2.3 Diabetes complications

Why is this important?

Approximately 6% of adults in Australia had diabetes in 2017–18.[1] The prevalence of diabetes in adults has almost doubled since 2001, although there was little change between 2014–15 and 2017–18.[1] Long-term complications of diabetes include stroke, heart disease, kidney disease, eye disease, nerve problems and foot ulcers.[2] Diabetes complications accounted for 276,965 hospital bed days and 7% of all potentially preventable hospitalisations in Australia in 2017–18.[3]

What did we find?

Between 2014–15 and 2017–18, the rate of hospitalisations for diabetes complications nationally increased by 7%.

In 2017–18, the rate was **12.2 times as high** in the area with the highest rate compared with the area with the lowest rate. Rates of hospitalisations for diabetes complications were markedly higher in remote areas than in other areas. Rates increased with socioeconomic disadvantage in major cities, and outer regional and remote areas. The rate for Aboriginal and Torres Strait Islander people was 3.7 times as high as the rate for other Australians.

What can be done?

Successful interventions for reducing hospitalisations for diabetes complications include supporting self-management; for example, a six-week structured program of education on self-management for people with diabetes reported an 88% reduction in hospitalisations.[4] A model of integrated care in Australia has reduced hospitalisations for diabetes complications by 47% in an early evaluation.[5] Telehealth program types and outcomes vary widely, but can reduce haemoglobin A1c (HbA1c) levels by approximately half[6], and some have led to reported reductions in hospitalisations.[7] HbA1c levels give an indication of average blood glucose levels and are used to estimate how well a person's diabetes is being managed.

Long-term interventions to address the social determinants of health may also reduce the rate of diabetes and its complications in Australia.

Diabetes complications

Context

Approximately 6% of adults in Australia had diabetes in 2017–18.[1] The prevalence in adults has almost doubled since 2001, although there was little change between 2014–15 and 2017–18.[1] Long-term complications of diabetes include stroke, heart disease, kidney disease, eye disease, nerve problems and foot ulcers.[2] Short-term complications include diabetic ketoacidosis.

Diabetes complications accounted for 276,965 hospital bed days and 7% of all potentially preventable hospitalisations in Australia in 2017–18.[3] The rate of hospitalisations for diabetes was 144 per 100,000 in Australia, and 93 per 100,000 in Canada, in people aged 15 years and over, in 2016.[8]

Of hospitalisations with a principal diagnosis of diabetes, type 2 diabetes accounts for most (64%), followed by type 1 diabetes (29%), gestational diabetes (5%) and other or unspecified diabetes (1%).[9]

Risk factors for type 2 diabetes

Risk factors for developing type 2 diabetes include physical inactivity, excess weight, poor diet and a genetic predisposition.[1] Aboriginal and Torres Strait Islander people are almost 3 times as likely to have diabetes as are other Australians, as a result of higher rates of risk factors for type 2 diabetes.[1,10]

Socioeconomic disadvantage strongly increases the risk: in 2011–12, adults in the lowest socioeconomic group had twice the rate of diabetes as those in the highest socioeconomic group (8% and 4%, respectively).[11] People who live in outer regional or remote areas of Australia have higher rates of diabetes than those in major cities or inner regional areas (7% and approximately 5%, respectively).[12]

Preventing complications

Hospitalisation is appropriate for certain complications of diabetes, such as kidney and foot damage, which are likely to require hospitalisation for effective treatment.[13] Some of these hospitalisations are considered potentially preventable because optimal management of blood glucose levels reduces the risk of diabetes complications.

Access to comprehensive, systematic care and follow-up reduces complications and preventable hospitalisations among people with diabetes.[14,15] For example, hospitalisation and lower-extremity amputation may be avoided by regular care in a high-risk foot clinic that includes vascular, orthopaedic, endocrine and podiatry services.[16]

About the data

All hospitalisations with a principal diagnosis of type 1, type 2 and unspecified diabetes are included.

Data are sourced from the National Hospital Morbidity Database, and include admitted patients in both public and private hospitals, including hospital care in the home.

Rates are based on the number of hospitalisations for diabetes complications per 100,000 people of all ages in 2017–18.

Because a record is included for each hospitalisation for the condition, rather than for each patient, patients hospitalised for the condition more than once in the financial year will be counted more than once.

The analysis and graphs are based on the usual residential address of the patient and not the location of the hospital.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

Data quality issues – for example, the extent of identification of Aboriginal and Torres Strait Islander status in datasets – could influence variations seen.

What do the data show?

Magnitude of variation

In 2017–18, there were 50,273 hospitalisations for diabetes complications, representing 184 hospitalisations per 100,000 people of all ages (the Australian rate).

The number of hospitalisations for diabetes complications across 325* local areas (Statistical Area Level 3 – SA3) ranged from 64 to 782 per 100,000 people. The rate was **12.2 times as high** in the area with the highest rate compared with the area with the lowest rate. The number of hospitalisations varied across states and territories, from 147 per 100,000 people in New South Wales to 277 in the Northern Territory (Figures 2.18–2.21).

After the highest and lowest 10% of results were excluded and 261 SA3s remained, the number of hospitalisations per 100,000 people was 2.9 times as high in the area with the highest rate compared with the area with the lowest rate.

Analysis by remoteness and socioeconomic status

Rates of hospitalisations for diabetes complications were markedly higher in remote areas than in other areas. Rates increased with socioeconomic disadvantage in major cities, and outer regional and remote areas (Figure 2.22).

Analysis by Aboriginal and Torres Strait Islander status

The rate for Aboriginal and Torres Strait Islander people (647 per 100,000 people) was 3.7 times as high as the rate for other Australians (173 per 100,000 people) (Figure 2.17).

Figure 2.17: Number of potentially preventable hospitalisations – Diabetes complications per 100,000 people of all ages, age and sex standardised, by state and territory of patient residence, by Aboriginal and Torres Strait Islander status, 2017–18[†]

The data for Figure 2.17, and the data and graphs for analysis by Primary Health Network are available at safetyandquality.gov.au/atlas

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* There are 340 SA3s. For this item, data were suppressed for 15 SA3s due to a small number of hospitalisations and/or population in an area.
Notes:
Some SA3 rates are more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
† Data by Aboriginal and Torres Strait Islander status should be interpreted with caution as hospitalisations for Aboriginal and Torres Strait Islander patients are under-enumerated, with variation among states and territories.
Population estimates as at 31 December 2017 are calculated as the average of the 30 June populations in 2017 and 2018.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Populations 30 June of 2017 and 2018.

Diabetes complications

Trends over time

Between 2014–15 and 2017–18, the rate of hospitalisations for diabetes complications per 100,000 people nationally increased by 7% (Figure 2.23).

For Aboriginal and Torres Strait Islander people, the rate of hospitalisations for diabetes complications per 100,000 people nationally increased by 8% between 2014–15 and 2017–18 (Figure 2.24).

Interpretation

The reported variation in the rate of hospitalisations for diabetes complications could be influenced by a number of factors, such as variation in:

- The prevalence of diabetes and risk factors for type 2 diabetes
- The level of concordance with guidelines by clinicians
- Access to integrated hospital and primary care
- Availability of out-of-hospital models of care, which may be lower outside major cities
- Systems for recall, referral and follow-up of people with diabetes
- Implementation of preventive health strategies
- The availability of allied health care and services for complications (for example, clinics for foot, eye and kidney complications)
- The availability of diabetes educators and access to support for diabetes self-management
- The level of consumer enablement
- Prevalence of mental health disorders that affect the ability to self-care, and use of antipsychotic medicines that increase the risk of obesity
- The frequency of preventive checks in primary care
- Socioeconomic disadvantage, health literacy and access to healthy food
- The ability to self-manage diabetes, including access to refrigeration for insulin
- The prevalence of risk factors for complications, including smoking, suboptimal management of blood glucose levels and dialysis (which can contribute to suboptimal management of blood glucose levels)[17]
- Clustering of populations with higher prevalence of type 2 diabetes, such as Aboriginal and Torres Strait Islander people, people born in the Pacific islands, and people born in southern and central Asia[2,18]
- Clustering of people with diabetes in aged care homes
- Access to healthcare services that provide culturally appropriate care
- The availability of Aboriginal and Torres Strait Islander staff for diabetes prevention and management
- The availability of health staff in remote areas
- Resourcing of primary care services relative to the local prevalence of diabetes
- Diagnostic error.

Because a record is included for each hospitalisation for the condition, rather than for the patient, patients hospitalised more than once for the condition or transferred between hospitals in the financial year will be counted more than once. This may increase the apparent rates of hospitalisations for people from outer regional or remote areas, who are more likely to be transferred to a major hospital.

Variations between areas may not directly reflect the practices of the clinicians who are based in these areas. Area boundaries reflect where people live, rather than where they obtain their health care. Patients may travel outside their local area to receive care.

Socioeconomic and demographic factors

Socioeconomic and demographic factors have a strong influence on rates of potentially preventable hospitalisations for chronic conditions, and are a greater influence than availability of primary care.[19] In some areas, the socioeconomic profile may have changed over the course of the time series.

Variation in health care and self-care

Quality of health care and self-care among people with diabetes varies. For example, people with diabetes in Australia receive care that corresponds to best-practice guidelines in approximately 63% of encounters with healthcare providers, according to data from 2009–10.[20] Levels of self-care and outcomes among people with type 2 diabetes improve with increasing levels of education and income.[21]

Change in New South Wales coding

National figures based on hospital admission data are strongly influenced by estimates from New South Wales (NSW), because this state accounts for around one-third of the total Australian population. Administrative changes to admission practices in NSW emergency departments occurred in July 2017: since then, only more severe cases (usually managed by emergency management units in emergency departments) have been included in hospital admission data. This resulted in an overall drop in hospital episodes (of around 3–5%), which may have an impact on trend analyses.

Reducing hospitalisations for people with diabetes

The increase in diabetes hospitalisations between 2014–15 and 2017–18 in the population overall, and in Aboriginal and Torres Strait Islander people, is concerning and should be addressed using a variety of strategies. These could be aimed at reducing rates of type 2 diabetes and improving management of all types of diabetes.

Integrated care models

Effective management of diabetes requires multidisciplinary, coordinated care.[22] The team of clinicians providing care may include general practitioners (GPs), medical specialists, nurses and allied health professionals. Although some people with diabetes are fortunate enough to receive this care, the current Australian health system does not provide the optimal supports for integrated team care.[23]

Health services are often fragmented, with poor communication between providers, and between community and hospital services.[22] For example, in some cases, the acute reason for hospitalisation may be managed without addressing the underlying suboptimal diabetes management. Partnerships between primary care providers – including Aboriginal Community Controlled Health Services (ACCHSs) – and specialists in the community, allied health professionals and hospitals are needed to provide better integrated care.

The majority of systematic reviews of integrated care for people with diabetes have shown a reduction in hospitalisations and improvements in management of blood glucose levels.[24] The term 'integrated care' covers a wide variety of models, and studies to clarify which models and components of care have the greatest impact would be valuable for guiding future implementation.[24] The differences between models, and in the type of outcomes measured, make it difficult to estimate the impact of the integrated care approach.

Diabetes complications

Models of care that integrate different specialties and primary care have been implemented with success in Australia – for example:

- An integrated primary and secondary care service in the community (see 'Case study' on this page)

- An outreach model for remote Aboriginal and Torres Strait Islander communities (see 'Case study: Outreach integrated care for remote Aboriginal and Torres Strait Islander communities' on page 115)[25]

- Integrated primary and tertiary care for women with diabetes in pregnancy in the Northern Territory (see page 119).[26]

Case study: Integrated primary and secondary care clinic for diabetes

A multidisciplinary, integrated primary and secondary care diabetes service has approximately halved the rate of hospitalisations due to diabetes complications in an early evaluation.[5] The success of this model is particularly encouraging, given that the users of the service had complex type 2 diabetes and were from socioeconomically disadvantaged areas.

The clinical team was made up of an endocrinologist, two or three GPs with advanced training in managing diabetes, a diabetes educator, a podiatrist, and other allied health professionals, as required. A trial of the model compared outcomes in 182 consumers who lived in the service catchment area in South Brisbane and 145 consumers who received usual care at a hospital outpatient clinic. Consumers attending the integrated service were less educated and had a significantly higher baseline HbA1c level than the control group (8.6% and 7.9%, respectively). Despite these differences, the average number of hospitalisations with a diabetes complication as the principal diagnosis was 47% lower in the intervention group than in the usual care group in the two years after the trial began. Eye and foot complications were the most common reason for hospitalisation.

The model of care has been expanded to a second site, and a randomised controlled trial found that blood glucose levels among consumers at the two sites were similar to those achieved in a hospital-based outpatient clinic.[27] Integrating primary and secondary care to develop the skills of the primary care team during consumer management is also being done in other ways – for example, through case conferences conducted by a specialist and involving the consumer, GP and practice nurse. Another recent Australian initiative based on this model has shown significant improvements in management of blood glucose levels and blood pressure.[20]

Case study: Outreach integrated care for remote Aboriginal and Torres Strait Islander communities

People living in remote Aboriginal and Torres Strait Islander communities of Australia have a critical need for accessible and culturally appropriate diabetes care, as well as the benefits of integrated specialist and primary care. Rates of diabetes and its complications are disproportionately high in these remote communities.

To address these challenges, an outreach specialist service was created in partnership with remote Aboriginal and Torres Strait Islander communities, and the local primary healthcare services in the Northern Territory.[25] The outreach team comprised diabetes nurse educators and endocrinologists. Each community clinic was visited three or four times a year by a diabetes nurse educator and twice yearly by an endocrinologist. People with suboptimal blood glucose levels and with complications were prioritised for care.

The outreach team reviewed consumers at each visit and provided management recommendations for the consumers, local doctors, Aboriginal health workers and remote area nurses. Care plans were made collaboratively between the outreach team and the local primary healthcare team, who then implemented the plans. The outreach team also strengthened the capacity of local primary healthcare providers through education sessions in diabetes management, as well as clinical support between visits.

An evaluation was conducted in three remote communities that had diabetes rates between 28% and 60% among adults.[25] By 12 months, the consumers' average HbA1c level was significantly reduced, and 63% of consumers had achieved a reduction in HbA1c.

According to the study authors, equitable partnerships between service providers and communities are crucial for ensuring that communities have the opportunity to help shape the way care is delivered, so that it is acceptable to consumers.[25]

Diabetes complications

Telehealth

A range of telehealth strategies are effective in improving management of blood glucose levels in people with type 2 diabetes, and can be significantly more effective than usual care.[6] For example, a one-year telephone self-management program for people with diabetes in the United States reduced hospitalisations by 10%.[7] Telehealth can decrease hospitalisations among adults with diabetes, but the type of intervention, and the results, vary widely.[28]

Teleconsultation (two-way communication between consumers and clinicians, or between clinicians) is the most effective type of telehealth for type 2 diabetes.[6] Supplementing outreach clinics for remote communities with telehealth consultations would reduce overall costs associated with delivery of specialist diabetes services, and reduce time away from usual activities for both consumers and clinicians.[29]

Telehealth is being used effectively in some parts of Australia.[30] Examples of telehealth for diabetes care include the Royal Flying Doctor Service in Victoria, which has provided an endocrinology telehealth program since 2013 via a customised videoconference platform, and the Diabetes Telehealth Service for Regional WA (see the 'Case study' on this page).

Telehealth has the potential for much wider use to improve access to health care in regional and remote areas, and for people with mobility problems or young children. Barriers to uptake of telehealth in regional and remote areas of Australia include[31]:

- Lack of adequate internet access in some areas

- Consumers not being aware of, or not knowing how to access, telehealth

- Cultural safety of telehealth services for Aboriginal and Torres Strait Islander people

- Lack of access to clinicians providing telehealth services

- Lack of Medicare item numbers for telehealth

- Lack of resourcing at the consumer end and the primary care end.

Case study: Diabetes Telehealth Service for Regional WA

The Diabetes Telehealth Service for Regional WA is a publicly funded, community-based, diabetes educator–led telehealth service for all types of diabetes. It promotes a hybrid, shared care approach connecting people with local face-to-face options, where possible. The service also offers access to a virtual endocrinology clinic for diabetes consumers, which their GPs or practice nurses can attend.

Kimberley Aboriginal Medical Services and Diabetes WA are currently collaborating to explore a model aiming to improve the cultural security of the Diabetes Telehealth Service for Regional WA, to increase community engagement. Diabetes WA is also collaborating with Royal Perth Hospital to enable more timely access to a multidisciplinary diabetes team via the Diabetes Telehealth Service for Regional WA for consumers on their waitlist with less complex needs.

Consumer enablement

Diabetes requires intensive self-management to prevent complications, and structured diabetes education has significant potential to improve outcomes for people with diabetes.[32–34] Structured diabetes education is evidence based, suits the needs of the person, has specific learning objectives and a structured curriculum, and is delivered by trained educators.[35] Structured education for people with type 2 diabetes addresses risk factors for complications, such as dietary habits, foot care and smoking.[34]

Reduction in hospitalisations has been reported; for example, a randomised controlled trial reported an 88% reduction in hospitalisations among people with type 2 diabetes who attended education sessions, compared with the control group.[4] The intervention consisted of a six-week program of 2.5-hour weekly classroom training sessions on diabetes self-management.[4] Structured education for people with type 1 diabetes also reduces the frequency of severe hypoglycaemic events.[36]

The Diabetes Education and Self-Management for Ongoing and Newly Diagnosed (DESMOND) program is a structured group education program based on a philosophy of consumer empowerment. A trial of the DESMOND program in 26 locations across regional Western Australia (WA) reported a significant increase in consumer activation, which is a measure of the extent of consumer involvement in their health care.[37] Consumer activation can be used as a reliable tool for improving type 2 diabetes self-management and clinical outcomes.[38] A high degree of activation may be needed to self-refer to a DESMOND program, and strategies to involve less-activated consumers are needed.[37] This might include increasing referrals from primary care providers to DESMOND programs.[37]

Advances in medical treatment

Newer medicines for lowering blood glucose, sodium–glucose cotransporter-2 (SGLT-2) inhibitors and glucagon-like peptide-1 (GLP-1) analogues can reduce the risk of cardiovascular and renal complications in people with type 2 diabetes.[39,40] SGLT-2 medicines may reduce heart failure hospitalisations by 30% in people with type 2 diabetes, compared with those taking placebo or other diabetes medicines.[41]

SGLT-2 and GLP-1 analogue medicines are now recommended by guidelines for consumers with diabetes who have, or are at high risk of, heart disease or chronic kidney disease.[42–44]

Preventing diabetic eye and kidney disease

Diabetic retinopathy is a leading cause of blindness in Australians aged 20–74 years. Early detection and management can prevent severe vision loss and blindness in almost all cases.[2] Screening for diabetic retinopathy has been shown to be effective in preventing blindness in rural and urban Australian settings, and preventive eye care is highly cost-effective.[45] Rural and remote populations have successfully been screened via telehealth.[45] National diabetic retinopathy screening programs in other countries have shown impressive reductions in blindness among people with diabetes, and the feasibility of a similar program in Australia merits examination.[45]

Earlier diagnosis of diabetes

Point-of-care testing for HbA1c has been suggested as a strategy to facilitate earlier diagnosis of diabetes – obtaining a fasting blood sugar level or undertaking an oral glucose tolerance test can present a barrier to diagnosis for many consumers.[46] Women who have had gestational diabetes are 7 times as likely to develop type 2 diabetes as other women, and follow-up of these women is often poor.[47] Among Australian women with gestational diabetes, Aboriginal and Torres Strait Islander women are 4 times as likely as other women to develop type 2 diabetes.[48] Improving detection and follow-up of diabetes in pregnancy could reduce complications in both the mother and the child.

Improving care for inpatients with diabetes

The estimated prevalence of diabetes among hospital inpatients in Australian studies is approximately 30%, and outcomes for this group are poorer than for those without diabetes.[49–51] Optimising care in hospital early in the admission could improve outcomes, and prevent or delay readmissions for future complications.[50] Aboriginal liaison officers and other Aboriginal and Torres Strait Islander hospital staff play an important role in supporting the consumer journey in hospital and at discharge.

In surgical patients, diabetes significantly increases the risk of six-month mortality, major complications, admission to intensive care and length of stay.[49] Suboptimal blood glucose levels before surgery appear to be an important contributor, and triaging consumers with diabetes (particularly those with suboptimal blood glucose levels) to pathways of care dedicated to higher-risk consumers may improve outcomes from surgery.[49]

Diabetes complications

Preventing type 2 diabetes

Preventing type 2 diabetes is key to reducing hospitalisations for diabetes complications in the future. Strategies to address the social determinants of health are needed to reduce the high rates of type 2 diabetes in areas of socioeconomic disadvantage. These determinants include education levels, employment, income levels and access to nutritious food.[52] Multifaceted approaches are needed to create environments that support healthy lifestyles, such as urban planning for active transport and policies to promote healthy eating.

Population health programs, such as lifestyle coaching services, can be effective in reducing risk factors for type 2 diabetes (see 'Case study' on this page). Type 1 diabetes is not preventable, but optimal blood glucose levels can prevent complications.

Case study: Telephone-based lifestyle coaching

The Get Healthy Information and Coaching Service is a free telephone-based intervention that aims to reduce risk factors for several chronic conditions. One component is aimed at decreasing excess weight among high-risk groups in New South Wales. The program includes a module tailored for adults at risk of developing type 2 diabetes.[53]

The program was successful in engaging high-risk groups; 42% of participants were from the two lowest socioeconomic brackets, and 43% lived outside major cities. After six months, participants had lost an average of 3.4 kg, and nearly one-third of participants lost at least 5% of their body weight.[53] Participants also significantly increased their healthy eating and physical activity behaviours.

The Get Healthy Information and Coaching Service includes a tailored service for Aboriginal and Torres Strait Islander people. Participants in the Aboriginal Program also lost an average of 4 kg, and significantly increased their physical activity and improved healthy eating behaviours.[54]

Improving care for Aboriginal and Torres Strait Islander people

Complex social determinants underlie the disparities in health, including diabetes rates and outcomes, between Aboriginal and Torres Strait Islander people and other Australians.[55,56] To address health inequities, improvements in social factors are required – for example, in education, employment and living conditions.[55]

In addition, the logistical and financial barriers to accessing timely and effective health care for Aboriginal and Torres Strait Islander people who live in remote areas need to be addressed.[55] Logistical barriers include time delays in laboratory analysis of samples for glucose testing. Glucose breakdown in samples while in transit to laboratory analysis was estimated to result in a 62% under-diagnosis of gestational diabetes in women in regional, rural and remote areas of WA.[57] ACCHS clinics in the Kimberley have implemented an alternative protocol for sample collection, using different collection tubes, to overcome this problem.

Cultural safety and culturally appropriate care

Misalignment of mainstream health services with Aboriginal and Torres Strait Islander culture is a barrier to accessing health care.[58] Culturally safe care can improve clinical diabetes outcomes and consumer satisfaction among Aboriginal and Torres Strait Islander people.[59]

Holistic, integrated and multidisciplinary models of care

Models of care that have shown early success for Aboriginal and Torres Strait Islander people with diabetes include home-based outreach case management that provides holistic, multidisciplinary care. A program for Aboriginal and Torres Strait Islander people with complex chronic conditions, including diabetes, has incorporated these principles using a participatory approach, in which consumers set their own health and wellbeing goals.[60] This exploratory study, using home-based, outreach case management of chronic disease, was developed and implemented in an urban Aboriginal and Torres Strait Islander primary healthcare service in Brisbane. The initial in-home assessment included a discussion about social, health and economic issues that would affect the consumer's ability to achieve their goals. The case manager coordinated services and case conferences with health professionals. Having care delivered in their own homes was important to consumers, as it increased their sense of safety

and receiving comprehensive care, and minimised inconvenience and cost of travel.[60] Case managers worked in a culturally appropriate manner, contributing to a mutually respectful relationship.[60] After 12 months, 73% of consumers had good, very good or excellent self-rated health status, compared with 33% at baseline.[60] Significant increases were also seen in appointments with medical specialists and allied health professionals. Significant improvements were seen in blood pressure, but not in HbA1c or excess weight levels.[60]

In the Fitzroy Valley of the Kimberley region, WA, preventive management of diabetes in Aboriginal and Torres Strait Islander people has been improved through partnerships between the Aboriginal medical service, the local hospital, the population health unit and the community health centre. This has enabled primary care services in the area to be integrated, and health services to be reoriented from predominantly acute, reactive care to more preventive activities and primary care. Activities include health promotion days for screening and education, and team outreach clinics for developing self-management plans with consumers. An increase by a factor of almost 10 in the proportion of eligible consumers having a diabetes annual cycle of care was seen after the culturally appropriate, integrated model of care was introduced, according to data from 2010.[61]

The Northern Territory Diabetes in Pregnancy Partnership includes an enhanced model of care, as well as a clinical register and longitudinal birth cohort.[26] The goals of the model of care include:

- Early testing of women

- Integration of primary and tertiary care for women with diabetes in pregnancy

- Improved communication between service providers

- Development of integrated care plans within existing IT systems

- Provision of care according to current guidelines.[26]

Diabetes complications

Health professionals involved in focus groups to evaluate the model said that it had improved contact between clinicians, resulting in more coordinated care.[26] For example, workshops and regional meetings increased understanding of roles, and engagement of clinicians in developing referral pathways resulted in increased uptake of referral pathways and care plans.[26] Increased access to specialist services through telehealth and allied health outreach visits also increased local health professionals' knowledge.[26] Persisting barriers to integration identified by the focus groups included workforce shortages and difficulties integrating the IT systems between government, non-government and ACCHS sectors.[26]

Food and nutrition

Access to traditional foods for Aboriginal and Torres Strait Islander people has been disrupted by colonisation, and improving nutrition could reduce the burden of type 2 diabetes in these populations. Positive effects on nutrition and chronic disease indicators can be achieved by incorporating nutrition and breastfeeding advice into maternal and child health services, and through multifaceted community nutrition programs.[62] The most important factor in determining the success of such programs is Aboriginal and Torres Strait Islander involvement in, or control of, the program.[62]

Eye care

Annual eye screening, clearly defined pathways of care and timely management are key to improving eye health in Aboriginal and Torres Strait Islander people with diabetes.[63] The Roadmap to Close the Gap for Vision includes a range of strategies, some of which have been implemented, to increase the accessibility and uptake of eye-care services by Aboriginal and Torres Strait Islander people.[18]

Foot care

A mobile outreach service that provides foot care and diabetes education in Perth, WA, has been well received by the Aboriginal and Torres Strait Islander community. The service addresses social issues as well as clinical care, and consumers are managed in partnership with their GPs. This model has achieved high attendance levels. Its outcomes are currently being evaluated.[64] Greater resourcing of high-risk foot services in remote Australia, including outreach services, could reduce the burden of diabetic foot complications in these areas.

Medical-grade footwear and orthotics can help prevent diabetic foot complications, but are difficult to access for people in many rural and remote areas. Providing appropriate footwear for Aboriginal and Torres Strait Islander people with diabetes in remote areas could prevent a substantial number of foot complications.[65]

End-stage kidney disease

Diabetes is the leading cause of end-stage kidney disease in Australia. The rate of end-stage kidney disease in Aboriginal and Torres Strait Islander people is more than 6 times higher than in other Australians.[66] Targeted chronic kidney disease programs appear to be effective in improving outcomes for Aboriginal and Torres Strait Islander people with chronic kidney disease.[67] Early detection of diabetes is also key to preventing long-term kidney damage.

Rates by local area

Figure 2.18: Number of potentially preventable hospitalisations – diabetes complications per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2017–18

Each circle represents a single SA3. The size indicates the number of hospitalisations.

	20
	200
	400
	600
	750
■	interpret with caution
▲	rate only

Potentially preventable hospitalisation rate – diabetes complications, by SA3

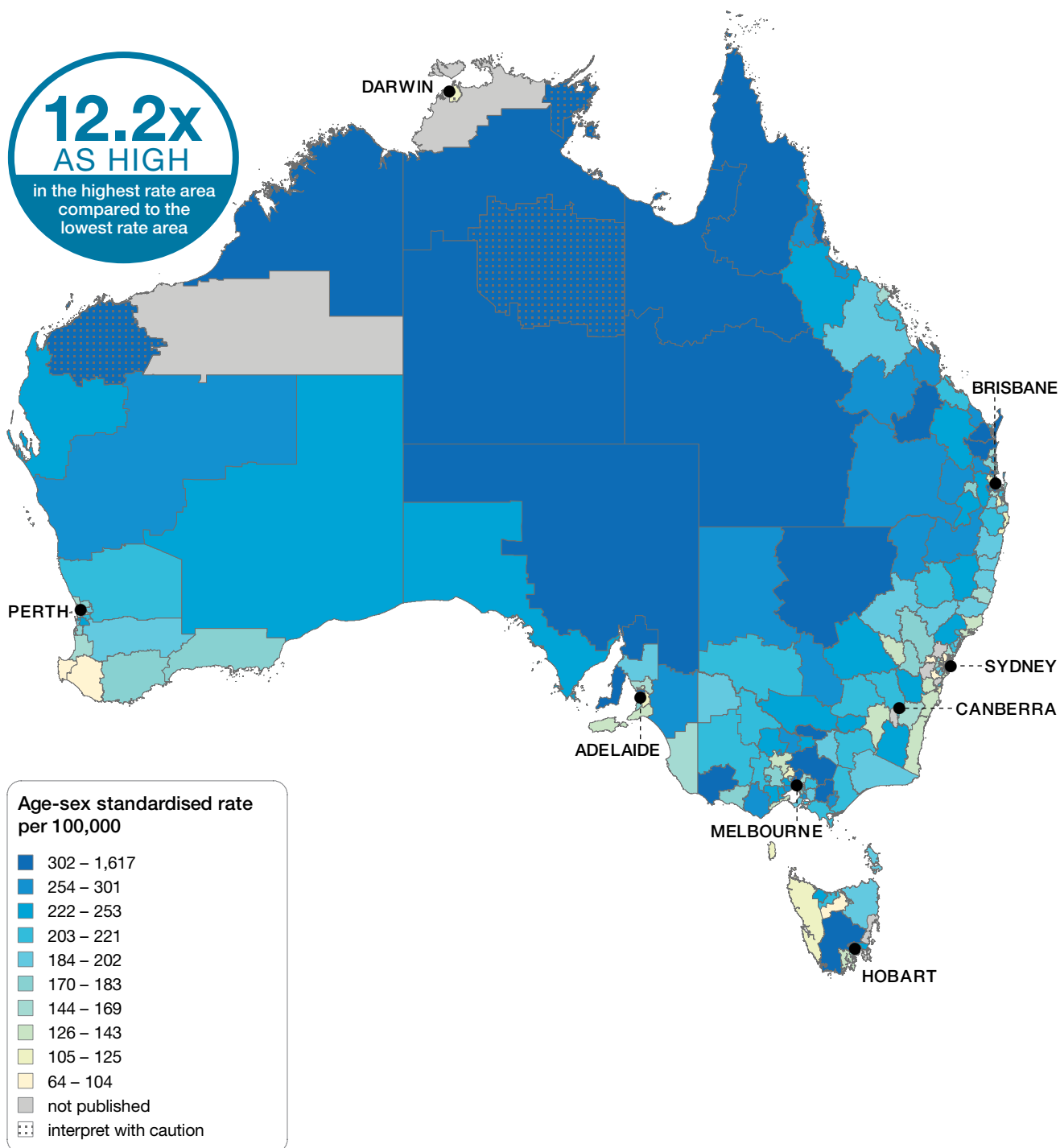| Lowest rate areas					Highest rate areas			
SA3	State	Rate	Hospitalisations		SA3	State	Rate	Hospitalisations
Mitcham	SA	64	56		Barkly	NT	1,617*	83
Pennant Hills - Epping	NSW	66	38		Baw Baw	Vic	782	518
Burnside	SA	68	40		Kimberley	WA	556	175
North Canberra	ACT	68	39		Brighton	Tas	537	100
Ryde - Hunters Hill	NSW	70	114		Outback - South	Qld	524	126
Stonnington - East	Vic	70	35		Outback - North	Qld	469	127
Ku-ring-gai	NSW	73	112		Maryborough	Qld	467	264
Eastern Suburbs - North	NSW	75	119		Far North	Qld	467	148
Prospect - Walkerville	SA	76	24		Strathpine	Qld	439	158
Manly	NSW	77	39		East Arnhem	NT	432*	51
Pittwater	NSW	78	62		Katherine	NT	420	78
North Sydney - Mosman	NSW	79	95					
Cottesloe - Claremont	WA	79	75					
Dural - Wisemans Ferry	NSW	81	22					
Sydney Inner City	NSW	82	155					
Baulkham Hills	NSW	84	140					
Unley	SA	89	41					

Notes:
Squares (■) and asterisks (*) indicate rates that are more volatile than other rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of hospitalisations are not published for confidentiality reasons.
Population estimates as at 31 December 2017 are calculated as the average of the 30 June populations in 2017 and 2018.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Populations 30 June of 2017 and 2018.

Diabetes complications

Rates across Australia

Figure 2.19: Number of potentially preventable hospitalisations – diabetes complications per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2017–18

12.2x AS HIGH in the highest rate area compared to the lowest rate area

Age-sex standardised rate per 100,000

- 302 – 1,617
- 254 – 301
- 222 – 253
- 203 – 221
- 184 – 202
- 170 – 183
- 144 – 169
- 126 – 143
- 105 – 125
- 64 – 104
- not published
- interpret with caution

Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
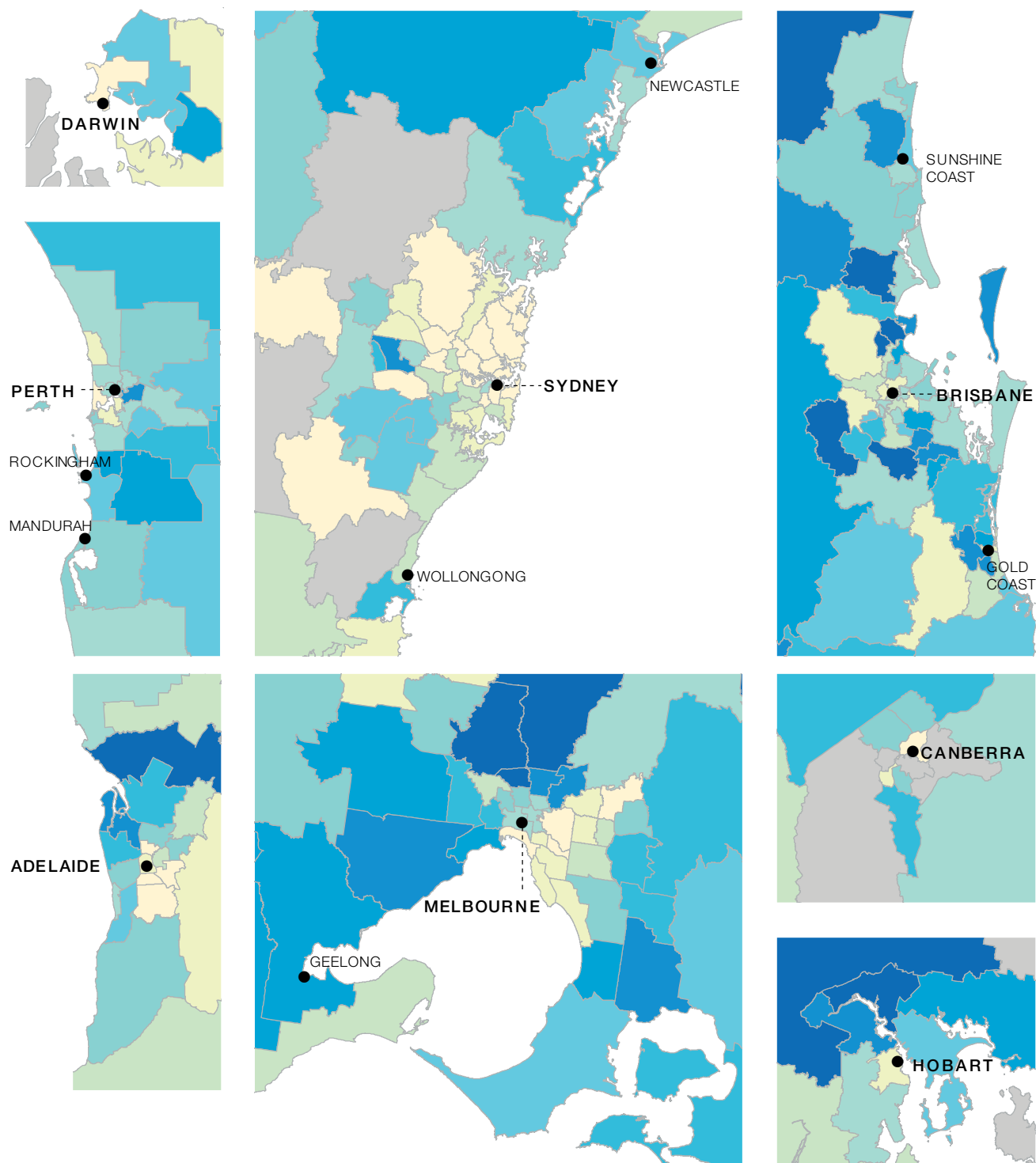Population estimates as at 31 December 2017 are calculated as the average of the 30 June populations in 2017 and 2018.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Populations 30 June of 2017 and 2018.

Rates across capital city areas

Figure 2.20: Number of potentially preventable hospitalisations – diabetes complications per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2017–18

Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Population estimates as at 31 December 2017 are calculated as the average of the 30 June populations in 2017 and 2018.
For further detail about the methods used, please refer to the Technical Supplement.
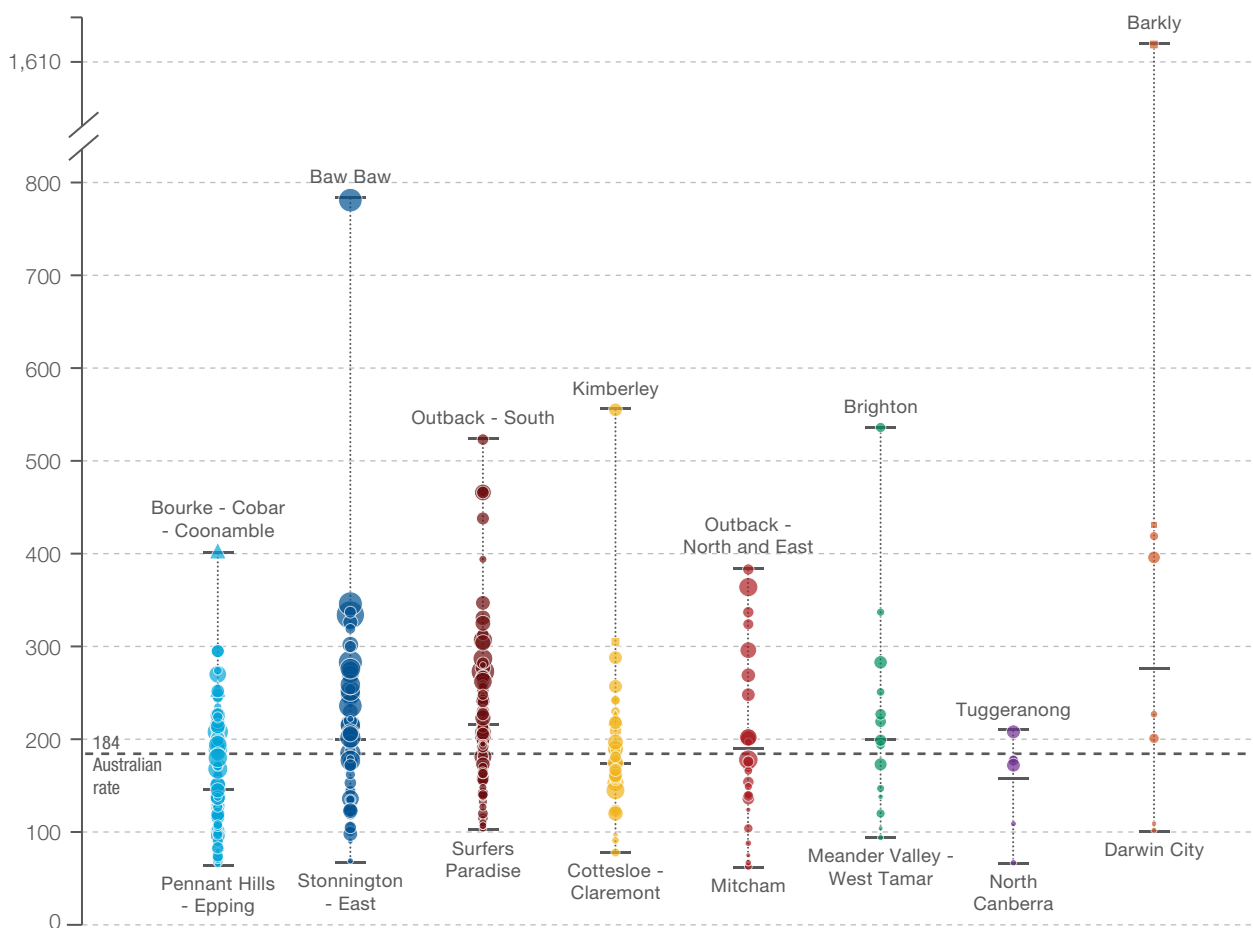**Sources:** AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Populations 30 June of 2017 and 2018.

Diabetes complications
Rates by state and territory

Figure 2.21: Number of potentially preventable hospitalisations – diabetes complications per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2017–18

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	404	782	524	556	384	537	209	1,617*
State/territory	147	200	217	175	190	201	159	277
Lowest rate	66	70	105	79	64	95	68	103
No. hospitalisations	13,134	14,004	11,696	4,803	3,850	1,270	649	617

Each circle represents a single SA3. The size indicates the number of hospitalisations.

▲ rate only   ■ interpret with caution
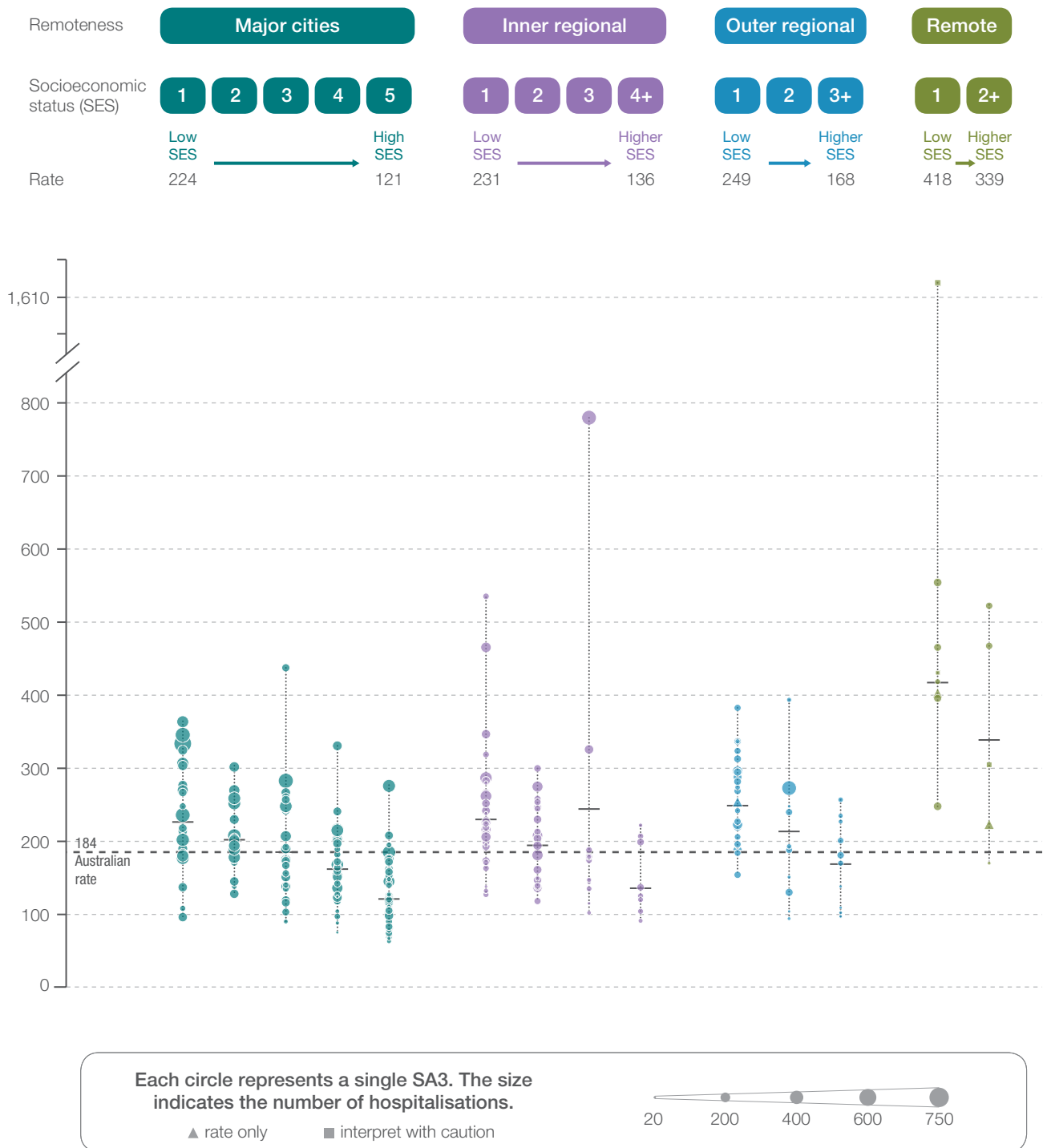
20 200 400 600 750

Notes:
Squares (■) and asterisks (*) indicate rates that are more volatile than other rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of hospitalisations are not published for confidentiality reasons.
Population estimates as at 31 December 2017 are calculated as the average of the 30 June populations in 2017 and 2018.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Populations 30 June of 2017 and 2018.

Rates by remoteness and socioeconomic status

Figure 2.22: Number of potentially preventable hospitalisations – diabetes complications per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2017–18

Remoteness	Major cities	Inner regional	Outer regional	Remote
Socioeconomic status (SES)	1 2 3 4 5	1 2 3 4+	1 2 3+	1 2+
	Low SES → High SES	Low SES → Higher SES	Low SES → Higher SES	Low SES → Higher SES
Rate	224 → 121	231 → 136	249 → 168	418 → 339

Each circle represents a single SA3. The size indicates the number of hospitalisations.

▲ rate only   ■ interpret with caution
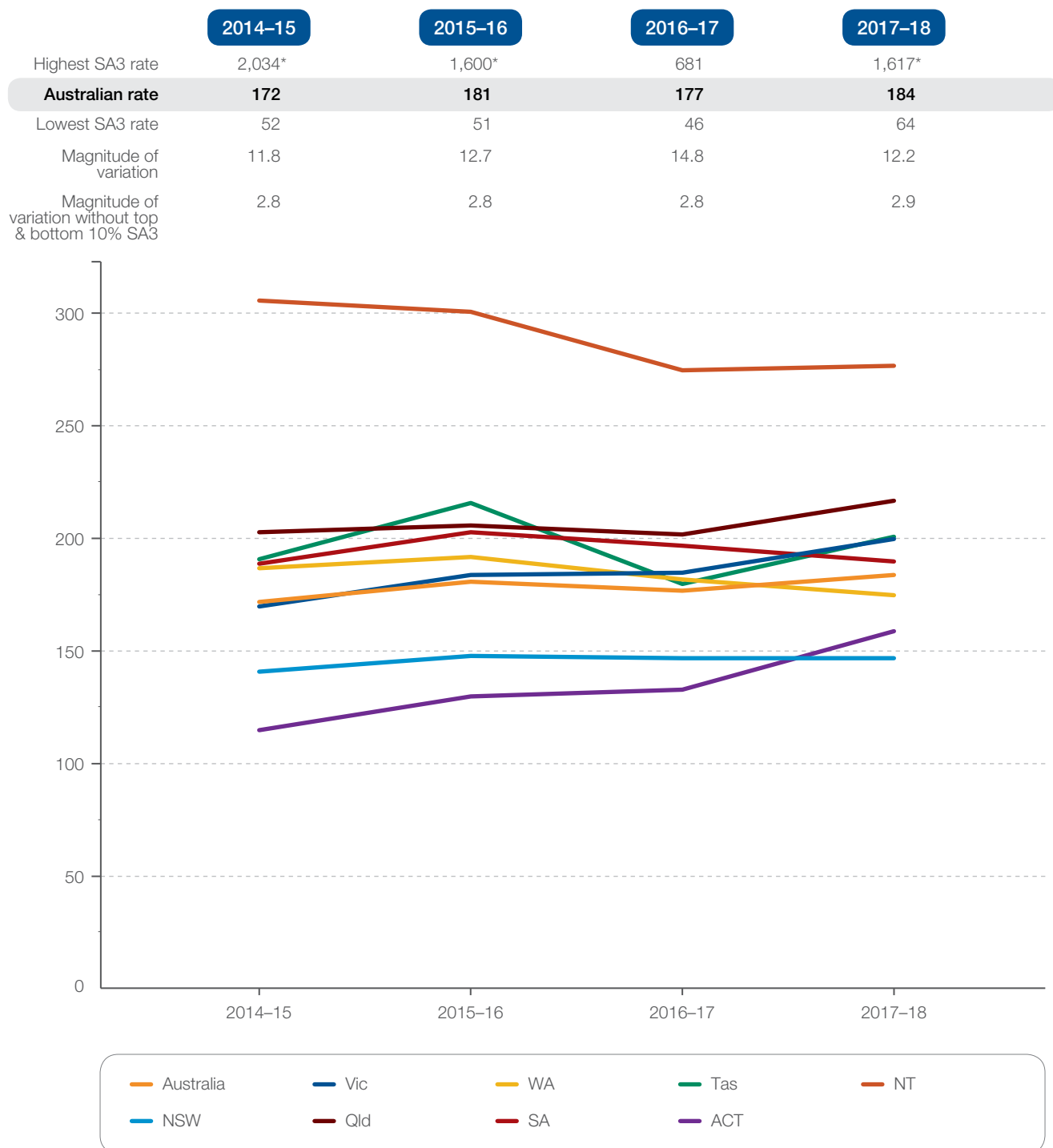
20   200   400   600   750

Notes:
Squares (■) indicate rates that are more volatile than other rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of hospitalisations are not published for confidentiality reasons.
Population estimates as at 31 December 2017 are calculated as the average of the 30 June populations in 2017 and 2018.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Populations 30 June of 2017 and 2018.

Diabetes complications

Rates across years

Figure 2.23: Number of potentially preventable hospitalisations – diabetes complications per 100,000 people of all ages, age and sex standardised, by state and territory of patient residence, 2014–15 to 2017–18

	2014–15	2015–16	2016–17	2017–18
Highest SA3 rate	2,034*	1,600*	681	1,617*
Australian rate	**172**	**181**	**177**	**184**
Lowest SA3 rate	52	51	46	64
Magnitude of variation	11.8	12.7	14.8	12.2
Magnitude of variation without top & bottom 10% SA3	2.8	2.8	2.8	2.9

Notes:
The asterisks (*) indicate rates that are considered more volatile than others, and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
Population estimates as at 31 December of the relevant year are calculated as the average of the 30 June populations before and after the relevant December. For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Populations 30 June of 2014 to 2018.

Rates for Aboriginal and Torres Strait Islander people across years

Figure 2.24: Number of potentially preventable hospitalisations – diabetes complications per 100,000 people of all ages, age and sex standardised, by Aboriginal and Torres Strait Islander status, 2014–15 to 2017–18
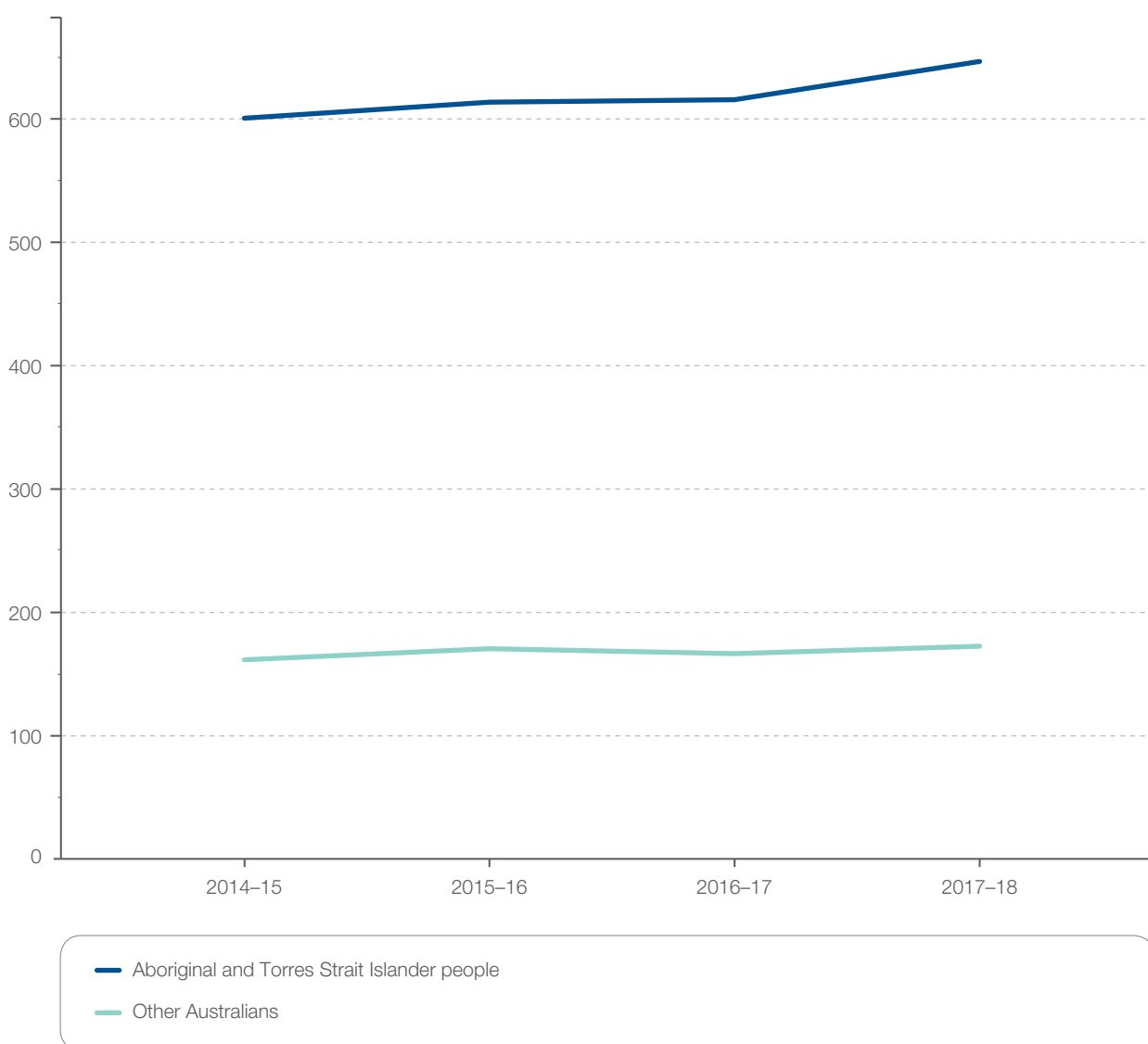
Notes:
Data by Aboriginal and Torres Strait Islander status should be interpreted with caution as hospitalisations for Aboriginal and Torres Strait Islander people are under-enumerated, with variation among states and territories.
Population estimates as at 31 December of the relevant year are calculated as the average of the 30 June populations before and after the relevant December. For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Populations 30 June of 2014 to 2018.

Diabetes complications

Resources

- American Diabetes Association. Standards of medical care in diabetes – 2020[43]

- Type 2 diabetes treatment algorithm[44]

- High risk foot: geographical inequities, importance of different diagnosis groups, forecast hospitalisations and access to services[68]

- Screening, assessment and management of type 2 diabetes mellitus in children and adolescents: Australasian Paediatric Endocrine Group guidelines[69]

- The Royal Australian College of General Practitioners. *Management of type 2 diabetes: A handbook for general practice*. East Melbourne, Vic: RACGP, 2020

- University of Melbourne, Indigenous Eye Health Unit. Check Today, See Tomorrow resource kit. Melbourne: University of Melbourne; 2015

- International Society for Pediatric and Adolescent Diabetes. *ISPAD Clinical Practice Consensus Guidelines 2014*. Berlin: ISPAD; 2014

- *Guidelines on the Prevention and Management of Diabetic Foot Disease*[70]

- UK National Institute for Health and Care Excellence (NICE) guidelines:
  - *Type 2 Diabetes in Adults: Management*, 2016
  - *Diabetes (Type 1 and Type 2) in Children and Young People: Diagnosis and management*, 2016
  - *Type 1 Diabetes in Adults: Diagnosis and management*, 2016
  - *Diabetes in Pregnancy: Management from preconception to the postnatal period*

Australian initiatives

The information in this chapter will complement work already underway to prevent diabetes and improve its management in Australia. At a national level, this work includes:

- Australian National Diabetes Audit

- National Association of Diabetes Centres (NADC) Models of Care toolkit

- NADC *Collaborative Interdisciplinary Diabetes High Risk Foot Services Standards*

- Wellbeing framework for Aboriginal and Torres Strait Islander people living with chronic disease

- KeepSight program

- Australian National Diabetes Strategy 2016–2020

- National Diabetes Services Scheme, including support programs and expansion to subsidise new technologies.

Many state and territory initiatives are also in place, including:

- Move for Diabetes, Australian Capital Territory and NSW

- Diabetes Taskforce, NSW Agency for Clinical Innovation

- Get Healthy Information and Coaching Service, NSW

- Western Sydney Diabetes project, NSW

- Hunter Alliance program, NSW

- Aunty Jean's Good Health Team program, NSW

- NSW Integrated Care trials

- Diabetes across the Lifecourse: Northern Australia Partnership

- Education services for heart disease and diabetes, Northern Territory (NT) and far north Queensland

- Improving Health Outcomes in the Tropical North (HOT North); NT, Queensland and WA

- Structured systems approach to improving health promotion practice for chronic disease prevention in Aboriginal and Torres Strait Islander communities, NT

- HealthLAB project, NT

- Diabetes in Pregnancy Partnership, NT

- Better Living Diabetes Program, Queensland

- Diabetes Queensland Aboriginal and Torres Strait Islander Online Peer Support Program, Queensland

- Improving diabetes care and management in Torres Strait remote primary healthcare settings, Queensland

- Model of Care for People with Diabetes, Darling Downs, Queensland

- Queensland Beacon clinics for integrated diabetes care

- Diabetes Service, Country Health SA, South Australia

- South Australian Aboriginal Diabetes Strategy

- South Australian Health and Medical Research Council Aboriginal and Torres Strait Islander diabetes foot complication prevention program, including the Kimberley Foot Initiative

- COACH Program, Tasmania

- Delivering Connected Care for Complex Patients with Multiple Chronic Needs, Tasmania

- LIFE! program, Victoria

- Combined renal and diabetes integrated care clinics, Victoria

- Royal Flying Doctor Service telehealth endocrinology services, Victoria

- Aboriginal Health Promotion and Chronic Care partnership initiative, Victoria

- Improving Care for Aboriginal and Torres Strait Islander Patients, Victoria

- Hospital Admission Risk Program (HARP), Victoria

- Framework for Action on Diabetes and Diabetes Service Standards, WA

- My Healthy Balance, WA

- Moorditj Djena – Strong Feet, WA

- Diabetes Telehealth Service, WA

- Let's Prevent – diabetes and cardiovascular disease prevention program, WA

- Get on Track Challenge – workplace-based physical activity and nutrition initiative, WA

- Diabetes Education and Self-Management for Ongoing and Newly Diagnosed (DESMOND) for Aboriginal and Torres Strait Islander people, WA

- *High Risk Foot: Geographical inequities, importance of different diagnosis groups, forecast hospitalisations, and access to services*, WA.[68]

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