Potentially preventable hospitalisations in Australia:

variations by sociodemographic characteristics and geographic areas, with a focus on Aboriginal and Torres Strait Islander people, 2012/13 to 2014/15

May 2018

PHIDU TORRENS UNIVERSITY AUSTRALIA
[public health information development unit]

Copyright

Suggested citation

Public Health Information Development Unit (2018). *Potentially preventable hospitalisations in Australia: variations by sociodemographic characteristics and geographical areas, with a focus on Aboriginal and Torres Strait Islander people, 2012/13 to 2014/15*. Adelaide: PHIDU.

Please direct enquiries to PHIDU Enquiries (phidu_enquiries@laureate.net.au)

Contents

Page

List of Figures

List of Tables

List of Maps

Acknowledgements

This report was written by Katie Beckwith and John Glover at the Public Health Information Development Unit (PHIDU).

The production of this report would have not have been possible without the support and contributions of:

- The Australian Institute of Health and Welfare for supplying the data from the National Hospital Morbidity Database
- State and Territory health departments for their consent to use of the data.

However, the responsibility for the content of the report rests wholly with PHIDU.

Executive summary

Potentially preventable hospitalisations (PPHs) are admissions to hospital that could potentially have been prevented through the application of appropriate preventative health measures and early disease management. PPHs are used in Australia and internationally as a health system performance indicator. A PPH is identified based on the diagnosis recorded in hospitalisation data.

Hospitalisation data from the National Hospital Morbidity Database were analysed by age, sex, primary diagnosis, geographical classifications and Aboriginal Australian identity.

Key results:

All Australians	Aboriginal Australians
• One in 16 hospitalisations (6.2% of all hospitalisations) were potentially preventable, equating to over 600,000 hospitalisations per annum	• One in 12 hospitalisations (8.3% of all hospitalisations) were potentially preventable, equating to almost 35,000 hospitalisations per annum
• PPHs were more than twice as prevalent in the Northern Territory than any other state or territory except Queensland	• Aboriginal Australians had a higher rate of PPH than non-Aboriginal Australians, overall, for condition categories and for almost all individual conditions
• There was a higher rate of PPHs among females than males, both overall and in the age groups 15 to 24 years and 25 to 44 years	• The PPH rate was higher among Aboriginal females than males, mostly for age groups 15 to 24 years and 25 to 44 years
• PPH rates were higher in each age group from 15 to 24 years	• Rates of PPHs were higher with older age groups from 15 to 24 years
• PPH rates were highest for urinary tract infection (UTI), dental conditions, chronic obstructive pulmonary disease (COPD), cellulitis and congestive cardiac failure (CCF)	• The highest PPH rates among Aboriginal Australians were for cellulitis, convulsions and epilepsy, COPD, dental conditions and UTI, closely followed by ENT infections and diabetes complications
• The higher rate of PPHs among females was largely due to higher rates of UTI and iron deficiency anaemia among females than males	• Aboriginal females were disproportionately hospitalised for UTI and iron deficiency anaemia compared to males, but these two conditions had a lower impact on the overall rate of PPHs among Aboriginal Australians than all Australians
• Males had higher rates of PPH for angina and diabetes complications	• There was less overall disparity between males and females for PPHs due to chronic conditions among Aboriginal Australians than non-Aboriginal Australians, with angina, CCF, COPD and diabetes complications influencing this result
• PPHs for acute conditions were more common than chronic among younger age groups, and chronic conditions were more common than acute among older age groups	• Acute conditions were more prevalent than chronic in the younger age groups, and chronic conditions were more prevalent in older age groups
• Higher rates of PPH were associated with greater remoteness and greater socioeconomic disadvantage	• Higher rates of PPH were associated with greater remoteness, though there was a lower rate in Very Remote than Remote areas
• Variability between PPH rates in Primary Health Networks is small across most of the country, with starkly high rates in NT and Western Queensland, and low rates in ACT, Tas and Northern Sydney.	• There is a high degree of variability in PPH rates across Indigenous Regions, with the highest rates in remote areas of NT and WA, and the lowest in Tas and ACT.

Differential rates of PPHs are associated with geographical, socioeconomic and cultural factors. Barriers of a distance and transport, social, financial and cultural nature are likely to contribute to the rate of PPHs. There is opportunity for further research and analysis into PPHs in Australia.

This page intentionally left blank

1 Introduction

Potentially preventable hospitalisations (PPHs) are admissions to hospital that could potentially have been prevented through the application of appropriate preventative health measures and early disease management. They represent a range of conditions that can either be prevented from occurring or where hospitalisation can be avoided through provision of timely and effective primary care in settings which include general practitioners, medical specialists, dentists, nurses and allied health professionals.[1] PPHs are used in Australia and internationally as a health system performance indicator.[2] In Australia, PPHs relate to the outcome 'Australians receive appropriate high quality and affordable primary and community health services' in the National Healthcare Agreement.[3]

A PPH is identified based on the diagnosis recorded in hospitalisation data. There are three categories of PPHs:

- vaccine-preventable conditions, such as measles, mumps and tetanus;
- acute conditions, such as urinary tract infection (UTI), ear, nose and throat (ENT) infections and perforated/bleeding ulcer; and
- chronic conditions, such as asthma, diabetes complications and angina[1] (see Table 8.1 Appendix 8.1).

PPHs in each condition category represents a different area of primary healthcare. Vaccine-preventable conditions point to primary prevention or vaccination services. Acute conditions point to secondary prevention or early detection and treatment services. Chronic conditions point to tertiary prevention or disease management and symptom reduction services. In addition, a higher prevalence of PPHs due to acute conditions may indicate a higher underlying prevalence of the condition, and possibly poor primary prevention. Likewise, chronic conditions may indicate poor primary and secondary prevention. Of course, prevention of chronic diseases is more complex than prevention of acute diseases, which is in turn more complex than the prevention of vaccine-preventable conditions.

The primary influences on PPH rates may be considered to fall in two categories: the underlying prevalence of a condition and associated risk factors (need), and the characteristics of health services (meeting the need). In turn, meeting the need involves two main aspects of health service provision. The first is adequacy of care, entailing availability, accessibility and affordability, and the presence of physical access and financial barriers. The second aspect is appropriateness of care, incorporating the quality and acceptability of care, and the presence of cultural or social barriers. While a higher rate of PPHs could indicate shortcomings in the adequacy or appropriateness of non-hospital care, it can also indicate the appropriate use of hospital services in response to greater need.[3]

Access to health services is a major concern for those living outside of major cities.[4] People living in Remote and Very Remote areas of Australia have poorer access to and use of health services compared to regional areas and Major Cities,[5] with increasing remoteness associated with fewer general practitioners, fewer appointments out of usual business hours and people waiting too long to see a GP.[6]

The availability and use of Indigenous-specific services has increased since the late 1990s, and there has been improvement in chronic disease detection and management with the introduction of the Indigenous chronic disease initiative in 2009-10.[7] Despite such improvements, there were 37 Statistical Areas Level 2 (SA2) identified where Aboriginal Australians had poor access to primary care services in 2012-13 and 2013,[8] and in 2012-13, 30% avoided going to a healthcare provider, and 36% faced barriers accessing healthcare.[7] Aboriginal Australians experience a higher prevalence of underlying diseases, and tend to live in more remote areas where access to health services is limited. The differences in PPH rates between Aboriginal and non-Aboriginal Australians could reflect persistent gaps in non-tertiary health care alternatives, incorporating primary prevention (e.g. immunisation), secondary prevention (early intervention) and tertiary prevention (disease and symptom management).[9,10]

This report explores the level and extent of variation in PPHs by demographic characteristics, regional area and level of disadvantage, with a focus on PPHs in the Aboriginal Australian population.

2 Methods

2.1.1 Data

Data have been compiled using hospitalisations data and estimate resident population (ERP).

Hospitalisations data were supplied by the Australian Institute of Health and Welfare (AIHW) from the National Hospital Morbidity Database (NHMD), on behalf of State and Territory health departments for 2012/13, 2013/14 and 2014/15. The data for these years have been combined to increase the number of hospitalisations available for analysis by small geographic areas; they have been coded to a common standard.

The conditions driving the selection of PPHs in this report follow the classification of selected PPHs from the National Healthcare Agreement.[1] The data includes hospitalisations by age, sex, condition and Population Health Area (PHA),[1] from essentially all hospitals in Australia, including public and private acute and psychiatric hospitals, free-standing day hospital facilities, alcohol and drug treatment hospitals and dental hospitals.

The data are based on the count of all hospitalisations. Repeated admissions for one person are counted as separate hospitalisations. Patients admitted to one hospital and transferred to another hospital are counted as separate hospitalisations. Although such transfers occur in all areas, they are likely to be more prevalent from regional to metropolitan areas, resulting in inflated rates of hospitalisations of people from regional areas. Some conditions may result in transfers more frequently than others.

Caution should be used in the interpretation of data for Aboriginal Australians because of under-identification of Aboriginal and Torres Strait Islander people. It is estimated that about 88% of Indigenous Australians nationally were identified correctly in public hospital admissions data in 2011–12. The extent to which Aboriginal Australians may be under-identified in private hospital data is unknown.[3]

ERP for the total Australian population was obtained from the Australian Bureau of Statistics (ABS), by age and sex by SA2 for 2011. For Aboriginal data, the 2011 ERP by age and sex by SA2 was developed by Prometheus Information Pty Ltd, under a contract with the Australian Government Department of Health.

The remoteness classification is based on the ABS remoteness structure 2011 which considers the physical distance of a location from the nearest Urban Centre (indicative of access to goods and services) based on population size.[11]

Quintiles of disadvantage are constructed using the ABS Index of Relative Socio-economic Disadvantage (IRSD) to create five groupings of areas, or quintiles. The groups represent area-based socioeconomic disadvantage, from the least disadvantaged 20% of the population (the group with the highest IRSD scores), to the most disadvantaged 20% (the group with the lowest IRSD scores).

2.1.2 Analysis

The hospitalisations data were extracted from the datasets for individual years 2012/13 to 2014/15, and aggregated.

---

[1] Population Health Areas are comprised of a combination of whole SA2s and aggregated SA2s. They were created as an alternative small area measure to SA2s in the Australian Statistical Geography Standard (ASGS) to better maintain confidentiality of data presented at small area level. It allows effective illustration of the extent of variation that exists between areas, that the next level of the ASGS (SA3s) does not. For more information, see http://phidu.torrens.edu.au/help-and-information/about-our-data/geographical-structures/pha-overview

Australian total 2011 ERP was concorded from SA2 to PHA. Aboriginal Australian 2011 ERP was concorded from SA2 to Indigenous Area (IARE).

Data for PHNs, Remoteness Areas and quintiles of socioeconomic disadvantage of area were produced from PHA data using correspondence files. Data for the Aboriginal population for Indigenous Region (IREG) and Remoteness Areas were produced from IARE data using correspondence files.

The Australian age-standardised rate (ASR) of PPHs for female, male and total Australians and for Aboriginal female, male and total Aboriginal Australians were calculated using the 2011 ERP, then divided by three to obtain the average annual ASR.

The Australian rates were used to indirectly age-standardise PPHs to the applicable population and produce ASRs.

Non-Aboriginal Australian rates for comparison with Aboriginal Australian rates were calculated from the differences between Aboriginal and total Australian numbers of hospitalisations and ERP for relevant variables.

PHAs were categorised to one of the five Australian Statistical Geography Standard (ASGS) Remoteness Areas, which are; Major Cities of Australia, Inner Regional, Outer Regional, Remote and Very Remote.

To compile quintiles of socioeconomic disadvantage, PHAs were ranked on their IRSD scores, and categorised into five population-equivalent groups based on those rankings.

2.1.3 Indigenous status

Note that the term Aboriginal Australian, Aboriginal male or Aboriginal female is used throughout this report to denote persons identifying as being of Aboriginal and/or Torres Strait Islander origin.

3 Potentially preventable hospitalisations

3.1 Potentially preventable and non-potentially preventable hospitalisations

In the three-year period from 2012/13 to 2014/15, 6.2% of hospitalisations were potentially preventable (Table 3.1). This equates to approximately one in 16 hospitalisations, and over 1.8 million potentially preventable hospitalisations (PPHs); an annual average of over 600,000.

The percentage of hospitalisations that were PPHs was slightly higher among males (6.4%) than females (6.1%), however females had more hospitalisations overall than males (15.4 million and 13.8 million, respectively).

Table 3.1: Potentially preventable hospitalisations and non-potentially preventable hospitalisations, by sex, Australia, 2012/13 to 2014/15

	Number			% of total	ASR per 100,000			Rate ratio
	Males	Females	Total		Males	Females	Total	M:F
PPH	880,349	931,142	1,811,499	6.2	2,639.4	2,765.9	2,702.9	0.95**
Non-PPH	12,963,213	14,441,284	27,404,900	93.8	38,864.7	42,896.6	40,890.6	0.91**
Total	**13,843,562**	**15,372,426**	**29,216,399**	**100.0**	**41,504.1**	**45,662.4**	**43,593.5**	**0.91****
PPH %	6.4	6.1	6.2	..	..	..	..	..

ASR = annualised age-standardised rate; PPH = potentially preventable hospitalisation

Note: Rate ratio is the ratio of male to female rates: rate ratios differing significantly from 1.0 are shown with * p < 0.05; ** p < 0.01

The overall rate of PPHs was 2,702.9 per 100,000 population. Females had statistically significantly higher rates of both types of hospitalisations than males, as demonstrated by the rate ratio (RR) of 0.95 for PPHs, and 0.91 for non-PPHs and total hospitalisations. The rate of hospitalisation among females was 2,765.9 per 100,000 population, and 2,639.4 per 100,000 population among males.

Figure 3.1 shows a comparison of male and female rates for PPHs, non-PPHs and total hospitalisations.

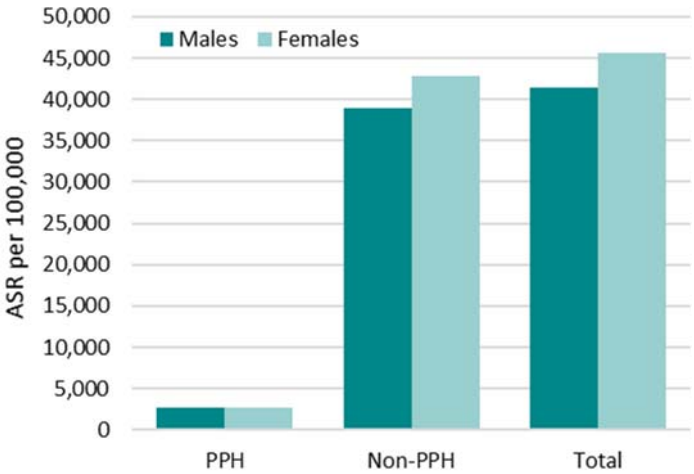


Figure 3.1: Potentially preventable hospitalisations and non-potentially preventable hospitalisations, annualised age-standardised rate per 100,000 population, by sex, Australia, 2012/13 to 2014/15

PPH = potentially preventable hospitalisation
ASR = annualised age-standardised rate

3.2 Age group and sex

In Table 3.2, persons aged 75 years and over accounted for almost three in 10 PPHs (28.9%). Persons aged 45 to 64 years accounted for the second highest percentage, with over one fifth of PPHs among this age group (21.5%). Together, these age groups contributed over half of all PPHs (50.4%), approaching one million PPHs (914,012) over the three-year period from 2012/13 to 2014/15. The lowest percentage of PPHs was for the persons aged 15 to 24 years, at 6.1%.

Although not shown in the table, the pattern was similar by sex. Females had a higher percentage of PPHs among those aged 75 and over (29.9%) than males (27.9%).

Table 3.2: Potentially preventable hospitalisations by age and sex, Australia, 2012/13 to 2014/15

	Number			% of total	ASR per 100,000			Rate ratio
	Males	Females	Total		Males	Females	Total	M:F
0–14	137,997	121,041	259,040	14.3	2,117.5	1,957.3	2,039.6	1.08**
15–24	41,959	69,261	111,220	6.1	890.8	1,544.2	1,209.5	0.58**
25–44	100,830	139,877	240,708	13.3	1,057.2	1,468.0	1,262.5	0.72**
45–64	198,340	191,299	389,640	21.5	2,380.7	2,260.5	2,320.2	1.05**
65–74	155,516	130,996	286,512	15.8	6,234.0	5,134.8	5,678.2	1.21**
75+	245,705	278,667	524,372	28.9	13,927.6	11,356.6	12,431.9	1.23**
Total	**880,349**	**931,142**	**1,811,499**	**100.0**	**2,639.4**	**2,765.9**	**2,702.9**	**0.95****

ASR = annualised age-standardised rate

Notes: Numbers and rates by age and sex may not add to the reported totals due to a small number of records without specified age or sex

Rate ratio is the ratio of male to female rates: rate ratios differing significantly from 1.0 are shown with * p < 0.05; ** p < 0.01

When standardised, persons aged 75 and over had the highest rate at 12,431.9 per 100,000 population, followed by those aged 65 to 74 years at 5,678.2 per 100,000 population. The lowest rate was among persons aged 15 to 24 years at 1,209.5 per 100,000 population.

The greatest difference between male and female rates was in the age group 75 years and over, with 23% more PPHs among males than females (RR = 1.23), followed by age 65 to 74 years, with 21% more PPHs among males than females (RR = 1.21). These differences were all statistically significant.

Males had a higher rate of PPHs than females for those aged 0 to 14 years and 45 to 64 years, though only by 8% and 5% respectively (RRs = 1.08 and 1.05). Conversely, the male rate was 42% lower than the female rate for ages 15 to 24-years (RR = 0.58), and 28% lower for ages 25 to 44 years (RR = 0.72). These rates were statistically significant.

Figure 3.2 shows the pattern of rate of PPHs by sex across age groups.

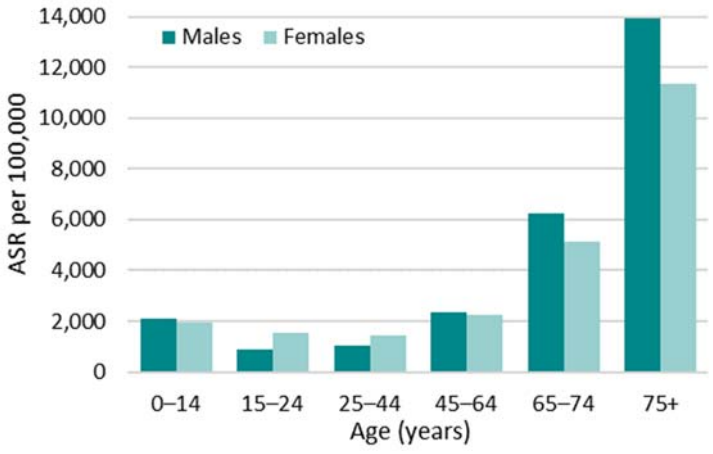


Figure 3.2: Potentially preventable hospitalisations, annualised age-standardised rate per 100,000 population, by age and sex, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate

3.3 Condition

Table 3.3 shows PPHs by condition and category of diagnosis. A list of conditions currently included in the PPH indicator is provided in Table 8.1 (Appendix 8.1).

During the period from 2012/13 to 2014/15, there was a similar percentage of PPHs for chronic conditions (47.7%) as for acute conditions (47.7%), and a much smaller percentage of vaccine-preventable conditions (5.3%). Influenza and pneumonia accounted for slightly over half of PPHs for vaccine-preventable conditions, at 2.8% of all conditions.

Of chronic conditions, the largest contributors were chronic obstructive pulmonary disease (COPD; 10.6% of all conditions), congestive cardiac failure (CCF; 8.8%), iron deficiency anaemia (6.9%), diabetes complications (6.9%) and angina (6.7%).

Urinary tract infections (UTI; 11.7%), dental conditions (10.7%), cellulitis (9.4%), ear, nose and throat (ENT) infections (6.4%) and convulsions and epilepsy (5.9%) contributed the greatest proportions to PPHs for acute conditions.

Table 3.3: Potentially preventable hospitalisations by sub-category and condition, Australia, 2012/13 to 2014/15

Sub-category and condition	Number	Rate	% of total
Vaccine-preventable	**96,705**	**144.3**	**5.3**
Influenza and pneumonia	50,557	75.4	2.8
Other vaccine-preventable	46,500	69.4	2.6
Chronic	**864,392**	**1,289.8**	**47.7**
Angina	120,661	180.0	6.7
Asthma	85,282	127.2	4.7
Bronchiectasis	17,590	26.2	1.0
Congestive cardiac failure	160,238	239.1	8.8
Chronic obstructive pulmonary disease	191,962	286.4	10.6
Diabetes complications	125,361	187.0	6.9
Hypertension	26,681	39.8	1.5
Iron deficiency anaemia	125,858	187.8	6.9
Nutritional deficiencies	1,510	2.3	0.1
Rheumatic heart disease	9,299	13.9	0.5
Acute	**863,651**	**1,288.6**	**47.7**
Cellulitis	171,199	255.4	9.4
Convulsions and epilepsy	106,932	159.6	5.9
Dental conditions	193,129	288.2	10.7
Ear, nose and throat infections	115,967	173.0	6.4
Eclampsia	231	0.3	–
Gangrene	28,589	42.7	1.6
Pelvic inflammatory disease	13,866	20.7	0.8
Perforated/bleeding ulcer	16,534	24.7	0.9
Pneumonia (not vaccine-preventable)	5,872	8.8	0.3
Urinary tract infections	211,332	315.3	11.7
Total PPH	**1,811,499**	**2,702.9**	**100**

PPH = potentially preventable hospitalisation

Notes: Rate is annualised age-standardised rate per 100,000 population

Sub-category and condition numbers, rates and percentages do not add to the reported total potentially preventable hospitalisations: while the reported figures are for primary reason for admission, there are a small number of records with more than one primary reason

The overall highest hospitalisation rates of conditions (Figure 3.3) are for UTI, dental conditions, COPD, cellulitis and CCF. These five conditions together account for over half of all PPHs (51.2%).

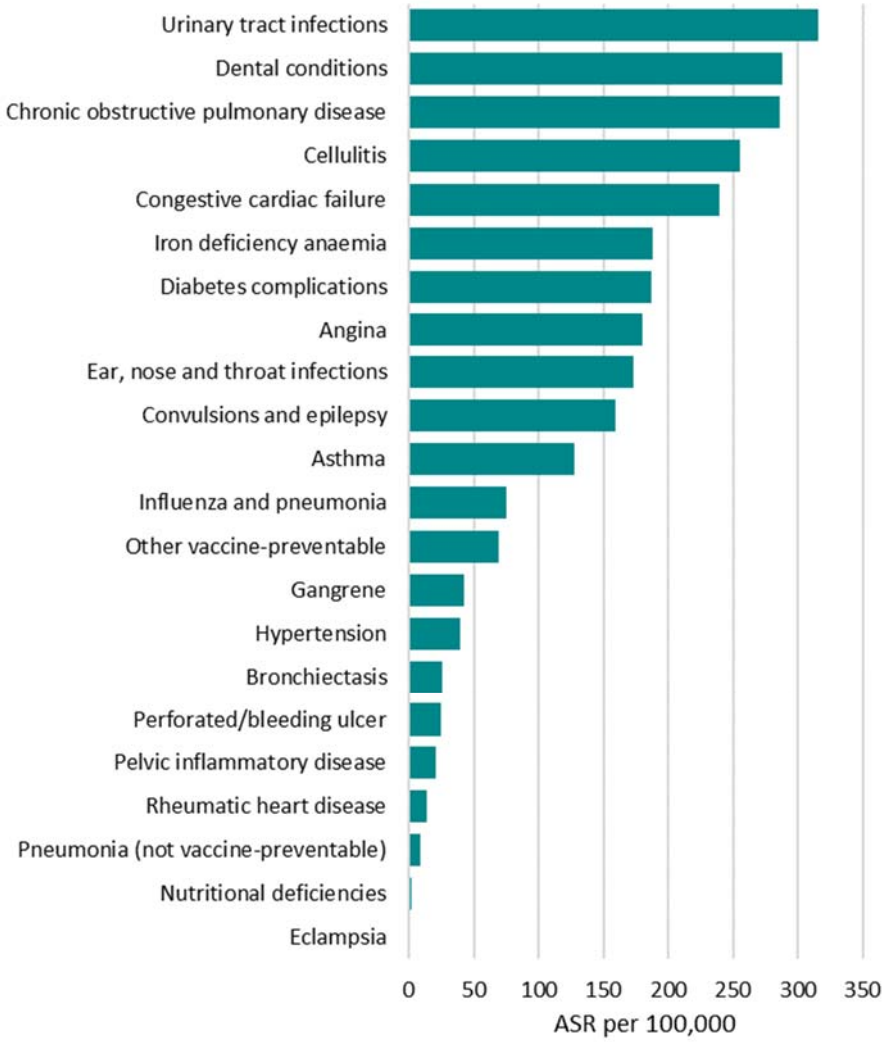


Figure 3.3: Potentially preventable hospitalisations by condition (ranked), annualised age-standardised rate per 100,000 population, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate

3.4 Condition and sex

Table 3.4 shows the difference between rates of conditions by sex. Males have a higher rate of PPHs for angina (RR = 1.54), perforated/bleeding ulcer (RR = 1.45) and diabetes complications (RR = 1.43) than females. The lowest RRs, signifying higher rates among females than males, were for bronchiectasis (RR = 0.48), UTI (RR = 0.49), hypertension (RR = 0.52) and iron deficiency anaemia (RR = 0.53).

The overall rate for females is higher than for males, as per discussion for Table 3.1. This is primarily driven by two conditions: UTI and iron deficiency anaemia. While the RRs for bronchiectasis and hypertension show large and significant differences, the rates of PPHs are not large, at 35.3 per 100,000 for bronchiectasis and 52.3 for hypertension. By comparison, rates for UTI and iron deficiency anaemia were large, at 422.4 and 244.7 per 100,000, respectively.

The largest RRs, signifying higher rates amongst males than females, are for angina at 1.54, perforated/bleeding ulcer at 1.45 and diabetes complications at 1.43. These ratios translate into rate differences of 77.9 for angina, 9.3 for perforated/bleeding ulcer and 67.6 for diabetes complications. These differences were all statistically significant.

Table 3.4: Potentially preventable hospitalisations by sub-category and condition, by sex, Australia, 2012/13 to 2014/15

	Males		Females		Rate ratio
Sub-category and condition	Number	Rate	Number	Rate	M:F
Vaccine-preventable	**51,099**	**153.2**	**45,606**	**135.5**	**1.12****
Influenza and pneumonia	23,551	70.6	24,087	71.5	0.98
Other vaccine-preventable	27,758	83.2	21,661	64.3	1.28**
Chronic	**431,430**	**1,293.5**	**432,930**	**1,286.0**	**1.00****
Angina	73,088	219.1	47,523	141.2	1.54**
Asthma	36,080	108.2	49,202	146.2	0.73**
Bronchiectasis	5,698	17.1	11,892	35.3	0.48**
Congestive cardiac failure	84,790	254.2	75,448	224.1	1.12**
Chronic obstructive pulmonary disease	100,758	302.1	91,204	270.9	1.10**
Diabetes complications	73,701	221.0	51,659	153.4	1.43**
Hypertension	9,079	27.2	17,601	52.3	0.52**
Iron deficiency anaemia	43,487	130.4	82,370	244.7	0.53**
Nutritional deficiencies	728	2.2	782	2.3	0.93
Rheumatic heart disease	4,038	12.1	5,261	15.6	0.77**
Acute	**404,428**	**1,212.5**	**458,317**	**1,361.4**	**0.88****
Cellulitis	95,927	287.6	75,271	223.6	1.27**
Convulsions and epilepsy	59,614	178.7	47,317	140.6	1.26**
Dental conditions	93,210	279.5	99,918	296.8	0.93**
Ear, nose and throat infections	57,753	173.1	58,212	172.9	0.99
Eclampsia	–	–	231	0.7	–
Gangrene	16,408	49.2	12,181	36.2	1.35**
Pelvic inflammatory disease	–	–	13,866	41.2	–
Perforated/bleeding ulcer	9,789	29.3	6,745	20.0	1.45**
Pneumonia (not vaccine-preventable)	3,098	9.3	2,774	8.2	1.12**
Urinary tract infections	69,115	207.2	142,217	422.4	0.49**
Total PPH	**880,349**	**2,639.4**	**931,142**	**2,765.9**	**0.95****

PPH = potentially preventable hospitalisation

Notes: Rate is annualised age-standardised rate per 100,000 population

Rate ratio is the ratio of male to female rates: rate ratios differing significantly from 1.0 are shown with * $p < 0.05$; ** $p < 0.01$

As more than one condition may be reported for a separation, the sum of conditions does not necessarily equal the reported total number of PPHs

3.5 Condition, age group and sex

Further analysis shows interesting variations between the most prevalent conditions causing PPHs by age and sex (Table 3.5). The least variation between the sexes in top ranked conditions is seen in the youngest age group (0 to 14 years) followed by the oldest age group (75 years and older). Across the lifespan, half of the conditions feature in the top four as the primary reason for PPHs at least twice when categorised by age and sex.

Overall, the largest difference in rates between males and females was seen for UTI in the 15- to 24-year age group (RR = 0.07). Females in this age group were almost 15 times more likely than males to be hospitalised for UTI. The two next largest differences are in the 25- to 44-year age group, for iron deficiency anaemia (RR = 0.19) and UTI (RR = 0.20); females were around five times more likely than males to be hospitalised for either condition in this age group. Females aged 45 to 64 years are more than twice as likely to be hospitalised for iron deficiency anaemia than males of the same age (RR = 0.42), representing the fourth largest difference, with the fifth largest seeing males more than twice as

likely as females to be hospitalised for diabetes complications among ages 65 to 74 years (RR = 2.12). All rate ratios between males and females were statistically significant, except for dental conditions among ages 0 to 14 years.

As noted, the higher rate of PPHs among females than males is due to differential rates of PPHs for UTI and iron deficiency anaemia. Table 3.5 shows that this heavily influenced by rates in two age groups: 15 to 24 years and 25 to 44 years.

The most prevalent condition leading to PPHs at ages 0 to 14 years was dental conditions, accounting for 27.5% and 29.6% of primary diagnoses among males and females respectively. The second most prevalent condition was ENT infections for both sexes (25.9% for males and 22.6% for females). The higher rate of PPHs among males compared to females in this age group was driven by higher rates of hospitalisation for asthma (RR = 1.54) and ENT infections (RR = 1.24).

Among ages 15 to 24 years, dental conditions remained the most prevalent condition leading to PPHs among males, comprising 20.4% of primary diagnoses, while UTI was the most prevalent condition among females, comprising 24.1% of principal diagnoses. Cellulitis was the second most frequent primary diagnoses for PPHs among males, comprising 18.3% of PPHs, while dental conditions were second highest among females, at 15.7%. Hospitalisations for UTI were chiefly responsible for the higher rate of PPHs among females in this age group (RR = 0.07).

Cellulitis was the most prevalent condition resulting in PPHs among males aged 25 to 44 years representing 20.9% of PPHs, and UTI was the most prevalent among females representing 16.8% of PPH. For both males and females, the second highest rate was for dental conditions, representing 16.7% and 12.4% of PPHs respectively. The higher overall rate among females in this age group was largely due to hospitalisations for UTI (RR = 0.20), and iron deficiency anaemia (RR = 0.19).

Among the age group 45 to 64 years, cellulitis showed the highest rate of PPHs among males constituting 13.3% of PPHs, and iron deficiency anaemia among females constituting 12.1% of PPH. Angina became a significant condition for males in this age group, accounting for the second highest percentage of PPHs diagnoses at 13.0%, while dental conditions remained a significant condition among females, accounting for 11.8% of PPH. The biggest driver of the disparity between rates among males and females was iron deficiency anaemia, with females more than twice as likely to be hospitalised for this condition than males (ratio = 0.42). This was counteracted, however, by rates for angina and diabetes complications, with males having almost twice the rate of hospitalisations for these conditions as females (RR = 1.87 for both conditions) and resulting in a higher overall rate of PPHs among males than females for this age group.

The highest rate of PPHs among both males and females aged 65 to 74 years was for COPD, constituting 19.7 % of PPHs among males and 20.8% among females. Angina remained as the second most prevalent primary diagnosis among males, at 13.5%, with UTI as the second most prevalent condition among females, at 12.6%. The overall rate of PPHs in this age group was higher among males than females (RR = 1.21). This difference was driven by rates for diabetes complications, (RR = 2.12), angina (RR = 1.80) and CCF (RR = 1.76).

Among persons aged 75 years and older, CCF was the most prevalent condition leading to PPH, comprising 22.2% of PPHs among males and 20.8% among females. This was followed by COPD for males, at 20.1%, and UTI for females, at 18.4%. The higher overall rate among males in the age group was due to higher rates for COPD (RR = 1.73), angina (RR = 1.60) and CCF (RR = 1.31).

Table 3.5: Potentially preventable hospitalisations by sub-category and condition, ranked in order of prevalence by age and sex, Australia, 2012/13 to 2014/15

Age	Selected condition	Males				Females				RR
(years)		No.	Rate	%	Rank	No.	Rate	%	Rank	M:F
0-14	Dental conditions	37,992	583.0	27.5	1	35,874	580.1	29.6	1	1.00
	ENT infections	35,727	548.2	25.9	2	27,316	441.7	22.6	2	1.24**
	Asthma	20,389	312.9	14.8	3	12,593	203.6	10.4	4	1.54**
	Convulsions and epilepsy	16,076	246.7	11.7	4	14,532	235.0	12.0	3	1.05**
	Other	28,099	431.2	20.4	..	30,953	500.5	25.6	..	0.86**
	Total	**137,997**	**2,117.5**	**100.0**	**..**	**121,041**	**1,957.3**	**100.0**	**..**	**1.08****
15-24	Dental conditions	8,572	182.0	20.4	1	10,893	242.9	15.7	2	0.75**
	Cellulitis	7,671	162.9	18.3	2	4,458	99.4	6.4	7	1.64**
	ENT infections	6,842	145.3	16.3	3	10,137	226.0	14.6	3	0.64**
	Convulsions and epilepsy	6,190	131.4	14.8	4	5,566	124.1	8.0	5	1.06**
	Diabetes complications	4,688	99.5	11.2	5	5,900	131.5	8.5	4	0.76**
	Urinary tract infections	1,178	25.0	2.8	7	16,718	372.7	24.1	1	0.07**
	Other	6,882	146.1	16.4	..	15,653	349.0	22.6	..	0.42**
	Total	**41,959**	**890.8**	**100.0**	**..**	**69,261**	**1,544.2**	**100.0**	**..**	**0.58****
25-44	Cellulitis	21,056	220.8	20.9	1	12,524	131.4	9.0	4	1.68**
	Dental conditions	16,810	176.2	16.7	2	17,356	182.1	12.4	2	0.97**
	Convulsions and epilepsy	13,596	142.5	13.5	3	10,177	106.8	7.3	7	1.33**
	Diabetes complications	8,996	94.3	8.9	4	8,262	86.7	5.9	8	1.09**
	Urinary tract infections	4,717	49.5	4.7	8	23,502	246.6	16.8	1	0.20**
	Iron deficiency anaemia	3,277	34.4	3.3	10	17,198	180.5	12.3	3	0.19**
	Other	32,898	344.9	32.6	..	51,279	538.2	36.7	..	0.64**
	Total	**100,830**	**1,057.2**	**100.0**	**..**	**139,877**	**1,468.0**	**100.0**	**..**	**0.72****
45-64	Cellulitis	26,417	317.1	13.3	1	17,961	212.2	9.4	5	1.49**
	Angina	25,777	309.4	13.0	2	13,998	165.4	7.3	6	1.87**
	Diabetes complications	22,918	275.1	11.6	3	12,424	146.8	6.5	7	1.87**
	COPD	19,161	230.0	9.7	4	22,033	260.4	11.5	3	0.88**
	Dental conditions	18,508	222.2	9.3	5	22,483	265.7	11.8	2	0.84**
	Urinary tract infections	13,048	156.6	6.6	7	22,021	260.2	11.5	4	0.60**
	Iron deficiency anaemia	9,534	114.4	4.8	10	23,062	272.5	12.1	1	0.42**
	Other	64,833	778.2	32.7	..	81,326	961.0	42.5	..	0.81**
	Total	**198,340**	**2,380.7**	**100.0**	**..**	**191,299**	**2,260.5**	**100.0**	**..**	**1.05****
65-74	COPD	30,697	1,230.5	19.7	1	27,232	1,067.4	20.8	1	1.15**
	Angina	20,948	839.7	13.5	2	11,926	467.5	9.1	4	1.80**
	CCF	17,752	711.6	11.4	3	10,290	403.3	7.9	6	1.76**
	Diabetes complications	16,150	647.4	10.4	4	7,784	305.1	5.9	7	2.12**
	Urinary tract infections	13,589	544.7	8.7	6	16,549	648.7	12.6	2	0.84**
	Iron deficiency anaemia	10,508	421.2	6.8	7	13,529	530.3	10.3	3	0.79**
	Other	47,049	1,886.0	30.3	..	44,473	1,743.3	34.0	..	1.08**
	Total	**155,516**	**6,234.0**	**100.0**	**..**	**130,996**	**5,134.8**	**100.0**	**..**	**1.21****
75+	CCF	54,518	3,090.3	22.2	1	58,052	2,365.8	20.8	1	1.31**
	COPD	49,288	2,793.9	20.1	2	39,689	1,617.5	14.2	3	1.73**
	Urinary tract infections	29,981	1,699.4	12.2	3	51,264	2,089.2	18.4	2	0.81**
	Angina	22,699	1,286.7	9.2	4	19,687	802.3	7.1	6	1.60**
	Iron deficiency anaemia	18,777	1,064.4	7.6	5	23,874	972.9	8.6	4	1.09**
	Other	71,754	4,067.3	29.2	..	87,234	3,555.1	31.3	..	1.14**
	Total	**245,705**	**13,927.6**	**100.0**	**..**	**278,667**	**11,356.6**	**100.0**	**..**	**1.23****

ENT = ear, nose and throat; COPD = chronic obstructive pulmonary disease; CCF = congestive cardiac failure

Notes: Rate is annualised age-standardised rate per 100,000 population

Rate ratio is the ratio of male to female rates: rate ratios differing significantly from 1.0 are shown with * $p < 0.05$; ** $p < 0.01$

Rank is the rank order of rates for the top four causes of PPHs for males and females: where rank order differs between males and females, more than four causes are included

As more than one condition may be reported for a separation, the sum of conditions does not necessarily equal the reported total number of PPHs

Figure 3.4 visually represents the data from Table 3.5, illustrating the change in the four most prevalent primary reasons for PPHs in each age group for males and females. While acute conditions were more prominent at younger ages as a top primary cause of PPH, chronic conditions were more prominent at older ages.

Dental conditions were a persistent prevalent cause of PPHs among young and middle age groups for both males and females. At ages 45 to 64 years they remain as top four conditions for females, making it a prevalent cause of PPHs for four of the six broad age groups, where most conditions only feature as a most prevalent cause for up to three age groups.

A marked impact on PPH rates is evident for cellulitis in younger and middle age groups for males, but not to the same extent for females. For age groups 15 to 24 years through to 45 to 64 years, cellulitis is the top or second top cause of PPHs for males. For females it is a top cause among 25- to 44-year-olds only.

Other standout conditions are UTI and iron deficiency anaemia. UTI is the top-ranked condition for females at ages 15 to 24 years and stays a top-ranked condition through to the oldest age group. Iron deficiency anaemia is a top four cause of PPHs among 25- to 44-year-olds and all older age groups.

In the older age groups, issues with the heart and lungs are prominent, particularly among men. Conditions include angina, COPD and CCF.

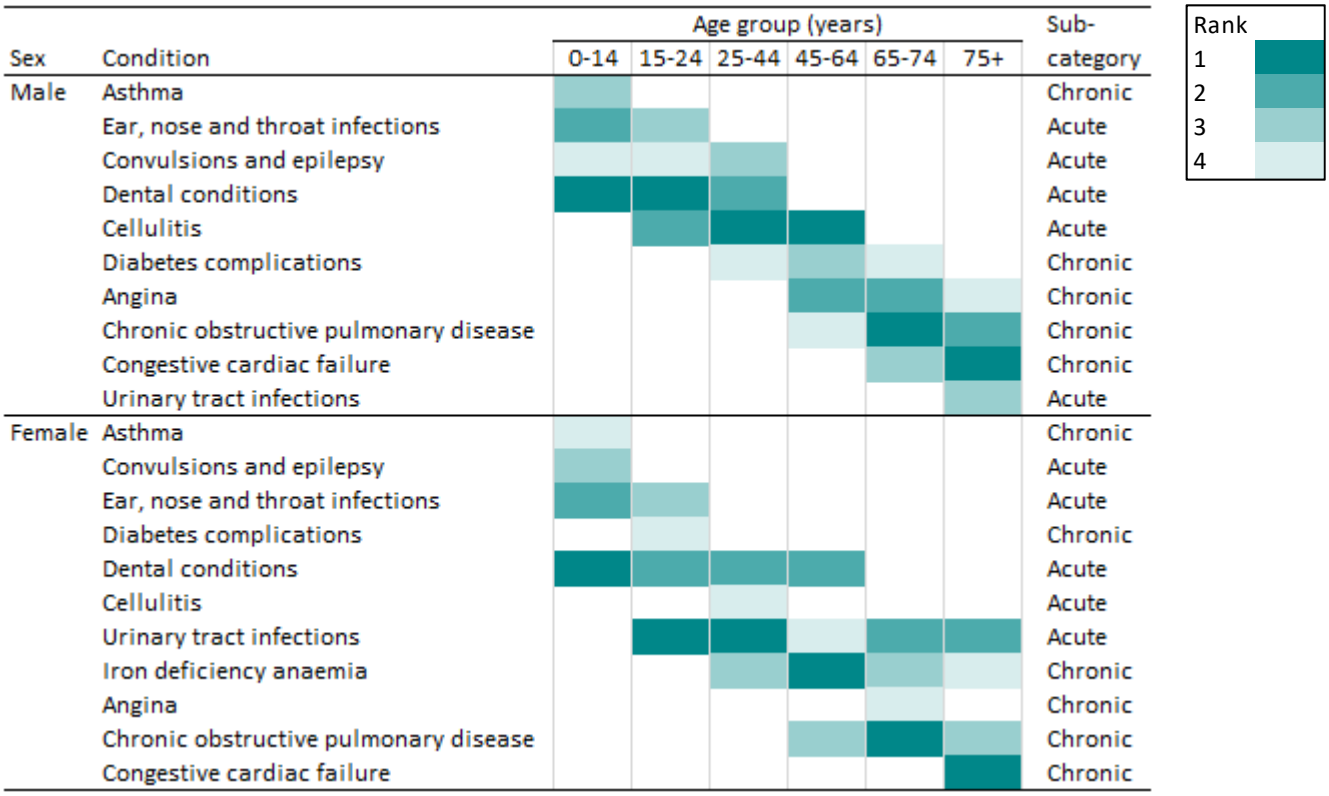


Figure 3.4: Potentially preventable hospitalisations by condition, ranked in order of prevalence by age and sex, Australia, 2012/13 to 2014/15

Notes: Rank is the rank order of rates for the top four causes of PPHs for males and females

Conditions are ordered by age group in which they are ranked among the top four causes of PPH: consequently, the order of conditions differ between males and females

3.6 Quintiles of socioeconomic disadvantage

The rate of PPHs increased consistently across the quintiles of socioeconomic disadvantage of area (Figure 3.5). In the least disadvantaged quintile, there were 2,110.9 PPHs per 100,000 population. The rate of PPHs was 3,275.3 per 100,000 population in the most disadvantaged, which was 55% above the rate in the least disadvantaged areas (RR = 1.55) and statistically significant.

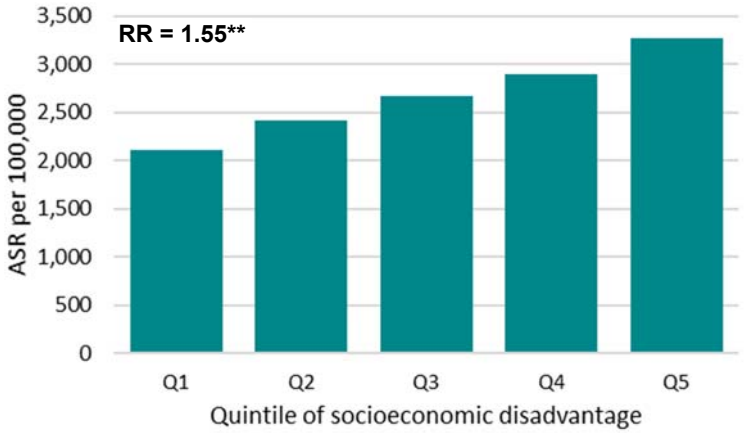


Figure 3.5: Potentially preventable hospitalisations by quintile of socioeconomic disadvantage, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate; RR = rate ratio
Q1 = least disadvantaged; Q5 = most disadvantaged

Figure 3.6 displays rates of PPHs across quintiles of socioeconomic disadvantage of area for categories of diagnosed conditions and the five most frequently diagnosed conditions.

There were increased rates of PPHs with increased disadvantage of area for all three condition categories. Vaccine-preventable conditions had the largest difference between categories of most and least disadvantage (RR = 2.08), with the starkest increase between the two most disadvantaged quintiles (Q4 and Q5). A steady increase across quintiles of disadvantage was evident for both acute and chronic conditions, however the increase was steeper for chronic (RR = 1.75) than acute (RR = 1.35).

Of the five most frequently diagnosed conditions for PPHs, all but dental conditions showed an increase in PPH rate with increased disadvantage of area. PPHs for dental conditions saw a small and inconsistent decrease with increasing disadvantage, and the magnitude of the difference was small (RR = 0.94). For the other selected conditions, a consistent increase with increasing disadvantage was apparent, with the largest difference between most and least disadvantaged area quintile recorded for COPD (RR = 2.53), followed by cellulitis (RR = 1.62), CCF (RR = 1.53) and UTI (RR = 1.31). All rate ratios between quintiles of least and most disadvantage in Figure 3.6 were statistically significant.

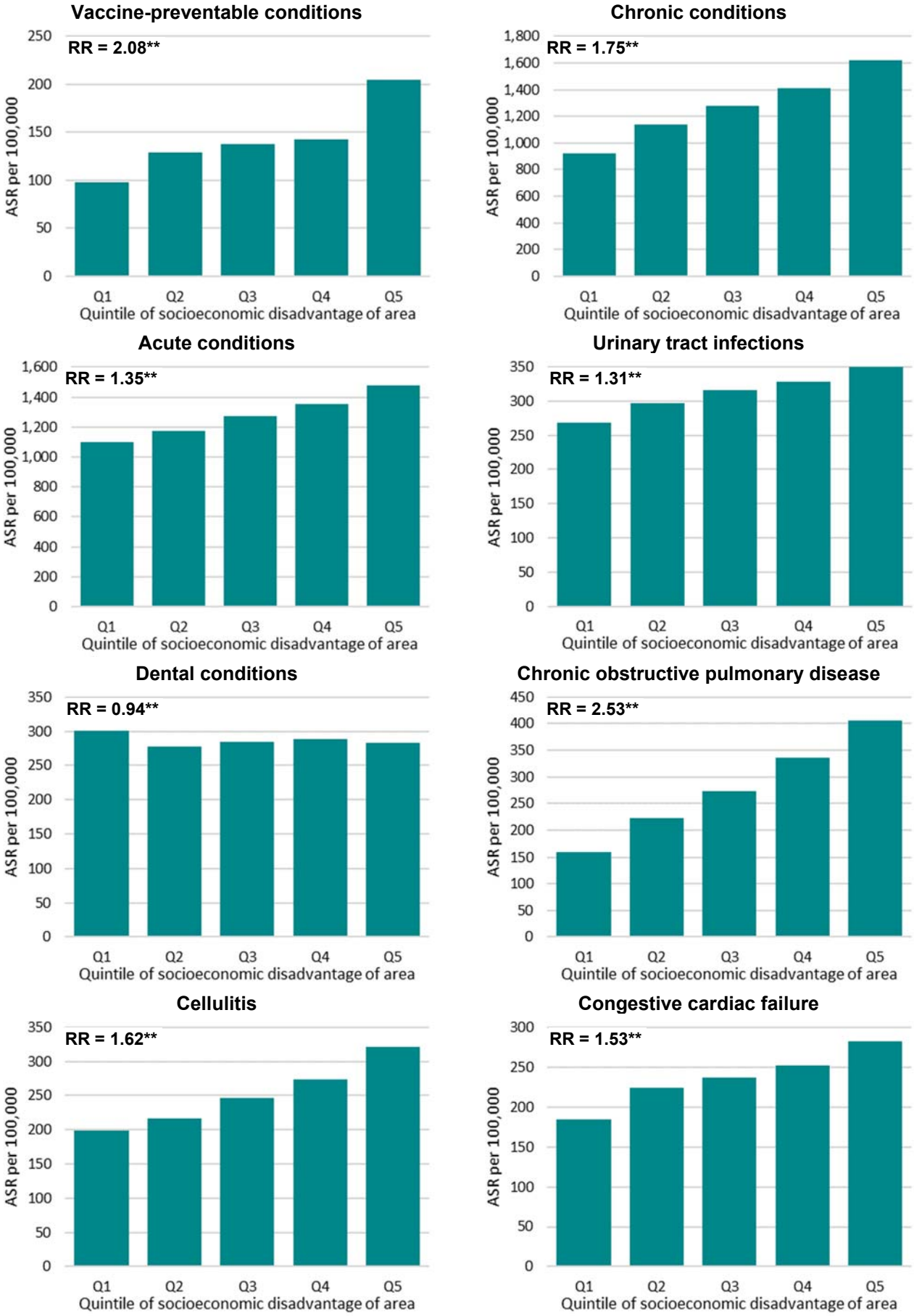


Figure 3.6: **Potentially preventable hospitalisations by category and selected conditions, by quintile of socioeconomic disadvantage, Australia, 2012/13 to 2014/15**

ASR = annualised age-standardised rate; RR = rate ratio
Q1 = least disadvantaged; Q5 = most disadvantaged

3.7 Remoteness

There was a strong relationship between PPHs and remoteness areas, with increasing rates of PPHs as remoteness increased (Figure 3.7). The lowest rate of PPHs was in Major Cities (2,540.1 per 100,000 population) and the highest in Very Remote areas (6,556.9 per 100,000 population). The rate in Very Remote areas was over two-and-a-half times higher than the rate in Major Cities (RR = 2.58).

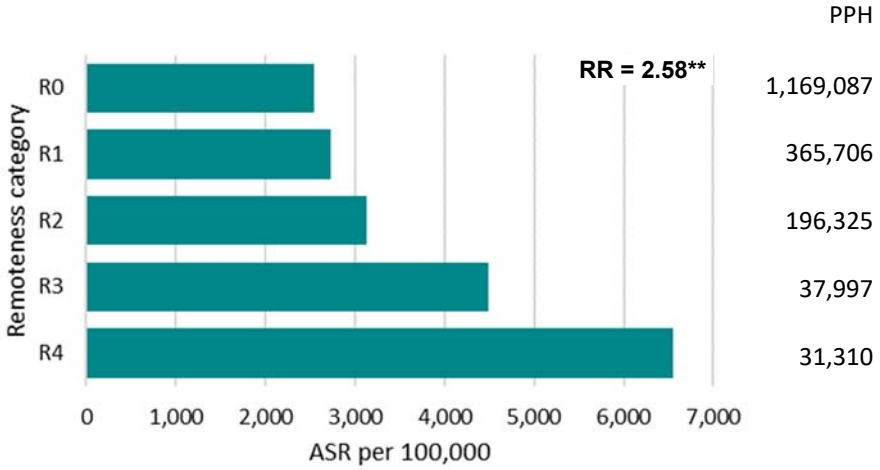


Figure 3.7: Potentially preventable hospitlisations by remoteness, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate; RR = rate ratio
R0 = Major Cities; R1 = Inner Regional; R2 = Outer Regional; R3 = Remote; R4 = Very Remote

Figure 3.8 shows PPH rates for diagnosis categories and selected conditions across remoteness classifications.

For vaccine-preventable, chronic and acute condition categories, the rate of PPH was higher with greater remoteness. The PPH rate was higher for Major Cities than either Inner or Outer Regional areas for vaccine-preventable conditions, and the RR was largest out of the condition categories (RR = 4.59). Chronic and acute conditions saw a consistent increase in PPH rates across remoteness categories and had similar magnitudes of difference in rates between Major Cities and Very Remote areas (RR = 2.54 for chronic conditions and 2.45 for acute conditions).

Rates in each of the five most frequently diagnosed conditions for PPHs generally increased with increased remoteness. The greatest difference between rates in Major Cities and Very Remote areas was for cellulitis (RR = 4.35), followed by COPD (RR = 3.23). For these conditions, there was a consistent increase in PPH rates with increased remoteness. There was variability between Major Cities, Inner Regional and Outer Regional areas for rates of PPH for UTI (RR = 1.78), dental conditions (RR = 1.49) and CCF (RR = 2.83); however, rates in Remote areas were consistently higher than in Major Cities, Inner Regional and Outer Regional areas, and rates in Very Remote areas were consistently the highest for these conditions. All rate ratios between Major Cities and Very Remotes areas in Figure 3.8 were statistically significant.

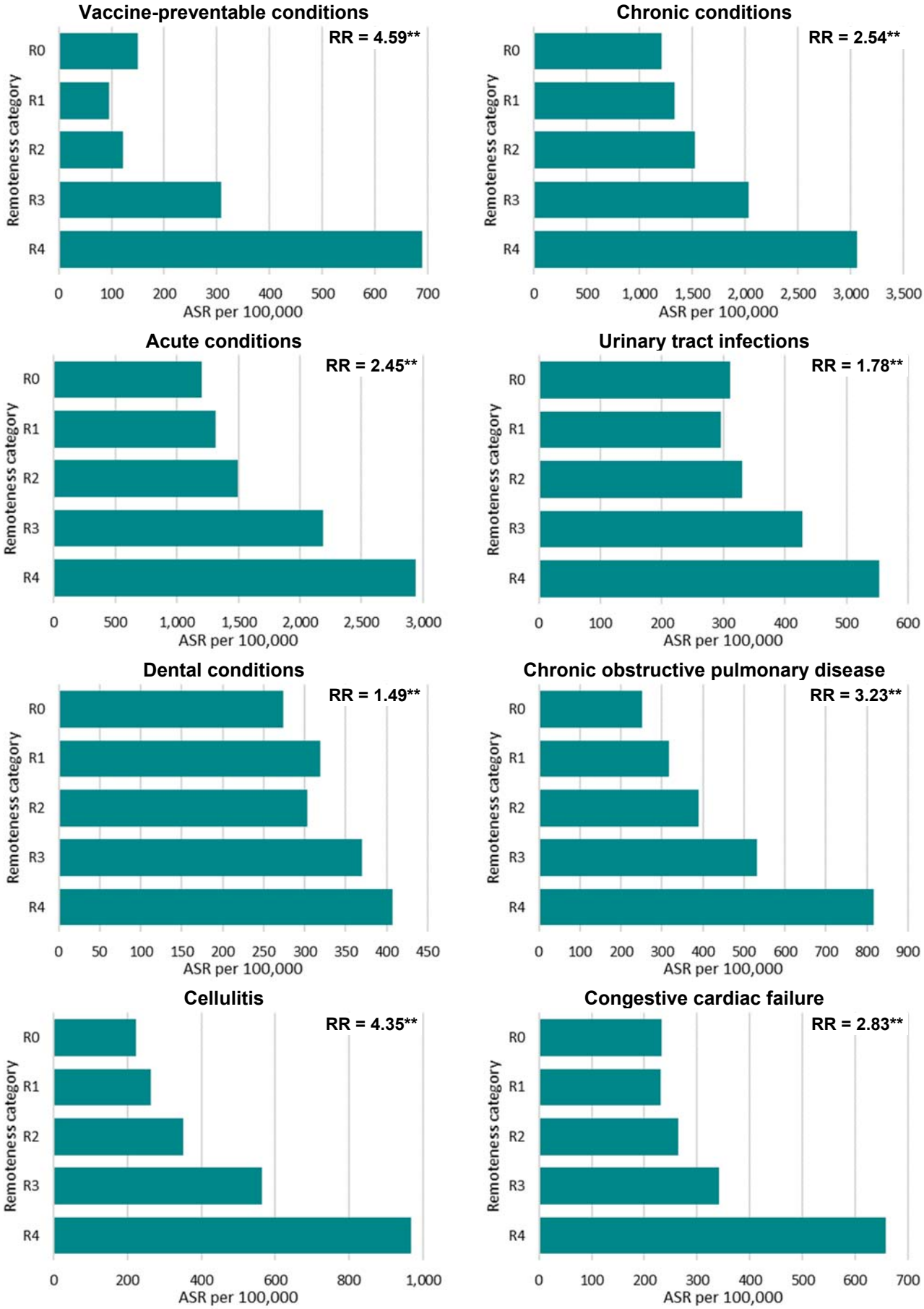


Figure 3.8: Potentially preventable hospitalisations by category and selected conditions, by remoteness, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate; RR = rate ratio
R0 = Major Cities; R1 = Inner Regional; R2 = Outer Regional; R3 = Remote; R4 = Very Remote

3.8 State and Territory

The Northern Territory had the highest rate of PPHs at 5,714.9 per 100,000 population (Table 3.6). This was more than twice the national average rate of 2,702.9 per 100,000 population. Queensland had the second highest rate, at 3,153.2 per 100,000 population which was 17% higher than the national average. The lowest rate of PPHs was in the Australian Capital Territory, with three-quarters the national rate (2,037.3 per 100,000 population), followed by Tasmania (2,309.4 per 100,000 population) and New South Wales (2,448.1 per 100,000 population).

Table 3.6: Potentially preventable hospitalisations by State/Territory, Australia, 2012/13 to 2014/15

	PPH		Total hospitalisations		%
	Number	Rate	Number	Rate	PPH
NSW	542,613	2,448.1	8,847,676	40,097.2	6.1
Vic	423,751	2,532.8	7,353,004	43,960.2	5.8
Qld	410,336	3,153.2	6,162,912	47,216.3	6.7
SA	149,223	2,833.6	2,157,224	41,253.9	6.9
WA	186,984	2,793.0	3,191,487	47,232.8	5.9
Tas	37,889	2,309.4	604,081	36,946.6	6.3
NT	29,510	5,714.9	407,697	76,039.4	7.2
ACT	20,119	2,037.3	358,484	35,462.1	5.6
Australia	**1,811,499**	**2,702.9**	**29,216,399**	**43,593.5**	**6.2**

PPH = potentially preventable hospitalisation

Notes: Rate is annualised age-standardised rate per 100,000 population

State/Territory totals do not sum to the Australian total due to the inclusion of overseas and unknown addresses in the Australian total

The highest percentage of hospitalisations that were potentially preventable was seen in the Northern Territory (7.2%) followed by South Australia (6.9%) and Queensland (6.7%). The lowest was in the Australian Capital Territory (5.6%) followed by Victoria (5.8%). The remaining states were close to the national average of 6.2%, ranging from 5.9% in Western Australia to 6.3% in Tasmania.

Figure 3.9 illustrates the pattern of PPH rates across States/Territories.

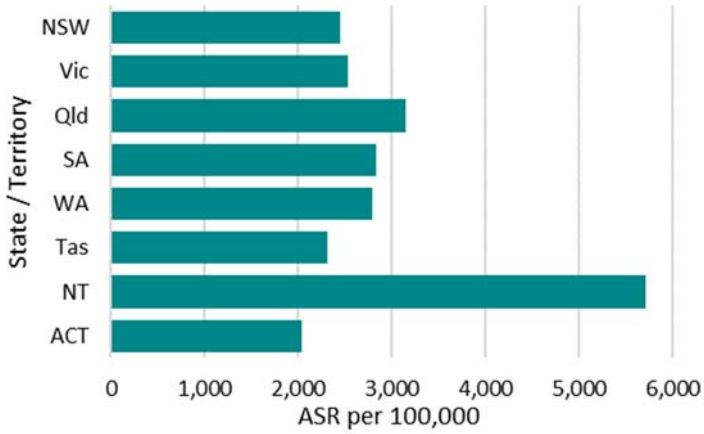


Figure 3.9: Potentially preventable hospitalisations by State/Territory, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate

3.9 Primary Health Network and Population Health Areas

When categorised by Primary Health Network (PHN), the rates range from below 2,000 to almost 6,000 per 100,000 population around the national average of 2,702.9 (Figure 3.10).

The highest rates of PPHs are seen for a number of regional PHNs; they are PHN701: Northern Territory (5,714.9 per 100,000 population), followed by PHN305: Western Queensland (4,812.0 per 100,000), PHN110: Murrumbidgee (3,576.5 per 100,000), PHN503: Country WA (3,456.3 per 100,000) and PHN307: Northern Queensland (3,418.8 per 100,000). In addition, above-average rates are found in all other Queensland PHNs and the two PHNs in South Australia.

All but one of the five PHNs with the lowest rates of PPHs are in the capital cities; they are PHN102: Northern Sydney (1,930.5 per 100,000 population), PHN801: Australian Capital Territory (2,037.3 per 100,000), PHN101: Central and Eastern Sydney (2,065.1 per 100,000), PHN601: Tasmania (the only non-capital city PHN, 2,309.4 per 100,000) and PHN202: Eastern Melbourne (2,315.6 per 100,000). As well as Tasmania and Australian Capital Territory, where the sole PHN for that state/territory has a below-average rate, all but one PHN in Victoria also have rates below the Australian average, the exception being PHN205: Murray (2,725.1 per 100,000 population).

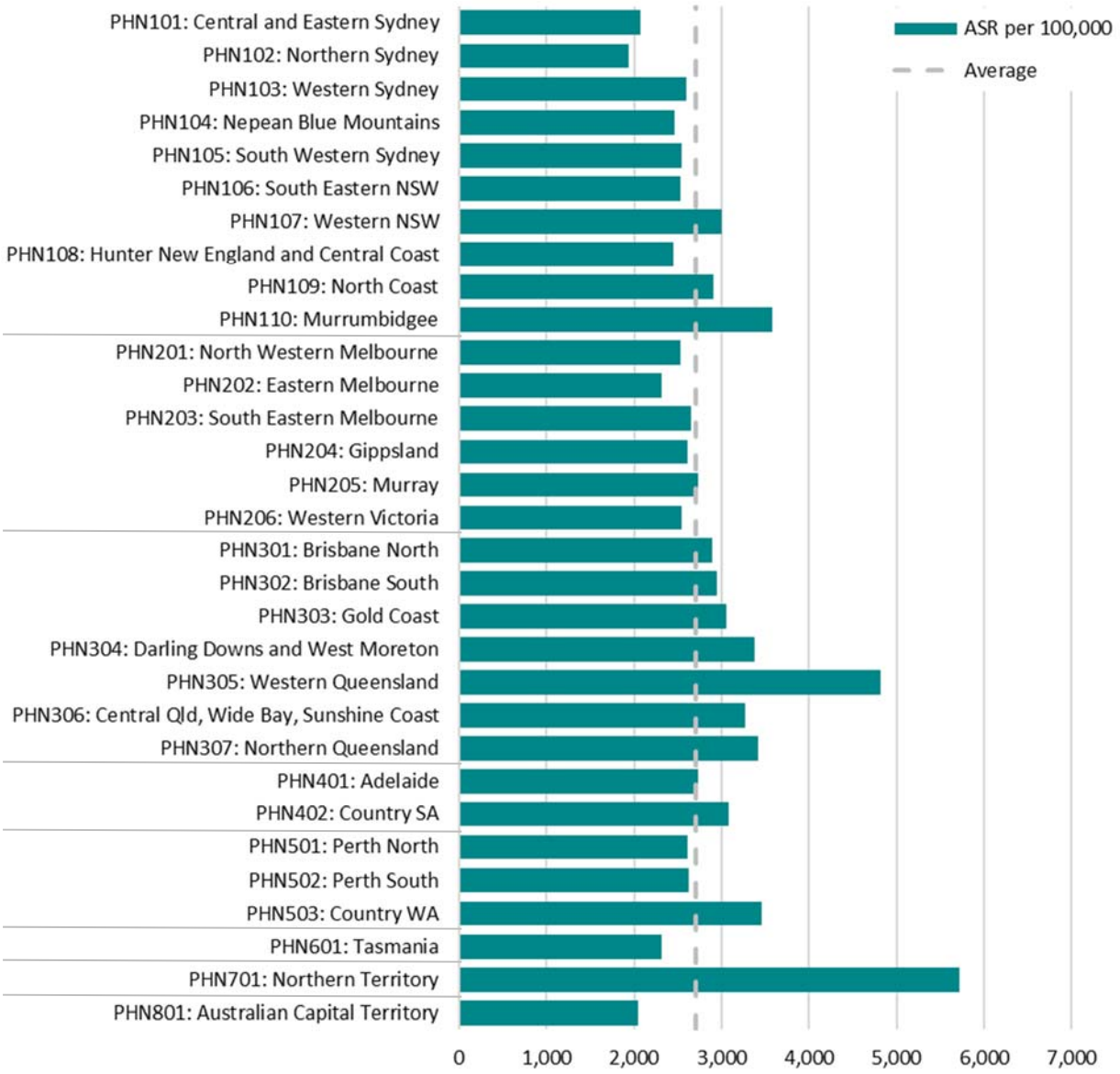
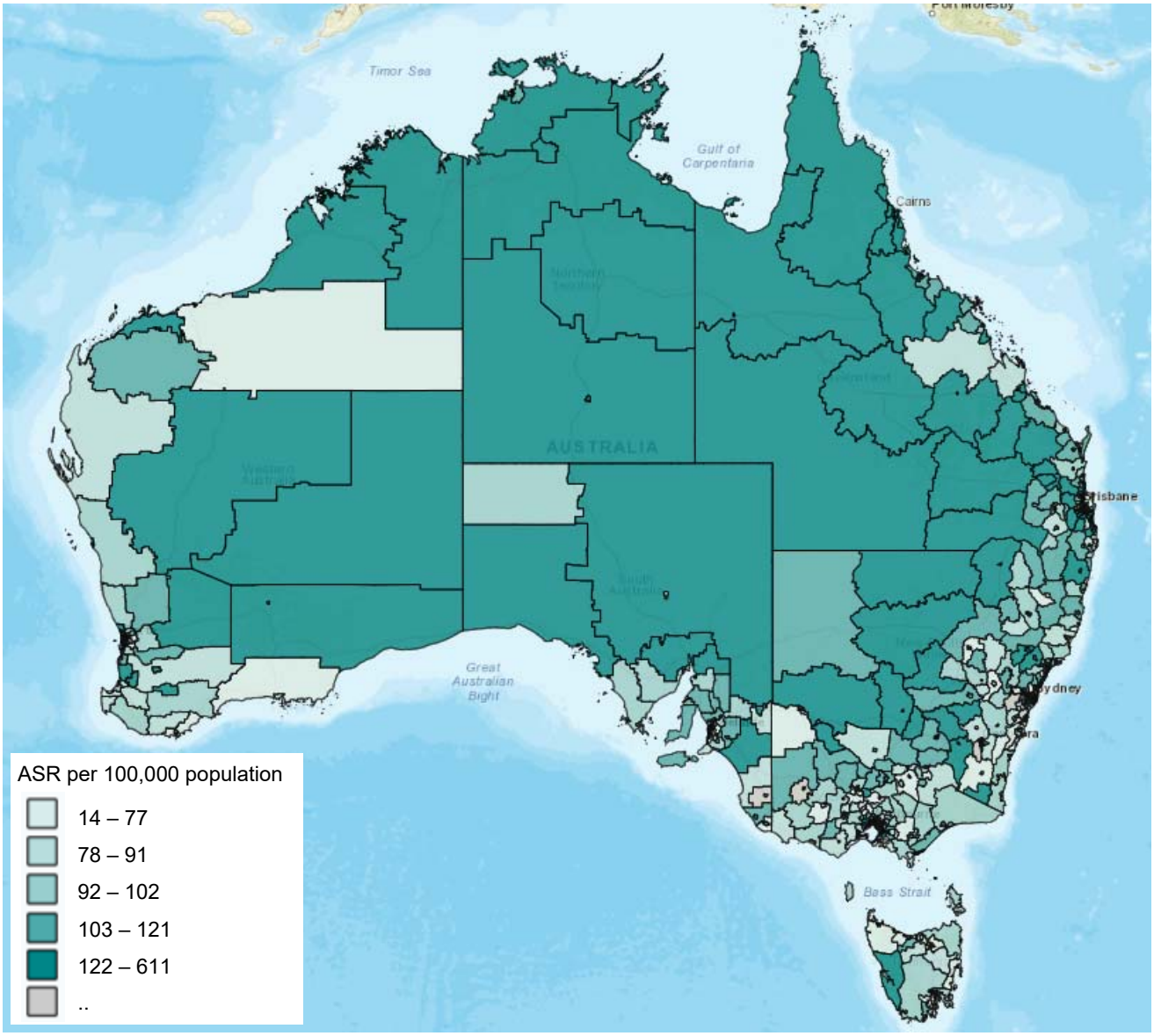


Figure 3.10: Potentially preventable hospitalisations by Primary Health Network, Australia, 2014/15
ASR = annualised age-standardised rate

Map 3.1 for PPHs in 2014/15 by PHA shows lower rates of PPHs to be largely confined to coastal areas in the south, east, and west, with higher rates across the majority of the country.

Of the ten PHAs with the highest rate of PPHs, five were in the Northern Territory and three were in Western Australia, with the remaining two in Queensland and South Australia. The highest rate was in the PHA of 70008: Alice Springs – Remote (17,508.0 per 100,000 population), followed by 70009: Barkly/ Tennant Creek (16,932.7 per 100,000 population), 50103: Halls Creek/ Kununurra (11,887.7 per 100,000 population), 50102: Derby - West Kimberley/ Roebuck (11,344.4 per 100,000 population) and 70011: Anindilyakwa/ East Arnhem/ Nhulunbuy (9,816.3 per 100,000 population).



Map 3.1: Potentially preventable hospitalisations by Population Health Areas, Australia, 2014/15

ASR = annualised age-standardised rate

Note: .. indicates that there were fewer than five PPHs in the PHA

Source: Social Health Atlas of Australia, PHIDU

The ten PHAs with the lowest PPH rates included five in Western Australia, two in Tasmania, and one each in Victoria, New South Wales and Queensland. The lowest of these were in Western Australia, in 50098: Kalgoorlie – North (405.8 per 100,000 population), 50110: East Pilbara (1,134.3 per 100,000 population), and 50086: College Grove – Carey Park/Davenport (1,300.2 per 100,000 population); and in Tasmania, in 60040: West Ulverstone (662.2 per 100,000 population), and 60023: Prospect Vale – Blackstone (668.7 per 100,000 population).

The map above and maps of other PPHs by selected condition are available online for the total Australian population for 2014/15 by various geographical classifications (including PHA, PHN and LGA) from http://phidu.torrens.edu.au/social-health-atlases/maps.

4 Potentially preventable hospitalisations of the Aboriginal Australian population

4.1 Potentially preventable and non-potentially preventable hospitalisations

Readers should bear in mind the caution noted in the Methods section as to the under-identification of Aboriginal Australians in these data.

Of all hospitalisations of Aboriginal Australians, 8.3%, or one in 12 hospitalisations, were potentially preventable (Table 4.1). This is higher than the percentage among the non-Aboriginal Australian population, where 6.1% of hospitalisations were PPHs. The rate of PPHs among Aboriginal Australians was 5,079.6 per 100,000 population, out of a total 61,498.4 hospitalisations per 100,000 population.

Table 4.1: Potentially preventable hospitalisations and non-potentially preventable hospitalisations, Aboriginal and non-Aboriginal population, Australia, 2012/13 to 2014/15

	Aboriginal			Non-Aboriginal		Rate ratio
	Number	Rate	% of total	Rate	% of total	A:N
PPH	102,082	5,079.6	8.3	2,629.5	6.1	1.93**
Non-PPH	1,133,817	56,418.8	91.7	40,410.6	93.9	1.40**
Total	**1,235,899**	**61,498.4**	**100.0**	**43,040.0**	**100.0**	**1.43****

PPH = potentially preventable hospitalisation

Notes: Rate is annualised age-standardised rate per 100,000 population

Data presented elsewhere may count an admission more than once if there is more than one principal diagnosis

Rate ratio is the ratio of Aboriginal to non-Aboriginal Australian population rates: rate ratios differing significantly from 1.0 are shown with * p < 0.05; ** p < 0.01

Aboriginal Australians have a higher rate of PPHs, non-PPHs and total hospitalisations than non-Aboriginal Australians. The rate of total hospitalisations was 40% higher among Aboriginal Australians than non-Aboriginal Australians (RR = 1.41). The difference was greater for PPHs, with a rate almost 90% higher among Aboriginal Australians than non-Aboriginal Australians (RR = 1.88). All rate ratios between Aboriginal and non-Aboriginal Australians were statistically significant.

Figure 4.1 depicts a comparison between the Aboriginal and non-Aboriginal Australian populations across PPHs, non-PPHs and total hospitalisations.

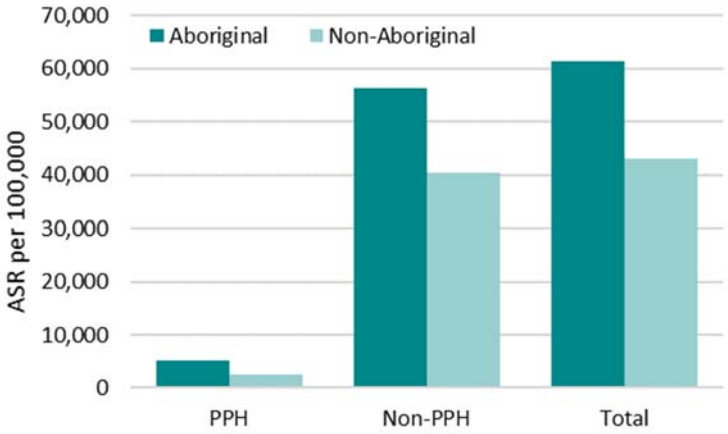


Figure 4.1: Potentially preventable hospitalisations and non-potentially preventable hospitalisations, Aboriginal and non-Aboriginal population, Australia, 2012/13 to 2014/15

PPH = potentially preventable hospitalisation;
ASR = annualised age-standardised rate

4.2 Age group and sex

Overall, Aboriginal females had a higher rate of PPHs than Aboriginal males (Table 4.2), with 5,487.2 PPHs compared to 4,668.9 per 100,000 population (RR = 0.85). The highest rate was seen for persons aged 65 years and over (19,214.9 per 100,000 population). The lowest rate, of 2,247.4 per 100,000 population, was at ages 15 to 24 years.

Table 4.2: Potentially preventable hospitalisations, annualised age-standardised rates per 100,000 population, Aboriginal and non-Aboriginal population, by age and sex, Australia, 2012/13 to 2014/15

	Aboriginal			Rate ratio[a]	Non-Aboriginal	Rate ratio[b]
	Male	Female	Total	M:F	Total	A:N
0-14	3,326.2	3,190.1	3,259.5	1.04**	1,966.0	1.66**
15-24	1,629.6	2,896.1	2,247.4	0.56**	1,162.1	1.93**
25-44	4,105.9	5,386.4	4,761.2	0.76**	1,164.6	4.09**
45-64	10,370.6	10,833.1	10,610.2	0.96**	2,169.8	4.89**
65+	19,395.6	19,073.8	19,214.9	1.02**	8,675.9	2.21**
Total	**4,668.9**	**5,487.2**	**5,079.6**	**0.85****	**2,629.5**	**1.93****

Note: Rate ratio (a) is the ratio of male to female rates: rate ratios differing significantly from 1.0 are shown with * p < 0.05; ** p < 0.01

Rate ratio (b) is the ratio of Aboriginal to non-Aboriginal Australian population rates: rate ratios differing significantly from 1.0 are shown with * p < 0.05; ** p < 0.01

Data presented elsewhere may count an admission more than once if there is more than one principal diagnosis

Figure 4.2 shows the comparison of rates by age and sex in the Aboriginal Australian population. While Aboriginal females had a higher total rate than Aboriginal males, in the youngest and oldest age groups males had higher rates than females. The highest rates for both sexes was for the 65 years and over age group, and the lowest for the 15 to 24 years age group. The largest difference between sexes was among ages 45 to 24 years, where females had a rate of PPHs more than 75% higher than males (RR = 0.56). There was little difference for ages 65 years and over (RR = 1.02). All rate ratios between Aboriginal males and females, and between Aboriginal and non-Aboriginal Australians were statistically significant.

Figure 4.3 illustrates the pattern of PPHs in the Aboriginal Australian population compared with the non-Aboriginal Australian population, by age group. The smallest RR across age groups is 1.60 among persons aged 0 to 14 years. The RR of Aboriginal Australian PPH rates to non-Aboriginal Australian PPH rates increased across age groups until the 65 years and over age group, with a lower RR than the preceding two groups. Among Aboriginal persons aged 45 to 64 years, the rate of PPHs is over four-and-a-half times greater than among the non-Aboriginal Australian population, with a RR of 4.57.

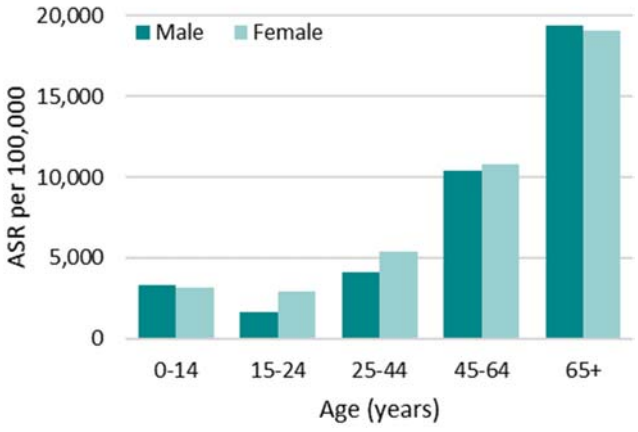


Figure 4.2: Potentially preventable hospitalisations, Aboriginal population, by age and sex, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate

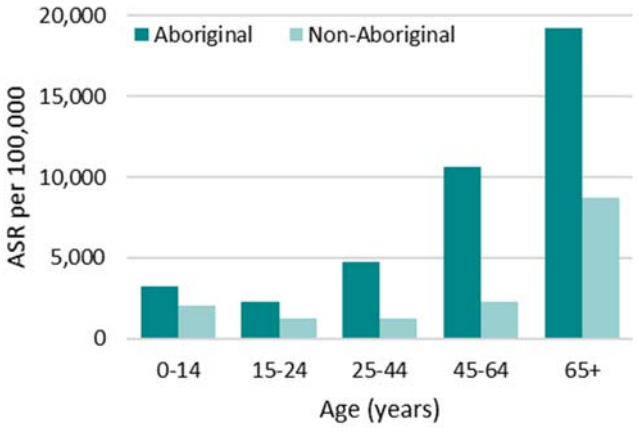


Figure 4.3: Potentially preventable hospitalisations, Aboriginal and non-Aboriginal population, by age, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate

4.3 Condition

Table 4.3 compares numbers and rates for Aboriginal and non-Aboriginal Australian populations by condition. All rate ratios are statistically significant with the exception of hypertension. Among the Aboriginal Australian population, admissions for cellulitis were the largest cause of PPHs.

For the vaccine-preventable conditions category, other vaccine-preventable conditions contributed two-thirds of PPHs (326.4 per 100,000 population). In comparison, among the non-Aboriginal population, other vaccine-preventable conditions accounted for less than half of vaccine-preventable PPHs.

Table 4.3: Potentially preventable hospitalisations by condition, Aboriginal and non-Aboriginal, Australia, 2012/13 to 2014/15

	Aboriginal			Non-Aboriginal			Rate ratio
Sub-category and condition	Number	Rate	% of total	Number	Rate	% of total	A:N
Vaccine-preventable	**9,796**	**487.4**	**9.6**	**86,909**	**133.7**	**5.1**	**3.65****
Influenza and pneumonia	3,327	165.6	3.3	44,311	68.2	2.6	2.43**
Other vaccine-preventable	6,510	326.4	6.4	42,879	66.0	2.5	4.95**
Chronic	**40,875**	**2,033.9**	**40.0**	**823,517**	**1,266.7**	**48.2**	**1.61****
Angina	4,611	229.4	4.5	116,000	178.4	6.8	1.29**
Asthma	4,912	244.4	4.8	80,370	123.6	4.7	1.98**
Bronchiectasis	1,541	76.7	1.5	16,049	24.7	0.9	3.11**
Congestive cardiac failure	5,165	257.0	5.1	155,073	238.5	9.1	1.08**
COPD	10,364	515.7	10.2	181,598	279.3	10.6	1.85**
Diabetes complications	8,743	435.1	8.6	116,618	179.4	6.8	2.43**
Hypertension	826	41.1	0.8	25,855	39.8	1.5	1.03
Iron deficiency anaemia	3,036	151.1	3.0	122,822	188.9	7.2	0.80**
Nutritional deficiencies	102	5.1	0.1	1,408	2.2	0.1	2.35**
Rheumatic heart disease	1,575	78.4	1.5	7,724	11.9	0.5	6.60**
Acute	**53,164**	**2,645.4**	**52.1**	**810,487**	**1,246.7**	**47.4**	**2.12****
Cellulitis	11,935	593.9	11.7	159,264	245.0	9.3	2.42**
Convulsions and epilepsy	10,683	531.6	10.5	96,249	148.1	5.6	3.59**
Dental conditions	9,049	450.3	8.9	184,080	283.2	10.8	1.59**
ENT infections	8,802	438.0	8.6	107,165	164.8	6.3	2.66**
Eclampsia	15	0.7	0.0	216	0.3	0.0	2.11**
Gangrene	1,988	98.9	1.9	26,601	40.9	1.6	2.42**
Pelvic inflammatory disease	1,278	63.6	1.3	12,588	19.4	0.7	3.28**
Perforated/bleeding ulcer	346	17.2	0.3	16,188	24.9	0.9	0.69**
Pneumonia (not vaccine-preventable)	221	11.0	0.2	5,651	8.7	0.3	1.27**
Urinary tract infections	8,902	443.0	8.7	202,430	311.4	11.8	1.42**
Total PPH	**102,082**	**5,079.6**	**100.0**	**1,709,417**	**2,629.5**	**100.0**	**1.93****

COPD = chronic obstructive pulmonary disease; ENT infections = ear, nose and throat infections; PPH = potentially preventable hospitalisation

Notes: Rate is annualised age-standardised rate per 100,000 population

As more than one condition may be reported for a separation, the sum of conditions does not necessarily equal the reported total number of PPHs

Data presented elsewhere may count an admission more than once if there is more than one principal diagnosis

Rate ratio is the ratio of Aboriginal to non-Aboriginal Australian population rates: rate ratios differing significantly from 1.0 are shown with * $p < 0.05$; ** $p < 0.01$

The five highest contributing conditions to Aboriginal Australian PPHs for chronic conditions were COPD (515.7 per 100,000 population), diabetes complications (435.1 per 100,000 population), CCF (257.0 per 100,000 population), asthma (244.4 per 100,000 population) and angina (229.4 per 100,000 population). In the non-Aboriginal population, COPD was also the most prevalent primary diagnosis, and angina was the fifth. CCF and diabetes were among the top five as was iron deficiency anaemia, rather than asthma.

The five highest contributing conditions to Aboriginal Australian PPHs for acute conditions were cellulitis (593.9 per 100,000 population), convulsions and epilepsy (531.6 per 100,000 population), dental conditions (450.3 per 100,000 population), UTI (443.0 per 100,000 population) and ENT infections (438.0 per 100,000 population). This was the same highest contributing five conditions as among the non-Aboriginal Australian population.

In total, there was almost twice the rate of PPHs among Aboriginal Australians than non-Aboriginal Australians (RR = 1.93). The largest difference in rates of PPH was for vaccine-preventable conditions, which were over three-and-a-half times the rate among Aboriginal Australians (RR = 3.65) and was largely driven by other vaccine-preventable conditions (RR = 4.95). Vaccine-preventable conditions accounted for less than 10 per cent of total PPHs for Aboriginal Australians (9.6%), almost twice the level among non-Aboriginal Australians (5.1%).

Compared to non-Aboriginal Australians, Aboriginal Australians had a higher rate of PPHs for chronic conditions overall (RR = 1.61). Within this category, the rate of PPHs for rheumatic heart disease (RHD) was over six-and-a-half times higher among Aboriginal Australians than non-Aboriginal Australians (RR = 6.60). Among the Aboriginal Australian population, PPHs for bronchiectasis was over three times the Australian rate (RR = 3.11), and rates were more than twice the non-Aboriginal Australian rates for diabetes complications (RR = 2.43) and nutritional deficiencies (RR = 2.35). Only iron deficiency anaemia had lower rates of PPHs among Aboriginal Australians than all Australians, with a RR of 0.80, and there were comparable rates for hypertension (RR = 1.03). Chronic conditions contributed 40.0% of PPHs for Aboriginal Australians, much lower than the 48.2% they contributed among the non-Aboriginal Australian population.

Aboriginal Australians had twice the rate of PPHs for acute conditions compared to non-Aboriginal Australians (RR = 2.12). For PPHs due to convulsions and epilepsy and pelvic inflammatory disease, the Aboriginal Australian rate was over three times the non-Aboriginal Australian rate (RRs = 3.59 and 3.28 respectively). Four further conditions had rates among Aboriginal Australians more than twice the non-Aboriginal Australian rates; ENT infections (RR = 2.66), cellulitis (RR = 2.42), gangrene (RR = 2.42) and eclampsia (RR = 2.11). Only one condition, perforated/bleeding ulcer, had a lower rate of PPHs among Aboriginal Australians than non-Aboriginal Australians (RR = 0.69). Overall, acute conditions contributed over half of PPHs among Aboriginal Australians (52.1%), compared to less than half in the non-Aboriginal Australian population (47.4%).

Figure 4.4 displays the rates for conditions comparing PPHs in the Aboriginal and non-Aboriginal Australian populations, ranked by the rate of Aboriginal Australian hospitalisations.

The seven most prevalent conditions overall accounted for over two-thirds of all Aboriginal PPHs (67.1%). They were cellulitis, convulsions and epilepsy, COPD, dental conditions, UTI, ENT infections and diabetes complications.

The following conditions account for the largest rate differences between Aboriginal Australians and non-Aboriginal Australians, in order of magnitude of difference: convulsions and epilepsy, ENT infections, cellulitis, other vaccine-preventable, diabetes complications, and COPD. The three top contributors to the rate difference are acute conditions.

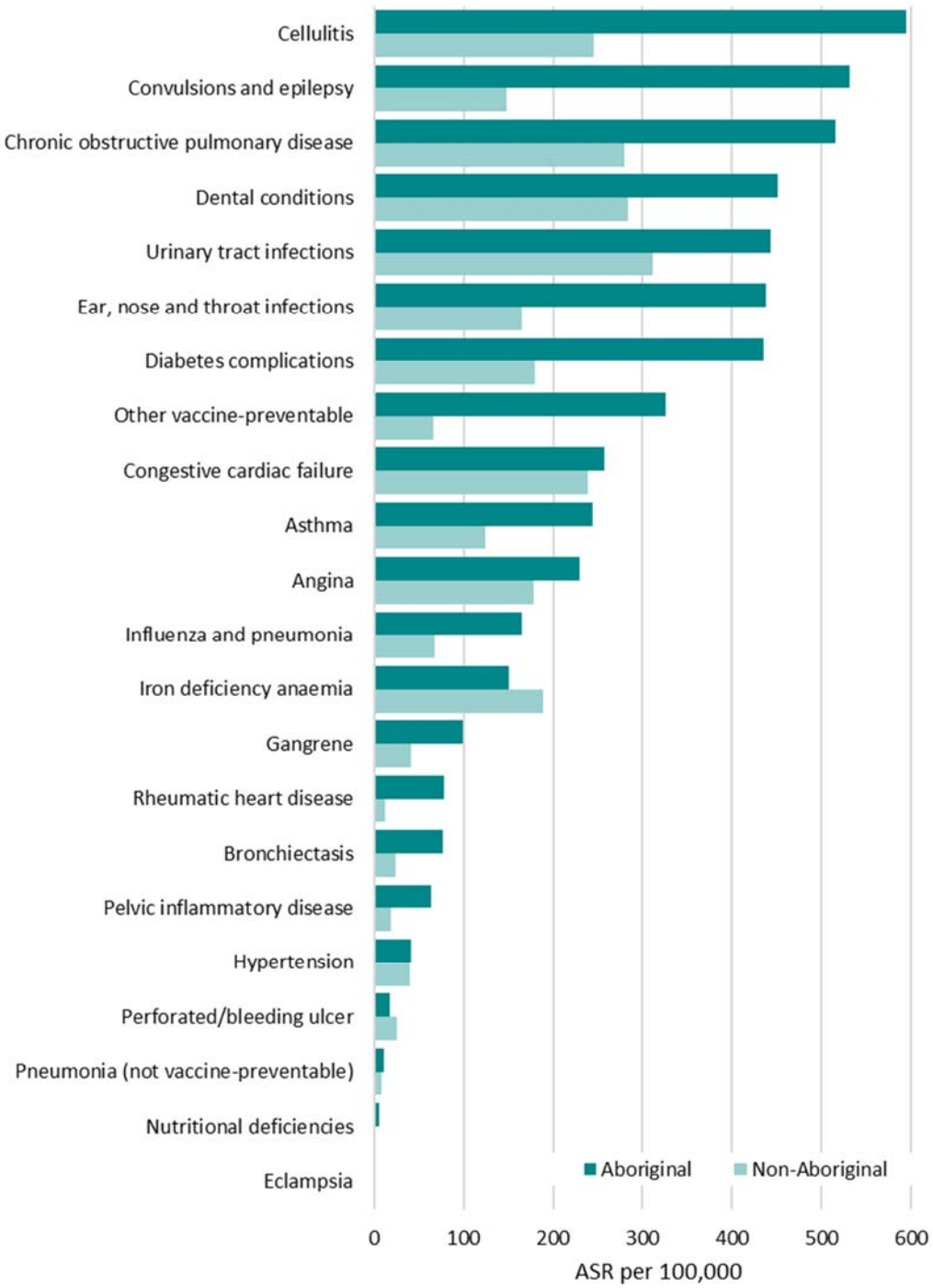


Figure 4.4: Potentially preventable hospitalisations by condition (ranked for Aboriginal Australian hospitalisations), Aboriginal and non-Aboriginal population, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate

4.4 Condition and sex

In Table 4.4, there are multiple conditions with statistically significant rate ratios between male and female Aboriginal Australians. Females had a higher rate of PPHs than males in the Aboriginal Australian population, as indicated by the RR of 0.85. Two conditions primarily contributed to this disparity: UTI was over four times more prevalent among females than males (RR = 0.23) and iron deficiency anaemia was almost three times more common among females than males (RR = 0.36), and both conditions accounted for a sizeable numerical rate difference.

Overall, there was greater disparity between the sexes among Aboriginal Australians (RR = 0.85) than was the case for all Australians (RR = 0.95; Table 3.3). Compared to the total population, among prominent chronic conditions, namely angina, CCF, COPD and diabetes complications, there were fewer PPHs among males relative to females in the Aboriginal Australian population. For example, PPHs for angina in the total population were over 50% more prevalent among males than females (RR = 1.54) but the rates for males and females were almost equal in the Aboriginal Australian population (RR = 1.04). For COPD, Aboriginal females had a higher prevalence than Aboriginal males (RR = 0.74), whereas for all Australians, males had a higher prevalence than females (RR = 1.10).

Table 4.4: Potentially preventable hospitalisations by condition and sex, Aboriginal population, Australia, 2012/13 to 2014/15

	Male		Female		Rate ratio
Sub-category and condition	Number	Rate	Number	Rate	M:F
Vaccine-preventable	**4,904**	**489.9**	**4,892**	**485.0**	**1.01**
Influenza and pneumonia	1,482	148.0	1,845	182.9	0.81**
Other vaccine-preventable	3,468	346.4	3,072	304.6	1.14**
Chronic	**18,292**	**1,827.3**	**22,583**	**2,239.1**	**0.82****
Angina	2,343	234.1	2,268	224.9	1.04
Asthma	1,847	184.5	3,065	303.9	0.61**
Bronchiectasis	910	90.9	631	62.6	1.45**
Congestive cardiac failure	2,576	257.3	2,589	256.7	1.00
Chronic obstructive pulmonary disease	4,399	439.4	5,965	591.4	0.74**
Diabetes complications	4,435	443.0	4,308	427.1	1.04
Hypertension	293	29.3	533	52.8	0.55**
Iron deficiency anaemia	792	79.1	2,244	222.5	0.36**
Nutritional deficiencies	55	5.5	47	4.7	1.17
Rheumatic heart disease	642	64.1	933	92.5	0.69**
Acute	**24,466**	**2,444.0**	**28,698**	**2,845.3**	**0.86****
Cellulitis	6,040	603.4	5,895	584.5	1.03
Convulsions and epilepsy	6,740	673.3	3,943	390.9	1.72**
Dental conditions	4,438	443.3	4,611	457.2	0.97
Ear, nose and throat infections	4,189	418.5	4,613	457.4	0.91**
Eclampsia	–	–	15	1.5	–
Gangrene	1,104	110.3	884	87.6	1.26**
Pelvic inflammatory disease	–	–	1,278	126.7	–
Perforated/bleeding ulcer	225	22.5	121	12.0	1.88**
Pneumonia (not vaccine-preventable)	102	10.2	119	11.8	0.86
Urinary tract infections	1,658	165.6	7,244	718.2	0.23**
Total PPH	**46,738**	**4,668.9**	**55,344**	**5,487.2**	**0.85****

PPH = potentially preventable hospitalisation

Notes: Rate is annualised age-standardised rate per 100,000 population

As more than one condition may be reported for a separation, the sum of conditions does not necessarily equal the reported total number of PPHs

Rate ratio is the ratio of Aboriginal male to Aboriginal female rates: rate ratios differing significantly from 1.0 are shown with * $p < 0.05$; ** $p < 0.01$

Among prominent acute conditions, the disparities are mixed. PPHs for cellulitis were more prevalent among males than females in the total population (RR = 1.27) but rates were similar for males and females among Aboriginal Australians (RR = 1.03). For convulsions and epilepsy, the rate was greater among males than females in both total and Aboriginal Australian populations, but almost three times more prevalent in males compared to females in Aboriginal Australians (RR = 1.72) than all Australians (RR = 1.26). For UTI, in both total and Aboriginal Australian populations females had a higher rate of PPH than males, but it was more than twice as prevalent among females than males among Aboriginal Australians (RR = 0.23) than all Australians (RR = 0.49).

4.5 Condition and age group

Table 4.5 shows the most prevalent conditions ranked within age groups among the Aboriginal Australian population. Among those aged 0 to 14 years, four conditions accounted for almost three-quarters of PPHs. A quarter of PPHs was accounted for by ENT infections alone (25.1%) with 816.8 PPHs per 100,000 population. The second most prevalent diagnosis in this age group was dental conditions (795.0 per 100,000 population), accounting for almost a quarter (24.4%) of PPHs.

Table 4.5: Potentially preventable hospitalisations by condition, ranked in order of prevalence by age, Aboriginal population, Australia, 2012/13 to 2014/15

Age (years)	Condition	Number	Rate	% of total	Cumulative %
0-14	Ear, nose and throat infections	5,896	816.8	25.1	25.1
	Dental conditions	5,739	795.0	24.4	49.5
	Cellulitis	2,838	393.2	12.1	61.6
	Convulsions and epilepsy	2,469	342.0	10.5	72.1
	Other	6,623	917.5	28.1	–
	Total	**23,529**	**3,259.5**	**100.0**	**–**
15-24	Cellulitis	1,549	385.5	17.2	17.2
	Urinary tract infections	1,360	338.4	15.1	32.3
	Convulsions and epilepsy	1,069	266.0	11.8	44.1
	Ear, nose and throat infections	1,033	257.1	11.4	55.5
	Other	4,039	1,005.1	44.7	–
	Total	**9,031**	**2,247.4**	**100.0**	**–**
25-44	Cellulitis	3,852	742.7	15.6	15.6
	Convulsions and epilepsy	3,651	704.0	14.8	30.4
	Other vaccine-preventable	2,328	448.9	9.4	39.8
	Urinary tract infections	2,316	446.6	9.4	49.2
	Other	12,946	2,496.2	52.4	–
	Total	**24,693**	**4,761.2**	**100.0**	**–**
45-64	Chronic obstructive pulmonary disease	5,579	1,864.3	17.6	17.6
	Diabetes complications	3,940	1,316.6	12.4	30.0
	Convulsions and epilepsy	3,096	1,034.6	9.8	39.8
	Cellulitis	2,904	970.4	9.1	48.9
	Other	16,882	5,641.3	53.2	–
	Total	**31,752**	**10,610.2**	**100.0**	**–**
65+	Chronic obstructive pulmonary disease	3,783	5,559.5	28.9	28.9
	Congestive cardiac failure	1,780	2,615.9	13.6	42.5
	Urinary tract infections	1,497	2,200.0	11.4	53.9
	Diabetes complications	1,328	1,952.0	10.2	64.1
	Other	4,848	7,124.6	37.1	–
	Total	**13,075**	**19,214.9**	**100.0**	**–**

Notes: Rate is annualised age-standardised rate per 100,000 population

Rank is the rank order of rates for the top four causes of PPHs among Aboriginal Australians

As more than one condition may be reported for a separation, the sum of conditions does not necessarily equal the reported total number of PPHs

Data presented elsewhere may count an admission more than once if there is more than one principal diagnosis

Among Aboriginal persons aged 15 to 24 years, the top four conditions represented over a half of PPHs. Cellulitis is the most prevalent diagnosis, with a rate of 385.5 per 100,000 population, 17.2% of PPHs in this age group. This is followed by UTI, constituting 15.1% of PPHs (338.4 per 100,000 population). These two conditions together constitute almost one third of PPHs for this age group.

In the age group 25 to 44 years, the four most prevalent conditions comprised almost half of PPH. Diagnoses of cellulitis comprised 15.6% of PPHs, or 742.7 PPHs per 100,000 population, and diagnoses of convulsions and epilepsy comprised 14.8% of PPHs, or 704.0 PPHs per 100,000 population. Together, they represented almost one third of PPHs in this age group.

Almost half of PPHs are also represented by the top four conditions among Aboriginal Australians aged 45 to 64 years. COPD accounted for almost one fifth of PPHs (17.6%), with a rate of 1,864.3 per 100,000 population. Diabetes complications accounted for more than one in ten PPHs (12.4%) with a rate of 1,316.6 per 100,000 population.

The four most prevalent conditions for Aboriginal Australians aged 65 years and over constituted almost two-thirds of PPHs in that age group, with the most prevalent condition, COPD constituting almost three in 10 (28.9%) with a rate of 5,559.5 per 100,000 population. This rate was more than twice the rate for the second most prevalent diagnosis for PPHs, CCF with a rate of 2,615.9 per 100,000 population, constituting 13.6% of PPHs in this age group.

In Figure 4.5, a clear delineation is evident between acute conditions dominating among younger age groups, and chronic conditions being more important among older age groups. Both cellulitis and convulsions and epilepsy are among the top four conditions for four out of the five broad age groups, 0 to 14 through to 45 to 64 years. UTI are among the top conditions for three age groups, from 15 to 24 years through to 65 years and over, with the exception of the age group 45 to 64 years, when chronic conditions became prevalent.

Despite only being prominent among age groups 45 to 64 years and 65 years and older, COPD and diabetes complications are the third and seventh most prevalent conditions leading to PPH.

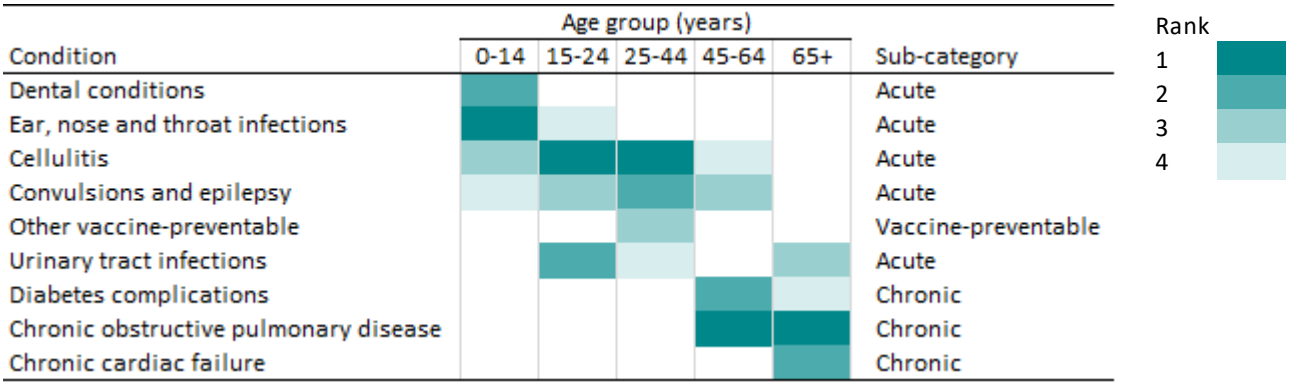


Figure 4.5: Potentially preventable hospitalisations by condition, ranked in order of prevalence by age, Aboriginal population, Australia, 2012/13 to 2014/15

Notes: Rank is the rank order of rates for the top four causes of PPHs for Aboriginal Australians
Conditions are ordered by age group in which they are ranked among the top four causes of PPH

4.6 Remoteness

There was a clear increase in the rate of PPHs with increased remoteness (Figure 4.6), however there was a lower rate of PPHs in Very Remote areas (8,313.5 per 100,000 population) than Remote areas (9,368.7 per 100,000 population). Even so, the rate in Very Remote areas was almost two and a half times the rate in Major Cities (RR = 2.43).

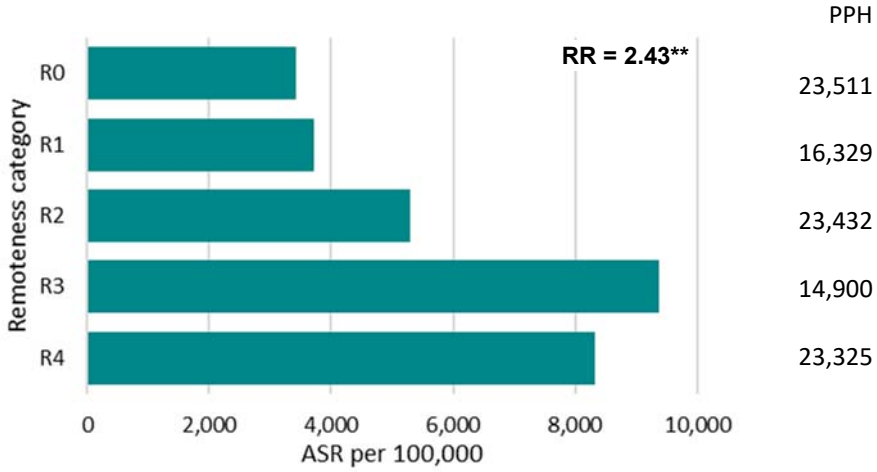


Figure 4.6: Potentially preventable hospitlisations by remoteness, Aboriginal population, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate; RR = rate ratio
R0 = Major Cities; R1 = Inner Regional; R2 = Outer Regional; R3 = Remote; R4 = Very Remote

Figure 4.7 displays PPHs by diagnosis categories and the most prevalent conditions by remoteness classification. For all condition categories and conditions, a relationship of higher PPH rates with greater remoteness is evident, though as with the overall PPH rate, the rates in Very Remote areas are lower than the rates in Remote areas, with the exception of vaccine-preventable conditions.

Of the condition categories, the largest RR was for vaccine-preventable conditions (RR = 3.83), followed by acute conditions (RR = 2.43) and then chronic conditions (RR = 2.21).

Cellulitis saw the largest RR of the selected conditions, with a RR of 3.53. The rate of PPHs due to cellulitis in Very Remote areas (1,173.8 per 100,000 population) was only marginally lower than the rate in Remote areas (1,258.9 per 100,000 population). The second highest RR was for ENT infections (RR = 2.65), followed by diabetes complications (RR = 2.24). All rate ratios for the difference between Major Cities and Very Remote areas were statistically significant.

There was a marked decrease between rates in Remote and Very Remote areas for convulsions and epilepsy, COPD and UTI.

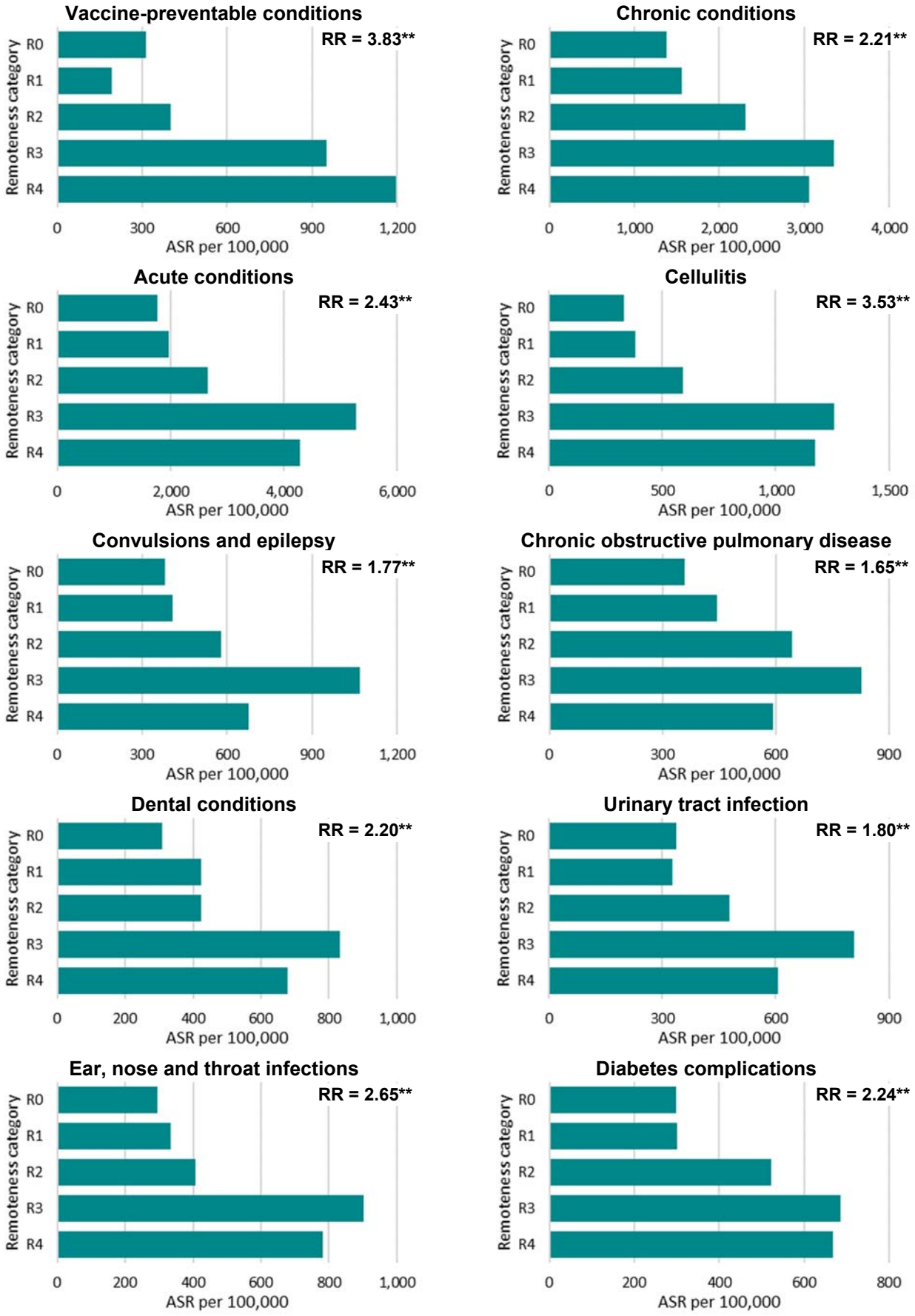


Figure 4.7: Potentially preventable hospitalisations by category and selected conditions, by remoteness, Aboriginal population, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate; RR = rate ratio
R0 = Major Cities; R1 = Inner Regional; R2 = Outer Regional; R3 = Remote; R4 = Very Remote

4.7 Indigenous Region and Indigenous Area

Figure 4.8 illustrates PPHs by Indigenous Region (IREG; see Map 8.1 Appendix 8.4 for a list of the regions and a map showing their locations).

The five IREGs with the highest rate of PPHs are located in the Northern Territory and Western Australia; 701: Alice Springs (17,632.3 per 100,000 population), 508: West Kimberley (14,858.4 per 100,000 population), 707: Tennant Creek (13,765.2 per 100,000 population), 504: Kununurra (12,061.7 per 100,000 population) and 702: Apatula (11,867.0 per 100,000 population).

The Regions with the lowest rate of PPHs were largely metropolitan; 601: Tasmania (1,650.5 per 100,000 population), 201: Melbourne (2,708.6 per 100,000 population), 801: ACT (3,071.8 per 100,000 population), Sydney – Wollongong (3,107.9 per 100,000 population) and South-Eastern NSW (3,223.5 per 100,000 population).

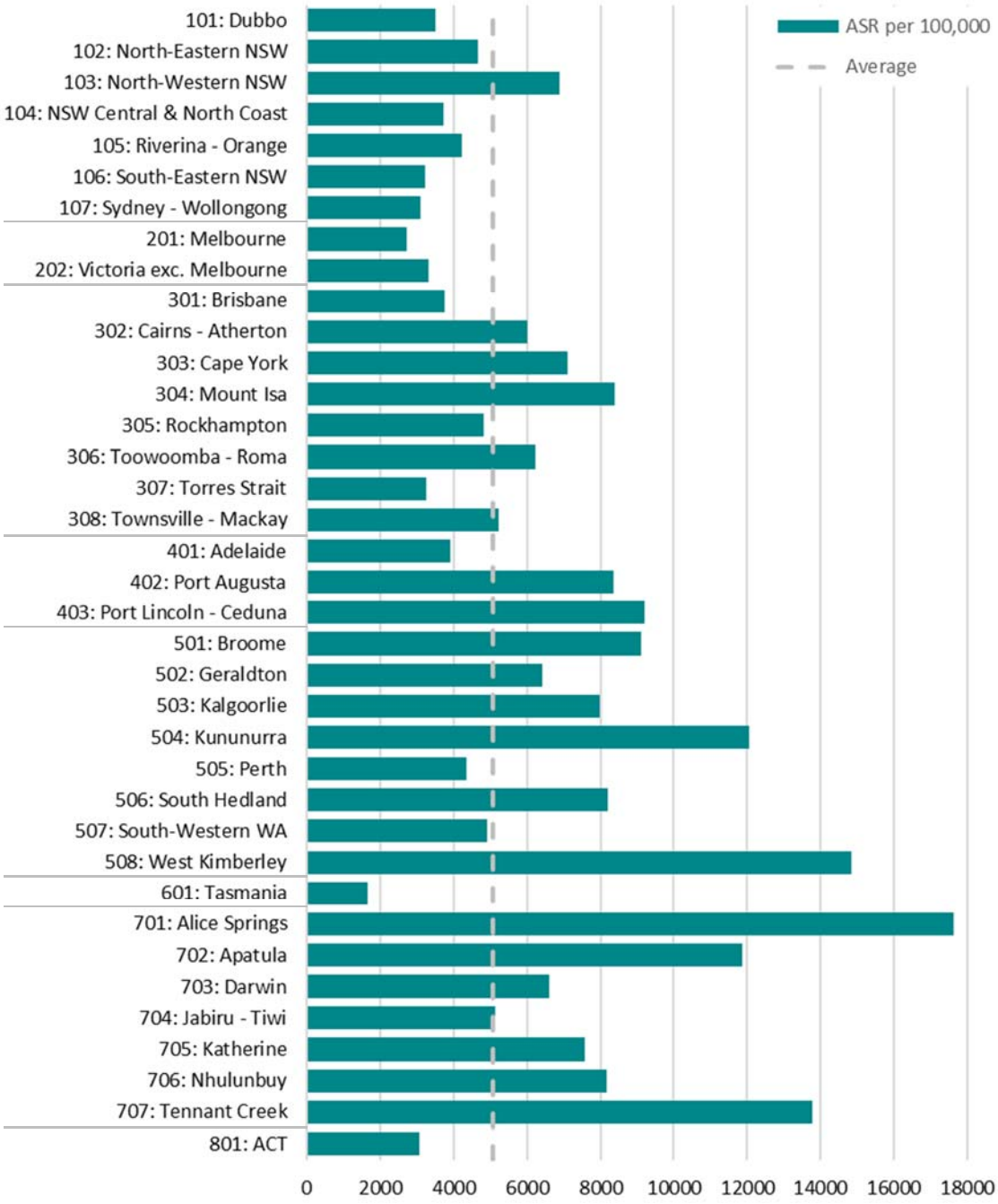


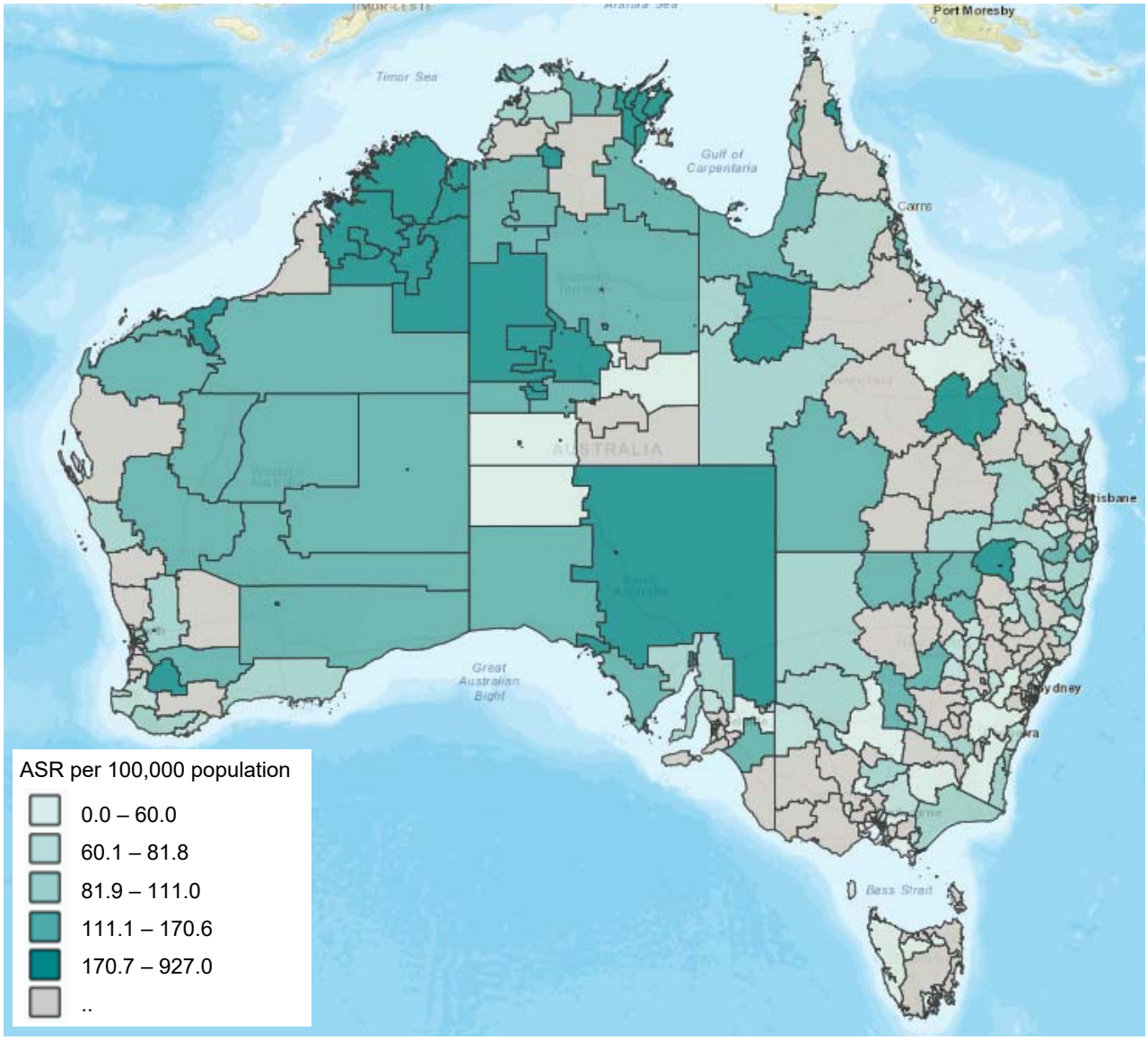
Figure 4.8: Potentially preventable hospitalisations by Indigenous Region, Aboriginal population, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate

The map below and other maps of PPHs by selected conditions are available online for the Indigenous population for 2012/13 to 2014/15 by indigenous Area (IARE) from http://phidu.torrens.edu.au/social-health-atlases/maps.

Rates were substantially higher than the Aboriginal Australian average in many IAREs, the highest of which were in the Northern Territory; 702015: Willowra (47,957.4 per 100,000 population), 702016: Yuelamu (43,573.5 per 100,000 population), 702017: Yuendumu and Outstations (41,867.6 per 100,000 population) and 702003: Anmatjere (41,781.4 per 100,000 population). The fifth highest rate was in 402003: Eyre in South Australia (28,557.6 PPHs per 100,000 population). There was a band of high rates of PPHs stretching from central Northern Territory north-west into Western Australia incorporating IAREs around the Kimberley.

Three IAREs in the Northern Territory had no PPHs recorded; they were 702005: Atitjere - Akarnenehe – Engawala, 702008: Kaltukatjara and Outstations and 702012: Urapuntja. The IAREs with the lowest PPH rates above zero were 601010: Tasmania – West Coast in Tasmania (991.2 per 100,000 population), 107025: Sutherland Shire in NSW (1,189.8 per 100,000 population), 601007: Meander Valley – Kentish in Tasmania (1,205.7 per 100,000 population), 601004: Huon Valley (1,403.7 per 100,000 population) and 201010: Melbourne – East in Victoria (1,434.0 per 100,000 population).



Map 4.1: Potentially preventable hospitalisations by Indigenous Areas, Aboriginal population, Australia, 2012/13 to 2014/15

ASR = annualised age-standardised rate

Note: .. indicates that there were fewer than five PPHs in the IARE

Source: Aboriginal and Torres Strait Islander Social Health Atlas, PHIDU

5 Discussion

Approximately one in 16 hospitalisations are potentially preventable. Females have a higher PPH rate than males, due to higher rates among ages 15 to 24 years and 25 to 49 years, primarily for conditions UTI and iron deficiency anaemia. There are large rate differences in older age groups, with higher rates for specific conditions among males compared to females, yet they are not sufficient to offset the higher rate of PPHs for UTI and iron deficiency anaemia among females in the more populous younger age groups. The younger age groups, as defined above, account for a larger percentage of the population (42.7% for males and 41.6% for females) than ages 65 years and over (12.8% for males and 14.9% for females) (Figure 8.1 Appendix 8.2).

For both sexes, dental conditions were a prominent diagnosis for PPHs among children through to middle-aged adults, and COPD and CCF were prominent diagnoses among older adults. For males, cellulitis was a common diagnosis for PPH in young- and middle-adulthood. For females, UTI and iron deficiency anaemia were frequent diagnoses for PPH throughout adulthood, with the exception of ages 15 to 24 years for iron deficiency anaemia.

Extremely high rates of PPH for COPD and CCF were evident in older age groups, however UTI and dental conditions had the highest rates overall due to their presentation in the younger age groups accounting for greater populations. Population distribution notwithstanding, the prevalence of COPD- and CCF-related PPH for ages 65 years and older is substantial.

Across younger- and older-adult age groups, UTI and iron deficiency anaemia are important conditions. For both conditions being female is a primary risk factor,[12,13,14] and PPHs for these conditions are many times higher among females than males in some age groups. As UTI is the condition associated with the highest rate of PPH, and iron deficiency anaemia the sixth highest, this is significant in terms of the overall PPH rate as well as the female rate.

Across multiple age groups including children, young- and middle-aged-adults, dental conditions contribute considerably to PPHs, and is the second largest contributor to the overall rate of PPH. Among adults, a poor dental visiting pattern is associated with lower socioeconomic status and poorer oral health outcomes[15], and cost has been identified as the primary reason for delaying or avoiding dental care.[16] Interestingly, there was no evident association between PPHs for dental conditions and quintile of socioeconomic disadvantage. Research into childhood dental disease supports a universal approach to improving dental health rather than targeting lower socioeconomic populations.[17]

Cellulitis is the fourth most prevalent diagnosis for PPHs overall. Soft tissue infections such as cellulitis are common and usually respond well to timely and appropriate intervention.[18] Hospitalisation is required in the presence of pre-existing conditions and symptoms indicating poor prognosis. Further investigation comparing PPH rates for cellulitis with underlying prevalence of pre-existing conditions such as kidney disease, diabetes and CCF may further explicate the extent to which PPHs are reflective of issues in primary care or of a greater need for hospitalisation due to the presence of high-risk conditions.

There was a clear gradient of increasing PPH rate with increased remoteness and with increased socioeconomic disadvantage. This may indicate issues with adequacy or appropriateness of primary health services for people living outside of populated areas, and with lower socioeconomic status, and possibly unequal disease experience.

Of the states and territories, the Northern Territory had the highest rate by a sizeable margin, with at least twice the rate of any other state or territory except Queensland. Compared to the gradient of PPH rates between states and territories, there is no corresponding gradient across States/Territories of the percentage of the population in the most disadvantaged quintile, living remotely or very remotely, that is Aboriginal Australian or that is both Aboriginal Australian and living remotely or very remotely (Figure 8.3 Appendix 8.3). From the data, there is a clear relationship between PPH rate and remoteness, socioeconomic disadvantage and Aboriginal Australian identity as individual factors, however neither factor alone explains the variation in rates around the country. More sophisticated statistical analysis and the investigation of related service data may better clarify the reasons for this variation.

Among Aboriginal Australians, the highest PPH rates were seen in remote Indigenous Regions, with Alice Springs, Tennant Creek and Apatula in the Northern Territory, and West Kimberley and Kununurra in Western Australia the highest. This supports the importance of the intersectionality of remoteness with Aboriginal identity for higher rates of PPHs. Regions with a zero rate in this data likely reflect data limitations rather than true zeros.[3] PPH rates were highly variable across Indigenous Regions.

The rate of all hospitalisations was greater among Aboriginal Australians than non-Aboriginal Australians, and there was greater disparity for PPHs than non-PPHs. All three categories of conditions, vaccine-preventable, acute and chronic, are higher among Aboriginal Australians than non-Aboriginal Australians, with some individual conditions many times higher. This suggests less adequate or appropriate primary health care for Aboriginal Australians than experienced in the rest of the population.

In the Aboriginal Australian population, acute conditions contribute more to the rate of PPHs than chronic diseases. This is likely a reflection of the underlying population distribution. Though PPH rates are lower in younger compared to older age groups, acute conditions are more prominent overall, as the younger age groups account for a greater proportion of the population than the older age groups, with more than 80% of Aboriginal males and females aged under 45 years (Appendix 8.2).

The rate for Aboriginal females is higher than for males in three out of the five age groups. As with the total population, this is most pronounced between the ages of 15 and 44 years, and the two key conditions are UTI and iron deficiency anaemia. Unlike the total population, UTI is the fifth most commonly diagnosed condition overall rather than the first, yet it was the single most frequent diagnosis for PPH among Aboriginal females.

Of the most common conditions, cellulitis and dental conditions saw no significant disparity between PPH rates for males and females, and the rates were markedly higher among Aboriginal than non-Aboriginal Australians. The experience of cellulitis is influenced by personal and community factors. Individual self-care and sanitary practices can help resolve infections, stop the spread of infection and prevent reinfection.[19] Community aspects include overcrowding and access to good washing facilities. Overcrowded housing is an issue for Aboriginal Australians, an issue that worsens with increased remoteness,[20] and often exists in combination with poor water quality and sanitation.[7] As cellulitis is the most prevalent condition contributing to PPHs among Aboriginal Australians, improving circumstances that influence cellulitis prevalence could help reduce PPHs overall.

Dental health is worse for Aboriginal Australians than the general Australian population, in both children and adults.[7] Dental decay in Aboriginal Australian children is higher than in Australian children at all ages,[21] with higher level of unmet need for treatment and greater severity of disease.[22] Periodontal disease and tooth loss is higher among Aboriginal Australian adults than the general adult population, and there is higher unmet need.[21] Unfortunately, research into the oral wellbeing and spread of dental disease among Aboriginal Australians is deeply lacking[23]. Yet risk factors remain the same for disease in Aboriginal Australians as in non-Aboriginal Australians; diet, oral hygiene and access to care; access to fluoridated water for dental decay specifically; and smoking, diabetes, stress and substance use for periodontal disease specifically.[7] Worryingly, dental health services are avoided more commonly than any other type of health service, suggesting fundamental issues in the provision of dental care to Aboriginal Australians.[7]

Of the other most common conditions, convulsions and epilepsy was a more prevalent diagnosis among males than females, and COPD more prevalent among females than males, and rates for both are substantially higher among Aboriginal than non-Aboriginal Australians.

Convulsions and epilepsy are a dominant diagnosis for PPHs until age 65 years. Research suggests that Aboriginal Australians experience more serious epilepsy and convulsive disease than non-Aboriginal Australians.[24] Contrary to Australian population data, an inverse relationship has been identified between hospital admission for seizure episodes and socioeconomic status, indicating a possible restriction of access to hospital care for socioeconomically disadvantaged Aboriginal Australian patients. In addition, readmissions and self-discharge is higher among Aboriginal than

non-Aboriginal Australians presenting for seizure care.[25] While there are concerns with primary care provision in this context, there are also concerns with hospital care provision. Even though convulsions and epilepsy were the second leading cause of PPH among Aboriginal Australians, it is possible the data underrepresents the true extent of health care access issues for this condition. It is also possible the high rate represents preventable readmissions for PPHs due to the condition.

This raises the broader question of whether access to hospital care is problematic for segments of the Aboriginal Australian population more generally. National data shows poorer access to hospital services when needed by Aboriginal Australians in remote than non-remote areas, and hospitals were the third most likely health service where access issues were experienced by Aboriginal Australians.[20] Population access data would provide a useful comparative measure, but such data seems restricted to populations of interest (people with disabilities) or selected health services (dental care).

COPD is primarily caused by smoking, and by exposure to fumes from fuel used for cooking and heating in homes with poor ventilation.[26] Smoking rates, while declining among Aboriginal Australians, are still higher than the general population.[27] Higher PPH rates may reflect the higher rates of smoking and poorer housing, in conjunction with issues around primary health services.

COPD and diabetes complications are conditions worthy of special note. PPHs for these conditions are prominent among age groups 45 to 64 years and 65 years and older, which constitutes less than one fifth of the Aboriginal Australian male and female population (Figure 8.2 Appendix 8.2), yet together they account for almost one fifth of all PPHs for Aboriginal Australians.

Aboriginal Australians have a prevalence of diabetes mellitus (type 2) up the three times the prevalence in the Australian population,[7,28] and higher prevalence of risk factors including obesity, high blood pressure and insufficient physical activity for health.[29] Furthermore, diabetes is a risk factor for severe infection including cellulitis, UTI[30] and dental infections,[31] all of which are high prevalence conditions among those leading to PPH.

Another notable result is the much higher prevalence of PPHs for other vaccine-preventable conditions among Aboriginal Australians than non-Aboriginal Australians. Higher rates of PPHs may reflect higher rates of vaccine-preventable conditions in the Aboriginal populace and in turn, lower access to or uptake of vaccination services, at least for a portion of the population. Vaccination data reveals that the overall percentage of Aboriginal children fully immunised is lower than for the non-Aboriginal population at ages one and two years, but higher at age five years. Further investigation could assess the specific diseases implicated, and whether there is disproportionate geographical spread of disease prevalence, lower vaccination coverage and the demographics of unvaccinated persons.

Aboriginal Australians experience the highest morbidity rates of any ethnic minority in the developed world.[25] Consequently, it is no surprise that they experienced higher PPH rates than non-Aboriginal Australians for the main conditions leading to PPH. The higher rate of PPHs for Aboriginal Australians suggest less adequate or appropriate primary health care than non-Aboriginal Australians but may be confounded by a higher rate of underlying disease and risk factors. In addition, due to the limitations of the data, it is known that hospitalisations for Aboriginal Australians are underrepresented in the data.[3] The extent to which this is true is unknown, nor is it known whether this underrepresentation is evenly spread across the population or concentrated according to sociodemographic or regional factors. In the spirit of the Close the Gap Campaign, an analysis of PPHs over time would be useful to assess movement towards or further deviation from the goal state of health equality.

6 Conclusion

PPHs in Australia are used as an indicator of adequacy and appropriateness of primary health care but may also reflect inequality in disease experience. Higher rates of PPHs are apparent among people living remotely, lower socioeconomic groups and Aboriginal Australians, demonstrating disproportionality of adequate and appropriate primary care according to geographical, social, financial and cultural factors. Barriers to primary care of a distance and transport, social, financial and cultural nature may be relevant, as may be factors contributing to the possible disparate disease experience among segments of the community. For Aboriginal Australians, quality of housing and health risk factors are important additional considerations, as well as equitable access to hospital services. Further investigation and more sophisticated statistical analysis would be beneficial to examine complex associations between sociodemographic factors and explore factors relevant to key individual conditions.

7 References

[1] Australian Institute of Health and Welfare (2016). *National Healthcare Agreement; PI 18-Selected potentially preventable hospitalisations*. Retrieved February 2018, from http://meteor.aihw.gov.au/content/index.phtml/itemId/598746

[2] Falster, M. & Jorm, L. (2017). *A guide to the potentially preventable hospitalisations indicator in Australia*. Sydney: Centre for Big Data Research in Health, University of New South Wales in consultation with Australian Commission on Safety and Quality in Health Care and Australian Institute of Health and Welfare.

[3] Australian Institute of Health and Welfare (2017). *Admitted patient care 2015-16: Australian hospital statistics (Health services series no.75. Cat. no. HSE 185)*. Canberra: AIHW.

[4] Bishop, L., Ransom, A. & Laverty, M. (2017). *Health care access, mental health and preventive health: Health priority survey findings for people in the bush*. Canberra: Royal Flying Doctor Service of Australia.

[5] Australian Institute of Health and Welfare (2017). *Rural and remote health*. Retrieved April 2018, from https://www.aihw.gov.au/reports/rural-health/rural-remote-health/contents/rural-health

[6] Duckett, S., Breadon, P. & Ginnivan, L. (2013). *Access all areas: new solutions for GP shortages in rural Australia*. Melbourne: Grattan Institute.

[7] Australian Health Ministers' Advisory Council (2015). *Aboriginal and Torres Strait Islander Health Performance Framework 2014 Report*. Canberra: AHMAC.

[8] Australian Institute of Health and Welfare (2016). Indigenous Australians' access to health services. In *Australia's health 2016 (Australia's health series no. 15. Cat. no. AUS 199)*. Canberra: AIHW.

[9] Gibson, O. & Segal, L. (2009). Avoidable hospitalisation in Aboriginal and non-Aboriginal people in the Northern Territory. *Medical Journal of Australia, 191*(1), 411.

[10] Li, S.Q., Gray, N., Guthridge, S., Pircher, S., Wang, Z. & Zhao, Y. (2009). Avoidable mortality trends in Aboriginal and non-Aboriginal populations in the Northern Territory, 1985-2004. *Australian and New Zealand Journal of Public Health, 33*(6), 544–50.

[11] Australian Bureau of Statistics (2018). *Remoteness structure*. Retrieved April 2018, from http://www.abs.gov.au/websitedbs/D3310114.nsf/home/remoteness+structure

[12] Kidney Health Australia (n.d.). *Urinary tract infections*. Retrieved March 2018, from http://kidney.org.au/your-kidneys/detect/urinary-tract-infections

[13] healthdirect (n.d.). *Iron deficiency*. Retrieved March 2018, from https://www.healthdirect.gov.au/iron-deficiency

[14] Mayo Clinic (n.d.). *Iron deficiency anaemia*. Retrieved March 2018, from https://www.mayoclinic.org/diseases-conditions/iron-deficiency-anemia/symptoms-causes/syc-20355034

[15] Ellershaw, A. C. & Spencer, A. J. (2011). *Dental attendance patterns and oral health status (Dental statistics and research series no. 57. Cat. no. DEN 208)*. Canberra: AIHW.

[16] Armfield, J. M. (2012). The avoidance and delaying of dental visits in Australia. *Australian Dental Journal, 57*, 1–5.

[17] Spencer, A. J. & Do, L. G. (2016). Interpretation of findings and a way forward to improving oral health and dental care. In: Do LG & Spencer AJ (Eds). *Oral health of Australian children: the National Child Oral Health Study 2012–14*. Adelaide: University of Adelaide Press.

[18] Gottlieb, T., Atkins, B. L. & Shaw, D. R. (2002). MJA practice essentials – infection diseases: 7: Soft tissue, bone and joint infections. *The Medical Journal of Australia, 176*(12), 609–615.

[19] The Royal Australian College of General Practitioners (2014). Managing skin infections in Aboriginal and Torres Strait Islander children. *Australian Family Physician, 43*(1-2), 16–19.

[20] Australian Bureau of Statistics (2011). *The Health and Welfare of Australia's Aboriginal and Torres Strait Islander peoples, 2010 (Cat. no. 4704.0)*. Retrieved May 2018, from http://www.abs.gov.au/AUSSTATS/abs@.nsf/lookup/4704.0Chapter865Oct+2010

[21] Roberts-Thomson, K. F., Spencer, A. J. & Jamieson, L.M. (2008). Oral health of Aboriginal and Torres Strait Islander Australians. *Medical Journal of Australia, 188*(10), 592–593.

[22] Australian Research Centre for Population Oral Health (2014). Oral health of Australian Indigenous children compared to non-Indigenous children enrolled in school dental services. *Australian Dental Journal (Data Watch), 59*(3), 395–400.

[23] de Silva, A. M., Martin-Kerry, J. M., McKee, K. & Cole, D. (2016). Caries and periodontal disease in Indigenous adults in Australia: a case of limited and non-contemporary data. *Australian Health Review, 41*, 469–479.

[24] Archer, J. & Bunby, R. (2006). Epilepsy in Indigenous and non-Indigenous people in Far North Queensland. *Medical Journal of Australia, 184*(12), 607–610.

[25] Plummer, C., Cook, M. J., Anderson, I. & D'Souza, W. J. (2013). Australia's seizure divide – indigenous versus non-indigenous seizure hospitalization. *Epilepsy and Behavior, 31*, 363–368.

[26] World Health Organization (2018). *Causes of COPD*. Retrieved March 2018, from http://www.who.int/respiratory/copd/causes/en/

[27] Australian Bureau of Statistics (2017). *Aboriginal and Torres Strait Islander Peoples: Smoking Trends, Australia, 1994 to 2014-15 (Cat. no. 4737.0)*. Retrieved March 2018, from http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/4737.0~1994%20to%202014-15~Main%20Features~Smoking%20Prevalence~10

[28] The Department of Health (2016). *Diabetes*. Retrieved May 2018, from http://www.health.gov.au/internet/main/publishing.nsf/content/chronic-diabetes

[29] Australian Institute of Health and Welfare (2016). Health behaviours and biomedical risks of indigenous Australians. In *Australia's health 2016 (Australia's health series no. 15. Cat. no. AUS 199)*. Canberra: AIHW.

[30] Li, M. & McDermott, R. (2016). High absolute risk of severe infections among Indigenous adults in rural northern Australian is amplified by diabetes – A 7 year follow up study. *Journal of Diabetes and its Complications, 30*(6), 1069–1073.

[31] Roberts-Thomson, K. F., Do, L. G., Bartold, P. M., Daniels, J., Grosse, A. & Meihubers, S. (2014). Prevalence, extent and severity of severe periodontal destruction in an urban Aboriginal and Torres Strait Islander population. *Australian Dental Journal, 59*(1), 43–47.

8 Appendix

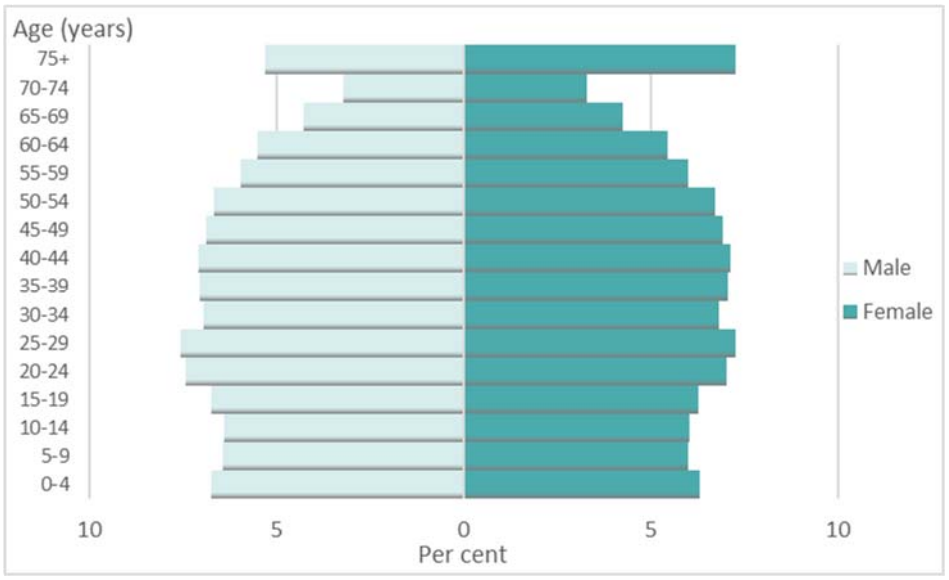
8.1 Appendix 1: ICD codes

Table 8.1: ICD-10-AM, 8th edition codes used for identifying potentially preventable hospitlisations

Category	Condition	ICD-10-AM codes	Additional requirements
Vaccine-preventable conditions	Pneumonia and influenza (vaccine-preventable)	J10, J11, J13, J14	In any diagnosis. Exclude people under 2 months.
	Other vaccine-preventable conditions	A08.0, A35, A36, A37, A80, B01, B05, B06, B16.1, B16.9, B18.0, B18.1, B26, G00.0	In any diagnosis.
Chronic	Asthma	J45, J46	As principal diagnosis. Exclude children aged less than 4 years.
	Congestive cardiac failure	I50, I11.0, J81	As principal diagnosis. Exclude cases with the following cardiac procedure codes: Blocks 600-606, 608-650, 653-657, 660-664, 666, 669-682, 684-691, 693, 705-707, 717 and codes 33172-00[715], 33827-01[733], 34800-00[726], 35412-00[11], 38721-01[733], 90217-02[734], 90215-02[732].
	Diabetes complications	E10.0–E10.9, E11.0–E11.9, E13.0–E13.9, E14.0–E14.9	As principal diagnosis.
	COPD	J41–J44, (J20)	As principal diagnosis; J20 only with additional diagnoses of J41, J42, J43, J44.
	Bronchiectasis	J47, (J20)	As principal diagnosis; J20 only with additional diagnosis of J47.
	Angina	I20, I24.0, I24.8, I24.9	As principal diagnosis. Exclude cases according to the list of procedures excluded from the Congestive cardiac failure category above.
	Iron deficiency anaemia	D50.1, D50.8, D50.9	As principal diagnosis.
	Hypertension	I10, I11.9	As principal diagnosis. Exclude cases with procedure codes according to the list of procedures excluded from the Congestive cardiac failure category above.
	Nutritional deficiencies	E40–E43, E55.0, E64.3	As principal diagnosis.
	Rheumatic heart diseases	I00–I02, I05–I09	As principal diagnosis.

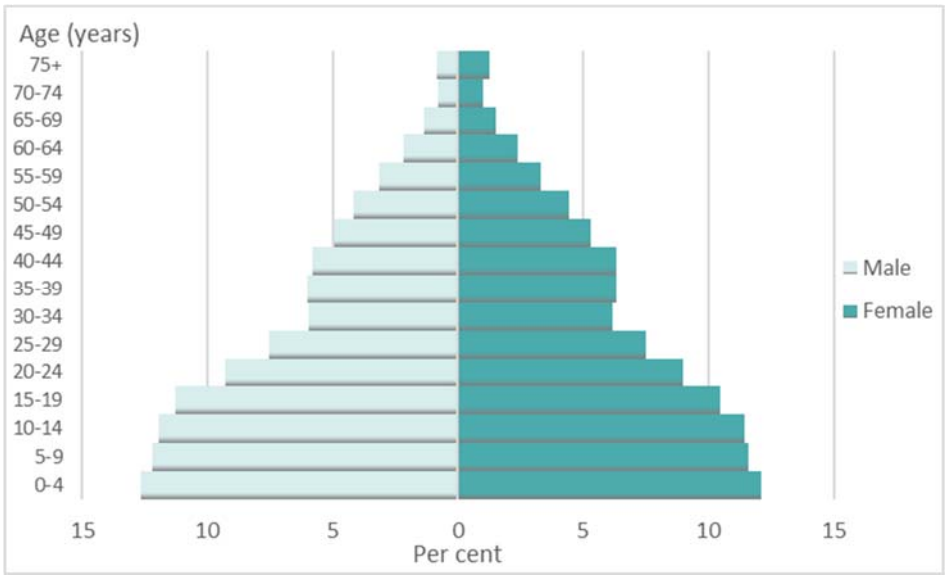
Acute	Pneumonia (not vaccine-preventable)	J15.3, J15.4, J15.7, J16.0	In any diagnosis. Exclude people under 2 months.
	Urinary tract infections, including pyelonephritis	N10–N12, N13.6, N15.1, N15.9, N28.9, N39.0, N39.9	As principal diagnosis.
	Perforated/bleeding ulcer	K25.0–K25.2, K25.4–K25.6, K26.0–K26.2, K26.4–K26.6, K27.0–K27.2, K27.4–K27.6, K28.0–K28.2, K28.4–K28.6	As principal diagnosis.
	Cellulitis	L02–L04, L08, L88, L98.0, L98.3	As principal diagnosis. Exclude cases with any procedure except those in blocks 1820 to 2016, or if procedure is 30216-00, 30216-01, 30216-02, 30676-00, 30223-01, 30223-02, 30064-00, 90660-00, 90661-00, and this is the only listed procedure.
	Pelvic inflammatory disease	N70, N73, N74	As principal diagnosis.
	Ear, nose and throat infections	H66, J02, J03, J06, J31.2	As principal diagnosis.
	Dental conditions	K02 K06, K08, K09.8, K09.9, K12, K13, K14.0	As principal diagnosis.
	Convulsions and epilepsy	G40, G41, R56	As principal diagnosis.
	Eclampsia	O15	As principal diagnosis.
	Gangrene	R02	In any diagnosis.
		I70.24, E09.52	As principal diagnosis.

8.2 Appendix 2: Population distribution, total and Aboriginal Australian populations



Age group (years)	Percentage Male	Female
0-14	19.5	18.4
15-24	14.1	13.3
25-44	28.6	28.3
45-64	25.0	25.1
65-74	7.5	7.6
75+	5.3	7.3
Total	**100.0**	**100.0**

Figure 8.1: Population pyramid, males and females, Australia, 2011



Age group (years)	Percentage Male	Female
0-14	36.8	35.1
15-24	20.6	19.4
25-44	25.3	26.3
45-64	14.4	15.4
65+	3.0	3.8
Total	**100.0**	**100.0**

Figure 8.2: Population pyramid, males and females, Aboriginal Australian population, Australia, 2011

8.3 Appendix 3: Population by socioeconomic disadvantage, remoteness and Aboriginal Australian identity

Table 8.2: Percentage of population in the most disadvantaged area quintile, in Remote and Very Remote locations, who are Aboriginal Australian, and who are Aboriginal Australian in Remote and Very Remote locations, by State/Territory, Australia, 2012/13 to 2014/15

	Most disadvantaged	Remote/ Very Remote	Aboriginal Australian	Remote/Very Remote and Aboriginal Australian
NSW	24.6	0.5	2.9	0.1
Vic	15.7	0.1	0.9	0.0
Qld	20.1	3.1	4.2	0.8
SA	24.5	3.7	2.3	0.4
WA	9.0	6.9	3.8	1.5
Tas	43.7	2.1	4.7	0.2
NT	31.9	44.2	29.8	23.7
ACT	0.0	0.0	1.7	0.0
Australia	**19.9**	**2.3**	**3.0**	**0.6**

Note: The most disadvantaged area quintile is based on SEIFA for all Australia, not within States/Territories

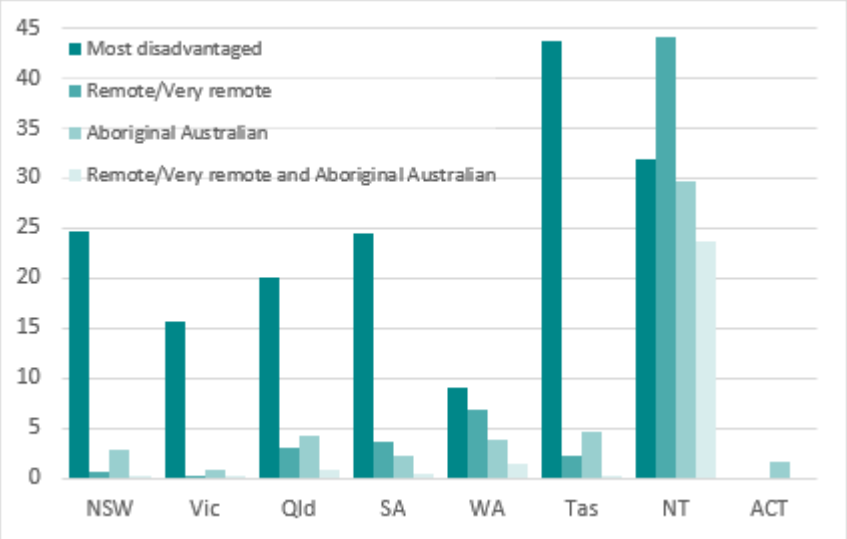
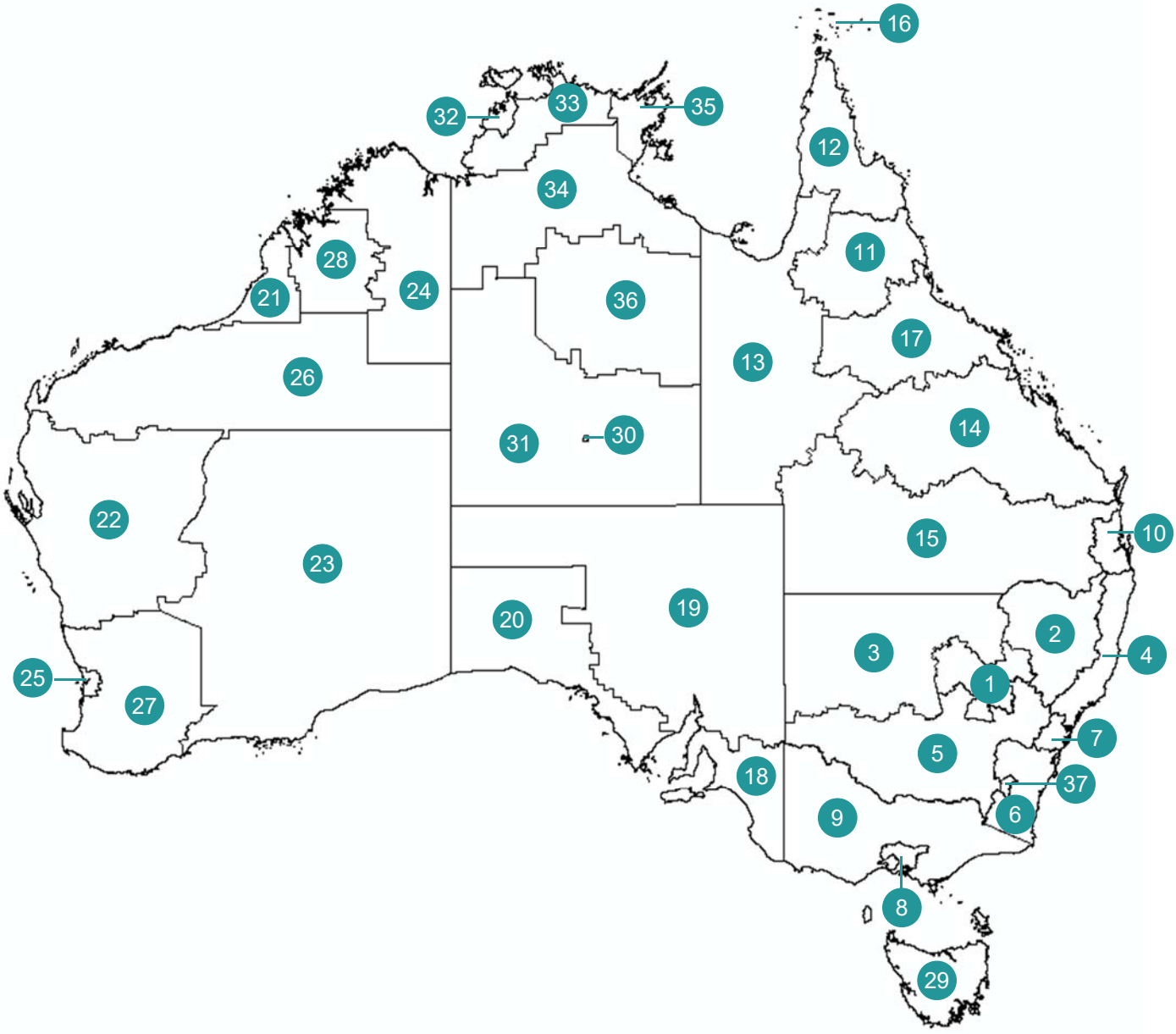


Figure 8.3: Percentage of population in the most disadvantaged area quintile, in Remote and Very Remote locations, who are Aboriginal Australian, and who are Aboriginal Australian in Remote and Very Remote locations, by State/Territory, Australia, 2012/13 to 2014/15

Note: The most disadvantaged area quintile is based on SEIFA for all Australia, not within States/Territories

8.4 Appendix 4: Key maps

Key to State/Territory Indigenous Regions, Australia 2011			
Area name	Map ref.	Area name	Map ref.
New South Wales		Western Australia	
101: Dubbo	1	501: Broome	21
102: North-Eastern NSW	2	502: Geraldton	22
103: North-Western NSW	3	503: Kalgoorlie	23
104: NSW Central & North Coast	4	504: Kununurra	24
105: Riverina – Orange	5	505: Perth	25
106: South-Eastern NSW	6	506: South Hedland	26
107: Sydney - Wollongong	7	507: South-Western WA	27
		508: West Kimberley	28
Victoria		Tasmania	
201: Melbourne	8	601: Tasmania	29
202: Victoria excluding Melbourne	9		
Queensland		Northern Territory	
301: Brisbane	10	701: Alice Springs	30
302: Cairns – Atherton	11	702: Apatula	31
303: Cape York	12	703: Darwin	32
304: Mount Isa	13	704: Jabiru – Tiwi	33
305: Rockhampton	14	705: Katherine	34
306: Toowoomba – Roma	15	706: Nhulunbuy	35
307: Torres Strait	16	707: Tennant Creek	36
308: Townsville – Mackay	17		
South Australia		Australian Capital Territory	
401: Adelaide	18	801: Australian Capital Territory	37
402: Port Augusta	19		
403: Port Lincoln – Ceduna	20		



Map 8.1: Indigenous Regions, Australia 2011

For Primary Health Networks, Population Health Areas and Indigenous Areas, go to:
http://phidu.torrens.edu.au/social-health-atlases/maps