76	0.6
Cardiovascular disease[(b)]	I00–I99	624	4.7
Cancer	C00–D48	344	2.6
Respiratory disease	J00–J99	119	0.9
External causes	V01–Y98	37	0.3
Other[(c)]	A00–A99, B00–B99, D50–D89, E00–E90, F00–F99, G00–G99, H00–H59, K00–K93, L00–L99, M00–M99, N00–N99, Q00–Q99	323	2.4
Total		**13,344**	**100.0**

(a) Excludes diabetic nephropathy.

(b) Excludes I12 and I13 because they are ICD-10 codes for hypertensive kidney failure or other chronic kidney diseases.

(c) Excludes codes for diseases defined above.

Source: Linked ANZDATA, AIHW National Mortality Database and National Death Index.

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The incidence of end-stage kidney disease is an important indicator of the health of the Australian population and valuable for health-care planning. End-stage kidney disease usually requires kidney replacement therapy to survive—either dialysis or a kidney transplant—but not all people with ESKD receive these treatments for a variety of reasons.

This report builds on an established method for estimating the incidence of end-stage kidney disease and indicates that for every new case treated with dialysis or transplant there is one that is not. The incidence rates of end-stage kidney disease are highest among those aged 75 and over.